PROJECT CHARIOT - PHASE III
PROGRESS REPORT

OGOTORUK CREEK BOTANICAL INVESTIGATIONS
CAPE THOMPSON, ALASKA

L. A. Viereck, R. E. Johnson
and
H. R. Melchior

Department of Biological Sciences
University of Alaska

December, 1960

This is a preliminary report and is
NOT FOR PUBLICATION

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INTRODUCTION

Botanical investigations of the Cape Thompson - Ogotoruk Creek region of northwest Alaska were initiated in May, 1959 by the University of Alaska under contract with the United States Atomic Energy Commission (Contract No. AT (04 -3) - 310). The first summer's field work was largely exploratory and descriptive in nature and included a species inventory of the vascular plants, mosses, and lichens; a qualitative description of the main vegetation types in Ogotoruk Valley; and a preliminary mapping of the vegetation types within the valley.

The results of the first summer's field work and winter visits have been partially reported in two reports: Ogotoruk Valley Botanical Project, December, 1959 Report, and the Phase II Interim Final Report, Ogotoruk Valley Botanical Project, June, 1960. For brevity, these will be referred to as the December, 1959 Botanical Report, and the June, 1960 Botanical Report. Materials reported in these earlier reports will not be repeated in this December, 1960 report.

Botanical investigations were continued during the summer and fall of 1960. The objectives of the 1960 field season were as follows:

1. To measure the frequency, cover, and synthetic features of the main vegetation types in Ogotoruk Valley.
2. To establish control vegetation plots in areas outside the potential blast and fallout area and to extend our understanding of the vegetation of the northwestern Alaska Coast.
3. To complete records of species occurrence in the area by continuing plant collections and identifications.
4. To revise and complete the vegetation map of the area.

5. To continue seed germination studies on certain species.
6. To commence palynological studies of bog and lacustrine sediments.
7. To initiate studies on some of the ecological problems in the Ogotoruk Valley area.
   a. to understand the relationship between permafrost, annual freezing-thawing cycles, and plant distribution.
   b. to understand the inter-relationships of the activities of the arctic ground squirrel and vegetation in the valley.

Preliminary results of the 1960 field work and additional information from the 1959 season are included in this report.

QUANTITATIVE ANALYSIS OF VEGETATION TYPES

The vegetation of the Ogotoruk Creek Valley has been separated into ten major and a number of minor types. Several of the major types have been divided into subtypes on the basis of apparent differences in species composition or conspicuous differences in patterned ground features (see December, 1959 Botanical Report).

Quantitative data gathered during the summer of 1960 serve to substantiate this division and naming of the communities set forth in 1959. Quantitative data also provide a basis from which to measure changes which may occur in the vegetation over a period of time. Data of this nature were also valuable when used in conjunction with data obtained from other biological studies being made in the area.

Quantitative data were gathered from 45 of the 54 permanent, one-acre plots set out during the summer of 1959. The methods of choosing the site, setting out, and location of these plots may be obtained from the December, 1959 Botanical Report. However, due to disturbance by vehicles, two of the plots (Plots 8 and 31) had to be moved to undisturbed localities in 1960. In several plots track marks made by vehicles were noted, but the severity of their disturbance did not justify the removal of the plots to new locations.

The quantitative data were obtained by the line intercept method. This method involved the establishment of two, permanent, 50-meter, intercepts in each of the plots investigated (See Figure 1). The intercepts were established parallel to each other and to a given side of a plot; this served to divide the plot into three equal parts. The beginning and terminating points were marked by wooden stakes and were located six meters inside the boundary of the plots. Thus, a so-called "buffer zone" was, in effect, located at the ends of each line so that any disturbance at the edge of the plot would not affect the intercept results. The lines were not oriented to any particular plot edge, but were situated so as to obtain the most representative sample of vegetation. For example, in ridged wet meadow, the intercept lines were staked out as nearly perpendicular to the ridges as possible.

Each line was divided into five, 10-meter segments. The vegetation that was intercepted in the first two meters of each segment was measured and recorded on data sheets illustrated below. To

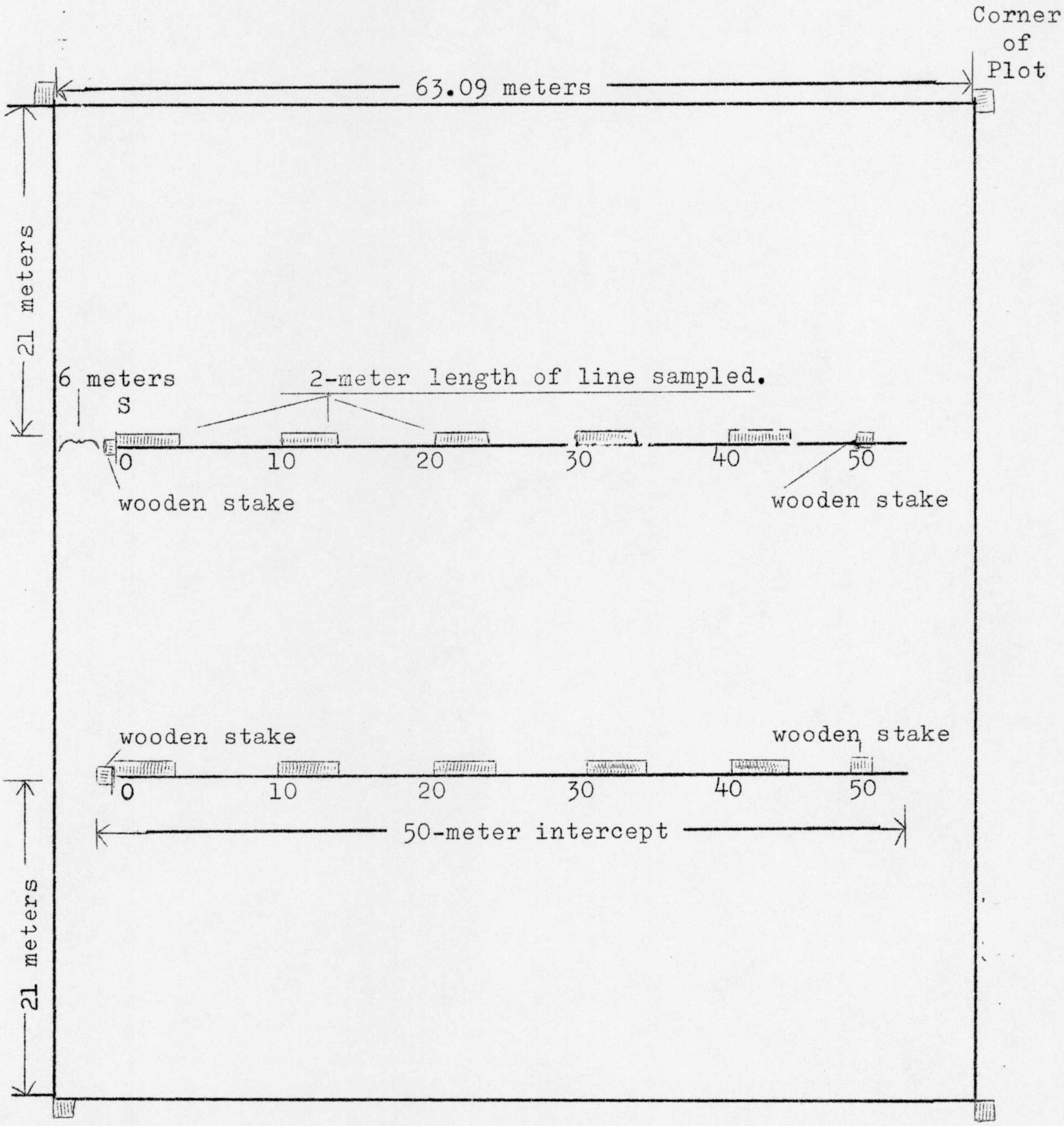


Figure 1. Plan of typical one-acre vegetation plots showing location of the two-50 meter intercepts.

determine cover, the distance that the foliage of each species was intercepted by the line in each 2-meter segment was measured. The total distance for each species was then obtained by adding the distance of interception in each segment. This distance for each species was then related to the total measured distance of the two lines in each plot (20-meters) and this was then expressed as a percentage. If layering occurred, as was often the case, the collective distance of all species exceeded 100 per cent. By relating the percentage of the line occupied by each species or groups of species to the total percentage occupied by all species multiplied by 100, the percentage composition or the relative abundance of each species or group of species was determined. Frequency was interpreted as the number of 2-meter segments in which a species occurred in relation to the total number of segments measured.

Due to the limited time available for complete analysis of the data and because many species still are not identified, only a general description of the three largest communities is contained in this report. Grouping of individual mosses, lichens, and grasses was necessitated by these problems in identification. A more complete breakdown of each community will be presented in the June, 1961 interim report at which time such determinations will have been made.

As mentioned above, one of the objectives for sampling the vegetation with the line intercept method was to establish a base study of the vegetation as it now exists in Ogotoruk Valley so that any changes that are brought about by fallout or throw-out from the blast can later be determined. On the basis of the analysis to date of the results of the quantitative data obtained during the summer of 1960, it is clear that the intercept method is of considerable value in obtaining information about the vegetation types when data from several plots are used, but data obtained from one plot are not adequate to show small changes that might occur in each individual plot. In order that these changes can be shown, it will be necessary either to intensify the use of the intercept method (approximately five times the amount of sampling would be needed) or to use another method, possibly that of Blytt-Sernander.

In addition, a method of detailed photography or some method of quadrat mapping should be added if minor changes in the vegetation are to be adequately shown at a later date.

VEGETATION PLOT DATA - LINE INTERCEPT Page ________.

Plot # __________. Type ________________________________. Location ______________________________

Observer ___________________. Date.__________________.

Species	1	2	3	4	5	6	7	8	9	10	Freq.	Cov.	% C.	Phen.	

1. Dryas Fellfield Type

The Dryas fellfield is the characteristic community of the well-drained, slate, shale, and sandstone ridges within and around Ogotoruk Valley. It is also the major type occupying the limestone ridges bordering the valley on the west. In comparison to other types, Dryas fellfield occupies an upland position and as a result, relatively exposed situations.

The landscape of the Dryas fellfield is characterized by mats of Dryas octopetala interspersed with crustose and foliose lichens, the most abundant of which are species of the foliose type Alectoria spp., Cornicularia divergens, Cetraria spp., and Ochrolechia frigida. Crustose lichens occupy the surface of most stones. Other vascular plants which are commonly found, in addition to Dryas octopetala, include Lupinus arctica, Salix phlebophlla, Carex podocarpa, Arenaria arctica, Kobresia myosuroides, Diapensia lapponica, and Arctostaphlos alpina. Various species of grass (Festuca and Poa) are common. Mosses, although not in great abundance, are frequently found, but usually in depressions.

The percentage of vegetation cover in the five plots investigated averaged 63 (Table 1). Dryas octopetala comprised almost 27 per cent of this cover, while lichens made up 52 per cent. Mosses contributed only a fractional part of the remaining cover, which was comprised mainly of various species of vascular plants. Soil and rocks not supporting vegetation amounted to 47 per cent.

A. Dryas Fellfield on Limestone

As the substrate on which this subtype grows is comparatively limited in extent, only one plot (8 - A) was studied on a quantitative basis. Dryas octopetala and lichens were found to be present in almost equal amounts and made up almost 80 per cent of the vegetative cover (Table 1). Kobresia myosuroides and various species of moss were secondary in abundance and comprised approximately 6 per cent and 4 per cent, respectively, of the vegetation. The remainder of the cover was made up of Carex podocarpa, Salix arctica, and Arenaria arctica. Other species which are characteristic to this type, but percentagewise of little importance, included Oxytropis arctobia, Potentilla biflora, Saxifraga oppositifolia, and Saxifraga eschscoltzii.

TABLE 1. Individual and mean per cent cover and per cent composition and mean frequency of the major species and groups of species occurring in five _Dryas_ Fellfield plots investigated.

Subtype	Limestone		Shale, Slate, Sandstone										
Plot	8-a		10		14		20		33		x̄	x̄	x̄
Species	Cover	Comp.	Cover	Comp.	Cover	Comp.	Cover	Comp.	Cover	Comp.	Cover	Comp.	Freq.
Dryas octopetala	21.8	38.0	20.8	23.4	8.0	22.1	6.3	10.6	28.1	39.2	17.0	26.7	84
Lichens	23.7	41.3	50.6	57.0	23.2	64.0	41.2	69.8	20.2	28.2	31.8	52.0	100
Lupinus arcticus	-	-	-	-	-	-	2.1	3.5	9.8	13.6	2.4	3.4	18
Salix phlebophylla	-	-	3.4	3.8	-	-	0.9	1.4	4.7	6.6	1.8	2.4	38
Grasses	-	-	1.1	1.2	1.7	4.7	1.1	1.9	3.1	4.4	1.4	2.4	46
Mosses	2.3	4.0	1.6	1.8	0.1	0.3	0.3	0.4	1.4	1.9	1.1	1.7	52
Carex podocarpa	1.0	1.6	0.6	0.7	0.6	1.5	1.0	1.7	1.6	2.2	1.0	1.6	40
Arenaria arctica	0.4	0.6	1.3	1.4	0.9	2.5	1.1	1.8	0.9	1.3	0.9	1.5	36
Kobresia myosuroides	3.6	6.2	-	-	-	-	-	-	-	-	0.7	1.3	14
Diapensia lapponica	-	-	0.5	0.6	-	-	3.2	5.4	0.1	0.1	0.8	1.2	10
Arctostaphylos alpina	-	-	3.6	4.1	-	-	0.6	1.0	-	-	0.8	1.0	6
Other vascular plants	4.9	8.3	5.4	6.0	1.8	4.9	1.5	2.5	1.5	2.5	3.0	4.8	-
TOTAL	57.7	-	88.9	-	36.3	-	59.3	-	71.4	-	62.7	-	-
Bare ground	46.0	-	34.8	-	68.8	-	50.4	-	34.0	-	46.8	-	-

SUMMARY

	Limestone Cover	Limestone Comp.	Shale, Slate, Sandstone Cover	Shale, Slate, Sandstone Comp.	x̄ Cover	x̄ Comp.
Vascular plants	31.7	54.5	29.3	45.8	29.8	47.5
Lichens	23.7	41.5	33.8	52.8	31.8	50.7
Mosses	2.3	4.0	0.9	1.4	1.1	1.8
Total cover	57.7	-	63.0	-	62.7	-
Bare ground	46.0	-	47.0	-	46.8	-

B. *Dryas* Fellfield on Shale, Slate, and Sandstone

This subtype, occupying all of the low ridges along Ogotoruk Creek and those bordering the east side of the valley, is by far the more common of the two *Dryas* fellfield subtypes. In appearance, it is similar to the subtype found on limestone, except for the presence of *Lupinus arcticus*. This legume is restricted to this subtype, and occurs especially in those stands inland from the coast.

Vegetative cover of this subtype was found to vary from 36 per cent to 89 per cent (Table 1). *Dryas octopetala* and lichens constituted 79 per cent of the cover, while *Lupinus arcticus*, although characteristic, was of secondary importance and made up only 3.4 per cent of the cover. Other plants such as *Arenaria arctica*, *Diapensia lapponica*, *Carex podocarpa*, and various species of mosses made up most of the remaining cover. Soil and rocks not covered by vegetation were found to have approximately the same cover as that found in the limestone subtype, i.e., 47 per cent.

2. *Eriophorum-Carex Wet Meadow*

This vegetation type occupies poorly drained sites within the Ogotoruk Valley. It is widely distributed, bordering lakes and small streams and on extensive flat areas bordering the creek. It also occurs at the heads of small tributaries mainly on the eastern side of the valley. This type usually occurs in areas too wet to support *Eriophorum* tussocks.

The wet meadow is dominated by *Eriophorum angustifolium* and *Carex aquatilis*. These co-dominants occur in proportions from nearly pure stands of either species to stands where abundance is nearly equal. Frequently *E. russeolum* and *E. scheuchzeri* are found in abundance in certain localized areas. (Because of the similarity of the basal shoots and leaves of these four species of sedges, and because they seldom occur in the flowering condition in this type, it was sometimes impossible to separate them in our intercept work. For this reason they have been listed together in the quantitative anaylsis.) *Sphagnum* spp. and other mosses often form a continuous mat beneath the *Eriophorum* and *Carex*. The abundance of *Salix* spp., *Betula nana*, and other species appears to be correlated to some degree by microrelief features, such as ridges and polygonal patterns.

Foliage cover of this vegetation type, due to layering of the vegetation, was high, averaging approximately 144 per cent in the 13 plots investigated (Table 2). *Carex aquatilis*, *Eriophorum angustifolium*, *E. russeolum*, and *E. scheuchzeri* made up almost 60 per cent of this cover, while Sphagnum spp. and other mosses comprised 23 per cent. Woody species (Salix pulchra, S. arbutifolia, and Betula nana) formed about 10 per cent of the cover, while Eriophorum vaginatum contributed 4.2 per cent. Lichens and other vascular plants constituted the remaining cover.

The wet meadow type can be divided into three subtypes on the basis of physical features such as ridges and polygonal patterns. The presence or absence of the features appear to affect the composition and general appearance of the stand.

A. Ridged Wet Meadow

The ridged subtype is found bordering the creek and its tributaries throughout the valley. The most important physical feature of this subtype is a series of low ridges that extend throughout the stand at right angles to the slope. These ridges (15 to 25 cms. high) act as dams and create areas that remain saturated or nearly so during most of the summer. Apparently, because these ridges cause a variation in moisture conditions, a greater number of species are encountered here than in either of the following two subtypes.

The vegetative cover of this subtype amounted to 150 per cent, exceeding that of the depressed center polygon and non-ridged subtypes by 16 per cent and 14 per cent, respectively (Table 2). This greater percentage of cover in the ridged subtype was due entirely to a greater cover of vascular plants. In contrast, however, the moss cover was somewhat less than that found in the other two subtypes.

