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Pre-ABOVE: Land Cover and Ecosystem Map Collection for Northern Alaska

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Documentation Revision Date: 2017-01-26

Data Set Version: V1

Summary

This data set provides four land cover and ecosystem classification maps for northern Alaska. The maps were produced for several projects and from different data sources including Landsat imagery and existing maps and models, and cover a range of ecosystem and vegetation classes. The data used to derive the maps covered the period 1976-08-04 to 2014-09-01.

There are six data files included with this data set: three maps in GeoTIFF (.tif) format, two layer files corresponding to two of the tiffs (.lyr), and one compressed shapefile (.zip). The shapefile is also provided in .kmz format for viewing in GoogleEarth, along with two map source reports, as companion files.

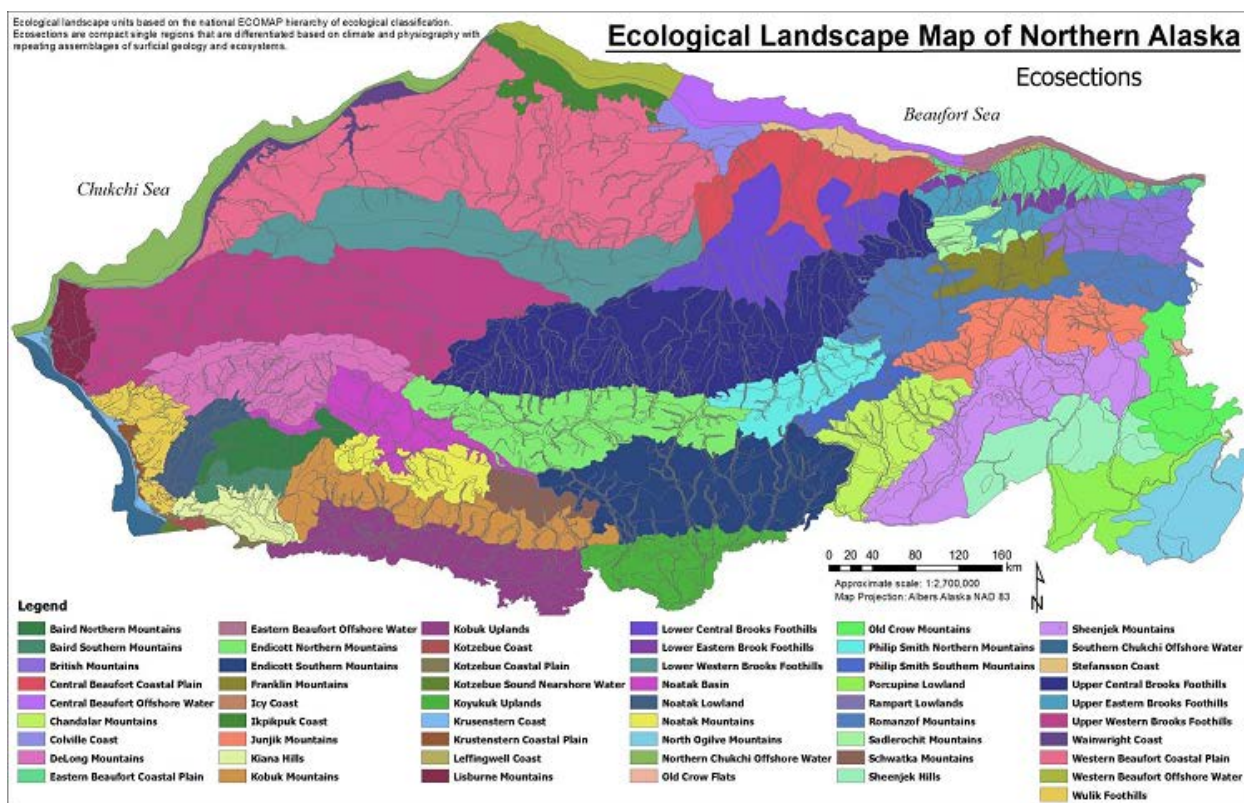


Figure 1. Ecological landscape sections from Landscape Level Ecological Mapping of Northern Alaska (2014 Update). From Jorgenson and Grunblatt, 2013.

