A PROPOSED INVENTORY METHOD FOR ANALYZING THE VISUAL RESOURCES OF ALASKA'S NORTH SLOPE

by

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B.S., Colorado State University, 1977

A MASTER'S THESIS

submitted in partial fulfillment of the

requirements for the degree

MASTER OF LANDSCAPE ARCHITECTURE

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KANSAS STATE UNIVERSITY
Manhattan, Kansas

1984

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ACKNOWLEDGEMENTS

I dedicate this study to my parents.

I would like to express my deepest appreciation to Alton Barnes, Dennis Day and Ronald Sullivan for their time, patience and guidance in preparation of this research.

This researcher also thanks Dick Bouts, Larry Field and Donald Hinrichsen from the BLM in Alaska whose assistance substantially aided in the development of this work.

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CHAPTER I

INTRODUCTION

Alaska - even the name connotes visions of grandeur and romantic ties with the past. However, Alaska is modernizing and facing radical changes. It is an unique state which has been endowed with high scenic quality and valuable natural resources. Because of the rapidly growing national demands for natural resources, Alaska is experiencing rapid rural development, urban growth, pressure to develop recreation resources, rapid exploration and development of its fossil fuel and hardrock mineral resources.

If Alaska is to wisely use its resources, preserve its natural treasures and maintain its beauty, land managing agencies must develop accurate methods of inventorying, analyzing and evaluating the resources they manage. One of the many resources which need special attention in Alaska is its visual quality. It is the dominant natural resource in Alaska's vast landscape and yet it is easily subject to ruin by unplanned or reckless development. This resource is especially sensitive to man's activities in the North Slope tundra region because of the openness of this mostly treeless landscape and the inability of the natural landscape to rapidly heal scars with a vegetative cover.

Wisest and best use of resources has always been of vital concern to landscape architects. In the future, as development pressures continue to increase on Alaska's North Slope, landscape architects will undoubtedly be called upon to plan projects and evaluate the impacts these projects will have on the region's visual quality. This thesis addresses the issues surrounding visual resource management in Alaska today and proposes a method which will make it possible for landscape architects and land managers to understand the visual resources of the North Slope and to accurately evaluate the impacts proposed projects could have on it.

History of Visual Resource Management

Within the last 20 years, visual resource analysis has become a fundamental component of environmental studies. "Simply stated, the visual resource is all that we have seen which still exists, and all that we may be able to see in the future" (Forest Landscape Management, 1972:7). The visual resource is a natural resource, and as such, it can be degraded or exploited, as can water, air, or mineral resources.

Beginning in 1969, the National Environmental Policy Act (NEPA) mandated that all federal agencies reorganize their planning methods and procedures and also emphasize environmental and scenic values within both Land Use Planning and Environmental Assessment studies. As such, the NEPA Act of 1969 was one of the first legislative mandates calling for the " protection of aesthetically pleasing surroundings" (BLM-VRM Program, 1980:9). With the passage of the Federal Land and Policy Management Act of 1976, the Visual Resource became an integral and co-equal resource under the multi-use concept of land management. The law requires that all lands be continually inventoried and managed for the visual resource, and that areas of critical environmental concern (ACEC) for scenic values be established (BLM-VRM Program, 1980).

This goal of protecting Alaska's visual resources is complicated in Alaska by the land ownership pattern in the state. Presently, Alaskan lands are parcelled among many owners, including native Alaskans, the state government, and the federal government. Within the federal government, many agencies manage extensive land holdings making a coordinated effort to protect the landscape more difficult. The Bureau of Land Management (BLM), a federal agency in the Department of Interior, has the largest land holdings in Alaska with jurisdiction over 167 million acres.

<u>Bureau of Land Management Visual Resource Management System - Review</u>

The Bureau of Land Management (BLM) is responsible for the management of several different kinds of resources including wildlife, minerals, range, soil, water, recreation, energy sources and the visual resource. Since 1975, the visual resource has become an integral part of the BLM management system. The purpose of visual resource management (VRM) system process is to provide a procedure by which land managers can identify the scenic quality of a region and analyze proposed man-made changes on national resource lands (BLM-VRM Program, 1980).

The BLM-VRM program is a three-phased process:

1) Inventory/Evaluation
   a) Scenic Quality
   b) Sensitivity Level
   c) Distance Zones
2) Management Classes
   a) Class 1
   b) Class 2
   c) Class 3
   d) Class 4
   e) Class 5
3) Contrast Rating/Environmental Assessment
   a) Contrast can be seen but does not attract attention
   b) Attracts attention and begins to dominate
   c) Demands attention and will not be overlooked by the average observer

Phase 1:

INVENTORY/EVALUATION			MANAGEMENT CLASSES	CONTRAST RATING/ENVIR.ASSESS.
scenic quality	sensitivity level	distance zones	Class 1 Class 2 Class 3 Class 4 Class 5	High Medium Low

Phase One, the Inventory/Evaluation consists of three steps: 1) assessment of the visual quality of the landscape, 2) assessing people's sensitivity to changes in the landscape, and 3) the determining distance at which people view these changes.

Phase 1/Step 1:

INVENTORY/EVALUATION			MANAGEMENT CLASSES	CONTRAST RATING/ENVIR.ASSESS.
scenic quality	sensitivity level	distance zones	Class 1 Class 2 Class 3 Class 4 Class 5	High Medium Low

Scenic quality is based in part "on overall impressions retained after driving through, walking through, or flying over an area of land" (BLM-VRM Program, 1980:18). Prior to the actual inventory, the land area in review is divided into subunits that appear similar or homogenous, such as: rolling meadow, mountainous, forest, or tundra plains. These are only a few landscape types which could exist in an area.

The BLM-VRM process uses seven key factors to determine the scenic quality within each land area. The key factors are: land form, vegetation, water, color, adjacent scenery, scarcity, and cultural modifications. Each factor is rated from zero to six, six having a high scenic value.

The sum of the rating scores assigns each landscape to one of three levels (A, B and C) of visual quality. The class designations as determined from the BLM-VRM manual are:

> "Class A - Areas that combine the most outstanding characteristics of each rating factor (highest point total).
>
> Class B - Areas in which there is a combination of some outstanding features and some that are fairly common to the regional province (intermediate point total).
>
> Class C - Areas in which the features are fairly common to the regional province (lowest point total)."(BLM-VRM Program:18)

Phase 1/Step 2:

INVENTORY/EVALUATION			MANAGEMENT CLASSES	CONTRAST RATING/ENVIR.ASSESS
scenic quality	sensitivity level	distance zones	Class 1 Class 2 Class 3 Class 4 Class 5	High Medium Low

The second step in the Inventory/Evaluation process is to determine visual sensitivity and this is accomplished by determining 1) user volume and 2) user attitudes toward changes in the landscape.

User volume is determined by the number of people viewing the landscape at various locations, and the number of people using the landscape in various ways. The rationale for using this data is that in a given area, the greater the frequency of use, the greater its sensitivity will be towards man-made modifications.

Data on user or public attitudes toward visual modifications in the landscape is collected through public workshops.

Phase 1/Step 3:

INVENTORY/EVALUATION			MANAGEMENT CLASS	CONTRAST RATING/ENVIR.ASSESS
scenic quality	sensitivity level	distance zones	Class 1 Class 2 Class 3 Class 4 Class 5	High Medium Low

The third step in the Inventory/Evaluation process is to determine distance zones which are used to indicate the relative detail that is perceived in natural and man-made features on the landscape. Distance zone categories as defined in the VRM manual are designated as either foreground-middleground, background, or seldom-seen, as measured from key observation points.

The key observation points (KOP) are the same as those used to determine visual sensitivity. Foreground-middleground is that area out from the KOP, usually 3-5 miles. It is at this distance that texture and form of individual plants is no longer apparent in the landscape. These lands are considered most important from a management standpoint because within this landscape zone proposed land use activities might be viewed in detail. Background is that area from 3-5 miles to approximately 15 miles. Within this landscape zone the landscape appears as a continuum, with form (mass or shape of an object) being the dominant visual element creating areas of light and shadow. Seldom seen areas are more than 15 miles from KOPs or unseen for other reasons (the backside of a mountain, for example).

Phase 2:

INVENTORY/EVALUATION			MANAGEMENT CLASSES	CONTRAST RATING/ENVIR.ASSESS.
scenic quality	sensitivity level	distance zones	Class 1 Class 2 Class 3 Class 4 Class 5	High Medium Low

Based on a composite overlay of the three Inventory/Evaluation factors - visual quality, visual sensitivity, and distance zones - each unit is assigned one of five management classes. Each of these classes contain specific management objectives for maintaining or enhancing the visual resource values and describes the degree of modification allowed in that particular landscape (BLM-VRM Program, 1980). For example, Class 3 has a management objective of:

> "Contrasts to the basic elements (land form, water, vegetation, color) caused by a management activity are evident, but should remain subordinate to the existing landscape." (BLM-VRM Program, 1980:27)

If a proposed roadway is to be built in a river valley having a class three management objective, the roads form, line, color, and texture must not dominate the present landscape.

Phase 3:

INVENTORY/EVALUATION			MANAGEMENT CLASSES	CONTRAST RATING/ENVIR.ASSESS.
scenic quality	sensitivity level	distance zones	Class 1 Class 2 Class 3 Class 4 Class 5	High Medium Low

The final step in the process involves studying individual projects and activities proposed on BLM land. This is done to determine the relative ease with which a proposed activity can be harmoniously incorporated into a landscape. To accomplish this, a contrast rating system is applied which measures the contrast of a proposed activity against the major features and elements in the landscape. These features and elements are fundamentally derived from the design arts. Major land features included are land/water surfaces, vegetation and structures. Landscape elements are the building blocks that comprise featured landscapes and visually appear as form, line, color and texture (see Figure 1).

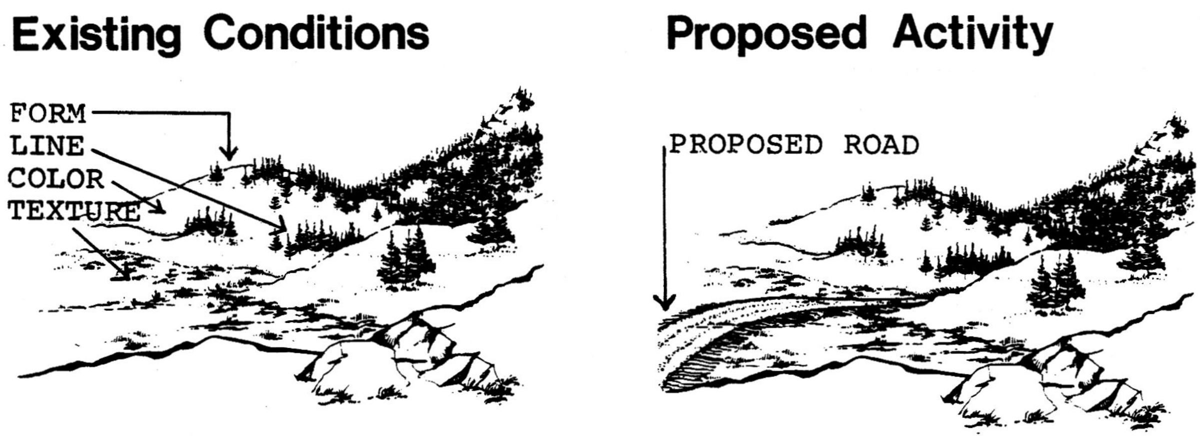


Figure 1. Contrast Rating-Adapted from BLM-VRM Publication, 1980:31

Problems With The BLM-VRM Application in Alaska

The original BLM-VRM system was designed and tested for use in the more populated Rocky Mountain region. Consequently, its basic methodology and usage is geared for the needs and priorities of the land managers from those areas.

Direct application of this system to the remote areas of Alaska has failed to achieve the intended results for three reasons. First, the scale of the areas being studied is so vast (BLM Alaskan lands are measured in the millions of acres, compared to tens or hundreds of thousands of acres in the Rocky Mountain region) and remote that it is extremely difficult and prohibitively expensive to get all of the specific information needed for the visual quality step. Second, the lack of roads, trails, railways and transportation networks in general combined with a very small resident and user population means that very few people see these lands and those that do, see them from the air. This lack of public participation makes evacuation of visual sensitivity virtually impossible. The third reason the BLM-VRM does not work on the North Slope is that constantly changing key observation points afforded by air travel and the absence of ground transportation routes makes accurately defining distance zones impossible.

From this, it is apparent that most of the Inventory/Evaluation phase of the BLM-VRM either is not appropriate for the North Slope landscape or the information acquired will be sketchy and therefore could compromise the effectiveness of land management decisions and policies.

Recognizing these problems Alaskan BLM management hired, in 1980, landscape architectural consultants. The consulting team, composed of two landscape architecture professors and two graduate students, including this author, worked collectively with BLM staff landscape architects.

Meeting in Anchorage on May 20, 1980, the team members recommended that both a hierarchical and descriptive inventory system be developed and implemented instead of the present inventory/evaluation phase of the current BLM-VRM system. To accomplish this goal three objectives were established at this initial meeting: 1) develop a classification and description of occurring and potential land use developments on Alaska BLM lands through a graphic and narrative format; 2) develop a descriptive inventory of the landscape focusing on the visual characteristics; and 3) the development of a visual vulnerability matrix which would identify how the visual elements (landform, land cover, waterform) would be affected by a proposed project.

These objectives proved far too ambitious and due to unforeseen time delays with base map preparation, weather, and coordination with team members between the group in Anchorage, the one in Fairbanks, a separation of 400 miles, only preliminary testing of the proposed methodology could be accomplished. (A more detailed explanation of the methodology and the descriptive inventory are presented in Chapter 2).

Funding was appropriated in the winter of 1981 to begin a wilderness study on the North Slope of Alaska. This study would lean heavily on the visual characteristics of the region to determine potential wilderness areas. Therefore, BLM proposed expanding the 1980 VRM work and combining it with the wilderness study. To facilitate the work and provide a link between the two, the author was hired to test and refine the proposed 1980 visual resource inventory and analysis study.

Purpose

This thesis focuses on the evaluation and refinement of the visual resource management system developed by the consulting team in 1980. The system will be tested on the southeastern quarter of the North Slope - a remote region in northern Alaska, approximately 8 million acres in size and located 300 miles north of Fairbanks. The majority of this region is under BLM jurisdiction. Refinements and changes proposed to the 1980 system will address Bureau needs in this specific region.

More specifically, the objectives of this study are:

1) To evaluate and refine the 1980 system into a methodology that:

   A. will describe the visual characteristics of the existing landscape, and

   B. will make it possible to determine the sensitivity of the visual resource to damage by proposed development.

2) To develop an early warning inventory and evaluation process for identifying the visual impacts that a landuse proposal may have in a remote area.

3) To determine the most effective data collection procedure commensurate with the scale of the effort and the scale of the land area involved.

4) To test the relationship of having analytical flexibility and hierarchical capabilities within the inventory and evaluation process.

CHAPTER TWO

METHODOLOGY

This chapter presents a brief summary of the visual inventory system developed in 1980, evaluates that system, outlines the methodology used to develop the revised system and presents the proposed system.

Before entering into an in-depth discussion of the inventory methodology, a brief explanation of the descriptive inventory process is needed.

Descriptive inventories attempt to replicate the features of a landscape by documenting various elements and their situation in an area. "The focus of this landscape documentation is placed on identifying the visually perceived features and structural components that form a particular landscape" (Litton, 1979:80). The structural components, or the "building blocks", of the visual landscape include: climatic conditions, land surface form, color, textural patterns, surface water patterns, and the cultural landscape. The interrelationship among these elements form natural landscape compositional patterns, such as the rolling plains, foothills, highlands, and mountains. Countless subtle variations exist within each major composition to form transition zones between areas. Also, the manmade or cultural landscape must be included to complete the visual image of a region. It is the various compositions and man-made patterns that interface to produce the characteristic visual impressions that each landscape expresses (Litton, Tetlow 1978).

The 1980 Study

Presently, Alaska BLM-VRM System Phase 1 (Inventory/Evaluation) is based on three steps, which are: identification of scenic quality inventory zones; determination of visual sensitivity levels; and delineation of distance zones. Due to the limitations discussed in Chapter One concerning these steps, current visual analysis studies in Alaska are based upon the scenic quality component only. Using the existing classification system, landscapes categorized as having high scenic quality are found in high topographic relief areas and, conversely, low scenic quality designated landscapes are lands inventoried as having little relief. This classification system does not truly reflect the Alaskan landscape. Consequently, visual resource management is presently performing a minor role in regional resource planning in regions where future visual experiences could be jeopardized.

Prior to the 1980 summer field season, the consulting landscape architects held a meeting at the Bureau of Land Management state office in Anchorage, Alaska. The objectives of this meeting were twofold: first, to identify the problems with the current BLM-VRM application in Alaska (these were enumerated in Chapter One), and second, to develop a more descriptive inventory process for the region. The justification to utilize the descriptive inventory process for the regional level was based on a number of factors. They are:

1) The present VRM system inadequately incorporates visual patterns and landscape elements into the regional landscape inventory.
2) Published data relating to visual resource management in Alaska is very limited.
3) The BLM has very limited budgets (time and money) to conduct the needed inventories.
4) The vast scale of land management units requires extensive investments of time and money if they are to be inventoried as outlined in the original BLM/VRM system.

In developing the descriptive inventory methodology, a literature review examining studies of similarily sized and scaled descriptive inventory projects was conducted. This review identified the works of R. Burton Litton, Jr., Robert J. Tetlow, Phillip Lewis, Jr., and Ervin Zube as being particularly relevant. Although they used different analysis techniques, all concluded that the descriptive assessment methods are justified. According to Litton, the visual descriptive inventory provides a documentation of the visual components that determines each landscapes' personality (Litton, 1979). All landscapes are, to varying degrees, a composition of land form, water form, vegetation and cultural development. In their works, Litton, Tetlow, Lewis and Zube concluded that two major steps are involved to accurately and objectively describe the landscape of a region. They are:

1) A review of existing environmental data pertinent to the landscape components of land surface form, color, textural patterns, surface water, and the built environment.
2) An inventory of the visual features and patterns which an area connotes through detailed narratives and photographic analysis.

Litton also suggests the use of low and high altitude flyovers to fully grasp landscape compositional patterns and to verify existing environmental data.

Two studies by R. B. Litton directly influenced this study, Forest Landscape Descriptions and Inventories - A Basis for Land Planning and Design (1968), and A Landscape Inventory Framework: Scenic Analysis of the Northern Great Plains (1978).

Litton's 1968 study identified six landscape structural components and seven compositional landscape types as a means to conduct a visual descriptive landscape inventory (Laurizio, Sullivan, 1980). Components and compositional types are grouped and listed in Table 1.

Scenic Analysis Factors	Landscape Compositional Types
Form	Panorama
Spatial Definition	Featured
Light	Enclosed
Distance	Focal
Observer Position	Undergrowth landscape
Sequence	Detailed landscape
	Ephermeral landscape

Table 1. R. B. Litton's Landscape Structural Components and Compositional Landscape Types

Litton's first study (1968) was developed to assist the Forest Service land managers and landscape architects in planning and design on Forest Service lands.

Litton's 1978 study extends the concept of scenic analysis which he introduced in his first study and focuses on the Northern Great Plains states.

In his 1978 study, Litton developed a hierarchical descriptive inventory system of landscape classification. Through this system, Litton systematically inventories the visual resource and the factors affected at each level of investigation. The hierarchy (see Table 2) is composed of four levels: Continuity, Province, Unit, and Setting. Each level should be viewed as a step or tier in understanding the visual resources of a landscape, which ranges from the regional perspective to a local, or more personal level.

Litton's Visual Classification System

Regional complex 1000's of square miles	Local complex 1-5 square miles

Continuity.....Province.....Unit.....Setting

FACTORS

Patterns of Land Form

Patterns of Vegetation

Patterns of Water

Patterns of Land Use

Table 2. Hierarchical Descriptive Inventory System of Landscape Classification.

Litton's second study has some similarities to his first; however, the significant difference is that the emphasis is placed more on developing an inventory methodology and less on the identification of the scenic resource. Litton's Visual Classification System does not quantify scenic or non scenic values; it is strictly an inventory tool and not an assessment of perception values.

Both of Litton's studies were tested in rural regions of the U. S. and for this reason, it was felt their application in Alaska was appropriate. No one study or methodology is universal. These studies provided a pattern to build upon and the methodology developed in 1980 reflects the situations and problems inherent in Alaska.

Initially, the descriptive inventory was conducted at Litton's Continity and Province levels, or the macro landscape image (Laurizio, Sullivan, 1980). A visual resource inventory conducted at the macroscale level yields a coarse and general assessment of an area's visual personality yet these first impressions of a region are important and usually quite accurate at this level of investigation. The "region", according to Mumford, "is a unit area formed by geologic structure, soil, surface relief, drainage, climate, vegetation and animal life" (Lewis, 1982:14).

The macroscale level of investigation is designed to serve three purposes. First, a regional perspective or overview can be visualized and this information can be recorded as base line visual data. Second, through an understanding of the physical landscape and the visual expression that it exhibits, regional visual design objectives can be developed. Third, public awareness of government land management objectives and of future project developments may provide a better avenue of communication between parties.

As one traverses Alaska by plane, a mosaic of landscape patterns becomes evident. These patterns are combinations of land forms, vegetation, water, land surface color and cultural data (Laurizio, Sullivan, 1980). To understand and evaluate the landscape patterns, a visual classification methodology based upon biophysical data such as physiography, soil information, vegetation, and cultural information, was used.

The inventory process consisted of four tasks: preparation of base maps, collection of inventory information, presentation of inventory data, and analysis. The Northwest Planning Unit was selected as the study site. The landscape character and size (.825-6.25 million acres) of BLM land management parcels in this unit are typical of other Bureau holdings in Alaska.

Base maps were drawn to graphically depict BLM managed lands and to provide a means to graphically display visual data.

To collect inventory information, the consulting team relied upon published data such as maps and research reports and supplemented this effort with aerial reconnaissance.

Inhouse Review

An inhouse review of existing published information included study of cultural modifications, regional land form types and patterns, natural vegetation patterns and major drainage systems. Also reviewed were topographic maps, aerial photographs, and general landscape information which could be gathered through conversations with local BLM resource personnel.

Presently, environmental inventories that are performed on BLM managed Alaskan lands are done on a demand basis or when money is appropriated for a specific project. Consequently, available data is limited, and presented in various formats and scales. This presented a major obstacle in analyzing the information. To overcome this hindrance and simplify the process, only information which best illustrated the visual landscape patterns and features of land form, water form and vegetation were used.

Air Reconnaissance

Air reconnaissance had three objectives:

1. to the extent possible, verify information found in published sources,
2. to record photographically the compositional elements of vegetation, land forms, water forms, land surface color and cultural features,
3. to record personal descriptions and impressions of the region.

Prior to the actual inventory flights, experimentation was conducted to determine the optimum flight altitude to meet the inventory objectives. This experimentation revealed that altitudes between 3,000 and 5,000 feet relative to the ground (rtg) provided ample time to record visual data and lessen the blueing effect which becomes noticeable over 5,000 feet altitude (rtg). At altitudes greater than 5,000 feet (rtg), 35 mm photographic quality decreases and most physical landscape demarcations were foreshortened to where they were no longer helpful in visual inventory pattern recognition. A fixed-wing, single engine, Cessna 206 plane was used for all aerial reconnaissance work.

The information gathered on these flights was used for mapping as well as the preparation of supportive text and documentation. The overflights also provided a means to "better" understand a large physiographic region within a very short timespan. Patterns that are visible from the air often play a major role in determining the character and description of a given area. This supports Litton's observations during his overflights of the Northern Great Plains.

Presentation of Information

Presentation of the descriptive inventory process was made at the conclusion of the 1980 summer field season. The presentation consisted of a series of mapped information mylar overlays for each of the BLM management subunits. This information graphically explained visual features (land form, water form, vegetation, land surface color and cultural modifications) that were observed during the aerial flights, and also, coincided with a detailed narrative of these landscape features. Subunit field data was obtained through the aerial flights and photographic records were made of observable visual features.

Analysis

Visual vulnerability was suggested by the consulting team as the principle measure of capability during the analysis phase of the 1980 study. However, due to limitations of both time and funding, visual vulnerability was treated in a cursory manner. The consulting team did make recommendations concerning various types of visual impacts. These disturbances were divided into three groups so they could be considered individually or collectively. For example:

Linear disturbances

. utility corridors

. trails

. seismic test lines

. survey lines

. roads

Point disturbances

. mines

. power plants

. wells (oil)

. landing strips

Area disturbances

. grouped placer mines

. reservoirs

. strip mines

. villages

. fire management areas

"These surface disturbances should first be described as completely as possible so that the reader will have a thorough mental image of each one.

Once these surface disturbances are described, the next problem is to relate these disturbances to the visual elements and discuss the relationships in terms of impact. These relationships can be discussed at a general level (by groups) or a specific level (individual disturbances considered) " (Laurizio, Sullivan, 1980:29).

"A general vulnerability map could be prepared that would be useful as a starting point for planning purposes. This map would be based on interpretation of four overlays. The overlays would be prepared for land form, water form, vegetation and cultural modifications were appropriate. Each of the land form categories, for example, would be rated as to its visual sensitivity to each of the three general surface disturbances " (Laurizio, Sullivan, 1980:34).

Conclusion - 1980 Study

The descriptive inventory system successfully defined the visual resources of the Northwest Planning Unit through identification of the region's landscape character - a major goal of the study. However, the system dealt exclusively with regional scale issues, and as such, has its limitations. Land managers not only need to understand the visual character of a region, they also need the ability to accurately predict the impact a site specific proposal will have on the visual resources of the environment. This ability is extremely important because most development will have major visual impacts at this scale which cannot be addressed with regional scale analysis alone. This is not to say it has no useful purpose or is without merit. One temptation is to overlook this portion of the methodology and go directly to a larger scale (more detailed) format. Visual analysis carried out at the Continuity and Province scale (regional) provides a means to better understand a changing and evolving landscape character over time (Litton, Tetlow, 1978). The characteristic landscape is a composition of many relationships - human, biological, and ecological. The regional level of visual analysis serves as an educational tool for land managers, resource personnel, and for public discussions and workshops. With an understanding of the visual resources at the regional scale, it becomes possible to mentally and physically create a visual image for a particular area. This visual image is important to the understanding of how and why landscapes change (good or bad) over a given period. The descriptive inventory is a benchmark at a known point in time for a particular region and, through further analysis, landscape elements and proposed surface disturbance can be studied.

Proposed Visual Resource Management System

Work in the 1981 study was initiated by reviewing the previous summer's work and the conclusions the 1980 team made about its work. The author agreed that a descriptive analysis would be a valuable and necessary component of any system and that a hierarchical inventory method should be used to adequately address the various needs of land managers of the North Slope region. After reviewing information gathered during 1980 and additional published data, the author first grouped information by subject and then categorized it according to scale. This inventory system and its format, which was developed at the conclusion of the 1980 study, grouped information into three categories.

Mapped, small scale visual data between 2.5 million and 1.0 million scale (40 miles - 16 miles to the inch) was classified as level one, or macroscale; level two, median scale, was illustrated by maps scaled at between 1.0 million and 250 thousand (16 miles - 2 miles to the inch); and, third, the microscale, level three, was scaled data between 63,360 thousand and 16,000 thousand (1 mile - .25 miles to the inch). Table 3 summarizes the scales of commonly used maps for inventory work, the level of detail illustrated, size of a minimum mapped unit, and possible uses of information.

From analysis of the various scales and their potential uses, it became apparent that a broad range of needs and concerns could be addressed within these scales; therefore, the author concluded that the proposed inventory should consist of three levels - macro, median and micro levels. The first two, macro and median, should be descriptive in nature and the third, micro, should be predictive.

Scale	Level of Detail	(Resolution) Size of Minimum Map Unit (square mi.)	Example of Uses
Macro Scale			
1:2,500,000- 1:1,000,000 (1" = 40 mi.- 1" = 16 mi.)	Broad/General Level 1*	4 sq.mi. to 10 sq.mi.	Regional Planning Reports (data presentation)
Median Scale			
1:1,000,000- 1: 250,000 (1" = 16 mi.- 1" = 4 mi.)	General/Moderate Level 1* Level 2*	2 sq.mi. to 4 sq.mi.	Regional Planning
Micro Scale			
1:250,000- 1: 63,360 (1" = 4 mi.- 1" = 1 mi.)	Moderate/Master Planning Level 2* Level 3* (Level 4)	.25 sq.mi. to 2 sq.mi.	Locational Planning Resource Inventories Resource Management
Not available at this time Larger scale	Specific/site planning Level 4* Level 5*	.25 sq.miles	Site Management Access Land Conveyance Development Land Status

*-Provisional classification framework for Alaskan vegetation. (Viereck and Dyrness, 1980)

Table 3. Adapted from Visual Resource Inventory and Analysis for the Alaskan Landscape, 1980.

Macroscale Inventory

The macroscale inventory, as proposed, utilizes four sources of information - Robert G. Bailey's Ecoregions of the United States, 1976, Clyde Wahrhaftig, Physiographic Divisions of Alaska, U.S.G.S., topographic maps and aerial reconnaissance.

Ecoregions of the United States by Robert G. Bailey, 1976.

Robert Bailey's mapping system for the conterminous United States, Alaska, and Hawaii is unique in that it attempts to classify ecological data into a hierarchical framework. This classification framework is subdivided into four levels: domain, division, province, and section (see Table 3). Within this framework, Bailey combines land surface form, climate, vegetation, and soils, to form "ecoregions". The remaining ecosystems - district, landtype associations, landtype, and phase and site - were suggested by Bailey as potential areas for further study but were not investigated in his original work.

The following Table 4 summarizes both Bailey's ecoregion work and the proposed visual resource inventory system for the North Slope.

PROPOSED VISUAL INVENTORY SYSTEM	HIERARCHY FOR ECOSYSTEMS BY BAILEY	DEFINED AS INCLUDING:
BAILEY'S ECOREGIONS STUDY		
Macroscale	1. Domain	Subcontinental area of related climates.
	2. Division	Single regional climate at the level of Koppen's types (Trewartha 1943).
Median Scale	3. Province	Broad vegetation region with the same type or types of zonal soils.
	4. Section	Climatic climax at the level of Kuchler's potential vegetation types (1964).
FUTURE ECOREGION STUDY		
Microscale	5. District	Part of a section having uniform geomorphology at the level of Hammond's land-surface form regions (1964).
	6. Landtype associations	Group of neighboring landtypes with recurring pattern of land-forms, lithology, soils and vegetation associations.
	7. Landtype	Group of neighboring phases with similar soil series or families with similar plant communities at the level of Daubenmire's habitat types (1968).
Site Scale	8. Landtype phase	Group of neighboring sites belonging to the same soil series with closely related habitat types.
	9. Site	Single soil type or phase and single habitat type or phase.

