

The Importance of Maryland's Forest: Yesterday, Today and Tomorrow



Dear Fellow Citizen,

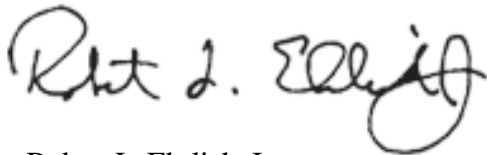
Maryland is rich and diverse in its people, its built environment, its natural resources, and its great beauty. Moving from the Atlantic Coast to the hills and valleys of Western Maryland, we enjoy an almost endless variety of landscapes, unique communities, and layers of history...but there is one unchanging common denominator stretching throughout our State - the great forest with its millions of pines, oaks, and poplars.

Over 40 percent of Maryland is forested and this vast storehouse of energy, shelter and oxygen is one of our most important sustainable assets. Marylanders have been protecting and managing this resource since 1906 and we will continue to do so, efficiently and responsibly.

This publication, *The Importance of Maryland's Forests: Yesterday, Today and Tomorrow*, is a primer on the history of our forest, its environmental and economic importance, its scientific management, and the challenges facing our continued stewardship. It talks of the quality and quantity of our woodlands from many perspectives - the forester, the harvester, the hiker, the landowner, the sailor on the Chesapeake Bay, and even the animals that make the forest their home. It supports an intricate web of natural relationships and, not surprisingly, an equally intricate web of human demands and concerns. The more we understand about this priceless asset, the better job we can do of protecting and managing its many benefits.

Let's continue to work for the future of our forest.

Sincerely,

A handwritten signature in black ink that reads "Robert L. Ehrlich, Jr." in a cursive style.

Robert L. Ehrlich, Jr.
Governor



Dear Friend of Maryland's Forests —

Forests are an integral part of Maryland's landscape, our environment and our economy. They are the single best land use for water quality protection and clean air, and provide wildlife habitat, aesthetic beauty and forest products – all important benefits too often taken for granted.

In an effort to help citizens better understand and appreciate the value of our trees and forests, the Maryland Department of Natural Resources and the Maryland Forest Service are pleased to present *The Importance of Maryland's Forests: Yesterday, Today and Tomorrow*.

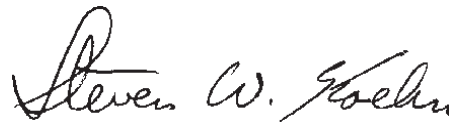
Forests once covered more than 95 percent of Maryland's landscape; now less than half that, 41 percent, remains. Approximately 130,600 private citizens (less than 3 percent of the population) own 76 percent of the forests of Maryland. In a rapidly urbanizing state such as ours, it is essential that we continue managing our forests in an environmentally responsible manner, while retaining local natural resource based economies.

Increasing forest fragmentation, escalating vulnerability to fire in the wildland-urban interface, loss of economically viable working forests and urban tree canopy cover, and the need to restore streamside forests to control runoff are just some of the challenges facing Maryland's foresters today.

Still, with good planning and thoughtful stewardship, sustainable forests that produce environmental and economic benefits are achievable. And we invite you to join our circle of partners, stakeholders and volunteers as we work to revitalize public and private forest management, and more effectively use the tools and programs available to us, linking people and forests from headwater streams to the Chesapeake Bay.



C. Ronald Franks
Secretary



Steven W. Koehn
State Forester

The Maryland Forest Service has been serving the public and managing the forest resources of Maryland since 1906. Our mission is to restore, manage, and protect Maryland's trees, forests, and forested ecosystems to sustain our natural resources and connect people to the land.

“We must be more than careful stewards of the land; we must be constant catalysts for positive change.”
Gifford Pinchot, the father of American Forestry

THE FOREST IN TIME

Solid unbroken forest is all around me, stretching far beyond my vision, for hundreds of miles. It is one of the few such forests remaining in the world. The forest regulates the water flow from the frequent heavy rains. It prevents floods, providing steady runoff in to the trout-filled streams. It used to support salmon runs. Such a forest is also the diffuse lung tissue of the earth to which we are irrevocably bound. It is not our "environment." It is us.
"The Trees In My Forest," Bernd Heinrich, Cliff Street Books, 1997

A Look Back

Maryland was once such a forest. Broken only by rivers, marshes, and mountain meadows, this primeval forest stretched from the wet soils of the Atlantic coastal plain to the hills, plateaus, and valleys of the Appalachians. The inhabitants, Native Americans who settled along the Chesapeake Bay and its tributaries, were the first users of the forest, clearing and burning small areas for farming and berry production. In large part, the great forest of countless millions of oak, tulip-poplar, eastern hemlock, beech, loblolly pine, white pine and American chestnut was left to grow and die and change with the rhythms of the land and sky.

In 1634, this picture began to change. A group of settlers arrived on an island in the Potomac and brought with them a new set of values and aspirations regarding the land. They saw a wilderness that blocked agriculture, bred disease, and sheltered dangerous animals. They also saw in the forest a rich source of lumber and fuel. In a few generations, tobacco, corn, and wheat instead of oaks and pines competed for the sun's energy. Industrious (and

successful) farmers cut, cleared, and burned to feed a young economy based on cash crops. As the settlers spread westward, houses, fences, fuel, and crops demanded more and more forest and it fell before them. Left behind were some unanticipated results. The rivers and streams



threading through the treeless farms collected the unprotected soil as it ran off the fields and filled the deep-water harbors of the Chesapeake Bay leaving a landscape of shifting shorelines and port communities without water. The impacts of early settlement unfolded over one hundred years and slowly collected into massive change; the next

alterations were faster and larger.

While settlers acted individually and often in isolation, industrialization moved forward with an efficient coordination of people and resources. The production of iron required more "input" than the production of tobacco or corn. It required more raw materials, specialized skills, and a controlled source of energy. Throughout much of the 1700's and 1800's, the controllable energy source was charcoal. The character of the forest changed from an obstacle to farming to a vast reservoir of fuel. To encourage the industry, the Maryland Assembly in 1719 offered 100 acres of land to anyone who built an iron furnace. A single operation, the Principio Furnace in Cecil County, consumed 10,000 acres of woodland during its 100 years of production.

Iron led to steel, and steel and steam led to mobility. The huffing engines of the early 1800's changed the perception of the forest once again and it became the major source of raw materials for a variety of industries. The railroads with their wooden ties not only allowed access to remote forests but they expanded the market for Maryland wood products all the way to St. Louis by 1857. The steam-powered circular saw outstripped the old water-powered mills in production of saw timber for lumber. Pulpwood

for paper was shipped widely, and tanbark from hemlocks and chestnut oaks supplied the chemicals needed for tanning leather in growing industrial centers. The forest supplied the Industrial Revolution and helped build the great cities that would change its future once again.

Forest clearing reached its peak in the mid-1800's. In the decades after the Civil War, thousands of acres of local farmland were abandoned to better land in the Midwest and West or a more secure occupation in the booming cities. More land was released by better farming techniques that increased crop yields so that fewer acres were needed to produce the same amount. Still more land was made available by over 200 years of logging which had thinned the forest of its healthy and high quality trees. Set by

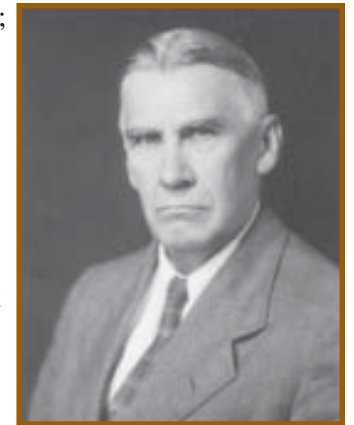
natural causes and sparks from steam engines, fire completed the job by raging over land made vulnerable by indiscriminate logging. The Great Depression produced even more abandoned land as the cities and the West attracted desperate people. The forest now had new opportunities and moved in to fill the space.

The abandoned agricultural, cut-over, or burned lands were first covered by grasses and brambles, then shrubs and small trees, and today's forest was established. These forests grew in a relatively short time and are now even-aged forests between 70 and 120 years old. The tree species found in these "new" forests are similar to those of the 1600's, but the broad composition of the forest has changed dramatically. The original forests were primarily com-

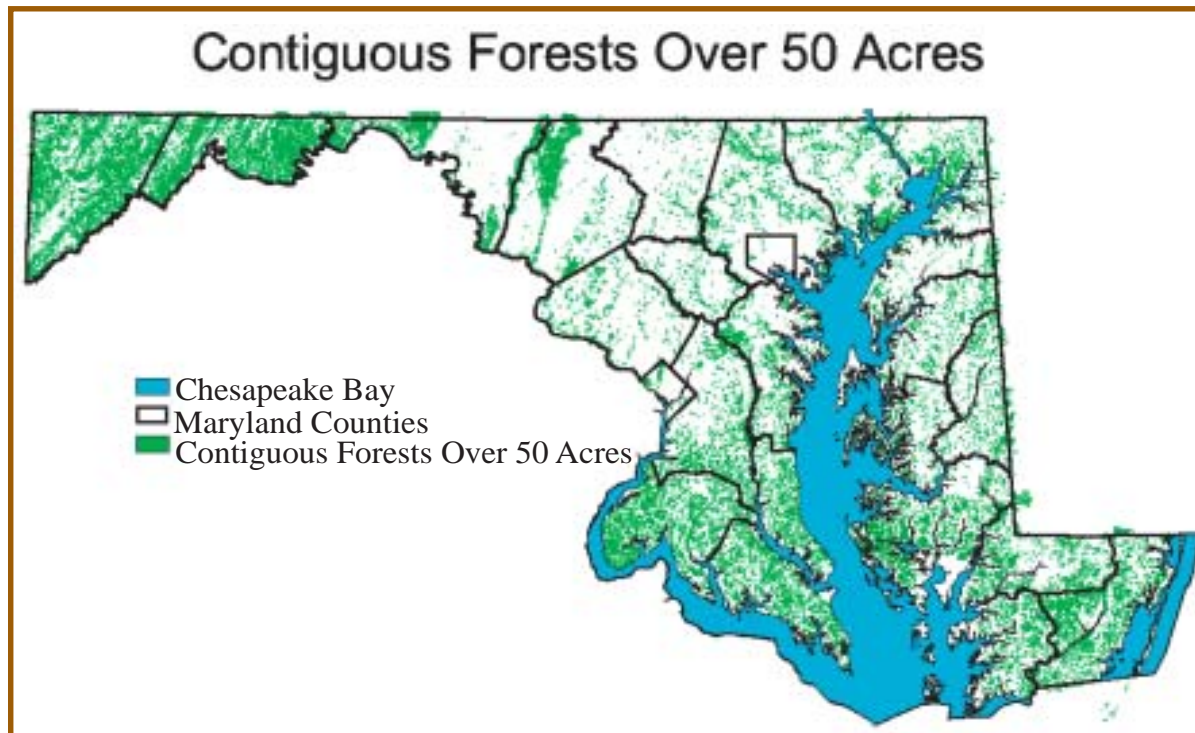
posed of hardwoods; today, pine is more abundant than it once was due to planting programs, natural succession, and scientific forest management.

Scientific forest management meant that the forest, for the first time, had some help when it tried to reestablish itself. By the late 1800's, a national conservation movement led by such notables as Theodore Roosevelt, John Muir, and Gifford Pinchot began to focus attention on wholesale timber harvesting and the lack of regard for forest regeneration. The movement saw the formation of the National Park and National Forest systems, conservation organizations, and many State forestry agencies. In the early 1900's, forestry schools were formed around the nation and supported research on how forests could be managed to provide adequate regeneration and meet other land use objectives. As the schools developed, so did the science of forest management.

The Maryland State Board of Forestry was organized in 1906, primarily to control forest fires. Maryland's first State Forester, Fred Besley, single-handedly inventoried every 5-acre woodlot in Maryland and produced the first forest inventory, printed in 1916. The first State forest nursery was established in 1914 to supply seedlings for reforestation. In the 1940's, the Maryland Forest Division began to offer woodland owners professional forestry assistance, as well as seedlings, to ensure forest regeneration.



