Forestry and Tree Planting in Maryland

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Abstract

After nearly four centuries of harvesting and clearing for agricultural and urban expansion, Maryland has 2.5 million ac (1.0 million ha) of forest covering approximately 43 percent of the total land area; most of these forests are considered "timber land."

The physiography of Maryland combines features from both northern and southern latitudes, resulting in a diversity of forest compositions. Most of Maryland's forests are hardwood types; 11 percent of the State's forests are pine. The most common species found in Maryland is red maple, and its dramatic rise in frequency is directly attributable to the absence of fire in the landscape. Uneven-aged silviculture is most prevalent, although even-aged management is commonly practiced in pine-producing areas. State nursery operations formally began in 1914, and, today, the nursery produces more than 3 million bareroot seedlings annually, representing 40 to 50 species. Numerous State and Federal programs support tree planting by offering technical and financial assistance. Land parcel sizes are trending smaller, which will challenge the ability to perform needed silviculture activities on greater portions of the landscape in the future.

Introduction

Maryland is often characterized as "America in miniature" because of its diverse physiography, history, and cultures, all resembling, in some aspect, the places and peoples found elsewhere in the United States. A visitor to Maryland can encounter within a day's drive hardwood-covered mountains; pine flats abutting sandy ocean beaches; vast forests; expansive agricultural districts dotted with small woodlots; and sprawling, tree-lined suburban complexes surrounding major urban centers. The central feature of Maryland's geography is the Chesapeake Bay, the largest estuary in the United States, which has enormous influence on the economy and ecology of Maryland and its forests. All of these elements have shaped the extent and composition of Maryland's forest resources.

Maryland's 2.5 million ac (1.0 million ha) of forest cover approximately 43 percent of the total land area (figure 1), and most (95 percent) of these forests are considered timber land (Lister et al. 2011). Moreover, 76 percent of these forests are privately owned, with most owners being families and individuals (Lister et al. 2011).

Maryland's Forest History

Colonization of Maryland began in earnest in 1634. Because the Chesapeake Bay region was interlaced with deep waterways coursing through highly fertile lands ideal for raising crops to export back to England, the earliest successful efforts to colonize North America were focused on the region that today is Virginia and Maryland. Forests were cleared for agricultural improvements, and the resultant timber products were heavily used as fuel and further refined into lumber and poles for boats, houses, barns, shops, bridges, roadways, forts, and nearly anything else needed to be made and too expensive to import. Wood was a major export commodity alongside tobacco, fish, and game hides (Middleton 1953). Later, as utilization technologies improved, fine crafts such as furniture and architectural millwork developed into highly respected trades, with demand for American products increasing in fine parlors throughout Europe (Middleton 1953). No less important, but having much less glamour, the utilitarian trades of cratings, cooperages, wagons, tanning, shingles, and various specialties of lumber manufacture all became major uses of forests (Besley and Dorrance 1919). For example, boatbuilders especially prized white oak and Atlantic white cedar (*Chamaecyparis thyoides* [L.] Britton, Sterns & Poggenb.). Loblolly pine and yellow poplar were the choice species for general construction. It is interesting that red maple, a very common species today, was scarce in most forests because of the ubiquitous use of fire, first by the Native Americans to keep forest undergrowth managed, and later by the colonists in combination with grazing to clear forests for conversion to tobacco and grain fields.

This trend of forest clearing for agricultural expansion continued throughout the 18th century and peaked in the 1830s. As the land was cleared, many of the smaller rivers silted in to the point of eliminating their use as transportation networks; however, by then, the inland population centers had grown

