Completion of the 2011 National Land Cover Database for the Conterminous United States – Representing a Decade of Land Cover Change Information

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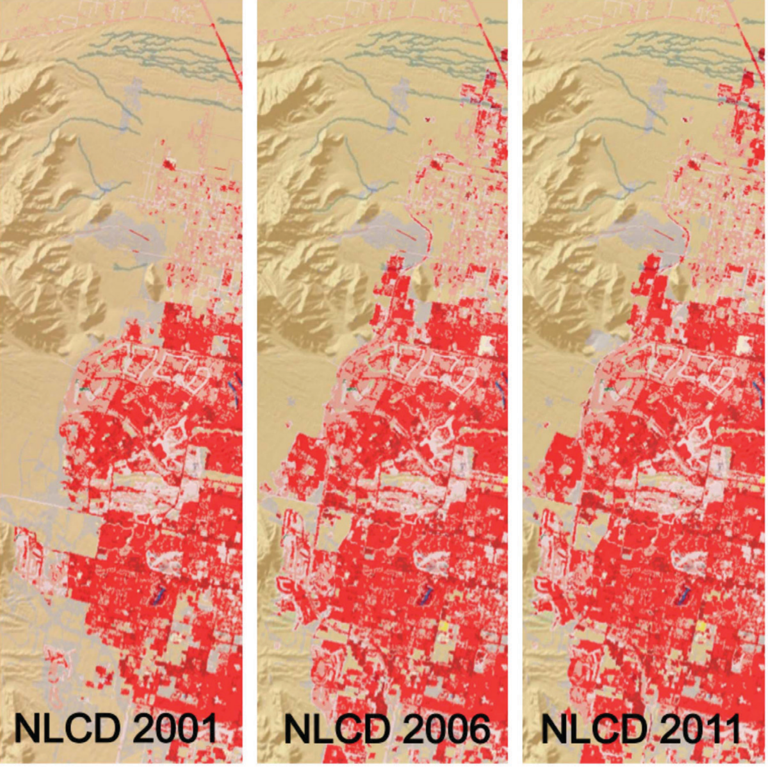


Introduction

The National Land Cover Database (NLCD) provides nationwide data on land cover and land cover change at the native 30-m spatial resolution of the Landsat Thematic Mapper (TM). The database is designed to provide five-year cyclical updates of United States land cover and associated changes. The recent release of NLCD 2011 products now represents a decade of consistently produced land cover and impervious surface for the Nation across three periods: 2001, 2006, and 2011 (Homer et al., 2007; Fry et al., 2011). Tree canopy cover has also been produced for 2011 (Coluston et al., 2012; Coluston et al., 2013). With the release of NLCD 2011, the database provides the ability to move beyond simple change detection to monitoring and trend assessments. NLCD 2011 represents the latest evolution of NLCD products, continuing its focus on consistency, production, efficiency, and product accuracy. NLCD products are designed for widespread application in biology, climate, education, land management, hydrology, environmental planning, risk and disease analysis, telecommunications and visualization, and are available for no cost at http://www.mrlc.gov. NLCD is produced by a Federal agency consortium called the Multi-Resolution Land Characteristics Consortium (MRLC) (Wickham et al., 2014). In the consortium arrangement, the U.S. Geological Survey (USGS) leads NLCD land cover and imperviousness production for the bulk of the Nation; the National Oceanic and Atmospheric Administration (NOAA) completes NLCD land cover for the conterminous U.S. (CONUS) coastal zones;, and the U.S. Forest Service (USFS) designs and produces the NLCD tree canopy cover product. Other MRLC partners collaborate through resource or data contribution to ensure NLCD products meet their respective program needs (Wickham et al., 2014).

Methods

NLCD 2011 production sought accurate representation of nominal year 2011 land cover condition and the change occurring between 2006 and 2011 through methods and algorithms that were scientifically based, quantifiable, scalable, and repeatable. Product generation followed identical protocols nationally for consistency and accuracy across both space and time. Production protocols spanning source data preparation, spectral change detection, land cover change modeling and mapping, impervious and canopy generation, and post-processing strategies are outlined in the following sections.

Source Data Preparation

Landsat 5 Thematic Mapper (TM) imagery provided the foundation for spectral change analysis, land cover classification, and imperviousness modeling for all NLCD 2011 products. All Landsat images were acquired from the USGS Earth Resources Observation and Science (EROS) Center Landsat archive, where they were radiometrically and geometrically calibrated. All reflective bands were converted from a digital number to top-of-atmosphere (TOA) reflectance through the Level 1 Product Generation System (LPGS). Two Landsat scene pairs were selected for analysis and classification for each path/row in CONUS for each target year of 2006 and 2011. Image date selection objectives included a leaf-on and leaf-off scene pair for each path/row with acquisition anniversary dates within two weeks of each other in order to maintain as much phenological consistency as possible.

