

# Northeast Regional Land Cover Change Report 1996–2010



## About This Report

The *Northeast Regional Land Cover Change Report, 1996–2010*, is one in a series of regional reports that summarize the land cover status of the coastal United States in 2010 and land cover changes over the previous decade and a half. This report provides an overview of key findings using reader-friendly maps and graphics.

## About the Coastal Change Analysis Program

Satellite imagery is a great way to get a big-picture view of the cumulative impacts of changes along our nation's coasts. The Coastal Change Analysis Program (C-CAP) within the National Oceanic and Atmospheric Administration (NOAA) Office for Coastal Management produces nationally standardized land cover and land cover change information for coastal regions of the United States, including the Northeast, using multiple dates of satellite imagery. C-CAP's data products provide inventories of coastal intertidal areas, wetlands, and adjacent uplands at approximately five-year intervals. This information helps to support decision-making about coastal resources and communities. The raster-based maps generated by C-CAP serve as a baseline for studies of coastal changes and evaluations of past or future management actions.

To learn more about the C-CAP data products used in this report and to access the data sets, please visit [www.coast.noaa.gov/digitalcoast/data/ccapregional](http://www.coast.noaa.gov/digitalcoast/data/ccapregional).

## About the NOAA Office for Coastal Management

NOAA's Office for Coastal Management works at the center of the nation's coastal management efforts. From implementing the National Coastal Zone Management Program to providing technical assistance to coastal communities through the Digital Coast, the organization strives to help the nation's coastal communities prosper in the face of numerous natural and man-made challenges. To learn more, visit the website at [www.coast.noaa.gov](http://www.coast.noaa.gov).



# INTRODUCTION



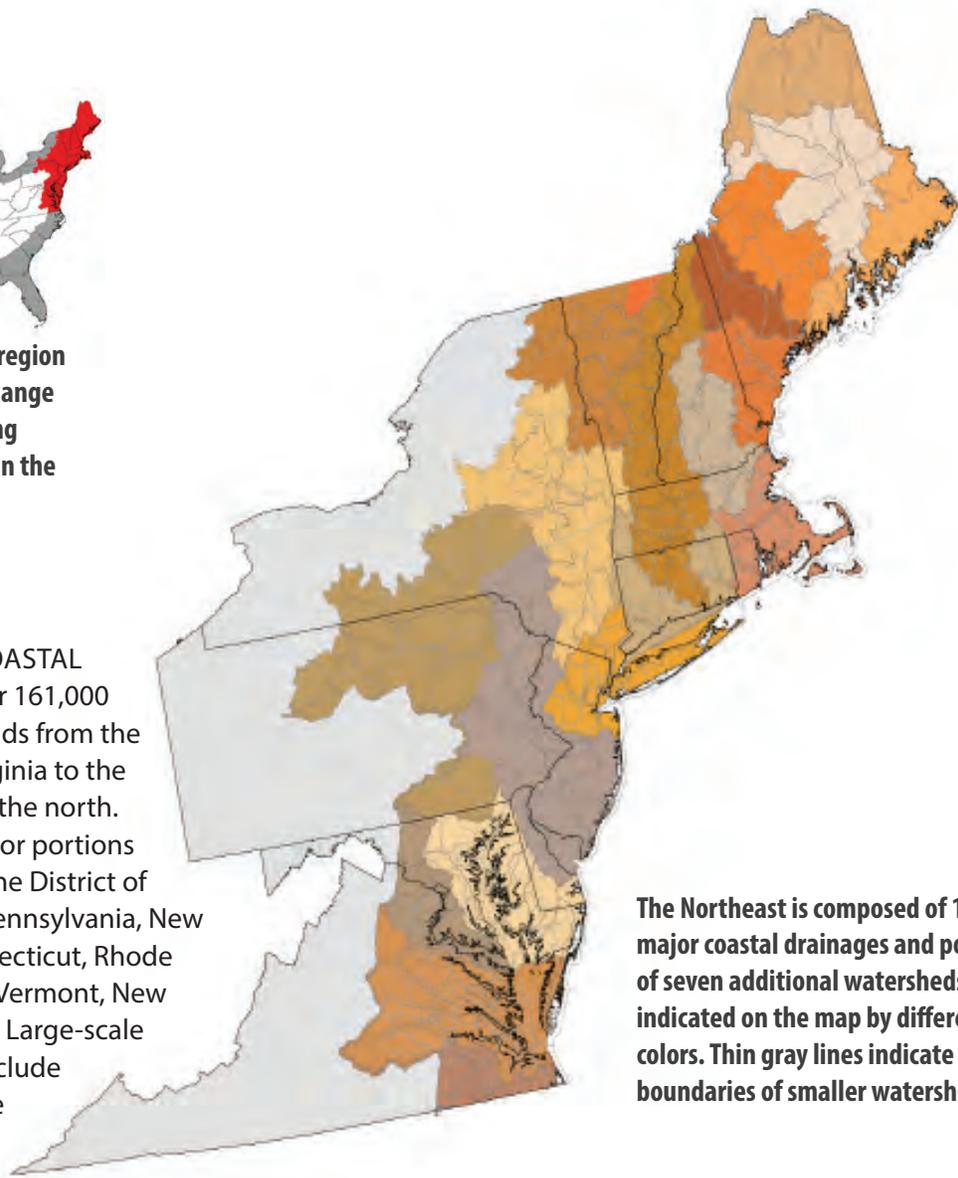
**Location of the Northeast region (red) within the Coastal Change Analysis Program's mapping coverage area (dark gray) in the contiguous United States.**

**T**HE NORTHEAST COASTAL REGION covers over 161,000 square miles and extends from the southern border of Virginia to the border with Canada in the north. The region includes all or portions of Virginia, Maryland, the District of Columbia, Delaware, Pennsylvania, New Jersey, New York, Connecticut, Rhode Island, Massachusetts, Vermont, New Hampshire, and Maine. Large-scale geographic features include the Gulf of Maine, Cape Cod Bay, and estuarine systems such as Long

Island Sound, the New York Bight, Delaware Bay, and Chesapeake Bay. The geology of the region includes rocky shorelines, wetlands, beach–dune complexes, barrier islands with extensive intertidal and freshwater wetlands, and low-lying sandy coastal plains, along with riparian habitat.

The Northeast coastal region is rich with history, culture, and economic opportunities and is home to 70 million people, with 58 million living within coastal counties (and the District of Columbia). These counties contain 40% of the total land area. The region has significant coastal-dependent industries, including tourism and recreation and marine transportation. Located in the Northeast are four of the nation's ten largest metropolitan areas (including the largest, New York City), three of the top five U.S. commercial fishing ports (value of fish landed), and five of the nation's top twenty cargo ports (international cargo volume).