Citation

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1. Data Set Overview

This data set provides four land cover and landscape-level ecological maps for northern Alaska. The maps were produced from several data sources including Landsat data and existing maps and models, and cover a range of ecosystem and vegetation classes. The data used to derive the maps cover the period 1976-08-04 to 2014-09-01.

Map names and descriptions:

- **Landsat MSS Land Cover Map of Northern Alaska:** A landcover map in GeoTIFF (.tif) format. The map covers all of northern Alaska, from the Brooks Range divide to the coast. It is in 50-m pixels resolution, and has nine land cover categories based on an unsupervised classification of a Landsat Multispectral Scanner (MSS) composite. A layer file (.lyr) with symbology is also included which corresponds to this tiff file. The Landsat data used to derive the map cover the period 1976-08-04 to 1986-09-13.
- **Ecosystems of Northern Alaska:** A landcover map in GeoTIFF (.tif) format. This map is in 30-m pixel resolution. The legend has 36 terrestrial ecosystem classes and 4 non-vegetated classes, nested within five landscape types: coastal, riverine, lowland, upland, and alpine. It covers all of Alaska north of the latitudinal treeline on the southern side of the Brooks Range. A layer file (.lyr) with symbology is also included which corresponds to this tiff file. The data used to make the map cover the period 1986-1999.
- **2013 NSSI Landcover for North Slope of Alaska:** A landcover map in GeoTIFF (.tif) format. This map has 24 classes and is a mosaic of different map sources. The area covers the far western Arctic, and for the area between the National Petroleum Reserve - Alaska (NPRA) and Arctic National Wildlife Refuge.
- **Landscape Level Ecological Mapping of Northern Alaska (2014 Update):** When unzipped, this file provides a shapefile (.shp). This is the 2014 update to the 2006 base (and 2012 update) ecological landscape map for northern Alaska. It includes 533 ecological subsections, nested within 55 eco-sections and 14 ecoregions. The entire map covers 413,089 km², of which 391,951 km² covers the land portion, excluding the Beaufort and Chukchi seas.

Project: Arctic-Boreal Vulnerability Experiment

The [Arctic-Boreal Vulnerability Experiment](#) (ABOVE) is a NASA Terrestrial Ecology Program field campaign that will take place in Alaska and western Canada between 2016 and 2021. Climate change in the Arctic and Boreal region is unfolding faster than anywhere else on Earth. ABOVE seeks a better understanding of the vulnerability and resilience of ecosystems and society to this changing environment.

Acknowledgements:

These data were obtained from the Alaska Arctic Geoecological Atlas (<http://agc.portal.gina.alaska.edu>), which provides access to existing Arctic vegetation plot and map data in support of the ABOVE campaign.

2. Data Characteristics

Spatial Coverage: Northern Alaska

Domain: Core ABOVE

State/territory: Alaska

Grid cells: Ah0Av0, Ah1Av0, Ah0Av1, Ah1Av1

Region: Northern Alaska

Spatial Resolution: 30-m and 50-m

Temporal Coverage: 1976-08-04 to 2014-09-01

Temporal Resolution: Annual

Study Area: (all latitudes and longitudes given in decimal degrees)

Site	Westernmost Longitude	Easternmost Longitude	Northernmost Latitude	Southernmost Latitude
Northern Alaska	-169.712	-130	71.54222	65.55917

Data file information

There are six data files included with this data set: three maps in GeoTIFF (.tif) format, two layer files corresponding to the tiffs (.lyr), and one shapefile (.shp). The shapefile is also provided in .kmz format as a companion file. Two map source reports are also included as companion files.