Common image extents for each path/row were defined by calculating the intersection area of all Landsat images; this boundary was then subsequently used for clipping all image and ancillary data for each path/row. Ancillary datasets required for analysis included NLCD 2001, NLCD 2006, National Elevation Dataset (NED) derivatives of slope, aspect, elevation, and topographic position, USDA Natural Resources Conservation Service Soil Survey Geographic (SSURGO) database Hydric Soils, National Agricultural Statistics Service (NASS) 2011 Cropland Data Layer (CDL), National Wetlands Inventory (NWI), and nighttime stable-light satellite imagery (NSLS) from the NOAA Defense Meteorological Satellite Program (DMSP). These ancillary data combined with Landsat imagery and derivatives were used as independent variables in the land cover decision tree modeling process. All data were georegistered to the Albers Equal Area projection grid and resampled to a 30-m cell resolution.

Enhanced Spectral Change Detection

For NLCD 2011, two major change detection advancements over previous NLCD methods were implemented. First, unlike NLCD 2006 (Fry et al, 2011), two pairs rather than one pair of Landsat images between 2006 and 2011 (one leaf-on pair and one leaf-off pair) were utilized for spectral change analysis. Use of an additional image pair for land cover change detection reduced commission errors caused by seasonal phenology in agriculture and wetland dominant areas, and reduced omission errors due to limitations of using one image pair in areas with clouds and shadows, fire disturbance, forest cutting, and urban development. Second, the core spectral change detection method used for NLCD 2011 was an enhanced and improved version over NLCD 1992, 2001, and 2006 methods (Homer et al., 2004; Fry et al., 2009; Xian et al., 2009). The 2011 change method referred to as the Multi-Index Integrated Change Analysis (MIICA) model (Jin et al., 2013) uses paired Landsat imagery from 2006 and 2011 to capture a full range of land cover disturbances and land cover changes. The MIICA model accomplishes this by using multiple indices for detecting changes, which recognizes the complementary and sensitivity of each index in detecting various types of land cover changes. Specific indices include the Normalized Burn Ratio (NBR), the Normalized Difference Vegetation Index (NDVI), the Change Vector (CV), and the Relative Change Vector (RCV) (Jin et al., 2013). The four indices were first computed for each pixel of a Landsat scene and then subsequently differenced by 2006 and 2011 scene pairs. During computation, MIICA uses global means and standard deviations from the four spectral indices to set relative image path/row thresholds to determine change areas and to differentiate the change direction (i.e., biomass increase or decrease) between the two time periods (Jin et al., 2013).

For 2011, the MIICA model was also enhanced with a separate process called the Zone model (Jin et al., 2013). This model uses two pairs of NBR change and NDVI change images across a growing season to identify change areas related to forest disturbance and succession. Because the Zone model is more sensitive to the sometimes subtle spectral change from forest cutting and regrowth than the MIICA model, results were used to reduce MIICA omission errors in forest change areas, especially for regions where forests can regrow rapidly.

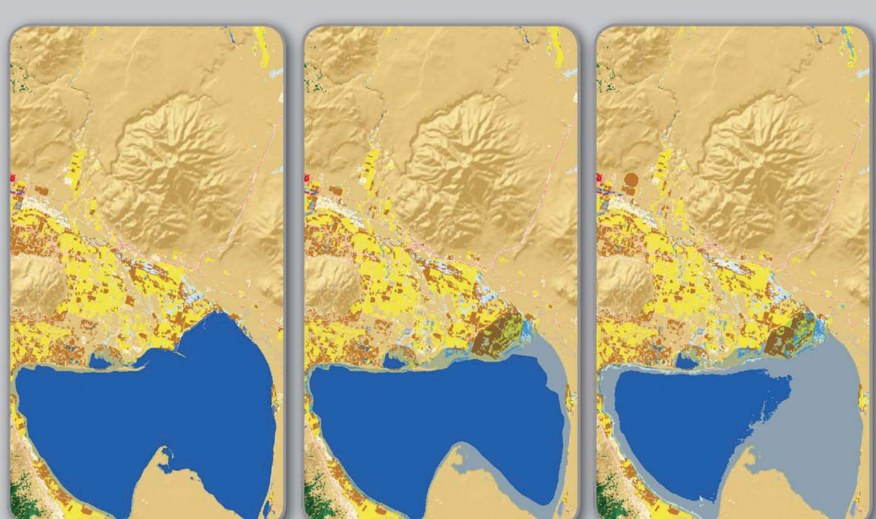
Integrated Land Cover Change Labeling

After the MIICA change detection process identified areas of potential change, additional steps were required to determine if the change was valid and to appropriately label the land cover change between 2006 and 2011. To accomplish this, several steps were required: (1) enhancing and refining training data for land cover classification; (2) improving land cover classification by use of three Landsat images from circa 2011 for each path/row; and (3) establishing a set of knowledge-based rules for land cover labeling within spectral change areas for use in the decision tree algorithm. The goal of labeling advancements was to improve overall classification accuracy and product quality from NLCD 2006 procedures (Fry et al., 2011), which used more simple training procedures, only one date of imagery from each era, and no knowledge-based rules.

