Land Cover

Land cover represents the actual or physical presence of vegetation (or other materials where vegetation is nonexistent) on the land surface. Land cover is also often described as what can be seen on land viewed from above. It is one means to describe landscape patterns and characteristics that are critical in understanding aspects of the environment, including the availability of and changes in habitat, the potential for dispersion of chemicals and other pollutants, and potential contributors to climate change, such as reflectivity of the land.

In 1992, several federal agencies interested in land cover agreed to operate as a consortium, known as the Multi-Resolution Land Characteristics (MRLC) Consortium. The goal of the MRLC Consortium is to generate consistent and relevant land cover information at the national scale for a wide variety of environmental, land management, and modeling applications (MRLC Consortium, 2013). The MRLC Consortium has supported the publication of four national land cover products: the 1992 National Land Cover Dataset (NLCD), the 2001 National Land Cover Database (Homer et al., 2007), the 2006 National Land Cover Database (Fry et al., 2011), and the 2011 National Land Cover Database (Jin et al., 2013). Publication of the 2006 NLCD enabled the MRLC Consortium to include systematic monitoring of land cover *change over time.* The Consortium also implemented a change in the mapping interval from 10 years to 5 years (Fry et al., 2011).

This indicator provides summary-level land cover information from the 2011 NLCD, as well as land cover trend data from the comparison of NLCD 2001 and NLCD 2011. NLCD 2011 covers the contiguous U.S.; land cover data for Alaska and Hawaii are scheduled to be released by mid-2015.

The 2011 NLCD provides a synoptic nationwide classification of land cover into 16 classes at a spatial resolution of 30 meters. For this indicator, the 16 land cover classes were aggregated into seven major land cover types: forest, herbaceous/grassland, shrubland, developed, agriculture, wetlands, and other (includes ice/snow, barren areas, and open water). See the definitions page for a detailed description of each land cover category. Open water is shown on the land cover map (Exhibit 1) but is otherwise not discussed as a land cover type in this indicator. See theWater theme area for more information on trends related to water. More information about forests can be found in the Forest Extent and Type indicator, and wetland acreage is discussed in greater detail in the Wetlands indicator.

What the Data Show

The 2011 NLCD for the contiguous 48 states shows approximately 486 million acres of forest cover, 442 million acres of agriculture, 431 million acres of shrub, 290 million acres of grass, 111 million acres of developed land, and 101 million acres of wetland cover (Exhibits 1 and 2).

A comparison of NLCD 2001 and 2011 data shows that 96.99 percent of pixels (each pixel representing an area of about 30 meters square) remained unchanged across the two databases (MRLC, 2014b). Exhibit 3 reflects the 3.01 percent of pixels that did change: with pixels converted to acres, it shows net changes between 2001 and 2011 by acreage and by percent change relative to the total amount of land for each land cover class in 2001. Grassland, developed land, and shrubland showed the largest increases in acreage, while forest cover had the largest loss of acreage during this 10-year period (MRLC, 2014b). The increase in developed land cover was largest in terms of percent change (4.7 percent) from its 2001 baseline. The total 10-year land cover change of 3.01 percent represents an area roughly the size of Idaho.

NLCD 2011 data show variation in land cover types by EPA Region (Exhibit 4), with forest dominating in Regions 1, 2, 3, and 4; agriculture in Regions 5 and 7; grassland in Region 8; and shrubland in Regions 6 and 9. Region 10, excluding Alaska from the calculations, is dominated by roughly equal areas of forest and shrubland. In the contiguous 48 states, two-thirds of the grassland acreage in the nation is located in Regions 6 and 8; more than one-third of the wetland acreage is in Region 4; more than 80 percent of shrubland acreage is in Regions 6, 8, and 9; and more than half the developed acreage occurs in Regions 4, 5, and 6. Forest coverage ranges from a high of 65 percent of Region 1 to 12 percent of Region 7. Region 5 contains the most agriculture acreage of any region, with more than 99 million acres or nearly 47 percent of the total acreage of the Region.

