Soil Survey Series 1956, No. 17

Issued October 1960

SOIL SURVEY AND VEGETATION

Northeastern Kodiak Island Area, Alaska

UNITED STATES DEPARTMENT OF AGRICULTURE
Soil Conservation Service
and
UNITED STATES DEPARTMENT OF THE INTERIOR
Bureau of Land Management
In cooperation with
ALASKA AGRICULTURAL EXPERIMENT STATION

HOW TO USE THE SOIL SURVEY AND VEGETATION REPORT

THIS SOIL SURVEY report contains information on the soils, the vegetation, and the crops of the Northeastern Kodiak Island Area. It will help those who are responsible for the use and management of land.

Readers who are interested chiefly in specific parts of the Area or in the native vegetation for livestock will be interested in the sections Ownership of Land, Agriculture, Descriptions of the Soils, Capability Groups of Soils, and Vegetation.

Those who are interested in wildlife management, in land use planning, and in the location and development of roads, power lines, docks, industries, and recreational areas will find useful information in the sections on General Description of the Area, Settlement and Development, and Engineering Interpretations of the Soils.

Scientists who are concerned mainly with the technical aspects of soil science, range management, forestry, geography, and geology will find valuable information in the sections Formation, Classification, and Morphology of Soils, and Vegetation.

Engineers and others who use soil as a material in construction will find helpful information in the section Engineering Interpretations of the Soils.

The maps in the back of the report show where the various kinds of soil and vegetation were mapped in the Area. To find information on the maps, readers should first identify rivers, creeks, bays, roads, and other familiar landmarks. Most of the main streams shown on the maps are named. Several streams and creeks are not named on the map but, in the report, may be mentioned by the name local residents commonly use. By referring to the map legend and the map scale and then measuring from the identified landmarks, the approximate boundaries of the desired tracts can be located.

The Guide to Mapping Units and Capability Units at the end of the report will simplify the use of the map and the report. This guide gives the map symbol for each soil, the name of the soil, the page on which the soil is described, the capability unit in which the soil has been placed, and the page where the capability unit is described.

* * *

The fieldwork for this survey was completed in 1956. Unless noted otherwise, all statements refer to conditions at the time of the survey.

COVER PICTURE

The head of Middle Bay. Chiniak and Kizhuyak soils are on the valley bottom. A marginal moraine is on the far side of valley. The vegetation is predominantly bluejoint, hair-grass, and fireweed (types 1T–CAL, 1T–DES–EPI, and 3–EPI–CAL).

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UNITED STATES DEPARTMENT OF AGRICULTURE, SOIL CONSERVATION SERVICE, AND UNITED STATES DEPARTMENT OF THE INTERIOR, BUREAU OF LAND MANAGEMENT, IN COOPERATION WITH ALASKA AGRICULTURAL EXPERIMENT STATION

General Description of the Area

Kodiak Island is in the western part of the Gulf of Alaska, about 90 miles south of the southern tip of the Kenai Peninsula. About 40 miles west of the island, across Shelikof Strait, is the rugged Alaska Peninsula. Several smaller islands belonging to the Kodiak group are north, south, and east of Kodiak Island and are separated from it by narrow straits. The land area of the island proper is about 3,588 square miles (*4*).[1]

Most of Kodiak Island is in the Kodiak National Wildlife Refuge. The Northeastern Kodiak Island Area, covered by this report, is a peninsula between Marmot Bay to the north and Ugak Bay to the south. It is the largest part of Kodiak Island not in the refuge. The western boundary of the Area lies along streams flowing north into Kizhuyak Bay (an arm of Marmot Bay) and south to Hidden Basin at the head of Ugak Bay. Included in the Area are several small offshore islands east of the city of Kodiak, which is the only incorporated community on Kodiak Island. The Northeastern Kodiak Island Area has an area of 533.5 square miles, 53.5 square miles of which were not covered by the survey. The areas not surveyed are in the U.S. Naval Reservation near Kodiak and Cape Chiniak. The back of cover shows the Northeastern Kodiak Island Area in relation to the rest of Kodiak Island and the Alaska mainland.

Physiography and Relief

Most of the Northeastern Kodiak Island Area is hilly or mountainous. Elevations range from sea level to 3,366 feet at the summit of Center Mountain in the southwestern part of the Area. The irregular coastline has prominent headlands and sea cliffs and many narrow, steep-walled bays. The principal streams of the Area flow into the heads of these bays. These streams, generally less than 10 miles long, flow mostly through fairly narrow, flat-bottomed valleys bordered by strips of rolling or hilly land. The valleys are separated by steep ridges and mountains. The lower ends of valleys widen into broad, flat meadows that are generally bordered by low gravelly dunes on the coast. Some coastal areas, especially in the southeastern part of the Area, are level or rolling.

Geology

Geologically, Kodiak Island is an extension of the Kenai Mountains to the north. Although the island is subject to occasional earthquakes, metamorphic rocks predominate. Kodiak Island has no geologic resemblance to the volcanic Alaska Peninsula to the west.

According to Capps (*4*), the rock in the Northeastern Kodiak Island Area consists mostly of hard slate and graywacke. These generally occur in alternate, thin bands that are from 1 inch to 1 foot thick. The strata generally dip steeply and have been extensively folded and faulted. In the vicinity of Portage Bay, and in a few other places, beds of sandstone, shale, and conglomerate are exposed. These beds are also highly inclined and locally folded and crumpled. On Narrow Cape, at the southeastern extremity of the Area, however, a fairly extensive zone of moderately consolidated and gently folded sandstone occurs.

In several places in the Area, mainly in the southeast, the northwest, and along the western boundary, fairly small granitic masses (diorite and quartz diorite) were forced up through the slate and graywacke. These masses are related to a much larger granitic mass that is exposed as a long, narrow body extending through the middle of Kodiak Island just west of the survey area.

Except for some of the highest peaks, the Area was probably entirely covered by ice during the glacial period. Even after the main ice mass had melted, glaciers filled all of the principal valleys. The deeply in-

[1] Italic numbers in parentheses refer to Literature Cited, p. 46.

dented bays and the steep-walled, flat-bottomed valleys, typical of the present topography, are largely the result of glacial erosion and deposition. Most of the glacial debris—material from the adjacent or underlying rock—was carried out to sea by the slowly moving ice. Much of it, however, was deposited as hilly moraines along the margins of valleys and on rolling land along parts of the coast. During the melting of the ice, large volumes of debris-laden water flowed rapidly to the sea. At this time a thick deposit of coarse sand and gravel was deposited between the moraines along the valley walls to form the level valley floors.

A generalized map of the geology of the Northeastern Kodiak Island Area is shown in figure 1.

The ash fall of 1912

On June 6 to 8, 1912, huge quantities of ash were blown into the air by the eruption of Mt. Novarupta [2] on the Alaska Peninsula about 90 miles west of the city of Kodiak. The ash, carried by westerly winds, fell on the northern half of Kodiak Island, and all soils in the Northeastern Kodiak Island Area are covered with it. During a period of more than 48 hours, the city of Kodiak was blanketed by about 18 inches of this ash. Sulfurous fumes and the ash damaged the plant life considerably on this part of Kodiak Island. According to Georgeson (*7*), "There were three grades of ashes; first, a fine but rather heavy gray sand; next, a yellow deposit not unlike yellow clay dust; and lastly exceedingly fine gray powder, which had evidently been blown to great heights and which continued to settle through the atmosphere for days." This last fine material was distributed over a wide area. It was seen as far north as Rampart on the Yukon River and as far south as Victoria, British Columbia.

Where not disturbed, the ash generally occurs in the same sequence of layers. Immediately under the organic litter that has accumulated since the ash fall is a light-gray, coarse silt loam, 1 to 2 inches thick, firm and compact in place. Under this is a light yellowish-brown layer, generally from 3 to 5 inches thick, of similar texture and firmness. The third layer is loose, light yellowish-brown loamy fine sand, 1 to 2 inches thick. This grades to a grayish-brown loose, fine sand, 3 to 4 inches thick.

Beginning with the first rains following the ash fall and continuing for about a year thereafter, especially in winter, numerous slides of ash occurred on the higher and steeper slopes. Only a few inches of ash is left on these high, steep slopes. In a few places at the foot of mountains, the accumulation of ash was thick enough to cover trees, fences, and small buildings. Many small streams and springs were choked. Most of these accumulations later were washed out to sea by winter and spring rains.

Not much ash has been washed from the gentler slopes. Shortly after the ash fell, the native vegetation on foothills and on many steep slopes recovered and continued growing. Within a year, it was growing vigorously again.

In the broad valley bottoms, ash settled by rain had an average depth of about 12 inches, but in some areas it accumulated to depths of 24 inches or more. On drying, the ash cracked to depths of 4 to 10 inches, and grass and other plants grew up through the cracks. Many years passed before the native vegetation near the mouths of streams was completely reestablished.

Climate [3]

The only weather station in the Area is at an elevation of 21 feet above sea level at the Kodiak Naval Station near the city of Kodiak. Records have been compiled here since 1942. Before that date, weather data were recorded at the city of Kodiak about 5 miles southwest of the naval station. The weather data in table 1 were recorded at the naval station, and they can be considered as fairly representative of the Area as a whole. At higher elevations, temperatures are generally lower than those at the naval station. Year-long glaciers do not exist on Kodiak Island, but air drainage down canyons and river valleys produces considerable variation in temperature within fairly short distances. The rugged terrain also tends to produce considerable local variation in precipitation.

The Northeastern Kodiak Island Area has a maritime climate. Nearby oceans tend to keep temperature fairly stable, so that variations are within fairly narrow limits.

[2] Until recently, it was generally believed that Mt. Katmai, 6 miles from Mt. Novarupta, was the principal source of the ash on Kodiak Island. Measurements of ash thicknesses around both peaks by GARNISS H. CURTIS, Department of Geology, University of California, Berkeley, Cal., in 1953 and 1954 showed that this belief was incorrect, according to a personal communication.

[3] Prepared by C. E. WATSON, climatologist, Weather Bureau, United States Department of Commerce.

Figure 1.—**Geology of Northeastern Kodiak Island Area. Adapted from Capps (*4*).**

(Qmg) Pleistocene and Recent:
Present stream gravel, sand, and silt (*low terrace gravel; alluvial fans; beach deposits. Glacial morainal material*).

(Tms) Pliocene or Miocene:
Marine sandstones of Narrow Point, mildly folded and moderately indurated.

(Tss) Eocene (?):
Fresh-water sandstone, shale, and conglomerate, locally containing coaly seams (*generally steeply dipping and well indurated; locally highly contorted*).

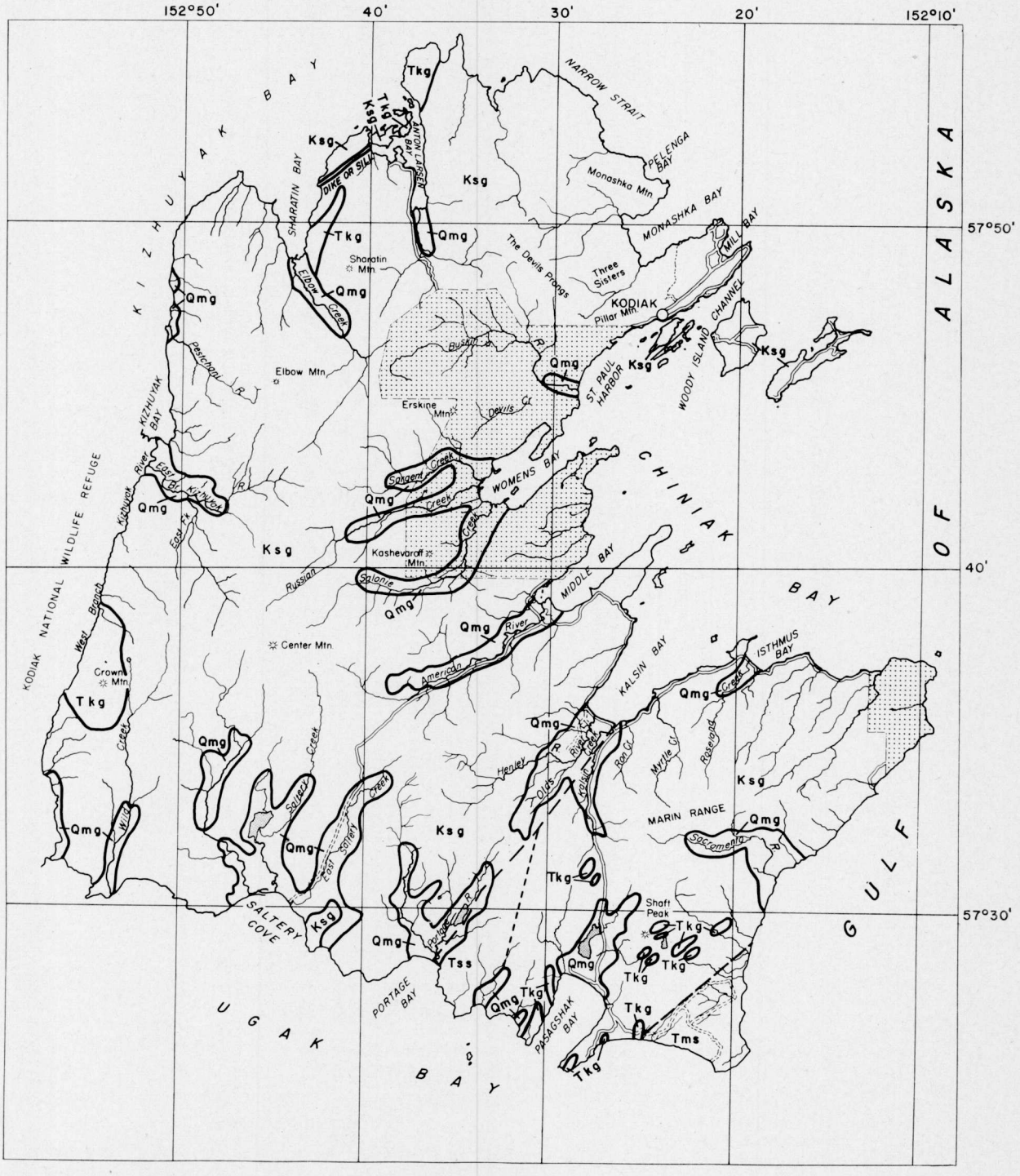
(Ksg) Mesozoic:
Mainly Upper Cretaceous rocks (*slate, argillite, graywacke, and conglomerate, thoroughly indurated, and generally highly metamorphosed*).

(Tkg) Later Upper Cretaceous or Early Tertiary:
Granular intrusive rocks, mainly quartz diorite, with some diorite, and minor amounts of gabbro.

------ Fault.

Shaded area: U.S. Naval Reservation.

Average differences between high and low temperature on individual days are 10 degrees or less throughout the year. The average temperature in August, the warmest month, is only about 26 degrees higher than that of January, the coldest month. Maximum temperatures reach 70 degrees or higher on only about 5 days each year, and a temperature as high as 90 degrees has never been recorded. The average length of the frost-free season is 171 days. On the average, it runs from about the first of May to about October 19. The shortest growing season of 86 days occurred in 1908; the longest, 201 days, in 1936.



Legend for figure 1 is on page 2.

TABLE 1.—*Climatic data for Kodiak, Alaska*

[Based on records at Kodiak Naval Station, 1942–1956]

Month	Temperature											Precipitation								
	Averages			Extremes				Maximum		Minimum		Total		Snow and sleet only						0.01 inch or more
	Maximum	Minimum	Average	Lowest		Highest		70° F. and higher	32° F. and lower	32° F. and lower	0° F. and lower	Average	Greatest daily	Average	Monthly maximum		24-hour maximum		Depth on ground, maximum	
	° F.	° F.	° F.	° F.	Year	° F.	Year	Days [1]	Days [1]	Days [1]	Days [1]	Inches	Inches	Inches	Inches	Year	Inches	Year	Inches	Year	Days [1]
January	33.3	24.7	29.0	−5	1947	51	1950	0	10	24	1	4.79	2.15	14.6	39.4	1956	21.5	1947	22	1947	17
February	35.1	26.5	30.8	−5	1943	52	1944	0	8	19	[2]	5.06	4.53	9.4	25.0	1953	7.0	1953	11	1954	16
March	36.3	26.9	31.6	−3	1944	53	1943	0	7	23	[2]	3.70	1.78	16.1	74.5	1956	9.7	1953	35	1956	14
April	40.6	32.0	36.3	10	1944	59	1948	0	1	14	0	4.02	2.75	6.6	21.6	1955	8.0	1947	25	1956	15
May	46.3	38.0	42.2	20	1949	76	1942	[2]	[2]	2	0	5.86	1.87	.2	2.0	1949	1.0	1949	[3]	[4] 1949	19
June	53.9	44.3	49.1	34	1947	86	1953	1	0	0	0	4.00	2.18	[3]	[3]	[4] 1955	[3]	1955	0	-------	15
July	58.4	49.0	53.7	40	[4] 1949	80	1955	2	0	0	0	3.71	2.46	0	0	------	0	------	0	-------	14
August	60.1	50.0	55.1	40	[4] 1942	81	1948	2	0	0	0	3.68	2.00	0	0	------	0	------	0	-------	14
September	54.3	44.8	49.6	31	1956	76	1942	[2]	[2]	[2]	0	5.88	3.43	[3]	.2	1956	[3]	1948	[3]	1948	17
October	45.6	36.3	41.0	19	[4] 1953	60	1946	0	1	8	0	7.15	3.63	1.1	7.3	1954	7.3	1954	2	1954	18
November	38.7	30.5	34.6	9	1945	54	1946	0	4	16	0	5.78	2.32	3.5	17.5	1956	9.0	1943	9	1943	17
December	33.7	25.0	29.4	5	1954	50	1955	0	11	25	0	4.21	1.84	11.0	18.0	1952	8.0	1942	14	1942	15
Year	44.7	35.7	40.2	−5	1947 (Jan.)	86	1953 (June)	5	42	131	1	57.84	4.53	62.5	39.4	1956	21.5	1947	35	1956 (Mar.)	191

[1] Average number of days.
[2] Less than ½ day.
[3] Trace, an amount too small to measure.
[4] Occurred also on later dates (months or years).

Precipitation is abundant all year; no month averages less than 3½ inches. The least rain occurs in March, July, and August. October, the wettest month, receives an average of more than 7 inches of precipitation. There is enough moisture for vegetation to grow rapidly during the long hours of daylight in the growing season. The maximum daylight of a little more than 18 hours occurs late in June.

Winter precipitation consists of snow and rain. At Kodiak, the average maximum depth of snow on the ground in winter is around 10 inches. The greatest depth ever recorded was 35 inches in March 1956. Maximum snow depth is frequently less than 6 inches; in 1940 the maximum depth was less than 2 inches. In years of low snowfall, cattle can graze in stream valleys most of the winter, but when snowfall is heavy, large amounts of hay or silage must be provided. Snow is persistent at the higher elevations. In the highest mountains it may not melt until August or September. Strong winds may occur in any season, but they are most common in winter. The highest average velocities occur in December, January, and February.

Wildlife

Kodiak Island has been widely publicized because of the Kodiak brown bear, which is reputed to be the largest meat-eating animal in the world. The bears normally feed on grass and roots in the spring and early summer and on salmon and other fish during most of the summer. In fall before hibernation, they feed on salmonberry, elderberry, and other berries.

As predators, bears are a constant source of danger to livestock. Most predation occurs in spring when the bears emerge from hibernation, but livestock may also be killed at other times of the year. Heavy livestock losses have been claimed, but some authorities believe that, in many cases, bears feed on animals that have died from other causes. However, the fear of loss from brown bears prevents ranchers from using range that is too far from headquarters. Continuous vigilance for bear adds to the cost of the livestock operation.

Most of the bears in the Northeastern Kodiak Island Area are in the vicinity of Cape Chiniak and Saltery Cove and adjacent to the Kodiak National Wildlife Refuge in the western part of the Area. For the Island as a whole, however, most bears are in the southern and western parts, in the wildlife refuge. Bears are hunted mainly in these places. The hunting season begins September 1 and extends through June 20. Livestock operators are allowed to kill bears on their lease area at any time if the animals molest livestock or damage property.

Eagles and foxes are also common predators of young animals, but the extent of their predation is not known.

Game animals that may compete with livestock for forage are elk and the Sitka black-tailed deer. The population of deer in the Area is estimated by the U.S. Fish and Wildlife Service to be about 1,000 animals. Elk have not been seen in the Northeastern Kodiak Island Area, but they are abundant on nearby Afognak and Raspberry Islands. Migration of elk to Kodiak Island is a distinct possibility, but it is believed they will feed mostly on forage that is inaccessible to livestock. However, in winters of heavy snow, elk may be driven to feed on livestock range and create conflicts similar to those experienced in the Western States. Goats occur near Hidden Basin, but they do not compete with livestock for feed. The number of wild animals will be partly controlled by the limited amount of winter feed in the Area.

Squirrels, muskrats, mice, foxes, beavers, and snowshoe rabbits are in the Area. Beavers and rabbits are fairly prevalent. In some places, beaver dams have flooded meadows. Rabbits have caused minor damage to native vegetation. Birds of the Area include the eagle, ptarmigan, spruce grouse, magpie, raven, sea gull, and sparrow. The most common insects are flies, mosquitoes, gnats, and spiders, but numerous others also occur.

Settlement and Development

Kodiak Island was discovered by Russian explorers in 1741 or 1743. The hostility of the native Kaniags discouraged the Russians from spending much time on the island until 1753, when a merchant party led by Stepan Glotof stayed there through the winter. The native population of Kodiak and adjacent islands before the Russian occupation has been estimated as 10,000 (*11*). By 1794 only 5,000 natives and 50 Russians were on these islands (*5*).

Settlement

The first white settlement in Alaska was established in 1784 on Three Saints Bay in the southern part of Kodiak Island. This settlement was the headquarters of the Shelikof Company, the forerunner of the Russian American Company, which controlled Alaska until the time of its purchase by the United States. The company headquarters were moved in 1792 to Pavlosk (Paul's) Harbor, the present site of the city of Kodiak, by Alexander Baranof, manager of the company. Although the company headquarters were moved again in 1805 to Sitka, the settlement remained an important trading post. Kodiak is the oldest continually occupied white settlement in Alaska. When Alaska was purchased by the United States in 1867, Kodiak was the second largest town in Alaska. It had a population of about 200, second only to Sitka.

In 1950 the population of the city of Kodiak was 1,710. It is estimated that the population of Kodiak had increased to 3,000 by 1956, and that of the Kodiak District, to about 8,000.

Industries

Apart from activities of the Kodiak Naval Station, the principal industry of the Area is fishing. Salmon, halibut, and shellfish are the most important fish. Whaling is also of some importance. There are several large fish canneries on Kodiak Island, two of them in the city of Kodiak. The value of the catch, for the entire island, is normally in excess of 15 million dollars a year.

About 1,200 head of cattle were in the Area in 1955. A small modern dairy plant meets part of the fresh milk requirements of Kodiak. Most dairy products used in the area, however, are imported.

In the past, there were small shipbuilding yards on Woody Island and at Uzinki on Spruce Island. The yard at Uzinki was established by the Russians while Kodiak was still headquarters for the Russian American Company. Neither of these yards is now operating. Some placer gold has been mined on the beaches and a few rock mines existed, but major gold strikes have never been reported.

Hunting for deer and the Kodiak brown bear, and sport fishing, are important local activities. Many sportsmen visit the island for this purpose every year.

The production of livestock is discussed elsewhere in this report.

Roads

All roads are single lane and unpaved except a 6-mile strip between the city of Kodiak and the naval station and some roads within the station. Roads connect the city of Kodiak with Spruce Cape to the east, Anton Larsen Bay to the northwest, Cape Chiniak to the southwest, and Narrow Cape, Pasagshak Bay, and Saltery Cove to the south. Roads and trails also exist on Woody and Long Islands, but those on Long Island have not been maintained. There are no roads in the more mountainous western half of the Area.

Daily air service, both passenger and freight, connects Kodiak with Anchorage. Charter air service is available to most points on the island and to many places on the nearby Alaska Peninsula. Small airstrips are maintained by two of the ranches in the Area. Regular steamship freight service from Seattle, Wash., and from Seward, Alaska, is available.

Facilities

Nearly all of the services and facilities available in cities of similar size elsewhere in the United States are available in Kodiak. Long-distance telephone service is provided by the Alaska Communication System, a branch of the Army Signal Corps. One rancher is connected to Kodiak by radio-telephone. Electric service is available in the immediate vicinity of Kodiak and on Woody Island. Banking facilities are also available in Kodiak.

The city of Kodiak has a public library and a modern hospital and school, but school buses do not serve the outlying ranches. Several religious denominations are represented in Kodiak. National radio and television programs are available to the entire community through the Armed Forces Radio Service at the naval station.

Ownership of Land

Except for a few small tracts of privately owned land, all of the Northeastern Kodiak Island Area outside of the city of Kodiak is owned by the United States Government. Of this area, 53.5 square miles has been reserved for military purposes; the rest is administered by the United States Department of the Interior, Bureau of Land Management.

The Alaska Grazing Act of 1927 authorized the use of public lands in Alaska for livestock grazing. The main purpose of the act was to establish grazing districts in the Territory and to issue grazing leases for the development of a livestock industry. The largest concentration of grazing leases in Alaska at the present time is in the area covered by this survey and on nearby islands. In 1956 there were seven active leases in the survey Area and six on neighboring islands. Most leaseholds are bordered by high ridges or other natural barriers to livestock.

There are no general laws providing for classification of public lands in Alaska for their highest and best use. The lands in the Northeastern Kodiak Island Area, however, have been withdrawn from homesteading pending further investigation. It is believed that most of the nonmountainous land in the Area is better suited to grazing and livestock production than to farm homesteads.

Agriculture

Livestock

Livestock were first brought to Kodiak Island in 1795 (*6*). From here the stock, a Siberian breed, was distributed to other Russian settlements in south-central and southeastern Alaska. When the Kodiak Livestock Breeding Station, a branch of the Alaska Agricultural Experiment Station, was established in 1908, evidence at the head of Kalsin Bay indicated that this area probably had been used by the Russians as a pasture or breeding center for livestock (*10*). Small herds of cattle were kept in the Area for many years, but the industry did not flourish.

The Kodiak Livestock Breeding Station introduced the hardy Galloway cattle into Alaska and demonstrated that beef cattle could be maintained fairly cheaply on Kodiak Island. The number of cattle in the Northeastern Kodiak Island Area has increased steadily since 1925, although the breeding station herd was transferred to the Matanuska Experiment Station that year.

Most of the cattle in the Area in 1955 were of the Hereford and Aberdeen Angus breeds, but some Galloway cattle still remain (fig. 2). One rancher introduced 27 head of Scotch Highland cattle in 1955 (fig. 3). In that year 125 head of cattle were slaughtered in the Area and sold to stores, private individuals, the Kodiak Naval Station, and to other local consumers. The meat was graded as commercial and good grades. The cattle had been fed on grass because high-protein feed was not available for finishing.

Dairy cattle thrive well in the Area, and their products are needed. All breeds that have been introduced—Guernsey, Jersey, and Holstein—seem to be suitable. Supplies of supplemental feed and preserved forage must be available for dairy cattle.

Sheep have been raised on nearby Sitkalidak Island and on Unalaska, Umnak, and Adak Islands in the Aleutian chain. A herd was also established on Kodiak Island by the Kodiak Livestock Breeding Station, but losses caused by bears were so great that the project was abandoned. Sheep require more feed and care than cattle, especially during the lambing season and in periods of heavy snow. The production of wool probably would be a profitable enterprise if danger from predators were eliminated.

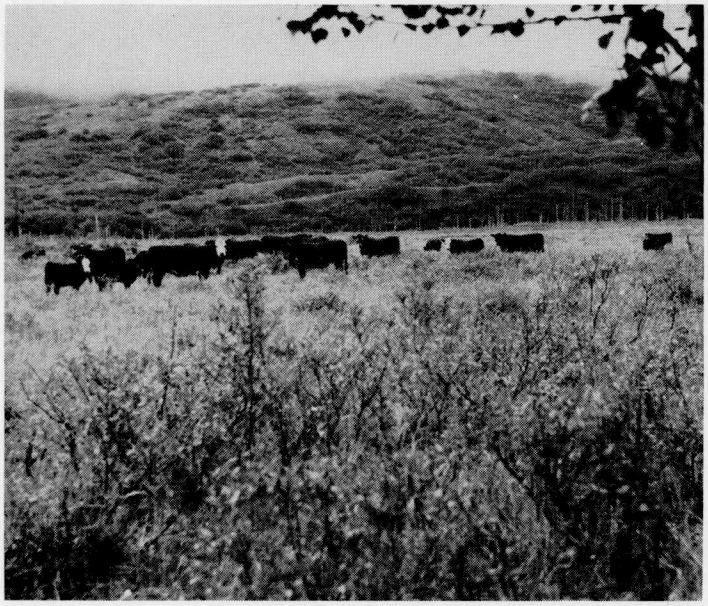


Figure 2.—**Aberdeen Angus and Galloway cattle grazing in willow and bluejoint (type 5–SAL–CAL). Slopes are in fireweed and alder (type 3–EPI–MA). Salonie silt loam is on the valley bottom, and Kodiak silt loam is on the slopes. Location, American River Valley above Middle Bay.**

Problems in the production of beef

The problems of establishing a livestock operation on Kodiak Island are similar in some ways to those faced by the first ranchers in the Western States. Chief among these are (1) difficulty and expense of transporting beef to market; (2) lack of long-term financing; (3) lack of secure land tenure; (4) need for slaughtering and marketing facilities; and (5) need for high-quality winter feed. Other problems peculiar to the area are the need for and high cost of fertilizer to produce winter feed and the high costs of operations.

