

Forestry and Tree Planting in New York State

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Abstract

The New York State tree nursery system was founded in 1902, making it the oldest State-run tree nursery in the United States (Solano 2003). Throughout the decades, the New York State tree nursery has evolved to meet the changing needs of tree planting in New York State. From the first small nurseries in the Adirondacks, the nursery system grew to multiple nurseries across the State that provide trees to fulfill local

planting needs. Since the first years of planting trees, when the State's land was barely 20 percent forested, through the huge reforestation programs in the 1930s and to the rising demand for native species in the 21st century, the nursery has grown the trees that have helped transform the State. Today, nearly 63 percent of the State is forested (figure 1) (NYS DEC 2010). As the effects of climate change become increasingly apparent, however, the need for trees and shrubs for replacement and mitigation will undoubtedly grow.



Figure 1. Forested areas in New York State. (Map source: New York State Department of Environmental Conservation [NYS DEC], 2010).

Introduction

New York's forests (figure 1) deliver the ecosystem services our society depends on daily, such as clean air, clean water, flood control, erosion control, carbon sequestration, natural cooling, drought mitigation, aquifer recharge, and a steady source of fresh oxygen from plant photosynthesis. They also produce a wealth of forest products, provide a place for outdoor recreation, and support associated economies.

New York has a long history of responding to challenges regarding the State's important forest resources, from the Forest Preservation Act of 1885 to the 2009 revision of the State's Open Space Conservation Plan (OSP) (NYS DEC 2010). As scientists learn more about the effects of global climate change, it becomes increasingly clear that healthy forests are essential to the Nation's future. The challenge is to keep the forests healthy and vigorous in the face of climate change, exurban sprawl, pests, diseases, and invasive species. By improving sustainable forest management practices, we can keep New York's forests as forests and keep them working for the future of the State and its residents.

Brief Overview of New York State's History, Politics, and Economy Regarding Forest Management

Early Deforestation

New York was one of the first States to have permanent European settlements, beginning in the 1600s with New York City and the Dutch communities along the Hudson River. At the time of European contact, the State was mostly forest. Native Americans had been using fire to manage forests, to encourage early succession communities for game, to maintain open ridge areas for blueberries, and to clear openings for agriculture. Until the opening of the first Erie Canal section from Rome to Utica in 1819, development of much of the State had been limited. The subsequent canal network was surprisingly extensive, considering the rugged topography of much of the State, and opened up vast areas of forested land for logging and agriculture (Verschoor 2006).

Serious deforestation started with the Industrial Revolution, which brought railroads, large-scale industry, and widespread use of steam engines. Logging became almost ruthlessly efficient, and large areas of the Adirondacks and other areas were heavily cut. Some industries were extremely dependent on forest products, notably the numerous tanneries, which used the high tannin bark of hemlocks; this use led to an almost complete removal of this species, especially in the Catskills (Kudish 2000).

By the 1880s, less than 20 percent of New York State was forested, and the remaining uncut forests in the Catskills and Adirondacks were being logged at a fast pace. In 1885, New York created the Forest Preserve Act to protect State-owned lands in the Catskills and Adirondacks from further exploitation (NYS DEC 2010). This act was strengthened in 1894 by an amendment to the New York State Constitution:

The lands of the State, now owned or hereafter acquired, constituting the forest preserve as now fixed by law, shall be forever kept as wild forest lands. They shall not be leased, sold or exchanged, or be taken by any corporation, public or private, nor shall the timber thereon be sold, removed or destroyed.

The Forest Preserve began with 681,000 acres (275,600 hectares) in the Adirondacks and 34,000 acres (13,760 hectares) in the Catskills. Today there are more than 2.6 million forested acres (1.05 million forested hectares) in the Adirondacks and more than 300,000 acres (121,400 hectares) in the Catskills, held as forever wild lands for New Yorkers. The Forest Preserve is the largest State-designated wilderness in the country and the largest wilderness area east of the Mississippi River (figure 2).

In the 1930s, years of drought resulted in the national climate crisis known as the Dust Bowl—which coincided with the Great Depression. Even in New York, farms failed from drought and millions of agricultural acres were abandoned. Some of this land was in such poor condition that nothing could grow on it.

