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PRELIMINARY VEGETATION MAP OF THE ESPENBERG PENINSULA, ALASKA, BASED ON AN EARTH RESOURCES TECHNOLOGY SATELLITE IMAGE

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16. Abstract
A vegetation map of the Espenberg Peninsula in the U.S. National Park Service's Chukchi-Imuruk Biological Survey region on the Seward Peninsula, Alaska, is presented. This map, at an original scale of 1:250,000, is based on interpretations of ERTS-1 scene #1009-22092 in enlarged, simulated color-infrared format. It is drawn on parts of four U.S. Geological Survey topographic sheets and depicts 14 vegetation types and related features. An accompanying text discusses something of the philosophy and purpose of vegetation mapping, previous vegetation maps of the Espenberg Peninsula, the preparation of the present map, and ecological aspects of the map units. The preliminary nature of the map and its value as a guide to further field work and map revision are emphasized.

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PRELIMINARY VEGETATION MAP OF THE ESPENBERG PENINSULA, ALASKA, BASED ON AN EARTH RESOURCES TECHNOLOGY SATELLITE IMAGE

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Vegetation maps are useful in several scientific and applied areas (Küchler 1953, 1967b: 307-396, 1973; J. H. Anderson et al 1973: 70). Of concern here is the possible usefulness of a vegetation map as (a) an inventory of plant communities and the landscape units and ecosystems they represent, or a product resembling Küchler's (1973: 512) "...tangible, integrated expression of the biogeocenose.," (b) a reservoir of basic information with which future environmental changes may be ascertained and evaluated, (c) a primary tool for land use planning and management, and (d) a guide to future and more thorough research.

The Earth Resources Technology Satellite-1, ERTS-1, has been a source of imagery depicting vegetation and other earth surface features since its launch by the United States National Aeronautics and Space Administration into a near-polar, sun synchronous orbit on July 23, 1972. The potential role of ERTS imagery in the analysis, description, classification and mapping of vegetation in Alaska is currently under study, and early results include several maps and otherwise show promise for vegetation science (Anderson 1973b, 1974; Anderson and Belon 1973; D. M. Anderson et al 1973; J. H. Anderson et al 1973).

A preliminary vegetation map of the Espenberg Peninsula in the Chukchi-Imuruk Biological Survey region on Alaska's Seward Peninsula, under study by the U. S. National Park Service, was made because of its possible uses as enumerated above, the availability of good ERTS imagery and the availability of results of the 1973 field Survey for use in interpreting the imagery (Fig. 1). The rest of the Survey region is covered by ERTS imagery, but this imagery is less suitable for vegetation mapping because of cloudiness or unfavorable season. However, this imagery is of sufficient quality to justify an attempt to map certain other places, such as the Imuruk Lake area, and it is possible that additional imagery of the highest quality for the Survey region will be obtained in the future.

The map here presented (Fig. 3) is preliminary pending (a) further ground control over the identification and delineation of units, (b) subdivision of the larger units to make the map more thoroughly informative regarding the distribution of plant communities, (c) augmentation and possible refinement of the map unit classification, (d) an accuracy analysis using aerial photographs and other information not yet acquired and (e) critical review by phytocenologists and land use personnel.