This table is not intended to define the levels precisely, but merely to indicate the general character of the classifications.

Table 4 Alaskan Visual Resource Classification Framework
Adapted from Ecoregions of the United States by Bailey,1976.

"A <u>domain</u> is a subcontinental area of broad climatic similarity such as lands having the dry (B) climates of Koppen (Trewartha 1943) or Thornthwaite (1931).

A <u>division</u> is a subdivision of a domain determined by isolating areas of differing vegetation and regional climates generally at the level of the basic climate types of Koppen.

A <u>province</u> is a subdivision that corresponds to a broad vegetation region having a uniform regional climate and the same type or types of zonal soil. Each province is characterized by a single climax association, but two or more climaxes may be represented within a single province. This often happens on mountains where each altitudinal zone may have a different climax. For the purpose of this classification, highland ecoregions such as mountains, plateaus, and high elevation plains (altiplano), in which a high degree of altitudinal zonation occurs, are considered separate provinces. They are classified according to the climatic regime of the lowlands in which they occur.

A <u>section</u> is a subdivision of a province and is based on local climatic variation. The section is characterized by a single climax association and reflects climatic variation within the broad regional climate. Variation in potential vegetation, as mapped by Kuchler (1964) is used as the principle indicator of a section." (Bailey, 1976).

Due to the hierarchical complexity of Bailey's ecoregions and direct application of ecological data to visual analysis, the original four ecosystems (Domain, Division, Province, and Section) were simplified for this study. To accommodate the macroscale, the four ecoregions (see Table 4) were recombined to best illustrate the visual resource and yet maintain the hierarchical relationship among the categories. As illustrated in Table 4, Domain and Division are combined to form the macroscale inventory, Level One. Province and Section are combined to form the median scale inventory, Level Two. Bailey's Section ecosystem was not available for use at the median scale, because of the homogenity of the Arctic North Slope region. This is due to the extremely northern latitude of the study area.

For this study, Domain and Division information will be used for the macroscale and Province information will be used for the median scale inventory.

Physiographic Divisions of Alaska by Clyde Wahrhaftig, 1965.

The Wahrhaftig report provides a regional physiographic descriptive inventory of the State at 1:2.5 million scale (1" = 40 miles). Wahrhaftig used physical appearance of the topography as a basis for delineating one division from another. This pattern is then modified by geologic structure which may or may not have a significant visual attribute. Wahrhaftig divided the state into three divisions: the Rocky Mountain System, the Intermontane Plateaus, and the Pacific Mountain System.

Wahrhaftig further divided these divisions into physiographic subdivisions called provinces, of which there are twelve in the state. These twelve provinces are further broken down so that there are sixty units of physiographic divisions for Alaska. For the purpose of the macroscale inventory, the smallest units are not appropriate because of the mapping limitations of the small scale base maps. Wahrhaftig's detailed narrative descriptions were very useful, however.

Topographic maps provided essential visual data for all three levels of the inventory. At the macroscale, however, topographic maps were used in conjunction with the Gordon and Shaine report to help interpret and describe the landscape patterns that exist within a region.

Through a Map-O-Graph enlargement process, these maps were all converted to a common base scale of 1:2,5 million (1" = 40 mi. approx.). This procedure helped coordinate the regional landscape characteristics being studied at the macroscale and established a common base map from which to work. The following maps were used at the macroscale level of investigation:

Name of Map/Purpose	Scale
Ecoregions of the U.S., Ecological patterns	1:17,000,000/1" = 268 mi. approx.
U.S.G.S. Topographic maps, Land form patterns	1: 5,000,000/1" = 80 mi. approx.
U.S.G.S. Topographic maps, Land form patterns	1: 2,500,000/1" = 40 mi. approx.
Alaska Lands Act, Land Ownership	1: 2,500,000/1" = 40 mi. approx.
Alaska Map A, Drainage Patterns	1: 5,000,000/1" = 80 mi. approx.

Field Work

The field work for the descriptive inventory both at the macro and the median scales was conducted, as previously stated, in a fixed-wing single engine Cessna 206 plane. During 1981, the reconnaissance flights were flown at 5000 feet altitude (rtg) over the Arctic North Slope Planning Unit. Personal descriptions and impressions of the area were recorded and a photographic inventory was made. These flights afforded the opportunity to verify published data and to record recent cultural modifications to the landscape.

Macroscale Inventory - Summary

The regional macroscale inventory can help in the visualization of a regional landscape in a relatively short time period. By inventorying a region's visual and natural characteristic patterns, visually and ecologically distinct landscapes can be distinguished. The knowledge gained through a macroscale inventory application reveals each region's natural intrinsic differences, and also helps in determining the limitations and opportunities over a regional area, which may be incorporated into regional landscape planning work. Once a basic understanding of a region has been achieved, a more refined inventory is needed to further the descriptive inventory process to the subregional level.

To evaluate the landscape at a finer descriptive level, level two, the median scale is applied. Level two will provide a more specific description of land form patterns, vegetation cover and patterns, water patterns, and existing cultural patterns which influence and make up the visually perceived environment.

Median Scale Inventory

The Median scale inventory is the second level of descriptive landscape investigation within the classification framework. It is used to portray the visual resources of an area below the macroscale level and, similarly, uses environmental data to determine existent landscape patterns.

Using the information from the median scale, the land manager is able to intuitively determine the natural physical restraints a region is likely to possess and, in general, determine probable impacts on the visual resource which might be inherent in project proposals.

Information on land form, vegetation form, and water form were inventoried in a fashion similar to the macroscale level except that the information gathered is depicted at a larger scale and in some cases a different format containing greater detail. For instance, at the macroscale level, the landscape character types were investigated at the regional continuum of 10-100 thousand square miles. The median scale inventory, however, focuses the visual resource investigation down to sub-regional areas of 1-10 thousand square miles. After reviewing published data and reflecting back on what was seen during the reconnaissance flights from the previous summer, it became apparent that land form, water form, and, to a lesser degree, vegetation patterns, are the dominant visual features in Alaska's Arctic North Slope region. To develop an accurate description of these features, the median scale inventory uses four data sources - publications, aerial oblique photography, topographic maps and aerial reconnaissance flights.

Publications

The primary publications proposed for use at this scale are Edwin H. Hammond's Land-Surface Form, 1965, information from Gorden and Shaine's Alaska Natural Landscapes, 1978, and R. G. Bailey's Ecoregions of the United States, 1976.

Land-Surface Form, developed by the geographer, E. H. Hammond, consists of a process whereby the visual expression or character of a landscape is determined. Hammond's work is similar to Fennerman, Powell, and Wahrhaftig in that it is a geomorphic study. Hammond's work, however, does differ in one specific area, its application of an 8% inclination cutoff point in regard to land utilization. As the level or slope of inclination increases beyond 8%, problems with erosion, vehicle movement and an overall feeling of increased terrain ruggedness becomes apparent (Hammond, 1969). The added characteristic of land utilization would appear on the surface to cloud the issue of a purely scientific analysis in defining land forms. However, ultimately, land use decisions will be made on locating proposed projects in remote regions of Alaska and, consequently, these decisions will affect future visual experiences. Therefore, on this basis, Hammond's work was felt to be a superior contribution to land form analysis in Alaska.

Specifically, Hammond's classes of land-surface form address five properties: 1. percentage of an area occupied by surfaces of gentle inclination (less than 8%); 2. local relief; that is, maximum difference in elevation within a limited area; 3. percentage of gently inclined surface that lies in the lower half of the local relief; 4. percentage of an area occupied by sand, ice, and standing water; and 5. patterns of major crests, peaks, and escarpments (Hammond, 1969).

Hammond's reasoning for using these five criteria is to "enable the user to compare and contrast the surface form of different parts of the country in specific terms," and also to "be especially effective in conveying a visual image of the surface form, be broadly suggestive of possible relationships to other phenomena of geographical interest especially potential landuse; be capable of being determined readily for broad areas from available map data, and be capable of simple expression" (Hammond, 1969:61).

One of the more useful features of Hammond's study is the unit area he chose to depict local relief. Hammond's experimentation led him to use a land unit size of six square miles and, by determining the maximum difference in elevation within this unit area, local relief was determined. Through a screening process, Hammond was able to segregate land forms into homogeneous areas and recognizable landscape patterns and features became evident.

Alaska Natural Landscapes by R. J. Gordon and B. A. Shaine, provides a subregional descriptive inventory of Alaska at 1:2.5 million scale (1" = 40 miles). Descriptions were made of "superlative" landscapes in Alaska. These superlative, one-of-a-kind landscapes include dormant volcanoes, wild and scenic rivers, fragile wetlands and mountain ranges. Once inventoried, these landscape features were divided into two categories: visual units of a single character type which stand out from a statewide perspective, and scenic complexes, where a diversity of outstanding visual units are in close proximity to each other. Wahrhaftig's physiographic province map of Alaska (1965) was used to regionalize terrain patterns and an Ecosystem Map (1973) was used to identify regional landcover diversity. Taken together, regional visual similarities and differences in landscape character types were effectively delineated at the median level scale of inventory.

Robert Bailey's Ecoregions of the United States, as previously described at the macroscale inventory level, was used to identify ecological pattern information. This information required some adjustments to best fit the visual inventory framework for the Arctic North Slope. Bailey's Domain and Division were adapted to represent the macroscale inventory whereas Province and Section are combined to form the median scale inventory, level two.

Aerial photography and U.S.G.S. topography maps were used extensively at the median scale level and each resource contributed a unique dimension to the inventory. Color infrared photographs, scaled to 1:63,360, were used to inventory land forms, water forms and cultural modifications. The photographs' resolution revealed individual topographic land form features and demarcations, also, when several photos were mosaic land form patterns were visible. Other advantages of using available photography is that it provides a recent record of the visual modifications on the Arctic North Slope, updating can be done quickly, it is cost effective in remote roadless areas, and inventory work can be done at any time.

Topographic survey maps scaled 1:250,000 were used as the base for all visual data at the median scale. These maps provided the dimension of height/relief not easily recognized in aerial photographs and also, spatial relationships of visual features to each other can be identified and studied.

Field Work

A visual introduction to Alaska's many different landscapes was obtained by using aerial reconnaissance during the macroscale inventory. These overflights helped establish a basic overview on how regions differ visually. Reconnaissance flights for the median scale inventory were aimed at studying the individual compositional landscape patterns of a specific area. Landforms, water forms and cultural patterns were inventoried as key elements in this process. The source data which was assembled in the office provided base information on these landscape features and the flights were used to validate what was on the maps and to identify and describe them in more detail.

The aerial reconnaissance field work was conducted in a Cessna 206 plane at a low altitude (1,000 feet - 3,000 feet relative to the ground) in contrast to the higher altitudes used during the macroscale level of study. Tasks completed during these lower overflights consisted of developing a 35mm photographic log of specific landscape components such as, land forms, water forms, vegetation forms, and land surface color; also, personal field notes and impressions while traversing the Arctic North Slope.

Initially, only one researcher was assigned to conduct this field work. Through trial and error, this number was increased to include an additional researcher because of the rapidity of changing landscape scenes observed when flying. Both investigators kept notes and each used a 35mm camera with a standard (50mm) lens and photographed landscape components using Kodak Ektachrome 200 ASA film.

As a final preflight precaution, and to efficiently use the plane, the pilots were versed on the objectives to be accomplished. This participation and communication turned out to be beneficial for all.

The pilots remained enthusiastic throughout the field season and this researcher used their expertise to locate and describe the visual landscape patterns (landmarks and unique features) on the Arctic North Slope. Also, their past experiences were again consulted for the development of the photographic log. This log included a record of the landscape components and the general types of visual impacts (i.e., linear, area, and point) that have occurred on the North Slope.

Median Scale Inventory - Summary

Through the application of the median scale inventory, many individual landscape patterns which were not seen at the macroscale due to the size of the land area, now become visible, such as individual landscape edges, boundaries, land form and water features. Information by Hammond and Bailey helped in the categorization of the landscape elements which were eventually used to determine visually discrete land areas. To verify the land areas, low level flyovers were made and photographic documentation kept for future needs. Familiarization became a key factor during this inventory effort.

For the Alaska North Slope landscape, land form or topography was determined as being the dominant visual factor, in contrast to other regions in Alaska where vegetation or water dominate the visual landscape scene. The median scale inventory can identify these major land form character types but is limited in the amount of detail it can show. Although it can assist land managers in making land use policy decisions, it cannot be used to predict the extent to which the visual resources of an area can be affected by a project. This can only be accomplished through the use of a larger scale, third level of analysis.

Microscale Inventory

As described previously, very accurate information about the Arctic North Slope's visual character and the components that form that character can be collected and analyzed to produce a vivid impression of the region. However, questions remain on how the subtle variations in the landscape character of a province/section can be defined. What makes some areas more vulnerable than others to degradation of their visual resources by development? How can land managers determine, beforehand, which areas will be affected most? The microscale inventory is designed to address these issues and to meet BLM's needs as expressed by their land managers and by this researcher's experience in working with the Alaskan BLM Visual Resource Management System. From these needs and concerns, four objectives were developed for this scale of the inventory process:

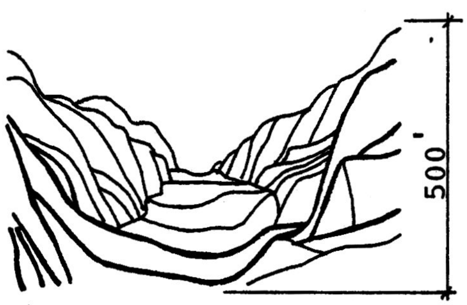
1) It should be able to predict the impact future development will have on the visual resources of the landscape.
2) It should contribute to better understanding of the visual resources on BLM Alaskan lands.
3) It should be simple in design and application so that non-professional staff can assist in developing the necessary information.
4) It should be inexpensive to implement.

Interactions among climate, geologic structure, vegetation, topography and time are a complex and naturally evolving cycle. What man sees in his surroundings are the end results of these interacting forces in the creation of land forms, water forms and vegetation forms. These physical characteristics will vary in type and degree and they distinguish one region from another.

In Alaska, especially on the Arctic North Slope, land form is the dominant visual characteristic. Water and vegetation are important visual elements and do add distinctiveness to particular areas in Alaska, but to a lesser degree than land form. This conclusion was made while conducting the median-scale field inventory during the summer of 1981. At that time, several different types of development were observed and it became apparent that man-made activities which occurred in steeper areas create much larger and more visible scars than development located on flatter terrain. Another factor is the North Slopes short 4-week growing season which prevents the growth of major vegetation, limiting potential screening and erosion control for developments. Therefore, to avoid irreparable damage to the visual resources, two major factors must be recognized. First, to avoid damage to the natural environment, slope percentages within an area must be delineated and taken into consideration in land use decisions. Second, to either avoid or amend present siting and construction practices so they would not alter the area's visual quality beyond acceptable standards, land management practices must be modified to implement recommendations developed based on the slope percentages inventory.

Another important observation noted from the 1981 low altitude field reconnaissance work is the continuing change in land form character. The observed changes usually occurred within a 3-5 minute viewing period and were frequently dramatic, such as a major break in topographic relief or the crossing of a river valley. These observations were not actually timed for this study but are subjective impressions noted by this researcher. When viewed from the ground, many of the subtle relief changes that are visible from the air are not as noticeable. Nevertheless, the aerial view did help in observing the existing development, in focusing on where further visual investigation should be concentrated, and on developing a large scale analysis technique that identifies the two physical characteristics which all land forms possess: relief and slope.

Relief is expressed as the difference in elevation between the highest and lowest points within a given area (See Figure 2) and slope is the difference in elevation between two points, divided by the horizontal distance (length) between them. Slope is usually expressed as a percentage or gradient equivalent in degrees (Figure 3).



$$\text{Percent Slope} = \frac{\text{Change in Elevation}}{\text{Distance}} \times 100$$

Figure 2. Relief

Figure 3. Slope

Relief and slope are tied together both visually and spatially and each landscape has a visual form which is an expression of these factors (Figure 4). Landscapes may be viewed as mosaic patterns of changing relief and slope.

Some landscapes appear flat with little vertical change while others are extremely rugged (see Figure 4). Again descriptors such as flat and rugged are used but at the microscale these physical characteristics are measured, plotted and graphically illustrated so that land managers can get a clear understanding of where and to what extent each type of land form exists.

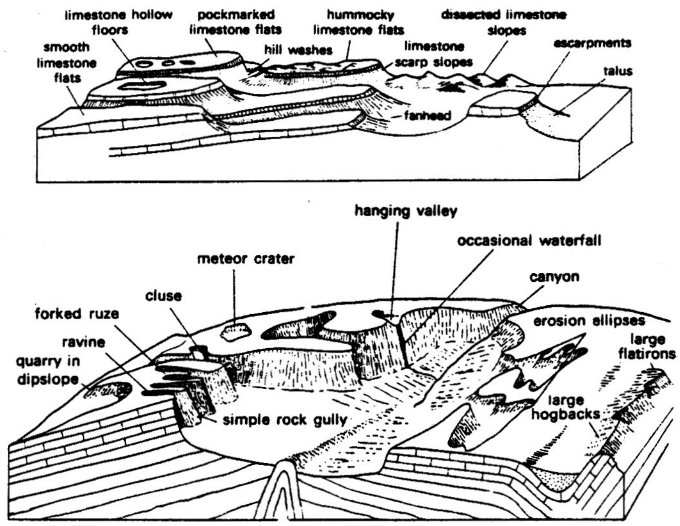


Figure 4. Visual Expression Through Land Form(from Townshed,1981)

Procedure

Using slope analysis to assist in determining where and how facilities will be located on a site is nothing new to landscape architecture. Traditionally, the slope is calculated between contours for the entire site and is part of the site inventory/analysis process depending on the scale of the project. Ideally, this procedure could be used in any region and at most scales. However, this is not feasible for Alaska BLM lands for a number of reasons which are interrelated. First, individual inventory units range in size from half-a-million to over five million acres on the North Slope. Land areas of this magnitude make the construction of a conventional slope analysis very time consuming. Second, the BLM does not have the manpower and funding necessary to undertake such a project. Third, computer systems using digitized terrain data are approximtely five years away from coming on line in the BLM Fairbanks District Office.

The primary goal of the microscale inventory is to develop a system that categorizes land form by slope, incorporates additional landscape character information about surface pattern and waterform, and accomplishes this at a scale and in a format that shows sufficient detail to be of use to the land managers. The method used to accomplish this started with a search of existing published information to find appropriate base data. This was followed by studying slopes and ranges of slopes that could be used to describe land form, developing mapping techniques, and supplementing this data with surface pattern and waterform information.

To find appropriate base data, published natural resource information was again reviewed as in the previous macro and medianscale inventory levels. Table 4 is a summarization of the data studied.

<u>Primary Visual Determinants</u>

Land form and Relief/Slope Characteristics	Scale
1) High altitude false color aerial photographs	1:63,360
2) Topographic maps	1:250,000/ 1:63,360

<u>Secondary Visual Determinants</u>

Water Patterns, Visual Surface Patterns	Scale
1) Topographic maps	1:250,000/1:63360

Table 4 Office Data - Microscale

There exists a basic similarity between the macroscale, median scale and microscale resource data base. The reason for this similarity is twofold. First, the hierarchical nature of the methodology and the data used to depict a visual phenomena, be small scale or large scale, should be transferable in application, to have a consistent inventory methodology. Second, in Alaska only a limited amount of pertinent BLM natural resource data exists, and when such information does exist, it is seldom in a usable scale format. Therefore, scale overlapping of some data occurs to fill the voids for the lack of information or information at an inappropriate scale.

Land forms were studied through the use of USGS topographic maps and NASA high altitude false color aerial photography, both scaled to 1:63,360. The imagery provided one method by which large land areas could be studied, in a short period of time and provides a good contrast between land form, water form, low shrub vegetation and other terrain features. As of 1981, most of Alaska has been photographed through federal agencies or private institutions and also in varying scales and formats.

USGS topographic maps were used in conjunction with aerial photography throughout the visual inventory process in both a primary and secondary role. Through the use of these maps, it is possible to accurately identify land form patterns and to calculate slope. Figure 5 is an example of a topographic map which was used to study land forms.

In a secondary role the topographic maps served in two additional ways. First, through an inventory process the presence, distribution, and the form of water features were identified and, second, visual surface patterns such as ridges, valleys, sideslopes, plateaus, and major edges were delineated (see Figure 6).

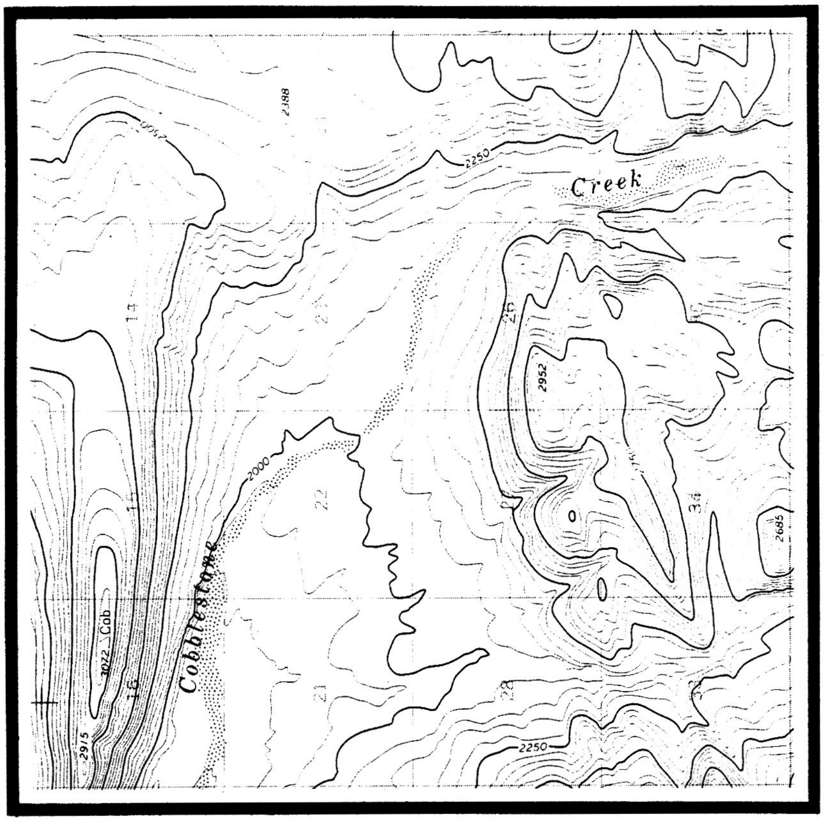


Figure 5. Chandler LK. Area - Cobblestone Creek
Scale - 1" = 1.0 miles

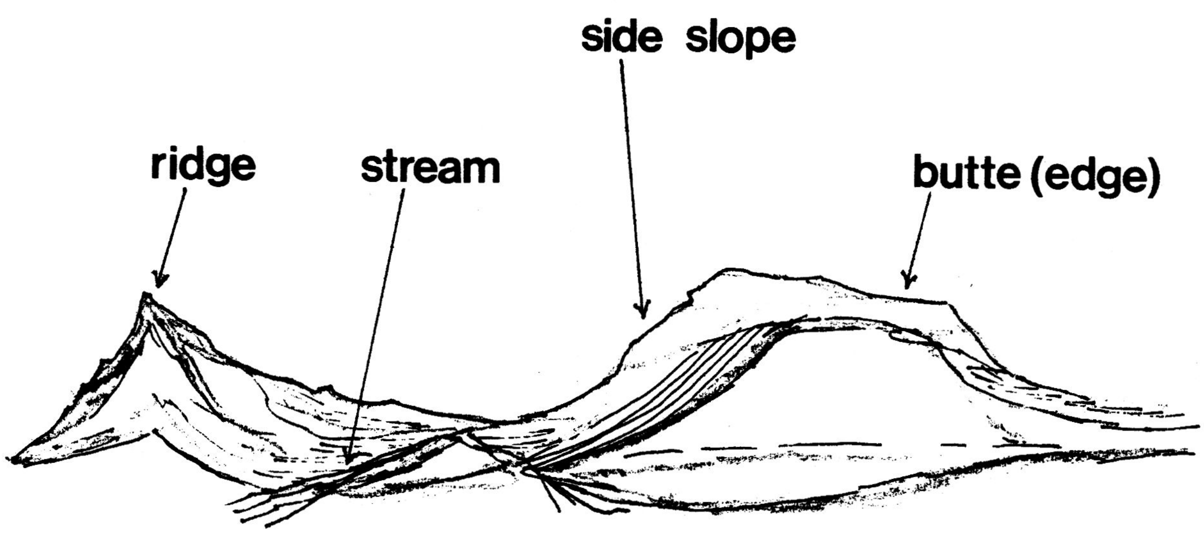


Figure 6. Chandler LK Area - Cobblestone Creek
No scale.

Typical ranges of slopes used in landscape architecture to identify land form types and their impact on land uses are:

Slope Percentages	General Description/Potential Impacts and Uses
0 - 5%	Flat Terrain, Standing Water Potential
5 - 8%	Gently Rolling, No Major Grading Needed, Good Water Movement
10 - 15%	Gently Rolling, Moderate Grading Needed, Some Erosion Potential
15 - 20%	Rolling, Major Grading Needed for Large Areas, Topography Should Influence Siting
20 - 25%	Steep, Avoid Grading Large Areas, Topography Should Dictate Siting
25% and Greater	Very Steep, No Major Development

Using these slope classes as land form type criteria, this researcher attempted to verify through field studies whether or not they accurately describe the North Slope landscape.

Field Work

The Central Arctic Management Area (CAMA) planning unit is located on the North Slope and managed by BLM. It was selected to verify the relief changes identified from both the low altitude flights and topographic maps. Verification of these land form/slope relationships required landing at several locations and an unbiased sampling was done to determine helicopter landing spots. The sampling was done by this researcher, two BLM staff landscape architects, and the helicopter pilot. The pilot was consulted to determine the range of the aircraft. For the Bell Jet Ranger Helicopter, 200 miles was the limit with all the stopping and starting of the aircraft.

Fifty inventory points were chosen and located within a 100-mile radius of the Galbrith Lake camp. At each inventory point color slides and black and white panorama prints were made, field notes were taken and the degree of slope that was visually perceived by individual team members was recorded. On most of the field trips, three people participated in taking notes and selecting slope classes. This researcher was present at all fifty inventory points. The ground survey was conducted in two phases. Phase One went from July 15 to July 18, 1981, and the second phase was from July 27 to August 3, 1981. Between phases, photographic inventory data was processed to determine if adjustments needed to be made in the inventory procedure; also, the location of each inventoried point was coded and accurately mapped on 1:63,360 USGS topographic maps. No adjustments were needed, so the same process was used for both phases.

With the completion of the ground inventory all fifty inventory points were located on 1:63,360 USGS scale topographic maps and a photographic record made for future reference.

Slope, as previously mentioned, was first established through an estimation process. At each of the fifty inventory points an evaluation was made on the amount of slope perceived, the land form character and spatial character within a half-mile radius of the inventory landing point. Five distinct land form types were observed through low altitude aerial reconnais-sance, and ground truthing was used to verify those observations. Figures 7-11 are illustrations of the five land form types, their locations on topographic maps, and a cross section of each. Table 6 is a summarization of the observations recorded from the plane:

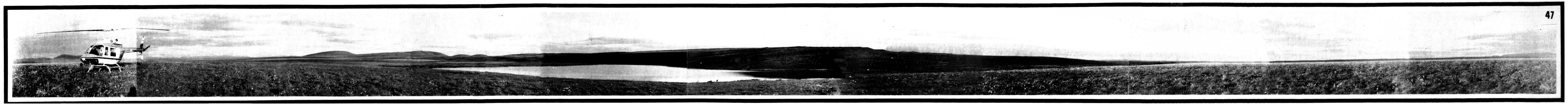
Land form Types	Spatial Character	Land Form Character
Type One	spacious indistinct, panorama	generally level
Type Two	defined, semi-enclosed	gently rolling
Type Three	distinct, enclosed	moderately hilly
Type Four	very distinct, enclosed	low mountains
Type Five	focal/monumental	high mountains

Table 6. Summary of Land Form Types on the North Slope

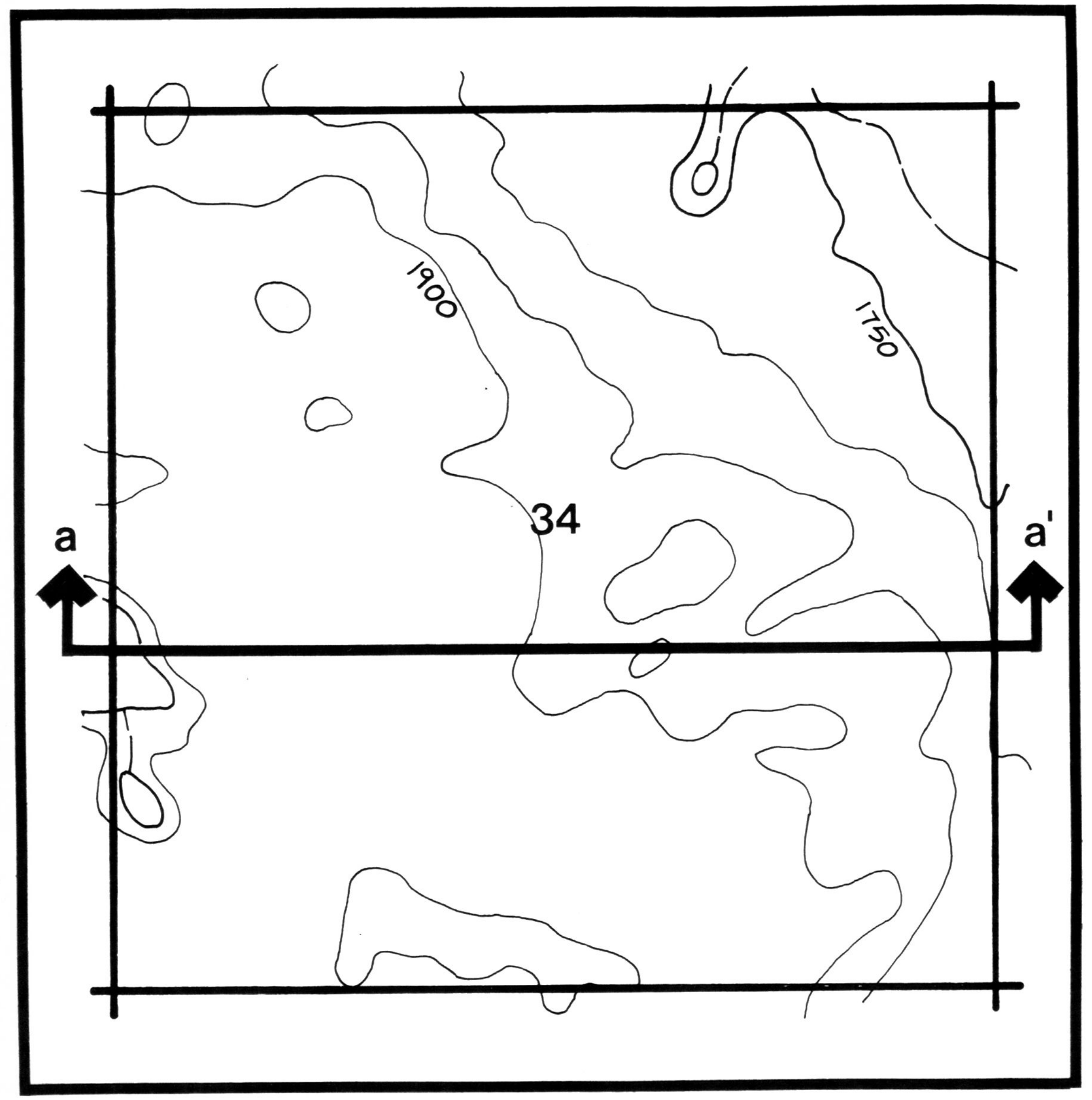
The ground truthing revealed that approximately 12 of the 50 inventory points had overlapping land form characteristics; when this occurred, the dominant land form characteristic was chosen to represent that land form type. Except for these 12, the remaining areas coincided with the five land form categories quite well.