Bringing Forests Back

Forests in all the Northeastern States were disappearing quickly by the end of the 19th century, but New York was the first State to take measures to reverse this trend toward total forest destruction. In 1901, the Forest, Fish and Game Commission planted the first tree plantation on State land in the Catskills to replace trees that had been burned. Because no North American sources for seedlings were available in large quantities, it was necessary to import seedlings from the huge tree nurseries in Europe. Europeans had long practiced sustainable forestry, growing many tree species, including North American trees such as eastern white pine (*Pinus strobus* L.) and red pine (*P. resinosa* Ait.), in tightly managed tree plantations, where seedlings were planted to replace trees that had been cut. Millions of tree seedlings would be needed to even begin restoring the ravaged forests of New York. The United States needed to develop its own sources of seedlings, grown close to where they would be planted, and free of imported pests and diseases. Federal and State tree nurseries were the best way to supply millions of seedlings at reasonable cost.

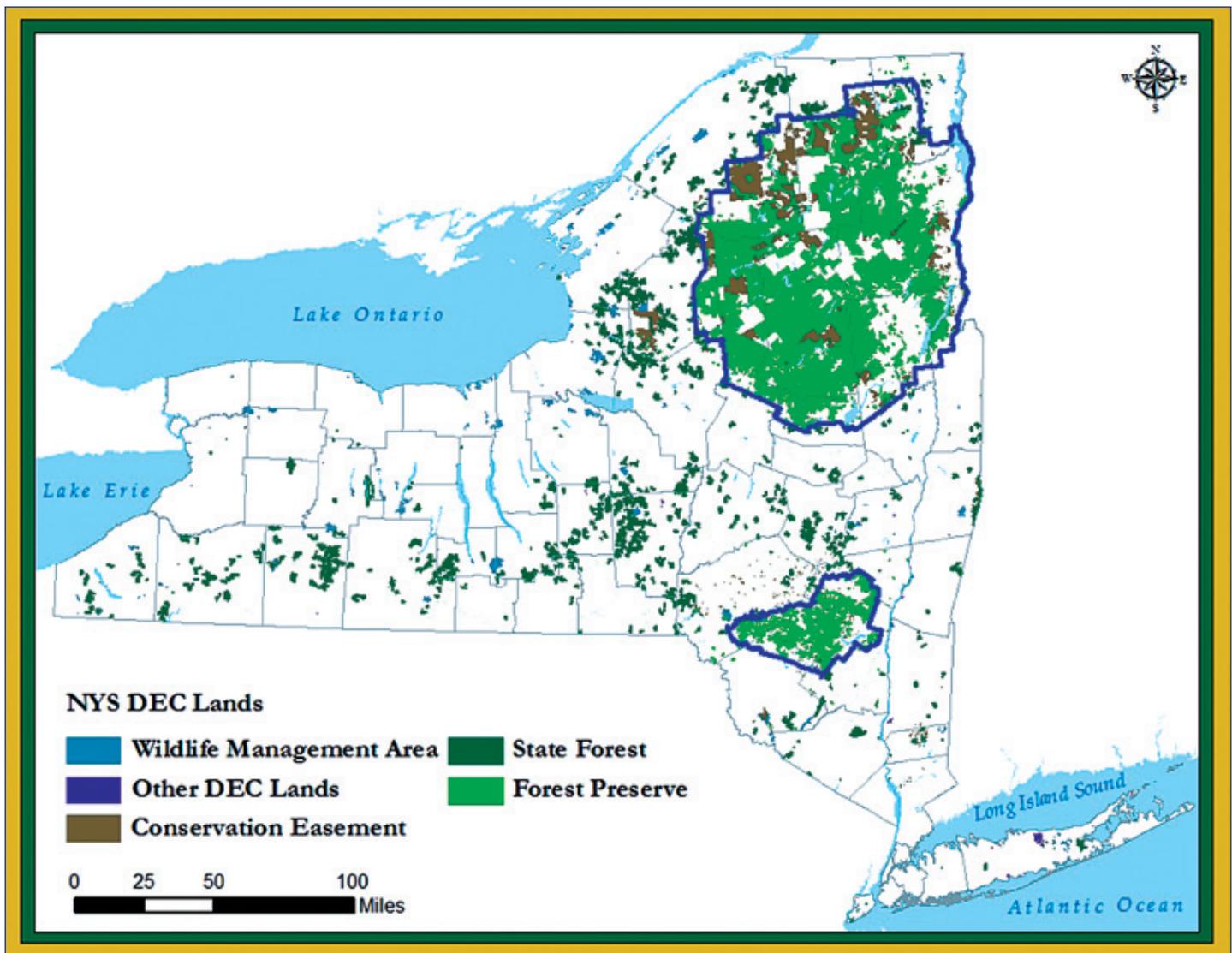


Figure 2. State land and conservation easements managed by the New York State Department of Environmental Conservation. (Map source: NYS DEC, 2012).

