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Forest and Forestry

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It is hard to imagine a resource that provides more benefits for humans than do forests. Food, shelter, tools, and fuels are all products of this natural treasury. The forest is also home to many animals and plants. Its trees help clear the air of pollution while enriching it with oxygen and slow down the sometimes destructive forces of wind and water. Forests are one of the major resources that can be renewed and improved. The science of managing forests is called **forestry**.

TYPES OF FORESTS

Forests are found in almost every part of the world. Only the north and south poles, the tops of some mountains, the deserts, and some prairies are bare of forests. Forests can be grouped by location, climate, or the types of trees common to them. Forests can also be described in terms of the uses made of them. Commercial forests, for example, are lands used for growing successive crops of trees for products. Wilderness preserves, on the other hand, are areas where no harvesting is allowed.

Trees in the forest are of two basic kinds. Hardwoods have broad leaves and bear their seeds in dry clusters or in fruits; examples are oak, maple, hickory, and apple. Most of the North American hardwoods are deciduous, which means they lose their leaves each fall. Softwoods have needle-shaped leaves and bear their seeds in cones, for which reason they are often called conifers; examples are pine, spruce, fir, and larch. Most softwoods are evergreen, which means they lose only some of their needles each year, and so remain green year-round. This description can be misleading, however, because several hardwoods, including the American holly and the magnolia, are also evergreen.

Hardwood Forests

One major type of hardwood forest is the steamy, tropical rain forest that grows in the tropics and subtropics. These forests are typically composed of big, old evergreen hardwood trees that grow in several layers, or groups according to height. The tallest layer may reach heights of 150 feet (45 meters) or more. Other layers, composed of shade-tolerant trees, reach to about 100 feet (30 meters). Smaller trees and vines cover the ground in the shade in a dense tropical rain forest. These forests are often called jungles, though true jungles are dense thickets of brush and vines that may not have any tall trees (see [Jungle](#)).

One of the largest and most important tropical rain forests is in South America. It extends from the mouth of the Amazon River, in Brazil, to the mouth of the Orinoco River, in Venezuela, and covers millions of acres. Another great rain forest girdles the waist of Africa, and much of Southeast Asia is covered with rain forests. In the United States, only the southern tip of Florida and a bit of the coast of Texas have tropical forests.

Beautiful woods such as rosewood, mahogany, ebony, and teak are commercially important

products of these forests. They are prized for fine furniture, cabinetry, and artistic uses.

Hardwood forests other than tropical ones cover much of the United States, most of Northern Europe, areas of northern Russia, eastern China, and the east coast of Australia. These forests include broad-leaved trees adapted to higher elevations with more moderate climates.

The largest forest area in the United States is the Central Hardwood Forest. It covers about 130 million acres (52.6 million hectares), from the edge of the central plains, across the lower edge of the Great Lakes states, to the coasts of New Jersey and New York. It straddles the Appalachian Mountains as far south as northern Georgia and spreads westward and covers large parts of eastern Texas. Because this area is blessed with rich soil and a moderate climate, it has been cleared in many places for farming.

Much of the wood for America's furniture industry comes from this forest. Hardwoods such as black walnut, red oak, white oak, yellow poplar (also called tulip tree), sweet gum, and sycamore are among the most valuable trees. A few softwoods are also found, including the shortleaf and white pines.

Softwood Forests

The Northern Forest covers much of the Great Lakes states and the New England states in the United States. It also extends along the ridges of the Appalachian Mountains as far south as northern Georgia. This forest also covers much of Canada and the interior of Alaska and stretches across northern Asia, Russia, and the Scandinavian countries.

The Northern Forest is composed of softwood trees such as white pine, hemlock, and red spruce. Several hardwood trees, such as oak, maple, birch, and basswood, are also present. Trees in this forest tend to be smaller and more slow-growing than those in warmer areas with longer growing seasons.

The softwood forests of the southeastern United States are sources of lumber, plywood, and paper pulp. The more important southern, or yellow, pines are the loblolly, longleaf, shortleaf, and slash. The bald cypress grows in southern swamps.

Hardwoods such as the red oak, white oak, hickory, gum, ash, pecan, and live oak are found along southern rivers. They are a significant part of the forest economy in the South.

Another important forest region in the United States is the softwood forest of the Rocky Mountains. There are almost 90 million acres (36.4 million hectares) of lumber-producing commercial forests. Ponderosa pine, Idaho white pine, Douglas fir, Englemann spruce, larch, lodgepole pine, and western red cedar are among the important softwoods.