Limitations

- Land cover data for the entire nation at adequate resolution to support the indicator have been produced for four nominal dates (1992, 2001, 2006, and 2011). To correct for changes in methodology, the NLCD 2001 and 2006 databases were revised and reissued as 2011 editions to provide full compatibility with the NLCD 2011. However, the NLCD 1992 dataset is not comparable with later versions.
- A formal accuracy assessment is underway for NLCD 2011. The overall accuracy of earlier NLCD land cover classifications at the aggregated level reported in this indicator is 85 percent for NLCD 2001 and 84 percent for NLCD 2006. Overall accuracy at the level of the 16 underlying classifications is 79 percent for NLCD 2001 and 78 percent for NLCD 2006 (Wickham et al., 2013).
- While the nominal date of the NLCD databases implies that data were collected during that year, in fact the data were collected from satellite imagery captured during the nominal year and, to some extent, the preceding and succeeding years.
- National estimates of land cover vary, depending on the survey approach, data sources, classification, timing, etc. The interaction of these variables will result in different estimates of the extent of any given land cover category depending on the data set used. Techniques relying on satellite data to generate land cover estimates classify what is visible from above, meaning they may underestimate developed cover in heavily treed urban areas and underestimate forest cover where trees have been harvested.
- No standardized land cover classification system is currently used among federal agencies (Sleeter et al., 2013).
- The NLCD is updated every 5 years. The data from each update are organized and analyzed for release about 2 years after the update. For each ROE indicator using NLCD data, the most recent available dataset is used.

Data Sources

- NLCD 2011 land cover data for the contiguous 48 states were obtained from the MRLC Consortium (2014a) and the USGS EROS Center (2014).
- Land cover trend data, comparing NLCD 2001 and NLCD 2011, came from the MRLC Consortium (2014b).

References

Fry, J., G. Xian, S. Jin, J. Dewitz, C. Homer, L. Yang, C. Barnes, N. Herold, and J. Wickham. 2011. Completion of the 2006 National Land Cover Database for the conterminous United States. Photogramm. Eng. and Rem. S. 77(9):858-864. https://cfpub.epa.gov/si/si_public_record_report.cfm?Lab=NERL&dirEntryId=237844.

Homer, C., J. Dewitz, J. Fry, M. Coan, N. Hossain, C. Larson, N. Herold, A. McKerrow, J.N. VanDriel, and J. Wickham. 2007. Completion of the 2001 National Land Cover Database for the conterminous United States. Photogramm. Eng. and Rem. S. 73(4):337-341. https://www.researchgate.net/publication/237239863_Completion_of_the_2001_National_Land_Cover_Database_for_the_Conterminous_United_States.

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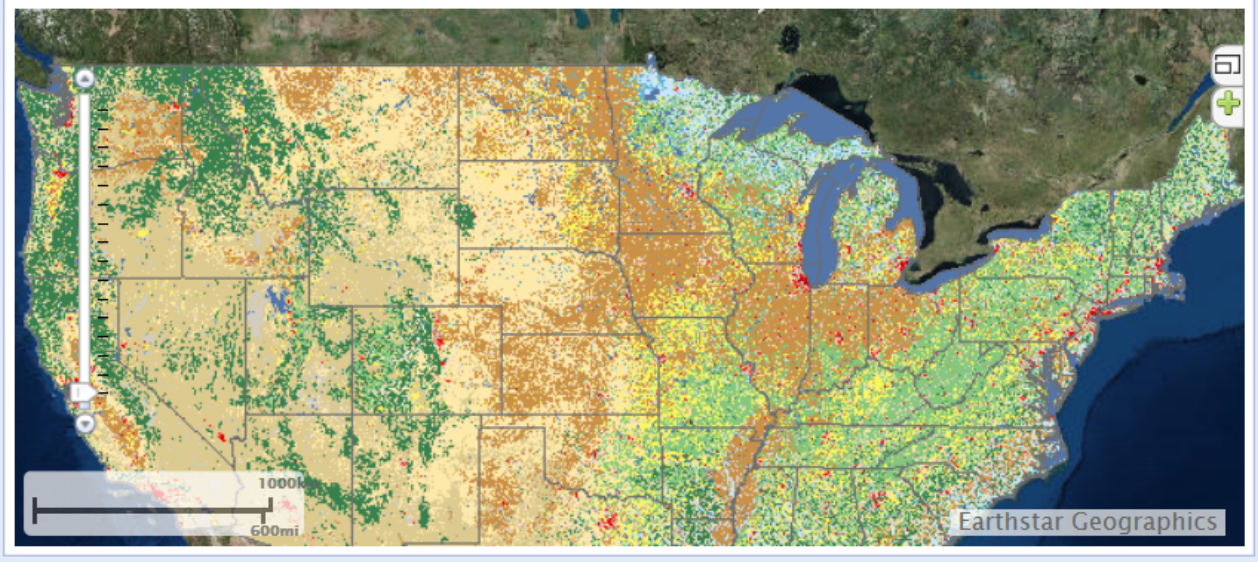
Wickham, J.D., S.V. Stehman, L. Gass, J. Dewitz, J.A. Fry, and T.G. Wade. 2013. Accuracy assessment of NLCD 2006 land cover and impervious surface. Rem. Sen. of Environ. 130:294-304.

