Vegetation in the vicinity of the **Toolik Field Station, Alaska**

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- The maps presented are components of the Arctic Geobotanical Atlas (http://www.ArcticAtlas.org/).
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Explanation

Overview

This publication contains a group of vegetation maps at three scales in the vicinity of the Toolik Field Station, Alaska, which is an arctic research facility run by the Institute of Arctic Biology at the University of Alaska Fairbanks. The maps are intended to support research at the field station. The front side of this map sheet contains a vegetation map and ancillary maps of a 751-km² region surrounding the upper Kuparuk River watershed, including the Toolik Lake and the Imnavait Creek research areas, as well as portions of the Dalton Highway and Γrans-Alaska Pipeline from the northern end of Galbraith Lake to Slope Mountain. The reverse side shows more detailed vegetation maps of the 20-km² research area centered on Toolik Lake and a 1.2-km² intensive research grid on the south side of Toolik Lake (red rectangles on Map A). All the maps are part of a hierarchical geographic information system (GIS) and the Web-based Arctic Geobotanical Atlas (http://www.arcticatlas.org/). The atlas also includes other map themes for all three areas and a previously published hierarchy of maps of the Imnavait Creek area (Walker et al. 1989; Walker and Walker 1996) (black rectangles on Map A). Photos and explanations of the geobotanical mapping units and the supporting field data and metadata can also be found on

Maps of the Upper Kuparuk River Region

The upper Kuparuk River region has terrain typical of the Southern Foothills of the Brooks Range, including landscapes affected by three major glacial events. Map A shows the vegetation of the upper Kuparuk River region at 1:63,360-scale. Other maps show a false-color infrared satellite image (Map B), glacial geology (Map C), surficial geomorphology (Map D) and Normalized Difference Vegetation Index (NDVI)/biomass (Map E) - all at 1:225,000-scale. Maps A and C were derived from a geobotanical map of the region. The base map for the geobotanical map was a 1:25,000-scale black-and-white orthophoto-topographic map that was prepared especially for this project by Vexcel Corp., Denver, CO in 1994 from stereo pairs of 1:60,000-scale, 9 x 9-inch colorinfrared aerial photographs that were obtained by NASA in 1982. The base map was prepared without groundcontrol points, but was registered as closely as possible to the 1:63,360 USGS map of the region. Vegetation and other geobotanical features were mapped by photo-interpretation onto 1:25,000-scale enlargements of the 1982 NASA aerial photographs. The minimum mapping unit was approximately 0.6 ha (1/8" at 1:25,000-scale). No formal accuracy assessment was performed, but 320 of the map polygons representing 3.2% of the total map polygons, and about 16% of the total map area were checked on the ground during helicopter-assisted transects in 1994. Geobotanical variables coded for each map polygon included: primary vegetation, secondary vegetation, tertiary vegetation, landform, surface deposit, primary surficial geomorphology and secondary surficial geomorphology. Secondary and tertiary types are subdominant types that cover more than 30% of a map polygon. The geobotanical map was made using methods and legends specially developed for northern Alaska (Walker et al. 1980, 1986, 1989). The GIS was developed following the integrated terrain-unit mapping approach (Dangermond and Harnden 1990). The resulting geobotanical maps were presented at conferences in 1996 (e.g., Walker et al. 1996) but remained unpublished until now. In 2007 the map boundaries were modified to register with a recent digital elevation model (DEM) of the Kuparuk River region (Nolan 2003) and the 1989 Système Probatoire d'Observation de la Terre (SPOT) image of the region (Map B). The legends were also modified to better fit the hierarchy of other maps in the Arctic Geobotanical Atlas.