The ideal ranch is one that is large enough to produce a satisfactory living for one family and yet is small enough to be managed efficiently. The number of animals necessary for an economic unit varies with the quality of stock, the location with respect to market, ability of the operator, and other factors. In the Western States, the optimum herd size is commonly considered to be about 200 breeding cows or 1,200 breeding ewes (*14*).

Ranchers in the survey Area must provide supplemental feed for at least 3 months every year. Consequently, a herd larger than 200 animals would probably be desirable to offset the additional cost of production. Only two of the ranch operations in the Northeastern Kodiak Island Area are now economic units as previously defined (fig. 4).

Leases are issued by the Bureau of Land Management to stockmen for periods of 20 years. There is no assurance of renewal at the end of that time.

The Northeastern Kodiak Island Area has a great undeveloped potential for livestock production. According to the survey of vegetation, the total grazing capacity of the Area is 45,477 animal-unit months per year. This estimate may be low because it does not include vegetation in areas that are now considered to be inaccessible to livestock, and it does not allow for any increase in carrying capacity through the seeding of more durable and palatable grasses. In 1955, the Area was stocked at only about one-fourth of its potential capacity.

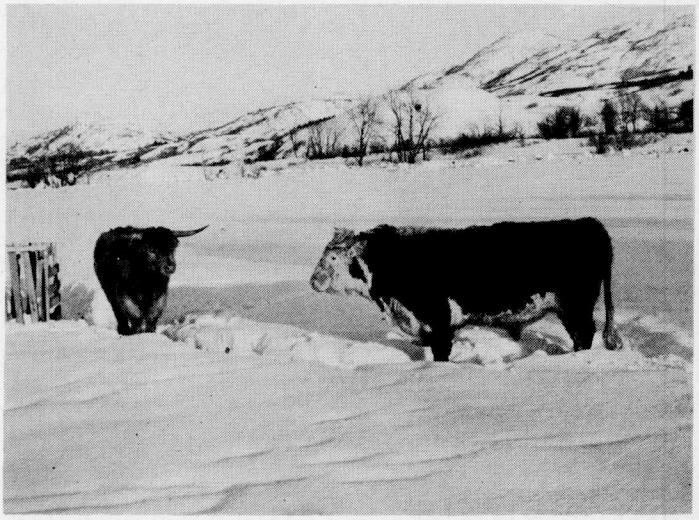


Figure 3.—**Cattle—Hereford, right, and Scotch Highland, left—wintering on Kodiak Island. Snow is normally less than 10 inches deep.**

Figure 4.—**Ranch headquarters in the valley at the head of Kalsin Bay.**

In 1955, ranchers in the Area netted approximately $30 per head on their livestock (*15*). Compared with ranching operations in the Intermountain Region, this return is satisfactory. Most sales of beef were on Kodiak Island. However, if the numbers of livestock are increased, beef will have to be sold on other Alaskan markets in competition with beef shipped in from Seattle. To compete successfully, Alaskan beef must be improved in quality. Meat of higher quality can be produced if more suitable winter feed is available. High-protein feed must be fed to support the animals during the winter.

An economic analysis (*15*) of livestock production and marketing indicates that a dependable supply of high-

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quality Kodiak beef can compete successfully on the Anchorage market with beef produced outside of Alaska.

Forage Crops

The growth of native grass for hay is exceptionally good on Kodiak Island (fig. 5). However, because of the uncertain weather, usually rain at time of harvest, hay of low quality is produced. Spoilage is considerable. Ensiling is the most efficient method of storing grasses for winter feed, but at the time of the survey only a small amount of forage was preserved in this way. Hay made from bluejoint, the dominant native grass in the Area, generally contains less protein than hay made from tame grasses. Bluejoint will not survive annual cuttings, but it can be cut in alternate years. This grass can be ensiled but not as satisfactorily as the native beach ryegrass and sedges growing near the heads of bays. Cattle do not relish fireweed silage, but they thrive on it when it is fed through necessity. Oats and a mixture of oats and peas can also be grown for silage.

Figure 5.—**Native hay harvested from sloping upland meadow near the mouth of Kalsin Bay. Background trees are Sitka spruce.**

Seedings of new grasses and legumes by the Kodiak Livestock Breeding Station were only moderately successful. Of the grasses tried, bromegrass and timothy were best. Creeping bentgrass, meadow fescue, and Kentucky bluegrass produced good stands but little growth. Of the legumes, only white clover survived. Alfalfa, alsike clover, and red clover winterkilled. More recently, however, alsike clover was seeded successfully on nearby Sitkalidak Island (*2*). Lupine is the most abundant native legume, and it is generally eaten by livestock without harm. Grain can be matured on Kodiak Island only in favorable seasons. The chances are 10 to 1 against the possibility that the grain can be harvested (*9*).

Fertilizers

All grasses have responded well to nitrogen fertilizer, and even more favorably to manure, particularly fresh manure, applied at the rate of 15 tons per acre. In 1915, when the growing season had favorable weather, oats produced a yield of 10 tons of silage per acre. This yield was reported to have been obtained on ash mixed with underlying soil (Kodiak silt loam) and fertilized with 240 pounds of calcium nitrate and 15 tons of cattle manure. Superphosphate was beneficial when used in combination with nitrate, but it was of no benefit when used alone. Good yields were obtained only when some of the underlying soil was turned up and mixed with the ash, and when the soil was fertilized liberally.

For satisfactory yields of grass, the Alaska Agricultural Experiment Station recommends fertilization with 300 pounds per acre of 10–20–10 fertilizer mixed with 100 pounds of ammonium nitrate. For a grass-legume mixture, less nitrogen is needed, but more phosphoric acid and potash should be used. Annual topdressings with nitrogen and phosphate are necessary for all seedings. Because of low soil temperatures during much of the growing season, at least part of the nitrogen fertilizer should be in the form of nitrate. Detailed fertilizer recommendations for various crops can be obtained from the Alaska Agricultural Experiment Station.

Because of its prohibitive cost, lime is not often used. Ranchers have applied lime to grass seedings and have obtained fair results. Crab shells, a by-product of the local canning industry, may be an inexpensive source of lime.

Other Agriculture

Agriculture, other than that connected with beef production, has been practiced on a limited scale. Only about 65 acres was cultivated in 1956. A commercial dairy, milking about 40 Guernsey and Jersey cows, is in operation on land leased from the Navy at the head of Womens Bay. Most of the feed for these dairy cattle, except some native hay, is imported from other States. Fluid milk is sold in Kodiak.

Vegetables are not grown commercially in the Kodiak Area, and there are only a few home gardens. Vegetables have been grown successfully at the former Kodiak Livestock Breeding Station. The garden was on Kodiak silt loam, which is now part of the city of Kodiak. The soil was prepared by mixing the surface volcanic ash with several inches of the underlying, dark-colored material through deep plowing or disking. In addition, manure and nitrogen were applied. In favorable years, according to station reports, excellent yields were obtained from carrots, beets, cauliflower, cabbage, parsley, peas, rutabagas, turnips, and lettuce. In some years, potatoes yielded 6 or 7 tons per acre. In cool wet summers, however, only radishes and lettuce did well. Strawberries, gooseberries, and currants yielded abundantly, even in poor seasons.

Soils of the Area

In this section the methods and definitions used in the soil survey are explained, and the relation of the soil

series to the physiography are discussed. Then, the soil series and all the soils mapped in the Area are described in detail.

Soil Survey Methods and Definitions

Careful examination of soil exposed in a roadbank or in a pit will show that it is made up of nearly horizontal layers, or horizons. All of the horizons, taken collectively, make up the soil profile. The classification of soils is based on the characteristics of the soil profiles and their component horizons. Characteristics of horizons that are especially important in soil classification are (1) organic-matter content; (2) color; (3) texture, or relative proportions of gravel, sand, silt, and clay; (4) structure, or arrangement of these particles into aggregates or clusters; (5) consistence, or degree of compaction and plasticity; (6) aeration and drainage conditions; and (7) reaction, or degree of acidity or basicity. Other characteristics considered in classifying soils are the thickness and arrangement of horizons in the profile and the depth to rock or other underlying material.

The basic unit in soil classification is the *soil series*. A series consists of a group of soils that, except for the texture of the surface horizon, have no significant differences in the principal horizon characteristics. They have essentially the same arrangement of horizons in the profile and have developed from a particular type of parent material. Each series is named for a town or geographic feature near the place where it was first observed and identified. The names of some important soil series in the Northeastern Kodiak Island Area are Kodiak, Salonie, Pasagshak, and Chiniak.

Soils within a series are further divided into *soil types* on the basis of the texture of the surface horizon. The textural class name of the surface soil—loamy fine sand, silt loam, and so on—is added to the soil series name to create the name of the soil type. An example is Kodiak silt loam. In the Northeastern Kodiak Island Area, where volcanic ash makes up the upper layers of all soils, there is no significant variation in surface texture within any of the soil series. Each series, therefore, contains only one soil type.

A soil type can be divided into *phases* because of characteristics that are important in the use or management of the soil. For example, if the range of slope in a soil type is wide, two or more slope phases can be recognized. In this survey, slope and vegetation phases of some of the soil types were mapped.

During the survey, soils were examined systematically in many places throughout the Area, and lines were drawn on the map to indicate the boundaries of the soil types or phases of soil types. Where two kinds of soil occurred in such intimate geographical association that they could not be mapped separately, they were mapped as a *complex*. An example is the Saltery-Ugak complex, nearly level.

Bare rock, very shallow soils on the high and steep parts of ridges, and bare, gravelly areas along streams or on the coast were mapped as land types. The land types mapped in the Northeastern Kodiak Island Area are Rough mountainous land, Riverwash, Sea cliffs, and Gravel beaches.

The soil survey of the Northeastern Kodiak Island Area is a reconnaissance survey. Consequently, not all of the lines on the soil map have been observed in the field throughout their length. Their location has been inferred, in some cases, from topographic features and other external evidence. Valley bottoms were mapped in greater detail than hilly and mountainous areas. Soils within each of the soil boundaries are believed to be essentially uniform, but minor areas of other soil types may be included.

Soil Series in Relation to Physiographic Position

Soils of the Northeastern Kodiak Island Area may be divided into two groups: (1) Those on steep to rolling uplands, and (2) those on nearly level to gently sloping valley bottoms, including alluvial plains and terraces. The soils of the uplands differ markedly from those of the valley bottoms in profile characteristics, and, to a considerable extent, in agricultural potential. The soils in each physiographic group differ mainly in depth and in drainage characteristics.

Common to all soils in the Area is the upper layer of volcanic ash, which has been described in the section, Geology. The ash mantle is strongly acid throughout, and it is very infertile. Attempts to grow vegetables or to establish seedings of grasses without fertilization have been unsuccessful. The soils are improved by mixing the ash with some of the underlying material through disking or deep plowing, and then adding large amounts of fertilizer.

The main characteristics of the soil series are shown in table 2.

Soils of uplands

The steep and rolling uplands make up about 92 percent of the Northeastern Kodiak Island Area (fig. 6). Under the surface layer of volcanic ash, the soil is typically a dark reddish-brown silt loam very high in organic matter. It grades through a reddish-brown subsoil into stony, olive-colored, underlying material. The thickness of nearly stone-free soil ranges from 1 to 2 feet on most

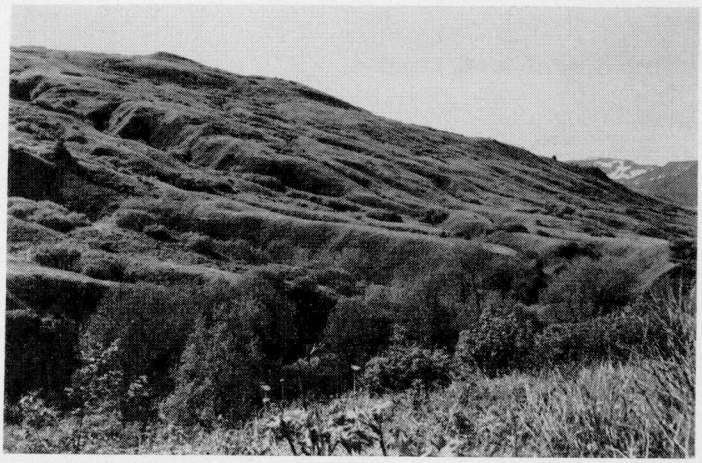

Figure 6.—**Highly dissected hillside typical of much of the Northeastern Kodiak Island Area.**

TABLE 2.—*Principal characteristics of the soil series*

Soil series	Physiographic position	Internal drainage	Thickness of volcanic ash surface layer	Description of—			
				Buried surface soil	Buried subsoil	Underlying material	Native vegetation
			Inches				
Chiniak	Low beach dunes.	Well drained	9–12	Very thin, dark reddish-brown gravelly loam, usually moist; absent in places.		Fine gravel or coarse sand.	Tall grass.
Kalsin	Valley bottoms [1]	Moderately well drained to imperfectly drained.	9–24	Very thin, dark-brown or dark reddish-brown silt loam high in organic matter; absent in places.	Dark-gray or dark grayish-brown silt loam; more than 15 inches thick; usually moist to wet.	Water-worked coarse sand and gravel.	Tall grass or balsam poplar and willow forest.
Kizhuyak	Valley bottoms [1]	Well drained to poorly drained.	24–40+			Coarse sand and gravel or silt loam.	Grass, sedge, balsam poplar and willow forest.
Kodiak	Uplands	Well drained	9–12	Dark reddish-brown silt loam high in organic matter; friable; usually moist.	Dark reddish-brown, blocky silt loam; usually moist to wet.	Weathered metamorphic rock or stony glacial till.	Tall grass, alder, or Sitka spruce.
Olds	Valley bottoms	Poorly drained	6–24	Dark-brown fibrous peat; fairly thin; usually wet.	Dark bluish-gray silt loam or silty clay loam, with sandy or peaty seams; usually very wet.	Coarse sand and gravel; very deep.	Grasses and sedges.
Pasagshak	Valley bottoms	Moderately well drained to imperfectly drained.	9–24	Very dark gray silt loam; less than 4 inches thick.		Water-worked coarse sand and gravel.	Balsam poplar and willow forest or tall grass.
Pyramid	Uplands	Well drained	3–6	Dark reddish-brown cobbly silt loam; usually moist.	Dark reddish-brown very stony silt loam; usually moist.	Hard metamorphic rock.	Tall grass.
Salonie	Valley bottoms	Moderately well drained to imperfectly drained.	9–24	Very thin, dark-brown or dark reddish-brown silt loam high in organic matter; absent in places.	Dark-gray or dark grayish-brown silt loam, 4 to 15 inches thick; usually moist or wet.	Water-worked coarse sand and gravel.	Tall grass or balsam poplar and willow forest.
Saltery	Shallow depressions.	Very poorly drained.	9–24	Dark-brown fibrous peat; very wet.	Dark-brown, fibrous peat; very wet.	Mucky silt loam	Grasses and sedges.
Sharatin	Valley bottoms [1]	Well drained	9–12	Dark reddish-brown silt loam high in organic matter; friable; usually moist.	Dark reddish-brown, blocky silt loam, streaked with yellowish brown; usually moist to wet.	Water-worked coarse sand and gravel.	Tall grass.
Ugak	Uplands	Very poorly drained.	9–12	Black, highly organic silt loam; usually wet.	Dark reddish-brown to olive silt loam; usually wet.	Stony glacial till	Grass, alder, some spruce, sphagnum moss.

[1] Valley bottoms include alluvial plains and terraces.

of the lower and gentler slopes to only a few inches on higher and steeper slopes.

Soils of the uplands include those of the Kodiak, Pyramid, and Ugak series. Areas of Saltery peat and Rough mountainous land also occur in the uplands. Sea cliffs border the uplands along the coast. Soils of the Kodiak series are dominant on lower slopes of foothills, and those of the Pyramid series occur on higher and generally steeper slopes. Ugak silt loam and Saltery peat are in poorly drained, upland depressions, many of them at the heads of minor drainageways. Rough mountainous land consists of the highest and steepest parts of ridges and mountains where soils are shallow and much bare rock is exposed. Sea cliffs are exposed headlands subject to erosion by waves.

Except for very steep slopes and thickly wooded areas, the uplands are well suited to grazing in the summer months. Most rangeland in the Area is on uplands. A small acreage on the smooth lower slopes is suitable for seeding grass for hay and silage. It is also suitable for gardens.

Soils of valley bottoms

Soils of the nearly level or very gently sloping valley bottoms, including alluvial plains and terraces, make up about 8 percent of the Northeastern Kodiak Island Area. In many places on the valley bottoms, the layer of volcanic ash is considerably thicker than 12 inches. The soils under the ash are mostly moderately well drained to imperfectly drained silt loams that overlie coarse sand and gravel. Fairly extensive, poorly drained areas and small terrace areas also occur.

The soils of valley bottoms are members of the Salonie, Pasagshak, Kalsin, Kizhuyak, Olds, Saltery, Chiniak, and Sharatin series. Areas of Gravel beaches and Riverwash also occur in the valley bottoms.

On the alluvial plains, the soil under the ash is generally dark-gray silt loam deposited by stream overflow on a deep bed of coarse sand and gravel that was laid down during the glacial period. The moderately well drained to imperfectly drained soils of the Salonie series are the most extensive soils on the alluvial plains. In these soils the silty layer between the overlying ash and the underlying coarse sand and gravel is from 4 to 15 inches thick. Less extensive are the soils of the Pasagshak series, which have a thinner silty layer, and the soils of the Kalsin series, which have a thicker silty layer. In several places on the alluvial plains, especially in low areas near the coast and in narrow strips along streams, volcanic ash has accumulated to depths of 2 feet or more. Here the soils were mapped in the Kizhuyak series. Soils of the Olds series were mapped in low areas where the water table is generally less than 2 feet below the surface.

Patches of Saltery peat occur in some areas near the coast that are permanently saturated. Soils of the Chiniak series are on low gravelly dunes along parts of the coast.

Soils of the Sharatin series, which resemble those of the Kodiak series in many characteristics, occur on fairly inextensive, better drained, higher terraces.

Except for poorly drained areas and where the soil is shallow over gravel, the valley bottoms are suitable for hay and silage if adequately fertilized. Most of the arable soils in the Area occur on bottom lands, and these were mapped in greater detail than the soils on uplands. The broad flats at the heads of bays make good pasture and have been used extensively for it. Excellent silage can be produced from sedges and grasses that grow in these areas.

Descriptions of the Soils

In this subsection the soil series and soil mapping units are described. The potential of each soil for agriculture is explained to the extent that present knowledge permits. The approximate acreage of each soil is shown in table 3. A list of mapping units and their map symbols is given in the Guide to Mapping Units and Capability Units at the end of the report. The location and distribution of the soils are shown on the soil map in the back of the report.

The types of vegetation, their use, and their value for grazing are discussed in the section Vegetation.

TABLE 3.—*Approximate acreage and proportionate extent of soils in the Northeastern Kodiak Island Area, Alaska*

Soils	Acreage	Percent of area
Chiniak silt loam, nearly level	206	0. 1
Chiniak silt loam, gently sloping	572	. 2
Chiniak silt loam, moderately sloping	498	. 2
Gravel beaches	1, 138	. 4
Kalsin silt loam	1, 187	. 4
Kizhuyak loamy fine sand, high water table	537	. 2
Kizhuyak loamy fine sand, low water table	409	. 1
Kodiak silt loam, gently sloping	1, 264	. 4
Kodiak silt loam, moderately sloping	495	. 2
Kodiak silt loam, rolling	1, 996	. 6
Kodiak silt loam, hilly	12, 868	4. 2
Kodiak silt loam, steep	37, 985	12. 4
Kodiak silt loam, forested, rolling	31	(1)
Kodiak silt loam, forested, hilly	7, 058	2. 3
Kodiak silt loam, forested, steep	10, 164	3. 3
Kodiak silt loam, forested, very steep	719	. 2
Kodiak and Pyramid silt loams, very steep	25, 877	8. 4
Olds silt loam	1, 984	. 6
Pasagshak silt loam, nearly level	8, 516	2. 8
Pasagshak silt loam, gently sloping	1, 587	. 5
Pyramid loamy fine sand, hilly	473	. 1
Pyramid loamy fine sand, steep	1, 504	. 5
Pyramid loamy fine sand, very steep	58, 138	18. 9
Riverwash	1, 527	. 5
Rough mountainous land	117, 487	38. 2
Salonie silt loam, nearly level	3, 067	1. 0
Salonie silt loam, gently sloping	818	. 3
Saltery peat	420	. 1
Saltery-Chiniak complex	353	. 1
Saltery-Ugak complex, nearly level	2, 122	. 7
Saltery-Ugak complex, gently sloping	2, 681	. 9
Saltery-Ugak complex, moderately sloping	127	(1)
Sea cliffs	2, 041	. 7
Sharatin silt loam, nearly level	859	. 3
Sharatin silt loam, gently sloping	499	. 2
Total	307, 207	100. 0

[1] Less than 0.1 percent.

Chiniak series

Soils of the Chiniak series are well drained, and they occur on stabilized, low, gravelly dunes that have formed parallel to the coast at the heads of bays. Generally

these low dunes occur only in narrow strips along the coast, but they cover a broader area at the head of Middle Bay and in a few other places.

Layers of volcanic ash, laid down in the sequence normal for this Area, make up the upper 9 to 12 inches of the Chiniak soils. Below the ash, the soil is mainly coarse sand or fine gravel, mostly water-worked fragments of slate. The upper 2 or 3 inches of this material is former surface soil consisting of dark reddish-brown gravelly loam.

A dense stand of tall grass, mainly bluejoint and beach ryegrass mixed with fireweed and sedge, covers most of the Chiniak soils. The major types of vegetation mapped on these soils are 1T–CAL, 1T–CAL–EPI, and 1T–EMO.[4] On Cape Chiniak, an open stand of Sitka spruce covers the soil.

The Chiniak soils are used extensively for pasture because the native grass, especially beach ryegrass, is very palatable. This grass also makes ensilage. Too frequent cutting or overgrazing reduces the vigor of the grass and allows invasion of less desirable plants.

Chiniak silt loam, nearly level (0 to 3 percent slopes) (ChA).—This coarse-textured soil is low in fertility and should be kept in native grass and associated plants. Good stands of native grass can be maintained if overuse is prevented. This soil is in capability unit VIs–2.

Chiniak silt loam, gently sloping (3 to 7 percent slopes) (ChB).—This soil is similar to the nearly level phase of Chiniak silt loam except in slope. It is more extensive than the nearly level phase. It is in capability unit VIs–2.

Chiniak silt loam, moderately sloping (7 to 12 percent slopes) (ChC).—Except for slope, this soil is similar to the other Chiniak silt loams. It is less extensive than the gently sloping phase and is in capability unit VIs–2.

Gravel beaches (Gb).—These narrow beaches occur along much of the coast, especially on the shores of bays. The beaches are commonly backed by low, gravelly dunes on which the Chiniak silt loams occur. Gravel beaches do not support vegetation, for the lower areas are under water during high tide, and the upper areas are sometimes covered by water in stormy weather. Kelp, washed up on the beaches, is eaten by cattle, especially in winter. This mapping unit is in capability unit VIIIs–1.

Kalsin series

Soils of the Kalsin series are moderately well drained to imperfectly drained, and they occur on valley bottoms. Volcanic ash makes up the upper part of the Kalsin soils. In most places the layers of ash have the sequence and thickness normal to the Area. In some, however, additional ash has washed in, and, as a result, the thickness of the ash ranges from 12 to 24 inches. In a few areas adjacent to streams, a thin layer of alluvium has accumulated on the ash.

Kalsin soils have a silt loam layer between the overlying volcanic ash and the underlying coarse sand and gravel that is generally about 24 inches thick, but its thickness ranges from 15 to 40 inches or more. The thickness of this layer differentiates the Kalsin from the associated Salonie soils. Thin seams or pockets of sand or fine gravel may occur in the silty layer of the Kalsin soils, normally at depths greater than 24 inches. Like the Salonie soils, some areas of the Kalsin soils are subject to occasional overflow in spring.

The natural vegetation on the Kalsin soils is like that of the Salonie soils. Tall grass is dominant in most of the soil area, but in some places the natural vegetation is balsam poplar and willow forest. The main types of vegetation are 1T–CAL–DES, 1T–CAL–SAL, 3–EPI–CAL, and 10–BP–CAL.

Kalsin silt loam (Ka).—This soil is low in most plant nutrients, but, if adequately fertilized, it will produce good yields of forage crops. Its potential as cropland or pasture is similar to that of the Salonie soils. It may, however, stay wet a little later in spring than the Salonie silt loams. Included with this soil are patches of Salonie soils and a few areas of poorly drained Olds soils that were too small to map separately. Kalsin silt loam is in capability unit IVw–1.

Kizhuyak series

The soils of this series are mostly in broad, low areas near the mouths of the main streams. In these areas the water table is high, commonly less than 2 feet from the surface. It is farther from the surface where these soils occur as low levees along some streams and at the foot of several hills.

The soils of this series have formed in thick accumulations of volcanic ash that washed from steep slopes shortly after the ash fall of 1912. The profile consists of alternate layers, varying in thickness, of loose loamy fine sand and fine sand ash and massive coarse silt loam ash. As a rule, the uppermost layer is loamy fine sand. A mat of roots and straw covers the surface, and most plant roots do not penetrate below this layer into the ash. Normally, all the colors of ash in this Area—light gray, grayish brown, and light yellowish brown—are represented in the soil profile, but the sequence of colors varies from place to place.

The Kizhuyak soils are very infertile. The native vegetation draws most of its nutrients from the mat of decaying vegetation on the surface of the soil. The soils may be used for pasture, but the vegetation will deterioriate rapidly if overgrazed. If cut annually for hay or silage, native grasses will reestablish themselves only slowly.

Kizhuyak loamy fine sand, high water table (Kb).—This poorly drained soil is the more extensive of the two mapping units in this series. Vegetation consists mostly of sedges and grasses and some willows. The main type of vegetation is 2W–CAL and 2W–CAL–CAR. Moss is common on this soil. Like the poorly drained Olds soils, this soil is best suited to pasture. It is in capability unit VIw–1.

Kizhuyak loamy fine sand, low water table (Kc).—This well-drained soil occurs mainly in narrow strips along the lower courses of streams. In a few places, it is at the foot of steep hills along edges of valley bottoms. The native vegetation consists of forests of balsam poplar and willow, and, in places, tall grass and forbs. The main type of vegetation is 2W–CAL. The soil is low in fertility and is best suited to pasture. It is in capability unit VIs–2.

[4] The meaning of vegetation symbols is explained in the section Vegetation.

Kodiak series

These are the most extensive soils in the Northeastern Kodiak Island Area. They occur in all parts and cover 32 percent of the Area. These well-drained soils occupy hills bordering the fairly narrow valleys and much of the coastline, and they extend up to the steep slopes on the lower parts of many ridges and mountains. For the most part, they occur on hummocky complex slopes in areas marked by many deep drainageways and short, steep knolls. Exceptions are the areas of these soils on long, gentle slopes in the vicinity of Narrow Cape, and the areas on comparatively smooth slopes on a few isolated hills near the coasts.

The boundary between the Kodiak soils and the soils on the alluvial plains is normally abrupt and clearly defined. On higher slopes, however, soils of the Kodiak series do not have a clear-cut boundary with the Pyramid soils.

The Kodiak soils generally have developed on weathered metamorphic rocks, mostly slate and graywacke, and on glacial till derived from these rocks. In places in the southern part of the Area, Kodiak soils overlie softer rocks, mainly sandstone and shale.

A litter of partly decayed vegetation has accumulated on the volcanic ash that fell in 1912. This litter is straw where tall grass predominates, and needles and twigs where trees predominate. Below the litter, the volcanic ash is from 9 to 12 inches thick (fig. 7). The normal sequence of layers can still be seen in it. On steeper slopes and tops of knolls in complex topography, the layer of ash has been thinned by erosion. Under the ash is the buried former surface soil consisting of weakly granular, dark reddish-brown silt loam high in organic matter. The subsoil, starting 4 to 7 inches below the old soil surface, is a more reddish silt loam, also fairly high in organic matter. At 6 to 8 inches below the old surface soil, the subsoil grades to a brown, gravelly silt loam, which, in turn, grades to stony, olive-colored underlying material.