Carex aquatilis, Eriophorum angustifolium, E. russeolum and E. scheuchzeri, accounted for almost 60 per cent of the cover, while Sphagnum species and other mosses constituted approximately 21 per cent. The woody plants (Salix pulchra, S. arbutifolia, and Betula nana) made up 15 per cent. Eriophorum vaginatum, occurring on the drier ridges, comprised an additional 6 per cent, while the remaining portion was made up of lichens and other vascular plants.

B. Non-Ridged Wet Meadow

This subtype is similar to the ridged wet meadow in appearance, but it lacks the ridges. It appears to be drier than the depressed center polygon subtype, but somewhat wetter than the ridged subtype.

In comparison to the depressed center polygons, this non-ridged subtype has a greater percentage of vascular plants but lesser amounts of mosses. The total vegetation cover amounted to 137 per

TABLE 2. Individual and mean per cent cover and per cent composition and mean frequency of the major species and groups of species occurring in thirteen Wet Meadow plots investigated.

Subtype	Depressed Center Polygons						Non-Ridged				Ridged	
Species / Plot	34		37		48		22		27		1	
	Cover	Comp.	Cover	Comp.	Cover	Comp.	Cover	Comp.	Cover	Comp.	Cover	Comp.
Carex aquatilis Eriophorum angustifolium E. russeolum E. scheuchzeri	92.4	65.8	58.1	53.3	71.6	46.8	93.9	77.5	78.2	51.4	93.9	74.0
Mosses	34.0	24.4	39.0	35.8	74.0	48.4	16.2	13.4	52.1	34.2	11.9	9.3
Salix pulchra	-	-	-	-	-	-	7.7	6.3	5.6	3.7	16.8	13.1
E. vaginatum	-	-	-	-	2.3	1.5	3.3	2.7	3.9	2.6	-	-
Betula nana	1.0	0.7	5.5	5.1	2.5	1.7	-	-	9.8	6.4	0.9	0.7
Salix arbutifolia	11.1	7.9	-	-	1.9	1.2	-	-	-	-	-	-
Lichens	0.1	0.1	2.1	1.9	0.1	0.1	-	-	-	-	T	T
Other vascular plants	2.9	2.1	4.3	3.9	0.4	0.3	0.1	0.1	2.6	1.7	3.8	2.8
Total cover	141.5	-	109.0	-	152.8	-	121.2	-	152.2	-	127.3	-
Bare ground	-	-	-	-	-	-	-	-	-	-	-	-

Subtype	Ridged																
Species / Plot	11		12		18		21		39		41		45				
	Cover	Comp.	Cover	Comp.	Cover	Comp.	Cover	Comp.	Cover	Comp.	Cover	Comp.	Cover	Comp.	$\bar{x}$ Cover	$\bar{x}$ Comp.	$\bar{x}$ Freq.
Carex aquatilis Eriophorum angustifolium E. russeolum E. scheuchzeri	80.6	33.6	93.8	74.6	87.8	74.7	68.0	39.8	98.9	55.5	67.3	54.3	81.9	70.5	82.0	59.3	100
Mosses	83.3	34.6	6.2	4.9	21.3	18.0	45.1	26.4	58.1	32.6	12.4	9.9	10.9	9.3	35.7	23.2	88
Salix pulchra	22.5	9.4	16.1	12.8	0.9	0.7	-	-	18.1	10.2	15.8	12.8	4.3	3.7	8.3	5.6	55
E. vaginatum	19.2	8.0	2.4	1.9	2.0	1.7	33.4	19.6	0.5	0.3	9.8	7.9	9.2	7.9	6.6	4.2	28
Betula nana	12.8	5.1	6.1	4.8	3.4	2.9	6.1	3.6	-	-	-	-	8.5	7.3	4.4	2.9	39
Salix arbutifolia	-	-	1.1	0.9	-	-	8.2	4.8	1.1	0.6	0.6	0.4	1.1	0.9	1.9	1.3	22
Lichens	2.1	0.9	0.2	0.1	-	-	8.3	4.9	1.3	0.7	2.1	1.7	0.4	0.3	1.2	0.8	24
Other vascular plants	20.7	8.4	-	-	2.6	2.0	1.4	0.9	0.1	0.1	16.2	12.9	0.1	0.1	4.2	2.7	-
Total cover	241.2	-	125.9	-	118.0	-	170.5	-	178.1	-	124.2	-	116.4	-	144.3	-	-
Bare ground	-	-	-	-	6.3	-	-	-	-	-	-	-	-	-	0.4	-	-

SUMMARY

	Depressed Center Polygons Cover	Depressed Center Polygons Comp.	Non-Ridged Cover	Non-Ridged Comp.	Ridged Cover	Ridged Comp.	$\bar{x}$ Cover	$\bar{x}$ Comp.
Vascular plants	84.6	62.9	102.4	74.9	117.2	78.0	107.4	76.0
Mosses	49.0	36.5	34.3	25.1	31.2	20.8	35.7	23.2
Lichens	0.8	0.6	-	-	1.8	1.2	1.2	0.8
Total cover	134.4	-	136.7	-	150.2	-	144.3	-
Bare ground	-	-	-	-	0.8	-	0.4	-

cent (Table 2). Carex aquatilis and Eriophorum angustifolium constituted over 64 per cent of this cover, while Sphagnum spp. and other mosses made up approximately 24 per cent. Salix pulchra replaced Salix arbutifolia as the most abundant willow and comprised over 5 per cent of the vegetative cover. Betula nana, E. vaginatum, and species of grasses (Poa spp. and Calamagrostis spp.) constituted the remaining portion of the vegetation. The percentage of lichens was nil.

C. Depressed Center Polygons

This subtype is found mainly in the upper Ogotoruk Valley adjacent to the ponds, where ice wedge polygons have formed in flat, wet areas. The centers of the polygons are 25 to 50 cms. lower than the surrounding, elevated ridges and are usually very wet.

Vegetative cover of this subtype varied from 109 to 153 per cent and averaged 134 per cent (Table 2). Carex aquatilis and Eriophorum scheuchzeri were the most abundant species, and along with E. angustifolium made up over 55 per cent of the cover. Sphagnum spp. and other mosses constituted about 37 per cent of the cover. Salix arbutifolia and Betula nana were the next most abundant species and formed approximately 6 per cent of the vegetation. Other vascular plants constituted only a small percentage of the total, while the lichens were of even less importance.

3. Eriophorum Tussock Type

Eriophorum tussock tundra is widespread in the Ogotoruk Valley and probably occupies more area than any other type. It occurs extensively on broad, flat slopes between the stream and the steep slopes on either side of the valley. The tussock tundra usually occupies slightly drier locations than the wet meadow.

The tussocks fromed by Eriophorum vaginatum are the most conspicuous features of the type. They are approximately 30 cms. high, vary from 30 to 60 cms. in diameter, and usually support ericaceous shrubs on their sides and tops. Mosses are also prevalent throughout the tussocks.

The Eriophorum tussock type can be divided into three subtypes on the basis of presence or absence of large ice wedge polygons and frost scars which affect the vegetation composition.

A. Eriophorum Tussocks with Polygons

This subtype has a more complete cover of vegetation than the other two subtypes, with only about 4 per cent of the soil surface being unvegetated (Table 3). The Eriophorum tussocks and less moisture-tolerant species covered the raised centers of the polygons, while in the depressions a wetter type of vegetation occurred.

The foliage cover, due to layering, was high, exceeding 156 per cent. Eriophorum vaginatum and mosses were the most abundant species and made up 38 per cent and 23 per cent of the cover, respectively. Ericaceous shrubs constituted almost 15 per cent of the vegetation, while the woody shrubs, Salix pulchra and Betula nana, comprised about 10 per cent. Lichens were more abundant than in the frost scar subtype and constituted nearly 8 per cent of the cover. Carex bigelowii was found in the raised central portions of the polygons, but made up an insignificant amount of the foliage cover. Occurring in the polygonal depressions, Carex aquatilis, made up 5 per cent of the cover. The grasses, Rumex arcticus, and other vascular plants constituted the remaining portion of the cover.

B. Eriophorum Tussocks with Frost Scars

The main physical characteristic of this subtype is the presence of frost scars. The percentage of the area occupied by these scars varied from zero to 34 in seven stands investigated, while the average was 17 per cent (Table 3)

Eriophorum vaginatum tussocks are the dominant features of the stand, making up 36 per cent of the total (128 per cent) vegetative cover. The woody shrubs, Betula nana and Salix pulchra, comprised over 11 per cent and 7 per cent of the cover, respectively, while the ericaceous shrubs (Ledum decumbens and Vaccinium vitis idaea) constituted 14 per cent collectively. Sphagnum species and other mosses occurred with a high frequency and made up about 15 per cent of the cover. Lichens, although frequently found, comprised less than 5 per cent of the foliage cover. Carex aquatilis and C. bigelowii were found in localized areas and made up only 3.5 per cent of the cover, while the grasses (Deschampsia caespitosa, Calamagrostis sp., and Arctagrostis latifolia) occurred more frequently and constituted 2.2 per cent of the cover. Characteristic species, such as Rumex arcticus, Petasites frigidus, and Luzula spp., made up the bulk of the remaining portion of the cover.

TABLE 3. Individual and mean per cent cover and per cent composition and mean frequency of the major species and groups of species occurring in twelve <u>Eriophorum</u> Tussock plots investigated.

Subtype	Frost Scar											
Plot	24		31		32		36		44		52	
Species	Cover	Comp.	Cover	Comp.	Cover	Comp.	Cover	Comp.	Cover	Comp.	Cover	Comp.
<u>Eriophorum vaginatum</u>	51.0	36.3	55.9	48.0	43.3	24.8	48.9	35.8	27.5	29.6	50.1	48.7
Mosses	28.9	20.6	16.4	14.1	30.7	17.6	20.0	14.6	15.1	16.1	11.6	11.3
<u>Ledum decumbens</u>	26.7	19.0	12.6	10.8	38.1	21.8	2.5	1.8	2.3	2.6	10.4	10.1
<u>Betula nana</u>	3.3	2.4	12.7	10.9	21.3	12.2	18.8	13.8	15.5	16.7	13.4	13.0
<u>Salix pulchra</u>	5.8	4.1	8.3	7.1	6.8	3.9	12.9	9.4	12.6	13.5	8.5	8.2
Lichens	8.8	6.3	1.6	1.4	14.8	8.5	2.9	2.1	3.8	4.0	1.0	0.9
<u>Carex aquatilis</u>	-	-	-	-	-	-	15.1	11.0	3.2	3.4	-	-
<u>Vaccinium vitis-idaea</u>	10.2	7.3	0.6	0.5	6.8	3.9	0.7	0.5	-	-	-	-
Grasses	2.5	1.8	4.1	3.5	2.9	1.7	0.2	0.1	0.7	0.8	2.2	2.1
<u>Carex bigelowii</u>	-	-	0.3	0.3	4.1	2.4	0.7	0.5	6.2	6.6	-	-
<u>Rumex arcticus</u>	1.5	1.1	2.6	2.2	1.5	0.9	-	-	1.7	1.8	5.2	5.1
Other vascular plants	1.6	1.1	1.3	1.2	4.1	2.3	14.2	10.4	4.7	4.9	0.6	0.6
Total cover	140.3	-	116.4	-	174.4	-	136.9	-	93.3	-	103.0	-
Bare ground	8.7	-	21.4	-	26.1	-	-	-	14.3	-	33.7	-

Subtype			Polygon								<u>E</u>. <u>vag</u>. and <u>C</u>. <u>big</u>.				
Plot	55		4		23		42		46		54				
Species	Cover	Comp.	Cover	Comp.	Cover	Comp.	Cover	Comp.	Cover	Comp.	Cover	Comp.	$\bar{x}$ Cover	$\bar{x}$ Comp.	$\bar{x}$ Freq.
<u>Eriophorum vaginatum</u>	42.8	32.3	66.9	34.8	62.6	56.0	56.3	37.9	53.8	31.0	30.2	16.9	49.1	34.6	98
Mosses	16.6	12.5	48.8	25.5	21.1	18.8	21.4	14.4	51.1	29.3	81.9	45.6	30.3	21.3	96
<u>Ledum decumbens</u>	25.8	19.5	25.2	13.2	9.9	8.8	19.6	13.3	22.3	12.8	-	-	16.3	11.5	76
<u>Betula nana</u>	15.8	11.9	11.7	6.1	3.9	3.5	4.4	3.0	7.4	4.2	-	-	10.7	7.5	62
<u>Salix pulchra</u>	6.7	5.1	3.5	1.8	1.3	1.2	19.5	13.1	8.5	4.9	29.1	16.3	10.3	7.3	79
Lichens	8.1	6.1	14.7	7.6	5.8	5.1	17.8	11.9	10.3	5.9	22.6	12.6	9.4	6.6	81
<u>Carex aquatilis</u>	-	-	12.7	6.6	3.3	3.0	-	-	16.7	9.6	-	-	4.3	3.0	27
<u>Vaccinium vitis-idaea</u>	3.5	2.7	5.2	2.7	1.9	1.7	4.6	3.1	3.4	2.0	0.1	0.1	3.1	2.2	50
Grasses	6.7	5.1	-	-	1.1	1.0	1.1	0.7	-	-	4.5	2.5	2.2	1.5	41
<u>Carex bigelowii</u>	0.8	0.6	-	-	-	-	2.4	1.6	-	-	8.6	4.5	1.9	1.3	25
	-	-	-	-	-	-	-	-	-	-	-	-	1.3	0.9	15
<u>Rumex arcticus</u>	1.5	1.1	-	-	-	-	0.6	0.4	-	-	-	-	1.2	0.9	25
Other vascular plants	4.1	3.1	3.1	1.7	1.0	0.9	0.9	0.6	0.5	0.3	2.8	1.5	3.2	2.3	-
Total cover	132.4	-	191.8	-	111.9	-	148.6	-	174.0	-	179.8	-	142.0	-	-
Bare ground	15.8	-	-	-	10.4	-	5.4	-	-	-	6.0	-	11.8	-	-

SUMMARY

	Frost Scar Cover	Frost Scar Comp.	Polygon Cover	Polygon Comp.	<u>E</u>. <u>vag</u>. and <u>C</u>. <u>big</u>. Cover	<u>E</u>. <u>vag</u>. and <u>C</u>. <u>big</u>. Comp.	$\bar{x}$ Cover	$\bar{x}$ Comp.
Vascular plants	102.3	79.9	108.8	69.4	75.3	41.9	102.3	74.5
Mosses	19.9	15.5	35.6	22.7	81.9	45.5	30.3	19.6
Lichens	5.9	4.6	12.2	7.9	22.6	12.6	9.4	5.9
Total cover	128.1	-	156.6	-	179.8	-	142.0	-
Bare ground	17.1	-	3.9	-	6.0	-	11.8	-

C. Eriophorum - Carex bigelowii Tussocks

This subtype appears to occur on areas which are drier than those of the preceding two subtypes. The tussocks in comparison are poorly developed and scattered.

The cover of the one stand investigated (Plot 54) was high, practically 180 per cent. This was due mainly to a two- and almost three-fold increase in the amount of mosses in comparison to the other two subtypes. The abundance of Sphagnum spp. was not greatly different, but species of Hylocomium, Rhacomitrium, and Aulacomnium increased tremendously. These mosses constituted over 45 per cent of the total cover. Eriophorum vaginatum tussocks made up about 17 per cent of the cover, while Carex bigelowii made up about 5 per cent. Salix pulchra was found to be prevalent as were various species of lichens. These comprised 16 per cent and 13 per cent of the foliage cover, respectively. Ericaceous shrubs were noticeably absent, while grasses were somewhat more abundant than in the preceding subtypes and made up 2.5 per cent of the cover. The remaining portion of the cover was comprised of various species of other vascular plants.

CAPE DYER - CAPE LEWIS CONTROL AREA

As a control on the "before and after" study of vegetation on the permanent plots established in Ogotoruk Valley, it was proposed that permanent control plots be established in some area far enough away from the site of the nuclear blast that there would be no danger of any contamination from fallout and throwout. During the field summer of 1959, Kisimulowk Valley, located about seven miles south of Ogotoruk Creek, was selected as the Control Valley because the topography and vegetation were similar to that of Ogotoruk Creek. Correspondence with the Lawrence Radiation Laboratory during the winter of 1959 - 1960, however, indicated that this valley was too close to the site to ensure that there would be no radiation contamination. Kisimolowk Creek was therefore abandoned as a possible control area.

On 10 April, 1960 a flight was arranged to examine potential control areas between Cape Lisburne on the north and Kivalina on the south. After flying over much of this area at both high and low altitudes, it was decided that no one valley along the coast was similar enough to the Ogotoruk Valley to serve as a control valley. On this basis, it was decided to establish permanent control plots in vegetation types similar to those found in Ogotoruk Creek but in the general vicinity of Cape Dyer and Cape Lewis. Instead of a single control valley, a control area would be used that contained vegetation types similar to the main vegetation types in Ogotoruk Creek.

These control plots were established and studied during the 1960 field season.