Fred Besley

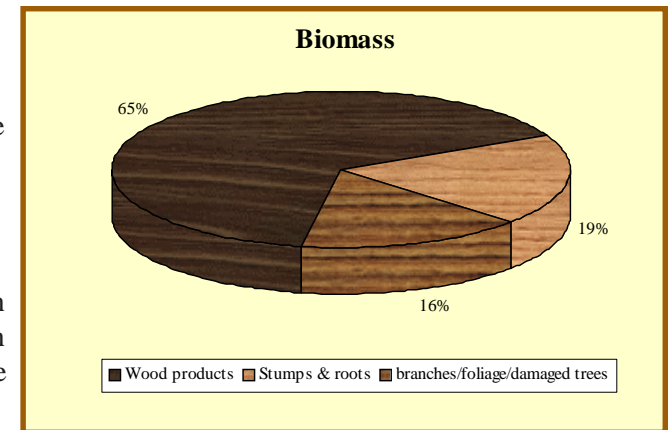


Over the past 30 years, understanding of the forest's functioning has grown in unexpected ways and unexpected places. In the late 1970's, scientists began an extensive study of the Chesapeake Bay to determine the specific reasons for its decline. Three major problems were identified: excess nutrients from wastewater, agricultural land, and developed land; sediment runoff from farms, construction sites, and other lands; and elevated levels of toxic chemicals. We have since learned that nutrient pollution, much of it caused by human activity on the land bordering streams and even hundreds of miles upstream in the watershed, has driven a fundamental biological, chemical, and physical change in the Bay. The main culprits behind the Bay's poor water quality and aquatic habitat loss are two nutrients – phosphorus and nitrogen. Both are natural fertilizers found in animal waste, soil, and even the atmosphere. These nutrients have always been found in the Bay; the problem lies in the amounts that now enter the Bay. When the Chesapeake was surrounded by undisturbed forest, very little phosphorus and nitrogen ran off

the land into the water. Most of it was absorbed or held in place by the natural forest. But when the forest was replaced by farms and cities the amount of nutrients reaching the Bay increased significantly.

These nutrients increase the growth of algae that block sunlight from reaching other plants. When the algae die and decompose, they remove oxygen from the water. So much oxygen is used by decomposing algae that fish and other animals must move to survive; those that cannot may die. Because forests contribute lower amounts of nitrogen and phosphorus to waterways than other land uses, their management has become an important part of Bay restoration.

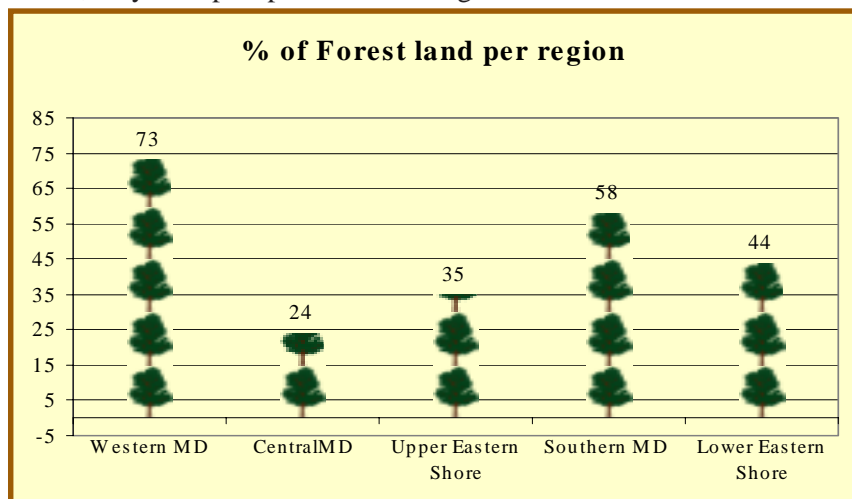
The Maryland forest we see today echoes human migration, the needs of agriculture, the lumber industry, iron and charcoal, wildfires, the first attempts at management, and, ultimately, the resiliency of nature. We will continue to influence the forest. Our charge is to do so responsibly and sustainably.



trees such as loblolly pine and baldcypress. The broad, undulating landscape of the Piedmont Province of central Maryland with its ridges and low knobs supports forests of red, white, and chestnut oak, yellow poplar, and ash with mixtures of pine/oak throughout. The Appalachian Province of Western Maryland includes the Blue Ridge Mountains, the Greater Appalachian Valley, and the Appalachian Plateau. These mountains and valleys contain an assortment of oak forests and northern hardwoods, along with a colder climate.

Forest cover varies from the two heavily forested (about 73%) counties of western Maryland to the less-forested (24 to 35%) urban, suburban, and agricultural counties of central Maryland and the Eastern Shore. Southern Maryland and the lower Eastern Shore also have a considerable amount of forest, 54 to 61% and 37 to 51% respectively.* These percentages translate into a startling number – there are more than 204 million tons of biomass in all live trees

*All figures are from the 1999 Forest Inventory and Analysis by the USDA Forest Service



Today's Forest

Maryland's wide range of soils, topography, and climate supports a natural diversity of plants, animals, insects, and reptiles much broader than most other states. The sandy, flat Coastal Plain Province of southeast Maryland with its mild climate and many wetlands marks the northernmost boundary for southern

Loblolly/Shortleaf Pine

Found primarily on the Coastal Plain in Maryland on moist and poorly drained soils. At higher elevations on the Coastal Plain, it is found on drier soils and often on abandoned farmland. About 12% of Maryland's forests are loblolly-shortleaf pine. The proportion of these two species varies; however, loblolly pine usually dominates. Herbaceous plants are usually sparse because little light reaches the forest floor.

Loblolly Pine/Hardwood

Found on the Coastal Plain Province. It represents a transition from forests dominated by pines to forests dominated by oaks and other hardwoods. Loblolly pine is a minor but important component, representing about 20% of the composition. Hardwood species reflect the amount of soil moisture on the site.

Oak/Hickory

About 60% of Maryland's forests are oak-hickory forest associations and they are found across the State. The proportions of each species vary greatly. Species makeup

depends on amounts of precipitation, and how water drains through soils.

Northern Hardwoods

Found primarily in the western provinces of the State. It occurs on a variety of soil and moisture conditions.

Oak/Northern Hardwoods

Found throughout the Appalachian Mountains in Maryland. It is commonly found on warmer, drier sites on south- and west-facing slopes in the Blue Ridge and Appalachian Plateau Provinces. The proportion of these species varies greatly.

Virginia Pine/Oak

Found throughout Maryland but most commonly on the Piedmont Plateau and the Coastal Plain. Primarily, it occurs on old fields and other well-drained sites. It represents a transition from areas with almost pure Virginia pine to oaks and other hardwoods that tolerate shady conditions.

Atlantic/Appalachian Hardwoods

Found on north- and east-facing slopes of the Appalachian Plateau Province in Maryland. This association occupies cooler moister sites. It is not commonly found further east. However, some small pockets occur in coves in western Montgomery County.

Hemlock/Northern Hardwoods

Found throughout the Appalachian Plateau Province in western Maryland. It occupies cooler moister sites. Small pockets of hemlock/northern hardwoods may be found in coves in western Montgomery County.

Atlantic/Oak/Gum/Cypress

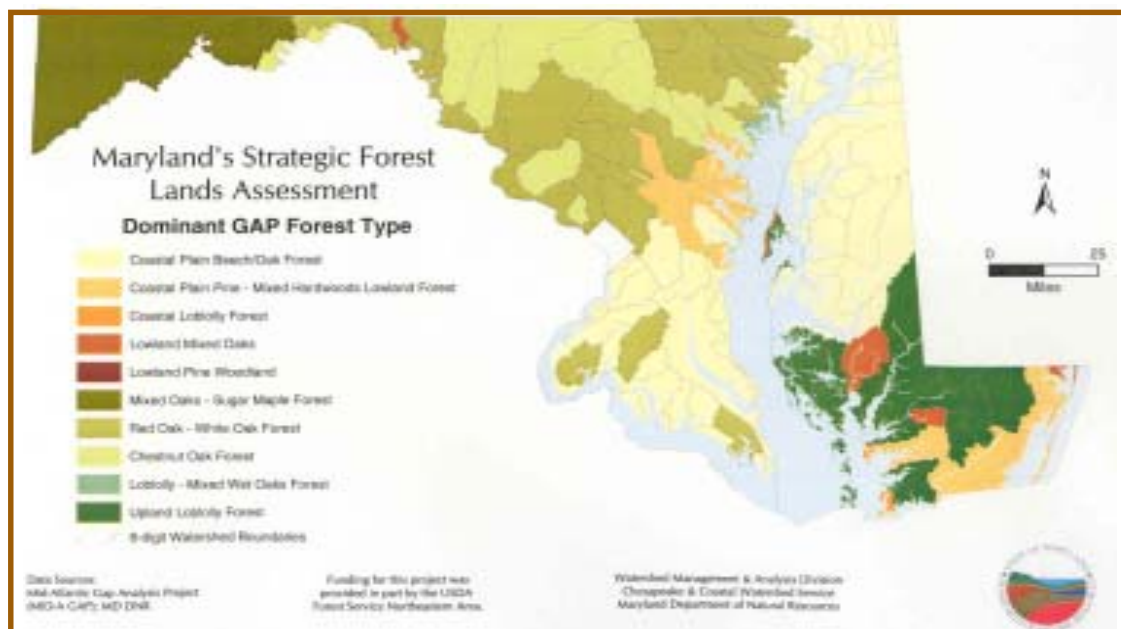
Found along the Chesapeake Bay and the lower western and eastern shore areas of the Coastal Plain. These forests are characterized by wet soils. Often, these sites are flooded during most of the growing season.

White Pine/Northern Hardwoods

Found throughout central and western Maryland. Generally, it is not found on the Coastal Plain. The understory in this forest association is sparse.

on forestland in Maryland. That is an average of nearly 80 tons per acre. Sixty-five percent of the weight is suitable for wood products, 19% is in stumps and roots, and the other 16% is distributed among branches, foliage, and damaged or deformed trees.

Maryland's various plant communities are categorized by the trees, shrubs, and herbs that are frequently found growing together due to similar soil, moisture, climate, and terrain preferences. These communities (or associations), including the animals living there, operate as highly complex and interrelated units. Typically, the dominant species are used to name the associations and they are determined by the number of individual plants of each species, how they are distributed across the area, and the size of the plants. More than 150 native tree species



are found in Maryland and certain of them grow in association with one another. Different methods are used for characterizing forests but generally, if a forest has a high number of large red and black oak trees, and many smaller hickories, the forest association would be oak-hickory. Similarly, if there are about the same number of sugar maple, American beech, yellow birch, and a few eastern hemlock, the forest association would be northern hardwoods.

It is important to understand forest communities because each supports different plants and animals, and provides different benefits. Threats to forest health, as well as effects of protection measures vary from one forest community to the next.

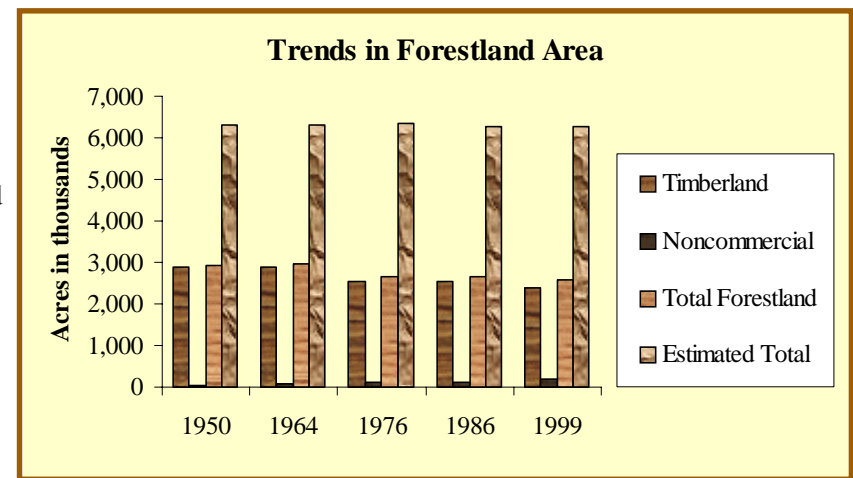
In addition to forest associations, there are several other important ways to categorize the forest for informational purposes. The growth of forest trees has traditionally been measured in terms of wood products since that is how forests

were used. These measurements are valuable today because they can be compared with measurements taken decades ago and allow us to focus on and understand the many different aspects of the forest.

🌲 *Forestland* is defined by the U.S. Forest Service as an area at least one acre in size that is at least 10% covered with trees of any size, or that formerly had such tree cover and is not currently developed in a nonforest use. It includes timberland and noncommercial forestland. The noncommercial forestland category includes reserved forestlands and unproductive forest. Harvesting for timber products on these lands is administratively restricted or economically impractical. Examples include parks, wildlife

preserves, wetlands with poor growing conditions, and many urbanizing areas. Most noncommercial forestland is owned by public agencies and has steadily increased in area from 23,000 acres in 1950 to 193,900 acres in 1999. Nearly all of this increase is due to the administrative reclassification of timberland into forestland.

🌲 *Timberland* is an area producing or capable of producing more than 20 cubic feet of industrial wood per acre per year. Not all forestland is timberland, but all timberland is forestland.