The rainy climate of the Pacific Northwest contributes to the growth of one of the United States' most productive softwood forest areas. It extends in a narrow band from the southern part of Alaska to central California. Inland, on the western slopes of the Coast Range, it extends somewhat farther south. These forests contain Douglas fir, California redwood, western hemlock, western red cedar, sugar pine, lodgepole pine, and white fir. Most of America's old-growth forests, stands which have not been harvested by humans or nature for hundreds of years, are in this region.

LIFE IN THE FORESTS

The forest types largely determine what plant and animal life will be found in the area. The amount and types of food, water, climate, and shelter will favor some life forms and discourage others. Within a given forest, human activity can also have a great influence on the plant and animal populations.

Many animals, especially the browsers-like deer and elk-use the forest for shelter. They spend

much of their time along the forest edge, eating grasses and brush, but they retreat to the woods for safety. Other animals, such as bears, can find the nuts and smaller animals that they feed on deeper in the woods, though they also enjoy the berries and roots they find along the forest edge and in clearings.

Squirrels prefer hardwood forests with lots of acorns and nuts, though they eat pine seeds as well. Beavers eat the soft inner bark of trees and use the trees for their lodges and dams. Seed-eating birds are more likely to nest along the forest edge.

Insects also have very specialized habitat requirements. The southern pine beetle, for example, feeds on only pines and their relatives. Others, like the gypsy moth, feed on many kinds of hardwood trees.

Often the health of the entire community depends on the vigor of the forest. And, as a forest changes with age or as a result of fire, insects, diseases, or human activity, it is likely to become favorable to an entirely new set of plants and animals.

MANAGING THE FOREST

The most modern aspects of the science of **forestry** are collectively called forest management. These aspects of **forestry** involve much more than just using the trees nature provides. Forest management is concerned with the complete life cycle of the trees and the forest, from getting trees off to a better start to making sure trees are harvested in a way that protects the future of the forest.

Forest management usually involves doing the same sorts of things nature does, but in a more planned and organized fashion. Nature plants trees, thins forest stands, and kills trees, but nature's efforts sometimes seem haphazard. Forest managers do these same things with a plan that benefits the forest stand and people, too. Nature lets trees burn or rot. Forest managers prefer to use the wood.

The Natural Forest Cycle

When a mature hardwood forest is harvested or killed by nature, it is not long before a new forest takes its place. There are seeds in the ground already, dropped there by the trees of the past. There are usually young trees on the ground-unless the stand was killed by fire or some other general catastrophe.

When nature renews a forest, it is often quite different from the original forest. A mature stand in the Central Hardwood Forest, for example, is usually composed of oaks and hickories and other species referred to as climax types. They are species that grow well in bright sunlight or in partial shade. They have long life spans and compete well for the moisture and the space available.

When these trees are removed or destroyed, however, other trees have a chance to get started. Seeds from pines or other trees in the vicinity blow onto the ground. Sometimes seeds sprout after being in the ground for many years. The new forest is composed mostly of trees referred to as early succession species. Usually some seeds of the climax types also survive. And some trees resprout from the root systems of trees that have been killed. But it is only after many years that the climax types will dominate the forest once again. This same succession takes place when farms and pastures are allowed to lie idle, allowing forests to develop.

Renewing the Forest

Foresters and landowners often plant seeds or seedlings of a particular kind of tree. The seedlings are usually grown in large nurseries, much as ornamental plants are grown for landscaping, and

transplanted when they are older and better able to survive.

When companies first began to replant harvested forests, all of the planting was done by hand. Since the 1940s more and more trees have been planted by machine. The tree planter is pulled by a tractor. A plowlike blade opens a furrow, an opening in the ground, so a worker can plant a seedling. Packing wheels on the planter then close the furrow around the tiny tree. A crew with a tree planter can plant thousands of seedlings in one day.

In forests where the ground is too rough to allow the use of such machines, planting is still done by hand. Sometimes seeds are spread over the ground by airplane or helicopter.

Harvesting the Forest

History records many instances of harmful harvesting of the forests, often to provide food or fuel. The once mighty forests of cedar in Lebanon are no more. Vast forests in China were destroyed during and after World War II. Rain forests in the Amazon Basin are today being cleared for croplands.

Forests have been devastated whenever people needed open land for farming. Most of the east coast of North America was once covered with dense forests. The new settlers cut the trees, used what wood they needed, and burned the rest.

