

Documentation for the Northern Eurasia Land Cover (NELC) Database

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1. Introduction to the NELC database

The NELC database is a land surface characterization that encompasses the Northern Eurasia Earth System Partnership (NEESPI) region. The database includes a 15-class land cover map based on a hierarchical classification scheme that follows the FAO Land Cover Classification System (LCCS). Also provided are the secondary labels for the land cover map that may be used in conjunction with the first data layer to provide a more extensive description of the land cover characteristics. The database includes three additional layers that characterize land use, wetlands, and tundra. The production of the NELC database is outlined in detail by Sulla-Menashe et al. 2010 (in press). The land cover legend is given as Table 1 and can be broken down into three increasingly specific layers as shown in Figure 1. The legends for the three non-land cover layers are provided in Table 2.

2. Data Description

- The NELC data are available as individual tiles on the MODIS sinusoidal grid (<http://nsidc.org/data/modis/landgrid.html>). There are 41 tiles covering the entire NEESPI study area.
- There are 6 files for each tile: nelda_h##v##.tif, probs_h##v##.tif, nelda2_h##v##.tif, probs2_h##v##.tif, nelda3_h##v##.tif, and probs3_h##v##.tif where the h and v indicate the horizontal and vertical tile numbers respectively. Data are stored as 1-byte unsigned characters in TIFF format. Each of the tiles has 2400 columns and 2400 rows. The nelda and nelda3 layers have one band and all the other layers have three bands.
- The nelda and probs layers describe the land cover information only. The nelda layer contains the 15 classes described in Table 1. The probs layer contains the posterior probabilities or classification “confidences” at each layer in the hierarchy (Figure 1): real values are between 0-100 with 255 values as fill.
- The nelda2 and probs2 files contain information about the 4 special non-land cover classes as summarized in Table 3. The nelda2 layers have two additional

- values: 0 for classes not considered in the classification and 4 for permanent water bodies. The probs2 layer contains the classification confidences for each corresponding nelda2 layer: real values are between 0-100 with 255 values as fill.
- The nelda3 and probs3 layers describe the second most likely land cover class. The nelda3 layer contains the 15 classes described in Table 1. The probs3 layer contains the classification confidences at each layer in the hierarchy (Figure 1): real values are between 0-100 with 255 values as fill. The second most likely class is chosen for the upper-most level of the hierarchy where the first prediction is most uncertain; otherwise, the first prediction is retained.
 - The tiles are in a MODIS sinusoidal projection with a reference Earth radius of 6371007.181 meters, a central meridian at 0 meters, and no false easting or northing. The pixel size is exactly 463.312716525 meters.
 - The coordinates for the center of the top-left corner pixel for each of the NELC tiles are provided in Table 3.

3. Known Issues

- Shrub-dominated areas
 - There is a problem with open tree areas transitioning to closed shrubland implying that closed shrubland does not appropriately refer to 60-70% shrub cover but could instead define an open canopy of small trees.
 - There are problems distinguishing between herbaceous and shrub-dominated tundra due to spectral similarities, convergent growth forms and a short growing season.
 - The shrub leaf type layer is not reliable due to a small training dataset and will be improved upon in future versions.
- Wetlands
 - The wetland classification is intentionally conservative and under-estimates wetlands across Northern Eurasia. It is especially conservative for forested wetlands, which are difficult to detect from satellite imagery.
- Tundra

- The tundra class is derived from observed snowfall patterns between 2001-2005 and is conservative with respect to the actual range of tundra ecosystems. Future work will better characterize the tundra using historical climate information.

Table 1. NELC Land Cover Legend		
Class Name	Code	Class Definition
Tree Dominated		
Evergreen Needleleaf – Tree Closed	1	The crown cover is more than 60%. The height is greater than 5m.
Evergreen Needleleaf – Tree Open	2	The crown cover is between 10 and 60%. The height is greater than 5m.
Deciduous Needleleaf – Tree Closed	3	The crown cover is more than 60%. The height is greater than 5m.
Deciduous Needleleaf – Tree Open	4	The crown cover is between 10 and 60%. The height is greater than 5m.
Deciduous Broadleaf – Tree Closed	5	The crown cover is more than (60-70)%. The height is greater than 5m.
Deciduous Broadleaf – Tree Open	6	The crown cover is between (10-20) and (60-70)%. The height is greater than 5m.
Mixed – Tree Closed	7	Areas dominated by trees where neither deciduous broadleaved or needleleaved nor evergreen needleleaved species represent > 75% of the tree cover present. The crown cover is more than (60-70)%. The height is greater than 5m.
Mixed – Tree Open	8	Areas dominated by trees where neither deciduous broadleaved or needleleaved nor evergreen needleleaved species represent > 75% of the tree cover present. The crown cover is between (10-20) and (60-70)%. The height is greater than 5m.
Shrub Dominated		
Shrub Closed	9	The crown cover is more than (60-70)%. The height is in the range of 5 - 0.3m.
Shrub Open	10	The crown cover is between (10-20) and (60-70)%. The height is in the range of 5 - 0.3m.
Herbaceous Dominated		
Herbaceous Closed	11	The crown cover is more than (70-60)%. The height is less than 3m.
Herbaceous Open	12	The crown cover is between (70-60) and (20-10)%. The height is less than 3m.
Non-Vegetated		
Barren	13	Non-vegetated areas of exposed soil, sand, or rock containing less than 10-15% vegetation cover during at least 10 months a year.
Permanent Snow and Ice	14	The land cover consists of perennial snow and ice for a period > 11 months
Water	15	The land cover consists of perennial natural water bodies where water is present > 11 months.