Much of the farmland in New York was on marginal land and, as better land became available out West, the agriculture industry began to decline in New York. When the Great Depression hit, many farmers could no longer make a living on their worn out, unproductive land (figure 3). The 1929 State Reforestation Act and the 1931 Hewitt Amendment authorized the Conservation Department to buy land for reforestation purposes (NYS DEC 2010, 2011). These lands were known as State reforestation areas and were the beginning of today's State Forest System in New York. Many of the early reforestation areas were established on some of the worst lands in the State. The Conservation Department began a massive tree-planting program to restore these lands for watershed protection, soil stabilization, flood prevention, and future timber production. Today, these areas are covered with healthy, well-managed State forests. (State Forests are still referred to as reforestation areas as originally defined in legislation.)

New York's Forest Practice Act (FPA) of 1946 recognized the importance and contributions of private forest lands. The FPA program was deemed vital to the interests of the people of New York State to ensure that the practice of forestry would be encouraged, that damage to the environment caused by unplanned and exploitive overcutting might be avoided, and that the industries of the State that are dependent on forest products might be stabilized as much as possible. The act provided free forestry assistance to private landowners. As late as 1970, 1 in 25 forest landowners received program technical assistance each year. Today, that number has declined to 1 in 300 because of decreases in program staffing and a sharp increase in the number of forest owners (NYS DEC 2010).

State funding for tree planting fell victim to the Depression, but the Federal Civilian Conservation Corps (CCC), founded by President Franklin D. Roosevelt in 1933, rescued the tree-planting program in New York. Millions of tree seedlings

were planted on the barren soil of the new State reforestation areas, work that provided employment for thousands of young men. Roosevelt was especially interested in reforestation work, having planted his own estate with seedlings from the State tree nursery beginning in 1912. His trips to view CCC projects in New York typically included visits to reforestation areas (figure 4). Plantations consisted mainly of conifers. Hardwoods regenerated naturally but, at the time, were considered much less valuable than softwoods (figure 5).



Figure 3. The droughts that contributed to the 1930s Dust Bowl also affected the Northeastern United States; many farms on already marginal agricultural land turned to sand. (Photo from NYS DEC archives, date unknown).



Figure 4. Franklin Roosevelt visiting a New York State Reforestation Area, circa 1930. (Photo from New York State Museum).



Figure 5. Norway spruce plantation in 2008. (Photo by Justin Perry, NYS DEC).

After World War II, a resurgence of tree planting occurred as more farmland fell vacant. Scientific game management led to the development of State-owned Wildlife Management Areas to provide optimal habitat for game species such as waterfowl and upland birds. The Park and Recreation Land Acquisition Act of 1960 and the Environmental Quality Bond Acts of 1972 and 1986, provided funds for the acquisition of additional State forest lands, including inholdings or parcels adjacent to existing State forests (NYS DEC 2011).

Creation of the Department of Environmental Conservation

In 1970, on the first Earth Day, the New York State Department of Environmental Conservation (DEC) was established. This new agency joined the mission of the old Conservation Department with the missions of State environmental quality bureaus that were part of the Department of Health. Today's DEC manages a variety of programs that protect air, land, and water resources, and the public lands and private forest landowner programs contribute mightily to this effort.

Topography and Climate of New York

The topography of New York reflects its complex geologic history. Nearly all of the State has been glaciated, and some areas are covered with thick glacial till and glacial lake sands and clay. Glacial deposits and soils are thin over the large areas of resistant bedrock, which control the topography.

