

Careers in Sustainable Forestry

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Trees provide many of the products, including lumber, paper, and cloth, which we need in a modern economy. In a properly managed forest, trees have an important role in preserving the natural environment. For example, forests help prevent soil erosion, provide habitats for wildlife, help remove carbon dioxide from the atmosphere, and provide settings for recreational activities. Jobs that are involved in this balance of fulfilling consumer needs and preserving the forest environment relate to careers in sustainable forestry.

Sustainable forestry ensures that forests are used in the most effective way and that their resources will be available for future generations. According to the United Nations Conference on Environment and Development, forest resources should be used in ways that do not cause damage to the forest system.¹ In addition to being protected against the harmful effects of pollution, fires, pests, and diseases, forests should not be overharvested in a manner that does not allow for natural regrowth and regeneration.

This report describes the importance of forest resources in the first section and explains some of the practices of sustainable forestry in the second section. The final section profiles key occupations in sustainable forestry careers. The information for each occupation includes a brief job description; the credentials needed to work in these occupations, such as education, training, certification, or licensure; and wage data.

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Forest ownership and resources

About one-third of the continental United States is covered in forest land. The total percentage of forested area in the United States has been stable over the past century, although there have been significant regional shifts in forest locations and composition. Major factors contributing to loss of forests include urbanization, conversion to agricultural use, and natural disasters. In other parts of the nation, forestry lands have increased, due to activities such as fire suppression and letting farmland revert to forests.²



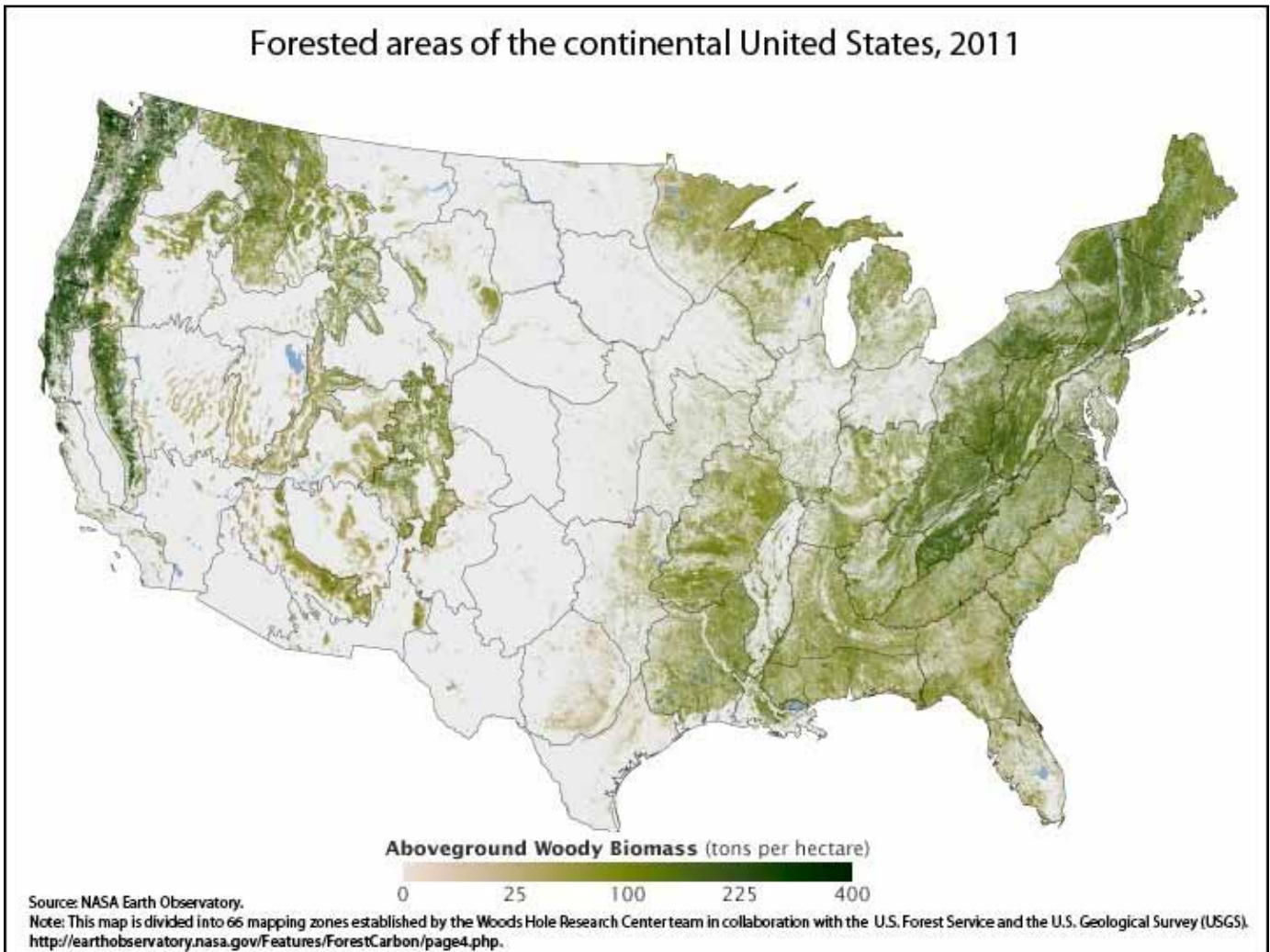
The map shows the locations of forests throughout the continental United States. Much forest land—about 44 percent—is controlled by federal, state, and local governments. Private companies and organizations, including Native American tribes, own about 21 percent. The remaining 35 percent are family-owned forests.³ (See chart.) A family-owned forest is an acre or more of land with at least 10 percent coverage by trees. It can be owned by an individual, couple, or family.