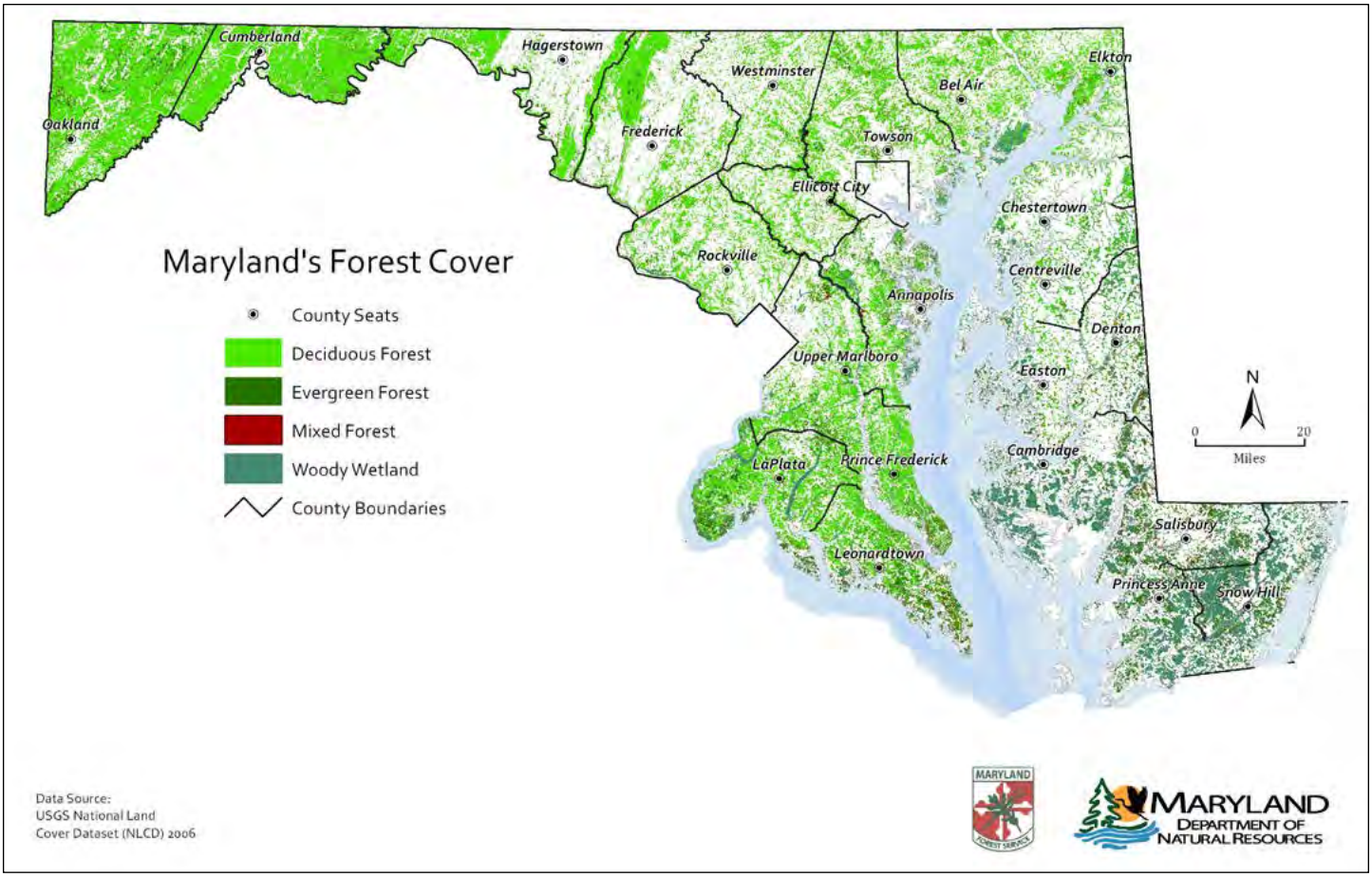

Figure 1. Maryland's forest cover. Source: U.S. Geological Survey National Land Cover Dataset (2006) updated by Maryland Forest Service (2013)

and adequate roadways directed commerce to the larger cities with deeper ports. By the mid-19th century, railroad networks rivaled shipping as bulk transportation networks. The rise of the railroad is significant to Maryland's forest history because that industry also spurred the demand for iron and the charcoal fuel needed to smelt the raw iron ore. Charcoal-fired furnaces were found throughout all of Maryland, with the larger furnaces in central and northern parts of the State providing steady, lucrative markets for fuel wood that lasted for decades and ultimately resulted in the clearing of tens of thousands of forested acres.