Few plant roots are in the ash layer, but there are many in the old surface soil. Because of frequent rains in the Area, the soil below the ash is nearly always close to the saturation point. The buried surface layer, because of its high organic content, is generally friable, even when wet. The subsoil and underlying material, however, are commonly fairly sticky. All layers in the buried soil are very strongly acid.

Many seep spots and springs occur throughout the Kodiak soils. Soils in these places and in drainageways running out of them are very wet, and they are identical with those described as the Saltery-Ugak complex. Many of these wet spots were too small to map separately and are included with the Kodiak soils.

In most places on the Kodiak soils, the native vegetation is practically undisturbed. It consists mainly of tall grass—dominantly bluejoint and tufted hair-grass mixed with fireweed, horsetail, salmonberry, and other herbaceous plants. Patches of mountain alder are common; in some places, especially on north- and east-facing slopes, alder completely shades the grass. Willow occurs on some of the more gentle slopes. The Kodiak soils support forests of Sitka spruce on Spruce Cape, northeast of the city of Kodiak, and over many square miles in the vicinity of Cape Chiniak. Sitka spruce also grows in smaller clumps in many other areas of Kodiak soils along the north shore between Cape Chiniak and Kizhuyak Bay. The soil under spruce forest has essentially the same characteristics as that under the tall grass. However, Kodiak soils that are covered predominantly by spruce were mapped separately because the two kinds of vegetation have different use potentials.

***Figure 7.*—Kodiak silt loam. Volcanic ash about 1 foot thick overlies the dark buried soil high in organic matter.**

Although the Kodiak soils have a very dense vegetative cover, they are low in plant nutrients. If properly grazed, however, the native vegetation on nonforested Kodiak soils can be kept in excellent condition. On some of the Kodiak soils, the spruce forest, if properly managed, will permanently yield usable lumber.

The principal types of vegetation on nonforested Kodiak soils are 1T–CAL–EPI, 1T–CAL–MA, 1T–CAL–SAL, 3–EPI–CAL, 5–MA–CAL, 5–MA–EPI, and 10–BET–EPI. The principal type on forested soils is 6–SP.

Grazing and lumbering have not significantly changed the composition or condition of the natural vegetation on most of the Kodiak soils. Most of the tall-grass area has not been grazed intensively, and several parts have never been grazed. Intensity of use depends on the steepness of slope and the percentage of tall grass and alder. The Kodiak soils have not been extensively cultivated.

However, small areas, mostly near the city of Kodiak, have been farmed.

Kodiak silt loam, gently sloping (3 to 7 percent slopes) (KdB).—The few places in which this soil occurs are mostly in the southeastern part of the Area. As a rule, this soil is somewhat thicker over bedrock than the Kodiak soils on steeper slopes. Erosion is not a serious problem.

This soil is best suited to growing winter feed or gardens. It is advisable to mix several inches of the underlying soil with the ash and to apply large amounts of fertilizer. Additions of cattle manure have been especially effective. Phosphate, applied with nitrogen, has also increased crop yields. This soil is in capability unit IIIc–1.

Kodiak silt loam, moderately sloping (7 to 12 percent slopes) (KdC).—This soil, like the gently sloping phase, is well suited to forage crops or garden vegetables. However, unless contour cultivation or other methods of control are used, soil erosion may become serious if the native vegetation is removed. This soil is in capability unit IVe–1.

Kodiak silt loam, rolling (7 to 12 percent slopes) (KdCC).—This soil is on complex slopes and rough uneven topography. The native vegetation may be brush or tall grass. The main tall grass is bluejoint. The brush consists mainly of mountain alder, birch, and willow. Areas in tall grass are good for pasture, but those in densely growing shrubs may be almost worthless. As a rule, seeps or springs occur in places covered with shrubs.

Generally, the Kodiak soils on complex slopes of 7 to 12 percent occur at lower elevations than Kodiak soils on steeper slopes. In many places, this phase of Kodiak silt loam borders soils of the valley bottoms. The grass on this soil becomes green somewhat earlier in spring, and the grazing season is slightly longer than on steeper soils.

This soil can be used only for grazing. It has many short slopes steeper than 12 percent. Consequently, if the grass and brush cover were removed, soil erosion would be more severe than on areas of Kodiak silt loam, moderately sloping. This soil is in capability unit VIe–1.

Kodiak silt loam, hilly (12 to 25 percent slopes) (KdD).—Except for slope, this soil has characteristics similar to those of the rolling phase. In most places, however, it is somewhat shallower over bedrock than the more gently sloping phases. This soil is in capability unit VIe–1.

Kodiak silt loam, steep (25 to 45 percent slopes) (KdE).—This soil generally occurs at higher elevations than the less sloping phases of Kodiak silt loam. It is slightly shallower and somewhat less stable, although the vegetative cover is about the same. Soil slips that occur on these steep slopes during periods of snowmelt send tons of soil sliding downhill to accumulate on the gentler slopes below. As a rule, the underlying material that is exposed on slips remains free of vegetation for many years, but a dense growth of alder eventually develops on the accumulated rubble. Soil slips, however, have occurred on only a small percentage of the soil area. Erosion would be severe in all areas if the natural vegetation were destroyed.

This soil can be grazed safely if stocked with the proper number of livestock. The grazing season is slightly shorter than it is on soils at lower elevations. This phase of the Kodiak silt loam is in capability unit VIe–1.

Kodiak silt loam, forested, rolling (7 to 12 percent slopes) (KfCC).—Except for the cover of Sitka spruce, this phase of Kodiak soil is comparable to the rolling phase of Kodiak silt loam. Spruce from this soil was once used fairly extensively by the Russians in shipbuilding. Since that time, the forests have had little commercial exploitation. Recently, however, they have been a source of lumber for military construction.

This soil is on complex slopes, and, normally, it can be used only for forestry. Soil erosion is likely to be severe if the forests are cleared. The soil is in capability unit VIe–2.

Kodiak silt loam, forested, hilly (12 to 25 percent slopes) (KfD).—Except for the cover of spruce, this soil is similar to the nonforested, hilly phase of Kodiak silt loam. It is suitable only for forestry and is in capability unit VIe–2.

Kodiak silt loam, forested, steep (25 to 45 percent slopes) (KfE).—Except for the cover of spruce, this soil is similar to the nonforested, steep phase of Kodiak silt loam. It is suitable only for forestry, and it is in capability unit VIe–2.

Kodiak silt loam, forested, very steep (45 to 80 percent slopes) (KfF).—On this soil, slips are not so numerous as on comparable slopes of the nonforested Kodiak silt loams. However, erosion would be severe if the forest were cleared. The use of this soil for forestry is limited by slope. The soil is in capability unit VIIe–1.

Kodiak and Pyramid silt loams, very steep (45 to 80 percent slopes) (KgF).—In the very steep areas of Kodiak soils, many patches of Pyramid soils occur. Since the boundary between the two soils is indefinite, these areas have been mapped in this undifferentiated unit. This unit has a cover of tall grass and brush that is as heavy as that on the more gently sloping Kodiak soils. It is too steep, however, to be intensively grazed. This mapping unit is in capability unit VIIe–1.

Olds series

Soils of the Olds series occur along the lower courses of main streams and in swales near the heads of bays. They are poorly drained. They make up about 8 percent of the alluvial plains and areas near the heads of bays.

The Olds soils have a mantle of volcanic ash covered in many places by moss that is several inches thick. In some areas the ash has the sequence of layers that is normal in this Area for most of the better drained soils. In most places, however, some of the ash has been washed away or additional ash deposited. The buried soil beneath the ash commonly has a surface layer of dark-brown, fibrous peat from 4 to 5 inches thick. The main body of the buried soil is a dark bluish-gray, heavy silt loam or silty clay loam. It ranges from 15 to 30 inches or more in thickness. In some areas thin seams of peat or sand may occur in this layer. The lower part of the Olds profile is a deep deposit of coarse sand or gravel.

The vegetation on the Olds soils consists mostly of sedges and grasses that can survive wetness. Willow is also fairly common. Near the coast, beach ryegrass is fairly prominent. The main types of vegetation on Olds soils are 2W–CAL, 2W–CAL–SAL, and 2W–CAR.

Olds silt loam (Os).—This soil is in level areas on valley bottoms where drainage is poor. The water table is less than 2 feet below the surface and usually is only a foot from it. The soil may be under water in spring or after prolonged heavy rains in summer. It is too wet for cultivation and is best used for pasture. Sedges and beach ryegrass are occasionally cut, and they make good quality hay and silage. Cutting these plants every year or overgrazing them will reduce their vigor and allow less desirable plants to invade. This soil is in capability unit VIw–1.

Pasagshak series

Soils of the Pasagshak series cover about 42 percent of the acreage in the valley bottoms. They are shallow and moderately well drained to imperfectly drained. Typically, they occur in fairly narrow strips along streams. They also occur in broad areas near the heads of bays and on gentle or moderate slopes at the bases of hills that border alluvial plains, especially at the mouths of steep mountain drainageways.

The surface soil is volcanic ash, commonly with the sequence of layers normal for this Area. The ash may be as much as 24 inches thick in places. It is underlain by a thin, very dark gray layer of alluvial silt loam that commonly ranges from 2 to 4 inches in thickness. In places this layer may be nearly absent. Under the layer of silt loam is coarse sand and gravel, many feet thick, that may contain a few lenses of silt or a small admixture of silt in the upper part. The whole profile is almost always moist or wet because of frequent rains in the Area.

As a rule, Pasagshak soils adjacent to streams support forests of balsam poplar and willow. The ground cover consists of grasses and herbaceous plants. The broad areas near the heads of bays are covered mainly by tall grass similar to that on Salonie soils. The main types of vegetation on Pasagshak soils are 1T–CAL–EPI, 1T–CAL–SAL, 5–SAL–CAL, and 10–BP–CAL.

Pasagshak soils are even lower in plant nutrients than other soils of valley bottoms because of the thinness of the layer of alluvial silt loam under the ash. Some of the native grasses in nonforest areas have been harvested for hay, and, if properly managed, will continue to produce good grass. Seedings of other grasses have been tried but have failed. It is doubtful that crops grown on Pasagshak soils will produce yields high enough to repay the cost of fertilizer and the preparation of the seedbed.

Pasagshak silt loam, nearly level (0 to 3 percent slopes) (PaA).—This soil, for the most part, occurs in long strips immediately adjacent to streams and in broad, flat areas near the mouths of streams. It may be flooded during periods of high water, especially in spring. Trees probably should be cut from some of this soil to improve the pasture, but a narrow strip of trees should be left next to the stream to help prevent bank erosion.

Patches of Salonie soils that were too small to map separately may be mixed with this mapping unit. This soil is in capability unit VIs–1.

Pasagshak silt loam, gently sloping (3 to 7 percent slopes) (PaB).—This soil occurs at the bases of hills that border the valley bottoms. For the most part, these areas are covered with tall grass, but some forests of balsam poplar and willow occur. The grass-covered areas are well suited to spring and fall pasture. This soil is in capability unit VIs–1.

Pyramid series

The soils of this series cover about 20 percent of the Northeastern Kodiak Island Area. As a rule, they occupy the steep and very steep slopes of ridges and mountains. They border the Kodiak soils on the lower slopes and Rough mountainous land on the steeper slopes of higher elevations.

Most of the original deposit of volcanic ash has washed away, and now only a layer consisting of loamy fine sand, commonly 3 to 6 inches thick, is left beneath the surface litter. Under the ash is the former surface layer of the buried soil. It is a dark reddish-brown, cobbly silt loam, 4 to 7 inches thick. It overlies a somewhat redder, very cobbly silt loam subsoil, which is underlain by hard parent rock. Outcrops of bare rock occur in places, and large soil slips are fairly common.

Pyramid soils differ from Kodiak soils in thinness of the remaining volcanic ash layer and in stoniness of the profile beneath the ash. The sequence of layers in the buried soil, however, is similar to that in Kodiak soils.

The Pyramid soils support a vegetation consisting mainly of bluejoint and tufted hair-grass. Fireweed, horsetail, salmonberry, and other plants are also present. Large brushy patches of mountain alder and birch are common. The principal types of vegetation are 1T–CAL–EPI, 5–MA–CAL, and 7L.

Most Pyramid soils are too steep for grazing, although they have suitable vegetation. The less steep soils can be safely grazed. All Pyramid soils are too steep for cultivation or for use as hay land.

Pyramid loamy fine sand, hilly (12 to 25 percent slopes) (PmD).—This soil is covered by vegetation similar to that on adjoining areas of Kodiak silt loam. It is in capability unit VIe–1.

Pyramid loamy fine sand, steep (25 to 45 percent slopes) (PmE).—This soil generally occurs on higher elevations than the Kodiak soils, and, consequently, the grazing season is somewhat shorter. Soil slips are fairly common. This soil is in capability unit VIe–1.

Pyramid loamy fine sand, very steep (45+ percent slopes) (PmF).—This soil adjoins Rough mountainous land. It is mainly at higher elevations than the Kodiak soils. Most slopes are less than 60 percent, but, in places, they may be nearly 100 percent. For the most part, this soil is too steep to graze (fig. 8). Rock outcrops are common, and slips are more common than on any of the other Pyramid soils. Slips occur on only a small percentage of the total area of this soil. Some, however, are large and leave noticeable scars on the sides of ridges. The vegetation on this soil is as dense as that on the less steep phases of Pyramid loamy fine sand. This soil is in capability unit VIIe–1.

Riverwash (Rh).—This land type consists of strips of water-worked fine and coarse gravel derived mostly from slate and graywacke. In summer when water is low, Riverwash is exposed in the larger streams. In spring and in other seasons after prolonged heavy rains, rapidly flowing water covers this land type. Most Riverwash is essentially barren, but in a few places balsam poplar and

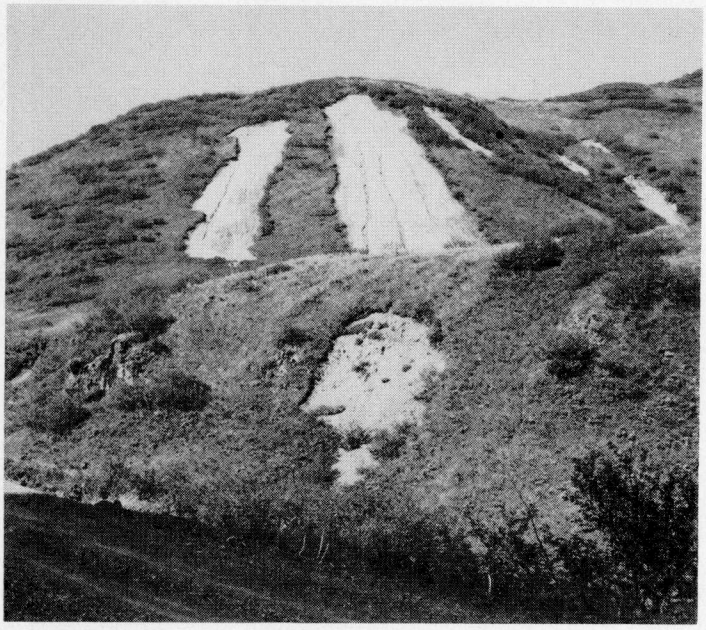

Figure 8.—**Slip scars in Pyramid loamy fine sand on high ridge, which is inaccessible to livestock (type 7L). In sloping foreground, Kodiak silt loam covered by bluejoint and alder (type 1T–CAL–MA).**

willow trees have established themselves in the gravel. This land type has no agricultural or grazing value, and it is in capability unit VIIIs–1.

Rough mountainous land (Rm).—This land type covers about 38 percent of the Area. It consists of very steep areas on the highest parts of ridges and mountains and on the very steep walls of valleys and ravines. Most of this land type consists of outcrops of bare rock or of very shallow soils that support a sparse growth of low shrubs, moss, and grass. Many of the highest points, especially in the western part of the Area, are covered by snow most of the summer.

Most Rough mountainous land grades to the steep Pyramid soils at somewhat lower elevations. Where soil has formed on this land type, it is even shallower than the Pyramid soils.

This mapping unit is not suitable for grazing or other agricultural use. Some of the ridges and deep narrow ravines may serve as barriers between cattle ranges. The major type of vegetation on most areas of Rough mountainous land is 7L. This land type is in capability unit VIIIs–1.

Salonie series

The Salonie soils make up more than 16 percent of the valley bottoms. They are moderately well drained to imperfectly drained and occur mostly on nearly level alluvial plains. Some areas are adjacent to streams, but most are in slightly higher positions some distance from streambanks. A few areas are on gentle slopes adjoining the foothills of steep ridges.

The mantle of volcanic ash on the Salonie soils is generally 9 to 12 inches thick and has the sequence of layers normal to this Area. However, in places where additional ash has washed in from uplands, its thickness may be as much as 24 inches. Over the ash there normally is a surface litter of matted leaves and straw several inches thick. In a few places subject to overflow, however, this organic layer is covered by alluvial silt, 1 to 4 inches thick. The buried soil beneath the ash has little profile development. The surface layer of this buried soil is a dark-brown or dark reddish-brown silt loam high in organic matter. It is now less than an inch thick. The bulk of the buried soil is a dark-gray or dark grayish-brown silt loam that contains many fine roots. This silt loam layer ordinarily ranges from 6 to 10 inches in thickness, but in places the range is from 4 to 15 inches. The silt loam overlies abruptly a glacial outwash deposit of coarse and rounded gravel that is many feet thick. Silty lenses of various thicknesses occur in places in the upper part of this coarse deposit.

Salonie soils are always moist or wet because of frequent rains and slow runoff. As a result, the lower part of the ash layer is commonly mottled yellowish red. The silt loam layer is normally slightly sticky and is never dry, although the underlying material is coarse and permeable. Each pebble in the upper part of the underlying material has a very thin, wet, silty coating. This coating, together with the high content of dark fragments of slate, give the material a black color.

Most areas of the Salonie soils are covered by water only occasionally. A few areas, however, are flooded when the rivers are high, especially in spring. During summer when stream levels are generally low, Salonie soils are seldom flooded.

The vegetation on the Salonie soils is mostly bluejoint and tufted hair-grass. Fireweed, horsetail, mountain alder, and willow are also present. Usually the grass is not dense. It is similar to, though not always identical with, the tall-grass vegetation on most of the uplands. In most places a thin layer of moss is on the surface. Areas of Salonie soils fairly close to streams support stands of willow and balsam poplar. The ground cover in these areas is tall grass similar to but less dense than that on nonforested Salonie soils. The principal types of vegetation are 1T–CAL, 1T–CAL–EPI, 1T–CAL–MA, 1T–CAL–SAL, and 10–BP–CAL.

Salonie soils are low in most plant nutrients, but they are especially deficient in nitrogen and phosphorus. They are also strongly acid. Despite the low natural fertility, these soils are suited to forage crops for winter feed, mainly because of their favorable topographic position. They are less desirable for vegetables than the gently sloping Kodiak or Sharatin soils because they warm up more slowly in spring.

Soils of this series have been used as pasture and for native hay. Good stands of several other grasses have been obtained from seedings. The yields of grass, however, have been low because of inadequate fertilization. Heavy fertilization is essential, and applications of manure are desirable. Lime may be beneficial. If the volcanic ash is mixed with several inches of the underlying silt and fertilizer is added, good yields of grass probably can be obtained. Pasturing is best for areas where the layer of volcanic ash is so thick that the underlying silt cannot be brought to the surface by tillage. The length of the grazing season on Salonie soils is greater than on soils of uplands. These soils can, therefore, be used most efficiently for pasture in the spring and fall when other grazing lands are not available.

Salonie silt loam, nearly level (0 to 3 percent slopes) (SaA).—This soil occurs on flood plains of principal streams and, in some places, may be flooded for short periods. It stays wet somewhat later in the spring than upland soils. This mapping unit includes small patches of Kalsin and Pasagshak soils that could not be delineated separately. A few small areas of the poorly drained Olds and Kizhuyak soils are also included, but these are of minor extent. Salonie silt loam, nearly level, is in capability unit IVw–1.

Salonie silt loam, gently sloping (3 to 7 percent slopes) (SaB).—This soil occurs near the outer edges of valleys bordering the uplands. It is never flooded by streams, but runoff and seepage from uplands keep it wet in the spring about as long as the nearly level Salonie silt loam. This soil is in capability unit IVw–1.

Saltery series

Soils of the Saltery series consist of very poorly drained, thick accumulations of undecomposed or slightly decayed sedges and grasses. They occur in shallow depressions near the heads of bays and in poorly drained upland depressions in complex association with Ugak silt loam.

The Saltery soils were covered by a layer of volcanic ash that generally is about 12 inches thick. On top of the ash there is now 3 to 4 inches of fibrous peat. Under the ash is a dark grayish-brown, extremely acid, fibrous peat that extends to depths of 30 inches or more and grades to a black, mucky silt loam. In places near the coast, a thin layer of fine gravel occurs in the upper few inches of this buried peat.

The water table is always a foot or less from the surface, but in spring and after heavy rains water stands on the surface. The dominant type of vegetation on the Saltery soils is 2W–CAL–CAR.

Saltery peat (Sb).—This soil occurs in shallow depressions near the heads of bays. It is suited only to pasture. Drainage probably is not feasible. The soil is in capability unit VIIw–1.

Saltery-Chiniak complex (Sc).—This mapping unit occurs in a few broad areas along coasts where the low dunes of Chiniak soils are separated by strips of Saltery peat. Each component, too small to map separately, occupies about half the area of the complex. The Saltery and Chiniak soils in this unit have the same suitabilities as large areas of these soils. Much of the Chiniak soil is, however, inaccessible to machinery during most of the summer because of the intervening areas of Saltery peat. This complex is in capability unit VIIw–1.

Saltery-Ugak complex, nearly level (0 to 3 percent slopes) (SdA).—This complex consists of areas of Saltery peat and Ugak silt loam so intricately associated that they could not be mapped separately. It occurs in poorly drained areas throughout the rolling to hilly uplands, mostly in narrow, gently to moderately sloping strips at the heads of secondary drainageways.

Saltery peat normally occurs near springs or seep areas. It is described under the Saltery series. Ugak silt loam is a mineral soil described under the Ugak series.

This complex is always saturated and has many beaver ponds. It supports a large group of plants—grasses, sedges, forbs, alder, willow, and, in the north, Sitka spruce. In most places the ground cover is sphagnum moss. The vegetation was classified as 2W–CAR, 2W–CAR–SAL, 2W–SAL–CAR, 5–SAL–BET, and 5–SAL–CAL.

The soils are too wet for any cultivated crops, and they are used for grazing. The production of grass is not high. Drainage is not likely to be feasible. The complex is in capability unit VIIw–1.

Saltery-Ugak complex, gently sloping (3 to 7 percent slopes) (SdB).—Except for slopes, this mapping unit does not differ significantly from the nearly level phase of the Saltery-Ugak complex. However, the water table may be slightly farther from the surface in summer. This is the most common phase of the complex, and it is in capability unit VIIw–1.

Saltery-Ugak complex, moderately sloping (7 to 12 percent slopes) (SdC).—Except in slope, this mapping unit does not differ significantly from the other phases of the Saltery-Ugak complex. It is in capability unit VIIw–1.

Sea cliffs (Se).—This land type consists of exposed headlands where steep or rolling hills are subject to erosion by waves. In places, the cliffs are more than 50 feet high and break off sharply from the uplands. They have no value for agriculture. The cliffs may support a few shrubs, but most of them have no vegetative cover. The main types of vegetation are 7L and 8. This land type is in capability unit VIIIs–1.

Sharatin series

The Sharatin soils are dominant on low terraces above the alluvial plains. They are mainly at the heads of valleys but are also on benches and on old alluvial fans near the mouths of valleys. They are not subject to flooding.

The surface material is volcanic ash with the sequence of layers normal for this Area. Under the ash is the buried former surface soil, a dark reddish-brown silt loam streaked with gray. This is underlain by a somewhat brighter reddish-brown silt loam subsoil streaked with yellowish brown. This silt loam breaks easily into subangular blocks when disturbed, but it is fairly sticky when wet. At depths ranging from 20 to 30 inches, the silt loam rests abruptly on coarse sand and gravel many feet thick. Except for this kind of substratum, the profile of Sharatin soils is similar to that of Kodiak soils.

Tall grass, similar to that on the upland Kodiak soils, covers most of the Sharatin soils. A few areas are covered by forests of balsam poplar and willow. The main types of vegetation on Sharatin soils are 1T–CAL, 1T–CAL–EPI, 1T–DES, and 5–SAL–CAL.

The Sharatin soils are used mostly for grazing, but the native grasses are cut for hay in a few areas. The soils are believed to have the same potential for vegetables and forage crops as the Kodiak soils. Management for these crops would be essentially the same. The Sharatin soils are strongly acid throughout and are generally low in most plant nutrients. In addition to proper tillage, they need nitrogen and phosphate fertilizers. Lime may be beneficial for cultivated crops.

Sharatin silt loam, nearly level (0 to 3 percent slopes) (ShA).—This soil occurs most commonly on inextensive stream terraces. It is in capability unit IIIc–1.

Sharatin silt loam, gently sloping (3 to 7 percent slopes) (ShB).—Because of slope, this soil is somewhat more likely to erode than the nearly level phase of Sharatin

silt loam. Erosion, however, is not a serious hazard. This soil is in capability unit IIIc–1.

Ugak series

Soils of the Ugak series occur in poorly drained areas of uplands mostly in strips at the heads of secondary drainageways. Some organic matter has accumulated at the surface of the volcanic ash. Below the volcanic ash is a dark-brown, peaty mat of roots and leaves about 1 inch thick. This is underlain abruptly by 3 to 5 inches of black silt loam. Below this is a moderately sticky, dark-brown silt loam that grades, within 6 inches, to an olive-colored silt loam substratum that is streaked with dark brown and black. The dark-brown and olive-colored layers commonly contain sharp-edged fragments of rock.

The Ugak soils were mapped only in a complex with the Saltery soils.

Capability Groups of Soils

Capability grouping is a system of classification used to show the relative suitability of soils for crops, grazing, forestry, and wildlife. It is a practical grouping based on the needs, limitations, and risks of damage to the soils, and also on their response to management. There are three levels above the mapping unit in the grouping—unit, subclass, and class.

The capability unit, sometimes called a management group, is the lowest level of grouping. A capability unit consists of soils that are similar in kind of management needed, in risk of damage, and in general suitability for use. For example, the capability unit is represented by the figures 1 and 2 in the classification symbols IIc–1 and VIs–2.

The next broader grouping, the subclass, is used to indicate the dominant kind of limitation. The letter symbol "e" means that the main limiting factor is risk of erosion if the plant cover is not maintained; "w" means that excess water retards plant growth or interferes with cultivation; "s" means that the soils are shallow, droughty, or unusually low in fertility; and "c" means that climate (temperature and lack of moisture) is the only major hazard or limitation.

The broadest grouping, the land class, is identified by Roman numerals. All the soils in one class have limitations and management problems of about the same degree, but they are of different kinds as shown by the subclass. All the land classes except class I may have one or more subclasses.

In classes I, II, and III are soils that are suitable for annual or periodic cultivation of annual or short-lived crops. Class I soils are those that have the widest range of use and the least risk of damage. They are level, or nearly level, productive, well drained, and easy to work. They can be cultivated with almost no risk of erosion and will remain productive if managed with normal care.

Class II soils can be cultivated regularly but do not have quite so wide a range of suitability as class I soils. Some class II soils are gently sloping; consequently, they need moderate care to prevent erosion; others may be slightly droughty or slightly wet, or somewhat limited in depth.

Class III soils can be cropped regularly but have a narrower range of use. These need even more careful management.

In class IV are soils that should be cultivated only occasionally or only under very careful management.

In classes V, VI, and VII are soils that normally should not be cultivated for annual or short-lived crops, but they can be used for pasture or range, as woodland, or for wildlife.

Class V soils are nearly level and gently sloping but are droughty, wet, low in fertility, or otherwise unsuitable for cultivation.

Class VI soils are not suitable for crops because they are steep or droughty or otherwise limited, but they give fair yields of forage or forest products. Some soils in class VI can, without damage, be cultivated enough so that fruit trees or forest trees can be set out or pasture crops seeded.

Class VII soils provide only poor to fair yields of forage or forest products.

Class VIII soils have practically no agricultural use. Some of the soils have value as watersheds, wildlife habitats, or as recreational areas.

No Class I, II, and V soils were mapped in the Northeastern Kodiak Island Area. The capability classes and units in the Area are given in the following list.