Exhibit1. Land cover of the contiguous U.S., based on 2011 NLCD



Opacity: Click here to toggle legend

Agriculture
- Cultivated crops
- Pasture/hay

Forest
- Deciduous forest
- Evergreen forest
- Mixed forest

Developed
- High intensity (impervious 80–100%)
- Medium intensity (impervious 50–79%)
- Low intensity (impervious 20–49%)
- Open space (impervious <20%)

Shrubland
- Shrub/scrub

Herbaceous
- Grassland

Wetland
- Woody wetland
- Emergent herbaceous wetland

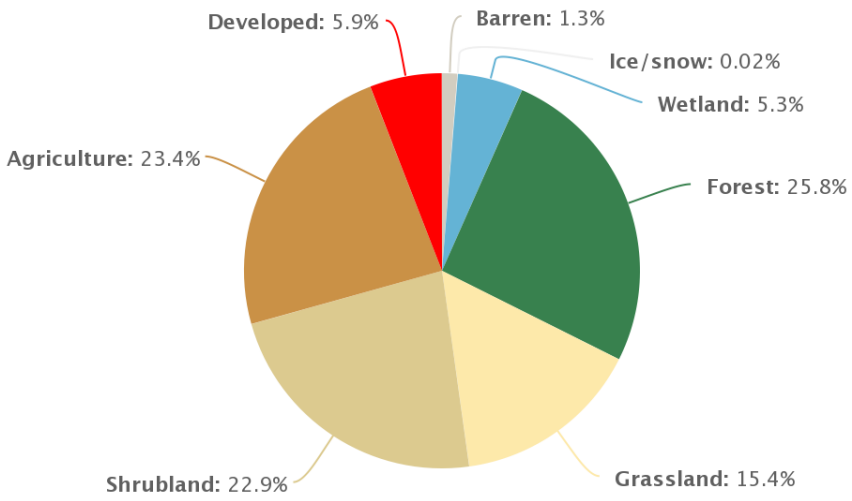
Other
- Open water
- Perennial ice/snow
- Barren land (rock/sand/clay)

See text for definitions of land cover categories.

Trend analysis has not been conducted because these data represent a single snapshot in time. For more information about uncertainty, variability, and statistical analysis, view the technical documentation for this indicator.

Data source: MRLC Consortium, 2014a

Exhibit 2. Land cover types in the contiguous U.S., based on 2011 NLCD



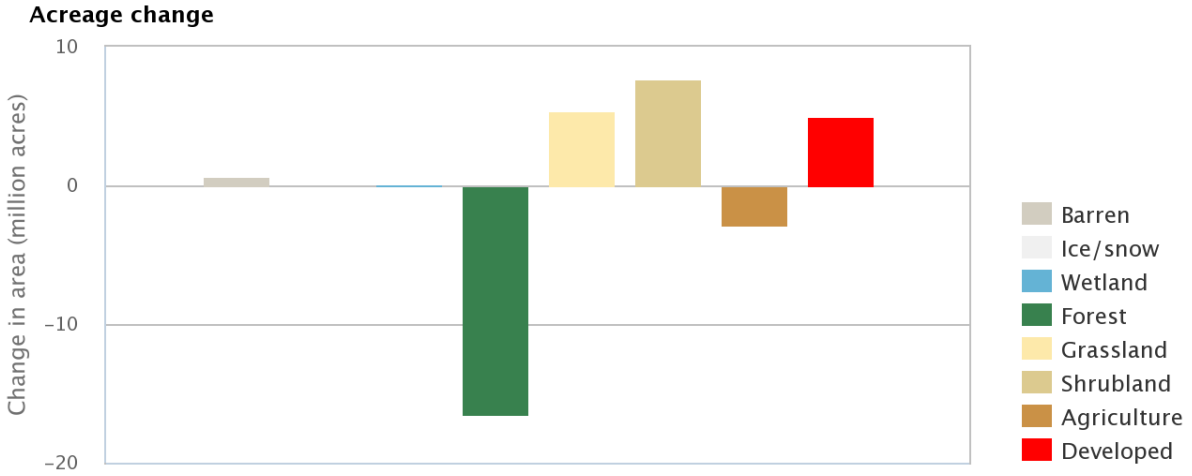
Coverage: Contiguous 48 states and the District of Columbia, excluding area classified as "open water." Total area covered, without open water, is 1.886 billion acres.