General Description of Area

The control area consists of a stretch of the coast from just south of Kipaloq Creek at Cape Dyer to the ridge north of Ukinyik Creek, a distance of about ten miles (Figure 2). All of the plots are located within the drainages of either Kipaloq Creek or Ukinyik Creek and within one mile of the coast (Figures 3 and 4). The control area is one of high ridges of shale and limestone, intersected with narrow valleys. The valley of Kipaloq Creek and its near neighbor to the south, Angowlik Creek, are presently the only extensive broad low areas in the region. From Cape Dyer northward the ridges become increasingly higher and the topography more dissected, culminating with Mt. Hamlet, 2034 feet in altitude, at the head of

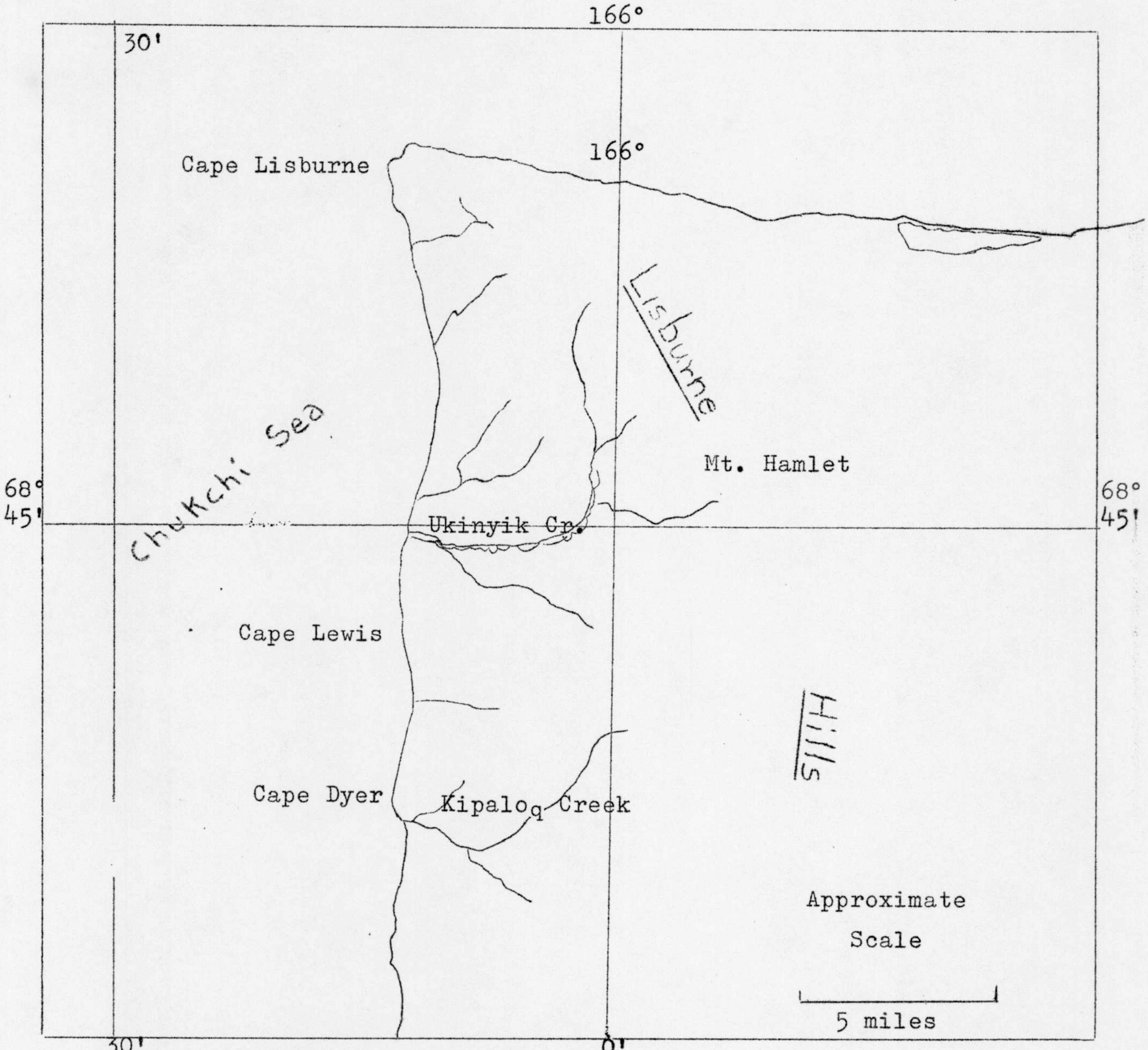


Figure 2. General location sketch map of the Cape Dyer - Cape Lewis control area.

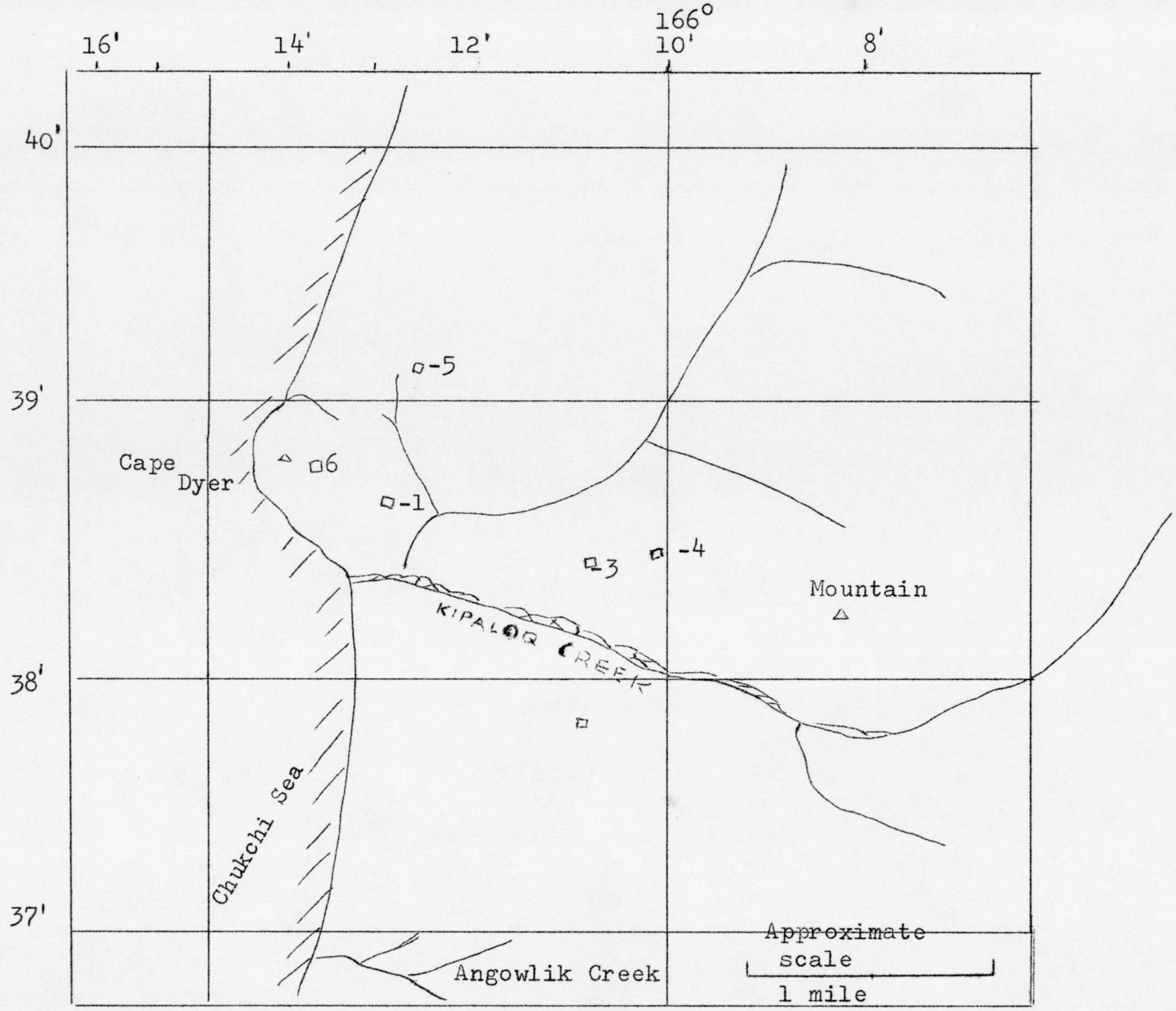


Figure 3. Location of plots in Kipaloq Creek, Cape Lewis-Cape Dyer control area.

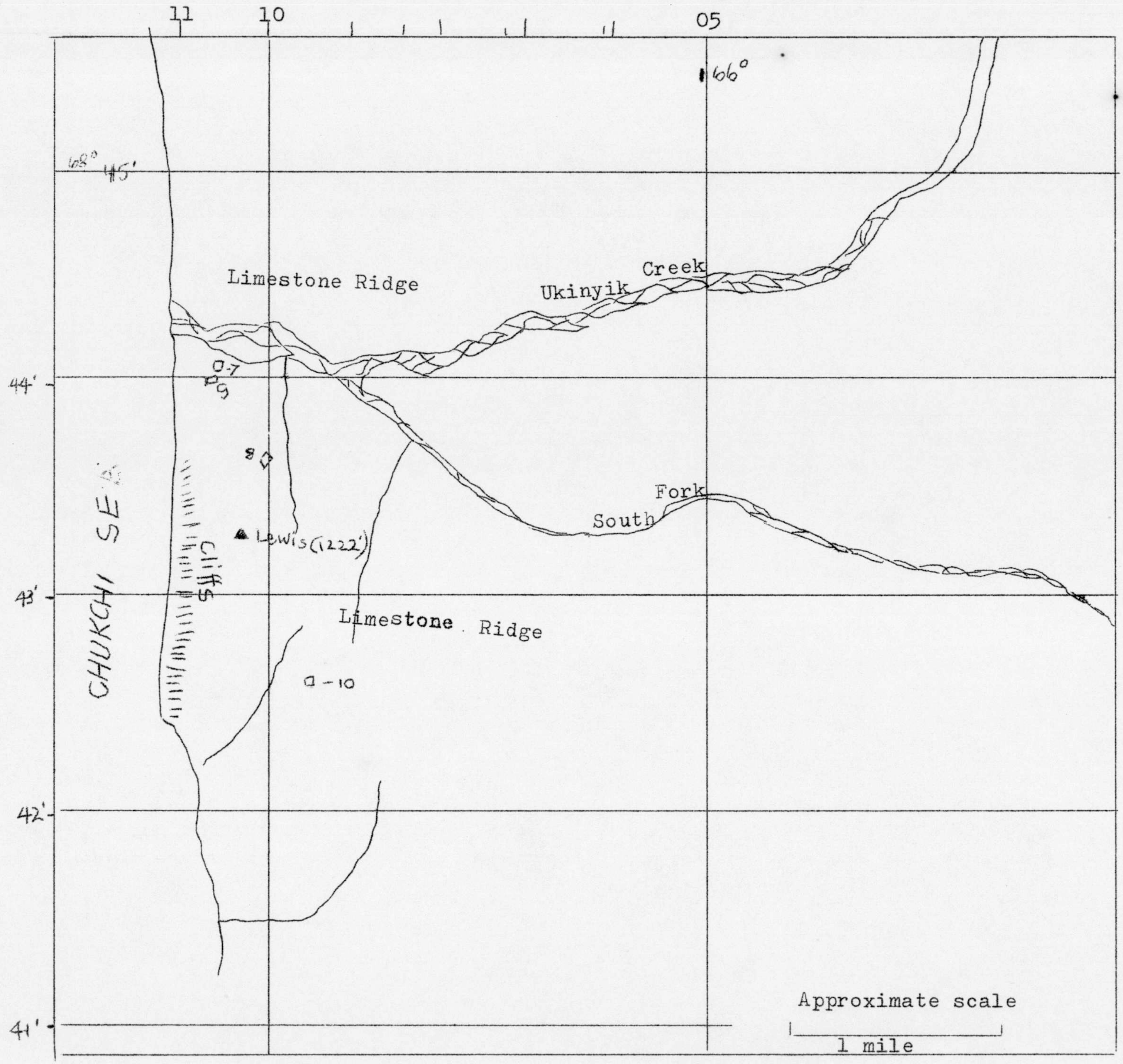


Figure 4. Location of plots in Ukinyik Creek, Cape Dyer-Cape Lewis control area.

Ukinyik Creek. Several ridges, terminating as sea cliffs, are over 1,000 feet in height. The valley walls of the more northerly streams, such as that of Ukinyik Creek, are steep and usually consist of loose talus. The valley bottoms are narrow, and the streams, when flowing, are usuallly confined to narrow stream beds. The stream bed of Ukinyik Creek has all the aspects of a braided stream valley below a glacier. There are large boulders in the broad active part of the stream bed, indicating considerable flow at some time during the year. However, during the entire period that we were at Ukinyik Creek, absolutely no water flowed along the surface of the gravel, the flow being limited to sub-surface drainage.

The hills in the vicinity of Cape Dyer and Kipaloq Creek are composed of shale and sandstone and have a rounded profile. At the surface the rocks are highly fractured and outcrops of bedrock are rare except along the sea cliffs. In the area of limestone north of Cape Dyer and extending all the way to Cape Lisburne, the ridges are steeper and outcrops and limestone spires are conspicuous. These limestone ridges and outcrops are conspicuously light in color when compared with the darker sandstones and shale to the south.

The bedrock structure of the control area appears to be similar to that found in the Ogotoruk Valley region, consisting of the Lisburne limestone formation, Noatak sandstone and chert, and limestone and shale of marine origin (Smith and Mertie, 1930). Quarternary deposits in the Lisburne area are far less extensive than those found in the Ogotoruk Valley. A much higher percentage of the Cape Lisburne area is occupied by outcrops of bedrock and ridges of fractured bedrock. The fine-particled Quarternary deposits are limited to narrow bands along the benches above the stream courses. In general, the same types of geological structures can be found in the control area as in the Ogotoruk Valley.

Climate

Climatic data from the U. S. Weather Bureau station (1954 - 1960) at Cape Lisburne has been recorded since May, 1954. A summary of precipitation and temperature for Cape Lisburne from 1954 to July, 1960 is given in Table 4. When more climatic data from Ogotoruk Creek becomes available a correlation between the two stations will be attempted.

During our one month at Kipaloq and Ukinyik creeks the weather patterns and temperatures roughly approximated those that occurred

TABLE 4. Climatic summary from U. S. Weather Bureau station, Cape Lisburne, Alaska, for the years 1954-1960.

	Precipitation (inches)	Number of years observed	Average temperature	Number of years observed
January	.81	4	- 3.5	5
February	.38	6	-10.9	6
March	.48	5	- 5.5	5
April	.47	6	10.6	6
May	.27	7	26.9	7
June	.85	7	38.1	6
July	1.70	7	44.5	6
August	3.94	6	43.9	5
September	3.12	5	37.3	5
October	1.28	5	24.4	5
November	1.06	5	5.5	5
December	.37	5	- 7.2	5
Monthly Average	1.23		17.0	
Annual Total	14.73			

at Ogotoruk Creek during the same period. Strong down-valley winds accompanied by clear skies were the prevailing conditions, with precipitation usually occurring with strong south and east winds from the ocean. In general, the climatic conditions of the control area appear similar to those of the Ogotoruk Valley.

Phytogeography

The importance of the area of the northwestern tip of Alaska from a phytogeographical standpoint has been discussed in the December, 1959 Botanical Report. This discussion holds true for the Cape Lisburne area as well as the Cape Thompson area. In fact, the presence of higher mountains (Mt. Hamlet - 2034 feet) and more rugged topography close to the coast make it an even more likely area for possessing a flora with a mixture of many different floral elements.

Jordal (1951) has discussed the phytogeographical importance of the Brooks Range and considers the Lisburne area briefly in his discussions. When the collections from our 1960 field season are identified it should be possible to analyze the flora of the Lisburne area in much the same way as Jordal has done for other parts of the Brooks Range.

History of Botanical Exploration, Cape Lisburne Area

The Cape Lisburne area has had a more active history of botanical exploration than has the Cape Thompson region, probably because Cape Lisburne is a more conspicuous landmark along the northwest coast of Alaska. Captain Cook, in 1778 was the first to stop at Cape Lisburne, which he named at that time, but apparently no botanical collections were made.

The first botanical collections at Cape Lisburne were made by George Lay and Alexander Collier (see Hooker and Arnott, 1841) who sailed as naturalist and surgeon on Capt. Beechey's vessel, the BLOSSUM. The vessel stopped at Point Hope and Cape Lisburne during the summers of 1826 and 1827.

In 1848 and 1850 Berthoud Seeman, naturalist on the ship HERALD, collected plants at Cape Lisburne during the search for the missing Franklin expedition (Seeman, 1852 - 1857). John Muir was the next naturalist to collect plants in the Cape Lisburne area during a stop of the CORWIN about 20 miles east of Cape Lisburne (Muir, 1917). Herbert Mason of the University of California stopped at the Cape during the summer of 1931 and gathered a small collection of plants.

The last botanist to visit the area was J. P. Anderson who collected locally at Cape Lisburne on 7 August, 1938 during an extended coastal collecting trip.

All of these collections have been reported in Hultén's Flora of Alaska and Yukon (1941 - 1950). No additional collections from this area have been reported in the literature. In summary, this extremely interesting and important area has been visited by several botanists from 1826 until 1938, but none of these collectors remained in the area for more than a day or two and none penetrated any distance from the coast. The collections made by us during the summer of 1960 are the first attempt at a listing of most of the species in the area. In none of the reports of other botanists are there any description of the plant communities occurring in the area.

Analysis of Vegetation

Work in the control area during the summer of 1960 consisted primarily of a reconnaissance of the area, a collection of the flora, a qualitative description of the important vegetation types, and the establishment of 10 permanent control plots in vegetation types similar to those found in Ogotoruk Valley. In each of the control plots permanent line intercepts similar to those used in Ogotoruk Valley were established and used in determining the per cent cover, the per cent composition, and the frequency of each of the species intercepted. The resulting data are presented in this report but no attempt is made to compare the results of the line intercept data from the control area with that from Ogotoruk Creek Valley.

The main vegetation types found in the Ogotoruk Valley also occur in the Cape Lisburne area, although in many cases they are of limited distribution. In order to obtain similar vegetation types to those that occur in Ogotoruk Creek it was necessary to work in two areas. The Kipaloq Creek Valley at Cape Dyer is broad, with a topography similar to that of Ogotoruk Creek, but much less extensive in scale. It has large areas of *Eriophorum* tussock type on large low areas south of the creek, wet meadow type in gently sloping valleys on the north side of the creek, and large areas of *Dryas* fellfield on the shale and sandstone ridges on both sides of the valley and in the valley bottom. *Dryas* steps and *Dryas* stripes and large areas of snow-bed communities also occur in this valley.

