DEPARTMENT OF THE INTERIOR
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VEGETATION AND LAND COVER ARCTIC NATIONAL WILDLIFE REFUGE COASTAL PLAIN, ALASKA

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USGS — VEGETATION AND LAND COVER, ARCTIC NWR, ALASKA 1:250,000 MAP I - 1443

VEGETATION AND LAND COVER MAP AND DATA FOR AN ENVIRONMENTAL IMPACT STATEMENT, ARCTIC NATIONAL WILDLIFE REFUGE, ALASKA: MULTISTAGE DEMONSTRATION OF AUTOMATION IN THEMATIC CARTOGRAPHY

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U.S. Geological Survey map I-1443 depicts Vegetation and Land Cover on the coastal plain portion of the Arctic National Wildlife Refuge (NWR), Alaska. This area is bordered by the Beaufort Sea and the Arctic Ocean on the north. Its eastern limit (the Aichilik River) lies 50 km west of the Canadian border. Its western limit (the Staines and Canning River delta) lies 90 km east of Prudhoe Bay, present center of petroleum production and northern terminus of the Alaska Pipeline. The Arctic NWR coastal plain spans an area 170 km from west to east between the Staines and Aichilik Rivers, and 60 km from the Arctic Ocean southward. The area between covers 6,640 sq. km (2,563 sq. mi.) and is shown on portions of the Barter Island, Demarcation Point, Flaxman Island, and Mt. Michelson 1° x 3° USGS topographic map quadrangles. The coastal plain serves as calving ground for the caribou, but other wildlife also call it home. The Arctic NWR, largest of such sanctuaries in the United States (36,000 sq. km, or 13,900 sq. mi.), extends much farther southward to the mountains of the Brooks Range, and eastward to the Canadian border.

The vegetation map measures 72 x 36 cm (28.5 x 14.3 in.), unfolded, and serves as Plate 1 in an environmental impact statement (EIS) being issued by the U.S. Fish and Wildlife Service in anticipation of seismic petroleum exploration in the wildlife refuge. The map will also serve as Plate 1 in Landsat Assisted Environmental Mapping in the Arctic National Wildlife Refuge, by D.A. Walker, W. Acevedo, K.R. Everett, L. Gaydos, J. Brown, and P.J. Webber, to be published as a Special Report by the U.S. Army Corps of Engineers Cold Regions Research and Engineering Laboratory (CRREL), Hanover, N.H. The map has also been issued as USGS Publication I-1443. Folded copies are available from the Western Distribution Branch, U.S. Geological Survey, Box 25286, Federal Center, Denver, Colorado 80225.

The map base is adapted from portions of four USGS 1:250,000-scale topographic maps, Universal Transverse Mercator (UTM) Projection, 1927 North American Datum. The UTM rectangular grid is shown for Zones 6 and 7 at 50,000-meter and 10,000-meter intervals. The geographic grid is indexed by tick crosses every 15 minutes of latitude and 30 minutes of longitude. Land lines and townships, numbered from the Umiat Meridian and Base Line, represent unsurveyed and unmarked protracted locations predetermined by the Bureau of Land Management. The 1955 magnetic declination varies from 33° to 36° East.

The classification of vegetation and land cover is derived by machine processing of digital multispectral data comprising portions of three Landsat scenes, one of them from a Canadian receiving station. There are 12 categories. The CRREL report describes these in more detail and relates the categories to those in other vegetation classification systems in use for northern Alaska.

For location control and area measurement, land cover classification is assigned to over three million map grid cells, each 50 x 50 m (0.25 ha or 0.6 acre) in the UTM rectangular coordinate system, Zones 6 and 7. The smallest unit of mapping is the Landsat pixel (0.46 ha), transformed to one of the map grid cells. Some generalization of land cover by spatial filtering has been attempted. Land cover area measurements for 12 classes and 89 townships are presented in acres and percent in a table printed on a back fold of the map. This facilitates comparison of the statistics with the corresponding areas on the map itself.

