Land Cover Map of the Kuparuk River Basin, Alaska

General Information

This document was transcribed from the original metadata, dated 01-May-1997. Minor edits were made to the document to correct several errors that were present in table 2.

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Map Basics:

1) NAD27 datum (Clarke 1866 ellipsoid)
2) UTM Zone 6 projection
3) 50 m pixels
4) 2226 columns by 4722 rows
5) lower left corner: x = 344000m E, y = 7590300m N

Geometric Rectification:

1) Cubic Convolution resampling
2) 2nd order polynomial registration.
3) RMSE error of 57.4 m based on 50 m pixels

Map Units:

(1) Barrens
(2) Moist nonacidic tundra
(3) Moist acidic tundra
(4) Shrublands
(5) Wet tundra
(6) Water
(7) Clouds and ice
(8) Shadows

MAP EXPLANATION

This map was prepared for studies in the Kuparuk River Basin in northern Alaska which are part of several National Science Foundation projects, including the Arctic System Science Flux Study and the Long-Term Ecological Research program.

Satellite Mosaic:

To expedite image processing, digital spectral data for a rectangular region encompassing the Kuparuk River watershed were extracted from an existing mosaic of Landsat Multi-Spectral Scanner (MSS) frames. The entire mosaic covers the Central Arctic Management Area (CAMA) and Arctic National Wildlife Refuge (ANWR),

Northeast Alaska, and was produced by the National Mapping Division, U.S. Geological Survey, EROS Data Center, Sioux Falls, SD. Images for the mosaic were acquired during snow-free growing seasons between 14 August 1976 through 2 August 1985. Due to prevalent cloud cover over the North Slope during most growing seasons, single time period (e.g., one week) mosaics of imagery from sun-synchronous satellites are generally not feasible. The mosaic (80-m nominal spatial resolution) was resampled to 50-m pixels, and geometrically corrected using cubic-convolution interpolation by means of a second-order polynomial registration, with a resultant RMSE of 57.4 m.

Mapping:

The general land cover types for this map were derived by classification of the MSS image. An IsoData unsupervised classification approach was implemented for land cover analysis, and was based on input of the green, red, and infrared spectral bands of the MSS image. Forty cluster classes were initially generated and then aggregated into eight land cover classes. Geobotanical maps and earlier Landsat-derived maps of the region were used for supplementary information to interpret the spectral classes [Walker et al., 1982; 1989; Walker, 1985; Walker and Acevedo, 1987; Walker and Walker, 1991; 1996; Walker et al., 1996]. Select stratification by land units refined the classification. For display purposes, the map was smoothed, with filtering based on the majority of contiguous neighboring cells. Digital data made available to investigators were not filtered.

Legend:

Vegetation units are groupings of finer-level units mapped at numerous sites within the basin [Walker et al., 1994; 1996]. Soil units were derived from field reconnaissance, detailed examination of soils at 12 flux tower sites, and a review of the literature relating soil taxa to vegetation types along the North Slope. The legend includes soil subgroups from the current Soil Taxonomy [Soil Survey Staff, 1975; 1994] and soil great groups from the proposed soil order dealing with permafrost-affected soils, the Gelisols [Bockheim et al., 1994]. A summary of map unit areas for the entire map and for within the watershed is shown in Table 1.

TABLE 1. Area summary of land cover classes for the entire map and for the watershed only.

Land Cover Class	Entire Map		Watershed Only	
	%	hectares	%	hectares
Barren	3.8	100,138	1.4	12,986
MNT	38.4	1,008,082	45.2	416,264
MAT	18.5	486,510	24.5	224,983
Shrublands	18.7	492,149	17.6	162,043
Wet tundra	7.9	207,468	6.2	57,404
Water	11.1	290,944	4.8	44,479
Clouds/ice	0.2	4,172	<0.1	302
Shadows	1.5	38,331	0.2	1,682
Total	100.0	2,627,793	100.0	920,143

Map Accuracy:

An accuracy assessment was done on the preliminary land cover map [Muller et al., 1998] and map units were estimated to have the accuracy shown in Table 2. Based on information obtained in the accuracy assessment, the distinction between nonacidic and acidic tundra was further refined for the final land cover map.

TABLE 2. Error matrix for accuracy assessment of preliminary land cover map (from Muller et al., 1998). Accuracy of moist nonacidic tundra and moist acidic tundra were likely improved by subsequent refinements made to the map.