Elevations range from sea level on the beaches of Long Island up to the 5,344 ft (1,683 m) summit of Mount Marcy in the Adirondack Mountains (figure 6). The Catskill Mountains, composed of resistant sedimentary sandstones and conglomerates, are located at the northeastern corner of the Appalachian plateau. The southernmost part of the State is Long Island, which was formed by a glacial terminal moraine. Most of the good farmland is along river valleys, the Great Lake plains, and the rolling hills of the Allegheny Plateau (figure 1), where soils are deepest. These areas were cleared for agriculture relatively early in New York's history; some have been in cultivation since the 1600s.

New York has a humid continental climate with hot summers and cold winters. Much of the State is within U.S. Department of Agriculture (USDA) hardiness zone 5, dropping to zone 4 in the higher elevations and northern areas. The coldest areas are in the central Adirondack Mountains, which fall into zone 3a, with a minimum temperature of -30 to -40 °F (-34 to -40 °C). Water bodies have a considerable influence on New



Figure 6. Mount Joe in the Adirondack Forest Preserve. (Photo by James Sessions, NYS DEC, 2009).

York’s climate and vegetation. The moderating effect of the Atlantic Ocean puts Long Island in USDA hardiness zone 7a. The Great Lakes have a strong influence on the climate of western New York, much of which is in zone 6, The Hudson River, the Finger Lakes, Lake Champlain, and the St. Lawrence River extend warmer climate zones into colder high-elevation areas. The 2012 USDA Hardiness Zone map shows a 5 degree Fahrenheit (2.8 degree Celsius) increase in average temperatures for the State since the last map was published in 1990. This increase has shifted the warmest areas of New York up to zone 7b and the coldest to zone 3b.

Ownership of Forest Land

Of New York’s 30.2 million acres of land area (not including interior water bodies or submerged coastal areas), forest land covers 18.95 million acres (7.67 million hectares), or 63 percent. Of this land area, 14.4 million acres (5.8 million hectares), or 76 percent of New York’s forest land area, is owned

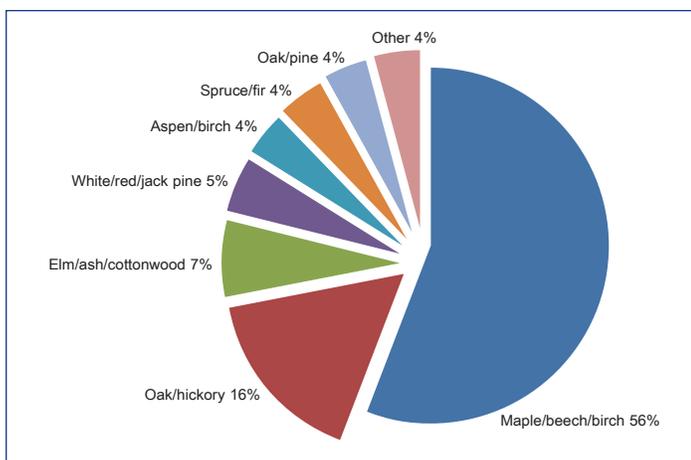


Figure 7. Area of forest land by forest type group. (Data source: NYS DEC, 2010).

by approximately 687,000 private landowners. The State owns 3.7 million acres (1.5 million hectares) of forest land and owns conservation easements on an additional 900,000 acres (364,220 hectares) of forest land (figure 2).

Forest Types and Their Primary Plant Species

With its wide climate range and varied topography, New York has a rich diversity of forest types and tree species. The present forests in New York began developing after the last glacier started to retreat 15,000 years ago. Nearly all of New York State was scraped over by the glaciers and then covered with a layer of raw glacial debris. As the climate slowly warmed, plants began to migrate north to colonize the barren postglacial landscape. Spruce species were the first to arrive, followed by white pine, hemlock, oak, beech, and, finally, chestnut, which arrived 2,000 years ago.

Major forest-type groups and their respective percent of total forest have changed little in recent decades. New York forest land continues to be dominated by the northern hardwood forest type (maple/beech/birch) (56 percent), followed by the oak/hickory forest type (18 percent) (figure 7). More than 100 species of commercial and noncommercial trees populate New York’s forests.

