



Forest sustainability in the state of New York, United States of America

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1. Introduction

The combustion of wood for energy purpose is not considered to contribute to the augmentation of greenhouse gases concentration in the atmosphere, as long as the CO₂ emissions released during the combustion of wood are balanced by the growth of new trees. It is therefore essential to investigate if the forests in the region where the wood used for energy purpose are managed in a sustainable way, avoiding resources associated with overexploitation of forests, land use change, depletion of carbon stocks, etc.

In this framework, literature research was carried out to produce a summary of forest management in New York state, including general condition, management and sustainability assessment.

2. New York forests overview

2.1. Location and distribution

New York is a state located in the Northeastern of United States of America, and covers a total surface area of 141,300 km². New York state is divided into 62 counties¹.

The US states of Pennsylvania, New Jersey, Connecticut, Massachusetts and Vermont border the New York state, as well as the Canadian province of Québec and Ontario.

In total, forests surface in New York state is estimated to be of approximately 7,57 million ha (18,7 million acres), which represents about 63% of the state surface².

Figure 2 presents the forest distribution throughout the state. The non-forested areas include mainly agricultural lands such as cropland and pastures. Urban areas represent approximately 6% of the land area³. Figure 2 also shows the Forest Inventory and Analysis (FIA) units, corresponding to groups of counties that have similar forest cover, soil, and economic conditions.

Figure 3 shows the proportion of forest land by predominant species group in New York state. Deciduous forests predominate largely in New York and account for the great majority of all forest species. Maple/Beech/Birch is the dominant forest-type group with over 56% of forest land area.

83% of the state's forest land is classified as timberland, the major parts of the remaining surface is reserved forest land ² (see Box 1 for the definition of various categories of forest land).

¹ New York state. [https://en.wikipedia.org/wiki/New_York_\(state\)](https://en.wikipedia.org/wiki/New_York_(state)). Consulted online 10th January 2019

² Albright, Thomas A. 2018. Forests of New York, 2017. Resource Update FS-170. Newtown Square, PA: U.S. Department of Agriculture, Forest Service, Northern Research Station. 4 p. <https://doi.org/10.2737/FS-RU-170>.

³ Department of Environmental Conservation, New York State. Habitats of New York State. <https://www.dec.ny.gov/animals/9402.html> Consulted online 10th January 2019.

Box 1: Definition of forest land categories following Forest Inventory and Analysis (FIA)

- **Timberland:** forest land that is producing or is capable of producing crops of industrial wood and is not withdrawn from timber utilization by statute or administrative regulation. These areas are capable of producing in excess of 20 cubic feet per acre (1.4 m³/ha) per year of industrial wood in natural stands. Inaccessible and inoperable areas can be included.
- **Reserved forest land** is all forest land that is withdrawn from timber utilization through statute without regard to productive status, e.g., state parks, national parks, and Federal wilderness areas.
- **Other forest land** consists of forest land that is not capable of growing 20 cubic feet per acre (1.4 m³/ha) per year and is not restricted from harvesting, e.g., some surface-mined areas with extremely degraded soil and some poorly drained areas where water inhibits tree growth. Sometimes such forest lands are referred to as being “less productive” or “unproductive” with respect to wood fiber production.

Source: Widmann R.H. et al. 2015. New York Forests, 2012. US Forest Service. Northern Research Station. Resource Bulletin NRS-98.

Figure 1: General maps of New York state



Source: https://www.nationsonline.org/oneworld/map/USA/new_york_map.htm

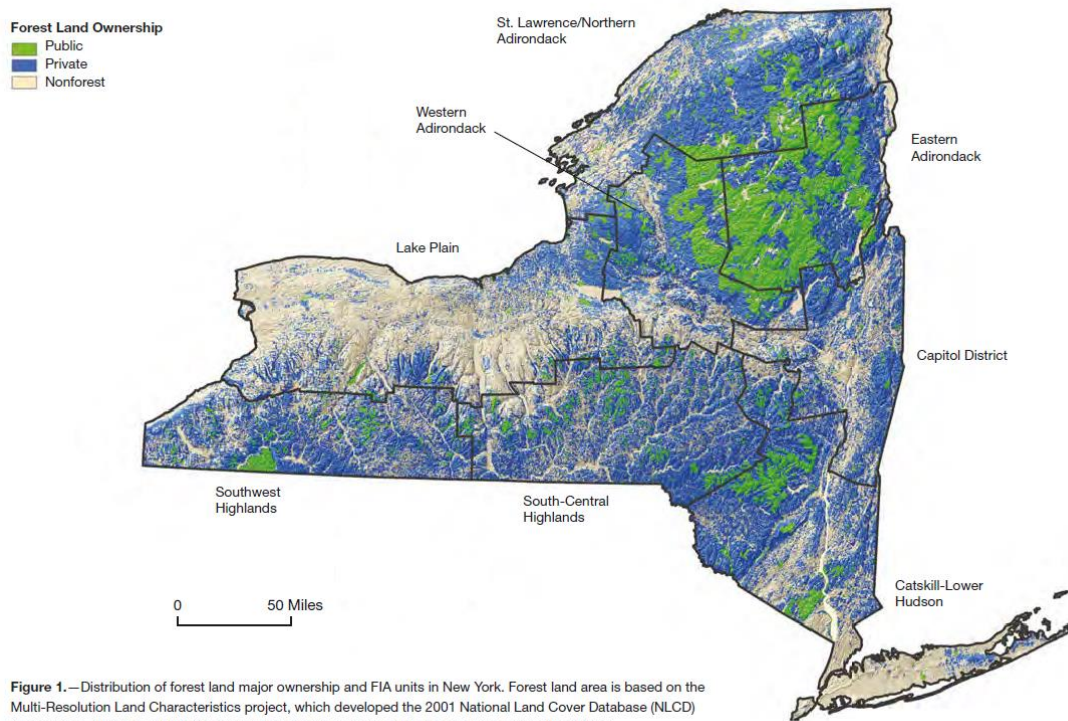
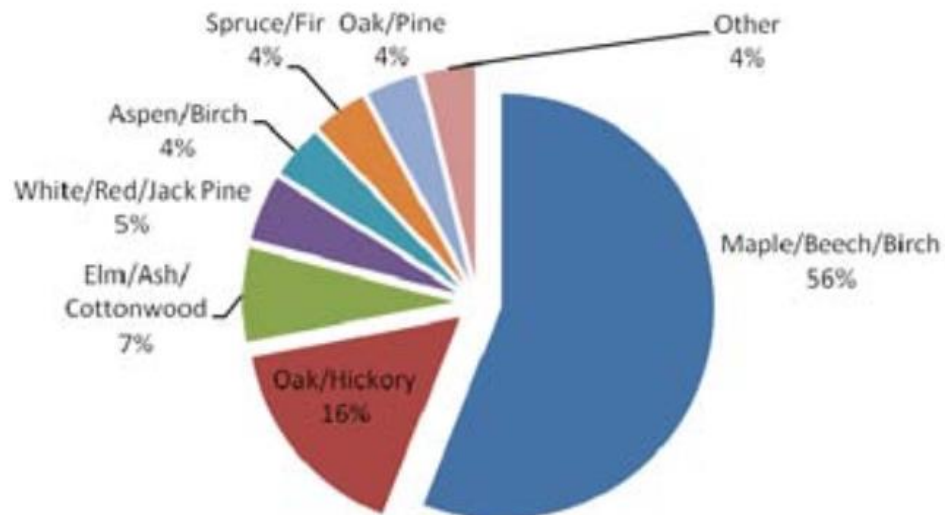
Figure 2 : Forest distribution in New York state

Figure 1.—Distribution of forest land major ownership and FIA units in New York. Forest land area is based on the Multi-Resolution Land Characteristics project, which developed the 2001 National Land Cover Database (NLCD) (Homer et al. 2007). The MRLC uses data from the Landsat satellite to map land across the Nation.

source : Widmann R.H. et al. 2015. New York Forests, 2012. US Forest Service. Northern Research Station. Resource Bulletin NRS-98.