Map A: Vegetation

The vegetation of the region was studied and mapped as part of the Arctic Long-Term Ecological Research (LTER) project at Toolik Lake and the Department of Energy R4D (Response, Resistance, Resilience and Recovery of vegetation from Disturbance) project at Imnavait Creek (Walker et al. 1994, Walker and Walker 1996). Fifty-seven plant communities and land-cover types were recognized during the mapping of the upper Kuparuk River region and are designated by the numeric GIS codes in the second column of the legend. These were grouped into the 14 physiognomic map units shown on Map A, which are compatible with the Circumpolar Arctic Vegetation Map (CAVM Team 2003) and the Alaska Arctic Tundra Vegetation Map

(Raynolds et al. 2005). Map B: False-Color Infrared Satellite Image

The French SPOT satellite data (20-m resolution) were obtained on 28 July 1989 and provides a view of the mapped region from space. The false-color infrared image shows more densely vegetated areas as brighter red tones. When compared with the glacial geology map (Map C), the older Sagavanirktok-age glacial landscapes have few lakes and redder tones indicating more dense vegetation, and the younger Itkillik-age glacial surfaces that have more lakes and grayer colors. The image data were also used to produce the NDVI/biomass

Map C: Glacial Geology

This map shows a simplified version of Thomas Hamilton's glacial geology map of the upper Kuparuk River region (Hamilton 2003). The glacial history of the region affects a wide variety of landscape and ecosystem properties, including topographic variation, abundance of lakes, plant production, soil carbon, spectral reflectance, piodiversity, trace-gas fluxes and heat flux of these landscapes. Glacial deposits within the upper Kuparuk River region are assigned to Sagavanirktok (middle Pleistocene, about 780-125 kya), Itkillik I (late Pleistocene, about 120-50 kya) and Itkillik II (late Pleistocene, about 25-11.5 kya) glaciations of the central Brooks Range glacial succession (Hamilton 2003). The legend units are arranged approximately from oldest to youngest.

Map D: Surficial Geomorphology

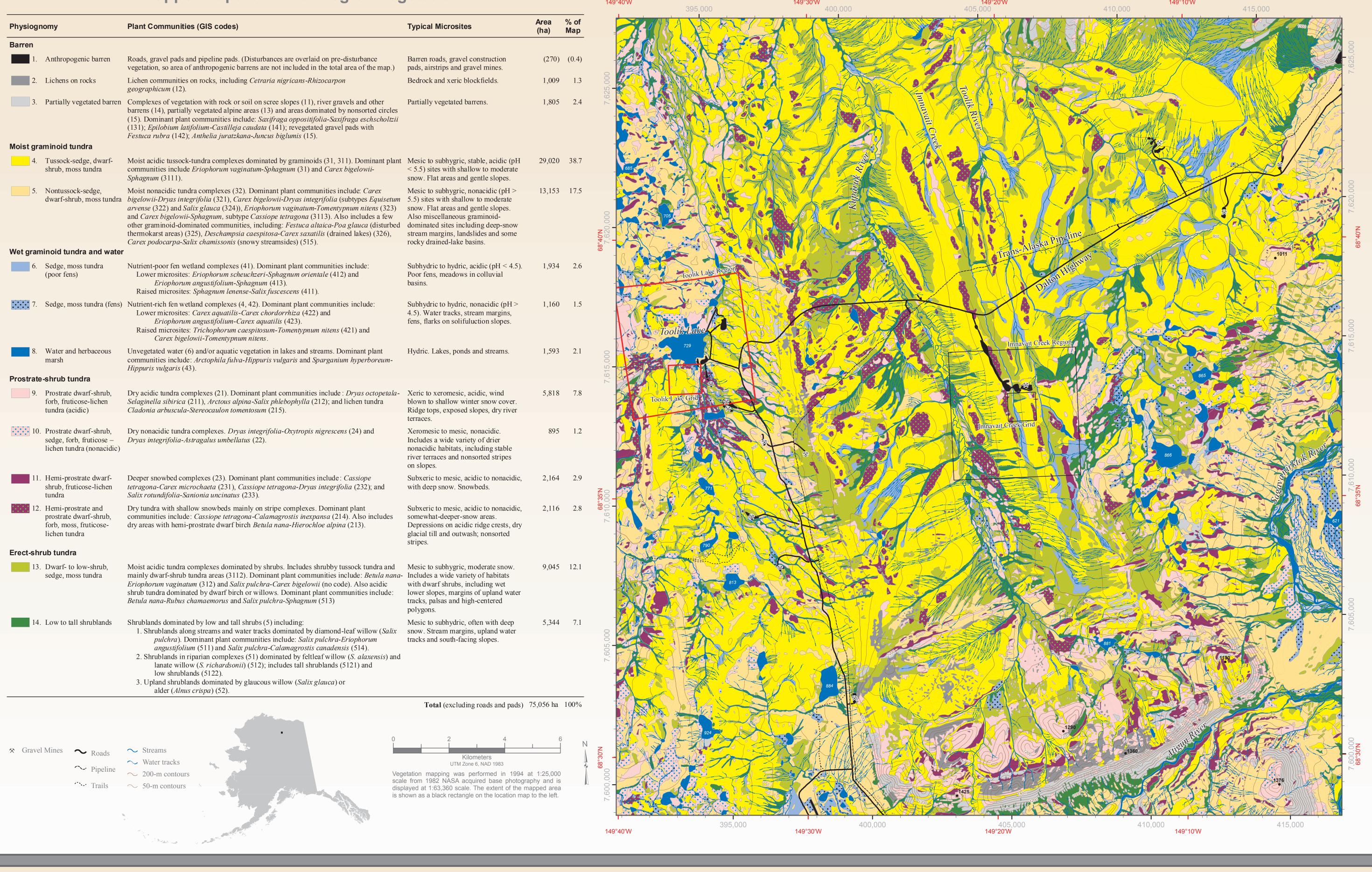
The surfaces of the landscapes in the Toolik Lake region have been modified by a variety of geomorphological processes including alluviation (movement of material by water), colluviation (movement of material by gravity) and periglacial processes (freezing and permafrost-related phenomena). Many of the surface forms have been described for the Imnavait Creek region (Walker and Walker 1996). Common surficial geomorphological features within the mapped area include sorted and nonsorted circles (frost boils), turf hummocks, gelifluction lobes and terraces, water tracks, high- and low-centered ice-wedge polygons, wetland features (strangmoor, aligned nummocks, palsas) and thermokarst features.

