The Forests of the First State

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Abstract

More than 400 years after European explorers first discovered Delaware, one-third of the State remains forested. Delaware has a long and rich history of timber production that has seen many changes since its initial settlement. A formal forest management policy for Delaware evolved around the turn of the 20th century, culminating with the formation of the State Forestry Department in 1927, driven in large part by a need for wildfire management. Delaware has a unique geographical position, resulting in a unique mix of forest types. Because of its shape, orientation, and location, the State enjoys the benefits of the southernmost range of the eastern hardwood forest type and the northernmost range of the southern pine and hardwood type. Because of the timber type variation in Delaware, a few different management regimes are practiced, each with its own silviculture concerns and management activities. The Delaware Forest Service (DFS) offers financial and technical assistance programs for private landowners, including the regulation of forest activities such as timber harvests and reforestation. The DFS also maintains a robust and ongoing forest health monitoring and management program to deal with potential outbreaks from environmental and human-caused factors. With an eye to the future, the DFS has plans under way for a periodic review and assessment to measure statewide progress in meeting forest management goals and to chart a pathway to healthier and sustainable forests for the 21st century.

Delaware's Forests and Forest History

The total land area of Delaware is roughly 1.25 million ac (506,000 ha) and is approximately one-third forested (figure 1) (DFS 2010a). Like many other States, Delaware experienced a sharp decline in forest land associated with the wave of European settlement that began around 1610. It is believed that 90 percent of Delaware was forested before settlement. The low point of forest cover in Delaware occurred in the early 1900s at approximately 350,000 ac (142,000 ha), followed by an increase to roughly 450,000 ac (182,000 ha) after the Great Depression. Another reduction in forest acreage during the early 2000s was associated with the housing boom.