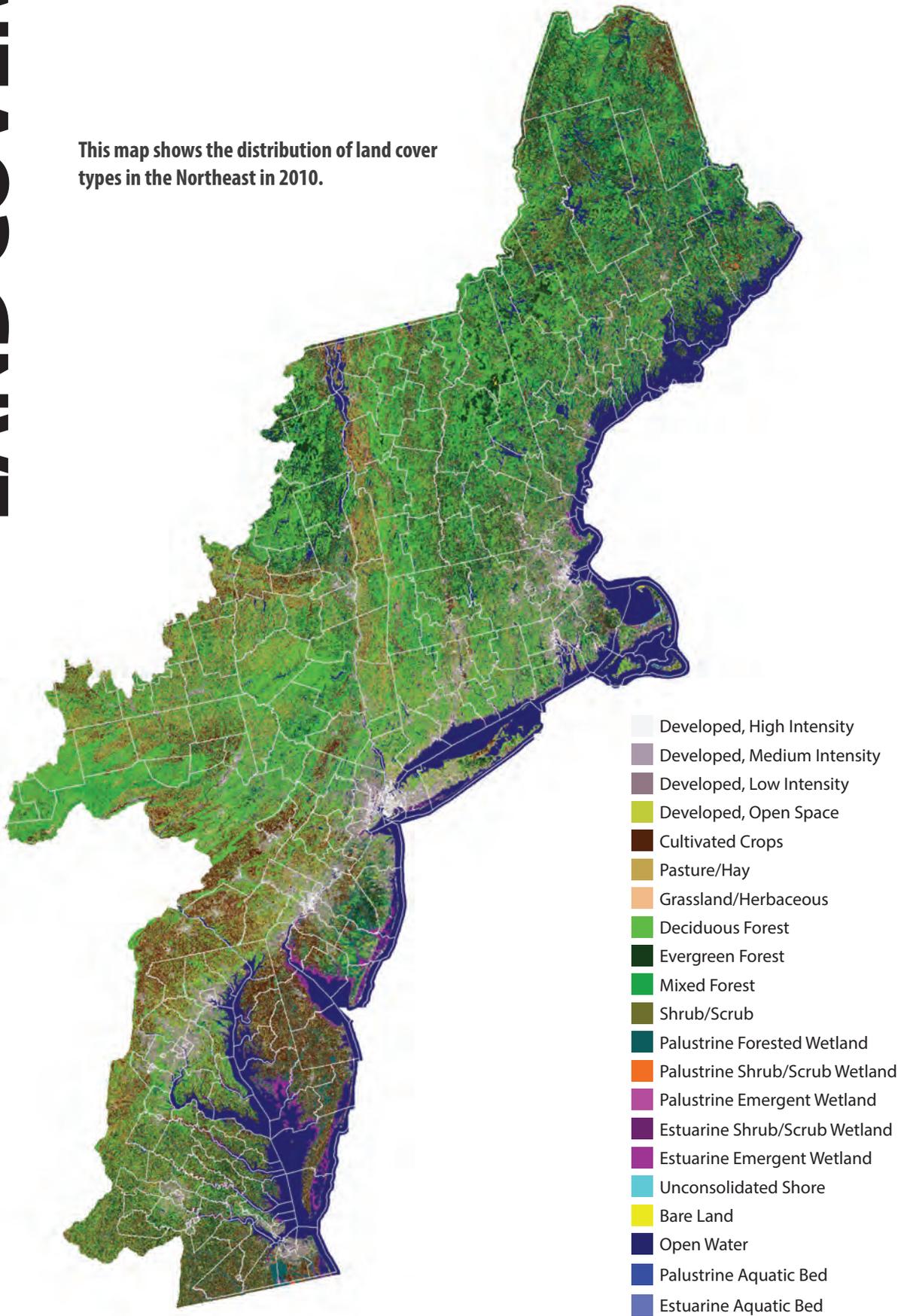
Many types of land cover, such as forest, grassland, and shrub/scrub, occur in the Northeast, and the amount of each land cover type changes over time. Using images and data collected by satellites, NOAA's Coastal Change Analysis Program (C-CAP) measured the area of each land cover type gained or lost from 1996 to 2010. In this report, 21 land cover classes are grouped into eight general categories: developed, agriculture, grass, shrub, upland forest, wetland, barren, and water.



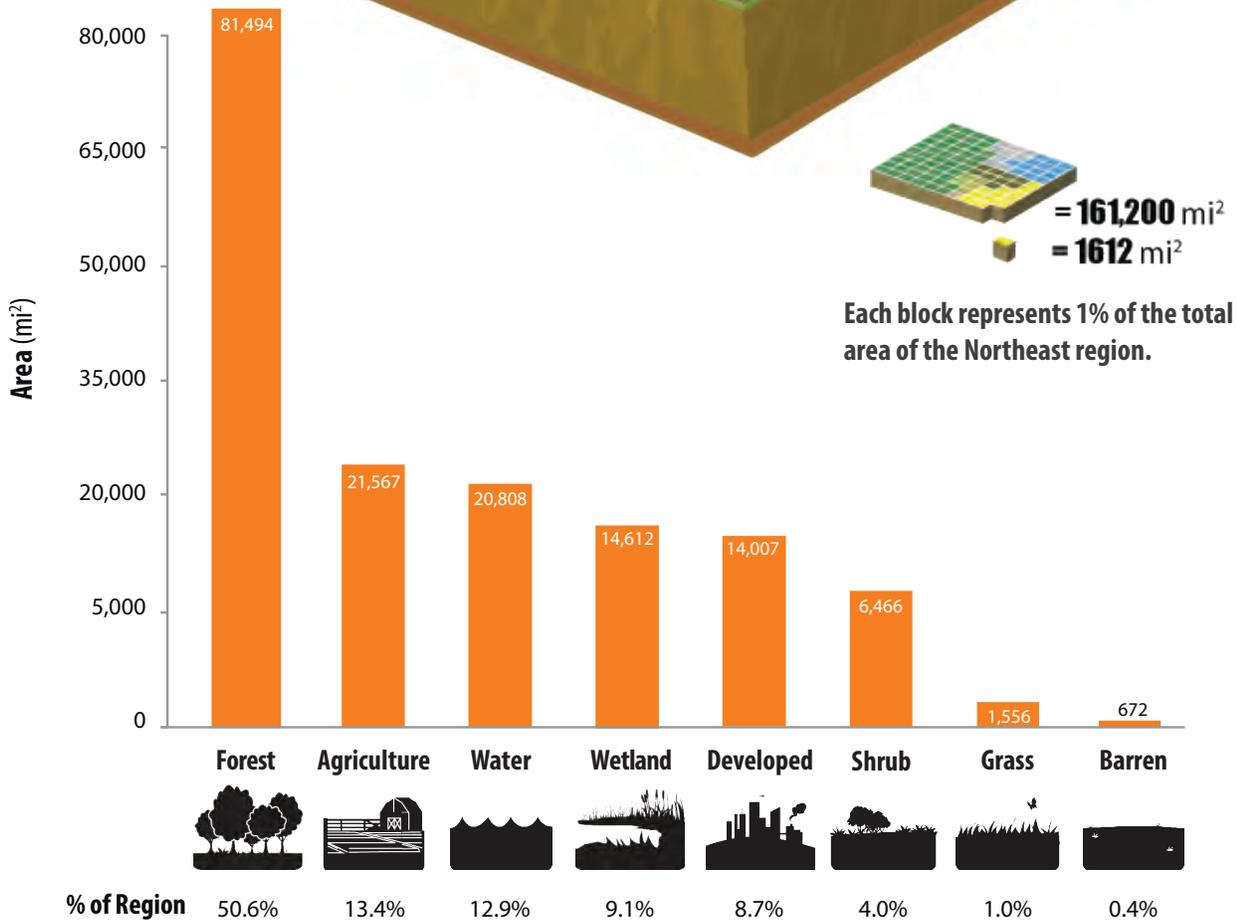
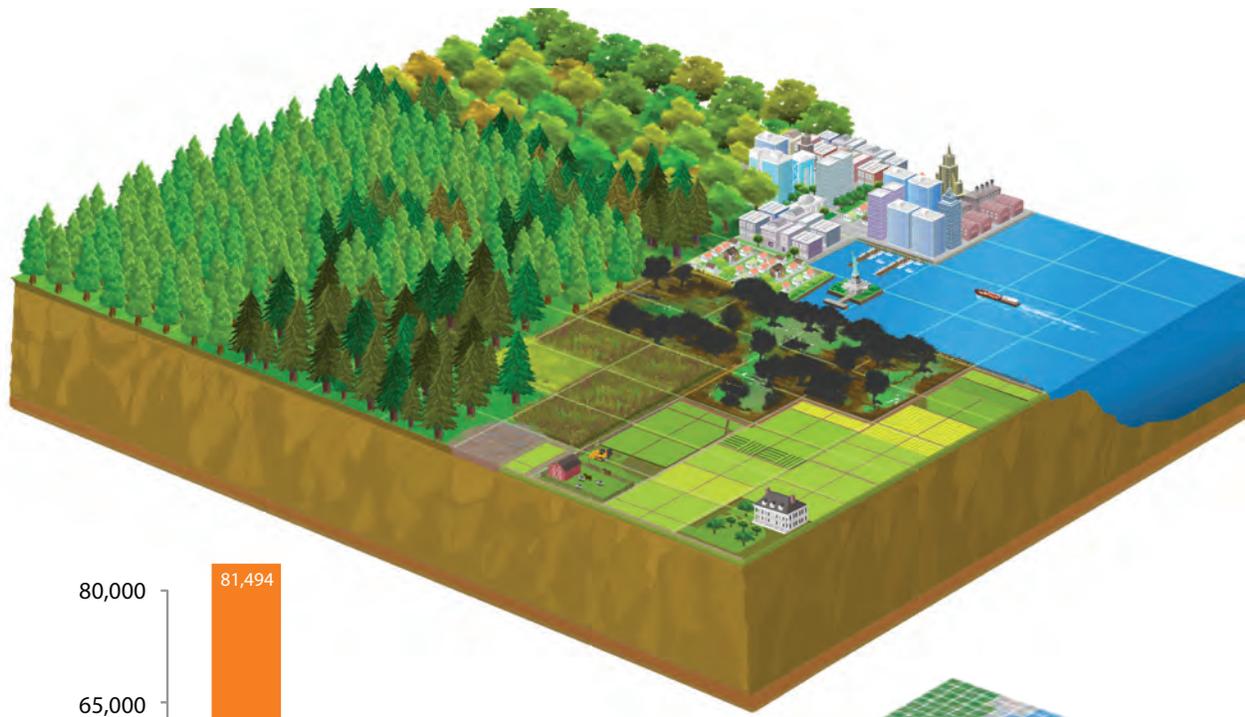
**The Northeast is composed of 17 major coastal drainages and portions of seven additional watersheds, indicated on the map by different colors. Thin gray lines indicate boundaries of smaller watersheds.**