However, it was necessary to move to Ukinyik Creek within the limestone formation, in order to obtain the Dryas fellfield on this substrate, the solifluction slope type, the Carex bigelowii high center polygon type, and the Eriophorum - Carex wet meadow type of flat wet areas similar to that found adjacent to the ponds north of Ogotoruk Creek.

In addition, several vegetation types not found in the Ogotoruk Valley occur in abundance in the control area. These types were described qualitatively and species lists were obtained for them, but these descriptions and lists have not been completed for this report.

The vegetation types that occur in both the Ogotoruk Valley and the control area are described below. Because they have been described in detail in the December, 1959 Botanical Report the types are only briefly described below.

The location and vegetation type of each of the ten control plots is given in Table 5.

Dryas fellfield type

The Dryas fellfield type is by far the most extensive vegetation type in the Lisburne area, due primarily to the large percentage of exposed ridges that occur in the area. Because the bedrock underlying these ridges is similar to that found in the Ogotoruk Creek area, the Dryas fellfield appears to be identical to those described in our December, 1959 Botanical Report.

The Dryas fellfield occurs on both limestone and on sandstone and shale substrate, and a permanent plot was placed on each of these two bedrock types. Control Plot 1 is located on shale and sandstone on a low shoulder (elevation 150 feet)of the hill that forms Cape Dyer. The plot appears identical to most of the Dryas fellfield plots found in the Ogotoruk Valley, especially those in the inland parts of the valley where Lupinus arcticus forms conspicuous clumps in the type.

The Dryas fellfield on limestone subtype occurs over extensive areas on the limestone ridges south of Cape Lisburne. Control Plot 10 is located at an elevation of 1,000 feet on the ridge that forms Cape Lewis. The vegetation of this plot is very similar to that found on the summit of Crowbill Ridge on the west side of Ogotoruk Creek. In addition to the Dryas mats, other mat plants including

TABLE 5. Location of vegetation plots in Cape Dyer-Cape Lewis control area, Summer 1960.

Control plot number	Vegetation type	Locality	Latitude	Longitude
1	*Dryas* fellfield on shale and sandstone	East side of Cape Dyer, Kipaloq Creek	68° 38' 40"	166° 13' 00"
2	*Eriophorum* tussock	Northeast side of Cape Dyer, Kipaloq Creek	68° 37' 55"	166° 10' 55"
3	*Dryas* steps	Kipaloq Creek	68° 38' 25"	166° 10' 50"
4	Snow-bed community	Kipaloq Creek	68° 38' 30"	166° 10' 05"
5	*Eriophorum*-*Carex* wet meadow	Kipaloq Creek	68° 39' 05"	166° 12' 50"
6	*Dryas* stripe	South slope of Cape Dyer, Kipaloq Creek	68° 38' 45"	166° 13' 40"
7	*Eriophorum*-*Carex* wet meadow	Ukinyik Creek	68° 44' 10"	166° 10' 30"
8	Solifluction slope	Ukinyik Creek	68° 43' 40"	166° 10' 00"
9	*Carex bigelowii* high center polygon	Ukinyik Creek	68° 44' 00"	166° 10' 45"
10	*Dryas* fellfield on limestone	Ukinyik Creek, South ridge	68° 42' 30"	166° 9' 30"

Salix arctica, Silene acaulis, Potentilla biflora, and Oxytropis nigrescens make up an important part of the vegetation cover. Fruticose and crustose lichens are scattered throughout the plot, except in areas of active frost action. The frequency, per cent cover, and per cent composition for these two plots are given in Table 6.

Eriophorum-Carex wet meadow type

This vegetation type is not common in the Cape Lisburne area because of the lack of level and gently sloping topography. It seems to occur more frequently in areas underlain with the shale and sandstone formation than in those underlain by the Lisburne Limestone. At Kipaloq Creek the wet meadow type occurs in broad sloping areas of poor drainage and on slopes at the head of small tributary streams. In the Ukinyik Valley this type was observed only in an old lagoon bed at the mouth of the creek.

This is the vegetation type of wet sites in the Ogotoruk Creek area and its scarcity in the control area is due primarily to lack of site rather than to any difference in precipitation between the two areas. In the Ogotoruk area the type occurs where there are deep deposits of sand and silt of Quarternary age on relatively level to gently sloping topography. This type of deposit and site was not common in the control area.

Two plots were established in this type in the control area; one most closely resembling the ridged wet meadow subtype (plot5) and the other the depressed-center polygons (Plot 7).

Control Plot 5 is located on a broad slope about one-half mile northeast of Cape Dyer. The vegetation is similar to that found in this type in similar areas in Ogotoruk Creek. The vegetation consists primarily of a cover of Carex aquatilis and Eriophorum angustifolium with an occasional small patch of small Eriophorum vaginatum tussocks. There are many frost scars in the plot and one can observe small ridges running parallel to the slope as have been described for this subtype in Ogotoruk Creek.

The vegetation in Control Plot 7 most closely resembles that found in the wet meadows adjacent to the ponds at Ogotoruk Creek, the depressed-center polygon subtype. The plot is located in an old lagoon that has been separated from the ocean by a high beach ridge that prevents even storm tides from flooding the lagoon.

TABLE 6. Per cent cover, per cent composition, and frequency of species in Plots 1 and 10 in the *Dryas* fellfield type in the Cape Dyer-Cape Lewis control area.

Species	Shale Subtype Plot 1			Limestone Subtype Plot 10		
	%-Cover	%-Comp.	Freq.	%-Cover	%-Comp.	Freq.
Dryas octopetala	27.8	49.0	80	35.0	45.3	90
Salix phlebophylla	5.8	10.2	50	.1	.1	10
Ochrolechia frigida	5.4	9.5	70	2.3	3.0	60
Cornicularia divergens	3.4	6.0	90	9.0	11.7	70
Kobresia myosuroides	2.9	5.1	70	1.4	1.8	50
Salix arctica	2.5	4.4	50	2.8	3.6	30
Silene acaulis	1.6	2.8	50	1.3	1.7	40
Luzula nivalis	1.2	2.1	50	-	-	-
Geum glaciale	1.0	1.8	20	-	-	-
Oxytropis arctobia	.6	1.1	10	-	-	-
Sphaerophorus globosus	.5	.9	10	.3	.4	20
Arenaria arctica	.5	.9	10	.2	.3	10
Lupinus arcticus	.4	.7	10	-	-	-
Ptilidium ciliare	.5	.9	10	-	-	-
Anemone multiceps	.4	.7	20	.4	.5	20
Oxytropis nigrescens	.3	.5	10	2.6	3.4	60
Saxifraga bronchialis	.2	.3	10	-	-	-
Arenaria dicranoides	.2	.3	10	-	-	-
Moss (Genus unknown)	.2	.3	10	-	-	-
Cladonia sp.	.2	.3	10	-	-	-
Cetraria islandica	.2	.3	10	-	-	-
Androsace chamajasme	.1	.2	20	-	-	-
Cetraria cucullata	.1	.2	10	.1	.1	10
Polygonum viviparum	.1	.2	20	-	-	-
Saxifraga hirculus	1.0	.2	10	-	-	-
Polytrichum sp.	.1	.2	10	-	-	-
Parmelia sp. (brown)	-	-	-	5.1	6.6	40
Parmelia sp. (black)	-	-	-	3.6	4.7	60
Lobaria sp.	-	-	-	2.6	3.4	70
Thamnolia vermicularis	-	-	-	1.6	2.1	50
Potentilla biflora	-	-	-	1.5	1.9	30
Dactylina arctica	-	-	-	.8	1.0	40
Moss (Genus unknown)	-	-	-	.7	.9	20
Poa sp.	-	-	-	1.7	2.2	30
Saxifraga oppositifolia	-	-	-	.6	.8	30
Cetraria nivalis	-	-	-	.5	.6	10
Pannaria sp.	-	-	-	.4	.5	20
Trisetum spicatum	-	-	-	.4	.5	10
Androsace ochotensis	-	-	-	.3	.4	20
Saxifraga escholtzii	-	-	-	.3	.4	10

TABLE 6. (Continued)

Species	Shale Subtype Plot 1			Limestone Subtype Plot 10		
	%-Cover	%-Comp.	Freq.	%-Cover	%-Comp.	Freq.
Cerastium sp.	-	-	-	.3	.4	20
Stereocaulon sp.	-	-	-	.3	.4	10
Alectoria ochroleuca	-	-	-	.2	.3	10
Arenaria rubella	-	-	-	.2	.3	10
Festuca brachyphylla	-	-	-	.2	.3	10
Pedicularis lanata	-	-	-	.1	.1	10
Rhytidium rugosum	-	-	-	.1	.1	10
Lloydia serotina	-	-	-	.1	.1	10
SUMMARY						
Vascular plants	44.9	80.5	-	49.3	64.1	-
Mosses	.7	1.4	-	1.0	1.0	-
Lichens	10.2	17.9	-	26.9	34.8	-
Bare ground and rocks	38.0	-	-	20.6	-	-

The surface of the old lagoon is level and there is a weakly formed polygonal pattern present. There was no standing water in the plot at the time that it was sampled, but at that time there had been no precipitation for nearly a month.

The vegetation of this plot consists of a mat of Carex aquatilis and Eriophorum angustifolium underlain by a moss layer which includes Rhytidium rugosum, Drepanocladus sp., and several other species. Scattered through this mat are Salix arbutifolia, Salix reticulata, and several herbaceous species.

Table 7 shows the frequency, per cent cover, and per cent composition for the two plots as obtained by the line intercepts.

Eriophorum tussock type

The tussock type occurs only in the southern part of the control area; it being entirely absent from the limestone areas. The only extensive areas of tussock that were seen in the control area occur on the broad benches south of Kipaloq Creek. There were no areas observed of the tussock subtype with polygons. The scarcity of the tussock type is probably due, as with the wet meadow type, to the rough topography and the lack of deposits of fine materials of Quarternary age.

Control Plot 2 in Kipaloq Creek is located about one mile inland on a gentle slope about one-half mile south of the creek (see Figure 3). The species composition in this plot appears to be quite similar to that found in the Eriophorum tussocks with frost scars subtype found in Ogotoruk Creek. In this plot the tussocks are 20 to 30 cms. in height and 25 to 40 cms. in diameter, a size that is somewhat less than that of most of the tussocks in Ogotoruk Valley. More than 50 per cent of the plot is occupied by frost scars in various stages of revegetation by Carex aquatilis and Eriophorum angustifolium. Both Betula nana and Salix pulchra occupy the tops of the tussocks and some of the areas between them. This is the only type in which sphagnum mosses occurred in abundance in the control area.

Per cent composition, frequency, and per cent cover for this plot are given in Table 8.

TABLE 7. Per cent cover, per cent composition, and frequency of species in Plots 5 and 7 in the Eriophorum-Carex wet meadow type in the Cape Dyer-Cape Lewis control area.

Species	Depressed Center Polygon Plot 7			Ridged Wet Meadow Plot 5		
	%-Cover	%-Comp.	Freq.	%-Cover	%-Comp.	Freq.
Carex aquatilis* / Eriophorum angustifolium	74.6	36.5	100	86.2	76.6	100
Mosses (several species)	100.0	48.9	100	-	-	-
Salix arbutifolia	12.4	6.1	100	14.7	13.1	90
Salix reticulata	5.4	2.6	70	1.9	1.7	30
Dryas integrifolia	5.1	2.5	100	-	-	-
Grass (basal leaves)	4.0	2.0	60	-	-	-
Pedicularis sp.	.8	.4	30	-	-	-
Saxifraga hirculus	.7	.3	50	-	-	-
Polygonum viviparum	.4	.2	50	.1	.1	20
Salix glauca	.4	.2	10	-	-	-
Equisetum variegatum	.2	.1	20	-	-	-
Caltha palustris	.2	.1	10	-	-	-
Eriophorum vaginatum	-	-	-	5.3	4.7	10
Hylocomium splendens	-	-	-	1.6	1.4	30
Aulacomnium palustris	-	-	-	1.5	1.3	30
Saxifraga cernua	-	-	-	.4	.4	40
Cetraria islandica	-	-	-	.2	.2	20
Saxifraga punctata	-	-	-	.2	.2	10
Aulacomnium turgidum	-	-	-	.2	.2	10
SUMMARY:						
Vascular plants	104.3	51.1	-	107.0	96.8	-
Mosses	100.0	48.9	--	3.3	2.9	
Lichens	-	-	-	.2	.2	-
Bare ground	-	-	-	-	-	-

*Also a small amount of Eriophorum russeolum.

TABLE 8. Per cent cover, per cent composition, and frequency of species in Plot 2 in the *Eriophorum* tussock type in the Cape Dyer-Cape Lewis control area.

	Eriophorum tussocks with frost scars Plot 2		
Species	%-Cover	%-Comp.	Frequency
Eriophorum vaginatum	24.2	28.6	90
Eriophorum angustifolium	12.8	15.2	70
Betula nana	12.2	14.4	80
Salix pulchra	11.1	13.2	90
Carex aquatilis	7.8	9.3	40
Sphagnum sp.	4.4	5.2	40
Aulacomnium palustris	1.8	2.1	40
Cetraria islandica	1.2	1.4	60
Polytrichum sp.	1.2	1.4	40
Hylocomium splendens	1.2	1.4	30
Aulacomnium turgidum	1.0	1.2	30
Dicranum sp.	1.0	1.2	30
Drepanocladus sp.	1.0	1.2	20
Cetraria cucullata	.7	.8	60
Carex bigelowii	.7	.8	10
Artemesia sp.	.3	.4	20
Cardamine bellidifolia	.2	.2	10
Peltigera aphthosa	.1	.1	10
Arctagrostis latifolia	.05	.1	10
SUMMARY:			
Vascular plants	5.0	69.4	-
Mosses	11.6	13.7	
Lichens	2.0	2.3	
Bare ground	5.0	-	-

Eriophorum-Carex solifluction slope type

Solifluction slopes identical to those found along the west side of Ogotoruk Valley were not found in the control area. However, several stands somewhat similar to this type occur along the slopes between Ukinyik Creek and the steep limestone ridges that mark the edge of the valley. One such stand, located about one mile inland on the north-facing slope of the valley, was considered to be suitable for a control plot in this type.

Control Plot 8 was established on a 5 to 8 degree slope in this stand. The solifluction lobes in this plot are smaller in size than those of the same type in Ogotoruk Valley, being 50 to 100 cms. in height and only 3 to 4 meters in length. The surface of the plot between the solifluction lobes is uneven, thus lending itself to a complex mosaic of vegetation.

The slopes between the solifluction lobes are covered primarily by a mat of Dryas integrifolia, Carex bigelowii, and Salix reticulata. In the depressions below the solifluction lobes, clumps of Salix pulchra and Salix glauca usually occur.

The important species in Control Plot 8 are listed in Table 9.

Carex bigelowii high center polygon type

This vegetation type has limited distribution in both the Ogotoruk Valley and the control area. In the latter the type was found only in Ukinyik Valley on a bench above the lagoon at the mouth of the creek. Plot number 9 is located in this stand.

This type in Ukinyik Creek is characterized by polygons five to eight meters in diameter that are marked by depressions 50 to 100 cms. in depth. These depressed borders between the polygons are steep sided and usually only one to two meters in width.

The vegetation on the high center polygons consists mainly of a loose mat of Carex bigelowii interspersed with many species, the most conspicuous being Polygonum bistortum, Arctogrostis latifolia, Dryas integrifolia, Petasites frigidus, and Salix pulchra. Mosses, especially Rhytidium rugosum and Hylocomium splendens, form a nearly continuous cover under the other vegetation. The depressions marking the polygons are wetter than the centers and consist mainly of a mat of Carex aquatilis and Eriophorum angustifolium.

In Table 10 is a list of the important species found in the plot, their frequency, per cent cover, and per cent composition.

TABLE 9. Per cent cover, per cent composition, and frequency of species in Plot 8 in the *Eriophorum*-*Carex* solifluction slope type in the Cape Dyer-Cape Lewis control area.

Species	Plot 8		
	%-Cover	%-Comp.	Frequency
Carex bigelowii	20.0	19.3	80
Eriophorum angustifolium	15.8	15.2	60
Dryas octopetala	13.6	13.1	100
Eriophorum vaginatum	9.4	9.1	70
Salix pulchra	8.4	8.1	80
Rhytidium rugosum	8.4	8.1	90
Salix reticulata	7.4	7.1	60
Moss (Genus unknown)	7.3	7.0	50
Carex aquatilis	3.6	3.5	20
Pleurozium schreberi	2.4	2.3	50
Cetraria cucullata	1.0	.9	50
Lobaria linita	.7	.7	10
Peltigera aphthosa	.6	.6	20
Aulacomnium palustris	.5	.5	10
Dicranum sp.	.4	.4	10
Petasites frigidus	.4	.4	10
Luzula nivalis	.4	.4	20
Pedicularis sp.	.4	.4	30
Astragalus umbellatus	.4	.4	10
Cetraria islandica	.6	.6	20
Valeriana capitata	.3	.3	10
Papaver sp.	.2	.2	10
Juncus triglumis	.2	.2	10
Polygonum viviparum	.2	.2	10
Grass (basal leaves)	.2	.2	20
Equisetum variegatum	.2	.2	20
Saxifraga hirculus	.2	.2	20
Salix glauca	.2	.2	10
Aulacomnium turgidum	.2	.2	10
Equisetum arvense	.1	.1	10
Stellaria ciliatosepala	.1	.1	10
Thalictrum alpinum	.1	.1	10
SUMMARY:			
Vascular plants	82.3	78.6	-
Mosses	19.2	18.5	-
Lichens	2.2	2.6	-
Bare ground	1.4	-	-

TABLE 10. Per cent cover, per cent composition, and frequency of species in plot 9 in the *Carex bigelowii* high center polygon type in the Cape Dyer-Cape Lewis control area.

