Forestry Resource Manual

Adapted from North Carolina Envirothon Forestry Resource Manual
Revised July 2018

Delaware Envirothon
Forestry Learning Objectives

Students must be able to…

A. Understand the historical roles of forests in society
1. Know the historical role and importance of forests
2. Explain the various benefits of trees and ecological roles of forests
3. Explain the importance of trees in urban areas and aspects of urban forestry
4. Understand forest land use and ownership in Delaware
5. Know the economic value of forests and the many products they provide

B. Understand and describe the physiology of trees and methods for their identification
1. Know the different parts of a tree and their functions
2. Explain the reproduction of the two main types of trees.
3. Describe the lifecycle of a tree and explain how trees grow
4. Understand the method and terminology required to use a dichotomous tree key
5. Know and identify major tree and shrub species native to Delaware's forests

C. Understand and describe the various characteristics and processes of forest ecology
1. Understand the concept and processes of forest ecology.
2. Identify the abiotic and biotics components of a forest ecosystem
3. Explain the process of photosynthesis and nutrient cycling
4. Understand and illustrate the process and stages of succession
5. Understand the developmental stages, structuring, and types of forests

D. Understand and describe the methods and practices of sustainable forest management
1. Identify and describe the various silvicultural principles and treatments
2. Understand tree harvesting and regeneration methods
3. Describe the various forest management objectives
4. Explain forestry best management practices
5. Explain the forest management cycle and each of its component parts

E. Understand and describe the methods and tools used in a forest inventory
1. Understand the importance of forestry measurements and identify the tools used for each
2. Demonstrate proficiency using various forestry tools and interpreting the collected data
3. Explain plot measurement procedures used in a forest inventory
4. Understand and explain the various objectives for completing a forest inventory
5. Explain what site index means and know to read a site index graph

F. Understand and describe practices involved in the conservation of forest resources
1. Explain the importance of forest health
2. Understand the major issues affecting Delaware's forests
3. Identify Delaware's main forest pests and diseases
4. Understand the programs available aimed at conserving forest resources
5. Explain the various laws and regulations aimed at conserving forest resources

Key Concept 1: Forests and Society

A forest is a living, complex community comprised of trees, associated plants, and animals. Trees, the distinguishing feature of a forest, are second only to grasses as the most common and widely distributed plants on earth. The plants and animals of the forest community grow, age, and die. Nutrients from their bodies are released and recycled by decomposers. From the soil, trees obtain nutrients and moisture. Sunlight provides trees with energy to make food, grow, and produce numerous forest products used by humans.

Forests – Past and Present

Forests have and do play important social and economic roles in the United States. Trees provided American Indians and early settlers with shelter, fuel, medicines, shade, tools, protection and other needs. American Indians and settlers used fire to clear sections of the forest for camps, settlements, and land to grow crops. Today, the United States is dependent on many products and services provided by our forests.

Vikings were the first people from outside of North America to utilize the North American forest. History states that Vikings sailed to the northern United States in search of timber for use in their settlements in Greenland. The Vikings returned and established a logging camp, which is thought to have been in present day Labrador.

After the adventurers and explorers, settlers began moving southward. American Indian trails, rivers, and tributaries were used as the highways, in the absence of roads. With the arrival of settlers, timber became important. The trees were used to make rafts and boats, cabins, sheds and fences for livestock, and blockhouses and stockades for protection. Forests supplied much of their food, clothing, and medicines, as well as fuel to keep warm and cook. As dependent on the forests as the settlers were, they also saw them as a hindrance. Settlers of that time found the forest a problem for both crop production and defense. Forests were cleared to grow crops, to provide grass for livestock, to eliminate hiding places for adversaries, and to discourage wild animals from areas of settlement.

Ships began making regular trips to the new land. The ships needed **naval stores** – tar, pitch, turpentine, and rosin, which were used for repairing, waterproofing, and painting ships. These products were also used for manufacturing soaps and candles, and treating cuts and bruises.