# LAND COVER

This map shows the distribution of land cover types in the Northeast in 2010.



**I**N 2010, UPLAND FOREST (51%), AGRICULTURE (13%), AND WATER (13%) were the most common categories of land cover in the region, accounting for approximately 77% of the area. The next most common cover types were wetlands (9%), development (9%), and shrub (4%). Less than 1% of the area was classified as grassland or barren.

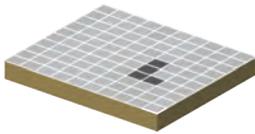


The 21 land cover classes in the Northeast region have been grouped into eight major categories that are displayed in the map graphic to highlight their relative distribution in 2010. More detailed information about these eight categories is displayed in the bar chart.

### TOTAL CHANGE IN LAND COVER

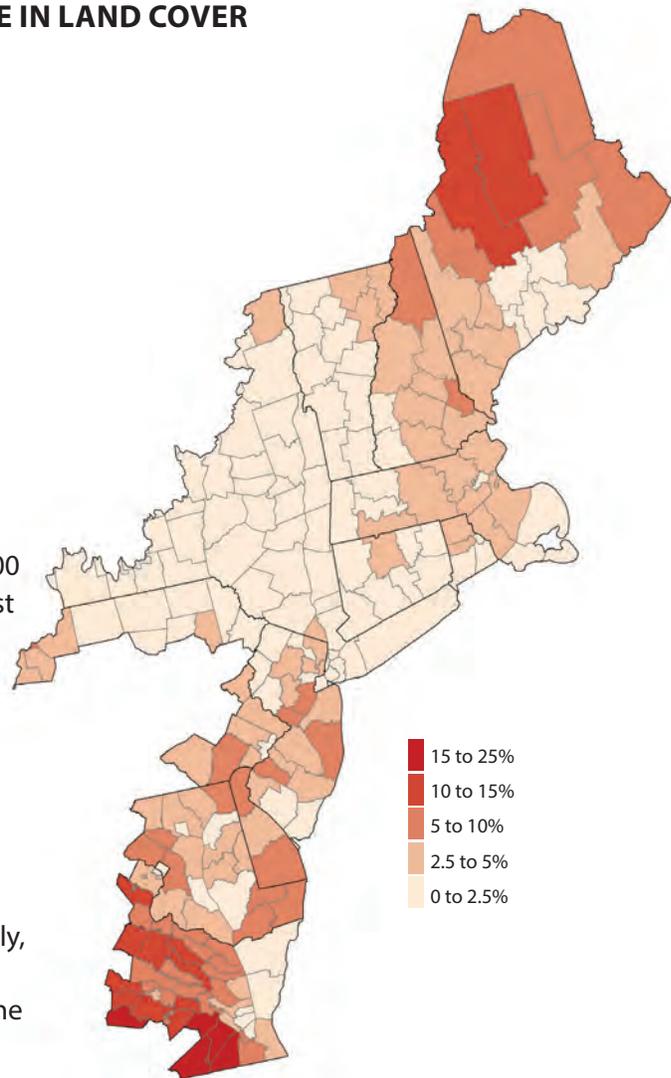
**AREA OF CHANGE**  
7,200 square miles

**4% OF REGION**

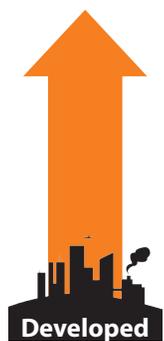


**F**ROM 1996 TO 2010, LAND COVER changed on 7,200 square miles, or just more than 4%, of the Northeast region. Areas of change were most common in southwestern portions of Virginia, in the Maine North Woods, and in the counties surrounding Boston and along the Washington-Baltimore-New York corridor. Much of this change is associated with silviculture, or timber management, activities, but a significant amount of development also occurred in the region.

With gains of 1,172 and 1,131 square miles, respectively, developed and shrub were the two land covers with the greatest net increases in area. Upland forest had the largest net decrease (2,637 square miles).



**+1,172 mi<sup>2</sup>**



**+1,131 mi<sup>2</sup>**



**+471 mi<sup>2</sup>**



**+138 mi<sup>2</sup>**

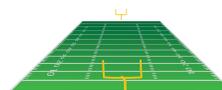


**+9 mi<sup>2</sup>**



**Total Area of Change Equivalent to**

**3,485,057**  
Football Fields



1 Football Field Every



**2 minutes**



**-90 mi<sup>2</sup>**



**-193 mi<sup>2</sup>**



**-2,637 mi<sup>2</sup>**

Net change per land cover category from 1996 to 2010. Arrows indicate the net loss or gain in each land cover category.