An extensive enhanced training dataset was assembled for NLCD 2011 to provide land cover training data for spectral change areas and to provide good balance among different land cover types in the training data pool. The training pool also incorporated several national datasets including NASS CDL (Johnson et al., 2010), NWI data, and hydric soils. A method that integrated these multi-source, multi-temporal training data and information on land cover condition and trajectory into the land cover labeling process was then utilized. This method utilized three Landsat images acquired from 2011 and several geospatial ancillary datasets (e.g., derivatives and a wetland potential index) to generate an initial 2011 land cover map through a classification tree algorithm. Then both the land cover map of 2011 and NLCD 2006 were spatially combined with the spectral change map of 2006–2011 obtained from the MIICA model to derive a land cover change map. This land cover change map contains only those pixels that are identified as change spectrally, and as a class label change between (2006) and (2011) labels.

Post-Classification Processing

Despite extensive efforts in image pre-processing, spectral change detection, and change labeling during NLCD 2011 creation, some mis-classification still occurred, which required correction by post-classification analysis. This analysis typically depends upon knowledge-based rules to refine initial model labeling using the trajectory of land cover history, an estimate of the expected land cover class extent and distribution in the year 2011, and other ancillary data sources. Each specific land cover type required slightly different post-classification analysis. Urban class pixels had top priority, with any change related to newly developed lands always being included in the final land cover change map. For agriculture classes, CDL was used to assist in post-classification refinement. For wetlands, ancillary data including NLCD 2006, SSURGO hydric soil, and NWI were combined to limit both commission and omission errors (e.g., a pixel classified initially



2001 Water Level Change
Honey Lake, California

2006 Water Level Change
Honey Lake, California

2011 Water Level Change
Honey Lake, California

USGS

2001 Urban Expansion Houston, Texas **2006 Urban Expansion** Houston, Texas **2011 Urban Expansion** Houston, Texas

USGS

as an upland vegetation class was changed to a wetland class if all three ancillary datasets identified it as a wetland class). For major forest transition areas in the southeastern and northwestern U.S. regions, applying knowledge about forest disturbance, succession stage, and management practice patterns in conjunction with a spectral-ranking approach greatly improved the quality and consistency of land cover change labeling by preventing illogical land cover changes in the final product.

Urban Impervious Estimation

The approach for updating new impervious surface growth and intensification between 2006 and 2011 was similar to the method used to produce the 2006 NLCD impervious surface change product (Xian et al., 2011; Xian et al., 2012). This method employed the NLCD 2006 impervious surface product as the baseline estimate and Landsat imagery pairs in 2006 and 2011 as the primary data source for identifying changed areas. Ancillary data such as DMSP NSLS, slope, and elevation were also used to help develop regression tree models for predicting new percent impervious surface in changed areas. Three major steps were required for this process: (1) modeling an impervious surface, (2) comparison of model outputs, and (3) final product clean-up. In step 1, DMSP nighttime lights imagery in 2006 was superimposed on the NLCD 2006 impervious surface product to exclude low density impervious areas outside urban and suburban centers to ensure only urban core areas be used to provide a stable and reliable training dataset. Two training datasets, one having a relatively large urban extent and one having a relatively small extent, were produced through imposing two different thresholds, ≥ 10 and ≥ 20, of nighttime lights imagery on the 2006 impervious product. In step 2, each of the two training datasets combined with 2006 Landsat imagery was separately applied with regression tree algorithms to build up regression tree models (Xian and Homer, 2010). Two sets of regression tree models were created and used to produce two 2006 synthetic impervious surface products. Similarly, the same two training datasets were used with 2011 Landsat and DMSP NSLS images to create two sets of regression tree models and produce two 2011 synthetic impervious surface products to ensure that only stable predictions are chosen as intermediate products. In step 3 the two synthetic product pairs were then compared to remove false estimates due to strong reflectance from nonurban areas and to retain 2006 impervious values in the unchanged areas. The 2011 impervious surface was updated individually in every Landsat scene over the entire CONUS, with individual scene products subsequently mosaicked together to produce a seamless 2011 impervious surface product.

In addition to identifying new impervious features for 2011, the process was sensitive enough to capture many previously unidentified impervious areas from earlier periods. Identifying these areas as 2011 change would have inaccurately placed the change in the wrong period. To correct this, an intensive combination of hand editing and automated processes was applied to identify and sort potential additions into the proper NLCD period (2001, 2006, or 2011). This approach was dependent on extensive use of high-resolution imagery from each period to accurately identify and sort the additions. All other impervious features were also checked during this process, enabling overall accuracy to be improved. These special edits were focused on the eastern half of CONUS because this area had the most inaccuracies from earlier periods. The additional processing resulted in a much improved impervious product throughout all published years and a more consistent national product.