Species	Plot 9 %-Cover	Plot 9 %-Comp.	Plot 9 Freq.
Carex bigelowii	33.4	30.4	100
Dryas octopetala	11.1	10.1	100
Salix reticulata	8.2	7.5	100
Rhytidium rugosum	7.9	7.2	90
Salix pulchra	7.0	6.4	50
Eriophorum angustifolium	4.8	4.4	30
Aulacomnium turgidum	4.0	3.6	50
Luzula nivalis	3.6	3.3	50
Hylocomium splendens	3.3	3.0	70
Carex aquatilis	2.5	2.3	30
Salix glauca	2.4	2.2	40
Cetraria cucullata	2.2	2.0	80
Cetraria islandica	1.9	1.7	60
Petasites frigidus	1.6	1.5	40
Astragalus umbellatus	1.1	1.0	60
Anemone narcissiflora	1.1	1.0	30
Moss (Genus unknown)	1.0	.9	20
Valeriana capitata	1.0	.9	40
Kobresia myosuroides	1.0	.9	10
Cerastium sp.	.9	.8	20
Polygonum bistortum	.9	.8	50
Lobaria linita	.9	.8	20
Poa arctica	.8	.7	20
Polygonum viviparum	.7	.6	40
Drepanocladus sp.	.7	.6	10
Saxifraga hirculus	.5	.5	10
Oxytropis leucantha	.4	.4	10
Stellaria ciliatosepala	.4	.4	50
Dicranum elongatum	.4	.4	10
Peltigera scabrosa	.4	.4	10
Polemonium acutiflorum	.4	.4	20
Salix arctica	.3	.3	10
Hedysarum alpinum	.3	.3	20
Saussaurea angustifolia	.3	.3	40
Polytrichum sp.	.3	.3	10
Pedicularis capitata	.3	.3	40
Ochrolechia frigida	.3	.3	10
Saxifraga punctata	.2	.2	10
Thamnolia vermicularis	.2	.2	10
Thalictrum alpinum	.2	.2	10
Cardamine microphylla	.1	.1	10
Dactylina arctica	.1	.1	20
Gentiana propinqua	.1	.1	10
Papaver radicatum	.1	.1	10
SUMMARY			
Vascular plants	86.4	78.6	-
Mosses	17.6	16.0	-
Lichens	6.0	5.3	-
Bare ground	-	-	-

Dryas steps and stripes type

Both Dryas steps and Dryas stripes occur commonly in the con trol area both in the limestone region and in the area underlain by sandstone and shale. The subtypes appear to be identical to those found in Ogotoruk Valley.

Control Plot 3, in the Dryas steps subtype, is located on the western slope of the large mountain in the center of Kipaloq Valley, about one mile inland from the coast (Figure 3). The steps formed in this type are 100 to 200 cms. across and 50 to 75 cms. on the rise. The flat surface of the steps is colonized mainly by herbaceous plants, especially legumes, while Dryas mats form an almost continuous cover along the edges and rises of the steps. Several legumes, especially Oxytropis leucanths and Oxytropis maydelliana form conspicuous clumps within the Dryas mats.

The Dryas stripe plot (Control Plot 6) is located on the steep south-facing slope of Cape Dyer, just north of the mouth of Kipaloq Creek. The vegetation consists of mats of Dryas octopetala forming stripes that alternate with lichen covered rocks up and down the slope. Scattered in the Dryas mats are occasional clumps of Oxytropis pigrescens, Polygonum viviparum, Silene acaulis, and Saxifraga bronchialis. The surface of the rock stripes are covered with crustose and occasionally fruticose lichens. In addition these rock stripes are colonized by Senecio residifolius, Campanula uniflora, Saxifraga flagellaris, and Androsace ochotensis.

Frequency, per cent cover, and per cent composition are given in Table 11 for the species in these plots.

Snow-bed communities

Large snow fields occur commonly in the control area due to the rugged topography that creates numerous snow accumulation areas. There is a great variation in the vegetation in snow-beds depending on many factors such as steepness and direction of slope, parent material, depth of snow, and duration of the snow in the spring and summer. It is impossible to describe a snow-bed that is typical of either the Ogotoruk Valley or of the control area because of the great variation of snow-bed communities within each of the areas.

TABLE 11. Per cent cover, per cent composition, and frequency of species in Plots 3 and 6 in the *Dryas* steps and stripes type in the Cape Dyer-Cape Lewis control area.

Species	*Dryas* steps Plot 3			*Dryas* stripes Plot 6		
	%-Cover	%-Comp.	Freq.	%-Cover	%-Comp.	Freq.
Dryas octopetala	47.4	67.5	100	33.4	65.9	90
Salix arctica	5.2	7.4	60	.8	1.6	20
Oxytropis leucantha	5.2	7.4	50	-	-	-
Astragalus polaris	2.6	3.7	70	-	-	-
Moss (Genus unknown)	1.0	1.4	10	-	-	-
Salix reticulata	.8	1.1	10	-	-	-
Astragalus alpinus	.8	1.1	30	-	-	-
Arenaria arctica	.8	1.1	30	.3	.6	20
Artemesia sp.	.8	1.1	30	-	-	-
Cornicularia divergens	.8	1.1	30	4.8	9.5	90
Thamnolia vermicularis	.7	1.0	40	.1	.1	10
Astragalus umbellatus	.6	.9	20	-	-	-
Kobresiä myosuroides	.6	.9	50	2.8	5.5	80
Silene acaulis	.6	.9	20	.3	.6	10
Oxytropis arctobia	.6	.9	20	-	-	-
Cetraria nivalis	.5	.8	40	.1	.1	10
Ochrolechia frigida	.4	.6	10	2.4	4.7	60
Potentilla sp.	.2	.3	10	-	-	-
Potentilla biflora	.2	.3	10	-	-	-
Luzula nivalis	.2	.3	10	-	-	-
Senecio residifolius	.2	.3	20	-	-	-
Carex scirpoidea	.2	.3	30	-	-	-
Oxytropis maydelliana	.2	.3	10	-	-	-
Oxytropis nigrescens	-	-	-	2.6	5.1	50
Salix phlebophylla	-	-	-	.6	1.2	20
Saxifraga bronchialis	-	-	-	.6	1.2	30
Anemone multiceps	-	-	-	.3	.6	20
Lobaria sp.	-	-	-	.3	.6	10
Smelowskia calycina	-	-	-	.3	.6	30
Androsace ochotensis	-	-	-	.2	.4	10
Bupleurum americanum	-	-	-	.2	.4	10
Castilleja pallida?	-	-	-	.2	.4	10
Umbillicaria sp.	-	-	-	.1	.2	10
Alectoria ochroleuca	-	-	-	.2	.4	10
Poa sp.	-	-	-	.1	.2	20
Thamnolia vermicularis	-	-	-	.1	.1	10
SUMMARY:						
Vascular plants	66.8	95.8	-	42.4	84.3	-
Mosses	1.0	1.4	-	-	-	-
Lichens	2.4	3.5	-	8.3	15.7	-
Bare rock	39.4	-	-	46.8	-	-

Quantitative work was not attempted on the snow-bed communities in Ogotoruk Valley because of this variation. However, in the control area, several snow-bed communities were described and a permanent plot set in one, because it was thought desirable to sample the vegetation and small mammals in at least one of the more common snow-bed communities in the control area.

Control Plot 4 is located on a steep west-facing slope of the mountain in the center of Kipaloq Valley. It is centered in a large snow-bed that forms along the whole west end of the mountain. The stand is heterogeneous due to the unevenness of the terrain within the plot, although most of the plot is probably covered by snow in winter. About 50 per cent of the plot consists of a mat of Cassiope tetragona interspersed with Carex spp., Papaver sp., and Bovkinia richardsonii; the latter occupying the deeper depressions in the slope. The type most closely approximates the ericaceous snow-bed community as described in the December, 1959 Botanical Report for Ogotoruk Creek.

Table 12 gives a listing of the frequency, per cent cover, and per cent composition of the main species in the plot.

Other vegetation Types

Several minor vegetation types occurring in Ogotoruk Creek were not located and sampled in the control area. These include Carex bigelowii frost scar type (now considered as an ecotone community in Ogotoruk Valley - see Page 39 of this report), ericaceous shrub polygon type, and saline marsh type. Gravel bars and bench communities occur in the Kipaloq and Ukinyik valleys, but they are not similar to those found in Ogotoruk Creek.

Several vegetation types occurring in the control area, but not in Ogotoruk Creek, were described during the summer of 1960 and species lists were made in many of them. A description of the more important of these types will be included in the 1961, June report.

TABLE 12. Per cent cover, per cent composition, and frequency of species in Plot 4 in a snow-bed community in the Cape Dyer-Cape Lewis control area.

Species	Plot 4 %-Cover	Plot 4 %-Comp.	Plot 4 Freq.
Cassiope tetragona	45.0	48.8	100
Dryas octopetala	13.6	14.8	70
Salix reticulata	7.9	8.6	70
Salix polaris	4.5	4.9	90
Cetraria islandica	3.7	4.0	60
Carex scirpoidea	2.6	2.8	50
Boykinia richardsonii	2.8	3.0	50
Carex sp.	2.2	2.4	40
Arctostaphylos alpinus	1.9	2.1	10
Silene acaulis	.8	.9	10
Vaccinium uliginosum	.7	.8	20
Tofieldia coccinea	.6	.7	20
Arctagrostis latifolia	.6	.7	20
Rhytidium rugosum	.5	.5	10
Equisetum scirpoides	.5	.5	20
Oxytropis nigrescens	.4	.4	10
Astragalus umbellatus	.4	.4	10
Anemone narcissiflora	.4	.4	20
Luzula nivalis	.4	.4	20
Cetraria cucullata	.4	.4	10
Arnica sp.	.3	.3	10
Cetraria nivalis	.3	.3	10
Saxifraga punctata	.3	.3	20
Anemone parviflora	.3	.3	20
Polygonum viviparum	.2	.2	20
Dactylina arctica	.2	.2	10
Arenaria arctica	.2	.2	10
Stereocaulon sp.	.1	.1	10
Cardamine purpurea	.1	.1	10
Cetraria dilesii	.1	.1	10
Polygonum bistortum	.2	.2	10
Potentilla biflora	.1	.1	10
Saxifraga reflexa	.1	.1	10
SUMMARY:			
Vascular plants	86.4	94.4	-
Mosses	.5	.5	-
Lichens	4.8	5.1	-
Bare ground	3.3	-	-

FLORISTIC SURVEY

The floristic survey of Ogotoruk Valley and surrounding area was continued during the summer of 1960, and a collection of all plants that occur in the control area was attempted. These collections have not as yet been completely processed and most of the field identifications have not been checked.

In Ogotoruk Valley collections were concentrated in habitats that had not been thoroughly investigated the previous summer. These included the many ponds between Ogotoruk Creek and the Kukpuk River, the limestone ridges at Cape Thompson, the limestone hills adjacent to the Kukpuk River, the gravel bars of the Kukpuk River, talus slopes, etc. In addition, collections were concentrated in the groups which contain special taxonomic problems in arctic areas such as the grasses, sedges, the Cruciferae, and *Papaver* and *Potentilla*. We also collected additional specimens of species that were still undetermined from the 1959 summer's collections.

Introduced Species

An attempt was made to find species that might have been introduced into the valley through the activities of man. Project Chariot provides an ideal situation for determining how rapidly man introduces plants into the arctic, because the flora of the valley is relatively well-known from our 1959 collections and previous to that summer there had been little disturbance by man.

The disturbed tundra between the camp and the beach offers an ideal seed bed for seeds that might have been transported in the material that was brought to Ogotoruk Creek by barge. These areas were thoroughly examined during the late summer of 1960.

Only one species, *Montia lamprosperma*, was found in this disturbed tundra. This species may have been introduced, but because it occurs naturally along the coast as far north as Kotzebue, it is possible that it occurred previously in Ogotoruk Valley but was overlooked during our 1959 floristic survey. The plant is small and could easily have been missed.

It is expected that during the summer of 1961 some introduced species such as are common in most of the villages along the coast will be found in Ogotoruk Valley. A continued search will be made for the occurrence of these introduced species.

Status of the Collections

Vascular plants

All of the 1959 collections have been identified, except for 53 specimens sent to Dr. Eric Hultén at Stockholm in February of 1959. Duplicates of most of these unknowns have also been sent to Dr. Albert W. Johnson, currently in Oslo, Norway. We expect to have determinations of these specimens before the June, 1961 report.

The 1960 collections from the control area and from the Ogotoruk Creek region are still being processed in the Herbarium of the University of Alaska. The undetermined plants from this collection will be sent out to various authorities during February of 1961.

Mosses and lichens

About 50 per cent of the mosses and lichens from the 1959 collections have been identified. Most of these were reported in the June, 1960 Botanical Report. The remainder are presently being studied by Dr. Weber and Dr. Shushan at the University of Colorado. In addition, duplicates of all the mosses and lichens have been sent to Dr. Johnson at Oslo. The macro-lichens are presently being examined by Hilda Krog at Oslo, who has been working on a macro-lichen flora of Alaska. She reports that one *Cetraria* collected in 1959 is probably a new species. The moss specimens will be taken to Dr. H. Persson of Stockholm, Sweden, the recognized authority on Alaskan mosses. It is hoped that the remainder of these specimens will be determined before the June, 1961 report.

In 1960 extensive collections of mosses and lichens were made in the area between Cape Dyer and Cape Lisburne, and some additional specimens were collected in the Ogotoruk Valley and Kukpuk River areas. These collections are presently being processed in the University of Alaska Herbarium. As many of these specimens as possible will be identified at the University of Alaska and the remainder will be sent out to various authorities for determination.

Additions to the Flora

A number of additional species were found in Ogotoruk Creek during the summer of 1960, and several of these have been positively determined. In addition a few of the unknown species from our 1959 collections have been identified since the June, 1960 Botanical

Report. These additions to the flora of the Ogotoruk region are listed below. They bring the total number of vascular plants known to occur in the area to 293. The 57 lichens and 50 mosses reported to date from the area represent about 50 per cent of our collections.

Mosses

Amblystegiella sprucei (Bruch) Loeske. In the Dryas stripe type.

Encalypta rhabdocarpon Schw. In the Dryas stripe type.

Philontis tomentella Mol. Ecotone community and in the Eriophorum-Carex solifluction slope type.

Sphagnum balticum Russ. In depression in the Eriophorum vaginatum tussock type.

Sphagnum fuscum (Schp.) Klinggr. In depression in the Eriophorum vaginatum tussock type.

Sphagnum nemoreum Scop. In depressions in the Eriophorum vaginatum tussock type.

Tetraplodon pallidus One clump in a wet spot on the slope of Crowbill Ridge.

Vascular Plants

Equisetum variegatum Schleich. In wet areas surrounding ponds and in the Eriophorum-Carex solifluction slope type.

Sparganium hyperboreum Laest. Common in the ponds between the Ogotoruk Creek and the Kukpuk River.

Potamogeton filiformis Pers. In a small pond in the Kukpuk River valley.

Festuca baffinensis Polunin. On the gravel bars of Ogotoruk Creek and the Kukpuk River.

Carex maritima Gunn. In seepage areas below limestone ridges in Ogotoruk Valley and the Kukpuk River Valley.

Montia lamprosperma Cham. Collected once in 1960 on the disturbed mud between Chariot main camp and the beach.

Arenaria physodes Fisch. ex DC. On the gravel bars of Ogotoruk Creek.

Astragalus polaris (Seem.) Benth. On the gravel bars of the Kukpuk River.

Epilobium angustifolium L. On an old sod house at the edge of the lagoons north of Cape Thompson.

Angellica lucida L. Scattered along the driftwood zone at the mouth of Ogotoruk Creek.

Campanula uniflora L. Scattered in the Dryas fellfield type.

Aster alpinus L. Very rare along the steep banks above the Kukpuk River.

Senecio congestus (R. Br.) DC. Two clumps seen on gravel bar of tributary of Ogotoruk Creek.

VEGETATION MAP

A final vegetation map of the Ogotoruk Valley has been assembled from information gathered during 1959 and 1960 (see attached map). A large part of the valley was mapped in 1959, while the northeastern, eastern, and southeastern portions were mapped in 1960. Field checks of communities mapped in 1959 were made during 1960 resulting in some modifications of the original boundaries outlined.

In addition to the boundary revisions on the final map, the name *Carex bigelowii* frost scar type (designated FS on the preliminary map) has been dropped and the name Ecotone communities adopted. When originally described, the *Carex bigelowii* frost scar type appeared to be homogeneous and to have certain characteristic features; the prevalence of pavement type frost scars, the predominance of *Carex bigelowii*, and the position of the community at the base of slate ridges seemed to make it a distinct type. However, through additional observations and comparison of supposedly similar areas throughout the valley, great diversity in species composition and general appearance of the type was found. *Carex bigelowii* in many instances was subdominant to *Dryas octopetala* and/or *Salix* spp. (*S. pulchra* and *S. arbutifolia*), while in other areas *C. bigelowii* was found to be dominant and *D. octopetala* and/or *Salix* spp. absent. In still other areas, these species appeared to share dominance, while minor species which were thought to be characteristic of the type were often sporadic in occurrence. Furthermore, moisture relations varied a great deal. Thus, the type was found to be very heterogeneous. The term frost scar, in addition, was considered to be misleading as it infers that this is the only community in which frost scars are found or are important. This inference is nottrue as frost scars are common in practically all communities throughout the valley.

Since these areas are composed of an admixture of species in variable proportions, they appear to be transitional to adajacent communities. Thus, the name Ecotone communities is considered to be more descriptive. This does not deliniate the areas as to a specified type, but implies diversity, the amount of which depends on the specific conditions of the locality, such as slope, snow accumulation, species present in adjacent communities, and moisture relations. Because of this, the Ecotone communities are considered not to occupy a specific ecological niche, but several, as they may occur at the junction of several well-defined types. A more detailed description of the Ecotone communities will be presented in the June report.

