Internal Report 607

REPORT OF YUKON RIVER TO PRUDHOE BAY VEGETATION MAPPING PROGRAM

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PREFACE

This report is in fulfillment of contract number DACA 89-79-M-1124 from the U.S. Army Corps of Engineers, Cold Regions Research and Engineering Laboratory (CRREL) in conjunction with Department of Energy (DOE) and Federal Highway Administration (FHWA) funding to CRREL. The contract called for 1) the preparation of a provisional vegetation atlas and 2) examination of the feasibility of using LANDSAT imagery to portray vegetation at 1:24,000 within the corridor. In addition to these requirements, this report includes a relevant section devoted to large-scale (1:6000) mapping methods for northern Alaska, which was part of a manual used at a vegetation mapping workshop a at the Institute of Arctic and Alpine Research, Boulder, Colorado, 4-5 June 1979.

Acknowledgments

We are grateful to Dr. Jerry Brown and USA CRREL personnel for their support during the 1975 through 1978 summer seasons, during which time the field work for the 21 maps was completed. We also appreciate the logistic support provided by Mr. David Witt at the Biome Center in Fairbanks. The Alyeska Pipeline Company and its subcontractors provided some necessary services and permission to conduct these studies within the pipeline corridor. Dr. David Murray and Barbara Murray, University of Alaska, and Dr. JoAnne Flock, University of Colorado, identified many of the plants in the study areas.

Several assistants helped in the field work, including Jane Westlye, Eleanor Werbe, Fred Rowley, and Ken Bowman. Maps and figures were drafted by Jim Adams.

CONTENTS

ILLUSTRATIONS

SUMMARY

This report contains the results of three major parts of the INSTAAR/CRREL 1:6000 vegetation mapping program along the Yukon River to Prudhoe Bay Haul Road. An appendix explains: 1) the methods of vegetation sampling, 2) the method of making a master landscape map, 3) the system of vegetation classification, and 4) the methods for making the vegetation maps. Details of the field procedures contain sampling forms, subjective scales for rating 9 site factors, scales for rating biomass within each layer of a vegetative community, and forms for summarizing community floristic information. A section contains a revised legend for coding vegetation and landform information and the field mapping methods for making master maps. The vegetation classification system describes the vegetation nomenclature system. Community physiognomy is the key part of the vegetation names, and physiognomy is stressed throughout the sampling methods, the master map codes, and the patterns on the final vegetation map. The vegetation maps represent the community physiognomy, and an alphabetic code represents the community floristics. Reference tables are given with complete lists of map patterns and floristic codes.

Part I contains the documentation for the 21 study sites, including aerial photographs, master maps, vegetation maps, legends, and site descriptions. A mock-up of the Finger Mountain site is presented as an example format for a final geobotanical atlas.

Part II contains a summary of preliminary investigations on the feasibility of using LANDSAT imagery for a vegetation map of the pipeline corridor north of the Yukon River. Although the maps are too small and too heterogeneous to be used as training fields for a supervised LANDSAT classification, they could be used to check the accuracy of an unsupervised classification. The maps could be expanded using available high quality 1:24,000 color photography for photointerpretation.

Training fields could then be selected for a supervised classification. An outline of a plan for constructing a supervised classification of the Haul Road route is presented.

INTRODUCTION

During the past several years large-scale vegetation mapping has become increasingly important in northern Alaska primarily due to resource development. Vegetation maps are a key reference for a wide variety of scientific and engineering purposes, and the often intricate landforms in glacial and periglacial environments require detailed portrayal of landscapes for many practical purposes. Prior to the construction of the trans-Alaska pipeline, vegetation mapping at a scale of 1:63,360 or less was restricted to small areas around some of the easily accessible villages, drill sites, and lakes. For example, Spetzman (1959) mapped sites at Barrow, Noluck Lake, and Anaktuvuk Pass. More recently large-scale maps have been made at Cape Espenberg (Racine, 1974), Barrow (Walker, 1977), Atkasook (Komárková and Webber, 1979), and Prudhoe Bay (Walker et al., in press). The construction of the pipeline provided unique access to a wide variety of previously unstudied ecosystems.

This mapping project was initiated for several reasons. The primary consideration was to examine the vegetation at selected sites along the trans-Alaska pipeline Haul Road in terms of long-term impact and possible consequences to both the vegetation and the integrity of the road. Detailed maps made early in the history of the road provide a valuable reference for future assessment of natural and man-induced changes. Areas with environment-related problems, particularly erosion sites, flooded areas, heavy-dust areas, and sensitive landscapes, were first selected as map sites. It was also evident that the maps would be a valuable record for future investigations along the pipeline corridor and that they could be used as ground-truth for small-scale mapping programs utilizing LANDSAT digital imagery or high-altitude photography. Consequently, several map areas were selected purely on the basis that they were representative of regional vegetation patterns or that they contained features of particular scientific interest. A total of 21 sites (Figure 1) were included in the program.

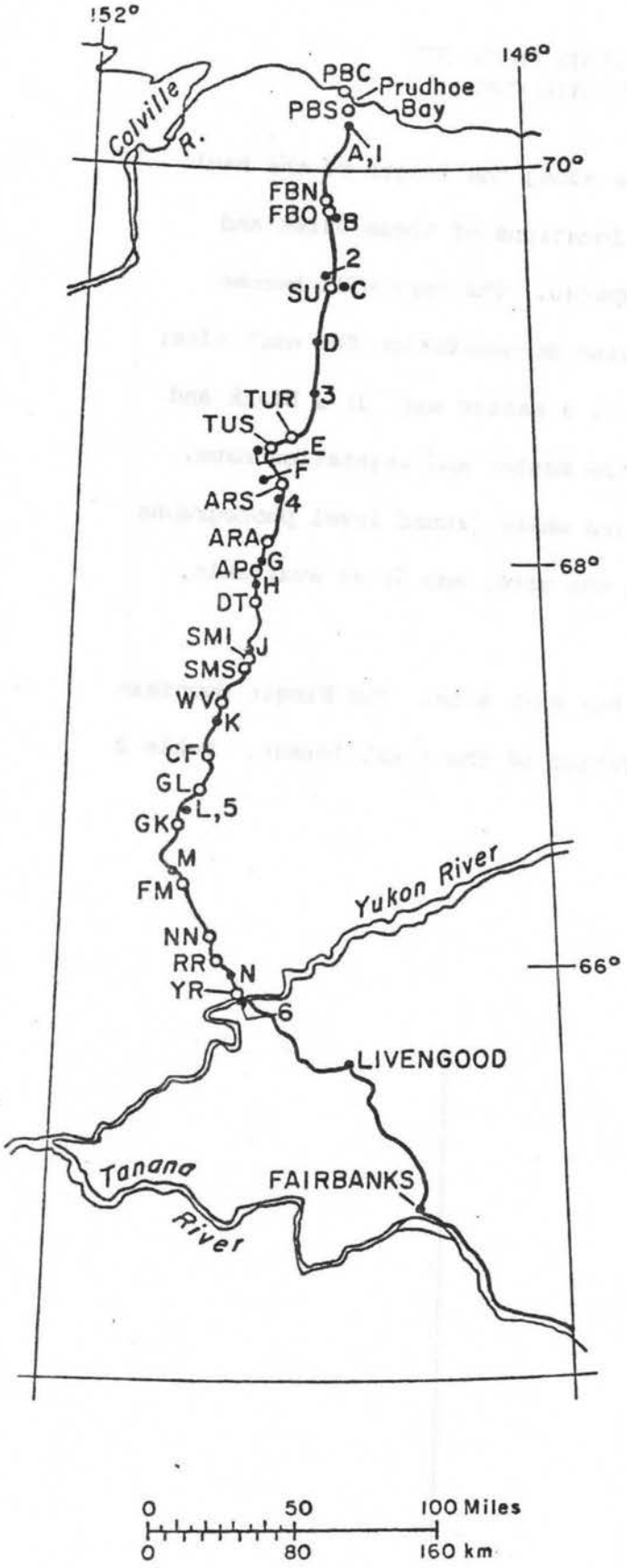
Currently, there are two main long-term goals of the mapping program. The first is to construct an atlas containing all the haul road maps, with complete legends, descriptions, and photographs. The atlas will, in turn, play a key part in the development of a "terrain use guide" which will provide information to agencies, private sector and the public interested in the ecology of areas adjacent to the pipeline route. The second goal is to coordinate the information gathered in this very detailed mapping program with the small-scale Alaskan vegetation mapping programs currently undertaken by the United States Geological Survey (USGS). One of the results of the haul road mapping program has been the development of a vegetation nomenclature system, that incorporates vegetation physiognomy, floristics, and ecology. The system is inherently hierarchial, in that it is applicable to both large and small scales, and could be of significant interest to the USGS and others interested in vegetation mapping in northern regions.

This report summarizes progress in three major parts: 1) the development of mapping methods, 2) the contents of the Haul Road vegetation atlas, and 3) the results of preliminary investigations regarding high-altitude photography and LANDSAT data. The methods manual contained in the appendix was written for an informal vegetation mapping workshop held at the Institute of Arctic and Alpine Research, 4-5 June 1979. It contains detailed descriptions of the vegetation sampling system, the master map, coding system, the methods of master map making, construction of the vegetation map, and the vegetation classification system. Part I of the report contains site descriptions and final draft versions of the maps and the vegetation legends. The Finger Mountain site has been selected to show a mock-up version for the final atlas. Part II summarizes the initial efforts to examine the vegetation maps with reference to 1:24,000 color photography and LANDSAT imagery.

PART I. MAPS FOR 21 SELECTED SITES ALONG THE YUKON RIVER TO PRUDHOE BAY HAUL ROAD

Draft maps have been completed for 21 sites along the length of the haul road highway (Figure 1). Table 1 contains the locations of these sites and aerial photographs from which the maps were prepared. The maps will become part of the atlas which will contain the following documentation for each site: 1) a 1:6000 black and white aerial photograph, 2) a master map, 3) a black and white vegetation map, 4) complete legends for the master and vegetation maps, 5) a site description, 6) three or four black and white ground level photographs depicting the more interesting features within the site, and 7) as available, 1:24,000 color aerial photographs.

The following pages contain items 1 to 5 for each site. The Finger Mountain site contains ground photographs as an illustration of the final format. Table 2 contains the key to the master maps.



LEGEND

MAP SITES

YR - Yukon River
RR - Ray River
NN - No Name Creek
FM - Finger Mountain
GK - Gobbler's Knob
GL - Grayling Lake
CF - South of Coldfoot
WV - Wiseman Vicinity
SMS - Sukakpak Mountain South
SMI - Sukakpak Mountain - Ice-cored Mound
DT - Dietrich River Treeline
AP - Atigun Pass
ARA - Atigun River Alluvial Fans
ARS - Atigun River Sand Dunes
TUS - Toolik Upland - South
TUR - Toolik Upland - Road Effects Site
SU - Sagwon Upland
FBO - Franklin Bluffs - Oil Spill Site
FBN - Franklin Bluffs - North
PBS - Prudhoe Bay Sand Dunes
PBC - Prudhoe Bay Coast

PIPELINE CAMPS and PUMP STATIONS

A. Deadhorse Airfield
B. Franklin Bluffs
C. Sagwon
D. Happy Valley
E. Toolik
F. Galbraith
G. Atigun
H. Chandalar
J. Dietrich
K. Coldfoot
L. Prospect
M. Old Man
N. Five Mile
—— Yukon-Prudhoe Road
• Camp and Pump Station Locations
o Vegetation Map Locations

1. Pump Station 1
2. Pump Station 2
3. Pump Station 3
4. Pump Station 4
5. Pump Station 5
6. Pump Station 6

Figure 1. Location of the vegetation mapping sites.

Table 1. Vegetation mapping sites.

Site Name	Coordinates	Distance from Yukon River (km)	Elevation (msm)	Area Mapped (km^2)	Aerial Photo Numbers*
Yukon River	149°45'W, 65°52'N	0	125	1.2	HR-1, 4078, V-1, 003
Ray River	150°00'W, 66°00'N	15	180	.8	HR-1, 4080, V-1, 051
No Name Creek	150°10'W, 66°06'N	23	200	.8	HR-1, 4082, V-1, 078
Finger Mountain	150°30'W, 66°22'N	43	490	.8	HR-1, 4085, V-1, 138
Gobbler's Knob	150°40'W, 66°45'N	75	550	.8	HR-1, 4090, V-1, 234
Grayling Lake	150°25'W, 66°57'N	93	385	1.2	HR-1, 4093, V-1, 290
South of Coldfoot	150°20'W, 65°05'N	105	365	.8	HR-1, 4096, V-1, 328
Wiseman Vicinity	150°06'W, 67°23'N	126	365	.8	RW-07, 4099, V-3, 163
Sukakpak Mountain - South	149°42'W, 67°34'N	143	425	.8	RW-07, 5102, V-3, 211
Sukakpak Mountain - Ice-cored Mounds	149°42'W, 67°36'N	145	425	.8	RW-16, 5103, V-5, 46
Dietrich River - Treeline	149°43'W, 68°01'N	179	760	.8	RW-07, 5108, V-3, 283
Atigun Pass	149°28'W, 68°08'N	191	1460	.8	SP-18, 1010, V-4, 041
Atigun Pass - Alluvial Fans	149°20'W, 68°16'N	202	915	.8	HR-1, 5112, V-2, 023
Atigun River - Sand Dunes	149°20'W, 68°20'N	216	790	.8	HR-1, 5114, V-2, 075
Toolik Upland - South	149°30'W, 68°38'N	231	790	.8	HR-1, 5116, V-2, 132
Toolik Upland - Road Effects Study Site	149°15'W, 68°40'N	239	850	1.9	HR-1, 5117, V-2, 155-157
Sagwon Upland	148°48'W, 69°23'N	294	275	.8	HR-1, 5127, V-2, 324
Franklin Bluffs - Oil Spill Site	148°45'W, 69°50'N	329	90	1.3	RW-07, 5133, V-3, 629
Franklin Bluffs North	148°45'W, 69°52'N	331	90	.8	RW-07, 5132, V-3, 619
Prudhoe Bay - Sand Dunes	148°17'W, 70°17'N	366	6	2.8	BPNS, 19A, 027-029
Prudhoe Bay - Coast	148°32'W, 70°22'N	370	0	2.2	BPNS, 14, 002-004

* Dates of photography:

HR-1 - Summer 1976
RW-07 1975
RW-16 1977
SP-18 1977
BPNS 1973

Table 2. Key to denominators of master map codes and other map symbols. The information is coded as follows:

$$\frac{\text{vegetation code}}{\text{landform code, microrelief class, slope class}}$$

Master Map - denominator codes:

Landform codes (first number):

1. Featureless, or with small non-aligned hummocks
2. Low-centered polygons
3. Aligned hummocks or strangmoor
4. Frost boils
5. Small ridge, hill or kame
6. River or creek bluff
7. Sand dunes
8. Closely spaced large rocks, talus or blockfield
9. Scattered large rocks
10. High-centered polygons
11. Irregular microrelief
12. Solifluction lobes
13. Thermokarsted polygon troughs
14. Mixed high- and low-centered polygons
15. Sandy beach
16. Scattered peat blocks (on coast)
17. Flat or weakly defined polygons
18. Discontinuous polygon rims
19. Pingo
20. Tor
21. Stream bottom with boulders
22. Ice-cored mounds
23. Rocky riverbank
24. Talus or scree consisting of small rocks
25. Intermittent water course
26. Wet stream course

Microrelief class (second number):

1. < 25 cm
2. 25 to 50 cm
3. > 50 cm

Slope class (third number):

0. < 2^{o}
1. 2 to 5^{o}
2. 5 to 30^{o}
3. > 30^{o}

also shown by ▲▲▲ in areas too narrow to map

Miscellaneous codes:

Stream course

Disturbance boundary or trail

Vegetation study site, abbreviated sample

Vegetation study site, detailed sample

▲▲▲ Steep bluff or slope

Culvert

Vegetation transect

Yukon River

The Yukon River site (149°45'W, 65°52'N, elevation 125 m s.m.) is located at the Yukon River bridge on the north side of the river. The road makes a bend to the northwest, and most of the map area lies between the river and the road. The pipeline is elevated and passes through the southern part of the mapped area.

Vegetation along the Yukon River is generally sparse in the immediate vicinity of the river banks. Ice scour marks on the rocks along the river testify to the role of the annual spring break-up in keeping the banks of the river free of larger growth forms. The early date of the mapping (June 5-7, 1978) prevented identification of some of the plants growing along the river. Adjacent to the river, the important species include a grass (Collection No. YR-24), Potentilla anserina, Astragalus alpinus ssp. alpinus, and Tanacetum bipinnatum ssp. huronense. The upper portions of the river bank include the same species and also have a few shrubs such as Shepherdia canadensis, Salix interior, and a few Populus balsamifera ssp. balsamifera seedlings. The first river terrace is narrow and has small P. balsamifera trees and a few P. tremula ssp. tremuloides with Alnus virida ssp. crispa, Rosa acicularis, Equisetum arvense, Chamerion platyphyllum, Tanacetum bipinnatum. The top of the river bluff has stands of large Picea glauca mixed with Betula papyrifera, Alnus viridis ssp. crispa, and several species of Salix including the tall willow, S. bebbiana and S. arbusculoides. The understory for the most part is dominated by Vaccinium vitis-idaea ssp. minus, V. uliginosum, Rosa acicularis, Pyrola asarifolia var. purpurea, Mertensia paniculata, and Hylocomium splendens.

The mapped terrain to the west of the river consists mainly of a tussock bog dominated by Carex lugens, Betula glandulosa, Salix planifolia ssp. pulchra and Chamaedaphne calycullata. The dominant mosses are Hylocomium splendens and

Aulacomnium palustre. Sphagnum is rare probably due to the relatively high pH values in the area (Webber et al., 1978). The margins of the bog have small Picea mariana. In slightly drier microsites the black spruce forests have an understory consisting mainly of Ledum groenlandicum, Vaccinium uliginosum, Betula glandulosa and several lichen species. The forests contain occasional small stands of larger trees (Picea spp.) which have understories of Vaccinium vitis-idaea, V. uliginosum, Ledum groenlandicum, Pyrola asarifolia, and Hylocomium splendens.

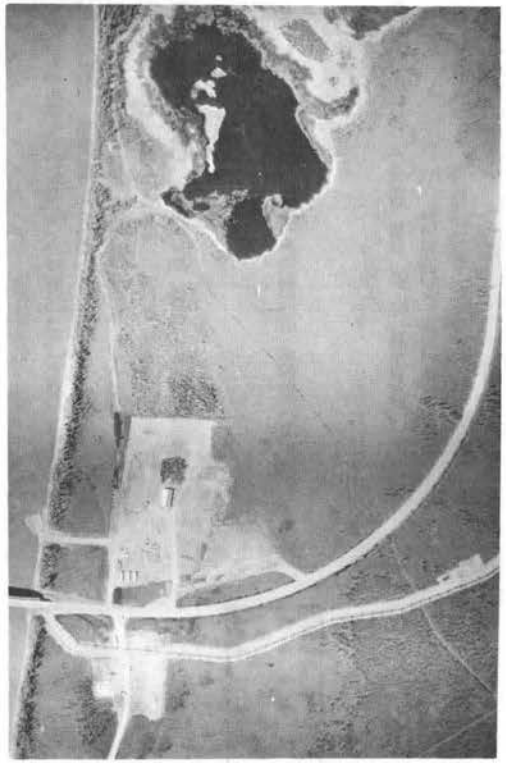
The northern part of the map is dominated by a small lake and associated sedge meadows which are prime habitat for several species of ducks, geese, hawks, owls, microtines and muskrats. A large population of frogs also attracts sandhill cranes.

The wettest marginal areas of the lake have vegetation dominated by Equisetum fluviatile. The drier meadow areas are dominated by Carex rostrata, C. aquatilis, and Comarum palustre. Surrounding the meadows are medium-height shrub communities dominated by Salix planifolia ssp. pulchra and Eriophorum angustifolium. These communities are heavily utilized by moose and ptarmigan.

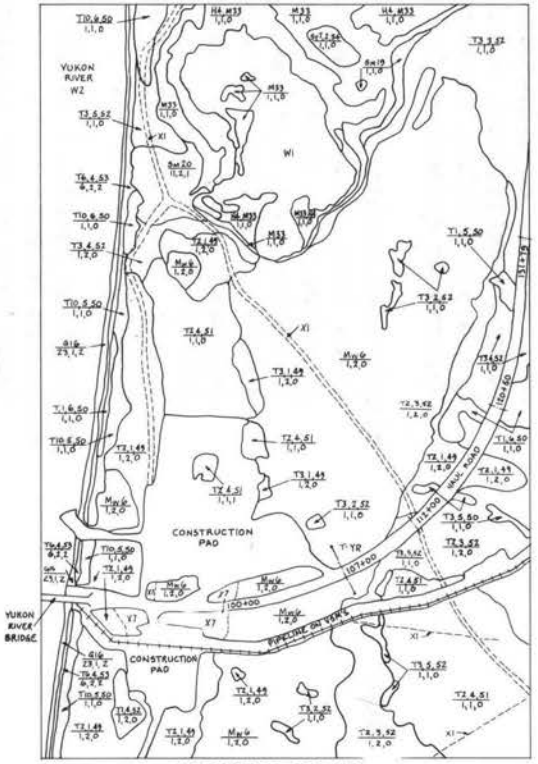
The principal disturbances in the map area are two major trails which meet in the northwest portion of the map. Near the Yukon River bridge there are some areas of minor flooding between the pipeline berm and the haul road.

YUKON RIVER

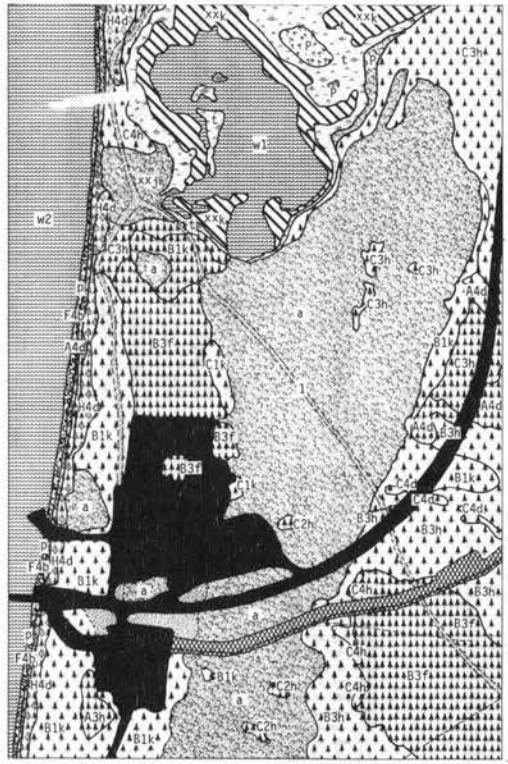
Aerial Photograph



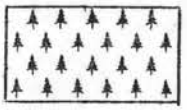
Master Map

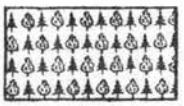
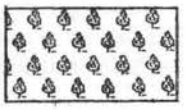
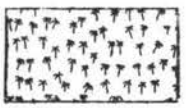


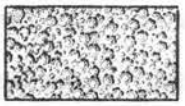
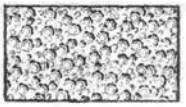
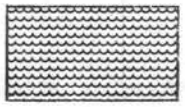
Vegetation

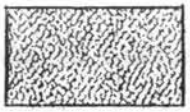
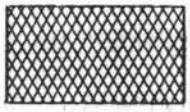


Vegetation Legend for Yukon River

Numerator of Master Map Code	Vegetation Map Pattern and Floristic Code	Description
		CLOSED EVERGREEN FOREST TYPES:
T1, 6, 50	A4d	MOIST *Picea glauca* CLOSED EVERGREEN FOREST Trees > 15 cm dbh; understory: scattered *Salix bebbiana*, with *Vaccinium vitis-idaea, V. uliginosum, Rosa acicularis, Mertensia paniculata, Pyrola asarifolia, Hylocomium splendens*
T1, 4, 52	A3h	MOIST *Picea glauca* CLOSED EVERGREEN FOREST Trees 5-15 cm dbh; understory: *Vaccinium vitis-idaea, V. uliginosum, Carex bigelowii, Ledum groenlandicum, Betula glandulosa, Pyrola asarifolia, Aulacomnium palustre, Hylocomium splendens, Peltigera aphthosa*
T2, 4, 51	B3f	MOIST *Picea mariana* CLOSED EVERGREEN FOREST Trees 5-15 cm dbh; understory: *Ledum groenlandicum, Vaccinium uliginosum, V. vitis-idaea, Arctous alpina* ssp. *rubra, Betula glandulosa, Carex bigelowii, Andromeda polifolia, Saussurea angustifolia, Pentaphylloides floribunda, Tomenthypnum nitens, Hylocomium splendens, Peltigera aphthosa, Cladina* spp.
T3, 4, 52	C3h	MOIST *Picea mariana* - *Picea glauca* CLOSED EVERGREEN FOREST Trees 5-15 cm dbh; understory: same as A3h
T3, 2, 52	C2h	MOIST *Picea mariana* - *Picea glauca* CLOSED EVERGREEN FOREST Trees < 5 cm dbh; understory: same as A3h
		OPEN EVERGREEN FOREST TYPES:
T1, 5, 50	A4d	MOIST *Picea glauca* OPEN EVERGREEN FOREST Trees > 15 cm dbh; understory: scattered *Salix bebbiana* with *Vaccinium vitis-idaea, V. uliginosum, Rosa acicularis, Mertensia paniculata, Pyrola asarifolia, Hylocomium splendens*

Numerator of Master Map Code	Vegetation Map Pattern and Floristic Code	Description
T3, 5, 50	C4d	MOIST *Picea glauca - Picea mariana* OPEN EVERGREEN FOREST Trees > 15 cm dbh; understory: same as A4d
T2, 3, 52	B3h	MOIST *Picea mariana* OPEN EVERGREEN FOREST Trees 5-15 cm dbh; understory: *Vaccinium vitis-idaea, V. uliginosum, Carex bigelowii, Ledum groenlandicum, Betula glandulosa, Pyrola asarifolia, Aulacomnium palustre, Hylocomium splendens, Peltigera aphthosa*
T3, 5, 52	C4h	MOIST *Picea mariana - Picea glauca* OPEN EVERGREEN FOREST Trees > 15 cm dbh; understory: same as B3h
T3, 3, 52	C3h	MOIST *Picea mariana - Picea glauca* OPEN EVERGREEN FOREST Trees 5-15 cm dbh; understory: same as B3h
T2, 1, 49	B1k	WET *Picea mariana* OPEN EVERGREEN FOREST Trees < 5 cm dbh; understory: *Carex lugens, Chamaedaphne calyculata, Betula glandulosa, Salix planifolia, Vaccinium uliginosum, Ledum groenlandicum, Aulacomnium palustre, Tomenthypnum nitens*
T3, 1, 49	C1k	WET *Picea mariana - Picea glauca* OPEN EVERGREEN FOREST Trees < 5 cm dbh; understory: same as B1k
T10, 5, 50 and T10, 6, 50	 H4d	MOIST *Picea glauca - Betula papyrifera* MIXED FOREST Trees > 15 cm dbh; understory: same as A4d
T6, 4, 53	 F4b	DRY *Populus balsamifera* OPEN DECIDUOUS FOREST Trees 5-15 cm dbh; understory: scattered *Alnus viridis* and *Salix* spp. with *Rosa acicularis, Shepherdia canadensis, Tanacetum bipinnatum, Equisetum arvense, Potentilla anserina*
S_T7, 2, 54	 p	DRY *Salix bebbiana - Shepherdia canadensis - Arctostaphylos uva-ursi - Pyrola asarifolia - Hylocomium splendens* TALL SCRUB

Numerator of Master Map Code	Vegetation Map Pattern and Floristic Code	Description
		MOIST *Salix planifolia - Eriophorum angustifolium - Aulacomnium palustre - Sphagnum* sp. SCRUB
S_M19	p	
		DISTURBANCE VEGETATION COMPLEX Many downed trees; non-homogeneous vegetation, moist scrub vegetation with following species: *Salix* spp., *Ledum groenlandicum, Vaccinium vitis-idaea, V. uliginosum, Calamagrostis canadensis, Chamaedaphne calyculata, Picea* spp., *Hylocomium splendens*
S_M20	xxjj	
		WET *Carex lugens - Chamaedaphne calyculata - Betula glandulosa - Salix planifolia - Aulacomnium palustre* TUSSOCK GRAMINOID MEADOW
S_M21	a	
		WET *Carex rostrata - C. aquatilis - Comarum palustre - Arctagrostis arundinacea* GRAMINOID MEADOW
M33	t	
		MARSH VEGETATION COMPLEX a) VERY WET *Equisetum fluviatile - Comarum palustre - Hippuris vulgaris* HORSETAIL MEADOW b) WET *Carex rostrata - C. aquatilis - Comarum palustre - Arctagrostis arundinacea* GRAMINOID MEADOW
H4, M33, and M33, H4	xx_k	
		DRY *Potentilla anserina - Astragalus alpinus - Shepherdia canadensis - Salix interior - Tanacetum bipinnatum* RIVER BAR BARREN
G16	p	
W1 and W2		WATER

Numerator of Master Map Code	Vegetation Map Pattern and Floristic Code	Description
X7		DISTURBED
		ROAD AND CONSTRUCTION PADS
	1	Winter trail
		PIPELINE

Ray River

The Ray River site (150°00'W, 66°00'N, elevation 180 m s.m.) is located 15 km north of Five Mile Camp along a stretch of road which overlooks the meandering Ray River. The region is characterized by steep hills with mixed spruce and deciduous forests. Some areas have extensive aspen stands. The pipeline is located just east of the eastern boundary of the map and is supported on VSM's through most of this section.

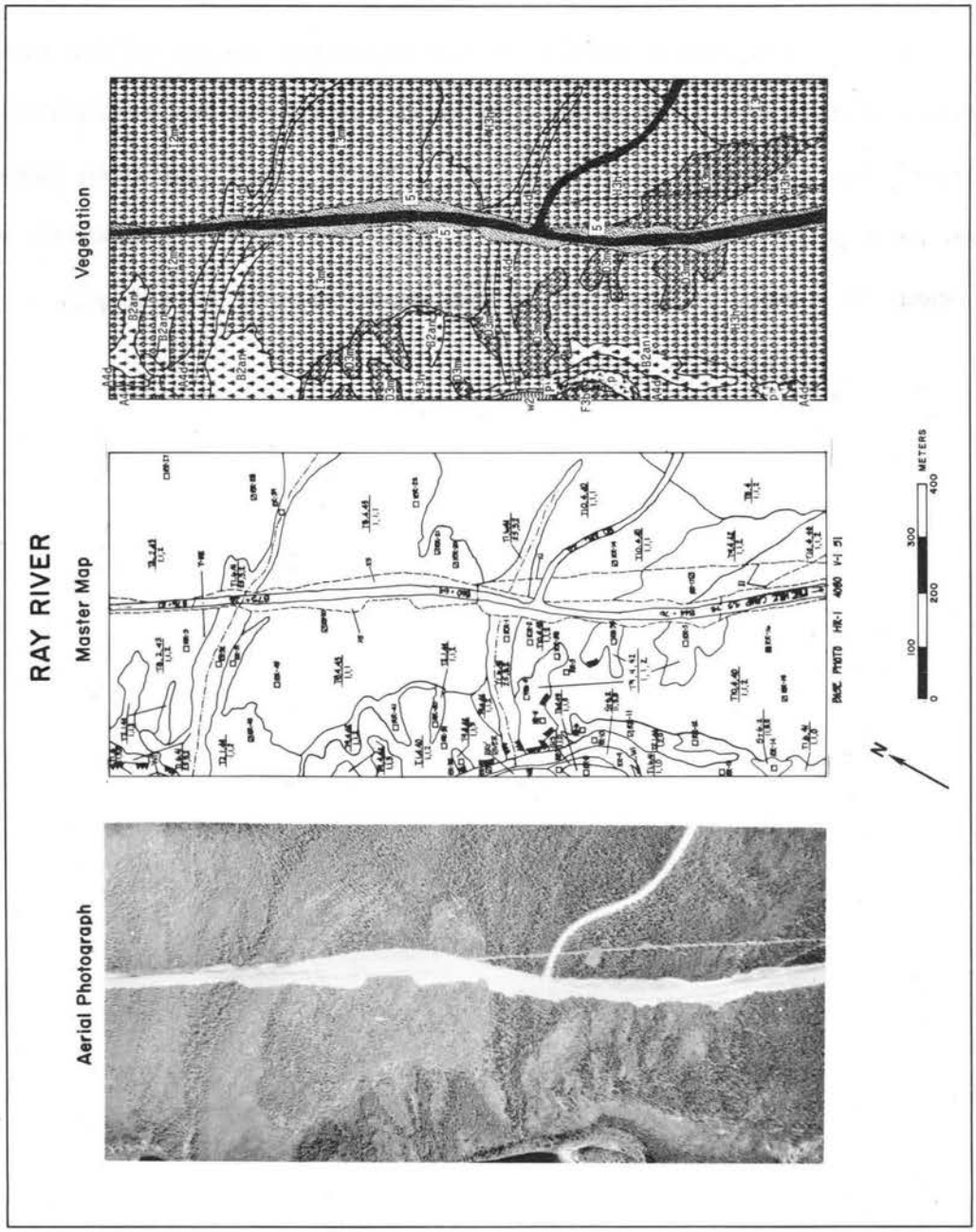
The southwest portion of the mapped area consists of a steep slope which drops to the terraces of the Ray River. Vegetation on this slope consists of dense Picea glauca with scattered Betula papyrifera. The understory is dominated by Vaccinium vitis-idaea, Geocaulon lividum, Ledum groenlandicum, Mertensia paniculata, and Hylocomium splendens. Along the highest terrace of the river there are large Picea glauca trees. Some trees have diameters at breast height exceeding 60 cm. The understory in this area consists mainly of Rosa acicularis, Linnaea borealis, Ribes triste, Equisetum arvense, Mertensia paniculata, and Hylocomium splendens. This forest type also extends up two small drainages which run from east to west across the mapped area. On the lowest terrace there is a boggy area with small Picea mariana, Sphagnum spp., Chamaedaphne calyculata, Rubus chamaemorus, Oxycoccus microcarpus, and Carex lugens. This same association with Chamaedaphne absent is also found on some hillsides in areas which have apparently been burned.

Lower terraces of the river have dense willow thickets and the vegetation on a small gravel bar is dominated by Populus balsamifera. A large area of aspen trees is located on a steep southwest facing slope in the southern half of the map. The understory for this forest type consists mainly of Arctostaphylos uva-ursi, Geocaulon lividum, Galium boreale, and Zygadenus elegans.

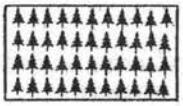
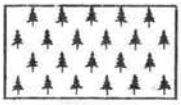
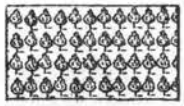
Fire has played a large role in the region. The central portion of the map is located on a broad hilltop which has been burned. Medium sized (5-10 cm dbh)

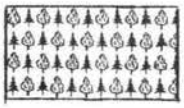
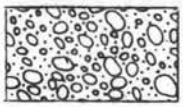
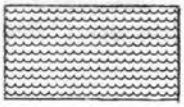
Picea mariana and Populus tremula ssp. tremuloides forest with a rich lichen understory covers most of this area. The area north of a small drainage (culvert no. 873+28) has a very similar forest, but Betula papyrifera occurs instead of aspen. Another similar forest occurs in the southeast corner of the map.

The main disturbance in this area is associated with the extensive fills and cuts necessary for construction of the road. These areas have been revegetated and are becoming well-stabilized. There is also a cleared trail which parallels the road about 50 m east of the road in the southern half of the map.


RAY RIVER
Aerial Photograph
Master Map
Vegetation
METERS
0
100
200
300
400
N

Vegetation Legend for Ray River

Numerator of Master Map Code	Vegetation Map Pattern and Floristic Code	Description
		CLOSED EVERGREEN FOREST TYPES:
T1, 6, 41	A4d	MOIST *Picea glauca* CLOSED EVERGREEN FOREST Trees > 15 cm dbh; understory: scattered *Alnus viridis* and *Betula papyrifera* with *Rosa acicularis, Linnaea borealis, Ribes triste, Mertensia paniculata, Equisetum arvense, Vaccinium vitis-idaea, Hylocomium splendens*
T1, 4, 40	A3h	MOIST *Picea glauca* CLOSED EVERGREEN FOREST Trees 5-15 cm dbh; understory: *Vaccinium vitis-idaea, Geocaulon lividum, Ledum groenlandicum, Mertensia paniculata, Hylocomium splendens, Peltigera aphthosa*
T1, 6	A4	MOIST *Picea glauca* CLOSED EVERGREEN FOREST Trees > 15 cm dbh; understory unspecified
T2, 1, 44	 B2an	WET *Picea mariana* OPEN EVERGREEN FOREST Trees < 5 cm dbh; understory: *Sphagnum* spp., *Vaccinium vitis-idaea, Rubus chamaemorus, Ledum palustre, Oxycoccus microcarpus, Carex bigelowii, Aulacomnium palustre*
		CLOSED DECIDUOUS FOREST TYPES:
T9, 4, 42	D3m	DRY *Populus tremula* CLOSED DECIDUOUS FOREST Trees 5-15 cm dbh; understory: *Arctostaphylos uva-ursi, Geocaulon lividum, Galium boreale, Zygadeneus elegans*
T6, 4, 45	F3b	DRY *Populus balsamifera* CLOSED DECIDUOUS FOREST Trees 5-15 cm dbh; understory: scattered *Salix* spp. and *Alnus viridis* with *Shepherdia canadensis, Geocaulon lividum, Stereocaulon* sp., *Drepanocladus uncinatus*

Numerator of Master Map Code	Vegetation Map Pattern and Floristic Code	Description
		MIXED EVERGREEN DECIDUOUS FOREST TYPES:
T10, 4, 40	H3h	MOIST *Picea glauca - Betula papyrifera* CLOSED MIXED FOREST Trees mostly 5-15 cm dbh; scattered trees > 15 cm dbh; understory: *Vaccinium vitis-idaea, Geocaulon lividum, Ledum groenlandicum, Mertensia paniculata, Hylocomium splendens, Peltigera aphthosa*
T8, 4, 43	I3n	MOIST *Picea mariana - Populus tremula* CLOSED MIXED FOREST Trees 5-15 cm dbh; understory: *Cladina arbuscula, C. rangiferina, Cladonia gracilis, Vaccinium vitis-idaea, Ledum palustre, Geocaulon lividum*
T8, 2, 43	I2n	MOIST *Picea mariana - Populus tremula* CLOSED MIXED FOREST Trees < 5 cm dbh; understory: same as I3n
T8, 4	I3	MOIST *Picea mariana - Populus tremula* CLOSED MIXED FOREST Trees 5-15 cm dbh; understory: mixture of those found in I3n and A3h
S_T6, 2	 p	MOIST *Salix* spp. TALL SCRUB
G13	 p	DRY *Salix alaxensis - Castilleja caudata - Galium boreale - Shepherdia canadensis - Epilobium latifolium* RIVER BAR BARREN
X5	 5	DISTURBED Road cut or embankment
W2 and W1		WATER
		ROAD

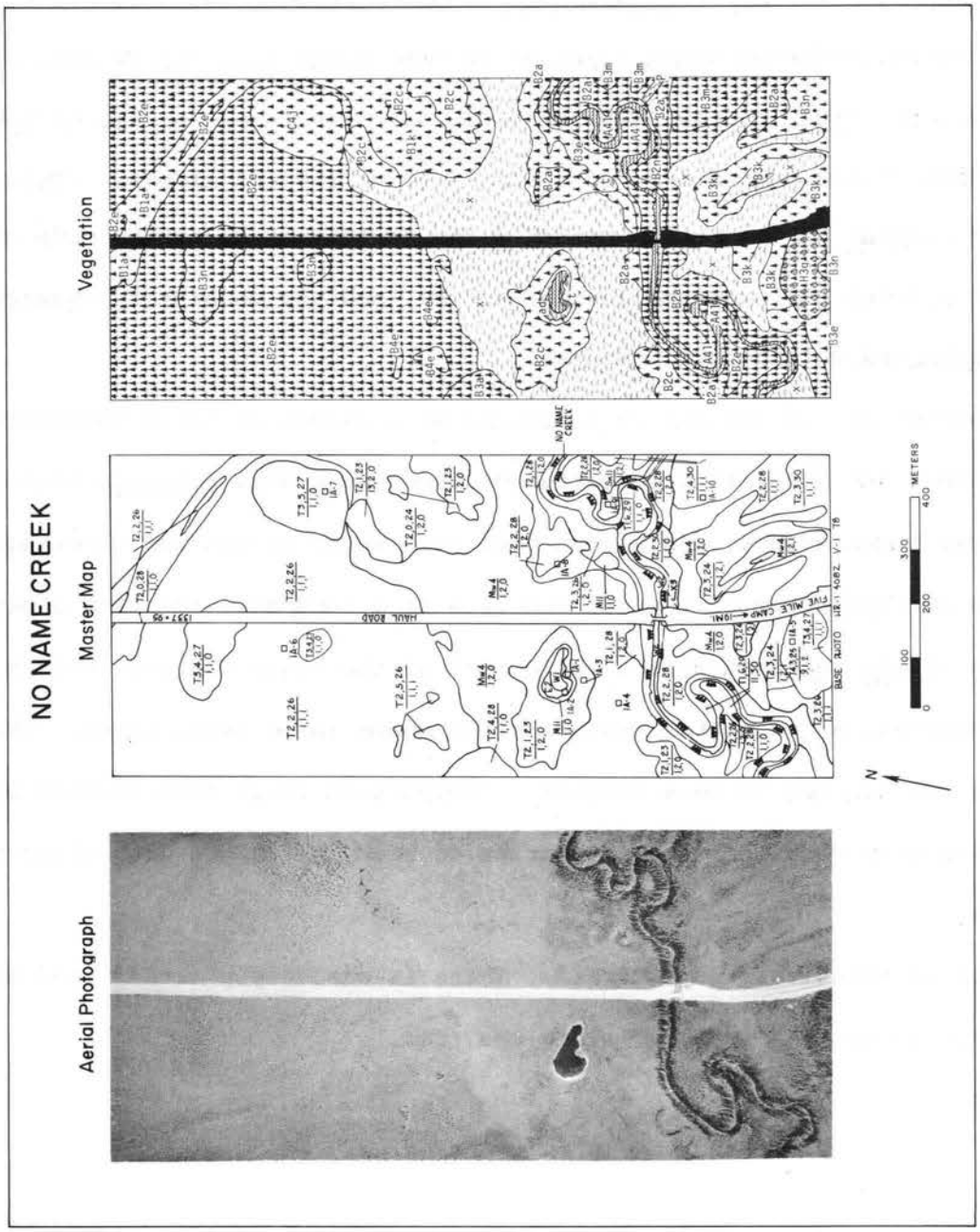
No Name Creek

No Name Creek (150°10'W, 66°06'N; 200 m s.m.) is located 23 km north of the Yukon River. The pipeline is about one km east of the mapped area. The terrain consists of a broad creek drainage situated between two long hills.