Naval stores came from eastern pine forests. They were one of Delaware's most valuable economic products for 200 years, and for much of that time, Delaware was a leader in the production of naval stores. Ships, particularly the British and French navies needed tall, straight trees for the masts of their ships. The eastern forests also provided these products.

With increasing travel, settlements and cities along the southern coast grew rapidly. More timber was needed to build and supply these cities. A great demand for wood and its products developed throughout the east coast and along major river highways.

The eastern forests seemed so vast that it was believed the wood supply would never be exhausted. The need for wise use and management of the forests was hard to understand at that time and there seemed to be no economic justification for managing them.

The development of the English colonies in the seventeenth century marked the beginning of commercial use of our forest resources. The first sawmill in the United States is thought to have been in Jamestown, Virginia, in 1625, and sawmills soon became a part of every colony. They supplied the local lumber demands and produced a surplus for export throughout the world. Industrial development in the South was influenced by the invention of the first steam-powered circular sawmill in 1803. By the 1890's, timber supplies in some areas of the country were becoming depleted, and the South was called upon to supply even larger amounts of wood. In 1895, lumbering had become a major industry in the South. By 1909, lumber production reached its peak, when 50,000 mills cut an estimated 46 billion board feet of lumber and employed 500,000 workers. In 1919, the South cut half of all the lumber used in the United States.

Settlers were unaware of the repercussions of their poor farming practices. Little thought was given to the future, and the forests were not managed. Many forests were cleared up to the stream edge and converted to farm and grazing lands needed to survive. Unaware of poor soil conservation practices and impacts to water quality, the settlers abused the landscape by allowing excessive soil erosion. This excessive soil erosion depleted soil nutrients and created poor ground for farming row crops. Once a cleared site was no longer productive, it was abandoned and another forested site was cleared.

Since colonial times, all of Delaware's forests have been harvested at least once for timber and/or other wood products. The state has virtually no forests that have not previously been harvested or significantly altered by humans at some point. Only a few **old growth stands** remain that have grown undisturbed by human influence.

The History of Forestry

The federal government first appropriated funds for the acquisition of timberland in 1799. These funds were used to buy reserves of live oaks in coastal South Carolina and Georgia to

supply the growing nation with reserves of ship timbers and masts. Years later additional public lands in Florida, Alabama, and Louisiana were purchased for their stands of cedars and live oaks, and funding was provided for experiments in planting and cultivating live oaks. This was the beginning of federal forest research in the United States.

In the years that followed, exploitation of the nation's forest resources increased and was encouraged by the federal government's policies.

By 1873, scientific concern over the destruction was growing. A report on "The Duty of Governments in the Preservation of Forests" was presented by Dr. Franklin Hough. President Grant encouraged Congress to take action in 1874, but action was not taken until 1876, when the first appropriation for forestry was made. An agent in the Department of Agriculture was to conduct forestry investigations including the first survey of the nation's timber resources. Dr. Hough was placed in the position and conducted the research. In 1881, a Division of Forestry was created in the Department of Agriculture.

Forestry, as a discipline, in the United States began at the Biltmore Estate near Asheville, NC. Gifford Pinchot was hired to manage the forest on the 7,000 acre estate. For three years, he worked to show that treating forests as sustainable (replaceable) resource could be profitable. Pinchot's goal was a revolutionary idea. He wanted to change the American exploitation and reckless use of its forest resources. Pinchot believed America's forests were renewable, despite the abuse of poor logging and planting practices, and that they could produce a sustainable supply of timber.

When Pinchot left Biltmore in 1895, George Vanderbilt hired Carl Schenck, from Germany, because America had no other trained foresters at that time. Schenck tried to teach his apprentices which trees should be cut and how many seedlings should be planted. He had to order seedlings from Germany, because there were no forest nurseries in America. Schenck realized that a school to train foresters was needed in America.