The owners of forest land have the greatest impact on sustainability. Forest owners who are motivated by market conditions seek to use their land in a profitable way. While most forest owners are content to sustain their forests when profitable, some resort to selling their land for converting to commercial or residential use, when it becomes more profitable to do so. To ensure continued forestland, some government agencies and non profits designate forest areas as wildlife preserves or parkland.

Forests are a vital part of the economy

Many of the products people use each day—such as wood and paper—come from forests. They are home to many natural resources, too; for example, much of our water comes from forested areas. Forests also are popular recreation areas and support a variety of wildlife. In addition, forests absorb and store carbon dioxide from the atmosphere, which is important for slowing the rate of global warming. To ensure that forest resources continue to be available in the future, forests must be carefully managed.

Wood and paper products are two of the most visible forest resources. Wood from harvested trees is used in most construction projects. This wood is usually harvested from mature trees, which provide higher quality wood at a higher volume than younger trees; but



mature trees can take decades to grow. Because of the time it takes to replace harvested trees, forests must be carefully managed to ensure that resources are continually available.

Water is not produced by forests, but the diversion of water for drinking and agricultural use does affect the health of forests. Forests in the United States are often in areas with the greatest amount of yearly rain and snowfall. These areas frequently are tapped to supply water for population centers and agricultural uses. If the water is not properly managed, the forest ecosystem suffers.

Recreation is another use for our nation’s forests. Forests are frequently used for outdoor activities, including hiking, camping, hunting, and fishing. Forests that are not properly sustained will not provide the same recreational value as those that are kept in a healthy state.