Figure 3: Proportion of forest land by forest-type group, 2008

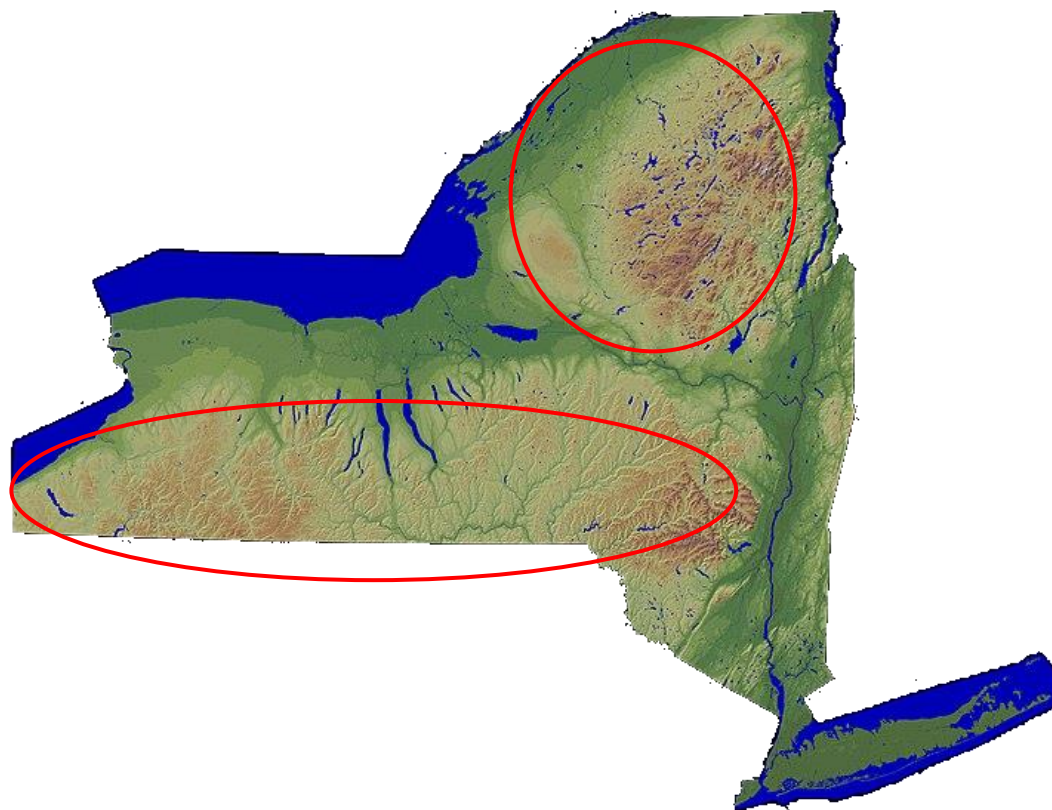
Source: Department of Environmental Conservation, New York state. Forest resource – Assessment and strategy 2010-2015. https://www.dec.ny.gov/docs/lands_forests_pdf/fras070110.pdf

2.2. Ecological regions

New York state is partly covered by the Appalachian Mountains, where the mountains generally assume the character of hills and finally sink to the level of the lowlands surrounding the great depression filled by the Great Lakes and the St. Lawrence River. Two main mountain masses can be identified in the state of New York (Figure 4) : the Adirondack Mountains in the North, and the Allegheny Plateau in the south terminating and culminating in the Catskill Mountains west of the Hudson ⁴.

The lowest point in New York state is at sea level. The highest point in the state, located in the northeast, is Mount Marcy in the Adirondack High Peaks Region of the High Peaks Wilderness Area, at 1629 m above sea level ⁵.

Figure 4: New York state topography



Source : United States Geological Survey

⁴ United States Geological Survey

⁵ "Marcy" datasheet. https://www.ngs.noaa.gov/cgi-bin/ds_mark.pl?PidBox=PG2096. Consulted online on 10th January 2019.

The major part of the state presents a continental climate, with only the Southeastern part presenting a temperate climate. The annual average temperature across the state ranges from around 39 °F (4 °C) over the Adirondack Mountains to near 53 °F (12 °C) across Long Island ⁶. Weather in New York is heavily influenced by two air masses: a warm, humid one from the southwest and a cold, dry one from the northwest⁷. Average precipitation across the region show maxima within the mountains of the Appalachians. Between 28 inches (710 mm) and 62 inches (1,600 mm) of precipitation falls annually across the Northeastern United States, and New York's averages are similar⁸.

Ecological regions, or ecoregions, are areas of general similarity in ecosystems and in the type, quality, and quantity of environmental resources. They serve as a spatial framework for the research, assessment, management, and monitoring of ecosystems and ecosystem components. Several levels are defined from coarse (I) to fine (IV) ecoregion delineation. New York state includes 9 level III ecoregions, which are mapped on Figure 5 and described hereunder⁹:

1. **Northeastern Highlands (58 on Figure 5):** *The Northeastern Highlands ecoregion covers most of the mountainous portions of New England and New York. It is characterized by hills and mountains, extensive forest cover, nutrient-poor frigid and cryic soils (mostly Spodosols), numerous glacial lakes, wetlands, bogs, and high-gradient coldwater streams. Forest vegetation is somewhat transitional between the boreal regions to the north in Canada and the broadleaf deciduous forests to the south. Typical forest types include northern hardwoods (maple-beech-birch), northern hardwoods/spruce, and northeastern spruce-fir forests. The region is sparsely populated compared to adjacent regions; farm-to-forest conversion began in the mid-19th century and continues today. In spite of this trend, alluvial valleys, glacial lake basins, and areas of limestone-derived soils are still farmed for dairy products, forage crops, fruits, and vegetables. The timber industry, recreational homes, and associated lodging and services sustain the forested regions economically, but they also create development pressure that threatens to change the character of the region. Many of the lakes and streams in the region are sensitive to acid deposition originating from industrial sources in the west and southwest.*
2. **Northeastern Coastal Zone (59 on Figure 5):** *The Northeastern Coastal Zone ecoregion covers most of southern New England and the coastal areas of New Hampshire and southern Maine. Its landforms include rolling or irregular plains. Soils are Inceptisols formed from glacial till that support Appalachian oak forest and northeastern oak-pine forests. Similar to the Northeastern Highlands (58), the Northeastern Coastal Zone contains relatively nutrient-poor soils and concentrations of Pleistocene glacial lakes, some of which are sensitive to acidification. This ecoregion, however, contains considerably less surface irregularity and a higher human population density than*

⁶ Northeast Regional Climate Center (2012). "Normal Average Temperatures (Deg F): Annual (1971-2000)". Cornell University.

⁷ "Climate of New York". New York State Climate Office - Cornell University.

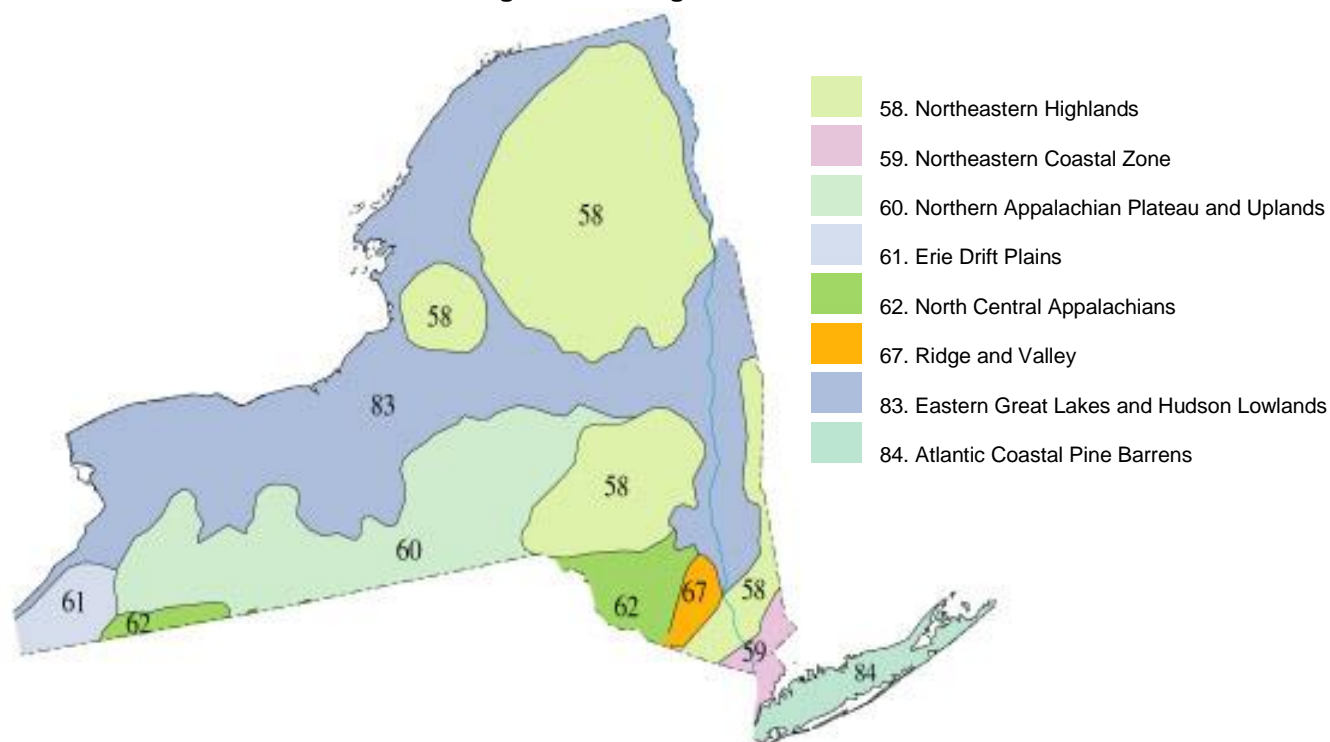
⁸ Allan D. Randall (1996). Mean Annual Runoff, Precipitation, and Evapotranspiration in the Glaciated Northeast United States, 1951-1980. United States Geological Survey.

⁹ Bryce, S.A., Griffith, G.E., Omernik, J.M., Edinger, G., Indrick, S., Vargas, O., and Carlson, D., 2010, Ecoregions of New York (color poster with map, descriptive text, summary tables, and photographs): Reston, Virginia, U.S. Geological Survey, map scale 1:1,250,000.