Preliminary Map Land Cover	Reference Data							User Acc. (%)
	Barrens	MNT	MAT	Shrub	Wet	Water	**Total**	
Barrens	**11**	.	.	.	.	.	11	**100.0**
MNT	.	**51**	.	.	6	.	57	**89.5**
MAT	.	12	**38**	1	.	.	51	**74.5**
Shrublands	.	.	2	**17**	.	.	19	**89.5**
Wet tundra	.	2	.	.	**14**	.	16	**87.5**
Water	.	.	.	.	.	**24**	24	**100.0**
Total	11	65	40	18	20	24	**178**	
Prod. Acc. (%)	100.0	78.5	95.0	94.4	70.0	100.0		

Overall Accuracy of map: P = 87.08% (95% confidence limits: L1 = 82.07% L2 = 91.95%)
Without occurrence of chance agreement: Te = 84.49% (95% confidence limits: L1 = 78.73% L2 = 90.25%)

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Land cover classes (code): common habitats

Barrens (1):

1. Lichen-covered, and partially vegetated siliceous rocks in foothills and mountains
2. Dry partially vegetated alpine tundra
3. Limestone bedrock
4. Barren and partially vegetated river alluvium
5. Barren coastal mud flats
6. Dunes
7. Roads and gravel pads

Moist nonacidic tundra (2):

1. Moist nonacidic hillslopes and moderately well-drained surfaces with pH ä 5.5
2. Dry nonacidic river terraces and gravelly well-drained slopes
3. Dry acidic tundra on hill crests, moraines and kames
4. Nonsorted-circle and -stripe complexes on the coastal plain and in the foothills
5. Moist/wet patterned-ground complexes [e.g. low-centered polygon complexes], especially on the coastal plain, with more than 50% moist nonacidic tundra

Moist acidic tundra (3):

1. Moist acidic hillslopes and moderately drained terrain with pH < 5.5

Shrublands (4):

1. Riparian shrublands along rivers
2. Watertracks and shrublands in basins in foothills
3. Tussock tundra dominated by shrubs
4. Shrublands on south-facing slopes

Wet tundra (5):

1. Rich fens on coastal plain, along rivers, and foothill basins
2. Poor fens in foothills
3. Wet/moist patterned-ground complexes (e.g. ice-wedge polygon complexes) with >50% wet tundra

Water (6):

1. Water
2. Marshes and aquatic vegetation with more than 50% standing water

Clouds and ice (7):

1. Aufeis along braided rivers
2. Clouds mainly at high elevations

Shadows (8):

1. Mostly steep terrain in the mountains
2. Some cloud shadows

Land cover classes (code): Dominant plant communities

Barrens (1):

1. Cetraria nigricans-Rhizocarpon geographicum
2. Selaginello sibiricae- Dryadetum octopetalae
3. Saxifraga oppositifolia-Saxifraga eschscholtzii
4. Epilobium latifolium-Castilleja caudata
5. Carex subspathacea-Puccinellia phryganodes
6. Elymus arenarius-Artemisia borealis
7. Unvegetated

Moist nonacidic tundra (2):

1. Dryado integrifolia-Caricetum bigelowii, Astragalus umbellatus-Dryas integrifolia
2. Oxytropis bryophila-Dryas integrifolia
3. Selaginello sibiricae-Dryadetum octopetalae, Salici phlybophyllae-Arctoetum alpinae
4. Juncus biglumis-Saxifraga oppositifolia, Astragalus umbellatus-Dryas integrifolia
5. Dryado integrifolia-Caricetum bigelowii, Carex aquatilis-Eriophorum angustifolium, Carex aquatilis-C. chordorrhiza

Moist acidic tundra (3):

1. Sphagno-Eriophoretum vaginati

Shrublands (4):

1. Salix alaxensis-S. lanata, Betula nana, Salix pulchra-Calamagrostis canadensis
2. Eriophorum angustifolium-Salix pulchra
3. Sphagno-Eriophoretum vaginati
4. Salix glauca-Alnus crispa

Wet tundra (5):

1. Carex aquatilis-Eriophorum angustifolium, C. aquatilis-C. chordorrhiza
2. Sphagnum orientale-Eriophorum scheuchzeri, Carex aquatilis-Sphagnum lenense, Sphagnum lenense-Salix fuscescens
3. Carex aquatilis-Eriophorum angustifolium, C. aquatilis-C. chordorrhiza, Dryado integrifolia-Caricetum bigelowii

Water (6):

1. Unvegetated
2. Carex aquatilis, Hippuris vulgaris-Arctophila fulva, unvegetated

Clouds and ice (7):

1. Unvegetated
2. Mostly alpine vegetation types, barrens

Shadows (8):

1. Primarily barrens, also snowbeds Carici microchaetae-Cassiopetum tetragonae and Dryas integrifolia-Cassiopetum tetragona

Land Cover Classes (code): Dominant soils--US Soil Taxonomy [Gelisol order]

Barrens (1):

1. Nonsoils, Lithic Cryorthents [nonsoils, Lithic Haplastatels]
2. Pergelic Cryorthents, P. Cryumbrepts [Haplaturbels, Haplastatels, Humistatels, Humiturbels]
3. Nonsoils, Lithic Cryorthents [nonsoils, Lithic Haplastatels]
4. Pergelic Cryorthents [not Gelisols, some Haplastatels]
5. Histic Pergelic Cryaquepts, P. Cryaquepts nonacid [Aquastatels]
6. Pergelic Cryopsamments [Psammostatels]
7. Nonsoils

Moist nonacidic tundra (2):