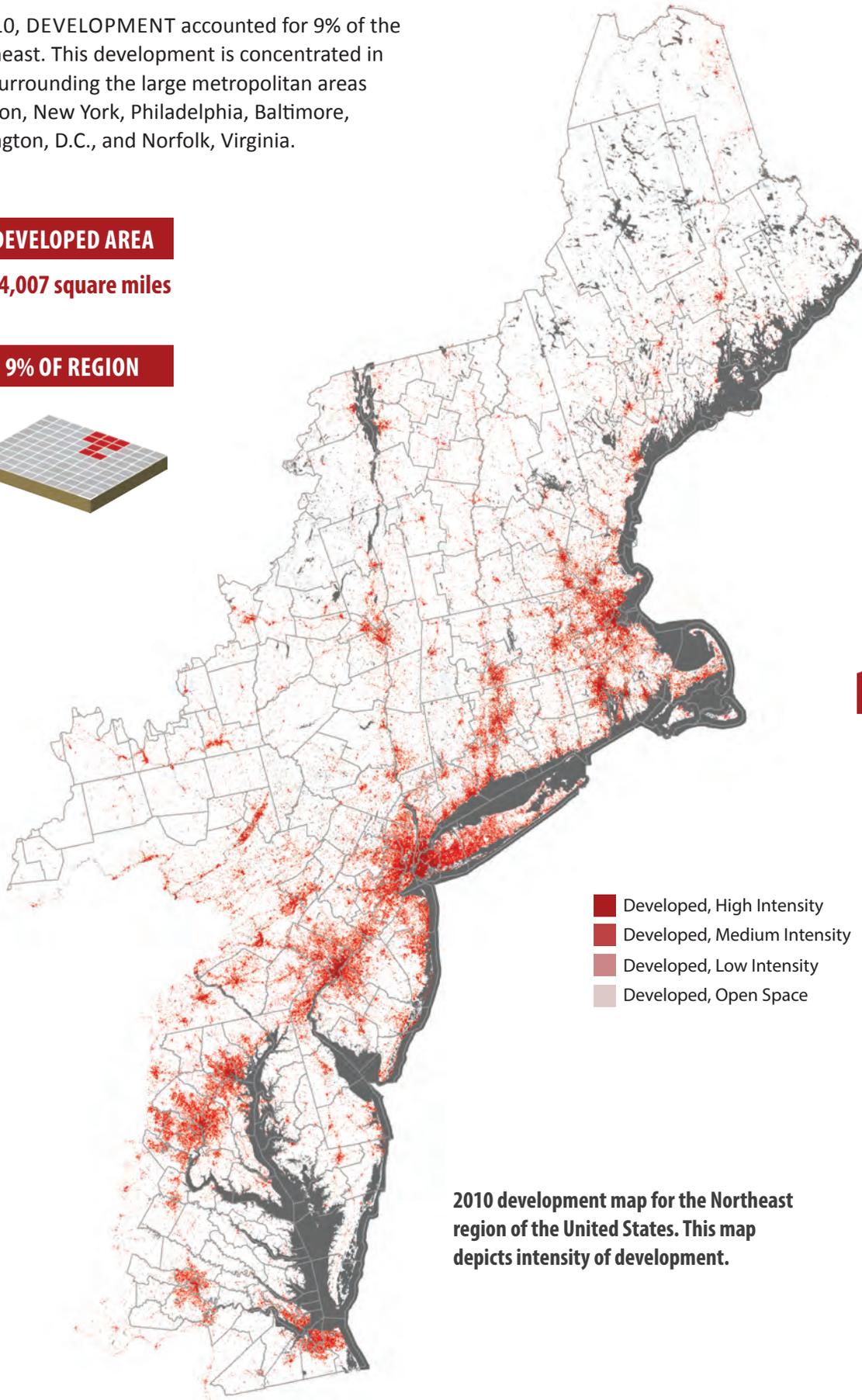
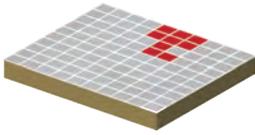


**I**N 2010, DEVELOPMENT accounted for 9% of the Northeast. This development is concentrated in areas surrounding the large metropolitan areas of Boston, New York, Philadelphia, Baltimore, Washington, D.C., and Norfolk, Virginia.

**DEVELOPED AREA**

**14,007 square miles**

**9% OF REGION**



- Developed, High Intensity
- Developed, Medium Intensity
- Developed, Low Intensity
- Developed, Open Space

**2010 development map for the Northeast region of the United States. This map depicts intensity of development.**

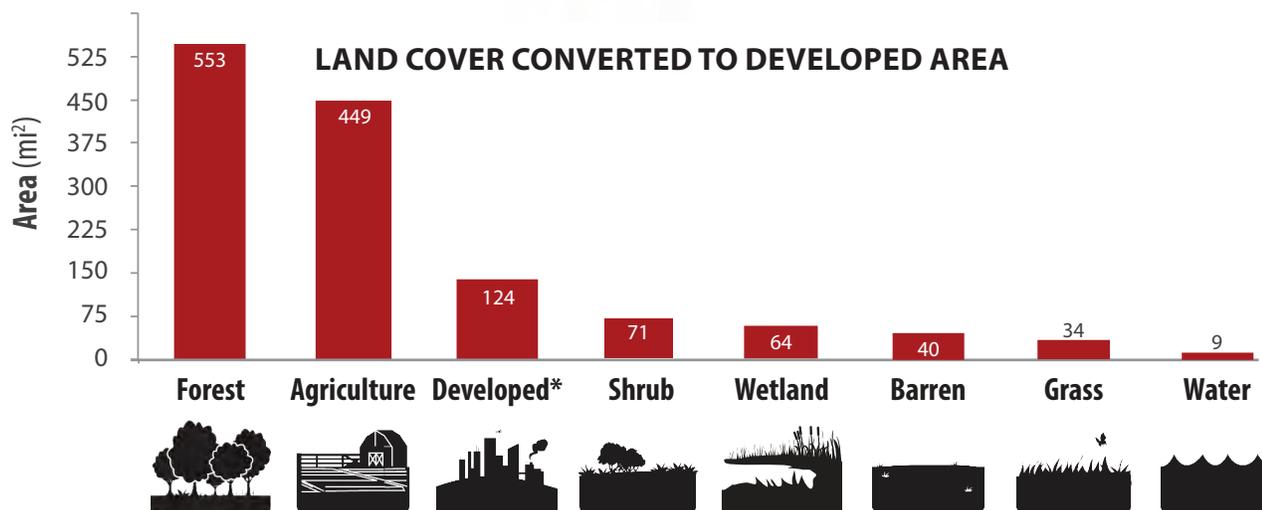
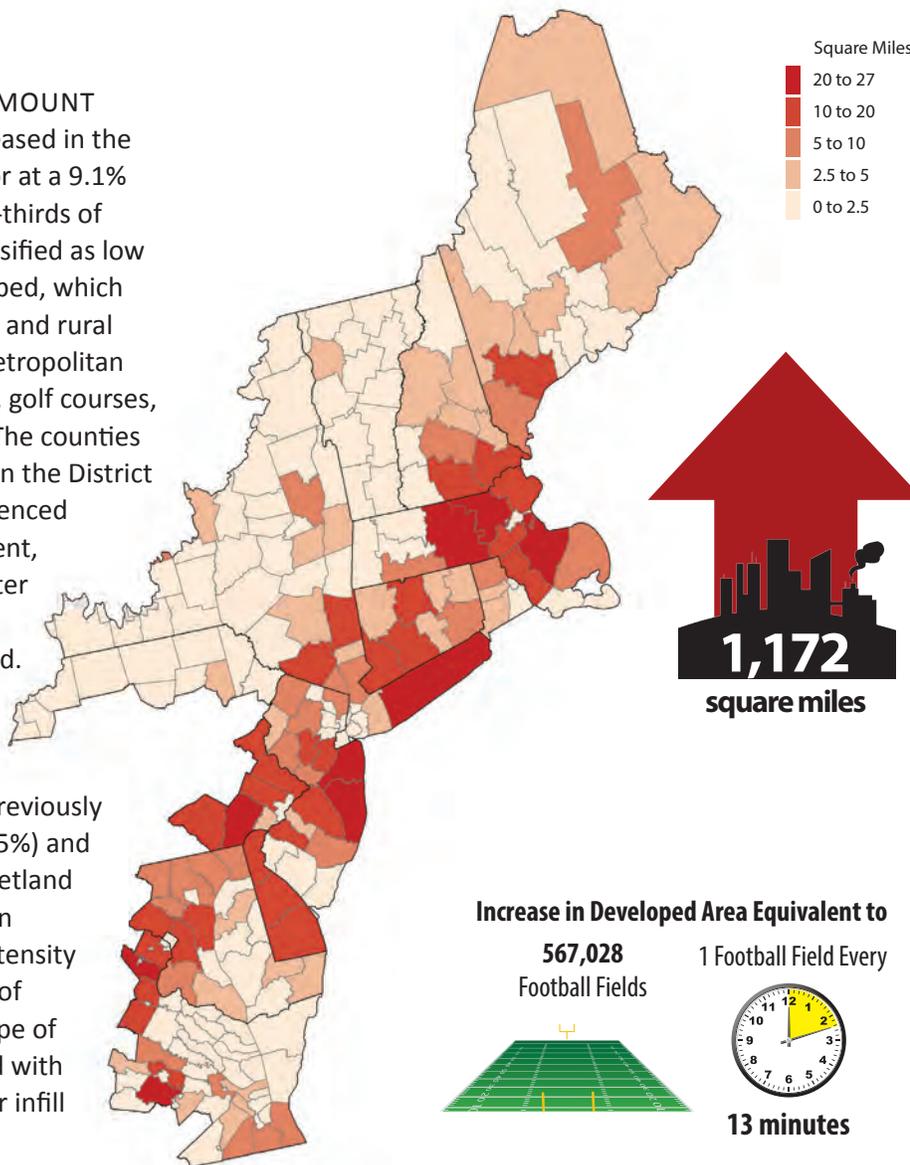
# DEVELOPED