Tree Canopy Cover

The NLCD 2011 percent tree canopy cover was modeled using photographic interpretation of National Agriculture Imagery Program (NAIP) aerial imagery, Landsat 5 imagery (and derivatives), ancillary data such as elevation (and derivatives), and previous NLCD data (Fry et al., 2011). Approximately 65,000 sample locations were photo-interpreted for percent tree canopy cover using NAIP imagery. These data and corresponding Landsat and ancillary data were used to develop a random forest model (Brieman, 2001) for each NLCD mapping zone (Homer and Gallant, 2001). Two versions of the NLCD percent tree canopy cover were developed: an analytical version and cartographic version. The analytical version is intended to be used for estimating average tree canopy cover in an area of interest and includes both percent tree canopy predictions and uncertainty around those predictions (Coulston et al., 2014). The cartographic version is intended to be used more as a visual backdrop in cartographic applications. Masking procedures and other post-processing procedures were used to reduce commission error and smooth seamlines between mapping zones. The 2011 NLCD percent tree canopy cover differs from the

2001 version primarily in the target definition of trees. In the 2001 version trees were considered to be > 5 m tall, while in the 2011 version trees were based on life-form with no height restriction. The 2011 percent tree canopy product is not designed to be directly comparable to the 2001 version.

Post-Processing And Product Description

Because NLCD components are produced separately, reassembly of these components into a final product is necessary. This process is fairly complex because it not only consists of many independent data layers for 2011 but also incorporates the right version of previous periods. In order to ensure NLCD consistency and direct comparison capability across time, earlier periods of NLCD (2001 and 2006) are re-versioned with the 2011 release. This re-versioning corrects minor inconsistencies with previous periods that would impede direct comparison. This assembly process started with the impervious layers. The previous 2001 impervious layer was updated with the edited impervious areas. The updated impervious change from 2001 to 2006 was added to the full 2001 impervious layer to create a new 2006 impervious layer, and the process was repeated for the 2011 impervious layer. The three completed impervious layers (2001, 2006, and 2011) were categorized into the four corresponding developed land cover types for each period.

The land cover is also assembled starting with the original NLCD 2001 land cover layer. The land cover in NOAA coastal areas was updated to NOAA's current version in all corresponding years. The previous developed land cover classes in both NOAA and NLCD areas were removed and replaced with the updated imperviousness product pixels, creating the "2011" edition of the 2001 impervious layer. These developed pixels were then applied to the 2001 land cover throughout the United States. In order to maintain direct linkage to the imperviousness product, developed pixels were applied to the land cover without further editing or processing. A "smart-eliminate" aggregation algorithm with a minimum mapping unit (MMU) of five 30-m pixels was applied to all other land cover classes besides urban, with an MMU of 12 pixels applied to cropland and hay/pasture pixels to complete the "2011" edition of NLCD's 2001 land cover. The same process was applied to create the "2011" edition of NLCD's 2006 land cover. NLCD 2006 land cover change pixels and updated impervious change pixels were directly applied to the 2001 land cover, and a smart eliminate of a five-pixel MMU for all land cover classes other than urban was again run to complete the creation of the "2011" edition of NLCD's 2006 land cover.

Assembly of the final 2011 land cover change pixels was implemented as an ongoing process during production. As each path/row was completed, results were checked and finalized and then used on adjacent path/rows as training data to develop consistency between path/rows. Following the completion of this process, the 2011 impervious change was then applied to the completed 2011 land cover change pixels to produce the updated "2011" edition of 2006 land cover to create NLCD 2011. A final five pixel "smart eliminate" MMU was again run on the completed 2011 land cover except for the urban class to produce the final product. NLCD 2011 products are represented across nine files, with an additional five files re-versioned for NLCD 2006 and two additional files re-versioned for NLCD 2001 (Table 1).

Table 1. NLCD 2011 product list with approximate zipped file sizes. This includes previous editions of NLCD which were revised as "2011" versions.