In 1898, this school became a reality when Dr. Schenck founded the first American school of forestry, the Biltmore Forest School, and brought his thorough training in scientific silviculture to the United States. That same year, the New York College of Forestry at Cornell University also opened to interested students. At these schools, students learned silviculture, dendrology, lumbering and technology, classification, zoology, law, economics, and more. They learned to cruise timber, fell trees, transplant seedlings, and saw logs.

In 1901, the Division of Forestry of the U.S. Government was known as the Bureau of Forestry, and in 1905, it became the Forest Service. Gifford Pinchot became the first chief of the Forest Service. The American Forestry Association's efforts led to the first law establishing forest reserves for the public domain enacted by Congress in 1891. These reserves became the national forests in 1907.

Recognized as the "Cradle of Forestry," the Biltmore Forest School closed in 1913, but it was a major part of the beginning of forestry in this country. It had a tremendous impact on the new practice of American forest management. Half of its 300 graduates went on to practice forestry

in the beginning U.S. Forest Service, state forestry programs, or timber companies; and they played important roles in the following decades. Pinchot and Schenck began it all with their idea that forests were renewable, that a sustainable supply of timber could be produced, and that forests could be profitable for landowners, if managed well.

State forestry began in 1885, when California established the first forest agency in the United States. That same year, Colorado, Ohio, and New York also began agencies. North Carolina, Virginia, Louisiana, and Texas were the only southern states to have forestry agencies prior to 1921.

State forestry agencies' progress has been aided by cooperation with the federal government. Laws impacting state forestry include the following.

- The Weeks Law – 1911 – financial aid to states in forest fire protection
- The Clarke-McNary Law – 1924 (amended 1949) – additional help for fire protection, production and distribution of nursery stock, and assistance in farm forestry
- The McSweeney-McNary Law – 1928 – a national program of forest research and a survey of forest resources
- Emergency Conservation Work Program, later known as the C.C.C. or Civilian Conservation Corps – 1933 – provided aid in reforestation, road construction, fire control, and other activities
- The Norris-Doxey Cooperative Farm Forestry Act – 1937 (superseded by the Cooperative Farm Management Act of 1950)-federal financial assistance to provide technical services to landowners in the management, harvesting, and marketing of forests
- The Forest Incentive Program – 1973 – share the cost of tree planting and forest management with small forest landowners
- Water Pollution Control Act – 1972 – Environmental Protection Agency (EPA) provided information to control non-point source pollution from silviculture practices
- The National Forest Management Act – 1976 – required the use of multiple-use management – an ecosystem approach

Forestry services are provided by many other agencies. The state extension services, through forestry specialists, work with forest landowners, public agencies, and private industry to advance forestry. The Natural Resource Conservation Service (NRCS) works with Soil and Water Conservation Districts providing technical services for planning an integrated soil, water, and forest conservation program for landowners, and coordinates with other organizations to help landowners make sound decisions concerning the wise use and treatment of forest resources. The Federal Land Banks provide long-term loans to forest landowners. The U.S. Department of Agriculture's Farm Services Agency, known as FSA, provides cost-sharing programs for forestry practices. The Tennessee Valley Authority is responsible for 22.2 million acres of forestland. The Bureau of Land Management has major land holdings in the Northwest and Alaska and carries out intensive forest management. America has come a long way from widespread exploitation of its forest resources to conservation, management, and wise use of those resources.

Today, the U.S. Forest Service manages forests on public lands and our national forests. The U.S. Forest Service has a double mandate: to maintain our forest resources and to provide an ongoing supply of timber.

In 2008, 74.6 million acres of forestland, 6% of all U.S. forestland, was reserved from commercial timber harvest in wilderness, parks, and other classifications. 751 million acres of land in the U.S. were classed as forestland in 2008 (USFS). This figure represents 33% of the total land area and amounts to about two thirds of the area that was forested in 1600.