New York forests are mainly of natural origin, meaning they developed from seed dispersed by surrounding mature forest or from seed sources stored in the soil. Fewer than 1 million acres (404,690 hectares) of forest land developed from plantations planted by various landowners, mostly from the 1930s through the 1970s (figure 8). About 350,000 acres (141,640 hectares) of planted acres exist on approximately 750,000 acres (303,510 hectares) of State-owned forest management

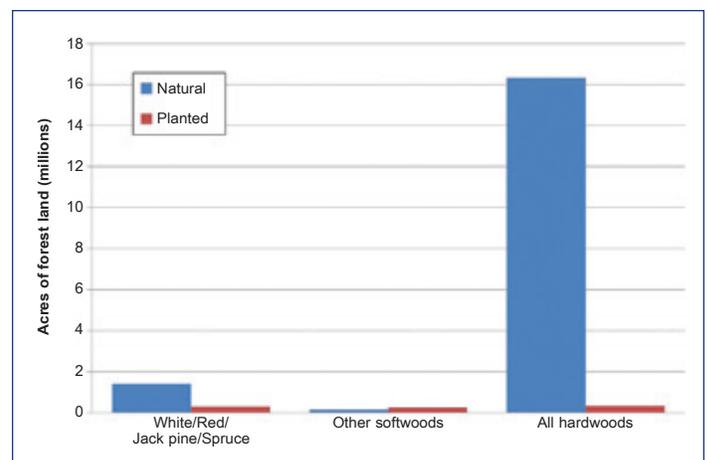


Figure 8. Area of forest land by stand origin. (Data source: NYS DEC, 2010).

land. The number of acres planted has waned substantially in recent decades, and some older plantations are being converted back to a natural forest condition.

Current Forest Restoration Projects

Current day restoration projects are primarily urban and community forestry and riparian buffer restoration projects. The term *urban forestry* still sounds contradictory to some people and yet, streets, parks, yards, and green spaces are where most New Yorkers are exposed to trees and their many benefits (figure 9). The number of community tree programs is increasing as the many benefits of trees are gaining recognition: physical and emotional health, storm water retention, more attractive places to live and visit, and energy savings for heating and cooling of buildings, to name a few (figure 10). The largest and most well-known urban forestry program is New York City's MillionTreesNYC campaign. Launched by



Figure 9. As more people live in developed cities and communities, the urban forest and its benefits become more essential. (Photo by Mary Kramarchyk, NYS DEC, 2006).



Figure 10. Street trees reduce heating and cooling costs in buildings and make communities more livable. (Photo by Mary Kramarchyk, NYS DEC, 2006).

the city's Parks Department and the New York Restoration Project, MillionTreesNYC is a collaboration of many partners, including community-based and nonprofit groups; city, State, and Federal agencies; corporations and small businesses; developers, architects, and landscape architects; private-property owners; and many New York residents. Hundreds of other municipalities, from large cities, to small villages, actively manage their community forests across the State.

Most communities buy trees directly from private nurseries. Some communities buy smaller, less expensive trees and grow them to the appropriate size for street planting. The State tree nursery works with some communities to provide seedlings that the community or a contracted private nursery grows to the appropriate size for street planting.

The storms and floods of 2011 reinforced one of the stated threats of global climate change—extreme weather events. Modeled after the successful Hudson River Estuary's Trees for Tribs program, New York State DEC's Trees for Tribs program engages volunteers in restoring thousands of feet of streamside buffer through tree planting using native bareroot stock from the State tree nursery (figure 11). The program provides landowners and local governments with low-cost or no-cost native planting materials and free technical assistance. Coordinating with local, Federal, and State agencies, Trees for Tribs focuses on comprehensive watershed restoration designed to protect the green infrastructure, which is the first line of defense against storm and flooding events; it also aims to protect property, water quality, fish, and wildlife. Trees for Tribs promotes best management practices for communities and encourages new programs, policies, and investments in tributary protection.



Figure 11. The success of Trees for Tribs is the result of partnerships with communities, nonprofit organizations, businesses, private landowners, and volunteers. (Photo by James Clayton, NYS DEC, 2011).

Challenges Facing the State's Trees

Although fire was considered the greatest threat to New York forests 100 years ago, land development and forest pests and diseases are now the biggest threats. Large deer populations have had a major negative effect on forest regeneration and have opened up forest understory areas for colonization by many invasive plants. Climate change is expected to present new challenges and exacerbate threats from existing forest pests.