Individuals and companies have learned to practice better harvesting techniques. The long-accepted practice of cutting only a few trees at a time from a particular stand is being challenged by foresters. They point out that the practice almost always resulted in taking the best trees and leaving inferior specimens to take over the forest. They prescribe following nature's approach of harvesting all the trees in an area at one time and encouraging seeds from the best trees available to reforest the land.

Improving the Forest

Over many years nature improves forests by removing inferior trees, an example of natural selection through the survival of the fittest (see [Darwin, Charles; Evolution](#)). But many natural events and human activities affect this process. Fires, floods, wind and ice storms, and harvesting practices all affect the growth of the forest. In general it is fair to say that nature's events generally improve the forests over the years and the activities of human beings in the past have harmed them.

Recently, through forest management, human beings have begun to do less harm, perhaps even help forests. In controlling the composition of the stand by planting species they prefer, human beings can improve the quality of the trees they plant. Much has been learned about the development of genetically improved strains of corn, wheat, and other food crops. This improvement can be accomplished quickly because these crops produce a new generation each year. Progress is slower with trees because they often take many years to produce seed.

When forest managers think of improving trees, they want trees with long, straight trunks that can be sawed into lumber or peeled for plywood more economically (see [Forest Products](#)). They want trees with small crowns, or tops, so more trees can get sunlight and grow on each acre. They want trees that are insect and disease resistant so their chances of maturing are better. And they want trees that will grow to commercial size as rapidly as possible.

Forest scientists have accomplished all these goals with pines and with some hardwood species such as sycamore, cottonwood, and yellow poplar. They have even learned to clone a superior tree, a process that produces more trees exactly like it. This is done in the laboratory by forcing tiny cuttings from the tree to develop roots and leaves.

The most commonly used method of tree improvement involves first locating superior specimens of

the species. Branches are collected from their crowns, often by shooting them off with guns.

The branches are grafted, or joined, onto rootstocks in special nurseries where they grow until they are old enough to bear seed. A great advantage of this method is that tree branches that come from mature trees bear seed much sooner than do trees that are grown from seed. The flowers on the selected branches are carefully pollinated with pollen from other superior trees. Thousands of combinations of pollen trees and branch trees are tested. The resulting seed is then planted. Many of the trees that grow from the seed have all the bad characteristics of their parents. But some have all the good characteristics. Forest scientists try to produce and plant as many seeds having the good combinations as they can.

An example of what can be achieved is that improved species of pines produce much more usable wood in the same time as ordinary wild trees produce relatively little. Such improvements mean that more wood can be grown on less land in a shorter time. As the world population grows and requires more land for homesites and food production, this ability to maximize wood production on each acre will be vital to future generations.

PROTECTING THE FOREST

Once the forest is started, protection is a major concern for forest managers. Fire is one of the most dramatic enemies, especially for hardwood species. But insects and diseases, while not so obvious as fire, destroy far more trees each year than are lost to fire and other natural disasters.

Insect and Disease Problems

Insect pests such as the gypsy moth, spruce budworm, southern pine beetle, and Douglas fir tussock moth destroy thousands of trees each year. In the 1930s the American chestnut, once one of the most attractive and commercially important trees in the United States, was virtually eradicated by the chestnut blight. The American elm has suffered much the same fate because of the Dutch elm disease.

As a rule, older, slower-growing trees that have lost their vigor, and trees that have been damaged by fire or drought, are most vulnerable to attack by insects and disease. Often, however, insect and disease infestations grow to epidemic proportions in weak stands and then the pests attack nearby healthier stands.

Forest scientists continually search for ways to control enemies of the productive forest. They have created many special chemicals to help control forest pests and diseases. Much ecological research is being done to encourage natural enemies of insect pests in order to control destructive populations (see [Farming, 'Future'](#)).

The Control of Fire

Protection against forest fires is often a matter of education. Many fires started by people to burn trash or leaves or dead grass get out of control and burn forests as well. Sometimes campfires or cigarettes cause fires. Arson is another common cause of fires in some areas. (See also [Fire Fighting](#).)

Most forests are watched during the spring and fall fire seasons to detect fires as early as possible. Fire damage can be held to a minimum by quick action. Fire roads are cut through forests to allow firefighters to quench blazes before they get hot enough to reach the tops of trees. Ground fires may damage hardwood trees, but they rarely do severe damage to mature pines. Crown fires, on the other hand, kill all trees.