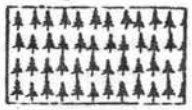
Along the well-drained upper banks of No Name Creek is a narrow band of tall white spruce (Picea glauca) with an understory consisting mainly of horsetails. Along the edges of the stream are dense stands of willow and alders. (This band is too narrow to appear on the map.) Within a few decimeters on either side of the creeks the trees are much smaller in stature, and the understory changes to dwarf shrubs and cottongrass tussocks.

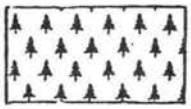
The central area of the map is dominated by a meadow of large cottongrass tussocks. There are also slightly better drained sites with Sphagnum bogs and small diameter black spruce, and also a pond with water lilies and other aquatic plants. The northern half of the map consists of a long hillside with a dense black spruce (Picea mariana) forest where most of the trees are very skinny. There are, however, a few better drained sites where large trees occur. The southern half of the map is more complex. Communities range from drunken black spruce forests with rich lichen understories to rocky hillsides with birch and white spruce.

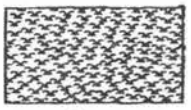
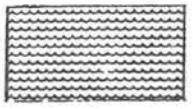
The area is relatively undisturbed. There is one deeply eroded road cut, apparently due to altered drainage along the road.


NO NAME CREEK
Aerial Photograph
Master Map
Vegetation
HAUL ROAD
FIVE MILE CAMP
NO NAME CREEK
METERS
0
100
200
300
400
N

Vegetation Legend for No Name Creek

Numerator of Master Map Code	Vegetation Map Pattern and Floristic Code	Description
		CLOSED EVERGREEN FOREST TYPES:
T1, 6, 29	A41	MOIST *Picea glauca* CLOSED EVERGREEN FOREST Trees greater than 15 cm dbh; understory: *Equisetum silvaticum, Vaccinium uliginosum, Ribes triste, Mertensia paniculata, Rosa acicularis, Pyrola asarifolia, Rhytidiadelphus triquetrus*
T2, 2, 28	B2a	MOIST *Picea mariana* CLOSED EVERGREEN FOREST Trees less than 5 cm dbh; understory: *Betula glandulosa, Vaccinium uliginosum, V. vitis-idaea, Salix planifolia, Chamaedaphne calycullata, Carex bigelowii, Peltigera aphthosa*
	B3a	Trees 5-15 cm dbh; understory: same as B2a
T2, 2, 26	B2e	MOIST *Picea mariana* CLOSED EVERGREEN FOREST Trees less than 5 cm dbh; understory: *Vaccinium uliginosum, V. vitis-idaea, Empetrum eamesii, Lupinus arcticus, Ledum groenlandicum, Rhytidiadelphus triquetrus, Peltigera aphthosa, Cladonia* spp., *Hippocheate variegata*
T2, 2, 30	B2n	MOIST *Picea mariana* CLOSED EVERGREEN FOREST Trees less than 5 cm dbh; understory: *Cladina* spp., *Cladonia* spp., *Empetrum eamesii, Ledum groenlandicum, Aulacomnium* spp.
T2, 4, 30	B3n	Trees 5-15 cm dbh; understory: same as B2n
T3, 4, 27	C3j	DRY *Picea glauca - Picea mariana* CLOSED EVERGREEN FOREST Trees 5-15 cm dbh; understory: *Lupinus arcticus, Pentaphylloides floribunda, Salix glauca, Vaccinium vitis-idaea, Chamerion platyphyllum, Festuca altaica, Cladina* spp., *Hylocomium splendens*

Numerator of Master Map Code	Vegetation Map Pattern and Floristic Code	Description
		OPEN EVERGREEN FOREST TYPES:
T2, 0, 28	B1a	MOIST *Picea mariana* EVERGREEN LOW SAVANNA Trees less than breast height; understory: *Betula glandulosa, Vaccinium uliginosum, V. vitis-idaea, Salix planifolia, Chamaedaphne calyculata, Carex bigelowii, Peltigera aphthosa*
T2, 1, 28	B2a	MOIST *Picea mariana* OPEN EVERGREEN FOREST Trees less than 5 cm dbh; understory: same as B1a
T2, 1, 23	B2c	MOIST *Picea mariana* OPEN EVERGREEN FOREST Trees less than 5 cm dbh; understory: *Chamaedaphne calyculata, Andromeda polifolia, Rubus chamaemorus, Oxycoccus microcarpa, Betula glandulosa, Sphagnum* sp.
T2, 3, 26	B3e	MOIST *Picea mariana* OPEN EVERGREEN FOREST Trees 5-15 cm dbh; understory: *Vaccinium uliginosum, V. vitis-idaea, Empetrum eamesii, Lupinus arcticus, Ledum groenlandicum, Hippocheate variegata, Rhytidiadelphus triquetrus, Peltigera aphthosa, Cladonia* spp.
T2, 5, 26	B4e	Trees greater than 15 cm dbh; understory: same as B3e
T2, 0, 24	B1k	WET *Picea mariana* EVERGREEN LOW SAVANNA Trees less than breast height; understory: *Eriophorum vaginatum, Chamaedaphne calycullata, Betula glandulosa, Salix planifolia, Sphagnum* sp.
T2, 3, 24	B3k	WET *Picea mariana* OPEN EVERGREEN FOREST Trees 5-15 cm dbh; understory: same as B1k
T2, 3, 30	B3n	MOIST *Picea mariana* OPEN EVERGREEN FOREST Trees 5-15 cm dbh; understory: *Cladina* spp., *Cladonia* spp., *Empetrum eamesii, Ledum groenlandicum, Aulacomnium* spp.
T3, 5, 27	C4j	DRY *Picea glauca - Picea mariana* OPEN EVERGREEN FOREST Trees greater than 15 cm dbh; understory: *Lupinus arcticus, Pentaphylloides floribunda, Salix glauca, Vaccinium vitis-idaea, Chamerion platyphyllum, Festuca altaica, Cladina* spp., *Hylocomium splendens*

Numerator of Master Map Code	Vegetation Map Pattern and Floristic Code	Description
T4, 3, 25	 H3g	DRY *Picea glauca - Betula papyrifera* OPEN MIXED FOREST Trees 5-15 cm dbh; understory: *Empetrum eamesii, Vaccinium vitis-idaea, V. uliginosum*, Polytrichaceae, *Dicranum* sp., *Cladina* spp., *Stereocaulon* sp.
S_M11	 p	MOIST *Salix planifolia - Pentaphylloides floribunda - Vaccinium uliginosum - Jurtsevia richardsonii - Tomenthypnum nitens* SCRUB
M11	 t	VERY WET *Carex rostrata - Carex limosa - Comarum palustre - Calliergon* sp. GRAMINOID MEADOW
M_W4	 x	WET *Eriophorum vaginatum - Chamaedaphne calycullata - Betula glandulosa - Salix planifolia* TUSSOCK GRAMINOID MEADOW
E2	 ad	VERY WET *Nuphar luteum* AQUATIC FORB MEADOW
W1 and W2		Water
	W1	Lake
	W2	Creek
		Road

No Name Creek

Key to Landforms, Size of Microrelief, Slope Class

Landforms (1st number in denominator):

1. Featureless or non-aligned hummocks
9. Scattered large rocks
11. Irregular microrelief
13. Thermokarsted polygon troughs

Microrelief Size (2nd number in denominator):

1. < 25 cm
2. 25 to 50 cm
3. > 50 cm

Slope Class (3rd number in denominator):

0. < 2^{o}
1. 2 to 5^{o}
2. 5 to 30^{o}
3. > 30^{o}

 Steep embankment

Finger Mountain

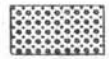
The Finger Mountain site (150°30'N, 66°22'N, elevation 490 m s.m.) is located 11.7 km south of Old Man Camp. The area is approximately at treeline and contains forested areas, a subalpine band of tree islands and a dry upland with widely spaced alder shrubs. There are also three large granitic rock outcrops, which are typical of the many tors which occur on the broad hills of the region. The pipeline is in the buried mode next to the east side of the road.

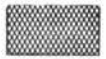
The tor features are richly covered with lichens, with the dominant genera being Umbilicaria, Parmelia, Physcia, Lecidea, and Cladonia. The lower parts of the tors are beautifully landscaped with lichen covered rocks, scattered small birch trees (Betula papyrifera), and an understory consisting primarily of lichens (Cladina arbuscula, C. alpestris, C. rangiferina, Stereocaulon sp.), dwarf shrubs (Ledum palustre, Betula nana), and the grass Hierochloë alpina. Most of the map is covered by upland surfaces with evenly spaced alder shrubs (Alnus viridis), Carex bigelowii, Betula nana, Ledum palustre, and the lichens Cetraria cucullata, and Cladina rangiferina. The upland trees have very widely scattered tree islands of either Betula papyrifera or Picea mariana. The downslope edges of this upland surface grade into subalpine meadows dominated by Carex bigelowii, Betula nana, and Sphagnum spp. These meadows also have uniformly spaced alder shrubs and tree islands consisting of Picea mariana. Many of these islands have flagged trees and krummholz which have been shaped by the strong winds which are predominantly from the east.

The forested areas consist mainly of medium sized (5-15 cm dbh), Picea mariana with scattered Betula papyrifera.

There is a small stream which cuts across the northeast corner of the map. The vegetation in the stream bottom consists of dense willow thickets with an understory consisting of Sphagnum sp., Mnium sp., and Comarum palustre.

Vegetation Legend for Finger Mountain

Numerator of Master Map Code	Vegetation Map Pattern and Floristic Code	Description
$T_O B5,39$	 B5a	MOIST *Picea mariana* CONIFEROUS LOW SAVANNA Scattered tree islands or krummholz < 5 cm dbh; understory: scattered *Alnus viridis* with *Betula nana, Ledum palustre, Carex bigelowii, Vaccinium vitis-idaea, Sphagnum* spp.
		OPEN DECIDUOUS FOREST TYPES:
$T_O E3,34$	E3m	DRY *Betula papyrifera* OPEN DECIDUOUS FOREST Trees 5-15 cm dbh; understory: *Cladina alpestris, C. rangiferina, Cetraria cucullata, Arctous alpina* ssp. *rubra, Loiseleuria procumbens, Stereocaulon* sp., *Ledum palustre, Betula nana*
$T_O E3,38$	E3f	DRY *Betula papyrifera* OPEN DECIDUOUS FOREST Trees 5-15 cm dbh; understory: *Ledum palustre, Betula nana, Cladina rangiferina, C. alpestris, Vaccinium uliginosum, V. vitis-idaea, Cladonia gracilia, Stereocaulon* sp.
		OPEN MIXED FOREST TYPES:
$T_O H5,38$	H5f	DRY *Picea mariana - Betula papyrifera* MIXED LOW SAVANNA Tree islands or krummholz < 5 cm dbh; understory: same as E3f
$T_O H3,38$	H3f	DRY *Picea mariana - Betula papyrifera* OPEN MIXED FOREST Trees 5-15 cm dbh; understory: same as E3f
$T_O H3,38,39$	H3	DRY *Picea mariana - Betula papyrifera* OPEN MIXED FOREST Trees 5-15 cm dbh; understory: mixture of those found in E3f and B5a
$S_t 50$	 P	WET *Salix planifolia - Comarum palustre - Sphagnum* sp. TALL SCRUB
$S_m 12$	 a	WET *Betula glandulosa - Salix planifolia - Spirea beauverdiana - Sphagnum* sp. SCRUB
$S_m 13, S_d 14$	 xx_i	FROST BOIL VEGETATION COMPLEX: a) Inter-frost boil areas: MOIST *Ledum palustre - Betula nana - Carex bigelowii - Vaccinium vitis-idaea - Sphagnum* sp. DWARF SCRUB b) Frost boils: DRY *Alnus viridis - Ledum decumbens - Betula nana - Cladina rangiferina - Cetraria cucullata - Rhacomitrium lanuginosum* SCRUB

Numerator of Master Map Code	Vegetation Map Pattern and Floristic Code	Description
L6	 n	DRY *Cladina alpestris - C. rangiferina - Cetraria cucullata - Arctous alpina* ssp. *rubra - Loiseleuria procumbens* LICHEN MEADOW
L5	 ah	DRY *Umbilicaria hyperborea - Parmelia* sp. - *Rhizocarpon geographicum - Cornicularia divergens* BLOCK FIELD BARREN
D12	 12	DISTURBED changed vegetation due to culvert
		BURIED PIPELINE
		ROAD

Description of the Finger Mountain Site

The Finger Mountain site (150°30'W, 66°22'N, elevation 490 m.s.m.) is located 11.7 km south of the Old Man Camp on the Yukon River to Prudhoe Bay Highway. The area is near treeline and contains forested areas, a subalpine band of tree islands and krummholz and a moist upland shrub savanna with widely spaced alder shrubs. There are also three large granitic rock outcrops, which are typical of the many tors which occur on the broad hills in this region of the Kokrine-Hodzana highlands. The Trans-Alaska Pipeline is located on the east side of the road in the buried mode.

The tor features are richly covered with lichens, primarily from the genera Umbilicaria, Parmelia, Physcia, Lecidea, and Cladina. The gentle slopes leading up to the tors are covered with beautiful lichen heath meadows with widely spaced birch trees. The primary taxa in these lichen meadows are Cladina arbuscula, C. alpestris, C. rangiferina, Stereocaulon sp., Ledum palustre, Betula nana, Loiseleuria procumbens, and Hierochloë alpina. Most of the map area is covered by subalpine shrub savanna, with evenly spaced Alnus viridis occurring mainly on frost boil surfaces. The inter-frost boil areas are dominated by dwarf scrub vegetation consisting of Ledum palustre, Betula nana, Carex bigelowii, Vaccinium vitis-idaea, and Sphagnum spp.

The upland surfaces have very widely scattered tree islands of either Betula papyrifera or Picea mariana. The downslope edges of the upland grade into subalpine meadows dominated by Carex bigelowii, Betula nana, and Sphagnum spp. These meadows also have uniformly spaced alder shrubs and tree islands consisting of Picea mariana. Many of these tree islands have flagged trees and krummholz shaped by the strong winds from the east.

The lower slopes are forested with medium-sized (5-15 cm dbh) Picea mariana and scattered Betula papyrifera. The understory is varied depending on the drainage of the substrate. The drier areas have Ledum palustre, Betula nana, Vaccinium uliginosum, V. vitis-idaea, Cladina rangiferina, C. alpestris, and Stereocaulon sp. The moister areas have Alnus viridis, Betula nana, Ledum palustre, Carex bigelowii, Vaccinium vitis-idaea, and Sphagnum spp.

There is a small stream which cuts across the northwest corner of the map. The stream bottom has dense willow thickets with an understory consisting of Sphagnum sp., Mnium sp., and Comarum palustre.

FINGER MOUNTAIN

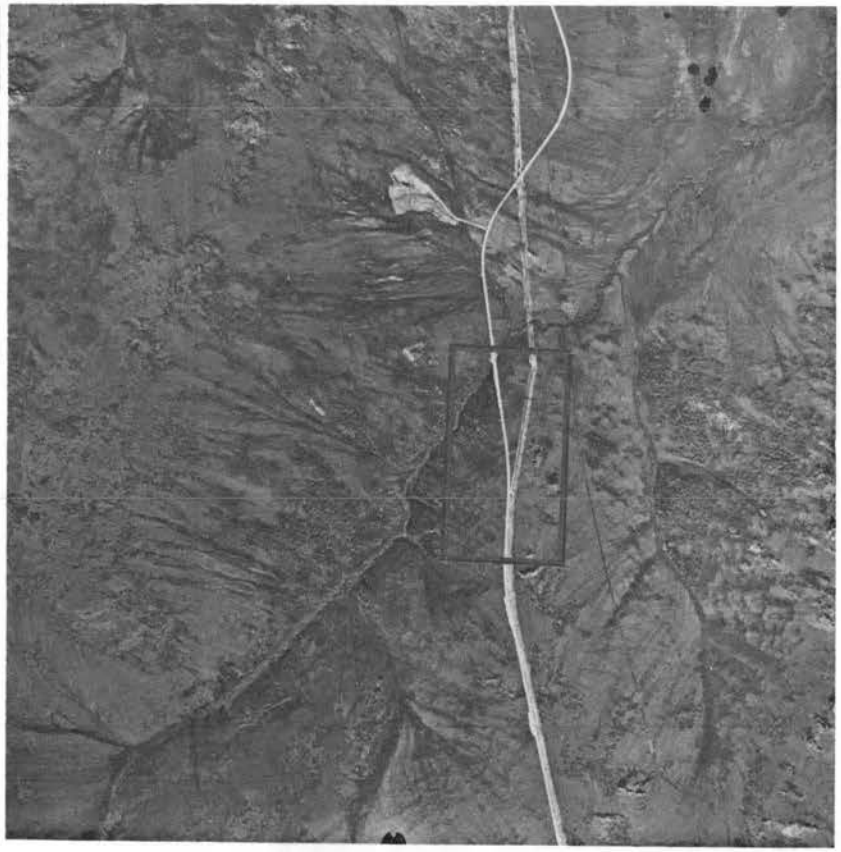


FIGURE 1 (above). The mapped area is at treeline. Strong winds shape the Black Spruce into flagged trees and krummholz.

FIGURE 2 (left). Color aerial photograph (1:24,000) of the Finger Mountain vicinity. The mapped area is in the rectangle. The region is characterized by rolling unglaciated uplands that are often crowned by granitic tors.

FIGURE 3 (right). Asmall drainage dominated by Salix planifolia ssp. pulchra. The creek empties into Olsons Lake in a large parkland near Old Man contruction camp.

FIGURE 4. A tor with scattered Betula papyrefera at its base. The ground cover is mostly Cladina alpestris and C. rangiferina lichen meadow. The rocks are covered with many species of lichens.

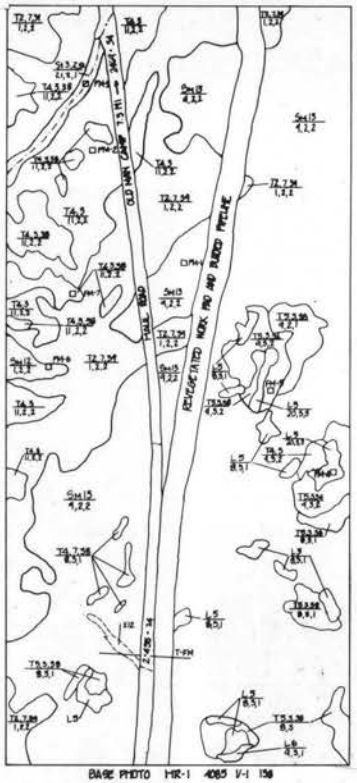
FIGURE 5. A view downslope toward treeline. Many of the trees near the treeline occur in linear groups that are oriented perpendicular to the wind. This is apparent on the 1:6000 aerial photograph. Shrub savanna occurs in the foreground.

FIGURE 6. Upland areas above most of the trees are characterized by Alnus viridis shrub savanna. Most of the alders occur on frost-boils. The inter-frost-boil areas are dominated by ericaceous shrubs, Sphagnum moss and Carex bigelowii.

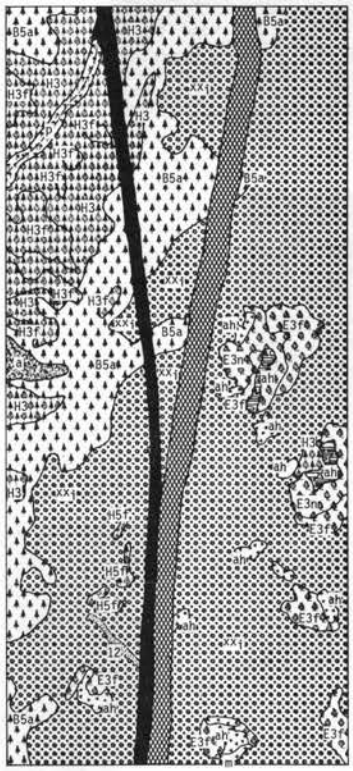
FINGER MOUNTAIN

Aerial Photograph

Master Map



Vegetation



Gobbler's Knob

The Gobbler's Knob site (150°40'W, 66°45'N, elevation 550 m s.m.) is located at the summit of the road over Gobbler's Knob, 10 km south of Pump Station 5. Material site MS-90-3 and the access road to the pipeline, 90 APL/AMS 4A, are in the mapped area. The pipeline is east of the mapped area and is buried.

The site is located at treeline. The forested areas generally have small (less than 5 cm dbh) widely scattered Picea mariana with an understory consisting of dwarf and medium sized (less than 2 m high) shrubs (Betula glandulosa, B. nana ssp. exilis, Vaccinium uliginosum, V. vitis-idaea ssp. minus, Spirea beauverdiana, Ledum palustre ssp. decumbens, Rubus chamaemorus), Sphagnum, and several species of lichens, primarily Cladonia, Cladina, and Cetraria. Drainages and protected microsites have taller shrubs (mainly Alnus viridis ssp. crispa and Betula glandulosa). In the southeastern part of the map the forest understory is somewhat drier with more extensive areas of lichens in the understory. These drier areas are, however, scattered and form a mosaic with the dwarf shrub community type. In the northwest corner of the map is an area of moderately dense medium sized (5 to 15 cm dbh) Picea mariana with an understory dominated by Vaccinium uliginosum, V. vitis-idaea ssp. minus, Ledum palustre ssp. decumbens, and feathermosses (Hylocomium splendens and Pleurozium schreberi). This community borders a drainage channel with dense Salix planifolia ssp. pulchra thickets.

Below the road at the summit parking area is a steep rocky slope with open Betula papyrifera and an understory dominated by lichens (Cetraria nivalis, Cornicularia divergens, Cladina rangiferina, Asahinea chrysantha, Alectoria ochroleuca), and prostrate shrubs (Loiseleuria procumbens, Empetrum eamesii ssp. hermaphroditum, and Diappensia lapponcia ssp. obovata). This community type is the most distinctive type within the map area, and occurs on several exposed knolls and well-drained microsites.

In areas above the treeline the terrain has many frost boils and the vegetation is similar to that above treeline at the Finger Mountain Site (150°30'W, 66°22'N, elevation 490 m s.m.). Scattered medium sized Alnus viridis ssp. crispa shrubs occur on many of the frost boils with lichens, Ledum, Vaccinium vitis-idaea, Empetrum, and other species from the drier end of the vegetation continuum. The areas between frost boils consist of dwarf shrub tundra with ericaceous shrubs, Carex bigelowii ssp. bigelowii, Sphagnum, and several species of fruticose lichens.

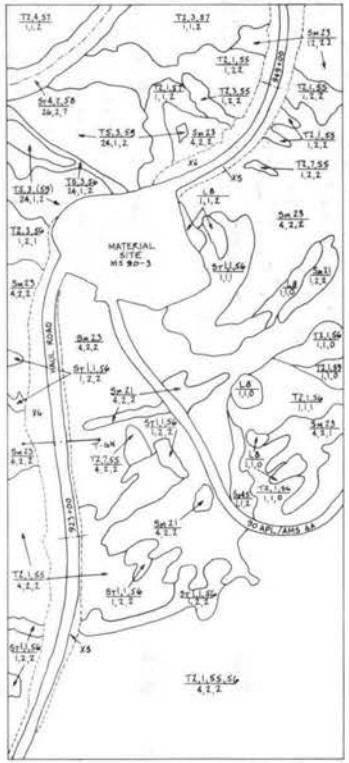
At the summit of the mountain (not included in the map area) there are extensive areas of lichen heath similar to community type L 8 (59) except that prostrate shrubs are less common and the lichen mat consists mainly of Cornicularia divergens and Alectoria nigricans. On the exposed slopes facing southeast a common vegetation type is one dominated by Hierochloë alpina with Salix phlebophylla, Arctous alpina ssp. alpina, Antennaria friesiana, Carex microchaeta, Selaginella sibirica, Minuartia arctica, Loiseleuria procumbens, Diapensia lapponica, the moss Polytrichum piliferum, and lichens including Cornicularia divergens, Alectoria nigricans, Cetraria nivalis, and Thamnolia sp. This vegetation type is probably the same type that is visible on the summits of hills to the west of Gobbler's Knob.

The main disturbance within the map area is the dust which is killing Sphagnum and other mosses and lichens on both sides of the road.

GOBBLER'S KNOB

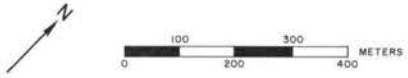
Aerial Photograph

Master Map

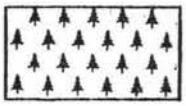


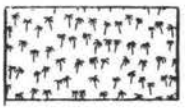
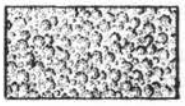
Vegetation

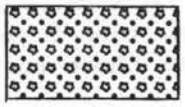
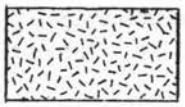
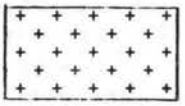
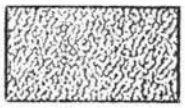
BASE PHOTO HR-1 4090 V-1 234



Vegetation Legend for Gobbler's Knob

Numerator of Master Map Code	Vegetation Map Pattern and Floristic Code	Description
T2, 4, 57	 B3e	MOIST *Picea mariana* CLOSED EVERGREEN FOREST Trees 5-15 cm dbh; understory: *Vaccinium uliginosum, Ledum palustre, Vaccinium vitis-idaea, Betula* spp., *Sphagnum* spp., *Pleurozium schreberi, Hylocomium splendens*
		OPEN EVERGREEN FOREST TYPES:
T2, 3, 56	B3a	DRY *Picea mariana* OPEN EVERGREEN FOREST Trees 5-15 cm dbh; understory: *Betula glandulosa, B. nana, Ledum palustre, Vaccinium uliginosum, V. vitis-idaea, Spirea beauverdiana, Cladina rangiferina, C. arbuscula, Cetraria nivalis, Cladonia* spp.
T2, 1, 56	B2a	Trees less than 5 cm dbh; understory: same as B3a
T2, 3, 57	B3e	MOIST *Picea mariana* OPEN EVERGREEN FOREST Trees 5-15 cm dbh; understory: *Vaccinium uliginosum, Ledum palustre, V. vitis-idaea, Betula nana, Sphagnum* sp., *Pleurozium schreberi, Hylocomium splendens*
T2, 1, 57	B2e	Trees less than 5 cm dbh; understory: same as B3e
T2, 3, 55	B3f	MOIST *Picea mariana* OPEN EVERGREEN FOREST Trees 5-15 cm dbh; understory: scattered *Alnus viridis* with *Ledum palustre, Betula nana, Vaccinium vitis-idaea, V. uliginosum, Carex bigelowii, Cladina* spp., *Cladonia* spp., *Sphagnum* spp., *Rubus chamaemorus*
T2, 1, 55	B2f	Trees less than 5 cm dbh; understory: same as B3f
T2, 7, 55	B5f	MOIST *Picea mariana* EVERGREEN LOW SAVANNA Tree islands or krummholz < 5 cm dbh; understory: same as B3f
T2, 1, 59	B2n	DRY *Picea mariana* OPEN EVERGREEN FOREST Trees less than 5 cm dbh; understory: *Cetraria nivalis, Cornicularia divergens, Cladina rangiferina, Asahinea chrysantha, Alectoria ochroleuca, Cladonia* spp., *Loiseleuria procumbens, Empetrum eamesii, Polytrichum juniperinum*

Numerator of Master Map Code	Vegetation Map Pattern and Floristic Code	Description
T2, 1, 55, 56	B2	MOIST *Picea mariana* OPEN EVERGREEN FOREST Trees less than 5 cm dbh; understory: mixture of those found in B3a and B3f
		OPEN DECIDUOUS FOREST TYPES:
T5, 3, 56	E3a	DRY *Betula papyrifera* OPEN DECIDUOUS FOREST Trees 5-15 cm dbh; understory: *Betula glandulosa, B. nana, Ledum palustre, Vaccinium uliginosum, V. vitis-idaea, Spirea beauverdiana, Cladina rangiferina, C. arbuscula, Cetraria nivalis, Cladonia* spp.
T5, 3, 59	E3n	DRY *Betula papyrifera* OPEN DECIDUOUS FOREST Trees 5-15 cm dbh; understory: *Cetraria nivalis, Cornicularia divergens, Cladina rangiferina, Asahinea chrysantha, Alectoria ochroleuca, Cladonia* spp., *Loiseleuria procumbens, Empetrum eamesii, Polytrichum juniperinum*
		TALL SCRUB TYPES:
S_T4, 2, 58	a	WET *Salix planifolia - Spirea beauverdiana - Comarum palustre - Calamagrostis canadensis - Drepanocladus* sp. TALL SCRUB
S_T1, 1, 56	o	DRY *Alnus viridis - Betula glandulosa - Ledum palustre - Vaccinium uliginosum - V. vitis-idaea - Cladina rangiferina* TALL SCRUB
S_M21	 a	DRY *Betula glandulosa - Ledum palustre - Vaccinium uliginosum - Vaccinium uliginosum - V. vitis-idaea - Cladina rangiferina* SCRUB

Numerator of Master Map Code	Vegetation Map Pattern and Floristic Code	Description
$S_M 23$	 xx_i	FROST BOIL or SOLIFLUCTION TERRACE VEGETATION COMPLEX: a) Frost boils and tops of solifluction terraces: DRY *Alnus viridis - Ledum palustre - Betula nana - Vaccinium vitis-idaea - Loiseleuria procumbens - Cladina arbuscula* SCRUB b) Inter-frost boil and inter-terrace areas: MOIST *Betula nana - Ledum palustre - Vaccinium uliginosum - V. vitis idaea - Hylocomium splendens - Sphagnum* sp. - *Cladina rangiferina* DWARF SCRUB
$S_D 45$	 g	DRY *Empetrum eamesii - Vaccinium uliginosum - Ledum palustre - Loiseleuria procumbens* - Polytrichaceae - *Dicranum* sp. - *Cladonia alpestris* SNOW PATCH DWARF SCRUB
L8	 ag	DRY *Cetraria nivalis - Cornicularia divergens - Cladina rangiferina - Asahinea chrysantha - Loiseleuria procumbens* - Polytrichaceae LICHEN MEADOW
X5, X6	 5	DISTURBED Road cut or embankment
		ROAD AND MATERIAL SITE

Grayling Lake

Grayling Lake (150°25'W, 66°57'N, elevation 385 m s.m.) is near the summit of a divide which separates the Jim Creek drainage from the South Fork of the Koyukuk River. The map site is located along the southern end of the lake. It is approximately 17 km north of Pump Station No. 5. The pipeline is about 125 m west of the road in the elevated mode.

Judging from the tundra-like vegetation and the presence of wind shaped trees in meadows around the southern end of the lake, the area apparently is affected by cold winds which are channeled through the pass and across the lake. The valley has been shaped by glaciers. Several glacial kames are evident within the mapped area. The largest of these is located on the western side of the map and is about 20-30 m high and 300 m long. The vegetation on this hill consists of a dense stand of Betula papyrifera (5-15 cm dbh) with scattered small Picea glauca. There is evidence of fire and very few birch seedlings; so it appears that the spruce will eventually dominate this hillside. The understory in this forest type consists mainly of Rosa acicularis, Linnaea borealis, Ribes triste, and Vaccinium vitis-idaea ssp. minus. Another modest sized kame is located just west of the center of the map. The vegetation on this feature is also dominated by birch but the stands are more open and the understory drier, consisting mainly of the lichens Cladina rangiferina, C. arbuscula, and Stereocaulon tomentosum with the crowberry, Empetrum eamesii ssp. hermaphroditum, and the alpine azalea, Loiseleuria procumbens. There are 17 other kames within the mapped areas. Most of these are only small mounds and have Picea mariana with understories of lichens and dwarf shrubs, e.g., Ledum palustre ssp. decumbens, Vaccinium uliginosum, and V. vitis-idaea ssp. minus.

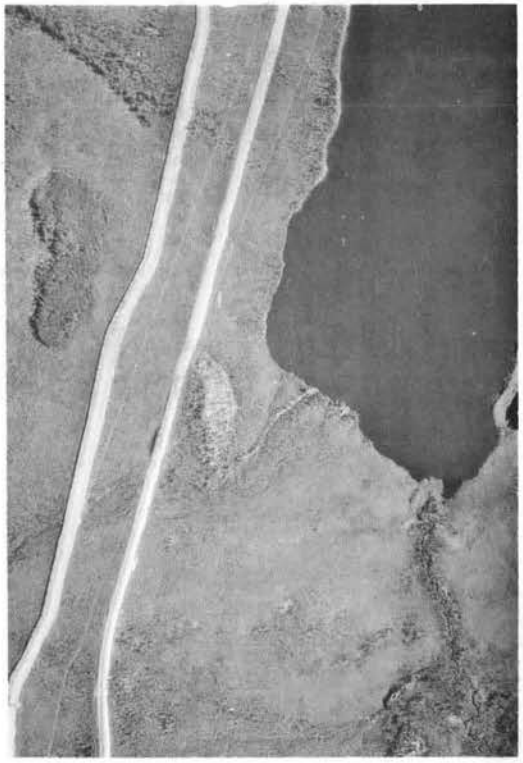
Most of the area is dominated by treed bog vegetation type consisting of scattered small black spruce (Picea mariana) and medium-high (.5 to 2 m) dwarf shrubs (including Betula spp., Salix spp., Alnus viridis ssp. crispa, Ledum spp., Vaccinium vitis-idaea, V. uliginosum, Rubus chamaemorus, Oxycoccus microcarpus, Andromeda polifolia, the sedge Carex bigelowii, Sphagnum spp., and several species of lichen).

Around the southern end of the lake are meadows with small Eriophorum vaginatum tussocks, fruticose lichens, dwarf birch, and ericaceous shrubs. The cottongrass meadows intergrade into meadows which are dominated by dwarf shrubs, but which are missing the taller shrubs such as Salix planifolia ssp. pulchra and Betula glandulosa. The spruce in these meadows are either widely scattered and very short or missing altogether. These meadows eventually interdigitate with the treed bogs.

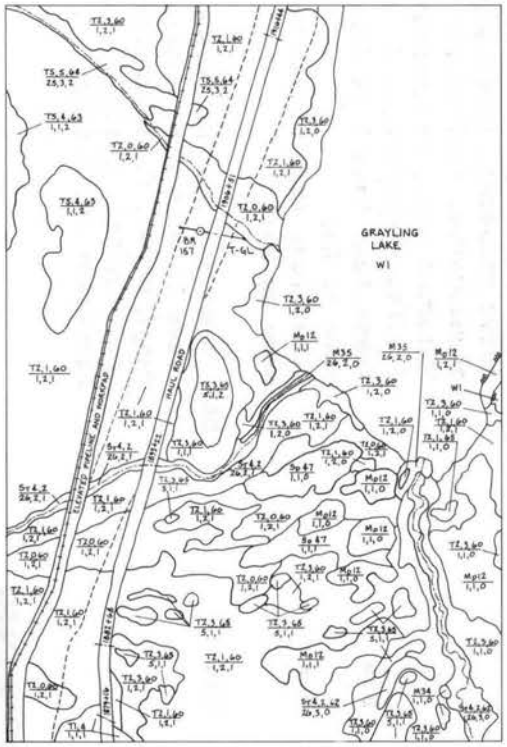
There are three small drainages which have distinctive vegetation types. The outlet to the lake contains a dense willow thicket dominated by Salix planifolia ssp. pulchra. This type is utilized by moose and a beaver which lives in the southern end of the lake. Another small drainage flows into the southwestern corner of the lake. This stream is also enclosed in a willow thicket. In the northwestern corner of the map there is an alluvial fan which has a small dry stream channel with large (greater than 15 cm dbh) birch and white spruce along it. The vegetation understory consists of a variety of plants which are not found elsewhere within the mapped area. Included here are Artemisia telisii ssp. elatior, Pentaphylloides floribunda, Boschniakia rossica, Anemone richardsonii, Polygonum alaskanum, Rubus idaeus ssp. melanolasius.

GRAYLING LAKE

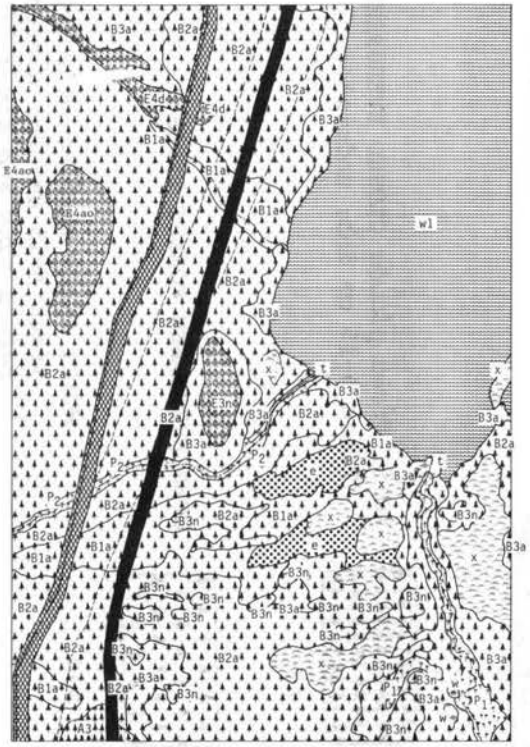
Aerial Photograph



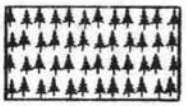
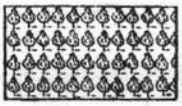
Master Map

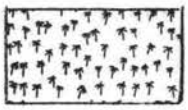
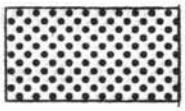
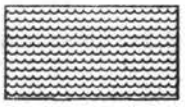
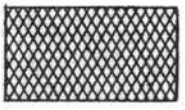


Vegetation



Vegetation Legend for Grayling Lake

Numerator of Master Map Code	Vegetation Map Pattern and Floristic Code	Description
T1, 4	 A3	MOIST *Picea glauca* CLOSED EVERGREEN FOREST Trees 5-15 cm dbh; understory: unspecified
		OPEN EVERGREEN FOREST TYPES:
T2, 3, 60	B3a	MOIST *Picea mariana* OPEN EVERGREEN FOREST Trees 5-15 cm dbh; understory: scattered *Betula nana* and *Alnus viridis* with *Vaccinium uliginosum*, *V. vitis-idaea*, *Ledum palustre*, *Carex bigelowii*, *Rubus chamaemorus*, *Pedicularis lapponica*, *Sphagnum* spp., *Pleurozium schreberi*, *Cladina rangiferina*, *C. arbuscula*
T2, 1, 60	B2a	Trees less than 5 cm dbh; understory: same as B3a
T2, 0, 60	B1a	Trees less than breast height; understory: same as B3a
T2, 3, 65	B3n	DRY *Picea mariana* OPEN EVERGREEN FOREST Trees 5-15 cm dbh; understory: *Cladina rangiferina*, *C. arbuscula*, *Stereocaulon* sp., *Cladonia pyxidata*, *Ledum palustre*, *Vaccinium vitis-idaea*, *V. uliginosum*
		CLOSED DECIDUOUS FOREST TYPES:
T5, 4, 63	E3ao	MOIST *Betula papyrifera* CLOSED DECIDUOUS FOREST Trees 5-15 cm dbh; understory: scattered *Alnus viridis* with *Linnaea borealis*, *Rosa acicularis*, *Ribes triste*, *Vaccinium vitis-idaea*, *Lycopodium annotinum*, *Pyrola grandiflora*
T5, 5, 64	E4d	MOIST *Betula papyrifera* CLOSED DECIDUOUS FOREST Trees greater than 15 cm; understory: scattered *Alnus viridis* and *Salix bebbiana* with *Rosa acicularis*, *Ribes triste*, *Artemisia telesii*, *Equisetum arvense*, *Potentilla fruticosa*, *Pyrola grandiflora*, *Vaccinium vitis-idaea*, *Calamagrostis canadensis*

Numerator of Master Map Code	Vegetation Map Pattern and Floristic Code	Description
T5, 3, 65	E3n	DRY *Betula papyrifera* CLOSED DECIDUOUS FOREST Trees 5-15 cm dbh; understory: same as B3n
		TALL SCRUB TYPES:
S_T4, 2, 62	p_1	MOIST *Salix planifolia - Calamagrostis canadensis - Rubus arcticus - Drepanocladus* sp. TALL SCRUB
S_T4, 2	p_2	WET *Salix planifolia - Equisetum arvense - Calliergon* sp. TALL SCRUB
S_D47	 e	MOIST *Vaccinium uliginosum - Betula nana - V. vitis-idaea - Ledum palustre - Carex bigelowii - Rubus chamaemorus - Sphagnum* sp. - *Cladina rangiferina* DWARF SCRUB
		GRAMINOID MEADOW TYPES:
M35	t	WET *Carex aquatilis - Comarum palustre - Viola epipsiloides - Rubus arcticus - Mnium* sp. GRAMINOID MEADOW
M34	w	WET *Calamagrostis canadensis - Rubus arcticus - Drepanocladus* GRAMINOID MEADOW
M_D12	 x	MOIST *Eriophorum vaginatum - Ledum palustre - Vaccinium uliginosum - V. vitis-idaea - Cladina arbuscula - Sphagnum* sp. TUSSOCK GRAMINOID MEADOW
Wl	 Wl	LAKE
		ELEVATED PIPELINE
		ROAD

South of Coldfoot

The South of Coldfoot site (150°40'N, 65°05'N, elevation 365 m s.m.) is located approximately 22 km south of Coldfoot Camp. The map contains the intersection to Material Site 96-1. The pipeline is close to the road and supported on VSM's.