Slope, spatial enclosure, and relief are interrelated factors that give visual expression to an area. As spatial enclosure increases within an area, slope and relief also increase for that specific area. For example, a quarter-mile wide canyon or a three-mile wide river valley exhibit similar land form elements - sideslopes, river channel and water; however, the magnitude and spatial enclosure for each are different.

As observed within the study area, locations with low spatial enclosure had flat, spacious, indistinct topographic relief over a half-mile horizontal viewing distance, whereas, in areas of high spatial enclosure, the land form character and relief exhibit a very high contrast through distinct monumental land form. Table 7 is similar to Table 6 except quantification is added to predict land form character and slope values. This chart is a compilation of data from the fifty inventory points and the visual relationships observed on the North Slope study area.

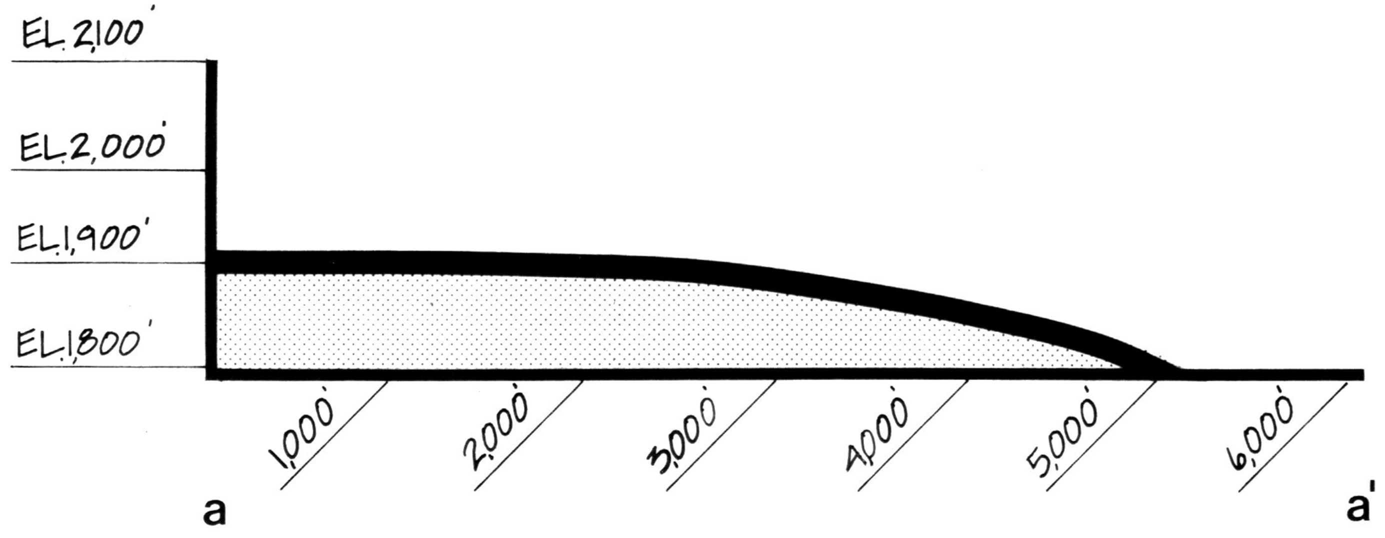


Panoramic View



Plan View

Scale 1"=1,000'

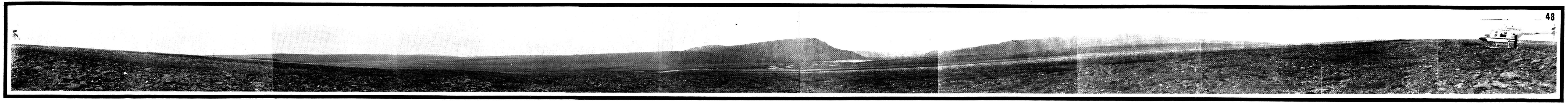


Type 1 Land Form Character Section (34)

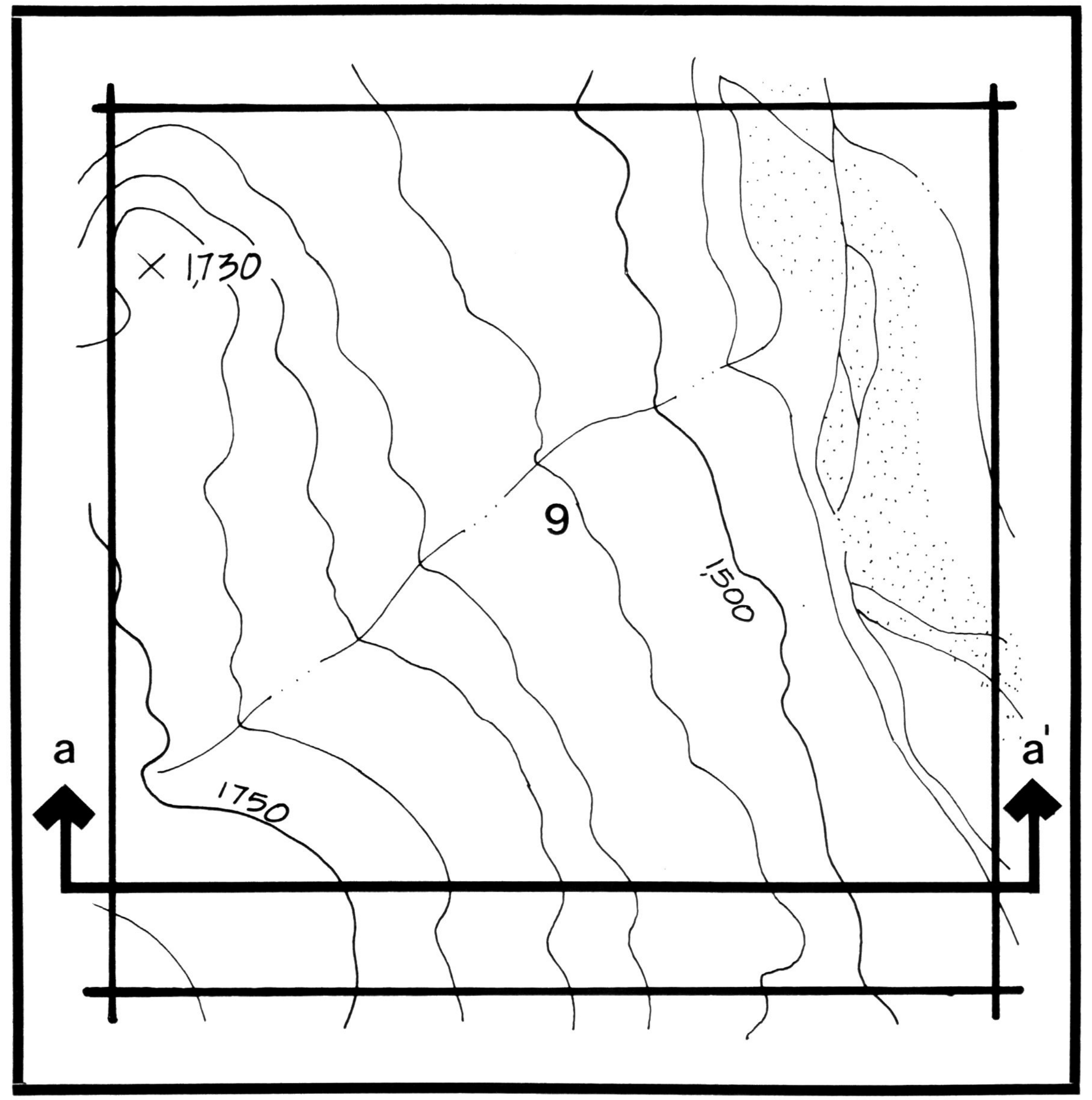
Scale Hor. 1"= 1,000', Vert. 1"= 200'

LAND FORM CHARACTER TYPE 1

figure 7

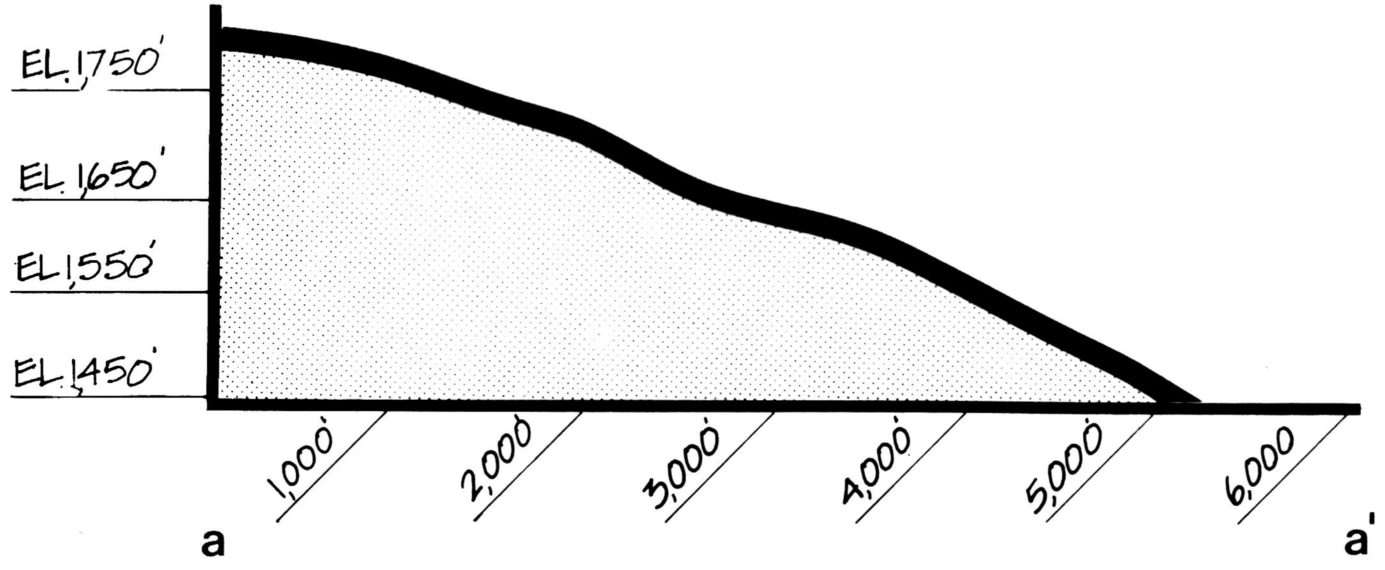


Panoramic View



Plan View

Scale 1"=1,000'

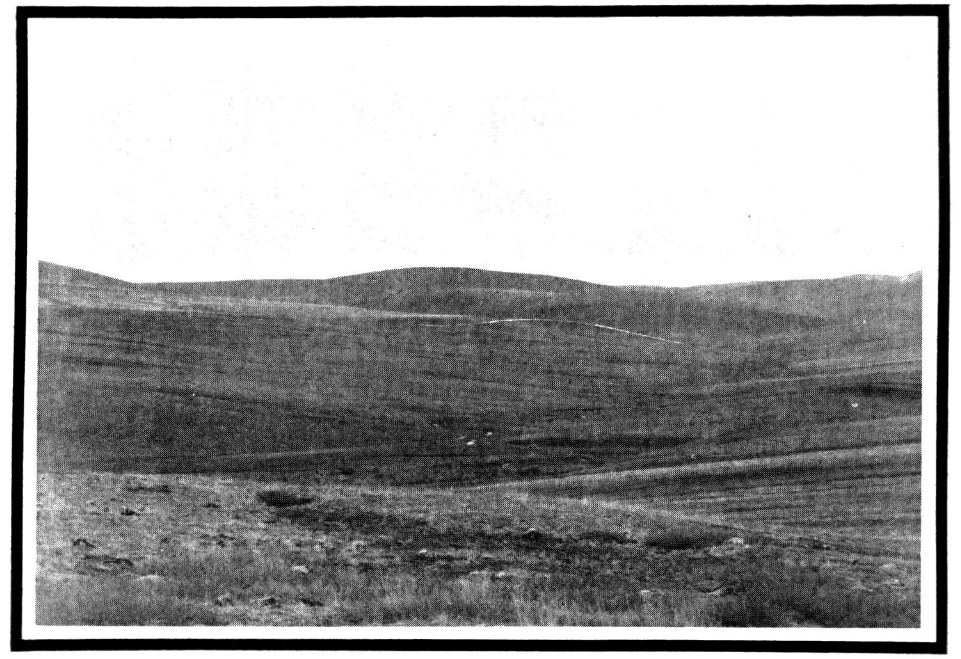


Type 2 Land Form Character Section(9)

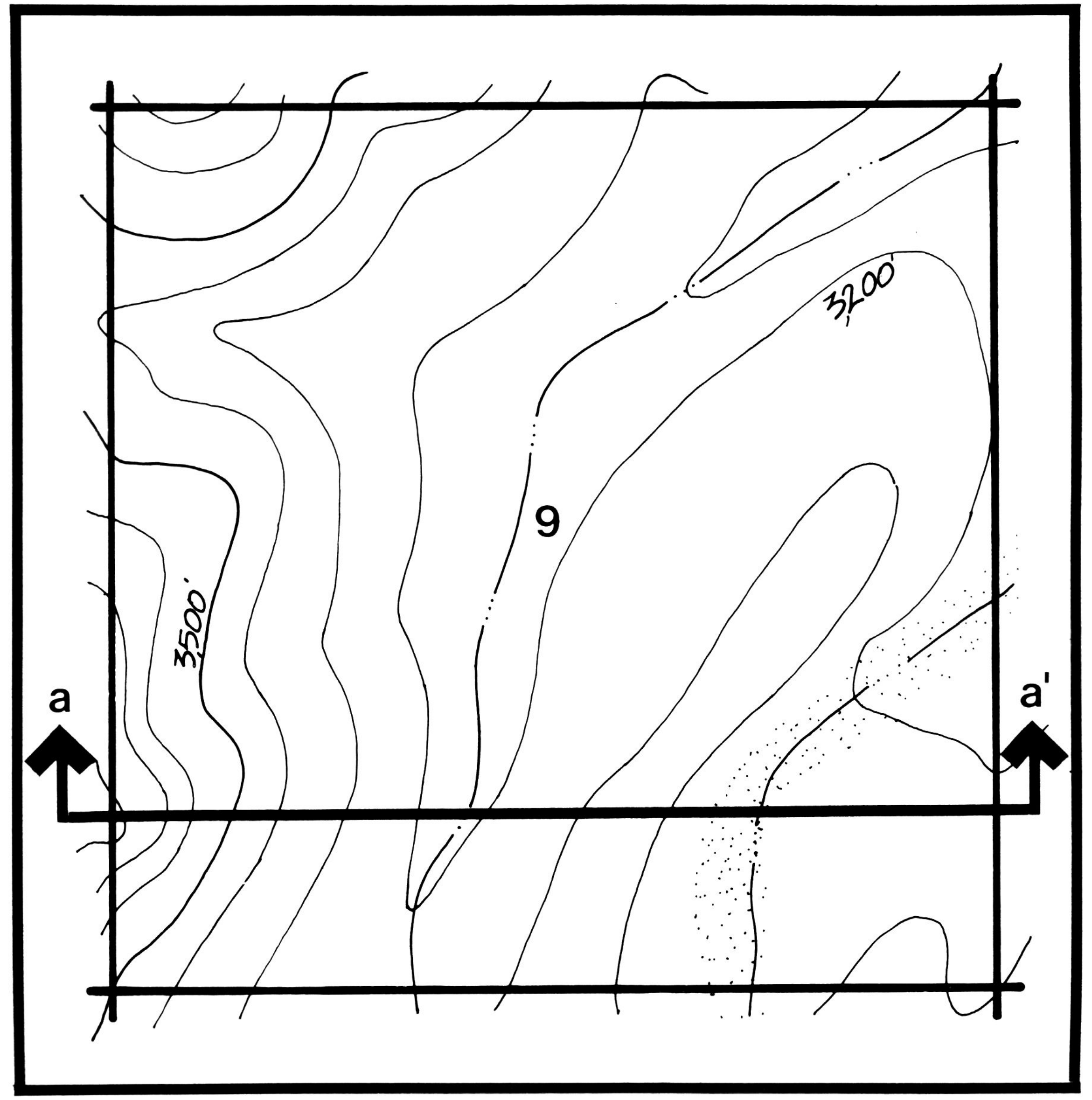
Scale Hor. 1"=1,000', Vert. 1"=200'

LAND FORM CHARACTER TYPE 2

figure 8

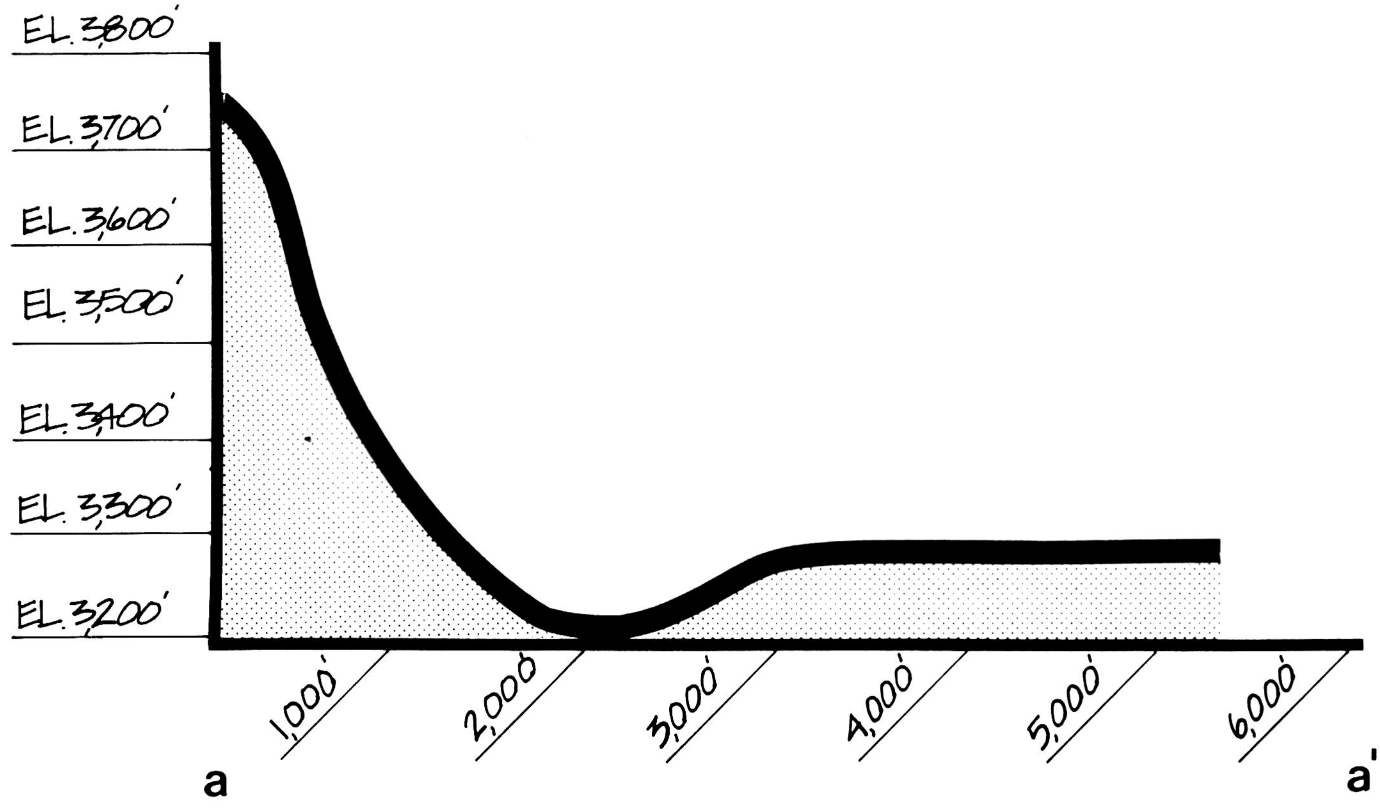


Panoramic View



Plan View

Scale 1"=1,000'

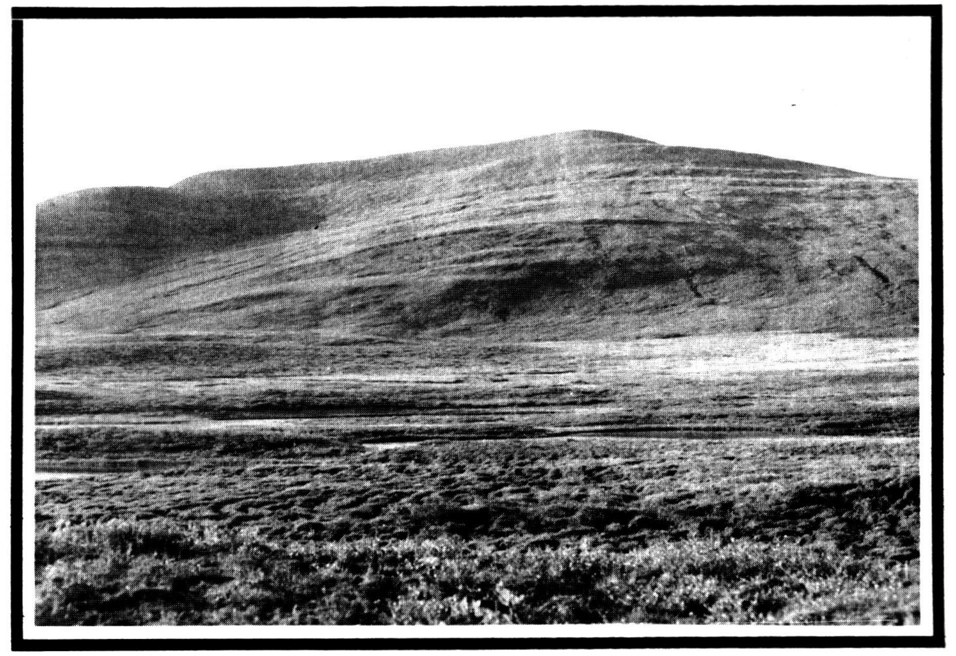


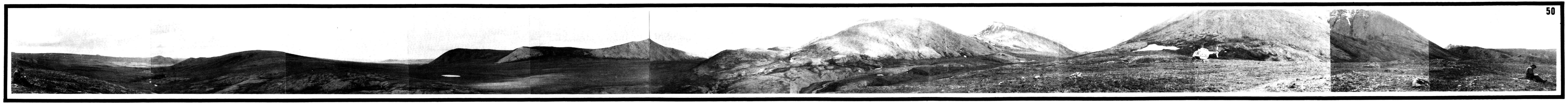
Type 3 Land Form Character Section(9)

Scale Hor. 1"=1,000', Vert. 1"=200'

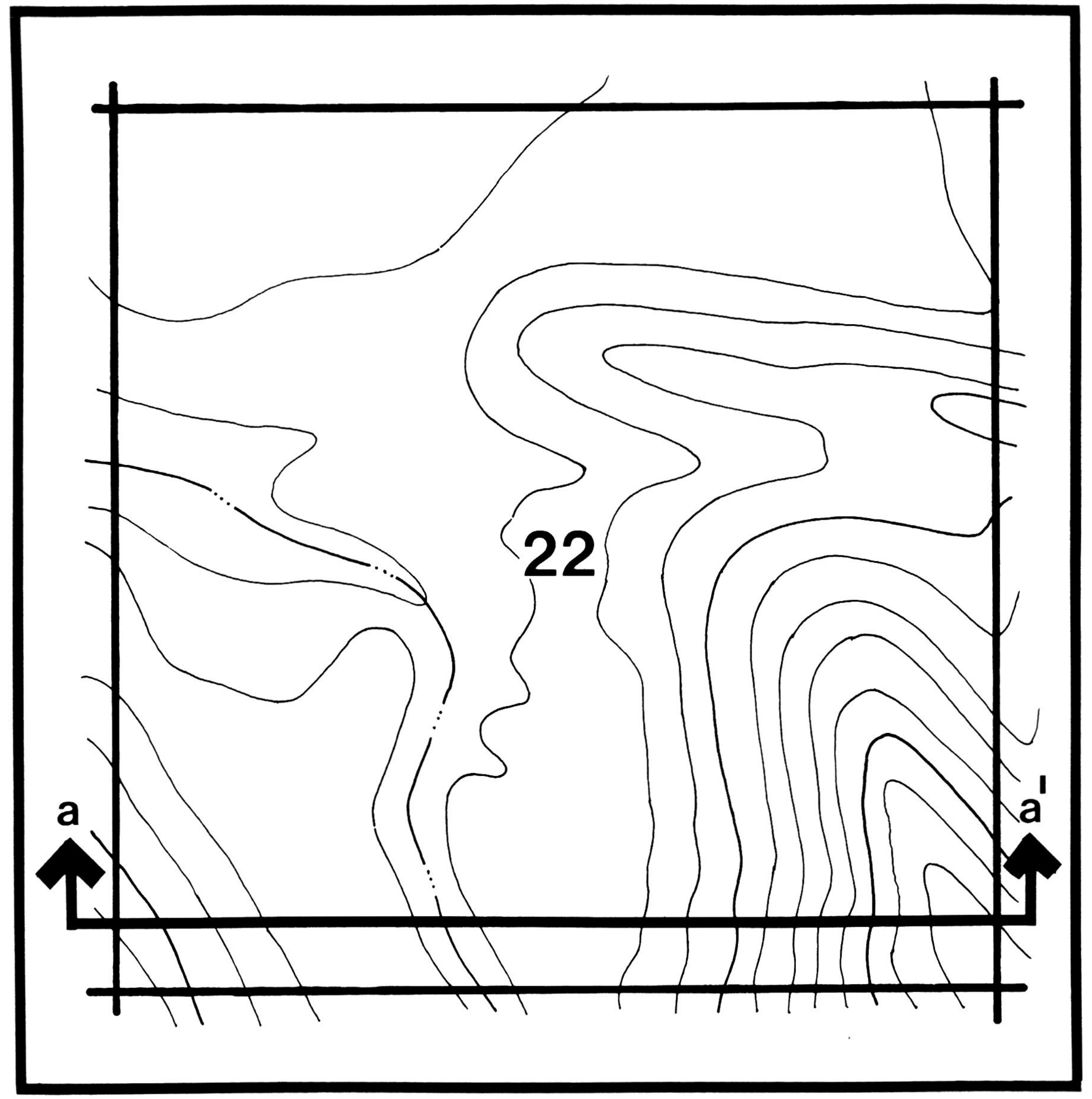
LAND FORM CHARACTER TYPE 3

figure 9



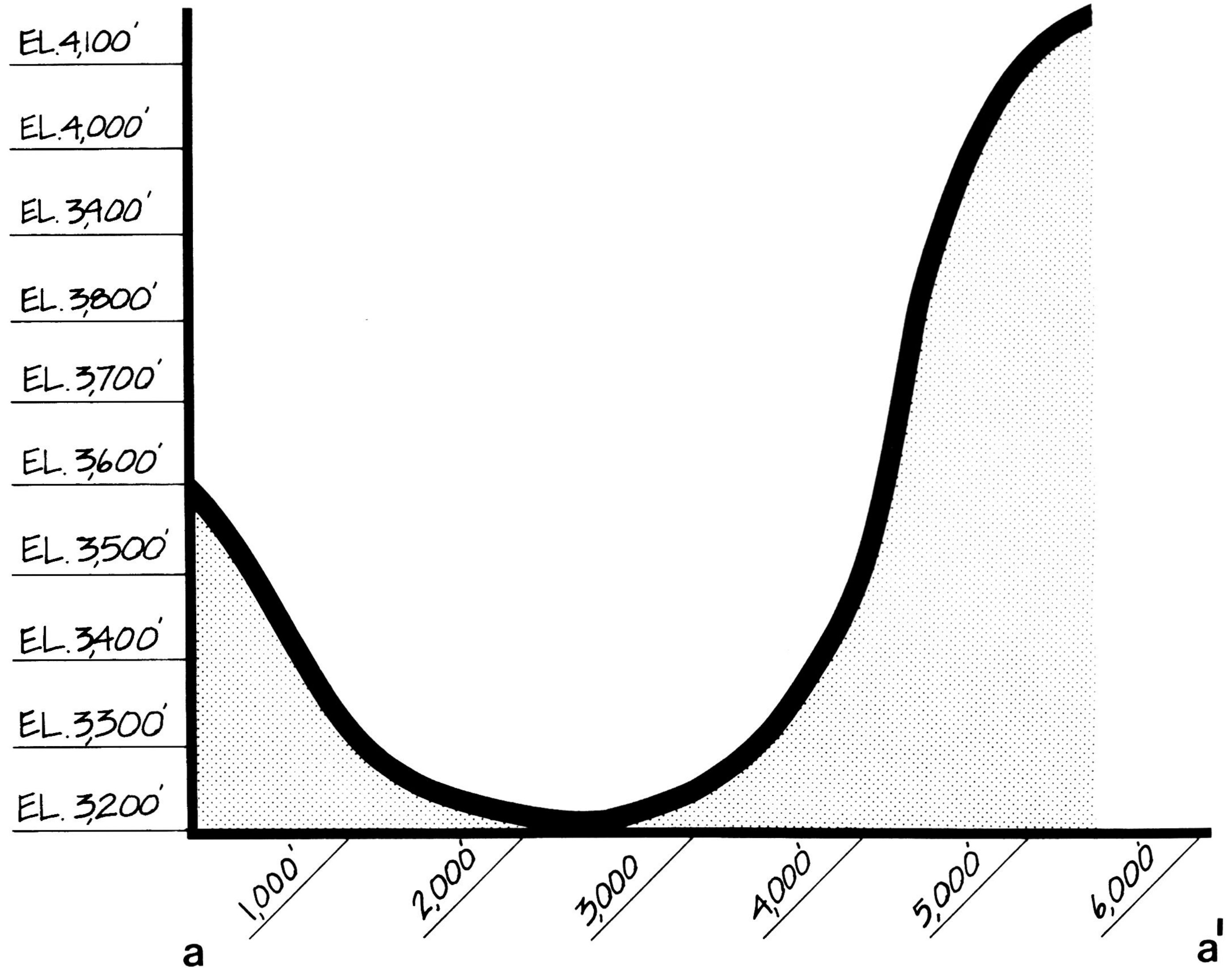


Panoramic View



Plan View

Scale 1" = 1,000'