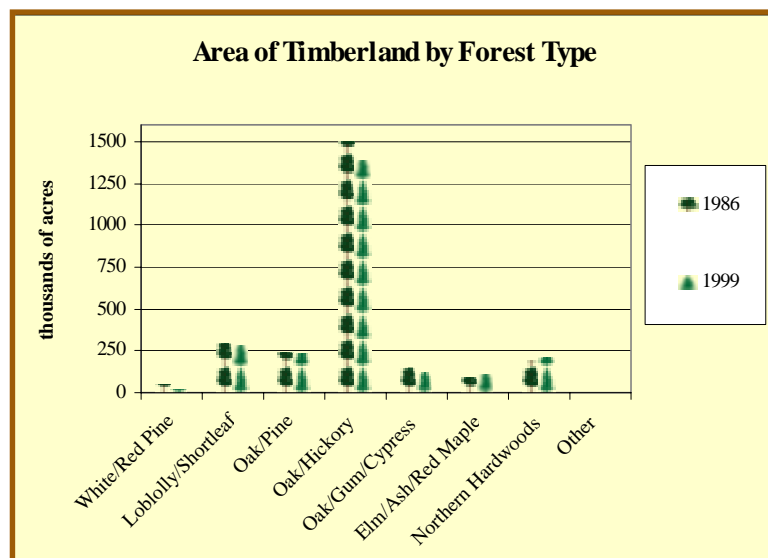
🌲 *Growing stock* is all live trees suitable for use as industrial wood products. Trees are also grouped according to their size with measurements of diameter taken 4½ feet from the ground (referred to as “diameter at breast height” or dbh).

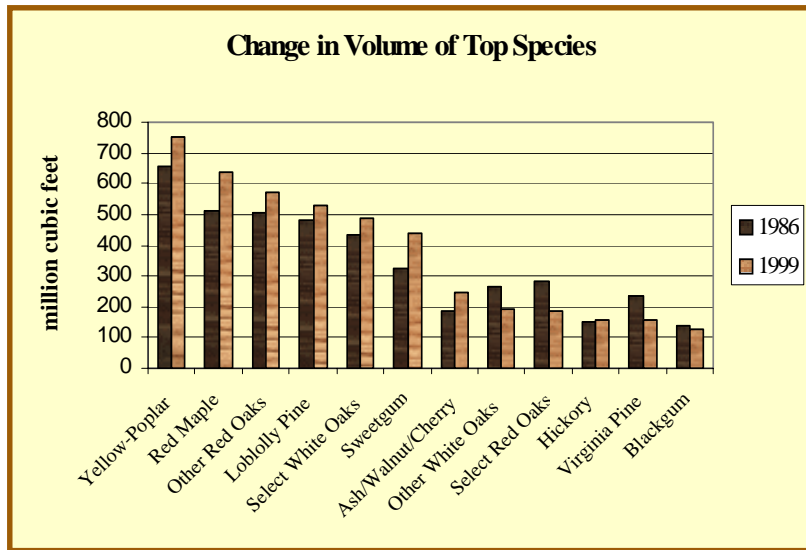
🌲 *Sawtimber* refers to trees at least nine inches dbh for softwoods and eleven inches dbh for hardwoods.

🌲 *Poletimber* refers to trees at least five inches dbh, but smaller than sawtimber. The seedling/sapling grouping includes stands where more than half the trees are saplings (up to 4.9 inches dbh) and seedlings (less than 4½ feet tall). Data and statistics for volume of growing stock and sawtimber, and for growth and removals are based on timberland.

Forestland Area Continues to Decline

The USDA Forest Service completed its fifth Forest Inventory and Analysis for Maryland in 1999. Using both ground and aerial surveys, the Forest Service looked at 1,098 ground plots across the state to determine changes in forest-





The Composition of the Forest is Changing

The majority of the timber in Maryland forests is yellow poplar, oak, and red maple - the major species in the oak-hickory forest type. The oak-hickory type covers 58% or 1.38 million acres, followed by loblolly-shortleaf pine (12% or 282,600 acres), oak-pine (10% or 229,600 acres), and northern hardwood (9% or 209,100 acres). Other types of forest combine for 262,700 acres. The decrease in the proportion of the combined oak species has

maple is the most common tree species by number in Maryland, accounting for 15% of all saplings and 15% of the live trees five inches and larger in dbh. Sweetgum is the second most common tree species by number, with 10% of the saplings and 9% of the trees at least five inches in diameter. Loblolly pine rounds out the top three overall, with 8% of the saplings and 14% of the trees five inches and larger in dbh. Since 1986, the average number of trees per acre that are 5 inches dbh has remained unchanged at 159, but the average diameter has increased from 9.3 inches to 9.6 inches.

land area, timberland area, volume of growing stock and sawtimber, and tree growth and removal. According to this work, Maryland contains 6.25 million acres of which 41% or 2.56 million acres is forestland. Surprisingly, this new measurement compares favorably with estimates from the early 1900's when forests and old fields covered 46% of the state. But, it is also a decrease of 3% or 79,500 acres since the previous inventory in 1986.

Timberland makes up the largest segment of Maryland's forestland. Ninety-two percent (2.37 million acres) of forestland and 38% of all land is timberland.

This is an overall decrease from 1986, when timberland totaled 2.52 million acres, or 95% of the forestland, and 40% of the land area.

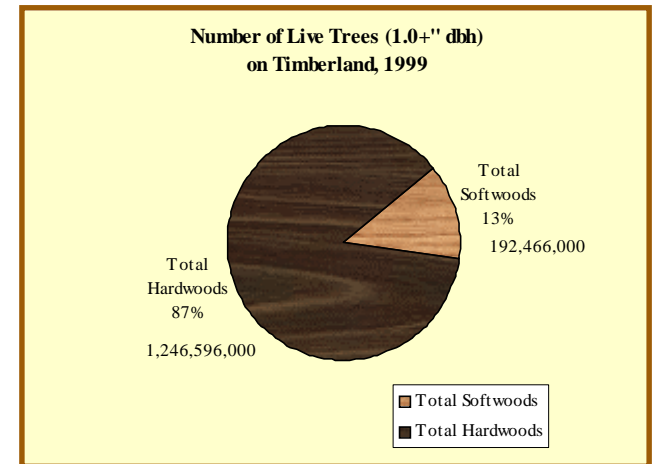
been attributed to many factors, among them; the high mortality of oak species following gypsy moth infestations, deficits in oak reproduction due to deer browsing, and a loss of periodic low intensity fires which oak's are more likely to survive than other species.

Yellow-Poplar Leads in Volume

The 1999 inventory identified 94 tree species in Maryland, though many of them are uncommon. The twelve most common species account for 88% of the total cubic foot volume. Yellow-poplar leads in volume followed closely by red maple.

The Number of Trees per Acre is Not Changing

There are 1.44 billion live trees 1.0 inch or larger in dbh on Maryland's timberland, or 609 trees per acre. Of these, 385 million (159 trees per acre) are at least 5.0 inches in dbh. Red



Forests are Maturing With Fewer Stands of Young Trees

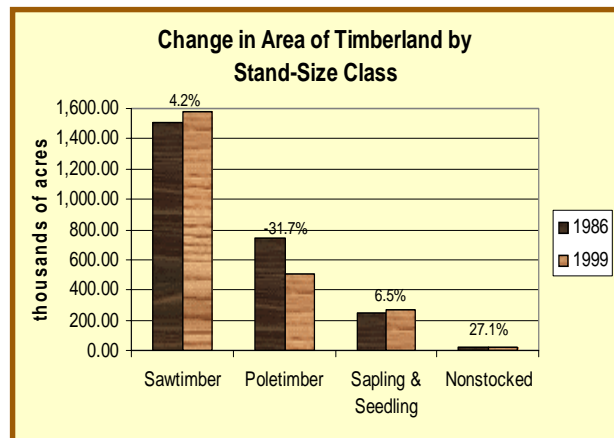
Most of the State's commercial forestland regenerated after extensive harvesting and farm abandonments at the turn of the century. Today, sawtimber stands occupy 66% (1.57 million acres) of timberland area. These large trees have increased in acreage since the last forest inventory and are vital to wildlife. Their understory of herbaceous plants and shrubs provide food and

cover, their boles and bark provide nesting and feeding sites, and the large dead trees, both standing and on the forest floor, provide additional food and cover. Since 1986, sawtimber stands have increased by 4% or 64,000 acres.

Poletimber stands cover 506,100 acres (21%). Trees in these stands are not sufficiently mature to produce large amounts of nuts and seeds, and often form dense overstories that inhibit the growth of understory vegetation. Poletimber stands have decreased in area by 31% since 1986.

Stands classified as sapling-seedling and nonstocked increased from 11% of timberland in 1986 to 12% in 1999. These stands typically contain early successional, pioneer tree species as well as a variety of herbaceous and shrub plants that need full sunlight to survive. These stands provide unique nesting and feeding opportunities for wildlife.

In a state that has seen tremendous population growth in recent years (the population has doubled since 1950), the fact that forests still cover 41% of the land is remarkable. There are three important reasons for this high percentage.



First, most of the population of Maryland has concentrated in and around Baltimore and Washington D.C. and a few other cities, leaving much of the state fairly rural. Second, there has been a sizable decrease in the amount of land used for farming. Land in farms is now half of what it was in 1950, a loss of 2.1 million acres. Although much of the lost farmland has been developed, some of it has been abandoned and has reverted to forestland through natural regeneration and tree planting. These new forests have offset much of the loss in forestland due to development. Third, Maryland forests have been restored, conserved and protected by a variety of effective forest management programs.

Life in the Forest

The ecosystem that we call the forest is filled with thousands of nearly invisible relationships among the kingdoms of life – animals, plants, fungi, and bacteria. All species, from the mitochondria bacteria and mycorrhizae fungi to oak trees and black bears are important components of healthy, self-sustaining forest ecosystems. They have evolved over the millennia to take advantage of differences in their environment, nearly infinite variations in soil moisture and acidity, sunlight, temperature, hydrology, and prey. For example, the cell of each leaf contains 50 to 100 chloroplasts, the microscopic green structures that are the tree’s solar energy panels. Once, they were algal parasites, now they live together in a beneficial relationship. A fungus that began infecting tree roots eventually became an “association” called mycorrhizae that is necessary for tree roots to

absorb nutrients from the soil. Squirrels and blue jays eat every acorn they can find, and, by dispersing the seeds, become symbiotic tree planters. These examples are a tiny part of biological diversity – the entire array of organisms and natural communities that thrive and depend on each other in complex interwoven lives.

Maryland’s biodiversity is rich and varied compared to its size. Roughly 900 species of vertebrate animals, 3,900 vascular plant taxa (species, subspecies, or varieties), 160 butterflies, 22 freshwater mussels, and thousands of other invertebrate animals can be found within its borders. Terrestrial and aquatic species are supported by over 100 different assemblages of plant communities, including tidal marshes, swamp forests, Coastal Plain bogs, pinelands, serpentine grasslands, upland hardwood forests, scrublands, and beds of submerged aquatic vegetation. These plant communities and habitat types are the basic fabric that maintains the web of life.

When the early colonists first explored this part of the New World, they found it teeming with animals, including elk, gray wolves, bison, and mountain lions. Today, these species are gone from Maryland and many more have greatly declined. In the years since European colonization, our forests have been changed and some species dependent upon them are now rare, endangered, or no longer dwelling in Maryland. When forests are under stress, individual species and their habitats become threatened, thereby endangering the health of the forest itself.

Maryland’s largest mammal, the black bear, requires large forested areas to survive. The best bear habitat is found in Garrett county where

expansive hardwood forests are interspersed with a dense rhododendron understory and wetlands. Until recently, it was believed that Eastern Wild Turkeys needed large forested areas to survive, yet a capture and release program has successfully reintroduced them in every county of Maryland. They may be found in mature hardwood and pine forests as well as grassy fields. White-tailed deer are very abundant and are found throughout Maryland in forests, farms, wetlands, parks, open areas, and suburban areas. Some suspect that white-tailed deer may be more numerous today than prior to European settlement. In pre-colonial times, they were prey for wolves and mountain lions and Native Americans hunted them year round – today, man is their only predator.

While diverse forest meet the habitat requirements of many different species and attract a great variety, large stretches of forest aren't always needed. Chipmunks and salamanders, for example, can thrive in a small patch of woods. But many species do require large blocks of forest to thrive. These species are called forest interior dwelling species, or FIDS. Scarlet tanagers are FID birds that have higher success rates when raising young if they

nest deep in the forest. Closer to forest edges, their eggs are often pushed out of nests by brown-headed cowbirds. The cowbirds then lay their eggs in the nest, leaving the tanagers to raise the young cowbirds. Cowbirds are rarely found in the center of large forests.