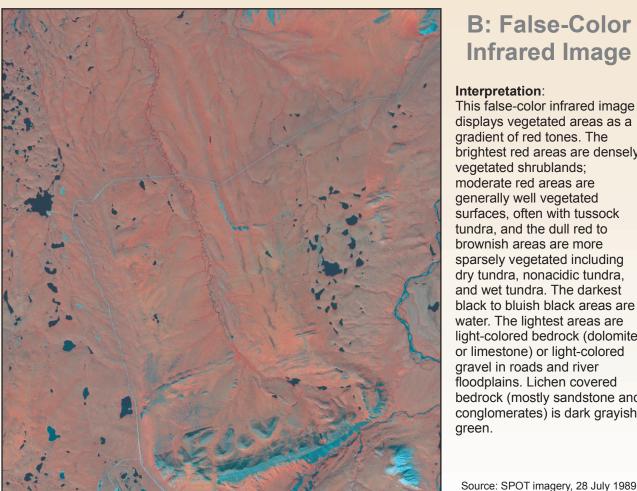
Map E: NDVI and Plant Biomass

NDVI is an index of vegetation greenness that can be linked to plant biomass and other biophysical properties of the vegetation, such as CO_2 and photosynthesis. The NDVI = (NIR - R)/(NIR + R), where NIR and R are the spectral reflectance values of the near-infrared (790-890 nm) and red (610-680 nm) bands, respectively. This map s derived from the same SPOT data as Map B. It is modified from an earlier version (Shippert et al. 1995) using more recent biomass information (Walker et al. 2008 in press). Water and barrens are generally displayed as black. Dry tundra and sparsely vegetated areas are displayed in gray. Vegetation density increases with darker