Class III.—Soils that have severe limitations that reduce the choice of plants or require special practices.
- Subclass IIIc: Soils severely limited by climatic factors.
  - Unit IIIc–1: Well-drained, level to gently sloping soils on uplands or terraces.

Class IV.—Soils that have very severe limitations that restrict the choice of plants, require very careful management, or both.
- Subclass IVe: Soils severely limited by risk of erosion if they are cultivated and not protected.
  - Unit IVe–1: Well-drained, moderately sloping soils on uplands.
- Subclass IVw: Soils severely limited by excess water.
  - Unit IVw–1: Moderately well drained to imperfectly drained, level to gently sloping alluvial soils.

Class VI.—Soils that have severe limitations that make them generally unsuited to cultivation and limit their use largely to pasture or range, woodland, or wildlife food and cover.
- Subclass VIe: Soils severely limited by erosion.
  - Unit VIe–1: Hilly or steep upland soils covered by brush or tall grass.
  - Unit VIe–2: Hilly or steep upland soils covered by forest.
- Subclass VIw: Soils severely limited by excess water.
  - Unit VIw–1: Poorly drained alluvial soils flooded part of the time.
- Subclass VIs: Soils severely limited by unfavorable characteristics in the root zone.
  - Unit VIs–1: Shallow, moderately well drained to imperfectly drained, level to gently sloping alluvial soils.
  - Unit VIs–2: Well-drained, level to moderately sloping, excessively sandy or gravelly soils.

Class VII.—Soils having very severe limitations that make them unsuited to cultivation and that restrict their use largely to grazing, woodland, or wildlife.
Subclass VIIe: Soils severely limited by erosion.
Unit VIIe–1: Very steep soils.
Subclass VIIw: Soils severely limited by excess water.
Unit VIIw–1: Very poorly drained soils.
Class VIII.—Soils and land forms having limitations that preclude their use for commercial plant production and restrict their use to recreation, wildlife, water supply, or esthetic purposes.
Subclass VIIIs: Land forms whose physical limitations prevent the growth of usable plants.
Unit VIIIs–1: Land types with little or no soil.

Descriptions of Capability Units

In this section each capability unit is described and the soils in it are listed. In addition, suggestions are given on how to use and manage the soils in each unit.

Capability unit IIIc–1

Well-drained, level to gently sloping soils on uplands or terraces

Kodiak silt loam, gently sloping.
Sharatin silt loam, nearly level.
Sharatin silt loam, gently sloping.

Erosion is not a serious problem on these soils. However, the soils of this group should be cultivated along the contour, especially where vegetables are grown, rather than up and down the slopes.

The soils in this unit are the best in the Area for cultivation. All climatically adapted vegetables and forage crops can be grown. The main hazard is climate. Vegetables do not grow well in seasons that are abnormally cool and cloudy. Successful haymaking is uncertain because of the frequent rains, but silage can be made with less risk.

Soils intended for cultivation should be prepared by mixing some of the underlying silt loam with the upper layer of ash. Heavy fertilization especially with nitrogen and phosphate is necessary, and it is likely that lime will help most crops. Manure is highly beneficial.

Capability unit IVe–1

Well-drained, moderately sloping soil on uplands

Kodiak silt loam, moderately sloping.

The hazard of erosion is greater on the soil of this unit than on the soils of unit IIIc–1. If this soil is used for crops, erosion control practices, especially contour cultivation, are necessary. Management of this soil is otherwise similar to that described for capability unit IIIc–1.

Capability unit IVw–1

Moderately well drained to imperfectly drained, level to gently sloping alluvial soils

Kalsin silt loam.
Salonie silt loam, nearly level.
Salonie silt loam, gently sloping.

These soils stay wet longer in spring than the soils on terraces and uplands, and they are flooded in places. Sites not subject to summer flooding are suitable for forage crops and for vegetables. The management of this unit is similar to that described for capability unit IIIc–1. The same climatic hazards exist.

Capability unit VIe–1

Hilly or steep upland soils covered by brush or tall grass

Kodiak silt loam, rolling.
Kodiak silt loam, hilly.
Kodiak silt loam, steep.
Pyramid loamy fine sand, hilly.
Pyramid loamy fine sand, steep.

Slopes on these soils range from 7 to 45 percent. Erosion is a serious problem if the vegetation is removed. Many slopes are too strong and irregular for the use of farm machinery. Most of the grazing land in the Area is in this capability unit. The vegetation can be maintained in excellent condition indefinitely if grazing is properly controlled.

Capability unit VIe–2

Hilly or steep upland soils covered by forest

Kodiak silt loam, forested, rolling.
Kodiak silt loam, forested, hilly.
Kodiak silt loam, forested, steep.

Slopes on these soils range from 7 to 45 percent. Most areas have slopes in the upper part of this range. These soils will erode if the dense forest is removed. They can, however, be used safely for lumber if cutting is properly controlled.

Capability unit VIw–1

Poorly drained alluvial soils flooded part of the time

Kizhuyak loamy fine sand, high water table.
Olds silt loam.

These soils always have a high water table; in spring and after heavy rains they are under water. They are too wet for cultivation. They have a fair stand of grasses and sedges and are suitable for pasture. Occasional cuttings for hay and silage will not injure the vegetation.

Capability unit VIs–1

Shallow, moderately well drained to imperfectly drained, level to gently sloping alluvial soils

Pasagshak silt loam, nearly level.
Pasagshak silt loam, gently sloping.

Except for the layer of volcanic ash, these soils are very shallow. They overlie a thick bed of coarse sand and gravel. They probably would not produce high yields of cultivated crops, even if fertilized. Their best use is for permanent pasture. Occasional cuttings of grass for hay or silage will not injure the stand. Forests of balsam poplar and willow cover much of this capability unit. These trees should be kept on streambanks to prevent erosion.

Capability unit VIs–2

Well-drained, level to moderately sloping, excessively sandy or gravelly soils

Chiniak silt loam, nearly level.
Chiniak silt loam, gently sloping.
Chiniak silt loam, moderately sloping.
Kizhuyak loamy fine sand, low water table.

The natural fertility of these soils is very low, and cultivated crops probably cannot be grown successfully. Good stands of grass can be maintained if management is good. The grass can be cut occasionally, but it will die out if cut every year. If overgrazed, the native species of grass will be replaced by poorer grasses. The main plant on the Chiniak soils is beach ryegrass, which is excellent for silage.

Capability unit VIIe–1

Very steep soils

Kodiak silt loam, forested, very steep.
Kodiak and Pyramid silt loams, very steep.
Pyramid loamy fine sand, very steep.

The vegetation on these soils is as dense as it is on the more gentle slopes. The danger of erosion, however, limits the use of these soils to light grazing or lumbering. If the vegetation is disturbed, slips and gullies will occur.

Capability unit VIIw–1

Very poorly drained soils

Saltery peat.
Saltery-Chiniak complex.
Saltery-Ugak complex, nearly level.
Saltery-Ugak complex, gently sloping.
Saltery-Ugak complex, moderately sloping.

These soils have a very high water table at all times, and they are frequently under water. The vegetation consists mainly of sedge, moss, willow, and other plants that can grow in wet areas. Spruce covers some of the poorly drained upland areas. These soils are too wet for cultivation, and the vegetation furnishes only poor grazing.

Capability unit VIIIs–1

Land types with little or no soil

Gravel beaches.
Riverwash.
Rough mountainous land.
Sea cliffs.

The main value of these soils is for recreation and wildlife habitat.

Engineering Interpretations of the Soils

This section was prepared mainly to assist engineers who use soil as a material in construction. The test data were obtained through the cooperation of the Division of Physical Research, Bureau of Public Roads.

This section, and the one entitled Formation, Classification, and Morphology of Soils, can be used by engineers to estimate the suitability of soils in the Area for roads, airfields, buildings, and other types of construction. The mapping and the descriptive report are somewhat generalized, however, and should be used only in planning more detailed field surveys to determine the in-place condition of the soil at the site of the proposed engineering construction.

The soil survey report can also be used for locating sources of sand and gravel and to determine routes for moving vehicles and construction equipment.

Soil Science Terminology

Some terms in this report, especially those that refer to texture and textural classes, have special meaning to agricultural soil scientists. In some cases, these same words have different meanings in accepted soil mechanics terminology. In pedology the definitions of some of these terms are as follows:

Soil.—The natural medium for the growth of land plants. It is composed of mineral or organic materials, or both. Deep, unconsolidated material, not affected by soil-forming processes other than mechanical weathering, and below the reach of plant roots, normally is not considered to be soil.

Sand.—Individual rock or mineral fragments in soils having diameters from 2.0 millimeters to 0.05 millimeter. The textural class name of any soil that contains 85 percent or more of sand but in which the percentage of silt plus 1½ times the percentage of clay does not exceed 15.

The textural class name generally indicates the dominant size of the sand particles; for example, very fine sand.

Silt.—Individual mineral particles ranging in diameter from 0.05 millimeter to 0.002 millimeter. The textural class name of any soil containing 80 percent or more of silt and less than 12 percent of clay.

Clay.—Mineral particles less than 0.002 millimeter in diameter. The textural class name of any soil containing 40 percent or more of clay, less than 45 percent of sand, and less than 40 percent of silt.

Loam.—The textural class name of any soil that contains 7 to 27 percent clay; 28 to 50 percent silt; and less than 52 percent sand. Loam is intermediate in texture between the fine-textured clayey soils and the coarse-textured sandy soils. It is also part of other textural class names. For example, silt loam is the name of a textural class with properties intermediate between those of a loam and soils of the silt class.

Soil Test Data

Three profiles each of Chiniak silt loam (coastal dunes), Kodiak silt loam (uplands), and Salonie silt loam (alluvial plains) were tested by the Division of Physical Research, Bureau of Public Roads, according to standard procedures of the American Association of State Highway Officials (*1*) to help evaluate the soils for engineering construction. Except for the poorly drained soils, these profiles represent most of the soil conditions in the Area. The test data are given in table 4.

Engineering Data and Recommendations

The estimated physical properties and the engineering classifications of soils in the Area, together with characteristics significant to engineering, are given in table 5. Complete profile descriptions can be obtained by referring to the section Formation, Classification, and Morphology of soils.

Some of the soil characteristics affecting earth construction are given in table 6.

Frequent rains and low average summer temperatures cause all soils in the Area to be constantly moist or wet. Because of the high moisture content in the soils, there is a large amount of runoff during hard rains and snow-

melt. As a consequence, streams rise rapidly several times a year. Roads near streams must be protected from erosion, and culverts must be large enough to carry the runoff.

In the hilly uplands, road construction is mostly on the Kodiak and Pyramid soils. Steep cuts in unconsolidated material should be protected by a cover of growing plants to prevent slumping. In most places, the Kodiak soils are underlain by unconsolidated, stony glacial till, but, in some places, the underlying material is hard rock that may require blasting.

On alluvial plains where volcanic ash occurs in the sequence of layers normal for this Area, the surface horizon is firm and strong. Under these favorable conditions, the subgrade gravel for roads can be laid directly on the ash. The lower part of the ash is loose fine sand and loamy fine sand and allows good subsurface drainage. The silty material under the ash is normally wet and slippery, but it is strong enough to support properly designed, light-traffic roads that are built on the ash. It is less permeable than the ash, but it is underlain by water-worked coarse sand and gravel. The silt ranges in thickness from a few inches in the Pasagshak soils to several feet in the Kalsin soils.

The poorly drained soils, especially extensive on valley bottoms and at the heads of bays, are not suitable as sites for foundations or for roads. Among the unsuitable soils are the Saltery-Ugak complex on uplands and the Olds, Saltery, and Kizhuyak (high water table phase) soils on alluvial plains. The Chiniak soils, which occur as stabilized, low gravelly dunes at the heads of bays, are most suitable for construction.

Areas of Riverwash are good sources of gravel except when flooded in periods of high water. Good gravel, containing a small quantity of silt, underlies the Pasagshak and the Salonie soils. Uniformly sized rounded aggregate can be easily obtained from gravel from either source by washing and sieving. Clean, fine gravel or very coarse sand can be obtained from low dunes along the coast mapped as the Chiniak soils. Metamorphic rock suitable for quarrying can be found in areas of Kodiak and Pyramid soils.

Formation, Classification, and Morphology of Soils

Formation of Soils

Soil is a natural body that covers most of the earth's land surface. Its formation and development are strongly influenced by temperature and by the amount, kind, and distribution of precipitation. These climatic factors also determine to a large extent the kind of vegetation that will grow in a particular area. The vegetation, in turn, has a profound influence on soil characteristics. Climate and vegetation modify the soil material or parent rock to produce a soil. The degree of modification depends on the length of time the forces have been active and on the way in which surface relief has allowed these forces to operate. On very steep gradients, for example, weathered material is removed almost as quickly as it is produced, and little or no soil is formed. In valley bottoms, weathered material from higher land accumulates in low spots, and here the soil is only partly the product of in-place soil-forming processes.

Parent material

The soils of the Northeastern Kodiak Island Area have developed from several different kinds of parent material. The upper part of all soils in the Area is volcanic ash deposited in 1912. Buried under the ash is the soil that existed before the ash fall. On the uplands, these buried soils have developed from hard, metamorphic rock and, in a few places, from acid igneous rock—or from glacial till derived from these rocks. On the alluvial plains, which occur as narrow strips along the lower courses of principal streams, the ash overlies silty alluvium. This material rests on a deep deposit of outwash sand and gravel.

Climate

The Area has a cool marine climate. Summers are cool, winters are moderate, and precipitation is high throughout the year. Under these conditions, a large quantity of water enters the soil. Much of it passes through the soil and eventually flows into drainageways or springs in the uplands or into the underlying gravel in the alluvial plains. Enough moisture is in the profile to keep the soils nearly always saturated. Because of the continual movement of water, most of the soluble minerals have been leached from the soils. As a result, most soils are now strongly acid and very low in nutrients.

Vegetation

The native vegetation over most of the Area is a dense stand of tall grass and forbs alternating with patches of mountain alder and other shrubs. Although its composition and density vary, this kind of vegetation covers both uplands and alluvial plains. Parts of the northern half of the Area, especially Cape Chiniak and Spruce Cape, are covered by forests of Sitka spruce. The soil profile under these spruce forests is identical with that under the grass. This indicates that trees have replaced grass fairly recently. In other places in the north, isolated clumps of spruce are surrounded by grass and alder; it is evident that the forest invasion is continuing. Detailed descriptions of vegetation in the Area are given in the section Vegetation.

Relief

Relief and topographic position have had a considerable effect on the properties of soils of the Area. On most steep slopes, the soils are shallow because of natural erosion. On the highest and steepest parts of ridges and mountains, the layer of weathered material over hard rock is very thin or absent, and bare rock is often exposed. Even on moderate slopes and hills, the soils buried by ash had rarely developed a thickness of more than 20 inches above weathered rock or stony glacial till. Soils of the alluvial plains consist of material that washed from uplands and was deposited by streams. In the latter part of the glacial period, coarse sand and gravel were deposited by rapidly flowing water. Later, after stream channels had been cut, finer material was deposited over the coarse sand and gravel by slowly moving water. The layer of finer material varies considerably in thickness. After the ash fall of 1912, volcanic ash was washed from the steep valley walls onto many areas in the alluvial plains.

TABLE 4.—*Engineering test data* [1] *for soil samples taken from*

Soil name and location	Parent material	Bureau of Public Roads report No.	Depth	Horizon	Moisture-density	
					Maximum dry density	Optimum moisture
			Inches		*Lb. per cu. ft.*	*Percent*
Chiniak silt loam:						
South shore of Kalsin Bay (modal) [6]	Volcanic ash over beach sand and gravel.	S 31510	0–5	C_1	71	35
		S 31511	13–28+	C_b	124	12
Isthmus Bay along Cape Chiniak Road (modal).	Volcanic ash over beach sand and gravel.	S 31512	1–5	C_2	74	31
		S 31513	11–24+	C_b	115	14
Low dune along southern part of Middle Bay.	Volcanic ash over beach sand and gravel.	S 31514	2–9	C_2	72	34
		S 31515	18–32+	C_b	110	17
Kodiak silt loam:						
1.3 miles north of Naval Ski Chalet along Anton Larsen Bay Road (modal).[6]	Volcanic ash over glacial till	S 31524	2–6	C_2	70	33
		S 31525	8–11	C_4	63	39
		S 31526	15–23	A_{31b}	51	67
3.1 miles northeast of Kodiak along Mill Bay Road (forested phase).	Volcanic ash over glacial till	S 31516	2–4	C_2	72	33
		S 31517	5–7	C_4	65	35
		S 31518	10–15	A_{31b}	66	45
		S 31519	19–27	C	113	15
9.2 miles southwest of United States Naval Reservation along Cape Chiniak Road.	Volcanic ash over glacial till	S 31520	1–3	C_2	76	28
		S 31521	5–9	C_4	69	35
		S 31522	12–19	A_{31b}	55	62
		S 31523	23–36+	CD	103	20
Salonie silt loam:						
1.2 miles south of Cape Chiniak Road along Saltery Cove Road (modal).[6]	Volcanic ash on silty alluvium over glacial outwash.	S 31527	7–10	C_4	62	40
		S 31528	10½–19	CG_b	95	24
		S 31529	19–31+	D	128	10
2.1 miles south of Cape Chiniak Road along Pasagshak Bay Road.	Volcanic ash on silty alluvium over glacial outwash.	S 31530	9–12	C_4	70	32
		S 31531	12½–20	C_{1b}	88	26
		S 31532	27–40+	D	116	13
0.5 mile north of Anton Larsen Valley Bridge along Anton Larsen Bay Road.	Volcanic ash on silty alluvium over glacial outwash.	S 31533	5–8	C_4	61	41
		S 31534	9–14	CG_b	80	33
		S 31535	14–24+	D	126	11

[1] Tests performed by Bureau of Public Roads according to standard procedures of the American Association of State Highway Officials (AASHO).

[2] Mechanical analyses according to the American Association of State Highway Officials Designation: T 88. Results by this procedure frequently may differ somewhat from results that would have been obtained by the soil survey procedure of the Soil Conservation Service (SCS). In the AASHO procedure, the fine material is analyzed by the hydrometer method and the various grain-size fractions are calculated on the basis of all the material, including that coarser than 2 mm. in diameter. In the SCS soil survey procedure, the fine material is analyzed by the pipette

TABLE 5.—*Characteristics and estimated physical properties significant*

Soil [1]	Topographic position	Average depth to water table	Soil horizon	Depth from surface	Classification		pH
					Unified	AASHO	
		Inches		*Inches*			
Chiniak silt loam	Low coastal dunes.	Deep [3]	C_1 (volcanic ash)	0–5	ML	A–4	5. 3
			C_2–C_3 (volcanic ash)	5–10	SM	A–2–4	5. 2
			A_b	10–13	SM or GM	A–2–4	4. 8
			C_b	13+	SP or GW	A–3 or A–1	5. 1
Kalsin silt loam	Valley bottoms	Deep	C_1–C_2 (volcanic ash)	0–5	ML	A–4	5. 2
			C_3–C_4 (volcanic ash)	5–11	SM	A–2–4	5. 2
			C_{1b}	11–25	ML	A–4	4. 8
			D	31+	GW	A–1	------

representative soils in the Northeastern Kodiak Island Area, Alaska

Mechanical analyses [2]											Liquid limit [3]	Plasticity index [3]	Classification	
Percentage passing sieve							Percentage smaller than—							
3-in.	2-in.	¾-in.	No. 4 (4.7 mm.)	No. 10 (2.0 mm.)	No. 40 (0.42 mm.)	No. 200 (0.074 mm.)	0.05 mm.	0.02 mm.	0.005 mm.	0.002 mm.			AASHO [4]	Unified [5]
					100	80	77	53	13	8	NP	NP	A–4(8)	ML.
	100	90	33	12	2	1	1	1	1	1	NP	NP	A–1–a(0)	GW.
					100	68	63	43	13	7	NP	NP	A–4(7)	ML.
		100	98	83	6	3	3	3	2	2	NP	NP	A–1–b(0)	SP.
					100	69	64	45	13	7	NP	NP	A–4(7)	ML.
	100	98	98	97	51	6	5	5	4	4	NP	NP	A–3(0)	SP–SM.
					100	70	66	44	13	6	NP	NP	A–4(7)	ML.
				100	98	18	17	16	10	6	NP	NP	A–2–4(0)	SM.
				100	98	72	66	46	17	8	NP	NP	A–4(7)	ML or OL.
					100	71	67	44	12	6	NP	NP	A–4(7)	ML.
				100	99	15	14	13	7	5	NP	NP	A–2–4(0)	SM.
	100	91	81	78	72	49	44	32	17	11	NP	NP	A–4(3)	SM.
	100	96	83	72	51	33	30	22	14	9	NP	NP	A–2–4(0)	SM.
					100	57	53	36	13	7	NP	NP	A–4(4)	ML.
				100	99	27	25	20	10	6	NP	NP	A–2–4(0)	SM.
				100	98	76	70	51	19	11	NP	NP	A–4(8)	ML or OL.
	100	96	83	75	64	52	50	34	20	11	35	4	A–4(3)	ML.
				100	99	21	20	17	8	6	NP	NP	A–2–4(0)	SM.
			100	99	97	88	85	68	38	24	45	12	A–7–6(10)	ML.
100	98	77	42	27	11	4	4	2	2	2	NP	NP	A–1–a(0)	GW.
					100	32	30	23	10	6	NP	NP	A–2–4(0)	SM.
				100	93	62	56	39	21	14	NP	NP	A–4(5)	ML.
100	99	70	37	25	15	8	8	6	4	3	NP	NP	A–1–a(0)	GW–GM.
				100	98	15	15	10	8	4	NP	NP	A–2–4(0)	SM.
				100	99	83	76	56	32	19	54	10	A–5(11)	MH or OH.
100	99	60	29	19	7	4	4	3	2	2	NP	NP	A–1–a(0)	GW.

method and the material coarser than 2 mm. in diameter is excluded from calculations of grain-size fractions. The mechanical analyses used in this table are not suitable for use in naming textural classes for soils.

[3] NP=Nonplastic.

[4] Based on the Classification of Soils and Soil-Aggregate Mixtures for Highway Purposes, AASHO Designation: M 145–49 (*1*).

[5] Based on the Unified Soil Classification System, Tech. Memo. No. 3–357, v. 1, Waterways Experiment Station, March 1953 (*16*).

[6] The complete profile of this soil is described in the section Formation, Classification, and Morphology of Soils.

to engineering of soils in the Northeastern Kodiak Island Area, Alaska

Permeability [2]	Structure	Consistence	Dispersion	Characteristics significant to engineering
Moderate	Massive	Firm	Low	Soil occupies low coastal dunes and is well drained. Upper 9 to 12 inches is volcanic ash. Beneath the ash is sand or fine gravel.
Rapid	Single grain	Loose	Low	
Rapid	Weak granular	Loose to friable	Low	
Rapid	Single grain	Loose	Low	
Moderate	Massive	Firm	Low	Alluvial soils. Moderately well drained to imperfectly drained but always moist because of frequent rains. The upper part of the ash layer is normally compact coarse silt loam, and the lower part is loose loamy fine sand or fine sand. Beneath the ash is heavy silt loam, 15 to 40 inches thick, underlain abruptly by gravelly glacial outwash.
Rapid	Structureless	Loose	Low	
Moderate	Weak blocky	Friable	Moderate	
Rapid	Structureless	Loose	Low	

TABLE 5.—*Characteristics and estimated physical properties significant to*

Soil [1]	Topographic position	Average depth to water table	Soil horizon	Depth from surface	Classification		pH
					Unified	AASHO	
Kizhuyak loamy fine sand.	Valley bottoms	12–24	C_1–C_2–C_3 or C (volcanic ash).	0–40+	ML and SM, layered.	A–4 and A–2–4, layered.	5. 3
Kizhuyak loamy fine sand.	Valley bottoms	Deep [3]	C (volcanic ash)	0–40+	ML and SM, layered.	A–4 and A–2–4, layered.	5. 3
Kodiak silt loam	Uplands	Deep [3]	C_1–C_2 (volcanic ash)	0–6	ML	A–4	4. 8
			C_3–C_4 (volcanic ash)	6–11	SM	A–2–4	5. 2
			A_{1b}	11–15	OL	A–5	4. 3
			A_{31b}	15–23	ML	A–4	4. 7
			C–D	27–42+	SM or ML	A–2–4 or A–4	4. 8
Olds silt loam	Valley bottoms	12–24	C_1 (volcanic ash)	0–4	ML	A–4	4. 9
			C_2 (volcanic ash)	4–9	SM	A–2–4	5. 4
			A_{ob}	9–14	Pt		4. 9
			C_b	14–32	CL	A–7–6	4. 7
			D	32+	GW	A–1	
Pasagshak silt loam	Valley bottoms	Deep [3]	C_1–C_2 (volcanic ash)	0–4	ML	A–4	5. 1
			C_3–C_4 (volcanic ash)	4–8	SM	A–2–4	5. 4
			A_b	8–10	ML	A–4	4. 6
			D	10+	GW	A–1	
Pyramid loamy fine sand.	Steep uplands	Deep [3]	C_1 (volcanic ash)	0–4	SM	A–2–4	5. 1
			A_{1b}	4–11	GM	A–1	4. 4
			A_{3b}–C_b	11–20+	GM	A–1	4. 9
Salonie silt loam	Valley bottoms	Deep [3]	C_1–C_2 (volcanic ash)	0–4	ML	A–4	5. 2
			C_3–C_4 (volcanic ash)	4–10	SM	A–2–4	5. 4
			CG_b	10½–19	ML	A–4	4. 7
			D	19+	GW	A–1	
Saltery peat	Valley bottoms	0–12	A_o	4–0	Pt		4. 6
			C_1 (volcanic ash)	0–8	ML	A–4	3. 7
			C_2 (volcanic ash)	8–12	SM	A–2–4	3. 7
			A_{ob}	12–36	Pt		4. 4
			C_b	36+	OL	A–5	
Sharatin silt loam	Valley bottoms	Deep [3]	C_1 (volcanic ash)	0–1	ML	A–4	
			C_2 (volcanic ash)	1–7	SM	A–2–4	5. 2
			A_{11b}	7–10	OL	A–5	4. 8
			A_{3b}	13–16	ML	A–4	5. 4
			C_{1b}	16–20	ML	A–4	5. 6
			D	25+	GW	A–1	
Ugak silt loam	Uplands	6–12	C_1 (volcanic ash)	0–6	ML	A–4	5. 5
			C_2 (volcanic ash)	6–10	SM	A–2–4	5. 3
			A_{1b}	11–15	OL	A–5	5. 1
			A_{3b}	15–19	ML	A–4	5. 7
			C_b	19–32+	ML	A–4	5. 5

[1] Estimates of physical properties are not given for the miscellaneous land types. Some of their characteristics significant to engineering follow. Gravel beaches: Mostly gravel (GP or A–1), partly flooded at high tide. Riverwash: Mostly gravel (GP or A–1) exposed in streambeds, except during periods of high water. Rough mountainous land: Mostly outcrop of slate and graywacke,

engineering of soils in the Northeastern Kodiak Island Area, Alaska—Continued

Permeability [2]	Structure	Consistence	Dispersion	Characteristics significant to engineering
Moderate and rapid in alternate layers.	Massive and structureless in alternate layers.	Firm and loose in alternate layers.	Low	Occurs in broad, low places near the mouth of streams. Normally, soil is a poorly drained, deep deposit of ash consisting of layered, loose loamy fine sand and coarse silt loam.
Moderate and rapid in alternate layers.	Massive and structureless in alternate layers.	Firm and loose in alternate layers.	Low	Occupies narrow stream levees and strips at the foot of hills. Well drained. Layered, loose loamy fine sand and compact coarse silt loam.
Moderate Rapid Moderate Moderate Moderate	Massive Single grain Weak fine blocky Moderate blocky Single grain	Firm Loose Friable Friable Friable	Low Low High High Moderate	Occurs mostly on rolling to steep complex slopes. Well drained but always moist because of frequent rains. First 9 to 12 inches consists of volcanic ash that is compact coarse silt loam in upper part and loose loamy fine sand or fine sand in lower part. Beneath the ash is silt loam 12 to 24 inches thick, the upper 4 to 6 inches of which is high in organic matter. At depths of 24 to 36 inches and extending to bedrock are strongly weathered fragments of slate and graywacke, or stony glacial till. Seepy spots are fairly common.
Moderate Rapid	Massive Single grain	Firm Loose	Low Low	Occupies poorly drained, shallow depressions. Similar to Kalsin silt loam, but may have layer of fibrous peat beneath the ash. Water table is always high.
Moderate Rapid	Massive Single grain	Friable Loose	Moderate Low	
Moderate Rapid Moderate Rapid	Massive Single grain Weak blocky Single grain	Firm Loose Friable Loose	Low Low Moderate Low	Same as Salonie silt loam, except that heavy silty clay layer is less than 4 inches thick.
Rapid Moderate Moderate	Single grain Weak granular Single grain	Loose Friable Friable	Low Moderate Moderate	Well drained but always moist because of frequent rains. Stony silt loam is between ash and the underlying bedrock, which is only a few feet below surface. Outcrops of rock are fairly common. Soil slips on steep slopes are common.
Moderate Rapid Moderate Rapid	Massive Single grain Weak blocky Single grain	Firm Loose Friable Loose	Low Low Moderate Low	Moderately well drained, to imperfectly drained but always moist because of frequent rains. Upper part of the ash consists of compact coarse silt loam; lower part is loose loamy fine sand or fine sand. Beneath ash is heavy silt loam 4 to 15 inches thick, which is underlain abruptly by gravelly glacial outwash.
Moderate Rapid	Massive Single grain	Firm Loose	Low Low	Occupies depressions and consists of ash over fibrous peat, 30 to 50 inches thick, which is underlain by highly organic silt loam. Water table is always high.
Moderate			High	
Moderate Rapid Moderate Moderate Moderate Rapid	Massive Single grain Weak fine blocky Moderate blocky Weak blocky Single grain	Firm Loose Friable Friable Friable Loose	Low Low High High High Low	Occupies alluvial terraces. Has same characteristics as the upland Kodiak series, except that at depths of 20 to 35 inches it is underlain abruptly by gravelly glacial outwash.
Moderate Rapid Moderate Moderate Moderate	Massive Single grain	Firm Loose	Low Low High High High	Occurs in depressions in uplands. Profile characteristics are like those of Kodiak silt loam, but the layer of highly organic silt loam immediately beneath the ash is thicker. Water table is always high.

or very thin soil over rock. Very steep. Sea cliffs: Stony glacial till in upper part; lower part is commonly outcrops of slate and graywacke.