Table 1. Data file names and descriptions

File name	Description
aga_northslope_landcover_muller_1999.tif	Landcover data (map) in GeoTIFF (.tif) format. The map covers all of northern Alaska, from the Brooks Range divide to the coast. It is in 50-m pixels resolution, and has nine land cover categories. This is the map named Landsat MSS Land Cover Map of Northern Alaska .
aga_northslope_landcover_muller_1999.lyr	A layer file with symbology for the above GeoTIFF
ecosystems_northern_alaska_jorgenson_2010.tif	Landcover data (map) in GeoTIFF (.tif) format. It covers all of Alaska north of the latitudinal treeline on the southern side of the Brooks Range and is in 30-m pixel resolution. The legend has 36 terrestrial ecosystem classes and 4 non-vegetated classes, nested within five landscape types. This is the map named Ecosystems of Northern Alaska
ecosystems_northern_alaska_jorgenson_2010.lyr	A layer file with symbology for the above GeoTIFF
nssi_landcover_final_2013oct1_albers83.tif	Landcover map in GeoTIFF (.tif) format. The map covers the far western arctic and the area between the National Petroleum Reserve - Alaska (NPRA) and Arctic National Wildlife Refuge. This map has 24 classes and is in 30-m pixel resolution. This is the map named 2013 NSSI Landcover for North Slope of Alaska
NoAk_Landscapes_2014.zip	A compressed shapefile (.shp). It provides the 2014 update to the 2006 ecological landscape map for northern Alaska (updated in 2012) and includes 533 ecological subsections, nested within 55 eco-sections and 14 ecoregions. The entire map covers 413,089 km ² , of which 391,951 km ² covers the land portion, excluding the Beaufort and Chukchi seas. This is the map named Landscape Level Ecological Mapping of Northern Alaska (2014 Update) .

GeoTIFF file properties

Table 2. Properties of the GeoTIFF files

File name	Map units	Data type	# Bands	Fill Value	Range of values
aga_northslope_landcover_muller_1999.tif	meter	Int32	1	2.1E+09	1 to 9
ecosystems_northern_alaska_jorgenson_2010.tif	meter	Int32	1	2.1E+09	-99 to 112
nssi_landcover_final_2013oct1_albers83.tif	meter	Byte	1	0	1 to 99

Table 3. Geographic extent of the GeoTIFF files

File name	West	East	South	North
aga_northslope_landcover_muller_1999.tif	-169.61	-138.39	67.38972	71.32194
ecosystems_northern_alaska_jorgenson_2010.tif	-169.712	-130	65.55917	71.54222
nssi_landcover_final_2013oct1_albers83.tif	-168.322	-139.61	67.54222	70.89806

Shapefile

File name: NoAk_Landscapes_2014.zip: When unzipped provides NoAk_Landscapes_2014.shp. These data are also provided as a companion file in .kmz format for viewing in GoogleEarth.

Table 4. Attributes of the shapefile.

Attribute	Description
ECOREGION	Name of ecoregion. Ecoregions are large units of land or water with generally similar ecosystems
PHYSIOGRAPHY	Physiography classes
LITHOLOGY	Description of rock composition and texture
SUBSECTION	Subsection name. Subsections are areas within Sections with similar surficial geology, lithology, geomorphic process, soil groups, subregional climate, and potential natural communities. Subsection boundaries usually correspond with discrete changes in geomorphology. Names of Subsections are usually derived from geologic features.
SECTION_	Section name. Sections are areas of similar sub-regional climate, geomorphic process, stratigraphy, geologic origin, topography, and drainage networks. Such areas are often inferred by relating geologic maps to potential natural vegetation "series" groupings such as those mapped by Kuchler (1964). In recent years, numerical analyses of weather station and remotely sensed climatic information have assisted in determining Section boundaries. Boundaries of some sections approximate geomorphic provinces (for example, Blue Ridge) as recognized by geologists. Section names generally describe the predominant geomorphic type or feature upon which the ecological unit delineation is based, such as Flint Hills, Great Lakes Morainal, Bluegrass Hills, Appalachian Piedmont.
GEN_GEOL	Generalized geology.
SUBSEC_CO	4-letter abbreviation of name of subsection
Soil_Lands	Combination of the the soil description and the landscape type
Biome	Biome name, either Boreal or Arctic
Eco_Landsc	Combination of Biome, Soil and Landscape

Table 5. Geographic extent of the shapefile.

File name	West	East	South	North
NoAk_Landscapes_2014.zip	-167.074406	-139.565033	66.444163	71.465808

Companion files

There are four companion files provided with this data set described below.