The map area contains two small drainages running from east to west with a broad hill in between the drainages. In the northeast corner of the map is a lake. There are several distinctive steep hillsides, mostly facing south, which contain open paper birch (Betula papyrifera) stands with xeric understories of kinnikinnick (Arctostaphylos uva-ursi) and lichens (Stereocaulon and Cladonia spp.). The broad hill contains black spruce mostly of medium and dwarf stature with an understory of Eriophorum vaginatum and Ledum decumbens with abundant lichens (mostly Cladoniaceae).

The wet areas within the drainages have tall stands of Carex aquatilis often with scattered plants of the marsh five-finger (Comarum palustre). Areas with slightly better drainage contain stands of Betula nana and Eriophorum vaginatum.

The northern drainage presents a classic moisture gradient. The wettest areas have Carex aquatilis sometimes with dense mats of Sphagnum moss. The low areas which are drained of water have distinctive communities composed of Sphagnum and Dicranum moss with cloudberries (Rubus chamaemorus) and an assemblage of ericaceous shrubs including Vaccinium uliginosum, V. vitis-idaea and Ledum palustre. Lichens are also abundant - particularly Cladina rangiferina. Some of the wet low areas have small better-drained islands (too small to map) which

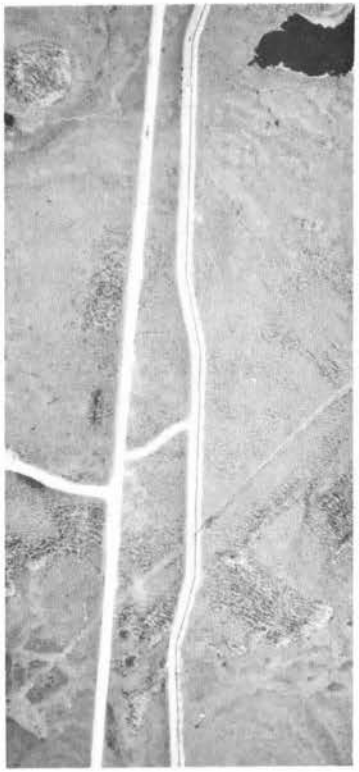
contain this community type usually with a few dwarf black spruce.

As one proceeds up the moisture gradient the Eriophorum vaginatum tussocks become larger until they dominate the understory community with an overstory of dwarf and medium sized black spruce. In still drier areas the understory is dominated by blueberry shrubs (Vaccinium uliginosum) and abundant Cladonia lichens. This final community is found at the edges of the birch stands mentioned earlier.

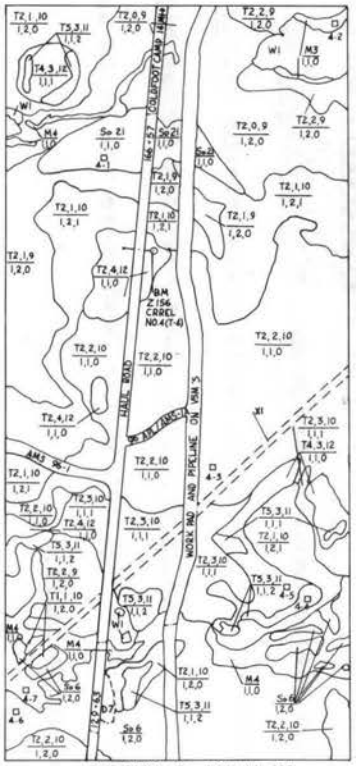
The only major disturbance in this area is a winter road. In the low areas the road has dense Carex aquatilis and in the drier areas the road is vegetated by rushes (Juncus castaneus), grasses (Arctogrostis arundinaceae), and horsetails (Hippochaete variegata) and several mosses (Bryum sp., Polytrichaceae sp. and Tomenthypnum nitens). There are also abundant small willow shrubs (Salix glauca) and some very small black spruce (Picea mariana), less than six inches high. There is also a small flooded area adjacent to the road where the black spruce are dying due to the high water table.

SOUTH OF COLDFOOT

Aerial Photograph



Master Map

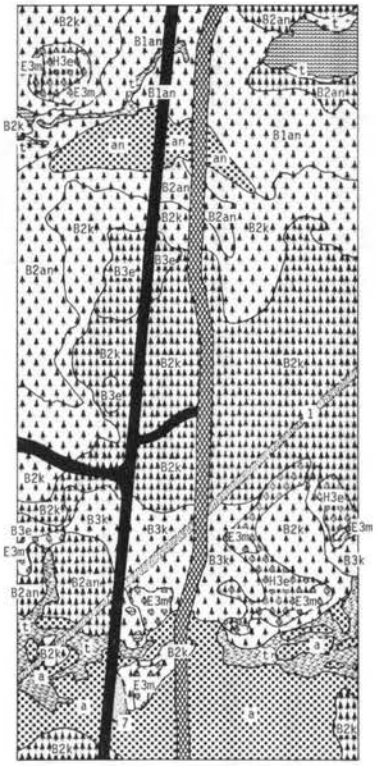


BASE PHOTO HR-1 4096 V-1 528

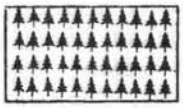
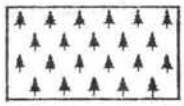
N

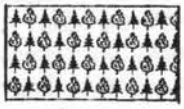
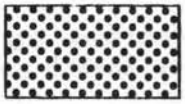
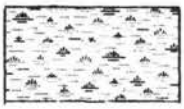
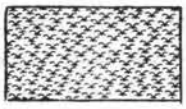
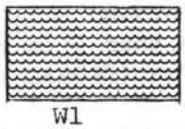
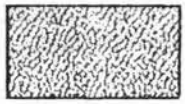
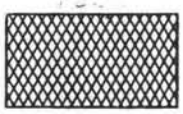
100 300 METERS
0 200 400

Vegetation



Vegetation for South of Coldfoot

Numerator of Master Map Code	Vegetation Map Pattern and Floristic Code	Description
		CLOSED EVERGREEN FOREST TYPES:
T2, 4, 12	B3e	DRY *Picea mariana* CLOSED EVERGREEN FOREST Trees 5-15 cm dbh; understory: *Vaccinium uliginosum, V. vitis-idaea, Ledum palustre, Carex bigelowii, Cladina arbuscula, Cladina rangiferina, Nephroma arcticum, Dicranum* sp., *Pleurozium schreberi*
T2, 2, 10	B2k	MOIST *Picea mariana* CLOSED EVERGREEN FOREST Trees less than 5 cm dbh: understory: *Eriophorum vaginatum, Ledum palustre, Vaccinium uliginosum, Carex bigelowii, V. vitis-idaea, Sphagnum* sp., *Hylocomium splendens, Cladina arbuscula, C. rangiferina*
T2, 2, 9	B2an	MOIST *Picea mariana* CLOSED EVERGREEN FOREST Trees less than 5 cm dbh; understory: *Rubus chamaemorus, Vaccinium uliginosum, Ledum palustre, Vaccinium vitis-idaea, Betula nana, Andromeda polifolia, Sphagnum* spp., *Dicranum* sp., *Cladina* spp.
		OPEN EVERGREEN FOREST TYPES:
T2, 3, 10	B3k	MOIST *Picea mariana* OPEN EVERGREEN FOREST Trees 5-15 cm dbh; understory: same as B2k (CLOSED EVERGREEN FOREST TYPE)
T2, 1, 10	B2k	Trees less than 5 cm dbh; understory: same as B2k (CLOSED EVERGREEN FOREST TYPE)
T2, 1, 9	B2an	MOIST *Picea mariana* OPEN EVERGREEN FOREST Trees less than 5 cm dbh; understory: same as B2an (CLOSED EVERGREEN FOREST TYPE)
T2, 0, 9	Blan	MOIST *Picea mariana* EVERGREEN LOW SAVANNA Trees less than breast height; understory: same as B2an (CLOSED EVERGREEN FOREST TYPE)

Numerator of Master Map Code	Vegetation Map Pattern and Floristic Code	Description
T5, 3, 11	 E3m	DRY *Betula papyrifera* OPEN DECIDUOUS FOREST Trees 5-15 cm dbh; understory: *Arctostaphylos uva-ursi*, *Geocaulon lividum*, *Empetrum eamesii*, *Vaccinium vitis-idaea*, *Festuca altaica*, *Cladina arbuscula*, *Stereocaulon* sp., Polytrichaceae
T4, 3, 12	 H3e	DRY *Picea mariana* - *Betula papyrifera* OPEN MIXED FOREST Trees 5-15 cm dbh; understory: same as B3e (CLOSED EVERGREEN FOREST TYPE)
		DWARF SCRUB TYPES:
S_D6	a	MOIST *Betula nana* - *Eriophorum vaginatum* - *Salix planifolia* - *Vaccinium uliginosum* - *Hylocomium splendens* DWARF SHRUB
S_D21	an	MOIST *Rubus chamaemorus* - *Sphagnum* sp. - *Vaccinium uliginosum* - *Andromeda polifolia* - *Cladina rangiferina* DWARF SCRUB
M3	 t	WET *Carex limosa* - *Baeothryon caespitosum* - *Andromeda polifolia* - *Drepanocladus* sp. GRAMINOID MEADOW
M4	 t	VERY WET *Carex aquatilis* - *C. saxatilis* - *Comarum palustre* GRAMINOID MEADOW
W1	 W1	WATER Lake
X1	 l	DISTURBED Winter trail
		ELEVATED PIPELINE
		ROAD

Wiseman Vicinity

The Wiseman Vicinity site (150°06'W, 67°23'N, elevation 365 m s.m.) is located about 8 km north of Coldfoot Camp. Most of the mapped area is on a fairly high (about 30 m) river terrace of the Middle Fork of the Koyukuk River. The east side of the road is vegetated mostly with dwarf spruce with a sedge tussock (Eriophorum vaginatum) and dwarf shrub understory. Some areas have taller willows and bog birch to 2 m high. On this side there are also occasional small glacial kames. These sites are better drained and support mixed stands of white spruce and paper birch. The drier sites on the kames have a dense lichen understory. The moister sites have a dwarf shrub (Vaccinium uliginosum and V. vitis-idaea) understory.

Closer to the river terrace the terrain is better drained and the dwarf spruce is replaced by a mixed spruce-birch forest with trees of medium stature (5-15 m tall, 20 cm dbh) with a dense willow and Vaccinium uliginosum understory.

The steep terrace has a dense mixed spruce-birch forest with a fairly open understory of Rosa acicularis, Ledum groenlandicum and the feather moss Hylocomium splendens.

The vegetation adjacent to the river consists mostly of medium stature white spruce with one fairly large stand of mixed spruce and paper birch. This band of trees is fairly narrow. Most of the area between the river and the major river terrace is vegetated by sedge tussocks and dwarf shrubs.

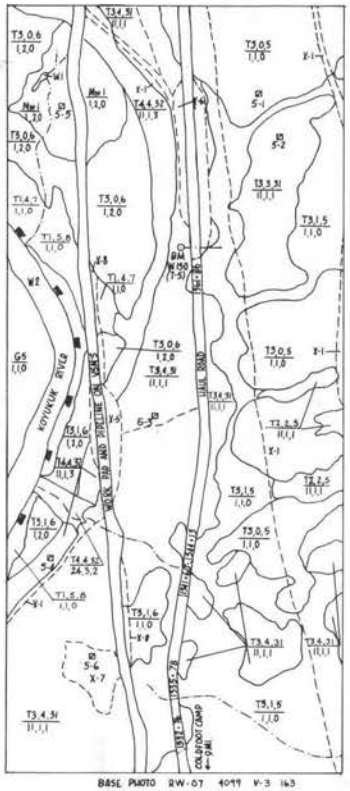
There are three disturbed areas of special mention. One is a large shoulder fill which has been revegetated with grasses. The grass has grown rapidly, but will probably slow down once the nutrients in the hydro-mulch have been exhausted. Another area is a winter road along the river terrace. The road has apparently not been used for several years. Spruce and alder are currently revegetating the site. And it looks as if complete recovery can be expected

within a few decades. An area of natural disturbance is a large gully eroded along the river terrace. The situation is somewhat similar to the erosion problems induced by the road at CRREL No. 6. The sides of the gully are stabilizing, and it should be interesting to compare this with the gullies at CRREL 6. A third area is a flooded area west of the work pad. Many live spruce are standing in up to a meter of water. Most of these trees as well as the understory can be expected to die unless the area is drained.

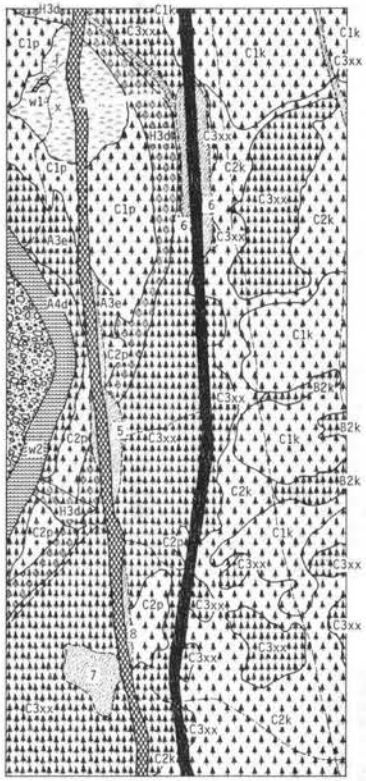
WISEMAN VICINITY

Aerial Photograph

Master Map



Vegetation



Vegetation Legend for Wiseman Vicinity

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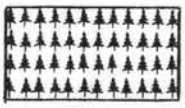
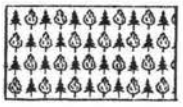
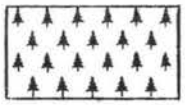
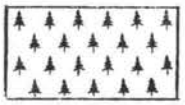
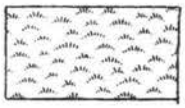
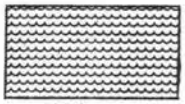
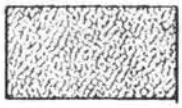
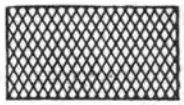
T1, 5, 8	 A4d	MOIST *Picea glauca* CLOSED EVERGREEN FOREST Scattered trees greater than 15 cm dbh; most are 5-15 cm dbh; understory: scattered *Alnus viridis* with *Rosa acicularis, Ribes triste, Vaccinium uliginosum, V. vitis-idaea, Boschniakia rossica, Peltigera canina, Hylocomium splendens, Pleurozium schreberi*
T1, 4, 7	A3e	MOIST *Picea glauca* CLOSED EVERGREEN FOREST Trees 5-15 cm dbh; understory: *Vaccinium uliginosum, Ledum palustre, V. vitis-idaea, Hylocomium splendens, Pleurozium schreberi, Peltigera aphthosa*
T2, 2, 5	B2k	MOIST *Picea mariana* CLOSED EVERGREEN FOREST Trees less than 5 cm dbh; understory: abundant *Alnus viridis* and *Salix glauca* with *Eriophorum vaginatum, Vaccinium uliginosum, Ledum palustre, Rubus chamaemorus, Carex bigelowii, Equisetum arvense, Sphagnum* sp.
T3, 4, 31	C3xx	MOIST *Picea mariana* - *Picea glauca* CLOSED EVERGREEN FOREST Trees 5-15 cm dbh; understory: a mosaic on many small mounds (kames?): a) well-drained, mostly south-facing hillsides: *Betula papyrifera, Cladina rangiferina, C. arbuscula, Stereocaulon alpinum, Vaccinium vitis-idaea, Empetrum nigrum, V. uliginosum, Hylocomium splendens* b) inter-mound areas: *Vaccinium uliginosum, Ledum palustre, Vaccinium vitis-idaea, Hylocomium splendens, Pleurozium shreberi, Peltigera apthosa, Cladina* spp.
T4, 4, 32	 H3d	MOIST *Betula papyrifera* - *Picea glauca* CLOSED MIXED FOREST Trees 5-15 cm dbh; understory: scattered *Alnus viridis* with *Rosa acicularis, Ribes triste, Vaccinium vitis-idaea, V. uliginosum, Ledum palustre, Boschniakia rossica, Hylocomium splendens, Pleurozium schreberi, Peltigera canina*

Numerator of Master Map Code	Vegetation Map Pattern and Floristic Code	Description
		OPEN EVERGREEN FOREST TYPES:
T3, 1, 5	C2k	MOIST *Picea mariana* - *Picea glauca* OPEN EVERGREEN FOREST Trees less than 5 cm dbh; understory: *Eriophorum vaginatum*, *Vaccinium uliginosum*, *Betula glandulosa*, *Salix planifolia*, *V. vitis-idaea*, *Ledum groenlandicum*, *Carex bigelowii*, *Hylocomium splendens*, *Sphagnum* spp., *Cladina* spp.
T3, 1, 6	C2p	WET *Picea mariana* - *Picea glauca* OPEN EVERGREEN FOREST Trees less than 5 cm dbh; understory: *Salix planifolia*, *Betula glandulosa*, *Eriophorum vaginatum*, *Vaccinium uliginosum*, *V. vitis-idaea*, *Ledum groenlandicum*, *Sphagnum* sp.
		LOW EVERGREEN SAVANNA TYPES:
T3, 0, 5	C1k	MOIST *Picea mariana* - *Picea glauca* LOW EVERGREEN SAVANNA Trees less than breast height; understory: same as C2k (OPEN EVERGREEN FOREST TYPE)
T3, 0, 6	C1p	MOIST *Picea mariana* - *Picea glauca* LOW EVERGREEN SAVANNA Trees less than breast height; understory: same as C2p (OPEN EVERGREEN FOREST TYPE)
M_W1	 x	WET *Eriophorum vaginatum* - *Betula glandulosa* - *Salix planifolia* - *Vaccinium uliginosum* - *Sphagnum* sp. TUSSOCK GRAMINOID MEADOW
G5		BARE GRAVEL
W1, W2		WATER
	W1	Lake
	W2	River

Numerator of Master Map Code	Vegetation Map Pattern and Floristic Code	Description
X1,5,6,7,8		DISTURBED
	5	Road cut
	6	Shoulder fill
	7	Flooded area
	8	Gravel and miscellaneous debris
		ELEVATED PIPELINE
		ROAD

Sukakpak Mountain - South

The Sukakpak Mountain - South site is located approximately thirteen miles south of Dietrich Camp between 103-APL-1 and 103 APL/AMS-1A. In this area the pipeline is buried in river gravels until about halfway toward the south of the map where it emerges from the river and is carried on VSM's. The road parallels the pipe about 150-200 m to the east on a river terrace about 100 feet above the river.

Vegetation along the river consists of willow communities which are in various stages of succession toward a fairly open spruce woodland with a dry vegetation mat. Old river channels contain a wet marsh community dominated by Carex saxitilis and Betula glandulosa.

East of the road are the gentle lower slopes of a mountain. The slopes have mostly open stands of dwarf spruce in a dwarf shrub-tussock sedge meadow. The dominant species here are Betula nana, Vaccinium uliginosum, V. vitis-idaea, and Ledum palustre, and Eriophorum vaginatum.

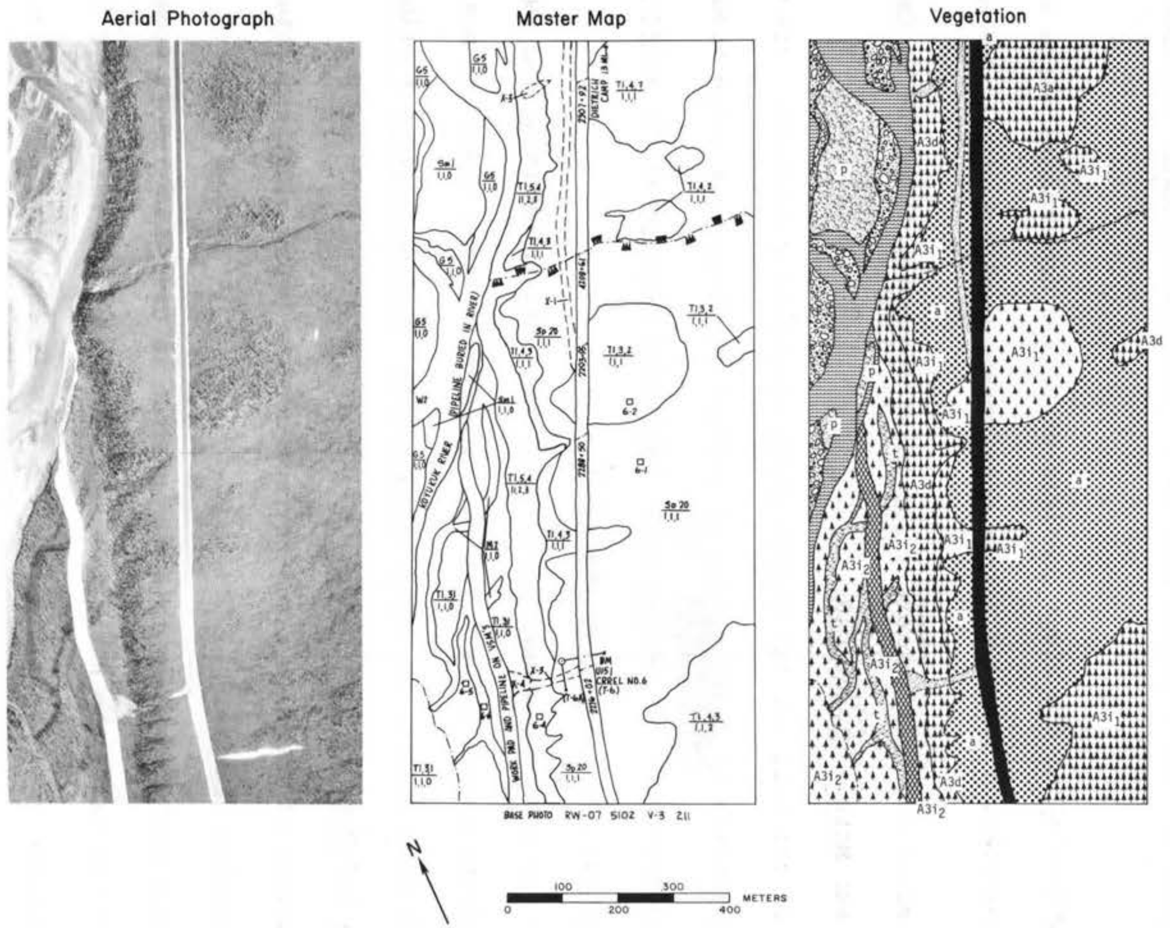
There are also occasional areas which have better drainage and support stands of larger white spruce trees. The understories in these areas are more diverse and support such species as Dryas integrifolia, Pentaphylloides floribunda, Carex scirpoidea and Tomenthypnum nitens.

The slopes of the main river terrace contain dense alder thickets with white spruce of medium stature.

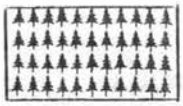
The main disturbance in this mapped area is caused by runoff from the mountain to the east. Up until the construction of the road, runoff has moved off the mountain in many areas. Now the flow is channeled into the culverts which produce high velocity discharge and have caused serious erosion in several places.

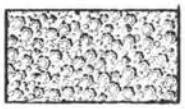
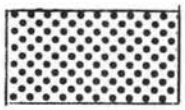
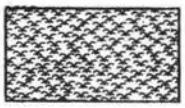
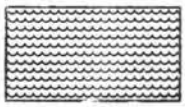
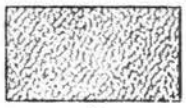
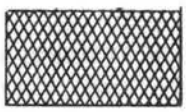
Another disturbed area is an old winter road which parallels the Haul Road.

SUKAKPAK MOUNTAIN – SOUTH



Vegetation Legend for Sukakpak Mountain South

Numerator of Master Map Code	Vegetation Map Pattern and Floristic Code	Description
		CLOSED EVERGREEN FOREST TYPES:
T1,4,3	A3a	MOIST *Picea glauca* CLOSED EVERGREEN FOREST Trees 5-15 cm dbh; understory: *Betula nana, Eriophorum vaginatum, Vaccinium uliginosum, V. vitis-idaea, Ledum palustre, Carex bigelowii, Sphagnum* sp., *Hylocomium splendens, Aulacomnium palustre, Cladina* spp.
T1,5,4	A3d	MOIST *Picea glauca* CLOSED EVERGREEN FOREST Scattered trees greater than 15 cm, most are 5-15 cm; understory: dense *Alnus viridis*, with *Salix arbusculoides, Salix glauca, Rosa acicularis, Ribes triste, Vaccinium vitis-idaea, Equisetum arvense, Hylocomium splendens, Rhytidium rugosum, Cladonia* spp.
T1,4,7	$A3e_1$	MOIST *Picea glauca* CLOSED EVERGREEN FOREST Trees 5-15 cm dbh; understory: *Vaccinium uliginosum, Ledum palustre, V. vitis-idaea, Carex bigelowii, Eriophorum vaginatum, Hylocomium splendens, Pleurozium schreberi, Peltigera aphthosa, Cladina* spp.
T1,4,2	$A3i_1$	DRY *Picea glauca* CLOSED EVERGREEN FOREST Trees 5-15 cm dbh; understory: *Dryas integrifolia, Vaccinium uliginosum, Carex scirpoidea, Arctostaphylos alpina* ssp. *rubra, Salix reticulata, Ledum groenlandicum, Tomenthypnum nitens, Cladina arbuscula, Cladonia pyxidata*
		OPEN EVERGREEN FOREST TYPES:
T1,3,2	$A3i_1$	DRY *Picea glauca* OPEN EVERGREEN FOREST Trees 5-15 cm dbh; understory: same as $A3_i$ (CLOSED EVERGREEN FOREST type).
T1,3,1	$A3i_2$	DRY *Picea glauca* OPEN EVERGREEN FOREST Trees 5-15 cm dbh; understory: scattered *Betula glandulosa* with *Dryas integrifolia, Carex scirpoidea, Vaccinium uliginosum, Rhododendron lapponicum, Pentaphylloides floribunda, Salix reticulata, Festuca altaica, Tomenthypnum nitens, Cladonia pyxidata, Cetraria cucullata*

Numerator of Master Map Code	Vegetation Map Pattern and Floristic Code	Description
S_M1	 p	DRY *Salix brachycarpa* ssp. *niphoclada* - *S. alaxensis* - *Populus balsamifera* - *Hedysarum mackenzii* - *Castilleja caudata* - *Hippochaete scirpoides* RIVER BAR SCRUB
S_D20	 a	MOIST *Betula nana* - *Eriophorum vaginatum* - *Vaccinium uliginosum* - *Sphagnum* sp. - *Hylocomium splendens* - *Cladina arbuscula* DWARF SCRUB
M2	 t	VERY WET *Carex saxatilis* - *Eriophorum vaginatum* - *Betula glandulosa* - *Pedicularis sudetica* - *Drepanocladus revolvens* - *Campylium stellatum* GRAMINOID MEADOW
G5		RIVER GRAVEL
W2	 W2	WATER River
X3,X4	 3 4	DISTURBED
		ELEVATED PIPELINE
		ROAD

Sukakpak Mountain - Ice-cored Mounds

This site (149°42'W, 67°36'N, elevation 425 m s.m.) is located at the foot of Sukakpak Mountain, 10 km south of the turnoff to the Dietrich Construction Camp. The pipeline is elevated in this region and is located just west of the mapped area.

The site is unique because of many small mound features which have formed on both sides of the road. The mounds reach maximum heights of about 3 m. The cause of these features is suspected to be subsurface ice. The mounds on the uphill (east) side of the road are much more disturbed with large cracks and other evidence of recent surface upheaval. Many of the mounds have medium-sized white spruce which have become tilted in all directions due to the growth of the mounds. Vegetation on the larger, more stable, mounds usually consists of Picea glauca and shrubs (Betula glandulosa, Salix lanata, Pentaphylloides floribunda, Ledum groenlandicum, Dryas integrifolia). The smaller mounds are often without trees but usually have Betula and other shrubs.

The area which receives runoff from the limestone cliffs on Sukakpak Mountain is very calcareous. Much of the area below the cliffs consists of moist to wet meadows with Baeothryon caespitosum, Triglochin palustre, T. maritimum, Kobresia simpliciuscula, Juncus triglumis, Carex atrofusca, Drepanocladus revolvens, and Catascopium nigritum. More mesic calcareous microsites have Dryas integrifolia, Andromeda polifolia, Kobresia simpliciuscula, Pentaphylloides floribunda, Anemone parviflora, Salix reticulata, Tofieldia pusilla, Tomenthypnum nitens, and Drepanocladus revolvens.

In the forested areas the understory is often somewhat dry and consists of Dryas integrifolia, Carex scirpoidea, Festuca altaica, Pentaphylloides floribunda, Arctous alpina ssp. rubra, Vaccinium uliginosum, Salix reticulata, and many species of lichens including Cetraria cucullata, C. richardsonii, and Cladoniaceae.

Very wet meadows on the west side of the road have Carex aquatilis, C. rotundata, Menyanthes trifoliata, Utricularia intermedia, and Scorpidium scorpioides.

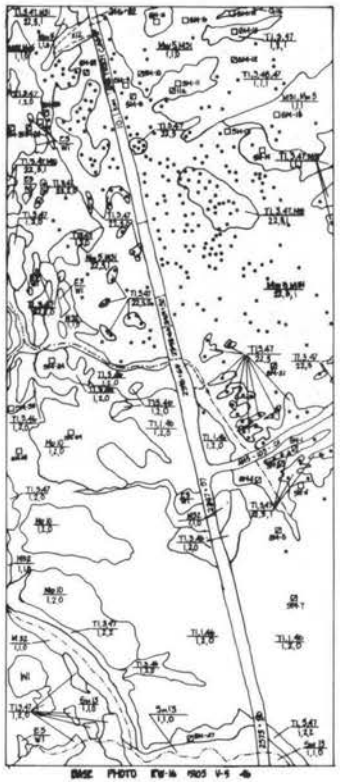
In the southern portion of the map, the soils are apparently more acidic. There are extensive Eriophorum vaginatum-Betula glandulosa meadows. This type is also the principal understory in Picea glauca forests in the southern part of the map. There is a small stream which crosses the map area near the southern boundary. Vegetation along the creek consists primarily of Carex aquatilis, C. rotundata, and Salix lanata. There are also extensive shrub meadows adjacent to the creek where the main species are Salix lanata and Betula glandulosa. On the sloping banks adjacent to the creek bottom are medium sized Picea glauca with an understory consisting of Vaccinium uliginosum, V. vitis-idaea, Betula glandulosa, Hylocomium splendens, Rhytidium rugosum, and Cladoniaceae.

Disturbances in the area are limited mainly to the drainage changes which are apparently contributing to growth of the mounds on the uphill side of the road.

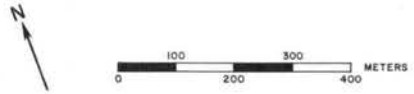
SUKAKPAK MOUNTAIN – ICE-CORED MOUNDS

Aerial Photograph

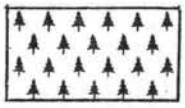
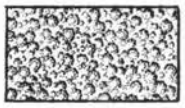
Master Map

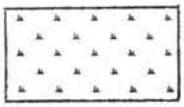
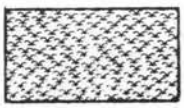
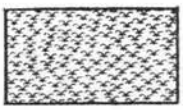
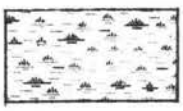
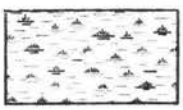
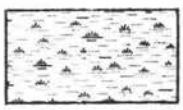
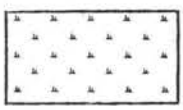


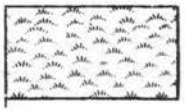
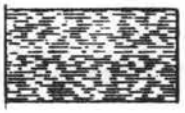
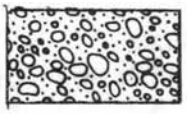
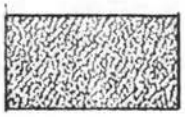
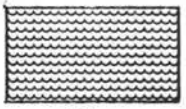
Vegetation



Vegetation Legend for Sukakpak Mountain - Ice-Cored Mounds

Numerator of Master Map Code	Vegetation Map Pattern and Floristic Code	Description
		OPEN EVERGREEN FOREST TYPES:
T1, 1, 46	A2k	MOIST *Picea glauca* OPEN CONIFEROUS FOREST Trees less than 5 cm dbh; understory: *Eriophorum vaginatum, Betula glandulosa, Salix lanata, Vaccinium vitis-idaea, Ledum palustre, Andromeda polifolia, Sphagnum* sp., *Dicranum* sp., *Hylocomium splendens*
T1, 3, 46	A3k	Trees 5-15 cm dbh; understory: same as A2k
T1, 3, 47	A3a	DRY *Picea glauca* OPEN CONIFEROUS FOREST Trees 5-15 cm dbh; understory: *Betula glandulosa, Salix lanata, Pentaphylloides floribunda, Ledum groenlandicum, Dryas integrifolia, Arctous alpina* ssp. *rubra, Rhododendron lapponicum, Vaccinium uliginosum, Carex scirpoidea, Tomenthypnum nitens, Rhytidium rugosum*
T1, 3, 47, 48	A3	DRY *Picea glauca* OPEN CONIFEROUS FOREST Trees 5-15 cm dbh; understory: a mosaic of that found in A3a and the following: *Dryas integrifolia, Carex scirpoidea, Festuca altaica, Pentaphylloides floribunda, Arctous alpina* ssp. *rubra, Vaccinium uliginosum, Hedysarum alpinum, Cetraria cucullata, C. richardsonii, Cladonia mitis, Salix reticulata*
T1, 3, 47, M31	xx_m • spot symbol for ice-cored mound	ICE-CORED MOUND VEGETATION COMPLEX: a) Ice-cored mounds: usually a few *Picea glauca* with understory as in A3a. b) Inter-mound areas: MOIST *Kobresia simpliciuscula - Dryas integrifolia - Salix reticulata - Tomenthypnum nitens* GRAMINOID MEADOW
S_m13	 P	WET *Salix lanata - Betula glandulosa - Carex aquatilis - Campylium stellatum - Equisetum arvense* SCRUB

Numerator of Master Map Code	Vegetation Map Pattern and Floristic Code	Description
M31	 u	MOIST *Kobresia simpliciuscula - Dryas integrifolia - Salix reticulata - Tomenthypnum nitens* GRAMINOID MEADOW
M32	 t	VERY WET *Carex aquatilis - C. limosa - Menyanthes trifoliata - Scorpidium scorpioides* GRAMINOID MEADOW
M32, M_w5	 xx_k or	MARSH VEGETATION COMPLEX: a) Depressions: VERY WET *Carex aquatilis - C. limosa - Menyanthes trifoliata - Scorpidium scorpioides* GRAMINOID MEADOW b) Slightly raised areas: WET *Baeothryon caespitosum - Triglochin maritimum - Pedicularis sudetica - Drepanocladus* sp. - *Campylium stellatum* GRAMINOID MEADOW
M_w5, M32	 xx_k	
M_w5	 t	WET *Baeothryon caespitosum - Triglochin maritimum - Pedicularis sudetica - Drepanocladus* sp. - *Campylium stellatum* GRAMINOID MEADOW
M_w5, M31	 xx_d or	NON-ALIGNED HUMMOCK VEGETATION COMPLEX: a) Raised areas and hummocks: MOIST *Kobresia simpliciuscula - Dryas integrifolia - Salix reticulata - Tomenthypnum nitens* GRAMINOID MEADOW b) Depressions and inter-hummock areas: WET *Baeothryon caespitosum - Triglochin maritimum - Pedicularis - Drepanocladus* sp. - *Campylium stellatum* GRAMINOID MEADOW
M31, M_w5	 xx_d	

Numerator of Master Map Code	Vegetation Map Pattern and Floristic Code	Description
M_d10	 x	MOIST *Eriophorum vaginatum - Betula glandulosa - Salix lanata - Sphagnum* sp. - *Hylocomium splendens* TUSSOCK GRAMINOID MEADOW
E3	 ao	VERY WET *Scorpidium scorpioides - Hippuris vulgaris - Potomogeton gramineus - Hippuris vulgaris* AQUATIC MEADOW
G15	 P	DRY *Salix alaxensis - Shepherdia canadensis - Pentaphylloides floribunda - Salix lanata* MUDFLOW BARREN
X12	 12	DISTURBED Changed vegetation due to culvert
W1	 W1	WATER Lake
		ROAD

Dietrich River Treeline

The Dietrich River Treeline site (149°43'W, 68°01'N, elevation 760 m s.m.) lies near the limit of spruce trees. There are white spruce trees along the haul road for a few kilometers beyond this site, but this site has alpine tundra along the east side of the road (west-facing slope). Spruce forests are along the valley bottom and on the east-facing slopes. The map area is about 8 km south of Chandalar Camp. The pipeline is buried and runs adjacent or very close to the road, crossing under the road toward the south end of the map.

This site exhibits great diversity in community types, as should be expected at such a major ecotone.

The slopes east of the pipeline are unforested except for only two Picea glauca. Dry sedge and small shrub tundra is dominant in most areas here. Scattered alders are also frequent in many areas on the east side. Along small drainage channels and on steep slopes near the road the alders are very dense - often mixed with Salix alaxensis.

There are also a few small outcrops of shale which have diverse dicot communities. One feature of note on this side of the valley is a fairly recent mudflow which is being revegetated by horsetails, grasses (Arctagrostis latifolia and Calamagrostis canadensis) and willows (Salix glauca and S. alaxensis).

The valley bottom consists of a series of gravel bars and river terraces. The areas closest to the Dietrich River (here only about 10 m wide) have willow, alder, and poplar communities. Further from the river there are stands of large (up to 25 cm dbh) white spruce with understories mostly of Crowberry (Empetrum eamesii and Lingonberry (Vaccinium vitis-idaea), often with a dense Cladonia lichen component. Other forested areas along the valley have very mixed understories.

East-facing slopes have open stands of medium sized white spruce with the most common understory being Betula glandulosa and Cladonia lichens. Drainages on this side of the valley are clogged with thick stands of alders and spruce.

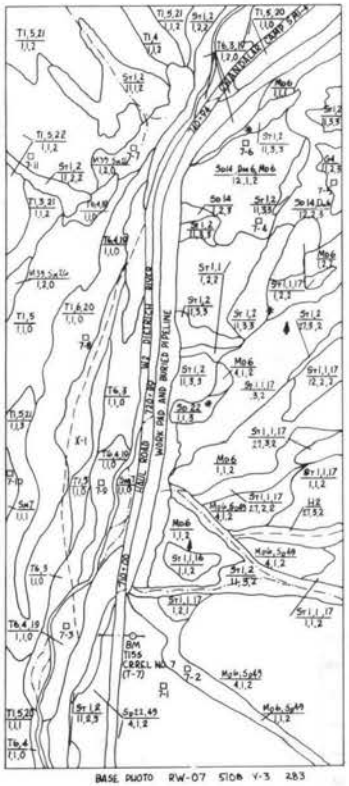
It is worth noting that this is the only forested map area where no evidence of previous fires was detected.

The only major disturbance in the area is a cleared winter trail which runs mostly along the west side of the stream.