There is other life in the forest and it is us. We enjoy forests for study, fun, exercise, peace and solitude, and any number of other reasons. Our enjoyment is both intellectual and emotional; the forest is both the ancient home of our ancestors and the modern counterpoint to our urban lives. Our “recreation” in natural settings is deeply rooted and deeply important and the wide array of forests across Maryland offer ample opportunity for different kinds of contact – hunting, horseback riding, backpacking, cross-country skiing, snowshoeing, rock climbing, caving, birding, picnicking, gathering nuts and berries,

photographing and watching wild animals, identifying and photographing wildflowers, and, maybe, just looking and listening. Hiking and camping in primitive areas are the top two recreational uses of our forests.

The latest information (2001) from the US Fish and Wildlife Service measured spending in Maryland for wildlife-related recreation to be approximately \$1.743 billion. The same source reports that nearly 40% of Marylanders participated in wildlife-related recreation and over one-quarter of a million nonresidents visited Maryland for fishing and hunting alone.

As our population burgeons and land use pressures intensify, it is increasingly important that we protect our most productive natural areas. Once gone, they cannot be fully restored.

Their resource potential, their utility for education and research, their recreational, aesthetic, and cultural values would be lost to future generations.



Harvesting The Forest

Heat is a form of energy. The source of that energy, captured by the trees' leaves, is the sun. Multiplying the potential energy of those two to three pieces of split wood by the untold thousands of logs accumulating in the trees all around me, I am awed by the sheer magnitude of energy that drives life, passing from one form to the next. The energy captured by trees and other plants will eventually be tapped by bacteria and fungi, by insects and other herbivores, and then passed on to birds and other predators, like us.

Bernd Heinrich

The Working Forest

Growing Stock Volume Has Increased

Nearly all of the forestland in Maryland is capable of growing trees suitable for wood products. Only about 10% of the forestland is held in reserves where trees are not removed for use. These lands include parts of State forests, designated wildlands, and urban forests. Harvesting and land use change can and has occurred across the remaining 90% of the land, but annual wood growth is more than annual wood removal and has been since 1952. **In fact, Maryland's forests now contain more large trees with increased volume than they did at the turn of the century.**

Since 1986, average annual harvesting and land use removal of *growing stock volume* totals 82.6 million cubic feet. Growing stock volume is a measure of live trees that are considered commercial and measure 5 inches dbh or larger. Sixty-three percent of this removal comes from harvesting, 28% is attributed to volume on timberland reclassified to noncommercial forestland, and 9% comes from timberland converted to nonforest uses. Average annual net growth since 1986 has been 106.8 million cubic feet. This surplus of growth represents an annual net increase in the volume of wood on timberland and

an average net gain of 24.1 million cubic feet per year.

Ratios of growth to removals of growing-stock volume vary with tree species. Yellow poplar is growing 4.5 times faster than it is being removed by harvest or land use change. Red maple is being taken twice as fast as it is growing. Loblolly pine, one of the top five species in growing stock volume, is equally balanced between removal and growth. Overall, during the most recent inventory period, growing stock volume increased by 7%.

Sawtimber Volume Has Increased

Average annual net growth of sawtimber on timberland is 428.6 million board feet. Harvesting and land use change removes 272.7 million board feet per year. The ratio of growth to removals of

sawtimber volume is 1.6 to 1 for a positive annual change of 156 million board feet. Yellow poplar showed an annual increase of 150 million board feet, a ratio of 6.2 to 1. Loblolly pine showed no significant increase in volume. *Sawtimber volume* has increased 14% since 1986. Volumes per acre have increased from 5,935 board feet to 6,797 board feet for a total of 16.1 billion board feet of sawtimber volume in Maryland (for comparison, a new home requires approximately 20,000 board feet of lumber).

The Renewable Resource

The economic and population shifts of the early 1900's affected much of Maryland's forest today. These forests are being used for a variety of products: building lumber, shipping

Average Annual Net Change of Growing Stock Volume on Timberland, 1986-1999
(in thousands of cubic feet)

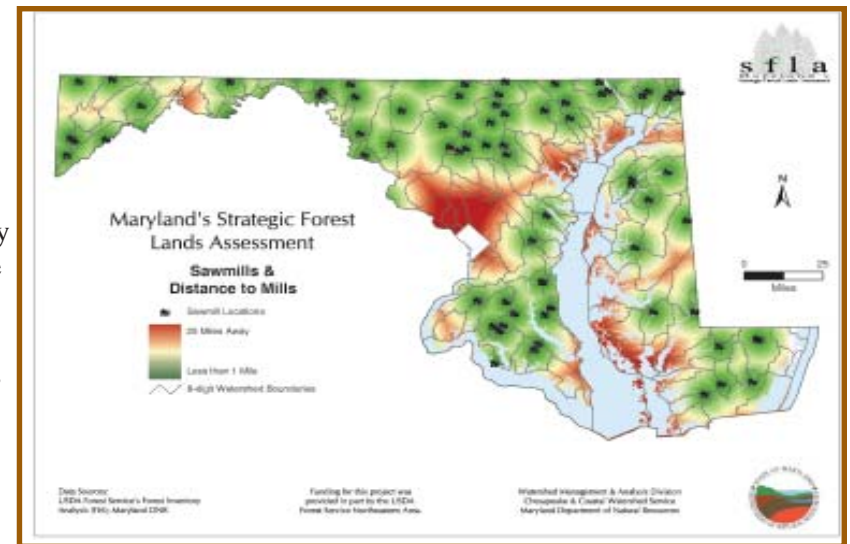
	Gross Growth	Mortality	Cull	Net Growth	Harvest Removals	Land Use Removals	Total Removals	Net Change
Softwoods	29,987	-6,254	-57	23,675	-15,981	-2,982	-18,963	4,711
Hardwoods	111,783	-30,288	1,622	83,117	-36,072	-27,619	-63,691	19,425
Total	141,769	-36,543	1,565	106,791	-52,053	-30,602	-82,655	24,137

crates, shelving and furniture, pallets, flooring, molding, mulch, chips for fuel and particle board, and pulp for paper. Many forest stands are now between 70 and 120 years old and have reached the age where most are about 18 inches in diameter. These large trees are used for veneer and other high quality wood products and have brought about an increase in the value of wood products over the last three decades.

In 1996 (the year for which the most comprehensive information is available), several hundred forest products operators and timber-dependent businesses operated in Maryland. These businesses provided nearly 14,000 jobs, had an annual output value of \$2.2 billion, and contributed \$.75 billion in value-added economic activity. According to the MD DNR Forest Service, 329 logging companies, 208 firewood companies, 104 sawmills, seven veneer log brokers, 280 Christmas tree farms, one pulp and paper mill, and eight reforestation planting companies are registered or licensed to do

business in Maryland. There are hundreds more that manufacture secondary forest products such as molding, wooden boats, caskets, doors, musical instruments, picture frames, and signs. The industry as a whole is broken into three major categories: Timber Management and Harvesting, Primary Wood Manufacturing, and Secondary Wood Manufacturing.

🌲 Timber Management and Harvesting includes the operation of timber tracts, tree farms, reforestation services, and forest nurseries; the harvest and transportation of logs; and the production of wood chips and rough, round, hewn, or split wood raw materials. This sector is concentrated on the Eastern Shore, employs a total of 1,375 and has an annual



statewide output of \$230 million.

🌲 The Primary Wood Manufacturing sector processes logs and related raw materials into lumber, veneer, plywood, pulp, paper, and other products. It is concentrated in the western counties, employs a total of 3,449 and has a \$720 million annual statewide output.

The final sector, Secondary Wood Manufacturing, turns the primary manufacturing products into finished ones, such as furniture, toys, cardboard containers, cabinets, and finished building components. It is focused in the central counties of Maryland, employs a total of 9,074 and has the largest annual statewide output – \$1.234 billion.

All regions of Maryland support some level of wood processing but the central and western portions account for over two-thirds of the annual output value and 60% of the employment. This is largely due to a concentration of secondary manufacturers in the central counties and paper and other product mills in the western counties.

Maryland Forestry and Wood Products Direct Output and Employment						
	Timber Management & Harvesting		Primary Wood Manufacturing		Secondary Wood Manufacturing	
	Output (in millions)	Employment	Output (in millions)	Employment	Output (in millions)	Employment
Central	\$29	173	\$75	392	\$601	4,325
Eastern	\$139	749	\$70	441	\$140	915
Southern	\$26	154	\$39	240	\$181	1,324
Western	\$36	294	\$484	2,237	\$104	931
State	\$230	1,375	\$720	3,449	\$1,234	9,074

Source: The Economic Importance of the Maryland Forest Products Industry.

The eastern counties support the largest timber management and harvesting output (\$139 million) and the southern counties follow the central region in secondary wood manufacturing output.

In addition to providing direct employment and income for Marylanders, the forestry and wood product industry generates income for business owners, property income, and indirect business taxes. This “Value-Added” economic activity boosts the industry’s contribution to the State’s economy by another \$.75 billion.

A healthy forest products industry helps ensure a healthy and resilient Chesapeake Bay. Without healthy wood fiber markets, forest landowners would have more economic incentive to grow houses rather than trees! Since forests, as a land cover, are the best for producing clean, fresh water, any loss of forestland to other uses has a detrimental effect on Chesapeake Bay restoration efforts.



Maryland Forestry and Wood Products Industry Value-Added Economic Activity (in Millions)				
	Timber Management & Harvesting	Primary Wood Manufacturing	Secondary Wood Manufacturing	Total
Central	\$13.53	\$20.71	\$193.14	\$227.37
Eastern	\$63.54	\$19.59	\$37.87	\$121.00
Southern	\$13.00	\$11.70	\$70.12	\$94.83
Western	\$15.38	\$183.16	\$35.31	\$233.85
State	\$105.95	\$248.76	404.53	\$759.23

Source: The Economic Importance of the Maryland Forest Products Industry.

The Forest Industry’s Impact

Because of the widespread commercial use of forest resources, timber plays a significant role in the economy of Maryland and the forestry industry has significant links to other Maryland industries. For every dollar of economic output value of the wood products industry, another dollar is produced elsewhere in Maryland’s economy. For every job in the wood products industry, two jobs are stimulated elsewhere. And for every dollar of value produced by the industry, nearly two more dollars in value are added as the product moves up the value-adding chain.*

The total annual payroll from the forest products industry in Maryland is more than \$420 million. If indirect benefits of these wages and salaries were included, the

effect would be even greater.**

Another way to look at the impact of the industry is to project how changes in overall output would ripple throughout the state’s economy. A 10% drop in primary wood manufacturing (\$72 million) would result in a \$156 million drop in the value of all goods and services in the state. Western Maryland would absorb nearly \$92 million of this loss. The same 10% decline would cost 1,390 jobs, most of them in Western Maryland. A 10% drop would also have a significant effect on wages, income, and taxes causing a \$76 million loss.***

*The Economic Importance of the Maryland Forest Products Industry, 1996

**Maryland’s Forest: Past, Present, & Future, Maryland Cooperative Extension Service, University of Maryland)

***The Economic Importance of the Maryland Forest Products Industry, 1996



The Forest Landowner

Selling wood is a major source of income for private owners (who hold 76% of the forestland in Maryland). If a viable forest economy is present, owners have economic incentives to keep their land in forests. If not, they are motivated to look for other uses. Conversion to other land uses, such as development, is encouraged when people become uncertain that keeping the land in farms and forests will yield future returns. Such an outcome, over time, will result in the loss of countless environmental benefits.

Forests are the preferred land use in efforts to improve water quality. Years of research have shown that forest is the best form of land use to reduce sedimentation, remove nutrients from groundwater, and regulate streamflow during storm events. All of which lead to improved water quality, enhanced habitat for living resources, and a better aquatic environment.

Healthy, managed, productive forests will help retain sustainable natural resource-based

industries by providing working landscapes from which a sustainable supply of resources is available. Many forest landowners rely on the income produced from their forestland whether it is from timber sales, hunting leases, or some nontraditional product. If the resource-based industries cannot operate due to regulatory constraints or insufficient raw material supply, they will close or relocate to other states, taking jobs and associated economic and environmental benefits with them. The loss of these industries would leave the landowner with limited management options and, if faced with economic needs, little opportunity for producing cash flow. The likely outcome would be the sale of the land for development.

Maryland's Association of Forest Conservancy District Boards: Unique to the Nation

Maryland established Forest Conservancy District Boards in 1943 to help its Forest Service promote forest management on privately owned woodlands. The original goal of the Boards was to help ensure a supply of forest products through scientific forest management. Today, their role has expanded to include leadership for the improvement of the environment in urban and suburban areas and education about the benefits of trees and forests. The volunteer members of the Boards serve as tree and forest advocates, and educators. The Forestry Boards are active in all twenty-three counties and Baltimore City.

In 1999, the income from timber sold on Maryland woodlands, whether as stumpage (price paid to the landowner for standing trees) or cut and then sold, was estimated to be \$32.4 million. This provided a direct economic benefit to Maryland workers. For every \$1 paid to landowners for a sale of timber in 1999, \$14 in direct wages and salaries was generated for the State's economy.