[2] Permeability classes are: Slow, 0 to 0.2 inch per hour; moderate, 0.2 to 5.0 inches per hour; rapid, more than 5.0 inches per hour.

[3] More than 4 feet deep in valley bottoms; in the bedrock in uplands.

TABLE 6.—*Soil characteristics*

Soil or land type	Topographic position	Susceptibility to frost heave	Highway construction	
			Characteristics affecting use for—	
			Earthwork when wet	Subgrade or base course
Chiniak silt loam	Low coastal dunes	Low	Coarse grained throughout	Stable when wet
Gravel beaches		Low	Coarse grained	Partly under water each day
Kalsin silt loam	Valley bottoms	Moderate	Soil under ash is slightly sticky when wet.	Ash is stable; silty soil underneath is moderately stable when wet.
Kizhuyak loamy fine sand.	Valley bottoms	Low	Water table is high in most places	Stable, but water table is high
Kodiak silt loam	Uplands	High to moderate.	Silty soil under ash liquefies at comparatively low moisture level.	Ash is stable; soil beneath ash is unstable when wet.
Olds silt loam	Valley bottoms	High	Silty soil under ash is sticky when wet; water table is high.	Poorly drained; water table is high.
Pasagshak silt loam	Valley bottoms	Low	Silty layer under ash is slightly sticky when wet.	Suitable, but the thin layer of silty soil under ash is only moderately stable when wet.
Pyramid loamy fine sand.	Uplands	Low	Soil is stony and shallow; slopes are steep.	Slopes are steep
Riverwash	Valley bottoms	Low	Coarse grained	Flooded part of time
Rough mountainous land.	Uplands	None	Very shallow over bedrock; steep slopes.	Steep slopes
Salonie silt loam	Valley bottoms	Moderate	Silty soil under ash is slightly sticky when wet.	Ash is stable; soil under ash moderately stable when wet.
Saltery peat	Valley bottoms and upland depressions.	Low	Water table high	Peat throughout; water table always high.
Sea cliffs	Uplands	Low	Soil stony and shallow; steep slopes.	Steep slopes
Sharatin silt loam	Valley terraces	High to moderate.	Silty soil under ash liquefies at comparatively low moisture level.	Ash is stable; soil under ash is unstable when wet.
Ugak silt loam	Uplands	High	Silty soil under ash liquefies at comparatively low moisture level; water table is high.	Silty soil under ash is unstable when wet; water table always high; poorly drained.

Time

All soils in the Northeastern Kodiak Island Area are relatively young. During the glacial period, the entire Area was covered by glacial ice. Soil formation started only after the ice melted. The ice in this Area probably melted somewhat later than the continental ice sheet in the northern part of the United States.

Classification and Morphology of Soils

Soils are classified into categories that are progressively more inclusive. The lowest categories commonly used in the field—series, type, and phase—are discussed in the section Soil Survey Methods and Definitions. The higher categories of classification are used mainly by soil scientists. Among these are great soil groups (*3*). Each great soil group contains soils having common characteristics that developed as a result of environmental influences. The eleven soil series identified in the Area have been placed in seven great soil groups.

The upper part of the soils in the Northeastern Kodiak Island Area consists of recently deposited volcanic ash, normally from 9 to 12 inches thick. Because of this layer of ash, the soils were formerly classed as Regosols (*13*). In this soil survey report, however, the soils have been grouped according to characteristics of the buried soil. An exception is the Kizhuyak series, which is made up of accumulations of ash more than 24 inches thick.

affecting engineering work

Highway construction—Continued		Soil and moisture conservation	
Suitability as source of—			
Topsoil	Sand and gravel	Drainage	Stock ponds
Not suitable	Sand or fine gravel is beneath ash.	Not needed	Permeable throughout.
Not suitable	Gravel. Parts are under water each day.	Not applicable	Not applicable.
Mixture of ash and silty soil is good.	Gravelly substratum at depths of 24 to more than 50 inches.	Gravelly substratum at depths of 24 to more than 50 inches.	Permeable substratum at depths of 24 to 50 inches.
Not suitable	None available	Soil occurs in shallow depressions.	Soil permeable throughout.
Mixture of ash and silty soil is good.	Substratum is stony	Substratum is stony	Substratum is stony.
Mixture of ash and silty soil is good.	Substratum is gravelly; always below water table.	Gravelly substratum at depths 24 to more than 50 inches. Soil is in shallow depressions.	Poorly drained.
Layer of silty soil is very thin.	Gravelly substratum at depths of 9 to 24 inches.	Gravelly substratum at depths of 9 to 24 inches.	Permeable substratum; at depths of 9 to 24 inches.
Soil is stony and shallow	Stony; shallow over bedrock	Not needed	Steep slopes.
Coarse, not suitable	Gravel; flooded part of time	Not applicable	Not applicable.
Very shallow soil	None available	Not applicable	Not applicable.
Mixture of ash and silty soil is good.	Gravelly substratum is 14 to 30 inches below surface.	Gravelly substratum is 14 to 30 inches below surface.	Substratum is permeable.
Suitable when mixed with mineral soil.	None available	Occurs in depressions	Poorly drained.
Soil stony and shallow	Variable	Not applicable	Not applicable.
Mixture of ash and silty soil is good.	Gravelly substratum at depths of 30 to 42 inches.	Gravelly substratum at depths of 30 to 42 inches.	Permeable substratum at depths of 30 to 42 inches.
Mixture of ash and silty soil is good.	Stony substratum always below water table.	Stony substratum	Poorly drained; stony substratum.

The soil series of the Northeastern Kodiak Island Area are classified into the following great soil groups:

Great soil group	*Soil series*
Ando soils	Kodiak
	Sharatin
	Pyramid (also partly Lithosol)
Alluvial soils	Salonie
	Kalsin
	Pasagshak
Regosols	Kizhuyak
	Chiniak
Bog	Saltery
Half-Bog	Olds
Humic Gley	Ugak (also partly Ando)
Lithosol	Pyramid (also partly Ando)

The characteristics of the soils in each great soil group are discussed on the following pages.

Ando soils

The soils in this great soil group have thick, dark surface horizons and normally no horizon of clay accumulation. Typically, these soils are very high in organic matter, and they have a very low base saturation. This great soil group is used tentatively in this report. Several soils in the group have been described previously as "Tundra without permafrost" (*13*).

The soils of the Kodiak, Sharatin, and Pyramid series are in the Ando group. The Pyramid soils have characteristics of both the Ando and the Lithosol groups.

KODIAK SERIES

A typical profile of Kodiak silt loam observed in the northern part of the Area on hilly upland along the

TABLE 7.—*Particle-size distribution and organic carbon in a typical profile of Kodiak silt loam* [1]

Horizon	Depth	Organic carbon	Size classes						
			Very coarse sand (2 to 1 mm.)	Coarse sand (1 to 0.5 mm.)	Medium sand (0.5 to 0.25 mm.)	Fine sand (0.25 to 0.1 mm.)	Very fine sand (0.1 to 0.05 mm.)	Silt (0.05 to 0.002 mm.)	Clay (less than 0.002 mm.)
	Inches	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*
C_1	0 to 2	1. 35	0. 2	0. 3	1. 3	18. 0	18. 0	60. 9	1. 3
C_2	2 to 6	. 55	----------	. 6	4. 9	23. 1	11. 7	56. 8	2. 9
C_3	6 to 8	. 34	----------	2. 2	17. 1	47. 4	5. 1	26. 2	2. 0
C_4	8 to 11	. 27	----------	6. 1	26. 4	51. 4	3. 1	11. 4	1. 6
A_{1b}	11 to 15	23+	. 5	2. 6	3. 0	9. 4	15. 4	63. 8	5. 3
A_{31b}	15 to 23	12+	. 1	. 2	1. 0	15. 3	25. 4	57. 3	. 7
C–D [2]	27+	3. 01	20. 5	8. 7	3. 8	10. 5	12. 4	37. 1	7. 0

[1] Analyses by Soil Survey Laboratory, Soil Conservation Service, Lincoln, Nebr.

[2] Material coarser than 2 millimeters (36.6 percent of whole sample) removed before analyses.

Anton Larsen Bay Road is described as follows. It consists of volcanic ash overlying a buried Ando soil.

A_{00} 4 to 1 inch, litter of straw and alder leaves.

A_0 1 to 0 inch, dark-brown (10YR 3/3) mat of partly decomposed organic materials; abrupt, smooth boundary; pH 4.3.

C_1 0 to 2 inches, volcanic ash consisting of light-gray (10YR 7/1) coarse silt loam; very weak, thin, platy structure; firm in place but friable when disturbed; few fine roots; abrupt, smooth boundary; pH 4.5.

C_2 2 to 6 inches, volcanic ash consisting of light yellowish-brown (10YR 6/4) coarse silt loam; massive; firm in place but friable when disturbed; few roots; abrupt, smooth boundary; pH 4.8.

C_3 6 to 8 inches, volcanic ash consisting of light yellowish-brown (10YR 6/4) loamy fine sand; loose in place; few roots; clear, wavy boundary; pH 5.1.

C_4 8 to 11 inches, volcanic ash consisting of grayish-brown (10YR 5/2) fine sand; loose in place; few roots; abrupt, smooth boundary; pH 5.3.

A_{1b} 11 to 15 inches, dark reddish-brown (5YR 2/2) silt loam; weak, fine, subangular blocky structure; friable; streak of dark grayish-brown (10YR 4/2) silt loam in center of horizon; many roots; abrupt, wavy boundary; pH 4.3.

A_{31b} 15 to 23 inches, dark reddish-brown (5YR 3/3) silt loam; weak to moderate, medium, subangular blocky structure; friable in place, but gives up moisture and becomes slick and sticky when worked; sticky when wet; streaks of brown (7.5YR 4/2) silt loam throughout horizon; fewer roots than in horizon above; gradual boundary; pH 4.7.

A_{32b} 23 to 27 inches, brown (7.5YR 4/2) gravelly silt loam; many angular fragments; abrupt, wavy boundary.

C–D 27 inches +, olive (5Y 4/3) gravelly sandy loam mottled with reddish brown; pH 4.8.

The Kodiak soils are underlain by weathered slate, graywacke, and hard granitic rock, or by glacial till derived from these rocks. Except for the recently deposited ash, the soil probably has formed from the weathered underlying parent material that was mixed with ash that fell before 1912.

The upper two layers of ash are silt loam in texture, but most of the silt approaches the size of very fine sand. The lower layers of ash are much coarser. The buried soil, especially the buried surface horizon, is very high in organic matter.

The vegetation is mainly grass—bluejoint and tufted hair-grass—mixed with fireweed, horsetail, and other forbs. Large patches of shrubs, mainly mountain alder, are common. Several areas are covered by forests of Sitka spruce. The soil under forest differs from soil under grass (the typical profile) only in that the surface litter consists of needles, twigs, and cones of spruce instead of straw and leaves of shrubs.

Particle-size and organic-carbon analyses of most layers in the typical profile of Kodiak silt loam are shown in table 7.

A Kodiak soil profile from the uplands between Middle Bay and Kalsin Bay, sampled by Kellogg and Nygard (*13*), had the chemical analyses shown in table 8. Evidently the volcanic ash had been disturbed at this site, and all ash layers were combined into one sample. Although the cation-exchange capacity of the buried soil is high, hydrogen makes up most of the adsorbed cations, and the base saturation is very low. These properties account for the strong acidity of the soil, and, in part, for its low natural fertility. The volcanic ash is less acid, but its exchange capacity is extremely low. This is typical of all layers of ash, according to the analyses of other soils not presented here (*13*).

The volcanic ash that covers soils in the Northeastern Kodiak Island Area was analyzed by Fulmer (*8*). It is not known which layer or layers were analyzed. The low

TABLE 8.—*Chemical analyses of Kodiak soil from uplands between Middle Bay and Kalsin Bay*

Horizon	Depth	pH	Exchangeable cations (meq. per 100 grams of soil)						Base saturation
			H	Ca	Mg	K	Mn	Sum	
	Inches								*Percent*
Ash	0–10	5. 8	1. 4	0. 2	0. 2	0. 2	0. 01	2. 0	30
A_{1b}	10–15	4. 9	95. 5	3. 5	1. 8	1. 2	. 08	102. 0	6
B_{2b} [1]	15–20	5. 1	106. 6	1. 7	. 8	1. 2	. 01	110. 3	3
B_{3b} [1]	20–26	5. 4	50. 1	. 3	. 6	. 9	. 04	51. 9	4
C_b	26+	5. 3	91. 4	. 9	. 6	1. 1	. 02	94. 0	3

[1] These horizons would now be considered A_{31} and A_{32}, respectively.

content of plant nutrients, except potassium, is evident. The ash added very little fertility to the soil that was covered. It is highly magnetic. The results of the chemical analyses follow.

Component	*Percent*
Loss on ignition	0.65
SiO_2	72.16
Fe_2O_3	2.85
MnO	.41
TiO_2	Trace
Al_2O_3	13.25
CaO	3.80
MgO	.47
Na_2O	3.86
K_2O	2.48
SO_3	.20
P_2O_5	.36
Total	100.49

SHARATIN SERIES

The Sharatin soils occur on terraces above the alluvial plains and, in a few places, on sloping alluvial fans. A description of a typical profile of Sharatin silt loam on a low terrace south of Anton Larsen Bay follows.

A_{00} 2 to 0 inch, mat of grass roots, straw, and some moss; pH 4.8.

C_1 0 to 1 inch, volcanic ash consisting of light yellowish-brown (10YR 6/4) coarse silt loam; massive; firm in place; few roots; abrupt, smooth boundary.

C_2 1 to 7 inches, volcanic ash consisting of pale-brown (10YR 6/3) loamy fine sand mottled with yellowish red; apparently some mixing since deposition; loose in place; few roots; abrupt, wavy boundary; pH 5.2.

A_{11b} 7 to 10 inches, dark reddish-brown (5YR 3/2) silt loam streaked with very dark grayish brown; weak, fine, subangular blocky structure; friable; roots plentiful; gradual boundary; pH 4.8.

A_{12b} 10 to 13 inches, dark olive-gray (5Y 3/2) silt loam; weak, fine, subangular blocky structure; friable; fewer roots than in horizon above; irregular, thin discontinuous streak of dark yellowish brown in lower part of horizon; abrupt, irregular boundary; pH 5.1.

A_{3b} 13 to 16 inches, dark reddish-brown (5YR 3/4 and 5YR 3/2) silt loam; moderate, medium, subangular blocky structure; sticky when wet but friable when moist; few roots; clear boundary; pH 5.4.

C_{1b} 16 to 20 inches, mixed dark reddish-brown (5YR 3/4) and dark yellowish-brown (10YR 4/4) silt loam; colors occur as large patches; very weak, medium, subangular blocky structure; sticky when wet, friable when moist; few roots; clear, wavy boundary; pH 5.6.

C_{2b} 20 to 25 inches, dark reddish-brown (5YR 3/4) silt loam streaked with darker red and lighter yellowish brown; moderate, medium, subangular blocky structure; friable; few roots; abrupt, wavy boundary; pH 5.4.

D 25 to 36 inches +, coarse sand and gravel glacial outwash material; pH 5.0.

This soil differs from soils of the Kodiak series primarily in having a substratum of coarse sand and gravel rather than weathered rock. The native vegetation is much like that on the Kodiak soils.

PYRAMID SERIES

The Pyramid soils occupy very steep slopes of ridges and mountains. They have properties both of the Ando and of the Lithosol great soil groups. Much of the volcanic ash has washed away, and the buried soil is shallow and gravelly throughout. However, the colors and sequence of horizons are typical of Ando soils. A description of a typical Pyramid soil on a steep ridge adjacent to the Pasagshak Bay Road follows.

A_{00} 4 to 1½ inches, litter, mostly straw.

A_0 1½ to 0 inch, very dark grayish-brown (10YR 3/2) mat of partly decomposed leaves; many roots; abrupt, smooth boundary; pH 4.7.

C_1 0 to 4 inches, volcanic ash consisting of light brownish-gray (10YR 6/2) loamy fine sand; mottles of dark brown, especially in lower part of horizon; loose in place; few roots; abrupt, smooth boundary; pH 5.1.

A_{1b} 4 to 11 inches, dark reddish-brown (5YR 3/2), angular cobbly silt loam; upper one-half inch somewhat darker; weak, fine, granular structure; friable; roots plentiful; clear, wavy boundary; pH 4.4.

A_{3b}–C_b 11 to 20 inches +, dark reddish-brown (5YR 3/4), very cobbly silt loam grading to weathered parent rock; pH 4.9.

The parent material of Pyramid soils is mostly weathered slate and graywacke. The vegetation on the Pyramid soils is identical with that on Kodiak soils.

Alluvial soils

This group of soils is developing in material that has washed from higher areas and was deposited fairly recently by streams on flood plains. Little or no alteration of the alluvium has occurred through soil-forming processes. In this group are soils of the Salonie, Kalsin, and Pasagshak series.

SALONIE SERIES

The Salonie soils are typical Alluvial soils. Many areas of these soils are flooded part of the time. The surface layer is volcanic ash. Under it is a layer of silty alluvium from 4 to 15 inches thick. This layer was deposited over glacial outwash consisting of coarse sand and gravel. Normally, just beneath the ash is a thin, highly organic layer that was the former surface layer of the buried soil. A description of a typical profile of Salonie silt loam in the valley south of Middle Bay follows.

A_0 2½ to 0 inch, dark reddish-brown (5YR 2/2) mat of grass roots and partly decomposed organic material; contains a thin layer of coarse silt loam, evidently deposited during stream overflow; abrupt, smooth boundary; pH 5.1.

C_1 0 to 1½ inches, volcanic ash consisting of light-gray (10YR 7/1) coarse silt loam; massive; firm in place but friable when disturbed; few roots; abrupt, smooth boundary; pH 5.2.

C_2 1½ to 4 inches, volcanic ash consisting of light yellowish-brown (10YR 6/4) coarse silt loam; massive; firm in place but friable when disturbed; abrupt, smooth boundary; pH 5.5.

C_3 4 to 7 inches, volcanic ash consisting of light yellowish-brown (10YR 6/4) loamy fine sand; mottles of yellowish red, mainly around root channels; loose in place; few roots; clear, wavy boundary; pH 5.4.

C_4 7 to 10 inches, volcanic ash consisting of grayish-brown (10YR 5/2) fine sand mottled with yellowish red; loose in place; few roots; abrupt, smooth boundary; pH 5.4.

A_{1b} 10 to 10½ inches, dark reddish-brown (5YR 2/2) silt loam; very high in organic matter; friable; many roots; abrupt, smooth boundary; pH 5.3.

CG_b 10½ to 19 inches, dark-gray (5Y 4/1) silt loam; massive in place, but breaks into very fine, subangular blocky fragments; friable when moist, slightly sticky when wet; roots plentiful; abrupt, smooth boundary; pH 4.7.

D 19 to 31 inches +, black (5Y 2/1) gravelly very coarse sand; pH 5.1.

The vegetation on Salonie soils in most places is tall grass that is dominantly bluejoint and tufted hair-grass. It is mixed with fireweed, horsetail, and other forbs. Some places are covered by forests of balsam poplar and willow.

A particle-size analysis of the CG_b layer in this representative Salonie silt loam profile shows that it contains 20.0 percent clay and 73.2 percent silt. The rest is mainly very fine sand. The layer contains 2.33 percent organic carbon.

Layers in the volcanic ash in the Salonie soils have the same texture as comparable layers in the Kodiak soils. The Salonie soils are very low in natural fertility. They are less acid than the Kodiak soils.

KALSIN SOILS

The Kalsin soils are similar to the Salonie soils except that the main part of the buried profile—the layer of silty alluvium—is thicker. Lenses of fine or very fine sandy loam are common in or below the silty layer. The underlying material in the Kalsin soils is coarse glacial outwash. A description of a typical profile of Kalsin silt loam in the valley south of Kalsin Bay follows.

A_0–A_1 1 to 0 inch, dark-brown (10YR 3/3), thin mat of roots underlain by mixture of roots and silty mineral material that has very fine granular structure; friable; abrupt, smooth boundary; pH 5.1.

C_1 0 to 1½ inches, volcanic ash consisting of light-gray (10YR 7/1) coarse silt loam; massive structure; firm in place; few roots; abrupt, wavy boundary; pH 5.2.

C_2 1½ to 5 inches, volcanic ash consisting of light yellowish-brown (10YR 6/4) coarse silt loam; massive; firm in place; few roots; abrupt, wavy boundary; pH 5.2.

C_3 5 to 8 inches, volcanic ash consisting of light yellowish-brown (10YR 6/4) loamy fine sand mottled with yellowish red; loose in place; few roots; clear, wavy boundary; pH 5.3.

C_4 8 to 11 inches, volcanic ash consisting of grayish-brown (10YR 5/2) fine sand mottled with yellowish red; loose in place; few roots; abrupt, wavy boundary; pH 5.1.

C_{1b} 11 to 25 inches, very dark grayish-brown (2.5Y 3/2) fine silt loam; weak, medium, subangular blocky structure; friable when moist, sticky when wet; few roots; abrupt, wavy boundary; pH 4.8.

C_{2b} 25 to 31 inches, very dark grayish-brown (2.5Y 3/2) very fine sandy loam; structureless; friable when moist; few roots; abrupt, wavy boundary; pH 5.2.

D 31 inches +, coarse sand and gravel.

In physical and chemical properties, the Kalsin soils are similar to the Salonie soils. However, the Kalsin soils usually stay wet a few days longer in the spring. Vegetation on the Kalsin soils is identical with that on Salonie soils.

PASAGSHAK SERIES

The Pasagshak soils occur on sloping alluvial fans; on long, narrow strips adjacent to streams; and in broad areas near the heads of bays. The layer of silty alluvium between the overlying volcanic ash and the underlying sand and gravel is normally only about 2 inches thick. It is never more than 4 inches thick. Except in thickness of this silty layer, Pasagshak soils resemble the Kalsin and Salonie soils. A typical profile of Pasagshak silt loam at the head of Anton Larsen Bay follows.

A_0 1 to 0 inch, mat of very dark grayish-brown (10YR 3/2), partly decayed leaves and straw; abrupt, smooth boundary; pH 4.9.

C_1 0 to 2 inches, volcanic ash consisting of light-gray (10YR 7/1) coarse silt loam; massive; firm in place but friable when disturbed; few roots; abrupt, wavy boundary; pH 5.2.

C_2 2 to 4 inches, volcanic ash consisting of light yellowish-brown (10YR 6/4) coarse silt loam; massive; firm in place but friable when disturbed; few roots; abrupt, wavy boundary; pH 4.9.

C_3 4 to 5 inches, volcanic ash consisting of light yellowish-brown (10YR 6/4) loamy fine sand mottled with yellowish red; loose in place; few roots; clear, wavy boundary; pH 5.0.

C_4 5 to 8 inches, volcanic ash consisting of grayish-brown (10YR 5/2) fine sand mottled with yellowish red; loose in place; few roots; abrupt, wavy boundary; pH 5.4.

A_b 8 to 10 inches, very dark-gray (5Y 3/1) silt loam faintly mottled with very dark grayish brown; weak, very fine, subangular blocky structure; friable when moist; roots abundant; abrupt, wavy boundary; pH 4.6.

D 10 to 24 inches, very dark grayish-brown (2.5Y 3/2) very gravelly silt loam; not sticky when wet; few roots; pH 5.2.

The vegetation on Pasagshak soils is mainly forests of balsam poplar and willow. Tall grass and forbs, similar to those on the Salonie and Kalsin soils, are also common. Some of the Pasagshak soils are subject to flooding, but the rapidly moving waters deposit very little silt.

Regosols

Soils in this great soil group consist of deep, unconsolidated mineral deposits in which few or no clearly expressed soil characteristics have been developed. The soils of the Kizhuyak and Chiniak series are in this group.

KIZHUYAK SERIES

The Kizhuyak soils consist of thick accumulations of volcanic ash. A litter of organic material has formed on the surface, but these soils are otherwise unmodified by soil-forming factors. They occupy poorly drained places filled with volcanic ash that washed from the hills shortly after the ash fall. In places, however, these soils occur as narrow, well-drained levees along streams. The sequence of layers in the profile varies from place to place. A description of a typical profile of Kizhuyak loamy fine sand in a poorly drained position near the head of Middle Bay follows.

A_0 1 to 0 inch, dark-brown (7.5YR 3/2) mat of roots and straw; few mycelia; abrupt, smooth boundary; pH 4.7.

C_1 0 to 4 inches, pale-brown (10YR 6/3) loamy fine sand mottled with yellowish red; loose in place; few roots; abrupt, wavy boundary; pH 5.4.

C_2 4 to 27 inches, alternating layers, usually less than 1 inch thick, of grayish-brown (10YR 5/2) coarse silt loam and light-gray (10YR 7/2) loamy fine sand; thin streaks of yellowish red along the few root channels; a few thin layers of organic material; the silt loam layers are massive and firm, and the loamy fine sand layers are loose; abrupt, wavy boundary; pH 5.3.

C_3 27 to 40 inches +, light yellowish-brown (10YR 6/4) coarse silt loam with a few streaks of light gray; massive; firm in place; no roots; pH 5.2.

The water table is commonly within 2 feet of the surface in these poorly drained profiles, but it is many feet deep on the levees. The vegetation on the poorly drained areas consists mostly of sedge, grass, and willow; the vegetation on the levees is commonly like that on the Alluvial soils. Natural fertility and the supply of organic matter are very low.

CHINIAK SERIES

Soils of the Chiniak series consist of volcanic ash underlain by a deep deposit of fine gravelly or coarse sandy, beach dune material. In places a thin, weakly developed surface horizon had formed in the dune material before the ash fall. In other places a surface horizon is not

evident. A description of a typical profile of Chiniak silt loam on the shore of Kalsin Bay follows.

A_0 2½ to 0 inch, dark-brown (10YR 3/3) mat of roots and partly decayed organic material; sprinkling of grains of volcanic ash; abrupt, smooth boundary; pH 5.3.
C_1 0 to 5 inches, volcanic ash consisting of light yellowish-brown (10YR 6/4) coarse silt loam; massive; firm in place but friable when disturbed; few roots; abrupt, wavy boundary; pH 5.3.
C_2 5 to 7 inches, volcanic ash consisting of light yellowish-brown (10YR 6/4) loamy fine sand; loose in place; few roots; clear, wavy boundary; pH 5.0.
C_3 7 to 10 inches, volcanic ash consisting of grayish-brown (10YR 5/2) fine sand; loose in place; few roots; abrupt, wavy boundary; pH 5.4.
A_b 10 to 13 inches, dark reddish-brown (5YR 3/3) gravelly loam; weak, fine, granular structure; friable; few roots; clear, wavy boundary; pH 4.8.
C_b 13 to 28 inches +, fine gravel, mostly slate fragments; pH 5.1.

The Chiniak soils are very low in fertility. The water table is many feet deep. The tall-grass vegetation on these soils differs from that on most other soils in that beach ryegrass is an important component.

Bog soils

This great soil group consists of peat or muck soils that have developed from swamp or marsh vegetation. The Saltery series is in this group.