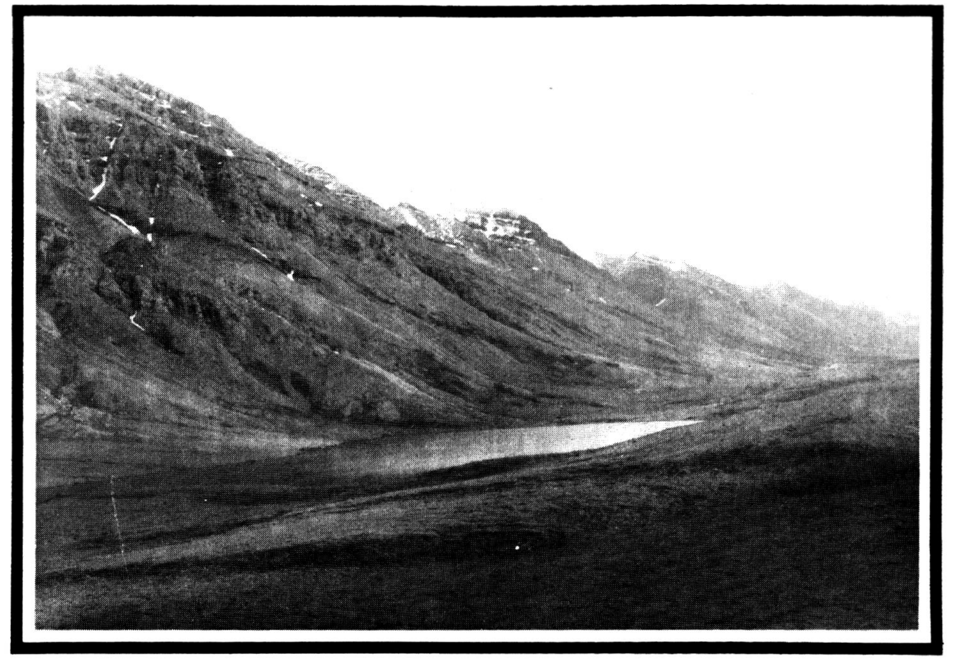


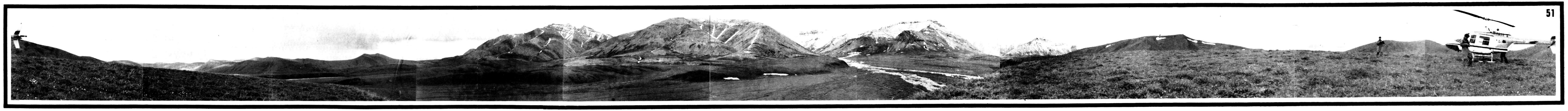
Type 4 Land Form Character Section (22)

Scale Hor. 1" = 1,000', Vert. 1" = 200'

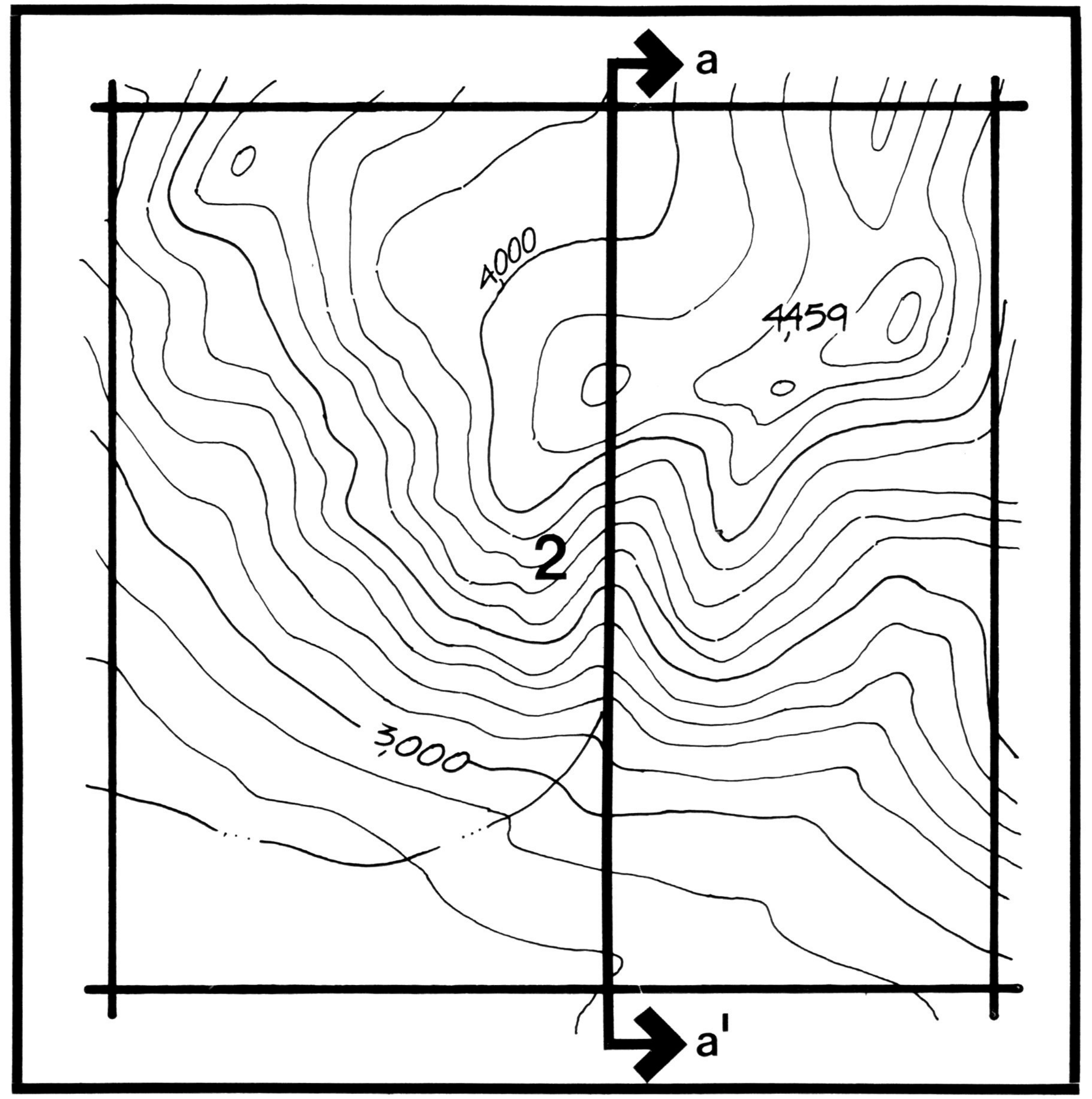
LAND FORM CHARACTER TYPE 4

figure 10



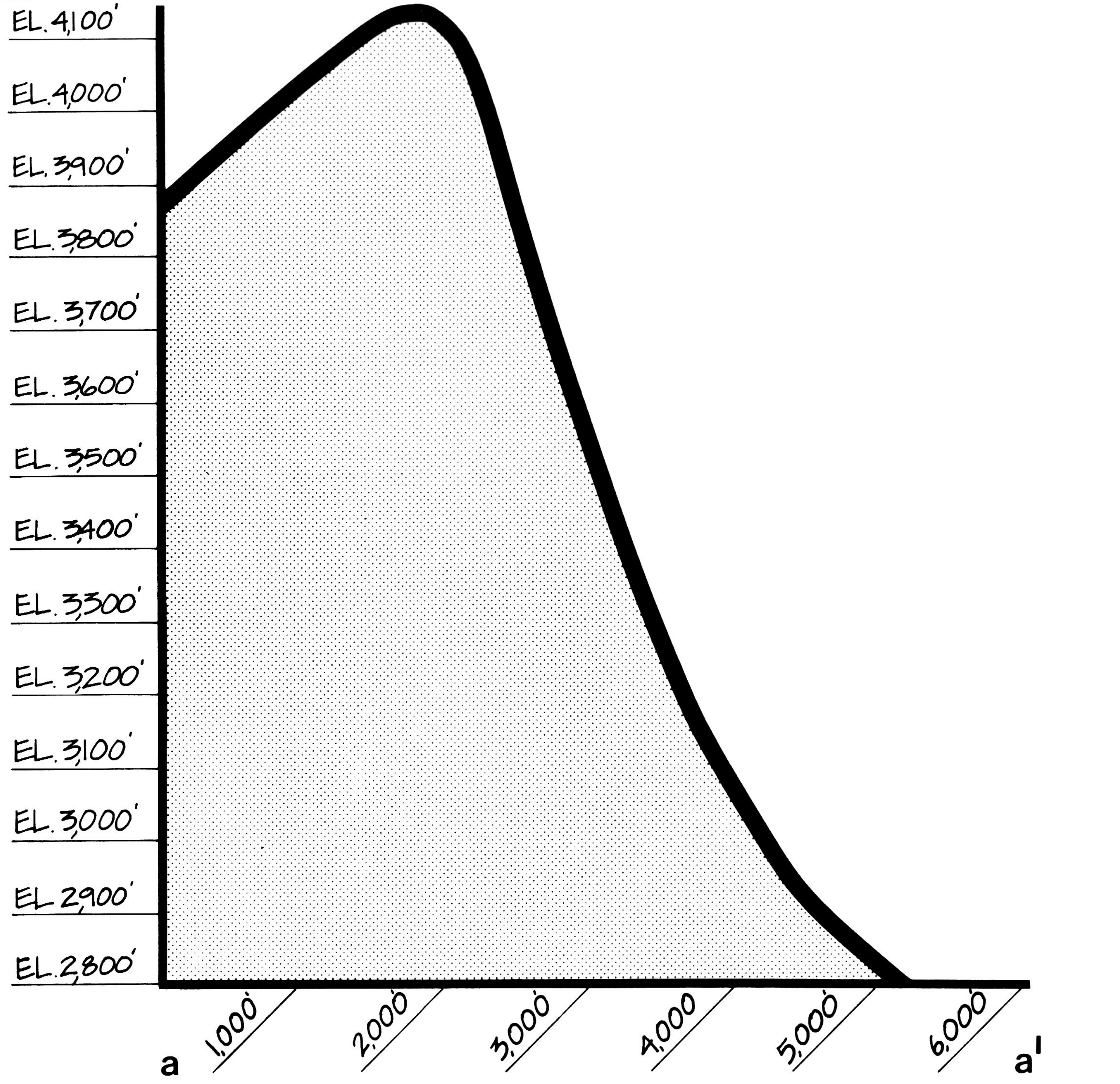


Panoramic View



Plan View

Scale 1"=1,000'

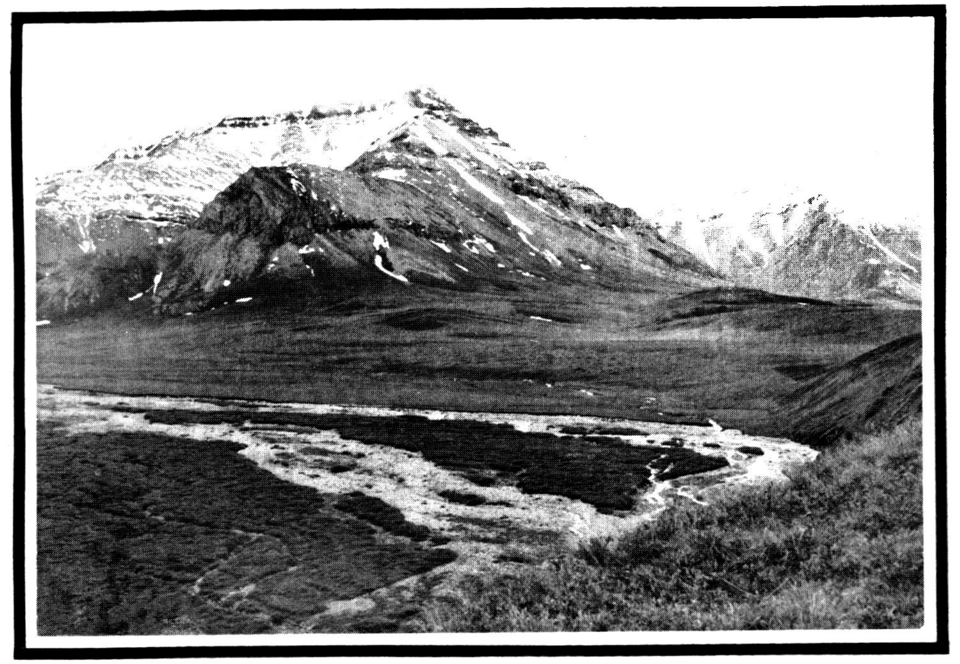


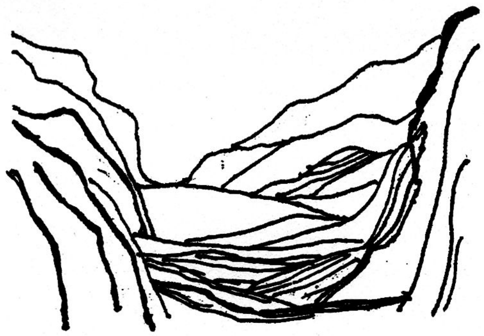
Type 5 Land Form Character Section (2)

Scale Hor. 1"=1,000, Vert. 1"= 200'

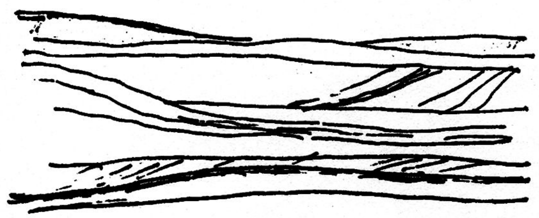
LAND FORM CHARACTER TYPE 5

figure 11





High Spatial Enclosure



Low to Moderate Spatial Enclosure

Microscale Pilot Test

After the ground survey points were accurately located on USGS topographic maps, both slope and relief factors were also finalized (see Table 6) as follows. Assuming an area displayed a gently rolling land form type and a spatial character of semi-enclosed, x amount of slope and x amount of relief must likewise be present. The slope was estimated to be 5% (professional judgment) prior to the ground survey. In a mile (5,280 feet) horizontal distance, a 5% slope would result in a relief change of approximately 250 feet. By locating a gently rolling land form on the corresponding topography map and actually calculating the slope for that point, a check for accuracy was made. By modeling at least fifty ground points, it was determined an accurate correlation could be made between the actual slope and land form type and the predicted slope and land form of an area. The accuracy was borne out, as stated earlier, indicating that it is possible to predict slope percentages accurately without actually doing a direct field investigation and a traditional slope analysis.

Land form Types	Spatial Character	Landform Character	Slope%	Relief*
Type 1	Indistinct/spacious	Generally level	0-3%	0-200'
Type 2	Minor defined/ semi enclosed	Gently rolling	4-9%	200-500'
Type 3	Defined/enclosed	Moderately hilly	9-14%	500-800'
Type 4	Distinct/focal	Low mountains	15-25%	800-1300'
Type 5	Highly distinct/ monumental	Rugged mountains	26% & >	1,300' and greater

*Note: Relief is determined per half mile.

Table 7. Quantification of Spatial Character, Land form Types, and Slope Percentages

To test the new microscale inventory procedure on classifying land form types, spatial character, land form character, slope and relief and also mapping accuracy, a seventy-two square mile test area was used. This area was visited frequently by this researcher, between inventory phases, and was located near the CAMA summer camp on Galbrith Lake. Knowing and being familiar with the surrounding land forms and the area generally, this researcher chose not to use high altitude aerial photography for this test area. Prior to the testing, a one-mile grid was placed over a 1:63,360 scale topographic map of the study area. These grids, called visual landscape grid units (VLGU's), were used to simplify horizontal measurements for the large study area. Within each grid square the high and low relief values were subtracted and then divided by 5,280 feet; this yielded both relief, land form character, spatial character and land form type for each VLGU.

After working through a number of grid cells using the above method, it was learned that counting contour lines within the grid square and multiplying this number by the contour interval (expressed in feet on the map) proved to be much faster and less prone to mathematical errors for determining relief. Once relief is determined the land form category type can be determined from Table 7.

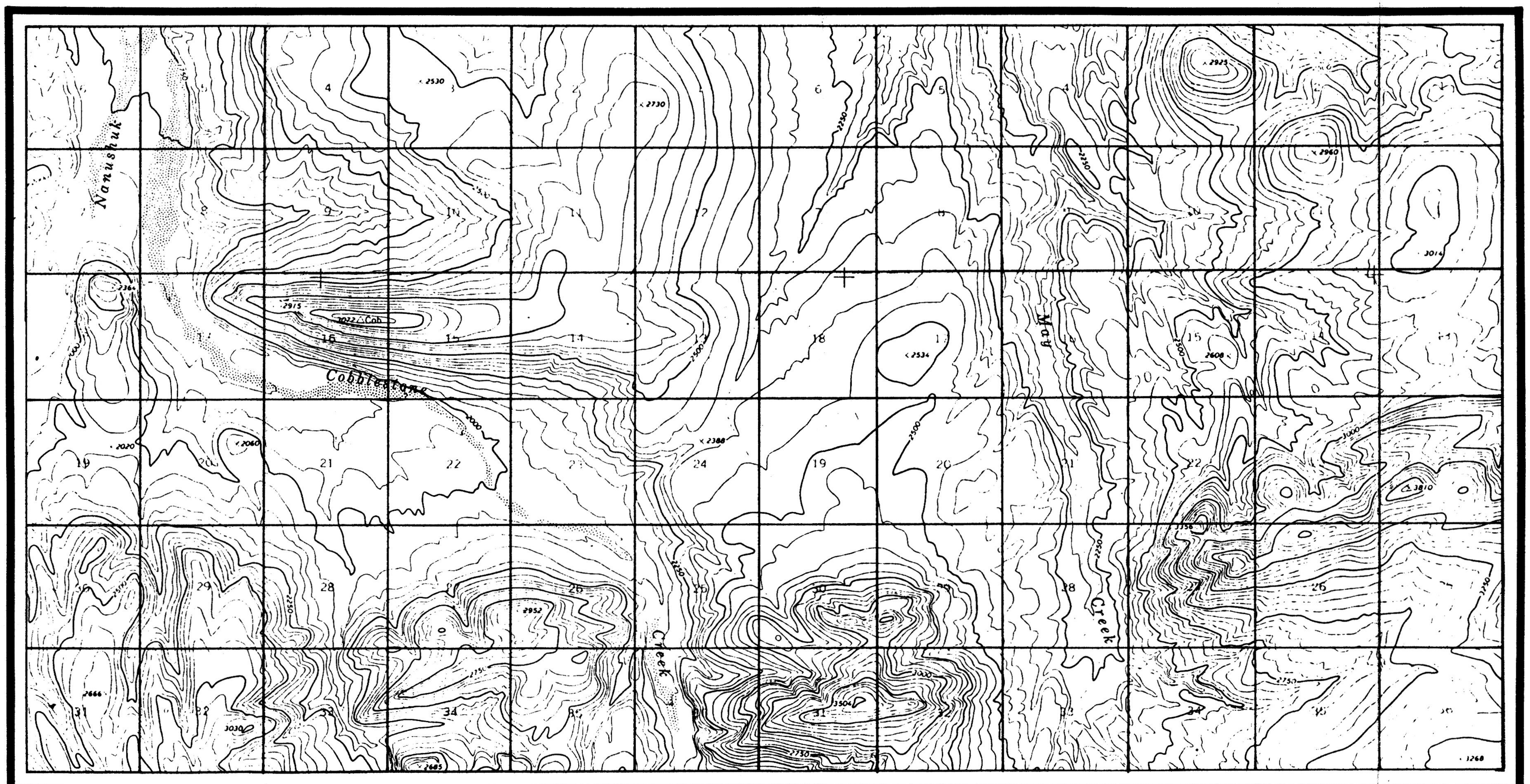
Figure 12 is the contour map of the test study area. Figure 13 is the corresponding slope/relief analysis superimposed over the gridded one mile by one mile contour map.

One problem noted with using a coarse grid such as a mile, is that the averaging relief over a large area tends to eliminate intervening high and low points, when in reality the land form has much diversity. Therefore, a quarter-section square grid overlay was tested to determine if the accuracy could be improved using the same 1:63,360 scale topographic map. The results show (Figure 14) that a substantial improvement can be achieved. This also proved, by field investigation, to be a more realistic representation of the actual land form character.

To determine the cost benefit ratio of using the mile grid overlay vs. the quarter-section grid overlay, this researcher timed both procedures. A moderately sloped township area (6 mi. x 6 mi.) required 20 minutes to complete at the mile grid level. For the same area the quarter-section grid required 40 minutes to complete. Using a quarter-section grid took twice as long; however, the accuracy increased by a factor of four. This increase in accuracy is a desirable feature, therefore, the case study area which will be discussed in chapter three will be completed and tested at this level.

Test Study Area

Contour Map



Legend

Contour Line

13 Section

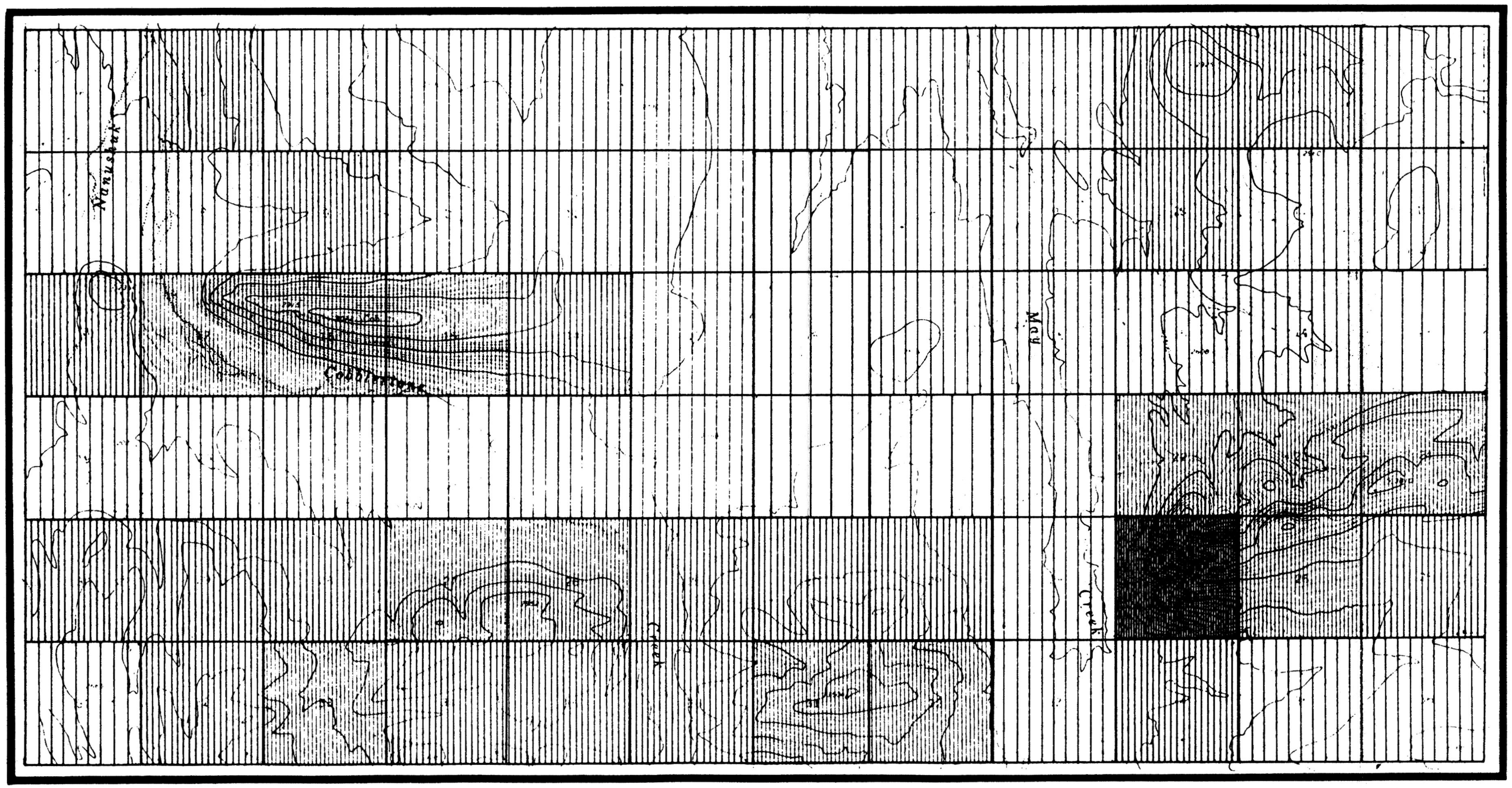
0miles 1 2

1inch = 1mile

Contour Interval 50'

Figure 12

Test Study Area
1 Mile Grid Cell
Symbolic Land Form Character



Pilot Study

Legend

Land Form Types

- Type 1
- Type 2
- Type 3
- Type 4
- Type 5

0miles 1 2

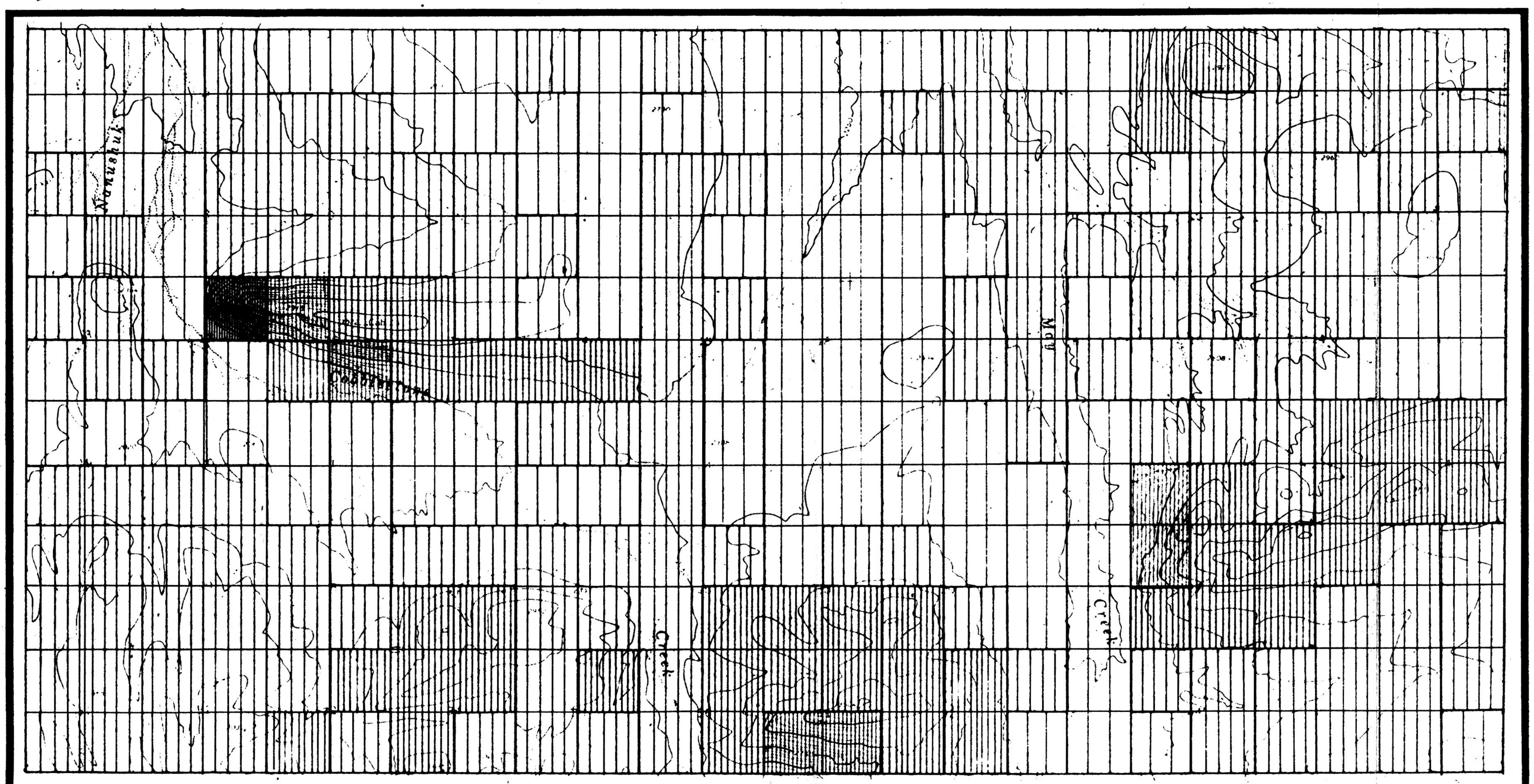
1 inch = 1mile

Contour Interval 50'

Figure 13

Test Study Area
1/2 Mile Grid Cell
Symbolic Land Form Character

Pilot Study



Legend

Land Form Types

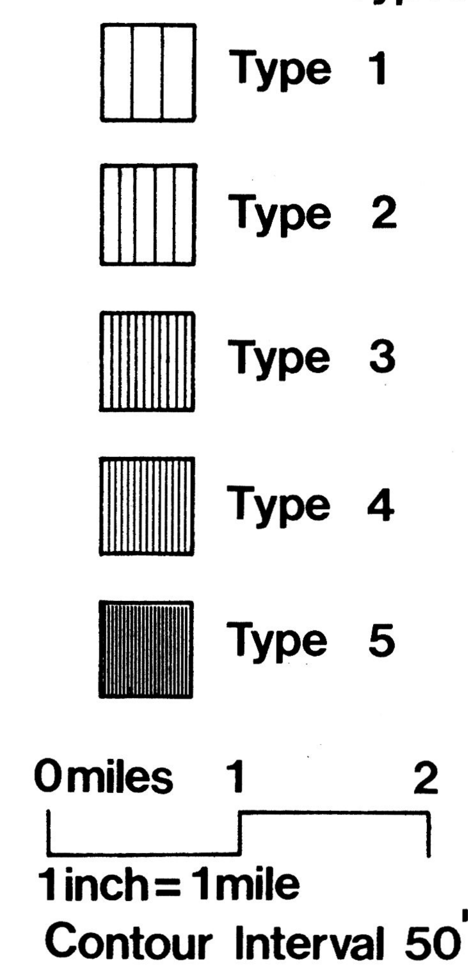


Figure 14

Table 8 summarizes the distinguishing microscale factors which were used to evaluate and record the visual resources at the microscale.