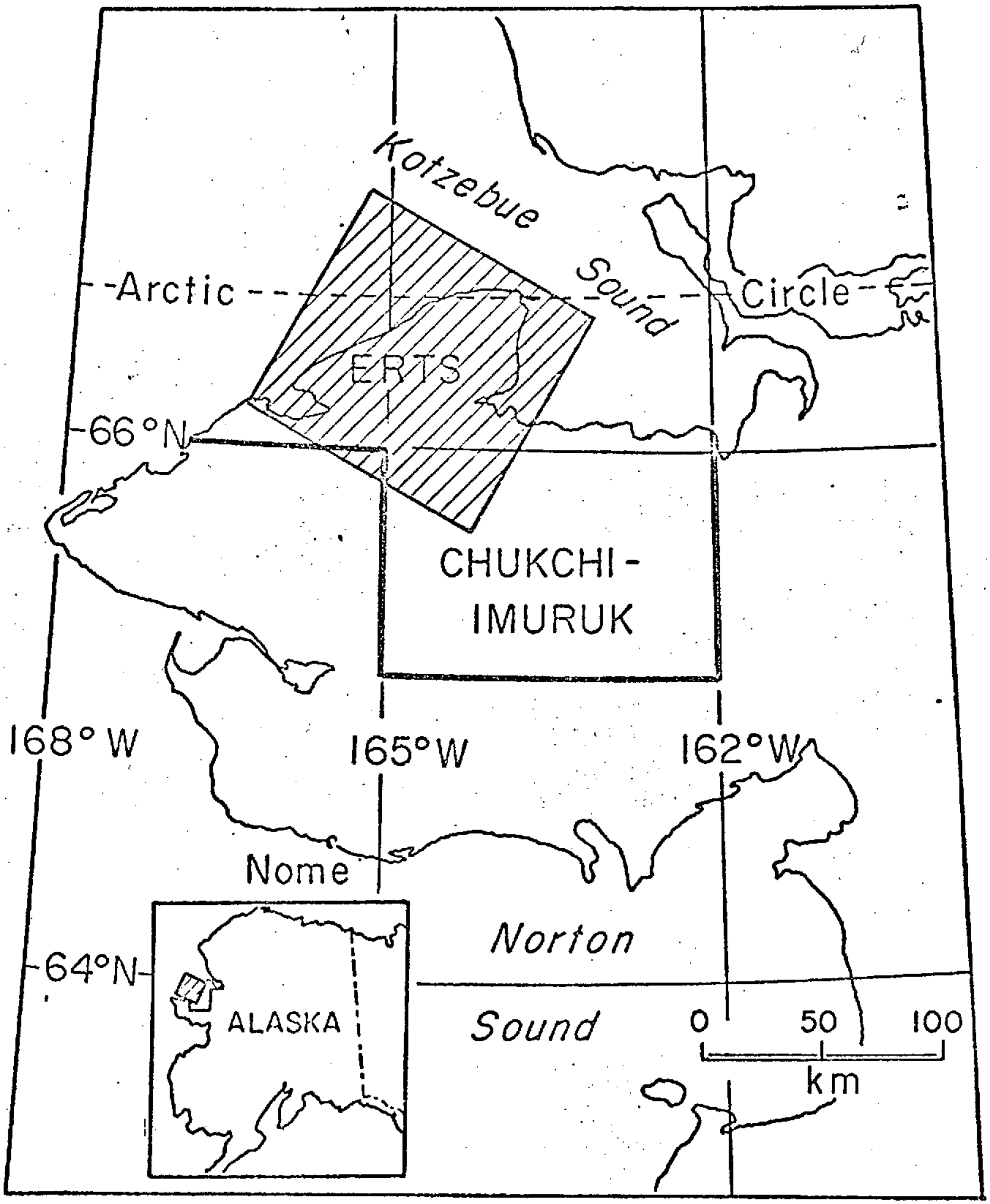


Figure 1. Location of the Chukchi-Imuruk Biological Survey, ERTS-1 scene 1009-22092, and the Espenberg Peninsula map-area, the latter being the land area of the scene.

Previous Work

The earliest known vegetation map of the Espenberg Peninsula is a sketch map by Collier (1908: 55) covering the whole Seward Peninsula. This map, at a scale of approximately 1:4,800,000, shows three broad vegetation types and the western limit of spruce timber. Most of the Espenberg Peninsula is mapped as "Tundras; Willows and Grass Along Watercourses." The southeastern approximately one third of the map-area is mapped as "Timberless Uplands; Willows and Grass Along Watercourses." Collier's third map unit, "Timbered Areas, with Scattering Growth of Spruce," is limited to the eastern and southeastern parts of the Chukchi-Imuruk Biological Survey area, some distance from the Espenberg Peninsula.

Sigafoos (1958a) authored a 1:500,000 scale vegetation map of the Seward Peninsula. Regarding the Espenberg Peninsula, this map is similar to Collier's in showing an unbroken "Wet Tundra" over most of the area, with "Wet Tundra Willows" in the southeast. In addition, it shows several units of "Dry Tundra" in the beach ridge zone of the northern and northwestern coast, around Devil Mountain, and around Serpentine Hot Springs. Also shown are several units of "Coastal Marsh," notably adjacent to the eastern end of Shishmaref Inlet. Two other map unit classes, "Shrub Tundra" and "Open Spruce Forest," are absent from the Espenberg Peninsula map-area but occur in the eastern and southeastern parts of the Survey area (Fig. 1). Sigafoos' map is based on a substantial amount of botanically oriented field work and seems to give a good idea of the general distribution of major vegetation types, a conclusion based on comparisons with later maps and the new one presented here. However, the level of information on Sigafoos' map is coarse, and the map suffers from the spatial and topographic inaccuracies of the 1913 base map that he used.

Another map by Sigafoos (1958b), at a scale of 1:2,500,000, depicts vegetation types only roughly comparable classificatorially and spatially with those of the preceding map. Most of the Espenberg Peninsula is shown covered by "Herbaceous Tundra." The northern and northwestern coastal strip is mapped under the unit class "Rock Desert, Sand Plains, and Bare Rock," as are the highlands around Serpentine Hot Springs. "Shrub Tundra" is shown around Devil Mountain, along the lower Serpentine River and in the vicinity of Serpentine Hot Springs.