Ecoregion 58. Although European settlers attempted to farm much of the Northeastern Coastal Zone until the mid-19th century, woodland and urban and suburban development now dominate much of the landscape, with minor areas of pasture and cropland.

3. **Northern Allegheny Plateau (60 on Figure 5):** *The Northern Allegheny Plateau is made up of horizontally bedded, erodible shales and siltstones, and moderately resistant sandstones of Devonian age. It is often lower and less forested than the adjacent unglaciated North Central Appalachians (62). Its rolling hills, open valleys, and low mountains are covered by till from Wisconsinan Age glaciation and the landscape is a mosaic of cropland, pastureland, and woodland. Soils are mostly mesic Inceptisols that are limited by stoniness and seasonal wetness. Historically, the natural vegetation was primarily Appalachian oak forest dominated by white oak and red oak, with some northern hardwood forest at higher elevations. The Northern Allegheny Plateau has more level topography and more fertile, arable land than the more rugged and forested North Central Appalachians.*
4. **Erie drift plain (61 on Figure 5):** *The rolling terrain of the Erie Drift Plain covers the southwest corner of New York where the Northern Allegheny Plateau (60) descends toward the Great Lakes. Lake Erie's influence substantially lengthens the growing season and increases winter cloudiness and snowfall in the northern part of the region. Deposits from successive Pleistocene ice sheets and glacial lakes cover the horizontally bedded sedimentary rock and form beach ridges, hummocky stagnation moraines, kettles, and wetlands. Poorly drained soils are prevalent, making the region unsuitable for intensive row crop agriculture. The adjacent unglaciated portions of Ecoregion 62 to the east have steeper slopes, colluvial soils, and more forested land.*
5. **North Central Appalachians (62 on Figure 5):** *The North Central Appalachians ecoregion is a vast, elevated plateau composed of horizontally bedded sandstone, shale, siltstone, conglomerate, and coal. Its highly dissected hills and low mountains were only partly glaciated. The region reaches its highest elevations in south central New York on erosion-resistant sandstones. Soils, derived from residuum, colluvium, and till, often have a frigid temperature regime; they are low in nutrients and support extensive northern hardwood and Appalachian oak forests, with isolated highland pockets of spruce and fir.*
6. **Northern Piedmont (anecdotic, hence not represented on Figure 5):** *In southeastern New York and northeastern New Jersey, the Northern Piedmont is underlain by sedimentary rocks that are more susceptible to erosion than the metamorphic crystalline rocks that form the core of the adjacent Northeastern Highlands (58). The sedimentary rocks of the Northern Piedmont have been eroded and smoothed to irregular plains and low hills. Scattered, forested rocky ridges occur on diabase and basalt intrusions. Overall, physiography and lithology contrast with the low mountains of the Northeastern Highlands (58) and the Ridge and Valley ecoregion (67), and the flat coastal plains of the Atlantic Coastal Pine Barrens (84). Forest vegetation is Appalachian oak-hickory forest on well-drained upland sites, with sugar maple and mixed hardwood forests on more fertile soils. Although the overall regional land cover is a mix of small farms interspersed with small woodlots and residential, commercial, and industrial development, the portion of Northern Piedmont Ecoregion that is in New York has become highly urbanized.*

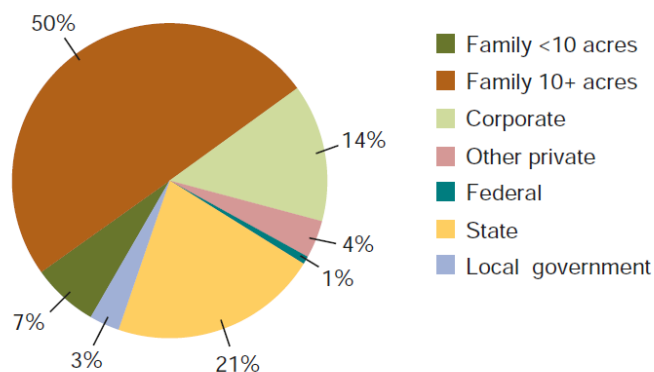
7. **Ridge and valley (67 on Figure 5):** *The Ridge and Valley ecoregion has a broad latitudinal extent and a diversity of landscape types. Forested ridges alternate with agricultural valleys. Surface morphology is influenced by lithological characteristics. Ridges are capped by resistant sandstone or conglomerate. Valleys tend to be created on weaker strata, including limestone and shale. Valleys derived from limestone and dolomite have a smoother surface and lower drainage density than those developed in shale. Shale valleys often display a distinctive rolling topography. Soils derived from limestone are fertile and well-suited to agriculture, while those derived from shale typically have a lower agricultural potential. Native vegetation of valleys, slopes, and hilltops is sugar maple/mixed hardwood. Hemlock grows with the hardwoods on cooler and moister sites.*
8. **Eastern Great Lakes Lowlands (83 on Figure 5):** *The Eastern Great Lakes Lowlands ecoregion surrounds the highland ecoregions of northern New York State. Valleys and lowlands are underlain by interbedded limestone, shale, and sandstone rocks that are more erodible than the more resistant rocks composing the adjacent mountainous areas. The topography and soils of the lowlands have also been shaped by glacial lakes and episodic glacial flooding. Limestone-derived soils are fine-textured, deep, and productive. As a result, much of the region was cleared for agriculture or urban development and less native forest remains than in surrounding ecoregions like the Northeastern Highlands (58) or the Northern Allegheny Plateau (60). Most agricultural activity is devoted to dairy operations, although orchards, vineyards, and vegetable farming are important locally, particularly near the Great Lakes.*
9. **Atlantic coastal Pines Barrens (84 on Figure 5):** *The Atlantic Coastal Pine Barrens is a coastal plain ecoregion, distinguished from the Middle Atlantic Coastal Plain (63) to the south by its coarser-grained soils, cooler climate, and northeastern oak-pine barrens vegetation. The coastal climate is more moderate than that inland with a narrower range of seasonal temperatures and a longer growing season. Ecoregion 84 is transitional to the coastal ecoregion (59) to the north. The characteristic sandy beaches, grassy dunes, bays, marshes, and scrubby oak-pine forests exist in contrast to the rocky, forested coastline found farther north in Ecoregion 59. The xeric, quartz-sand soils are acidic and have limited nutrient availability. Salt marshes, swamps, and floodplain forests are present in low sites on hydric soils. Freshwater wetlands and marshes may be present in dune swales*

Figure 5: Ecoregions of New York state

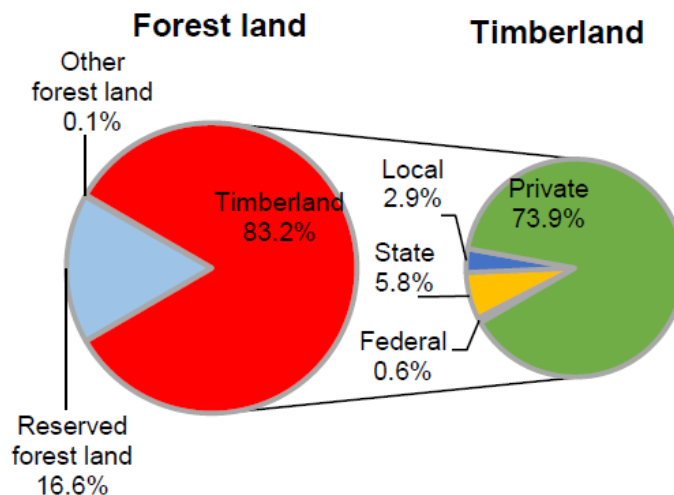
Source: National Health and Environmental Effects Research Laboratory U.S. Environmental Protection Agency. <https://hort.purdue.edu/newcrop/cropmap/newyork/maps/NYeco3.html> Consulted online 10th January 2019.

2.3. Forest ownership

Forest land in New York state is mainly privately owned. About 25% of New York forest land is publicly owned, either by local government, the state or the Federal government (Figure 6 and Figure 7). Timberland represents 83.2% of the total forest land in New York state, of which the majority is owned by private owners, mostly families (Figure 7).

Figure 6: Proportion of forest land by ownership class, 2012

Source: Widmann R.H. et al. 2015. New York Forests, 2012. US Forest Service. Northern Research Station. Resource Bulletin NRS-98.

Figure 7: Proportion of forest land by land use and ownership class, 2017

Source: Albright, Thomas A. 2018. Forests of New York, 2017. Resource Update FS-170. Newtown Square, PA: U.S. Department of Agriculture, Forest Service, Northern Research Station. 4 p. <https://doi.org/10.2737/FS-RU-170>.

2.4. Competent authorities

Forest management in USA is organized following several levels.

At the federal level, the structure in charge of forest management is a branch of the Department of Agriculture, the US Forest Service (USFS). The mission of the Forest Service is *"to sustain the health, diversity, and productivity of the Nation's forests and grasslands to meet the needs of present and future generations."* The USFS is subdivided in three operational divisions: (1) the National Forest System (NFS); (2) Research and Development (R&D); and (3) State and Private Forestry (S&PF). In 2008, US Congress passed legislation requiring the states to prepare Forest Resource Assessments and Strategies (now referred to as Forest Action Plans) to assess the status of forests in their states and to develop strategies to protect those forests for the future¹⁰. In addition to the management of the national forests, the Forest Service was delegated responsibilities for forest management and wood technology research, and for providing assistance to private forest landowners. In cooperation with emerging state-level public forestry agencies, the Forest Service geared up to improve wildfire suppression and to provide technical and financial assistance to small forest landowners¹¹.

