One sign of stress to the state’s ecological diversity is the increasing number of rare or endangered species listed. More than 40 percent of the native vascular plant species in the State are considered rare, and approximately 17 percent of New Jersey’s plant species are listed as endangered (see *Endangered Plants* chapter of this Environmental Trends series). Like plant species, about one-third of the known vertebrate animal species in New Jersey are classified as either rare or endangered.

In addition to the traditional on-the-ground surveys and analyses, the State has taken advantage of the recent advancements in the use of aerial photography and satellite imagery to better monitor land use and land cover. Changes, such as a transition from undeveloped land, e.g., forests or wetlands, to developed land, e.g. residential, which can readily be observed, are now monitored as new aerial photography and satellite data become available. Other changes, such as type or size of trees in a forest, are more subtle and continue to rely upon routine surveys and inventories for assessment.

**Status and Trends**

An important parameter of land use and land cover is the amount of urban land in the State. Urban land includes both land with houses, buildings and pavement, and other areas that are essentially impervious to infiltration of rainfall. In addition, barren land, or land that has been denuded of vegetation or other cover, may represent ongoing construction activities, but may also represent open sandy areas and beaches.

There have been two important studies conducted over the years in New Jersey that both address the change in land use and land cover over time, using two different technologies. Beginning in 1986, the NJ Department of Environmental Protection (NJDEP) began a rigorous, detailed study of the status and trends in land use and land cover (LULC) using aerial images and photo-interpretation. Major benchmarks updating the 1986 data have been completed using 1995, 2002, 2007, and 2012 aerial imagery. These data are mapped to a one-acre minimum mapping unit and most recently used one-foot resolution digital imagery. An analysis of trends based on available data is presented.

During the 26-year period of 1986 to 2012, the NJDEP data show an increase of almost 350,000 acres of development, nearly 37 acres per day on average. The increase in urban land is in large part due to losses of agricultural and forested lands. Recently though, the pace of wetland and forest loss has decreased.
Rutgers University Center for Remote Sensing and Spatial Analysis (CRSSA) has used satellite data from 1972 (LANDSAT 1) to 2001 (various satellite sources) to quantify LULC status and trends. During this 29-year period, CRSSA found that over 600,000 acres of land had been developed in New Jersey. This represented an increase of about 68% in the amount of developed land over that time period. This dataset shows strong agreement with the State’s data and provides a snapshot of land-use conditions prior to the State’s assessments.

The amount of urban land in New Jersey, compared with population growth in the same period, is shown in Figure 1 below. This chart highlights that developed lands have expanded at a greater rate than population growth.

Aerial photography and satellite imagery show changes in the State’s overall land use. Figure 2 summarizes DEP’s evaluation of land-use/land-cover (LULC) types based on aerial photography data in 1986 and 2012. These data for 1986 indicate that 49% of the State was either forested or wetlands and 22% was developed. Similar data for 2012 show that 44% of the State was either forested or wetlands and 27% of the State developed, representing a loss in both forests and wetlands and an increase in urban land over time. The same data indicate a decrease in agricultural area from 14% to 10%.

The most recent detailed five-year...
The data reveal significant details about the State’s forests that are not observable via satellite or aerial photos alone. The average size of trees in New Jersey’s forests is changing. Forest stand structures today are typically more mature and contain larger trees than they have in the past. Since 1972, areas characterized by poletimber (greater than 5-inches diameter at breast height) and saplings/seedlings have declined, while the areas of larger trees (sawtimber) have increased and remained stable (Figure 4). This summary incorporates data from a series of previous inventories. Overall, the woody biomass of New Jersey’s forests has increased in recent years. The 2015 estimate of the net volume of growing stock trees with a diameter greater than five inches has increased 5.2% from the 2010 estimate. However, there are concerns that forest regeneration has declined so much that there are virtually no young seedlings to be found in some regions. At least some of the decline in regeneration can be traced to deer. For example, a project to restore acreage of the Atlantic white-cedar has found regeneration is only successful where deer browsing is controlled. Another reason for less regeneration is forest succession, where the thick canopy of mature trees limits establishment and growth of some species of seedlings. Not only is development consuming forest areas, it also is breaking up existing contiguous forest areas into smaller tracts. This fragmentation degrades watersheds, reduces wildlife habitat, increases site disturbances and favors invasion by exotic plant species and predators such as feral housecats. Fragmentation is believed to be a contributing factor in the decline of some bird species and other wildlife.

There are also indications that New Jersey’s forests are troubled by an increase in insects and disease. Insects that are especially problematic include the emerald ash borer, Asian long-horned beetle, which is currently eradicated in NJ, the gypsy moth, the hemlock woolly adelgid, and the southern pine beetle. Tree diseases that require careful monitoring include bacterial leaf scorch and sudden oak death. Invasive species also are a problem in forested areas in the State. An initial survey of invasive plants by the USDA showed that invasive plants are widely distributed in
Currently, multiflora rose (*Rosa multiflora*), Japanese honeysuckle (*Lonicera japonica*) and Japanese barberry (*Berberis thunbergii*) are the most frequently encountered invasive plants statewide, but the abundance is greatest in the northern part of the State. It is not yet clear to what degree these and other invasive species cause harm. However, it is likely that as invasive species spread, the number and abundance of native plant species will decline, resulting in a loss of overall species diversity and a reduction in the value and health of New Jersey’s forests. For a discussion of threatened and endangered plants in the State, please see the *Endangered Plants* chapter in this Environmental Trends series.