Spetzman (1963) authored a 1:2,500,000 scale Alaska vegetation map showing the general distribution of nine major vegetation types, four of which are shown on the Espenberg Peninsula: "High Brush," of minor occurrence in the southeast; "Moist Tundra;" "Wet Tundra and Coastal Marsh;" and "Barren and Sparse Dry Tundra." These appear to be approximately the equivalents of three of Sigafoos' (1958a) units, his "Wet Tundra Willows;" "Dry Tundra;" "Wet Tundra;" and, again, "Dry Tundra" respectively. Spetzman's map is approximately as detailed as Sigafoos' with respect to the distribution of vegetation types in spite of its smaller scale. There are a few discrepancies between the two maps resulting in some uncertainty as to which is the more representative.

Spetzman also mapped vegetation on U. S. Geological Survey topographic maps in the 1:250,000 series using the same nine map unit classes as on his Alaska State map. The value of these maps lies in their providing more detailed information on the distribution of the vegetation types represented. The detail nevertheless is coarse relative to the map scale. These maps are unpublished except for transparent plastic overlays made from them, recently available through the Joint Federal-State Land Use Planning Commission for Alaska in Anchorage, to be used in conjunction with U. S. Geological Survey maps.

Küchler's (1967a) map of potential natural vegetation of Alaska at a scale of 1:7,500,000 depicts "Cottonsedge Tundra (*Eriophorum*)" and "Watersedge Tundra (*Carex*)" on the Espenberg Peninsula. The former occurs in a large unit around the Devil Mountain and Kileak Lakes. The latter is continuous throughout the rest of the area.

Hutchison's (1967) Alaska forest map shows "Non-Forest" on the Espenberg Peninsula and most of the Chukchi-Imuruk Biological Survey region.

Viereck (in Viereck and Little 1972) published an Alaska vegetation map which is for the most part a condensation of Spetzman's (1963) map with some revisions based on its author's abundant firsthand knowledge of Alaska vegetation. However, at one half the scale, 1:5,000,000, it is necessarily less informative than Spetzman's map regarding the distribution of vegetation types. It is curious that the northern and northwestern coastal strip of the Espenberg Peninsula, mapped appropriately enough under "Barren and Sparse Dry Tundra" by Spetzman, is mapped by Viereck as "Alpine Tundra."

In 1973 the Joint Federal-State Land Use Planning Commission for Alaska published a 1:2,500,000 scale map, *Major Ecosystems of Alaska*, which appears to be a copy of Spetzman's map except for its incorporating the revisions of Viereck's map and its featuring an ecosystem oriented terminology. "Moist Tundra" and "Wet Tundra" ecosystems are shown in the Espenberg Peninsula map-area. The alpine tundra term applied on Viereck's map was retained here.

Anderson and Belon (1973) produced an ERTS image-based vegetation map of the western Seward Peninsula, one of the first maps of this type. This map overlaps the Espenberg Peninsula map-area and is presented here, slightly modified to show the extent of overlap (Fig. 2) and to incorporate some refinement in the map unit classification. The chief contribution of this map beyond the more useful previous maps, i.e. those of Sigafoos (1958a) and Spetzman (1963), is its showing more spatial information for previously defined vegetation types through use of geographically smaller units and several mosaic classes. In addition it shows the distribution of a new vegetation type, possibly a grassland tundra (class 7), and two ephemeral features, fire scars (class 4) and senescent vegetation (class 5).

Perhaps some vegetation or quasi-vegetation maps were produced for various publications or limited-distribution reports dealing with reindeer-caribou management on the Seward Peninsula, although J. R. Luick, an authority on this subject (personal communication 1974), knew of none. No search was made for such maps, but it is unlikely that, with the possible exception of local areas, these would be more informative than some of the maps reviewed above.