By 1914, 2.2 million ac (890,312.0 ha) of Maryland's forest supported 3.8 billion board feet (9.0 million m^3) of timber, which, in turn, fed a highly respected and valued industry of 800 sawmills, more than 300 wood-based manufacturers, and several ancillary businesses (Besley 1916, Besley and Dorrance 1919). Significant even by today's standards, 16,790 people relied on forest products for their wage, making it the second largest single industry in the State (Besley and Dorrance 1919). Loggers produced 229 million board feet (540,380 m^3) of logs, with hardwoods comprising 129 million board feet (304,405 m^3) and pine accounting for the other 100 million board feet (235,975 m^3) (Besley and Dorrance 1919). Lumber products accounted for only 40 percent of the annual timber harvest, with most of the harvest (60 percent) processed into pulpwood, railroad ties, piling, cordwood (i.e., fuel wood), tanbark, staves, shingles, lath, and charcoal (Besley and Dorrance 1919).

Today, 100 years later, Maryland still has roughly the same acreage of forest (2.5 million ac [approximately 1.0 million ha]) (figure 1), but these forests harbor a fivefold increase of timber (more than 22.0 billion board feet [5.2 million m^3]) (Lister et al. 2011). The annual growth rate has almost tripled during the past century, exceeding the goal first espoused by Maryland's first State forester, Fred Besley, when he proclaimed that the "production of Maryland's forests might be raised 100 percent" (Rider 2006). Yearly harvest volumes remain relatively constant at approximately 200 million board feet (472,000 m^3), and yet annual growth exceeds removals by at least 25 percent (Lister et al. 2011, Rider 2006). Ranked by highest volume of standing growing stock inventory, the principal commercial species include yellow poplar, red maple, loblolly pine, white oak, sweetgum, black cherry, and various species of red oak (Frieswyk 2001). Manufacturing still

remains a vital component to Maryland's welfare, with the wood industries continuing as major players in the manufacturing sector (Rider 2006). Statewide, wood industries employ in excess of 10,000 people in 1,843 operations, which is 8 percent of all manufacturing jobs in the State (Rider 2012).

Forest Distribution and Composition

The physiography of Maryland combines features from both northern and southern latitudes, resulting in an interesting mix of forest compositions. For example, native stands of red spruce (*Picea rubens* Sarg.) dominate the high-elevation mountains of far western Maryland, while bald cypress (*Taxodium distichum* [L.] Rich.) dominate the most southern and eastern regions. Both of these forest types are minor in extant, but their existence demonstrates the wide range of site conditions resulting from the combination of latitude and elevation across five physiographic regions (i.e., Allegheny Plateau, Ridge and Valley, Piedmont, Upper Coastal Plain, and Lower Coastal Plain) within a span of just 250 mi (400 km) (figure 2).

Western Maryland (extending from Frederick County west to the State border) is very mountainous and forests are the principal land use. Although agriculture is present in western Maryland, it is largely confined to valley floors. Central Maryland is a rolling landscape typical of the Piedmont and is heavily cleared to accommodate agriculture and urban centers. Forests in the central part of the State are typically confined to riparian areas or small woodlots associated with farms (usually in areas too rocky to farm). Yellow poplar (*Liriodendron tulipifera* L.), oaks (*Quercus* spp.), red maple (*Acer rubrum* L.), and hickory (*Carya* spp.) are common tree species. Southern Maryland (loosely defined as the area east of Washington, DC, and south of Annapolis, MD) has deeper, less rocky soils; the more fertile soils are farmed and the less fertile, gravelly soils are typically forested with white oak (*Q. alba* L.), Virginia pine (*Pinus virginiana* Mill.), and yellow poplar. Some parts of southern Maryland produce stands of loblolly pine (*P. taeda* L.) and sweetgum (*Liquidambar styraciflua* L.) that rival those found in forests farther south. The Eastern Shore (land to the east of the Chesapeake Bay and west of the Atlantic Ocean) supports a mixture of hardwoods, such as yellow poplar, sweetgum, red maple, and various oak species, in its northern section, but its southern section is very similar to coastal plain forests of the southeast, with loblolly pine, sweetgum, and red maple.

The most common species found in Maryland is red maple (figure 3), and its dramatic rise in frequency is directly attributable to the absence of fire in the landscape (Lister et al. 2011). Because Maryland is the fifth most densely populated State in the United States, liability issues related to smoke and fire damage have virtually eliminated the use of fire as a management tool. Meanwhile, oaks have shown a steady decline in the past few decades (Lister et al. 2011). A lack of oak recruitment appears to be the cause for this decline. Yellow poplar has increased steadily during the same period while loblolly pine abundance has remained constant (Lister et al. 2011).