Table 6. Companion file descriptions

File name	Description
NoAk_Landscapes_2014.kmz	The data provided in the shapefile NoAk_Landscapes_2014.shp in kmz format for viewing in Google Earth
NSSI_Land_Cover_Map_Final_Summary_Report.pdf	This is " North Slope Science Initiative Landcover Mapping Summary Report " provided as a reference for the map named 2013 NSSI Landcover for North Slope of Alaska and the file nssi_landcover_final_2013oct1_albers83.tif . This report is also available from the map archive of the Alaska Arctic Geoecological Atlas (http://agc.portal.gina.alaska.edu)
Northern_AK_Landscape_Mapping_Field_Photos_Final_Report.pdf	The report " LANDSCAPE-LEVEL ECOLOGICAL MAPPING OF NORTHERN ALASKA AND FIELD SITE PHOTOGRAPHY " provided as a reference for the map named Landscape Level Ecological Mapping of Northern Alaska (2014 Update) and the file NoAk_Landscapes_2014.shp . This report is also available from the map archive of the Alaska Arctic Geoecological Atlas (http://agc.portal.gina.alaska.edu)
Northern_Alaska_Veg_Maps.pdf	A pdf of this guide document

3. Application and Derivation

An ecological land classification is essential to evaluating land resources and refining management strategies for various areas. More specifically, a landscape-level stratification can be used to more efficiently allocate inventory and monitoring efforts, to improve land cover classifications developed from

remote sensing, to partition ecological information for analysis of ecological relationships and develop of predictive models, and to improve recommendations for ecological restoration.

4. Quality Assessment

The maps were produced from several sources. Refer to the related publications for additional details regarding the individual maps.

5. Data Acquisition, Materials, and Methods

These data were obtained from the Alaska Arctic Geoecological Atlas (<http://agc.portal.gina.alaska.edu>), which provides access to existing Arctic vegetation plot and map data in support of the ABOVE campaign. The maps were produced from several data sources including Landsat data and existing maps and models, and cover a range of ecosystem and vegetation classes. The data used to derive the maps cover the period 1976-08-04 to 2014-09-01.

Landsat MSS Land Cover Map of Northern Alaska (Data Files: [aga_northslope_landcover_muller_1999.tif](#) and [.lyr](#))

This map includes nine land cover categories. It covers all of northern Alaska, from the Brooks Range divide to the coast. It is based on an unsupervised classification of a Landsat Multispectral Scanner (MSS) composite created by the National Mapping Division, U.S. Geological Survey EROS data center, Anchorage, Alaska. Landsat scenes used covered the period 1976-08-04 to 1986-09-13. Geobotanical maps and earlier Landsat-derived maps of the region were used to interpret the spectral classes.

A preliminary land-cover map of northern Alaska was made by extrapolating a Landsat Multi-Spectral Scanner (MSS)-derived classification of the Kuparuk River Region (KRR) to all of northern Alaska. A 26-scene mosaic was used that was previously made by the EROS Data Center, and a K-means unsupervised classification algorithm to produce eight broad land-cover categories. Ancillary data were used to improve the classification for a region of sandy tundra not encountered in the KRR and to separate shadows in the mountains from water and wetlands elsewhere.

For additional details, refer to Muller et al. (1999).

Table 7. Land Cover categories in the northern Alaska-MSS map (NA-MSS)

Dry Prostrate-shrub Tundra and Barrens
Moist Graminoid, Prostrate-shrub Tundra
Moist Tussock-graminoid, Dwarf-shrub Tundra
Moist Dwarf-shrub, Tussock-graminoid, Tundra
Moist Lowshrub Tundra and other Shrublands
Wet Graminoid Tundra
Water
Clouds and ice
Shadows

Ecosystems of Northern Alaska (Data Files: [ecosystems_northern_alaska_jorgenson_2010.tif](#) and [.lyr](#))

This landcover map includes 36 terrestrial ecosystem classes and 4 non-vegetated classes, nested within five landscape types: coastal, riverine, lowland, upland, and alpine.

The map was funded by The Nature Conservancy to provide a seamless ecological context for analysis of the distribution of biodiversity in the Northern Alaska ecoregion. It covers all of Alaska north of the latitudinal treeline on the southern side of the Brooks Range.