### INCREASE IN DEVELOPED AREA

**F**ROM 1996 TO 2010, THE AMOUNT OF DEVELOPED AREA increased in the region by 1,172 square miles, or at a 9.1% rate of growth. More than two-thirds of this new development was classified as low intensity or open space developed, which typically includes the suburban and rural neighborhoods surrounding metropolitan areas and the associated parks, golf courses, and housing with large lawns. The counties making up the corridor between the District of Columbia and Boston experienced the bulk of this new development, particularly counties on the outer edges of these metropolitan areas as development expanded.

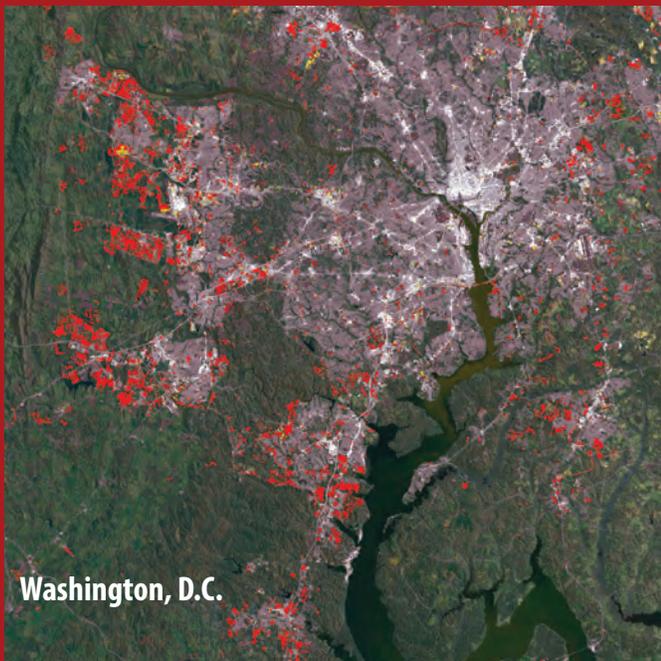
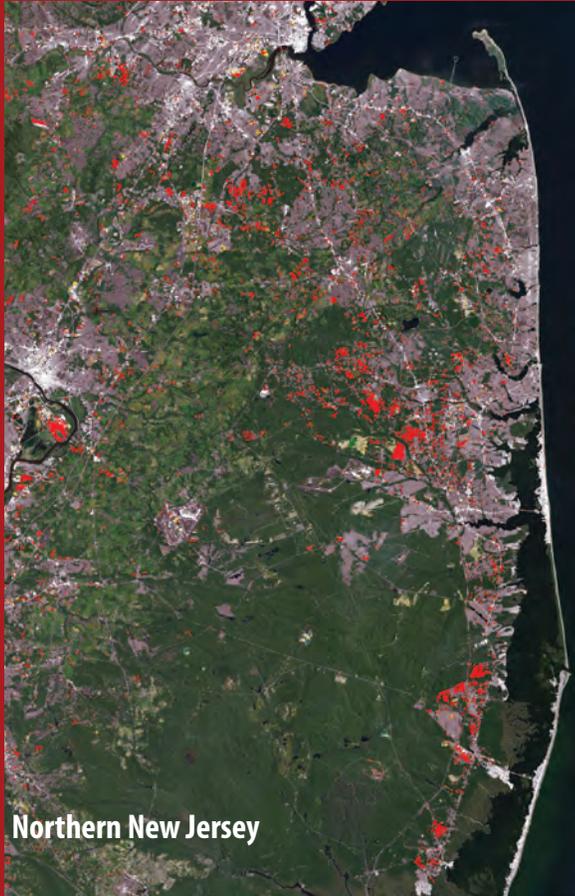
New development across the Northeast during the 14-year time period came from lands previously categorized as upland forest (45%) and agriculture (37%). Shrub and wetland cover types each contributed an additional 5%. Development intensity increased on 124 square miles of already developed land; this type of change is commonly associated with increasing density of housing or infill development within city limits.



This bar graph shows the area of each land cover that was converted to development between 1996 and 2010.