SALTERY SERIES

Soils of the Saltery series consist mainly of undecomposed sedge and grass. They have developed where the water table is always at or near the surface. They occur along the coast in a complex with the Chiniak soils. They also occur in low areas back of the coastal dunes and in a complex with the Ugak series in poorly drained upland. The original peat was covered by volcanic ash, but a new layer of peat is forming over the ash. A description of a typical profile of Saltery peat in a lowland near the head of Middle Bay follows.

A_0 4 to 0 inch, dark-brown (10YR 4/3) fibrous peat; abrupt, smooth boundary; pH 4.6.
C_1 0 to 8 inches, volcanic ash consisting of light brownish-gray (10YR 6/2) coarse silt loam; massive; firm when moist, not sticky when wet; few roots; abrupt, smooth boundary; pH 3.7.
C_2 8 to 12 inches, volcanic ash consisting of gray (N 6/0) fine sand; loose in place; few roots; abrupt, smooth boundary; pH 3.7.
A_{0b} 12 to 30 inches +, very dark grayish-brown (10YR 3/2) fibrous peat; much fine gravel in upper few inches; pH 4.4.

The vegetation on Saltery peat is a thin stand of sedge, grass, and some forbs.

Half-Bog soils

This great soil group consists of poorly drained soils having a mucky or peaty surface horizon and a gray mineral subsoil. The soils of the Olds series are in this group.

OLDS SERIES

The Olds soils consist of volcanic ash that has been deposited over a former surface horizon of peat. Under the peat is a dark-gray subsoil, which is nearly always below the water table. The subsoil texture is normally much finer than that of the silty Alluvial soils. It contains lenses of coarse sand and, in places, layers of peat.

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A description of a typical profile of Olds silt loam near the head of Kalsin Bay follows.

A_0 2 to 0 inch, very dark-brown (10YR 2/2) mat of roots and straw; abrupt, smooth boundary; pH 5.0.
C_1 0 to 4 inches, volcanic ash consisting of light yellowish-brown (10YR 6/4) coarse silt loam streaked with light gray; massive; firm in place; few roots; abrupt, wavy boundary; pH 4.9.
C_2 4 to 9 inches, volcanic ash consisting of light-gray (10YR 7/2) loamy fine sand mottled with yellowish red; loose in place; few roots; abrupt, smooth boundary; pH 5.4.
A_{0b} 9 to 14 inches, dark-brown (10YR 3/3) fibrous peat, slightly darker in the upper one-half inch; contains a layer of coarse sand, less than 1 inch thick, near bottom of horizon; clear, wavy boundary; pH 4.9.
C_b 14 to 32 inches, dark-gray (5Y 4/1) silty clay loam with thin layers of very dark gray (5Y 3/1) coarse sand; massive; many dead roots; pH 4.7.
D 32 inches +, coarse sand and gravel.

The vegetation on Olds soils consists of sedge, grass, and willow. A thin layer of moss is on the surface of the soil in many places. The water table is always high, and the soil is under water part of the time. Constant saturation causes a grayish and, in many places, a bluish color in the subsoil.

Humic Gley soils

In this great soil group are the poorly drained soils with moderately thick, dark-colored, organic mineral surface horizons underlain by gray or mottled mineral subsoils. The soils of the Ugak series are in this group. The Ugak soils have many characteristics of the Humic Gley group, but they also have some characteristics of the Ando group.

UGAK SERIES

The Ugak soils occur on poorly drained upland in association with Saltery peat. Under the surface layer of volcanic ash is a very dark former surface horizon and a dark reddish-brown subsoil. The underlying material is commonly stony glacial till. Although very wet, the profile beneath the surface soil resembles that of the Ando soils. A description of a typical profile of Ugak silt loam in a long, gently sloping, poorly drained area in the hills east of Kalsin Bay follows.

A_0 1½ to 0 inch, dark-brown (7.5YR 3/2) mat of partly decayed organic material; abrupt, smooth boundary.
C_1 0 to 6 inches, volcanic ash consisting of light yellowish-brown (10YR 6/4) coarse silt loam; mottles of yellowish red and a few streaks of light gray; massive; firm in place; few roots; pH 5.5.
C_2 6 to 10 inches, volcanic ash consisting of light brownish-gray (10YR 6/2) loamy fine sand mottled with yellowish red; loose in place; few roots; abrupt, smooth boundary; pH 5.3.
A_{0b} 10 to 11 inches, dark-brown (10YR 3/3) peaty mat of roots and leaves; abrupt, smooth boundary; pH 4.8.
A_{1b} 11 to 15 inches, black (10YR 2/1) silt loam; too wet to observe structure; nonsticky; many roots; few rock fragments; pH 5.1.
A_{3b} 15 to 19 inches, dark-brown (10YR 3/3) silt loam containing angular rock fragments; slightly sticky when wet; pH 5.7.
C 19 to 32 inches +, olive (5Y 4/3) silt loam streaked with dark brown and black; slightly sticky; pH 5.5.

The vegetation on Ugak soils is sedge, grass, mountain alder, birch, and other shrubs. In places in the north, Sitka spruce covers these soils. The water table generally is less than 18 inches below the surface. Under these perennially wet conditions, a highly organic surface soil,

now buried by ash, has developed. The sequence of horizons, however, is very similar to that in the Kodiak soils.

Lithosols

Soils in this great soil group do not have well-developed horizons, and they consist mainly of fragments of rock. The Pyramid soils have some of the characteristics of this group. A typical profile of a Pyramid soil was described under Ando soils because the Pyramid soils also have characteristics of these soils.

Lithosols occur in most of the areas mapped as Rough mountainous land or Sea cliffs. Vegetation on these soils consists mostly of shrubs, sparse grass, and, at higher elevations, moss.

Vegetation

Except for land occupied by the city of Kodiak and small tracts owned privately, all the Northeastern Kodiak Island Area is owned by the United States Government. Most of the Area is administered by the Department of the Interior, Bureau of Land Management. Federal land on Kodiak Island was opened to grazing by the Alaska Grazing Act of 1927, which enables ranchers to lease large acreages of forage-producing land for grazing.

Most of the Area is covered by grasses or shrubs. In the north, especially on Spruce Cape and Cape Chiniak, dense forests of Sitka spruce cover the soil. Poplar and willow are common on bottom lands. Many places have been grazed and cultivated, but most of the vegetation is essentially in the climax stage of development. Extensive cutting of trees and grazing on the level soils along the coast has caused some change in the vegetation from the climax types.

The vegetation was surveyed to provide information for the proper management of Federal land. Close coordination of recreation and the production of livestock, water, timber, and wildlife is essential for the welfare of people who depend on the soil for their income. The survey will help in the administration of grazing leases, as it provides basic data on the suitability and potential of the native vegetation for livestock.

Survey Method

Plant scientists walked over the land and examined the species of plants that grew. On aerial photographs or suitable maps, they delineated the predominant types of vegetation (range) in the Area. Eleven major types of vegetation (range) were mapped on the Northeastern Kodiak Island Area as follows:

Map Symbol	*Type of vegetation (range)*
1T	Grassland (tall grass).
2D	Meadow (dry).
2W	Meadow (wet).
3	Perennial forbs (weeds).
5	Browse (shrubs).
6	Conifers (evergreen trees).
7L	Wasteland or land not accesible to livestock because of steepness or similar barriers.
7B	Not accessible to livestock because of dense brush.
7T	Not accessible to livestock because of dense timber.
8	Barren land (no vegetation).
10	Broadleaf trees (deciduous trees).

Each vegetation type was sampled for the purpose of checking visual estimations on kinds of plants and volume, or abundance, of growth. At least three samples were taken on each type of vegetation, and, except where a particular vegetation type was especially uniform, at least ten samples were taken for each 640 acres. A metal hoop, 3.5 feet in diameter, measuring 9.6 square feet, was used in sampling. The volume of vegetation circled by the metal hoop was estimated, and occasionally clipped and weighed. In weighing, each group of a particular species or genera of plants was weighed and recorded separately. Separate weighing and recording were used because each plant species has a different forage value, which is determined by livestock preference, food value, and resistance to grazing. The sample plots were selected at random so as to eliminate the element of choice. Most commonly, a number of paces (for example, 10 paces) were counted, while walking through the area, and the hoop was thrown down on the last step.

At intervals of 2 weeks, or at shorter intervals if it was necessary, samples of plants were collected, weighed, dried, and the percentage of dry matter in them computed. The weight of usable forage was determined by multiplying the plants green weight by the percentage of dry matter and then multiplying the product by the percentage of the plant that is consumed when grazed the proper amount (proper use percentage, table 9). The weight of properly grazed, usable forage available from 1 acre divided by the weight of dry forage needed per animal-unit month (800 pounds) gives the acreage required to provide forage for an animal unit for a month of grazing.

All plants identified in the Northeastern Kodiak Island Area, their symbols, and proper use percentages are listed in table 9.

TABLE 9.—*Plants identified in the Northeastern Kodiak Island Area, their symbols, and proper use percentages* [1]

GRASSES AND GRASSLIKE PLANTS

Symbol	Scientific name	Common name	Proper use [2] (spring, summer, and fall)	
			Cattle and horses	Sheep and goats
			Percent	*Percent*
AGR	*Agropyron* spp.	Wheatgrass	40	20
AGS	*Agrostis* spp.	Redtop	40	30
CAL	*Calamagrostis* spp.[3]	Bluejoint	20	20
CAR	*Carex* spp. (tall)[3]	Sedges (meadow)	60	50
DES	*Deschampsia* spp.[3]	Tufted hair-grass	40	20
Emo	*Elymus mollis*	Beach ryegrass	40	20
ERI	*Eriophorum* spp.	Cottongrass	40	10
FES	*Festuca* spp.	Fescue	40	40
Hod	*Hierochloe odorata*	Sweetgrass	30	20
HOR	*Hordeum* spp.	Wild barley	20	10
JUN	*Juncus* spp.[3]	Rush	20	10
Par	*Phalaris arundinacea*	Reed canarygrass	50	20
Pal	*Phleum alpinum*	Alpine timothy	60	30
Ppe	*Phleum pratense*	Common timothy	50	30
POA	*Poa* spp.	Bluegrass	40	20
SCI	*Scirpus* spp.	Bulrush	10	10
Tma	*Triglochin maritima*	Arrowgrass (poison)	[4]	[4]
Tsp	*Trisetum spicatum*	Trisetum	30	20

See footnotes at end of table.

TABLE 9.—*Plants identified in the Northeastern Kodiak Island Area, their symbols, and proper use percentages* [1]—Continued

Symbol	Scientific Name	Common Name	Proper use [2] (spring, summer, and fall)	
			Cattle and horses	Sheep and goats
		FORBS		
			Percent	*Percent*
ACH	*Achillea* spp.[3]	Yarrow	10	20
ACO	*Aconitum* spp.	Monkshood (poison)	(4)	(4)
Agn	*Angelica genuflexa* [3]	Angelica	40	60
ANN	Annuals	Annual plants	10	20
Ape	*Arenaria peploides*	Sea beach sandwort	20	20
Cpd	*Castilleja pallida*	Yellow paintbrush	10	20
Coc	*Cicuta occidentalis*	Waterhemlock (poison).	PO.	PO.
EPI	*Epilobium* spp.[3]	Fireweed	20	40
EQU	*Equisetum* spp.[3]	Horsetail	10	10
FER	Ferns	Ferns	0	0
GER	*Geranium* spp.	Geranium	20	40
Hln	*Heracleum lanatum* [3]	Cowparsnip	50	60
Ise	*Iris setosa*	Wild iris, flag	0	0
Lma	*Lathyrus maritimus* [3]	Beach pea	50	50
Lpa	*Lathyrus palustris*	Marsh pea	50	50
Lhu	*Ligusticum hultenii*	Wildcelery	20	30
LUP	*Lupinus* spp.	Lupine	20	20
Npo	*Nuphar polysepalum*	Yellow pond lily	0	0
Occ	*Osmorhiza occidentalis.*[3]	Sweet-anise or sweetroot.	20	40
POY	*Polemonium* spp.	Jacob's-ladder	10	20
POT	*Potentilla* spp.	Cinquefoil	0	10
Pag	*Pteridium acquilinum pubescens.*	Western bracken fern.	0	0
RAN	*Ranunculus* spp.	Buttercup	10	20
RUM	*Rumex* spp.	Dock	10	20
SAN	*Sanguisorba* spp.	Burnet	10	20
SMI	*Smilacina* spp.	Solomons-seal	0	0
Smu	*Solidago multiradiata.*	Goldenrod	0	0
Tof	*Taraxacum officinale*	Dandelion	50	30
Tal	*Thalictrum alpinum*	Alpine meadowrue	0	10
Tpa	*Trifolium pratense*	Red clover	60	60
TRI	*Trifolium* spp.	Clover	60	60
VER	*Veratrum* spp.	False-hellebore	10	30
VIC	*Vicia* spp.[3]	Vetch	40	40
VIO	*Viola* spp.	Violet	0	0
		SHRUBS AND TREES		
MA	*Alnus* spp.[3]	Mountain alder	10	10
Apo	*Andromeda* polifolia	Bog-rosemary	0	0
Aur	*Arctostaphylos uva-ursi.*	Bearberry	0	0
Ati	*Artemisia tilesii*	Dusty-miller (sagebrush).	0	0
Bna	*Betula nana exilis*	Swamp birch	0	10
BET	*Betula* spp.[3]	All birch	0	10
Cso	*Cornus stolonifera*	Red-osier dogwood	10	20
Eho	*Oplopanax horridus* [3]	Devilsclub	0	0
Eng	*Empetrum nigrum*	Crowberry	0	10
Lde	*Ledum decumbens*	Narrow-leaved Labrador-tea.	0	0
BS	*Picea mariana* [3]	Black spruce	0	0
SP	*Picea sitchensis* [3]	Sitka spruce	0	0
BP	*Populus tacamahaca.*[3]	Balsam poplar	0	0
POT	*Potentilla* spp.	Cinquefoil	10	20
ROS	*Rosa* spp.[3]	Rose	20	40
Rse	*Rubus spectabilis* [3]	Salmonberry	10	20
SAL	*Salix* spp.[3]	Willow	40	40
SAM	*Sambucus* spp.	Elderberry	30	50
Sbe	*Spiraea beauverdiana.*	Beauverd spirea	0	10
Vca	*Vaccinium cespitosum.*	Dwarf blueberry	0	10
Vvi	*Vaccinium vitis-idaea.*	Lowbush cranberry	0	10
Ved	*Viburnum edule* [3]	Highbush cranberry	0	0

[1] Several plants of very limited occurrence are not in this list. All annual forbs are grouped as annuals.

[2] Proper use means utilization of range vegetation to the best advantage. It includes maintaining optimum vigor of forage plants by utilizing them in a way that will encourage the growth of climax (primary) forage and prevent soil and soil nutrients from deteriorating. The percentage figures indicate the estimated part of each plant that can be utilized in order to maintain proper use. The figures on proper use in this table were obtained from the Bureau of Land Management and U.S. Forest Service and are based on information in actual use in Idaho, Montana, and Washington.

[3] Plant is in the climax vegetation.

[4] Poisonous plant. For additional information on this subject see p. 37.

Vegetation Types

Forty-six different plant associations, or vegetation types, were identified on the Northeastern Kodiak Island Area. Most, but not all, types normally occur as a pattern on similar soils or on similar kinds of topography. In general, tall grasses and some forbs, interspersed with forests of poplar and willow, occur on the bottom lands. Tall grasses, forbs, shrubs, and some broadleaf trees dominate on the hillsides, except in the northern part of the Area where forests of Sitka spruce are predominant. The highest parts of hills, which are under snow part of the summer, support only a sparse cover of grass, forbs, and shrubs.

The following list gives the vegetation types (map symbols), the main plants, and the occurrence of each vegetation type. The symbols identifying each type consist of two elements. The symbols preceding the first dash indicate the vegetation type (see list, page 32), and the letters following the first dash indicate the plant or plants dominant in the vegetation (see table 9). Thus, for example, the symbol 1T–CAL–BET means the grassland vegetation type, in which bluejoint and birch are dominant. These symbols are useful shortcuts to those who have learned the system, but they are not an adequate substitute for the description of the vegetation type given here. Large trees, although they may be a conspicuous part of the vegetation type, and noted in the symbol for the type,

may not be considered in the composition of the type, because the leaves are not available to livestock.

1T–CAL: Grass, 45 percent (bluejoint and tufted hair-grass); forbs, 53 percent (fireweed and horsetail); shrubs, 2 percent (salmonberry and rose). This type occurs on well drained and moderately well drained hillside soils mostly of the Kodiak series and on the nearly level valley bottoms and terraces where the Sharatin, Salonie, Chiniak, and Kalsin soils predominate.

1T–CAL–BET: Grass, 30 percent (bluejoint, tufted hair-grass, and beach ryegrass); forbs, 57 percent (fireweed, horsetail, fern, and geranium); shrubs, 13 percent (salmonberry). This type is on well-drained, hilly or steep Kodiak soils.

1T–CAL–BP: Grass, 52 percent (bluejoint, sedge, tufted hair-grass, and bluegrass); forbs, 46 percent (yarrow, angelica, annuals, fireweed, horsetail, fern, sweet-anise, Jacob's-ladder, and burnet); shrubs, 2 percent (balsam poplar, rose, salmonberry, and willow). The balsam poplar tends to die out when flooded by beaver dams or spring runoff. This type is on gently sloping upland Kodiak soils.

1T–CAL–DES: Grass, 60 percent (bluejoint, sedge, tufted hair-grass, beach ryegrass, and sweetgrass); forbs, 40 percent (yarrow, annuals, horsetail, and vetch). The present composition of the cover indicates heavy use in the past. This type is on valley bottoms mapped as the Kalsin and Salonie soils.

1T–CAL–EPI: Grass, 42 percent (bluejoint and tufted hair-grass); forbs, 55 percent (fireweed, annuals, and horsetail); shrubs, 3 percent (salmonberry, elderberry, and mountain alder). This type is on uplands occupied by Kodiak and Pyramid soils and on the nearly level valley bottoms and terraces occupied by the Sharatin, Pasagshak, Salonie, and Chiniak soils.

1T–CAL–MA: Grass, 41 percent (bluejoint and tufted hair-grass); forbs, 46 percent (fireweed and annuals); and shrubs, 13 percent (salmonberry and mountain alder). This type is mostly on steep or hilly Kodiak soils and occasionally on Salonie soils.

1T–CAL–SAL: Grass, 43 percent (bluejoint and tufted hair-grass); forbs, 46 percent (fireweed, horsetail, and annuals); shrubs, 11 percent (willow and salmonberry). This type is mostly on gently sloping or hilly Kodiak soils and occasionally on the poorly drained Kalsin, Pasagshak, and Salonie soils.

1T–DES: Grass, 60 percent (bluejoint, sedge, tufted hair-grass, and bluegrass); forbs, 28 percent (Jacob's-ladder, fireweed, and annuals); shrubs, 12 percent (rose, salmonberry, and willow). This type is a pasture that has had continual use. Originally it probably was 1T–CAL, but repeated trampling has made the site drier. It is on gently sloping Kodiak soils and on the Sharatin soils of valley terraces.

1T–DES–CAL: Grass, 93 percent (bluejoint, sedge, tufted hair-grass, and bluegrass); forbs, 5 percent (yarrow, annuals, horsetail, and Jacob's-ladder); shrubs, 2 percent (willow). Cutting the plants for hay and heavy grazing has packed the soil, which is now wet because of standing water. This type is on poorly drained valley bottoms mapped as the Olds soils.

1T–DES–EPI: Grass, 90 percent (bluejoint, sedge, tufted hair-grass, and beach ryegrass); forbs, 10 percent (yarrow, annuals, fireweed, horsetail, and lupine). This type is on the Sharatin soils on well-drained terraces.

1T–EMO: Grass, 78 percent (beach ryegrass and tufted hair-grass); forbs, 22 percent (annuals and fireweed). This type is on low coastal dunes occupied by the Chiniak soils. It is always near salt water, and occasionally is covered by high waves.

2D–CAL: Grass, 49 percent (bluejoint, sedge, and tufted hair-grass); forbs, 48 percent (fireweed and horsetail); shrubs, 3 percent (willow). Drainage and use are changing this type from wet meadow to the more valuable tall grass. This type is on well-drained, level or gently sloping valley terraces occupied mainly by the Sharatin soils.

2W–CAL: Grass, 69 percent (bluejoint, sedge, and tufted hair-grass); forbs, 27 percent (horsetail and fireweeds); shrubs, 4 percent (willow). This type is flooded by beaver dams or spring runoff to the extent that it is wet most of the time. It is on poorly drained valley bottoms mapped as the Olds and Kizhuyak soils.

2W–CAL–CAR: Grass, 81 percent (bluejoint, sedge, and tufted hair-grass); forbs, 11 percent (horsetail and annuals); shrubs, 8 percent (willow and spruce). Water stands on this area for long periods of time. This type is on poorly drained, high water-table soils of the Kizhuyak series and Saltery peat.

2W–CAL–EPI: Grass, 66 percent (bluejoint, sedge, tufted hair-grass, and bluegrass); forbs, 28 percent (yarrow, annuals, fireweed, horsetail, ferns, and meadowrue); shrubs, 6 percent (willow). This type is on steep to rolling Kodiak soils of the uplands and on alluvial plains occupied by the Pasagshak soils.

2W–CAL–SAL: Grass, 63 percent (bluejoint, tufted hair-grass, and sedge); forbs, 29 percent (horsetail, annuals, and fireweed); shrubs, 8 percent (willow). This type is on valley bottoms and terraces mapped as the Olds, Sharatin, and Kizhuyak soils.

2W–CAR: Grass, 86 percent (sedges, bluejoint, tufted hair-grass, and scattered rushes); forbs, 6 percent (horsetail and annuals); shrubs, 8 percent (willow and occasional birch and spruce). This type is on poorly drained, nearly level valley bottoms occupied by the Olds soils and on upland depressions occupied by the Saltery-Ugak complex.

2W–CAR–CAL: Grass, 79 percent (sedge and bluejoint with lesser amounts of tufted hair-grass, rush, and bluegrass); forbs, 13 percent (horsetail, annuals, cinquefoil, vetch, and lupine); shrubs, 8 percent (willow and a smaller amount of mountain alder). This type is on pastured river bottoms occupied by the Kizhuyak soils.

2W–CAR–EQU: Grass, 83 percent (bluejoint, sedge tufted hair-grass, and cottongrass); forbs, 10 percent (annuals and horsetail); shrubs, 7 percent (willow). This type occupies the poorly drained, very wet Saltery peat soils.

2W–CAR–SAL: Grass, 54 percent (bluejoint, sedge, and tufted hair-grass); forbs, 30 percent (yarrow, an-

nuals, yellow paintbrush, horsetail, and wildcelery); shrubs, 16 percent (willow). This type is in poorly drained upland depressions occupied by the Saltery-Ugak complex.

2W–SAL–CAR: Grass, 47 percent (bluejoint and sedge and scattered redtop, tufted hair-grass, cottongrass, and rush); forbs, 17 percent (horsetail, and small quantities of iris, lupine, Jacob's-ladder, cinquefoil, burnet, and meadowrue); shrubs, 36 percent (mainly willow with birch, narrow-leaved Labrador-tea, lowbush cranberry, and highbush cranberry). This type is in poorly drained, upland depressions mapped as the Saltery-Ugak complex.

3–HLN: Grass, 47 percent (redtop, bluejoint, sedge, tufted hair-grass, beach ryegrass, and meadow barley); forbs, 49 percent (yarrow, angelica, annuals, fireweed, horsetail, geranium, cowparsnip, iris, wildcelery, lupine, sweet-anise, ferns, dock, burnet, false-hellebore, and vetch—all equally represented); shrubs, 4 percent (dusty-miller and salmonberry). This type is only on Long Island, and it has been heavily grazed in the past. It occurs on moderately sloping Kodiak soils.

3–EPI–CAL: Grass, 33 percent (bluejoint and tufted hair-grass with some sedge and bluegrass); forbs, 62 percent (fireweed, horsetail, and annuals associated with many other forbs in smaller amounts); shrubs, 5 percent (salmonberry, rose, and mountain alder, with small amounts of dusty-miller, willow, elderberry, and lowbush cranberry). This type covers the largest acreage. It occurs on hilly or steep uplands occupied by well drained Kodiak soils and on valley bottoms occupied by moderately well drained Kalsin soils (fig. 9).

3–EPI–DES: Grass, 31 percent (bluejoint, tufted hair-grass, sedge, and bluegrass); forbs, 63 percent (fireweed, annuals, yarrow, and horsetail); shrubs, 6 percent (mostly salmonberry and a smaller amount of rose). This type is only on Near, Round, and Gull Islands, and it has been heavily grazed. It occupies Kodiak soils.

***Figure 9.*—A slope covered mainly by fireweed and bluejoint (type 3–EPI-CAL) growing on Kodiak silt loam. Location, west side of Kalsin Bay.**

3–EPI–MA: Grass, 35 percent (bluejoint, tufted hair-grass, redtop, and sedge); forbs, 52 percent (mostly annuals and fireweed, with many others in smaller amounts); shrubs, 13 percent (mainly salmonberry, with lesser amounts of mountain alder, rose, willow, and elderberry). This type is on well-drained, steep or rolling Kodiak and Salonie soils, immediately below places inaccessible to livestock.

3–EPI–SAL: Grass, 35 percent (bluejoint and tufted hair-grass with lesser amounts of redtop and sweetgrass); forbs, 54 percent (annuals, fireweed, burnet, and many other scattered forbs); shrubs, 11 percent (willow and lowbush cranberry). This type is on shallow, moderately well drained to imperfectly drained Pasagshak soils. It occurs occasionally over a fairly high water table.

5–MA–BP: Grass, 28 percent (bluejoint only); forbs, 25 percent (annuals and ferns); shrubs, 47 percent (mountain alder and balsam poplar). This type occupies old stream channels consisting mainly of gravel and sand that were mapped as Pasagshak soils.

5–MA–CAL: Grass, 32 percent (bluejoint, sedge, and tufted hair-grass); forbs, 55 percent (fireweed and ferns with lesser amounts of annuals, sweet-anise, and other forbs); shrubs, 13 percent (mountain alder, salmonberry, rose, and elderberry). This type is associated with the Sitka spruce type. It occurs on hilly, steep uplands and inaccessible places occupied by the Pyramid and Kodiak soils.

5–MA–EPI: Grass, 35 percent (bluejoint, tufted hair-grass, and sedge); forbs, 48 percent (fireweed, annuals, sweet-anise, and fern, with many other forbs); shrubs, 17 percent (salmonberry, mountain alder, elderberry, and rose). This is one of the dominant types of vegetation, especially on steep slopes and inaccessible places having gradients of 45 percent or more mapped as Kodiak soils (fig. 10).

5–SAL–BET: Grass, 28 percent (redtop, bluejoint, tufted hair-grass, fescue, sedge, and cottongrass); forbs, 39 percent (yarrow, angelica, annuals, horsetail, fern, geranium, lupine, sweet-anise, burnet, gold-

***Figure 10.*—Vegetation consisting mainly of alder in the overstory and a fireweed ground cover (type 5–MA–EPI).**

enrod, false-hellebore); shrubs, 33 percent (birch, rose, willow, alder, devilsclub, salmonberry, lowbush cranberry, and highbush cranberry). This type is on uplands occupied by Kodiak soils and the Saltery-Ugak complex and on the valley terraces mapped as Sharatin soils.

5–SAL–CAL: Grass, 36 percent (bluejoint, tufted hair-grass, sedge, and scattered beach ryegrass, meadow barley, and bluegrass); forbs, 42 percent (annuals, fireweed, and horsetail); shrubs, 22 percent (willow, rose, and cinquefoil). This type occupies the Saltery-Ugak complex on uplands and the Sharatin and shallow Pasagshak soils on terraces and valley bottoms.

5–SAL–DES: Grass, 25 percent (tufted hair-grass, bluejoint, sedge, and bluegrass); forbs, 68 percent (equal amounts of annuals, fireweed, horsetail, fern, geranium, sweet-anise, cinquefoil, burnet, and meadowrue); shrubs, 7 percent (willow). This type occurs on upland depressions mapped as the Saltery-Ugak complex.

5–SAL–EPI: Grass, 45 percent (mostly bluejoint, tufted hair-grass, and some sedge); forbs, 37 percent (mostly fireweed and yarrow with lesser amounts of annuals, yellow paintbrush, horsetail, sweet-anise, Jacob's-ladder, and burnet); shrubs, 18 percent (willow). This type has been repeatedly grazed by livestock. It is on valley bottoms mapped as the Salonie and Pasagshak soils.

5–SAL–MA: Grass, 68 percent (mostly bluejoint, sedge, tufted hair-grass, rush, and some redtop); forbs, 7 percent (mostly annuals, fireweed, and horsetail with lesser amounts of yarrow, lupine, and meadowrue); shrubs, 25 percent (mountain alder, swamp birch, and willow). This type is on poorly drained, nearly level valley bottoms mapped as the Olds soils.