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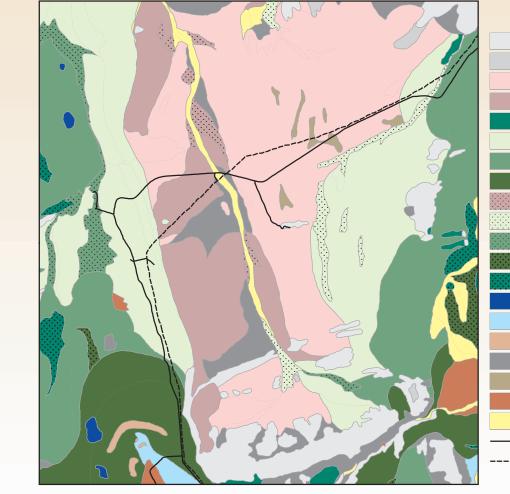






B: False-Color **Infrared Image** Interpretation:

displays vegetated areas as a gradient of red tones. The brightest red areas are densely vegetated shrublands; moderate red areas are generally well vegetated surfaces, often with tussock tundra, and the dull red to brownish areas are more sparsely vegetated including dry tundra, nonacidic tundra, and wet tundra. The darkest black to bluish black areas are water. The lightest areas are light-colored bedrock (dolomite or limestone) or light-colored gravel in roads and river floodplains. Lichen covered bedrock (mostly sandstone and conglomerates) is dark grayish



Bedrock with discontinuous cover Drift of Sagavanirktok, undifferentiated Drift of Sagavanirktok, late advance Drift of Itkillik age, undifferentiated Drift of Itkillik Phase I Drift of Itkillik Phase II Drift of latest Itkillik readvance Outwash Sagavanirktok, late advance Outwash of Itkillik Phase I Outwash of Itkillik Phase II

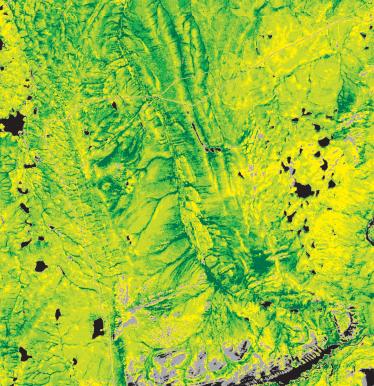
C: Glacial Geology

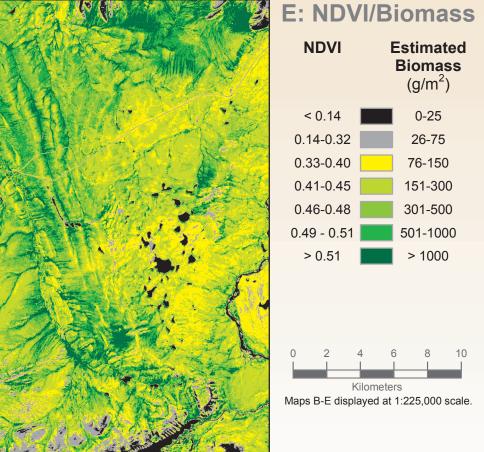
Outwash of latest Itkillik readvance Ice-contact deposits Active kettles Undifferentiated lacustrine deposits Undifferentiated gravel and beach deposits Undifferentiated colluvium Ice-rich silt deposits and colluvial basins Undifferentiated fan deposits Undifferentiated alluvium

Source: simplified from Hamilton, 2003

Stony surfaces Non-sorted circles and/or stripes Gelifluction features including lobes, terraces, turf hummocks) Well-developed hill-slope water tracks Indistinct hill-slope water tracks High- or flat-centered ice-wedge polygons and palsas Wetland surface forms (including low-centered polygons) Water (including thermokarsts and beaded streams) Irregular microrelief (glacial till, rolling relief, stream channels)

Surficial Geomorphology





File: /geodata/raster/ArcticAtlas/ToolikMap/uk25k Region27x40p1.mxd 28"x40" sheet trimmed to 27"x40" (1/2" white margin) DRAFT: Side 1 (front), 2008-12-08