Map classes were modeled using existing land cover maps covering portions of the project area, integrated and reclassified using ancillary information to partition ecological characteristics. Physical, biological and geographical information were incorporated to produce the ecosystem classification. The data used to make the maps cover the period 1986-1999. The data were re-interpreted and combined into a map of consistent thematic classification and spatial resolution to generate a seamless, unified map of terrestrial ecosystems for the project area.

For additional details, refer to Jorgenson and Heiner (2003).

Table 8. 36 ecosystem classes nested within five landscape types: coastal, riverine, lowland, upland, and alpine (Nowacki et al. 2001).

Alpine types = 17.9% of ecoregion	Upland types = 57.0% of ecoregion	Lowland types = 16.6% of ecoregion	Riverine types = 4.6% of ecoregion	Coastal types = 3.5% of ecoregion
Alpine glaciers	Upland spruce forest	Lowland spruce forest	Riverine spruce forest	Coastal grass and dwarf shrub tundra
Alpine noncarbonate barrens	Upland birch-aspens	Lowland low birch-willow	Riverine balsam poplar	Coastal wet sedge tundra

	spruce forest	shrub	forest	
Alpine carbonate barrens	Upland birch-aspen forest	Lowland moist sedge-shrub tundra	Riverine tall alder-willow shrub	Coastal barrens
Alpine mafic barrens	Upland tall alder shrub	Lowland wet sedge tundra	Riverine low willow shrub tundra	Coastal water
Alpine noncarbonate dwarf shrub tundra	Upland low birch-willow shrub tundra	Lowland lake	Riverine dryas dwarf shrub tundra	
Alpine noncarbonate dwarf shrub tundra	Upland dryas dwarf shrub tundra		Riverine moist sedge-shrub tundra	
Alpine mafic dwarf shrub tundra	Upland shrubby tussock tundra		Riverine wet sedge tundra	
	Upland tussock tundra		Riverine barrens	
	Upland moist sedge-shrub tundra		Riverine waters	

2013 NSSI Landcover for North Slope of Alaska (Data File: nssi_landcover_final_2013oct1_albers83.tif)

This map includes 24 landcover classes. The map area was delineated using the North Slope Borough boundary. The map includes an approximately 60 million acre area stretching from the border of Canada to Pt. Hope in the western arctic and from the Arctic Ocean south to the Brooks Range. Areas to the west of the NPR-A (west arctic area) and also areas between the NPR-A and Arctic NWR (Prudhoe/Toolik area) had previously not been mapped using Landsat 30 meter resolution data. New landcover maps were created for the west arctic and Prudhoe/Toolik areas. Field data were collected during 2008 (west arctic -Wainwright), 2010 (Prudhoe/Toolik), and 2011 (west arctic - Pt. Hope) to be used as reference data for image classifications. The western arctic area was classified using an iterative, combined supervised/unsupervised image processing technique that has previously been used to map land cover for more than 100 million acres throughout other portions of arctic and boreal Alaska (Ducks Unlimited, Inc., 2013). The Prudhoe/Toolik area was mapped using a combination of a random forest classifier supplemented with iterative, combined supervised/unsupervised classifications. The map was part of the North Slope Science Initiative (NSSI), a multi-year project to produce a moderate resolution landcover base map for the North Slope of Alaska to serve as a primary base layer for long-term science and planning activities on the North Slope.

The map is a mosaic of different map sources:

- (1) For the NPR-A area, existing landcover maps produced by the Bureau of Land Management (BLM) and Ducks Unlimited, Inc. in mid-1990's were crosswalked to the NSSI land cover map classification scheme. Reviews of the 1990's NPR-A maps by many ecologists and biologists familiar with the area indicated that the Dwarf Shrub and Tussock Tundra classes were mapped incorrectly in the areas south of the arctic coastal plain and into the Brooks range. For this reason, these two classes were masked out.
- (2) New Landsat TM5 images acquired between 2005 and 2010 were downloaded, and those masked areas were reclassified using these recent Landsat images.
- (3) The updated classification for these areas were then overlayed onto the crosswalked NPR-A map to replace the incorrectly mapped Dwarf Shrub and Tussock Tundra pixels.
- (4) The corrected NPR-A map was then mosaiced with the new NSSI maps from the west arctic and Prudhoe/Toolik areas. In areas where the Landsat TM images used in the west arctic and Prudhoe/Toolik maps overlapped the NPR-A, the west arctic and Prudhoe/Toolik maps were required to eliminate clouds from this area.
- (5) The remaining portions of the NSSI mapping area (those areas not covered by the west arctic, Prudhoe/Toolik, and revised NPR-A maps) were then filled in using a statewide land cover mosaic that was recently developed by the [Alaska Natural Heritage Program](#)