6–SP: Grass, 21 percent (bluejoint, sedge, and tufted hair-grass); forbs, 44 percent (annuals, ferns, horsetail, and fireweed and other forbs in lesser amounts); shrubs, 35 percent (mostly devilsclub with lesser amounts of salmonberry and mountain alder). This type grows on uplands having gradients ranging from 12 percent to more than 45 percent that are mapped as the Pyramid soils and the forested phases of the Kodiak soils.

10–BET–CAL: Grass, 15 percent (bluejoint and tufted hair-grass); forbs, 74 percent (equal numbers of annuals, fireweed, horsetail, fern, geranium, sweet-anise, and burnet); shrubs, 11 percent (mountain alder, rose, salmonberry, and willow). Birch is dominant, but it is not considered part of the composition because its leaves are not always accessible to livestock. This type occurs on hilly, steep, and inaccessible uplands occupied by the Pyramid and Kodiak soils.

10–BET–EPI: Grass, 13 percent (bluejoint, tufted hair-grass, and sedge in descending order of abundance); forbs, 74 percent (fireweed, annuals, fern, and lesser amounts of horsetail, sweet-anise, burnet, yarrow, angelica, Solomons-seal, and goldenrod); shrubs, 13 percent (rose, birch, salmonberry, willow, mountain alder, and lowbush cranberry). This type is on the hilly or steep Kodiak soils.

10–BET–SAL: Grass, 57 percent (bluejoint, sedge, tufted hair-grass, and rush); forbs, 30 percent (angelica, annuals, fireweed, horsetail, ferns, Jacob's-ladder, and burnet); shrubs, 13 percent (mountain alder, birch, balsam poplar, rose, salmonberry, willow, and lowbush cranberry). This type is on hilly or steep Kodiak soils.

10–BP–CAL: Grass, 52 percent (bluejoint, tufted hair-grass, and sedge are the most abundant); forbs, 40 percent (fireweed, horsetail, annuals, sweet-anise, and others); shrubs, 8 percent (balsam poplar, willow, elderberry, rose, mountain alder, and salmonberry). This type is on upland Kodiak soils and on Salonie, Kalsin, and Pasagshak soils, and the low water-table phase of Kizhuyak soils in valley bottoms.

10–BP–EPI: Grass, 45 percent (bluejoint and tufted hair-grass); forbs, 50 percent (fireweed, annuals, horsetail, sweet-anise, and Jacob's-ladder); shrubs, 5 percent (balsam poplar, mountain alder, willow, elderberry, rose, and highbush cranberry). This type is along streams and on old flood plains occupied by Pasagshak soils.

10–BP–MA: Grass, 39 percent (bluejoint, tufted hair-grass, and sedge); forbs, 44 percent (annuals, fireweed, sweet-anise and lesser amounts of yarrow, fern, geranium, cowparsnip, Jacob's-ladder, and meadowrue); shrubs, 17 percent (mountain alder, balsam poplar, willow, elderberry, dusty-miller, rose, and salmonberry). This type occurs on Pasagshak soils on valley bottoms.

10–BP–SAL: Grass, 57 percent (bluejoint and tufted hair-grass); forbs, 30 percent (fireweed, annuals, fern, sweet-anise, horsetail, and other forbs in lesser quantities); shrubs, 13 percent (willow and lesser quantities of balsam poplar, rose, salmonberry, elderberry, and devilsclub). This type occurs on soils similar to those described for type 10–BP–EPI but in areas closer to streams.

7L: No vegetation recorded. This type may contain any of the previous listed combinations of plants, but the forage is not accessible to livestock because of steep terrain or impassible barriers. Roads or trails into these places will make much more forage available to livestock.

7B: This type is similar to type 7L, except that inaccessibility is caused from dense stands of brush. Eradication of brush may allow use of these areas for grazing.

7T: This type is inaccessible to livestock because of dense stands of timber. Some of the timber is suitable for commercial utilization.

8: This type contains no productive soil; consequently, no vegetation. It is mostly streambeds and sandy areas along the beaches.

The percentages of plants by class and by species in the vegetation types are given in table 10.

Grazing Capacity

The Northeastern Kodiak Island Area contains 307,207 acres, of which 101,863 acres is suitable for grazing and 65 acres is in cultivation The rest, 205,279 acres, is barren or inaccessible to livestock and is mapped as vegetation types 7L, 7B, 7T, and 8.

The part suitable for livestock will provide one animal-unit month of grazing on an average of about 2.25 acres of forage. The most extensive type, 3–EPI–CAL, can support an animal-unit month of grazing on 1.8 acres. The inextensive type 1T–EMO, on low dunes along parts of the coast, requires 0.7 acre to graze one animal for a month.

The dominant plants in the climax vegetation of the Northeastern Kodiak Island Area are bluejoint, tufted hair-grass, sedge, fireweed, horsetail, willow, mountain alder, salmonberry, balsam poplar, and Sitka spruce (fig. 11). These and the other climax plants in the Area are shown in table 9.

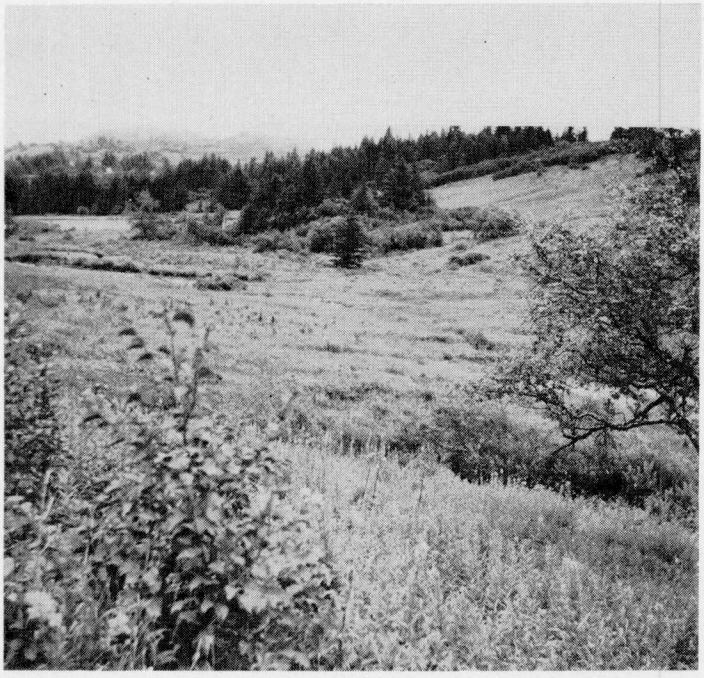

Figure 11.—**Shrubs, mainly willow and alder (type 5–SAL–MA), left foreground; forbs and shrubs, mainly fireweed and willow (type 3–EPI–SAL), center; and Sitka spruce (type 6–SP) on hills in background. The soil on hills is Kodiak silt loam.**

Several plants are considered to be "increasers" because they thrive at the expense of other plants. The increasers are wild barley, sweetgrass, bluegrass, tufted hair-grass, false-hellebore, yarrow, lupine, goldenrod, mountain alder, spruce, and various annuals. These plants invade former cultivated fields and ranges that have been overgrazed. The decreasers in this ecological change are bluejoint, beach ryegrass, sedge, fireweed, horsetail, and willow. The greatest change in vegetation has occurred in the valley bottoms, where livestock graze most heavily. In one place, overuse has depleted the native grass to the extent that 18.1 acres is required to supply grazing for an animal-unit month. This, however, is an uncommon condition. None of the hilly land has been overgrazed enough to cause soil erosion.

Poisonous plants are scattered throughout the Area. One poisonous plant, arrowgrass, occurs in bogs or on tidal flats at the heads of bays and most extensively on 6 acres near Monashka Bay. The poisonous waterhemlock and monkshood occur along streambanks or in other moist areas. Areas containing poisonous plants should not be heavily grazed in spring. The poisonous plants should be eradicated wherever practical. Information concerning the reduction of possible livestock losses from poisonous plants is available in: U.S. Dept. Agr. Farmers' Bulletin No. 2106, Sixteen Plants Poisonous to Livestock in the Western States, 1958. It can be purchased from the Superintendent of Documents, Washington 25, D.C.

According to the vegetation survey, it is estimated that the Northeastern Kodiak Island Area can provide 45,477 animal-unit months of grazing each year during the average 8-months grazing season of April through November. Of this capacity, 44,949 animal-unit months are available in the grazing units; the rest is in range outside the grazing units. The occurrence, extent, and carrying capacity of each vegetation type in the Area are shown in table 11.

Range Management

Except for a few areas near ranch headquarters, rangeland on the Northeastern Kodiak Island Area is essentially in its natural condition. The vegetation could be used more efficiently if individual pastures were fenced and large areas of similar topography were segregated for winter, spring-fall, and summer use. As a rule, cattle can move into the high summer range by late June and remain there through September. The valley bottoms and lower hills provide the best grazing in spring and fall. Areas near beaches provide limited grazing in the winter season—December through March.

As herds increase, the valley bottoms and gentle slopes will probably be used as cropland for the production of winter livestock feed. Consequently, increasing grazing pressure on the rolling and hilly uplands will require the opening up of summer ranges that are now inaccessible to livestock. Trails and stock driveways should be located to facilitate the movement of livestock between valley bottoms and mountain ranges and from ranches to market or shipping centers.

Enough water is in most parts of the Area. Salt locations that are distant from water may help to distribute livestock and to obtain a more uniform utilization of forage.

Herding is desirable to obtain the maximum use of the forage and to protect the animals from predators. This would be especially necessary if sheep become established in the Area. A system of pasture rotation could reduce the extent of herding in some instances.

Most of the native vegetation will not tolerate excessive grazing, and it may give way to less desirable forbs and annual grasses. To counteract this and to improve the quality of forage, it may be desirable to seed more tolerant and palatable plants. Among the species that could be seeded for this purpose are smooth bromegrass (*Bromus inermis*), Reed canarygrass (*Phalaris arundinacea*), bluegrass (*Poa* spp.), meadow foxtail (*Alopecurus pratensis*), orchardgrass (*Dactylis glomerata*), white clover (*Trifolium repens*), and alsike clover (*Trifolium hybridum*).

TABLE 10.—*Numbers of plots measured and the percentages of plants by class*

[Absence of data means

Vegetation types [1]	Number of plots	Average percentage of grass and grasslike plants in type	Grass and grasslike plants—percentage by species [1]															
			AGR	CAL	CAR	DES	Emo	ERI	FES	Hod	HOR	JUN	Par	Pal	Ppe	POA	SCI	Tma
1T–CAL	25	44.6	1.8	36.8	12.3	29.8	12.3		1.7		1.8					3.5		
1T–CAL–BET	2	30.7		50.0		25.0	25.0											
1T–CAL–BP	1	52.0		25.0	25.0	25.0										25.0		
1T–CAL–DES	1	60.4		20.0	20.0	20.0				20.0						20.0		
1T–CAL–EPI	16	42.6		36.2	17.0	31.9	2.1			4.3	2.1					6.4		
1T–CAL–MA	12	41.0		30.9	21.4	30.9	2.4			2.4		2.4		2.4		7.2		
1T–CAL–SAL	14	43.2		34.8	19.6	32.6	2.2			2.2						6.5		2.1
1T–DES	2	60.2	9.1	18.2	18.2	18.2	9.1					9.0				18.2		
1T–DES–CAL	1	93.4		33.3	33.3	33.4												
1T–DES–EPI	1	90.1		25.0	25.0	25.0	25.0											
1T–EMO	8	78.4		18.2	13.6	22.7	40.9									4.6		
2D–CAL	4	48.6		40.0	30.0	30.0												
2W–CAL	12	69.1	3.2	29.0	22.6	22.6	6.4				3.2	3.3				9.7		
2W–CAL–CAR	7	81.1	6.4	22.6	22.6	22.6	6.4	6.4		3.2		3.2		3.3		3.3		
2W–CAL–EPI	1	65.5		25.0	25.0	25.0										25.0		
2W–CAL–SAL	5	63.2	8.3	29.2	16.7	25.0	8.3		4.2		4.2					4.1		
2W–CAR	45	86.2	1.4	28.1	30.9	23.0	2.9	.7			.7	5.8				6.5		
2W–CAR–CAL	7	79.2		26.5	26.5	17.6	5.9	5.9			2.9	8.8				5.9		
2W–CAR–EQU	1	83.2		25.0	25.0	25.0		25.0										
2W–CAR–SAL	1	54.2		33.3	33.4	33.3												
2W–SAL–CAR	2	46.6	12.5	25.0	25.0	12.5		12.5				12.5						
3–HLN	1	47.5	16.6	16.7	16.6	16.7	16.7				16.7							
3–EPI–CAL	26	33.2	5.4	36.5	13.5	24.3	6.8		1.3	1.4						10.8		
3–EPI–DES	3	31.0	7.7	23.0	15.4	23.0	7.7				7.7					15.5		
3–EPI–MA	7	35.4	21.0	31.6	15.8	31.6												
3–EPI–SAL	2	35.3	16.7	33.3		33.3				16.7								
5–MA–BP	1	27.8		100.0														
5–MA–CAL	8	31.9		36.4	27.3	22.7	4.5									9.1		
5–MA–EPI	12	35.0		48.3	17.2	20.7	3.4				3.5					6.9		
5–SAL–BET	2	28.4	20.0	20.0	10.0	20.0		10.0	20.0									
5–SAL–CAL	26	36.4		37.4	22.4	32.8	3.0				1.4					3.0		
5–SAL–DES	1	24.6		25.0	25.0	25.0										25.0		
5–SAL–EPI	2	45.6		40.0	20.0	40.0												
5–SAL–MA	2	67.6	11.2	22.2	22.2	22.2						22.2						
6–SP	21	20.8	3.0	54.5	15.2	15.2					3.0					9.1		
10–BET–CAL	1	15.5		50.0		50.0												
10–BET–EPI	4	12.6		57.1	14.3	28.6												
10–BET–SAL	1	56.8		25.0	25.0	25.0						25.0						
10–BP–CAL	37	51.7	4.7	41.9	16.3	20.9	1.1		1.1		3.5	1.2				9.3		
10–BP–EPI	2	45.5		66.6		33.4												
10–BP–MA	3	39.2		50.0	16.7	33.3												
10–BP–SAL	5	57.3		57.1		42.9												

[1] Symbols for species are explained in table 9.

and by species in the vegetation types in the Northeastern Kodiak Island Area

plant did not occur]

Average percentage of forbs in type	Forbs—percentage by species [1]																	
	ACH	Agn	ANN	Ape	Cpd	Coc	EPI	EQU	FER	GER	Hln	Ise	Lma	Lpa	Lhu	LUP	Npo	Occ	POY
53.1	15.9	-----	12.7	-----	-----	-----	25.4	20.6	-----	-----	1.6	-----	1.6	-----	3.2	7.9	-----	3.2	-----
57.2	7.1	-----	7.0	-----	7.1	-----	14.4	14.4	14.3	14.4	-----	-----	-----	-----	-----	7.1	-----	7.1	-----
45.8	11.1	11.1	11.1	-----	-----	-----	11.1	11.1	11.2	-----	-----	-----	-----	-----	-----	-----	-----	11.1	11.1
39.6	25.0	-----	25.0	-----	-----	-----	-----	25.0	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
54.5	10.1	3.8	11.5	-----	1.7	-----	16.3	11.0	6.8	5.8	2.5	-----	1.0	-----	1.0	3.8	-----	5.7	1.7
46.2	8.3	3.1	12.5	-----	1.0	-----	13.6	11.5	9.4	5.2	3.1	-----	1.0	-----	-----	2.1	-----	8.3	3.2
45.6	7.0	1.6	11.3	-----	5.4	-----	13.3	11.1	3.6	6.3	1.7	0.9	3.2	-----	-----	6.3	-----	7.3	3.2
28.3	13.3	-----	13.3	-----	6.7	-----	13.3	13.3	6.7	6.7	-----	-----	6.7	-----	-----	6.6	-----	-----	-----
4.8	25.0	-----	25.0	-----	-----	-----	-----	25.0	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	25.0
9.9	20.0	-----	20.0	-----	-----	-----	20.0	20.0	-----	-----	-----	-----	-----	-----	-----	20.0	-----	-----	-----
21.6	6.7	-----	33.2	6.7	-----	-----	20.0	6.7	-----	-----	-----	-----	6.7	-----	-----	6.7	-----	6.7	-----
48.4	13.3	-----	20.0	-----	-----	-----	26.7	26.7	6.6	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
26.8	10.6	4.3	10.6	-----	-----	-----	12.8	14.9	6.4	2.1	-----	-----	-----	2.1	2.1	4.3	-----	4.3	4.3
11.1	10.8	2.8	13.3	-----	-----	-----	8.1	18.9	-----	2.8	-----	2.7	-----	-----	2.8	-----	-----	5.4	10.8
28.4	14.3	-----	14.3	-----	-----	-----	14.3	14.3	14.3	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
29.0	6.7	10.0	20.0	-----	-----	-----	16.7	20.0	-----	3.3	-----	-----	3.3	-----	-----	3.3	-----	3.3	3.3
6.2	4.0	-----	28.0	-----	-----	-----	10.0	28.0	-----	-----	-----	2.0	3.0	-----	2.0	-----	-----	6.0	2.0
13.3	8.9	2.9	14.7	-----	-----	-----	8.9	20.5	-----	-----	-----	-----	-----	-----	-----	8.9	-----	2.9	-----
10.3	-----	-----	50.0	-----	-----	-----	-----	50.0	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
30.3	20.0	-----	20.0	-----	20.0	-----	-----	20.0	-----	-----	-----	-----	-----	-----	20.0	-----	-----	-----	-----
16.7	7.7	-----	7.7	-----	-----	-----	7.7	15.4	-----	7.7	-----	7.7	-----	-----	-----	7.7	-----	7.7	7.7
48.8	5.9	5.9	5.9	-----	-----	-----	5.9	5.9	5.6	5.9	5.9	5.9	-----	-----	5.9	5.9	-----	5.9	-----
61.5	9.8	3.4	10.3	-----	2.9	-----	15.5	11.5	8.0	3.4	2.9	1.1	.7	-----	1.1	2.9	-----	4.6	2.9
62.6	14.3	-----	21.4	-----	-----	-----	21.6	14.3	-----	-----	-----	7.1	-----	-----	-----	7.1	-----	-----	-----
52.3	4.7	4.7	13.9	-----	2.2	-----	13.9	7.0	7.0	7.0	2.2	-----	-----	-----	-----	-----	-----	4.7	4.7
54.2	6.2	6.3	12.5	-----	-----	-----	12.5	6.2	6.2	6.3	6.3	-----	-----	-----	-----	-----	-----	6.3	6.3
25.1	-----	-----	33.4	-----	-----	-----	-----	-----	33.3	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
54.8	7.4	1.9	12.8	-----	1.9	-----	14.8	9.2	14.8	3.7	3.7	-----	-----	-----	-----	-----	-----	11.1	-----
47.7	8.3	1.9	12.0	-----	1.9	-----	13.0	7.4	10.2	5.5	6.5	.9	-----	-----	-----	.9	-----	11.1	-----
38.7	6.3	6.3	12.5	-----	-----	-----	12.5	6.3	6.2	12.5	-----	-----	-----	-----	-----	6.3	-----	6.2	-----
42.2	5.5	1.4	16.3	-----	.7	-----	16.9	16.3	4.9	2.8	4.2	.7	1.4	2.1	.7	1.4	-----	8.5	.7
67.9	-----	-----	11.1	-----	-----	-----	11.1	11.1	11.2	11.1	-----	-----	-----	-----	-----	-----	-----	11.1	11.1
36.7	20.0	-----	10.0	-----	10.0	-----	20.0	10.0	-----	-----	-----	-----	-----	-----	-----	-----	-----	10.0	10.0
6.8	11.2	-----	22.2	-----	-----	-----	22.2	22.2	-----	-----	-----	-----	-----	-----	-----	11.1	-----	-----	-----
43.9	3.8	1.0	18.3	-----	-----	-----	11.5	14.4	16.3	1.9	4.8	1.0	-----	-----	1.9	1.0	-----	5.8	-----
74.0	-----	-----	14.3	-----	-----	-----	14.3	14.3	14.3	14.3	-----	-----	-----	-----	-----	-----	-----	14.2	-----
73.7	5.0	5.0	15.0	-----	-----	-----	20.0	10.0	15.0	-----	-----	-----	-----	-----	-----	-----	-----	10.0	-----
30.2	-----	14.3	14.3	-----	-----	-----	14.3	14.3	14.3	-----	-----	-----	-----	-----	-----	-----	-----	-----	14.2
39.7	3.0	4.2	13.9	-----	-----	-----	14.8	14.8	8.9	2.1	3.8	-----	-----	-----	-----	-----	-----	11.4	3.4
49.8	-----	-----	13.4	-----	-----	-----	13.4	13.4	6.6	-----	6.6	-----	-----	-----	-----	-----	-----	13.4	13.4
44.2	7.7	3.8	11.5	-----	-----	-----	11.5	3.8	7.8	7.7	7.7	-----	-----	-----	-----	-----	-----	11.5	7.7
30.2	-----	6.3	12.5	-----	-----	-----	15.6	9.3	12.5	3.1	3.1	-----	-----	-----	-----	-----	-----	12.5	3.1

TABLE 10.—*Numbers of plots measured and the percentages of plants by class and by*

Vegetation types [1]	Number of plots	Forbs—percentage by species [1]—Continued													
		POT	Pag	RAN	RUM	SAN	SMI	Smu	Tof	Tal	Tpa	TRI	VER	VIC	VIO
1T–CAL	25	1. 6				6. 3									
1T–CAL–BET	2					7. 1									
1T- CAL–BP	1					11. 1									
1T–CAL–DES	1													25. 0	
1T–CAL–EPI	16	1. 0	6. 0			6. 7		1. 7					1. 0	1. 9	
1T–CAL–MA	12		1. 0			7. 3				1. 0			6. 3	2. 1	
1T–CAL–SAL	14	6. 4				6. 3	0. 9	1. 6						. 9	1. 7
1T–DES	2	6. 7				6. 7									
1T–DES–CAL	1														
1T–DES–EPI	1														
1T–EMO	8							6. 6							
2D–CAL	4													6. 7	
2W–CAL	12	2. 1				6. 4		4. 2		4. 3				4. 2	
2W–CAL–CAR	7	8. 1	2. 7					2. 7		2. 7				5. 4	
2W–CAL–EPI	1					14. 2				14. 3					
2W–CAL–SAL	5	3. 4				6. 7									
2W–CAR	45	2. 0				12. 0								1. 0	
2W–CAR–CAL	7	11. 7				2. 9		5. 9		2. 9				8. 9	
2W–CAR–EQU	1														
2W–CAR–SAL	1														
2W–SAL–CAR	2	7. 6				7. 7				7. 7					
3–HLN	1		5. 9		5. 9	5. 9							5. 9	5. 9	
3–EPI–CAL	26		. 6			6. 9	. 6	4. 0		. 6			2. 9	3. 4	
3–EPI–DES	3					7. 1		7. 1							
3–EPI–MA	7		4. 7			7. 0		7. 0		2. 3			4. 7	2. 3	
3–EPI–SAL	2					12. 5		6. 2						6. 2	
5–MA–BP	1						33. 3								
5–MA–CAL	8		1. 9			1. 9	3. 7	1. 9					7. 4	1. 9	
5–MA–EPI	12		. 9			7. 5	2. 8	. 9		. 9			6. 5	. 9	
5–SAL–BET	2					12. 5		6. 2					6. 2		
5–SAL–CAL	26	. 7	. 7			8. 4	. 7	2. 1		. 7			. 7	1. 4	
5–SAL–DES	1					11. 1				11. 1					
5–SAL–EPI	2					10. 0									
5–SAL–MA	2									11. 1					
6–SP	21		1. 0			6. 7	5. 8	1. 9					1. 9	1. 0	
10–BET–CAL	1					14. 3									
10–BET–EPI	4					10. 0	5. 0	5. 0							
10–BET–SAL	1					14. 3									
10–BP–CAL	37		2. 1			3. 8	3. 0	2. 1	1. 2	4. 6			1. 3	1. 6	
10–BP–EPI	2		6. 6							6. 6			6. 6		
10–BP–MA	3		3. 9				3. 8			7. 7				3. 9	
10–BP–SAL	5		3. 1			6. 3	6. 3			6. 3					

[1] Symbols for species are explained in table 9.

species in the vegetation types in the Northeastern Kodiak Island Area—Continued

Average percentage of shrubs in type	Shrubs—percentage by species [1]																				
	MA	Apo	Aur	Ati	Bna	BET	Cso	Eho	Eng	Lde	BS	SP	BP	ROS	Rse	SAL	SAM	Sbe	Vca	Vvi	Ved
2. 3	11. 1													33. 3	44. 4	11. 2					
12. 1															100. 0						
2. 2	20. 0												20. 0	20. 0	20. 0	20. 0					
0																					
2. 9	16. 7			5. 6										11. 1	38. 7	5. 6	16. 7			5. 6	
12. 8	24. 3													18. 9	27. 1	13. 5	13. 5				2. 7
13. 3	3. 5					3. 6							7. 1	10. 7	17. 9	53. 6				3. 6	
11. 6														33. 3	33. 3	33. 3					
1. 8																100. 0					
0																					
0																					
3. 0																100. 0					
4. 1	12. 5												12. 5			75. 0					
7. 8	10. 0											20. 0		10. 0		50. 0					10. 0
6. 1																100. 0					
7. 8					11. 1										11. 1	66. 7	11. 1				
7. 6	5. 0				2. 5	7. 5						7. 5		5. 0		67. 5			2. 5		2. 5
7. 5	14. 3															85. 7					
6. 5																100. 0					
15. 5																100. 0					
36. 7					14. 3	14. 3				14. 3						28. 6				14. 2	14. 3
3. 7				50. 0											50. 0						
5. 3	17. 5			2. 5										27. 5	35. 0	7. 5	7. 5			2. 5	
6. 4														33. 3	66. 7						
12. 3	13. 6					4. 5	4. 5	4. 7				4. 5		13. 6	22. 7	13. 6	9. 1			4. 7	4. 5
10. 5																50. 0				50. 0	
47. 1	33. 3												33. 4				33. 3				
13. 1	18. 2							9. 1						18. 2	27. 2	18. 2	9. 1				
17. 3	22. 0				2. 0			6. 0				4. 0		14. 0	24. 0	8. 0	16. 0			2. 0	2. 0
32. 8	10. 0					10. 0		10. 0						20. 0	10. 0	20. 0				10. 0	10. 0
20. 0	7. 1				1. 7	1. 8		1. 8				1. 8	3. 6	10. 7	16. 1	41. 1	5. 4			8. 9	
5. 7																100. 0					
17. 6																100. 0					
25. 4	25. 0				25. 0											50. 0					
35. 8	10. 4						2. 2	31. 3				8. 3		6. 2	27. 1	6. 2	6. 2			2. 1	
10. 5	25. 0													25. 0	25. 0	25. 0					
12. 5	9. 1					18. 2								27. 2	18. 2	18. 2				9. 1	
13. 0	14. 3					14. 3							14. 3	14. 3	14. 3	14. 3				14. 2	
7. 3	14. 1			1. 1				2. 2					17. 4	14. 1	10. 8	20. 7	18. 5				1. 1
4. 6	20. 0												20. 0	10. 0		20. 0	20. 0				10. 0
16. 6	23. 1			7. 6									23. 1	7. 7	7. 7	15. 4	15. 4				
12. 4	11. 8							5. 9					17. 6	17. 6	11. 8	23. 5	11. 8				

TABLE 11.—*Occurrence, extent, and carrying capacity of vegetation types in the Northeastern Kodiak Island Area, Alaska*