To simplify map printing, the map cells for the two UTM zones were merged into one (Zone 6), and selected planimetric features from the four component topographic maps were compiled into one new base map. To print the multicolor digital map on a four-color printing press, two approaches using a large-format laser plotter were investigated. Both use the square raster unit of spatial information. One uses it also as a spatial unit for arranging halftone dots to achieve the multicolor effects from the four ink colors. The other uses the laser printer to simulate dot screens and angles directly onto the the color separation films (from which the printing plates are made) at the same time data are read from the spatial data file on tape. The resulting colors replicate those otherwise achieved at USGS using open-window plate negatives, conventional mechanical screens, and the same four process ink colors. These differences in the two dot systems are visible only under a hand lens. Other differences are more easily detected, but result chiefly from cosmetic changes. The square-dot version in brighter colors on coated paper was printed by the contractor in time for use in the preliminary EIS, but it lacks the area measurement table in the later version. The conventionally angled dot version in somewhat softer colors on conventional USGS map paper does contain the area measurement table, and is more nearly to scale. It is the version used in the final EIS and the CRREL report, and is the only one distributed by the USGS Western Distribution Branch. Black-and-white versions at scales of 1:250,000 and 1:1,000,000 have also been produced as byproducts of the laser printer without further reprocessing of the data base in the computer. The data file can also be viewed and further analyzed on interactive video display equipment in a research laboratory at USGS.

The production of this map demonstrates a succession of five stages of automated thematic cartography applied in a problem-solving context: (1) capture of spatial data in multispectral format by sensors aboard Earth-orbiting satellite; (2) interpretation and classification of spatial data; (3) geometric transformation of the spatial data; (4) area measurement of classes by areas specified by the user; and (5) conversion of the spatial data to yet another multispectral format for map publication by four-color process printing.

Preparation of the Arctic NWR Vegetation and Land Cover Map was made possible by the collaboration of three agencies. The results appeared in their separate publications. Authorship of the vegetation and field review are by William Acevedo (Technicolor Government Services, serving the National Aeronautics and Space Administration Ames Research Center) and Donald Walker (University of Colorado, Institute of Arctic and Alpine Research, under the sponsorship of the U.S. Army Corps of Engineers Cold

Regions Research and Engineering Laboratory). Design of map and statistical products is by Leonard Gaydos and James R. Wray (U.S. Geological Survey). The USGS effort was augmented by staff and facilities of the Eastern Mapping Center, the Western Mapping Center, the EROS Data Center, one contractor, and the headquarters staff of the National Mapping Division's Office of Geographic and Cartographic Research.

The arctic map is one more step in a continuing effort to apply emerging technologies to pressing environmental problems and the need for increasingly responsive ways to manage Earth resources. Foreseeable future operational and developmental efforts include the following: (1) preparation of interim maps of vegetation and land cover by standard map quad in northern Alaska as part of a nationwide inventory; (2) preparation of a larger scale special vegetation map of a drilling site area west of Prudhoe Bay; (3) further assessment of theme content and positional accuracy; (4) demonstration of land cover change detection and update; and (5) merging of land cover data with other data sets (such as census demographic data and digital elevation models) for increased sensitivity and applicability to other resource management problems.

Summary adapted from "Vegetation and Land Cover Map and Data for an Environmental Impact Statement, Arctic National Wildlife Refuge Alaska: "Multistage Demonstration of Automation in Thematic Cartography," by Leonard Gaydos and James R. Wray, U.S. Geological Survey, an oral/visual presentation at Auto-Carto 5/ISPRS IV Joint Symposium, "Environmental Assessment and Resource Management," August 22-28, 1982, Hyatt Regency Hotel, Crystal City, Virginia. The presentation describes a USGS publication, map I-1443. Copies may be ordered from Western Distribution Branch, U.S. Geological Survey, Box 25286, Federal Center, Denver, Colorado 80225. The price (August 1982) is $2.50 each postpaid to addresses in U.S. and Canada. Maps are sent folded.