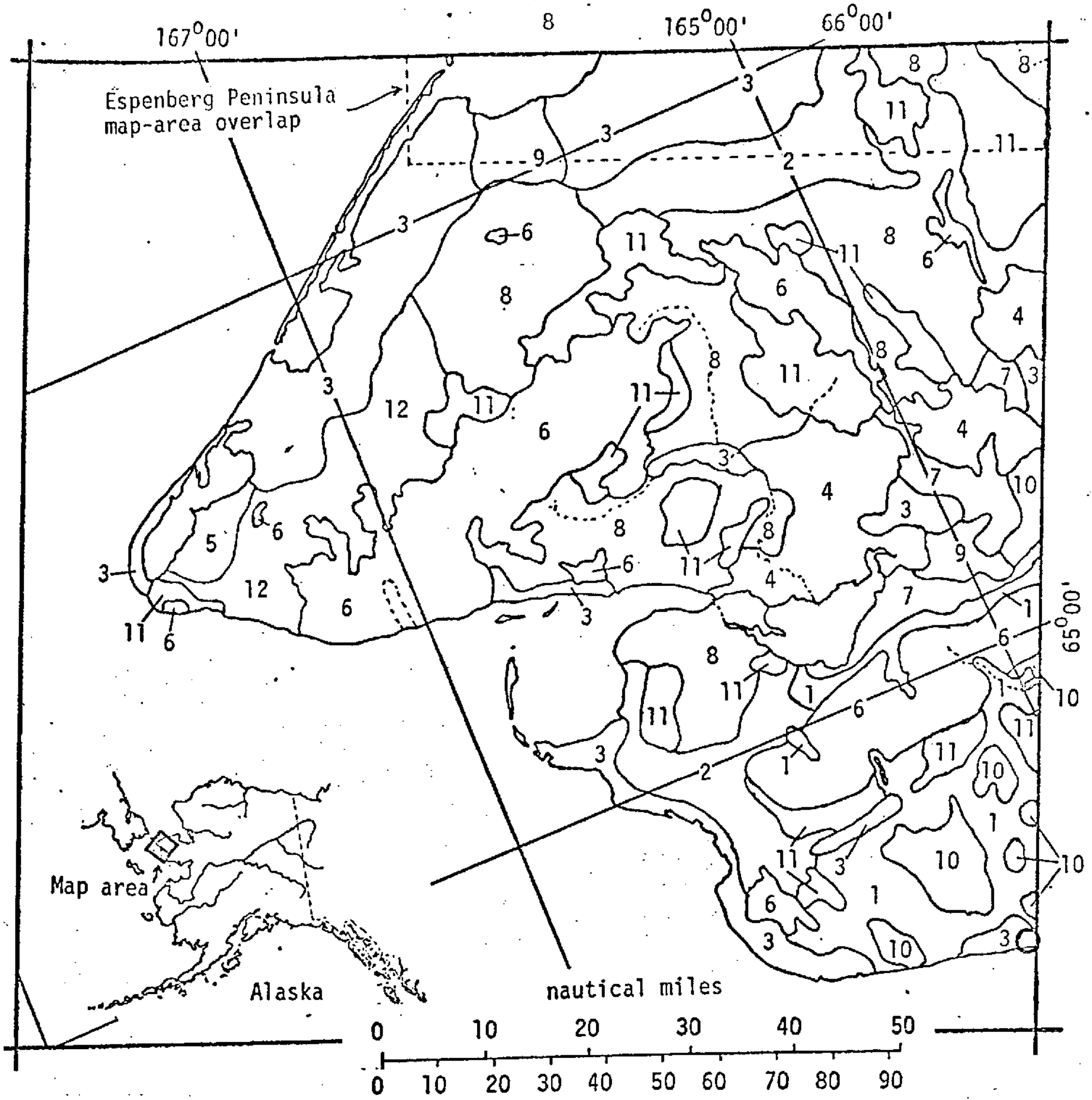


Figure 2.

VEGETATION MAP OF THE WESTERN SEWARD PENINSULA, ALASKA

based on ERTS image 1009-22095

1. Shrub Thickets
2. Upland Tundra
3. Wet Tundra
4. Fire Scars
5. Senescent Vegetation
6. Highland and Mountain Areas with Sparse and No Vegetation
7. Possible Grassland Tundra
8. Shrub Thicket-Upland Tundra Mosaic
9. Shrub Thicket-Wet Tundra Mosaic
10. Shrub Thicket-Highland/Mountain Areas Mosaic
11. Shrub Thicket-Upland Tundra-Highland/Mountain Areas Mosaic
12. Upland Tundra with Some Senescent Vegetation

Reference: Anderson and Belon 1973

Methods

The image used for mapping is a photographic print in simulated color-infrared format at a scale of 1:250,000. It was made from NASA ERTS-1 Scene No. 1009-22092, taken by the satellite at an altitude of approximately 500 nautical miles on August 1, 1972, at about 1110 hours LST. The product acquired from NASA was a 9-1/2 inch reconstituted, simulated color-infrared transparency. This was printed by projection onto Eastman Kodak direct reversal color print material. The desired scale was achieved by first putting the base map on the enlarger easel and adjusting the projected image to it, using prominent landmarks as guides. The base map comprises parts of the Bendeleben, Kotzebue, Shishmaref and Teller sheets in the U. S. Geological Survey 1:250,000 Alaska Topographic Series.

A sheet of transparent plastic suitable for drafting was cut to fit the image. This was placed over the map, and several landmarks prominent on both the map and the image were traced onto it. These comprised lakes, lagoons and the coastline. Other features not readily visible on the image, including stream forks and bench marks, also were traced onto the plastic to facilitate reference back to the map when the plastic was used over the image.