The Forest Service is increasingly not only managing forests to provide a sustainable supply of timber but also for the conservation of other resources. The current movement in forestry and its focus for the future is **forest stewardship**. **Forest Stewardship** is the responsibility to maintain and improve our forests as ecosystems and all the services they provide – soil and water, wildlife habitat, recreation, trees, and natural beauty. Another way of saying this is sustainable forestry, but not just for the trees. It is sustainable forests as ecosystems, or **ecosystem management** rather than forest management. **Ecosystem Management** is an ecological approach to natural resource management to assure productive, healthy ecosystems by blending social, economic, physical, and biological needs and values. In ecosystem management, foresters consider the complex ecosystems of forests and their roles as wildlife habitat, as watersheds, as recreational areas, as soil types that historically supported particular types of forests, and for their **aesthetic value**. **A forest's aesthetic value** is its importance or value as a place to be enjoyed for its natural beauty.

Ecological Benefits of Trees

Forests are very valuable. We can easily see the products they provide for us and understand our dependence on them. We are much more dependent on forests than we often realize or acknowledge. The ecological value of forests cannot be measured as easily as their economic value.

Trees Help Control Runoff

The leaves and branches of trees reduce the impact of rain. Rainfall descends off the tree at a slower speed than if falling directly from the sky. Subsequently, raindrops falling from trees reach the soil with less force and allow water to be gradually absorbed into the soil. Forested areas act as huge sponges that absorb precipitation, because the forest floor contains ground litter and humus that creates more surface area for water to adhere to. This reduces stormwater runoff. The litter and humus protect the soil below and promote root growth. Root growth creates a porous and permeable soil that allows water to seep into the soil where it is stored. Roots also hold soil in place. Forest soils act as a natural filtering agent as water soaks into it.

Some of the water which enters the soil will evaporate thus helping to control the air humidity in the forest. Some water will flow laterally into streams and lakes which provides stream recharge. This is called base flow. Base flow regulates stream flow even when it is not currently raining. Some water absorbed by forest soils will move further down into the soil and may enter the ground water where it may stay for centuries. Some water will be taken up by

plants, and transpired back into the atmosphere as part of the photosynthesis process. In these ways, trees slow down the rate of water flow off the land and allow some to return to the groundwater, helping to regulate stream and river flows in the process.

Tree Help Reduce Soil Erosion
On forested areas, raindrops are intercepted and impacts slowed by the leaves, limbs, needles and duff on the forest floor allowing most of the rain to hit softly and to soak into the soil. When water does start to run off, roots, dead branches and leaves slow water movement allowing most of the water to soak into the porous soil. Roots also play a part by making the soil more porous, greatly increasing its aeration and water holding capacity when they die.

Soil erosion on forested land amounts to less than several hundred pounds per acre per year. On disturbed land without an intact forest floor, soil loss can increase. Reducing erosion also reduces the other pollutants that adhere to soil particles and are washed into the streams, rivers, and lakes along with the sediment.

Forest Soil Development
Trees provide dead leaves and limbs, which fall onto the ground. As they decay, they become a part of the soil. Forest soils typically have high organic matter content and deep topsoil. The nutrients taken out of the soil for the tree's growth are eventually returned via the dead leaves and limbs, and ultimately by the tree itself when it dies, falls, and decays.

Retention of Snow Melt
In areas of the country where heavy snowfalls occur, forests help slow snow melt for up to several weeks longer than in open areas, thus allowing the melting snow to slowly seep into the soil. Forest soils also tend to freeze less deeply, allowing more water from the melting snow to be absorbed. By delaying the snowmelt and by absorbing the water, forests prolong the infiltration period and decrease the amount of runoff, thus helping to reduce flooding and equalizing stream flow in the rivers and streams.