New York City, as a major port for international trade, has unfortunately been an entry point for many pests and diseases, leading to successive waves of tree species mortality. With the expansion of global trade beginning in the late 19th century, plants from Europe and Asia were imported in huge quantities without regulation or inspection. Chestnut blight was first discovered in 1904 on trees in the Bronx Zoo, followed by white pine blister rust in 1907, found on imported eastern white pine (*Pinus strobus* L.) seedlings. Dutch elm disease, gypsy moth, and a wide range of other pests and diseases continued to arrive in New York during the 20th century, despite the regulation of imported plants and wood products beginning in 1912, with the first Federal plant quarantine act.



Figure 12. Staff setting a sticky trap for emerald ash borer. (Photo from NYS DEC, 2010).

Hemlock woolly adelgid (*Adelges tsugae* Annand) has decimated eastern hemlock (*Tsuga canadensis* [L.] Carr.) populations in southeastern New York and continues to spread. Butternut canker (*Sirococcus clavignenti-juglandacearum* Nair, Kostichka & Kuntz) has reduced butternut (*Juglans cinerea* L.) to a fraction of its former abundance. Asian longhorned beetle (*Anoplophora glabripennis* [Motschulski]) was discovered in New York City in 1996 and has already destroyed hundreds of trees, especially maples (*Acer* spp.), in the New York metropolitan area. Emerald ash borer (*Agrilus planipennis* Fairmaire), discovered in western New York in 2009, has already been found in numerous other locations throughout the State (figures 12 and 13).

Invasive plants are a major problem in many forests, especially those forests that are close to abundant seed sources, such as forests near urban and suburban areas. Some State forests in heavily populated counties, such as Putnam and Westchester, are heavily infested with invasive ornamental species, notably Japanese barberry (*Berberis thunbergii* DC.), honeysuckles (*Lonicera japonica* Thunb., *L. maackii* [Rupr.] Herder, *L. morrowii* A. Gray [incl. *x bella*]), Oriental bittersweet (*Celastrus orbiculatus* Thunb.), winged burning bush (*Euonymus alatus* [Thunb.] Sieb.), porcelain berry (*Ampelopsis brevipedunculata* [Maxim.] Trautv.), Norway maple (*Acer platanoides* L.), and an ever-increasing number of other invasive species favored by suburban residents.

To date, the effects of climate change in New York have primarily been warmer and shorter winters, along with more extreme precipitation events. The warmer winters are a growing problem for many aspects of forest management. Earlier springs may lengthen the growing season, but the phenology of many tree species is increasingly out of sync with the



Figure 13. Emerald ash borer larva. (Photo from NYS DEC, 2010).

weather. New York is the Nation's second largest producer of maple syrup, but early warm spring conditions can produce early bud break, which prematurely ends the tapping season.

Green Certification of State Forests

New York manages its State forests for a wide diversity of habitats and communities of varying ages and structural diversity, with the goal of having ideal conditions available on the landscape for every indigenous species. Modest planting occurs on State forests to fill gaps in the landscape. New York's State forests are green certified, which means they are managed sustainably (figure 14). The certification guidelines and efforts to fill gaps in the forest cover can come into conflict because green certification guidelines oppose planting in favor of natural regeneration. Sometimes natural regeneration will not result in the desired forest cover type.

The New York State Tree Nursery System

In the past 110 years, the New York State tree nursery system produced more than 1.7 billion seedlings. In the early years, most seedling production was conifer species used for reforestation, primarily eastern white pine (*Pinus strobus* L.), Norway spruce (*Picea abies* [L.] Karst), red pine (*Pinus resinosa* Ait.), Scotch pine (*Pinus sylvestris* L.), and white spruce (*Picea glauca* [Moench] Voss). These seedlings were usually planted in single-species plantations. At the time, conifers were preferred to hardwoods because they had a higher timber value. Conifers were also easier to grow in huge quantities and could better tolerate stressful planting conditions and poor soils.



Figure 14. Brookfield Woods in the green-certified Charles Baker State Forest. (Photo by Wells Horton, 2009).

Coping with the weather is the most difficult aspect of nursery management (figure 15). Irrigation can make up for the shortage of rainfall, but few effective practices prevent damage from too much heat, rain, wind, or snow. Frost heaving is another natural occurrence, which is difficult to control. These conditions can result in significant damage to a crop and little can be done to reduce the loss. This risk is why government agencies, rather than commercial nurseries, have been involved in raising seedlings to meet reforestation and conservation project needs.