The plastic was positioned over the image by matching the prominent landmarks. Vegetation and other units interpreted on the image were then traced onto it. The plastic had sometimes to be shifted slightly as mapping proceeded, as an exact scale match over the entire map-area was not achieved because of minor differential scale distortion between the base map and the image. This shifting presented only a slight potential for error because of the considerable number of landmarks, mostly lakes, that were traced onto the plastic. Lakes are abundant in the map-area and are quite distinct on the image.

In preparing for vegetation mapping, the image was carefully examined in order to identify spectral signatures, which are color units, or units of different hue, intensity and brightness, to the extent that this is possible with presumably normal color vision. Strong reflected light was used. Interpretations were based on the assumption that the colors for most land areas resulted primarily from the spectral reflectance of vegetation, since vegetation is generally known to cover the land surface everywhere in the map-area except for sand dunes, coastal mud flats and rocky barrens in the highlands. Areas lacking vegetation, of minor extent, were easily distinguished by their colors which contrasted distinctly with colors indicating the presence of vegetation. With these exceptions in mind, it was further assumed that different colors represented reflectances of different spectrophotometric character from different plant communities and hence that the variety of colors on the image portrayed the variety of plant communities on the ground. Colors representing vegetation include reds, pinks, yellow-pinks and brown-pinks. Non-vegetation areas are represented by blues, blue-grays, brown-blues and, in the case of water, blue-blacks. The terms applied to these colors are somewhat subjective.

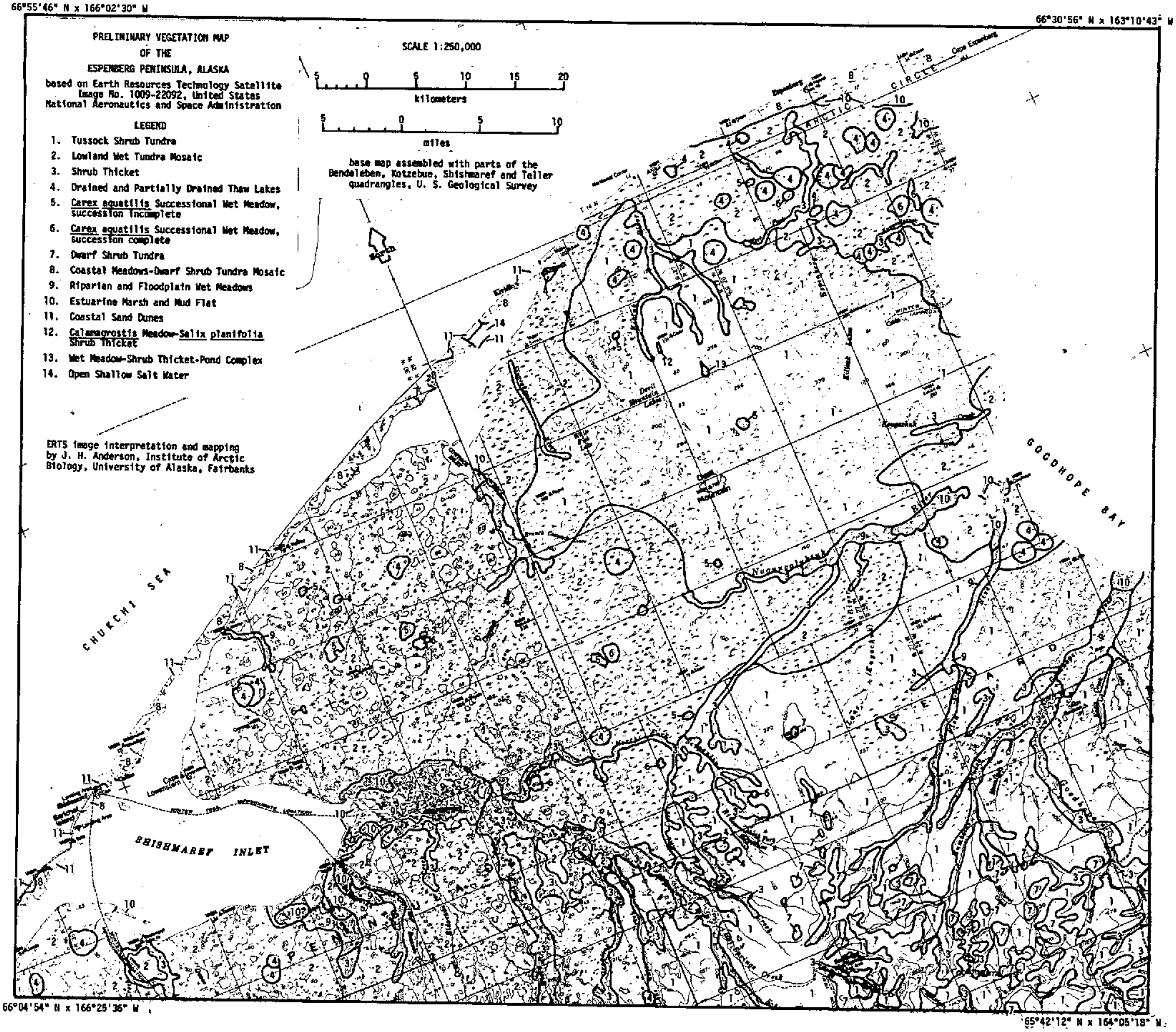
Colors were identified to plant community, or vegetation type and association, using field data obtained at several locations by the 1973