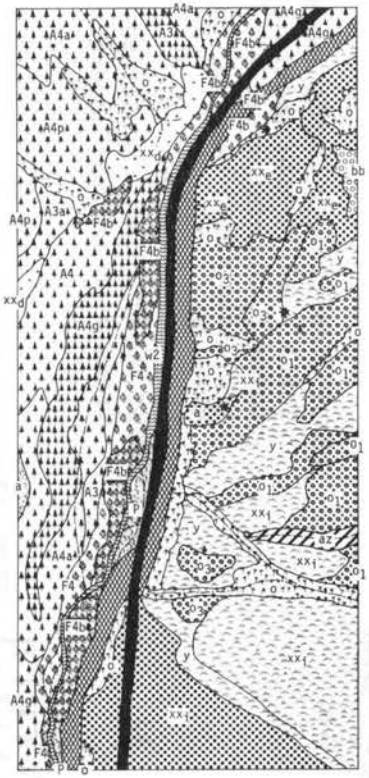
DIETRICH RIVER – TREELINE

Aerial Photograph

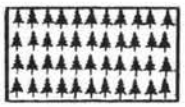
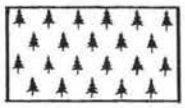
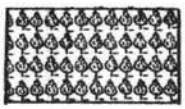
Master Map

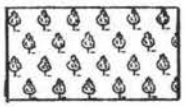
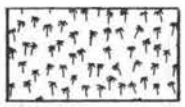


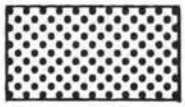
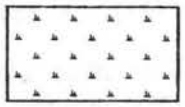
Vegetation

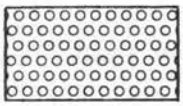
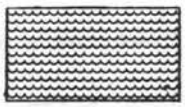
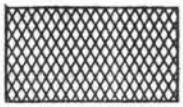


Vegetation Legend for Dietrich River Treeline

Numerator of Master Map Code	Vegetation Map Pattern and Floristic Code	Description
		CLOSED EVERGREEN FOREST TYPES:
T1, 6, 20	A4g	MOIST *Picea glauca* CLOSED EVERGREEN FOREST Trees > 15 cm dbh; understory: *Empetrum eamesii*, *Vaccinium vitis-idaea*, *Cladonia* spp., *Rhytidium rugosum*, *Hylocomium splendens*
T1, 4	A3	MOIST *Picea glauca* CLOSED EVERGREEN FOREST Trees 5-15 cm dbh; understory: unspecified
		OPEN EVERGREEN FOREST TYPES:
T1, 5, 21	A4a	DRY *Picea glauca* OPEN EVERGREEN FOREST Trees > 15 cm dbh; understory: *Betula nana/glandulosa*, *Cladina* spp., *Cladonia* spp., *Vaccinium vitis-idaea*, *Salix glauca*, *Ledum palustre*, *Festuca altaica*, Polytrichaceae
T1, 3, 21	A3a	Trees 5-15 cm dbh; understory: same as A4a
T1, 5, 20	A4g	MOIST *Picea glauca* CLOSED EVERGREEN FOREST Trees > 15 cm dbh; understory: same as A4g (CLOSED EVERGREEN FOREST TYPE)
T1, 5, 22	A4p	MOIST *Picea glauca* OPEN EVERGREEN FOREST Trees > 15 cm dbh; understory: *Salix lanata*, *Vaccinium uliginosum*, *Equisetum arvense*, *Empetrum eamesii*, *Hylocomium splendens*, *Rhytidium rugosum*, *Cladina* spp.
T1, 5	A4	MOIST *Picea glauca* OPEN EVERGREEN FOREST Trees > 15 cm dbh; understory: very mixed
T1, 3	A3	Trees 5-15 cm dbh; understory: very mixed
		CLOSED DECIDUOUS FOREST TYPES:
T6, 4, 19	F4b	DRY *Populus balsamifera* CLOSED DECIDUOUS FOREST Trees 5-15 cm dbh; understory: scattered *Salix alaxensis* and *Alnus viridis* with *Shepherdia canadensis*, *Empetrum eamesii*,

Numerator of Master Map Code	Vegetation Map Pattern and Floristic Code	Description
T6, 4, 19 (cont.)	F4b	*Arctous alpina* ssp. *rubra*, *Hedysarum mackenzii*, *Drepanocladus* sp., *Stereocaulon* sp.
T6, 4	F4	Trees 5-15 cm dbh; understory: similar to F4b but more mixed
		OPEN DECIDUOUS FOREST TYPES:
T6, 3, 19	F4b	DRY *Populus balsamifera* OPEN DECIDUOUS FOREST Trees 5-15 cm dbh; understory: same as F4b (CLOSED DECIDUOUS FOREST TYPE)
T6, 3	F4	Trees 5-15 cm dbh; understory: similar to F4b but more mixed
		SHRUB SAVANNA TYPES:
S_T1, 1, 17	O_1	MOIST *Alnus viridis* - *Carex bigelowii* - *Betula glandulosa* - *Ledum palustre* - *Dicranum* sp. - *Cladina arbuscula* SHRUB SAVANNA
S_T1, 1, 16	O_2	DRY *Alnus viridis* - *Betula glandulosa* - *Salix planifolia* - *Hierochloë alpina* - Polytrichaceae - *Cladonia pyxidata* SHRUB SAVANNA
S_T1, 1	O_3	MOIST *Alnus viridis* SHRUB SAVANNA (understory: very mixed)
S_T1, 2	 O	MOIST *Alnus viridis* TALL SCRUB
S_M8	 a	DRY *Betula glandulosa/nana* - *Cladina rangiferina* - *Ledum palustre* - *Vaccinium vitis-idaea* - *Festuca altaica* - Polytrichacea SCRUB
S_M7	p	DRY *Salix alaxensis* - *Shepherdia canadensis* - *Hedysarum mackenzii* - *Arctous alpina* ssp. *alpina* - *Stereocaulon* sp. RIVER BAR SCRUB

Numerator of Master Map Code	Vegetation Map Pattern and Floristic Code	Description
S_D22, 49	 xx_i	FROST BOIL VEGETATION COMPLEX: a) Inter-frost boil areas: MOIST *Betula nana - Salix planifolia - Ledum palustre - Rhytidium rugosum - Peltigera aphthosa* DWARF SCRUB b) Frost boils: DRY *Vaccinium vitis-idaea - Hierochloë alpina - Cladina rangiferina* - Polytrichaceae DWARF SCRUB
S_D22	a	MOIST *Betula nana - Salix planifolia - Ledum palustre - Rhytidium rugosum - Peltigera aphthosa* DWARF SCRUB
S_D14, D_M6 and S_D14, D_M6, M_D6	xx_e	SOLIFLUCTION TERRACE VEGETATION COMPLEX: a) Fronts of terraces and snow accumulation areas: MOIST *Cassiope tetragona - Boykinia richardsonii - Empetrum eamesii - Cetraria cucullata - Hylocomium alaskanum* SNOWPATCH DWARF SCRUB b) Tops of terraces and drier microsites: DRY *Dryas octopetala - Salix phlebophylla - Hierochloë alpina - Arctous alpina* ssp. *rubra - Cladina rangiferina* PROSTRATE SCRUB c) Interlobe areas: MOIST *Carex bigelowii - Vaccinium uliginosum - Betula nana - Ledum palustre - Rhytidium rugosum* GRAMINOID MEADOW
M39, S_M26	 xx_d	NON-ALIGNED HUMMOCK VEGETATION COMPLEX: a) Depressions and wetter microsites: WET *Eriophorum angustifolium - Carex rotundata - Drepanocladus revolvens* GRAMINOID MEADOW b) Hummocks and drier microsites: scattered *Alnus viridis* with MOIST *Salix glauca - Vaccinium uliginosum - Carex bigelowii - Tomenthypnum nitens* SCRUB
M_D6	 y	MOIST *Carex bigelowii - Vaccinium uliginosum - Betula nana - Dicranum* sp. *- Rhytidium rugosum* GRAMINOID MEADOW
M_D6, S_D49	xx_i	FROST BOIL VEGETATION COMPLEX: a) Inter-frost boil areas: MOIST *Carex bigelowii - Vaccinium uliginosum - Betula nana - Dicranum* sp. *- Rhytidium rugosum* TUSSOCK GRAMINOID MEADOW b) Frost boils: DRY *Vaccinium vitis-idaea - Hierochloë alpina - Cladina rangiferina* - Polytrichaceae DWARF SCRUB

Numerator of Master Map Code	Vegetation Map Pattern and Floristic Code	Description
H2	 az	MOIST *Equisetum arvense - Arctagrostis arundinaceae - Salix alaxensis - Calamagrostis canadensis - Juncus arcticus* MUDFLOW HORSETAIL MEADOW
G4	 bb	DRY *Saxifraga tricuspidata - Artemisia arctica - Minuartia arctica - Thuidium abietinum* UPLAND BARREN
	 W2	WATER
		BURIED PIPELINE
		ROAD
		Isolated tree
		Rock outcrop

Atigun Pass

The Atigun Pass site (149°28'W, 68°08'N, elevation 1460 m s.m.) is located at the summit of the pass which crosses the Brooks Range and the Continental Divide. It is the highest point on the highway and represents the only truly alpine tundra encountered along the road. The pipeline is east of the road and is buried. Access road APL-110-18 is within the mapped area.

The area is extremely rugged and covered by talus and scree slopes. Bedrock outcrops occur at several places on both sides of the road. On the east and west sides of the road, steep slopes lead up to mountain peaks which are outside the map area. Two features which are thought to be lobate rock glaciers also occur, one at the southern edge of the map, and one near the northeast corner of the map. On the northern side of the pass is a steep scree-filled drainage which is fed by runoff from several debris chutes on the mountain to the west. In the north-central portion of the map a rounded bedrock outcrop with a small, fairly gently sloping meadow to the east.

Most of the hillsides are covered by talus, which although barren in appearance, are actually densely covered by lichens. The lichens are mostly Umbilicaria, Cetraria hepatizon, with many crustose lichens including Lecidea flavocaerulescens, Rhizocarpon geographicum, and Haematomma lapponicum. On the west side of the road (northeast-facing slopes) the talus has many moss and lichen mats, dominated by Hylocomium splendens. Imbedded in the moss are Carex microchaeta, Acomastylis rossii, Stellaria longipes, several saxifrages including Saxifraga serpyllifolia, S. bronchialis, S. tricuspidata, S. rivularis, and S. davurica, and Salix phlebophylla. The common lichens on these mats include Nephroma expallida, Dactylina arctica, D. ramulosa, Cetraria islandica, Alectoria ochroleuca, Cetraria cucullata, C. nivalis, Cladonia rangiferina, C. arbuscula, C. gracilis, and Sphaerophorus globosus. Snowbeds commonly occur in the talus on the east side (west and northwest-facing slopes). Common species in these areas include Oxyria digyna, Solorina crocea, Stereocaulon tomentosum, Cetraria delesii.

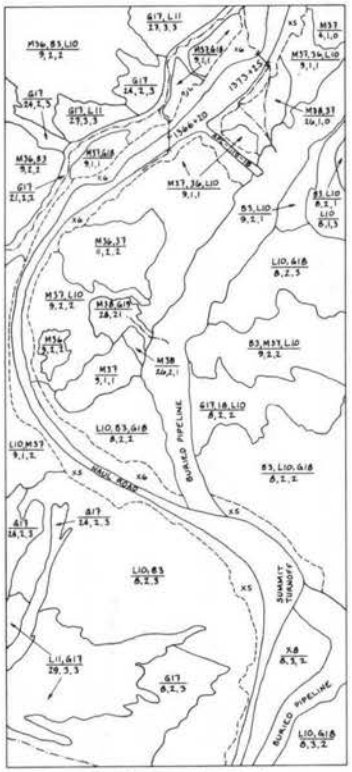
At the base of a snowbed near the center of the map is a small ponded area which contains many frost boils. The frost boils are mostly barren with Ranunculus nivalis, Petasites frigidus, Stereocaulon tomentosum, and Phippsia algida. The rounded rock outcrop toward the middle of the map has fairly dry sedge meadows associated with it. The dominant taxa are Carex microchaeta, Poa alpigena, Salix phlebophylla, Luzula confusa, Polygonum bistorta, Geum glaciale, Trisetum spicatum, and Lycopodium selago. The chief cryptogams are Polytrichum alpinum, Rhacomitrium lanuginosum, Cladonia rangiferina, C. alpestris, Cetraria nivalis, and Cornicularia divergens. The northern end of the map has some small wet meadows with Sphagnum. And on the hillsides to the west of these meadows are some steep but fairly stable slopes dominated by Dryas octopetala. On the west side of the road there are several very active debris chutes which are practically void of all vegetation except for a few scattered crustose lichens. The main disturbance is along the buried pipeline where extensive blasting was necessary to bury the pipe in the rocky terrain. One very interesting small tarn near the summit of the pass that contained unusual emergent lichen and moss communities has been destroyed by the pipeline. There has also been considerable erosion at some localities along the road but this is rather minor considering the extensive erosion and debris chutes which are naturally present in the area.

The aerial photograph used for the map was very dark and difficult to use in the field. Most of the area consists of intricate mosaics of small microsites typical of alpine regions.

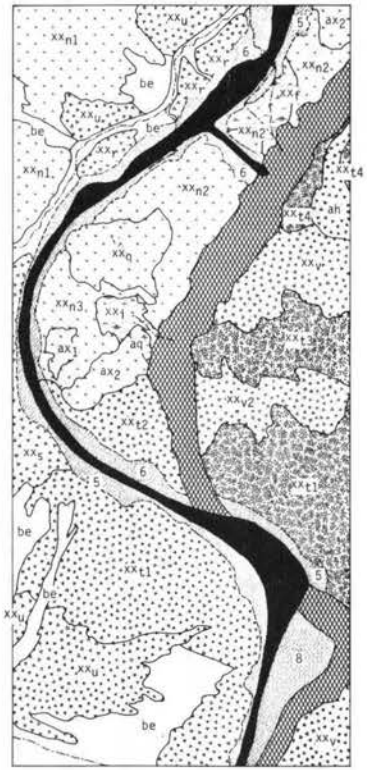
ATIGUN PASS

Aerial Photograph

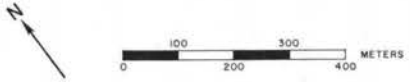
Master Map



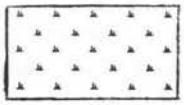
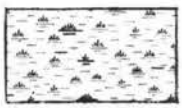
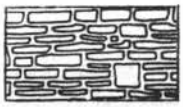
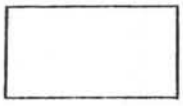
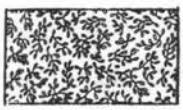
Vegetation

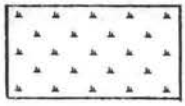
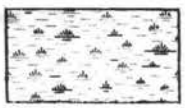


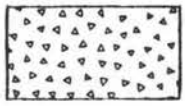
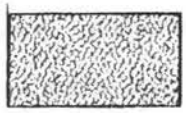
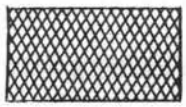
BASE PHOTO SP-18 V-4 1010 041



Vegetation Legend for Atigun Pass

Numerator of Master Map Code	Vegetation Map Pattern and Floristic Code	Description
		UPLAND GRAMINOID MEADOW TYPES:
M36	ax_1	DRY *Carex microchaeta - Dryas octopetala - Salix phlebophylla - Cetraria cucullata - Hylocomium splendens* GRAMINOID MEADOW
M37	ax_2	MOIST *Carex microchaeta - Salix phlebophylla - Saxifraga bronchialis - Hylocomium splendens - Cladina rangiferina* GRAMINOID MEADOW
		
M38	aq	WET *Carex aquatilis - Nardosmia frigida - Salix phlebophylla - Saxifraga punctata - S. foliolosa - Mnium* sp. GRAMINOID MEADOW
		
L10	ah	DRY *Umbilicaria hyperborea - U. proboscidia - Cetraria hepatizon - Lecidea flavocaerulescens - Rhizocarpon geographicum - Rhacomitrium languginosum* TALUS SLOPE BARREN
		
L11	ai	DRY *Rhizocarpon geographicum - Xanthoria elegans - Alectoria minuscula - Lecidea* sp. ROCK OUTCROP BARREN
		
G17	be	Very steep talus - no vegetation
		
B3	af	MOIST *Hylocomium splendens - Aulacomnium turgidum - Saxifraga bronchialis - S. serpyllifolia - Nephroma expallidum - Cladonia gracilis* MOSS MEADOW

Numerator of Master Map Code	Vegetation Map Pattern and Floristic Code	Description
	No map pattern - not a dominant community	
G18	bd	MOIST *Solororina crocea - Cetraria delesii - Oxyria digyna - Stereocaulon* sp. - *Schistidium alpicola* SNOWPATCH LICHEN MEADOW
G19	bf	WET *Nardosmia frigida - Phippsia algida - Stereocaulon* sp. - *Psoroma hypnorum* FROST BOIL BARREN
	VEGETATION COMPLEXES	
		
M36,37	xx_q	IRREGULAR MICRORELIEF VEGETATION COMPLEX: Mixture of floristic codes ax_1 and ax_2
M37,36,L10	xx_{n2}	ROCK GRAMINOID MEADOW VEGETATION COMPLEX: Mixture of floristic codes ax_1 and af
M37,36,L10	xx_{n2}	Mixture of floristic codes ax_2, ax, and ah
M37,L10	xx_{n2}	Mixture of floristic codes ax_2 and ah
M37,G18	xx_r	SNOWPATCH GRAMINOID MEADOW VEGETATION COMPLEX: Mixture of floristic codes ax_2 and bd
		
M38,37	xx_f	STREAM VEGETATION COMPLEX: Mixture of floristic codes aq and ax_1
M38,G19	xx_i	FROST-BOIL VEGETATION COMPLEX: Mixture of floristic codes aq and bf
		
B3,L10,G18	XX_{t1}	TALUS/MOSS MEADOW VEGETATION COMPLEX: Mixture of floristic codes af, ah, and bd
B3,M37,L10	xx_{t3}	Mixture of floristic codes af, ax_2, and ah
B3,L10	xx_{t4}	Mixture of floristic codes af and ah

Numerator of Master Map Code	Vegetation Map Pattern and Floristic Code	Description
		
L10,M37	xx_s	TALUS/GRAMINOID MEADOW VEGETATION COMPLEX: Mixture of floristic codes ah and ax_2
L10,B3	xx_{t1}	TALUS/MOSS MEADOW VEGETATION COMPLEX: Mixture of floristic codes ah and af
L10,B3,G18	xx_{t2}	Mixture of floristic codes ah, af, and bd
G17,L11	xx_u	ROCK OUTCROP/TALUS VEGETATION COMPLEX: Mixture of floristic codes ai and be
L10,G18	xx_v	TALUS SLOPE/SNOWPATCH VEGETATION COMPLEX: Mixture of floristic codes ah and bd
G17,G18,L10	xx_{v2}	Mixture of floristic codes be, bd, and ah
		
L11,G17	xx_u	ROCK OUTCROP/TALUS VEGETATION COMPLEX: Mixture of floristic codes ai and be
		DISTURBED TYPES:
X5	5	Road cut
X6	6	Shoulder fill
X8	8	Gravel and miscellaneous debris
		BURIED PIPELINE
		ROAD

Atigun River Alluvial Fans

This site (149°20'W, 68°16'N, elevation 915 m s.m.) is located approximately 10 km north of Atigun Camp in the wide glaciated valley of the Atigun River. The pipeline is 50 to 100 m west of the road supported on VSM's. The left hand (west) side of the map is on an old flood plain of the river, and the east side of the map are several alluvial fans and talus slopes leading up to a mountain.

Vegetation on the floodplain is deceptively complex, but is dominated by dry tundra communities with the sedges Carex bigelowii and Eriophorum vaginatum dominant. There are several small areas with localized frost boil activity. Eriophorum vaginatum is more abundant in these areas. On the western side of the map there is a small alluvial ridge with abundant frost boils and a low shrub community dominated by the bog birch Betula nana. There are also wet areas where Carex aquatilis and Eriophorum angustifolium are more abundant.

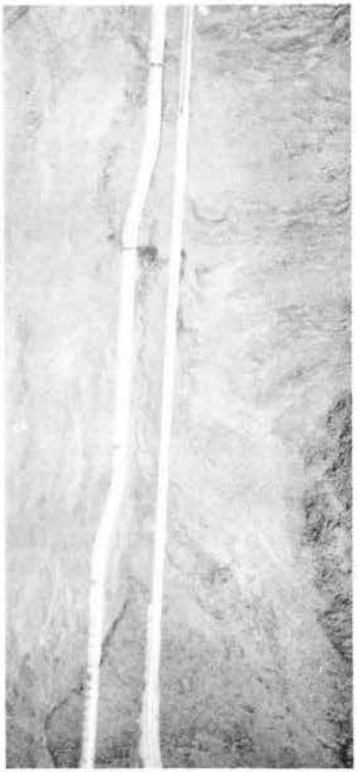
In the transition from the floodplain to the slopes of the mountain to the east there is a fairly wet area with aligned hummocks. Vegetation on the hummocks is dry tundra and in between the hummocks wetter sedges such as Carex saxatilis and C. rariflora are more abundant.

Vegetation on the alluvial fans is also quite complex. Small depressions and snow accumulation areas are easily detectable by the abundance of the Lapland Cassiope (Cassiope tetragona). Areas which are more exposed have mat dicots (Dryas octopetala) and fruticose lichens. The majority of the lower slope of the mountain is covered with an open low shrub community of Salix glauca and S. planifolia ssp. pulchra with a dry understory dominated by Dryas octopetala. Small streams draining the mountain have low Salix alaxensis communities in local patches. The southern part of the map is dominated by a very large alluvial fan. Vegetation on this fan is mainly Dryas octopetala with an abundance of Geum glaciale. In the southeast corner of the map is a large fairly recent mudflow

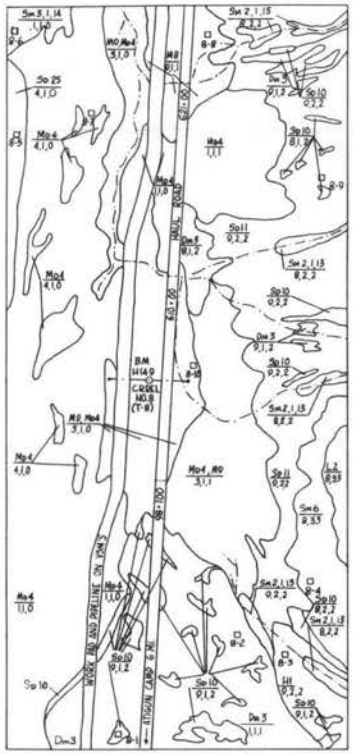
overtopping the large alluvial fan. The dominant species here is the horsetail Equisetum arvense with mosses (Rhytidium rugosum, Tomenthypnum nitens and Hylocomium splendens). A very steep but stable talus slope on the east side of the map has abundant shrubs (Salix glauca and Empetrum nigrum). Other areas on this talus slope have only rock lichens. There are no major disturbances in this area other than the usual accumulation of dust along the haul road. It appears that the snowbank communities are being particularly affected by the dust. Cassiope tetragona and many of the lichens are doing poorly in these areas. There is also some minor ponding located in the area between the haul road and work pad at about the middle of the map.

ATIGUN RIVER – ALLUVIAL FANS

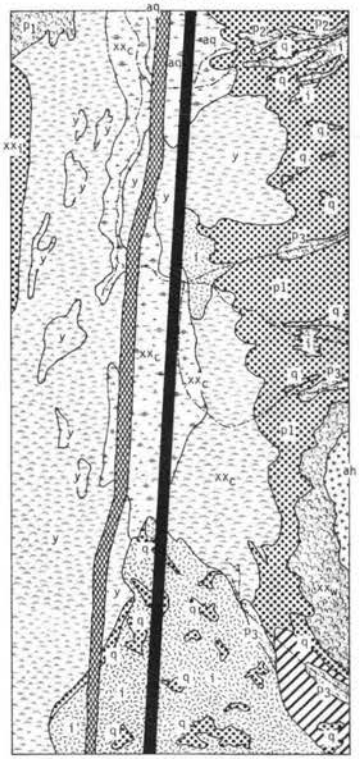
Aerial Photograph

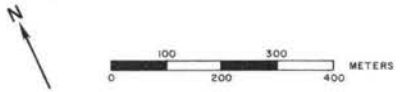


Master Map



Vegetation





Vegetation Legend for the Atigun River Alluvial Fans

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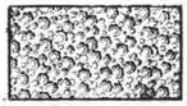
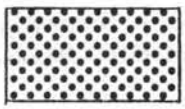
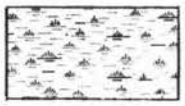
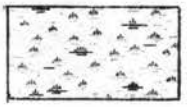
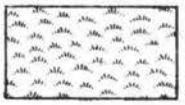
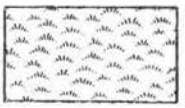
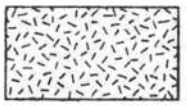
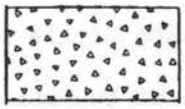
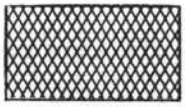
		SCRUB TYPES:
S_M6	xx_w	TALUS SLOPE/SCRUB VEGETATION COMPLEX: a) Inter-rock areas: DRY *Salix glauca - Empetrum eamesii - Betula nana - Rhytidium rugosum* SCRUB b) Rocks: DRY *Umbilicaria proboscidia - U. hyperborea - Cetraria hepatizon - Rhizocarpon geographicum* TALUS SLOPE BARREN
$S_M3,1,14$	p_1	DRY *Salix glauca - Dryas octopetala - Salix reticulata - Festuca altaica - Rhytidium rugosum - Cetraria cucullata* SCRUB
$S_M2,1,15$	p_2	WET *Salix alaxensis - Carex aquatilis - S. arctica - Valariana capitata - Saxifraga hirculus - Campylium stellatum* STREAM BANK SCRUB
$S_M2,1,13$	p_3	MOIST *Salix alaxensis - S. glauca - Salix pulchra - Equisetum arvense - Aulacomnium turgidum - Hylocomium splendens* STREAM BANK SCRUB
		DWARF SCRUB TYPES:
S_D10	q	DRY *Cassiope tetragona - Ledum palustre - Vaccinium vitis-idaea - Rhacomitrium lanuginosum - Cetraria richardsonii* SNOW PATCH DWARF SCRUB
S_D11	p_1	DRY *Salix glauca - Dryas octopetala - Salix reticulata - Rhytidium rugosum - Cetraria cucullata* DWARF SCRUB
S_D25	xx_i	FROST-BOIL COMPLEX: a) Inter-frost-boil areas: MOIST *Betula nana - Carex bigelowii - Nardosmia frigida - Dicranum* sp. DWARF SCRUB b) Frost boils: DRY *Dryas octopetala - Salix phlebophylla - Saussurea angustifolia - Rhytidium rugosum* PROSTRATE SCRUB

Numerator of Master Map Code	Vegetation Map Pattern and Floristic Code	Description
M8	 aq	WET *Carex aquatilis - Valariana capitata - Salix arctica - Saxifraga hirculus - Campylium stellatum* GRAMINOID MEADOW
M9, M_D4	 xx_c or  xx_c	ALIGNED HUMMOCK VEGETATION COMPLEX: a) Hummocks and higher microsites: MOIST *Carex bigelowii - Eriophorum vaginatum - Salix reticulata - Dryas integrifolia - Tomenthypnum nitens* TUSSOCK GRAMINOID MEADOW b) Inter-hummock areas: WET *Carex aquatilis - Eriophorum angustifolium - Pedicularis sudetica - Scorpidium scorpioides* GRAMINOID MEADOW
M_D4	 y	MOIST *Carex bigelowii - Eriophorum vaginatum - Salix reticulata - Dryas integrifolia - Tomenthypnum nitens* TUSSOCK GRAMINOID MEADOW
D_M3	 i	DRY *Dryas octopetala - Salix reticulata - Carex microchaeta - Neosieversia glacialis - Rhytidium rugosum - Cetraria cucullata* PROSTRATE SCRUB
H1		MOIST *Equisetum arvense - Salix reticulata - S. pulchra - Aulacomnium turgidum - Hylocomium splendens* HORSETAIL MEADOW

Numerator of Master Map Code	Vegetation Map Pattern and Floristic Code	Description
L2	 ah	DRY *Umbilicaria proboscidia - U. hyperborea - Cetraria hepatizon - Rhizocarpon geographicum* TALUS SLOPE BARREN
		ELEVATED PIPELINE
		ROAD

Atigun River Sand Dunes

This map area for CRREL No. 9 is located at the Atigun River crossing (149°20'W, 68°20'N, elevation 790 m s.m.) 10 km south of the Galbraith Camp turnoff. APL-114-3 is located about in the middle of the map. The pipeline is supported on VSM's to the east of the road.

The vegetation here is strongly influenced by the aeolian deposits from the Atigun River. Sand dunes occur mainly along the west and north sides of the Atigun River. Extending for a considerable distance north of the river there are aligned hummocks (about a meter high in places) apparently of aeolian origin.

The active dunes along the river have a mosaic of communities. The tops of the larger dunes support fairly dense willows (Salix alaxensis, Salix glauca, and Salix brachycarpa ssp. niphoclada). The more active interdune areas have mainly sparse grass and dicot communities. Other stabilized areas have communities of the mat dicot Dryas octopetala and Arctous alpina ssp. rubra.

The area north of the more active dunes consists of rolling microrelief of aligned sand hummocks. The tops of the hummocks have Dryas and bearberry with Rhododendron lapponicum. The areas between hummocks are dominated by mosses (mainly Tomenthypnum nitens and Rhytidium rugosum) with Salix reticulata and Carex bigelowii. Further north the hummocks become more and more dominated by the sedge Carex bigelowii, and Salix planifolia ssp. pulchra also becomes more abundant. In the vicinity of the CRREL Transect there is an upland area with frost boils. The vegetation here is more of a dry sedge tundra dominated by Carex bigelowii with scattered Eriophorum vaginatum tussocks. The frost boils are mostly unvegetated.

There are also areas with low-centered polygons. The wettest polygons have Carex aquatilis and mosses (mainly Drepanocladus revolvens and Scorpidium

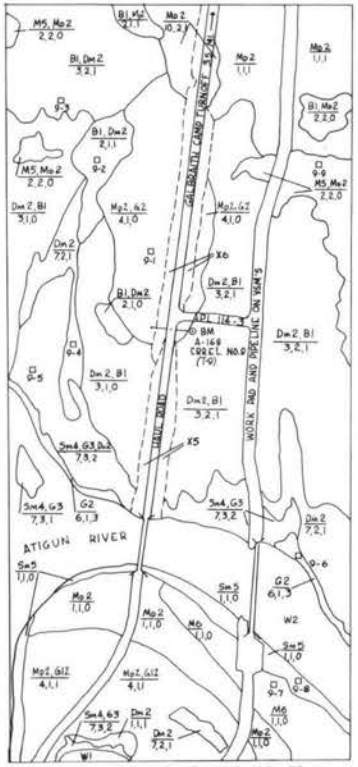
scorpioides). The drier polygons have distinctive moss communities, mainly of Tomenthypnum nitens with Carex bigelowii and Salix reticulata.

The main disturbance in the area is a road cut through unstable sandy peat down to the Atigun River bridge. This area now seems to be stabilizing rather well. There is also a hydro-seeded shoulder fill north of the road cut. The grasses here are doing poorly and there is some doubt whether they will live once the nutrients in the mulch are exhausted.

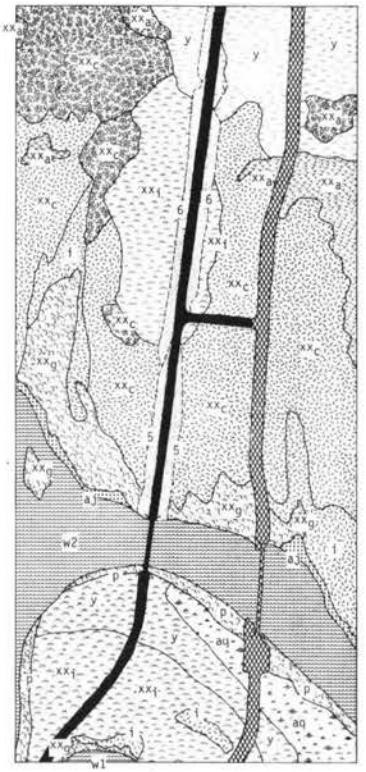
ATIGUN RIVER – SAND DUNES

Aerial Photograph

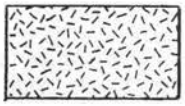
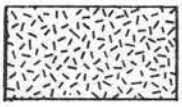
Master Map

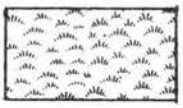
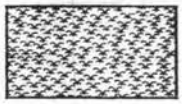
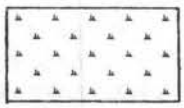
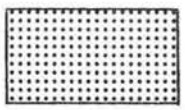


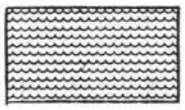
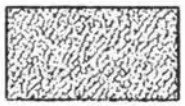
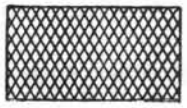
Vegetation



Vegetation Legend for Atigun River - Sand Dunes

Numerator of Master Map Code	Vegetation Map Pattern and Floristic Code	Description
		SCRUB VEGETATION TYPES:
S_M4, G3 and S_M4, G3, D_M2	xx_g	SAND DUNE VEGETATION COMPLEX: a) Tops of dunes: DRY *Salix glauca - S. alaxensis - S. niphoclada - S. reticulata - Arctous alpina* ssp. *rubra* SCRUB b) Active inter-dune areas: DRY *Equisetum arvense - Anemone multifida - Chamerion latifolium* BARREN c) Stabilized areas: DRY *Dryas octopetala - Arctous alpina* ssp. *rubra - Rhododendron lapponicum - Ditrichum flexicaule - Thamnolia vermicularis* PROSTRATE SCRUB
S_M5	p	MOIST *Salix lanata - S. alaxensis - Hedysarum alpinum - Equisetum arvense - Tomenthypnum nitens* RIVER BANK SCRUB
		DRY *Dryas octopetala - Arctous alpina* ssp. *rubra - Rhododendron lapponicum - Ditrichum flexicaule - Thamnolia vermicularis* PROSTRATE SCRUB
D_M2	i	
D_M2, Bl		ALIGNED HUMMOCK VEGETATION COMPLEX: a) Tops of hummocks: DRY *Dryas octopetala - Arctous alpina* ssp. *rubra - Rhododendron lapponicum - Ditrichum flexicaule - Thamnolia vermicularis* PROSTRATE SCRUB b) Inter-hummock areas: MOIST *Tomenthypnum nitens - Rhytidium rugosum - Carex bigelowii - Salix reticulata* MOSS MEADOW
	xx_c	
or	or	
Bl, D_M2		
	xx_c	

Numerator of Master Map Code	Vegetation Map Pattern and Floristic Code	Description
	 y	MOIST *Carex bigelowii - Dryas octopetala - Salix reticulata - Tomenthypnum nitens* TUSSOCK GRAMINOID MEADOW
M_D2		
M_D2, G12	xx_i	FROST BOIL VEGETATION COMPLEX: a) Inter-frost boil areas: MOIST *Carex bigelowii - Dryas octopetala - Salix reticulata - Tomenthypnum nitens* TUSSOCK GRAMINOID MEADOW b) Frost boils: bare mud
M5, M_D2	 xx_a	LOW-CENTERED POLYGON VEGETATION COMPLEX: a) Polygon centers: VERY WET *Carex aquatilis - C. saxatilis - Drepanocladus revolvens - Scorpidium scorpioides* GRAMINOID MEADOW b) Polygon rims: MOIST *Carex bigelowii - Dryas octopetala - Salix reticulata - Tomenthypnum nitens* GRAMINOID MEADOW
M6	 aq	WET *Carex aquatilis - Eriophorum angustifolium - Campylium stellatum* GRAMINOID MEADOW
B1, M_D2	 xx_a	LOW-CENTERED POLYGON VEGETATION COMPLEX: a) Polygon centers: MOIST *Tomenthypnum nitens - Rhytidium rugosum - Carex bigelowii - Salix reticulata* MOSS MEADOW b) Polygon rims: MOIST *Carex bigelowii - Dryas octopetala - Salix reticulata - Tomenthypnum nitens* GRAMINOID MEADOW
G2	 aj	DRY *Chamerion latifolium* RIVER BANK BARREN

Numerator of Master Map Code	Vegetation Map Pattern and Floristic Code	Description
W1 or W2		WATER
	W1	Lake
	W2	River
		
X5	5	Road cut
X6	6	Shoulder fill
		ELEVATED PIPELINE
		ROAD

Toolik Upland - South

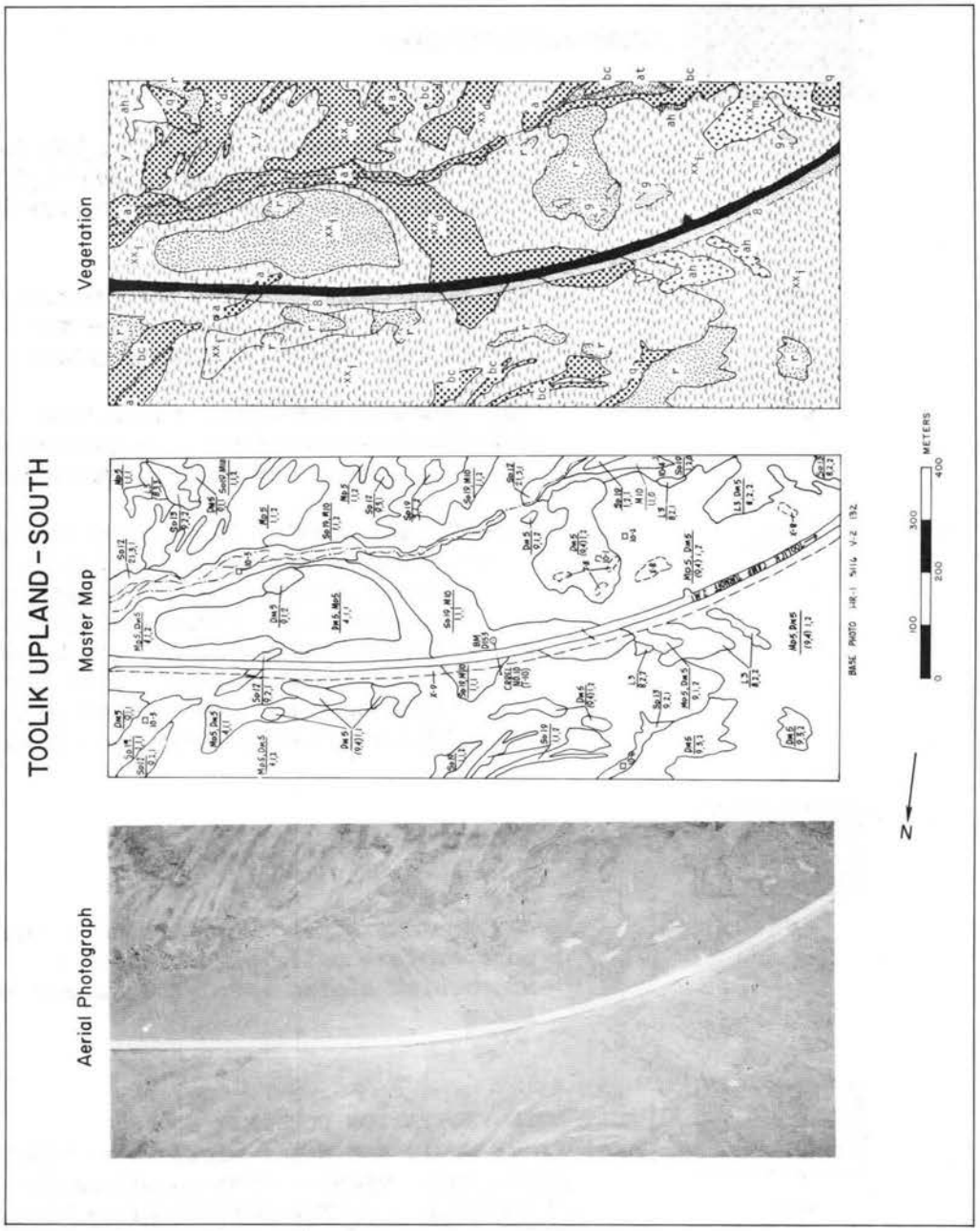
The Toolik Upland - South map area (149°30'W, 68°38'N, elevation 790 m s.m.) is located approximately 3 km north of the Toolik Camp turnoff. The pipeline at this point is several kilometers east of the road.

The terrain in this vicinity is hilly with many glacial kames and glacial lakes. The landscape is rocky and the soils shallow in most places. Frost boils are also a common feature. The terrain in the mapped area consists mostly of a series of long gently-sloping north-facing hills. To the east of the road is a small drainage.

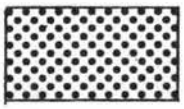
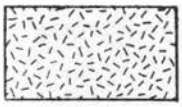
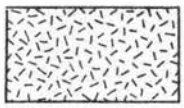
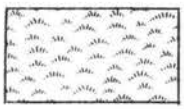
Vegetation in the mapped area consists of mat dicot and prostrate shrub communities (Dryas octopetala and Arctous alpina ssp. alpina) on the tops of small knolls, the edges of frost boils and in very dry exposed microsites. More mesic sites have upland tundra dominated by Carex bigelowii, with several ericaceous shrubs (Vaccinium vitis-idaea, V. uliginosum, Ledum palustre) and bog-birch (Betula nana) and diamond-leaf willow (Salix planifolia ssp. pulchra). In the small drainage and on poorly drained hillsides the vegetation is dominated by Sphagnum tundra with abundant Betula nana and cloudberry (Rubus chamaemorus). Some very wet areas have Carex chordorrhiza and Eriophorum angustifolium communities.

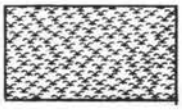
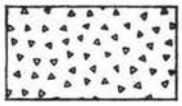
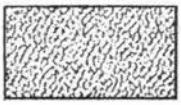
In very rocky places there are complexes of vegetation. The rocks are covered with crustose and foliose lichens and often there are small snowbed communities associated with these places which are dominated by Cassiope tetragona.

The major disturbance in this area is the gasline trench, which has been reseeded, but the grass is doing very poorly. There are also several small areas which have been bladed and stripped of vegetation.


TOOLIK UPLAND - SOUTH
Aerial Photograph
Master Map
Vegetation
BASE PHOTO HR-1 5116 V-2 132
METERS
0
100
200
300
400
N

Vegetation Legend for Toolik Upland - South

Numerator of Master Map Code	Vegetation Map Pattern and Floristic Code	Description
		DWARF SCRUB TYPES:
S_D12	a	MOIST *Betula nana - Salix planifolia - Festuca altaica - Aconitum delphinifolium - Pentaphylloides floribunda - Aulacomnium palustre* DWARF SCRUB
S_D19	bc	WET *Rubus chamaemorus - Sphagnum* sp. - *Betula nana - Vaccinium uliginosum - Eriophorum scheuchzeri* DWARF SCRUB
S_D13	q	DRY *Cassiope tetragona - Vaccinium uliginosum - Loiseleuria procumbens* - Polytrichaceae - *Stereocaulon* sp. SNOWPATCH DWARF SCRUB
S_D19, M10	xx_d	NON-ALIGNED HUMMOCK VEGETATION COMPLEX: a) Hummocks and drier microsites: WET *Rubus chamaemorus - Sphagnum* sp. - *Betula nana - Vaccinium uliginosum - Eriophorum scheuchzeri* DWARF SCRUB b) Inter-hummock areas: VERY WET *Carex chordorrhiza - Eriophorum angustifolium - Carex rotundata* GRAMINOID MEADOW
		PROSTRATE SCRUB TYPES:
D_M5	r	DRY *Arctous alpina* ssp. *alpina - Dryas octopetala - Salix phlebophylla - Hierochloë alpina* - Polytrichaceae PROSTRATE SCRUB
D_M5, M_D5	 xx_i or  xx_i	FROST BOIL VEGETATION COMPLEX: a) Frost boils and drier microsites: DRY *Arctous alpina* ssp. *alpina - Dryas octopetala - Salix phlebophylla - Hierochloë alpina* - Polytrichaceae - *Nardosmia frigida* PROSTRATE SCRUB b) Inter-frost boil areas: MOIST *Carex bigelowii - Betula nana - Salix planifolia - Vaccinium uliginosum - Sphagnum* sp. - *Dicranum* sp. TUSSOCK GRAMINOID MEADOW
M_D5, D_M5		

Numerator of Master Map Code	Vegetation Map Pattern and Floristic Code	Description
M_D5	 y	MOIST *Carex bigelowii - Betula nana - Salix planifolia - Sphagnum* sp. - *Dicranum* sp. TUSSOCK GRAMINOID MEADOW
M10	 at	VERY WET *Carex chordorrhiza - Eriophorum angustifolium - Carex rotundata* GRAMINOID MEADOW
L3	 ah	DRY *Umbilicaria* sp. - *Cetraria hepatizon - Rhizocarpon geographicum* BLOCKFIELD BARREN
L3, D_M5	xx_m	BLOCKFIELD VEGETATION COMPLEX: a) Blockfields: DRY *Umbilicaria* sp. - *Cetraria hepatizon - Rhizocarpon geographicum* BLOCKFIELD BARREN b) Non-rock tundra areas: DRY *Arctous alpina* ssp. *alpina - Dryas octopetala - Salix phlebophylla - Hierochloë alpina* - Polytrichaceae PROSTRATE SCRUB
L8	 8	Gravel and miscellaneous debris
L9	9	Revegetated 8" gasline trench
		Road

Toolik Upland Road Effect Study Site

This site (149°15'W, 68°40'N, elevation 850 m s.m.) is located 16 km north of the turnoff to the Toolik Lake Camp. This is an area of broad rolling hills with vegetation typical of that which covers much of the Foothills of the Brooks Range. Cottongrass (Eriophorum vaginatum) dominates the landscape with dwarf birch (Betula nana), Labrador tea (Ledum palustre), Cloudberry (Rubus chamaemorus), and Ligonberry (Vaccinium vitis-idaea). Sphagnum spp. are the dominant mosses and several species of Cladonia occur regularly. In some, apparently drier, areas Carex bigelowii and Salix planifolia ssp. pulchra are important components of the vegetation. Frost boils are a ubiquitous feature on the upland surfaces. The vegetation on these features usually includes the following plants: Rubus chamaemorus, Luzula arctica, Cassiope tetragona, Rhacomitrium lanuginosum, Polytrichaceae, Cladoniaceae.