At the New York state level, the New York State's Department of Environmental Conservation (NYSDEC) is the regulatory agency for environmental issues. Its mission is manifold and implies *"the conservation, improvement and protection of New York's natural resources and environment and to preventing, abating and controlling water, land and air pollution, in order to enhance the health, safety*

¹⁰ New York State Department of Environmental Conservation. New York Forest Action Plan. <https://www.dec.ny.gov/lands/60829.htm> Consulted online on 11th January 2019.

¹¹ MacCleery D. n.d. Re-inventing the united states forest service: evolution from custodial management, to production forestry, to ecosystem management. <http://www.fao.org/docrep/010/ai412e/AI412E06.htm> Consulted online on 11th January 2019.

and welfare of the people of the state and their overall economic and social well-being". NYSDEC is responsible for the management of Forest preserve and collaborates with other political levels to protect the environment, and assist private owners to manage their land¹².

New York is a "home-rule" State which means each jurisdiction or political subdivision (i.e.: town) has the ability, within limits, to adopt regulations that could extend to forest management activities. A comprehensive and accurate list of those local ordinances does not exist. The following are the principal programs and regulations in New York that embody forest management standards and guidelines or regulate forestry activities:

- NYS Forest Tax Law
- NYS Forestry Best Management Practices for Water Quality
- Silvicultural Management Practices for Nonpoint Source Pollution Prevention and Water Quality Protection
- NYS Forest Practice Board Standards
- NYS Environmental Conservation Law regulations:
 - o water quality,
 - o wetlands,
 - o stream crossings,
 - o fire prevention,
 - o insects and diseases,
 - o pesticides,
 - o rare, threatened and endangered species habitats,
 - o Wild, Scenic and Recreational Rivers
- Strategic Plan for State Forest Management
- Adirondack Park State Land Master Plan
- Catskill Park State Land Master Plan

Most of the forest management standards and guidelines for privately owned/family forests are ultimately voluntary¹³. Forests managed by New York State Department of Environmental Conservation (NYSDEC), are exploited following recognized standards of sustainability (see section "Forest certification").

Local government plays a critical role in forest management because of New York's home rule authority to plan and regulate land uses. State and Federal authorities are moving increasingly in the direction of delegating responsibility for environmental controls to the local level, yet many town comprehensive plans do not identify forest lands as a valuable, renewable natural resource and many zoning ordinances do not list forest uses or timber harvesting as allowed uses in any zone¹⁴.

¹² New York State Department of Environmental Conservation. Our mission. <https://www.ny.gov/agencies/department-environmental-conservation> Consulted online on 14th January 2019

¹³ Best Management Practices Field Guide. 2018. New York State Forestry. Voluntary best management practices for water quality

¹⁴ Daniels K.H. 2005. A Municipal Official's Guide to Forestry in New York State https://www.dec.ny.gov/docs/lands_forests_pdf/guidetoforestry.pdf

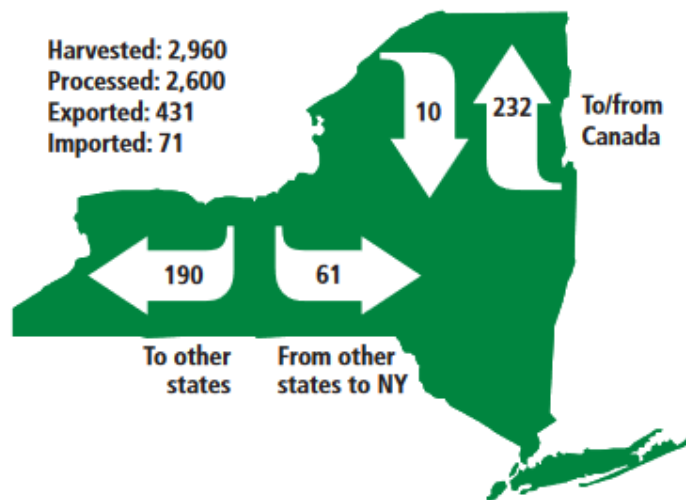
To encourage sustainability of non-industrial private forest land, New York's Forest Stewardship Initiative helps private landowners develop forest management plans. The Forest Tax law provides incentives for managed forest lands. Many landowners have worked with the New York State Department of Environmental Conservation (NYSDEC) Lands & Forest's Private Forest Management staff to develop management plans for their land. Almost 0.8 million ha (2 million acres) of private forest land is managed under the Forest Stewardship Program and about 263,046 ha (650,000 acres) are covered by the Forest Tax Law program. But there are more than 4 million ha (10 million acres) of private forest land outside these programs. Much of this land is left un-managed, but could contribute significant carbon sequestration under active forest management¹⁵.

2.5. Overview of wood-related industry

According to the North East State Foresters Association ¹⁶, the contribution of the forestry sector to New York's Gross State Product in 2011 was 1,7%.

The total economic output of Forest-based Manufacturing & Recreation was \$23,7 billion in 2011. Figure 8 illustrates the wood flows in New York state. The export destinations include mostly regional locations: other US states and Canada ¹⁶. While most of the timber harvested in New York is processed in New York, timber products flow freely in the regional economy. In 2011, 10,728,697.6 m³ (2,960,000 cords¹⁷) of timber were harvested in New York, 9,423,856 m³ (2,600,000 cords) were processed in New York while 1,562,185.36 m³ (431,000 cords) were exported, mostly to Canada, and 257,343.76 m³ (71,000 cords) were imported (Figure 8).

Figure 8 : Wood flows to and from New York state in 2011 – in 1000 cords



¹⁵ New York State Department of Environmental Conservation. Trees: The Carbon Storage Experts. <https://www.dec.ny.gov/lands/47481.html> Consulted online on 14th January 2019

¹⁶ North East State Foresters Association. 2013. The economic importance of New York's forest-based economy 2013. https://www.dec.ny.gov/docs/lands_forests_pdf/economicimportance2013.pdf

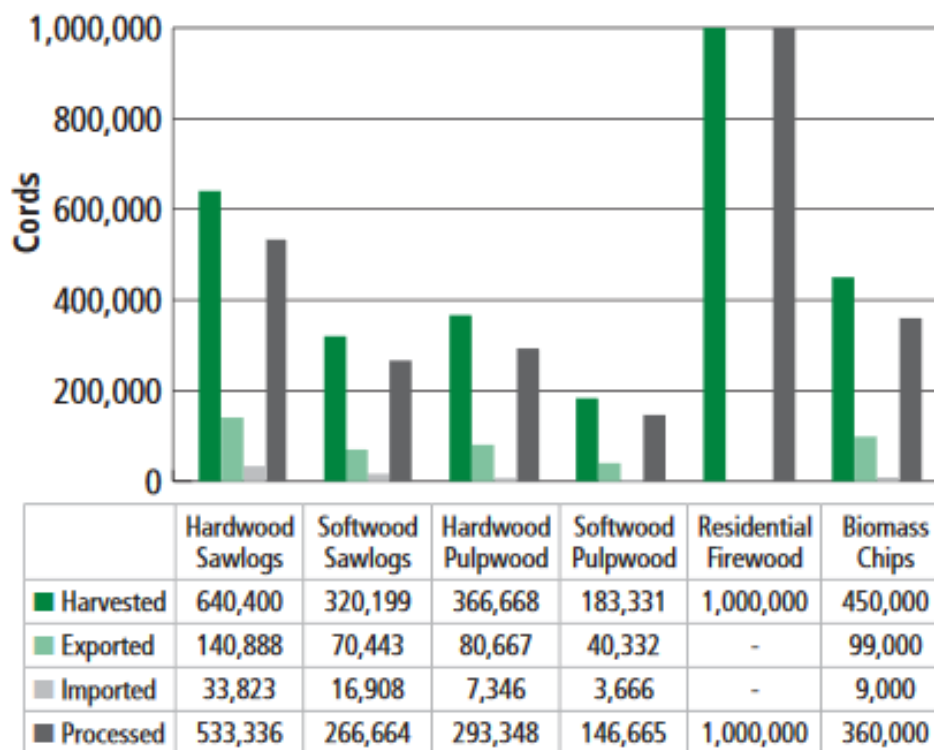
¹⁷ 1 cord = 3,62456 m³

Source: North East State Foresters Association. 2013. The economic importance of New York's forest-based economy 2013.
https://www.dec.ny.gov/docs/lands_forests_pdf/economicimportance2013.pdf

The direct employment in forest industry in 2011 was estimated to be 43 912 jobs and additional indirect employment is estimated to 49 185 jobs (which includes recreational activities). The direct employment includes forestry, logging and trucking (2 300 jobs), wood products manufacturing (8 866), furniture and related products manufacturing (14 500 jobs), paper manufacturing (16 500 jobs), wood energy (700 jobs) and Christmas trees and maple syrup (1 046 jobs). Forest recreation activities represents 31 926 jobs.