Relief -- Difference in elevation within a one square mile grid cell, Average magnitude of relief

R-1, Flat 0 - 150'
R-2, Gently rolling, 200' - 450'
R-3, Moderately hilly, 500' - 700'
R-4, Low mountains, 800' - 1300'
R-5, Rugged, 1400' - greater

Slope -- Relief data divided by the horizontal grid cell distance (1 mile), Average slope across grid cell

S-1, 0-3%
S-2, 4-9%
S-3, 9-14%
S-4, 15-25%
S-5, 26% and greater

Water -- Presence, Distribution Cover Percentage and Form

W-1, 0%
W-2, 0-25%
W-3, 25-50%
W-4, 50% - greater

A - Coast line
B - Minor drainage
C - Major river
D - Lake
E - Ice

Visual Surface Patterns

P-1, Ridge
P-2, Valley
P-3, Plateau
P-4, Side Slope
P-5, Edge (visually distinct juncture between physiographic or ecologic zones)

Table 8. Summary of Distinguishing Factors used to Inventory and Predict the Visual Landscape Expression and Spatial Dimensions of Landscapes on the North Slope

Microscale Inventory Summary

Placing future development in steep areas is obviously going to have a greater impact on the visual resources of an area than placing the same development in flatter terrain. By calculating the slope categories of an area through the use of the visual landscape grid unit and using supplemental information on water and surface patterns, land managers will have a greater understanding of the existing visual resource and the specific impacts a project will have on the visual resource. Because the inventory is based on the amount of elevation change within a grid cell, a non-design professional staff can compile the data base as well as evaluate the data during times of restricted funding. Another benefit the grid microscale offers is the format can be easily digitized for future computer use with other resource information.

CHAPTER III

CASE STUDY

The case study was undertaken to test how well the proposed inventory/analysis method would meet BLM needs. As stated previously, this system should:

1) describe the visual characteristics of the existing landscape

2) make it possible to determine the sensitivity of the visual resource to damage by proposed development

3) be an early warning inventory and evauation process for identifying the visual impacts that a land use proposal may have in a remote area

4) be an effective data collection procedure commensurate with the scale of the effort and the scale of the land area involved

5) have analytical flexibility and hierarchical capabilities within the inventory and evaluation process

The Study Area

The Arctic North Slope is under the jurisdiction of three land management agencies: The Federal Government, Alaska State Government and Native Alaskan Corporations. Within the federally managed lands the Bureau of Land Management (BLM) manages most of the Arctic North Slope (Figure 15).

This region of Alaska is bordered by the Brooks Mountain Range to the south and the Arctic Ocean to the north (See Map 1). The case study site, which has been designated by the BLM as the Central Arctic Management Area (CAMA), is located (See Map 1) approximately 300 miles north of Fairbanks and encompasses nearly 7,000 sq. mi., roughly the size of the State of New Jersey.

Except for a few native villages, trans-Alaska pipeline installation camps, exploration oil wells, and a network of abandoned winter snowmobile trails, CAMA, in appearance, is virtually a wilderness. Ground transportation is limited to the Dalton Highway. This gravel road links the Prudhoe Bay to the City of Fairbanks. Presently, road traffic is limited to trucks north of the Yukon River; however, public pressure has been increasing within the last three years to open the road to all vehicular traffic and also to build facilities for sightseeing and general automobile service.

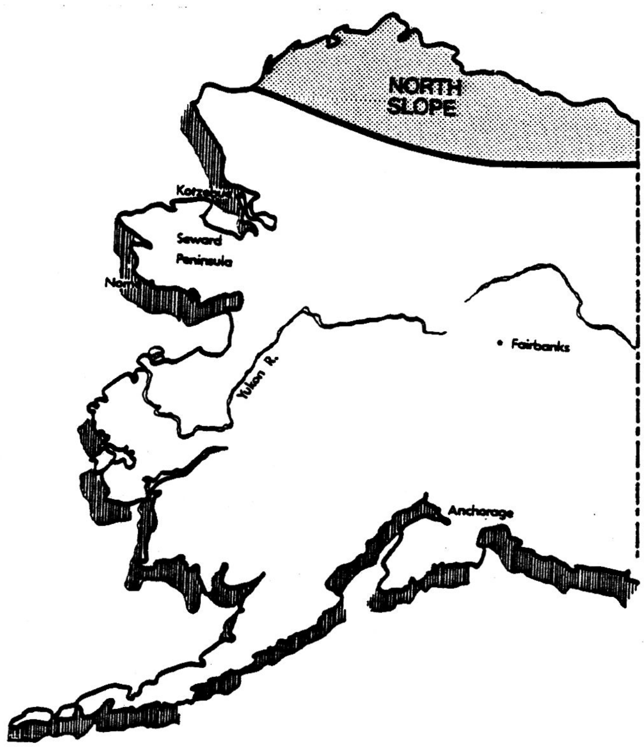


Figure 15. Alaska Arctic North Slope

Macroscale Inventory

Objective

The macroscale is used to create a physical profile of regional landscape characteristics. This can be a complex issue because visual perception is subject to many influences and variables which are subject to individual biases. However, some characteristics can be objectively defined and thus become the bases for mapping and describing the macro scales.

Macroscale Data Sources

In mapping visual resources at the macroscale there are four basic data sources:

- Climatic Descriptions and Vegetation Characteristics

  Ecoregions of the United States by R. G. Bailey

- Drainage Information

  Topographic Maps - United States Geological Society

  Physiographic Divisions of Alaska by C. Wahrhaftig

- Land Form Information

  Physiographic Divisions of Alaska by C. Wahrhaftig

- Aerial Reconnaissance, Personal Descriptions and Impressions

Macroscale Procedures

Two types of data were gathered at the macroscale inventory level. The first was to assemble environmental information that would efficiently depict the visual characteristics of the study area. The second was to photograph and validate through aerial overflights the environmental information chosen, and also record personal impressions and perceptions generated during these flights.

Visually Perceived Regional Patterns

Regional Ecological Patterns (refer to Map 2)
Domain/Division Scale

Climate

The weathering process after millions of years has created the Arctic North Slope visual characteristics. Even though man has no control over climate he must be cognizant of its forces and the landscape changes that are continually occurring because of these forces.

"The Polar Domain and Division is controlled by polar and arctic air masses and as a group have low temperatures, a severe winter season, and only small amounts of precipitation. Within the tundra division approximately 190 days are warmer than the mean temperature of 32° F., and in some years there are as few as 55 days" (Bailey, 1978:2). In late May, warm temperatures and sunlight return; only traces of snow remain in the southern regions of the case study area. With the early summer months the Arctic tundra emerges into a magnificent carpet of colorful miniature white flowers.

Vegetation

"Vegetation within CAMA (Map 2) is a tundra `prairie' consisting of grasses, sedges, lichens, and willow shrubs. Traced southward the vegetation changes into birch-lichen woodland, then into the needleleaf forest. In some places a distinct treeline separates the forest from tundra. Koppen used this line, which coincides approximately with the 50° F. isotherm (Figure 16) of the warmest month, as a boundary between subarctic and tundra climates" (Bailey 1978:2).

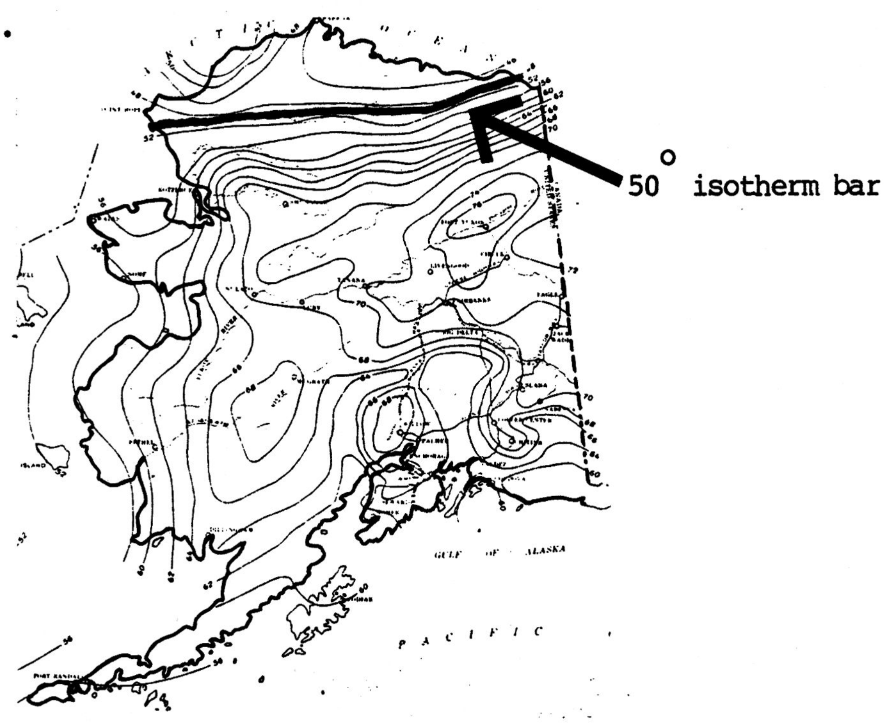


Figure 16. 50°F. isotherm - Boundary Between Subarctic Division and Tundra Division. This line is approximate and subject to ± 50 miles locational change.

Plates 1 through 4 are aerial reconnaissance black and white photographs taken in early June over a portion of the case study area. The dark grey/black patches depict wet tundra or low lying areas, while the light grey areas illustrate dry tundra or barren ground.

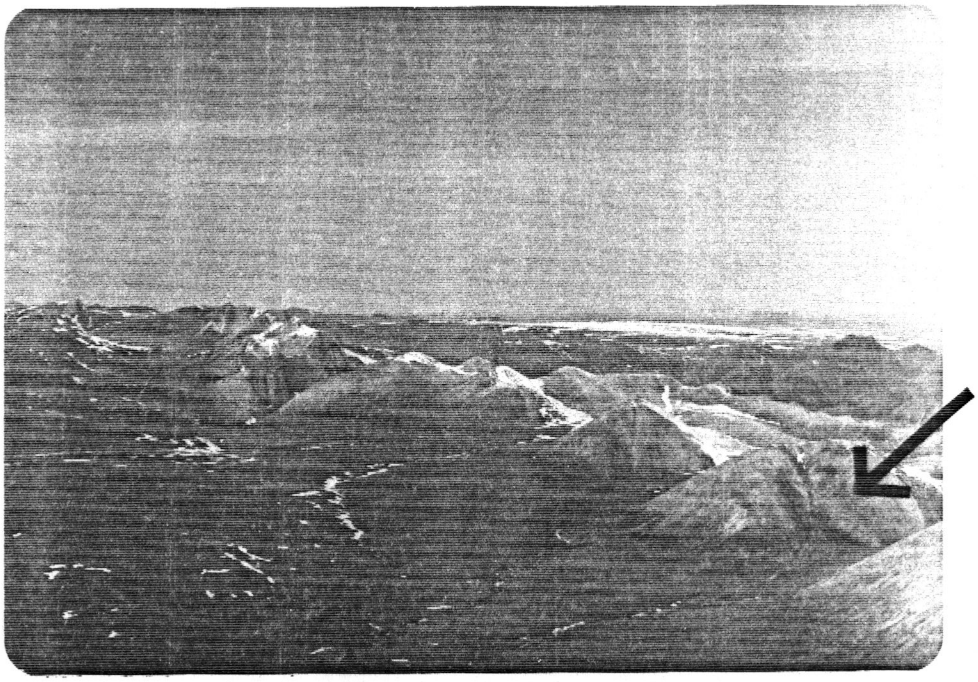


Plate 1. Arctic North Slope Tundra - Foothills Vegetation Pattern

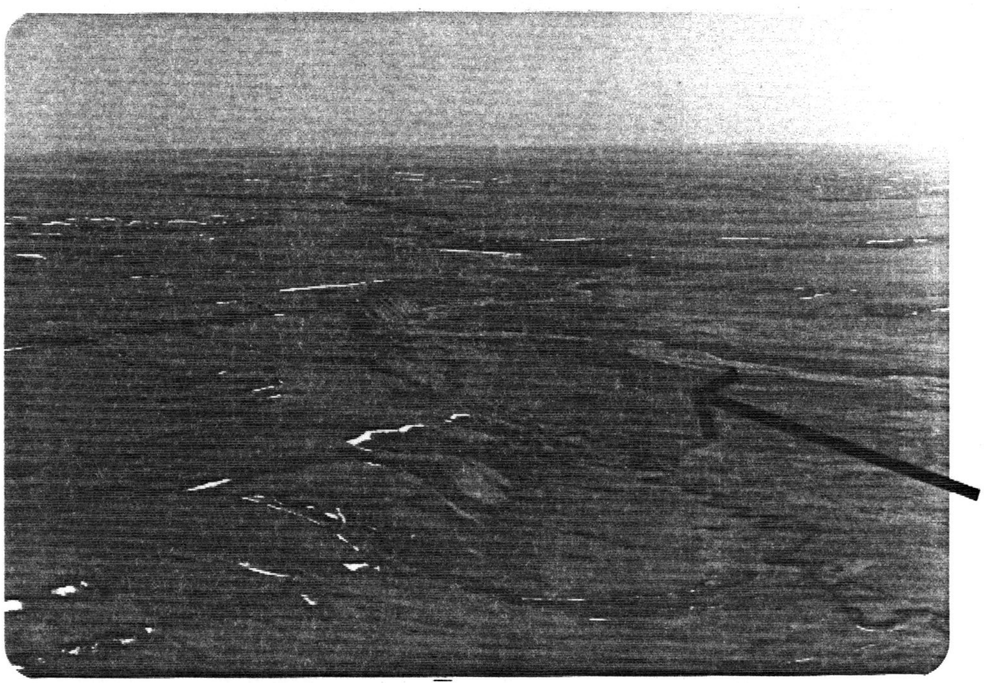


Plate 2. Arctic North Slope Tundra - Plains Vegetation Pattern

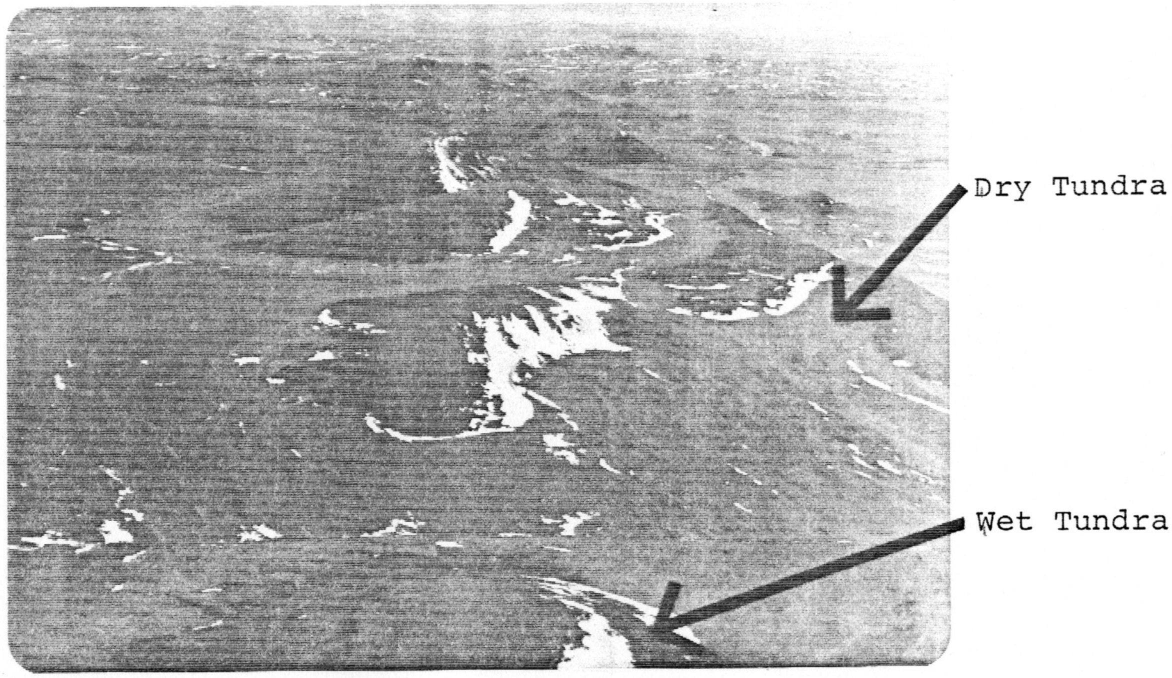


Plate 3. Arctic North Slope Tundra - Side Slope Vegetation

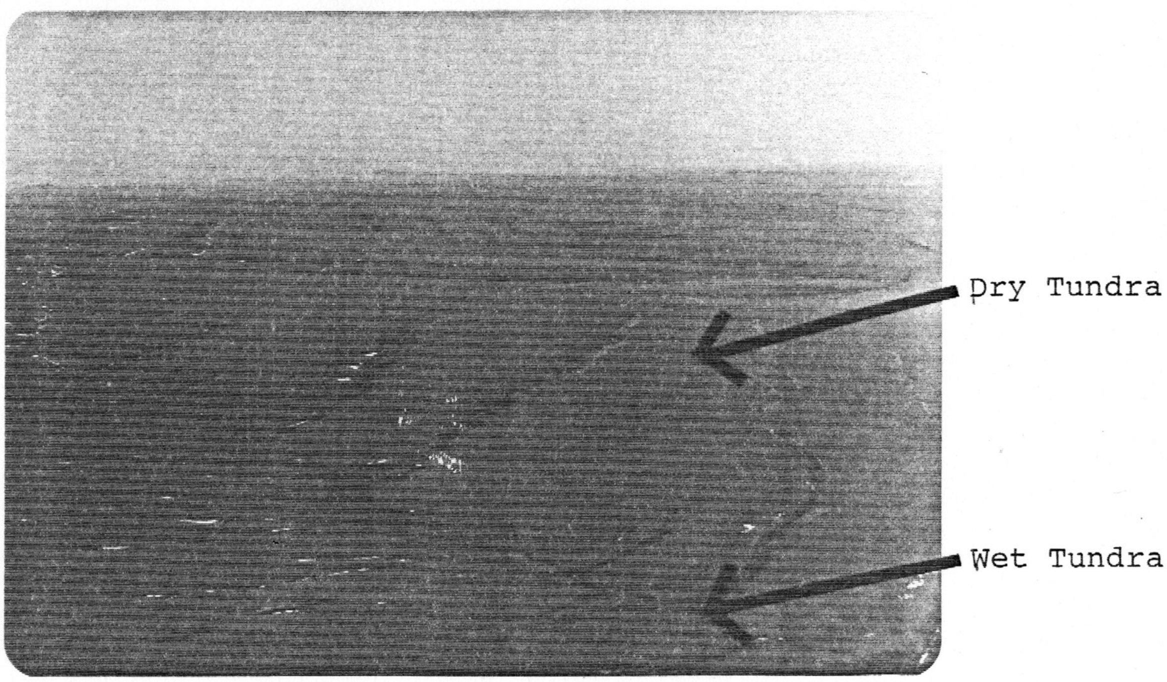


Plate 4. Arctic North Slope Tundra - Small River Valley

Surface Water Visual Patterns (refer to Map 3)
Domain/Division Scale

"The Brooks Range North Slope and The Arctic Foothills are crossed by north-flowing rivers from sources in the Brooks Range. Most rivers have swift, braided courses across broad gravel flats that are locally covered in winter with extensive sheets of aufeis, or anchor ice, that freezes to the riverbed; this filling of the channels causes the streams to flood their gravel flats" (Wahrhaftig, 1965:20).

There are eight major rivers that pass through the study area. They are: Killik River, Chandler River, Anakturuk River, Itkillik River, Kuparuk River, Sagaranirktok River, Ivashak River, and the Canning River. Plate 5 is an example of a major river channel.

Plate 5. Major River Type - The Chandler River

Physiographic Visual Patterns (refer to Map 4)
Domain/Division Scale

The study area is bisected into 2 major physiographic divisions: Tundra Lowland (1) and the Brooks Range (2). Within the Tundra Lowlands Division there are two major physiographic subdivisions: Arctic (a) and Western (b). The Arctic subdivision also has two divisions - the Arctic Lowlands (1a1) and Arctic Foothills (1a2). The Arctic Foothills (1a2) and the Brooks Range North Slope (2a) make up about 80-90% of the physiography of CAMA.

"The Arctic Foothills (1a2) consists of rolling plateaus and low liner mountains (Plate 6). These foothills range in altitude from 600 feet to 3,500 feet above sea level. Characteristic landforms include: broad east-trending ridges, mesalike undulating mountains, buttes and knobs" (Wahrhaftig, 1965:21). The entire province is underlain by 600-1,000 feet of permafrost (permanently frozen soil except the top 4-12 inches which thaws during the summer). Another distinctive physiographic feature found in the low-lying regions of the Arctic Foothills is the development of polygonal and other geometric patterns in the frozen tundra (Plate 7). This pattern terrain is the result of the permafrost being subjected to continuous cycles of freezing and thawing over many years, and soil slumping and stratification occurring in the active 4-12 inch soil zone.

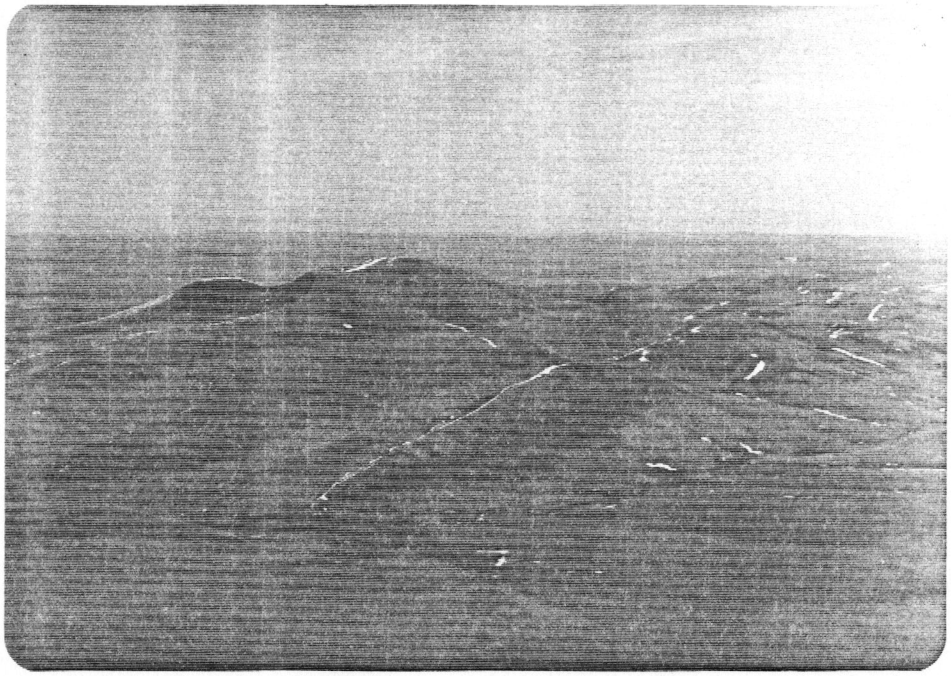


Plate 6. The Arctic Foothills - Rolling Plateaus and Low Liner Mountains

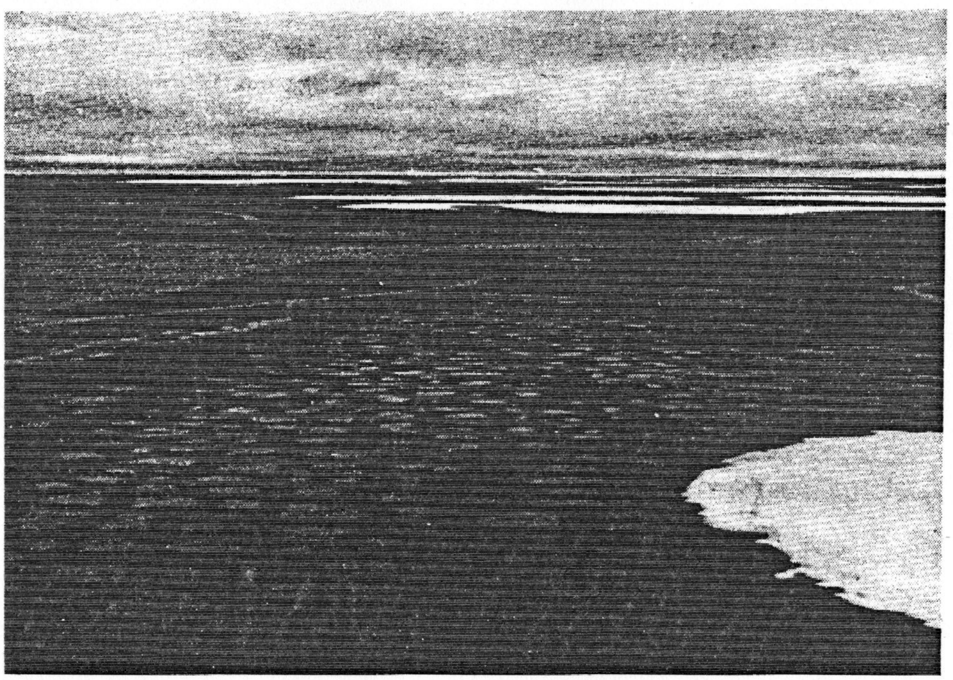


Plate 7. The Arctic Foothills - Polygonal Pattern Terrain

Bordering the Arctic Foothills is the Brooks Range North Slope (2a). These small to moderate size mountains consist of rugged glaciated east-trending ridges, broad U-shaped valleys and morainal topography (Plates 8 and 9). The ridges rise to generally 5,000-6,000 feet in altitude at the southern boundary of the study area (Wahrhaftig, 1965:21).

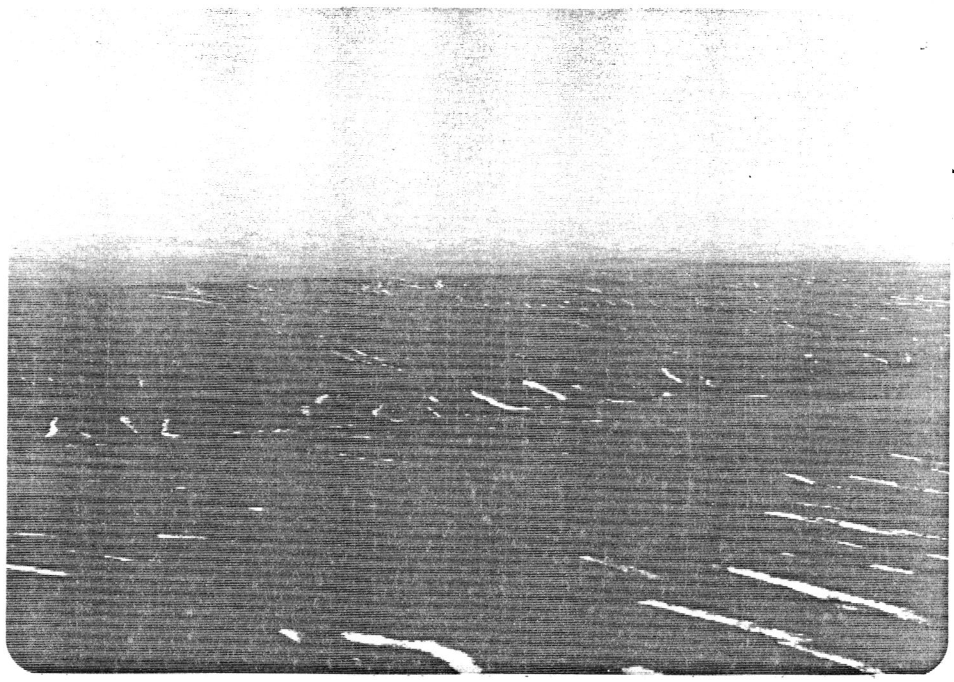


Plate 8. Brooks Range North Slope - Small to Moderate Mountains

Plate 9. Brooks Range North Slope - Southern Boundary, Broad U-Shaped Valleys and Morainal Topography

Aerial Reconnaissance (refer to Map 5)

To verify the office data, and to experience first-hand the visual resources of the Arctic North Slope, aerial reconnaissance was used specifically in three ways. First, by separating oneself physically from the ground plane visual patterns (which in themselves are very complex) only distinct visual images remained to be inventoried. Second, to inventory large roadless land parcels the aerial flyovers afford the only realistic method to view the Arctic North Slope. Third, the aerial flight made it possible to photograph and record visual impressions immediately and assemble a permanent record of visual characteristics for future study.

Personal Impressions - Vegetation

When viewed from a plane the Arctic North Slope tundra is a composition of curvilinear lines, textures, and mottled color patterns ranging from light brown to dark green. However, three major vegetation types were discernible within CAMA at the macroscale: wet tundra, lowland or plain tundra, and mountain tundra/exposed rock.

The wet tundra will trend from the light yellow-brown of winter into olive green during the summer. Riparian vegetation within the wet tundra is dark green, has a coarser texture than surrounding tundra, and accents the stream channel.

The lowland or plain tundra is light yellow-green and appears like a carpet at high altitudes. This is the predominant vegetation type viewed within the study area, and in some locations miles of colorful wildflowers highlighted the rolling tundra landscape.

The mountain tundra was found in the more rugged landscapes and on the tops of ridges in the plains. Generally, the color varied from a pale yellow to a light brown. Frequently, cloud banks shrouded the higher ground making accurate observations difficult; also, the color patterns that were visible were dulled by shadows. Where vegetation was absent (ridges, large mountains), grey-blue and brown rock and brown soil contrasts with the browns and greens of the tundra.

Personal Impressions - Surface Water

Water in CAMA is a major visual element and adds variety to the landscape during the three to four months it is not frozen or covered with snow. In an attempt to categorize waterform visually, several elements were considered. Among these were location of major water features (such as lakes, rivers and large areas of standing water) and classification of river channel types.