Regional differences reflect the physiographical influences of landscape position, soil type, and localized weather effects. Sugar maple (*Acer saccharum* Marshall), black cherry (*Prunus*

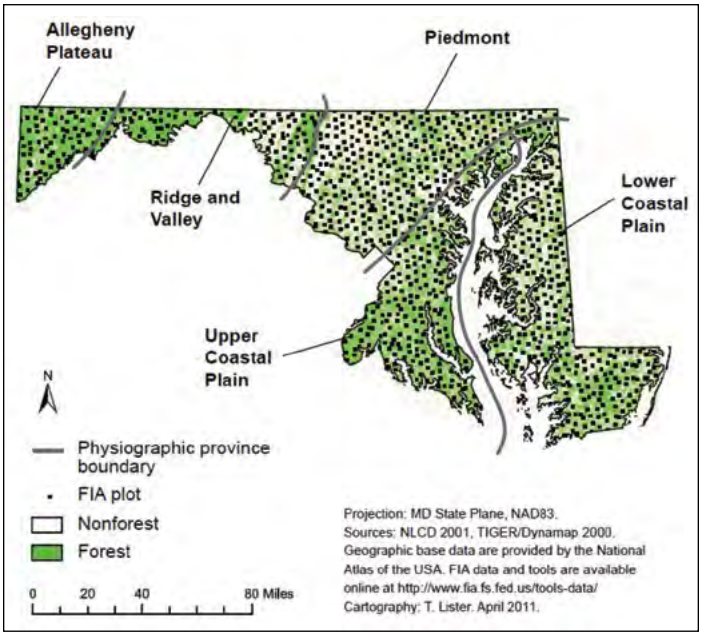

Figure 2. Physiographic provinces of Maryland. Source: Lister et al. (2011)

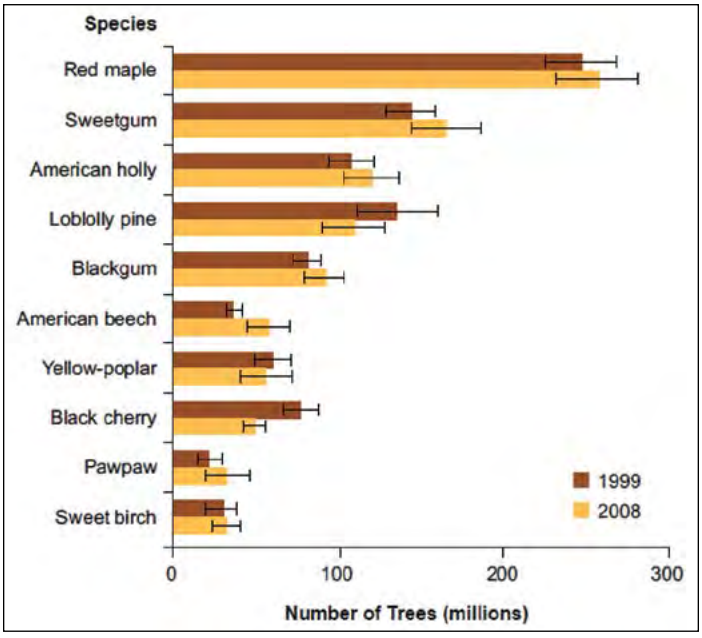

Figure 3. Relative abundance of timber species in Maryland. Source: Lister et al. (2011)

serotina Ehrh.), and northern red oak (*Quercus rubra* L.) are of superior form and quality in the far western portion of western Maryland, where the growing season is relatively short, cool, and wet. North-facing cove sites with deep and rich soils produce stands of trees exhibiting phenomenal timber qualities that are sought by savvy buyers from the world over. The coastal plain of the Eastern Shore has a longer, hotter growing season and the alluvial silts and sands are generally very low-lying and poorly drained, resulting in conditions highly favorable to loblolly pine and sweetgum. Maryland exhibits the northernmost limit of the natural range of loblolly pine, and many consumers greatly prefer the dense wood habit of Maryland grown pine compared with that of fast growing loblolly pines in the Deep South.