1. Histic Pergelic and P. Cryaquepts (nonacid), P. and Histic P. Cryaquolls, P. Cryoborolls [Histiturbels, Hististatels, Aquaturbels, Aquastatels]
2. Pergelic Cryorthents [not Gelisols, some Haplasatels]
3. Pergelic Cryumbrepts, P. Cryochrepts [Umbriturbels, Ochriturbels]
4. Ruptic Pergelic Cryaquepts (nonacid), R. Pergelic Cryaquolls [Humiturbels, Haplaturbels, Humistatels, Haplastatels]
5. Pergelic Cryaquolls, P. and Histic P. Cryaquepts, P. Cryohemists and P. Cryosaprists (euic) [Aquaturbels, Histiturbels, Aquastatels, Hististatels, Hemistels and Sapristels (euic)]

Moist acidic tundra (3):

1. Pergelic and Histic P. Cryaquepts [Aquaturbels, Histiturbels, Aquastatels, Hististatels]

Shrublands (4):

1. Pergelic Cryorthents, P. Cryoborolls, P. Cryaquents [not Gelisols, some Haplastatels, Humistatels, Aquastatels]
2. Histic Pergelic and P. Cryaquepts (nonacid) [Aquastatels]
3. Pergelic and Histic P. Cryaquepts [Aquaturbels, Histiturbels, Aquastatels, Hististatels]
4. Haplastatels, Humistatels

Wet tundra (5):

1. Pergelic and Histic P. Cryaquepts (nonacid), P. Cryaquolls; P. Cryohemists, P. Cryosaprists, and P. Cryofibrists (euic) [Aquastatels and Hististatels (nonacid); Hemistels, Sapristels, and Fibristels (euic)]
2. Pergelic and Histic P. Cryaquepts (nonacid), P. Cryaquolls, P. Cryohemists, P. Cryosaprists, and P. Cryofibrists (euic) [Histiturbels, Aquatrubels, Hististatels, Aquastatels, Hemistels, Sapristels and Fibristels (euic)]
3. P. Cryofibrists, Pergelic Cryohemists, and P. Cryosaprists (euic); P. and Histic P. Cryaquolls, P. and Histic P. Cryaquepts [Fibristels, Hemistels, and Sapristels (euic) , Hestistatels, Histiturbels, Aquastatels, Histiturbels, Aquaturbels]

Water (6):

1. Nonsoil
2. Nonsoil, some Fibristels, Hististatels, Aquastatels

Clouds and ice (7):

1. Nonsoils
2. Nonsoils, Lithic Cryorthents [nonsoils, Lithic Haplastatels]

Shadows (8):

1. Nonsoils, Lithic Cryorthents [nonsoils, Lithic Haplastatels]

Notes:

1) Data were geometrically and radiometrically corrected and scenes were mosaicked prior to classification.

2) Shadow areas: The preliminary map had areas classified as water that are actually shadows. Mountain areas were stratified according to a landunits map. Those cells classified as water (clusters 1,2,3,5,7 in 40 cluster classification) in the mountain units were reclassified as shadow. Cells in non-mountainous areas that were obviously cloud shadows rather than water were changed to shadows as well.

3) Some confusion existed in the preliminary map between wetlands and shrublands in the coastal plain. Thaw lake coastal plain areas were stratified according to landunits map. Cells of cluster 14 of the 40 cluster classification previously classified as wetlands were reclassified as shrublands in all units other than the thaw lake coastal plain.

4) Coastline was clipped according to landunits map. Island areas were retained, sea ice areas were removed.

5) Cloudy areas over the Kuparuk headwaters were patched with similarly-classified SPOT data.

6) The map accuracy assessment in summer of 1996 noted some error associated with the delineation between moist nonacidic tundra and moist acidic tundra at the major ecotone of the two types. With this information, we were better able to spectrally define the two units, resulting in some reclassification of acidic and nonacidic tundra on the final map.

6) For display purposes, the map was smoothed using a majority filter on the 8 contiguous neighboring cells for 10 iterations. The data files available are the original, unfiltered data.

File available in two formats:

1) ASCII

File name: landcover.txt
File format: ASCII
Description: The ASCII file consists of header information containing a set of keywords, followed by cell values in row-major order. The file format is:

```
ncols         2226
nrows         4722
xllcorner     344000
yllcorner     590300
cellsize      50
NODATA_value  -9999
row 1 cell values
row 2 cell values
.
.
.
row 4722 cell values
```

2) ArcInfo Export File

```
Arc: describe landcover
   Description of Grid LANDCOVER

Cell Size = 50.000              Data Type: Integer
Number of Rows    = 4722        Number of Values = 8
```

Number of Columns = 2226 Attribute Data (bytes) = 8

BOUNDARY STATISTICS

Xmin = 344000.000 Minimum Value = 1.000
Xmax = 455300.000 Maximum Value = 8.000
Ymin = 590300.000 Mean = 3.297
Ymax = 826400.000 Standard Deviation = 1.529

COORDINATE SYSTEM DESCRIPTION

Projection UTM
Zone 6
Datum NAD27
Units METERS Spheroid CLARKE1866
Xshift 0.00000 Yshift -7000000.00