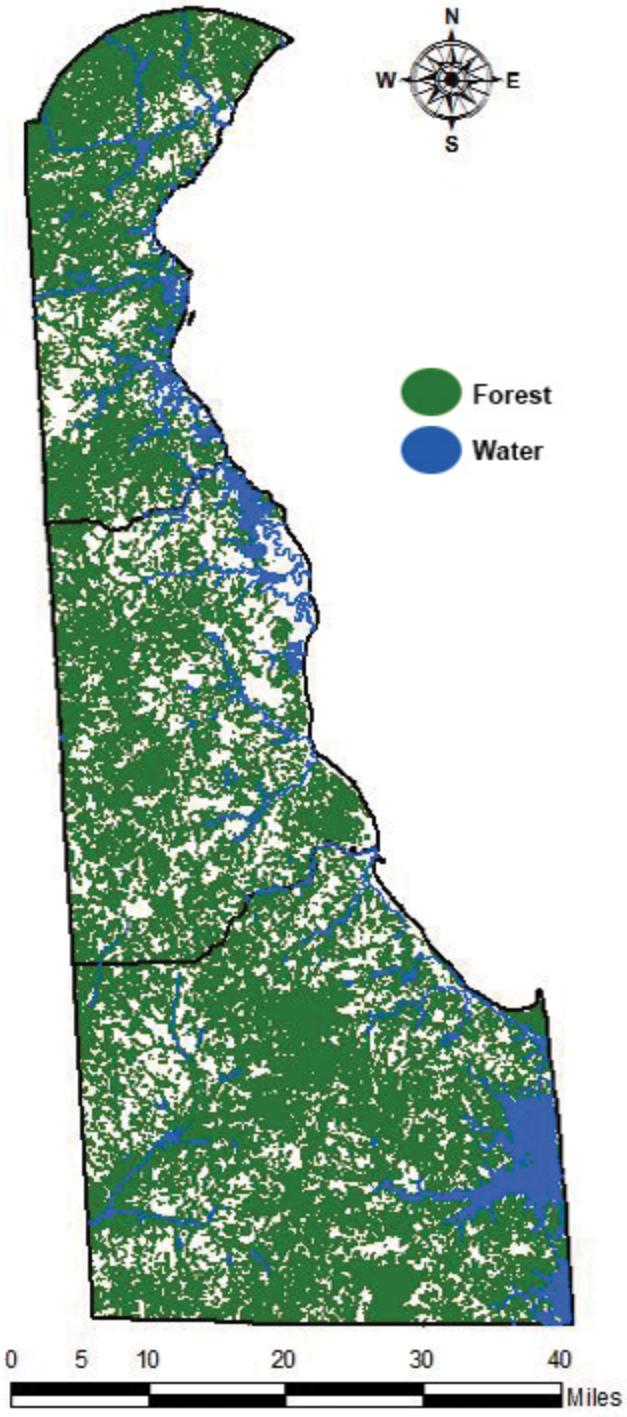

Figure 1. Approximately 30 percent of Delaware is forested. (Source: Delaware Forest Service 2012)

Forest land in Delaware has since stabilized at approximately 370,000 ac (150,000 ha), with only minor annual fluctuations (table 1). Delaware loses approximately 2,000 ac (809 ha) per year of forest land because of agriculture and development; some of this loss is offset by afforestation.

Table 1. Delaware forest acreage, 1907–2007.

Year	Acres of forest (thousands)
1907	350
1938	423
1953	454
1963	392
1977	392
1987	398
1997	389
2002	383
2007	371

Source: Delaware Forest Service (2010a)
Metric conversion: 1 ac = 0.404 ha

Delaware has a long and rich history of timber production that has seen many changes since the initial European exploration and settlement. The earliest uses for Delaware's timber resources were building ships and settlements. As the area became more settled, trade was established with Europe and included ship-building materials, barrel staves, cedar shingles, charcoal, and tanning bark. It was not long before numerous sawmills were established along the streams and rivers, producing all sorts of wood products for local use and trade. Numerous sawmills produced lumber for wagons and wheels, crates, and many other uses. From the mid-1800s to mid-1900s, charcoal and railroad ties were major products. The 1950s saw a boom in machine-made wood products, such as "spoon wood" and "basket wood." Wood production in Delaware rose to a high of 55 million board feet (130,000 m^3) in 1909 and dropped to a low of 5.2 million board feet (12,300 m^3) in 1918, but has since stabilized at approximately 14.4 million board feet (34,000 m^3) annually (DFS 2010a).

Current wood production in Delaware is roughly 46 percent softwood and 54 percent mixed hardwood (DFS 2010a). The main products are hardwood and softwood sawtimber, mixed pine pulpwood, pilings, and some hardwood veneer. The current growing stock volume in Delaware is 810 million ft^3 (22.9 million m^3), a 17-percent increase since 1999 (Lister et al. 2012). Approximately 2.9 billion board feet (6.8 million m^3) of sawtimber are in Delaware, a nearly 30-percent increase since 1999 (Lister et al. 2012). Hardwoods account for most of this volume and have been responsible for most of the increases (table 2).

Table 2. Volume of forest growing stock in Delaware, 1957–2009.

	Volume (million cubic feet)				
	1957	1972	1986	1999	2009
Softwoods	230	184	164	115	120
Hardwoods	273	403	496	581	690
Total	503	587	660	696	810

Source: Delaware Forest Service (2010a)
Metric conversion: 1 million ft^3 = 28,317 m^3

A formal forest management policy for Delaware evolved around the turn of the 20th century. In 1906, Professor Hayward, Director of Delaware Agriculture Experiment Station, applied to the U.S. Forest Service (now the Forest Service, an agency of the U.S. Department of Agriculture [USDA]) for a cooperative study of Delaware's forests. This led to the publication of Sterrett's *Report on Forest Conditions in Delaware and a Forest Policy for the State* (1908). In 1909, Delaware's General Assembly passed legislation to create a forestry advisory board; however, no funds were allocated and a board was never appointed. In the late 1920s, a series of large fires in the Great Cypress Swamp reignited concern about forest management in the State. In 1927, the General Assembly established the State Forestry Department (Senate Bill 16). Its original responsibilities included fire control, a State nursery, and State forests. William S. Taber was appointed the first State forester and served for 43 years.

State forest management areas began with the establishment of a tree nursery north of Ellendale in 1928. In 1936, the State purchased the 844-ac (342-ha) gun club property north of Georgetown, including the historic Redden Lodge—the centerpiece of Redden State Forest. Acquisition of the 672-ac (272-ha) Tybout Tract was complete in 1941, representing the first property of what would become Blackbird State Forest. Today, State forest land totals more than 19,200 ac (7,770 ha).