Forest Management

The Maryland Forest Service manages more than 200,000 ac (80,930 ha) of designated State forest (figure 4), but most forest lands are privately owned. Most of Maryland's forests are hardwood types; only 11 percent of Maryland's forests are pine. That fact, combined with a deep cultural aversion toward clearcutting among loggers and landowners alike, results in uneven-aged management of hardwoods to be the prevalent silvicultural system employed throughout most of Maryland. In stark contrast, forest management in the pine areas of the lower Eastern Shore follows a "clear-cut—plant—thin" silvicultural system typical of southern yellow pine management. Statewide, only about 20 percent of the 10,000 ac (4,000 ha) harvested annually are clearcut. Pulpwood markets are available throughout all of Maryland, but nowhere are they the dominant market driver. Sawtimber is clearly the mainstay of forest markets and, therefore, most landowners retain their timber for relatively long rotations, with pulpwood production incidental to sawtimber harvests or from mid-rotation thinnings in the pine-growing regions.

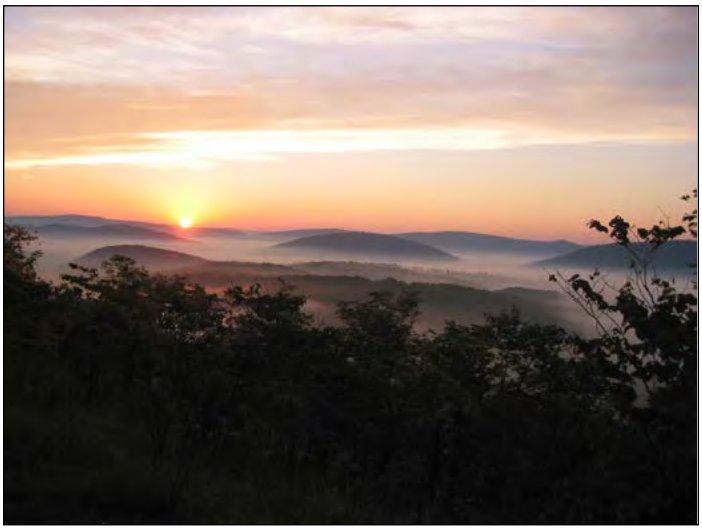

Figure 4. Summertime sunrise in Green Ridge State Forest, Maryland. (Photo by Mark Beals, Maryland Forest Service, 2009)

Hardwood Management

Most loggers produce cut-to-length logs either at the stump or on the landing, although tree-length mill delivery is becoming more popular as hardwood utilization standards improve. Group selection and individual tree selection are the most commonly deployed harvest strategies and natural regeneration from stump sprouting is typically sufficient to regenerate the stand following harvest. Browsing by overly abundant deer populations are problematic, however, for long-term retention of oak regeneration throughout most of Maryland. In addition, invasive species such as Japanese barberry (*Berberis thunbergii* DC), multiflora rose (*Rosa multiflora* Thunb.), Japanese stiltgrass (*Microstegium vimineum* [Trin.] Camus), eastern hay-scented fern (*Dennstaedtia punctilobula* [Michx.] T. Moore), and others often prevent adequate regeneration. Motivated landowners typically will replant with 1-0 bareroot nursery stock protected with a tree tube. Timber stand improvement practices are becoming increasingly familiar as more landowners realize the benefits derived from actively improving stand composition and stocking levels at earlier ages. Most timber stand improvement practices employed in hardwood regions involve reducing stocking levels and utilizing the felled material as firewood whenever practical.

Even in the regions of the Eastern Shore and southern Maryland, where pure stands of loblolly pine are most prevalent, the hardwood acreage still represents 50 percent of the total forest. Because of the dominance of the pine industry, however, hardwood silviculture in these areas tends to also be even-aged and stands of yellow poplar, red maple, sweetgum, and mixed oaks are typically tree-length clearcut. Harvested hardwood stands are either allowed to regenerate naturally or are converted to pine after chemical site preparation.