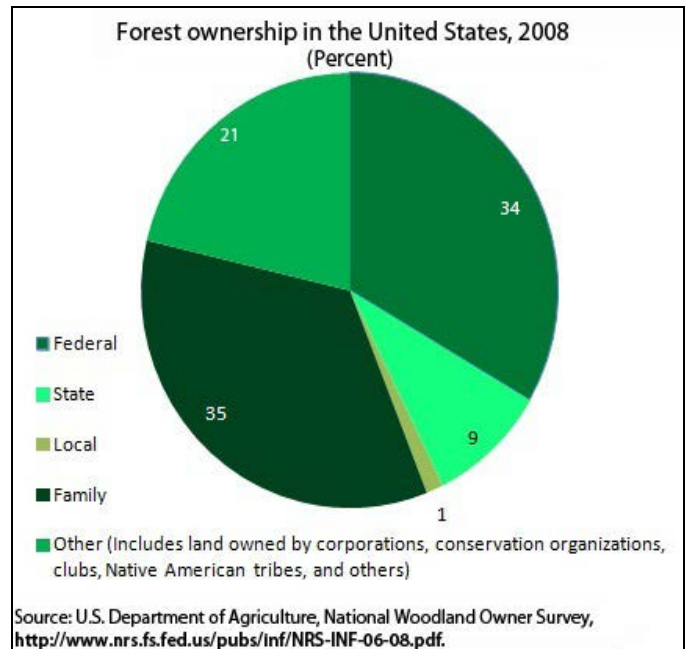
Wildlife is in abundance in our forests. The many animals that depend on healthy forest environments for their survival include various species of birds, bears, deer, elk, rodents, and other types of wild animals. Deforestation has resulted in many species becoming threatened or endangered.

Carbon dioxide sinks and reservoirs refer to systems that remove and store carbon dioxide from the atmosphere. Forested areas have abundant plant life, which absorbs carbon dioxide from the atmosphere. Carbon dioxide is a leading contributor to global climate change; and forests are important for removing some of it from the atmosphere so it will not contribute to further global warming.

Sustainable forestry practices

The goal of sustainable forest management is to use forest resources so they will not be depleted in the future. This means that resources, such as wood and wood fiber are harvested in a way that does not permanently damage the ecosystem and that allows for replacement. To ensure that forests are properly managed, several programs set standards of sustainable forest operations and verify that forest owners adhere to these standards. The most widely adopted standards have been developed by the Sustainable Forestry Initiative (SFI).⁴

The basic practices of sustainable forestry are reforestation; protecting biological diversity, water resources, and special sites; maintaining long-term forest and soil productivity; and recycling wood and fiber products.



These practices help to ensure that the needs of the present are met without compromising the ability of future generations to meet their needs.

Reforestation involves replacing forest resources that have been used. This is usually done by planting new trees to replace trees removed during logging operations, as well as repairing any damage done during removal of trees. Logging involves more than just cutting down trees. Roads and trails must be carved into the forest to transport machinery and other equipment to the logging site. The timber must then be moved out of the forest to an area where it can be transported to a mill.

Protecting biological diversity is a broad term referring to defending all life forms within forested areas. Forests are made up of trees, but they also have a variety of other plants and animals, including tiny microorganisms. Biological diversity applies to different levels of the forest environment—from the overall forest ecosystem—to individual species. Many species depend on the forest environment for their survival, so protecting forests is important for maintaining the different habitats of plant and animal species. Biologically varied forests allow plants and animals to adapt to continually changing environmental conditions.⁵ By protecting plant species and not over-harvesting trees, forests should remain biologically diverse. Some forests are set aside by federal and state governments as parks or dedicated wilderness areas, or they may be bought by conservation groups, to protect them from commercial use and redevelopment.

Protecting water resources is a vital part of forest management. Much of our water comes from rivers and streams that originate in forest lands, as well as from snowpack buildup in or near forests. The forests themselves require a large amount of water for tree and plant development. Areas that are cleared of vegetation, such as by logging or wildfires, are vulnerable to runoff and mudslides. Sustainable forest management helps prevent these problems from occurring.

Protecting special sites means preserving forest areas that are significant. This can include wildlife areas, old-growth tree stands, geological features, and sites of archeological significance. Many of these sites are set aside as national parks and wildlife refuge areas, state parks, and other state and local protected areas.

Maintaining forest and soil productivity means preserving the ability of forest soil to nourish a growing forest. Forest soils have a variety of nutrients and are chemically balanced to support the forest ecosystem. If these nutrients are depleted or if there is some chemical imbalance, the soil will not support the forest ecosystem, and forest productivity will be reduced. This could lead to tree diseases and tree death, which could have detrimental

effects on wildlife. Proper forest management ensures that the soil composition remains in a condition that can fully support the forest.