A second name change has been made: the name of the vegetation type referred to in the December, 1959 and June, 1960 Botanical Reports as "mixed grass-sedge saline marsh" has been shortened to "saline marsh".

The vegetation map which is attached to this report is a modified, complete, and improved version of the preliminary vegetation map attached to the December, 1959 Botanical Report. A new base map was traced on vellum from the original base map (for compilation of original, consult December, 1959 Botanical Report). A copy of this base map was made on photocloth and the boundaries of the vegetation types placed on this copy. An overlay of various Zip-A-Tone patterns were placed within these boundaries and represent the different vegetation types and communities. This product was in turn reproduced on high fiber content paper for the final printed copies.

The master copy of the base contour map of the Ogotoruk Creek drainage, at a scale of approximately 1/20,000 and without the vegetation types, is available at the University of Alaska. Copies of this map at the scale of 1/20,000 or at a reduced scale can be provided to Chariot investigators at cost.

SEED GERMINATION STUDIES

Seeds, collected in the summer of 1959 from 27 species of plants which occur commonly in Ogotoruk Valley, were tested for germination in the spring of 1960. The germination studies were still in progress when the June, 1960 Botanical Report was prepared; therefore, the data included in the report at that time were incomplete. For a presentation of methods used in the study, however, the reader is referred to this June report. The final results of these tests and discussion of their significance is presented in the following pages and in Tables 13, 14, and 15.

Discussion

Germination occurred in 14 out of the 26 species tested. Causes for the lack of response in the 13 species which did not show germination are unknown. The species which did not germinate (see Table 15) included 4 sedge species (Cyperaceae), 3 ericaceous species, 3 lousewort species (*Pedicularis*), and 1 each of Woodrush (*Luzula*), Lupine (*Lupinus*), and Saxifrage (*Saxifraga*). Bliss (1958) had similar results with some of the same species. In Bliss's study, *Empetrum nigrum* and *Pedicularis lanata* did not germinate under any test condition; *Carex aquatilis* and *Carex bigelowii* demonstrated no germination in the dark but both showed a low per cent germination in the light; *Cassiope tetragona* showed no response in the dark, but showed a high per cent germination in the light; *Eriophorum angustifolium* demonstrated a low per cent germination in both light and dark; and *Lupinus arcticus* showed a high per cent germination in both light and dark. We obtained the same results for *Empetrum nigrum* as did Bliss. A comparison of the other species with Bliss's study can be made only with results which he obtained for seeds tested in the dark. Discounting possible variations due to differences in temperature between the two studies, we can say that our results under dark conditions are comparable to those of Bliss, except for *Eriophorum angustifolium* and *Lupinus arcticus*. In our seeds of *E. angustifolium*, no germination occurred, whereas Bliss, with samples three times as large as ours, showed a low per cent germination for this species. Slightly different results were obtained for *L. arcticus*. No germination occurred with our seeds of this species but Bliss recorded a high per cent germination using a sample smaller than ours.

TABLE 13. Final results of 1959 germination tests on seeds from Ogotoruk Creek (excluding species which did not germinate and which are listed on Table 14).

Species	Vegetation type in which coll.	CONDITIONS OF TEST			GERMINATION			
		Location	Ave. temp. range °F.	Light or dark	No. seeds tested	No. days in test	Min. no. days for germin.	Per cent germination
Allium schoenoprasm	--	Incubator	71°-79°	dark	100	23	3	75.0
Arenaria arctica	DS#	"	"	dark	100	23	3	31.0
Astragulus alpinus	DS	Greenhouse	69°-75°	light	77*	31	16	1.2
		"	"	dark	97	32	2	3.0
		Greenhouse	63°-70°	light	96	31	ND**	0.0
		"	"	dark	90	32	33	1.1
		Greenhouse	52°-64°	light	100	31	ND	0.0
		"	"	dark	100	32	ND	0.0
Betula nana	T	Incubator	71°-79°	dark	100	23	5	3.0
Dryas octopetala	EP	Greenhouse	69°-75°	light	100	19	14	1.0
		"	"	dark	100	19	ND	0.0
		Greenhouse	52°-64°	light	100	19	ND	0.0
		"	"	dark	100	19	ND	0.0
		Incubator	71°-79°	dark	100	12	ND	0.0

Refer to December Report 1959 (pg.21) for meaning of abbreviations.

* Counts of less than one hundred seeds, indicate certain seeds had to be removed beaause of destruction by fungus.

**The ND symbol indicates the minimum number of days required for germination had not been determined at the conclusion of the test series.

TABLE 13. Final results of 1959 germination tests on seeds from Ogotoruk Creek (excluding species which did not germinate and which are listed on Table 14).

Species	Vegetation type in which coll.	CONDITIONS OF TEST			GERMINATION			
		Location	Ave. temp. range °F.	Light or dark	No. seeds tested	No. days in test	Min. no. days for germin.	Per cent germination
Eriophorum viginatum	T	Greenhouse	69°-75°	light	100	31	6	48.0
		"	"	dark	100	32	7	16.0
		Greenhouse	63°-70°	light	99	31	7	39.3
		"	"	dark	100	32	11	9.0
		Greenhouse	52°-64°	light	100	31	21-26	5.0
		"	"	dark	100	32	27-32	1.0
Hedysarum alpinum	--	Incubator	71°-79°	dark	20	23	13	5.0
Juncus castaneus	--	Greenhouse	69°-75°	light	100	19	8	1.0
		"	"	dark	100	19	ND	0.0
		Greenhouse	52°-64°	light	100	19	8	13.0
		"	"	dark	100	19	ND	0.0
		Incubator	71°-79°	dark	100	12	ND	0.0
Oxyria digyna	SB	Greenhouse	69°-75°	light	100	19	5	27.0
		"	"	dark	100	19	5	6.0
		Greenhouse	52°-64°	light	100	19	5	34.0
		"	"	dark	100	19	5	16.0
		Incubator	71°-79°	dark	100	23	3	18.0

TABLE 13. Final results of 1959 germination tests on seeds from Ogotoruk Creek (excluding species which did not germinate and which are listed on Table 14).

Species	Vegetation type in which coll.	CONDITIONS OF TEST			GERMINATION			
		Location	Ave. temp range $^\circ$F.	Light or dark	No. seeds tested	No. days in test	Min. no. days for germin.	Per cent germination
<u>Oxytropis nigrescens</u>	DF	Greenhouse	69°-75°	light	88	31	2	21.5
		"	"	dark	72	32	2	13.8
		"	63°-70°	light	95	31	1	13.5
		"	"	dark	49	32	2	12.2
		"	52°-64°	light	93	31	3	6.4
		"	"	dark	94	32	3	12.7
<u>Oxytropis arctobia</u>	DF	Greenhouse	69°-75°	light	92	31	1	14.1
		"	"	dark	100	32	2	7.0
		"	63°-70°	light	99	31	1	7.0
		"	"	dark	96	32	2	10.4
		"	52°-64°	light	97	31	2	12.3
		"	"	dark	96	32	2	8.3
<u>Petasites frigidus</u>	GB	Greenhouse	69°-75°	light	100	19	5	4.0
		"	"	dark	100	19	8	6.0
		"	52°-64°	light	100	19	5	46.0
		"	"	dark	100	19	8	26.0
		Incubator	71°-79°	dark	100	12	8-15	59.0

TABLE 13. Final results of 1959 germination tests on seeds from Ogotoruk Creek (excluding species which did not germinate and which are listed on Table 14).

Species	Vegetation type in which coll.	CONDITION OF TEST: Location	Ave. temp. range °F.	Light or dark	GERMINATION: No. seeds tested	No. days in test	Min. no. days f. germin.	Per cent germination
<u>Rumex</u> <u>arcticus</u>	T.	Greenhouse	69°-75°	light	100	31	2	29.0
		"	"	dark	100	32	4	16.0
		"	63°-70°	light	100	31	3	10.0
		"	"	dark	99	32	2	12.1
		"	52°-64°	light	100	31	9	21.0
		"	"	dark	100	32	3	22.0
<u>Saxifraga</u> <u>bronchialis</u>	EP	Greenhouse	69°-75°	light	100	19	8	21.0
		"	"	dark	100	19	8	1.0
		"	52°-64°	light	100	19	8-11	18.0
		"	"	dark	100	19	ND	0.0
		Incubator	71°-79°	dark	100	23	ND	0.0

Table 14. Calculated "Z" values* for 1959 Ogotoruk Creek seeds tested under various conditions.

Species	at 69°-75° between light & dark	at 63°-70° between light & dark	at 52°-64° between light & dark	in light between 69°-75° & 63°-70°	in light between 69°-75° & 52°-64°	in light between 63°-70° & 52°-64°	in dark between 69°-75° & 63°-70°	in dark between 69°-75° & 52°-64°	in dark between 63°-70° & 52°-64°
Astragulus alpinus	.79	1.02	**	1.03	1.03	**	1.00	1.73	1.07
Eriophorum vaginatum	4.82	4.97	1.67	1.27	6.89	5.80	1.50	4.31	2.59
Juncus castaneus	1.00	--	3.73	--	3.33	--	--	**	--
Oxyria digyna	4.00	--	2.94	--	1.08	--	--	2.26	--
Oxytropis nigrescens	1.27	.22	1.45	1.43	2.95	1.61	.26	.21	.09
Oxytropis arctobia	1.61	.84	.91	1.60	.37	1.25	.84	.34	.50
Petasites frigidus	.65	--	2.95	--	6.86	--	--	3.86	--
Rumex arcticus	2.20	.47	.17	3.39	1.31	2.15	.79	1.08	1.85
Saxifraga bronchialis	4.52	--	4.45	--	.54	--	--	1.00	--

*These values are based on the Standard error of difference of proportions test. The plus and minus sign for each number has been left out in this chart. Values of 1.96 or higher indicate a significant difference at the 5% level between per cent germination for the conditions indicated at the top of the column. Values of 2.58 or higher indicate a significant difference at the 1% level.

**Can not be tested because no germination took place in either condition.

TABLE 15. List of 1959 seeds from Ogotoruk Creek which did not respond to germination tests.*

Species	No. of Seeds Tested	Max. No. of Days in Tests
Carex aquatilis	100	23
Carex bigelowii	100	23
Carex membranacea	493	23
Cassiope tetragona	100	17
Diapensia lapponica	100	23
Empetrum nigrum	498	32
Eriophorum angustifolium	100	23
Lupinus arcticus	100	23
Luzula nivalis	100	23
Pedicularis lanata	99	12
Pedicularis pennelli	600	33
Pedicularis sp.	50	12
Saxifraga hirculus	499	23

*For information on the test conditions see the June 1960 Botanical Report, especially Table 2.

The failure of seeds of some species to germinate should not be interpreted as meaning they were non-viable; it is quite possible that the essential conditions for germination were not provided in our tests.

Some species responded well to a variety of tests and demonstrated significant differences in per cent germination between two or more conditions (see Table 14). Seeds of some other species, which were tested in only one situation, showed a high per cent of germination, indicating that the test conditions were probably close to optimal or at least very favorable.

Per cent gernination varied greatly between species, ranging from a low of 1 per cent in _Dryas octopetala_ to a high of 75 per cent in _Allium schoenoprasm_. Rate of germination, that is the length of time necessary for the first seeds to germinate in any given test condition, was also quite variable. On the other hand, at least one species, _Oxyria digyna_, showed no differences in rate between four conditions, although there were significant differences in per cent germination between seeds in the light and those in the dark.

Of all the species tested, _Eriophorum vaginatum_ demonstrated the best response to various test conditions as illustrated by differences in both per cent and rate of germination. Seeds of this species showed a marked response to different temperature regimes, the highest germination per cent being recorded for seeds in the warmest room, and the lowest per cent for seeds in the coolest room (see Tables 13 and 14). The seeds also showed a significant difference in per cent germination between light and dark conditions. This difference showed in all three temperature regimes used, but was most pronounced at the higher temperatures (see Tables 13 and 14). Our test results are particularly interesting, because Bliss (_op. cit._) reported no germination in this species under dark conditions.

Some species, such as _Saxifraga bronchialis_, responded only to differences between light and dark with temperature making no significant difference. _Oxyria digyna_ responded similarly to light and dark and less so to differences in temperature. Just the reverse response is shown by _Petasites frigidus_ which demonstrated the most significant differences in per cent germination with temperature variation, but also showed a higher per cent germination in light than in dark.

Certain species, such as Astragalus alpinus and Oxytropis arctobia, showed no signifcant difference between any of the conditions even at the 5 per cent level, whereas Oxytropis nigrescens responded significantly between two temperature extremes in the light in one case, but not in any of the other test conditions. One species, Rumex arcticus, demonstrated such erratic differences that it defies interpretation without further tests.

In summary, nine of the fourteen species which showed germination responded signifcantly to a variety of test conditions. For some of these, light was a more important factor than temperature while the reverse was true for others. Several species responded more favorably to higher temperatures while at least one, Petasites frigidus, seemed to favor cold temperatures. All of the species seemed to prefer light over dark conditions. It is therefore clear that each species reacted individually to the various test conditions, and therefore, no grouping of the plants into categories of similar germination requirements is possible.

PALYNOLOGY

One of the objectives of the 1960 field season was to obtain pollen samples from peat and lake deposits that might yield information on the history of climatic changes of the Ogotoruk Creek region. To date, there are no published pollen profiles from the northwestern section of Alaska, and any pollen data that could be obtained would be useful not only to the knowledge of the Ogotoruk Creek environs but also to the over-all picture of climatic changes in Alaska.

Our review of the literature on this subject is not complete, but a few of the more important studies might be mentioned at this time. Heusser (1957) has reviewed the present status of palynology work in Alaska. Most of the studies of this nature have been conducted in southern and interior Alaska (Heusser, 1952, 1953, 1954, and 1955; Hanson, 1953; Rigg, 1914 and 1937; Bowman, 1934; and Chaney and Mason, 1936). Some studies of pollen have also been made in the adjacent parts of Canada by Hanson (1950, 1952, 1953, and 1955), Heusser (1956), Terasmae (1959), and Terasmae and Fyles (1958). Livingston (1955 and 1956) has obtained profiles from arctic Alaska, both north and south of the Brooks Range, and finds evidence for a postglacial period with a climate warmer and drier than that which exists in arctic Alaska today. Another study of significance in northern Alaska is that of Hopkins and Benninghoff (1953) who found evidence for an interglacial period in which the climate of the Seward Peninsula was much like that of southeastern coastal Alaska today. Information from the unglaciated area of northwestern Alaska might add considerably to our understanding of these regional climatic shifts.

Coring of peat deposits in arctic Alaska is made especially difficult by the presence of permafrost close to the surface. Special coring devices have been designed (Potzer, 1955; and Gerard, 1954) for coring into permafrost. During the spring of 1960, the University of Alaska had two permafrost bits similar to those described by Potzer designed and produced for use during the summer field season, but both of these bits proved to be ineffective in coring through the frozen deposits at Ogotoruk Creek. If cores are to be obtained from the Ogotoruk region, some other method of coring must be used, possibly that of Gerard (1954).

The 1960 field season was partially successful in that several pollen profiles were obtained in an area of eroding polygons northwest of the pond area between Ogotoruk Creek and the Kukpuk River. In this area active erosion and melting of the ice wedges have left thawed mounds with undisturbed profiles from which pollen samples could be obtained. By picking steep north-facing sides of these mounds (Figure 5) samples were taken with a mininum of danger of disturbance from slumping.

The profile in this area consisted of about 30 cms. of sod and decaying vegetation over 15 to 20 cms. of light gray silt and clay. Below this were nearly 2-meters of partially decayed moss and other organic materials. One macro-fossil at a depth of 2-meters was identified as Calliergon turgescens (T. Jens.) Kindb., a moss that occurs commonly in small ponds in the valley at the present time. Below this peat layer, and frozen in all the profiles that we examined, were about 2.5 meters of organic layers alternating with coarse alluvial deposits and interspersed with well preserved willow roots and stems. Pollen samples were taken at 10 cm. intervals throughout this profile and from the conspicuous organic layers in the lower deposit. The total section sampled was slightly over 4 meters in depth. Below this profile there was a frozen layer of coarser material with no apparent organic material.

The samples from these profiles have been preserved in alcohol at the University of Alaska. It is hoped that they can be analyzed during the spring of 1961.