The Maryland Department of Agriculture reports that "farm revenue" for forest products reached over \$33 million in 2000 and has averaged over \$30 million since 1996. But many of Maryland's 130,000 forest landowners are still unaware of the sustainable value of their forestland. Information targeted to the general public about the value of forests and trees does help create an awareness of the resource but continued work is required to supply personally relevant material that will motivate a landowner to "do" something with his forestland.

Forest landowners in Maryland can receive information and recommendations to better care for their forestland by contacting the MD DNR Forest Service office in their County. The *Forest Stewardship Program* provides technical assistance to help individual landowners enhance or protect the timber, fish/wildlife habitat, water quality, wetlands, and recreational/aesthetic values of their property, as well as find ways to use sustainable land management practices that protect the Chesapeake Bay. Practices eligible for technical and/or financial assistance include afforestation, forest improvement, windbreaks and hedgerows, streamside and wetlands protection, fish habitat improvements, wildlife habitat enhancement, and soil and water protection. Over the past 10 years, an average of 28,500 acres/year has been enrolled.

Improving the Management of the Forest

Woodland Incentive Program - This provides cost-share assistance to private landowners for tree planting, site preparation, and timber stand improvement practices. It covers up to 50% of the cost of eligible practices and is available to owners of at least 10 but not more than 500 acres that have potential to be harvested for logs, pulpwood, firewood, woodchips, posts and other forest products. Maryland distributes approximately \$100,000 to 75-100 landowners covering 1,500-2,000 acres each year.

MD DNR Forest Service, 580 Taylor Avenue, Annapolis, Maryland 21401, 410-260-8531.

Forest Conservancy District Boards - County forestry boards are allowed to review all timber harvests in the state. State law provides that any forestlands of three acres or greater on which commercial cutting is done must be left “in a favorable condition for regrowth,” that young growth be retained, that restocking after harvest be arranged, and that the operator maintain adequate growing stock after selective cutting. In practice, the forestry boards only review timber harvests in the Chesapeake Bay Critical Area and in specific parts of Frederick County.

MD DNR Forest Service, 580 Taylor Avenue, Annapolis, Maryland 21401, 410-260-8531

Master Logger Program - This is a series of comprehensive training courses designed for the logging professional. Program attendance is completely voluntary but the Master Logger Program endorses only those loggers that complete the training agenda. Training covers such topics as best management practices, forest management, logging aesthetics, logging safety, and first aid and CPR. Landowners, foresters, and all interested may attend the courses. *Maryland Forests Association, P.O. Box 599, Grantsville, Maryland 21536, 301-895-5369, mfa@hereintown.net*

Forest Conservation and Management Agreement - A property tax program that allows owners of five or more contiguous acres of forestland to apply for a reduced or frozen property tax assessment. If the owner agrees to not develop the land for nonforest uses for a minimum of 15 years, the property tax assessment is frozen at \$125/acre for the life of the agreement. Maryland has about 1,300 agreements covering 97,539 acres of forested land. A “forest conservation and management plan” is required.

MD DNR Forest Service, 580 Taylor Avenue, Annapolis, Maryland 21401, 410-260-8531.

Timber Stand Improvement and Reforestation Income Tax Modification (TaxMod) - In this program, taxpayers may subtract from their adjusted gross income on their state income taxes an amount that is double the cost of reforestation and timber stand improvement practices (less any cost-share assistance). Eligibility requires ownership or lease of 10 - 500 acres of forestland capable of growing more than 20 cubic feet of wood per acre per year and available for the primary purpose of growing and harvesting trees.

MD DNR Forest Service, 580 Taylor Avenue, Annapolis, Maryland 21401, 410-260-8531.

Sustaining the Forest Base

Why do we need forest? There are many compelling reasons, but they are generally tabulated in quarterly balance sheets. Ecosystem “services” include air and water purification, flood control, erosion control, nutrient recycling, and pollination services. Ecologically, forest is natural habitat and most species on earth are adapted to it and require it. There have been and are many practical arguments for forest – practical in the material sense. Ultimately advocates for forest are motivated also by ethics rooted in our own psychological dependence on wilderness. Conservationists...have all in their own way reaffirmed that like other animals we, too, need forest or other wilderness to live healthy adapted lives.

Bernd Heinrich

Forests and Land Use

Nature, over the course of eons, has built a forest ecosystem that is integral to the maintenance and fundamental quality of our lives. There is no forest where we completely understand all the relationships among its living parts – plants, animals, fungi, and bacteria – much less the relationships of these living parts with its nonliving parts – geology, climate, hydrology, and soil. But we do understand a coarser interdependence; without functioning forests the whole system fails.

The greatest threat to Maryland’s forest base is the conversion of forestland to nonforest uses – a somewhat bureaucratic way of saying that the natural forest vanishes. But also, as residential and other development spreads across the landscape, the spatial configuration of the remaining natural forest changes. The creation of small isolated patches of remaining forest reduces habitat quality for species that require large tracts of interior forest and reduces the opportunity for the gene flow and migration needed to maintain resilient natural plant and animal populations. In addition, large blocks of forest are often subdivided into “smaller” parcels which increases the

potential for their conversion to nonforest use and reduces the amount of actively-managed large blocks of forest.

Projections by the Maryland Department of Planning estimate that between 1990 and 2015 the land area dominated by urban development will increase to a total of 1.5 million acres. This is an increase of 48%. The total area developed may be 25% of Maryland. Without changes in land use planning and effective resource-specific controls, thousands of acres of forests could be lost to development.

The need is to prepare for the addition of one million people over the next 20 years, develop a coordinated strategy to strengthen the State’s ability to direct growth, and enhance our older developed areas. This translates to an “inside” game to revitalize towns and an “outside” game to manage and protect resource lands. In short, Maryland is trying to spend money more efficiently, protect its trees and forests, and keep its communities strong.

Historically, the need to protect a particular species of plant or animal or a natural system such as tidal wetlands or the Chesapeake Bay’s 1000-foot critical area has brought about a new law and regulatory actions that prohibit some

activities previously allowed. This approach to natural resources protection and management often generates controversy and creates adversarial relationships between government and landowners.

The *Forest Conservation Act* (FCA) was adopted in 1991 to conserve the State’s forest resources during land development. It is one of the first laws of its kind in the United States. The Act requires identification of existing forest stands, protection of the most desirable forest stands and establishment of areas where new forests can be planted. Forest conservation planning occurs during the initial site planning of a proposed development, when forest conservation can occur without causing undue economic costs. The FCA establishes standards for local authorities to enforce during development. The Act is a means to protect not only forest and trees in developing areas, but also any sensitive areas identified during the local planning or comprehensive land use plan adoption process. Over nine years 8,700 acres of forest have been planted and 46,000 acres have been retained through the Forest Conservation Act.

Even though a large number of restrictive regulations are in place, this approach is slowly giving way to the use of voluntary programs that

use incentives rather than mandates to achieve desired results. Several of these types of programs are available for forest owners.

A *Forest Conservation and Management Agreement* freezes property assessments at lower rates in exchange for a landowners commitment to put their land under proper management.

Maryland *TAXMOD* allows owners of forestland who reforest their property or carry out timber stand improvement to deduct double their cost of employing these measures from their income for tax purposes.

The voluntary *Forest Legacy* (funded through the US Forest Service and responsible for over 1,400 acres of forest preservation) and *Rural Legacy* programs offer easement protection for forest and agricultural land. Maryland has set a goal to protect 200,000 acres of vital resources by the year 2011, earmarking \$138 million for the *Rural Legacy Program* to accomplish these goals. Thus far, the State has preserved more than 40,000 acres.

The *Conservation Reserve Enhancement Program*, created in 1998, pays farm landowners to create riparian buffers, retire highly erodible soils, and restore wetlands on agricultural land. It offers voluntary easements for permanent protection and is a major part of the *Stream ReLeaf* initiative to establish 1,200 miles of buffer in the Chesapeake Bay watershed. Maryland's goal is to enroll 100,000 acres statewide by 2002: 70,000 acres of riparian buffers, 20,000 acres of highly erodible lands, and 10,000 acres of wetlands. The program has been extended, and as of June 2003, 64,000 acres were enrolled.

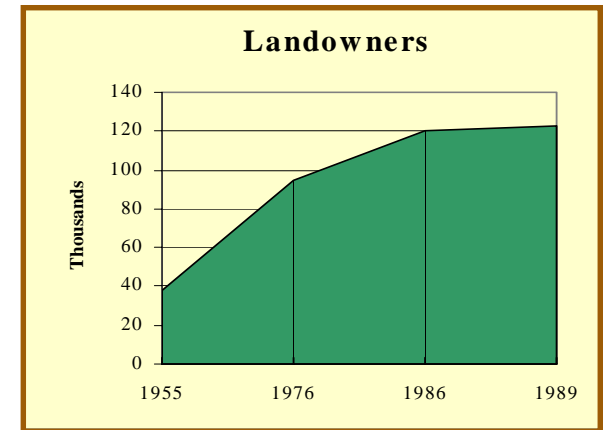
The *Urban Initiative* represents a new comprehensive approach to address natural resource preservation, conservation, and restoration in the urban context. Examples of the Urban Initiative include such projects as the Anacostia River watershed in Prince George's County with tree and riparian buffer planting, wetland restoration in Federalsburg, helping teachers from two Annapolis elementary schools integrate natural resource conservation into classroom instruction, and designing a "retrofit" bioretention pond in a parking lot as part of the Elkton Downtown Revitalization Plan.

The *Maryland Greenways Commission* is charged with promoting and coordinating the protection and development of natural greenway corridors in cities, suburbs and rural areas. Some greenways are pristine wildlife or ecological corridors not intended for human use or access; others are designed primarily to accommodate recreational users or educational activities. A greenway can be a protected creek bed, a trail, a ridgeline, or strip of vegetation along a stream bank, a converted railroad or a utility right-of-way.

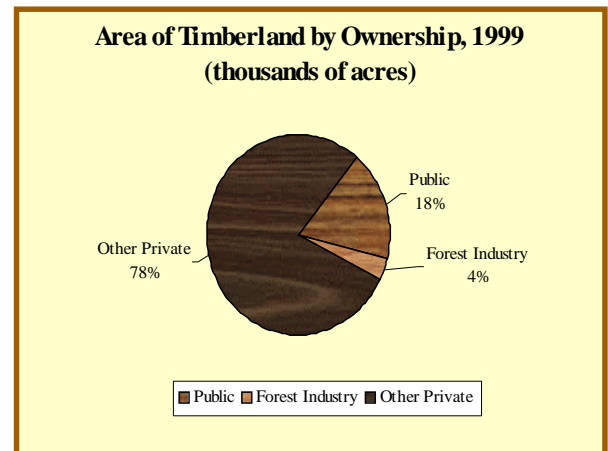
These voluntary, non-regulatory measures are all part of an expanded effort in Maryland to improve environmental protection through use of the carrot rather than the stick.

Forest Ownership

Maryland's timberland is over three-quarters privately owned. People own forestland for recreation, investment, timber production, wildlife habitat, and simple aesthetic enjoyment. In 1999, there were roughly 2.4 million acres of timberland and approximately 78% was owned by private



individuals. The forest industry owned less than 4%, or 88,000 acres. Federal, State, and local entities owned 421,000 acres, or 17%. Between 1955 and 1976, the number of private owners increased from 35,000 to 95,800. By 1989, there were 130,600 private owners. In 1976, 55% or 52,690 owners held less than 10 acres. By 1989, the number of owners holding less than 10 acres increased to 65% or 84,890. Each property is sold on an average of once every 12 years and only 39% of the owners have had harvest experience with their forest.



The State Forests of Maryland are made up of roughly 137,000 acres in four major parcels: Potomac- Garrett, and Savage River State Forests in Garrett County; Green Ridge State Forest in Allegany County; and Pocomoke State Forest in Worcester County. About half of the State Forest acreage is in a management category that permits harvesting. Over the past five years, 4,534 acres (about ½ of 1% of the total available forest per year) have been harvested.

Recent studies show that conserving open space does not require an either/or choice between the environment and economics. Forest conservation and protection is a sound investment. Studies comparing the fiscal impact of development to the conservation of relatively unfragmented open space (such as forests) have found that conservation and protection of open space has a more positive benefit on a community's economy than fragmented sprawl development. The benefits come from lower costs of community services, increased property values resulting in higher tax revenues, greater recreational opportunities, more tourism dollars, and natural water quality improvements and runoff control.