Figure 1. Structure of the NELC Hierarchy.

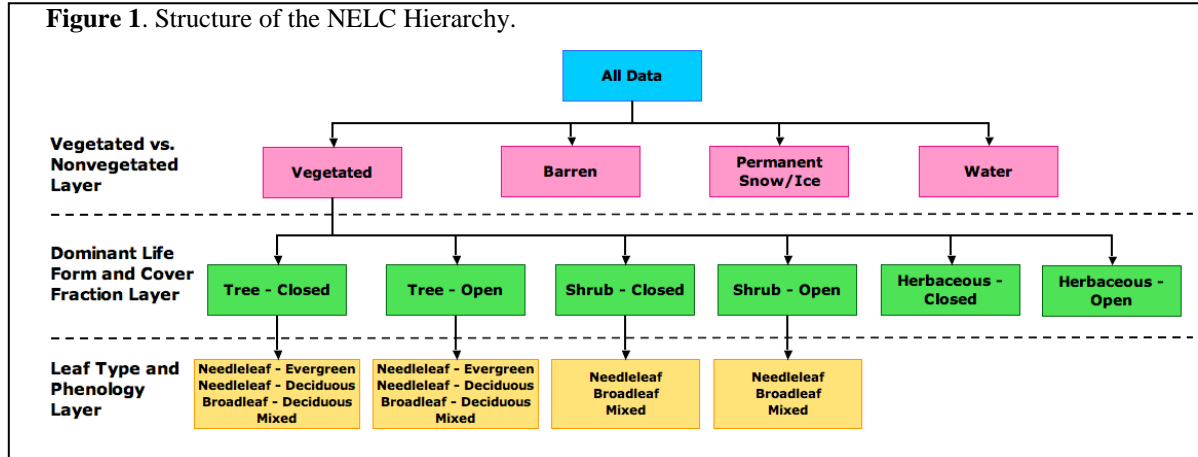


Table 2. NELC Special Layers Legend.

Layer	Class Name	Code	Definition
1. Human Land Use	Natural herbaceous or pasture	1	Herbaceous areas not cultivated for food production.
	Cultivated	2	Peak cultivated herbaceous vegetation accounts for 75-100% of the cover.
	Urban	3	Land cover consists of built up areas where buildings or man-made structures cover > 15% of the area.
2. Wetlands	Non-wetland vegetation	1	Vegetation that is inundated with water < 4 months annually.
	Herbaceous dominated wetland	2	Herbaceous dominated vegetation inundated with water > 4 months annually.
	Woody plant dominated wetland	3	Tree or shrub dominated vegetation inundated with water > 4 months annually.
3. Tundra	Non-tundra herbaceous or shrub	1	Herbaceous or shrub dominated vegetation that is snow free > 3 months of the year.
	Lowland tundra	2	Herbaceous or shrub dominated vegetation that is snow free for 1-3 months of the year. Elevation is < 500m.
	Alpine tundra	3	Herbaceous or shrub dominated vegetation that is snow free for 1-3 months of the year. Elevation is > 500m.

Table 2. Coordinates of the Center of the Upper Left Corner Pixel in the MODIS grid

h	v	x (m)	y (m)	h	v	x (m)	y (m)
18	1	231.6562383	8895372.501	23	1	5559984.255	8895372.501
18	2	231.6562383	7783421.981	23	2	5559984.255	7783421.981
18	3	231.6562383	6671471.462	23	3	5559984.255	6671471.462
19	1	1112182.176	8895372.501	23	4	5559984.255	5559520.942
19	2	1112182.176	7783421.981	23	5	5559984.255	4447570.422
19	3	1112182.176	6671471.462	24	2	6671934.774	7783421.981
19	4	1112182.176	5559520.942	24	3	6671934.774	6671471.462
20	1	2224132.696	8895372.501	24	4	6671934.774	5559520.942
20	2	2224132.696	7783421.981	24	5	6671934.774	4447570.422
20	3	2224132.696	6671471.462	25	2	7783885.294	7783421.981
20	4	2224132.696	5559520.942	25	3	7783885.294	6671471.462
21	1	3336083.215	8895372.501	25	4	7783885.294	5559520.942
21	2	3336083.215	7783421.981	25	5	7783885.294	4447570.422
21	3	3336083.215	6671471.462	26	2	8895835.814	7783421.981
21	4	3336083.215	5559520.942	26	3	8895835.814	6671471.462
21	5	3336083.215	4447570.422	26	4	8895835.814	5559520.942
22	1	4448033.735	8895372.501	26	5	8895835.814	4447570.422
22	2	4448033.735	7783421.981	27	3	10007786.33	6671471.462
22	3	4448033.735	6671471.462	27	4	10007786.33	5559520.942
22	4	4448033.735	5559520.942	28	4	11119736.85	5559520.942
22	5	4448033.735	4447570.422				