In 1948, the first farm (service) forester was appointed to help private landowners. Today, financial and technical assistance to nonindustrial private landowners is one of the core programs of the Delaware Forest Service (DFS), a section within the State's Department of Agriculture. In 1995, the DFS began regulating forestry activities by issuing permits for compliance with its best management practices (BMP) program and instituting the State's Seed Tree Law, designed to protect commercially important native species.

Forest Composition

Delaware has a unique geographical position in the United States, resulting in an interesting mix of forest types. Because of its shape, orientation, and location, the State enjoys the benefits of the southernmost range of the eastern hardwood forest type and the northernmost range of the southern pine/hardwood type. Situated on the Peninsula south of Pennsylvania, known as the Delmarva Peninsula, Delaware is mostly lowland, coastal area. Most of Delaware is part of what is known as the "coastal plains" of the Southeast United States. Soils in this region consist of mostly sandy loam with some clay. Important timber species common to the coastal plain include loblolly pine (*Pinus taeda* L.), Virginia pine (*P. virginiana* Mill.), Atlantic white cedar (*Chamaecyparis thyoides* L.), bald cypress (*Taxodium distichum* L.), white oak (*Quercus alba* L.), southern red oak (*Q. falcata* Michx.), black oak (*Q. velutina* Lam.), yellow poplar (*Liriodendron tulipifera* L.), red maple (*Acer rubrum* L.), American holly (*Ilex opaca* Aiton), and sweetgum (*Liquidambar styraciflua* L.). Some of these species, such as loblolly pine, bald cypress, and Atlantic white cedar, are at the northernmost portion of their native range.

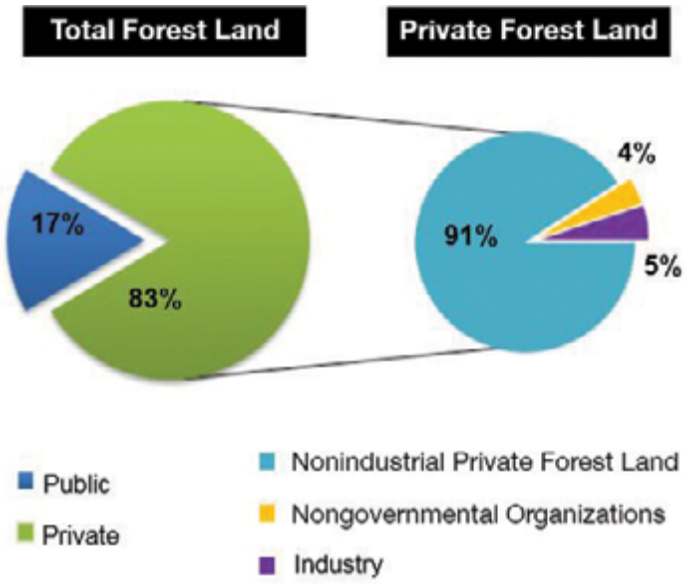

Figure 2. Delaware forest land ownership, 2009. (Source: Delaware Forest Service 2010a)

The northernmost part of Delaware lies within the eastern Piedmont geographic region. This region is characterized by a rocky parent material and clay soils. Important timber species common to this region include northern red oak (*Quercus rubra* L.), yellow poplar, white oak, red maple, black oak, and American beech (*Fagus grandifolia* Ehrh.).

Forest Ownership

Of the forest land in Delaware, 83 percent is privately owned, and 91 percent of that land is owned by nonindustrial private owners (figure 2). Public ownership includes the U.S. Fish and Wildlife Service and several State agencies, such as the DFS, State parks, and State wildlife areas (figure 3) (DFS 2010a).