Maryland allocates millions of dollars every year to its three principal land preservation programs: *Program Open Space*, the *Agricultural Land Preservation Foundation*, and the *Rural Legacy Program*. These efforts share the basic aim of protecting undeveloped land from the pressure of an ever-expanding population. Through 2002, nearly \$1 billion has been allocated to State and local governments for the acquisition of approximately 285,000 acres under *Program Open Space*. Funded by a portion of the real estate transfer tax, more than 3,000 county and

city parks and conservation areas have been created. Also funded by the transfer tax, the *Agricultural Land Preservation Foundation* has 3,062 agricultural and woodland preservation districts covering more than 398,000 acres including the purchase of easements on 1,551 properties totaling 217,000 acres.

A Giant Step for Sustaining the Forest

The acquisition of 58,000 acres on the Eastern Shore is the largest conservation land purchase in Maryland's history. In 1998, the State, together with the Richard King Mellon Foundation and The Conservation Fund, purchased land owned by Chesapeake Forest Products Company to create a national model of public/private cooperation for sustainable forestry. The preservation of these lands will protect water quality, essential wildlife habitat, the rural landscape and economy of the region, and will add to recreational opportunities.

Fragmentation and Parcelization

In addition to the number of acres lost to development, the location, size, and number of owners of the remaining forests is critical to management. As forestland is fragmented into smaller and smaller blocks by residential homes and developments many wildlife species are affected. Fragmented forests resemble "islands" surrounded by a "sea" of farms, houses, roads, and other products of civilization. The species

restricted to these islands are limited to fewer potential partners and run the risk of inbreeding. Combined with the natural population fluctuations caused by storms and fire, isolated pockets of species can simply disappear. Even seemingly sound fragments of forests are made vulnerable by their "edges." This boundary is more susceptible to damage from high winds and, even more importantly, is ripe for invasion by predators and parasites from the adjacent open areas, including invaders that could never survive in a deep, interior forest. In effect, the "edge" reduces the size of the already isolated "island" and further limits its capacity as a healthy, diverse ecosystem.

Forested areas are "parceled" when increasing numbers of owners control smaller and smaller portions of the forest. The "paper" subdivision or parcelization of large blocks of forest is the beginning of forest fragmentation. These small parcels of forestland are more likely to be converted to nonforest uses, such as agriculture or residential development. Smaller parcels and more owners make the traditional benefits of forests more difficult to obtain and the management options available to ensure these benefits become more limited and difficult to implement.

Assessing the causes, consequences, and patterns of fragmentation and parcelization is critical to management planning for maximum economic and ecological benefits. Parcelization and fragmentation of forested areas often corresponds with a decrease in the percentage of forestland actively managed. Without management, forest health is likely to be overlooked, and forest benefits become less predictable and more incidental.

The *Green Infrastructure* land network is a concept that will combat fragmentation and protect and link Maryland's remaining ecologically valuable lands. These lands will include, for example, large contiguous tracts of forestlands, important wildlife habitats, wetlands, riparian corridors, and areas that contain key elements of Maryland's biological diversity. The network will be linked by a system that connects large contiguous blocks of natural resource lands (hubs) through corridors that encompass the most ecologically valuable areas between these hubs (e.g. areas of high aquatic integrity, wetlands, wildlife migration routes and important forestlands). Green Infrastructure is a coordinated statewide approach to land conservation and restoration that will: 1) systematically identify and protect lands with important ecological and biodiversity-related characteristics; 2) address problems of forest fragmentation, habitat degradation, and water quality; 3) maximize the influence and effectiveness of public and private land conservation investment; 4) promote shared responsibility for land conservation between public and private sectors; and 5) guide and encourage compatible uses and land management practices.

The Urban Forest

Forest is natural habitat and most terrestrial species on earth are adapted to it and require it. This applies not only to our rural forest residents but to our urban forest residents. The urban forest ties our communities of brick and concrete back to their roots in nature.

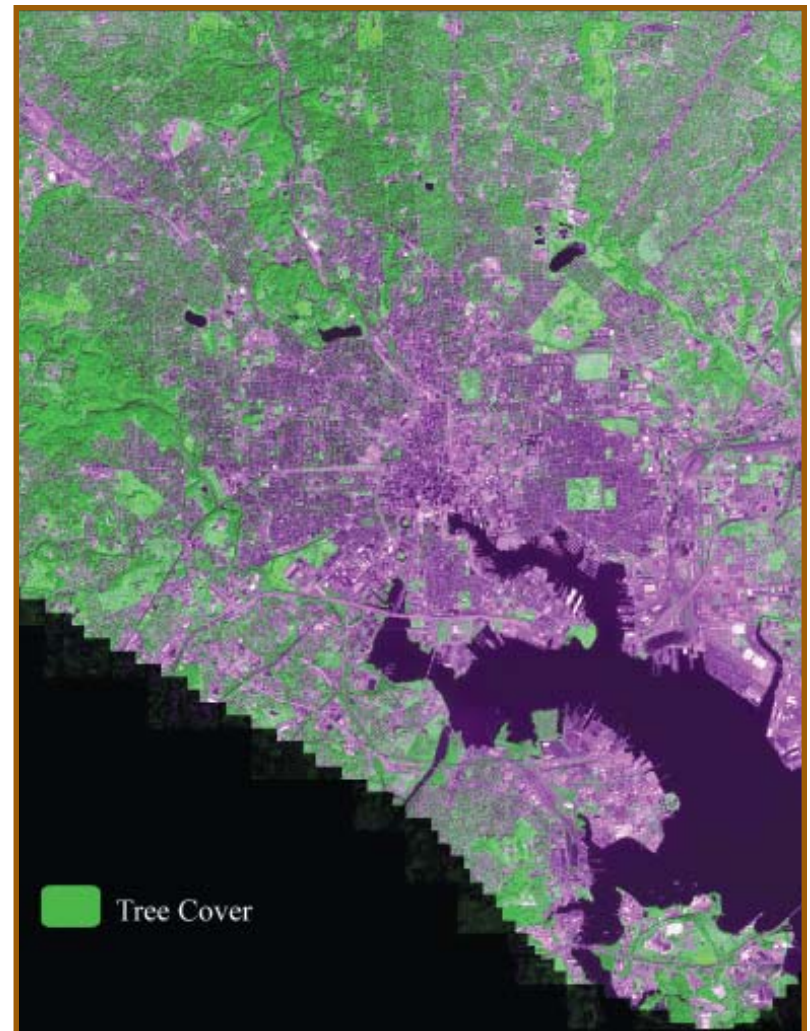
Maryland is home to about 4.8 million people. It is ranked 14th in the nation in population, and it

has the 6th highest population density with an average of 489 people per square mile statewide. Nearly 80% of Marylanders live in the greater metropolitan areas of Baltimore and Washington. The forests of these communities are invaluable assets.

Tree-lined streets shape the character of a town, individual trees add value to property, and, collectively forests and trees reduce air pollution by absorbing gaseous pollutants and filtering dust, ash, and smoke. A dense grove of trees about 50 feet wide reduces the apparent loudness of noise by as much as 50%. Forests and trees buffer glare caused by lights and the sun, provide wind protection, and cool the air. A vigorous urban forest reduces heat retention, known as the "heat island effect" and lowers home cooling costs. Runoff and erosion from storms is reduced because leaves slow raindrops allowing them to soak into the soil, thus reduces runoff and therefore the need for erosion control structures. Trees provide habitat for white-tailed deer, squirrels, chipmunks, birds, raccoons, and scores of other animals. In short, trees are an integral part of the physical and emotional life of cities.

A backyard or planting strip along a highway is not necessarily the favored location for most trees. In urban areas, soils are

generally disturbed, graded, and compacted, with low levels of oxygen and high levels of salt. As a result, the trees and forests of our cities are subject to stresses and limitations not shared by rural areas. Therefore, plans to establish or maintain urban forests must be adapted to suit the urban environment.



Baltimore City

Stresses influencing the health of urban forests include lack of space for roots to grow, too little or too much water, nutrient deficiencies, insects and diseases, and low levels of oxygen in the soil. Stress is added by improper pruning and other treatments, wounds from machines and people, artificial lights, altered waterways, compacted soil, and soil contaminated with salt, pesticides, and fertilizers. Nationwide, the average life span of a tree in a downtown area is less than 10 years. Proper planning and species selection can decrease these impacts.

Urban forests are typically categorized into four zones. The zones are the suburban fringe, the suburbs, city residential, and the city center. The suburban fringe is the area between rural areas and established residential communities. Here, new subdivisions are found and new development is expected but opportunities for forest conservation remain. In the suburbs much of the natural forest has been removed for housing subdivisions. The city residential zone

features individual homes and townhouses on small lots. The space allotted to trees is about half that in the suburbs. The city center has limited space for trees but they grow in pots, holes in sidewalks, vacant lots, greenways, and parks. Trees in rights-of-way and other publicly-owned trees make up about 5% of the urban forest.

Maryland's *Roadside Tree Law* passed in 1914, this Law and its regulations were developed to protect roadside trees (trees in public road rights-of-way) by ensuring their proper care and protection and in the interest of promoting and maintaining safe, unobstructed, and aesthetically pleasing public road rights-of-way. The law,

one of the nation's oldest tree protection laws, shows the importance of trees to Marylanders even early in the last century. Permits are required to care for or remove such trees. Individual permits are available for a single tree or group of trees. Blanket permits for ongoing tree maintenance programs, such as those conducted by utilities and highway agencies are also available. Commercial practitioners who perform this work must have a Maryland Tree Expert License. All permitted work is reviewed by the MD DNR Forest Service.

The goal of urban forestry is to help blend the living elements of a community with the built infrastructure so that conflicts are reduced and communities are more livable. The *Urban and Community Forestry Program* coordinates several programs to enhance or protect urban forests and trees, including Tree-Mendous Maryland, Tree City USA, and Excellence in Forest Conservation and Land Development.



Helping to Sustain the Forest Base

Rural Legacy - This program provides state funds to local governments and land trusts to acquire land and conservation easements to protect agricultural and forestlands. Funding comes from a variety of sources, including general obligation bonds and proceeds from the real estate transfer tax.

MD DNR Rural Legacy Program, 580 Taylor Avenue, E-4, Annapolis, MD 21401, 410-260-8428, 410-260-8404 (fax).

Forest Legacy - A voluntary program of the US Forest Service administered in cooperation with state foresters. Under Forest Legacy, state forestry agencies may purchase private forests in full, or acquire conservation agreements on the lands from willing sellers. The US Forest Service may fund up to 75% of the program costs, with at least a 25% match from non-federal sources. Forest Legacy areas must be environmentally important forest areas that are threatened by conversion to nonforest uses. To qualify, landowners must prepare a multiple resource management plan, or Stewardship Management Plan, to guide long-term care of their forestland.

MD DNR Forest Service, 580 Taylor Avenue, E-1, Annapolis, Maryland 21401, 410-260-8531.

Program Open Space - This provides grants to counties and local governments for open space and recreation areas. Funded by a realty transfer tax on residential and commercial property, it has provided funds to acquire over 200,000 acres of land.

MD DNR Program Open Space, 580 Taylor Avenue, E-4, Annapolis, Maryland 21401, 410-260-8426, 410-260-8404 (fax).

Maryland Environmental Trust - A statewide land trust established in 1967 to protect farmland and forestland, wildlife habitat, waterfront, significant natural areas, and historic sites. It solicits donated conservation easements and purchases easements using money from the general fund, Program Open Space, and other sources. In 2000, it held 482 easements on 64,737 acres. *MD DNR MET, 100 Community Place, Crownsville, MD 21032, 410-514-7903.*

Maryland Agricultural Land Preservation Program - This program focuses on farms, not forests, but may include some wooded agricultural land. If farmland meets the minimum criteria established by the MALPF, landowners sign a voluntary agreement that the land will be maintained in agricultural use for five years. Once the land is in preservation status, the landowner becomes eligible to apply to sell an agricultural land preservation easement to MALPF. As of 1998, preservation easements had been purchased on over 152,000 acres. *Maryland Agricultural Land Preservation Program, Wayne A. Cawley, Jr. Building, 50 Harry S. Truman Parkway, Annapolis, Maryland 21401-7080, 410-841-5860.*

Forest Conservation Act - The Act provides guidelines for the amount of forestland retained or planted after the completion of development projects. These guidelines vary for each development site and are based on land use categories. Where little or no forest exists, the Act requires that forests be established by planting trees. Under some conditions planting may occur outside of the project site where a forest would provide protection to other natural resources, such as streams or wetlands. It applies to all activities requiring a permit for subdivision, grading, or sediment control that is larger than 40,000 square feet. Information on the condition of the existing forest and a plan for conserving the most valuable portions of the forest are required.

MD DNR, Forest Service, Tawes State Office Building, 580 Taylor Avenue, Annapolis, MD 21401, 410-260-8531.

Roadside Tree Law - Passed in 1914, this law is designed to protect trees in rights-of-way. It requires the MD DNR Forest Service to supervise tree maintenance work performed in rights-of-way to maintain electricity, telephone, and other utilities. Licenses are issued and training is provided to tree experts who maintain trees in rights-of-way. Also, permits are issued to citizens who want to care for trees in rights-of-way adjacent to their homes.