\* Increases in development intensity

## HIGHLIGHT: METROPOLITAN DEVELOPMENT TRENDS

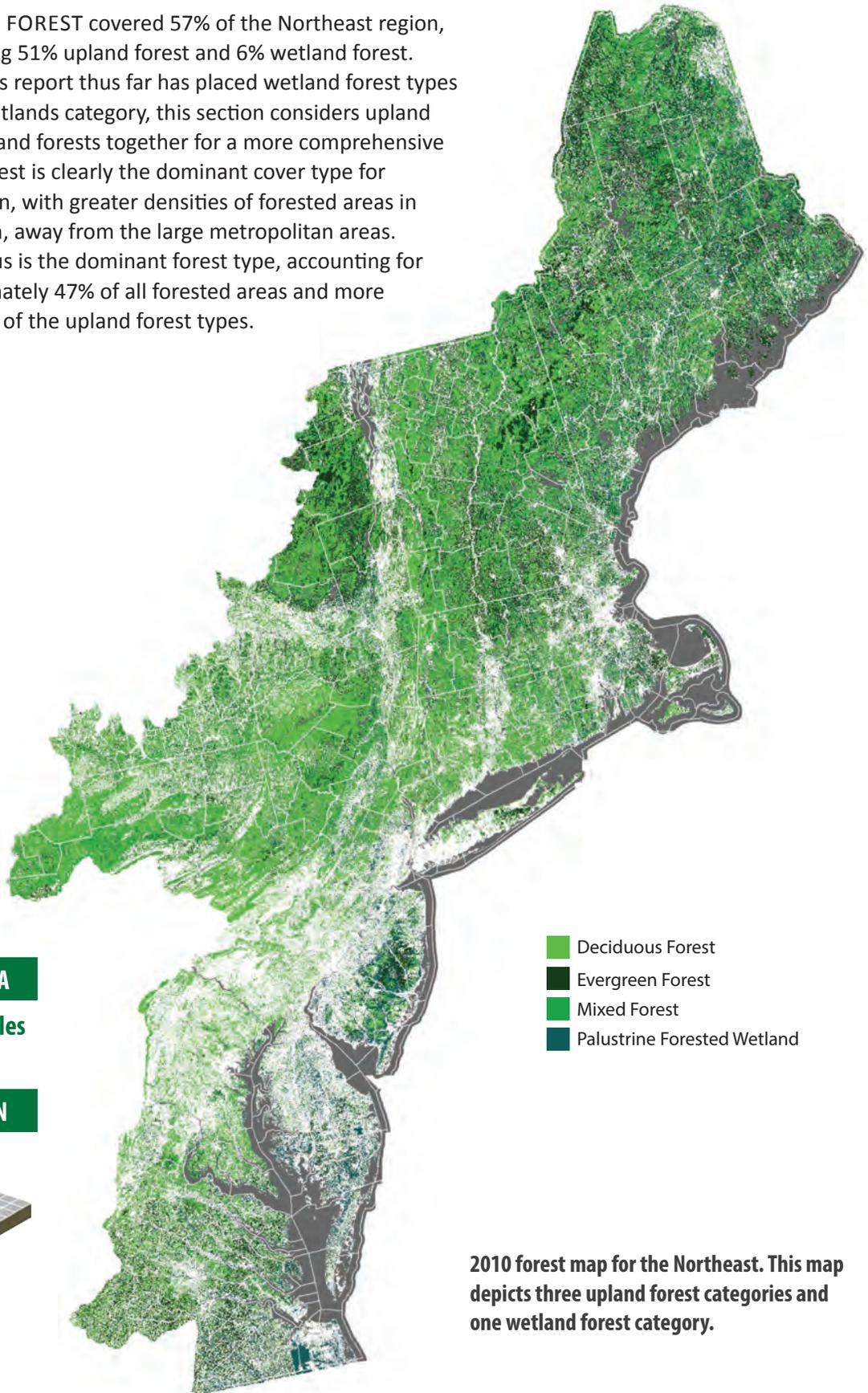


■ Pre-1996 High Intensity   ■ Pre-1996 Moderate Intensity   ■ Increased Intensity   ■ New Development

These images of large metropolitan areas within the Northeast region show patterns of new development (red) and increased density or infill development (yellow). This development often forms a halo pattern around a preexisting city core, reflecting the expansion of major roads and population growth away from the downtown. Background images: Esri

# FOREST

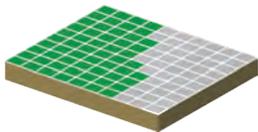
IN 2010, FOREST covered 57% of the Northeast region, including 51% upland forest and 6% wetland forest. While this report thus far has placed wetland forest types in the wetlands category, this section considers upland and wetland forests together for a more comprehensive view. Forest is clearly the dominant cover type for the region, with greater densities of forested areas in the north, away from the large metropolitan areas. Deciduous is the dominant forest type, accounting for approximately 47% of all forested areas and more than half of the upland forest types.



**FORESTED AREA**

**91,602 square miles**

**57% OF REGION**



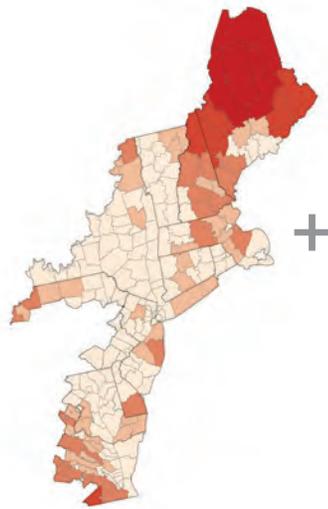
- Deciduous Forest
- Evergreen Forest
- Mixed Forest
- Palustrine Forested Wetland

**2010 forest map for the Northeast. This map depicts three upland forest categories and one wetland forest category.**



**FOREST AREA LOST**

3,977 square miles

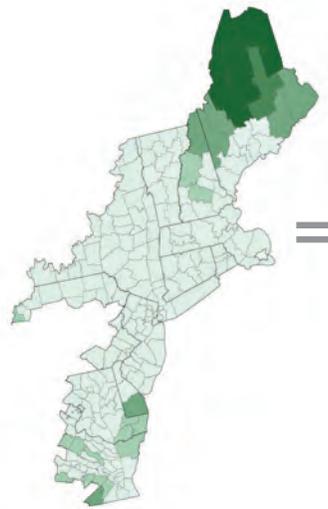


Square Miles

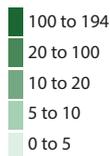


**FOREST AREA GAINED**

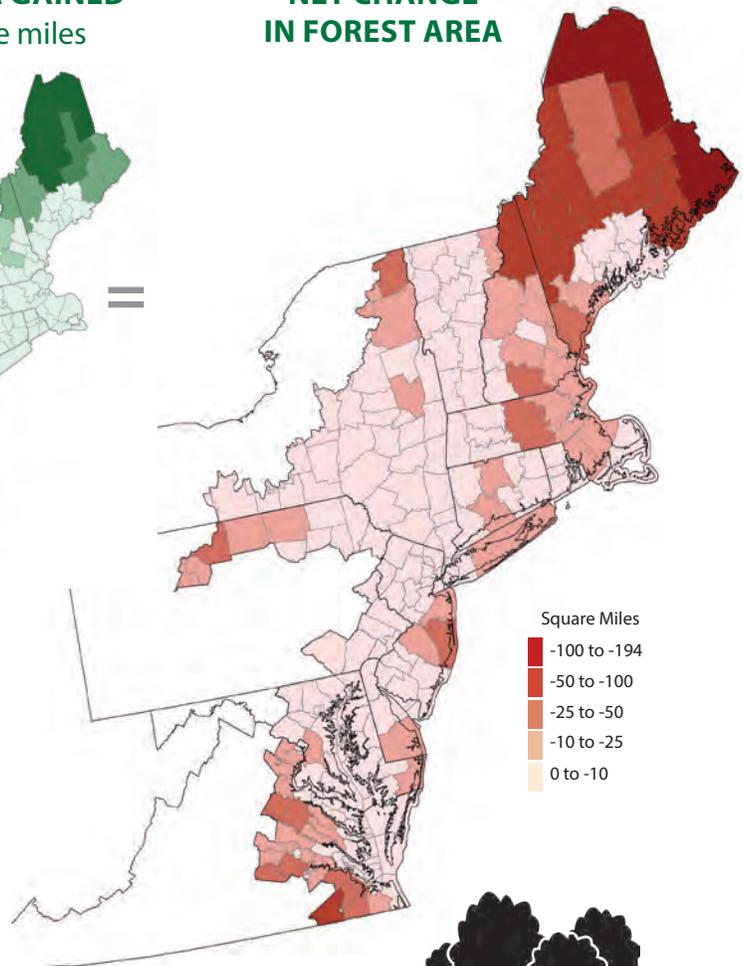
1,054 square miles



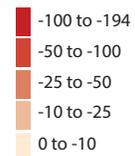
Square Miles



**NET CHANGE  
IN FOREST AREA**



Square Miles



**F**ROM 1996 TO 2010, 3,977 SQUARE MILES OF FOREST changed to other types of land cover (above left), and 1,054 square miles of other land cover changed to forest (above center). The result was a net loss of 2,923 square miles of forest. Most of these changes occurred in northern Maine.



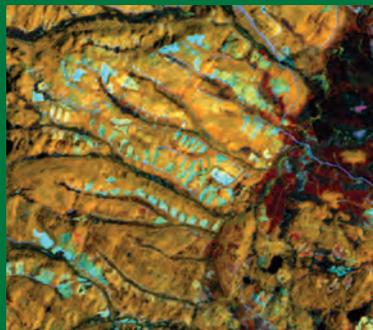
**2,923**

square miles



**Silviculture Activities in Forest Lands**

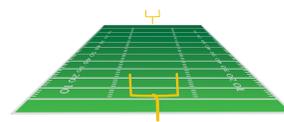
Timber activities often result in a patchwork appearance in the landscape. The map on the left shows the patterns of land cover change, including grass (beige), scrub (olive), evergreen (green), and bare road (yellow), resulting from timber harvest and regrowth. The image on the right is the satellite imagery of the same area.