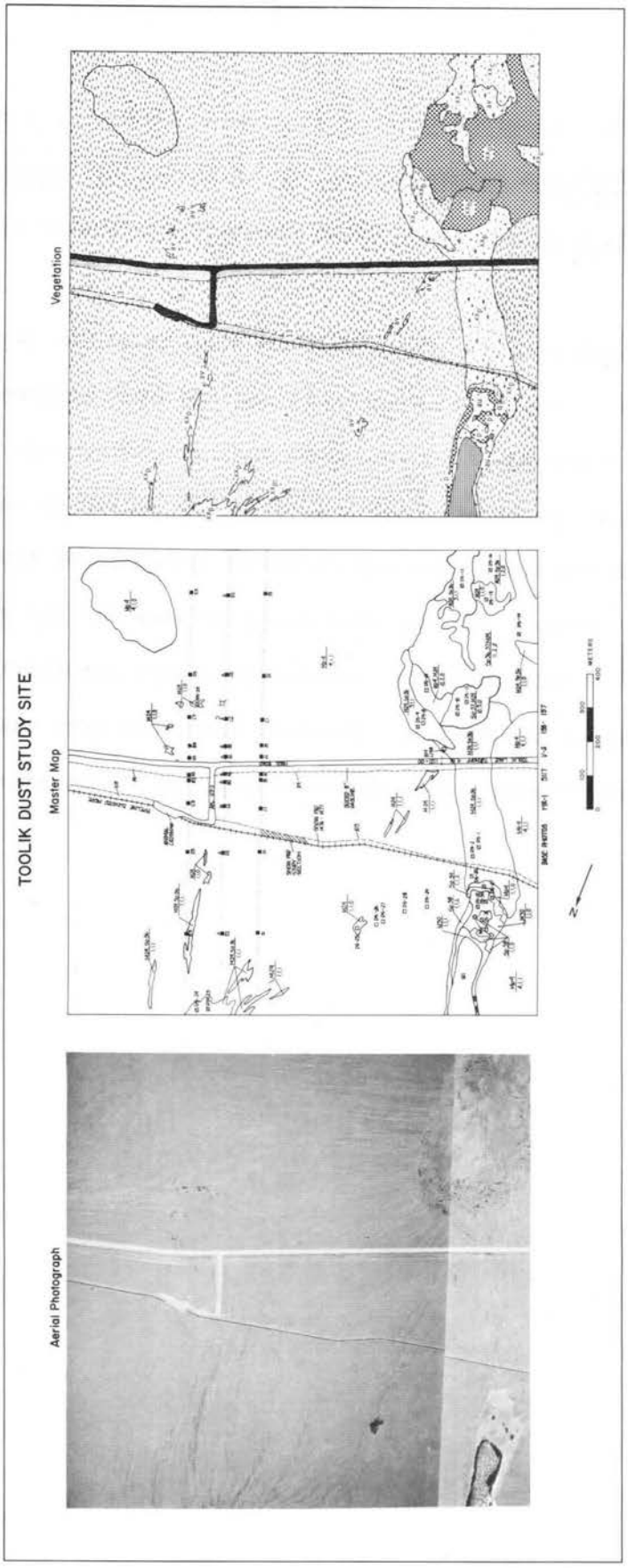
There are many slightly wetter sites, usually associated with shallow drainage channels. Vegetation in these sites is dominated by Eriophorum scheuchzeri and Sphagnum spp. Hummocks in these areas usually have Salix ovalifolia, Betula nana, and Sphagnum spp. The west end of the dust transect and also a large area in the southeast corner of the map have poor drainage with complex landform and vegetation patterns. Some local areas have aligned hummocks with vegetation similar to that found in moist drainages mentioned above. Some areas have high-centered polygons which have communities dominated by dwarf shrubs (Rubus chamaemorus, Betula nana, Vaccinium vitis-idaea, Salix ovalifolia, and Sphagnum spp.). More well-developed high-centered polygons have drier centers with Rhacomitrium lanuginosum, Dicranum spp. and several fruticose lichen species.

There is a lake in the southwest corner of the map which has several communities associated with it which are not found in other areas of the map.

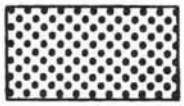
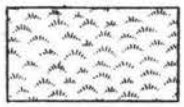
Included here are a Cassiope tetragona snowbed community, a meadow community dominated by Eriophorum angustifolium, Carex aquatilis, Nardosmia frigida, and Drepanocladus brevifolius, and a shrub community dominated by Salix planifolia ssp. pulchra.

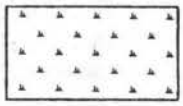
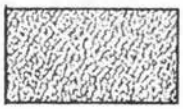
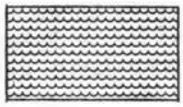
The main disturbances, other than the dust from the Haul Road, include the gasline area which has been revegetated and the area adjacent and east of the pipeline where there was a snowpad used during construction of the pipeline.

This site is the location of a major study regarding the impact of dust on upland tundra vegetation. The map shows the location of the vegetation transects involved in the study. The map also shows an area for the study of impact caused by the snowpad. Eight permanent photo points were established in this section to monitor recovery of vegetation. Two thaw transects were also established, and notes were taken regarding miscellaneous aspects of the impact.


TOOLIK DUST STUDY SITE
Aerial Photograph
Master Map
Vegetation

Vegetation Legend for Toolik Upland Road Effects Study Site

Numerator of Master Map Code	Vegetation Map Pattern and Floristic Code	Description
		DWARF SCRUB TYPES:
S_D38	p	MOIST *Salix planifolia - Nardosmia frigida - Aulacomnium palustre - Equisetum arvense* DWARF SCRUB
S_D39	q	MOIST *Cassiope tetragona - Rubus chamaemorus - Vaccinium vitis-idaea - Dicranum* sp. - *Cetraria richardsonii* SNOWPATCH DWARF SCRUB
S_D36, 37, M29	xx_o or xx_b	THERMOKARST TERRAIN VEGETATION COMPLEX (mixed landforms including strangmoor, non-aligned hummocks, high-centered polygons and thermokarst ponds) or HIGH-CENTERED POLYGON VEGETATION COMPLEX: a) Wet hummocks, slightly elevated boggy areas: WET *Rubus chamaemorus - Sphagnum* sp. - *Betula nana - Pedicularis labradorica - Andromeda polifolia* DWARF SCRUB b) Drier hummocks: MOIST *Betula nana - Vaccinium uliginosum - Rhacomitrium lanuginosum - Cladina rangiferina* DWARF SCRUB c) Depressions and wetter microsites: WET *Eriophorum scheuchzeri - Carex aquatilis - Sphagnum* sp. - *Drepanocladus* sp. GRAMINOID MEADOW
M_D9	 x	MOIST *Eriophorum vaginatum - Betula nana - Ledum palustre - Sphagnum* sp. - *Cladina arbuscula* TUSSOCK GRAMINOID MEADOW
M_D9, M29	xx_b	HIGH-CENTERED POLYGON VEGETATION COMPLEX: a) Tops of polygons: MOIST *Eriophorum vaginatum - Betula nana - Ledum palustre - Sphagnum* sp. - *Cladina arbuscula* TUSSOCK GRAMINOID MEADOW b) Polygon troughs: WET *Eriophorum scheuchzeri - Carex aquatilis - Sphagnum* sp. - *Drepanocladus* sp. GRAMINOID MEADOW

Numerator of Master Map Code	Vegetation Map Pattern and Floristic Code	Description
M29	 av	WET *Eriophorum scheuchzeri* - *Carex aquatilis* - *Sphagnum* sp. - *Drepanocladus* sp. GRAMINOID MEADOW
M29, S_D36	xx_p or xx_c	UPLAND TUNDRA DRAINAGE CHANNEL VEGETATION COMPLEX or ALIGNED HUMMOCK VEGETATION COMPLEX: a) Lower microsites: WET *Eriophorum scheuchzeri* - *Carex aquatilis* - *Sphagnum* sp. - *Drepanocladus* sp. GRAMINOID MEADOW b) Hummocks: WET *Rubus chamaemorus* - *Sphagnum* sp. - *Betula nana* - *Pedicularis labradorica* - *Andromeda polifolia* DWARF SCRUB
M30	 au	MOIST *Eriophorum angustifolium* - *Carex aquatilis* - *Nardosmia frigida* - *Saxifraga cernua* - *Brachythecium* sp. GRAMINOID MEADOW
		DISTURBED TYPES:
X9	9	Revegetated 8" gasline trench
X13	13	Changed vegetation due to ice road
W1		WATER
	W1	Lake
		ROAD

Sagwon Upland

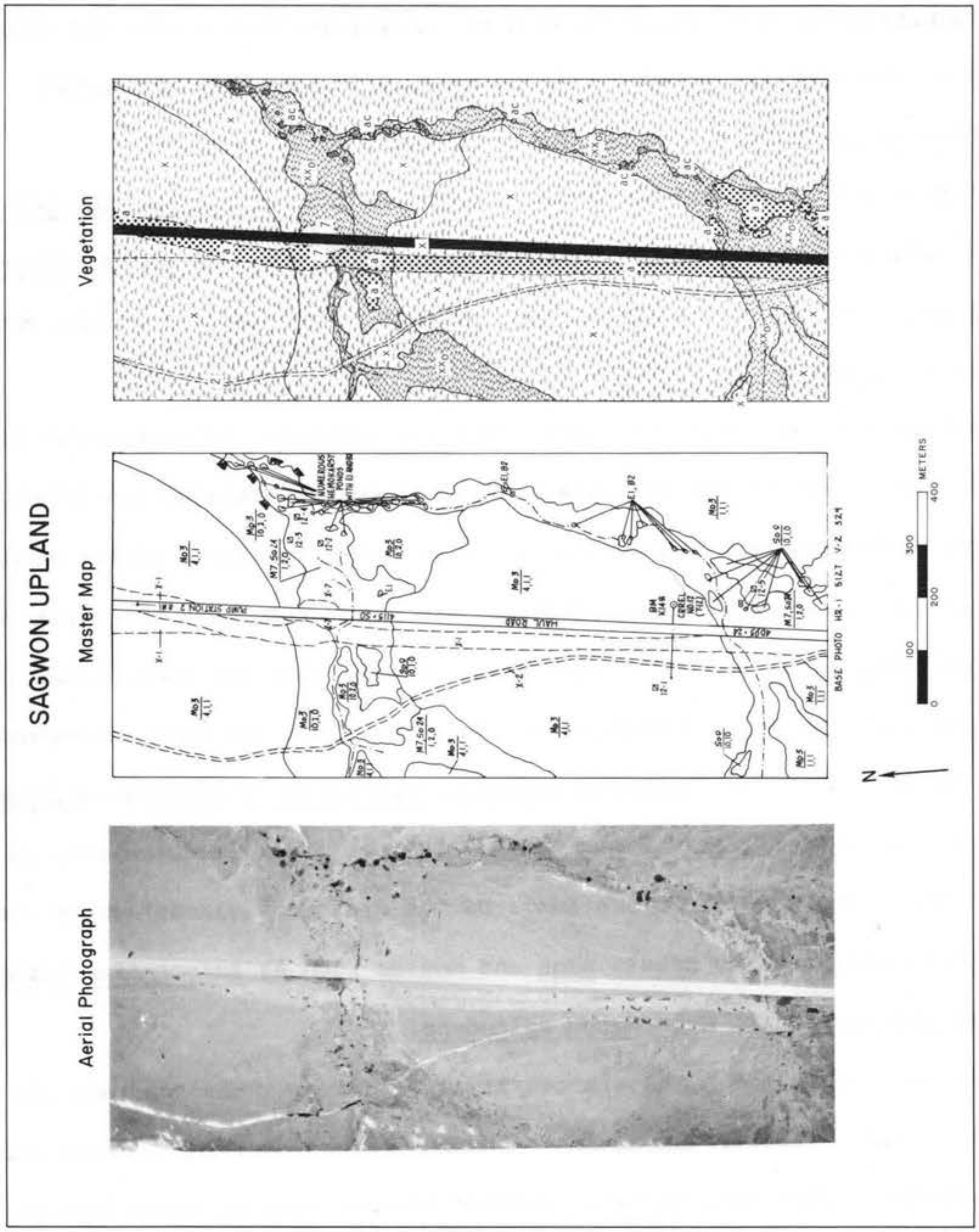
The Sagwon Upland site (148°48'W, 69°23'W, elevation 275 m s.m.) is located west of the Sagwon airstrip and approximately 24 km north of Happy Valley on the Sagwon Upland. Along this portion of the route the pipeline is buried beneath the Sagavanirktok River which is several kilometers east of the map area.

The site contains broadly rolling hills with ice-rich permafrost. Two small drainages in this area exhibit many thermokarst features.

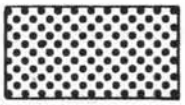
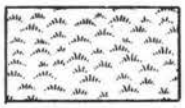
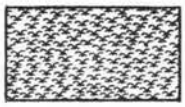
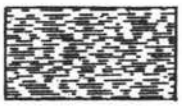
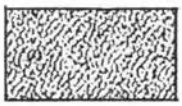
Vegetation on the upland sites is dominated by Eriophorum vaginatum tussocks with a number of small shrubs including Ledum palustre, Vaccinium vitis-idaea, Betula nana, and Salix planifolia ssp. pulchra. The dominant mosses are several species of Sphagnum.

Within the two small drainages there are complexes of vegetation not easily mapped. In several areas the upland adjacent to the drainage has broad high-centered polygons. The vegetation in the drainages consists of wet meadow communities usually with Carex aquatilis dominant often with the marsh fivefinger (Comarum palustre). Slightly drier areas on moss hummocks have willow (Salix planifolia ssp. pulchra) communities. Very wet sites and many thermokarst pits have aquatics including Coptidium palasii, Manyanthes trifoliata, Arctophila fulva and the moss Calliergon giganteum. In some areas (particularly in the more southern drainage there are small better drained "islands" which contain communities dominated by Betula nana and mosses such as Aulocomnium turgidum, Tomenthypnum nitens and Hylocomium splendens.

The main disturbed areas are two trails - one a winter road and the other a bladed trail. Serious thermokarst and erosion has occurred in some sections of the latter. The CRREL terrain transect crosses both of these trails. Also along the road, there is a broad band of vegetation being affected by dust. This could be more serious in this area than in others because of the abundance of Sphagnum which appears to be more easily killed by dust.


SAGWON UPLAND
Aerial Photograph
Master Map
Vegetation
HAUL ROAD
METERS
0
100
200
300
400
N

Vegetation Legend for Sagwon Upland

Numerator of Master Map Code	Vegetation Map Pattern and Floristic Code	Description
S_D9	 a	MOIST *Betula nana - Vaccinium uliginosum - Salix planifolia - Aulacomnium turgidum - Tomenthypnum nitens - Sphagnum* sp. DWARF SCRUB
M_D3	 x	MOIST *Eriophorum vaginatum - Ledum palustre - Betula nana - Sphagnum* sp. - *Hylocomnium splendens* TUSSOCK GRAMINOID MEADOW
M7, S_D24	 xx_o	THERMOKARST TERRAIN VEGETATION COMPLEX: a) Low areas: VERY WET *Carex aquatilis - Comarum palustre - Sphagnum* sp. GRAMINOID MEADOW b) Hummocks, palsas, and slightly raised microsites: WET *Salix planifolia - Betula nana - Carex aquatilis - Sphagnum* sp. DWARF SCRUB
E1, B2 and E1	 ac	THERMOKARST PONDS with either: a) VERY WET *Menyanthes trifoliata - Coptidium pallasii* AQUATIC FORB MEADOW or b) VERY WET *Calliergon giganteum* AQUATIC MOSS MEADOW
		DISTURBED TYPES:
X2	2	Winter trail
X7	7	Flooded area
X9	9	Revegetated 8" gasline trench
		Road

Franklin Bluffs Oil Spill Site

This area (148°45'W, 69°50'N, elevation 90 m s.m.) was mapped four days after a 1800 bbl spill occurred on July 20 at the site following a rupture in a vent pipe. Most of the impacted area can be classified as moist or mesic calcareous tundra, types which are very common along the Sagavanirktok River. A small lake with submerged moss vegetation was also impacted. This lake received light spray from the oil spill and was later drained as a source of water during the clean-up operations. The map shows the vegetation as it existed in 1976. The moist tundra sites within the impacted area have the sedges Eriophorum angustifolium, Carex aquatilis; the horsetail, Hippochaete variegata; the dicotyledon, Pedicularis sudetica; and the mosses, Drepanocladus brevifolius, Cinclidium arcticum and Meesia triquetra. The slightly drier sites have Eriophorum angustifolium and Carex bigelowii; with the shrubs (< 25 cm), Salix lanata and Cassiope tetragona; the prostrate shrubs, Dryas integrifolia, Salix reticulata, S. arctica, and Arctous alpina ssp. rubra; and the mosses, Tomenthypnum nitens and Ditrichum flexicaule.

There are other vegetation types within the map area which were not impacted by the oil. Most of these are associated with the river and its old channels. The dry river bluffs are dominated by Dryas integrifolia, Arctous alpina ssp. rubra, Salix reticulata, Astragalus alpinus, Oxytropis borealis, Carex scirpoidea, Kobresia myosuroides, Distichium capillaceum and Ditrichum flexicaule. Lower terraces have shrub communities (< 50 cm) which are dominated by Salix glauca with Arctous alpina ssp. rubra, Hedysarum alpinum, Anemone parviflora, Oxytropis borealis, Tomenthypnum nitens, and Ditrichum flexicaule. The gravel bars have scattered plants of Astragalus alpinus, Salix alaxensis, Artemisia borealis, Chamerion latifolium, Salix glauca and many others.

Prior to the spill the main disturbances in the area were several vehicle trails which are noticeable because of increased flowering of Eriophorum

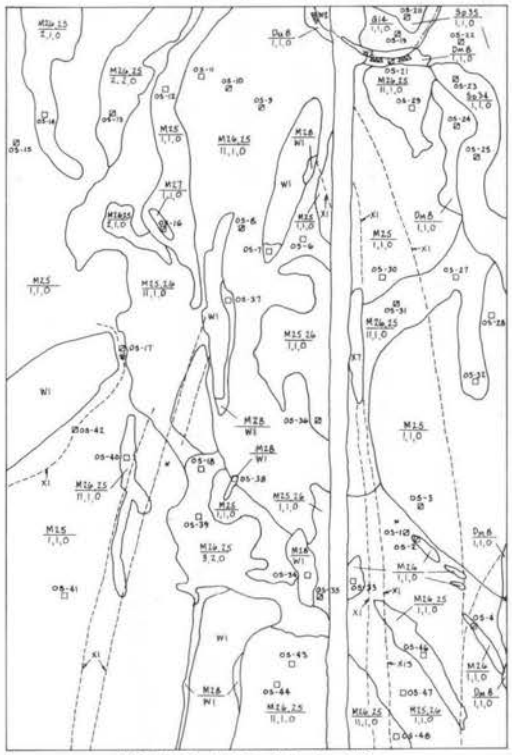
vaginatum and a slightly moister microenvironment in the tracks. There was also a small flooded area adjacent to the work pad in the vicinity of the recent spill.

The map shows the approximate extent of areas which received light oil spray, heavy oil spray, and total saturation respectively. Areas within the light spray zone will probably show total recovery within one year. In the zone of heavy spray there will probably be good recovery by the sedges and willows which are the dominant plants. The fate of other plants such as the erect dicots, horsetails, mosses, and lichens is less certain. In the zone of total saturation the area has been so disturbed that it is doubtful that there will be much recovery within several years.

FRANKLIN BLUFFS OIL SPILL SITE

Aerial Photograph

Master Map



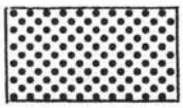
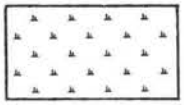
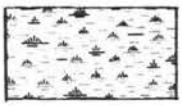
BASE PHOTO RW-07 5133 V-3 GZ9

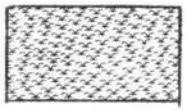
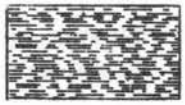
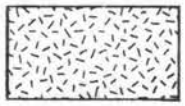
N

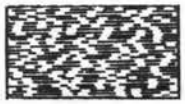
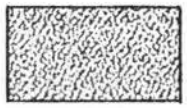
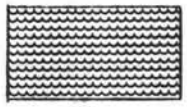
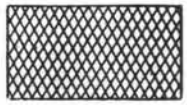
100 300
0 200 400 METERS

Vegetation

Vegetation Legend for Franklin Bluffs Oil Spill Site

Numerator of Master Map Code	Vegetation Map Pattern and Floristic Code	Description
		DWARF SCRUB TYPES:
S_D	p_1	WET *Salix lanata - Carex aquatilis - Hippochaete variegata - Campylium stellatum* DWARF SCRUB
S_D35	p_2	DRY *Salix glauca - Arctous alpina* ssp. *rubra - Hedysarum alpinum - Anemone parviflora - Ditrichum flexicaule* RIVER BAR DWARF SCRUB
		MOIST GRAMINOID MEADOW TYPES:
M25	au	MOIST *Eriophorum angustifolium* s.l. - *Salix lanata - Dryas integrifolia - Arctous alpina* ssp. *rubra - Tomenthypnum nitens* GRAMINOID MEADOW
M25,26	xx_d	NON-ALIGNED HUMMOCK VEGETATION COMPLEX: a) Hummocks and drier microsites: MOIST *Eriophorum angustifolium* s.l. - *Salix lanata - Dryas integrifolium - Arctous alpina* ssp. *rubra - Tomenthypnum nitens* GRAMINOID MEADOW b) Wetter microsites: WET *Eriophorum angustifolium - Carex aquatilis - Hippochaete variegata - Pedicularis sudetica - Drepanocladus brevifolius* GRAMINOID MEADOW
		WET and VERY WET GRAMINOID MEADOW TYPES:
M26	au	WET *Eriophorum angustifolium - Carex aquatilis - Hippochaete variegata - Pedicularis sudetica - Drepanocladus brevifolius* GRAMINOID MEADOW

Numerator of Master Map Code	Vegetation Map Pattern and Floristic Code	Description
M26,25	xx_a	LOW-CENTERED POLYGON VEGETATION COMPLEX
	xx_e	ALIGNED HUMMOCK VEGETATION COMPLEX
	xx_d	NON-ALIGNED HUMMOCK VEGETATION COMPLEX: a) Lower microsites: WET *Eriophorum angustifolium - Carex aquatilis - Hippochaete variegata - Pedicularis sudetica - Drepanocladus brevifolius* GRAMINOID MEADOW b) Higher microsites: MOIST *Eriophorum angustifolium* s.l. - *Salix lanata - Dryas integrifolium - Arctous alpina* ssp. *rubra - Tomenthypnum nitens* GRAMINOID MEADOW
M27	 aq	VERY WET *Carex aquatilis - Scorpidium scorpioides* GRAMINOID MEADOW
M28	 ab	VERY WET *Arctophila fulva* AQUATIC GRAMINOID MEADOW
M28	 ay	VERY WET *Scorpidium scorpioides - Hippuris vulgaris* AQUATIC MOSS MEADOW
$D_M 8$	 i	DRY *Dryas integrifolia - Arctous alpina* ssp. *rubra - Carex scirpoidea - Salix reticulata - Distichium capillaceum* PROSTRATE SCRUB

Numerator of Master Map Code	Vegetation Map Pattern and Floristic Code	Description
		
G14	p	DRY *Salix alaxensis - S. glauca - Astragalus alpinus - Chamerion latifolium - Artemisia borealis* RIVER BAR BARREN
X7		DISTURBED
	7	Flooded area
W1		WATER
	W1	Lake
		BURIED PIPELINE
*		Large bird mound

Franklin Bluffs - North

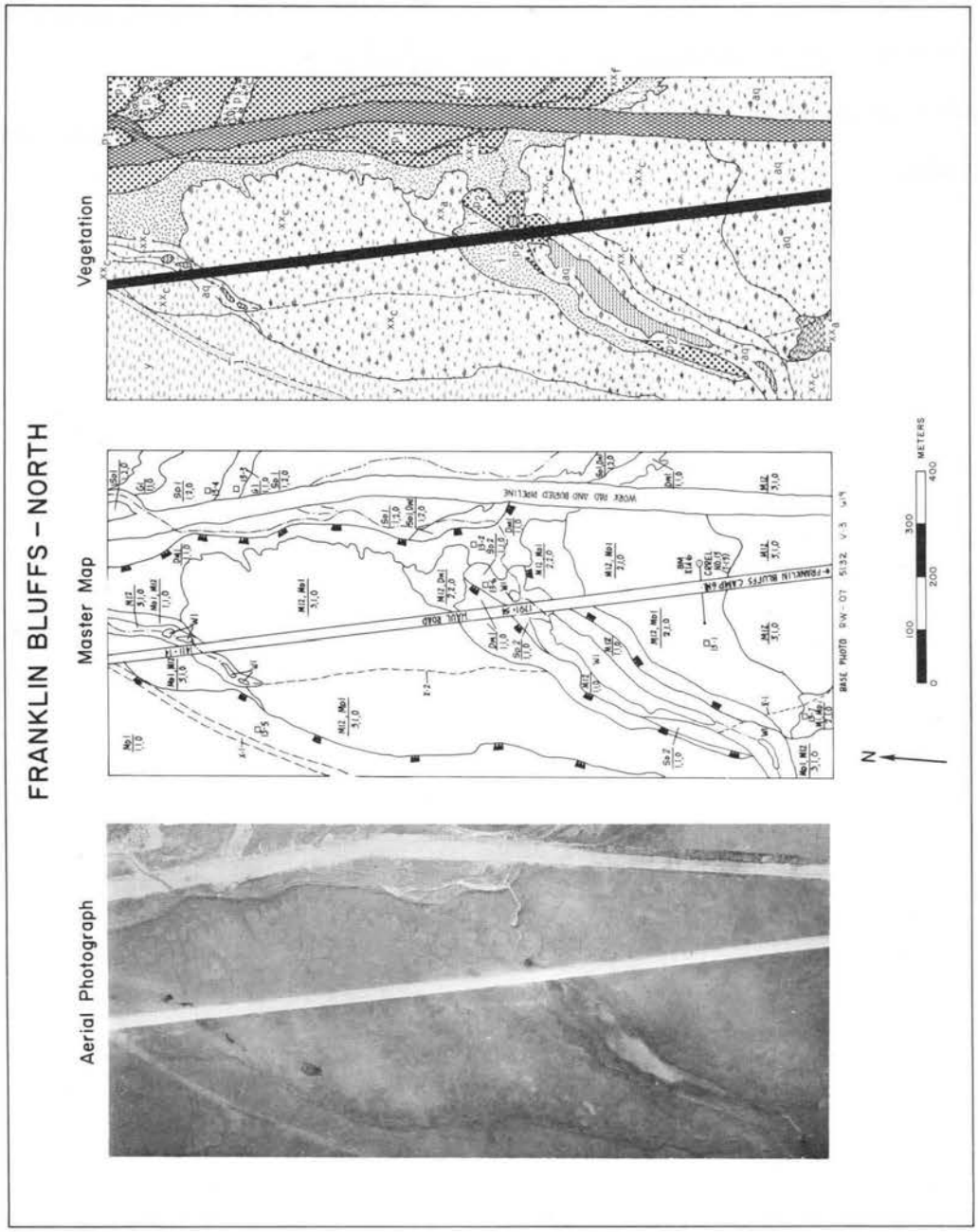
This map area (148°45'W, 69°50'N, elevation 90 m s.m.) is located west of Franklin Bluffs on a series of river terraces of the Sagavanirktok River. Franklin Bluffs Camp is about 15 km south of the area.

The pipeline is located about 200 m east of the road buried in river gravels. Vegetation of the area is typical of much of the coastal plain near the Sagavanirktok River. Wet tundra occurs in the level areas. Areas with better drainage are characterized by a dry tussock tundra dominated by Carex bigelowii. Along the upper edges of the low terraces are communities of mat and cushion dicots mixed with prostrate ericaceous shrubs. The area within the floodplain is dominated by willow communities. The soils are calcareous and support abundant calciphiles such as Dryas integrifolia, Saxifraga oppositifolia, Carex atrofusca, and Scorpidium scorpioides.

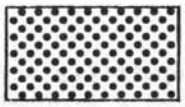
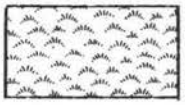
The major topographic relief within the site is associated with two small river terraces about 2-4 m high and also two small drainages which dissect the site from the west. There is also a small lake and a few ponds. The eastern part of the mapped area lies within the floodplain of the Sagavanirktok River and has willow shrub (Salix alaxensis and S. glauca) communities with most of the willows being less than 1 m high. On top of the first terrace mat dicots and prostrate ericaceous shrubs extend for a few meters back from the terrace edge. This community also occurs on the terraces associated with the more southern of the two small drainages. The area between the two major river terraces is dominated by low wet tundra - with areas of low-centered polygons and aligned moss-sedge hummocks. Vegetation in the lower areas is mainly Carex aquatilis, Eriophorum angustifolium, Drepanocladus brevifolius, and Cinclidium latifolium. The upper terrace has more of an upland tussocky tundra dominated by Carex bigelowii and Salix lanata.

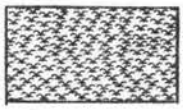
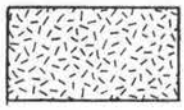
The major disturbance in the area is the ponding along both sides of the road and also the accumulation of dust on the vegetation - particularly in the wet areas. The CRREL transect crosses an impounded area. (The extent of present ponding is not shown on the map because at the date of the aerial photo used for the map (summer 1975), ponding had not yet occurred.)

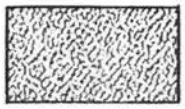
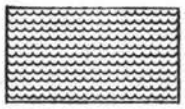
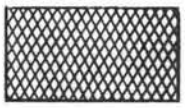
Other disturbances in the area include a winter road and a deeply rutted Rolligon track.


FRANKLIN BLUFFS – NORTH
Vegetation
Master Map
Aerial Photograph
N
0
100
200
300
400
METERS

Vegetation Legend for Franklin Bluffs North

Numerator of Master Map Code	Vegetation Map Pattern and Floristic Code	Description
		DWARF SCRUB TYPES:
S_D1	p_1	DRY *Salix alaxensis - S. brachycarpa - Hedysarum alpinum - Arctous alpina* ssp. *rubra - Castilleja caudata* DWARF SCRUB
S_D2	p_2	MOIST *Salix lanata - Dryas integrifolia - Hippochaete variegata - Tomenthypnum nitens* SNOWPATCH DWARF SCRUB
S_D1,D_M1	xx_f	RIVER BANK VEGETATION COMPLEX: a) Dry protected microsites: DRY *Salix alaxensis - S. brachycarpa - Hedysarum alpinum - Arctous alpina* ssp. *rubra - Castilleja caudata* RIVER BAR DWARF SCRUB b) Dry more exposed microsites: DRY *Dryas integrifolia - Arctous alpina* ssp. *rubra - Salix reticulata - Distichium capillaceum* PROSTRATE SCRUB
		TUSSOCK GRAMINOID TYPES:
M_D1	y	MOIST *Carex bigelowii - Dryas integrifolia - Salix reticulata - S. lanata - Arctous alpina* ssp. *rubra - Tomenthypnum nitens* TUSSOCK GRAMINOID MEADOW
$M_D1,M12$	xx_c	ALIGNED HUMMOCK VEGETATION COMPLEX: a) Top of hummocks: MOIST *Carex bigelowii - Dryas integrifolia - Salix reticulata - S. lanata - Arctous alpina* ssp. *rubra - Tomenthypnum nitens* TUSSOCK GRAMINOID MEADOW b) Lower microsites: WET *Carex aquatilis - Eriophorum angustifolium - Hippochaete variegata - Drepanocladus brevifolius* GRAMINOID MEADOW

Numerator of Master Map Code	Vegetation Map Pattern and Floristic Code	Description
		WET GRAMINOID MEADOW TYPES:
M12	aq	WET *Carex aquatilis - Eriophorum angustifolium - Hippochaete variegata - Drepanocladus brevifolius* GRAMINOID MEADOW
M12,M_D1	xx_c	ALIGNED HUMMOCK VEGETATION COMPLEX: a) Wet inter-hummock areas: WET *Carex aquatilis - Eriophorum angustifolium - Hippochaete variegata - Drepanocladus brevifolius* GRAMINOID MEADOW b) Tops of aligned hummocks: MOIST *Carex bigelowii - Dryas integrifolia - Salix reticulata - S. lanata - Arctous alpina* ssp. *rubra - Tomenthypnum nitens* GRAMINOID MEADOW
M12,M_D1	xx_a	LOW-CENTERED POLYGON VEGETATION COMPLEX: a) Low polygon centers: WET *Carex aquatilis - Eriophorum angustifolium - Hippochaete variegata - Drepanocladus brevifolius* LOWLAND GRAMINOID MEADOW b) Polygon rims: DRY *Dryas integrifolia - Arctous alpina* ssp. *rubra - Salix reticulata - Distichium capillaceum* PROSTRATE SCRUB
		
M1,M_D1	xx_a	LOW-CENTERED POLYGON VEGETATION COMPLEX: a) Polygon basins and troughs: VERY WET *Carex aquatilis - Eriophorum angustifolium - Scorpidium scorpioides* LOWLAND GRAMINOID MEADOW b) Polygon rims: MOIST *Carex bigelowii - Dryas integrifolia - Salix reticulata - S. lanata - Arctous alpina* ssp. *rubra - Tomenthypnum nitens* GRAMINOID MEADOW
		
D_M1	i	DRY *Dryas integrifolia - Arctous alpina* ssp. *rubra - Salix reticulata - Distichium capillaceum* RIVER BLUFF PROSTRATE SCRUB

Numerator of Master Map Code	Vegetation Map Pattern and Floristic Code	Description
		
G1	p	DRY *Salix alaxensis - Hedysarum alpinum - Artemisia arctica - Chamerion latifolium* RIVER BAR BARREN
		
X1	1	DISTURBED - winter trail
		WATER
W1	W1	Lake
		BURIED PIPELINE
		ROAD

Prudhoe Bay Sand Dunes

This site (148°17'W, 70°17'N, elevation 6 m s.m.) is located within the Prudhoe Bay oilfield about 1 km south of the East Dock area in a region where the road passes through a portion of the sand dunes associated with the delta of the Sagavanirktok River. This section of the road was constructed in 1968 and has been heavily used since, especially in late summer and early fall after the arrival of the supply barges for the oilfield.

The dunes are composed of fine sand which erodes into steep-sided dunes. The tops of most dunes have sparse vegetation consisting mainly of the hardy grass Leymus arenarius with scattered plants of Polemonium boreale and Artemisia borealis. Inter-dune areas are often completely barren or have vegetation composed mainly of Salix ovalifolia. The sand at the eastern margin of the dune area is considerably more stable, and extensive mats of vegetation have become established. Less stable areas have Salix ovalifolia and Artemisia borealis as dominant plants with scattered erect and rosette dicotyledons, including Parrya nudicaulis, Armeria maritima, and Androsace chamaejasme. The most stable sands have Dryas integrifolia, Kobresia myosuroides, and Oxytropis gorodkovii. There are also small perched lakes within the dunes, some of which have narrow margins of Carex aquatilis and Dupontia fisheri. Tundra areas to the west of the active and stable dunes receive an annual deposit of aeolian material, the majority of which is probably transported in the winter months. Deposits of sands up to 10 cm thick laying over the previous summer's vegetation have been measured in some polygonal areas. Ice-wedge polygons in the sand dune vicinity have a very different character than polygons covering most of the Prudhoe Bay region. Rims of the polygons are much higher (often over 50 cm, compared to rims rarely exceeding 25 cm in most of the Prudhoe region), and more rounded with troughs which are poorly expressed or absent. The vegetation on

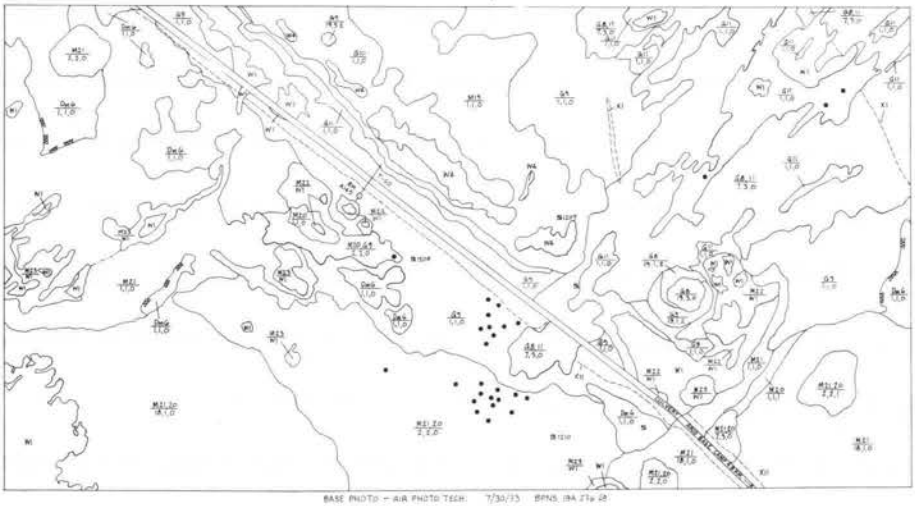
the rims has a very small moss component compared to rims in most areas at Prudhoe where Tomenthypnum nitens forms thick mats on polygon rims. Important species on the polygon rims include Carex aquatilis, Dryas integrifolia, Salix ovalifolia, and Bistorta vivipara. The centers of the polygons in the dunes area, in contrast, have very thick moss carpets, composed of Drepanocladus brevifolius, Cinclidium latifolium, Meesia triquetra, and Calliergon sp. The difference in the moss carpets on the rims and in the centers creates striking differences in the depth of thaw. Maximum thaw on the rims has been measured at 80 cm while thaw in the polygon centers rarely exceeds 45 cm.

Another interesting feature on the map is a large area east of the road which was flooded by salt water--apparently from a storm which breached levees in the coastal beaches. This left an extensive area covered by thick mats of dead Carex aquatilis and moss. Areas adjacent to this zone are now being colonized by Dupontia fisheri and scattered Cochleariopsis groenlandica and Puccinellia andersonii. South of the map area are several ponds with Scorpidium scorpioides growing in up to 1½ m of water.

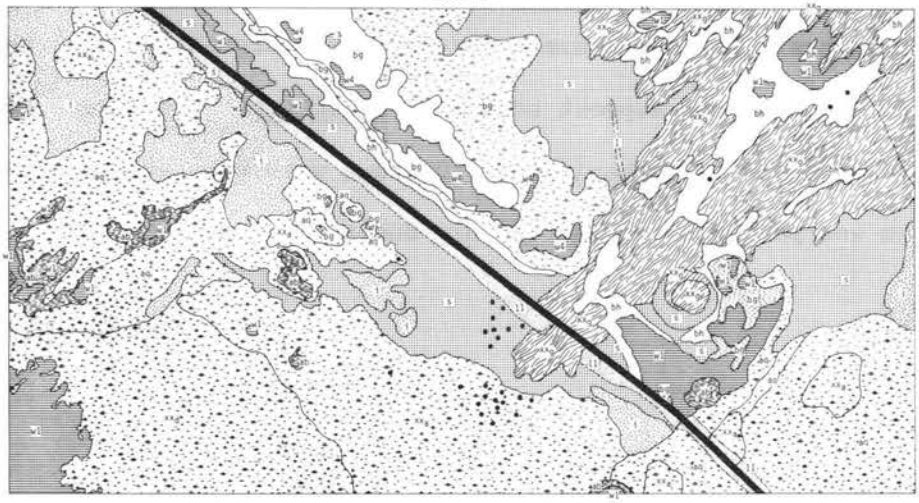
The main disturbance at this site is due to the road, which has caused changes in the natural vegetation adjacent to the road mainly by increasing the soil moisture. The dunes are naturally quite dry but several ponded areas adjacent to the road now support stands of Eriophorum russeolum. Deschampsia caespitosa and Dupontia fisheri occur in areas with moisture intermediate between the wet ponded sites and the dry dunes.