**Wetlands and other prime wildlife habitat**

Certain areas of the state are especially important in maintaining biodiversity. The NJDEP’s Division of Fish and Wildlife’s Endangered and Nongame Species Program (ENSP) adopted a geographic information system (GIS) approach to imperiled species protection called the Landscape Project. The project uses GIS to identify and delineate habitat critical to the long-term survival of New Jersey’s wildlife. Comparisons between the satellite imagery used to track changes in land use and land cover between 1995 and 2012, discussed above, and the Landscape Project maps reveal that prime wildlife habitat (habitat for listed endangered and threatened species, as well as priority wildlife species) has been lost to development.

**Residential and non-residential construction**

The change in the amount of developed land in the State can also be tracked through building permits. Information from these permits and certificates provide useful indicators on the level of construction activity in the State; the type of structures that are built; the number of dwelling units authorized for construction and completed; and the square footage of nonresidential space. This information is submitted monthly to the New Jersey Department of Community Affairs by municipal construction officials.

There are two broad categories of construction: residential and nonresidential. Residential construction is measured by unit, and divided further into new construction and redevelopment. An increase in the issuance of building permits for residential construction from 1996 to 2000 is highlighted in Figure 5. After this period, there was an overall decline in permits, with an increase in redevelopment permits. Residential permits again began to rise in 2004, with permit issuance at its peak in 2005. After that, a significant decline continued until 2009. Since then, the number of residential construction permits has generally increased.

The geographic distribution of residential construction permits highlights a shift from suburban sprawl to the recentralization of metropolitan areas. This regional transformation to a growing urban core is linked to changes in age demographics and economic changes. Specifically, the Boomer generation is retiring and downsizing homes, whereas the Millennial generation is composing a larger portion of the workforce and favoring more sustainable, urban living/working arrangements. The 2008 economic recession is also suspected to have had an influence on these changing community preferences. As seen in Figure 6, there is a significant increase in the relative percentage of residential construction permits by development type over time, with a shift from single-family houses and duplexes (one and two family permits) to multifamily and mixed use buildings (Kendall Tau P-value < 0.001). Examples of multifamily and mixed use buildings can include college dormitories, assisted living facilities, and multi-level buildings with a mix of apartments and commercial use. The shift to more concentrated dwellings is apparent geographically based on a recent five-year snapshot of the State. The map below (Figure 7) highlights that residential construction permits over the period of 2011 to 2015 were issued predominantly for multifamily dwellings in more highly-populated counties (such as Hudson, Essex, and Passaic Counties) relative to less urbanized counties (such as Cumberland, Salem, and Cape May) in...
rules at N.J.A.C. 7:15 give local planners more flexibility regarding wastewater infrastructure decisions. The proposed rules focus new sewer infrastructure projects on areas of targeted growth while remaining protective of environmentally sensitive areas and cognizant of local zoning efforts. Efforts are also directed at protecting riparian areas to reduce flood impacts and maintain the health of surface waters.

- **Nonresidential construction is measured by square footage.** The three major categories of nonresidential construction are retail, office, and other. This last category includes such things as hotel/motel, educational institution, and storage facility construction. During the period of 1996 – 2015, nonresidential building permit issuance peaked in 2001 and decreased until 2009 (Figure 8). Nonresidential building permits have generally increased since 2011.

**Outlook and Implications**

The State continues to undertake initiatives to prevent environmentally damaging land-use change and encourage sustainable growth. Specifically, the NJDEP continues to work towards planning that reflects existing water supply and wastewater demands, as these two needs are fast becoming the limiting factor with respect to development. For example, the DEP Water Quality Management Planning (WQMP)
waters. Maintenance of Category One (C1) waterways will provide additional protections to waterbodies and help prevent water-quality degradation by discouraging development where it would impair or destroy natural resources and environmental quality. The State is also increasing the amount of open space preserved by expanding and improving the state and local park system, and restoring and expanding urban forests and open space. For additional trend information please see the individual Open Space Preservation, State Parks and Forests, and Urban and Community Forests chapters in this Environmental Trends series.

More Information

http://www.nj.gov/dep/landuse/
http://www.nj.gov/dep/watersupply/
http://www.state.nj.us/dep/fgw/ensp/landscape/index.htm
http://www.njfishandwildlife.com/
http://www.nj.gov/dep/dwq/
http://www.nj.gov/dep/stormwater/
http://www.nj.gov/dep/wqmp/
http://www.state.nj.us/dep/parksandforests/index.html
http://www.state.nj.us/dep/gis/

References

1NJ Department of Environmental Protection (DEP), 2004, New Jersey Comparative Risk Project, NJDEP, Trenton, NJ. Available at http://www.state.nj.us/dep/dsr/njcrp/. Also named as important stressors to the environment in the study were indoor air pollution, invasive species, and outdoor air pollution.


9Research in satellite and related new methods of monitoring changes in the land surface is carried out at the Grant F. Walton Center for Remote Sensing and Spatial Analysis at Rutgers University (CRSSA), which can be found at http://www.crssa.rutgers.edu/projects/lc/

10Refer to the NJ Forest Inventory and Analysis data available at https://www.nrs.fs.fed.us/fia/data-tools/state-reports/NJ/


14 Lempicki, Edward, NJDEP Bureau of Forest Management, Trenton, personal communication, 12/16/04.


16 NJDEP. Forest Health in New Jersey. See http://www.state.nj.us/dep/parksandforests/forest/njfs_forest_health.html.


22 Please see http://www.nj.gov/dep/wrm/wqmprule.html.