Chukchi-Imuruk Biological Survey party. Wherever possible a direct correlation between vegetation type and color was established. These correlations were the basis for extrapolating vegetation interpretations to other parts of the map-area. Information on black and white aerial photographs at a scale of approximately 1:40,000 was also obtained for a few local areas. Interpretations were refined on the basis of physiographic position of the map units, identified through reference to the topographic map, in view of known general relationships of tundra plant communities to physiography.

The terminology used in naming map unit classes according to vegetation types follows the terminology of Racine (1974) as closely as possible. Reference should be made to Racine's vegetation classification for more information on the composition, structure and habitat relationships of the types and associations involved than is presented below. Four of Racine's five primary types are important enough in the map-area to depict: Shrub Thickets, Tussock-Shrub Tundra, Dwarf Shrub Tundra, and Meadows. Most of the associations constituting these types occur in the map-area. Only the Forest and Woodlands type is not mapped, as no stands are known in the area.

Results and Discussion

The preliminary vegetation map of the Espenberg Peninsula is presented as Figure 3. The 14 map unit classes on it are of three kinds. (1) Classes 1, 3, 5, 6, and 7 represent areas wherein a single vegetation type prevails and stands of other types (a) do not occur, (b) are isolated,



66°55'46" N x 166°02'30" W
66°30'56" N x 163°10'43" W
66°04'54" N x 166°25'36" W
65°42'12" N x 164°05'18" W
PRELIMINARY VEGETATION MAP
OF THE
ESPENBERG PENINSULA, ALASKA
based on Earth Resources Technology Satellite Image No. 1009-22092, United States National Aeronautics and Space Administration
LEGEND
1. Tussock Shrub Tundra
2. Lowland Wet Tundra Mosaic
3. Shrub Thicket
4. Drained and Partially Drained Thaw Lakes
5. Carex aquatilis Successional Wet Meadow, succession incomplete
6. Carex aquatilis Successional Wet Meadow, succession complete
7. Dwarf Shrub Tundra
8. Coastal Meadows-Dwarf Shrub Tundra Mosaic
9. Riparian and Floodplain Wet Meadows
10. Estuarine Marsh and Mud Flat
11. Coastal Sand Dunes
12. Calamagrostis Meadow-Salix planifolia Shrub Thicket
13. Wet Meadow-Shrub Thicket-Pond Complex
14. Open Shallow Salt Water
ERTS image interpretation and mapping by J. H. Anderson, Institute of Arctic Biology, University of Alaska, Fairbanks
SCALE 1:250,000
5 0 5 10 15 20
kilometers
5 0 5 10
miles
base map assembled with parts of the Bendeleben, Kotzebue, Shishmaref and Teller quadrangles, U. S. Geological Survey
CHUKCHI SEA
SHISHMAREF INLET
GOODHOPE BAY
ARCTIC CIRCLE

Figure 3

few and small or otherwise of insignificant areal importance, (c) are of some secondary importance but could not be identified with acceptable certainty because of insufficient field data or (d) could not be adequately discerned on the ERTS image for mapping. The prevailing type may include more than one association. (2) Classes 2, 8, 9, 10, 12, and 13 represent mosaic areas occupied by two or more vegetation types in stands of approximately equal areal importance and where the tesserae (a) are too small to map individually and label at a scale of 1:250,000, (b) could not be delineated because of widespread intergradation or (c) could not be identified because of insufficient field data, even though distinct on the ERTS image. (3) Map unit classes 4, 11, and 14 represent landscape features best identified in other than vegetation terms, although vegetation is a prominent component of the drained thaw lakes represented by class 4.

The map unit class descriptions below are tentative pending revision and validation based on field studies designed according to the findings of the vegetation analysis, classification and mapping so far accomplished.