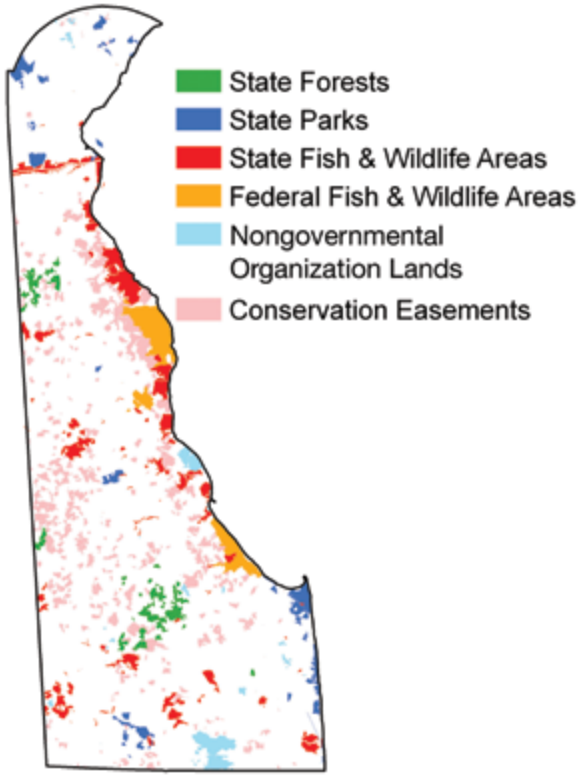

Figure 3. Delaware's publicly owned lands. (Source: Delaware Forest Service 2010a)

Forest Management in Delaware

Because of the variation of timber types in Delaware, a few different management regimes are practiced, each with its own silviculture concerns and management activities. In southern Delaware, the primary management regime is southern pines (figure 4). Loblolly pine is grown naturally and in plantations. Management for southern pines includes stand establishment (natural or artificial) followed by aerial chemical application to control woody competition. A precommercial thinning is sometimes conducted to reduce stocking and speed growth (figure 5). One or more commercial thinnings are conducted during the rotation, followed by one or more controlled burns to reduce fuel loads and clear understory competition. Prescribed fire is also used to maintain and improve wildlife habitat. A clearcut harvest is conducted around age 50. Stand establishment is a common obstacle to this type of silviculture. Variations in weather and soil conditions make survival of young seedlings difficult at times. Other management concerns are wildfire, insects, and disease.

Figure 4. Pine forest in southern Delaware. (Photo by John Petersen, Delaware Forest Service, 2012)

Figure 5. Young pine stand after precommercial thinning. (Photo by Samual Topper, 2014)

Management is less intense in the southern hardwood forest types. Stand establishment is done naturally using three methods: selection harvest, shelterwood harvest, and seed-tree harvest. Manual timber stand improvement work is sometimes done to manipulate species composition. Most landowners harvest timber periodically using the selection harvest method. This approach continues until the land is depleted of suitable sawtimber and then is left to recover on its own. The issue of most concern in these forest types is high-grading. The DFS works to educate landowners about the dangers of high-grading and how to avoid it.

In Delaware's Piedmont region, northern hardwoods are grown in rotations of 80 to 100 years (figure 6). Usually only one intermediate selection harvest is conducted before the natural regeneration sequence is initiated. Regeneration occurs naturally through shelterwood or seed-tree harvests.

Figure 6. Hardwood stand in northern Delaware. (Stock photo by Delaware Forest Service, 2014)

Delaware tracks all timber harvests of more than 1 ac (0.4 ha) in size through a State permitting and BMP program administered by DFS. In 2013, 4,203 ac (1,700 ha) were permitted statewide (table 3). This system tracks only acres permitted, not acres harvested (figure 7). Although DFS foresters conduct periodic inspections on all timber sales, no data are available for how many of the permitted acres are harvested each year or harvested at all.

Table 3. Timber harvest permits in Delaware, by type and year.