All NLCD 2011 Products (For the Conterminous United States)	NLCD 2011	NLCD 2006 (2011 Edition)	NLCD 2001 (2011 Edition)	File Size (zipped)
Land Cover	X	X	X	1.1 GB
Percent Developed Impervious	X	X	X	713 MB
Percent Tree Canopy Cover – Analytical Version	X			10.4 GB
Percent Tree Canopy Cover – Cartographic Version	X			3.2 GB
Land Cover Change, 2006 – 2011 (pixels identified as changed between NLCD 2006 (2011 version) and NLCD 2011)	X			128 MB
*Land Cover Change, 2001 – 2011 (pixels identified as changed between NLCD 2001 (2011 version) and NLCD 2011)	X			74 MB
Land Cover Change, 2001 – 2006 (pixels identified as changed between NLCD 2001 (2011 version) and NLCD 2006 (2011 version)		X		13 MB
Percent Developed Impervious change, 2006–2011 (pixels identified as changed between NLCD 2006 (2011 version) impervious and NLCD 2011 impervious)	X			66 MB
Percent Developed Impervious change, 2001–2006 (pixels identified as changed between NLCD 2001 (2011 version) impervious and NLCD 2006 (2011 version) impervious)		X		8 MB
Land Cover Change Index, 2006 – 2011 (identifies "from" and "to" land cover class values for changed pixels based on a matrix of all possible change combinations)	X			1.4 GB
*Land Cover Change Index, 2001 – 2011 (identifies "from" and "to" land cover class values for changed pixels based on a matrix of all possible change combinations)	X			1.4 GB
Land Cover Change Index, 2001 – 2006 (identifies "from" and "to" land cover class values for changed pixels based on a matrix of all possible change combinations)		X		1.4 GB

* This layer contains less overall change than the sum of 2001-2006 and 2006-2011 products because land cover change can transition twice in 10 years for the same pixel. When this occurs, the latest change class is given.

Results

A total of 464 Landsat path/rows were analyzed across CONUS for land cover and impervious surface change between 2006 and 2011. Image acquisition dates ranged from 05/04/2004 to 10/02/2007 for nominal 2006 imagery and from 02/05/2009 to 11/10/2011 for nominal 2011 imagery. One additional image date was selected for circa 2011 to aid in the 2011 classification protocol, with dates ranging from 04/17/2009 to 11/11/2011. Analyzed change products from 2006–2011 were harmonized to ensure direct change comparison with previous NLCD 2001 and 2006 products, and these products (NLCD 2001 and 2006) were then re-released as the "2011" versions.

For the period 2006 to 2011, 98.23% and 1.77% of CONUS land cover were mapped as unchanged and changed, respectively (Table 2). The largest net losses occurred in the evergreen and deciduous forest classes, covering 20,547 km^2 and 10,491 km^2, respectively. The largest net gains occurred in the shrub/scrub and grassland/herbaceous classes at 17,657 km^2 and 10,005 km^2, respectively (Table 2, Figure 1).

Similar rates of no change (98.37%) and change (1.63%) occurred during the 2001 to 2006 period (Table 2). The largest net losses again occurred in the evergreen (19,905 km^2) and deciduous forest (5,590 km^2) classes, and the largest net gains occurred in the shrub/scrub 13,495 km^2) and grassland/herbaceous (11,655 km^2) classes. The overall change rate for the cumulative period 2001 to 2011 was 2.96% (Table 2, Figure 1).

The total land extent of urban impervious surface for CONUS expanded from 6.04% of the total CONUS area in 2001 to 6.2% in 2006 and 6.34% in 2011. For the period 2001–2006, 7.62% of this impervious surface extent increased in density (changed from a lower impervious value to a higher value), with 4.92% of the impervious extent increased in density during 2006–2011 (Figure 2).

Table 2. Net land cover gains and losses by land cover class across CONUS for the periods 2001–2006, 2006–2011, and 2001–2011 in square kilometers (km2). Net and percentage change for each 5-year time period do not directly add up to the 10-year net change numbers because some land cover categories change more than once during a 10-year period. Numbers in parenthesis represent the numeric name of the class.

	2001 to 2006 Net Gain/ Loss (km²)	2006 to 2011 Net Gain/ Loss (km²)	2001 to 2011 Net Gain/ Loss (km²)
Open Water (11)	-2,268	3,941	1,673
Perennial Ice/Snow (12)	0	0	0
Developed-Open Space (21)	2,563	821	3,383
Developed-Low Intensity (22)	2,689	1,748	4,437
Developed-Medium Intensity (23)	5,441	3,609	9,049
Developed-High Intensity (24)	1,975	1,453	3,427
Barren Land (31)	2,141	567	2,708
Deciduous Forest (41)	-5,590	-10,491	-16,082
Evergreen Forest (42)	-19,905	-20,547	-40,452
Mixed Forest (43)	-4,642	-5,455	-10,097
Shrub/Scrub (52)	13,495	17,657	31,153
Grassland/Herbaceous (71)	11,655	10,005	21,660
Pasture/Hay (81)	-6,356	-3,354	-9,710
Cultivated Crops (82)	-2,312	696	-1,616
Woody Wetlands (90)	-447	-2,608	-3,054
Herbaceous Wetlands (95)	1,562	1,959	3,521
TOTAL	**83,039**	**84,912**	**162,024**
Percent of U.S. that changed	**1.63%**	**1.77%**	**2.96%**

Discussion

NLCD data have remained relevant by sustaining continuous product improvement through ongoing research and development (Homer et al., 2004; Xian et al., 2009; Xian et al., 2010; Jin et al., 2013; Wickham et al.. 2014) and by providing users with products that are regionally and nationally consistent across space and time. Products are also frequently updated (Homer et al., 2007; Fry et al., 2011) and regularly validated (Stehman et al., 2003; Wickham et al., 2010; Wickham et al., 2013). The updated methods employed for NLCD 2011 production resulted in products that include more comprehensive land cover change detection, less commission error, and a reduced production time.