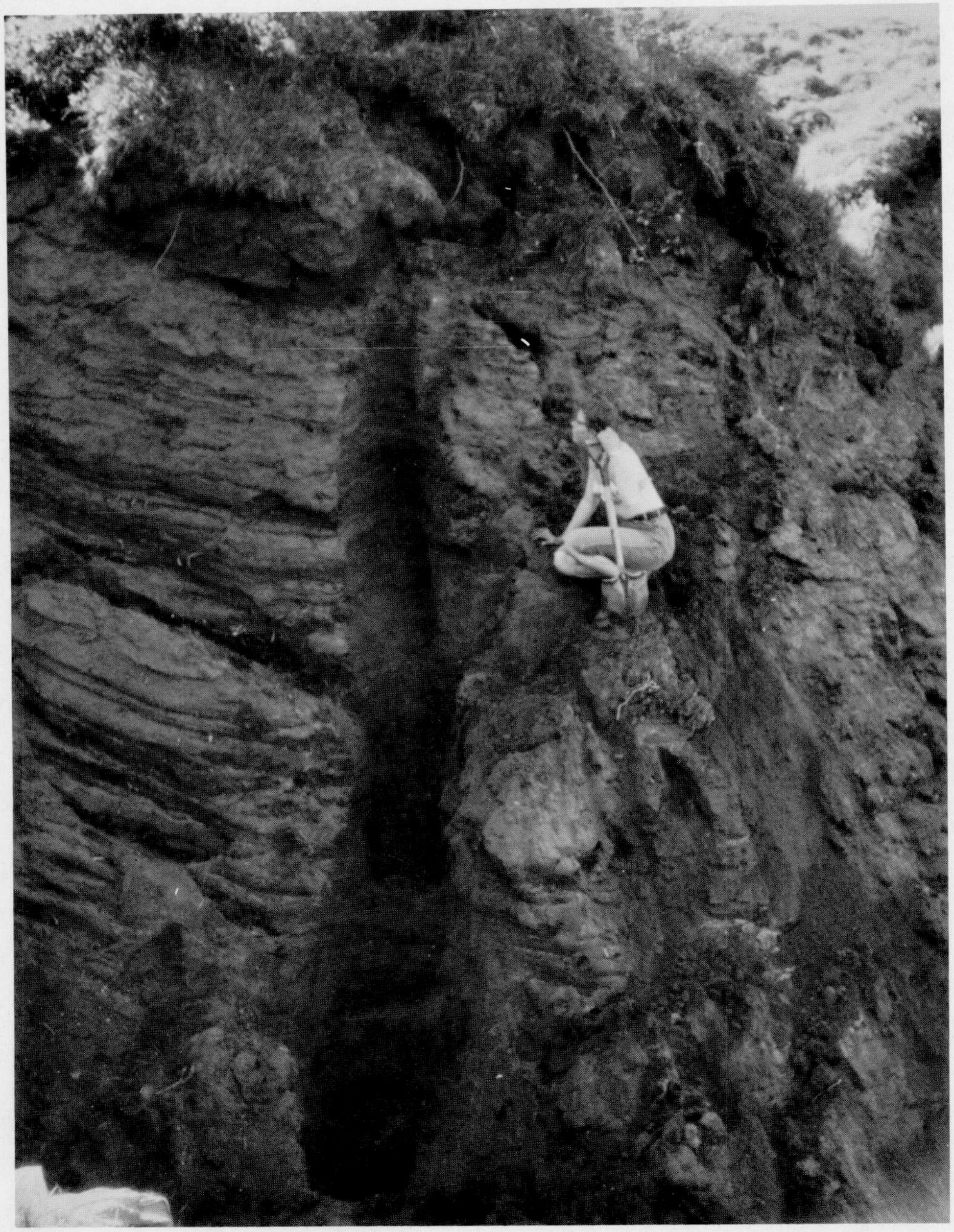


Figure 5. Steep north-facing side of a mound showing one of the profiles from which pollen samples were taken.

THE EFFECTS OF ARCTIC GROUND SQUIRREL ACTIVITIES ON VEGETATION

Arctic Ground Squirrels are rather prolific and social creatures and frequently populate large areas rather heavily. They are burrowing animals; and, while they are known to eat a great variety of foods, they are primarily herbivores. Because of these characteristics they exert a marked influence on the vegetation wherever they occur. In Ogotoruk Valley, where a basis for evaluating the effects of a nuclear explosion are desired, it is necessary first to learn more about natural factors of disturbance. Hence, this study of the effects of Arctic Ground Squirrels on the vegetation in the vicinity of Ogotoruk Creek has been initiated.

Intensive analyses of data gathered during the 1960 field season has been postponed until after the completion of this December, 1960 Botanical Report. Therefore, only preliminary remarks based on field observations can be made at this time. A comprehensive report, however, will be submitted in June, 1961.

Observations of ground squirrels made at Ogotoruk Creek throughout the 1960 field season provide us with the following list of activities which affect the vegetation:

a. Foraging: includes locating and consuming plant tops and roots.

b. Burrow construction: includes large home burrows, individual "poke" holes, house cleaning of existing burrows, and possibly small specialized burrows for hibernation.

c. Nest building: gathering principally sedges and grasses as nest material for hibernation and early care of young.

d. Fecal deposition: this appears to be concentrated in the immediate vicinity of the burrows, particularly at the entrance to tunnels.

e. Dusting: the exact nature of this activity is not yet well understood.

f. Runways: these are most conspicuous along stream banks and areas of high population such as the willow dune sites along the Kukpuk River.

Some information has been obtained concerning the effect which each of these activities has on any given vegetation type, but there is need for additional information in this regard.

Squirrels were observed engaging in one or more of the activities mentioned above in many of the vegetational communities or types which occur in the vicinity of Ogotoruk Creek. They were conspicuously absent, however, from the Eriophorum tussock type, and all of its sub-types. Areas of Eriophorum-Carex wet meadow, Eriophorum-Carex solifluction slope, and saline meadow receive only limited use by the ground squirrels. One important activity which they do conduct in these four types is the gathering of nest material. This activity, however, appears normally to be limited to the periphery of these areas. All of the other vegetation types and many of the communities, especially ecotonal ones, serve as the location of one or more home burrows for ground squirrels. Data on the extent to which each of these types and communities is used were gathered from a transect across Ogotoruk Valley established for this purpose. These data have not yet been analysed.

Quantitatively, intensity of use, methods of disturbance and their ultimate effect on the vegetation are factors which have proved difficult to measure and assess. Some valuable preliminary data, mostly qualitative, on these factors were gathered during 1960 by observation and by recording activities on 16mm motion picture film, but more quantitative data will be needed before final evaluations can be made.

A preliminary vegetation map covering the region of the ground squirrel pilot study area has been compiled (Figure 6). This area is located on the southeast-facing slope of Crowbill, and is under joint study by the botanists and mammalogists. The map outlines the vegetation types and communities in greater detail than was possible on the vegetation map of the entire Ogotoruk Creek drainage. The letter designations used on this map are identical with those used in the large map* of the whole Ogotoruk Creek drainage with two exceptions:

1. Some of the capital letters are followed by lower case letters which represent certain appropriate sub-types and sub-communities described in the December, 1959 Botanical Report.

2. Three communities not used for the vegetation map of the Ogotoruk Creek drainage have been added: MM = Mixed meadow; BE = Beach embankment; BG = Beach gravel. Two of

* Reference made to map in December 1959 Botanical Report.

these, MM and BE, are ecotonal communities which have not been described in previous reports. They will be discussed in the June, 1961 Botanical Report. Beach gravel (BG) designates a littoral community, which, in the vicinity of the pilot study area is essentially a sterile community as far as observable plant life is concerned.

During the summer of 1960 the foundations for this ground squirrel-vegetation study were laid and considerable preliminary data were gathered. We plan on continuing this study for one more summer in order to obtain a more thorough understanding of the effects of ground squirrel activities on the vegetation in Ogotoruk Valley.

Figure 6. Vegetation map of ground squirrel pilot study area.

KEY

DF = *Dryas* fellfield

DSi= *Dryas* stripe

DSe= *Dryas* step

WM = *Eriophorum-Carex* wet meadow

Sbc= Snowbed in creek bottom

SBe= Snowbed, ericaceous

TS = Talus slope

MM = Mixed meadow

BE = Beach embankment

BG = Beach gravel

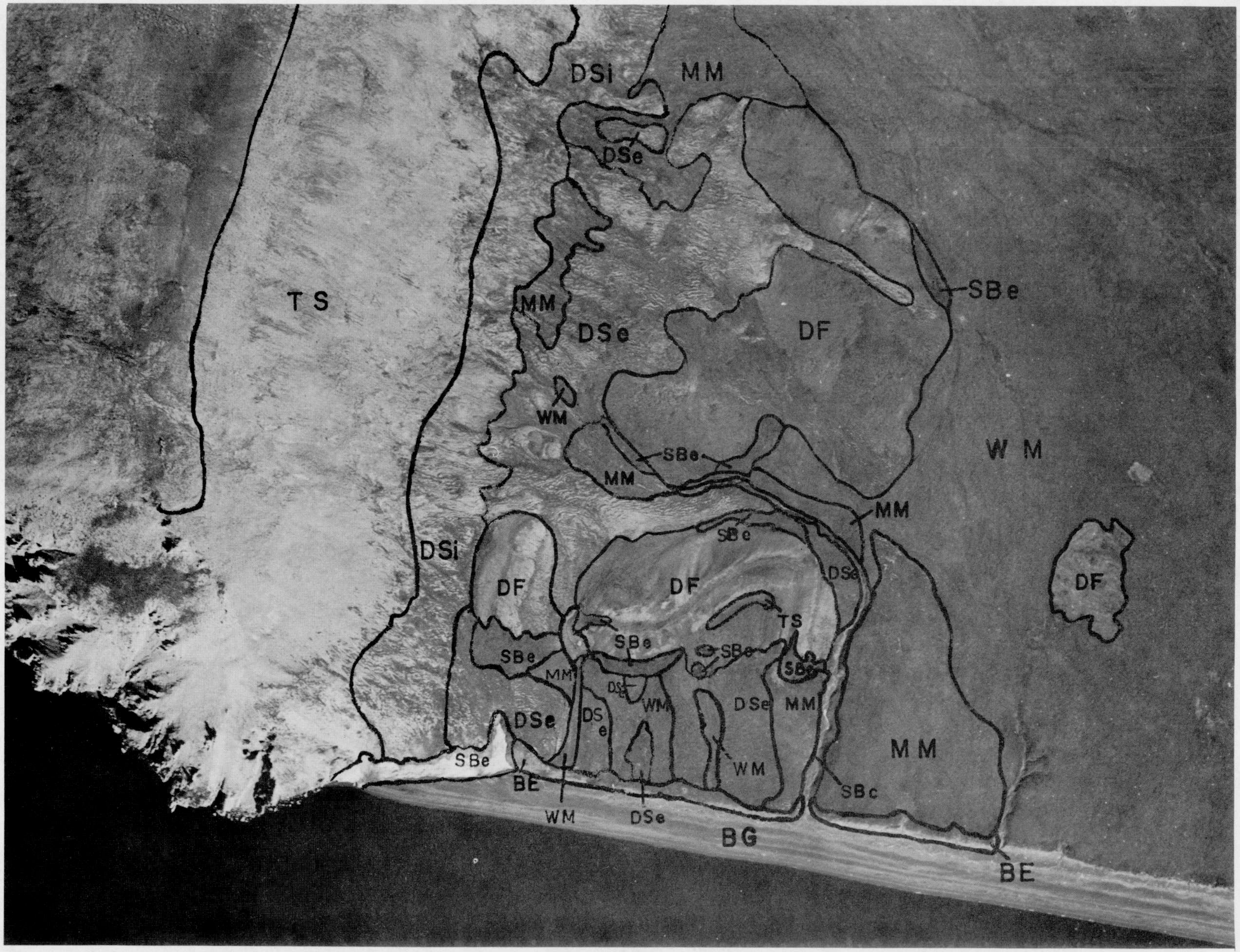


Figure 6

FALL OBSERVATIONS AND RECONNAISSANCE

Since Fall has been suggested as a possible time of the year for detonation of the nuclear devices at Chariot Site, gathering certain data regarding the conditions of the environment in relation to the vegetation during this period is appropriate. In order to obtain this kind of data, Mr. Herbert Melchior spent the week of 6-14 October 1960 at Ogotoruk Creek. In addition, he repeated the photographs that were taken of plots between 8-10 April 1960.

Weather conditions, on arrival at the site, were excellent for field work and remained that way for several days. However, just prior to this (26 September-3 October), a thaw had occurred, followed by considerable rainfall (1.28 inches recorded in 6 days by the U. S. Weather Bureau at the Site). The rain was followed by a quick freeze on 4 and 5 October. The freeze came about so quickly that water flowing over the frozen soil and vegetation froze in place, leaving streams of ice in many of the surface drainages. This phenomenon was particularly evident in the ground squirrel pilot study area (see Figure 7). Although this surficial ice condition was most obvious on slopes, it occurred throughout the valley wherever there was a surface drainage or a depression.

Possible effects which the ice streams may have on the ground squirrels and other small mammals are discussed in the report of the Terrestrial Mammal Investigations. Since all the plants had entered their over-wintering condition, it is doubtful if the accumulation of ice would have any immediate effect. However, several inches of ice covered with snow can be expected to melt slowly in the spring and, therefore, prolong winter conditions in these places. Such conditions would delay spring growth for the plants involved, conceivably to the point of preventing the completion of their annual reproductive cycle.

The ecological importance of this icing condition can not be fully determined at this time; however, the acquisition of additional information next spring should make possible a more complete understanding of its significance to the vegetation.

On 12 and 13 October, photographs repeating the winter ones taken 8-10 April 1960 (see June, 1960 Botanical Report) were obtained; these October photographs are reproduced on the following pages, Figures 7-18. We wish to stress that these photographs illustrate conditions at a given moment only and do not necessarily represent typical conditions for Ogotoruk Valley in mid-October.

The weather (in part, courtesy of D. A. Clay, U. S. Weather Bureau) for a period of three days prior to the taking of these pictures follows:

9 October: Clear, cold (11°F. at 0900). Wind at Base Camp, NE at 22-25 knots. Essentially no snow cover throughout the valley. A few well-protected depressions in the *Dryas* fellfield type contained small amounts of old snow which had withstood the warm temperatures and rain of the period 26 September-3 October.

10 October: Overcast and snowing. Average amount of snowfall, .7 inch. Maximum wind observed at Base Camp, E at 9 knots.

11 October: Clear, moderately cold (20°F.). Wind at Base Camp reached a maximum observed rate of N at 25 knots. In contrast, maximum wind speed recorded at Microenvironmental Station A 34.7 at the U. of A. plot 45, located 5.5 kilometers NNE of Base Camp, was only 6 knots.

12 October: Clear, cold (11°F. at 0830). Maximum wind observed at Base Camp, N at 20 knots. Maximum wind recorded at Microenvironmental Station A 34.7 was 9 knots.

13 October: Clear, cold (15°F. at 1330). Maximum wind observed at Base Camp, N at 22 knots. Maximum wind velocity recorded at Microenvironmental Station A 34.7 was 11 knots.

It is interesting to note the difference in wind velocity between Chariot Base and the Microenvironmental Station A 34.7, about 5.5 kilometers NNE of Chariot Base Camp. It is true that the respective anemometers are at different levels, with the one at Chariot Base set on top of a pole approximately 20 feet above the ground surface, whereas the anemometer at A 34.7 is only a few feet above the ground surface. Increased wind drag near the surface of the ground might account for some of the difference in the readings at the two stations, but frequent wind velocity checks made with a Dwyer Wind Gauge held 4 to 5 feet above ground at Chariot Base gave similar readings to those of the dial anemometer 20 feet above the ground. This suggests that the differences in wind velocity between Chariot Base and Microenvironmental Station A 34.7 are real and not simply the result of differential wind drag at different elevations above ground. Such a conclusion is further supported by the pattern of snow cover that remained two days after the fresh fall on 10 October.

The background portion of Figure 14 clearly shows an absence of snow cover over large areas by the mouth of Ogotoruk Valley. A closer look at two widely separated and diverse sites within the mouth region of the valley (Figures 8 and 9) indicates that most of the new snow which fell on 10 October was blown away by 12 October. In contrast to this situation, Figures 10 and 11 show plots just north of Slate Creek or approximately 4 kilometers NNE of Chariot Base where the snow which fell on 10 October remained in place.

The difference in wind velocities occurring near the mouth of the valley and those further back, as reflected in the distribution and structure of snow formations, has been discussed in some detail in both the June, 1960 Botanical Report and the June, 1960 Terrestrial Mammal Investigations Report.

Although observations of wind and snow conditions,made on two occasions last winter and again this fall, have revealed a great deal about these important ecological factors in an Arctic environment, only repeated visits to the area during the winter, spring and fall will provide a complete picture of the range of variation which they exhibit from year to year and, ultimately, their full significance in the ecosystem. Data collected this year, from the U. S. Weather Bureau Microenvironmental Stations throughout the valley, will be of value to those investigators who are concerned with the relationships of snow cover to the organisms occurring in the valley, but these data are no substitute for on the spot observations of the local variations which occur and which effect microhabitats.

Figure 7. Ice streams on surficial drainages in the ground squirrel pilot study area located on the east-facing slope of Crowbill. Taken on 8 October 1960, prior to the snowfall which occurred on 10 October.

Figure 8. <u>Dryas</u> fellfield on shale ridge. Taken 12 October 1960, 2 days after a .7 inch snowfall. Some old snow, lying in depressions, survived the rains which preceded the snowfall. The decimeter stake marks the SW corner of Plot 14.