Year	Clearcut		Selection		Thinning	
	Permits	Acres	Permits	Acres	Permits	Acres
1997	83	3,553	43	973	11	447
1998	56	2,870	54	1,564	14	398
1999	54	1,904	42	1,095	8	439
2000	81	3,888	51	1,530	8	717
2001	62	2,344	47	2,301	2	37
2002	74	2,609	59	1,488	1	9
2003	87	3,208	48	1,428	11	637
2004	59	2,181	49	1,453	15	1,157
2005	74	2,446	46	1,209	14	1,286
2006	73	1,979	47	1,373	17	1,109
2007	58	1,690	56	1,254	20	1,111
2008	41	1,232	58	1,457	17	2,557
2009	40	1,211	45	918	20	908
2010	47	2,323	36	972	32	3,161
2011	39	876	49	1,422	13	561
2012	43	1,259	41	1,556	23	1,657
2013	51	1,698	35	1,237	9	1,268

Source: Delaware Forest Service (2013)
Metric conversion: 1 ac = 0.404 ha

Figure 7. Clearcut harvest of loblolly pine forest in southern Delaware. (Photo by Samual Topper, 2014)

Delaware has a unique law affecting timber harvests—the Delaware Seed Tree Law (Delaware Code 2014). The Seed Tree Law is intended to guard against the loss of two commercially important timber types—the loblolly pine type and the yellow poplar type. The law states that if the harvest area is 10 ac (4 ha) or more, contains at least 25 percent loblolly pine and yellow poplar, and the land will remain forest land, then the landowner is responsible for successfully regenerating the stand back to a loblolly pine and yellow poplar stand within 2 years of the completion of harvest. This regeneration can be natural or artificial.

Most of the reforestation is conducted in the southern portion of the State. Most planting done in Delaware is reforestation of loblolly pine plantations (figure 8). Planting is conducted in the spring of each year. Between 2008 and 2013, nearly 1.5 million seedlings were planted. In 2014, 128,000 trees were planted in Delaware on about 250 ac (101 ha) (table 4). Approximately 100 ac (40 ha) are planted annually under the Conservation Reserve Enhancement Program, administered by the USDA Natural Resources Conservation Service. The trees used for Delaware's planting program are obtained from the Maryland State Forest Service Nursery, because Delaware no longer has a State nursery. Delaware does have a seed orchard that the DFS maintains to provide seed to the Maryland nursery when needed.

Cost-share funding available to Delaware landowners takes the form of the USDA Environmental Quality Incentives Program and a State cost-share program.

Figure 8. A worker reforests a 60-acre (24.3-ha) clearcut harvest site in Kent County, DE, with loblolly pine seedlings. (Photo by John Petersen, Delaware Forest Service, 2014)

Table 4. Acres and number of trees planted in Delaware, 2008–2014.

Year	Acres planted	Number of trees planted
2008	982.0	481,250
2009	428.0	230,100
2010	273.5	123,000
2011	373.0	175,500
2012	384.5	220,500
2013	412.0	246,875
2014	255.0	128,000

Source: Delaware Forest Service (2014)
Metric conversion: 1 ac = 0.404 ha

Forest Industry in Delaware

For landowners, Delaware has a wide range of options regarding forest management assistance. The DFS, the primary source of forestry assistance in the State, employs five service foresters who serve forest landowners and offer technical assistance in all aspects of forest management. They write stewardship plans, assist with harvest and reforestation planning, conduct insect and disease diagnoses and recommendations, plan and conduct prescribed burning, provide education and outreach, and conduct many other resource management activities. The services of DFS service foresters are free of charge to Delaware landowners.

Consulting foresters are another source of forestry information in Delaware. No certification or license is required in Delaware, other than a commercial business license. Despite this fact, all the consulting foresters who operate in Delaware have forestry or related degrees and a high level of experience. Delaware participates in the Master Logger program that encourages loggers and timber buyers to participate in this program. Because no regulation is in place regarding the review of timber harvests and forest management activities from a silvicultural perspective, many Delaware landowners still receive timber management advice from loggers and timber buyers.

DFS has a staff of 23 full-time positions, including 10 foresters, plus 1 casual-seasonal employee. The overall timber industry in Delaware employs more than 2,600 people, with a total payroll of roughly $92 million (DFS 2010a) (table 5). Most of this employment is in the secondary timber industry.

Table 5. Employment in Delaware's forest industries over time.

Year	Employed
1954	1,800
1967	2,200
2002	2,600

Source: Delaware Forest Service (2010a)

Threats to Delaware's Forests

The threats to Delaware's forests are similar to those in many other States and can be categorized into two major groups—environmental and human-caused.