The Brooks Range North Slope is literally alive with thousands of small, glacial fed streams, which flow through narrow valleys. Falls, rapids and deep dark blue pools are common in this section of the study area.

These small streams converge as they reach the middle of the Arctic Foothills landscape. Here the rivers are large, have a single fixed channel, are fast flowing, and crystal clear. From an aerial perspective the water is milky in appearance. There are stretches of rapids in some of the rivers observed, but the norm is a deep and dark, fast-flowing channel.

In the northern section of the study area the major rivers begin to meander and eventually become braided. In some rivers, 20 or more braids are common with gravel bars between them. The river valleys of the major rivers were large, generally 1/2 - 2 miles in width.

Lakes are numerous on the Arctic North Slope and thousands dot the landscape within the CAMA. In the more mountainous areas, lakes are enclosed and give the impression of being jewels set in a ring.

Personal Impressions - Landforms

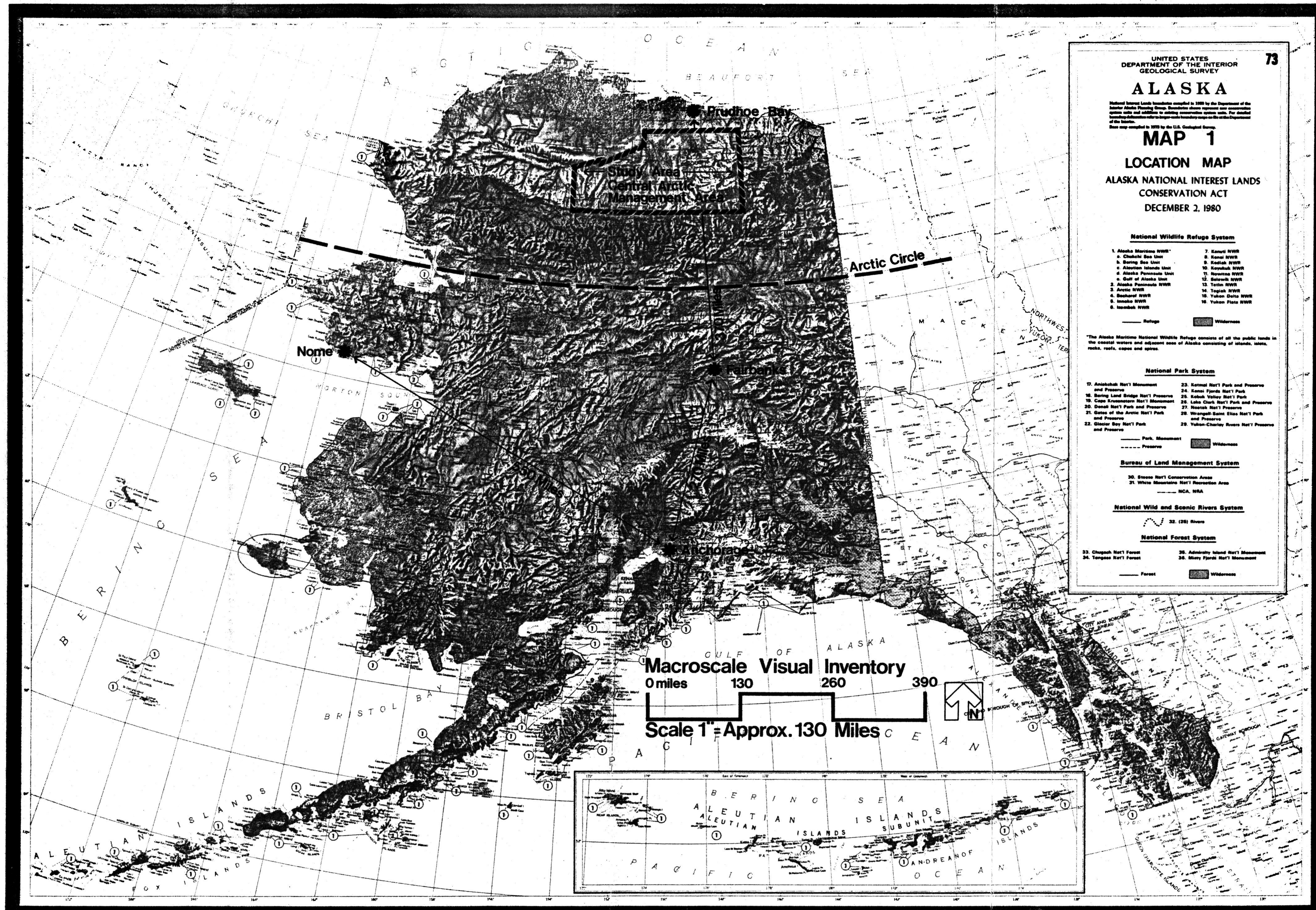
Every landscape has a describable visual character. Within CAMA the major visual characteristic that creates form, scale, edges and differentiates one landscape from another is landform.

The separation between the Arctic Foothills and the Brooks Range North Slope is visually dramatic. This major edge is the result of the juxtaposition of different strata and the upheaval of the Brooks Mountain Range.

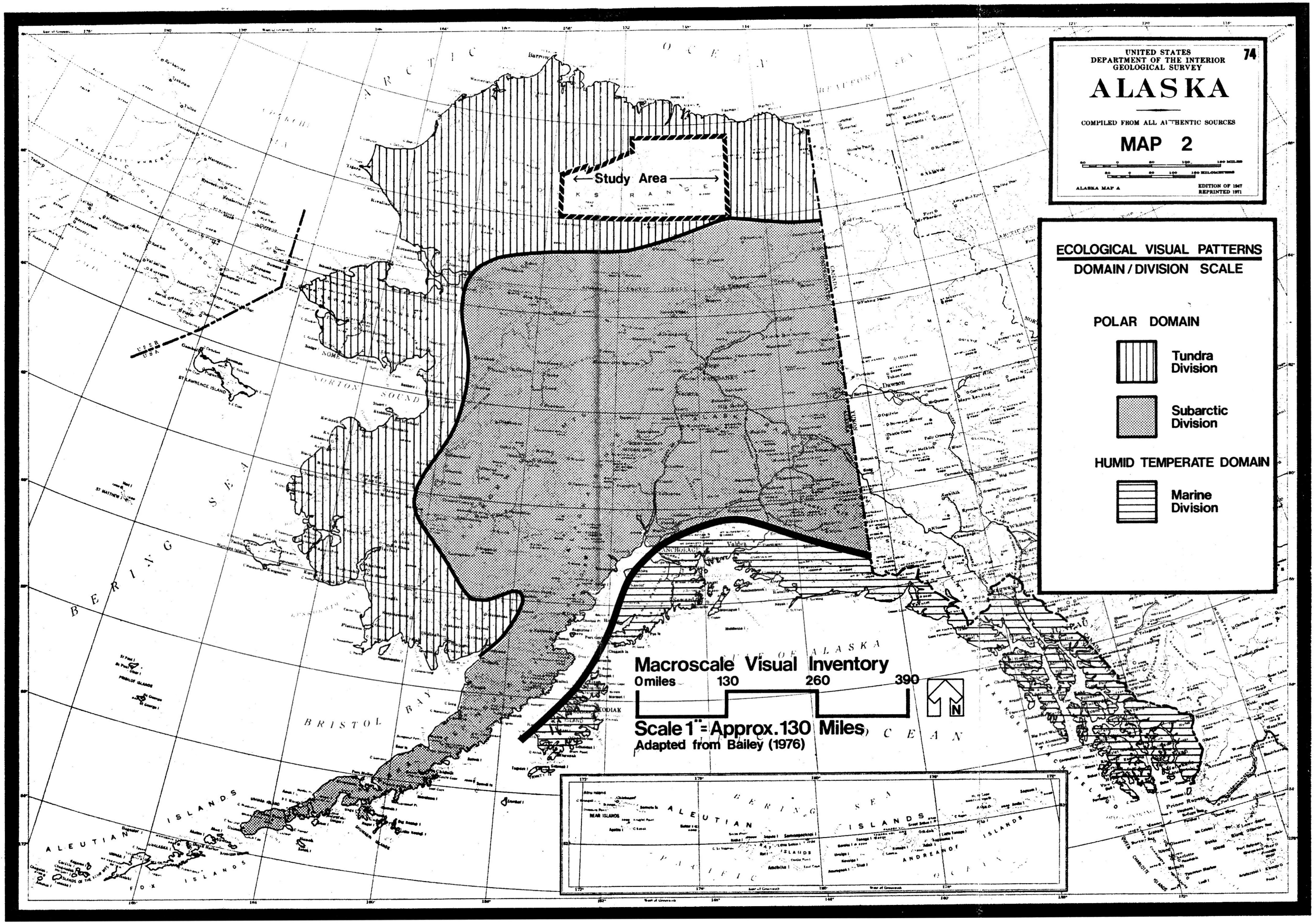
On the northern-most portion of the study area, the Arctic Foothills lose elevation quickly and the Arctic Plains begin. The plains are flat and have little visible relief. Most of the relief is offered by the scattered stream valleys.

Within the middle region of the study area, the landform consists of gently to steeply rolling hills. Some peaks are flat, some rounded, and others are sharp, forming hogbacks. The hills have been dissected by rivers, creating buttes, knolls and ridges with intervening large flat plains. This middle region of CAMA is visually rich with different landform types.

The southern boundary of CAMA is the northern edge of the Brooks Mountain Range which has been classified by Wahrhaftig as the Brooks Range North Slope. This landscape contains the most massive landforms in CAMA. Most of the peaks are above 5,000 feet and hold their snow throughout the year; also, they are void of vegetation except in the valleys between peaks. While inventorying this area of CAMA, the mountain passes often had populations of mountain sheep and moose.



UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY
73
ALASKA
Base map compiled in 1973 by the U.S. Geological Survey.
MAP 1
LOCATION MAP
ALASKA NATIONAL INTEREST LANDS
CONSERVATION ACT
DECEMBER 2, 1980
National Wildlife Refuge System
1. Alaska Maritime NWR*
a. Chukchi Sea Unit
b. Bering Sea Unit
c. Aleutian Islands Unit
d. Alaska Peninsula Unit
e. Gulf of Alaska Unit
2. Alaska Peninsula NWR
3. Arctic NWR
4. Becharof NWR
5. Innoko NWR
6. Izembek NWR
7. Kanuti NWR
8. Kenai NWR
9. Kodiak NWR
10. Koyukuk NWR
11. Nowitna NWR
12. Selawik NWR
13. Tetlin NWR
14. Togiak NWR
15. Yukon Delta NWR
16. Yukon Flats NWR
Refuge
Wilderness
*The Alaska Maritime National Wildlife Refuge consists of all the public lands in the coastal waters and adjacent seas of Alaska consisting of islands, islets, rocks, reefs, capes and spires.
National Park System
17. Aniakchak Nat'l Monument and Preserve
18. Bering Land Bridge Nat'l Preserve
19. Cape Krusenstern Nat'l Monument
20. Denali Nat'l Park and Preserve
21. Gates of the Arctic Nat'l Park and Preserve
22. Glacier Bay Nat'l Park and Preserve
23. Katmai Nat'l Park and Preserve
24. Kenai Fjords Nat'l Park
25. Kobuk Valley Nat'l Park
26. Lake Clark Nat'l Park and Preserve
27. Noatak Nat'l Preserve
28. Wrangell-Saint Elias Nat'l Park and Preserve
29. Yukon-Charley Rivers Nat'l Preserve
Park, Monument
Preserve
Wilderness
Bureau of Land Management System
30. Steese Nat'l Conservation Areas
31. White Mountains Nat'l Recreation Area
NCA, NRA
National Wild and Scenic Rivers System
32. (25) Rivers
National Forest System
33. Chugach Nat'l Forest
34. Tongass Nat'l Forest
35. Admiralty Island Nat'l Monument
36. Misty Fjords Nat'l Monument
Forest
Wilderness
ARCTIC OCEAN
BEAUFORT SEA
CHUKCHI SEA
Prudhoe Bay
Study Area
Central Arctic
Management Area
Arctic Circle
Nome
Fairbanks
NORTON SOUND
BERING SEA
Anchorage
GULF OF ALASKA
BRISTOL BAY
PACIFIC OCEAN
ALEUTIAN ISLANDS
FOX ISLANDS
Macroscale Visual Inventory
0 miles
130
260
390
Scale 1" = Approx. 130 Miles
N
BERING SEA
ALEUTIAN ISLANDS
ALEUTIAN ISLANDS SUBUNIT
ANDREANOF ISLANDS
PACIFIC OCEAN



74
UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY
ALASKA
COMPILED FROM ALL AUTHENTIC SOURCES
MAP 2
ALASKA MAP A
EDITION OF 1947
REPRINTED 1971
ECOLOGICAL VISUAL PATTERNS
DOMAIN / DIVISION SCALE
POLAR DOMAIN
Tundra Division
Subarctic Division
HUMID TEMPERATE DOMAIN
Marine Division
Study Area
Macroscale Visual Inventory
0 miles
130
260
390
N
Scale 1" = Approx. 130 Miles
Adapted from Bailey (1976)
ST LAWRENCE ISLAND
NORTON SOUND
BERING SEA
BRISTOL BAY
GULF OF ALASKA
KODIAK
Valdez
Dawson
ALEUTIAN ISLANDS
FOX ISLANDS

UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY

75

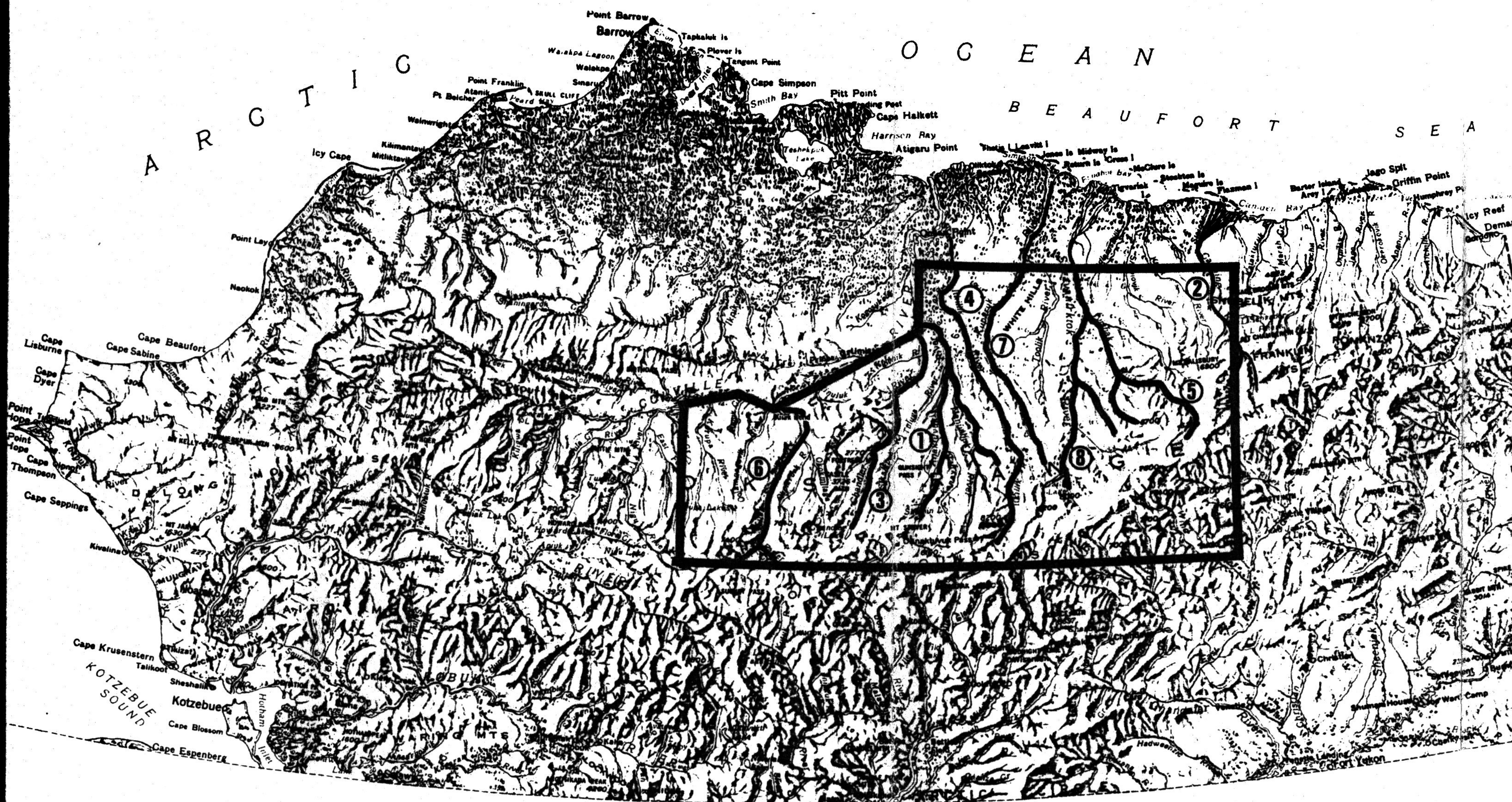
ALASKA

COMPILED FROM ALL AUTHENTIC SOURCES

MAP 3

ALASKA MAP A

EDITION OF 1947
REPRINTED 1971



SURFACE WATER VISUAL PATTERNS
DOMAIN / DIVISION SCALE

MAJOR RIVERS

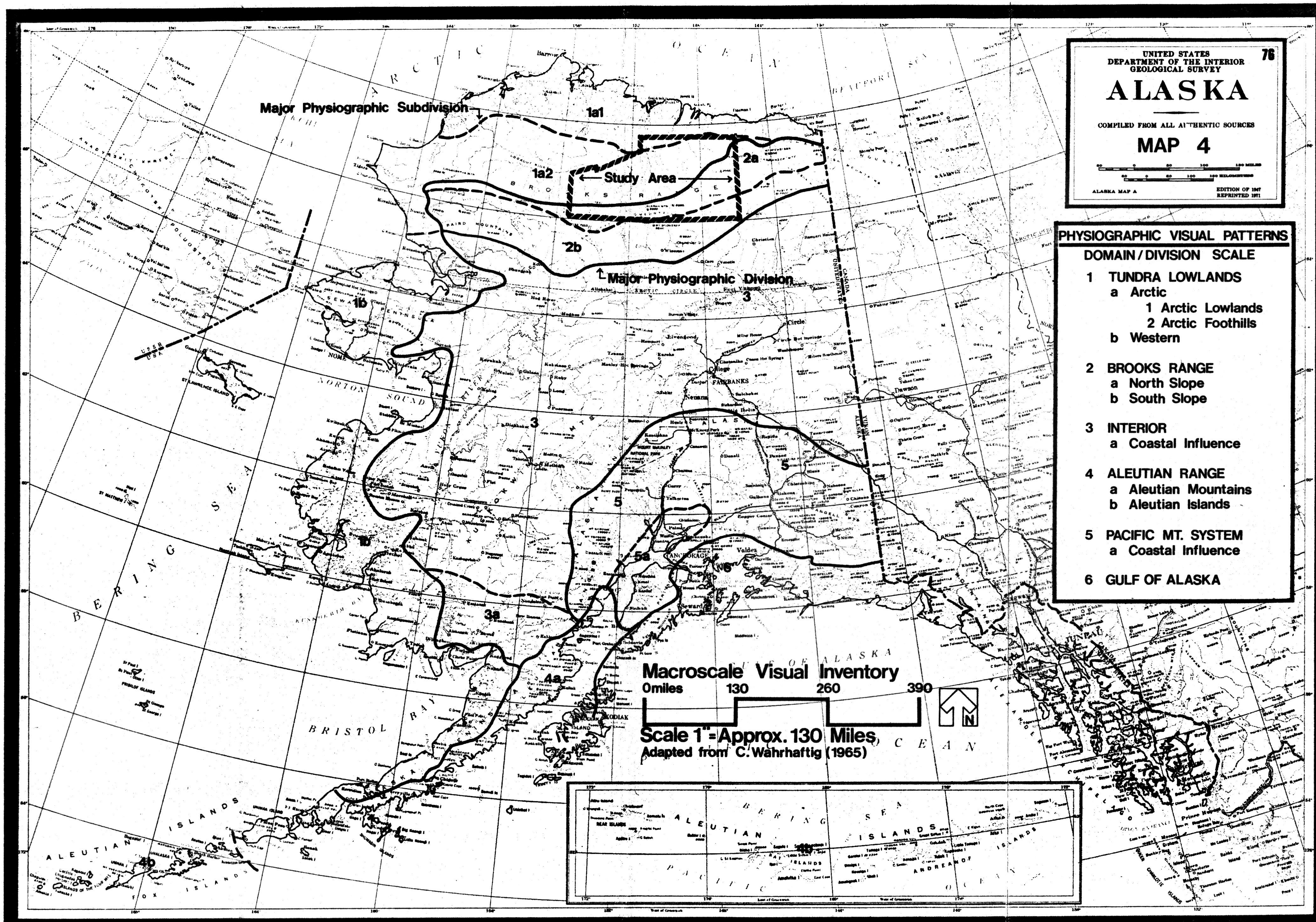
1 Anaktuvuk River
2 Canning River
3 Chandler River
4 Itkillik River
5 Ivashak River
6 Killik River
7 Kuparuk River
8 Sagavanirktok River

Macroscale Visual Inventory

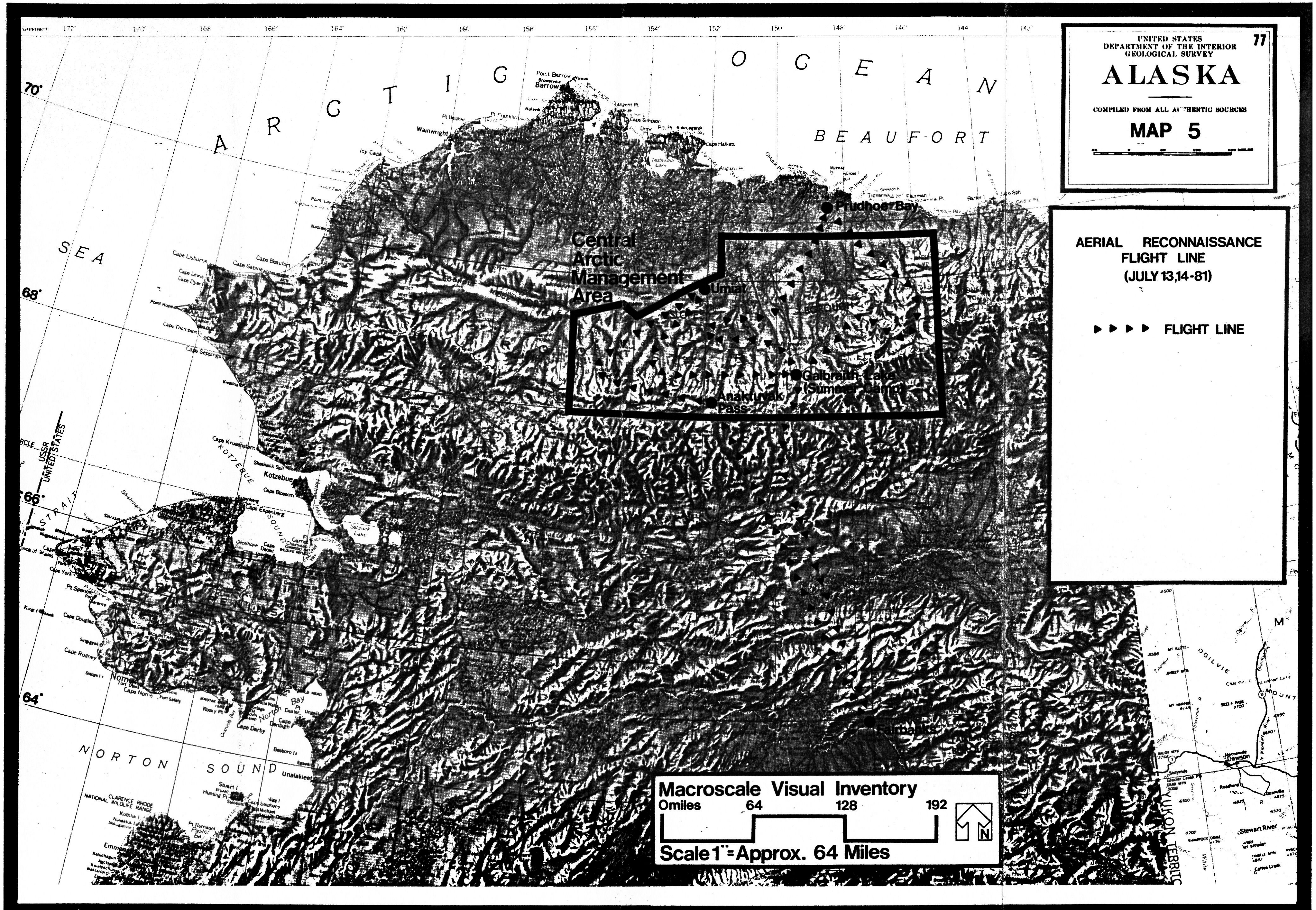
0 miles 58 116 174

N

Scale 1" = Approx. 58 Miles



UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY
ALASKA
COMPILED FROM ALL AUTHENTIC SOURCES
MAP 4
ALASKA MAP A
EDITION OF 1967
REPRINTED 1971
PHYSIOGRAPHIC VISUAL PATTERNS
DOMAIN / DIVISION SCALE
1 TUNDRA LOWLANDS
a Arctic
1 Arctic Lowlands
2 Arctic Foothills
b Western
2 BROOKS RANGE
a North Slope
b South Slope
3 INTERIOR
a Coastal Influence
4 ALEUTIAN RANGE
a Aleutian Mountains
b Aleutian Islands
5 PACIFIC MT. SYSTEM
a Coastal Influence
6 GULF OF ALASKA
Major Physiographic Subdivision
Study Area
Major Physiographic Division
1a1
1a2
2a
2b
1b
3
3a
4a
4b
5
5a
6
Macroscale Visual Inventory
0miles 130 260 390
Scale 1" = Approx. 130 Miles
Adapted from C. Wahrhaftig (1965)
ARCTIC OCEAN
BERING SEA
NORTON SOUND
BRISTOL BAY
GULF OF ALASKA
PACIFIC OCEAN
ALEUTIAN ISLANDS
FOX ISLANDS
ANDREANOF ISLANDS
FAIRBANKS
ANCHORAGE
NOME
JUNEAU
KODIAK



UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY
ALASKA
COMPILED FROM ALL AUTHENTIC SOURCES
MAP 5
77
AERIAL RECONNAISSANCE
FLIGHT LINE
(JULY 13,14-81)
FLIGHT LINE
ARCTIC OCEAN
BEAUFORT
SEA
Central
Arctic
Management
Area
Prudhoe Bay
Umiat
Galbraith Lake
(Sumner Camp)
Anaktuvuk
Pass
Fairbanks
Kotzebue
Nome
Barrow
Wainwright
Point Hope
Cape Lisburne
NORTON SOUND
KOTZEBUE SOUND
USSR
UNITED STATES
YUKON TERRITORY
Dawson
Macroscale Visual Inventory
0miles 64 128 192
N
Scale 1" = Approx. 64 Miles

Median Scale Inventory

Objective

The objective of the median scale descriptive inventory is to describe in detail the visual character differences between the subregional areas within CAMA, and to highlight sensitive landscapes, such as special scenic locations, or those having a unique one-of-a-kind character. To complete the first task a composite map was developed utilizing E. H. Hammond's Classes of Land-Surface Form in the United States 1966 map, and R. G. Bailey's Ecoregions of the United States 1976. The second task of locating and describing sensitive "superlative landscapes" was accomplished with the assistance of the 1978 study entitled Alaska Natural Landscapes by R. J. Gordon and B. A. Shaine.

Descriptions of surface water patterns were taken exclusively from 1:250,000 scale USGS topographic maps.

Subregional Visual Patterns (refer to map 6)
Province/Section

Four subregional areas (see map 6 - A,B,C,D) within CAMA were identified as being visually distinct. These areas were first identified during the macroscale aerial reconnaissance and further verified through a lower altitude flight during the medianscale inventory. Descriptive data by Hammond and Bailey and personal impressions and photography forms the essential part of this inventory.

The classification scheme used for this inventory is as follows:

1. Dry Tundra Province
2. Alaska Arctic Lowland

Ecoregions (Province), R.G. Bailey

3. Plains with High Hills
4. 50-80% of the Area Gently sloping
5. 500-1000 ft. Local Relief
6. 50-75% of Gentle Slope is in Lowland

Land-Surface Form, E.H. Hammond

The first two categories are vegetation characteristics derived from Bailey's ecoregion work. Categories 3-6 are land-surface form classifications designated by Hammond and have been adapted for subregional area descriptions of landform.

Subregional Area A - The Smooth Plains

The smooth plains area encompasses approximately 3,500 square miles and extends from CAMA's east boundary to the northwest boundary and from the north border southward for 50 miles (refer to map 6).

Landform

The plains are flat and have little visible relief (Plates 10 and 11). More than 80% of the area is gently sloping and local relief is between 100-300 ft. Most of the slope that does occur is located on the upland areas. Relief is mainly offered by stream valleys, pingos (pingos are large ice formations that push upward causing a bulge on the surface of the earth; most are less than 50 ft. in height and 100-200 ft. across at their base) and ice wedge polygons. Two noted land form features in this area are the Siotukuyuk Bluff and Schrader Bluff.

Water Form

Thousands of lakes in all sizes and shapes dot the smooth plains. Many lakes are classified as thaw lakes which do not have inflow or outflow points. Major lakes found in the smooth plains are: Imaoknik Lake, Nakaktook Lake and Shirukak Lake. There are many lakes equal in size to these which have not been named. The rivers are expansive, slow moving, and all flow northward to the Arctic Ocean. River valleys between one and two miles wide, and with 30 or more river braides are commonly found in the smooth plains. Major rivers that flow through this subregion include: The Anaktuvuk, Itkillik, and Kuparuk (Plate 12).

Vegetation Form

The vegetation on the plains is a combination of dry and wet tundra. In the low areas the tundra has a dark olive color during July and August and in the upland regions it is pale yellow/green. The river valleys have 4-6 ft. high thickets of willows and is very localized. From the air the tundra is smooth in texture except where ice polygons are present.

Imageability

The smooth plains major visual characteristic is its flatness and endless tundra. There are no landmarks or reference points and panorama views of 50 miles or more are common.