With the release of NLCD 2011, NLCD now provides a decade of land cover change for CONUS over three time periods. A fundamental concept of geodesy is that Earth surface measurements need to be updated routinely because the forces that shape the Earth's surface are constantly changing (Torge, 2001). The same is true for land cover (Wickham et al., 2014), and understanding the spatiotemporal patterns, causes, and consequences of land cover change is now considered a scientific discipline that requires routine measurement (Gutman et al., 2012; Turner et al., 2007). For CONUS, NLCD has shown that 1) change was relatively constant over the two five-year intervals that comprise the 10-year observation period; 2) there has been an non-uniform spatial pattern of change, with change concentrated in the southeastern United States and localized sections of the Pacific Northwest and Northeast (Figure 3); and 3) forests have experienced the highest net losses (-66,631 km^2) through conversion largely to shrub/scrub and grassland/herbaceous (+52,813 km^2), a pattern documented in previous decades (Sleeter et al., 2013).

NLCD 2011 impervious surface products document the continued expansion of the urban footprint extent over the 10-year period and suggest that the rate of urban expansion was not constant over the two five-year intervals. Urban impervious extent increased from 6.04% of the CONUS surface area in 2001 to 6.2% in 2006, but this nearly 0.2% increase declined to approximately 0.1% between 2006 and