PRUDHOE BAY SAND DUNES

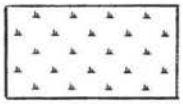
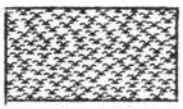
Master Map

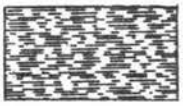
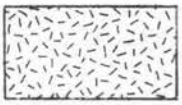
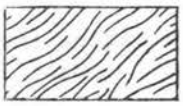
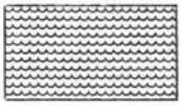


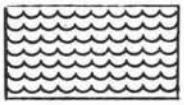
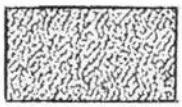
Vegetation



Vegetation Legend for Prudhoe Bay Sand Dunes

Numerator of Master Map Code	Vegetation Map Pattern and Floristic Code	Description
		MOIST GRAMINOID MEADOW TYPES:
M20	aq	MOIST *Carex aquatilis - Dryas integrifolia - Salix ovalifolia - Hippochaete variegata* GRAMINOID MEADOW
M20,G9	xx_a	LOW-CENTERED POLYGON VEGETATION COMPLEX: a) Polygon basins: MOIST *Carex aquatilis - Dryas integrifolia - Salix ovalifolia - Hippochaete variegata* GRAMINOID MEADOW b) Polygon rims: DRY *Salix ovalifolia - Artemisia borealis - Androsace chamaejasme* BARREN
		WET GRAMINOID MEADOW TYPES:
M21	aq	WET *Carex aquatilis - Dupontia fisheri - Drepanocladus brevifolius - Calliergon richardsonii* GRAMINOID MEADOW
M19	bg	WET *Dupontia fisheri - Carex aquatilis - Salix ovalifolia* GRAMINOID MEADOW
M21,20	xx_a	LOW-CENTERED POLYGON VEGETATION COMPLEX
	xx_d	DISCONTINUOUS LOW-CENTERED POLYGON VEGETATION COMPLEX: a) Polygon basins and lower microsites: WET *Carex aquatilis - Dupontia fisheri - Drepanocladus brevifolius - Calliergon richardsonii* GRAMINOID MEADOW b) Polygon rims: MOIST *Carex aquatilis - Dryas integrifolia - Salix ovalifolia - Hippochaete variegata* GRAMINOID MEADOW
		
M22	bg	VERY WET *Dupontia fisheri - Carex aquatilis* GRAMINOID MEADOW

Numerator of Master Map Code	Vegetation Map Pattern and Floristic Code	Description
		AQUATIC GRAMINOID MEADOW TYPES:
M23	ab	VERY WET *Arctophila fulva* AQUATIC GRAMINOID MEADOW
		
D_M6	i	DRY *Dryas integrifolia - Artemisia borealis - Kobresia myosuroides* SANDY FLATS BARREN
		BARREN TYPES:
G9	s	DRY *Salix ovalifolia - Artemisia borealis - Androsace chamaejasme* SANDY FLATS BARREN
	no pattern	
G11	bh	No vegetation
G10	bg	Dead vegetation caused by flooding with salt water
		
G8 and G8,11	xx_g • spot symbol for isolated dunes	SAND DUNE VEGETATION COMPLEX: a) Dunes: DRY *Leymus arenarius* SAND DUNE BARREN b) Inter-dune areas: No vegetation
		WATER TYPES:
W1	W1	Fresh water

Numerator of Master Map Code	Vegetation Map Pattern and Floristic Code	Description
		
W4	W4	Brackish water
		
X1	1	Vehicle tracks
X11	11	Changed vegetation due to flooding
		Road

Prudhoe Bay Coast

This area (148°32'W, 70°22'N, elevation: sea level) is located at the northernmost extension of the road network at Prudhoe Bay near the Arco West Dock. The road in this vicinity was completed in the summer of 1975 and has not seen much traffic to date (July 1977). The mapped area is mainly north of the road and extends to the beaches of the Beaufort Sea.

Vegetation immediately adjacent to the coast is represented by three fairly distinct communities. Active areas of the beach and slumping coastal bluffs have little or no vegetation. Slightly more stable areas have scattered plants of Cochleariopsis groenlandica, Stellaria humifusa, Phippsia algida, and Puccinellia andersonii. In quiet lagoon areas that are frequently flushed with salt water, Carex subspathacea and Puccinellia phryganodes form dense mats of vegetation. These areas are frequently utilized by waterfowl as indicated by the heavy concentrations of goose feces. Stable areas between the beach or lagoonal areas and the highest storm strand line often have communities with dense cover of Dupontia fisheri. These areas are often quite sandy and sometimes have large active frost boils with little or no vegetation.

Inland from the beach areas, the landscape is flat with many lakes. Most of the larger lakes are elongated and oriented perpendicular to the dominant winds from the east-northeast. Some of the lakes have Arctophila fulva communities in areas of shallow water. The terrain between the lakes is often quite rough due to the presence of aligned hummocks, rims, troughs, and high centers associated with ice-wedge polygons. The western half of the mapped area is considerably more broken up than the eastern half. Microrelief variations in map units in the western half sometimes exceed 50 cm while the relief in the eastern half rarely exceeds 25 cm. The vegetation also reflects this. The vegetation in the eastern half is generally meadow-like with large areas of

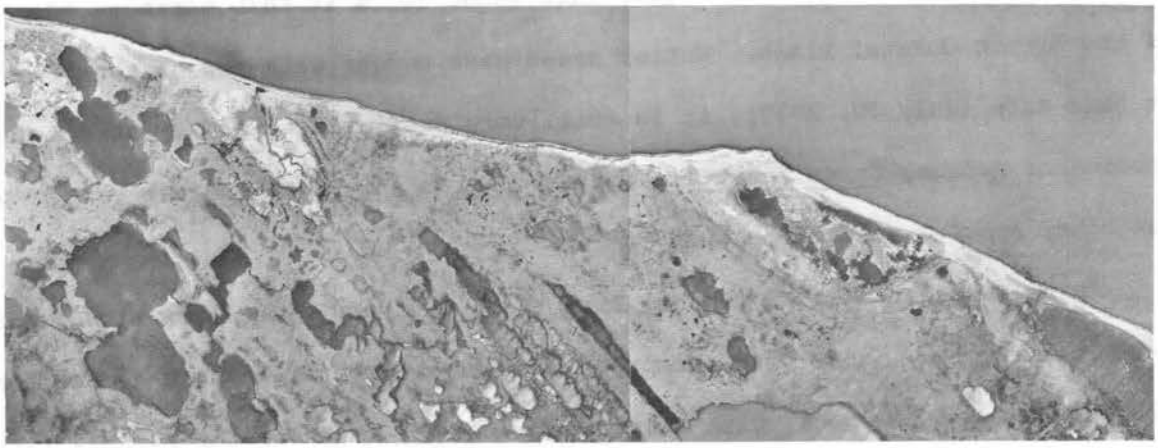
mesic tundra dominated by sedges (mainly Carex aquatilis and Eriophorum angustifolium) and prostrate willows such as Salix pulchra, S. ovalifolia, and S. arctica. The willows appear to grow no higher than about 10 cm at this northern edge of the Arctic Coastal Plain. Wetter areas have sedges with few or no willows. At this date (July 30, 1977), it is still very difficult to differentiate the species of sedges; Carex aquatilis and Eriophorum angustifolium are very abundant, but other species also undoubtedly occur.

In the western half of the map area there are many microsites with drier vegetation types. These sites occur on slightly raised areas such as the tops of high-centered polygons, with frost active areas. Much of the soil is covered by lichens such as Cladonia pyxidata, Thamnolia vermicularis s.l., Ochrolechia frigida, and Fulgensia bracteata. Dominant vascular plants include Salix rotundifolia, Carex cf. rotundata, Dryas integrifolia, Luzula arctica, and Carex misandra. Mosses are not abundant, but Dicranum spp. and Polytrichum juniperinum and Bryum spp. are usually present. Areas with aligned hummocks have vegetation which is often dominated by the lichen Ochrolechia frigida.

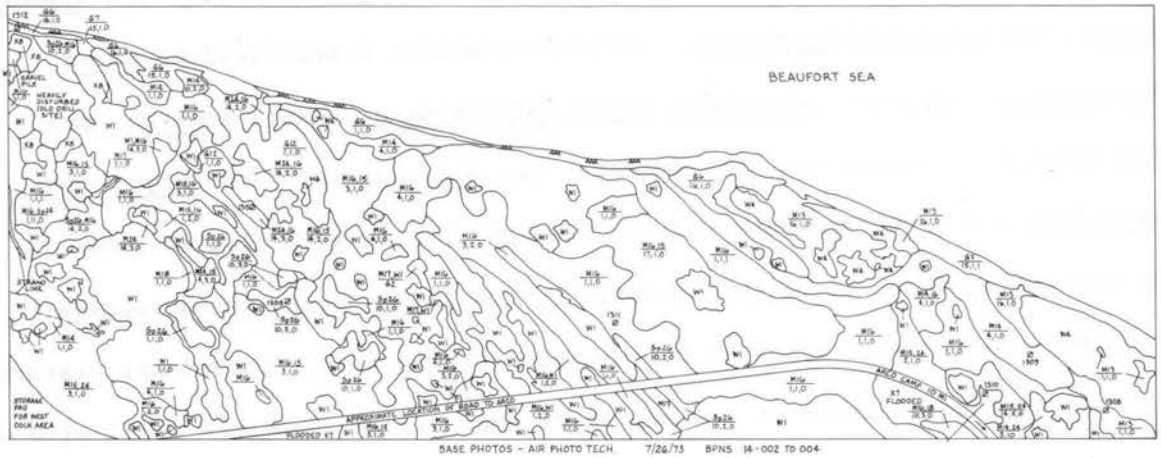
There are two main types of disturbance at this site. The oldest disturbance is in the northwest corner of the map where there is an abandoned drill site with much debris, scraped tundra, and scattered gravel in the immediate vicinity. There are weedy communities of mosses and liverworts in the area, especially around the sewage pond. The other type of disturbance consists of large flooded areas adjacent to the road. These areas are merely indicated on the map with no boundaries. This is because the photography used for the mapping was taken in 1973, before construction of the road.

PRUDHOE BAY COASTAL SITE

Aerial Photograph

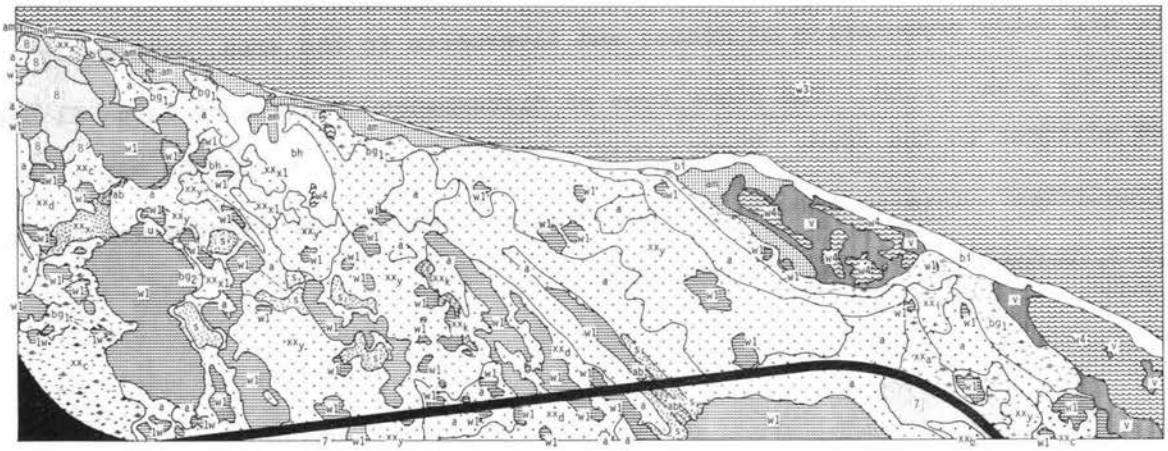


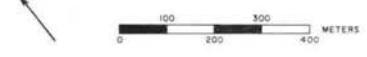
Master Map



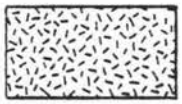
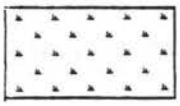
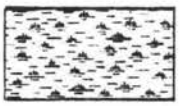
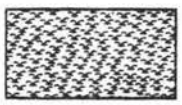
BASE PHOTOS - AIR PHOTO TECH. 7/26/73 BPNS 14-002 TO 004

Vegetation

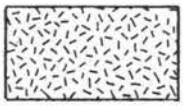
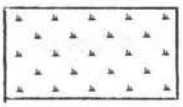
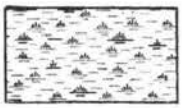
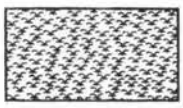


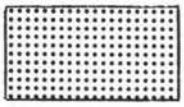
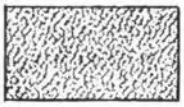
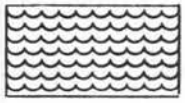
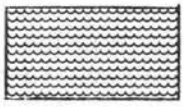


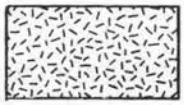
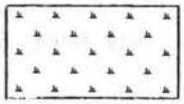
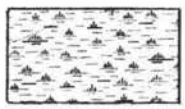
Vegetation Legend for Prudhoe Bay Coastal Site

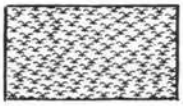
Numerator of Master Map Code	Vegetation Map Pattern and Floristic Code	Description
		
S_D26	s	DRY *Salix rotundifolia - Ochrolechia frigida - S. planifolia - Poa arctica - Dicranum elongatum* PROSTRATE SCRUB
		MOIST GRAMINOID MEADOW TYPES:
M24	u	MOIST *Carex bigelowii - Ochrolechia frigida - Salix planifolia - Dicranum elongatum* GRAMINOID MEADOW
M16	a	MOIST *Carex aquatilis - Salix planifolia - Eriophorum angustifolium - Campylium stellatum* GRAMINOID MEADOW
		WET GRAMINOID MEADOW TYPES:
M14	bg_1	WET *Dupontia fisheri - Cochleariopsis groenlandica - Puccinellia andersonii - Stellaria humifusa* GRAMINOID MEADOW
M15	aq	WET *Carex aquatilis - Eriophorum angustifolium - Dupontia fisheri - Drepanocladus* sp. GRAMINOID MEADOW
M18	bg_2	WET *Dupontia fisheri - Carex aquatilis - Saxifraga cernua - Campylium stellatum - Calliergon* sp. GRAMINOID MEADOW
		
M17	ab	VERY WET *Arctophila fulva* GRAMINOID MEADOW
		
M13	v	WET *Carex subspathacea - Puccinellia phryganodes - Stellaria humifusa* SALINE GRAMINOID MEADOW

Vegetation Legend for Prudhoe Bay Coastal Site

Numerator of Master Map Code	Vegetation Map Pattern and Floristic Code	Description
		
S_D26	s	DRY *Salix rotundifolia - Ochrolechia frigida - S. planifolia - Poa arctica - Dicranum elongatum* PROSTRATE SCRUB
		MOIST GRAMINOID MEADOW TYPES:
M24	u	MOIST *Carex bigelowii - Ochrolechia frigida - Salix planifolia - Dicranum elongatum* GRAMINOID MEADOW
M16	a	MOIST *Carex aquatilis - Salix planifolia - Eriophorum angustifolium - Campylium stellatum* GRAMINOID MEADOW
		WET GRAMINOID MEADOW TYPES:
M14	bg_1	WET *Dupontia fisheri - Cochleariopsis groenlandica - Puccinellia andersonii - Stellaria humifusa* GRAMINOID MEADOW
M15	aq	WET *Carex aquatilis - Eriophorum angustifolium - Dupontia fisheri - Drepanocladus* sp. GRAMINOID MEADOW
M18	bg_2	WET *Dupontia fisheri - Carex aquatilis - Saxifraga cernua - Campylium stellatum - Calliergon* sp. GRAMINOID MEADOW
		
M17	ab	VERY WET *Arctophila fulva* GRAMINOID MEADOW
		
M13	v	WET *Carex subspathacea - Puccinellia phryganodes - Stellaria humifusa* SALINE GRAMINOID MEADOW

Numerator of Master Map Code	Vegetation Map Pattern and Floristic Code	Description
		
G6	am	DRY *Cochleariopsis groenlandica - Puccinellia phryganodes - Stellaria humifusa - P. andersonii* **BEACH BARREN**
	no pattern	
G7	bi	Beach sand, and peat blocks
G12	bh	Bare mud
		DISTURBED TYPES:
X7	7	Flooded area
X8	8	Gravel and debris
		SALINE WATER
W3	W3	Ocean
W4	W4	Brackish water
		
W1	W1	Fresh water
		ROAD

Numerator of Master Map Code	Vegetation Map Pattern and Floristic Code	Description
		VEGETATION COMPLEXES
		
S_D26,M16	xx_x	MIXED HIGH- AND LOW-CENTERED POLYGON VEGETATION COMPLEX: a) Higher microsites: floristic code s b) Lower microsites: floristic code a
		
M24,16	xx_{x1}	MIXED HIGH- AND LOW-CENTERED POLYGON VEGETATION COMPLEX: a) Higher microsites: floristic code u b) Lower microsites: floristic code a
M16,15	xx_{x2}	a) Higher microsites: floristic code a b) Lower microsites: floristic code aq
M16,W1	xx_d	NON-ALIGNED HUMMOCK VEGETATION COMPLEX: a) Higher microsites: floristic code a b) Lower microsites: fresh water
	xx_c	ALIGNED HUMMOCK VEGETATION COMPLEX
M16,15	xx_y	MEADOW VEGETATION COMPLEX: a) Higher microsites: floristic code a b) Lower microsites (e.g., shallow depressions): floristic code aq
M16,18	xx_b	HIGH-CENTERED POLYGON VEGETATION COMPLEX: a) High polygon centers: floristic code a b) Polygon troughs: floristic code bg_2
		
M14,24	xx_c	ALIGNED HUMMOCK VEGETATION COMPLEX: a) Lower microsites: floristic code bg_1 b) Higher microsites: floristic code u
M14,16	xx_i	FROST-BOIL VEGETATION COMPLEX: a) Inter-frost-boil areas: floristic codes bg_1 and a b) Frost-boils: no vegetation

Numerator of Master Map Code	Vegetation Map Pattern and Floristic Code	Description
	xx_c	ALIGNED HUMMOCK VEGETATION COMPLEX
M15,24	xx_y	MIXED HIGH- AND LOW-CENTERED POLYGON VEGETATION COMPLEX
	xx_a	LOW-CENTERED POLYGON VEGETATION COMPLEX: a) Lower microsites: floristic code aq b) Higher microsites: floristic code u
		
M17,W1	xx_k	MARSH VEGETATION COMPLEX: a) Shallow water: floristic code ab b) Deeper water: no vegetation

PART II. PRELIMINARY INVESTIGATION OF THE FEASIBILITY OF USING LANDSAT IMAGERY AND HIGH-ALTITUDE COLOR PHOTOGRAPHY FOR HAUL ROAD VEGETATION MAPPING

LANDSAT Imagery

Although LANDSAT is ultimately the most practical solution to mapping large areas such as the pipeline corridor, the map sites in this mapping program are too small to generate categories for a supervised LANDSAT classification. During an early-June meeting with Leonard Gaydos from the USGS, a 9-in. LANDSAT image of a portion of the North Slope was examined for resolution of the mapping areas. The image had five of the map areas from the Atigun River Sand Dunes site to the Franklin Bluffs Oil Spill Site. The sites were visible on the image, but calculations showed that the average 0.8-km^2 map has only 183 pixels in it, assuming the average ground area of a pixel to be 0.45 hectares. The largest of the maps, the Prudhoe Bay Sand Dunes, is 2.8 km^2 and contains 638 pixels. Generally at least 2000 to 3000 pixels per vegetation type are required for a supervised classification (L. Gaydos, pers. comm., 12 July 1979). If the map areas are to become useful for a supervised classification, it will be necessary to expand the maps to cover larger areas. This can be done using high resolution color photography at a scale of 1:24,000, which is intermediate between LANDSAT and our maps (next section). The maps could find an immediate use with respect to an unsupervised classification. The well-known landscapes within the map areas will be used to test the categories generated by cluster analysis. This will be done as soon as lineprinter images become available at the required scale.

High altitude (1:24,000) color photography

Figures 3 through 8 show the location of six of the map sites on black and white copies of high quality color aerial photography. The photography was taken in late summer 1978 by Northwest Alaskan Pipeline Company,

Two of the map sites have been enlarged to a scale of approximately 1:6000 (Figures 7 and 8) for comparison with the 1976 and 1977 black and white photography

used for the vegetation mapping. It is evident that the color images contain all of the detail that is on the black and white images, and are better in many respects (see captions for Figures 7 and 8). The fall season enhances many features such as graminoid meadows, deciduous forests and Arctous alpina prostrate scrub. The snow cover in the mountains is also at a minimum on south-facing slopes, although north-facing cirques and the highest summits have shallow snow cover.

For most areas it will be possible to interpret vegetation beyond the boundaries of the map areas. The use of physiognomic vegetation categories (Table 3) appears to be the most logical approach to define map unit boundaries. However, caution should be exercised in interpreting too far beyond the map areas since there are many features which are difficult to interpret on the basis of the 21 map areas alone.

Table 3. Current USGS unsupervised classification categories for tundra on the Alaskan North Slope with the equivalent physiognomic categories from this report.

USGS Category	Physiognomic Category
Barrens	BARREN
Dryas Heath	PROSTRATE SCRUB
Tussock	TUSSOCK GRAMINOID MEADOW
Herbaceous Meadow	MOIST GRAMINOID MEADOW
Marsh	WET or VERY WET GRAMINOID MEADOW
Mixed Herbaceous Meadow/Tussock	A variety of COMPLEX types
Brush	SCRUB or TALL SCRUB

With a view toward a supervised LANDSAT classification for the corridor north of the Yukon River it is recommended that the following steps be taken:

1. Obtain 1:6000 enlargements of the 1:24,000 late-summer 1978 NWAP color photography for all 19 road sites.
2. Overlay the map boundaries on the 1:6000 color enlargements and expand the maps to the edges of the photographs. Identify areas which present problems of interpretation.
3. Transfer the map boundaries to the 1:24,000 color images for the 19 sites. Vegetation at the northern end of the corridor can be interpreted using the vegetation maps in the Prudhoe Bay geobotanical atlas (Walker et al., in press).

4. Expand the map to cover as much of the 1:24,000 image as possible, being careful not to overinterpret. Identify problem areas.
5. Examine the remainder of the 1:24,000 images for unusual or unknown features, and identify these areas.
6. Visit each of the sites to identify vegetation in the problem areas. The major emphasis should be on the previously mapped 19 1:24,000 photo areas and on units large enough (i.e., about 8 ha) to have uniform signatures on LANDSAT imagery. Helicopter support will be necessary for many of the map areas.
7. The information obtained could then be used to develop a supervised LANDSAT classification for the corridor. This could be done in conjunction with the USGS program at the Ames Research Center at Moffett Field, California.

Suggested vegetation categories

The vegetation units currently in use by the USGS in its unsupervised classification program on the North Slope are very compatible with physiognomic categories used in the mapping program described in this report (Table 3). Most of the physiognomic categories (Table 3) can be distinguished on LANDSAT imagery. There could be problems distinguishing between the dwarf shrubs, shrub, and tall shrub units; it may be necessary to combine some categories. Other categories can probably be split, for example, graminoid meadows could be divided into wet, very wet, and moist graminoid meadows. Several of the barren types also have distinct signatures.

The units used for the black and white vegetation maps would be a good place to start for a supervised classification. In some cases floristic information can be used to further define the units. For example, in fall scenes it will be possible to distinguish Dryas prostrate scrub units from Arctous prostrate scrub units. The same may be true for other situations such as distinguishing Sphagnum and feathermosses (e.g. Tomenthypnum nitens) in the moss layer of some communities.

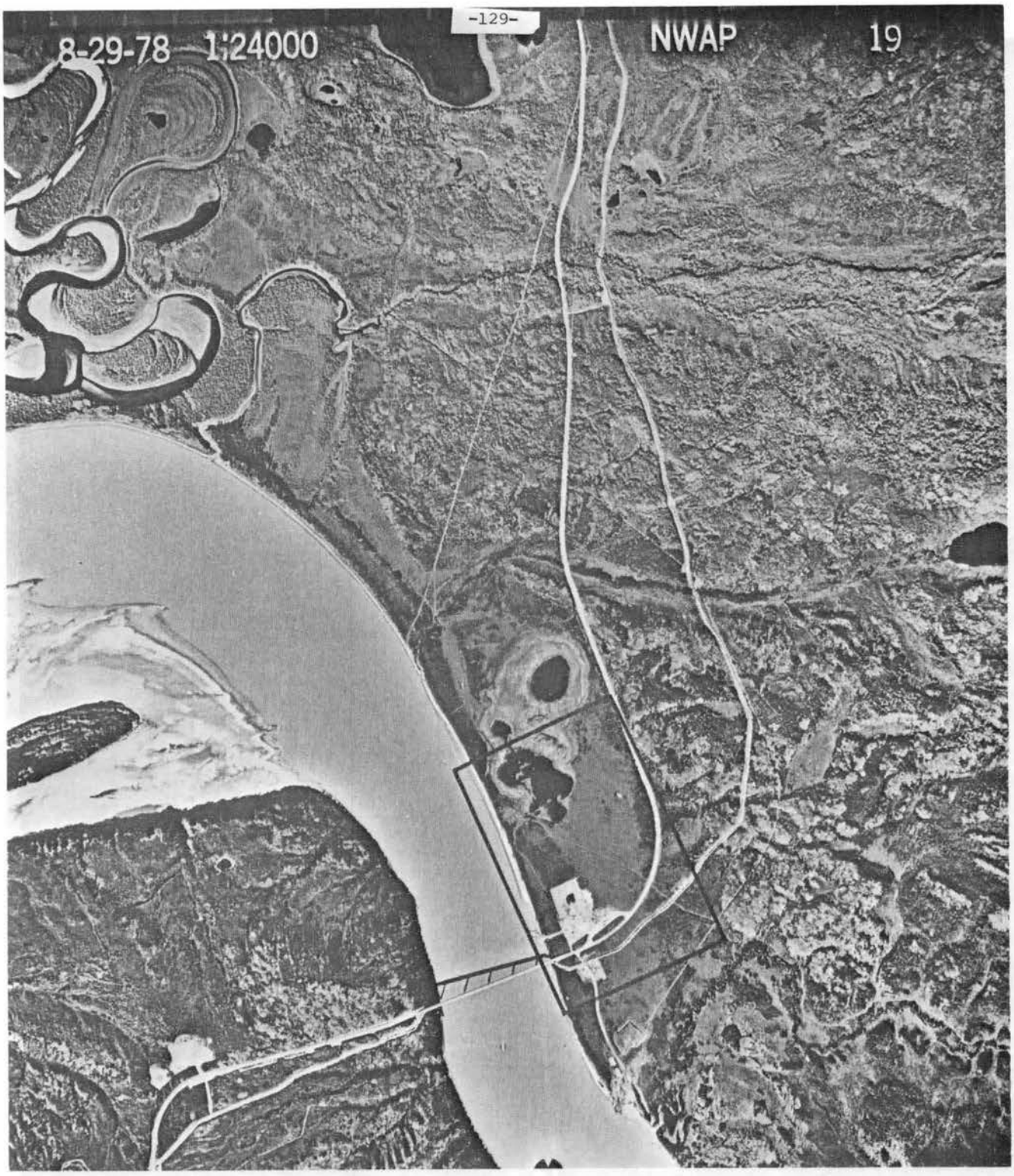


Figure 3. Yukon River site at 1:24,000. The black rectangle shows the area of the study site. The site contains representative river bank communities, a partially drained lake, scrub and tussock graminoid meadows, and a black spruce forest. The photo also shows extensive deciduous forests typical of the Yukon lowlands on the hills north of the river. The Ray River and its meanders are in the upper left corner. The communities are enhanced by the autumn change of color, particularly in the graminoid meadows.

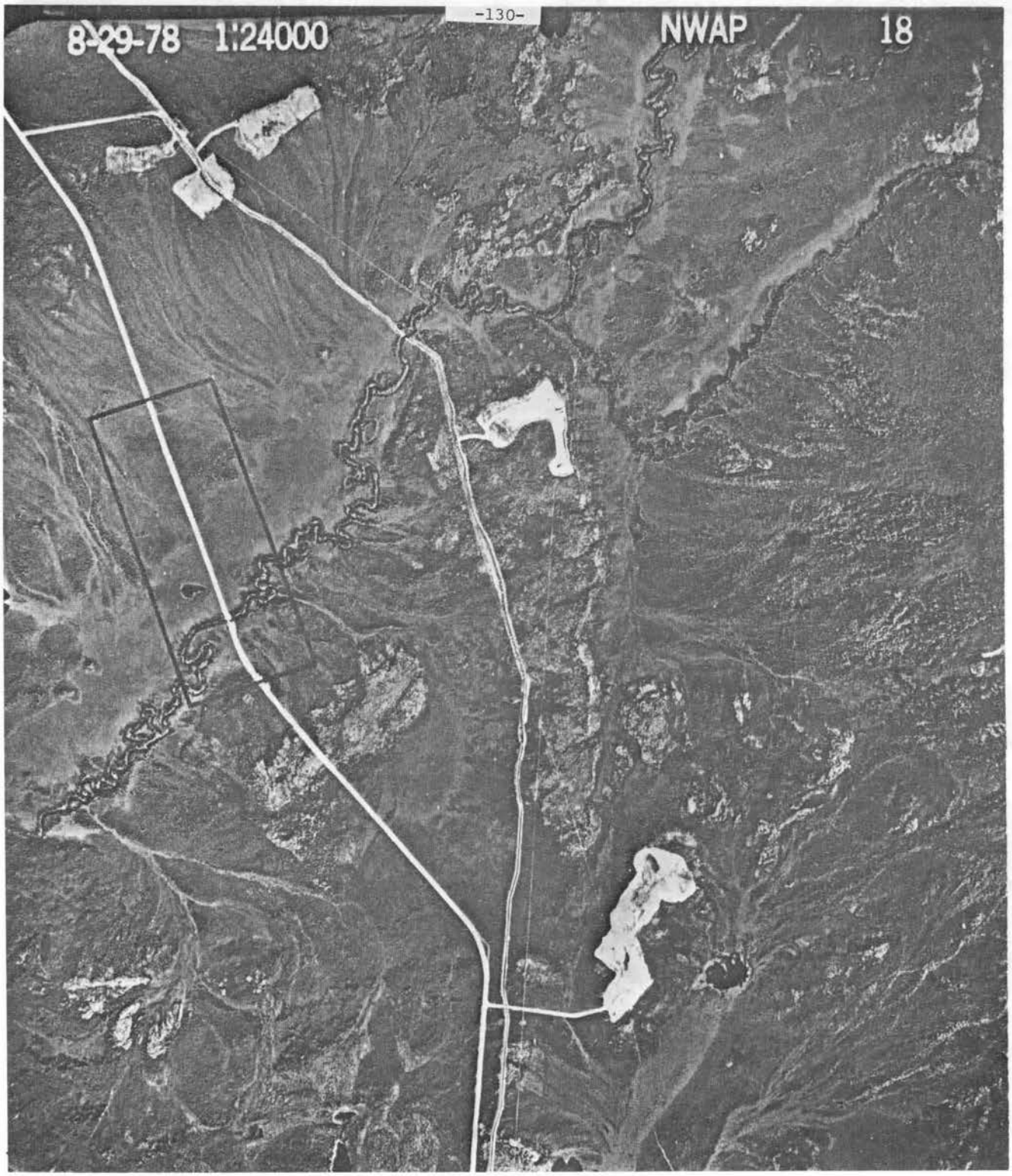


Figure 4. No Name Creek (1:24,000). The site contains representative lowland bog communities, elfin black spruce forests and mature white spruce stands along the creek. The rolling terrain is typical of much of the route between the Yukon River and the Brooks Range. Three revegetated material sites are apparent along the route of the pipeline.

Figure 5. Atigun Pass site (1:24,000). The site contains rugged alpine terrain with a variety of talus slope complexes, graminoid meadows and prostrate shrub communities. Deep shadows make many portions of the photo difficult to interpret.

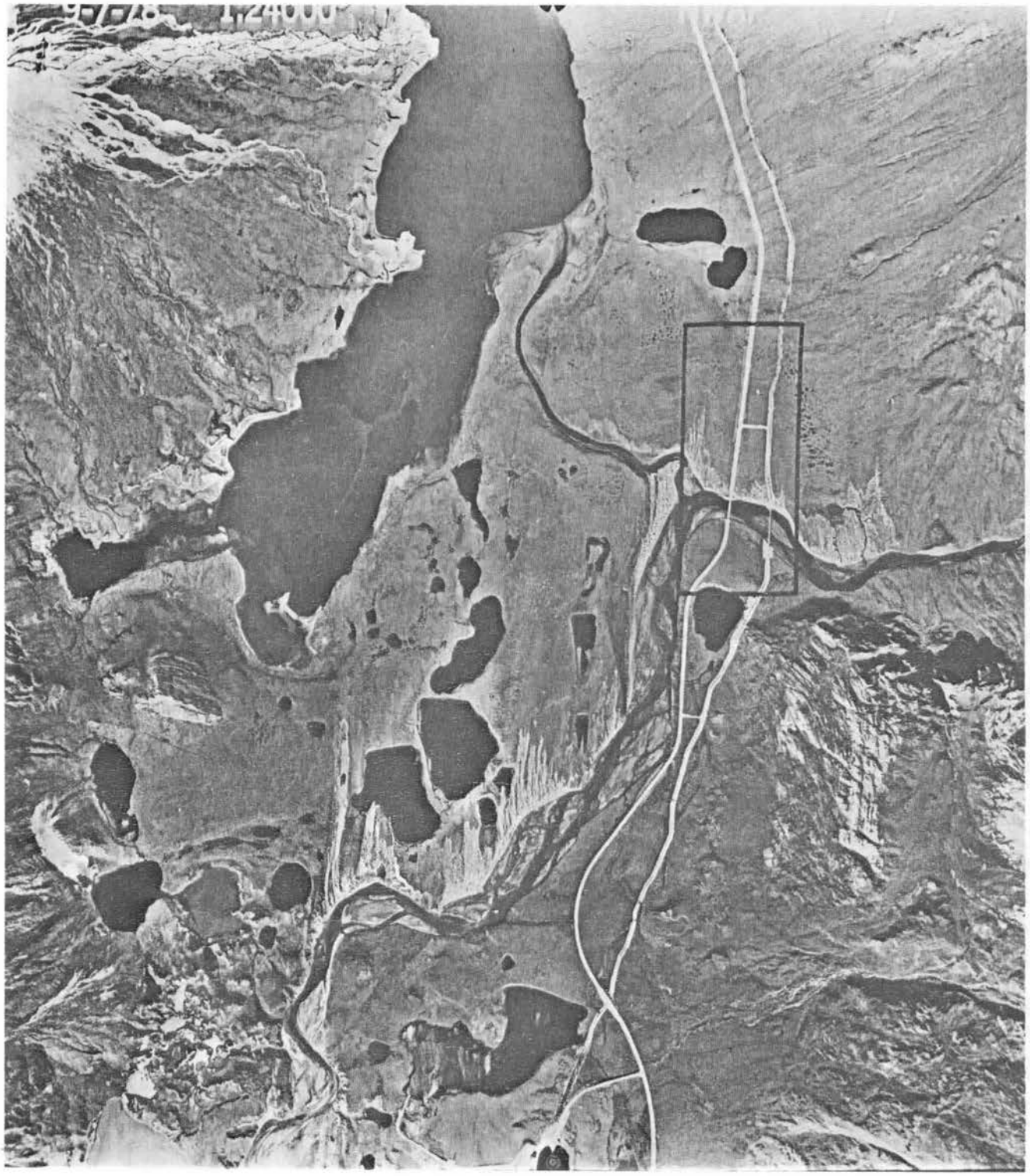


Figure 6. Atigun River Sand Dunes site (1:24,000). The site contains dunes and mostly moist graminoid communities, and a few low-centered polygons. Dwarf scrub occurs along the banks of the river. Galbraith Lake is the largest of several glacial lakes and ponds. A large alluvial fan is in the upper left-hand corner. The river enters Atigun Canyon at the right side of the photo.

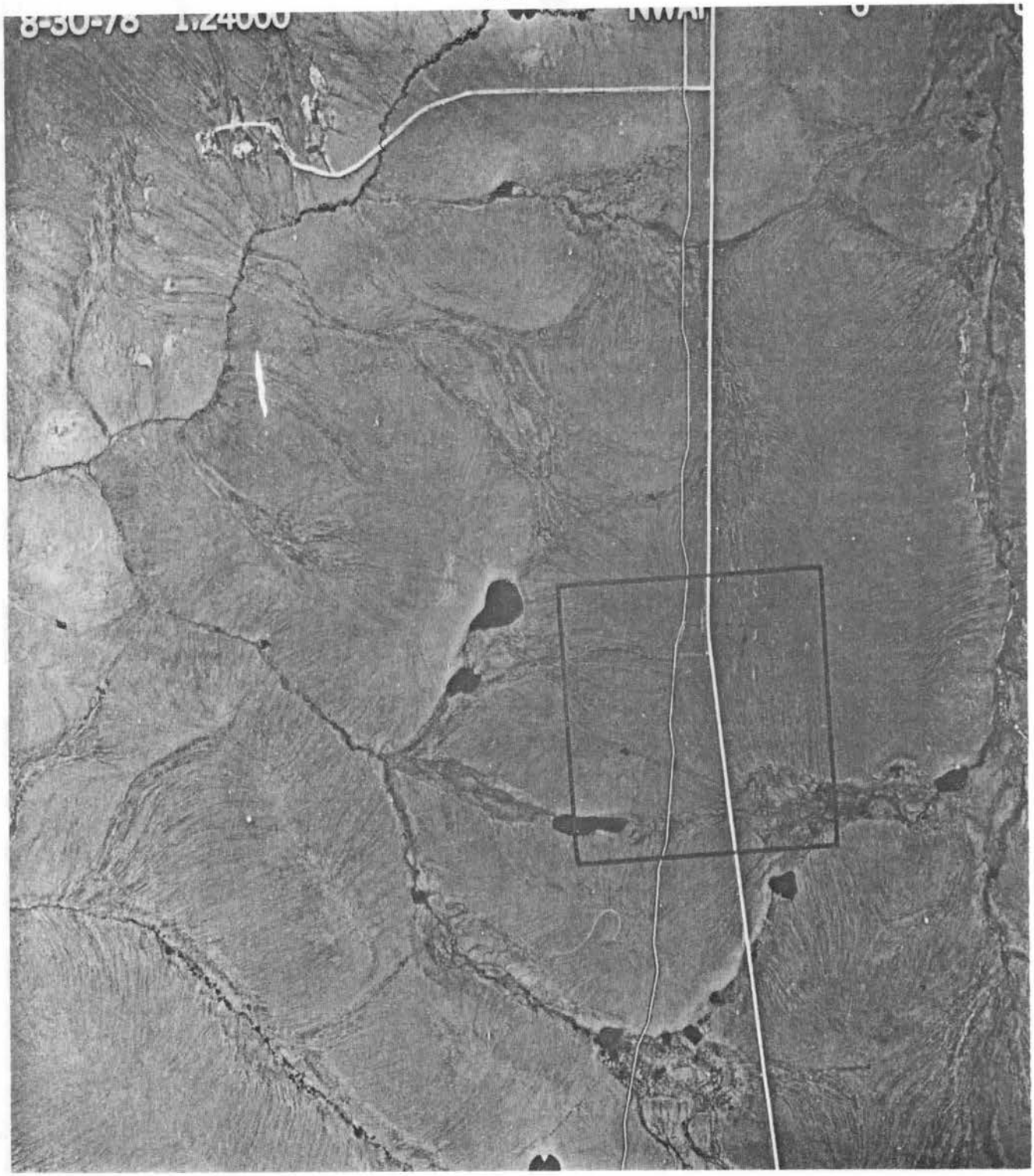


Figure 7. Toolik Upland Road Effects site (1:24,000). The site is representative of broad expanses of upland tundra in the Southern Foothills. Thermokarst and thermal erosion features, including beaded streams and complicated lowlands, are apparent in many of the drainages.

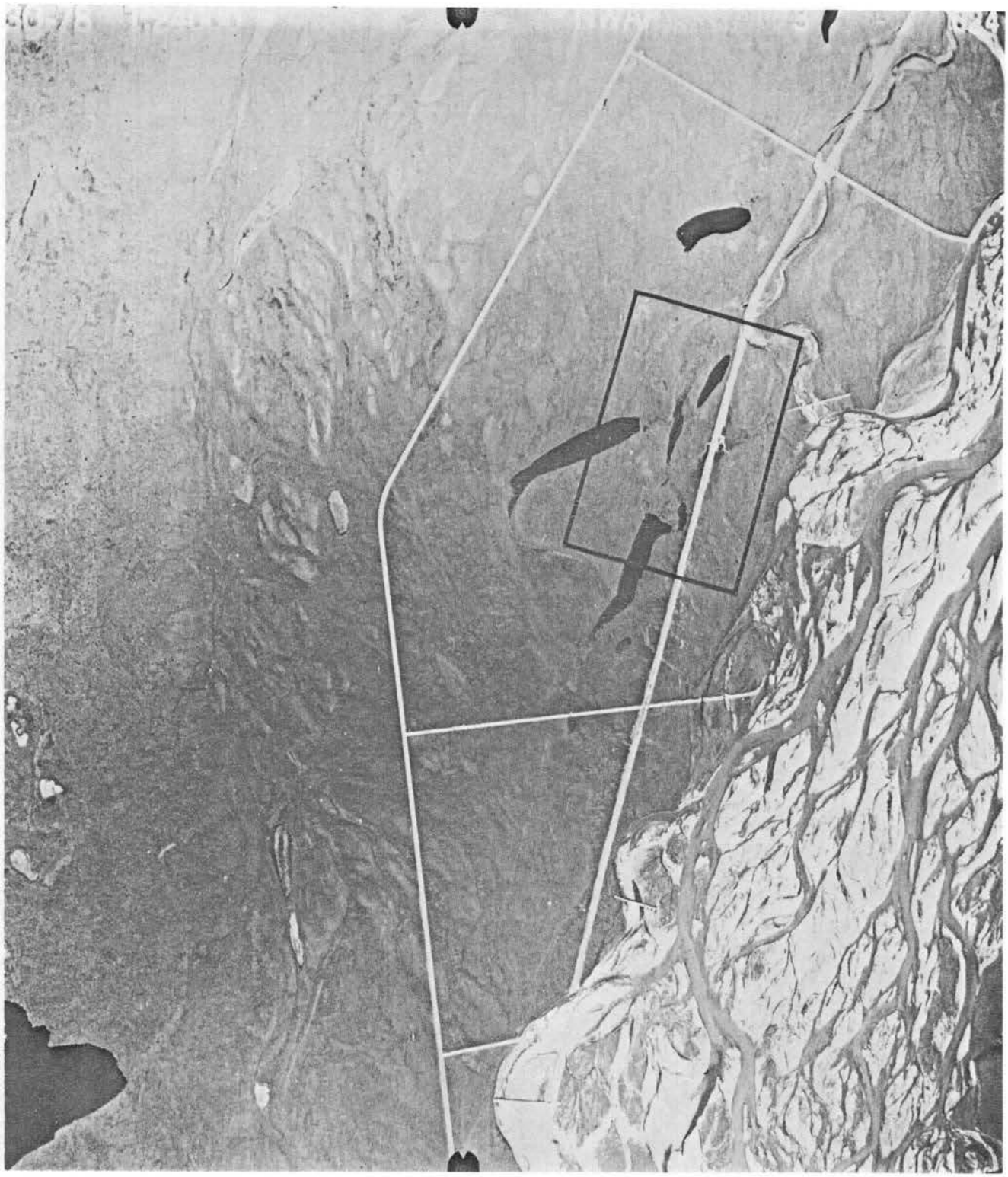


Figure 8. Franklin Bluffs Oil Spill site (1:24,000). The site is on the alluvial terraces of the Sagavanirktok River. Several old stream meander channels occur and are responsible for the lakes within the study area. Vegetation is mostly moist and wet graminoid communities. Along the river and on the gravel bars dwarf and prostrate shrub communities occur. The orange borders along some of the river margins are Arctous alpina ssp. rubra in autumn color.