Figure 9 illustrates the wood flows in New York by category of product.

Figure 9 : Volumes of forest products in New York state in 2011



Source: North East State Foresters Association. 2013. The economic importance of New York's forest-based economy 2013.
https://www.dec.ny.gov/docs/lands_forests_pdf/economicimportance2013.pdf

3. Sustainability of New York state forest

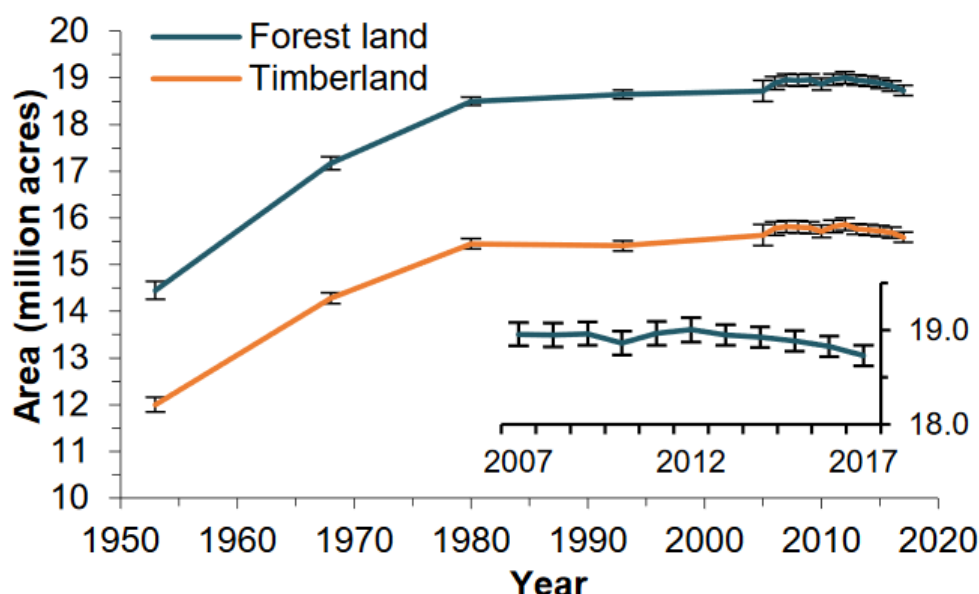
3.1. Evolution of forest area and risk of conversion

Forest land in New York has been relatively stable for nearly 4 decades, ranging from 7.49 million ha (18.5 million acres) in 1980 to 7.7 million ha (19.0 million acres) in 2012 (Figure 10). The 2017 forest

land estimate is of 7.57 million ha (18.7 million acres), representing a reduction of forest surface of 1.4% over 5 years. The 2017 estimate represents the lowest full-cycle estimate since annual inventory began in 2002¹⁸.

A closer analysis utilizing plots that changed land use between 2012 and 2017 reveals a net forest land loss of 57,060 ha (141,000 acres). Most of this loss went to the idle farmland (32,375 ha; 80,000 acres) and other undeveloped (19,425 ha; 48,000 acres) categories. Generally, such land-use change results from small changes in maintenance patterns (mowing, edge maintenance, etc.). Furthermore, analysis of change is complicated by a change in definition of “forest land” from a minimum 10 percent stocking to a minimum 10 percent canopy cover, between 2012 and 2017. This may have resulted in land that previously qualified as forest land to no longer be categorized as such¹⁹.

Figure 10: Changes in forest land and timberland surfaces between 1953 and 2017



Source: Albright, Thomas A. 2018. Forests of New York, 2017. Resource Update FS-170. Newtown Square, PA: U.S. Department of Agriculture, Forest Service, Northern Research Station. 4 p. <https://doi.org/10.2737/FS-RU-170>.

The Draft FSC National Risk Assessment for the conterminous United States of America indicates that the risk of land conversion can be considered as specified risk in some counties on the Pacific Coast and in the Southeast region, while the rest of the country, including New York state, can be considered as low risk.²⁰

¹⁸ Albright, Thomas A. 2018. Forests of New York, 2017. Resource Update FS-170. Newtown Square, PA: U.S. Department of Agriculture, Forest Service, Northern Research Station. 4 p. <https://doi.org/10.2737/FS-RU-170>.

¹⁹ Albright, Thomas A. 2018. Forests of New York, 2017. Resource Update FS-170. Newtown Square, PA: U.S. Department of Agriculture, Forest Service, Northern Research Station. 4 p. <https://doi.org/10.2737/FS-RU-170>.

²⁰ Draft FSC National Risk Assessment for the conterminous United States of America, FSC-NRA-USA V2-0 draft 2017 (REVISED 01/03/18)

3.2. Standing trees volumes and removals

An assessment of the volumes of standing trees is performed on a yearly basis based on inventories conducted by the USDA Forest Service, Forest Inventory and Analysis (FIA) program of the Northern Research Station.

In 2017, the net volume of standing trees in forest land in New York state were estimated to 1,215.5 million m³ (42,926.9 million ft³), for trees over 5 inches in diameter, and 983.8 million m³ (34,742.6 million ft³) in timberland ²¹. These numbers represent a 4.6% and 5.0% increase over 5 years (roughly a 0.92 and 1% mean annual increase) in net volume of standing trees compared to 2012 in forest land and timberland respectively.

In 2017, the annual net growth of growing stock trees exceeded the combination of mortality, harvest and other removal, both in total forest land and in timberland (details in Table 1).

Table 1 shows that growing stock trees is increasing in forest land, and slightly decreasing in timberland (note that the last estimate is well within the sampling error).

Table 1 : New York forest statistics, 2017 and 2012.²²

	2017 Estimate	Sampling error (%)	2012 Estimate	Sampling error (%)	Change from 2012 (%)
Forest land					
Area (thousand acres)	18,730.8	0.6	19,005.5	0.7	-1.4
Number of live trees (million trees)	11,867.4	1.3	12,143.7	1.3	-2.3
Aboveground biomass of live trees (thousand oven-dry tons)	1,169,405.3	0.9	1,120,867.6	1.0	4.3
Net volume of live trees (million ft ³)	42,926.9	1.0	41,048.5	1.1	4.6
Annual net growth of live trees (thousand ft ³ /yr)	761,838.0	2.8	735,519.1	3.0	3.6
Annual mortality of live trees (thousand ft ³ /yr)	488,271.1	3.3	483,625.8	3.0	1.0
Annual harvest removals of live trees (thousand ft ³ /yr)	253,359.8	8.1	299,959.4	7.4	-15.5
Annual other removals of live trees (thousand ft ³ /yr)	15,276.3	40.1	21,614.5	35.9	-29.3
Timberland					
Area (thousand acres)	15,587.3	0.7	15,864.2	0.8	-1.7
Number of live trees (million trees)	9,406.9	1.5	9,693.5	1.5	-3.0
Aboveground biomass of live trees (thousand oven-dry tons)	948,818.3	1.1	905,870.5	1.2	4.7
Net volume of live trees (million ft ³)	34,742.6	1.2	33,091.9	1.3	5.0
Net volume of growing stock trees (million ft ³)	30,922.3	1.2	29,711.9	1.4	4.1
Annual net growth of growing stock trees (thousand ft ³ /yr)	617,184.4	2.4	618,185.3	2.5	-0.2
Annual mortality of growing stock trees (thousand ft ³ /yr)	260,677.6	4.3	260,833.5	3.8	-0.1
Annual harvest removals of growing stock trees (thousand ft ³ /yr)	202,231.5	8.3	245,873.1	7.5	-17.7
Annual other removals of growing stock trees (thousand ft ³ /yr)	23,070.2	30.8	29,876.6	28.5	-22.8

Source: Albright, Thomas A. 2018. Forests of New York, 2017. Resource Update FS-170. Newtown Square, PA: U.S. Department of Agriculture, Forest Service, Northern Research Station. 4 p. <https://doi.org/10.2737/FS-RU-170>.

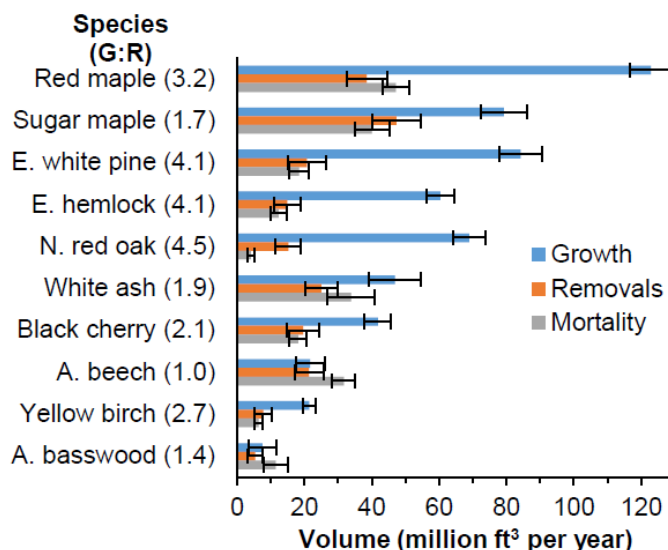
Comment: Volume estimates are for trees 5 inches and larger in diameter. Number of trees and biomass estimates are for trees 1 inch and larger in diameter. Sampling errors in tables and error bars in figures represent 68 percent confidence intervals

²¹ Albright, Thomas A. 2018. Forests of New York, 2017. Resource Update FS-170. Newtown Square, PA: U.S. Department of Agriculture, Forest Service, Northern Research Station. 4 p. <https://doi.org/10.2737/FS-RU-170>.