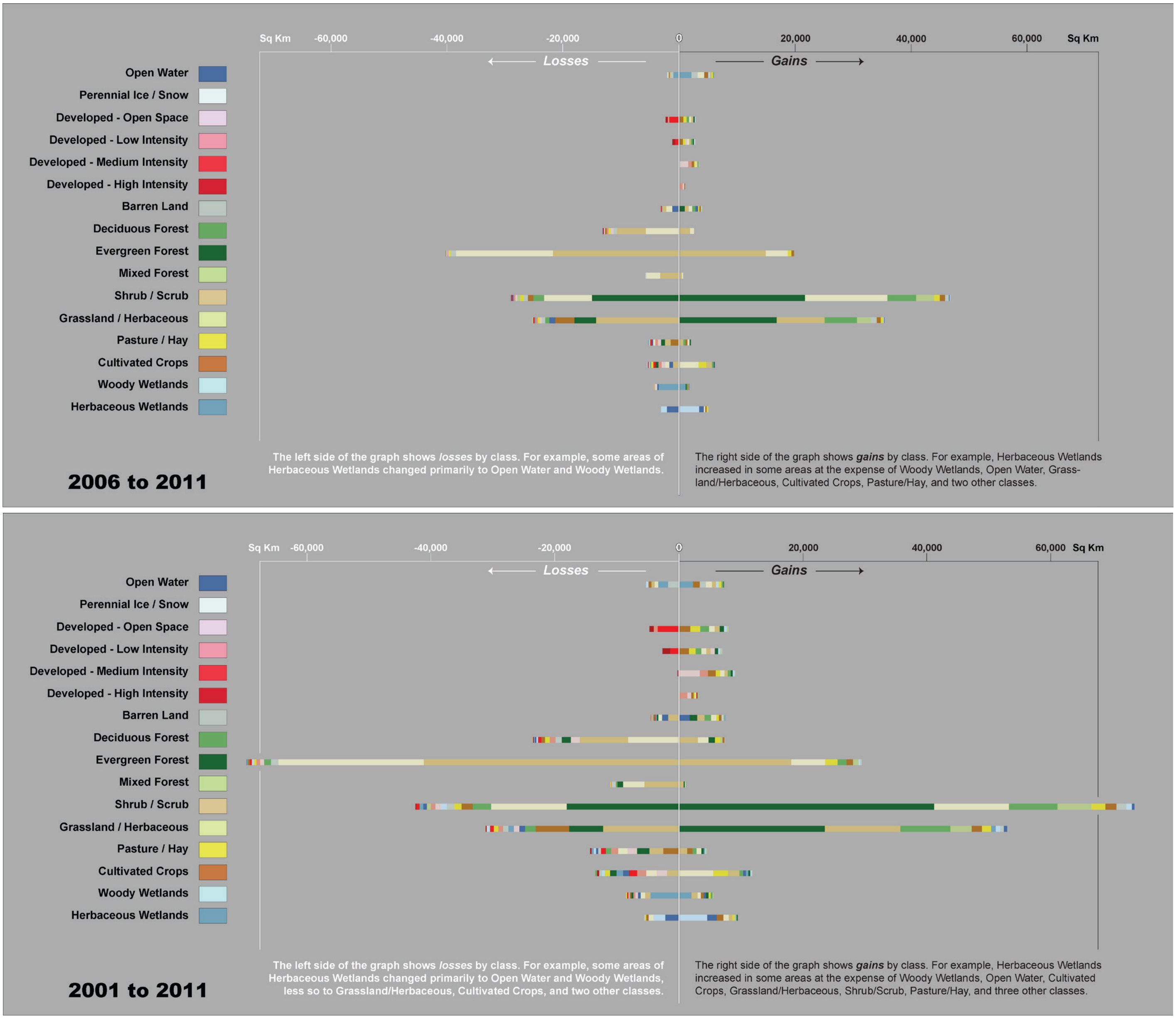


Figure 1 (above). Source and magnitude of land cover class gain and loss for each NLCD land cover class for 2006–2011 and 2001–2011. The length of the bars represents the percent change relative to the total change area with the equivalent area in square kilometers annotated at the end of each bar. Proportions of each bar are colored by the proportional contribution from each land cover class to the total loss or gain. The left side of the chart (white numbers) represents class loss magnitudes and presents which classes a class loss was converted "to" in 2006 or 2011, while the right side of the chart (black numbers) represents class gain magnitudes and presents which classes a class gain was converted "from" in 2001 or 2006.

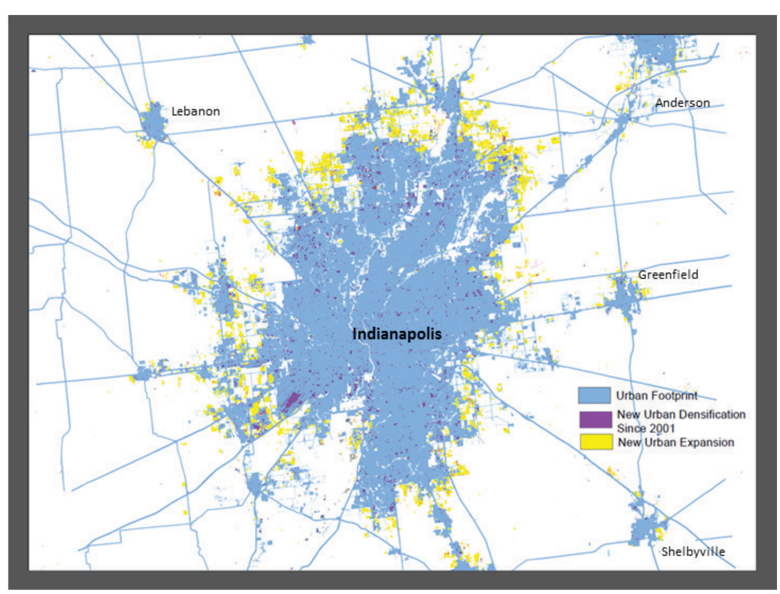


Figure 2 (right). Growth of urban impervious surface for Indianapolis, Indiana, between 2001 and 2011 from the National Land Cover Database. Blue represents the total urban footprint for the city, purple areas show where urban impervious surface increased in density over 10 years, and yellow areas represent expansion of the urban impervious extent into previously nonurban areas over 10 years.