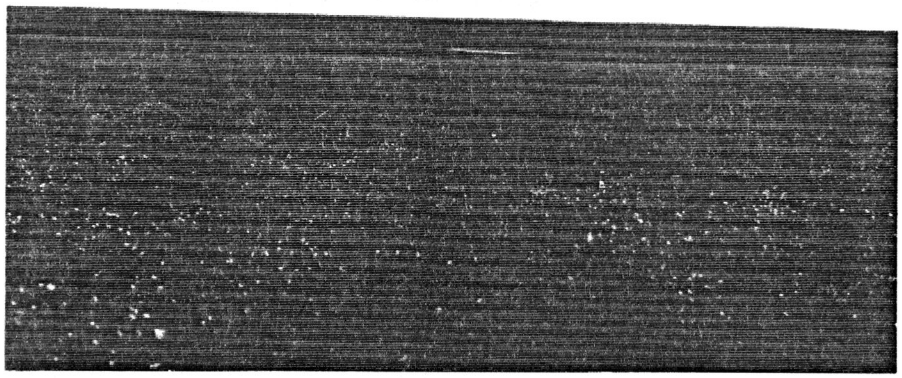


Plate 10. Subregional Area A. The Smooth Plans, Land Form

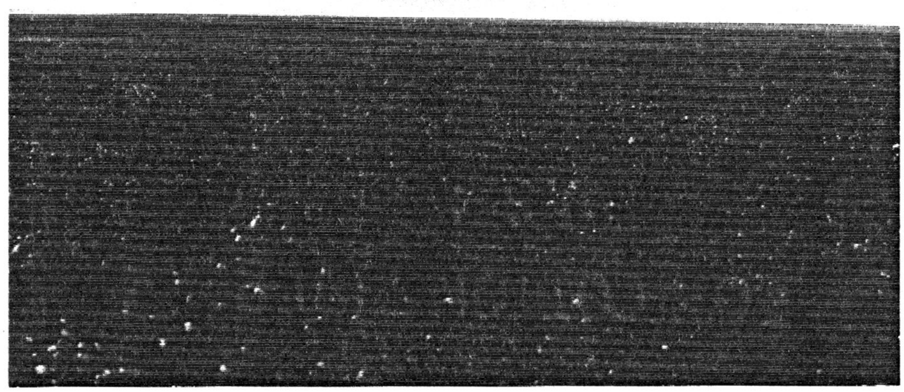


Plate 11. Subregional Area A. The Smooth Plains, Land Form

Plate 12. Subregional Area A. The Smooth Plains, Water Form

Subregional Area B - Plains with High Hills

Plains with high hills are found in two separate areas within CAMA. They encompass approximately 4,200 square miles. In one location plains with high hills begin at the east boundary of the study area and forms a visual edge between the smooth plains and the Brooks Range. This parallels the Brooks Mountain Range forming a belt approximately 18 miles wide and 150 miles long. The second location of this subregion borders the western boundary of the study area (refer to map 6).

Landform

The plains with high hills consists of 50-80% of the area having a gentle topography and a local relief of between 500-1000 ft. Within this area the hills and valleys are well-rounded and give the impression of rolling waves (Plate 13). Most of the slope occurs on the upland areas and through natural erosion from streams, buttes, ridges and intervening large flat terraces have been formed (Plate 14). Major landform features included in this subregional area are: The White Hills, Kakukturat Bluff, Arc Mountain, Rooftop Ridge, Table Top Butte, Twin Bluffs, Kayak Mountain, Banded Mountain, Sivugak Bluff.

Water Form

Concentrations of thaw lakes are found in this subregional area. These lakes are of various shapes and sizes and some are quite large; however, most do not exceed 300-500 acres. Major lakes within this area are Ahaliorak Lake and Sitchiak Lake and the major rivers are the Anaktuvuk, Itkillik, Kuparuk, Ivashak and the Sagavanirktok. These rivers all trend northward, have channel widths of 200-300 ft and watershed basins of hundreds of square miles (Plate 15). At the southern edge of this subregion, rivers are fixed in one channel and meander in a sinuous pattern; once reaching the smooth plains to the north, they become braided.

Vegetation Form

Low dry tundra covers the unit with narrow bands of riparian vegetation bordering most streams. Many of the taller ridges are devoid of vegetation and thus a sharp contrast exists at these locations.

Imageability

The variety of landforms and spatial enclosure makes this landscape most memorable. There are buttes, serrated ridges, bluffs and complex drainage basins that project a visual image of a great labyrinth.

Plate 13. Subregional Area B. Plains with High Hills, Land Form

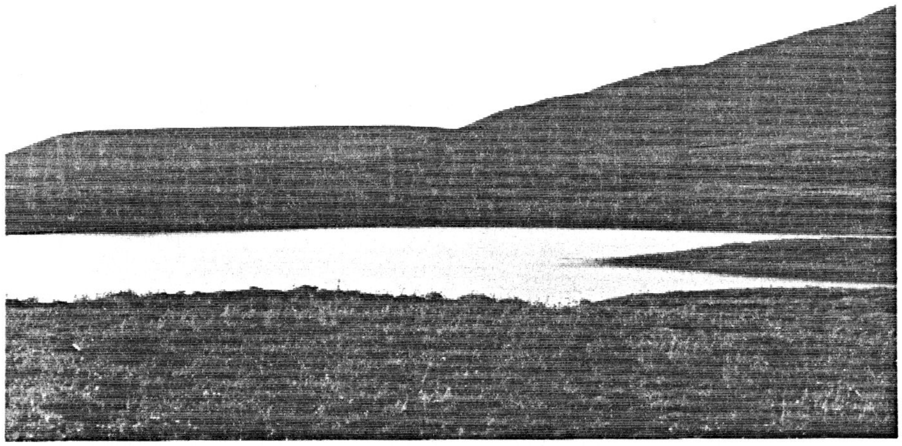


Plate 14. Subregional Area B. Plains with High Hills, Land Form - Buttes, Ridges, Thaw Lake

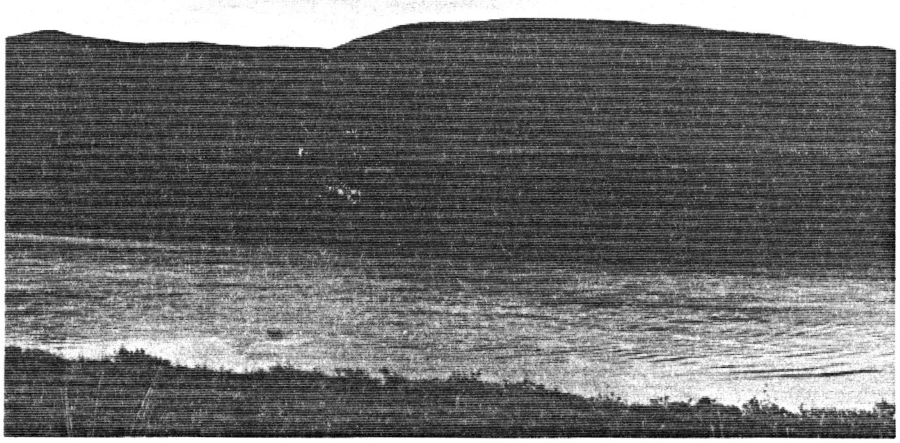


Plate 15. Subregional Area B. Plains with High Hills, Water Form

Subregional Area C - Open High Hills

The open high hills area borders the northwest boundary of CAMA and extends into the study area for approximately 60 miles and covers 2,196 square miles (refer to map 6).

Land Form

The open hills are distinguished by east-west trending ridges and moderately sloping terrain. Local relief is 500-1000 feet, and 20-50% of the area is gently sloping; of the gently sloping lands 50-75% is in the lowlands. The rounded ridges are 4-6 miles long and hummock in appearance (Plates 16-17). There is a profusion of landform features found within the Open High Hills unit. The major features are: Ayiyak Mesa, Gunsight Mountain, Gunsight Pass, Grandstand Ridge, Kikakpak Bluffs, Hatbox Mesa, Niakogan Buttes, and Outpost Mountain, Uluvak Bluffs Niakogon Buttes.

Water Form

Generally, the percentage of water features within this area is low; however, two major rivers, the Chandler and Killik, bisect it. Both rivers flow northward and have confluences with the Colville River at the northwest boundary of CAMA. Because of the surrounding landform, most rivers meander and are fixed channel except at the confluence points where they tend to become braided (Plate 18).

Vegetation Form

A low mat of dry tundra uniformly covers the valley bottoms and hills. A narrow band of riparian vegetation borders many of the streams.

Imageability

The ridges themselves are very impressive and distinguish this unit from other areas. However, the numerous landform features within this small unit is its most memorable characteristic.

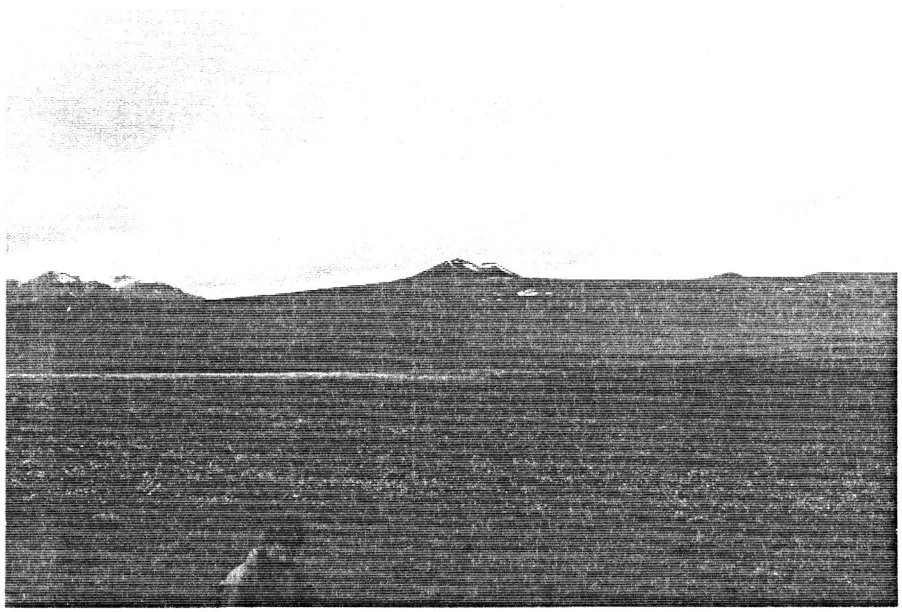


Plate 16. Subregional Area C. Open High Hills, Land Form

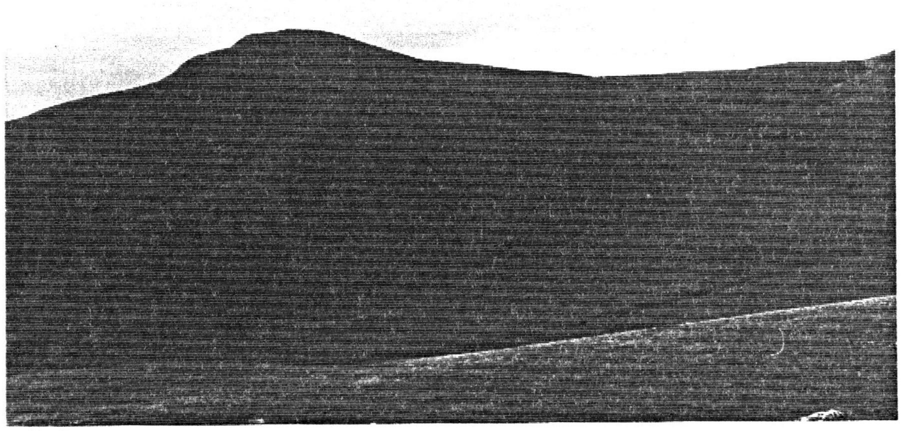


Plate 17. Subregional Area C. Open High Hills, Land Form - Rounded Ridges 4-6 Miles Long

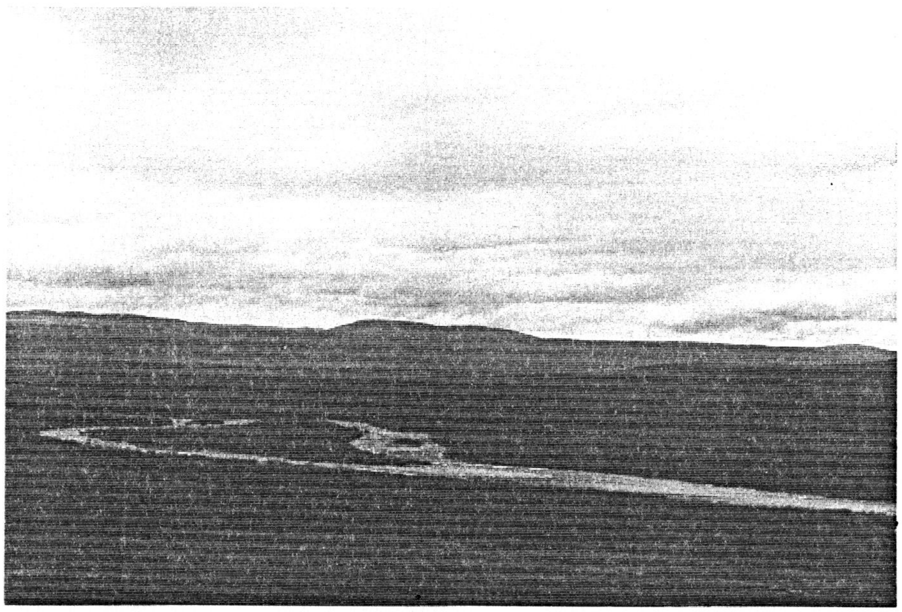


Plate 18. Subregional Area C. Open High Hills, Water Form-
Meander and Fixed Channel

Subregional Area D - Open Low Mountains

The open low mountains encompass approximately 3,100 square miles and parallels the Brooks Mountan Range. This subregion stretches across the southern boundary of CAMA (refer to map 6).

Land Form

Area D is very rugged and the scale of the landform is the largest within CAMA. A wide range of landform types exist, such as buttes, knolls and hogback ridges (Plates 19-20). Some features are flat, some rounded, some sharp, and others are elongated forming serrated ridges. Local relief is between 1000-3000 ft. and 20-50% of the area is gently sloping; of the gently sloping lands 50-75% is in the lowlands. Major landform features include: Kakuktukruick Bluff, Atigun Gorge, Higaknit Mountain, Nasauvak Mountain, Castle Mountain, Fortress Mountain, Pingaluligit Mountain, Hkilikruick Ridges, and Kikiktat Mountain.

Water Form

All of CAMA's major rivers flow through this area. The river channel widths are small in comparison to their counterparts downstream; however, the water in these rivers is swift moving, crystal clear, and flow over boulders forming rapids and pools (Plates 21-22). Hundreds of small streams are born in this part of CAMA and they join rivers of considerable size including the Anaktuvuk, Canning, Chandler, Ivashak, Killik, Kuparuk, and Sagavanirktok Rivers.

Vegetation Form

The valleys and lower slopes of the mountains are covered by a mat of dry tundra. The tall mountains are generally barren, and the lower peaks usually have small patches of tundra. Because of the lack of thick tundra mats on the high mountain side slopes, natural erosion has caused considerable land slumping in this area of CAMA.

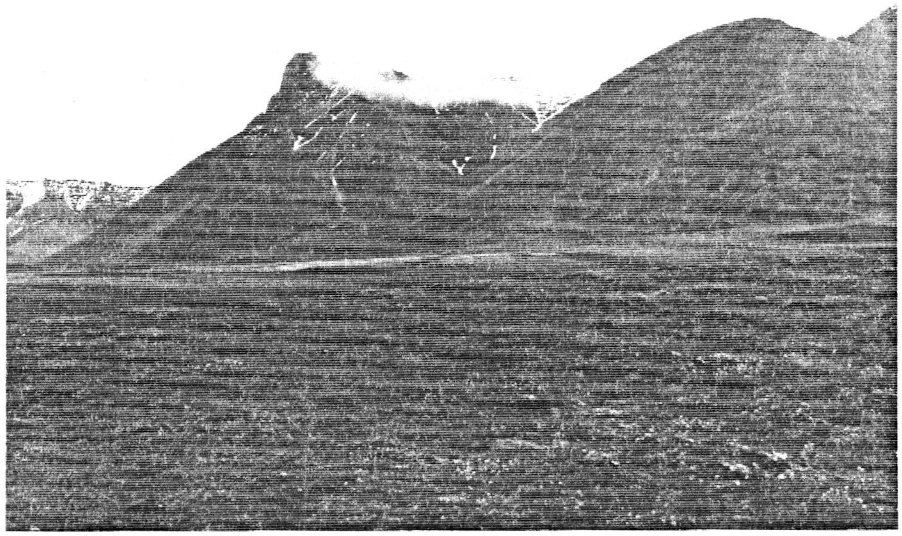


Plate 19. Subregional Area D. Open Low Mountains, Land Form

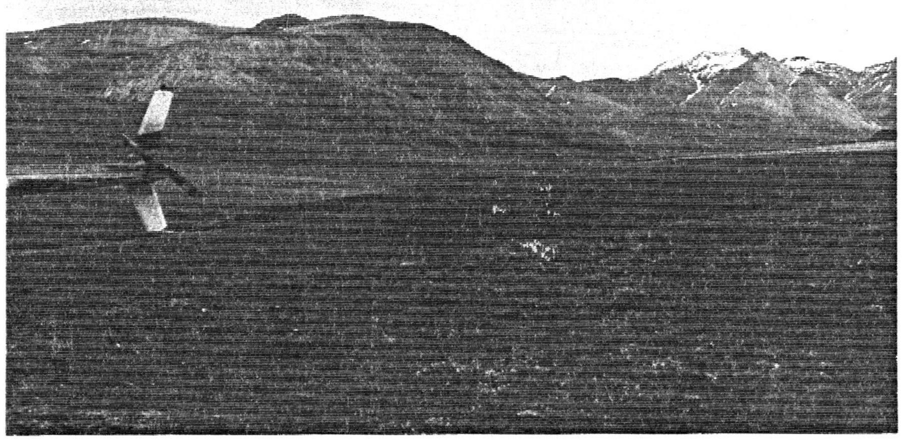


Plate 20. Subregional Area D. Open Low Mountans, Land Form - Ridges and Knolls

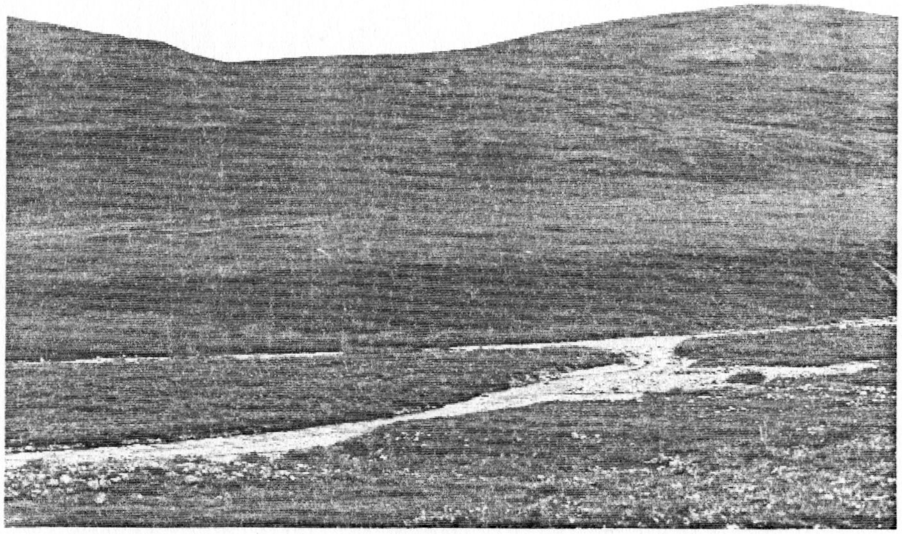


Plate 21. Subregional Area D. Open Low Mountains, Water Form - Mountain Streams (Headwaters)

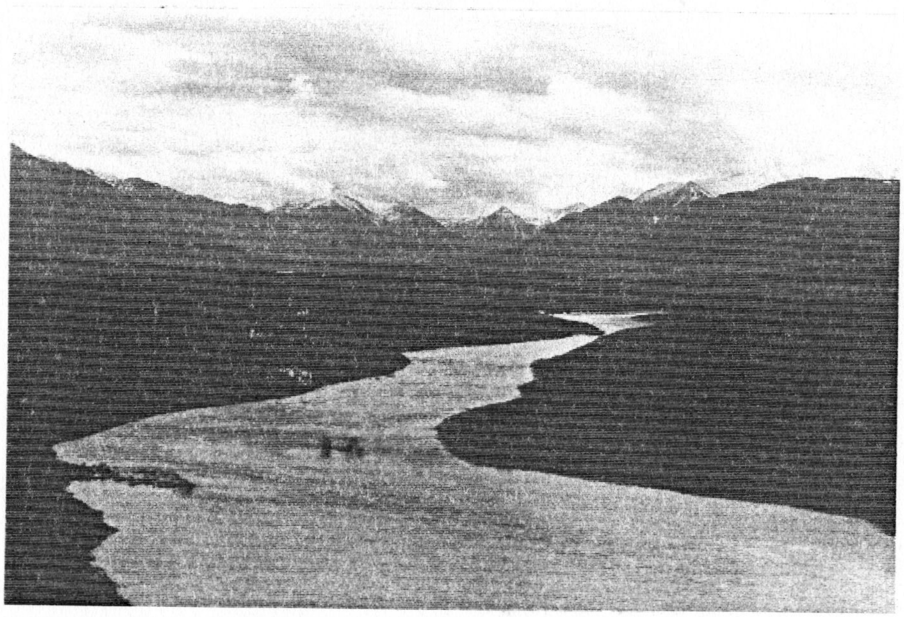


Plate 22. Subregional Area D. Open Low Mountans, Water Form - Major River, the Chandler River already 50-70 miles long

Imageability

The most memorable features within this unit are the scale and magnitude of individual land elements. Sight distances are short and the feeling of enclosure is present.

Medianscale - Visually Sensitive Landscapes

The second objective of the medianscale is to locate and describe sensitive landscapes on the Arctic North Slope. This was accomplished with the assistance of the Gordon and Shaine report, Alaska Natural Landscapes.

Within the study area there are 10 sensitive landscape areas that have been inventoried by Gordon and Shaine (see map 7). Of these ten, six are located directly within CAMA and four others straddle the southern boundary. These ten land units are:

1. Atigun Gorge Unit
2. Chandler Lakes and High Valleys
   a) Chandler-agiak Valley
3. Chandler River Mesas/Hogbacks
   a) Hatbox Mesa
4. Echooka-Ivishak Mt. Front
   a) Echooka springs and aufeis
5. Franklin Bluffs - White Hills
6. Gates of the Arctic Mountains
   a) Ulo Valley
   b) gates of the Arctic-einie ck.
7. Northwest Philip Smith Mts.
   a) ribdon-accomplishment low pass
8. Rooftop Ridge Unit
9. Shainin Lake Unit
10. Upper Killik Area
    a) Killik River
    b) Krupa Lake

The Gordon and Shaine report describes each area's physical characteristics and its relationship to the immediate surrounding of which it is a part. The following descriptions are numbered to coincide with Map 7.

" 1. ATIGUN GORGE:

A narrow canyon at the north edge of the mountains, in places a chasm as much as 2000 feet deep, revealing multi-layered very contorted rock strata, eight miles in length.

2. CHANDLER LAKES AND HIGH VALLEYS:

Chandler-Agiak Valley: Large Chandler Lake set in cliff-rimmed U-shaped valley near the north front, with a series of lakes to north and south in Chandler and similarly aligned Agiak valleys. At south end, valley system ends at Lonely Lake, atop peculiar wide flat east-west basin lying nearly astride the divide.

3. CHANDLER RIVER MESAS AND HOGBACKS:

Hatbox Mesa: Irregular flat-topped mesa rising above upper foothills west of Chandler Lake. One of the most striking arrays of mesas and buttes in Alaska, such as Castle and Fortress Mountains, river bluffs such as Paunagaktuk, Niakogon and Tuktu along the Chandler. Also curious notches in hills such as "The" (Kiruktagiak) Notch north of Chandler Lake. Features formed from various sedimentary types; fossils.

4. ECHOOKA-IVISHAK MOUNTAIN FRONT:

Echooka Springs and Aufeis: Large year-round springs, fine cottonwood grove. Extensive permanent field of stream overflow ice. Smooth massive bare slopes facing the lowlands. Largest aufeis field in Arctic Alaska at Ivishak junction with Saviukviyak River. Abrupt mountain front in Echooka-Ivishak area, among most striking in Brooks Range.

5. FRANKLIN BLUFFS-WHITE HILLS:

White hills, very pale, form isolated plateau 600 feet above Arctic plain, deeply dissected into badlands. To north, Toolik River pingo fields. To east, equally high bluffs along Sagavanirktok River, also eroded into badlands, but here brightly colored. Wildlife often seen, including peregrine falcon. To south along river, excellent examples of braiding in shallow non-glacial stream.

6. GATES OF THE ARCTIC MOUNTAINS:

Ulo Valley: Valley of the north-flowing Itkillik River, with Itkillik Lake at mouth. Exceptionally striking steep-walled mountains with strata varying from light to nearly black. Isolated cirque-headed side valley to west beneath Cocked Hat Mountain, with pinnacles.

Mount Doonerak Area: East-west side valley along north side of Doonerak with Kinnorutin Pass set off on both sides by narrow canyons. Gorges and tarn lakes in valleys bounding Donnerak; a horn-shaped peak carved out of dark sedimentary rock, rising above level of adjacent mountains.

7. NORTHWEST PHILIP SMITH MOUNTAINS:

Ribdon-Accomplishment Low Pass: Open east-west pass and tarn connecting head of Ribdon South Fork and Accomplishment Creek, directly beneath exceptionally rugged glaciated portion of Philip Smith Mountains.

From Elusive Lake, set well into the mountains, south to the main divide, the South Fork Ribdon, Accomplishment Creek, uppermost Wind River country has narrow valleys and austere rocky mountains with little vegetation.

8. ROOFTOP RIDGE:

In foothills east of Anaktuvuk River, hogback, very steep on north side. Varied rock types in Racetrack Basin and hills just to north.

9. SHAININ LAKE:

Fairly large lake in broad U-shaped valley at north front, with rugged gray limestone mountain slope rising abruptly above it, and Mount Wachsmuth distinct from adjacent mountains, protruding onto the foothill lands.

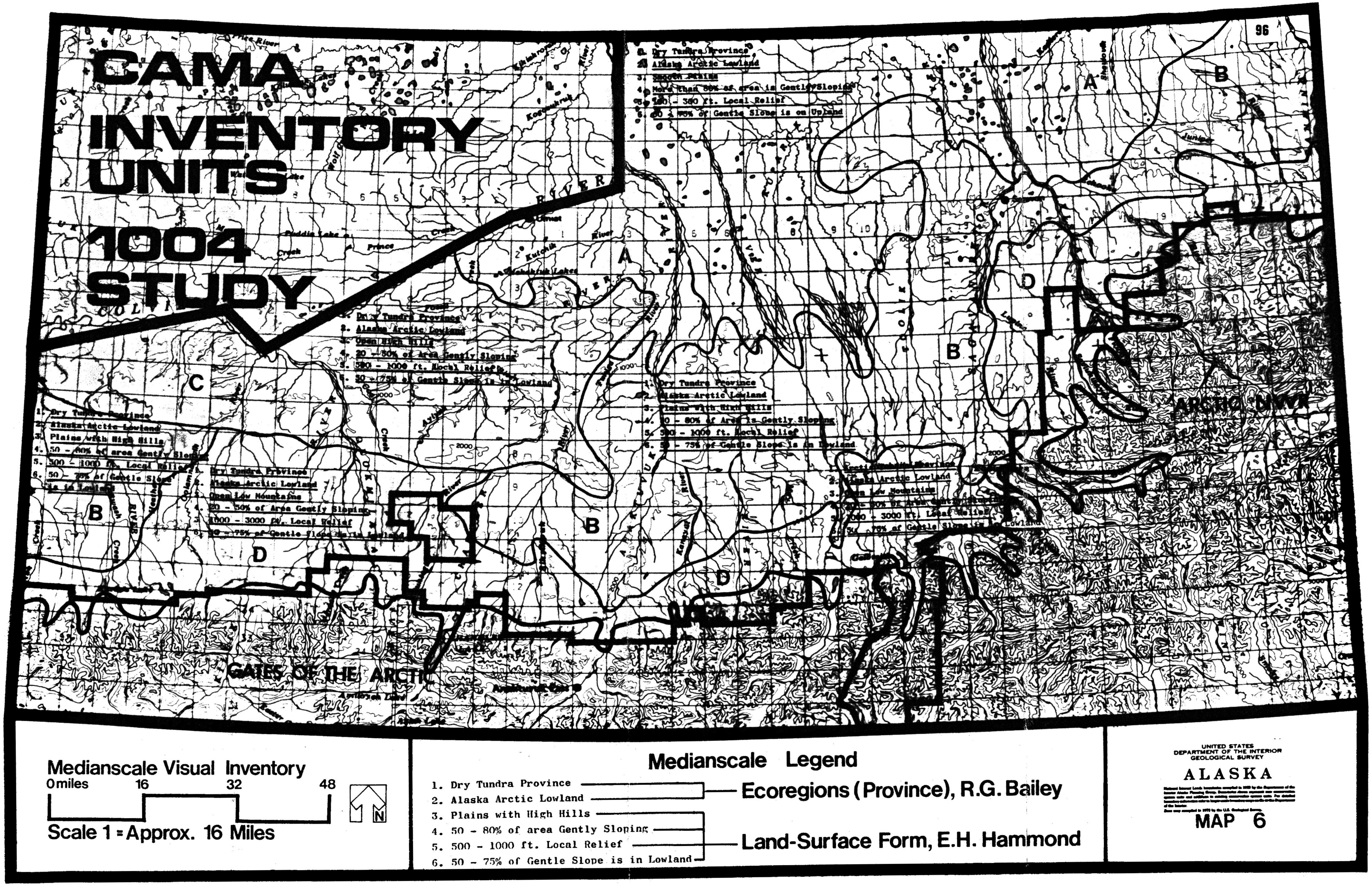
10. UPPER KILLIK-KURUPA LAKES AREA:

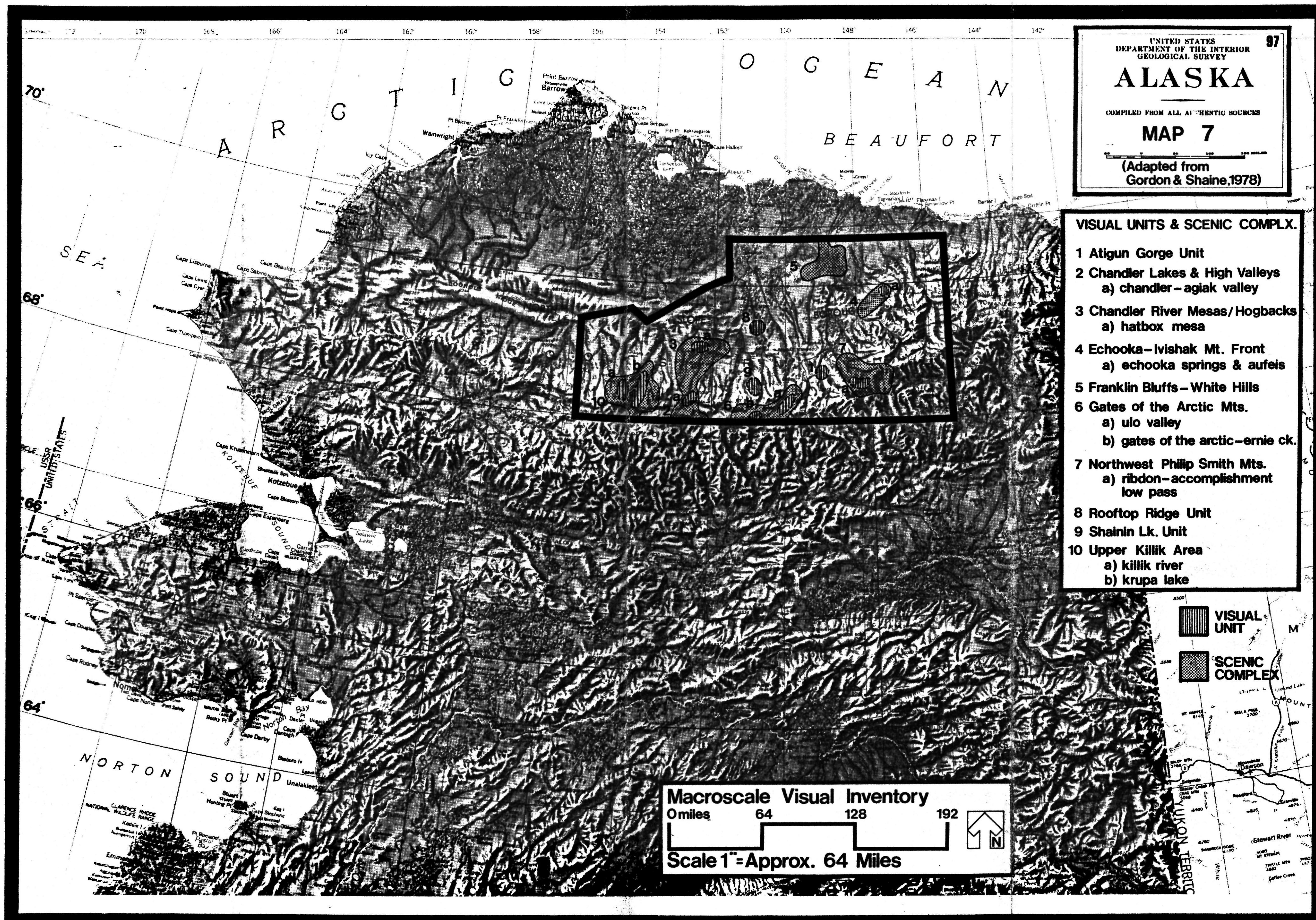
Overlapping the upper foothills, the complex includes rolling tundra interspersed with sharp low mountains. At the north front of the Range intensively eroded stark pale hills are backed by a steep mountain wall. Sharp horns occur near the east end, and tarns and hanging valley are numerous.