Pine Management

Pine management is common on the lower Eastern Shore and scattered throughout southern Maryland. Even-aged silviculture is widely practiced but to varying degrees of intensity. Because of consistently reliable markets for both pine sawlogs and pulpwood, management intensity is generally highest on the Eastern Shore. Loblolly plantation development reached a zenith in the 1980s after ramping up in the 1960s from the initial onset of industrial forest management led by several paper manufacturers. Following clearcut harvesting, these

plantations were established with the aid of mechanical site preparation to include windrowing, bedding, and either machine- or hand-planting using genetically superior 1-0 bare-root nursery stock grown from local seed sources. Planting densities of trees were typically 720/ac (1,777/ha) with a spacing of 6.0 by 10.0 ft (1.8 by 3.0 m) conducted in late winter to early spring. Drainage ditches were installed on the larger tracts that also harbored more productive soils. Prescribed burning was also used extensively in southern Maryland to reduce residual brush and slash. With the widespread use of helicopter applications of imazapyr, chemical site preparation eventually displaced most of the mechanical site preparation and prescribed burns. Machine planting also continually declined in favor of cost-competitive, highly mobile handcrews.

Mechanical thinning of pine stands became an established forest management technique in the 1990s. Thinning enables landowners to produce revenue from pulpwood products while simultaneously improving the growth rate and quality of the residual stand. At a stand age of 18 to 22 years, every fifth row typically is removed entirely and inferior trees are removed from the rest. The residual basal area goals typically result in the harvest of about one-third of the stand density to yield a post-harvest basal area of 70 to 90 ft^2/ac (16 to 21 m^3/ha). A second thinning is often conducted at a stand age of 28 to 30 years and again with a goal of retaining 70 to 90 ft^2 of basal area/ac (16 to 21 m^3/ha). After landowners saw the success from mechanically thinning pine plantations, convincing them to thin overstocked pine stands at even earlier growth stages was not difficult. The popularity of precommercial thinning of pine stands was accelerated when government forestry agencies began offering cost-sharing opportunities to encourage the practice. Today, the Maryland Forest Service supports approximately 1,000 ac (405 ha) of precommercial thinning annually.

Final harvests of loblolly pine occur between age 50 and age 70 (figure 5). Longer stand rotations run the risk of being infected with red heart (*Phellinus pini*). Harvests are clearcuts and tree length production of either sawtimber or pulpwood is standard.

Figure 5. Variable retention harvest in loblolly pine stand on Maryland's Eastern Shore. (Photo by Jack Perdue, Maryland Forest Service, 2009)

Nursery Operations

Maryland was one of the first States to organize a formal agency dedicated to the restoration, management and protection of forest resources. In 1906, the Maryland Forest Service was established under the leadership of Fred W. Besley, a student and employee of Gifford Pinchot at the U.S. Department of Agriculture (USDA), Forest Service. Besley was the superintendent at USDA Forest Service Tree Nursery at Halsey, NE, the first Federal tree nursery established in the country. Protecting and establishing roadside trees was a high priority in the early years of the Maryland Forest Service, and legislation passed in 1906 to protect and enhance roadside trees also included authorizations to develop a tree seedling nursery. The establishment of the nursery was accomplished in 1914 on the grounds of the Maryland Agricultural College (now the University of Maryland). Over time, and with the legendary work ethic and innovations of Silas Sines, the nursery manager, the nursery expanded and outgrew its space in increasingly crowded College Park (Zumbrun 2006). In 1949, a new nursery was established farther out in the countryside between Washington, DC, and Baltimore, MD. The Buckingham Tree Nursery provided a great leap forward in the sciences of seedling production and established the tree improvement program to develop genetically superior loblolly and white pine (*Pinus strobus* L.) seedlings (Zumbrun 2006). After 45 years of service, Sines retired in 1974, and John Ayton became the second nursery manager.

In 1995, a major highway project displaced the Buckingham Tree Nursery, and a new nursery was established near Preston in Caroline County on Maryland's Eastern Shore. Ayton developed and designed the new nursery and was particularly impressed with the sandy loam soils at the new location and the fact that the 300 ac (121 ha) of land would support irrigation, spaces for seed orchards, and opportunities to rotate crops as needed to maintain soil health and control disease. Ayton retired with 35 years of service 1 year after opening the new nursery, which is befittingly named after him (Zumbrun 2006) (figure 6). At its peak in the 1990s, the John S. Ayton State Tree Nursery produced 7 million seedlings annually. Today, two full-time employees and two part-time employees annually produce 3 million seedlings of 40 to 45 species common to Maryland forests (figures 7 and 8). Also, 25 ac

(10 ha) of seed orchard area are at the nursery providing seed for 15 hardwood species and an additional 12 ac (5 ha) of loblolly pine and white pine seed orchard (figure 9). Another 25 ac (10 ha) of loblolly and pitch pine (*Pinus rigida* Mill.) seed orchards are located offsite on the lower Eastern Shore but are not currently used for seed collection. The balance of seed is either collected by staff or volunteers or purchased.