**Decrease in Forest Area Equivalent to**

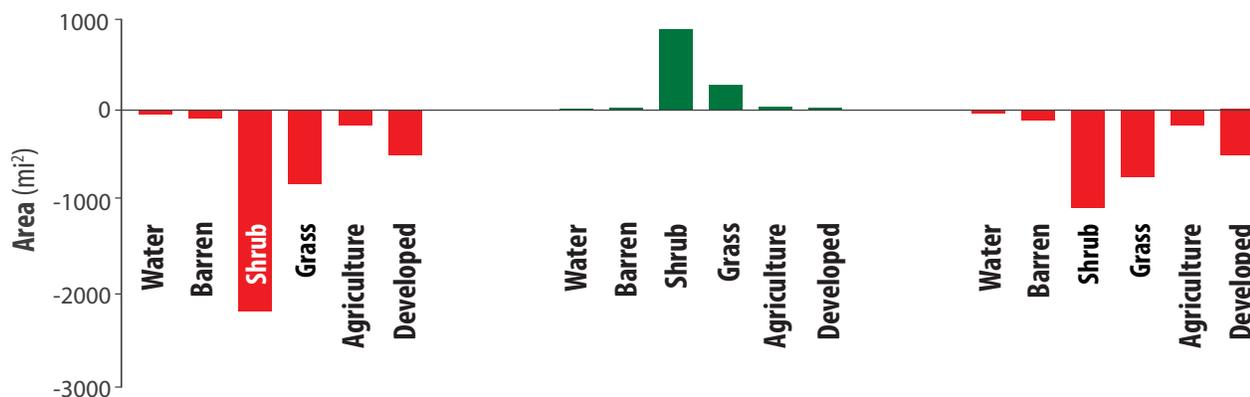
**1,414,732**  
Football Fields

1 Football Field Every



**5 minutes**

**FOREST LOST TO OTHER LAND COVER** + **FOREST GAINED FROM OTHER LAND COVER** = **NET CHANGE OF FOREST TO OTHER LAND COVER**



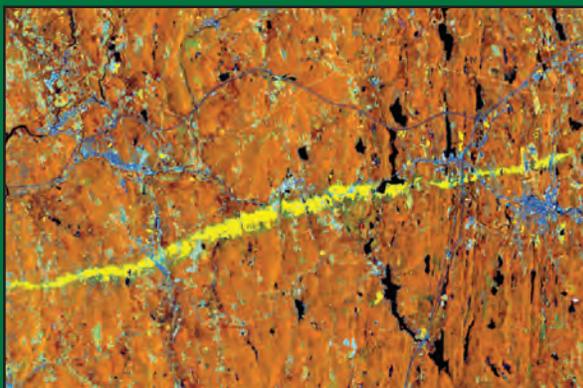
These graphs show the categories of land cover that forests were lost to or gained from, along with the resulting net change between each of these categories and forests between 1996 and 2010.

**M**OST OF THE LOSSES IN FOREST LAND COVER consisted of changes from forest to grass or shrub (75% of all forest losses, combined). At the same time, most gains came from areas that were formerly shrub and changed to forest (87% of all gains). This pattern suggests that many of the region's forested areas are undergoing transitions that do not result in permanent loss. However,

losses of forest to development are more likely to be permanent. Approximately 599 square miles of forest were lost to development during the study period, accounting for 20% of the net losses. Of these losses, 553 square miles were upland forests, with only 46 square miles of wetland forest lost to development.

### HIGHLIGHT: IMPACTS OF STORMS

On June 1, 2011, several tornadoes touched down in Massachusetts, destroying 1,400 houses and 78 businesses. Damages surpassed \$200 million. Landsat data from just after one tornado (left) reveal a tornado scar over 22 miles long. The aerial photograph on the right also shows a section of the tornado's path. The tornado-scarred areas are now classified as grass and scrub.



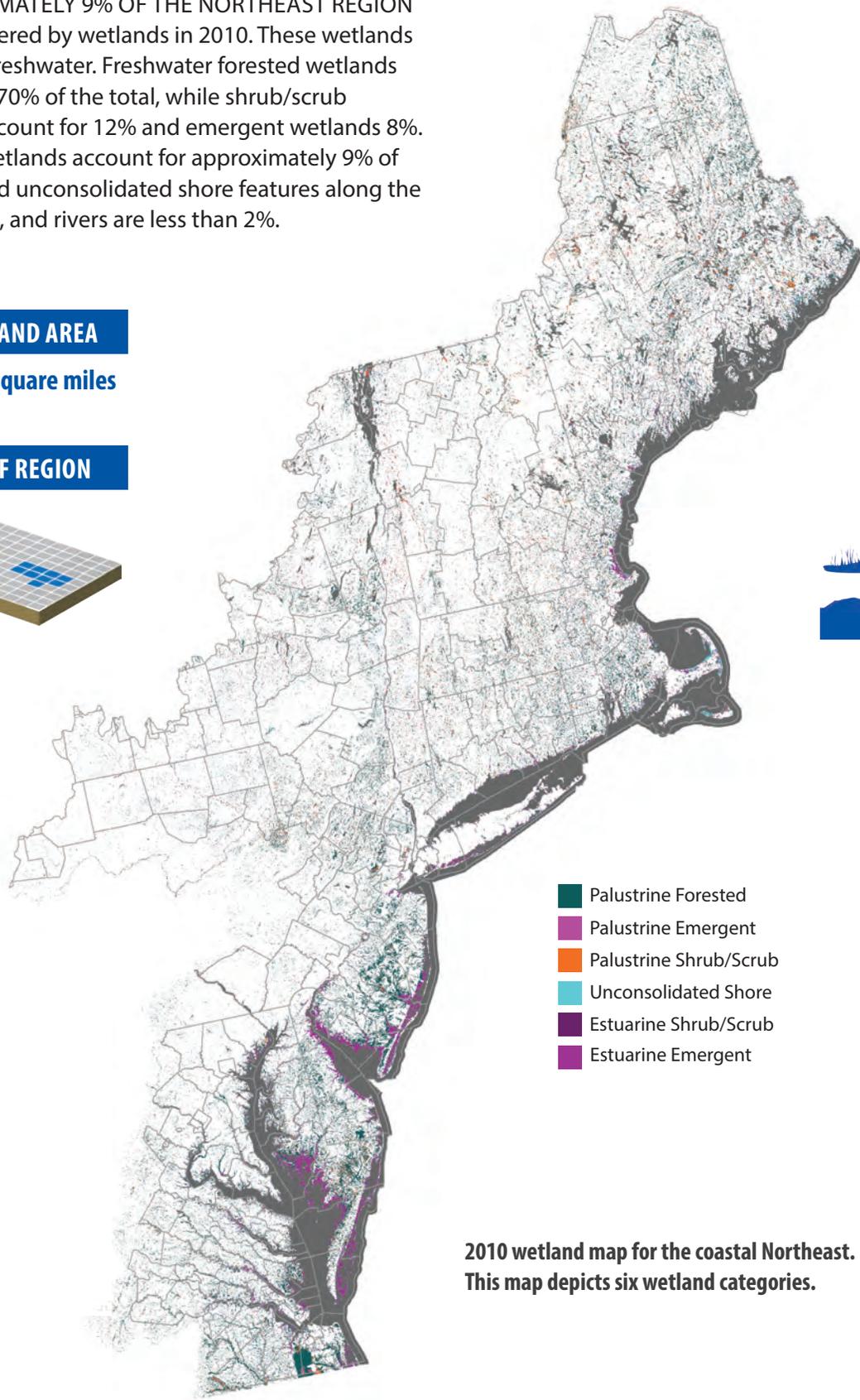
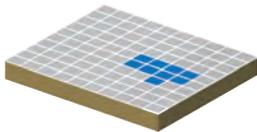
# WETLAND

**A**PPROXIMATELY 9% OF THE NORTHEAST REGION was covered by wetlands in 2010. These wetlands are mainly freshwater. Freshwater forested wetlands account for 70% of the total, while shrub/scrub wetlands account for 12% and emergent wetlands 8%. Estuarine wetlands account for approximately 9% of the total, and unconsolidated shore features along the coasts, lakes, and rivers are less than 2%.