Flood Prevention and Water Flow
Forested watersheds with good management practices do not typically have extremes of water flow in winter and summer and thus aid in flood control. Areas that are poorly managed or where forests are depleted in the headwaters experience heavy flows of water from rain, carrying topsoil downstream in flash floods. This affects aquatic life and reduces the productivity of the streams and rivers for many years. Forest streams usually have little sediment, even during times of high stream flow and intense rain events.

Influence on Climate
Forests influence our climate, perhaps globally and certainly in a localized area. Trees keep the forest cooler in summer and warmer in winter than open areas, and the same variations are true for daily fluctuations. Humidity is higher in the forest, because trees release moisture by transpiration and break the force of the wind, resulting in less evaporation from the forest soils. During the winter, the forest soil is less subject to frost because litter and humus act as an insulating layer. The climate of an area can be greatly influenced by the amount of forests it has. In the tropical rain forest 50-80% of the moisture in the air comes from transpiration and evaporation carried out by the trees in the area.

Anytime a large area of forested land is cleared, the annual amount of precipitation decreases and the area's climate gets hotter and dryer. The soil becomes drier and is more likely to be eroded away, because there are no longer tree roots to hold it in place. Over time an area that was once a lush, green forest can turn into grassland or even a desert due to climate changes caused by the loss of the forest.

Temperature Differences in Cities and Homes

Residential areas of cities typically have more trees than the downtown areas. Those trees play a role in the temperature differences between the two areas. The shade of a tree will typically make temperatures about 15 degrees cooler. The **transpiration** process absorbs heat during the evaporation process, which also cools the air in the immediate vicinity. During **transpiration**, water evaporates from plants through leaf openings called stomata. Trees can significantly reduce the amount of energy consumed in buildings through transpiration and by blocking the sun. A tree with its leaves is very effective at blocking out the sun's radiation. It can block out up to 95% of the sun's radiation and even a tree without leaves can block out up to 50% of the sun's radiation. Trees are more effective at cooling a building than blinds, plastic coating, or heavy coatings on glass. In fact, if trees were planted around each house in the United States, homeowners would save an estimated 15 to 50% on heating and cooling bills. Trees reduce the wind speeds thus making heating and cooling even more efficient.

The Cycling of Essential Nutrients

Forested areas also play an important role in the cycling of nutrients, particularly carbon. Forests take up approximately 90% of the carbon dioxide (CO_2) removed from the atmosphere. Trees and other plants use carbon dioxide, along with water and sunlight, in a process known as **photosynthesis,** to make their own food. A by-product of this process is oxygen, the atmospheric gas necessary for all animals. The carbon is stored in plant tissues during their life and returned to the ecosystem by decomposers as leaves, needles, branches, or the entire tree, decays. The carbon is released as carbon dioxide when wood is burned to clear land or as fuel.

Trees serve as nutrient recyclers

Tree roots take up dissolved nutrients and water. These nutrients are used in the process to make food for the tree. Nutrients are stored in the various parts of the tree, including the roots, trunk, branches, leaves and seed, until they are needed. Like all living things, trees die from diseases, old age and insects. They die, fall and are broken down by decomposers such as insects, fungi and bacteria. Through the decomposition process, trees return their nutrients and other elements back to the soil to be recycled through the forest ecosystem. Other essential nutrients including nitrogen, phosphorus, potassium and sulfur are stored in the trees. These nutrients are also released by decomposers to be reused by the biotic portion of the ecosystem.

Removal of Air and Other Pollutants
Trees also act as a filter for the air, reducing the amount of air pollution. The leaves and needles of trees absorb significant amounts of particulates from the air. They also reduce wind velocity allowing dust particles in the air to settle out by gravity.