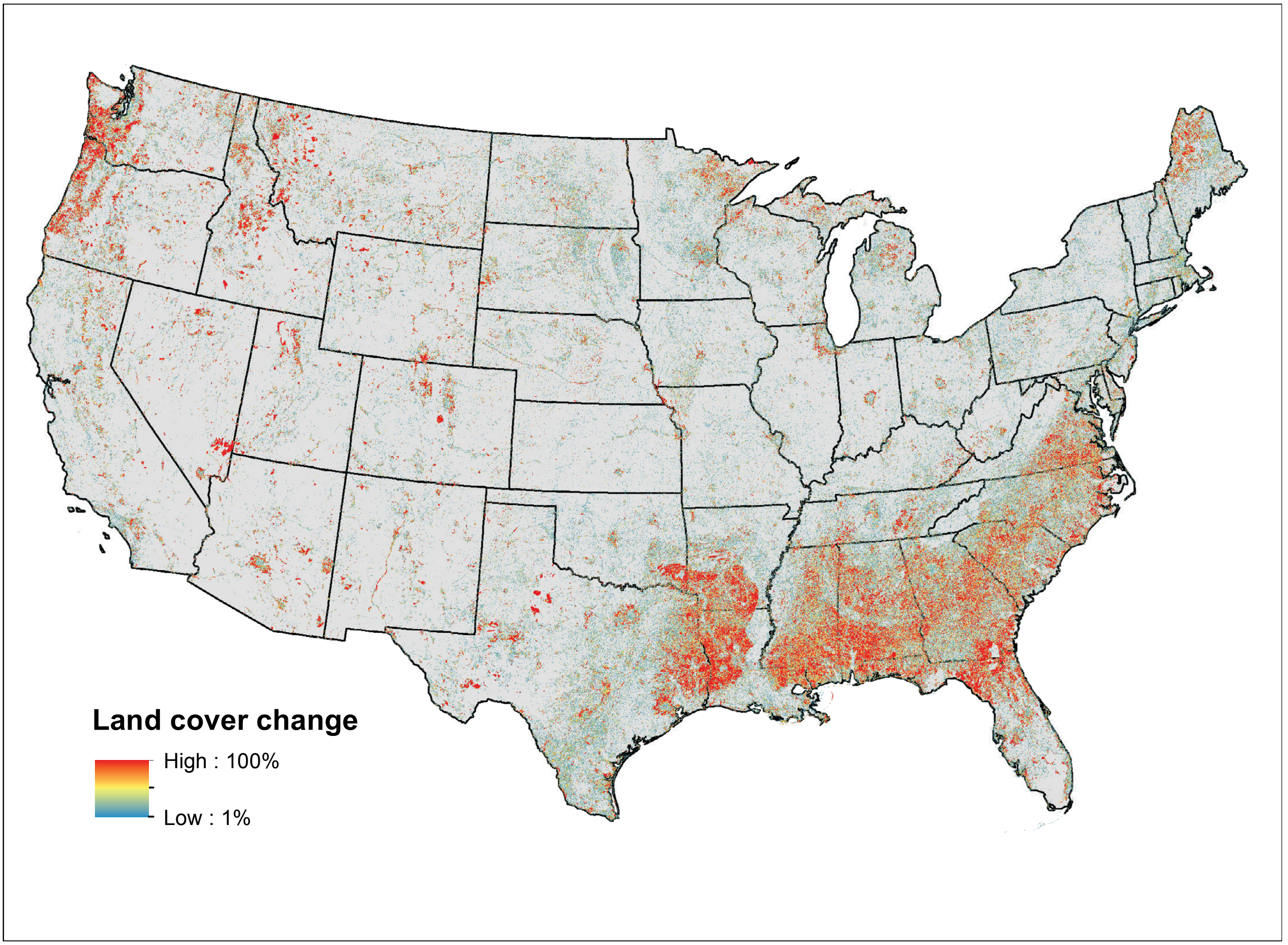


Figure 3. The geospatial distribution and magnitude of land cover change in the conterminous United States between 2001 and 2011 in 1% intervals. Change was calculated as the proportion of 30 m change pixels in a 1 km x 1 km grid. White areas represent places with no land cover change, green tones represent areas with low proportions of land cover change, and red tones areas of high proportional change. Primary land cover change drivers appear to be wildland fire, forest harvesting, urbanization, agricultural conversion, and forest disease.

2011 (Figure 2). This slower expansion of urban growth is also reflected in the densification change rates of the imperviousness classes within the urban footprint—only 4.99% of all impervious pixels increased in density from 2006 to 2011, in contrast to 7.62% of pixels increased in density from 2001 to 2006. The reduction of urban growth from 2001–2006 to 2006–2011 may be partly attributable to the U.S. recession that began in 2008. Although urban growth was expanding, many newly developed areas retained (or established) tree canopy cover. In an example of how the NLCD tree canopy cover product can complement analysis, this product reveals new urban areas converted to the NLCD land cover open space developed class between 2006 and 2011 had an average tree canopy of 22.8%. Similarly, new areas of the low intensity urban class had an average percent tree canopy cover of 14.6% and new areas of the medium intensity urban class had an average of 9.9%.

A formal accuracy assessment of the NLCD 2011 land cover change product is currently underway, with interpretation of sample points expected to be completed early in 2015. Accuracy protocols will analyze the decade of change information from all three NLCD periods and will build on past methods developed for NLCD 1992 and NLCD 2001 (Stehman et al., 2003; Wickham et al., 2010; Wickham et al., 2013) and will depend on independent analysis of high-resolution reference data sources representing the historical date of the products.

NLCD 2011 for Alaska is also now available and includes statewide products of land cover and impervious surface, as well as land cover and impervious surface change between 2001 and 2011. A 2011 version of the tree canopy cover product will soon be available for southeast Alaska. NLCD 2011 land cover products for Hawaii and Puerto Rico will be available later in 2015. The next generation of NLCD is under current research and development and will be produced in 2016. Next generation research to improve accuracy, produce additional periods of NLCD back to the mid-1980s and add additional products will all be considered for the NLCD 2016 product suite.

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