Bareroot seedlings are the only products offered for sale at the Ayton State Tree Nursery. Pricing is designed to remain "at cost" and the goal is to keep reforestation costs low to lessen financial barriers to planting trees. Containerized or ball and burlapped stock is available through the large and diverse commercial nursery industry found throughout Maryland.

Seedlings are machine dug from nursery beds in late winter and manually graded, counted, root-dipped, and packaged in units of 25, 50, 100, or 1,000 seedlings per bundle, depending on species. These bundles are stored in industrial coolers until they are shipped for planting a few weeks later in early spring. Orders are facilitated by a secure Web site, over the phone, or through the assistance of a Maryland Forest Service forester. Smaller orders are shipped directly to customers using UPS (United Parcel Service). Refrigerated tractor-trailers are used to transport seedlings in bulk to temporary walk-in coolers throughout the State, where Forest Service foresters pick up seedlings required for the plantings they are coordinating on behalf of private landowners.

The Ayton State Tree Nursery is the only nursery in Maryland producing bareroot seedlings. By law, seedlings may be sold only for conservation purposes, and trees grown from seedlings produced at the Ayton State Tree Nursery may not be sold in the future with intact root systems.

Tree Planting Programs

Maryland landowners are offered numerous forms of cost-share to plant seedlings (figure 10). The State-administered Woodland Incentive Program (WIP) provides 65 percent reimbursement for all tree planting costs, including site preparation, seedlings, planting labor, and up to 400 tree tubes/ac (988/ha). Federal cost-share is offered by the USDA, Natural Resources Conservation Service (NRCS) through the Environmental Quality Incentive Program (EQIP), which provides 75 percent of anticipated costs for a similar range of planting activities. Landowners can simultaneously subscribe to both programs to receive a maximum 90-percent reimbursement. Although both programs provide assistance

Figure 6. Entrance sign to the John S. Ayton State Forest Tree Nursery at its grand opening. (Photo by Richard Garrett, Maryland Forest Service, 2004)

Figure 7. Aerial view of seedling beds at Maryland's John S. Ayton State Forest Tree Nursery. (Photo by Richard Garrett, Maryland Forest Service, 2009)

Figure 8. One employee constitutes the entirety of the weeding crew at Maryland's State tree nursery. Soil fumigants are used in small portions of the nursery, but most weed control is accomplished by diligence with cultural techniques. (Photo by Richard Garrett, Maryland Forest Service, 2009)

Figure 9. Hazelnut seed orchard during early development. (Photo by Richard Garrett, Maryland Forest Service, 2009)

with supplemental reforestation practices, such as controlling grasses or reinforcement planting, neither program provides support for ongoing maintenance of tree tube replacement or removal.

In the past decade, planting sites were roughly equally allocated between reforestation and afforestation. More recently, however, reforestation acreages have been steadily declining and will likely continue to do so. Nearly all corporate timber lands in Maryland were divested between 2000 and 2010, and the many new owners are not harvesting as intensively, which results in fewer acres to reforest. Much of these former corporate timber lands are now encumbered by conservation easements that require all future owners to ascribe to forest certification standards. These standards limit timber harvests to no more than 40.0 ac (16.2 ha) maximum, and most are much smaller. Natural regeneration is a preferred low-cost regeneration technique on small harvest sites. Afforestation has also declined in recent years because of the waning popularity of riparian buffer establishment programs such as the Conservation Reserve Program and the Conservation Reserve Enhancement Program. In 2004, the nursery provided all seedlings for tree plantings on 4,033 ac (1,632 ha) of combined reforestation and afforestation efforts, and, by 2014, this total had dropped to 1,134 ac (459 ha). The nursery has adapted to these declining seedling markets by increasing direct marketing to individual landowners interested in planting trees not associated with timber harvesting or riparian buffer establishment. Likewise, the Maryland nursery provides seedlings to forestry agencies of other States that do not have seedling nurseries.