The amount of carbon dioxide a tree takes in and uses is becoming increasingly important, because the amount of carbon dioxide in the air continues to increase as we burn more and more fossil fuels. More carbon dioxide in the atmosphere could cause the temperatures on earth to increase through the greenhouse effect. The role of forests in global warming is being debated. At least one study by Duke University has shown that some trees grow faster and better in air that contains more carbon dioxide. This study found that young loblolly pines grew 25% faster in air that had a higher concentration of carbon dioxide. The test air was meant to represent the level of carbon dioxide expected to be in the air in 2050. The scientists cautioned that the growth would level off as the trees mature and that the trees' ability to absorb the carbon dioxide was not an ultimate answer to global warming, because most trees do not grow as quickly as the loblolly. The study does, however, indicate the important role that trees can play in reducing the amount and type of some air pollutants.

Wildlife Habitat
Another ecological benefit of forest is the **habitat** they provide. Trees provide homes, food, water, and shelter in an arrangement that allows hundreds of animals to survive. In fact, forests provide habitats for more wildlife species than any other biome in the world. When forests are removed some species of wildlife move to a more suitable habitat and others may become endangered or extinct.

Other types of forest vegetation or forests in varying stages of succession favor other species of wildlife. Wildlife species are dependent on a variety of plants from grasses, forbs, and shrubs, to young or mature trees. These species benefit from periodic burns or the management of the forest to have varying age stands of trees or open areas. Songbirds are an example of these species. Many songbirds, including neo-tropical migratory species are dependent on our forests for breeding and raising their young.

Water Quality and Fish Environment
The canopy of forest vegetation along waterways shades the water from the full heat of the sun keeping water temperatures cooler. This is important for certain species of fish, such as trout, that cannot tolerate warm waters. The complete removal of shading vegetation from creeks and streams can create unsuitable habitat for cold water fish.

Trees also help prevent erosion; keeping streams clear of pollutants and sediments that are undesirable for fish and other aquatic life. Sediments in the water can suffocate fish eggs, insect larva, and mollusks. Sedimentation is North Carolina's number one water pollutant by volume.

Noise Abatement
Forests also help buffer the noise pollution created by cities and industries. All of the individual parts of the trees absorb excess sounds. They are especially good at absorbing high

frequency sounds that humans don't like, such as the noise of cars along a highway. A belt of trees 98 feet wide and 49 feet tall has been shown to reduce highway noise by almost 50%. Trees not only absorb some of the noise made by humans, they also create noises themselves. The noise produced by the trees, such as the wind in the leaves or the birds singing in the tree, are often much more pleasant than the noise produced by humans.

Greenbelts for Moisture Storage Zone
Urban planners are increasingly using greenbelts of trees and other plants around cities. These areas provide moisture storage zones and allow water to infiltrate into the soil returning it to the groundwater and affecting the quantity and quality of runoff. This is extremely important in cities where water runoff is high. Water can be diverted from streets and parking lots to these storage zones. A mature oak tree pumps water from the soil and can transpire 100 gallons of water or more into the atmosphere during a hot summer day creating available pore space to store water.

Reduction of Wind Erosion
In windy open areas, trees make effective windbreaks. A row of trees, with dense foliage, 20 feet high can reduce the speed of the wind for a distance of up to 400 feet. The windbreaks are used to protect crops, homes, barns, and livestock from hot or cold winds and blowing snow. The trees also reduce the harmful effects of the wind in drying out and blowing the soil through wind erosion. This helps prevent the loss of valuable topsoil and the covering of fertile soil or crops with sand. Windblown soil can be transported up to thousands of miles away and can carry attached pollutants including viruses, mercury, bacteria and other pollutants.

Trees provide the base of the food chain in streams
Leaves and woody material that fall from trees and reach a stream, lake or pond provide the base of the aquatic food chain. The leaves and other organic materials when broken down are called **detritus.** Some micro and macro-invertebrates feed on detritus while other micro and macro invertebrates are predators that feed on the organisms that eat detritus.

Reduction of Glare and Reflection
Particularly in cities, trees are used to provide effective barriers to excessive glare and reflection from surfaces such as concrete and glass.

Social, Recreational, and Aesthetic Value
Forests also provide areas for humans to enjoy. We use forest resources as parks and other places to escape into nature. People enjoy forests for hiking, biking, camping, nature study, bird watching, photography, picnicking, hunting, fishing, and also enjoy them for their scenic and aesthetic value.