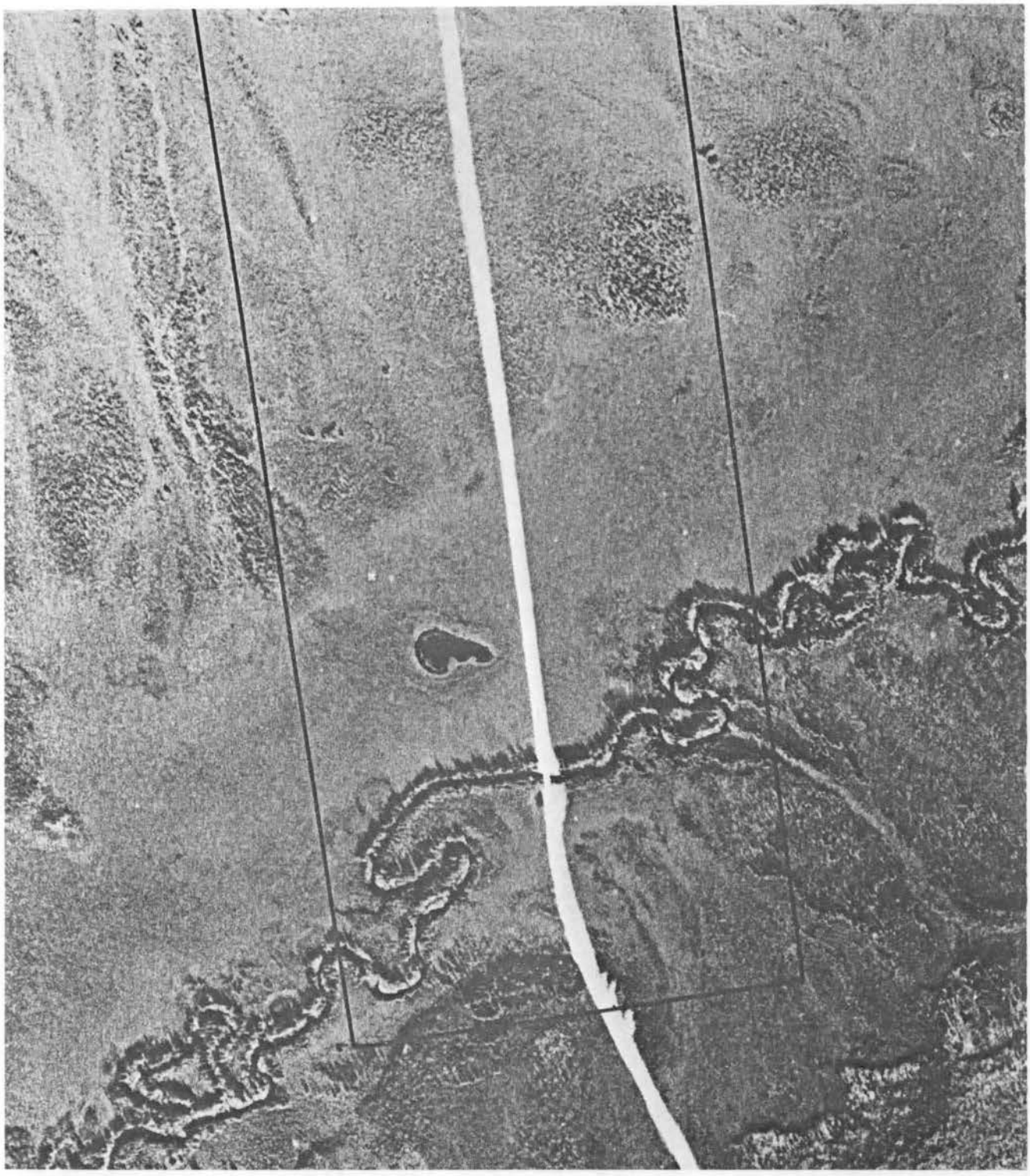


Figure 9. No Name Creek site (about 1:6000). Comparison with the black and white photograph used for mapping this site shows much more detail in the color photograph. Details in the meadow communities are particularly evident. A large expanse of lichen-spruce woodland occurs near the lower right-hand corner.

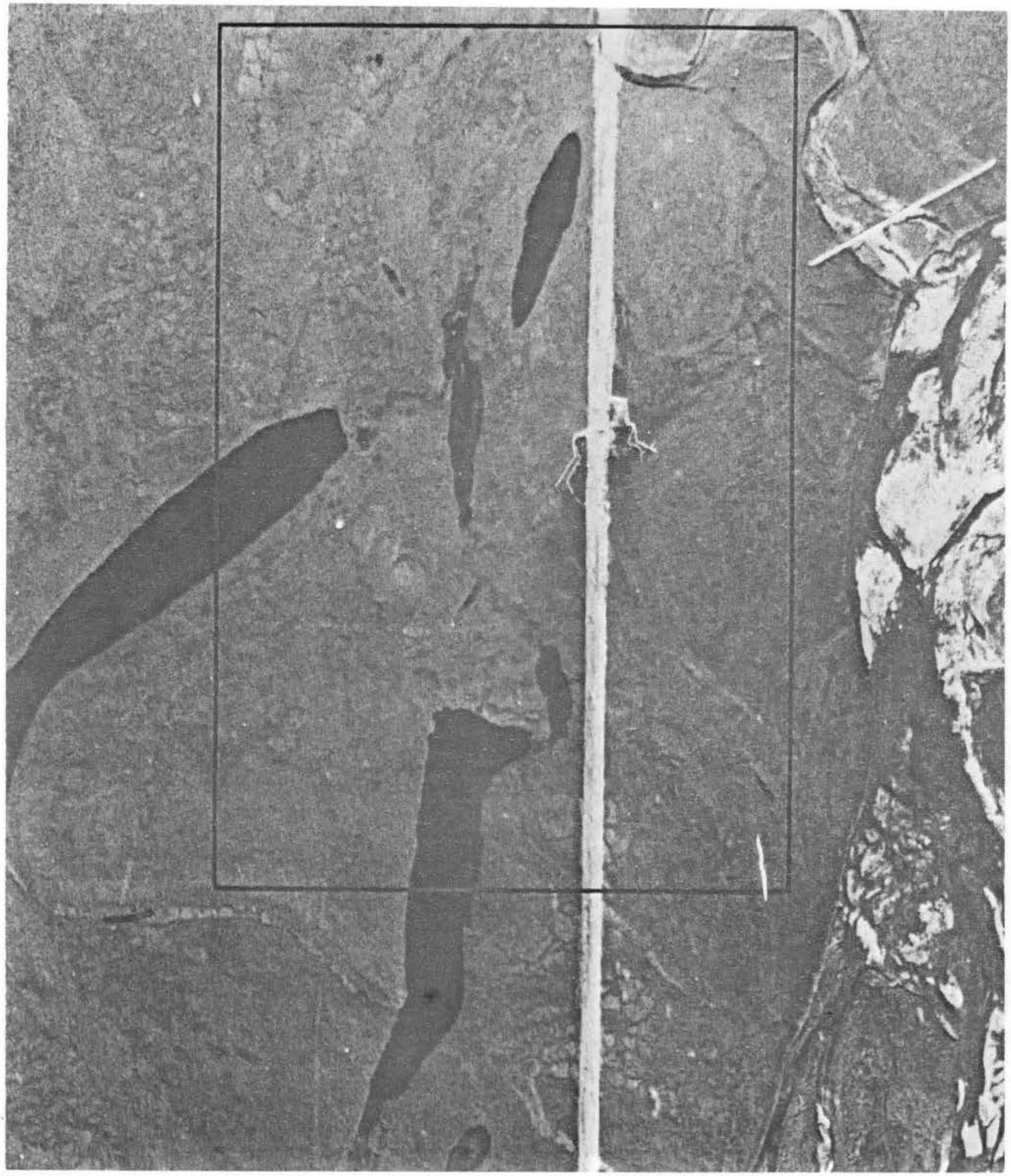


Figure 10. Franklin Bluffs Oil Spill site (about 1:7000). Again much more detail is apparent on this photo than on the one used for field mapping. The site of the July 1977 oil spill is apparent near the middle of the photograph.

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APPENDIX:
A LARGE-SCALE (1:6000) VEGETATION MAPPING METHOD FOR NORTHERN ALASKA

This appendix is part of a manual used for an informal Alaskan vegetation mapping workshop at the Institute of Arctic and Alpine Research, 4-5 June 1979. It is expected that much of the manual will be revised following input from workers using the method during the 1979 field season. It should therefore be considered preliminary at the time of this report. The workshop was hosted by the Plant Ecology Laboratory. Those in attendance were working on mapping projects in the Ray River and Arrigetah Mountains of Alaska and the Front Range of Colorado.

The manual is divided into five chapters: Chapter 1, Introduction; Chapter 2, Vegetation Sampling; Chapter 3, The Master Map; Chapter 4, Vegetation Classification System; and Chapter 5, The Vegetation Map.

CHAPTER 1

INTRODUCTION

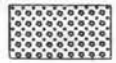
This manual contains an overview of the methods of detailed composite vegetation mapping that the Institute of Arctic and Alpine Research Plant Ecology Lab has developed in Alaska during the past seven years at Barrow (Walker, 1977), Prudhoe Bay (Webber and Walker, 1975; Everett et al., 1978; Walker et al., in press), Meade River (Komárková and Webber, 1979), Fish Creek (Komárková and Webber, 1978), and at 21 sites along the Trans-Alaska Pipeline north of the Yukon River (Webber et al., 1979; Walker and Webber, in prep.). The method is particularly useful at the 1:6000 scale we have used on most of our field maps. We feel a similar scale is necessary for land-use purposes in permafrost regions because of the very complicated landscapes which make maps at smaller scales overly general for most practical applications.

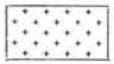
The aim of the system is to produce two types of maps. The first is a composite map, or master map (Figure 1), encoded with vegetation, landform, microrelief, and slope information. The second type of map is a black and white vegetation map (Figure 1) which is derived from the composite map.

One of the most important aspects of the entire system is that the names of the vegetation units follow a consistent system of nomenclature based on principal plant taxa, physiognomic structure, and ecology of the plant communities.

This manual explains the entire process used in the production of our maps. The system, as it is described here, is somewhat of a modification of our earlier methods (Webber et al., 1979) and is divided into four sections, that describe 1) the field sampling methods, 2) the preparation of the composite map, 3) the system of plant community nomenclature, and 4) the final vegetation map.

Vegetation Legend for Finger Mountain

Numerator of Master Map Code	Vegetation Map Pattern and Floristic Code	Description
$T_O B5,39$	 B5a	MOIST *Picea mariana* CONIFEROUS LOW SAVANNA Scattered tree islands or krummholz < 5 cm dbh; understory: scattered *Alnus viridis* with *Betula nana, Ledum palustre, Carex bigelowii, Vaccinium vitis-idaea, Sphagnum* spp.
		OPEN DECIDUOUS FOREST TYPES:
$T_O E3,34$	E3m	DRY *Betula papyrifera* OPEN DECIDUOUS FOREST Trees 5-15 cm dbh; understory: *Cladina alpestris, C. rangiferina, Cetraria cucullata, Arctous alpina* ssp. *rubra, Loiseleuria procumbens, Stereocaulon* sp., *Ledum palustre, Betula nana*
$T_O E3,38$	E3f	DRY *Betula papyrifera* OPEN DECIDUOUS FOREST Trees 5-15 cm dbh; understory: *Ledum palustre, Betula nana, Cladina rangiferina, C. alpestris, Vaccinium uliginosum, V. vitis-idaea, Cladonia gracilis, Stereocaulon* sp.
		OPEN MIXED FOREST TYPES:
$T_O H5,38$	H5f	DRY *Picea mariana - Betula papyrifera* MIXED LOW SAVANNA Tree islands or krummholz < 5 cm dbh; understory: same as E3f
$T_O H3,38$	H3f	DRY *Picea mariana - Betula papyrifera* OPEN MIXED FOREST Trees 5-15 cm dbh; understory: same as E3f
$T_O H3,38,39$	H3	DRY *Picea mariana - Betula papyrifera* OPEN MIXED FOREST Trees 5-15 cm dbh; understory: mixture of those found in E3f and B5a
$S_t 50$	 P	WET *Salix planifolia - Comarum palustre - Sphagnum* sp. TALL SCRUB
$S_m 12$	 a	WET *Betula glandulosa - Salix planifolia - Spirea beauverdiana - Sphagnum* sp. SCRUB
$S_m 13, S_d 14$	 xx_i	FROST BOIL VEGETATION COMPLEX: a) Inter-frost boil areas: MOIST *Ledum palustre - Betula nana - Carex bigelowii - Vaccinium vitis-idaea - Sphagnum* sp. DWARF SCRUB b) Frost boils: DRY *Alnus viridis - Ledum decumbens - Betula nana - Cladina rangiferina - Cetraria cucullata - Rhacomitrium lanuginosum* SCRUB

Numerator of Master Map Code	Vegetation Map Pattern and Floristic Code	Description
L6	 n	DRY *Cladina alpestris - C. rangiferina - Cetraria cucullata - Arctous alpina* ssp. *rubra - Loiseleuria procumbens* LICHEN MEADOW
L5	 ah	DRY *Umbilicaria hyperborea - Parmelia* sp. - *Rhizocarpon geographicum - Cornicularia divergens* BLOCK FIELD BARREN
D12	 12	DISTURBED changed vegetation due to culvert
		BURIED PIPELINE
		ROAD

Description of the Finger Mountain Site

The Finger Mountain site (150°30'W, 66°22'N, elevation 490 m.s.m.) is located 11.7 km south of the Old Man Camp on the Yukon River to Prudhoe Bay Highway. The area is near treeline and contains forested areas, a subalpine band of tree islands and krummholz and a moist upland shrub savanna with widely spaced alder shrubs. There are also three large granitic rock outcrops, which are typical of the many tors which occur on the broad hills in this region of the Kokrine-Hodzana highlands. The Trans-Alaska Pipeline is located on the east side of the road in the buried mode.

The tor features are richly covered with lichens, primarily from the genera Umbilicaria, Parmelia, Physcia, Lecidea, and Cladina. The gentle slopes leading up to the tors are covered with beautiful lichen heath meadows with widely spaced birch trees. The primary taxa in these lichen meadows are Cladina arbuscula, C. alpestris, C. rangiferina, Stereocaulon sp., Ledum palustre, Betula nana, Loiseleuria procumbens, and Hierochloë alpina. Most of the map area is covered by subalpine shrub savanna, with evenly spaced Alnus viridis occurring mainly on frost boil surfaces. The inter-frost boil areas are dominated by dwarf scrub vegetation consisting of Ledum palustre, Betula nana, Carex bigelowii, Vaccinium vitis-idaea, and Sphagnum spp.

The upland surfaces have very widely scattered tree islands of either Betula papyrifera or Picea mariana. The downslope edges of the upland grade into subalpine meadows dominated by Carex bigelowii, Betula nana, and Sphagnum spp. These meadows also have uniformly spaced alder shrubs and tree islands consisting of Picea mariana. Many of these tree islands have flagged trees and krummholz shaped by the strong winds from the east.

The lower slopes are forested with medium-sized (5-15 cm dbh) Picea mariana and scattered Betula papyrifera. The understory is varied depending on the drainage of the substrate. The drier areas have Ledum palustre, Betula nana, Vaccinium uliginosum, V. vitis-idaea, Cladina rangiferina, C. alpestris, and Stereocaulon sp. The moister areas have Alnus viridis, Betula nana, Ledum palustre, Carex bigelowii, Vaccinium vitis-idaea, and Sphagnum spp.

There is a small stream which cuts across the northwest corner of the map. The stream bottom has dense willow thickets with an understory consisting of Sphagnum sp., Mnium sp., and Comarum palustre.

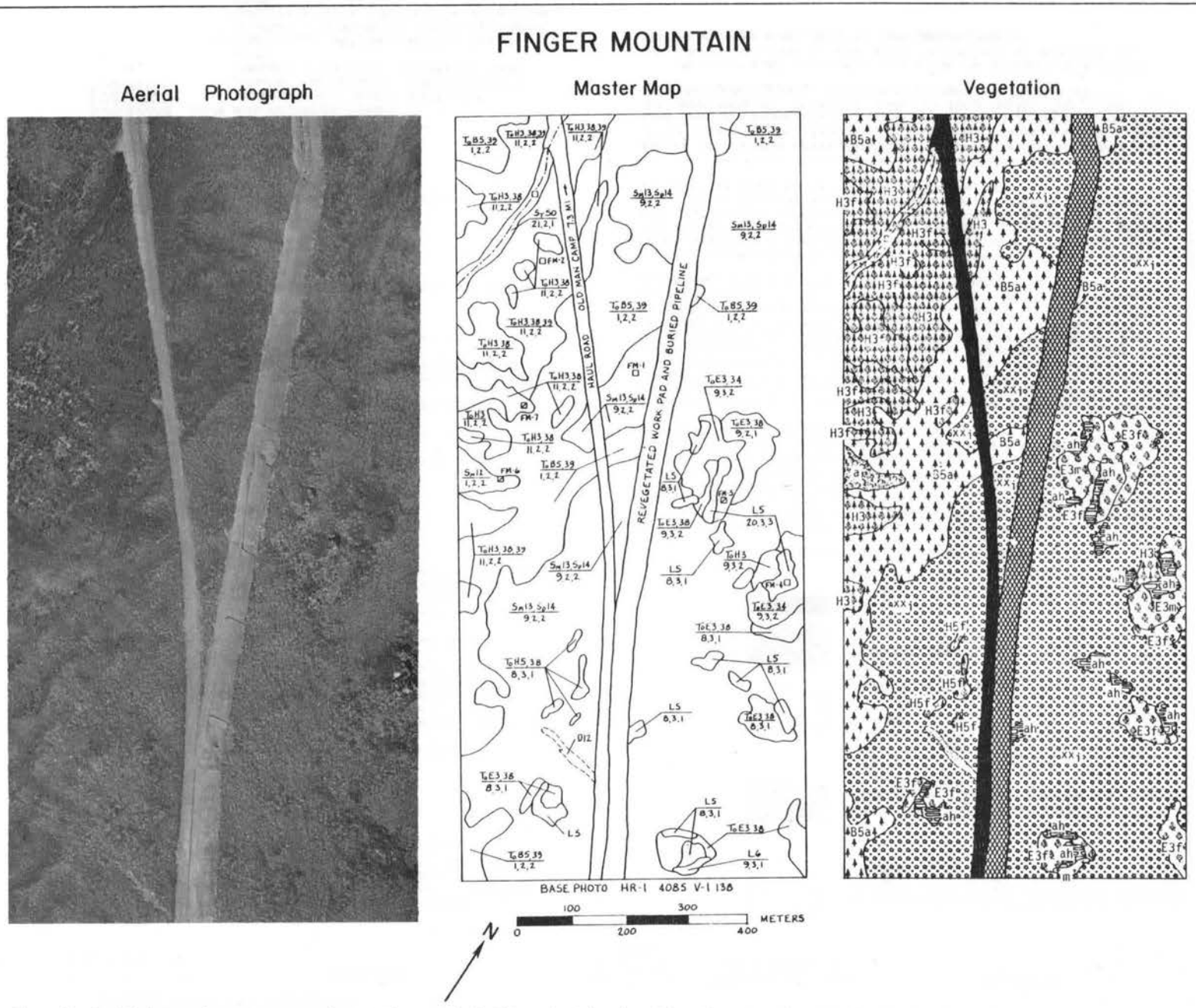


Figure 1. Aerial photograph, master map, and vegetation map of the Finger Mountain site, Yukon River to Prudhoe Bay Highway, Alaska.

The vegetation sampling method outlined in Chapter 2 is the foundation upon which the maps are built. The sampling system is comprehensive and will yield data useful for a variety of vegetation analysis techniques. However, the mapping system does not require a complete analysis of the data before the production of the vegetation map. This may bother some who are used to basing their map units on a detailed Braun-Blanquet analysis or cluster analysis. We do not propose replacing more thorough methods with the procedures outlined here; however, our experience has shown that very often a map is needed before a detailed analysis can be completed or when funds are unavailable to follow the more rigorous procedures suggested in most vegetation classification systems (e.g., Braun-Blanquet, 1964; Du Rietz, 1936; Küchler, 1967) and gradient analysis methods (Whittaker, 1967; Bray and Curtis, 1957; Orloci, 1966; Swan et al., 1969). With the method described here you should be able to produce a complete master map while in the field.

Plant nomenclature in this volume follows Löve and Löve (1975) for vascular plants; Crum, Steere, and Anderson (1973) for mosses; and Hale and Culberson (1970) for lichens.

CHAPTER 2

VEGETATION SAMPLING

The amount and quality of vegetation sampling depends on your budget and the type of analysis you intend to perform with the data. The sampling procedure outlined here is comprehensive and lends itself well to both Braun-Blanquet and gradient analysis methods. The main prerequisite is basic taxonomic ability with the three major groups of plants, the vascular plants, the lichens, and the bryophytes. This system is not an absolute requirement in the production of a map. A map can be produced with a more abbreviated sampling system. This, in fact, has been the case with most of the maps produced by the Plant Ecology Lab. An abbreviated sample is often necessary because of time restrictions or when no detailed analysis of the vegetation data is foreseen. An example of an abbreviated sampling method is presented in the next chapter, which describes production of composite maps.

Relevé Location, Size, and Quantity

In vegetation sampling, the single most important consideration is the choice of the sample site or relevé. The site should be located in uniform vegetation. This means non-random sampling. This may sound like heresy to gradient analysis experts, but we find that true random sampling is virtually an impossible task to adequately represent the entire spectrum of communities. However, identifying homogeneous stands of vegetation is often difficult and requires considerable experience before it can be done with confidence, especially in complex ecosystems.

As you sample you will see patterns in the vegetation and recognize plant community types. If the sole purpose of the sampling is to produce a map, the communities which you sample should be distinctive enough so that you have some characteristic patterns or gray tones by which to recognize them on aerial

photographs. The communities should also be extensive enough that they appear in more than one isolated spot of the map. Smaller communities, such as those associated with animal dens or narrow bands along streams, will generally not be worth sampling for a vegetation map alone, but it may be necessary to sample these sites for a more comprehensive vegetation analysis. In some cases, small habitats should be sampled when they occur as part of a vegetation complex. For example, individual frost boils are too small to map, but they usually occur as part of mosaics consisting of frost boils and inter-frost boil areas. Each part of the mosaic should be sampled separately. Every so-called community is actually a mosaic, and if this concept is carried to its extreme, it would mean that even the tussocks in an upland tundra region should be sampled separately from the inter-tussock areas. This may, indeed, be necessary in a study of microenvironments, but at the scale of 1:6000 recognizing such small habitats can only lead to confusion.

Strict rules regarding plot size are difficult to follow. For example, in a uniform Carex bigelowii upland tundra community the relevé size would be different than when sampling the same vegetation type on low-centered polygon rims or hummocks. In polygonal terrain, the size and shape of the relevés will vary with the shape of the microrelief features. We have found that permanent plots, although very valuable for long-term studies, can limit the observor and often include non-homogeneous portions because of their rigid shapes. For this reason, we usually consider relevés with irregular nonfixed boundaries that include as much of the stand type as necessary for a representative sample. In a forest this may be 100 m^2 or more; on a small animal den it could be less than 1 m^2. Most tundra ecologists consider 10 m^2 to be an adequate sample for graminoid communities. In fellfields or river bar areas where the plants are widely scattered, a relevé would be much larger, perhaps 1000 m^2 or more.

The number of relevés required to describe a community can vary from one to many. A single relevé placed in a very typical example of the community type may be sufficient. Sometimes it is necessary to rely on data from a single relevé to describe non-extensive vegetation types. We have produced maps where all the community types have been described on the basis of one relevé each. This is not a good practice, however. Usually it is best to have at least 5 relevé samples for each community type. The implication of this statement is that even for very simple maps, a lot of sampling is required.

Recording Relevé Information

The relevé record consists of two major parts. The first part consists of the site description. The second part is the tabulation of plant taxa and their percentage cover values. The first part is usually done by an assistant thoroughly trained in the various rating systems. The second part requires a botanist.

Site Factors

Table 1 is a sample form for the relevé site factors. Most of it is self-explanatory, but the following notes are added for clarification:

1. Relevé no. This is the plot number.

2. Map name. Include the name of the map area and the aerial photograph number.

3. Master map code. This will be filled in after completion of the master map legend.

4. Map unit no. See "Mapping Methods" 5c.

5. Site description. Include a general description of the vegetation (e.g., "Wet Eriophorum vaginatum meadow," or Picea mariana bog with Sphagnum and Rubus chamaemorus"). This will help later in locating and grouping relevés with similar vegetation. Also make notes regarding the topography, position

with respect to drainage basins, and microrelief features.

6. Sample area. Estimate the size of the area sampled.

7. Depth of thaw. Estimate or measure the depth of the active layer using a metal probe. Take several measurements.

8. Slope aspect and inclination. Use an inclinometer until you can estimate the slope with some degree of confidence.

9. Site scales. Use 10-point subjective environmental gradient scales (Table 2). The scales are still preliminary and may need further refinement.

   a. Site and soil moisture. The site rating regards the overall aspect of the site, and soil rating deals specifically with the soil. Sometimes an apparently dry site with abundant lichens and plants from the dry end of the moisture gradient will occur above soils that are completely saturated.

   b. Temperature, snow, wind, and stability. See Table 2 for examples.

   c. Surface age. This scale is defined on the basis of glacial advances, and time since major natural or man-related disturbances.

   d. Cryoturbation. This refers to the degree of frost stirring in the soil and its expression at the soil surface.

   e. Fire. Scale should refer to the amount of evidence of fire and the degree of recovery, size of new growth, etc. Check for buried charcoal.

10. Relief. Mesorelief refers to diameter and height of relatively large features such as hillsides, width of drainage channels, size of polygonal features, etc. Microrelief refers to hummocks, tussocks, rocks, etc.

11. Age of vegetation. This can be inferred from size of trees, percentage cover of plants, types of plants, cover of lichens, etc. Take a tree core sample, or examine growth rings on willows, birch, etc.

12. Percentage cover. Estimate the percentage cover for each growth-form category.

13. Height. Estimate or measure the height of the vegetation within each layer. Note that this refers to synusia and not the growth-forms. The height of the synusia will vary in each stand of vegetation.

14. Biomass. This again uses a subjective 10-point scale (Table 2). The estimates are made for each layer defined under "Height" (see above).

15. Animals. Animal activity is based on a 4-point (0-3) subjective scale (Table 2).

16. Plant phenology. This is based on a preselected list of plants with wide distributions. Record the plants from the list which occur within the sample site and their stage of development (e.g., length of new growth, number of new leaves, number of inflorescences, leaf death, leaf senescence, etc. See Report of the US/IBP Phenology Committee, 1972.).

17. Soil. The soil type should be based on the soil taxonomy of the U.S. Department of Agriculture, Soil Conservation Service (Soil Survey Staff, 1975), e.g., Pergelic Cryaquept. If the soil type is unknown, a more general description can be used, e.g., peaty loam. If a soil scientist is part of the mapping operation, he should describe the soil. Otherwise, a brief description of each soil horizon should be included on the sample form. Take a picture of the soil and collect a plastic bagful of soil from the top 10 cm for chemical and physical analysis.

18. Disturbance. Include man-induced and natural disturbances.

19. Checklist. Before leaving the relevé site, complete the checklist.

Plant Taxa

This part is done on a separate form (Table 3) or in a field book so that while one person concentrates on the plants, the other can be describing the

site factors. Percentage cover values should be given for all vascular plants, lichens, and bryophytes. List the vascular plants separately from the cryptogams. These values are rough visual estimates. For plants with less than 1 percent cover, (+) can be used to denote taxa with several plants but insignificant cover, and (-) for taxa where only a single plant is noted.

Collections should be made for all taxa including the ones which you think you know. Carefully collect the vascular plants which you have doubt about. These collections should include the entire plant if possible. Put them in a plastic bag with a little moisture to help preserve the plants. Collect plant parts that can be used to verify your identification for all the remaining plants. All these plant pieces can be put in a single paper bag labeled with the relevé number. This bag will be useful when you tabulate all your data. Mosses and lichens should be put in separate labeled paper bags.

When you return to camp carefully press and identify the unknown or rare plants and include a label (Table 4) with the necessary collection information. The bags with the remaining vascular plants, lichens, and mosses can be pressed paper bags and all. This will help save space when you finally pack all your specimens.

Table A1. Sample form for relevé site factors.

Relevé No._____ Map Name_____

Observer_____ Date_____

Master Map Code_____ Map Unit No._____

Site Description_____

_____

_____

Sample Area_____ Depth of Thaw_____

Slope Aspect_____inclination(°)_____ Depth of Water_____

Site Scale (1-10):

site moisture_____

soil moisture_____

temperature_____

snow_____

wind_____

surface age_____

stability_____

cryoturbation_____

fire_____ (fire evidence_____)

Relief:

Microrelief:

Type_____

Height_____Width_____

Mesorelief:

Type_____

Height_____Width_____

Vegetation:

Age of Vegetation: Estimate_____ Evidence_____

Percentage Cover:

All vegetation_____

Trees (> 2 m)_____

Tall shrubs (> 2 m)_____

Medium ht. shrubs (.5-2 m)_____

Dwarf shrubs (10-50 cm)_____

Prostrate shrubs (< 10 cm)_____

Graminoids_____

Forbs_____

Bryophytes_____

Lichens_____

Rocks_____

Bare soil_____

Water_____

Height:

Tree layer (m)_____

Shrub layer (m)_____

Herb layer (cm)_____

Ground layer (cm)_____

Biomass (scale 1-10):

Overall_____

Tree layer_____

Shrub layer_____

Herb layer_____

Ground layer_____

Photo Nos.:_____

Animals:

Name	Scale (0-3)	Evidence
Bear		
Caribou		
Moose		
Lemmings		
Microtines		
Ground squirrels		
Ptarmigan		
Other birds		
Insects		
Others		

Plant Phenology:

Species	Stage

Soil:

Soil type_____ Parent material_____

Description (include horizon names, depths, color, texture, structure, character of boundaries, % rocks, %fibre, % mottles):

Photo Nos._____ Soil sample top 10 cm_____

Disturbance:

Type_____ Age_____

Notes:_____

Checklist:

( ) Mark location on photo
( ) Mark location on map
( ) Soil sample
( ) Tree core
( ) Vegetation photo
( ) Soil photo
( ) Vascular plant sample
( ) Moss sample
( ) Lichen sample
( ) Permanent plot staked and marked

Table 42. Subjective environmental gradient scales.

Site Scales:

Scale	Site Moisture	Soil Moisture	Summer Air Temperature	Snow	Wind
1	Very dry, little or no moisture within 10 cm of surface, exposed to strong winds	Very dry, no apparent moisture, no clumping	Very cold sites, high altitude with north-facing slopes	Little or no snow cover in winter, ridge top sites	Completely sheltered from the wind
2	Very dry, little moisture near surface, somewhat less exposed sites	Very dry, some moisture but doesn't clump	Cold sites, high altitude with moderate solar exposure, north-facing coastal plain sites or flat sites extreme arctic coast	Little snow cover in winter, exposed slopes	Exposed to occasional very light (1-5 km/hr) winds
3	Dry, some moisture near the surface, very exposed	Dry, clumps but then crumbles	Cold sites, moderate altitudes, flat coastal plain sites	Slopes usually snow covered in winter	Very light winds common
4	Dry, some moisture near the surface, somewhat less exposed sites	Dry, clumps and stays in a ball	Cool sites, flat surface in Arctic Foothills	Slopes snow covered in winter, snowmelt by late May	Occasional light (5-10 km/hr) winds
5	Moist, top 10 cm continually moist to wet, moderately well-drained sites	Moist, binds, but can be taken apart	Moderate temperatures, south-facing slopes on Arctic Coastal Plain or high mountains	Shallow depressions, somewhat prolonged snow cover, melt by early June	Light winds common
6	Moist, top 10 cm near saturation, less well-drained sites	Moist, binds completely into gooey ball	Moderate temperatures, south-facing slope, Arctic Foothills	Snowpatches, snowmelt by late June or early July	Occasional moderate (20-30 km/hr) winds
7	Wet, continually saturated soil but no standing water	Wet, can squeeze some water out	Moderate temperatures, flat site at intermediate altitudes south of Brooks Range	Snowpatches, somewhat later snowmelt by late July	Moderate winds common
8	Wet, usually with standing water early in summer	Wet, can squeeze lots of water out	Warm temperatures, flat site, lower altitudes south of Brooks Range	Snowpatches, later snowmelt, early August	Occasional strong winds (40-60 km/hr), winds otherwise light
9	Very wet, usually with standing water late in summer	Very wet, totally saturated	Warm, south-facing slopes at intermediate altitudes in interior Alaska	Snowpatches, very late snowmelt, late August	Strong winds common, winds otherwise moderate
10	Very wet, deep standing water year round	Very wet, soil taken from underwater	Warmest south-facing slopes at lower altitudes in interior Alaska	Snowpatches, very late snowmelt, sometimes may have snow cover all year	Strong winds common, occasional very strong (> 60 km/hr) winds

Table 2. (cont.)

Site Scales:

Scale	Surface Age	Stability	Cryoturbation	Fire
1	Constant disturbance	Completely unstable, always moving (e.g., sand dunes)	0% of surface disturbed	No evidence
2	Less than 1 year since severe disturbance	Annually unstable (e.g., avalanche slopes, river bars)	< 1%	Buried charcoal
3	1-10 years	Periodically unstable (e.g., 50 year flood-plain)	1-2%	Charcoal on surface rare
4	10 to 100 years	Unstable, vegetation in patches, on slope	2-5%	Charcoal on surface common
5	100 to 1000 years, last disturbance during late Holocene	Unstable, vegetation in patches, on flat	5-10%	Older burn, living trees have burn scars
6	1000 to 10,000 years last disturbance during early and mid-Holocene	Moderately stable, open vegetation, on slope	10-15%	Older burn, regrowth of large trees (> 15 cm dbh)
7	Old surface, last disturbance during late Wisconsin (30,000 yrs. B.P.)	Moderately stable, open vegetation, on flat	15-25%	Older burn, regrowth of moderate-sized trees (5-15 cm dbh)
8	Old surface, last disturbance during early Wisconsin (30,000 - 70,000 yrs. B.P.)	Stable surface, completely vegetated, moderate slope	25-50%	Recent burn, small trees and/or complete vegetation cover
9	Very old surface, last disturbance during pre-Wisconsin time	Stable surface, completely vegetated, slight slope	50-75%	Recent burn, no regrowth of trees
10	Very old unglaciated surface	Stablest surfaces, completely vegetated, flat	75-100%	Complete burn, no regrowth of vegetation

Table 2. (cont.)

Vegetation Biomass Scales:

Scale	Overall	Tree Layer	Shrub Layer	Herb Layer	Ground Layer
1	Barren, very sparse vegetation	Scattered small trees (< 5 cm dbh)	Shrubs rare	Very widely scattered herbs	Very sparse
2	Prostrate scrub or lichen meadow	Scattered medium trees (5-15 cm dbh)	Scattered dwarf shrub (.1-.5 m)	Scattered short herbs (< .1 m)	Scattered
3	Graminoid meadow	Open small trees	Scattered medium shrubs (.5-2 m)	Open short herbs	Open thin cover (< 2 cm)
4	Tussock graminoid meadow with thick moss	Closed small trees	Open dwarf shrubs	Closed short herbs	Closed thin cover
5	Dwarf scrub	Scattered large trees (> 15 cm dbh)	Closed dwarf shrubs	Open medium herbs (.1-5 m)	Open moderate thickness (2-5 cm)
6	Scrub	Open medium trees	Scattered tall shrubs (> 2 m)	Closed medium herbs	Closed moderate thickness
7	Dense tall scrub or open small evergreen trees	Closed medium trees	Open medium shrubs	Open tall herbs (.5-1 m)	Open thick (5-15 cm)
8	Open medium-sized trees or dense small tree (< 5 cm dbh)	Open large trees (> 15 cm dbh)	Closed medium shrubs	Closed tall herbs (.5-1 m)	Closed thick
9	Open large trees (> 15 cm dbh) or dense medium sized trees (5-15 cm dbh)	Closed large trees	Open tall shrubs	Open very tall herbs (> 1 m)	Open very thick (> 15 cm)
10	Dense large trees (> 15 cm dbh)	Closed very large trees (> 25 cm dbh)	Closed tall shrubs	Closed very tall herbs	Closed very thick

Animals Scales:

0 No sign

1 Slight evidence

2 Moderate evidence

3 Abundant evidence

Table A3. Plant taxa form. The second and third columns are used for computer coding.

PLOT NUMBER ______________

SPECIES	LIFEFORM CODE	CODE NUMBER	PERCENTAGE COVER

Table A4. Collection label for plant specimens.

Trans-Alaska Pipeline Haul Road, 1978

Collection No._____ Herbarium No._____

Plant Name_____

Field Name_____

Locality_____ Plot No._____

Longitude_____ Latitude_____ Altitude_____

Ecol. Notes: Moisture_____ Slope_____

Community_____

_____

Coll: Walker and Bowman Date_____

CHAPTER 3

THE MASTER MAP

A composite map, or master map, is one which contains a variety of terrain information encoded onto a single map. Each delineation on the map, or map unit, contains a series of alphanumeric codes which represent different attributes of the terrain. The composite mapping system described here is by no means a rigid one. It does give a good picture of the landscape and has worked for all the various terrain and vegetation types we have encountered in northern Alaska. It is an open-ended system which considers the plant communities on each map to be unique entities so there is no need to force them into some preestablished classification scheme. The method of naming the plant communities, which is described in the next chapter, follows logically from the codes used on the composite map.

This section is divided into two parts. This first part describes the master map coding system, and the second part describes the field methods.

Master Map Coding System

The coding system portrayed here is modified from one which we used on the Trans-Alaska Pipeline route (Webber et al., 1979). It contains vegetation, landform, microrelief size, and slope class information. Each map unit on the master map (Figure 1) contains a code in fraction form. The numerator of the fraction represents the vegetation, and the denominator represents the landform, microrelief size, and slope class respectively.

Denominator of the Master Map Codes - Landforms, Microrelief, Slope, and Soil

A key to the information in the denominator is in Table 5. The key contains all the landforms which occurred on our various maps and could be expanded to include new features. An additional code could be added to represent the soil type.

Table 5. Key to denominators of master map codes (from Webber et al., 1979). The information in the master map code is contained in the following order:

$$\frac{\text{Vegetation codes}}{\text{Landform, Microrelief class, Slope class}}$$

. A sample of a soils legend is also included (lower right). The soils code would preceed the landform code in the denominator.

Landform categories (first number):

1. Featureless, or with small non-aligned hummocks
2. Low-centered polygons
3. Aligned hummocks or strangmoor
4. Frost boils
5. Small ridge, hill or kame
6. River or creek bluff
7. Sand dunes
8. Closely spaced large rocks, talus or blockfield
9. Scattered large rocks
10. High-centered polygons
11. Irregular microrelief
12. Solifluction lobes
13. Thermokarsted polygon troughs
14. Mixed high- and low-centered polygons
15. Sandy beach
16. Scattered peat blocks (on coast)
17. Flat or weakly defined polygons
18. Discontinuous polygon rims
19. Pingo
20. Tor
21. Stream bottom with boulders
22. Ice-cored mounds
23. Rocky riverbank
24. Talus or scree consisting of small rocks
25. Intermittent water course
26. Stream course

Microrelief class (second number):

1. < 25 cm
2. 25 to 50 cm
3. > 50 cm

Slope class (third number):

0. < 2°
1. 2 to 5°
2. 5 to 30° also shown by ΔΔΔ in areas
3. > 30° too narrow to map

Note: The small table below contains an example of a soils legend (Everett et al., 1978).

Code (1st no.)	*Taxonomic name*	*Identifying field characteristics*
1	Pergelic Cryoboroll	A cold (Cryo) more or less freely drained soil, underlain by permafrost (Pergelic) with a dark, humus-rich, granular textured surface horizon > 18 cm thick.
2	Pergelic Cryaquoll	A cold, dark-colored, wet soil, prominently mottled in the lower part of the humus-rich, weakly granular surface horizon.
3	1) Histic Pergelic Cryaquept 2) Pergelic Cryohemist Complex	1) A cold, wet, gray mineral soil, commonly mottled, having a surface horizon > 25 cm thick, composed of predominantly organic (peaty) material. 2) A cold, wet, dark-colored soil composed of moderately decomposed organic materials to depths > 40 cm.
4	1) Histic Pergelic Cryaquept 2) Pergelic Cryofibrist Complex	1) As above. 2) A cold, wet, reddish to yellowish colored soil composed of little decomposed fibrous organic materials to depths > 40 cm.
5	Pergelic Cryorthent	A cold, somewhat freely drained gravelly soil lacking significant horizon development and generally free of organic matter.
6	Pergelic-Ruptic-Aqueptic Cryaquoll	The cold soil of frost scar areas in which a Cryaquoll soil (no. 2) is intimately associated with and interrupted by a cold, wet, gray colored and mottled mineral soil lacking any significant organic surface horizon – a Pergelic Cryaquept.