Lightning is still a common cause of fires. If these fires are in remote areas, they can damage large

parts of a forest before they are discovered and controlled. Firefighters sometimes have to be flown to the fire in helicopters. Sometimes firefighters called smoke jumpers parachute into battle against forest fires.

Once a stand has been damaged or killed by fire, useable wood is removed quickly to prevent the buildup of destructive insect populations and to prepare for the reforestation of the area. As destructive as fire can be, foresters have learned to set fires that imitate nature to benefit the forest. Fires set by lightning destroy climax forests and allow a new succession of tree species, starting with softwoods, to begin. Natural fires also serve to reduce competition in softwood forests. Forest managers sometimes use controlled fire to control unwanted hardwood growth in pine stands. This leaves more moisture and nutrients for the pines. It also reduces the ground litter of leaves and branches that might fuel a hotter fire, and it exposes the soil, allowing grasses and brush to grow and feed wildlife.

PUBLIC BENEFITS OF THE FOREST

Besides their obvious value as producers of timber and food and as sanctuaries for wildlife, forests play a crucial role as protectors of fragile mountain soils, controllers of rivers, and places of comfort and recreation for humans.

Water and Wind Control

When land is bare, it is subject to erosion by wind and water. When it is covered with plants, however, it is protected against erosion.

The canopy of trees slows the wind, lessens its severity, and becalms the forest. It also slows the fall of raindrops. The leaves on the forest floor and the root systems of the trees slow the movement of rainfall so that the water soaks into the ground rather than running off. Trees also intercept wind-driven snow, which piles up and melts slowly in the spring.

Forest managers can increase water flow for various reasons (to fill a lake, for example) by harvesting trees in the watershed. The watershed consists of all the highland areas with sources of the water such as snow melt and small streams. If flooding is a problem on bare ground areas, planting trees can be part of the solution. If the water table, the level of underground water, is too high, planting water-tolerant trees can help to use up more water and lower the water table. Many cities own and manage large forest tracts to protect their water supplies.

Recreational Value

Just as people have used the forest as a resource for products, they have also turned to it for recreation and inspiration. Hunting, hiking, fishing, and camping are among the more popular recreational uses of the forest. Much of the recreation takes place along the forest edge where people can stroll or picnic without too much inconvenience. Campers often prefer open, parklike forest settings.

Since the early 1970s interest in outdoor recreation has grown, especially in those activities that take the participant far off the beaten path. Wilderness hiking and primitive camping are two examples. This interest has resulted in the establishment of many wilderness areas in national forests and parks (see [National Parks](#)).

REGULATION OF FORESTS

In many parts of the world forestland is regulated by government agencies as a national resource. Some famous forests, like the Black Forest in Germany, are very thoroughly managed.

In the United States a large part of the forestland belongs to the federal government. Most of this is managed by the Forest Service, a branch of the Department of Agriculture, to perpetuate the forest and provide all the benefits of timber supply, wildlife management, watershed management, and recreation. The Forest Service protects the trees from natural enemies and manages their harvests.

Many state governments own forests. These are managed by **forestry** agencies that also help private landowners develop the forests on their lands.

Forest industry companies practice good forest management and encourage their neighbors to do the same. In the United States the industry established the American Tree Farm System in 1941 to do just that. Company and state foresters seek landowners doing a good job of planning, protecting, and harvesting their forests and certify them as members of the system. The foresters also work with people who want to improve their management, helping them with tree planting and fire and insect control.

These three groups of landowners, working in harmony and taking advantage of modern **forestry** developments, assure that the forests of the United States continue to provide wood products and all the other benefits of well-managed stands. Similar groups are active in many of the developed countries.

CAREERS IN FORESTRY

When **forestry** was in its infancy, it was a career for hardy men who loved the outdoors. Most of the foresters worked for the government and spent their time protecting the forests against fires and illegal woodcutters.

In recent years foresters have become much more professional. Now a man or woman who wants to practice **forestry** is expected to have a college degree in forest sciences. Many professional foresters work for the government, but their work is different from that of their predecessors. Professional foresters are usually called on to be forest managers, directing other people in the tree planting, tree improvement, and protection activities they prescribe.

The United States Forest Service is a major employer of foresters. State agencies, forest industries, and teaching in colleges or technical schools are other career fields. Individuals who prefer to be self-employed may become consultant foresters, selling their services to companies and private landowners.

Many foresters find careers in research, working in such areas as tree improvement or insect control. Some researchers work for government agencies, but industry also employs forest scientists. People with less formal training may still find careers as forest rangers, protecting the forests, or in related activities such as harvesting and tree planting.