²² ft³ = 0.0283168 m³

Figure 11 shows that, for the top ten species in volume of live trees, growth exceeds or equal removal.

Figure 11: Average annual net growth, removals, and mortality volume on timberland, New York, 2017



Source: Albright, Thomas A. 2018. Forests of New York, 2017. Resource Update FS-170. Newtown Square, PA: U.S. Department of Agriculture, Forest Service, Northern Research Station. 4 p. <https://doi.org/10.2737/FS-RU-170>.

Comment: with net growth to removals ratios (G:R) in parentheses, for the top 10 species ranked by total net volume on timberland

3.3. Protection of ecosystems and biodiversity

Of the 1.9 million ha (4.7 million acres) of land managed by the New York State Department of Environmental Conservation (NYSDEC), nearly 1.21 million ha (3 million acres), or 61%, are classified as Forest Preserve²³. Comprised of 1.05 million ha (2.6 million acres) in the Adirondack Forest Preserve and 115,740 ha (286,000 acres) within the Catskill Forest Preserve, these lands represent a majority of all state owned property within the Adirondack and Catskill Parks²⁴. These forests are managed differently than timberland where various intensities of harvesting often are practiced. Although harvesting is prohibited on reserve forest land, much of it was harvested prior to public ownership (hence has been influenced by human activities). Trees on these lands contribute to watershed protection, recreational enjoyment, habitat for certain wildlife, and carbon storage. In New York, most reserved forest land is classified as Forest Preserve in the State owned portion of the Adirondack State Park²⁵.

²³ Forest preserve are properties owned by New York state that are required to be kept "forever wild" by Article 14 of the state constitution, and thus enjoy the highest degree of protection of wild lands in any state. New York's Forest Preserve, comprises almost all the lands owned by the state of New York within the Adirondack and Catskill parks. It is managed by the state Department of Environmental Conservation (DEC).

²⁴ New York State Department of Environmental Conservation. New York's Forest Preserve. <https://www.dec.ny.gov/lands/4960.html> Consulted online on 14th January 2019.

²⁵ Widmann R.H. et al. 2015. New York Forests, 2012. US Forest Service. Northern Research Station. Resource Bulletin NRS-98.

The NYSDEC manages more than 318,488 ha (787,000 acres) of State Forests. Unlike the Forest Preserve, State Forests are located throughout New York State - except within the Adirondack and Catskill Parks - and include Reforestation Areas, Multiple-Use Areas, Unique Areas and State Nature and Historic Preserves. These lands are highly valued for the recreational opportunities they provide and for their contributions to ecosystem health²⁶.

Figure 12 : Location of the two forest preserves in New York

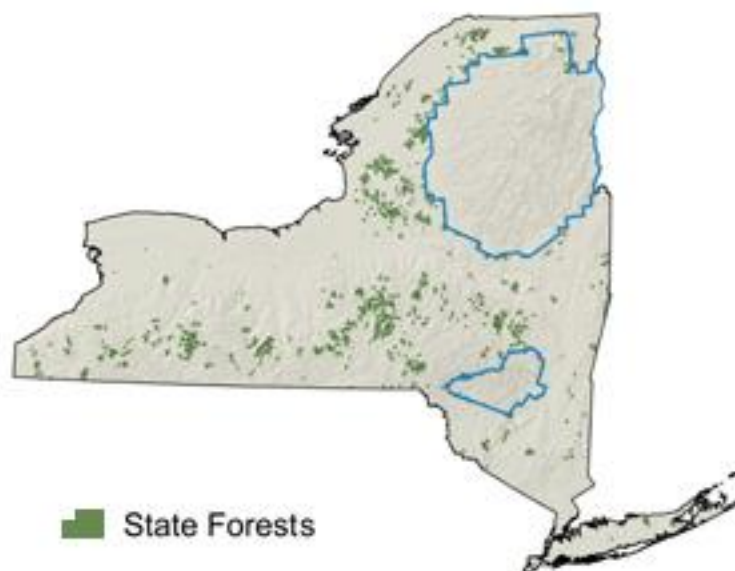


Source: New York State Department of Environmental Conservation. New York's Forest Preserve.

<https://www.dec.ny.gov/lands/4960.html> Consulted online on 14th January 2019.

Comment: Green surface corresponds to forest preserve lands and blue line represents the limits of the parks.

²⁶ New York State Department of Environmental Conservation. State forests. <https://www.dec.ny.gov/lands/40672.html> Consulted online on 14th January 2019.

Figure 13 : Location of the State Forests in New York

Source: New York State Department of Environmental Conservation. State forests. <https://www.dec.ny.gov/lands/40672.html>
 Consulted online on 14th January 2019.

Comment: Green surface corresponds to State Forests and blue line represents the limits of the State parks.

Another important land conservation tool employed widely across the United States, conservation easements are used to protect a variety of important natural resources and landscape values, such as water quality, wildlife habitat, sensitive ecosystems, wetlands, riparian areas, scenic areas, working forests, and historic sites. The primary function of an easement is to limit or eliminate future development and undesirable land uses on a property, while allowing for continued private ownership and traditional management. Most conservation easements are structured to meet multiple objectives. Some easements prohibit all future development, while others allow for limited new buildings or other improvements. Most easements allow traditional uses of the land, such as forestry, agriculture, or recreation, to continue as long as the conservation goals of the property are being met. New York State acquires conservation easements primarily on properties that buffer existing state lands, provide additional public recreational opportunities, and/or maintain large working forests. Hundreds of thousands of acres of land in New York are now protected by conservation easements acquired by the state; most of that land consists of large tracts of commercial timberland in the Adirondack and Tug Hill regions, however, NYSDEC also holds easements on a variety of other properties across the state. The NYSDEC manages more than 365,027 ha (902,000 acres) of Conservation Easement lands across New York State. Eighty-seven percent (317,679 ha; 785,000 acres) of these lands are located within the Adirondack Park²⁷.

²⁷ New York State Department of Environmental Conservation. Conservation Easements. <https://www.dec.ny.gov/lands/41156.html> Consulted online on 14th January 2019.

3.4. Protection of water

The US Federal *Clean Water Act* requires States to develop non-point source pollution prevention plans covering all categories of potential non-point water pollution, including silvicultural activities. New York's Silvicultural Non-point pollution prevention plan calls for a mix of outreach, education and voluntary "best management practices (BMP) for timber harvesting" to minimize and address this potential pollution source. In 2000, the Empire State Forest Products Association, the NYC Watershed Agricultural Council's Watershed Forestry Program, the NYS Department of Environmental Conservation jointly developed a pocket field guide of "New York State Forestry Best Management Practices for Water Quality"²⁸. This guide book has been an effective tool used by timber harvesters, professional foresters and forest landowners²⁹.

Studies have shown that while timber harvesting is not a major cause of water quality problems, skid trails, haul roads and landings have the potential to be sources of sedimentation, erosion and siltation of streams and other water bodies. For this reason, NYSDEC developed a field guide "NYS Forestry Best Management Practices for Water Quality". It presents suggestions, guidelines and technical references on a range of timber harvesting BMPs to have an economically viable timber harvest which protects the soil, water and remaining timber resources from loss or degradation³⁰.

The focus points of these BMPs for water protection are to:

- Protect water quality by minimizing erosion and surface water run-off
- Maintain hydrologic processes by limiting disturbances to water flow patterns
- Maintain water temperature along shorelines and streambanks

The use of the "New York State Forestry Best Management Practices for Water Quality" is voluntary on privately owned forests. No monitoring or statistics have been found regarding to what extent the best practices are implemented in NY state.

State Forests, i.e. managed by New York State Department of Environmental Conservation (NYSDEC), are exploited following recognized standards of sustainability (see section "Forest certification"), hence ensuring protection of water.

The local management of water quality, soil health, community and natural resource resiliency, green infrastructure, and other local natural resource is led by New York State Soil and Water Conservation Districts, supported by the New York State Soil and Water Conservation Committee³¹.

²⁸ https://www.dec.ny.gov/docs/lands_forests_pdf/forestrybmp.pdf

²⁹ New York State Department of Environmental Conservation. Forest resource assessment & strategy 2010 – 2015. https://www.dec.ny.gov/docs/lands_forests_pdf/fras070110.pdf

³⁰ New York State Department of Environmental Conservation. NYS Forestry Best Management Practices for Water Quality. <https://www.dec.ny.gov/lands/37845.html>. Consulted online on 14th January 2019.

³¹ New York State Soil and Water Conservation Committee. Strategic plan 2014-2018. <https://www.nys-soilandwater.org/aem/forms/Strategic-Plan.pdf>

3.5. Protection of soils

Soil is important to forest sustainability since it is, literally, what supports trees. Natural soil conditions, and their ability to support tree and forest growth, are negatively impacted by a variety of factors including acid deposition, compaction, development and “hard-surfacing”, erosion, land cover, fire and even non-native earthworms ³².