1. Tussock-Shrub Tundra

This class represents a major portion of the Espenberg Peninsula east of the 165th meridian. The area represented encompasses an upland landscape where, in general, meso-scale topography would promote soil drainage. It contrasts with the poorly drained lowland area of class 2, covering much of the rest of the map-area. Class 1 represents the three Tussock-Shrub Tundra associations, of which *Eriophorum vaginatum* Tussock-Shrub Tundra is probably the most widespread.

2. Lowland Wet Tundra Mosaic

This class represents the abundant low lying wet places in the map area except for the larger stream valleys and encompasses a mosaic of stands of approximately equal areal importance mostly too small to map and label individually. The majority of these are of the Meadow vegetation type, with Eriophorum angustifolium, Eriophorum-Carex and Carex aquatilis Wet Meadow associations most extensively represented. The Tussock-Shrub Tundra type also is important here, represented by locally important stands on raised sites of better drainage. Linear stands of the Low-Medium Willow Shrub Thicket association, too narrow to map separately, occur along the many smaller streams.

Numerous drained and partially drained thaw lakes occur throughout the area of class 2. Many of these are contiguous and constitute complexes. These complexes and isolated drained thaw lakes, some of considerable size (see class 4), are conspicuous on the ERTS image and therefore appear to be highly characteristic features of the lowland wet tundra landscape.

3. Shrub Thicket

This map unit class represents the wider linear stands of riparian willow shrub thicket throughout the Espenberg Peninsula and the larger stands of upland willow thickets in the southeast. The Low-Medium Willow Shrub Thicket association is most abundantly represented. Low willows around 1 m in height dominate in riparian stands in the north and northwest parts of the map-area and in the seaward segments of stream valleys where classes 9 and 10 are not mapped. Medium height thickets dominated by willows around 2 m tall are the common expression of this association along stream valleys and on some slope sites around lakes in the central and south-central parts of the map-area. Medium height thickets also are important in the highlands in the southeast, where there also are a few stands of the Tall Willow Shrub Thicket association, particularly around Serpentine Hot Springs. Stands of the Alder Shrub Thicket association are scattered in the map area; for example, a number of stands too small to map separately from the tussock-shrub tundra matrix are known in the vicinity of North Killeak Lake. There also are some small stands of tall willow shrub thicket in this and similar areas, including those represented by units 12 and 13.

4. Drained and Partially Drained Thaw Lakes

As stated above, these are conspicuous in the area represented by class 2. A drained thaw lake is here defined as one with little or no open water apparent on the ERTS image. A partially drained thaw lake is one retaining some open water, in most cases as small arcuate lakes around the perimeter. The genesis and evolution of thaw lakes in the Imuruk Lake area was treated by Hopkins (1949); presumably thaw lakes on the Espenberg Peninsula undergo a change sequence similar to the one he described.

Drained and partially drained thaw lakes appear from their various spectral signatures to include a vegetation of some diversity. Eriophorum angustifolium, Eriophorum-Carex and Carex aquatilis Wet Meadow associations seem to be particularly well represented in them. Their significance was not realized until after the field season when the ERTS image was studied. Therefore no special attempt was made in the field to examine their vegetation. Only the larger or otherwise more conspicuous of the drained and partially drained thaw lakes are mapped. A relationship between the phenomena of class 4 and of classes 5 and 6 is suspected, but no firsthand knowledge of it is available yet.

5 and 6. *Carex aquatilis* Wet Meadow. 5: Succession incomplete; 6: Succession complete

These map unit classes represent stands of what is possibly the *Carex aquatilis* Wet Meadow association which, as is here hypothesized, develop as some thaw lakes drain or as succession otherwise progresses from open water to closed vegetation. That a succession is involved is indicated by the occurrence of various apparent stages. These include an open lake stage, a stage in which a lake is narrowly ringed by *Carex aquatilis* wet meadow, one in which the areas of open water and this vegetation are more nearly equal, and finally a stage in which open water has, or nearly has disappeared and been replaced by this vegetation. The latter stage is manifest in several locations where vegetation appears on the ERTS image but where lakes are shown on the older topographic map. These locations are mapped as unit class 6. Similarly, intermediate stages, depicted as class 5, are indicated by lakes smaller than when the topographic map was made and now ringed by *Carex aquatilis* wet meadow within the original lake margin.

The 1:250,000 scale maps were based on aerial photographs and surveys of 1949-1951, and the ERTS image was obtained about 22 years later, in 1972. Thus it appears that this succession occurs rapidly. The no. 6 unit just southeast of Lake 105 near the center of the map is now vegetation, whereas in 1950 a sizable body of water was present here.