The recycling of wood and fiber products decreases our nation's dependence on forest resources for many commercial and industrial products. Increased applications of recycled paper and wood allow people to use these resources without having to harvest new trees. Many wood and paper products combine new and recycled materials, which have the benefit of being strong, while using fewer forest resources.

Who works to preserve and maintain forests?

Many different types of workers preserve and maintain healthy forests. Scientists study and monitor forest systems. Fire protection and prevention workers manage forest fires. Forest and conservation and logging workers cultivate and harvest trees for wood and paper products. Each of these groups is responsible for certain aspects of maintaining a healthy forest and ensuring that its forest resources are used effectively.



Workers in sustainable forestry may be employed by federal, state, and local governments; by private companies; and on privately owned farms. Some are self-employed. Most forestry workers spend a great deal of time outdoors and may have to walk long distances through densely wooded areas. They sometimes work in dangerous conditions.

The Green Goods and Services (GGS) survey was conducted by BLS to count green jobs in industries that produce goods or provide services that benefit the environment. The forestry and logging industries are included in the BLS definition of green jobs. These workers represent a portion of those employed in forestry and logging; since they are associated with the production of green goods and services, they are most likely involved in sustainability. The GGS survey found that there was a total of 10,564 private sector workers in the forestry and logging industry group in 2011.⁶ This included 1,292 workers in timber tract operations, 434 in forest nursery and gathering of forest products, and 8,837 workers in logging. The survey also found 11,133 workers in support activities for forestry and agriculture. The total number of workers employed in forestry and logging was 48,930 in 2011.⁷

Science occupations

Scientists have an important role in sustainable forestry. They monitor the overall health of forests, as well as study and analyze specific aspects of living things, such as tree and other plant life and wildlife. Scientists also advise other forest workers on how to maintain a forest ecosystem and improve its productivity. Many types of science occupations, including conservation scientists, foresters, environmental scientists and specialists, soil and plant scientists, and wildlife biologists, are involved in sustainable forestry. These workers are assisted by biological technicians, environmental science technicians, and forest and conservation technicians.

Conservation scientists manage, improve, and protect natural resources. They work with forest owners, managers, and government agencies to devise ways to use and improve land, while safeguarding the environment and controlling erosion. They help landowners by preparing land use plans to meet conservation objectives and determine the most appropriate use for a particular forest site.



Conservation scientists give technical help to people who are concerned with conserving soil, water, and related natural resources. For private landowners, these conservationists develop programs to make the most productive use of land without damaging it and to help with problems such as handling erosion. Conservationists help private landowners and governments by advising on water quality, preserving water supplies, preventing groundwater contamination, and conserving water.

Foresters have a wide range of duties, and their responsibilities vary depending on their employer. Some primary duties of foresters include drawing up plans to regenerate forested lands, monitoring the progress of those lands, and supervising tree harvests. Foresters also create plans and do inspections to protect forests from disease, harmful insects, and damaging wildfires. An example of protection planning is preparing controlled burns that are used to manage the growth of underbrush and other plants in a forest. Foresters may choose and direct the preparation of sites on which trees will be planted. They advise on the type, number, and placement of trees. To ensure sustainability in a specific location,

foresters may compare the growth with the decline of various species and the size of trees, and use that information to determine which trees should be harvested and sold to mills. Their volunteer or outreach work may include educating teachers and students about problems facing forest lands.

Environmental scientists and specialists identify problems and find solutions that minimize hazards to the health of the environment. Environmental scientists may reclaim lands and bodies of water that have been contaminated by pollution, for example, or assess the risks of logging or other forest activities. They recommend ways to minimize the environmental impact of these activities.

Soil and plant scientists research soil, plants, and other forest products. Soil scientists examine the composition of soil as it relates to plant or tree growth and investigate effects of alternative soil treatment practices on tree productivity. They develop methods of conserving and managing soil. Plant scientists strive to improve timber yields, and they advise foresters and other sustainable forestry workers about techniques that could enhance production efforts.