Trees enhance property values. Whether in a city, a development, or a rural area, the presence of trees on the property makes it more appealing to buyers.

Summary
Trees provide many ecological benefits. They help regulate the amount of water runoff, impact the climate of an area, play important roles in the cycling of nutrients, reduce pollution, provide

habitat for wildlife and places for people to enjoy nature. These benefits occur as oxygen, air purification, soil fertility, erosion control, water recycling, humidity control, and wildlife habitats. The ecological value of our forest resources has been disregarded for years. It has only been recently that we have begun to acknowledge our dependence on the forest, its resources, and the services it provides for us. The ecological value of the forest is not a widely shared worldview. The goal of forest stewardship is to have the public view forests for their true value and to see the forest not only for its immediate economic value but for its more important long-term ecological value.

Important Roles of Forests – Economic Value

Forest resources are renewable but we still must take great care in managing them, recognizing their true value, and not abusing them. Forests have immeasurable economic as well as ecological value.

The greatest economic contribution of forests is in the products derived from trees. Our society is wood oriented. Forests provide the timber we use to build our houses and other structures, pulp for the paper we write on, fuel in various places throughout the world, and other substances such as medicines and dyes. It has been estimated that forests provide more than 300 billion dollars' worth of goods alone each year. Cereal and other food boxes, sports equipment, furniture, and flavorings are just a few.

Wherever you look there are wood products. Stop for just a minute and think about all of the paper or other wood products you use in an average day. Americans use enough paper and wood products each year to fill a train of two million boxcars circling the Earth at the equator. One can easily see that Americans are very dependent on wood and wood products.

On the global scale, more than half (55%) of the timber cut each year is used for heating and cooking. This timber is in the form of fuel wood and charcoal. Charcoal is often used in urban areas of developing countries for cooking, heating, and in some industries.