As for the protection of water, the protection of soil in New York state relies on the implementation of Best Management Practices (BMP), which can be found in the “New York State Forestry Best Management Practices for Water Quality”.

The focus points of these BMPs for soil protection are to:

- Minimize soil erosion
- Protect nutrient balances in the soil

As for water protection, the BMPs are implemented on a voluntary basis.

State Forests, i.e. managed by New York State Department of Environmental Conservation (NYSDEC), are exploited following recognized standards of sustainability (see section “Forest certification”), hence ensuring protection of soil.

The local management of water quality, soil health, community and natural resource resiliency, green infrastructure, and other local natural resource is led by New York State Soil and Water Conservation Districts, supported by the New York State Soil and Water Conservation Committee³³.

3.6. Protection of carbon stocks

Forest ecosystems represent the largest terrestrial carbon sink on earth. In forest land, the carbon stocks mainly include:

- living above ground and below ground woody biomass,
- soil organic carbon,
- carbon in litter.

Carbon stocks are not directly measurable. Instead, a combination of empirically derived carbon estimates (e.g., standing live trees) and models (e.g., carbon in soil organic matter based on stand age

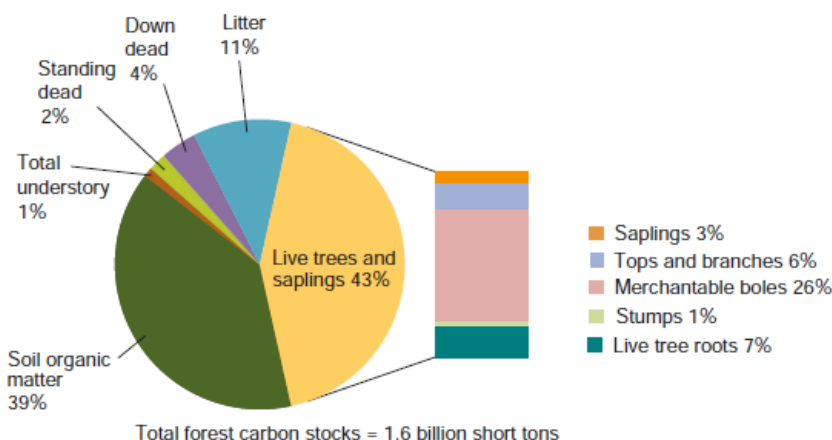
³² New York State Department of Environmental Conservation. Forest resource assessment & strategy 2010 – 2015. https://www.dec.ny.gov/docs/lands_forests_pdf/fras070110.pdf

³³ New York State Soil and Water Conservation Committee. Strategic plan 2014-2018. <https://www.nys-soilandwater.org/aem/forms/Strategic-Plan.pdf>

and forest type) were used to estimate New York's forest carbon in 2012³⁴. The procedure to evaluate carbon stock is detailed in ³⁵.

The contribution of the various compartments of the ecosystem to the forest land carbon stock in the New York state is represented on Figure 14.

Figure 14 : Estimated carbon stocks on forest land by forest ecosystem component in New York state in 2012



Source: Widmann R.H. et al. 2015. New York Forests, 2012. US Forest Service. Northern Research Station. Resource Bulletin NRS-98.

Carbon stocked on New York forest land, at the ecosystem level, is 1.6 billion tons, and increased by 2.2 percent between 2007 and 2012³⁶. A similar estimation is not available between 2012 and 2017 but as the net volume of standing trees increased between these years, an increase in the above-ground carbon stock is expected.

Carbon in living trees can increase relatively quickly in young stands, then slows down, and after 100 years, nearly stops, whereas carbon in the soil changes slowly as stands grow old. Sixty-one percent of New York's live tree carbon is contained in stands 41 to 80 years old stands³⁷.

The largest pool, aboveground carbon in live trees and saplings, is influenced by timber harvesting and other disturbances. Because nearly three-fourths of New York's forests are less than 80 years old and dominated by relatively long-lived species, it can be expected that they will continue to accumulate

³⁴ Widmann R.H. et al. 2015. New York Forests, 2012. US Forest Service. Northern Research Station. Resource Bulletin NRS-98.

³⁵ Smith, J.E.; Heath, L.S.; Skog, K.E.; Birdsey, R.A. 2006. Methods for calculating forest ecosystem and harvested carbon with standard estimates for forest types of the United States. Gen. Tech. Rep. NE-343. Newtown Square, PA: U.S. Department of Agriculture, Forest Service, Northeastern Research Station. 216 p.

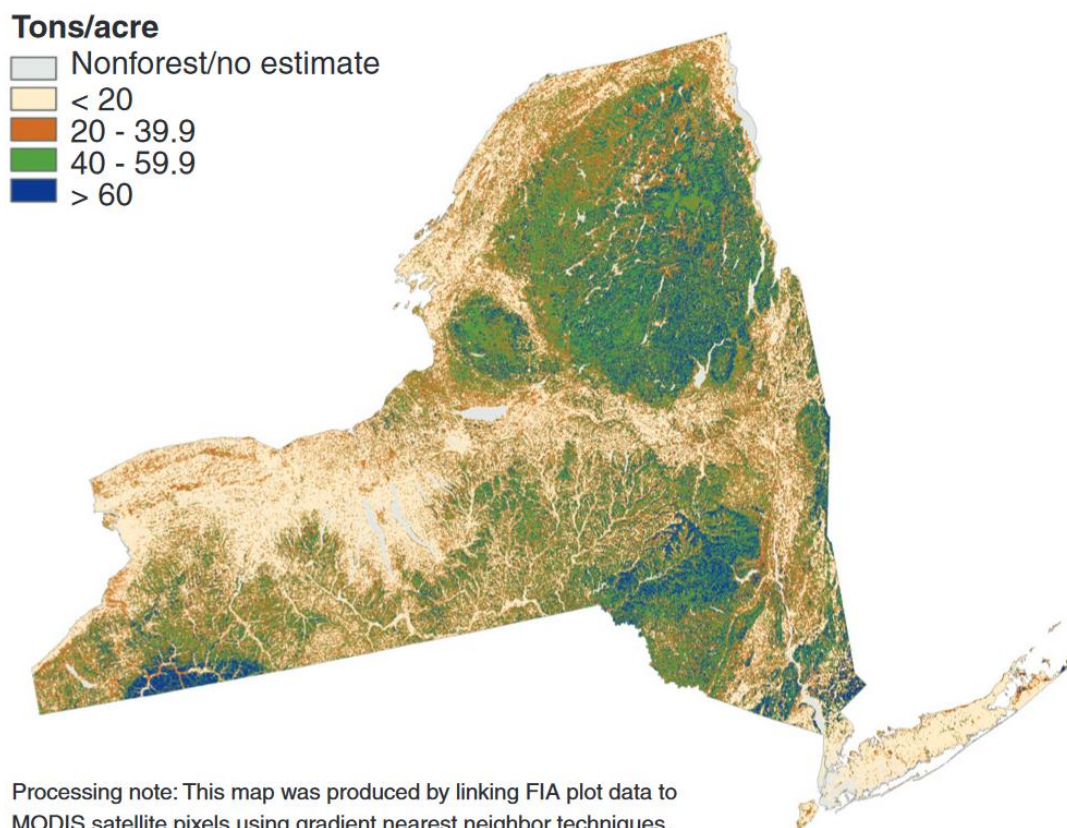
³⁶ Widmann R.H. et al. 2015. New York Forests, 2012. US Forest Service. Northern Research Station. Resource Bulletin NRS-98.

³⁷ Widmann R.H. et al. 2015. New York Forests, 2012. US Forest Service. Northern Research Station. Resource Bulletin NRS-98.

aboveground carbon at a fairly rapid pace. The rate of increase will slow as stands grow older. Soil carbon, the second largest pool, is important to long-term carbon sequestration, but because changes to it are slow, there are few opportunities to manage for it in the near term³⁸.

Figure 15 shows the spatial distribution of carbon stocks in New York state.

Figure 15 : Distribution of biomass per acre on forest land in New York, 2007



Source: Widmann, R. H. et al. 2012. New York's Forests 2007. Resour. Bull. NRS-65.

3.7. Protection of air quality

The main impact of forestry on air quality relates to fire. It includes wild fire (which are unintended) and prescribed fire (which is used as part of forest management under controlled conditions).

Prescribed fire is a tool used to manage fire dependent ecosystems in a manner that develops a resilient natural balance of fire in the desired vegetation. Forest and wildlife managers use prescribed

³⁸ Widmann R.H. et al. 2012. New York's Forests 2007. Resour. Bull. NRS-65.

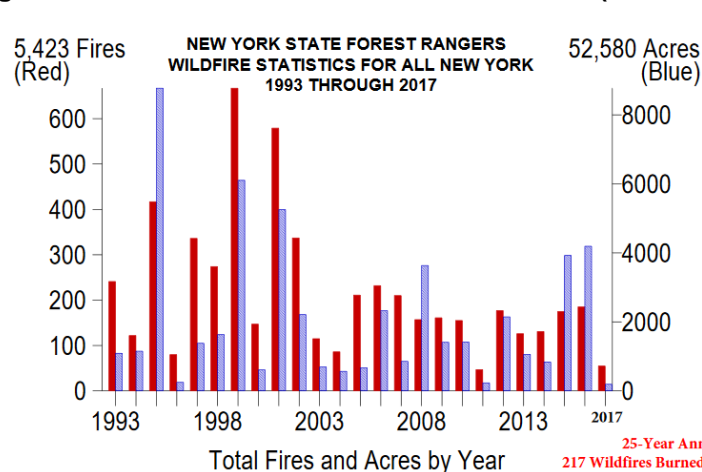
fire to burn wildlands in order to accomplish specific management goals. These fires are regulated by law and regulation and require technical expertise to conduct the burns safely³⁹.