For additional details refer to the companion file [NSSI_Land_Cover_Map_Final_Summary_Report.pdf](#).

Table 9. Area and percentage of area mapped by land cover class.

Class #	Classname	Acres	Hectares	% of Mapped Area
1	Bare Ground	1,051,010	425,328	1.75%
2	Sparsely Vegetated	3,955,923	1,600,904	6.58%
3	Open Water	4,461,378	1,805,454	7.42%
5	FWM: Arctophila Fulva	96,525	39,062	0.16%
6	FWM: Carex Aquatillis	2,292,907	927,905	3.82%
7	Wet Sedge	5,448,997	2,205,129	9.07%
8	Wet Sedge - Sphagnum	3,329	1,347	0.01%
9	Mesic Herbaceous	247,410	100,123	0.41%

10	Tussock Tundra	7,401,623	2,995,328	12.32%
11	Tussock Shrub Tundra	14,377,941	5,818,542	23.93%
14	Mesic Sedge-Dwarf Shrub Tundra	3,917,366	1,585,300	6.52%
16	Dwarf Shrub - Dryas	6,136,081	2,483,182	10.21%
18	Dwarf Shrub - Other	2,432,092	984,232	4.05%
19	Birch Ericaceous Low Shrub	3,920,093	1,586,404	6.52%
20	Low-Tall Willow	2,295,337	928,889	3.82%
21	Alder	449,794	182,025	0.75%
22	Marine Beach/Beach Meadow	5,210	2,108	0.01%
23	Coastal Marsh	37,504	15,177	0.06%
50	Ice / Snow	1,114,762	451,127	1.86%
51	Burned Area	227,416	92,031	0.38%
91	Open Needleleaf	171,412	69,367	0.29%
92	Woodland Needleleaf	26,541	10,740	0.04%
95	Open Mixed Needleleaf/Deciduous	393	158	0.00%
96	Deciduous	2,596	1,050	0.00%
99	Unclassified (cloud, terrain shadow, etc.)	16,205	6,558	0.03%
	Total	60,089,856	24,317,474	100.00%

Landscape Level Ecological Mapping of Northern Alaska (2014 Update) (Data File: **NoAk_Landscapes_2014.shp**, also provided as a companion file in .kmz format)

This is the 2014 update to the 2006 ecological landscape map for northern Alaska (previously updated in 2012). This product provides landscape level ecological mapping of northern Alaska. It includes 533 ecological subsections, nested within 55 eco-sections (see Fig.1) and 14 ecoregions covering 413,089 km² (Jorgenson and Grunblatt, 2013).

The updates to the previous map produced by The Nature Conservancy (Jorgenson and Heiner, 2004) include:

- compilation and georectification of existing surficial geology maps of northern Alaska to provide better base information for updating the map delineations;
- complete ecological mapping within NPRA;
- improved ecological boundary delineations, unit classification, and reference documentation across the entire North Slope
- integration of ecological mapping products with available photography in a web based tool for improved interpretation and understanding; and
- provides results in format appropriate for regional GIS analysis at an approximate scale of 1:300,000 ($\pm 150\text{m}$).

For additional details refer to the companion file **NorthernAK_Landscape_Mapping_Field_Photos_Final_Report.pdf**.

6. Data Access

These data are available through the Oak Ridge National Laboratory (ORNL) Distributed Active Archive Center (DAAC).

[Pre-ABOVE: Land Cover and Ecosystem Map Collection for Northern Alaska](#)

Contact for Data Center Access Information:

- E-mail: uso@daac.ornl.gov
- Telephone: +1 (865) 241-3952

7. References

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