Environmental threats include native and nonnative insects and disease, deer browse, and wildfire. Delaware has not had any known occurrences of the most well-known invasive insects such as emerald ash borer (*Agrilus planipennis* Fairmaire) and Asian longhorned beetle (*Anoplophora glabripennis* Motschulsky). Monitoring programs, however, are in place for detecting these pests. Forest managers also monitor for sirex woodwasp (*Sirex noctilio* Fabricius) and sudden oak death (*Phytophthora ramorum*). Gypsy moth (*Lymantria dispar*) is a recurring problem but has not reached critical mass for many years. Delaware has not sprayed for the gypsy moth since the late 1990s. The State, however, is struggling with some invasive plants, namely Norway maple (*Acer platanoides* L.), mile-a-minute weed (*Ipomoea cairica* [L.] Sweet), and phragmities (*Phragmites australis* Cav.).

Uncontrolled native species include bacterial leaf scorch (*Xylella fastidiosa*), southern pine beetle (*Dendroctonus frontalis* Zimmermann), and whitetail deer (*Odocoileus virginianus*). Populations of southern pine beetle have been on the increase for the past 3 years, but so far have not reached epidemic levels. Whitetail deer continue to pose a challenge to forest management. DFS is currently conducting a long-term study of deer browse on plant species composition and prevalence.

Although wildland fire is not a substantial threat in Delaware, it is a concern in the wildland urban interface and in the coastal areas. Volunteer fire departments are the primary responder for wildfires in Delaware; the DFS is available to assist upon request and responds to approximately 50 wildfires per year, most in the southern portion of the State.

Delaware's main human-caused forest threats are forest fragmentation and parcelization, as well as urban sprawl and wildland urban interface issues. Both of these issues cause problems for implementing traditional forest management concepts. Today's average forest ownership size is less than 10 ac (4 ha), down by roughly one-third in three decades.

More information about the threats to Delaware's forests and its plans for addressing them is in the Delaware Statewide Forest Strategy, which is available for review on the DFS Web site (DFS 2010b).

The Future

Delaware continues to face the challenges associated with being a small State with little in-State industry and some challenges that all States face, such as changing climate, exotic and invasive plants and animals, and changing public perceptions and expectations of forest land. One bright spot on the horizon is the increased use and value of low-quality and small-diameter wood. Delaware is in a good position to expand its traditional forest markets as these new utilization trends continue. DFS is looking ahead to 2015 when the agency will update its statewide assessment and strategy. DFS met many of the goals set out in the original documents (DFS 2010a, 2010b) and looks forward to identifying new challenges and opportunities in the near future. More information about the challenges and opportunities facing Delaware and its plans for addressing them is in the Statewide Assessment and Strategy, which is available for review on the DFS Web site (DFS 2010b).

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ADDITIONAL INFORMATION

Delaware Forest Service Web site: http://www.dda.delaware.gov/forestry/

Delaware Forest Service FY 2013 Annual Report: http://www.delawaretrees.com/2013_dfs_annual_report.pdf

Delaware Forest Service Resource Assessment: http://www.dda.delaware.gov/forestry/061810_DFS_ResourceAssessment.pdf

Delaware Forest Service Statewide Strategy: http://www.dda.delaware.gov/forestry/061810_DFS_Strategy.pdf

Delaware Forest Service BMP Manual/Harvest Regulations: http://www.dda.delaware.gov/forestry/forms/2007/2007_BMP.pdf

Delaware Forest Service Timber Industry Directory: http://www.dda.delaware.gov/forestry/forms/2009/2009_DFSWood%20Directory.pdf

Delaware Forest Service Big Trees Of Delaware Book: http://www.dda.delaware.gov/images/forestry/BigTreesOfDelawareThirdEdition.pdf

Delaware Forest Service Timber Harvest Permit/Harvest Regulations: http://www.dda.delaware.gov/forestry/forms/2011_ESPermit_withRegs.pdf

Delaware Forest Service Forest Use Regulations: http://regulations.delaware.gov/AdminCode/title3/400/402.shtml

Delaware Forestry Association: http://delawareforest.com

Delaware Urban Forestry: http://delawaretrees.com

Maryland/Delaware Master Logger Program: https://www.extension.umd.edu/masterlogger