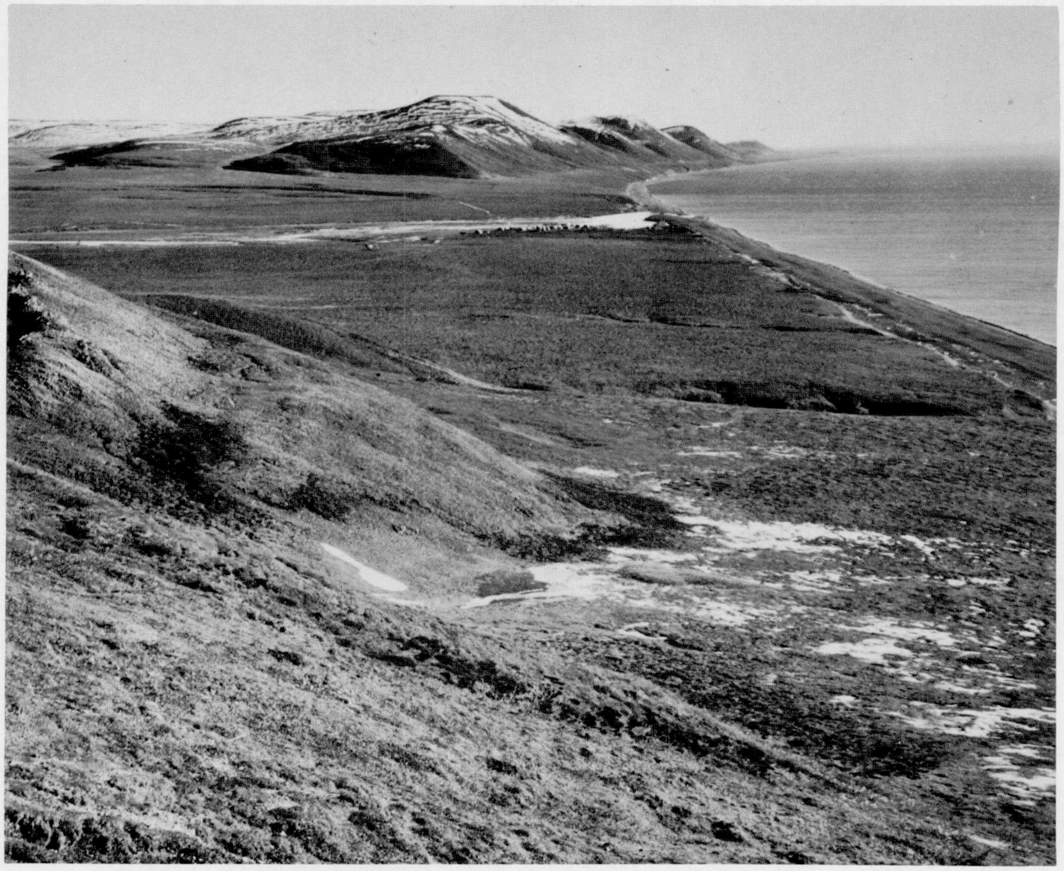


Figure 7 (above) Figure 8 (below)

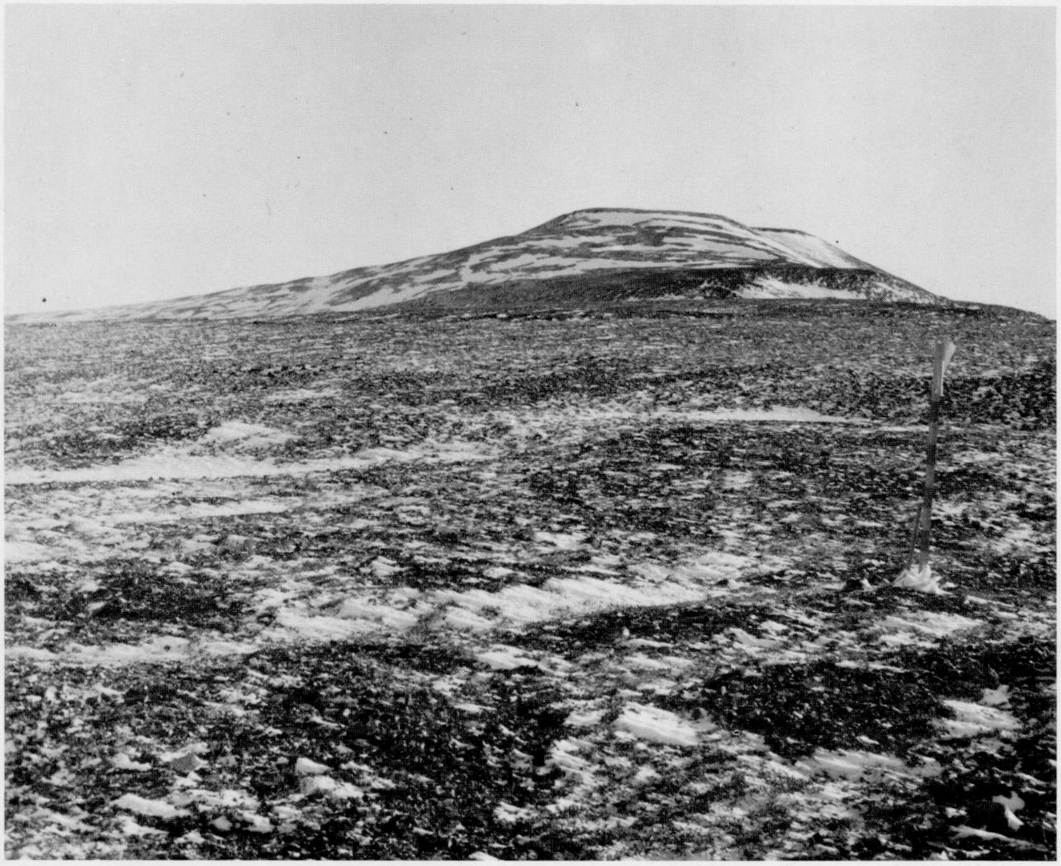


Figure 9. Frost scar in Plot 12 (*Eriophorum*-*Carex* wet meadow). Taken 12 October 1960, two days after a snowfall of .7 inch. Plot 12 is located approximately 100 yards back from the beach.

Figure 10. *Eriophorum* tussocks in Plot 23, 12 October 1960. Note covering effect of .7 inch snowfall at this location in the valley as compared with that of Plot 12 (Figure 9 above) near the mouth of the valley. See text for explanation. Decimeter pole marks the NE corner of the plot.

Figure 9 (~~above~~ below) Figure 10 (~~below~~ above)

Figure 11. Widely separated Eriophorum tussocks in Plot 24, 12 October 1960. Note the similarity between the appearance of this plot and Plot 23 (Figure 10) and the uniform snow cover on the Dryas fellfield ridges in the background. The decimeter pole in the foreground marks the SE corner of Plot 24.

Figure 12. Pavement boil type frost scars in Plot 13 (ecotone community). Note the snow-covered ice streams, especially around the decimeter pole which marks the NE corner of the plot. Taken on 12 October 1960. Errata: In the June 1960 Botanical Report, page 32, this plot was incorrectly indicated as being Plot 15. For a discussion of the change in vegetation type name, see this report, page 44.

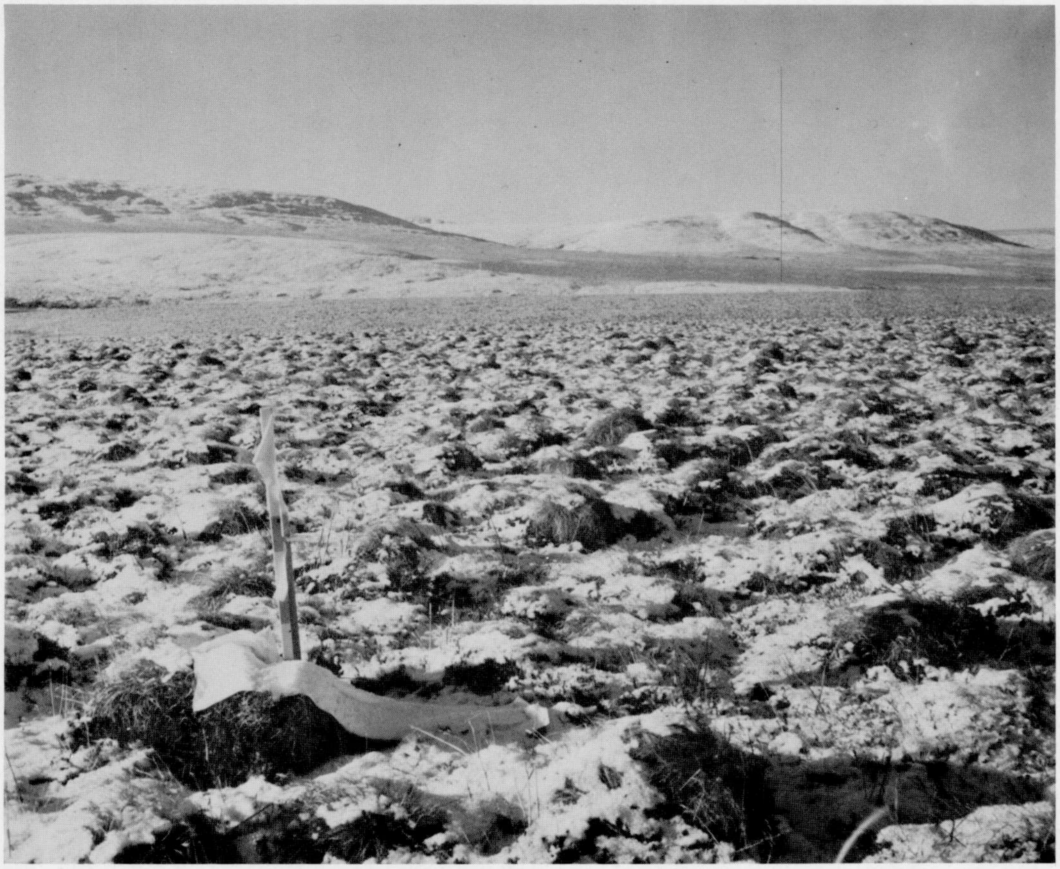


Figure 11 (above) Figure 12 (below)

Figure 13. Looking west across Plot 35. This plot is located 9 kilometers up the valley (N) from Chariot Base. Compare this with the view across the mouth of the valley in Figure 14. Taken on 13 October 1960.

Figure 14. South-facing snow patch on the east side of Ogotoruk Creek. Note the steepness of slope pictured here and compare with more gentle slope resulting from snow deposition as pictured in Figure 7, page 37, in the June 1960 Botanical Report. This photograph of the snow poles across Plot 15 was taken on 12 October 1960.

Figure 13 (above)

Figure 14 (below)

Figure 15. A view looking west across the center of Plot 26 in the gully of Slate Creek, 12 October 1960. Compare this picture with Figure 8, page 38, in the June 1960 Botanical Report. Note the snow-free appearance of the *Dryas* fellfield ridges in the background and compare with those in Figures 10, 11 and 13. See text for discussion.

Figure 16. Willow clump located 20 feet north of the NE corner of Plot 5 (gravel bar), 12 October 1960. The NW corner pole of the plot can be seen in the center of the picture. Compare with Figure 9, page 40, of the June 1960 Botanical Report.

Figure 15 (above) Figure 16 (below)

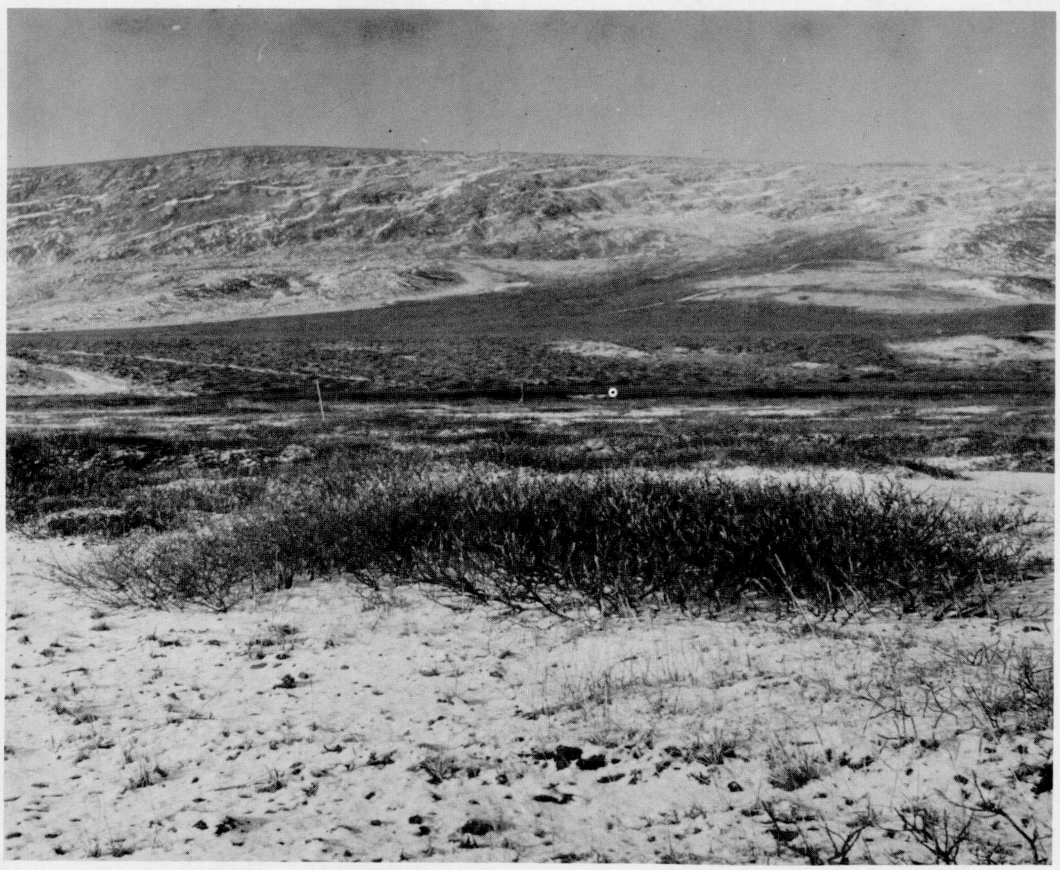
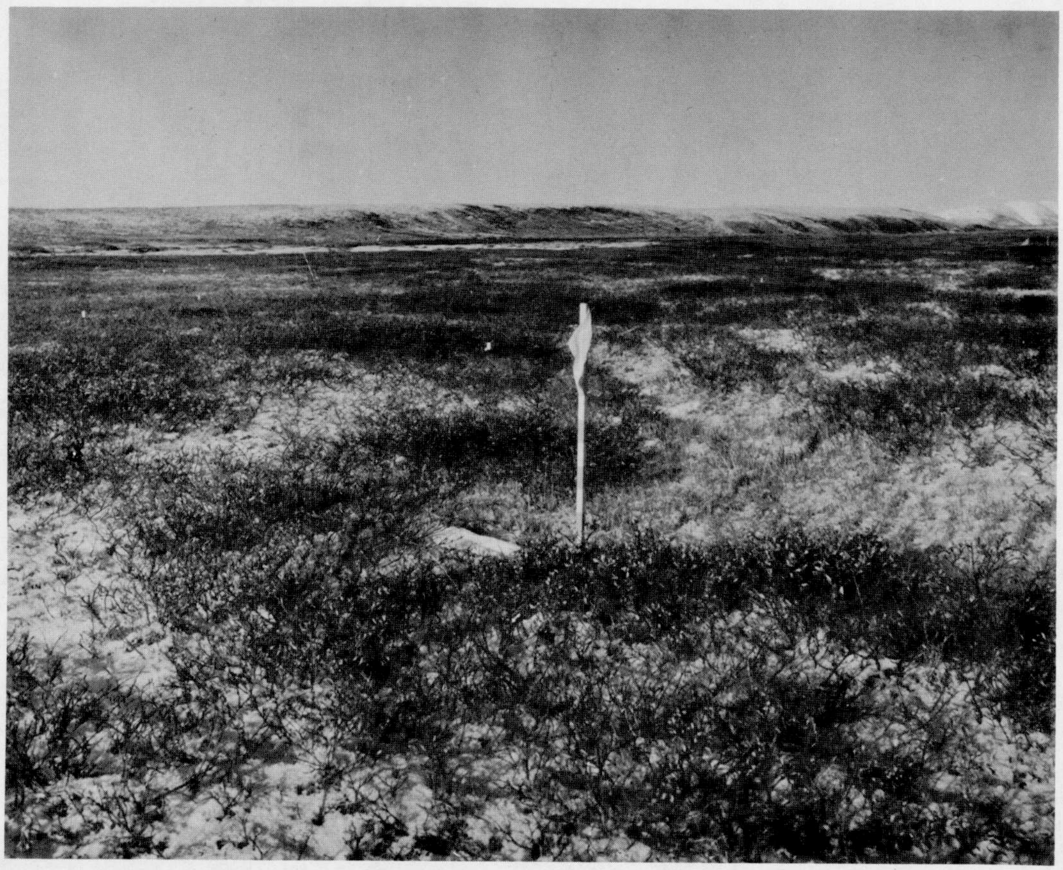


Figure 17. The high willows of Plot 19. View looking west or downstream, 12 October 1960. Compare this picture with Figure 10 in the June 1960 Botanical Report.

Figure 18. Plot 47 (Salix-Lupinus bench community) looking north across the plot from the SE corner, 12 October 1960.

Figure 17 (above)

Figure 18 (below)



BOTANY IN RELATION TO THE NUCLEAR BLAST

One of the main objectives of the environmental studies in the Ogotoruk Creek area has been to provide a basis for an assessment of the biological damage that will be incurred with the detonation of the nuclear blast in Ogotoruk Creek. Because of this objective, certain aspects of the vegetation should receive more careful consideration in the basic pre-blast studies.

The tundra vegetation is the important base for the food web of all the arctic animals. Any accumulation of radioactive isotopes within the vegetation will ultimately affect all the other organisms in the tundra ecosystem. Although radioactive fallout from the blast is predicted to be small, the amounts may be of significance in the food chain of the land organisms.

A glance at the quantitative data from the 1960 line intercepts shows that lichens and sedges make up a relatively high percentage of composition of several of the most important vegetation types in Ogotoruk Valley: Dryas fellfied - lichens 51 per cent; Eriophorum tussock type - sedges 40 per cent, lichens 6 per cent; Eriophorum-Carex wet meadow type - sedges 59 per cent. The June, 1960 report of the Hanford Laboratory (Davis, J. J., D. G. Watson, W. C. Hanson, 1960) shows that in Ogotoruk Valley these groups of plants already possess high amounts of radioelements. Lichens, for instance, were found to have 1.4 micro-micro curies of strontium 90 per gram (dry weight), while both lichens and sedges were found to be high in gamma emmitters. Gorham (1959) has found that lichens from Canada have a much higher accumulation of radioactive fallout than do angiosperms from the same areas. This is of special importance when it is considered that much of the diet of the caribou consists of lichens and sedges, especially during the winter months when the caribou tend to congregate in the Ogotoruk Creek and Kukpuk River areas. Hvinden (1958) has found that strontium 90 in reindeer bones is higher than in grazing sheep in the same area and relates this to the possibility that the reindeer diet consists primarily of the more radioelement-rich lichens.

It is beyond the scope of the botanical study of the University of Alaska to deal directly with this uptake of radioactive isotopes in the vegetation. We wish to urge, however, that studies be intensified in this direction and that more samples of individual plant species be analyzed for their radioelement content. This analysis will provide a more accurate basis for prediction of the importance of the fallout to the vegetation, to the caribou and other animals, and to the human consumer.

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