Maryland hosts or participates in several incentive programs designed to encourage tree planting. The WIP is the hallmark cost-share program for most traditional, rural forest improvement work. Eligibility standards for this program require that the forest shall be capable of producing a commercial product at some point in the future, but no stipulation requires the landowner to harvest. The WIP supports planting of bareroot seedlings on more than 1,000 ac (405 ha) annually and chemical site preparation on 900 ac (364 ha) annually. The NRCS EQIP cost-share also supports planting and site preparation efforts but to a far lesser extent because of the comparative complexities of enrollment application forms. The Glatfelter Pulpwood Company (Spring Grove, PA) provides an annual stipend to the Maryland Forest Service to offset seedling costs on a first-come, first-serve basis to landowners in regions where the company procures pulpwood.

Figure 10. Planting seedlings with tree tubes. (Photo by Richard Garrett, Maryland Forest Service, 2003)

In addition, the Maryland Forest Service offers several other programs designed to encourage planting of larger trees in areas more closely associated with built environments or urban settings. For example, the "Lawn to Woodland" program offers free tree planting of seedlings on lawn areas up to 1.0 ac (0.4 ha); the "Marylanders Plant Trees" program offers a $25 coupon through participating retail nurseries for purchasing container stock and then registering the location of the planting on a State Web site; the "Tree-mendous Maryland" program coordinates the planting of balled-and-burlapped stock in public spaces in partnership with volunteers; and the "Healthy Forests, Healthy Waters" program is a grant-funded effort intended to plant seedlings in high-priority watersheds in locations that directly improve water quality.

Future Issues

Like many other forested areas in the country, Maryland is experiencing a decline in forested acres. The most recent survey indicates that, between the years 1998 to 2007, Maryland's net decline in forest cover was approximately 3,000 ac (1,214 ha) per year (Lister et al. 2011). Approximately 7,000 ac (2,833 ha) of forest are lost each year to land development while 4,000 ac (1,619 ha) of open land are converted to forest cover, mainly from former agricultural land (Lister et al. 2011). It is not surprising that land development is expected to continue and, in future years, this development will likely gravitate away from the increasingly valuable agricultural lands and more toward the comparatively less expensive forested lands. In addition, forest gains from agricultural reversion to forest will likely diminish significantly. The combined result will be an increasing rate of forest loss.

Challenges that lie ahead for forestry and forest management are rooted in demographic shifts. In 1975, small forest ownerships of less than 10 ac (4 ha) were held by 52,690 landowners (Kingsley and Birch 1980, Powell and Kingsley

1980). Today, the number of small ownerships has increased to 129,480 landowners (Lister et al. 2011). The implications of this increase are many, especially when considering that overall forest acreage is declining, which means that larger tracts capable of supporting management activities are diminishing. The continuing decrease in tract sizes, which affects the capacity to carry out meaningful silvicultural activities, is fueled in large part by the increased mobility of our population. Land transfers are frequently precipitous catalysts for subdividing properties into smaller units for resale. Also, most forest owners in Maryland are 60 years old or older, and they often subdivide their lands before transferring to family members. Younger land owners and those who inherit land often value forests for their nonfinancial amenities and less so for their utilitarian market values, and these landowners tend to harvest less often and are less aware of the need for active management to maintain forest health. Smaller tracts are less efficient for timber harvesting and, although the quality of timber products on a small tract may be high, the overall volume is not sufficient to recoup the costs of harvesting. Therefore, as more forested properties are subdivided and shift into the "small tract" category, more of the forest is no longer economically or socially eligible for continued active management.

Conclusions

The diversity of Maryland's climate, physiography, and cultures all affect the past, present, and future condition of the State's forested landscapes. For four centuries, the forests of Maryland have provided needed resources for a wide variety of products and purposes, and only during the past century have people deliberately invested in stewardship of this resource. The results are mixed: evidence of positive effects include the fact that our forests are five times as bountiful as they were 100 years ago, yet most recent data demonstrate forested acreage is declining. More challenging is the fact that average tract sizes are decreasing, which is a deepening concern because owners of smaller properties are less interested in managing the small portions of the forest they own for forest products, or to invest in protecting these forests against threats to forest health.

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