Vegetation type	Topographic position	Principal soils	Area of type	Forage available to livestock[1]	Estimated average carrying capacity
			Acres	*Animal-unit months*	*Acres per animal-unit month*
1T–CAL	Terraces, hills, and moderately well drained alluvial plains.	Sharatin, Kalsin, Salonie, and Chiniak.	2, 850	983	2. 9
1T–CAL–BET	Steep uplands	Kodiak	3, 008	547	5. 5
1T–CAL–BP	Rolling uplands	Kodiak	121	60	2. 0
1T–CAL–DES	Moderately well drained alluvial plains; heavily grazed.	Kalsin and Salonie	127	7	18. 1
1T–CAL–EPI	Terraces, rolling or steep hills, and moderately well drained alluvial plains.	Kodiak, Pyramid, Sharatin, Salonie, Pasagshak, and Chiniak.	3, 196	1, 897	1. 9
1T–CAL–MA	Rolling to steep uplands; occasionally on moderately well drained alluvial plains.	Kodiak and Salonie	6, 365	2, 752	2. 3
1T–CAL–SAL	Rolling to steep uplands and moderately well drained alluvial plains.	Kodiak, Kalsin, Salonie, and Pasagshak.	3, 594	1, 250	2. 9
1T–DES	Terraces and rolling uplands; pastures that have had continual use.	Sharatin and Kodiak	303	164	1. 8
1T–DES–CAL	Poorly drained sites on alluvial plains	Olds	19	47	. 4
1T–DES–EPI	Well-drained terraces	Sharatin	5	3	1. 7
1T–EMO	Low dunes along coast	Chiniak	414	629	. 7
2D–CAL	Terraces and well-drained alluvial plains	Sharatin	261	74	3. 5
2W–CAL	Poorly drained sites on alluvial plains	Kizhuyak and Olds	403	266	1. 5
2W–CAL–CAR	Poorly drained sites on alluvial plains	Kizhuyak and Saltery	706	281	2. 5
2W–CAL–EPI	Steep or rolling uplands and moderately well drained alluvial plains.	Kodiak and Pasagshak	507	299	1. 7
2W–CAL–SAL	Poorly drained sites and some moderately well drained sites on alluvial plains.	Kizhuyak, Olds, and Sharatin	744	720	1. 1
2W–CAR	Depressions in uplands; poorly drained alluvial plains.	Olds and the Saltery-Ugak complex.	2, 319	1, 347	1. 7
2W–CAR–CAL	Poorly drained sites on alluvial plains; pastured.	Kizhuyak	172	132	1. 3
2W–CAR–EQU	Bogs	Saltery	27	45	. 6
2W–CAR–SAL	Depressions on uplands	Saltery-Ugak complex	422	379	1. 1
2W–SAL–CAR	Depressions on uplands	Saltery-Ugak complex	413	343	1. 2
3–HLN	Steep uplands; on Long Island only	Kodiak	64	54	1. 2
3–EPI–CAL	Steep or rolling uplands; occasionally on moderately well drained alluvial plains.	Kodiak and Kalsin	20, 088	11, 295	1. 8
3–EPI–DES	Steep or rolling uplands; heavily grazed	Kodiak	56	12	4. 7
3–EPI–MA	Steep to rolling uplands	Kodiak and Salonie	2, 580	1, 830	1. 4
3–EPI–SAL	Moderately well drained alluvial plains	Pasagshak	145	74	1. 9
5–MA–BP	Moderately well drained alluvial plains; mostly sand and gravel.	Pasagshak	93	18	5. 2
5–MA–CAL	Steep to rolling uplands	Kodiak and Pyramid	8, 816	3, 262	2. 7
5–MA–EPI	Steep uplands	Kodiak	14, 023	9, 142	1. 5
5–SAL–BET	Terraces; rolling to steep uplands	Saltery-Ugak complex, Sharatin, and Kodiak.	464	397	1. 2
5–SAL–CAL	Depressions on uplands; poorly drained and moderately well drained sites on alluvial plains.	Saltery-Ugak complex, Pasagshak, and Sharatin.	2, 487	611	4. 1
5–SAL–DES	Depressions on uplands	Saltery-Ugak complex	6	3	2. 0
5–SAL–EPI	Moderately well drained alluvial plains	Salonie and Pasagshak	86	58	1. 5
5–SAL–MA	Poorly drained sites on alluvial plains	Olds	5	2	2. 5
6–SP	Steep or rolling forested uplands	Kodiak, (forested phases) and Pyramid.	15, 427	1, 278	12. 1
10–BET–CAL	Steep or hilly uplands	Kodiak and Pyramid	702	93	7. 5
10–BET–EPI	Steep or hilly uplands	Kodiak	1, 166	437	2. 7
10–BET–SAL	Steep or rolling uplands	Kodiak	170	121	1. 4
10–BP–CAL	Moderately well drained alluvial plains	Kodiak, Kalsin, Salonie, Pasagshak, and Kizhuyak.	7, 189	2, 988	2. 4
10–BP–EPI	Alluvial plains immediately adjacent to streams.	Pasagshak	1, 064	796	1. 3
10–BP–MA	Alluvial plains immediately adjacent to streams.	Pasagshak	280	156	1. 8
10–BP–SAL	Alluvial plains immediately adjacent to streams.	Pasagshak	976	625	1. 6
7L, 7B, 7T	Steep uplands and sea cliffs	Pyramid, Kodiak, Rough mountainous land, and Sea cliffs.	203, 801	0	----------
8	Steep uplands, stream channels, and gravel beaches.	Riverwash, Rough mountainous land, and Gravel beaches.	1, 472	0	----------
Cultivated land	Level bottom lands	----------	65	0	----------
Poisonous plants	Bogs	Saltery	6	0	----------
Total			307, 207	45, 477	

[1] Determined by dividing total pounds of usable dry forage produced by 800, the number of pounds of forage one animal unit will consume per month. Forage availability expressed as animal-unit months are based on estimated proper use percentages, which are subject to change as additional information is accumulated.

New seedings of range plants may need some fertilization. Experimental range fertilization on Kodiak Island soils has not been done. However, it is likely that a fertilizer containing nitrogen, phosphate, and potash should be used and that it should be applied at about the same rate as for forage crops intended for harvest. The application of calcium nitrate alone has been shown to be useful in some places.

Pasture grass in winter is of very poor quality, as it is extremely low in protein and very high in crude fiber. Cattle forced to eat it make little growth, and meat quality declines. Proper winter feeding requires that animals be given preserved forage in the form of hay or ensilage. High protein supplements, fed with roughage, could also be used. Hay is difficult to cure because of frequent rains; consequently, ensiling is probably the more desirable method for preserving forage for winter use.

Grazing Units

Federal land in the Northeastern Kodiak Island Area is divided into "grazing units," some of which are leased to ranchers. The boundaries of the units normally are natural barriers, and the units are geographic areas on the island, not units in the sense that the soils and vegetation are uniform. Off-shore islands in the Area are not in these grazing units. Figure 12 shows the location of all grazing units in the Area. Descriptions of these units follow.

Hidden Basin unit

This unit is at the head of Ugak Bay. It can be reached only by boat or plane. The unit is not leased, but, according to the vegetation survey, the estimated forage capacity is 698 animal-unit months per year. This unit contains about 19,548 acres, of which only 2,635 acres is considered to be accessible to livestock.

Wild Creek and a stream at the boundary of the Kodiak National Wildlife Refuge are the two main drainages. Steep topography predominates; the milder slopes are along the coast and on valley bottoms. Bluejoint grass is the main plant; mountain alder is second in abundance. The unit has been grazed very little, if at all, by livestock; consequently, the original, or climax, vegetation predominates.

Predator bears in the unit will probably necessitate the herding and close supervision of grazing animals.

Saltery Cove unit

This unit is on Ugak Bay. It is currently under lease for a 20-year term. According to the vegetation survey, the unit can provide 7,453 animal-unit months of grazing each year. The unit contains about 41,548 acres, of which 14,776 acres is accessible for grazing.

A large amount of water is in the unit. Saltery Creek, originating in Saltery Lake, is the main drainage. Steep slopes are along the perimeter of the unit, and broad valley bottoms are at lower elevations. The vegetation is mainly bluejoint interspersed with birch and poplar. Very little grazing has occurred in the past, but a few horses have grazed during the past 3 years. They wintered very nicely without extra feed.

A road was built into the unit in 1956, but its use is limited by washouts. The permanency of the road cannot be determined at present.

Portage unit

This unit is on the north side of Ugak Bay, and there are no roads into it. The unit was leased in 1951 for a 20-year term. A few cattle were stocked, but they were soon taken off the range and sold. The lessee intends to restock the unit with sheep and manage them through herding. The vegetation survey shows the unit can produce 7,254 animal-unit months of grazing per year. This unit contains about 18,531 acres, of which 8,184 acres is considered accessible to livestock.

Lake Miam and Summit Lake are the main sources of water for the principal stream, which forms the drainage system of the unit. The topography ranges from that of steep uplands and large upland terraces to that of valley bottoms and lowlands. Fireweed is the dominant plant; bluejoint is an understory. The many wet meadows on the unit are covered mainly by sedge and bluejoint. Only the lowland near the bays has been used, and that to limited extent.

Pasagshak unit

This unit is on the north shore of Ugak Bay. It can be reached most conveniently by graded road running between the city of Kodiak and Narrow Cape. The unit is leased for a 20-year term. According to the vegetation survey, 3,663 animal-unit months of grazing are available. The unit contains about 16,219 acres, of which 5,473 acres can be grazed.

Many streams are in this unit. The main drainage is Rose Tead Creek, which flows into Pasagshak Bay. The topography is steep except for valley bottoms, which provide most of the forage used by the operator's livestock.

Fireweed and bluejoint in equal quantities are the dominant plants. Where the forage has been heavily grazed and cut for hay, fireweed is less abundant. In these places, bluejoint grass and bunch grasses are present in much larger quantities.

Narrow Cape unit

This unit is located at the outlet of Ugak Bay. Access to it is from the city of Kodiak by way of a graded road, which is maintained partly by the lessee. According to the survey, the unit has available only 5,053 animal-unit months of forage. The unit contains about 22,640 acres, of which 11,163 acres can be grazed.

Lake Valley, Pine Valley, and Little Creeks, and the Sacramento River are the main drainages. The topography consists of valley bottoms, upland estuaries, steep hillsides, and broad, rolling plains on lowlands.

Bluejoint grass is the dominant plant; sedges are of secondary dominance. Cattle have grazed this unit for several years, but some parts have been only lightly used.

Kalsin unit

This unit is on Cape Chiniak and Kalsin Bay. It is accessible by two roads, one extending through the middle of the unit, and one extending to Cape Chiniak. The unit is leased for a 20-year period. According to the

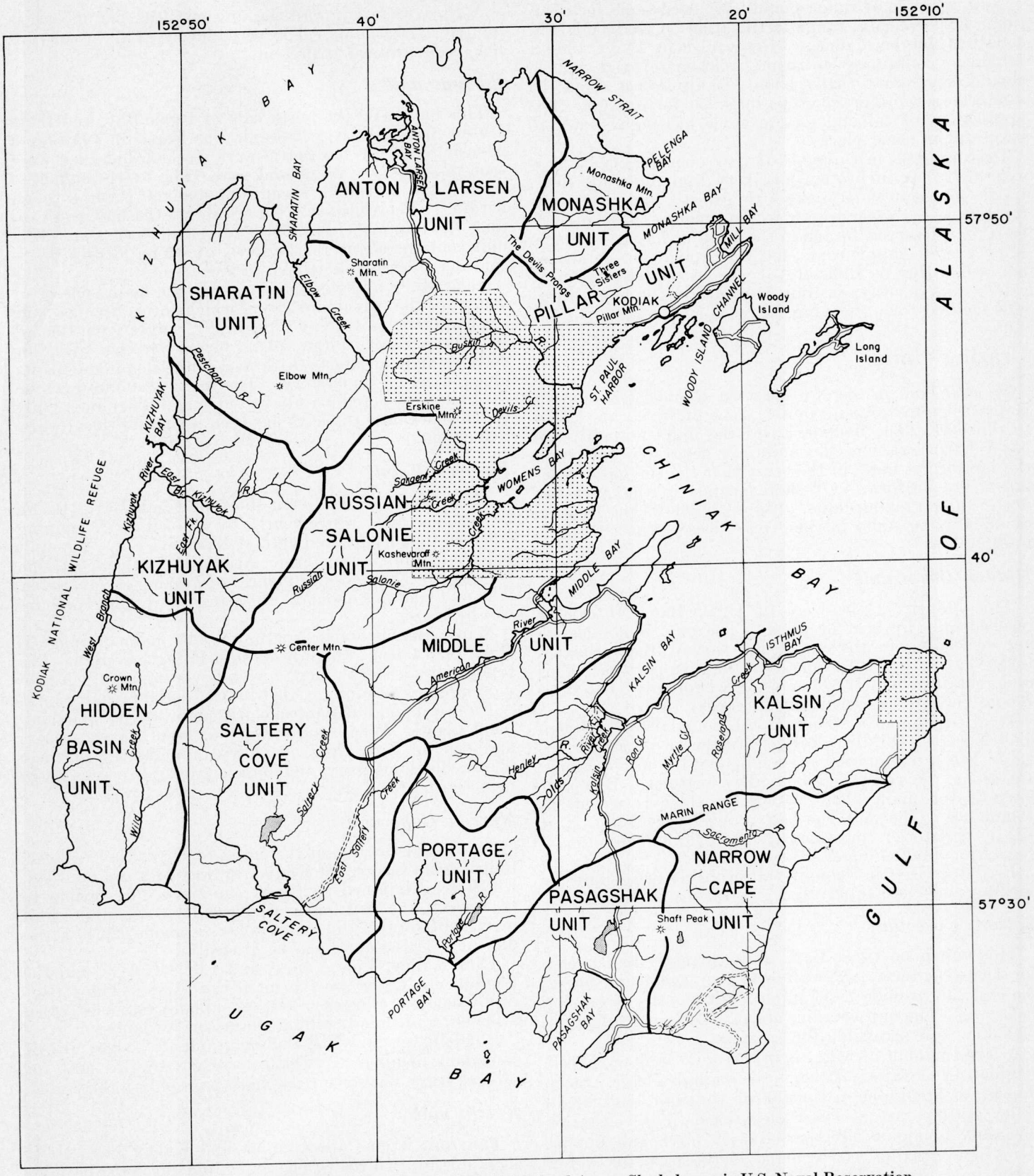

Figure 12.—Grazing units on the Northeastern Kodiak Island Area. Shaded area is U.S. Naval Reservation.

vegetation survey, 4,946 animal-unit months of forage are available. In severe weather, however, the Sitka spruce type in this unit is valuable as livestock shelter.

The unit contains about 41,818 acres, of which 23,583 acres is suitable for grazing. About 171 acres is privately owned. Many rivers and streams are in this unit; the main ones flow into Kalsin Bay. The topography ranges from nearly level tideland to steep and somewhat inaccessible hillsides. Sitka spruce covers most of the Kalsin unit. Alder and bluejoint grass are the second and third most abundant plants. Most of the grazing is on lowlands; very little use has been made of the uplands.

Middle unit

This unit is on Middle Bay. It can be reached from the city of Kodiak by roads that traverse the accessible parts of the unit. The current lease is for a 20-year period. The unit has been grazed since 1932. According to the vegetation survey, there are 3,540 animal-unit months of forage available. The unit contains 21,780 acres, of which 8,673 acres is suitable for grazing. About 161 acres is privately owned.

The American River is the main drainage. Steep mountains surround the unit and slope into undulating foothills and a level valley bottom. Fireweed is the main plant, and it is closely associated with bluejoint. Poplar covers a large acreage adjoining streams. Near the head of Middle Bay, pastures that have been grazed for several years now consist of low, perennial bunch grasses.

Russian-Salonie unit

This unit is adjacent to the southwestern corner of the U.S. Naval Reservation. It is accessible by roads from Womens Bay. The unit is not leased, but according to the vegetation survey, it has a grazing capacity of 716 animal-unit months per year. It contains 15,649 acres, of which only a small part is suitable for grazing. Drainage flows toward Womens Bay.

There are two parts in this unit: Salonie Creek and the Russian Creek Federal lands. The Salonie Creek part is on the south side of the naval reservation and contains 460 acres suitable for grazing. The forage can supply 94 animal-unit months per year of grazing. Poplar and various kinds of brush cover the land.

The part known as the Russian Creek Federal lands contains 1,582 acres suitable for grazing. It has an estimated carrying capacity of 622 animal-unit months per year. The vegetation is predominantly fireweed.

Pillar unit

This unit is in the northeastern part of Kodiak Island, on Monashka Bay. It has not been leased for grazing, but, according to the vegetation survey, it can supply 1,636 animal-unit months of grazing per year. The unit contains 7,129 acres, of which 2,480 acres can be used for grazing. The rest can be used as sources of gravel, and as sites for homes and cabins in city expansion. In addition to the 2,480 acres suitable for grazing, the city of Kodiak controls 3,038 acres of good grazing land, which can furnish 1,509 animal-unit months of grazing per year.

Pillar Creek, flowing into Monashka Bay, is the main drainage. The land adjacent to streams is fairly level and usable. Mountain alder is the dominant plant; spruce is the secondary dominant. The unit has been used only in the vicinity of the city of Kodiak.

Monashka unit

This unit is in the northeastern part of Kodiak Island. A road through this unit to the city of Kodiak has been planned. If built, it would make Uzinki Village and Spruce Island more accessible to Kodiak. Fish and other seafood could then be trucked to Kodiak instead of having to be transported by boat through rocky waterways that are dangerous in stormy weather.

The unit is not leased for grazing, but according to the vegetation survey, it can furnish 1,371 animal-unit months of feed per year. It contains 11,755 acres, of which 3,072 acres is suitable for grazing. Spruce is the main plant, and mountain alder is second in dominance. Monashka Creek is the largest of several streams. The unit has not been used for a long time.

Anton Larsen unit

This unit is in the northern end of Kodiak Island. It can be reached by a gravel road from the city of Kodiak and the naval reservation. The unit is leased for a 20-year term. According to the vegetation survey, 5,587 animal-unit months of forage are available. The unit contains 32,599 acres, of which 13,191 acres is suitable for grazing.

Anton Larsen Creek and its tributaries are the main drainages. The main usable acreage is the valley bottom, which is flanked by hills and precipitous mountains. Fireweed and bluejoint are the main plants; mountain alder is second in dominance.

Sharatin unit

This unit is on the southern edge of Sharatin Bay. It is accessible only by boat, a fact that may make it difficult to establish a livestock operation. Good harbors or lagoons for the mooring of boats appear to be lacking. The unit is not leased, but according to the vegetation survey, it can furnish 1,974 animal-unit months of grazing per year. It contains 31,971 acres, of which only 5,275 acres can be used for grazing.

Elbow Creek is the main drainage in the unit, but smaller streams are near the perimeter. The small percentage of land usable for grazing indicates that most of the terrain is rough and steep. Mountain alder is the main plant; fireweed is second in abundance.

Bears are common because the lack of settlement has allowed them unmolested existence.

Kizhuyak unit

This unit is in the western part of the Kodiak Island Area, at the head of Kizhuyak Bay. It has never been used by livestock. The vegetation survey shows it can supply 1,058 animal-unit months of forage per year. It contains about 26,074 acres, of which only 1,296 acres is usable for grazing. Under present conditions, the unit is too small for a livestock operation.

The topography is very steep, and dense stands of brush and trees cover the land. Mountain alder and fireweed are the dominant plants, but balsam poplar covers large acreages along streams.

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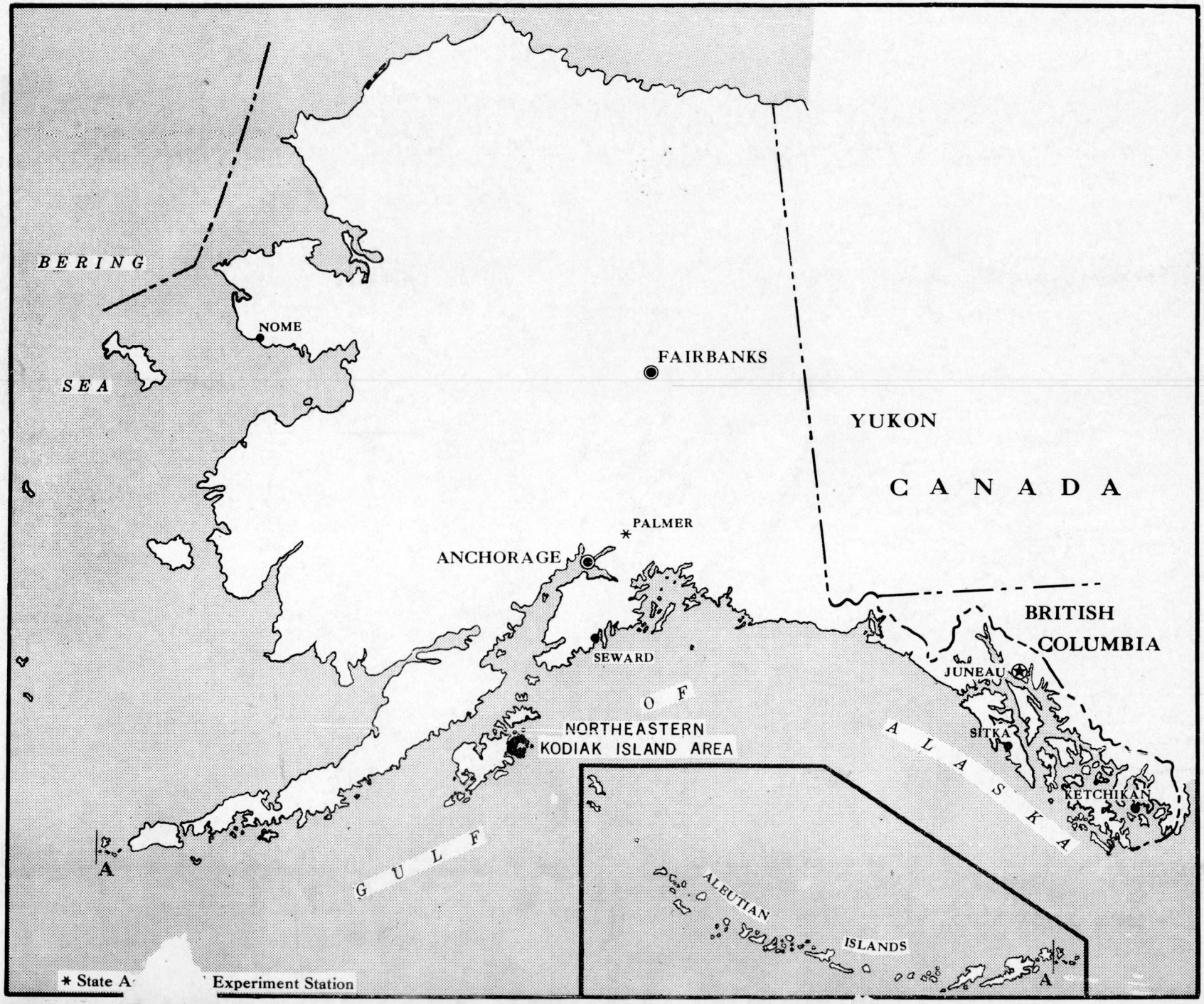
GUIDE TO MAPPING UNITS AND CAPABILITY UNITS



Location of [illegible]stern Kodiak Islar[illegible] Area in Alaska

U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

SOIL MAP
NORTHEASTERN KODIAK ISLAND AREA, ALASKA

ALASKA AGRICULTURAL EXPERIMENT STATION

Soils surveyed 1956 by Samuel Rieger, Ernest G. Link, and Albert D. Backer, Soil Conservation Service.
Correlation by A. H. Paschall, Soil Conservation Service.

Scale 1:63360
1 0 1 2 Miles
0 15,000 Feet

Soil map constructed 1959 by Cartographic Division, Soil Conservation Service, USDA, from 1952 aerial photographs. Map based on Universal Transverse Mercator projection, 1927 North American datum.

The first letter in each soil symbol is the initial of the soil series name. If slope forms part of the soil name, a second capital letter shows the range of steepness. Some of the soils for which no slope letter is shown are nearly level; some have a range of slope.

LEGEND

COLOR	SYMBOL	NAME
	ChA	Chiniak silt loam, nearly level
	ChB	Chiniak silt loam, gently sloping
	ChC	Chiniak silt loam, moderately sloping
	Ka	Kalsin silt loam
	Kb	Kizhuyak loamy fine sand, high water table
	Kc	Kizhuyak loamy fine sand, low water table
	KdB	Kodiak silt loam, gently sloping
	KdC	Kodiak silt loam, moderately sloping
	KdCC	Kodiak silt loam, rolling
	KdD	Kodiak silt loam, hilly
	KdE	Kodiak silt loam, steep
	KfCC	Kodiak silt loam, forested, rolling
	KfD	Kodiak silt loam, forested, hilly
	KfE	Kodiak silt loam, forested, steep
	KfF	Kodiak silt loam, forested, very steep
	KgF	Kodiak and Pyramid silt loams, very steep
	Os	Olds silt loam
	PaA	Pasagshak silt loam, nearly level
	PaB	Pasagshak silt loam, gently sloping
	PmD	Pyramid loamy fine sand, hilly
	PmE	Pyramid loamy fine sand, steep
	PmF	Pyramid loamy fine sand, very steep
	SaA	Salonie silt loam, nearly level
	SaB	Salonie silt loam, gently sloping
	Sb	Saltery peat
	Sc	Saltery-Chiniak complex
	SdA	Saltery-Ugak complex, nearly level
	SdB	Saltery-Ugak complex, gently sloping
	SdC	Saltery-Ugak complex, moderately sloping
	ShA	Sharatin silt loam, nearly level
	ShB	Sharatin silt loam, gently sloping

MISCELLANEOUS LAND TYPES

	Gb	Gravel beaches
	Rh	Riverwash
	Rm	Rough mountainous land
	Se	Sea cliffs

U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

VEGETATION TYPES
NORTHEASTERN KODIAK ISLAND AREA, ALASKA

U. S. DEPARTMENT OF THE INTERIOR
BUREAU OF LAND MANAGEMENT
ALASKA AGRICULTURAL EXPERIMENT STATION

LEGEND

Symbol	Vegetation Type
1T-CAL	Tall grass, dominantly bluejoint
1T-CAL-BET	Tall grass, dominantly bluejoint, with birch
1T-CAL-BP	Tall grass, dominantly bluejoint, with balsam poplar
1T-CAL-DES	Tall grass, dominantly bluejoint, with hair-grass
1T-CAL-EPI	Tall grass, dominantly bluejoint, with fireweed
1T-CAL-MA	Tall grass, dominantly bluejoint, with mountain alder
1T-CAL-SAL	Tall grass, dominantly bluejoint, with willow
1T-DES	Tall grass, dominantly hair-grass
1T-DES-CAL	Tall grass, dominantly hair-grass, with bluejoint
1T-DES-EPI	Tall grass, dominantly hair-grass, with fireweed
1T-EMO	Tall grass, dominantly wyegrass
2D-CAL	Dry meadow, dominantly bluejoint
2W-CAL	Wet meadow, dominantly bluejoint
2W-CAL-CAR	Wet meadow, dominantly bluejoint, with sedge
2W-CAL-EPI	Wet meadow, dominantly bluejoint, with fireweed
2W-CAL-SAL	Wet meadow, dominantly bluejoint, with willow
2W-CAR	Wet meadow, dominantly sedge
2W-CAR-CAL	Wet meadow, dominantly sedge, with bluejoint
2W-CAR-EQU	Wet meadow, dominantly sedge, with horsetail
2W-CAR-SAL	Wet meadow, dominantly sedge, with willow
2W-SAL-CAR	Wet meadow, dominantly willow, with sedge
3-HLN	Perennial forbs, dominantly cow parsnip
3-EPI-CAL	Perennial forbs, dominantly fireweed, with bluejoint
3-EPI-DES	Perennial forbs, dominantly fireweed, with hair-grass
3-EPI-MA	Perennial forbs, dominantly fireweed, with mountain alder
3-EPI-SAL	Perennial forbs, dominantly fireweed, with willow
5-MA-BP	Shrubs, dominantly mountain alder, with balsam poplar
5-MA-CAL	Shrubs, dominantly mountain alder, with bluejoint
5-MA-EPI	Shrubs, dominantly mountain alder, with fireweed
5-SAL-BET	Shrubs, dominantly willow, with birch
5-SAL-CAL	Shrubs, dominantly willow, with bluejoint
5-SAL-DES	Shrubs, dominantly willow, with hair-grass
5-SAL-EPI	Shrubs, dominantly willow, with fireweed
5-SAL-MA	Shrubs, dominantly willow, with mountain alder
6-SP	Conifers, dominantly Sitka spruce
7B	Inaccessible Land due to dense brush
7L	Inaccessible Land
7T	Inaccessible Land due to dense timber
8	Barren Land
10-BET-CAL	Deciduous trees, dominantly birch, with bluejoint
10-BET-EPI	Deciduous trees, dominantly birch, with fireweed
10-BET-SAL	Deciduous trees, dominantly birch, with willow
10-BP-CAL	Deciduous trees, dominantly balsam poplar, with bluejoint
10-BP-EPI	Deciduous trees, dominantly balsam poplar, with fireweed
10-BP-MA	Deciduous trees, dominantly balsam poplar, with mountain alder
10-BP-SAL	Deciduous trees, dominantly balsam poplar, with willow

Vegetation surveyed 1956 by R. Eugene Wunderlich, Carl M. Rice, and William L. Larramendy, Bureau of Land Management, and Waldo R. Frandsen, Soil Conservation Service.

Vegetation map constructed 1959 by Cartographic Division, Soil Conservation Service, USDA, from 1952 aerial photographs. Map based on Universal Transverse Mercator projection, 1927 North American datum.

Scale 1:63360
1 ½ 0 1 2 Miles
0 15 000 Feet