Kurupa Lakes: A pair of narrow deep blue moraine-dammed lakes at the foot of massive rugged mountains. A setting which Detterman (USGS) considers "the most spectacular scenery in the Arctic lowlands." Gray limestone cliffs along the south wall contrast with vari-colored chert on the north side, and highly folded layers in the valley walls. A broad U-shaped valley to the south terminates in a group of cirque lakes.

Upper Killik River: Montane portion flows slowly through pond-like section. Set in an exceptionally wide valley, the river is bordered by high rock-ribbed mountains cut by deep side canyons. The river bottom is incised into finely laminated lake bottom sediments, in places capped by partially stabilized sand dunes of considerable height. Outstanding examples are found of depositional glacial topography with a remarkable series of many types of moraines. Long winding bouldery rapids have developed where the river crosses sets of end "

(Gordon and Shaine, 1978:34-37).


CAMA INVENTORY UNITS
1004 STUDY
96
A
B
C
D
ARCTIC NWR
GATES OF THE ARCTIC
Dry Tundra Province
Alaska Arctic Lowland
Smooth Plains
Open High Hills
Plains with High Hills
Open Low Mountains
Medianscale Visual Inventory
0 miles 16 32 48
N
Scale 1 = Approx. 16 Miles
Medianscale Legend
1. Dry Tundra Province
2. Alaska Arctic Lowland
3. Plains with High Hills
4. 50 - 80% of area Gently Sloping
5. 500 - 1000 ft. Local Relief
6. 50 - 75% of Gentle Slope is in Lowland
Ecoregions (Province), R.G. Bailey
Land-Surface Form, E.H. Hammond
UNITED STATES DEPARTMENT OF THE INTERIOR GEOLOGICAL SURVEY
ALASKA
MAP 6


97
UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY
ALASKA
MAP 7
(Adapted from
Gordon & Shaine,1978)
VISUAL UNITS & SCENIC COMPLX.
1 Atigun Gorge Unit
2 Chandler Lakes & High Valleys
a) chandler-agiak valley
3 Chandler River Mesas/Hogbacks
a) hatbox mesa
4 Echooka-Ivishak Mt. Front
a) echooka springs & aufeis
5 Franklin Bluffs-White Hills
6 Gates of the Arctic Mts.
a) ulo valley
b) gates of the arctic-ernie ck.
7 Northwest Philip Smith Mts.
a) ribdon-accomplishment low pass
8 Rooftop Ridge Unit
9 Shainin Lk. Unit
10 Upper Killik Area
a) killik river
b) krupa lake
VISUAL UNIT
SCENIC COMPLEX
Macroscale Visual Inventory
0 miles 64 128 192
Scale 1"=Approx. 64 Miles
N
ARCTIC OCEAN
BEAUFORT
NORTON SOUND
Point Barrow
Barrow
Wainwright
Cape Lisburne
Kotzebue
Nome
Norton Bay

Microscale Inventory

Objective

The objective of the microscale inventory is to predict how vulnerable an area's visual resources are to change by future development. The case study is utilized to test the proposed system, to illustrate how it is implemented, and to suggest, with the use of a matrix, the visual vulnerability of each slope class to impact by linear, area and point surface disturbances.

Microscale Data Sources

The following data sources were used to inventory the visual resource at the microscale level:

- Land form and Relief/Slope Characteristics

  1) High altitude false color aerial photographs by NASA
  2) Topographic Maps - United States Geological Society

- Water Patterns and Terrain Surface Patterns

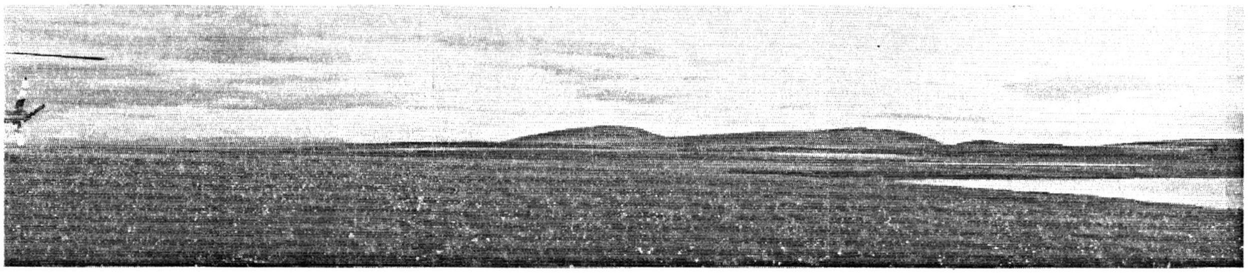
  1) Topographic Maps - United States Geological Society

Microscale Application

Within the Central Arctic Management planning unit a test study area (see Map 8) of approximately 19 miles by 33 miles (627 sq. mi./401,280 acres) was selected to test the application procedure developed and described in Chapter 2, pages 37-59. This particular study area was chosen for the following reasons: (1) it displayed a wide range of different slopes; (2) topographic base map information was readily obtainable; and (3) helicopter flying range was restricted to 200 miles.

<u>Microscale Visual Patterns</u> (refer to Map 9)
District/Landtype associations/Landtype

SLOPE CLASS - TYPE ONE.

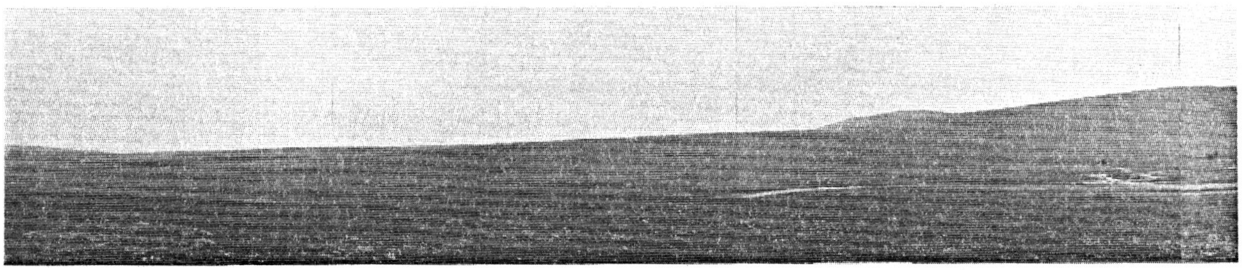


SLOPE CLASS Type	Spatial Character	Land form Character	Relief	Slope%
Type 1	Indistinct/spacious	Generally level	0-200'	0-3%

Figure 17. Slope Class - Type One

Slope class one is symbolized on Map 9 by having the lightest tone which is designated by 2 vertical lines per grid cell. This slope class encompasses approximately 245 square miles or 43% of the total study area acreage. As illustrated on Map 9, five areas are larger than 10 square miles in size. Two areas, each of considerable size, are located on the eastern and western borders of the study area. Both areas depict river basin landscapes and have indistinct/spacious visual character, level land form and slopes between 0-3%. Typically, slope class type one landscape tends to be broad depressions or plateaus with little internal visual variety in elevation or features (See Figure 17).

SLOPE CLASS - TYPE TWO



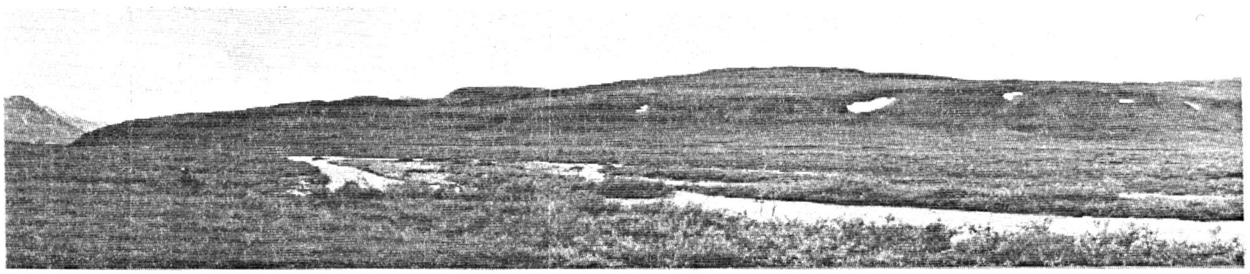
SLOPE CLASS Type	Spatial Character	Land form Character	Relief	Slope %
Type 2	Minor defined/ semi enclosed	Gently rolling	200-500'	4-9%

Figure 18. Slope Class - Type Two

Slope class two is identified on Map 9 by four vertical lines per grid. This slope type makes up 200 square miles or 35% of the total study area.

Slope class type two is often a transitional zone between the level valley floors or terraced landscapes and the more rugged slopes which are also present in the study area. Frequently, ribbons or linear landscape patterns are evident and usually define the edge of the floodplain. For example, on the eastern border of the study area between Hkillik River Valley and the mesa-like land form to the west, there is a slope transition occurring. This transition zone is from 1 1/2 miles to 2 miles wide, and exhibits a change in elevation of approximately 1000 feet. Some transition zones are large as portrayed in the previous example; however, also revealed from Map 9 were areas one grid wide, which frequently act as doorways or openings leading into another area of steeper or flatter terrain characteristics.

SLOPE CLASS - TYPE THREE



SLOPE CLASS Type	Spatial Character	Land form Character	Relief	Slope %
Type 3	Defined/Enclosed	Moderately Hilly	500-800'	9-14%

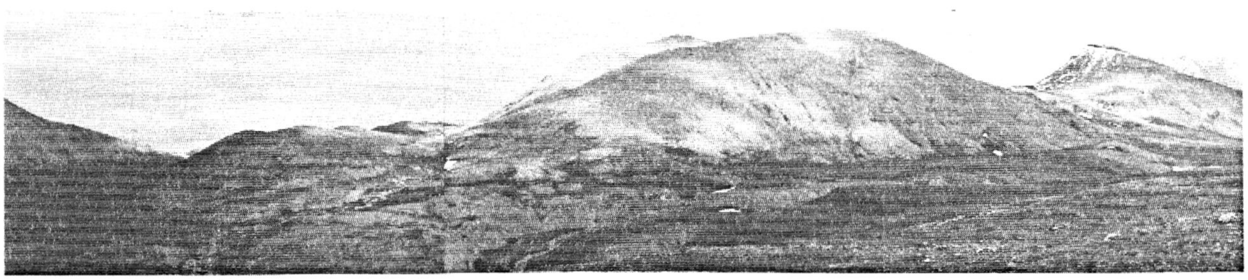
Figure 19. Slope Class - Type Three

Slope class three is depicted on Map 9 by a moderate tone gradation of nine vertical lines per grid. Approximately 14% of the study area is composed of this slope type.

As revealed from Map 9, slope class type three has a wide distribution throughout the study area and is not found in large single concentrations.

Slope Class 3 has two important visual characteristics: one is enclosure that is created by the land forms, and second, is spatial direction also created through the surrounding vertical side slopes. An example illustrating these characteristics is the Hanushuk Bluff which is located in the west central part of the study area. This bluff is approximately 500 feet in height and parallels the Hanushuk River for about six miles in a north/south direction. Frequently, individual land features, such as knobs, hogbacks, bluffs and ridges of moderate size typify this slope class and major boundaries and edges between areas are created (See Figure 19).

SLOPE CLASS - TYPE FOUR

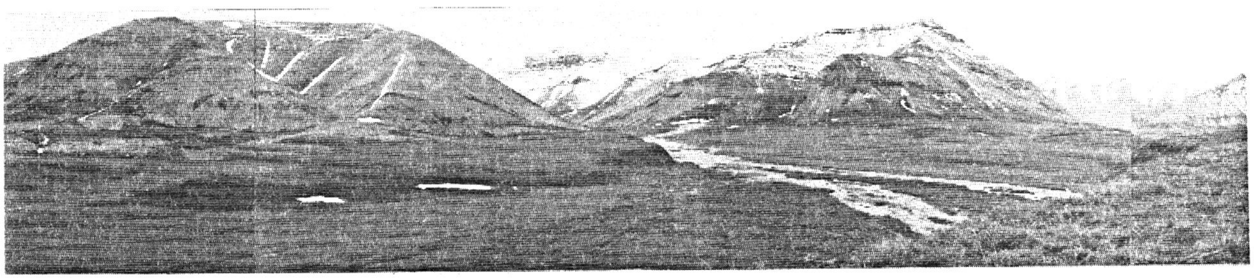


SLOPE CLASS Type	Spatial Character	Land form Character	Relief	Slope %
Type 4	Distinct/Focal	Low Mountains	800- 1300'	15-25%

Figure 20. Slope Class - Type Four

Slope Class Four is identified on Map 9 by 14 vertical lines per grid. Within the study area approximately 7% or 38 square miles is classified as type four. As illustrated in Figure 20, type four is composed chiefly of low mountains, focal and distinct canyons and steep bluff areas. An example of a type four slope class is depicted in the lower south eastern corner of Map 9, along the Itkillik R.. This area rises to over 1,000 feet in elevation within a 1/2 mile horizontal distance, creating a visually strong focal attraction within the immediate area. Because of their contrasting size to other land forms and their rarity in this particular study area, class four slopes are easily remembered and almost command further study.

SLOPE CLASS - TYPE FIVE



SLOPE CLASS Type	Spatial Character	Land form Character	Relief	Slope %
Type 5	Highly Distinct/ Monumental	Rugged Mountains	over 1,300'	26% & >

Figure 21. Slope Class - Type Five

Slope class five is delineated on Map 9 by 23 vertical lines per grid and has the darkest tone. One percent or approximately 6 square miles of the study area has slopes with a type five designation. As exemplified through Map 9, slope class five is rare and occurs more frequently in the highly mountainous landscapes outside of this particular study area. In the few areas where it has been identified and inventoried, type five slopes indicate a highly distinct/monumental spatial character and precipitous side slopes. Figure 21 is an example of slope class five and magnitude of relief that is portrayed.

Visual Vulnerability of Slope Classes

On the North Slope, slope and land form are inextricably tied together to form part of the visual landscape. As previously explained in Chapter 2, land form is the dominant physical element in the North Slope region. To prevent undue physical damage to land form which in turn affects visual character, fundamental knowledge of slopes and their tolerance or intolerance to surface disturbances by man's activities should be understood before making decisions regarding land use.

Because of the fragility of the North Slope environment, slope plays a critical role in determining both the physical and visual outcome of a project. Slope related problems on the North Slope fall into two categories: the first is slope failure due to melting and erosion of the permafrost once vegetative cover is removed; and second, tundra landscape changes caused by surface disturbances remain visible for very long periods of time due to extremely slow vegetation regeneration rates. To lessen visual impacts and avoid costly damage to future structures that are built on the North Slope it is necessary to make the proper match between land uses and slopes. Generally, constructing anything in steep terrain will produce greater damage to the landscape's visual resources than building the same projects on level ground. Obviously, a development requiring large flat aeas will cause greater impact on the visual resources of a steep landscape than it would if placed on flatter terrain. The microscale inventory alerts land managers of this potential problem and also identifies areas that can accommodate development with less impact to the visual resource. Linear types of development such as roads and pipelines have the potential to cause large surface disturbances in a rugged area. However, if development is proposed in rugged terrain, land mangers can either try to find alternative routes through flatter terrain or work to have the facility placed low and parallel to the contours thus reducing the area of disturbance.

Visual impacts of specific projects is not a part of this study. However, through past experiences, Alaskan BLM management can predict future development trends on the North Slope. Predicted developments were divided into three groups according to the type of surface disturbance each would make - linear, area and point visual impacts. The following is a summary of the projects likely to occur in each group:

<u>Linear Disturbance</u>

utility corridors*
trails*
seismic test lines
survey lines
roads*

<u>Area Disturbance</u>

reservoirs
strip mines
villages
installation camps*

<u>Point Disturbances</u>

mines
oil wells*
landing strip*

* - projects most likely to occur

The Visual Vulnerability Matrix was designed to identify the potential impacts major facilities could have on each of the five land form types.

<u>Visual Vulnerability Matrix</u>

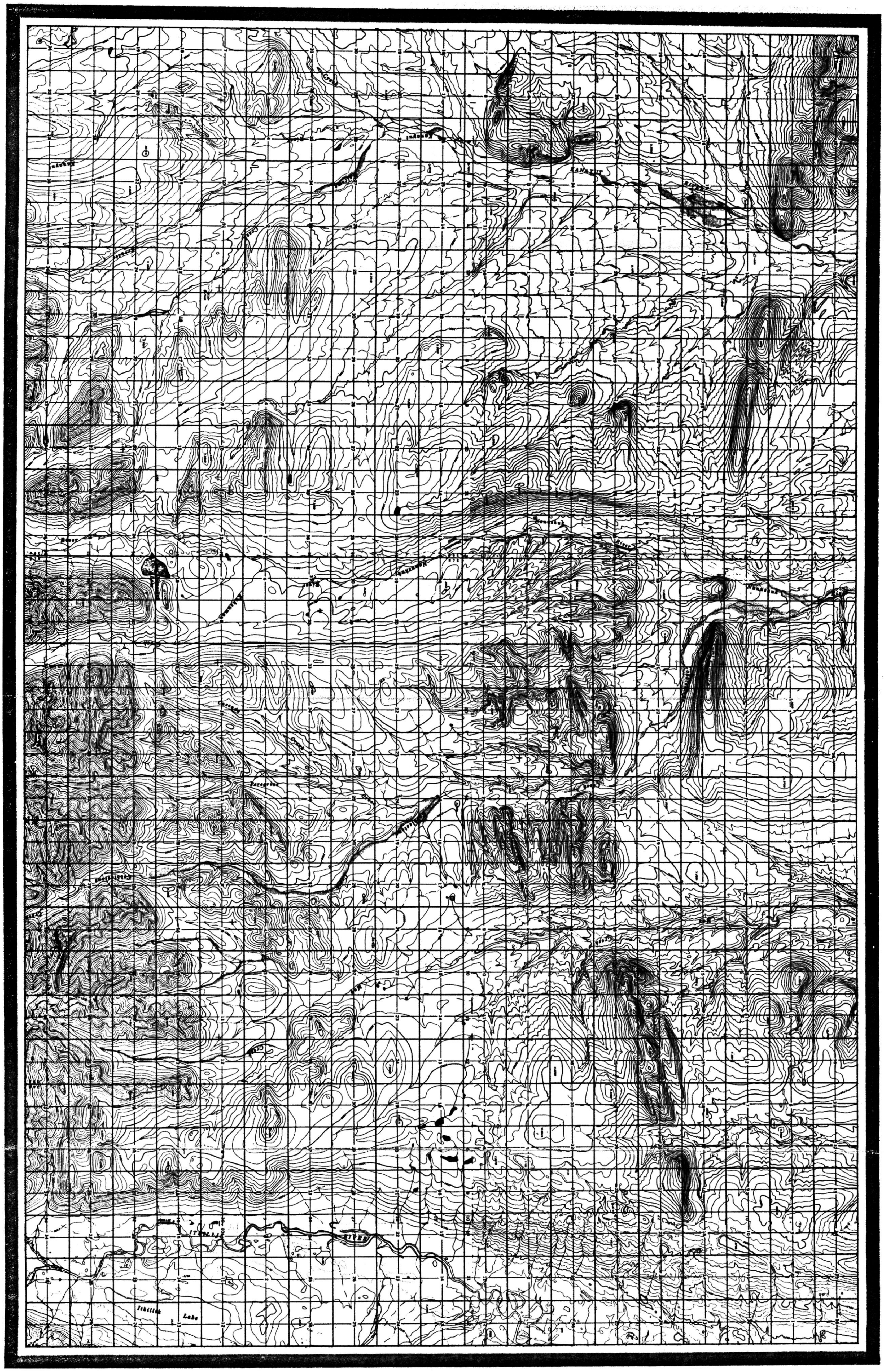
The Visual Vulnerability Matrix was designed to identify the potential impacts major facilities could have on each of the five land form types identified in the microscale inventory. Comments in the matrix grid cells are not intended to be complete but to give an idea of the kinds of information that could be presented.

"The matrix, then, presents the types of information that might be useful for management decisions involving land uses. For example, if a utility corridor was proposed through the case study area the manager could refer to the linear disturbances cells in the matrix. These cells would contain relevant information concerning the effects a utility corridor would have on each of the land forms" (Laurizio, Sullivan 1980:32).

VISUAL VULNERABILITY MATRIX

	Land Form 1	Land Form 2	Land Form 3	Land Form 4	Land Form 5
Point & Area Disturbances	LARGE OPEN AND RELATIVELY FLAT AREAS OPEN VISTAS. LACK OF VISUAL VARIETY. NEW ELEMENT WILL TEND TO DOMINATE VIEW. VASTNESS OF SCAL DIFFICULT TO COMPREHEND.	ENOUGH RELIEF TO ABSORB SOME IMPACTS & PROVIDE SOME SCREENING. LOCATION & DESIGN OF IMPACTS CRITICAL TO MINIMIZE IMPACTS	IMPACTS OF LESS THAN 300 FEET TOTAL HEIGHT CAN BE SCREENED HOWEVER, EROSION POTENTIAL MODERATE VISUAL VULNERABILITY MODERATE.	STEEP RELIEF LOCATION OF DISTURBANCES IMPORTANT (BE LOW HORIZON, RIDGES,) EDGES OF LAND FORM SHOULD DICTATE LOCATION OF NEW ELEMENT.	HIGH DIVERSITY AND HIGH VISUAL VULNERABILITY. PROPER PLACEMENT OF DISTURBANCES IMPORTANT (AVOID STEEP SIDE SLOPES & RIDGE LINES) HIGH EROSION POTENTIAL ON STEEP SLOPES
Linear Disturbances	LACK OF TOPOGRAPHIC VARIETY MAKES DISTURBANCES MORE VISIBLE. LINEAR DISTURBANCE MORE CONSISTENT W/ FORM & SHAPES WITHIN THIS LAND FORM TYPE.	UNDULATING LAND FORM WILL PROVIDE SOME SCREENING. BREAK UP OF CONTINUITY OF LINEAR DISTURBANCE	UNDULATING LAND FORM-SCREENING POSSIBLE FOR MOST IMPACTS. SCALE OF LAND FORM & SCALE OF IMPACTS WILL SOMEWHAT BE COMPATABLE.	LAND FORMS LESS RUGGED THAN #5. LINEAR ELEMENTS SHOULD FOLLOW PATHS OF LEAST RESISTANCE IN THIS TOP.	SHARP ANGULAR ABRUPT LINES. HIGH VISUAL VARIETY & VULNERABILITY. LINEAR DISTURBANCE INCONSISTENT & UNNATURAL. AVOID RIDGE LINES; EDGE IS VISUALLY DOMINANT-ALIGNMENT & DESIGN IMPORTANT.

Figure 22. Visual Vulnerability Matrix



Microscale Inventory

scale 1"= 2.25 miles

0 miles 2 4 6

Map 8

DGL 1/84

N

Microscale Inventory

Map 9

scale 1" = 2.25 miles

0 miles 2 4 6

DGL 1/84

N

Legend

Land Form Character Types

1 2 3 4 5

CHAPTER IV

CONCLUSION

The North Slope, for the most part, lacks major vegetative cover, such as trees and large shrubs. Therefore, any development placed in this region potentially will have a major impact on the areas' visual resources. This study focused on developing an analysis method that would accurately describe the visual resources of this landscape and also determine the sensitivity of this resource to damage by proposed development. The need to have a flexible system capable of being used for many purposes led to development of a three level inventory system. The system has two major components; one descriptive and the other predictive.

The descriptive inventory is limited in the amount of detail it can portray. It is best utilized to describe the visual resource characteristics of regional and subregional areas. Descriptive inventories are most effective for developing base line data which in turn can be used to determine and support broad based policies affecting a region's visual quality.

The predictive inventory provides BLM land managers with a tool to analyze the impacts future site specific projects will have on the visual resurces of an area. Additionally, and more importantly, this system makes it possible for land managers to develop viable alternatives for site selections and to suggest site design criteria which will reduce the visual impacts of a proposed project.

For landscape architects and BLM land managers, this system provides a vehicle to illustrate the importance of understanding the North Slope's visual resource and the problems associated with managing this resource.

Also, this system should make it possible to have improved communication between the BLM, and other federal and state agencies and the public on policy decisions affecting the visual resource.

Implementation of this system would not require a large investment of additional resources because it is dependent on existing published data and is designed to be implemented by non-professional personnel. In fact, the system should make more efficient use of available resources possible by helping land managers eliminate unnecessary field work and to guide future study to the more sensitive landscapes where detail visual study is imperative. Additional savings may be realized because the information for the predictive inventory could be digitized for computerization which would allow great flexibility for analysis and future interfacing with other environmental data.

The inventory method was designed and tested for a specific region of Alaska which has a very unique landscape character. The flexible nature of this system suggests that it could have application in other areas of Alaska. However, only through additional testing will it be possible to accurately determine if ths visual inventory system has statewide applicability.

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A PROPOSED INVENTORY METHOD FOR ANALYZING THE VISUAL RESOURCES OF ALASKA'S NORTH SLOPE

by

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B.S., Colorado State University, 1977

AN ABSTRACT OF A MASTER'S THESIS

submitted in partial fulfillment of the

requirements for the degree

MASTER OF LANDSCAPE ARCHITECTURE

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KANSAS STATE UNIVERSITY
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1984

ABSTRACT

Alaska is a unique state which has been endowed with many natural resources. The visual resource of Alaska's vast landscape is a resource which needs continual monitoring because it is easily subject to ruin by unplanned or careless development practices.

Within the Alaskan North Slope region the Bureau of Land Management (BLM) is the major land management agency and has jurisdiction over most development activities. As a federal agency, the BLM is mandated to inventory, evaluate and manage all of its land resources. Presently, the BLM in Alaska is using a visual resource inventory process designed for use in the populated Rocky Mountain states. This system has proven to be inappropriate for inventorying remote roadless regions of Alaska where increased development activities are occurring.

The objectives of this research are (1) to determine the problems within the Alaska BLM visual resource inventory procedure; (2) develop a descriptive inventory method that focuses on the visual characteristics of Alaska; (3) develop a predictive inventory method that is capable of accurately identifying impacts future development will have on the visual resource; and (4) to test analytical flexibility and hierarchical capabilities of the proposed inventory methodology.

Three levels of visual inventory are proposed - the macroscale, medianscale and microscale. The first two, macro and median, are descriptive and the third, micro, is predictive. The descriptive levels parallel the work of R. Burton Litton Jr. and Robert Tetlow and are used for regional and subregional visual resource inventory. The descriptive inventory utilizes published environmental data and visual descriptions from aerial reconnais-

sance work to describe land form patterns, vegetation patterns and water form. The predictive inventory uses slope to identify major land form types, identifies visually sensitive areas, water form and visual surface patterns. Low level aerial observation, ground survey, photography and topographic maps were used as information sources for the predictive inventory.

A case study area located on Alaska's North Slope was used to test the proposed methodology. Results indicate that descriptive inventories are accurate to varying degrees for depicting the visual character of the landscape. It is most useful in establishing base line data for regional visual resources and for broad based policy decisions. The predictive inventory results indicate how sensitive the landscape's visual resources are to development. This information can be used to (1) wisely allocate money and manpower for more detailed studies where needed; (2) identify the need for careful site planning which is responsive to landform; and (3) identify appropriate alternative locations for future development.

By combining both descriptive and predictive inventories, knowledge on the visual resource in remote areas is increased. The method better conveys and depicts this information to land managers and planners and this inventory tool can help illustrate how land planning actions may affect future visual changes on the North Slope of Alaska.