MD DNR Forest Service, 580 Taylor Avenue, Annapolis, Maryland 21401, 410-260-8531.

The TREE-MENDOUS MARYLAND Program - encourages Marylanders to plant, care for and maintain trees to help restore and protect the natural environment, in particular, our greatest natural resource, the Chesapeake Bay. Program components include the Gift of Trees, volunteer opportunities, and tree purchasing. Information is available *MD DNR Forest Service, 580 Taylor Avenue, Annapolis, Maryland 21401, 410-260-8531.*

Tree City USA - A program conducted by the National Arbor Day Foundation in conjunction with the National Association of State Foresters. To qualify as a Tree City in a given year, a jurisdiction must have a tree board or department responsible for tree care (and a tree ordinance establishing or designating such); have an urban forestry program supported by the spending of at least \$2 per capita and have a proclamation recognizing and celebrating Arbor Day.

MD DNR Forest Service, 580 Taylor Avenue, Annapolis, Maryland 21401, 410-260-8531.

PLANT - An awards program administered by MD DNR Forest Service and the Maryland Forest Conservancy District Boards. Awards are given based on the number of accomplishments completed by the applicant during the award year. A minimum of four accomplishments is required to be recognized. Acceptable accomplishments for PLANT awards range from holding a one-time tree event or ceremony (Arbor Day) to having built comprehensive ongoing planting and maintenance programs. *MD DNR Forest Service, 580 Taylor Avenue, Annapolis, Maryland 21401, 410-260-8531.*

Maintaining The Quality of the Forest

The carbon dioxide is taken up from the air, masses of which seep across continents in a matter days. Since these air masses mix together as in a giant blender, it stands to reason that those 4.6 million carbon dioxide molecules taken up by just one tracheid cell (say in a twig of a maple seedling next to my cabin) in just one second could have come from a decaying log in the Amazon, a car on a Los Angeles freeway, a coal-burning power plant in Utah, a hornbill in Indonesia, and a baboon in Tanzania. If we could put a pinhead-size red dot on a map of the world to indicate the source of each of those 4.6 million molecules that were taken up in the last week by one growing tracheid cell, then the whole map from pole to pole would be colored solid red... Conversely, if we colored the map with blue dots for the fate of each of the oxygen molecules that the tracheid produces at the same time, then in a week or less, the earth map would be a nearly solid blue. Each wood cell of every tree in my forest is in a give-and-take with the rest of the world.

Bernd Heinrich

Clean Air

According to the US Department of Energy, deforestation, industrial activity, and the use of fossil fuels have elevated carbon dioxide levels in Earth's atmosphere by 25 percent over the last 100 years. Concentrations of this heat-trapping gas continue to rise. Earth's mean surface temperature has increased as much as 1.4 degrees Fahrenheit since 1860. Many scientists maintain that unabated emissions of CO₂ and other greenhouse gases will bring further global warming and climate change.

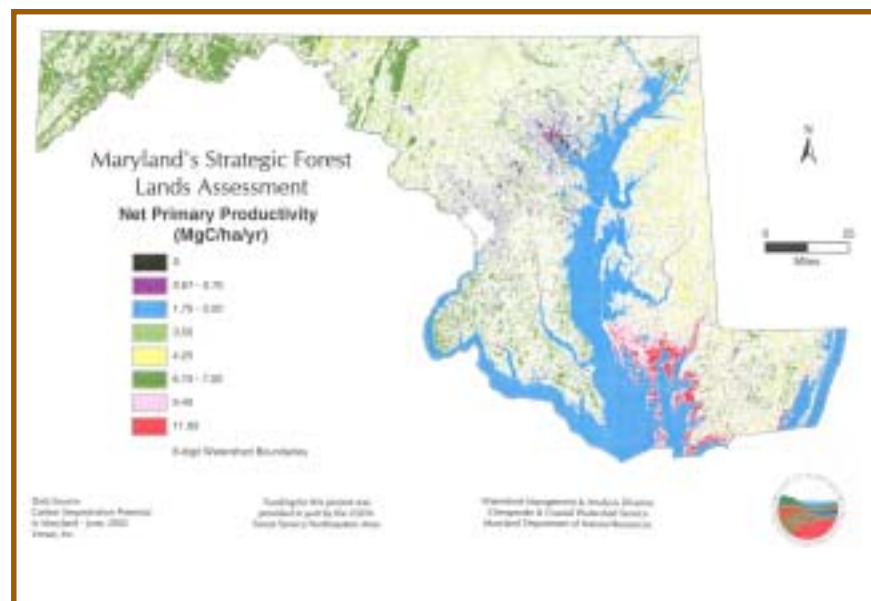
Forests play a key role in global warming, since they are both sources and sinks of carbon dioxide emissions. In fact, forest loss to agriculture or development, along with overharvesting, have made forests the second largest source of CO₂. However, when existing forests are conserved and sustainably managed, or cut-over

forests are replanted, they become effective long-term sinks. The process, called carbon sequestration, occurs when grassy crops and fast-growing trees remove carbon from the air and store it in soil or use it to grow roots, stems, and leaves. An estimated 3.5 billion tons of carbon dioxide, a major greenhouse gas, could be

removed from the atmosphere by using farmland and forests to absorb it. The United States currently generates an estimated 5.8 billion tons of carbon dioxide annually.

Along with carbon dioxide, trees remove nitrogen dioxide, carbon monoxide, sulfur dioxide, ozone, and particulate matter from the air. They also reduce and moderate local temperatures, reducing energy demand for artificial cooling (and its accompanying pollution) during peak temperature periods. Currently, all Marylanders live in areas that meet federal standards for carbon monoxide, sulfur dioxide, particulate matter, and nitrogen dioxide. Only 13% of Marylanders live in areas where standards for one-hour ozone are exceeded, for which trees deserve some of the credit.

Forests help clean air by removing carbon dioxide and pollutants and releasing oxygen. These are normal



physiological and biochemical processes of plant metabolism and growth, but excessive amounts of chemical pollutants in the air may interfere with these processes and cause physical damage to trees and other plants.

Ozone is a gas normally found in air in small quantities. High concentrations of ozone cause chronic health problems in people and may injure some plant species. Trees that seem to be sensitive to ozone damage include eastern white pine and black cherry. Other species of pine, ash, poplar, maple, and oak may be sensitive as well. While damage from high concentrations of ozone does not seem to kill trees, it is an additional stress on their health. Since 1992, ozone damage in Maryland has been monitored through the Forest Health Monitoring System but the extent to which ozone is affecting forest health and ecosystem diversity remains unclear. While ozone levels can differ within a few miles due to elevation changes and other site factors, air quality data indicate general increases in ozone levels across Maryland. Scientists are concerned about the relationship of forest health and concentrations of ozone in the atmosphere and some feel that ozone levels may be reaching concentrations where natural adaptations may no longer be effective in buffering the gas.

Clean Water

Acid deposition includes rain, snow, fog, gases, aerosols, and particulates like dust that are acidic in nature. Chemicals such as sulfate, nitrate, nitrite, and ammonium ions in the air react with precipitation and deposition making them even more acidic. Natural sources of these chemicals include fires, volcanos, and marshes.

These have been reacting with precipitation and dry deposition throughout time. However, automobiles, power plants, and factories, have increased the amounts of these chemicals to the point that natural adaptations may no longer be effective in keeping the pH levels in balance.

In 1991, the National Atmospheric Deposition Program found that Maryland is located in or near the region of highest levels of acid precipitation in the United States. Maryland also receives higher levels of sulfate and nitrate in the form of precipitation than the rest of the country. Actual measured effects of acid deposition on forests are limited. While no direct adverse effects on forests have been documented, indirect effects may result from long-term changes in pH levels in streams and lakes and soil chemistries.

Studies indicate that approximately one-third of all headwater streams in Maryland are susceptible to impacts from acid deposition or are already acidic. The ability of vegetation, soils, and bedrock to buffer acidic inputs and lessen impacts depends on the path water takes through the watershed. Rain seeping through leaf litter to a small stream and then to a large stream has a different impact than rain flowing across a rock outcropping into a pond then following a stream to a lake. The potential for long-term effects of acid deposition on soils is greatest on poorly buffered soils, particularly at high elevations where soils are thin or where soils are already moderately acidic. Changes in soil chemistry may worsen for 50 to 60 years before effects on forests are observed. Similarly, it may take 40 or 50 years for watersheds to show improvements in response to less acid precipitation and deposition.



Forests are efficient filters, cleaning sediments and other pollutants from water. Forest buffers, strips of forests along bodies of water, are essential to maintain clean water. Tree roots protect waterways by stabilizing stream banks and shorelines and reducing erosion. Shade from trees lowers water temperatures in the summer and increases amounts of oxygen dissolved in the water. Dissolved oxygen is needed by fish and plants. Forests increase large woody debris and organic matter in waterways, thereby improving living conditions for cold-water fish and spawning conditions for warm-water fish. Planting and maintaining forest buffers is a cost-effective means of reducing amounts of pollutants entering waterways, including the Chesapeake Bay. In Maryland, there are almost 17,000 miles of streams and 7,500 miles of shorelines. Many of these areas have naturally vegetated buffers of 100 feet or more, but 36% lack this basic environmental protection. Over 1/3 of these inadequately buffered waterways are in developed areas, with the remainder in rural areas.

Stream systems across the state have also been impacted by changes in land use and land cover. The reduction in forest cover and increase in impervious surfaces through development can be seen in eroding banks, deepening channels, and finer sediments in the stream bed. All of these changes affect both the function and the aesthetic qualities of the stream and all are directly related to the land use activities taking place within the watershed.

Restoration of a watershed involves coordination of all of the various land use and land cover components to establish a balance between habitat requirements, aesthetic goals, and land development needs. These components include

forest management and planting, riparian buffer creation or enhancement, stream channel restoration, wetland restoration/creation, pollution prevention techniques, and appropriate land development methods.

Stewardship and careful management of our streamside and shoreline areas are important to many of our goals for the Chesapeake Bay: reducing nutrients, improving habitat, enhancing watershed management, and achieving our natural resource protection goals. Maryland *Stream ReLeaf* is a project committed to restoring forested buffers along streams and shorelines, and to conserving riparian buffers throughout the State. In 1996, Maryland pledged to create 600 miles of riparian forested buffers by the year 2010. This goal was reached in 2001 and a new goal of an additional 600 miles has been set.

Strategic Forest Lands Assessment

Strategic Forests are key blocks of forest that provide the optimal mix of ecological and socioeconomic values necessary to support natural resource based industries and maximize ecological benefits. SFLA uses Geographic Information Systems to identify where forest conservation efforts would make the greatest contribution towards achieving a sustainable forest resource land base. To do this, SFLA evaluates where multiple ecological features and processes are occurring. It also attempts to understand the socioeconomic variables (timber, jobs, and recreation) that support and will continue to sustain forest resource-based industries. The vulnerability (threat of

conversion to a non-forested use) of specific forested landscapes, especially those of high ecological integrity and significant economic benefit, is then determined. Finally, folding in the capabilities of Maryland's forest conservation and restoration programs helps round out a complete framework for focusing resource management actions.

Forest Health

Pests and diseases are a natural part of forest life and, while they influence all aspects of the forest, individual attacks may have few long-term impacts. Defoliation of one species may result in slower growth and even some death, but other species may respond with increased growth and reproduction. Animals that feed on insects may thrive on the abundant food during outbreaks. It is only when insects and diseases reach levels where natural adaptations are not effective in limiting damage that they significantly affect the forest. Large scale damage can erase valuable visual and scenic qualities, recreational opportunities, watershed integrity, wood products, and wildlife habitat.

In Northern and Western Maryland, thousands of acres of forest have suffered varying degrees of gypsy moth defoliation and an estimated 428 million board feet of oak timber has been lost. These forests are regenerating but with new tree species less amenable to wildlife and less valuable as timber. Defoliation from this major pest increased dramatically from 1,197 acres in 1999 to 22,824 acres in 2000. Consequently, almost 17,000 acres were treated in

2000, the most since 1996. As the gypsy moth moved south into previously unaffected areas of Southern Maryland and the Eastern Shore, defoliation, mortality, and changes in Maryland species composition has increased.

The hemlock woolly adelgid, a native of Asia introduced to the United States in the 1950's, is a serious pest of hemlock trees. This aphid-like insect is commonly found in urban forests around Baltimore and Washington, and has also spread to the native hemlock stands of western Maryland. The extent of damage is not well-documented but spraying is underway.

The pine shoot beetle, a European native, is attacking forests in Maryland's four western counties. A Federal quarantine restricts movement of pine Christmas trees, pine nursery stock,

and pine logs from these counties unless they are inspected and certified as pest-free. A native beetle, the southern pine beetle, periodically ravages Southern Maryland and the Eastern Shore killing hundreds of acres of woodland, particularly native timber, causing large changes in wildlife habitat.