Numerator of the Master Map Codes - Vegetation

The vegetation codes contain two parts. The first part is an alphabetic letter which represents the visually dominant growth-form in the community. The second part consists of a number or series of numbers and letters which further describes the community. In all the growth-form categories except the tree and tall shrub categories, the number or numbers following the growth-form code refer to a specific community or communities. For tree communities, there are three codes following the growth-form code. These represent the dominant tree taxon, the stature of trees, and the understory community respectively.

Growth-form codes. The first letter of the numerator represents the visually dominant growth-form (Table 6). The dominant growth-forms are important for naming the plant communities (Chapter 4) and are the basis for the patterns appearing on the final vegetation map (Chapter 5).

Community codes - non-forested areas. In non-forested areas the number(s) which follow the growth-form code represent specific communities. Each community has a unique number, or community code, which is given to it when it is first described. For example, the first community described for a map is given the number 1. If it is a dwarf shrub community, its complete code is S_d1. If the second community described is a graminoid community, its code is G2. If the community occurs as an understory in forests, the community code number would be preceded by a series of alphanumeric codes describing the forest (next section).

Community codes - forested areas. In forested areas, the understories are described independently of the trees. Forests have four parts to the vegetation code: 1) the growth-form code, either T_c or T_o, denoting a closed or open canopy of trees, 2) a letter which denotes the dominant tree taxon or taxa, 3) a number representing the stature of the trees, and 4) the community code of

Table A6. Master map growth-form codes. These occur as the first part of the numerator of the master map fraction code, and represent the visually dominant plant growth-form.

Code	Growth-form
T_c	Trees (closed canopy, 60 to 100 percent crown canopy)
T_o	Trees (open canopy, 5 to 60 percent crown canopy)
S_t	Tall shrubs (greater than 2 m tall)
S_m	Medium height shrubs (.5 to 2 m tall)
S_d	Dwarf shrubs (10 to 50 cm tall)
S_p	Prostrate shrubs (less than 10 cm tall)
G	Single-shooted graminoids
G_t	Tussock graminoids
A	Rooted aquatic herbs
H	Horsetails
M	Mosses
L	Lichen
B	Barren
Non-vegetation codes	
D	Disturbed
W	Water

the understory. Table 7 contains a key to the various portions of the forest codes. For example, the code T_CA3,1 represents a closed canopy of Picea glauca with diameters at breast height from 5 to 15 cm; the understory is community number 1.

Vegetation complexes. In some areas there may be several distinctive plant communities which are too small to map individually but which occur together as a mosaic or complex of communities. In this case the vegetation portion of the master map code may contain more than one community code. If two or more of the communities have the same dominant growth-form, they are listed consecutively, following the growth-form code, with the community which covers the largest area listed first. For example, the code G23, 27 would indicate a vegetation complex consisting of two graminoid communities (community code numbers 23 and 27); community number 23 is dominant.

Disturbed areas. The numbers following D codes refer to specific types of disturbances (see Table 14).

Examples for interpreting master map codes. Table 8 contains three examples which further explain the master map coding system.

Mapping Methods

These methods roughly follow those of Küchler (1967).

1. Literature and map review. Before going into the field, conduct a thorough study of all relevant literature and available maps regarding vegetation, geology, soils, geomorphology, climate, and general ecology.

2. Photography. Vertical aerial photographs (scale 1:6000 if possible) with good contrast are essential. Use black and white photographs with a glossy finish. These will be drawn on with drafting ink. Any supplementary photography, particularly color or color IR, is very valuable. Stereo photos and a stereoscope are useful for interpreting landform features and slope.

Table A7. Master map vegetation codes for forested areas. The codes in forest areas consist of four parts: 1) the growth-form code, either T_C or T_O, which denotes either a closed or open canopy of trees, 2) a letter which denotes the dominate tree taxon or taxa, 3) a number representing the stature of the trees, and 4) the community code of the understory.

First symbol - growth-form code

- T_C - Closed canopy of trees
- T_O - Open canopy of trees

Second symbol - dominant tree taxon or taxa

- A - *Picea glauca*
- B - *Picea mariana*
- C - Mixed *P. glauca* and *P. mariana*
- D - *Populus tremula*
- E - *Betula papyrifera*
- F - *Betula balsamifera*
- G - Mixed *P. tremula* and *B. papyrifera*
- H - *Picea* and *Populus papyrifera*
- I - *Picea* and *Populus tremula*

Third symbol - size of trees

- 1 - Mature trees less than breast height (but not Krummholz)
- 2 - Trees less than 5 cm diameter at breast height (dbh)
- 3 - Trees 5 to 15 cm dbh
- 4 - Trees greater than 15 cm dbh
- 5 - Krummholz

Fourth symbol - community code of the understory

This number is given to the understory community when it is first described. If the understory code is missing, this means that the understory is either very mixed or is undescribed.

Table 8. Examples for interpreting master map codes. Refer to Table 5 to interpret denominators. Refer to Tables 6 and 7 to interpret the numerators.

Example 1. Single plant community.

$$\frac{S_d 23}{1,1,0} = \frac{\text{(Dwarf shrub physiognomy) (community code 23)}}{\text{(featureless landform), (microrelief < 25 cm), (slope < 2°)}}$$

Example 2. Vegetation complex.

$$\frac{Gll, S_d 23}{2,2,0} = \frac{\text{(Graminoid physiognomy) (community code 11), (Dwarf shrub physiognomy) (community code 23)}}{\text{(low-centered polygons), (microrelief 25-50 cm), (slope < 2°)}}$$

Example 3. Forest community.

$$\frac{T_o B3,23}{1,1,1} = \frac{\text{(Open forest) (}\underline{\text{Picea mariana}}\text{) (Trees 5-15 cm dbh), (understory: community code 23)}}{\text{(featureless), (microrelief < 25 cm), (slope 2-5°)}}$$

3. Familiarization with the field area. The aerial photograph gives you a much better view of your study area than you will obtain at any vantage point in the field. Become thoroughly familiar with it. If possible do this from a point where you can see a large portion of the field area so you can begin relating features on the photograph to the actual terrain.

4. Draw preliminary map unit boundaries. Use a "000" Rapidograph pen to draw boundaries around areas with homogeneous patterns and/or gray tones. These units should be based on the landform and vegetation classification systems. You should attempt to draw all the map boundaries before proceeding with the field investigation. Be sure all boundaries at the edges of the photograph are continued onto adjacent photographs. Boundaries around disturbed map units (except cultural features) should be dashed-lines. A different line (e.g., -.-.) should be used for small streams. Steep bluffs are shown with the spot symbol, ▲▲▲.

5. Field transects

a) The equipment you will need for the field includes: a field book, the aerial photo map, 2 clipboards with metal covers, "000" rapidograph pen, pencils, relevé forms for site factors, relevé forms for plant species, metal thaw probe, plastic collection sacks, No. 4 paper sacks, felt tip marking pen, camera, film, florescent surveyors tape, meter stick, tree corer, shovel, garden trowel, hand lens.

b) Plan several transects through the map area so that you will not have to retrace your steps once you begin mapping. You should try to visit every map unit.

c) When you visit each map unit, first give the unit a number. This number should be consecutive with the number of the preceding unit and should appear on the photograph and in your field notes.

d) In your field book, give the unit its landform, microrelief, and slope codes. If the area is non-forested, note the visually dominant growth-form. If it is a forested unit, assign the T code, the code for the dominant tree species, and the stature code. Do not assign the understory community code at this time.

e) If the unit contains a good homogeneous stand of vegetation, sample it according to the procedure outlined in Chapter 2. Make a note in your field book that the sample data is on the relevé forms. Record the location of the relevé on the aerial photograph. If the area is a mosaic of communities, sample each community. If the area is non-homogeneous, note this in your field book, and make an abbreviated sample (see below). Also note the number of the previously visited map units, which this one most closely resembles. Estimate percentage of each community type within the unit.

Abbreviated samples. You may not want to record a complete relevé for the map unit for various reasons. The unit may be very small, it may not have a good homogeneous stand of vegetation, you may not require all the information for your analyses, or time may be lacking to do a thorough relevé. In these cases an abbreviated sampling procedure may be adequate. For an abbreviated sample, all the information can be put into the field book, following the landform, microrelief, slope, and forest codes. Simply record the major taxa in the unit with the percentage cover values. To save space in your field book, the names of the plant species can be shortened using a six letter abbreviation consisting of the first three letters of the genus and the first three letters of the species. For example, Carex aquatilis would be shortened to Caraqu. The shortened names will soon become as

familiar to you as the full names.

f) Correct any map unit boundaries that need to be changed. Remember that with a composite mapping method a change in any characteristic of the landscape, the vegetation, landform, microrelief, slope, or soil, will determine a boundary. This is the most difficult aspect of composite mapping since it is hard for a single worker to keep all aspects of the landscape in mind while working. Also, a single worker is unlikely to have the necessary expertise to map all the components of the landscape. For this reason it is best to work with three people, a soils specialist who maps the soils, landforms, and microrelief, a botanist who observes the botanical aspects of the landscape, and an assistant trained to perform the analyses of the site factors.

6. Summarize the vegetation data. When you have finished the transects and have completed the sampling, you should have a good idea of the vegetation units that you will portray on your map. Organize your relevé data forms into piles corresponding to your vegetation types. For each type, transfer the data from the field sheets onto a summary form (Table 9). Give each vegetation unit a unique community number.

7. Construct the final master map. For a small map from a single photograph, this can be done directly on the aerial photograph. Refer to your field book for the denominators of the master map codes and the forest codes. Obtain the community codes from the summary forms. For larger maps, you must first transfer the boundaries to a controlled map, such as a USGS topographic map. This is necessary because of the distortion on the photographs. After this you can trace the map units onto a sheet of drafting film. Each map unit should contain the map unit number and the full master map code. Be sure the map contains a title, a scale, a north arrow, and longitude and latitude tic

marks. You should also include relevé locations and cultural features. If there are roads, note the distance from the map margin to the nearest town.

Table A9. Plant community information-summary form.

Map Name_____ Coordinates_____ Altitude_____

Growth-form Code_____ Community Code_____ Date_____

Brief Description_____

_____

Relevé No.	
Sample area (m^2)	
Slope aspect	
Slope inclination^{o}	
Site scale (1-10):	
- site moisture	
- soil moisture	
- temperature	
- snow	
- wind	
- surface age	
- stability	
- cryoturbation	
Water - depth (cm)	
Surface horizon - depth (cm)	
Depth of thaw	
Age of vegetation (estimate, yrs)	
% Cover - all vegetation	
- trees	
- tall shrubs	
- medium ht. shrubs	
- dwarf shrubs	
- prostrate shrubs	
- graminoids	
- forbs	
- bryophytes	
- lichens	
- rock	
- bare soil	
- water	

Table A9. (cont.)

Map Code_____ p. 2

Relevé No.

Height - trees (m)

- shrubs (m)

- herbs (cm)

- ground layer (cm)

Biomass scale (1-10):

- overall
- trees
- shrubs
- herbs
- ground layer

Animal scale (0-3):

- bear
- caribou
- moose
- lemming
- microtines
- ground squirrels
- ptarmigan
- other birds
- insects

Tree core (yes, no)

Soil description (yes, no)

Soil sample (yes, no)

Collections (yes, no):

- Vascular plants
- Mosses
- Lichens

Permanent plot (yes, no)

Photo Nos.

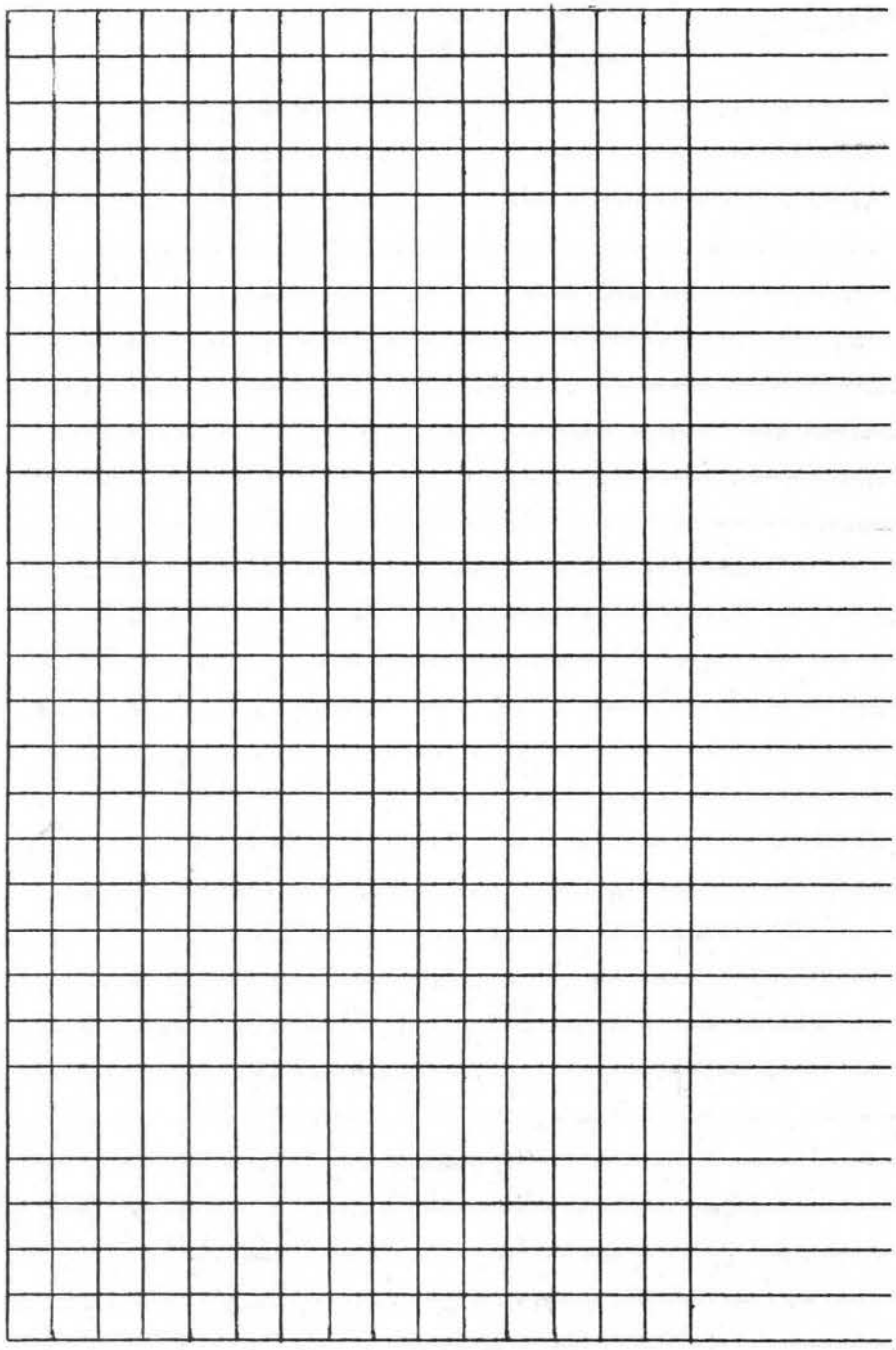


Table A9. (cont.)

Map Code ____________ p. 3

Percentage Cover

Species / Relevé No.																

CHAPTER 4

VEGETATION CLASSIFICATION SYSTEM

The system described here has taken some time to develop, but we feel it is consistent and avoids the problem of confusion of physiognomic, floristic, and ecological terminology in naming plant communities. The system is an open-ended one which does not restrict the mapper to some preestablished classification scheme. It allows the investigator to map first and classify later.

Simple Communities

The names of the plant communities are based on the physiognomy of the community, the principal plant taxa, and the ecology of the site. The names always contain three parts, and in some cases, may contain a fourth:

1) A site moisture category (VERY DRY, DRY, MOIST, WET, or VERY WET). This should be based on the 10-point subjective site moisture scale (see Table 2).

2) Several plant taxa. These should be dominant species and species particularly faithful to the community. These taxa should be in order of visual dominance with enough members of the shrub, herb, and cryptogam layers to adequately define the community. The number of taxa in the name should be kept to the minimum number necessary. This is generally less than six. Many can be defined with three or less. Forest communities contain only tree taxa in the main name; understory components and tree sizes are listed separately (see examples Table 10).

3) A plant physiognomy descriptor. This is based on the visually dominant growth-form in the community (see Table 11). The names of the tree dominated units follow Viereck (1975). The shrub, herbaceous, and bryoid dominated units draw heavily on Fosberg (1967). Table 12 shows the corresponding Fosberg (1967) and UNESCO (1973) equivalents for each unit. An attempt was made to show equivalents according to Dyrness and Viereck's (1977, 1978, and 1979) provisional classification framework for Alaskan vegetation, but such comparison was difficult since their Level I (Formation) categories were not consistently based

on plant physiognomy.

4) An ecologic modifier. This modifier may proceed the physiognomic descriptor, but it is not an obligatory part of the community name. A list of ecologic modifiers is in Table 13.

Vegetation Complexes

Often it is necessary to consider vegetation complexes, i.e., mosaics consisting of two or more plant communities. The method of naming complexes is contained in Table 10. A list of the types of vegetation complex types is in Table 13.

Table A10. Examples of vegetation units named according to the proposed system.

1. Example of a simple community:

   WET Betula glandulosa - Salix planifolia - Spirea beauverdiana - Sphagnum sp. SCRUB

2. Example of community where the physiognomic descriptor has an ecologic modifier:

   WET Carex subspathacea - Puccinellia phryganodes SALINE GRAMINOID MEADOW

3. Example of a forest community with a known understory:

   MOIST Picea mariana - Betula papyrifera CLOSED MIXED FOREST
   Trees 5-15 cm dbh; understory: Ledum groenlandicum, Vaccinium uliginosum, V. vitis-idaea, Hylocomium splendens, Cladina arbuscula

4. Example of a forest community with an undescribed or very mixed understory:

   MOIST Picea mariana CLOSED EVERGREEN FOREST
   Trees 5-15 cm dbh; understory: mixed or unspecified

5. Example of a vegetation complex (note: the first named community is dominant):

   LOW-CENTERED POLYGON VEGETATION COMPLEX:
   a) Polygon basins and troughs: WET Carex aquatilis - Drepanocladus brevifolius LOWLAND GRAMINOID MEADOW
   b) Polygon rims and hummocks: MOIST Carex bigelowii - Dryas integrifolia - Tomenthypnum nitens - Thamnolia subuliformis UPLAND GRAMINOID MEADOW

Table 11. Physiognomic descriptors for the proposed classification system with remarks and examples.

Physiognomic Descriptors	Remarks	Examples
Tree dominated units:	Includes Picea glauca, P. mariana, Betula papyrifera, Populus tremuloides, and P. balsamifera.	
Closed forests:	Trees with interlocking crowns	
CLOSED EVERGREEN FOREST	Dense stands of tall coniferous trees	Large Picea trees; well-drained sites along rivers and drainages.
CLOSED DECIDUOUS FOREST	Dense stands of deciduous trees	Populus balsamifera stands on river terraces; Populus tremula stands on south-facing slopes near Yukon River; Betula papyrifera stands on well-drained slopes.
CLOSED MIXED FOREST	Dense forests with evergreen and deciduous trees	Successional stands with mixtures of P. glauca, P. mariana, Betula papyrifera, and Populus tremula on upland slopes; successional stands of Picea mixed with Populus balsamifera on river terraces.
Open forests:	Trees with non-interlocking crowns	
OPEN EVERGREEN FOREST	Coniferous forests with open cover, includes many fairly dense forests of small trees which are nonetheless open because of the narrow tree crowns	Picea forests on lowland and upland sites.
OPEN DECIDUOUS FOREST	Deciduous forests with open cover or scattered trees; deciduous woodlands	Open Betula papyrifera stands near treeline and on some south-facing slopes.
OPEN MIXED FOREST	Mixed woodlands	Mixed evergreen-deciduous woodlands near treeline.
EVERGREEN LOW SAVANNA	Scattered evergreen trees, includes elfin forests in bogs	Picea "elfin woodlands" in boggy lowlands with permafrost close to the surface; Picea woodlands near treeline and in "lichen woodlands"; tree islands with krummholz near treeline.
Shrub dominated units:	Includes most woody non-tree forms and some tall plants with caespitose growth-forms (e.g., Alnus, Betula, Salix)	
TALL SCRUB	Shrubs taller than 2 m	Tall Alnus viridis ssp. crispa stands in mountain drainages; dense Salix thickets along creeks and river terraces.
SCRUB	Shrubs 50 to 200 cm tall	Betula glandulosa understory in open Picea forests; Salix spp. on river terraces and lake margins; Betula glandulosa in wet meadows and on dry sites.
DWARF SCRUB	Dwarf-shrubs 10 to 50 cm tall; caespitose-monocotyledons mosses and lichens may form large components	Bogs with dwarf-shrub heath (Vaccinium uliginosum, V. vitis-idaea, Ledum spp., etc.); Chamedaphne calycullata bogs; forest understory of dwarf-scrub heath; forest understory of Rosa acicularis; Salix communities near the Arctic coast; Cassiope tetragona snowbed communities.
PROSTRATE SCRUB	Dwarf-shrubs shorter than 10 cm, mat-forming or creeping dwarf shrubs, lichens mat and cushion-form non-woody dicotyledons may form large components	Arctostaphylous uva-ursi understory in Populus tremula stands; Arctostaphylous alpina heath, Dryas integrifolia heath, Loeseleuria procumbens heath.
SHRUB SAVANNA	Scattered more or less evenly spaced shrubs taller than 50 cm	Alnus viridis savanna near treeline.
Herbaceous dominated units:	Includes graminoids and forbs	
GRAMINOID MEADOW	Dominated by single monocotyledons, herbs, or horsetails, dwarf-shrubs, low-dwarf shrubs, mosses and lichens may form large components	Sedge meadows, including Carex aquatilis, C. rostrata, C. bigelowii, and Eriophorum angustifolium; meadows; marshy lowland meadows; coastal saline Puccinellia phryganodes meadows; grassy meadows.
TUSSOCK-GRAMINOID MEADOW	Dominated by caespitose monocotyledons; dwarf-shrubs, mosses and lichens may form large components	Eriophorum vaginatum meadows; Hierochloë alpina meadows; Carex lugens meadows; Baeothryon caespitosum meadows.
HORSETAIL MEADOW	Dominated by horsetails	Equisetum fluviatile marshes, Equisetum arvense meadows.
AQUATIC MEADOW	Dominated by rooted aquatic herbs	Arctophila fulva ponds; Nuphar polysepalum ponds.
Bryoid dominated units:	Includes mosses and lichens	
MOSS MEADOW	Dominated by mosses	Sphagnum bogs with few other species; Tomenthypnum nitens meadows; Scorpidium scorpioides ponds
LICHEN MEADOW	Dominated by fruticose lichens	Cladina understories in lichen woodlands; Cladina heath in alpine environments.
Sparsely vegetated units:		
BARREN	Includes all communities with widely spaced vascular plants and mostly bare soil or rocks	Leymus mollis sand dunes; Epilobium latifolium gravel bars; talus slopes with mainly crustose and foliose lichens; Cochleariopsis groenlandica coastal beaches; fellfields with scattered cushion plants.

Table 12. Comparison of the proposed physiognomic descriptors with the Fosberg (1967) and UNESCO (1973) equivalents.

Physiognomic Descriptors	Fosberg (1967) Equivalents	UNESCO (1973) Equivalents
Tree dominated units:	1A Forests, 1D Open Forests, and 1J Savannas	I Closed Forest, II Woodland
Closed forests:		
CLOSED EVERGREEN FOREST	1A17(a) Resinous evergreen narrow sclerophyll forest	I.A.10c and d. Evergreen needle-leaved forest with conical (or cylindrical) crowns
CLOSED DECIDUOUS FOREST	1A21 Winter deciduous orthophyll forest	I.B.3c. Subalpine or subpolar cold-deciduous forest
CLOSED MIXED FOREST	1A17/1A21	I.B.2b. Cold deciduous broad-leaved forest with evergreen needle-leaved trees
Open forests:		
OPEN EVERGREEN FOREST	1D14(a) Resinous open evergreen narrow sclerophyll forest	II.A.2c. Evergreen needle-leaved woodland with very narrow cylindro-conical crowns
OPEN DECIDUOUS FOREST	1D21 Open deciduous orthophyll forest	II.B.3c. Subalpine or subpolar cold-deciduous woodland
OPEN MIXED FOREST	1D11/1D21	II.B.3c. Cold deciduous broad-leaved forest with evergreen needle-leaved trees
EVERGREEN LOW SAVANNA	1J14 Evergreen narrow sclerophyll lichen savanna 1J15 Evergreen narrow sclerophyll swamp savanna 1B15 Evergreen narrow sclerophyll swamp	I.A.2c. Evergreen needle-leaved woodland with very narrow cylindro-conical crowns
Shrub dominated units:	1B Scrub, 1C Dwarf Scrub, and 1K Shrub Savanna	III Scrub, IV Dwarf-scrub and related communities
TALL SCRUB	1B21(a) Mesophyllous deciduous orthophyll scrub	III.B.3b. Subalpine or subpolar deciduous thicket
SCRUB	1B21(a) Mesophyllous deciduous orthophyll scrub	III.B.3b. Subalpine or subpolar deciduous thicket
DWARF SCRUB	1C1 Evergreen dwarf scrub 1C2 Deciduous dwarf scrub	IV.B.3. Cold-deciduous dwarf thicket IV.E. Mossy bog formations with dwarf shrub
PROSTRATE SCRUB	1C1 Evergreen dwarf scrub 1C2 Deciduous dwarf scrub	IV.B.3b. Cold-deciduous creeping or matted dwarf-thicket
SHRUB SAVANNA	1K2 Deciduous shrub savanna	III.B.3b. Subalpine or subpolar deciduous shrubland
Herbaceous dominated units:	1M Short Grass, 1P Submerged Meadows	V Herbaceous Vegetation
GRAMINOID MEADOW	1M21 Seasonal orthophyll meadow 1M22 Seasonal orthophyll marsh	V.C.8b. Graminoid sod-form tundra
TUSSOCK-GRAMINOID MEADOW	1M21 Seasonal orthophyll meadow	V.C.8a. Graminoid bunch-form tundra
HORSETAIL MEADOW	1M23 Seasonal sclerophyll meadow 1M24 Seasonal sclerophyll marsh	V.D.2a. Low forb communities, mainly perennials
AQUATIC MEADOW	1P21 Seasonal watergrass 1P23 Macrophyllous seasonal submerged meadows 21 Open submerged meadows	V.E.16. Rooted fresh-water communities, middle and higher latitude forb formations
Bryoid dominated units:	1O Closed Bryoid Vegetation	IV.D. Tundra
MOSS MEADOW	1O1 Closed bryophyte vegetation	IV.D.1. Mainly bryophyte tundra IV.E. Mossy bog formations with dwarf-shrub
LICHEN MEADOW	1O2 Closed lichen vegetation	IV.D.2. Mainly lichen tundra
Sparsely vegetated units:	3 Sparse Vegetation or Desert	
BARREN	3C2 Seasonal desert herb vegetation 3C13 Lichen tundra sparse phase	V.D.2a. Low forb communities, mainly perennials V.D.2b(3). Episodical forb communities V.C.7b. Alpine and subalpine meadows of higher latitudes

Table A13. Lists of ecologic modifiers and vegetation complex types.

Ecologic Modifiers

UPLAND
LOWLAND
SNOWBED
RIVERBANK
STREAMBANK
SALINE
BEACH
COASTAL
TALUS SLOPE
SANDY FLAT
SLUMPING BLUFF
RIVER BAR
ROCK OUTCROP
MUDFLOW
AQUATIC (i.e., deep water)

Examples of physiognomic descriptors with ecologic modifiers:

UPLAND GRAMINOID MEADOW
RIVER BAR BARREN
ROCK OUTCROP BARREN
STREAMBANK SCRUB

(For further explanation see Table 10)

Vegetation Complex Types

LOW-CENTERED POLYGON VEGETATION COMPLEX
HIGH-CENTERED POLYGON VEGETATION COMPLEX
NON-ALIGNED HUMMOCK VEGETATION COMPLEX
ALIGNED HUMMOCK VEGETATION COMPLEX
STRANGMOOR VEGETATION COMPLEX
SOLIFLUCTION TERRACE VEGETATION COMPLEX
STREAM VEGETATION COMPLEX
SAND DUNE VEGETATION COMPLEX
PALSA VEGETATION COMPLEX
MARSH VEGETATION COMPLEX
DISTURBED VEGETATION COMPLEX
THERMOKARST TERRAIN VEGETATION COMPLEX
ICE-CORED MOUND VEGETATION COMPLEX
MEADOW VEGETATION COMPLEX
MIXED HIGH- AND LOW-CENTERED POLYGON VEGETATION COMPLEX
UPLAND TUNDRA/DRAINAGE CHANNEL VEGETATION COMPLEX
ROCK/GRAMINOID MEADOW VEGETATION COMPLEX
SNOWPATCH/GRAMINOID MEADOW VEGETATION COMPLEX
TALUS/GRAMINOID MEADOW VEGETATION COMPLEX
TALUS/MOSS MEADOW VEGETATION COMPLEX
ROCK OUTCROP/TALUS VEGETATION COMPLEX
TALUS/SNOWPATCH VEGETATION COMPLEX
TALUS/SCRUB VEGETATION COMPLEX

Table 12. Comparison of the proposed physiognomic descriptors with the Fosberg (1967) and UNESCO (1973) equivalents.

Physiognomic Descriptors	Fosberg (1967) Equivalents	UNESCO (1973) Equivalents
Tree dominated units:	1A Forests, 1D Open Forests, and 1J Savannas	I Closed Forest, II Woodland
Closed forests:		
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CLOSED DECIDUOUS FOREST	1A21 Winter deciduous orthophyll forest	I.B.3c, Subalpine or subpolar cold-deciduous forest
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Sparsely vegetated units:	3 Sparse Vegetation or Desert	
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COASTAL
TALUS SLOPE
SANDY FLAT
SLUMPING BLUFF
RIVER BAR
ROCK OUTCROP
MUDFLOW
AQUATIC (i.e., deep water)

Examples of physiognomic descriptors with ecologic modifiers:

UPLAND GRAMINOID MEADOW
RIVER BAR BARREN
ROCK OUTCROP BARREN
STREAMBANK SCRUB

(For further explanation see Table 10)

Vegetation Complex Types

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HIGH-CENTERED POLYGON VEGETATION COMPLEX
NON-ALIGNED HUMMOCK VEGETATION COMPLEX
ALIGNED HUMMOCK VEGETATION COMPLEX
STRANGMOOR VEGETATION COMPLEX
SOLIFLUCTION TERRACE VEGETATION COMPLEX
STREAM VEGETATION COMPLEX
SAND DUNE VEGETATION COMPLEX
PALSA VEGETATION COMPLEX
MARSH VEGETATION COMPLEX
DISTURBED VEGETATION COMPLEX
THERMOKARST TERRAIN VEGETATION COMPLEX
ICE-CORED MOUND VEGETATION COMPLEX
MEADOW VEGETATION COMPLEX
MIXED HIGH- AND LOW-CENTERED POLYGON VEGETATION COMPLEX
UPLAND TUNDRA/DRAINAGE CHANNEL VEGETATION COMPLEX
ROCK/GRAMINOID MEADOW VEGETATION COMPLEX
SNOWPATCH/GRAMINOID MEADOW VEGETATION COMPLEX
TALUS/GRAMINOID MEADOW VEGETATION COMPLEX
TALUS/MOSS MEADOW VEGETATION COMPLEX
ROCK OUTCROP/TALUS VEGETATION COMPLEX
TALUS/SNOWPATCH VEGETATION COMPLEX
TALUS/SCRUB VEGETATION COMPLEX

CHAPTER 5

THE VEGETATION MAP

The final vegetation map is derived from the master map. It can take a variety of forms depending on the needs of the user. The map could show community floristics or simply show the vegetation physiognomy. The maps we describe here are somewhat of a compromise. They are coded with black and white patterns that represent plant physiognomy, but each unit also contains an alphabetic code that denotes the dominant plant taxon. The map used as an example (Figure 1) is one in a series of 21, that includes vegetation communities from all of northern Alaska. Any attempt to base consistent map patterns on a floristic framework would have been impossible, and a simple physiognomic portrayal seemed overly general. More detailed information for each plant community can be found in the vegetation legend accompanying each map.

Map Patterns

The patterns on the maps are Formatt® special effect patterns (Graphic Products Corporation, Rolling Meadows, Illinois 60008). The patterns correspond to physiognomic categories, or in some cases, the physiognomic category and ecologic modifier. Table 14 summarizes the patterns appearing on the 21 maps of the Trans-Alaska Pipeline route (Walker and Webber, in prep.).

Floristic Codes

A floristic code accompanies each map pattern. Forest communities have a three part code; the other physiognomic categories have a one part code. Vegetation complexes are coded with a subscripted "xx".

Non-forest codes. Table 15 contains the floristic codes accompanying the various map patterns for non-forest communities.

Forest codes. Table 16 contains the floristic codes for forest communities. The forest codes contain three parts, representing the dominant tree

taxon, the size of the trees, and the dominant taxon in the understory.

Vegetation complexes. In vegetation complexes, the alphabetic code refers to the type of complex rather than the dominant taxa. Vegetation complexes are always coded with a subscripted "xx". The subscript refers to the type of complex (see Table 16).

Disturbed areas. Disturbed areas are coded with a single number representing the type of disturbance (Table 16).

Table A14. Pattern codes for vegetation maps.

Pattern Codes for Vegetation Maps

Pattern and Formatt® No.

7213 doubled — CLOSED EVERGREEN FOREST

7212 doubled — CLOSED DECIDUOUS FOREST

7214 — MIXED FOREST

7213 — OPEN EVERGREEN FOREST and EVERGREEN LOW SAVANNA

7212 — OPEN DECIDUOUS FOREST

7113 — TALL SCRUB

7126 — SCRUB

7095 — DWARF SCRUB

7155 — PROSTRATE SCRUB

7190 — SHRUB SAVANNA

GRAMINOID MEADOW TYPES:

7107 — MOIST or DRY GRAMINOID MEADOW

710 — WET GRAMINOID MEADOW

7130 — VERY WET GRAMINOID MEADOW

7135 — SALINE GRAMINOID MEADOW

7223 — PIPELINE

black — ROAD OR CONSTRUCTION PAD

7127 — TUSSOCK GRAMINOID MEADOW

7118 — AQUATIC MEADOW

7104 — HORSETAIL MEADOW

7110 — MOSS MEADOW

7105 — LICHEN MEADOW

BARREN TYPES:

7097 — UPLAND BARREN

7119 — RIVER BAR BARREN

7133 — ROCK OUTCROP BARREN

7216 — SAND DUNE BARREN

7181 — SANDY BEACH BARREN or SANDY FLAT BARREN

7235 — TALUS or BLOCKFIELD BARREN

no pattern — BARREN SAND, MUD or TALUS

7231 — SALT WATER

7230 — FRESH WATER

7112 — DISTURBED

Table 15. (cont.)

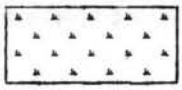
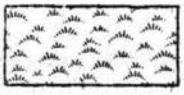
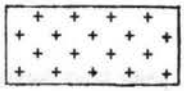
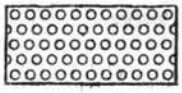
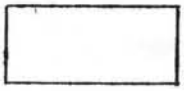
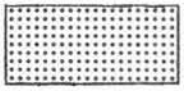
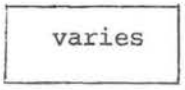
Physiognomic Category and Pattern	Floristic Code	Dominate Taxon
MOIST or DRY GRAMINOID MEADOW 	u	Carex bigelowii
	ax	C. microchaeta
	aq	C. aquatilis
	au	Eriophorum angustifolium
TUSSOCK GRAMINOID MEADOW 	x	Eriophorum vaginatum
	y	Carex bigelowii or C. lugens
	z	Hierochloë alpina
AQUATIC MEADOW 	ab	Arctophila fulva
	ac	Menyanthes trifoliata
	ad	Nuphar luteum
	ao	Hippuris vulgaris
HORSETAIL MEADOW 	az	Equisetum ssp. or Hippochaete spp.
MOSS MEADOW 	ae	Tomenthypnum nitens
	af	Hylocomium splendens
	an	Sphagnum spp.
	ay	Scorpidium scorpioides
LICHEN MEADOW 	n	Cladina spp.
	ag	Cetraria spp.
	bd	Solorina crocea
RIVER BAR BARREN 	p	Salix spp.
	aj	Chamerion latifolium
ROCK OUTCROP BARREN 	ah	Umbilicaria spp.
	ai	Rhizocarpon spp.
	ba	Cetraria hepatizon
or	bb	Saxifraga spp.
UPLAND BARREN 	be	No vegetation
	bf	Nardosmia frigida
or		
TALUS or BLOCKFIELD BARREN 		

Table 15. (cont.)

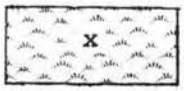
Physiognomic Category and Pattern	Floristic Code	Dominate Taxon
SANDY BEACH BARREN or SANDY FLAT BARREN 	al	Leymus arenarius
	bd	Artemisia spp.
	s	Salix spp.
or SAND DUNE BARREN 	am	Cochleariopsis groenlandicum
	aj	Chamerion latifolium
	bh	No vegetation

Non-floristic Codes

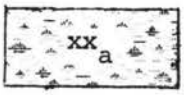
Physiognomic Category and Pattern	Floristic Code	Dominate Taxon
DISTURBED 	1	Winter trail or vehicle track
	2	Deeply rutted track
	3	Deep gully erosion
	4	Erosion deposits that have killed trees
	5	Road cut
	6	Shoulder fill
	7	Flooded area
	8	Gravel, vehicle tracks, misc. debris, etc.
	9	Revegetated 8" gasline trench
	11	Changed vegetation due to flooding
	12	Changed vegetation due to culvert
	13	Changed vegetation due to ice road
VEGETATION COMPLEX 	Pattern corresponds to the physiognomic category of the dominate community.	
	xx_a	LOW-CENTERED POLYGON VEGETATION COMPLEX
	xx_b	HIGH-CENTERED POLYGON VEGETATION COMPLEX
	xx_c	ALIGNED HUMMOCK or DISCONTINUOUS POLYGON RIMS VEGETATION COMPLEX
	xx_d	NON-ALIGNED HUMMOCK VEGETATION COMPLEX
	xx_e	SOLIFLUCTION TERRACE VEGETATION COMPLEX
	xx_f	STREAM VEGETATION COMPLEX
	xx_g	SAND DUNE VEGETATION COMPLEX
	xx_h	PALSA VEGETATION COMPLEX
	xx_i	FROST-BOIL VEGETATION COMPLEX
	xx_j	DISTURBED VEGETATION COMPLEX
	xx_k	MARSH VEGETATION COMPLEX
	xx_m	ICE-CORED MOUND VEGETATION COMPLEX
	xx_n	ROCK/GRAMINOID MEADOW VEGETATION COMPLEX
	xx_o	THERMOKARST TERRAIN VEGETATION COMPLEX
	xx_p	UPLAND TUNDRA/DRAINAGE CHANNEL VEGETATION COMPLEX
	xx_q	IRREGULAR MICRO-RELIEF VEGETATION COMPLEX
	xx_r	SNOWPATCH/GRAMINOID MEADOW VEGETATION COMPLEX
	xx_s	TALUS/GRAMINOID MEADOW VEGETATION COMPLEX
	xx_t	TALUS/MOSS MEADOW VEGETATION COMPLEX
	xx_u	ROCK OUTCROP/TALUS VEGETATION COMPLEX

xx_v	TALUS/SNOWPATCH VEGETATION COMPLEX
xx_w	TALUS/SCRUB VEGETATION COMPLEX
xx_x	MIXED HIGH- AND LOW-CENTERED POLYGON VEGETATION COMPLEX
xx_y	MEADOW VEGETATION COMPLEX

Examples:

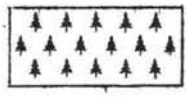
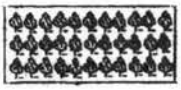
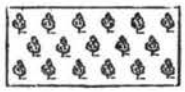
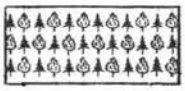


A tussock graminoid community; Eriophorum vaginatum is the dominate taxon.



A low-centered polygon complex; a wet lowland graminoid meadow community is dominate.

Table A16. Forest codes accompanying the map patterns. Order of codes: 1) dominant tree species, 2) size of trees, 3) understory dominant taxa.

Map Pattern	Forest Codes
	Dominant tree taxon (1st symbol):
EVERGREEN FOREST  or 	A - Picea glauca B - Picea mariana C - Mixed P. glauca and P. mariana
DECIDUOUS FOREST  or 	D - Populus tremula E - Betula papyrifera F - Populus balsamifera G - Mixed deciduous forest
MIXED FOREST 	H - Picea and Betula papyrifera I - Picea and Populus tremula

Size of trees (2nd symbol):

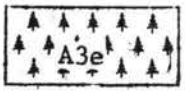
1. Mature trees less than breast height
2. Trees < 5 cm diameter at breast height (dbh)
3. Trees 5-15 cm dbh
4. Trees > 15 cm dbh
5. Krummholz

Understory dominant taxon (3rd symbol):

a. Betula glandulosa and/or B. nana
b. Shepherdia canadensis
c. Chamaedaphne calyculata
d. Rosa acicularis
e. Vaccinium uliginosum
f. Ledum groenlandicum and/or palustre
g. Empetrum eamesii
h. Vaccinium vitis-idaea
i. Dryas integrifolia and/or D. octopetala

Table A16. (cont.)

j. Lupinus arcticus
k. Poaceae or Cyperaceae
l. Equisetum spp.
m. Arctostaphylos uva-ursi
n. Cladina spp. and/or Cladonia spp.
ao. Linnaea borealis
an. Rubus chamaemorus

Example: 

An open Picea glauca forest with trees 5-15 cm dbh. Dominate taxon in the understory is Vaccinium uliginosum.