## WETLAND AREA

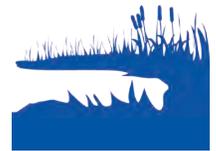
14,612 square miles

## 9% OF REGION



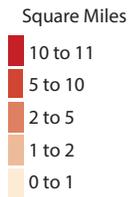
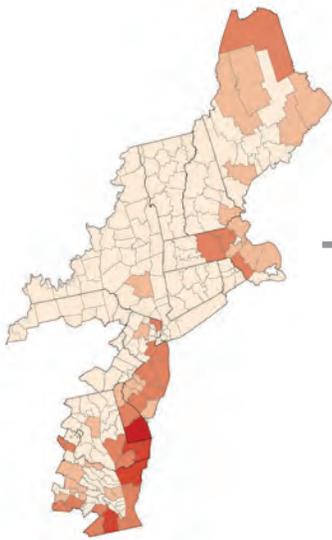
- Palustrine Forested
- Palustrine Emergent
- Palustrine Shrub/Scrub
- Unconsolidated Shore
- Estuarine Shrub/Scrub
- Estuarine Emergent

2010 wetland map for the coastal Northeast. This map depicts six wetland categories.



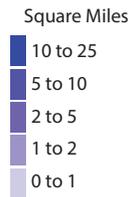
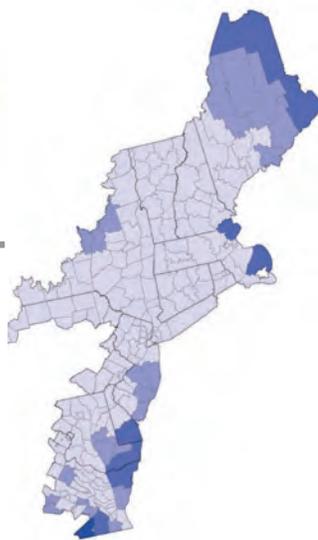
**WETLAND AREA LOST**

207 square miles

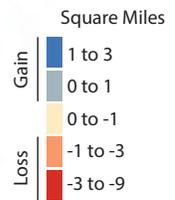
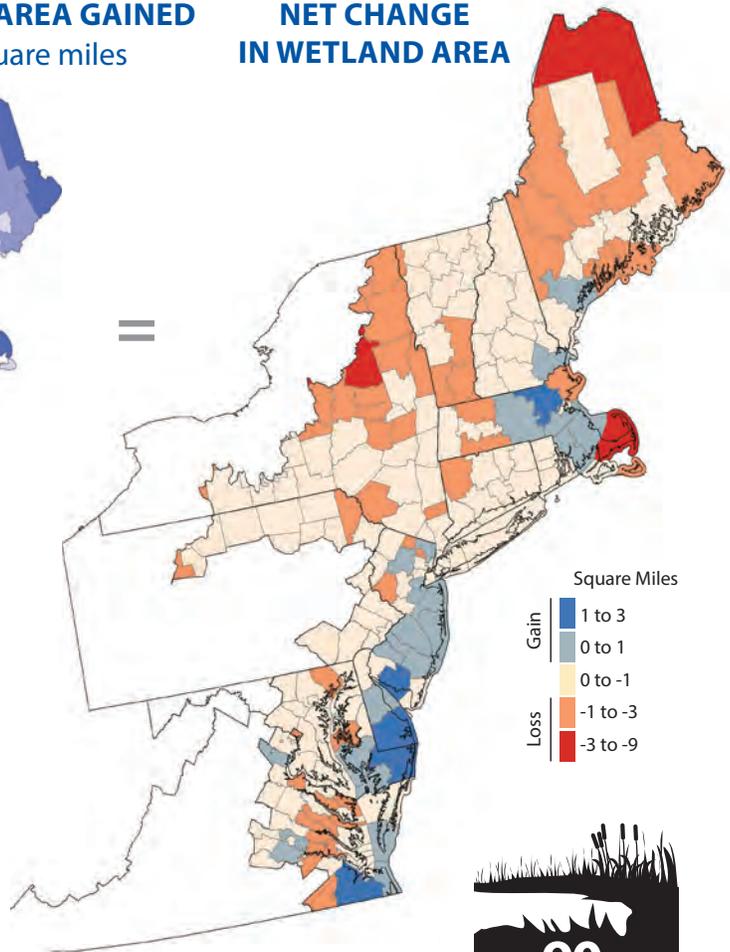


**WETLAND AREA GAINED**

117 square miles



**NET CHANGE  
IN WETLAND AREA**



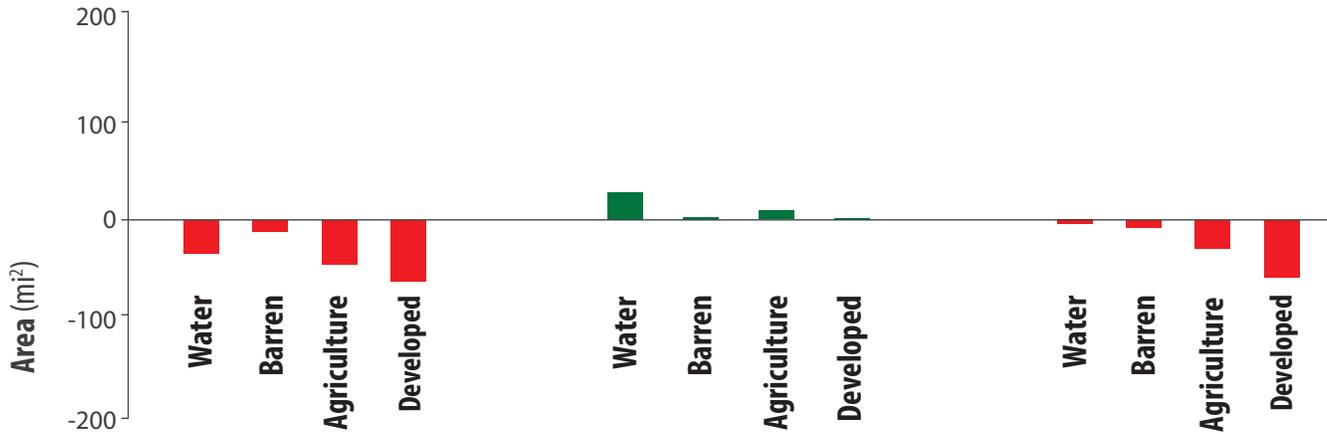
90 square miles



**T**OTAL WETLAND AREA ACROSS THE REGION remained stable from 1996 to 2010, with a loss of only 207 square miles (above left) and a gain of 117 square miles (above center). Some areas had a net gain and others had a net loss (above right), though all of these net changes were small in terms of the total wetland area. The overall net change was a decrease of 90 square miles for the entire Northeast coast, representing less than 1% of total wetlands present in 1996.



**WETLAND LOST TO OTHER LAND COVER** + **WETLAND GAINED FROM OTHER LAND COVER** = **NET CHANGE BETWEEN WETLAND AND OTHER LAND COVER**



These graphs show the categories of land cover that wetlands were lost to or gained from, along with the resulting net change between each of these categories and wetlands between 1996 and 2010.

**W**ETLANDS IN THE NORTHEAST were primarily lost to development (42% of all wetlands lost), agriculture (28%), and open water (21%). Most of these losses occurred in the category of freshwater forested wetlands. Most of the gains were from former water features (67% of all gains).

Losses to and gains from water were primarily related to sediment movement and fluctuations between water and estuarine marsh or unconsolidated shore. Areas of loss and gain were roughly equivalent, resulting in only a small net loss to water for the region. Most of these changes took place in the southern portion of the region, in the area around the Chesapeake and Delaware Bays.

**HIGHLIGHT: SEDIMENT MOVEMENT ALONG THE COASTS**

Shifting sands off the lower Delmarva Peninsula brought large changes to the area’s coastal islands and marshes. The 1996 satellite imagery (left) for one such area can be compared to image on the right which highlights increases (yellow) and decreases (red) of wetland areas between 1996 and 2010.