Spring seedling harvest usually begins in early April when the ground thaws, but it can vary from year to year depending on weather conditions. A warm, early spring can mean early bud break, whereas a colder spring, when snow is still on the ground in April, sets back harvest and subsequent spring planting operations.

Over the years, the State nursery has developed many propagation techniques and invented specialized equipment, such



Figure 15. Ice storm at the State nursery, 2007. (Photo by James Clayton, NYS DEC).

as a tractor-mounted root pruner using discarded trimming knives from nearby paper mills. Another innovation, which nursery staff invented and built, was lightweight weeding carts, which are still used today (Evans and Swartz 1977).

The State Nursery Today

In 1970, all State nursery operations were consolidated to one location. The present State nursery, located in Saratoga Springs, NY, was started in 1911 on land that the State bought to protect the famous Saratoga mineral springs (figure 16). Today, the nursery has 250 acres split between two nearby parcels: the 150-acre (60.7-hectare) office site on Route 50 and the 100-acre (40.5-hectare) Route 9 production area, located within Saratoga State Park.

The Route 50 section contains the offices and operating facilities, along with storage buildings, garages, four greenhouses, 12 acres (4.9 hectares) of planting beds, seed production areas, and about 75 acres (30.4 hectares) of forest. The operating facilities include a production line for grading and packing seedlings, a cooler for seedling storage, and the largest and most completely equipped seed-processing plant in the Northeast. The seed plant building also houses a seed cooler for long-term seed storage. The Route 9 area mostly includes planting beds, with one corner dedicated to seed production and cutting stools. Huge white cedar hedges, which border the Route 9 site, have become something of a local landmark. In addition to maintaining the nursery land, the State maintains and uses more than 200 acres (81 hectares) of seed production areas and orchards, located on State forests across the State.

The State nursery produces more than 1.2 million bareroot and container (plug) seedlings for outplanting annually, including about 200,000 seedlings for planting on State forests. At any one time, more than 5 million seedlings, representing at least 50 species, are growing at the nursery (figure 17). Since 1985, the State nursery has filled more than 18,000 orders and provided more than 632,000 seedlings through the School Seedling Program, an education program in which schools receive free seedlings.

The State nursery also processes its own local New York source seed, propagates flowers for department campgrounds and DEC offices, assists many environmental groups and educational institutes with various stages of planting projects, and grows larger potted stock up to 6 ft (1.8 m) in height for DEC-sponsored special projects.

Over the years, the nursery has responded to changing needs of tree- and shrub-planting programs (Verschoor 2007). Although the current 63-percent forest coverage of New York may seem to limit future demands for historically large quantities of reforestation seedlings, the reality is that demand for maintaining forest regeneration is likely to increase by replacing trees killed by forest pests and diseases and replanting areas damaged by storms. In addition, the need for stream protection for water quality and flood mitigation has increased demand for riparian species, such as those planted in the successful Trees for Tribs programs. The expansion of green infrastructure using native plants is opening new areas of opportunity for the nursery to provide local source native plant material. The nursery is currently testing a number of native species for use in green roofs, green walls, and stormwater



Figure 16. Aerial view of the State nursery in 2011. (Photo by Scott McDonnell, NYS DEC).



Figure 17. Red oak seedlings—one of many species produced at the State nursery. (Photo by Karin Verschoor, NYS DEC, 2006).

infrastructure. After these plants are proven effective, the hope is that commercial nurseries will make them more readily available. The nursery may be vital in introducing previously little known native plant material (for green infrastructure and landscape purposes) to the commercial market, which could significantly reduce the use of invasive plants.

Looking Forward

New York has an abundance of forests. In 2010, New York developed a Forest Action Plan that assessed the status of New York's forests and outlined strategies to address threats. The lack of forests may no longer be a primary concern, but no shortage of threats face New York's forests today. Protecting and improving the health of these forests has been, and

continues to be, a multifaceted effort among government, landowners, and the general public. Collectively, these stakeholders are the guardians of New York forests and the many benefits they provide, such as clean air and water, wildlife habitat, a source of natural resources, and a vital component of livable communities.

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