Wildlife biologists study the characteristics of animals, such as their interactions with other species, reproduction, diseases, and movement patterns. These biologists do a variety of scientific tests and experiments, such as collecting blood samples from animals, to assess their levels of nutrition. They may work with geographic information systems and other computer programs, to estimate populations and track the behavior of animals. They also use programs to forecast the spread of invasive species, diseases, and other potential threats to wildlife. In sustainable forestry, wildlife biologists work closely with public officials to develop wildlife management and conservation plans. These plans help ensure that species are protected from threats and that animal populations remain at sustainable levels.

Biological technicians assist scientists with tests, experiments, and analyses related to sustainable forestry. They may set up, maintain, and clean laboratory instruments and equipment, such as microscopes, scales, and test tubes. They gather and prepare plant, water, and soil samples for laboratory analysis to test for pollution levels,

diseases, and other factors that help determine the overall health level of the forest. Biological technicians may work in laboratories or outdoors, collecting samples and taking measurements.

Environmental science and protection technicians typically are supervised by environmental scientists and specialists. In sustainable forestry, these technicians often work on teams with scientists and other technicians, to solve problems related to environmental degradation and public health. They may assist with inspections of forest lands, to ensure that environmental regulations are being followed. They also set up equipment to monitor pollution levels; collect samples of air, soil, water, and other materials for laboratory analysis; and prepare charts and reports that summarize test results.

Forest and conservation technicians work to improve the quality of forests and other natural resources. They generally are supervised by foresters. They assist with a variety of tasks, including gathering data on water and soil quality, assessing fire hazards, selecting and marking trees to be cut, tracking wildlife, and monitoring the activities of loggers and other forest users. Forest and conservation



technicians may also supervise forest and conservation workers.

Credentials

Scientists need a bachelor's or higher degree. Conservation scientists typically need a degree in natural resource management or a related science field, such as agricultural science, soil and plant science, or environmental science. Soil and plant scientists generally have a degree in soil science, chemistry, geology, or a related field. Wildlife biologists need a degree in biology or zoology, and environmental scientists need a natural science or in environmental science degree. Although graduate work is not generally required, many scientists also have a master's degree or a Ph.D. Some wildlife biologists have a Doctor of Veterinary Medicine (DVM) degree.

Foresters enter the occupation with at least a bachelor's degree in forestry, forest resource management, or a related field. Sixteen states sponsor some type of credentialing process for foresters. Some states require licensing, others have laws requiring registration, and a few have a voluntary registration process.⁸ Licensing and registration usually requires that an applicant have a 4-year degree in forestry and several years of forestry work experience. Licensure requirements may also include passing a written exam.

Biological technicians and environmental science and protection technicians typically have an associate's degree or comparable postsecondary training. Novice technicians are often trained on the job by more-experienced technicians. Technicians may receive their training at a technical or community college.

Forest and conservation technicians typically need an associate's degree in forestry or a related field. Employers look for technicians who have a degree that is accredited by the Society of American Foresters. Many technical and community colleges offer programs in forestry technology or a related field. Some states have licensing and registration programs for forest and conservation technicians. These programs usually have requirements for education and work experience.

Wages

The table that follows shows wages for selected science occupations in May 2012. The wages shown are median annual wages for the United States as a whole; wages vary by employer and location.

Selected science occupations	Median annual wages, May 2012 ¹
Conservation scientists	\$61,100
Foresters	55,950
Environmental scientists and specialists, including health	63,570
Soil and plant scientists	58,740
Zoologists and wildlife biologists	57,710
Biological technicians	39,750
Environmental science and protection technicians, including health	41,240
Forest and conservation technicians	33,920

¹ Occupational Employment Statistics data are available at www.bls.gov/oes. The data do not include benefits.