The Department of Environmental Conservation defined the following objectives to mitigate the impact of wildfires⁴⁰:

- In order to minimize the occurrence of wildfire and the associated property loss, forest damage and sometimes loss of life, New York will need to accomplish the following objectives;
- Maintain a highly trained, well equipped forest ranger force that uses its expertise and resources to contain to most serious of fires.
- Support fire departments with their responsibility for initial attack of most wildfires.
- Enforce fire prevention laws, especially the apprehension of those who purposely set fires.
- Use wildfire predictive services to notify the public and fire officials of fire danger potential.
- Support and implement *FireWise and Ready, Set, Go!* programs.
- Conduct fire prevention programs in areas of greatest need.
- Practice safe debris burning and recreational fires in all forests and wildland urban interface environments as allowed by state and local regulations.
- Support fuel reduction techniques in critical wildland urban interface communities.
- Support communities with Community Wildfire Protection Plans (CWPP) with activities that further reduce the risk of wildfire.
- Identify communities-at-risk of destructive wildfires and support the development of CWPPs for these communities.

The surfaces affected by wildfire largely decreased during the 20th century. After 2000, some severe wildfire took place (particularly in 2008, 2015 and 2016, as shown by blue bars overpassing red bars in Figure 16)⁴⁰.

Figure 16 : Number of wildfire and areas affected (1993-2017)



³⁹ New York State Department of Environmental Conservation. Wildfires. <https://www.dec.ny.gov/lands/4975.html> Consulted online on 11th January 2019.

⁴⁰ New York State Department of Environmental Conservation. Wildfire in New York State <https://www.dec.ny.gov/lands/42378.html> Consulted online on 11th January 2019.

Source: New York State Department of Environmental Conservation. Wildfire statistics.
https://www.dec.ny.gov/docs/legal_protection_pdf/wildfireocc5.pdf Consulted online on 11th January 2019.

3.8. *Illegal logging*

The FSC Centralized National Risk Assessment considers that USA (as a whole) is at low risk in terms of illegal logging, as 20 over 21 indicators are classified as at low risk (the 21st criteria is characterized as N/A)⁴¹.

3.9. *Civil rights and traditional rights*

The Draft FSC National Risk Assessment for the conterminous United States of America indicates that the risk of violation of civil and traditional rights can be considered as low risk in the country as a whole, including the Northeast region and New York state in particular.⁴²

3.10. *Forest certification*

The main forest certification schemes used in New York state are⁴³:

- SFI (Sustainable Forestry Initiative⁴⁴), which is endorsed by PEFC (Programme for the Endorsement of Forest Certification)
- ATFS (American Tree Farm System™; endorsed by PEFC (Programme for the Endorsement for Forest Certification systems ⁴⁵)
- FSC (Forest Stewardship Council⁴⁶), which is specifically suitable for small private owners

The total area of privately owned forests certified through these three systems in New York State is 852,968 ha (2,107,727 acres). The certified forest area under each of those schemes is presented in the table hereunder, with some areas covered by several certification schemes:

⁴¹ United States of America CNRA Draft. Downloaded on 14th January 2019. <https://ic.fsc.org/en/document-center/id/157>

⁴² Draft FSC National Risk Assessment for the conterminous United States of America, FSC-NRA-USA V2-0 draft 2017 (REVISED 01/03/18)

⁴³ Empire State Products Association. Forest Certifications. <http://www.esfpa.org/content/forest-certifications> Consulted online on 14th January 2019

⁴⁴ <http://www.sfiprogram.org>

⁴⁵ American Tree Farm System Certification. <https://www.treefarmssystem.org/atfscertification> Consulted online on 28th January 2019

⁴⁶ www.fsc.org

Table 2 : Certified privately owned timberland in New York state

	SFI	ATFS	FSC	Total certified
Area certified	552,019 ha 1,364,066 acres	201,110 ha 496,592 acres	544,678 ha 1,345,926 acres	852,968 ha 2,107,727 acres

Source: <http://www.esfpa.org/content/forest-certifications>, consulted online on 11th January 2019.

Comment: some areas are covered by several certification scheme

State Forests managed by the New York State Department of Environmental Conservation's (NYSDEC) Bureau of Forest Resource Management earned the status of "certified" to the Forest Stewardship Council (FSC) and the Sustainable Forestry Initiative (SFI) forest management standards. With this recognition, NYSDEC has demonstrated that the forests under its care are managed sustainably⁴⁷.

*Note on family forest FSC certification: Over half of working forestland in the United States is owned and managed by some 10 million families and individuals collectively known as "family forest owners". The FSC-US Family Forests Program provides a market-driven incentive for this ownership group to engage in responsible forest stewardship. Through efficient, low cost group certification programs, family forest owners can better realize the economic benefits of stewardship and gain access to markets for FSC-certified wood and paper products.*⁴⁸

4. Conclusions

New York state has a very large forest land (7,57 million ha or 18,7 million acres in 2017), which represents about 63% of the state's land area. The forest surface has been relatively stable over the four past decades. Over 80% is considered as timberland and over 15% is reserved forest land. The state is diverse in terms of ecological and topographic conditions, with forest being less present in lowlands.

Approximately 75% of New York's forest land area is privately-owned (over 2/3 of which are owned by families). Public ownership accounts for the remaining 25%, mostly as reserved forest land.

Deciduous forests predominate largely in New York state and account for the great majority of all forest species. Maple/beech/birch and oak/hickory forest-type groups collectively comprise 73% of forest land in New York. Conifers are more limited.

Forest land in New York has been relatively stable for nearly 4 decades, ranging from 7.49 million ha (18.5 million acres) in 1980 to 7.7 million ha (19.0 million acres) in 2012 (Figure 10). The 2017 estimate is of 7.57 million ha (18.7 million acres) and represents a reduction of forest surface of 1.4% over the last 5 years. It also represents the lowest full-cycle estimate since the start of annual inventory system

⁴⁷ New York State Department of Environmental Conservation. State Forest Certification. <https://www.dec.ny.gov/lands/42947.html> Consulted online on 15th January 2019

⁴⁸ Family Forests. FSC United States website. <https://us.fsc.org/en-us/certification/forest-management-certification/family-forests> Consulted online on 15th January 2019

which began in 2002. This growth to removal ratios for the predominant species indicates that growth exceeds removal, with growing stock trees increasing in forest land.

An assessment of the volumes of standing trees is performed on a yearly basis based on inventories conducted by the USDA Forest Service, Forest Inventory and Analysis (FIA) program of the Northern Research Station. In 2017, the net volume of standing trees in forest land in New York state were estimated to 1,215.5 million m³ (42,926.9 million ft³), for trees over 5 inches in diameter, and 983.8 million m³ (34,742.6 million ft³) in timberland. Growing stock trees have increased in forest land, and slightly decreased in timberland (although this decrease is close to 0%).

Carbon stocked on New York forest land, at the ecosystem level, is 1.6 billion tons, and increased by 2.2 percent between 2007 and 2012⁴⁹. A similar estimation is not available between 2012 and 2017 but as the net volume of standing trees increased between these years, an increase in the above-ground carbon stock is expected. Because nearly three-fourths of New York's forests are less than 80 years old and dominated by relatively long-living species, it can be expected that they will continue to accumulate aboveground carbon at a fairly rapid pace. The rate of increase will slow as stands grow older.

Protected forest areas, mostly State preserve, cover 1.21 million ha (3 million acres), which is about 16% of the state forest land.

The local management of water quality, soil health, community and natural resource resiliency, green infrastructure, and other local natural resource is led by New York State Soil and Water Conservation Districts, supported by the New York State Soil and Water Conservation Committee. The protection of soil and water during forestry operations in New York relies on the voluntary implementation of "New York State Forestry Best Management Practices for Water Quality". It is unknown to what extent the best practices are implemented on the field because no monitoring statistics are available.

Even though controlled fires are used in forest management practices in New York, the use of fire is subject to permit and carefully monitored in order to preserve air quality.

The FSC risk assessment platform considers that USA is at low risk in terms of violation of illegal logging and in terms of violation of traditional and civil rights.

Three internationally recognized forest certification systems are present in New York: SFI, ATFS (endorsed by PEFC) and FSC. 16% of private land is certified by one or more of these systems. SFI and FSC are the most important systems, both with more than 50% of the certified forests (some areas are covered by more than one certification system). State Forests are covered by both the FSC and SFI standards. FSC-US help public and private partners establish and maintain FSC-certified family forest groups.

⁴⁹ Widmann R.H. et al. 2015. New York Forests, 2012. US Forest Service. Northern Research Station. Resource Bulletin NRS-98.

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