See text for definitions of land cover categories. See Exhibit 3 for trend analysis showing changes between NLCD 2001 and NLCD 2011.

For more information about uncertainty, variability, and statistical analysis, view the technical documentation for this indicator.

Data source: MRLC Consortium, 2014a; USGS EROS Center, 2014

Exhibit 3. Changes in land cover in the contiguous U.S., 2001–2011



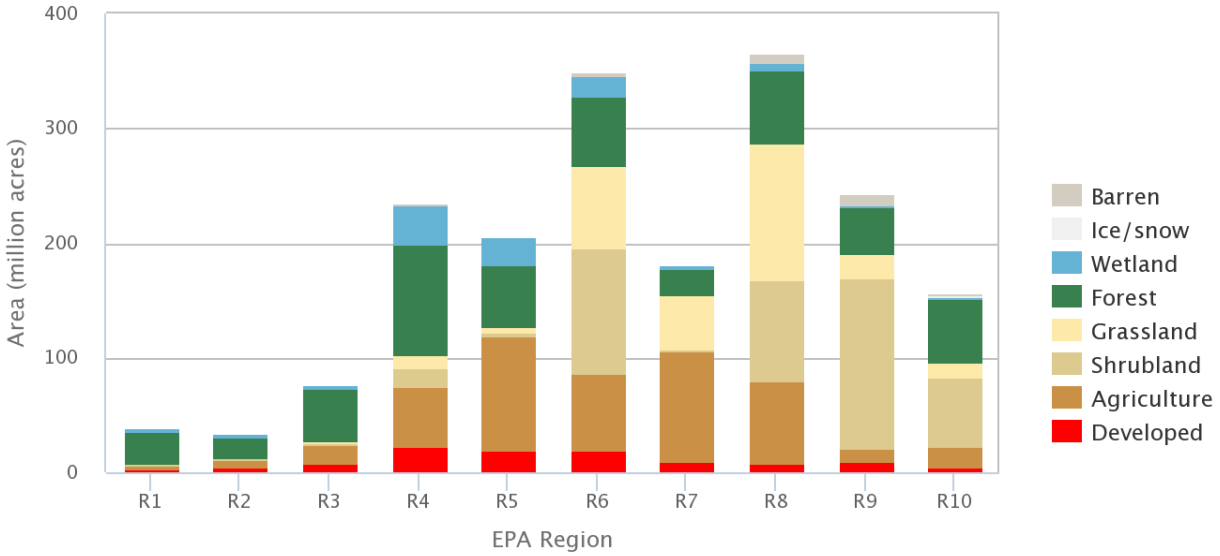
Coverage: Contiguous 48 states and the District of Columbia, excluding area classified as "open water."

See text for definitions of land cover categories.

Information on the statistical significance of the trends in this exhibit is not presented here. For more information about uncertainty, variability, and statistical analysis, view the technical documentation for this indicator.

Data source: MRLC Consortium, 2014b

Exhibit 4. Land cover types in the contiguous U.S. by EPA Region, based on 2011 NLCD



Coverage: Contiguous 48 states and the District of Columbia. Because of large variations in the way "open water" areas are measured, the open water land cover category is not included in this analysis.

See text for definitions of land cover categories.

Trend analysis has not been conducted because these data represent a single snapshot in time. For more information about uncertainty, variability, and statistical analysis, view the technical documentation for this indicator.

Data source: MRLC Consortium, 2014a; USGS EROS Center, 2014