A succession hypothesis based on lake drainage or substantial water level lowering seems more plausible than one based on the more familiar bog formation process wherein a mat of peat bearing live vegetation develops centripetally in a lake. It is unlikely that the latter would occur at anywhere near the observed rate, particularly in this subarctic region. Thus it remains to examine this phenomenon phytocenologically, to test the hypothesis that succession of some kind is occurring and, if drained and draining thaw lakes are involved, to determine why *Carex aquatilis* wet meadows only infrequently develop and predominate, whereas the majority of drained thaw lakes, including those of class 4, apparently contain a different vegetation. Perhaps this *Carex aquatilis* Wet Meadow vegetation represents a stage in further succession. The uncertain identity of this vegetation, based on minimal field data, needs to be checked, and its composition and structure need to be more thoroughly determined.

The phenomenon represented by map unit classes 5 and 6 was largely unnoticed prior to study of the ERTS image. A systematic survey of the Espenberg Peninsula, or similar areas, using ERTS imagery in conjunction with older maps and aerial photographs could help identify additional examples of it.

7. Dwarf Shrub Tundra

Stands of this vegetation type are of considerable areal importance in the highlands in the southeastern part of the map-area. The Barrens association seems to be represented by the largest and most widely distributed stands and to be the most distinct on the ERTS image. A few locations of the other associations are known, particularly of *Dryas* Dwarf Shrub Tundra around North Kileak Lake and *Carex bigelowii* Dwarf Shrub Tundra near Serpentine Hot Springs. It is likely that stands of all five associations, either too small to map or indistinct on the ERTS image, are widespread on the better drained low crests and summits throughout the tussock-shrub tundra area of class 1.

8. Coastal Meadows-Dwarf Shrub Tundra Mosaic

This class covers a mosaic of several vegetation types occurring in stands too small to distinguish on the ERTS image. These stands occupy a coastal zone consisting of a sequence of beach ridges and intervening troughs (Fig. 4). Barrens and Dryas and Carex bigelowii dwarf shrub tundra associations form a succession on the crests and upper slopes of these beach ridges, this succession trending generally from the former, younger stages near the ocean to the latter stage toward the interior. Between the ridges, Eriophorum angustifolium, Eriophorum-Carex and Carex aquatilis Wet Meadow associations are represented on flats and in troughs. In these topographically low areas ponds occur, some of which contain communities of aquatic species. In addition, stands of the Elymus arenarius Meadow association occur on some sand dunes, especially those forming the front line of dunes on the ocean side of the coast.

9. Riparian and Floodplain Wet Meadows

The vegetation represented by this class occurs on floodplains in the lower, seaward segments of several of the larger rivers. Many of the smaller stream valleys contain a similar vegetation in their seaward segments but, as with many occurrences of the Shrub Thicket type, this vegetation is in stands too narrow to map individually.

Stands of several wet meadow associations may be represented here, with the most important being the Carex aquatilis Wet Meadow association. These stands contain an open low willow stratum on the more inland sites

Figure 4. Low altitude aerial view eastward over the beach ridge zone at Cape Espenberg.

and scattered low willows on sites closer to the sea. As such, the riparian and floodplain wet meadows class may be a transition between Shrub Thicket and the wetter coastal meadow associations. The several class 3 units in the vicinity of Cape Espenberg may contain stands of this transition vegetation. Field observations indicate a general decrease in abundance and stature of willows northwestward across the map-area.

10. Estuarine Marsh and Mud Flat

This map unit class represents river mouth areas characterized by open shallow water and wet mud flats where plant cover is absent, sparse or otherwise not dense enough to preclude the predominate appearance of water on the ERTS image. These areas may lie partly below high tide level. This class represents in addition a few non-estuarine areas of otherwise similar physiographic position in the vicinity of Cape Espenberg. Vegetation here, not yet studied, may be a saline aquatic meadow or marsh type.

11. Coastal Sand Dunes

This class represents areas of surficially unstable sand dunes upon which a plant cover is scant or lacking. There are several such areas along the northwestern coast. It is likely that small stands of the *Elymus arenarius* and Salt Grass Meadow associations occur within these areas, and some dunes may bear scattered individuals of *E. arenarius* and a few ecologically related species.

12. *Calamagrostis* Meadow-*Salix planifolia* Shrub Thicket

A single occurrence of this two-component mosaic is depicted adjacent to North Devil Mountain Lake on the northwest. It was mapped because it was visited and described by the field party and was distinct on the ERTS image. Also, although small, it is isolated and therefore easily mapped and labeled.

13. Wet Meadow-Shrub Thicket-Pond Complex

The single area represented by this map unit class is adjacent to North Devil Mountain Lake on the east and was also seen by the field party. The shrub component includes alders and willows. As with class 12, the feasibility of depicting it was an opportunity to make the map somewhat more informative.

14. Open Shallow Salt Water

Only one unit of this class occurs on the map, between two sand dune areas a few km southwest of Kividlo. Here the ERTS image was interpreted as showing open but very shallow water. A mud flat may appear at low tide.

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