Fire protection and prevention occupations

Sustainable forestry includes a number of occupations related to fire protection and prevention. Workers in these occupations typically spend most of their time outdoors, sometimes in dangerous conditions. They use a variety of tools and equipment in their work. Fire protection and prevention workers must be physically fit, because their jobs are demanding and may involve walking long distances through heavily forested areas and wetlands.

Managing forest fires is an important part of sustainable forestry. Fires have an important role in forest ecology. In some extreme forest conditions, small fires turn into large, catastrophic fires that cause significant damage to the forest. However, some species of trees release seeds and spur new growth only in the presence of fires. Managing the fire threat is the work of foresters, as well as forest firefighters and fire inspectors. Forest firefighters respond to fires by containing and extinguishing them, while foresters and forest fire inspectors and prevention specialists enforce fire regulations by inspecting forests for fire hazards.

Forest firefighters use heavy equipment, hand tools, and water hoses to control forest fires. They also create fire breaks (gaps in vegetation that slow or stop the progress of a fire) to deprive fires of fuel. An important aspect to forest management is conducting controlled burns, in which fires are intentionally set to clear underbrush and manage the growth of plants and trees in the forest. These fires reduce underbrush and allow the forest to grow in a

healthy way. Firefighters sometimes assist foresters with conducting these burns.

Forest firefighters work under extremely physically demanding and potentially dangerous conditions. They are expected to respond to forest fires during all hours of the day and night and may spend several consecutive days or weeks fighting a fire. Some elite forest firefighters, known as smoke jumpers, parachute from planes to reach areas that would otherwise be inaccessible. Many forest firefighters work on a seasonal basis, generally from early spring to late summer.

Forest fire inspectors and prevention specialists inspect forests for fire hazards. They look for problems that pose a wildfire risk and recommend ways to reduce fire hazards. They patrol forest areas, to ensure compliance with fire regulations, and report fire conditions to a central command center. Most forest fire inspectors and prevention specialists work for state and local governments.



Credentials

Forest firefighters need to be at least 18 years old and need a high school diploma or equivalent. They are required to pass a physical fitness test, and they receive most of their training on the job. Forest fire inspectors and prevention specialists have at least a high school diploma; however, some positions require that workers have an associate’s or bachelor’s degree. Work experience in firefighting or fire suppression also may be necessary. Firefighters who plan and oversee controlled burns must complete additional training and become certified as a burn boss.

Wages

The table that follows shows wages for selected forest fire protection and prevention occupations in May 2012. The wages shown are median annual wages for the United States as a whole; wages vary by employer and location.

Selected fire protection and prevention occupations	Median annual wages, May 2012 ¹
Firefighters	\$45,250
Forest fire inspectors and prevention specialists	35,780

¹ Occupational Employment Statistics data are available at www.bls.gov/oes. The data do not include benefits.

Forest and conservation workers and logging occupations

Forest and conservation workers and loggers who practice sustainable forestry cultivate and harvest trees in ways that are environmentally friendly. Their tasks help maintain and improve forest quality. They harvest thousands of acres of forests each year, and the timber provides the raw material for numerous consumer and industrial products. Conservation and logging work is physically demanding, and logging jobs can be hazardous. Workers spend nearly all of their time outdoors, sometimes in poor weather and often in isolated areas. Loggers work in teams, with each worker specializing in a certain task.

Forest and conservation workers help to develop, maintain, and protect forests. Under the supervision of foresters and forest and conservation technicians, forest and conservation workers help to sustain and develop forests by doing tasks, such as planting seedlings or removing



diseased trees. They may spray trees and seedlings with insecticides and fungicides, to control insects and weed growth. Forest and conservation workers may work on tree farms, where they plant, cultivate, and harvest different types of trees. Workers who are employed by state and local governments clear brush and debris from trails, roadsides, and camping areas. Forest and conservation workers who have a fire protection background may help prevent fires by constructing fire breaks or assisting with controlled burns. Most of what forest and conservation workers do is physically demanding.

Fallers cut down trees with hand-held power chain saws and mobile felling machines. They ensure that the tree is cut safely, so that it falls in the direction desired to avoid hitting other workers or landing on equipment.