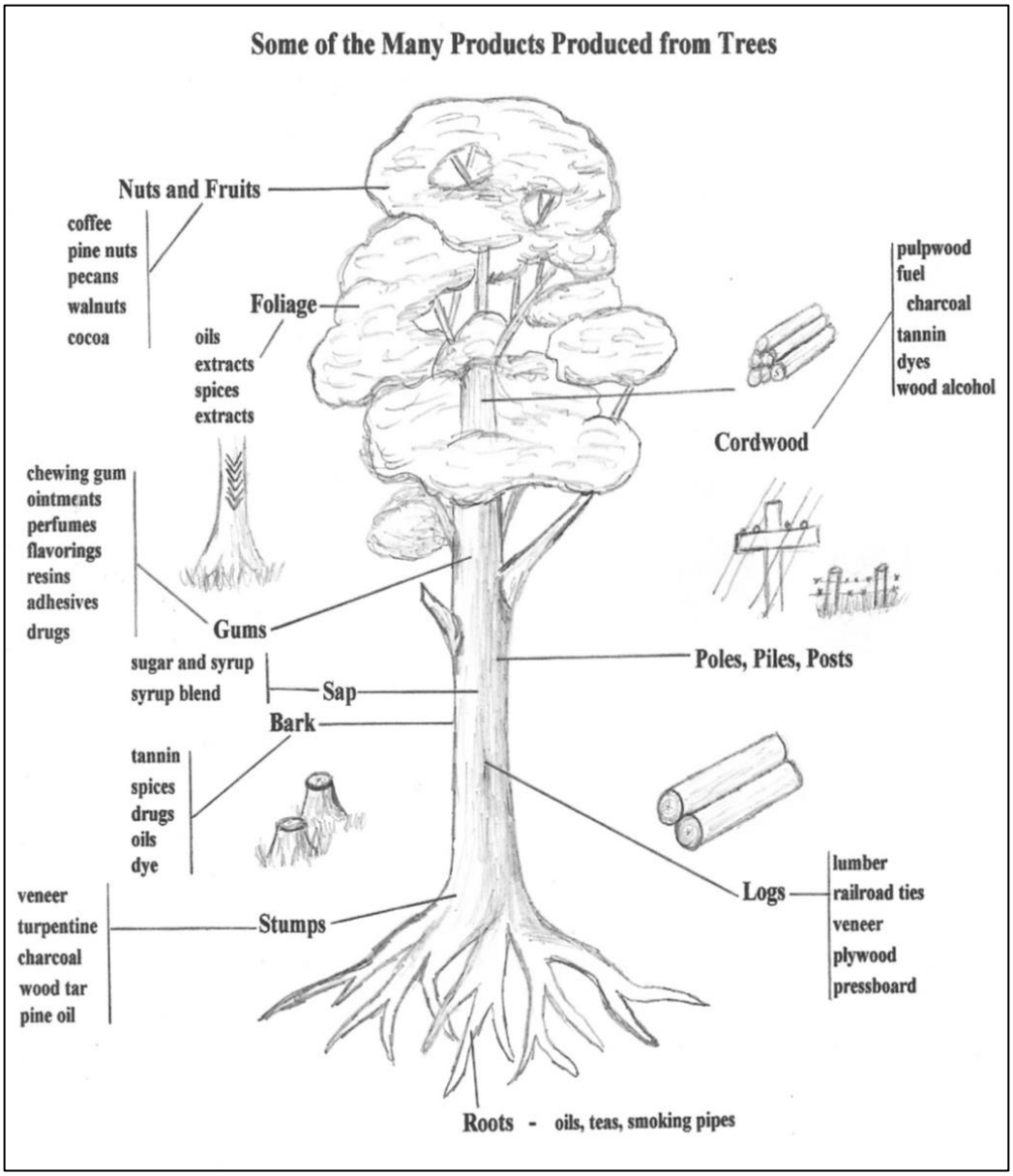
Approximately one-third of the timber cut is in the form of saw logs. These logs take the form of various building materials such as lumber, plywood, hardboard, particleboard, chipboard, veneer, poles, railroad ties, and piling, to name a few. Lumber is used to make furniture and other manufactured items.

One-sixth of the timber harvested is used as pulpwood to make paper products and a multitude of other products. Through chemistry, wood is used to produce a variety of products, including cellophane, rayon, plastics and other well-known products. According to the US Environmental Protection Agency estimates in 2011, paper making materials came from the following sources: 33% from recycled paper, 33% from whole trees and other plants and, 33% from wood chips and scraps from sawmills. Treeless paper and paper that contains more recycled paper is becoming increasingly common.

Less well known, but not to be overlooked, is the value of forests for animals, medicinal plants, and floral and nursery products. Forests are made of all kinds of plants, some of which offer financial return, as do the trees. Ginseng, found in the mountains, is a valuable medicinal plant and has a large export market. Sassafras root and leaves and many herbs are valued in some areas. Ferns, Galax, and Spanish moss are used in floral arrangements. Gum from sweet gum or red gum trees is purchased in some areas. The market for Delaware Christmas trees, mistletoe, pinecones, holly, and evergreen branches is growing.

Pine straw is sold for landscaping. “Lighter” wood, the pitch-laden wood of pines, is sold in some markets for starting fires in fireplaces, as is wood for fuel. The cutting and sale of barbecue wood and fire wood can also provide a profit for the small landowner.

Wild fruits, nuts and berries can provide income, as can mushrooms. There is also a limited demand for tree pollen of various species for use in allergy treatments. Forests also provide forage for cattle and sheep, especially in western U.S.



The demand for wood and wood products continues to increase. The demand for paper products has grown tremendously since 1950 and is expected to continue to grow. As the demand for wood continues to grow we must manage forest resources carefully. Timber is a renewable resource but it cannot be abused and continue to meet our demands and wants.