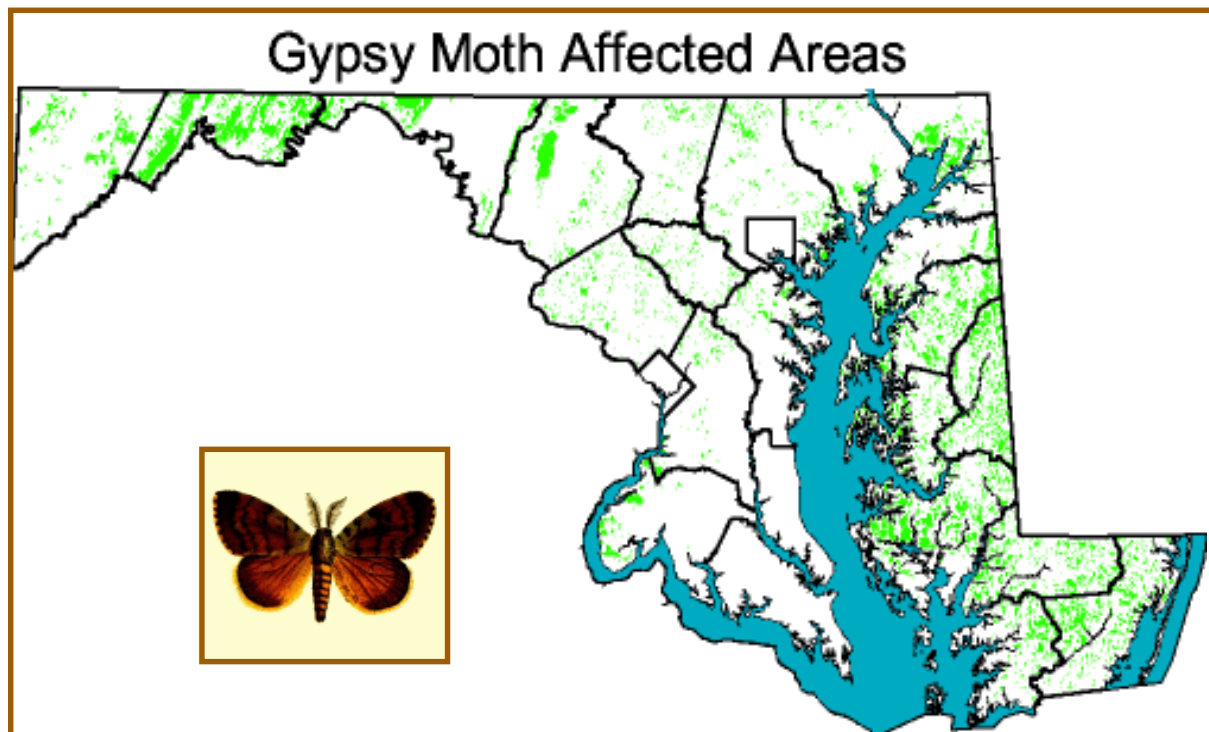
Ongoing surveys and assessments of forest insect and disease problems are a necessary part of forest management and decisions for treatment are often made. Pest control treatments are usually applied only to "critical" areas and forests that are actively managed. Critical areas include forested areas where people live or play and where there are high numbers of susceptible tree species. Treatments are generally effective and damage is usually restricted to areas that are not

treated. Treating entire areas that are affected by pests would be a massive project.

Wildfires

Fire has both positive and negative health effects on forests. Fires create mosaic patterns of new growth mixed in and around established plant and animal communities. New plant growth after fires provides an abundance of food and trees killed by fire provide shelter for birds and other animals. On the other hand, fire-caused injuries can result in decay and deformity and mortality from insects and diseases may increase in burned areas. Higher concentrations of nutrients are found in soils following fires because the ashes are mixed into the soil. Water filtering through burned areas washes nutrients out of the soil and into waterways often changing the chemistry of the water. Ironically, fish are more likely to suffer from fire than are other animals.

Maryland averages roughly 5,000 wildfires annually. The acreage of forest, marsh, and grasslands burned is between 8,000 and 9,000 acres. The top three causes (65%) of wildfire in Maryland are arson, debris burning, and children. Other fires are caused by lightning strikes, campfires, smoking, equipment use, and railroad operations. The MD DNR Forest Service responds to 600 to 700 fires each year which burn about 3,900 acres. The remaining wildfires are typically very small and are handled by the volunteer and paid fire service community of Maryland. The MD DNR Forest Service assists these fire companies in training, providing specialized equipment, investigating fire origins, and enforcing regulations.





Truck & Hand Pumps

Forest Diversity

Exotic and invasive plants established in Maryland are threatening forests and other native plant communities. Many of these plant species were introduced prior to the initiation of Federal plant quarantines in 1919 and others have been introduced more recently for landscaping, wildlife habitat, or erosion control. Favorable climate and soil conditions, and absence of competitors to keep them in check are allowing these introduced species to spread to menacing proportions. These invasions alter the structure and composition of the local ecosystem and lead to a reduction in biodiversity and a breakdown of regional distinctiveness. **Many experts feel the prolifera-**

tion of non-native species is the single greatest threat to biodiversity worldwide, second only to habitat destruction by man.

Once invasive plants gain a foothold they may degrade areas subject to erosion by replacing native grasses with plants that are much less effective at anchoring soil. An invaded area that becomes a mono-culture offers reduced habitat for animals. Since non-native species usually invade from “edges” they have caused a major shift of resources to eradication programs in areas with high infestations, typically parks and urban green spaces. Control is often difficult and expensive and site preparation to remove non-natives is now an initial step in most reforestation and habitat restoration programs. While not as obvious or dramatic as the damage caused by insects and diseases, introduced species can dominate forested areas and old fields or other openings preventing tree regeneration, inhibiting native herbaceous plants, changing visual quality, and reducing recreational use.

The MD DNR Forest Service concentrates its fire prevention and suppression in rural and suburban areas, but as the suburban fringe spreads and people move into forested areas, the complexity of suppressing fires involving both natural vegetation and structures increases. Narrow roads, flammable vegetation close to homes, and inadequate water supplies have increased the threat to life and property. This situation is important now and will become more so in the future. Special tactics and equipment will be needed to meet these risky and more and more common circumstances.



Some of the introduced exotic and invasive plant species causing problems in Maryland are:

- Norway maple
- Lesser celandine
- Winged euonymus
(burning bush)
- Porcelain berry
- Asiatic bittersweet
- Tree of heaven
- Japanese honeysuckle
- English ivy
- Devil's tear thumb
(mile-a-minute weed)
- Privet kudzu
- Perwinkle
- Garlic mustard
- Japanese spiraea
- Multiflora rose



Animals may also affect forest diversity. For example, populations of white-tail deer have risen dramatically in response to a lack of natural predators, an abundance of favorable habitat, and protective game laws. In the early 1990's, Maryland's deer population was estimated at 160,000 animals. The density ranged from approximately 25 deer per square mile in the rural regions of the State, to 15 per square mile in the suburban areas. These densities are high compared with the number of deer that most of Maryland can support. When there are too many animals for the land to support, the competition for food becomes intense. Nutritious foods become sparse, and without adequate diets, deer are small and unhealthy. In areas heavily browsed by deer, the diversity of plants is often significantly reduced and forested areas are difficult to regenerate when deer browsing pressure is high. Forests that survive repeated browsing develop slowly with widely-spaced trees of low vigor, poor form, and few species.

English Ivy, Tree of Heaven (Ailanthus) & Perwinkle

Helping Maintain the Quality of the Forest

Forest Stewardship Program - Funded by the US Forest Service, this program provides technical assistance to landowners voluntarily seeking to enhance wildlife habitat, establish windbreaks, enhance recreational opportunities, protect soil and water quality, increase wood production, and fulfill other multiple use objectives. It provides financial support to private landowners to develop Forest Stewardship Plans. Maryland foresters prepare on average 425 Plans on 25,000 acres each year.

MD DNR Forest Service, 580 Taylor Avenue, E-1, Annapolis, Maryland 21401, 410-260-8531.

Forest Land Enhancement Program (FLEP)- A new program established by the 2002 Farm Bill. It replaces the Forestry Incentive Program (FIP) and the Stewardship Incentive Program (SIP), which were repealed in the 2002 Farm Bill. FLEP is the new incentive program that encourages long-term sustainability of nonindustrial private forestlands by providing financial, technical and educational assistance by State Forest Service Agencies to assist private landowners in actively managing their land.

MD DNR Forest Service, 580 Taylor Avenue, Annapolis, Maryland 21401, 410-260-8531.

The Environmental Quality Incentive Program (EQIP) - A program authorized by the 2002 Farm Bill. EQIP offers financial and technical help to assist participants install or implement structural and management practices on eligible agricultural land. Provides incentives in the form of cost share payments to implement conservation practices including forestry management practices on nonindustrial private forestland. Program focus is geared towards livestock and agricultural production interests. The majority of practices will likely be funded at 50%. Limited resource producers and beginning farmers and ranchers may be eligible for cost-shares up to 90%.

MD DNR Forest Service, 580 Taylor Avenue, Annapolis, Maryland 21401, 410-260-8531.

Conservation Reserve Enhancement Program (CREP) - This allows states to leverage federal funds from the Conservation Reserve Program that allow agricultural landowners to enter 10- to 15-year contracts with the US Department of Agriculture under which they agree to convert highly erodible cropland or other sensitive acreage to vegetative cover, native grasses, wildlife plantings, trees, filter strips, or riparian buffers. In addition to rental payments, landowners can receive up to 50% of the costs making the conversions. By providing a financial contribution, states can use CREP to target a specific geographic area, such as a watershed or river, or specific resource types, such as wetlands or streams that provide habitat for endangered species. Maryland, the first state with an approved CREP, will enroll 70,000 acres of riparian buffers, restore 10,000 acres of wetlands, and enroll up to 20,000 acres of highly erodible land. *Contact your local Soil Conservation District or USDA Service Center.*

GLOSSARY

association - a collection of plants with ecologically similar requirements, including one or more dominant species from which the group derives a definite character.

biological diversity or biodiversity - the variety of life in all its forms and all its levels of organization. Biodiversity refers to diversity of genetics, species, ecosystems, and landscapes.

board foot - a unit for measuring wood volume in a tree, log, or board. A board foot is commonly 1 foot by 1 foot by 1 inch, but any shape containing 144 cubic inches of wood equals one board foot.

commercial forestland - any area capable of producing 20 cubic feet of timber per acre per year that has not been protected from such use by law or statute.

diameter at breast height (dbh) - standard measurement of a tree's diameter, usually taken at 4 1/2 feet above the ground.

forest - a biological community dominated by trees and other woody plants.

forest fragmentation - the subdivision of large natural landscapes into smaller, more isolated fragments.

forest types - associations of tree species that have similar ecological requirements. Maryland forest types include Allegheny hardwood, loblolly-shortleaf, northern hardwood, oak-gum-cypress, oak hickory, and oak-pine.

habitat - the ecosystem in which a plant or animal lives and obtains food and water.

hardwoods - a general term encompassing broadleaf, deciduous trees.

introduced species - a nonnative species that was intentionally or unintentionally brought into an area by humans.

pole timber - trees 4 to 10 inches dbh.

pulpwood - wood suitable for use in paper manufacturing.

sapling - a tree at least 4 1/2 feet tall and up to 4 inches in diameter.

sawlog - a log large enough to be sawed economically on a sawmill. Sawlogs are usually at least 8 inches in diameter at the small end.

sawlog tree - a tree at least 11 inches dbh and suitable for conversion to lumber. Sometimes, trees 11 to 14 inches dbh are called small sawlog trees, and trees larger than 18 inches dbh are called large sawlog trees.

sawtimber - trees from which sawlogs can be made.

stumpage - the value of standing trees in a forest.

stumpage price - the price paid for standing forest trees.

succession - the natural replacement of one plant (or animal) community by another over time in the absence of disturbance.

sustained yield - an ideal forest management objective in which the volume of wood removed equals growth within the total forest.

watershed - a region defined by patterns of stream drainage. A watershed includes all the land that contributes water to a particular stream or river.

wildlife habitat - the native environment of an animal. Habitats ideally provide all the elements needed for life and growth: food, water, cover and space.

The Mission of the Maryland Department of Natural Resources

To inspire people to enjoy and live in harmony with their environment, and to protect what makes Maryland unique - our treasured Chesapeake Bay, our diverse landscapes, and our living and natural resources.

The Mission of the Maryland Department of Natural Resources Forest Service

The Forest Service mission is to restore, manage, and protect Maryland's trees, forests and forested ecosystems to sustain our natural resources and connect people to the land.

Maryland Department of Natural Resources

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