Logging equipment operators use tree harvesters to fell trees, shear tree limbs, and cut the trees into desired lengths. They drive tractors and operate self-propelled machines, called skidders or forwarders, which drag or transport logs to a loading area.

Log graders and scalers inspect logs for defects and measure the logs to determine their volume. They estimate the

value of the logs or pulpwood (logs that are ground up for paper products). These workers often use handheld data collection devices to enter data about trees.

Other logging workers include buckers, who trim the tops and branches of felled trees and buck (cut) the logs into specific lengths; choke setters, who fasten chokers (steel cables or chains) around logs to be dragged by tractors or forwarded by a cable-yarding system; and rigging slingers and chasers, who set up and dismantle cables and guy wires of the yarding system. In addition, log sorters, markers, movers, and chippers sort, mark, and move logs based on species, size, and ownership, and they tend machines that chip up logs.

Credentials

Forest and conservation workers typically need a high school diploma before they begin working. They generally get on-the-job training by helping more experienced workers. Most logging workers have a high school diploma. They get on-the-job training, to become familiar with forest environments and to learn how to operate logging machinery.

Many states have training programs for logging workers, which may include technical instruction or field

training in areas such as best management practices, environmental compliance, and reforestation. Safety is a vital part of a logging worker's instruction. Tree fallers require more skill and experience than do workers in other logging occupations, so fallers typically work under the direct supervision of more-experienced logging workers.

Wages

The table below shows wages for selected logging occupations in the forestry and logging subsector in May 2012. The wages shown are median annual wages for the United States as a whole; wages vary by employer and location.

Selected forest conservation and logging occupations	Median annual wages, May 2012 ¹
Forest and conservation workers	\$24,340
Fallers	35,250
Logging equipment operators	33,380
Log graders and scalers	32,880
Logging workers, all other	34,260

¹ Occupational Employment Statistics data are available at www.bls.gov/oes. The data do not include benefits.

Conclusion

Forests provide a variety of natural resources, habitats for wildlife, and recreation opportunities. Sustainable forestry workers strive to ensure that our nation's forests



will continue to be used in an environmentally responsible way, while at the same time supplying numerous commercial and industrial products. Careers in sustainable forestry and logging include those in science occupations, fire protection and prevention occupations, and forest and conservation and logging occupations. These careers span several education levels, ranging from high school diploma to various levels of postsecondary education. Most of the occupations had median annual wages that were near or above the national median annual wage of \$34,750 in May 2012.

Notes

¹ *Report of the United Nations Conference on Environment and Development, Annex III* (Rio de Janeiro, 3–14 June 1992), www.un.org/documents/ga/conf151/aconf15126-3annex3.htm.

² "Forest Resources of the United States," adapted from the *National Atlas of the United States*, 2011, www.nationalatlas.gov/articles/biology/a_forest.html.

³ *Who Owns America's Forests? Forest Ownership Patterns and Family Forest Highlights from the National Woodland Owner Survey* (U.S. Department of Agriculture, 2008), www.nrs.fs.fed.us/pubs/inf/NRS-INF-06-08.pdf.

⁴ *Sustainable Forestry Initiative 2010-2014 Standard*, (Sustainable Forestry Initiative, 2010), www.sfiprogram.org/files/pdf/Section2_sfi_requirements_2010-2014.pdf.

⁵ *What is Forest Biological Diversity?* (Convention on Biological Diversity, 2011), www.cbd.int/forest/what.shtml.

⁶ Green Goods and Services (GGS) Survey (U.S. Bureau of Labor Statistics, 2013), www.bls.gov/ggs.

⁷ Occupational Employment Statistics (U.S. Bureau of Labor Statistics, 2013), www.bls.gov/oes.

⁸ For more information on licensure and registration by state, see Conservation Scientists and Foresters in the *Occupational Outlook Handbook* (U.S. Bureau of Labor Statistics, 2012), www.bls.gov/ooh/life-physical-and-social-science/conservation-scientists.htm#tab-4.