Forests and Forestry

By Chadwick D. Oliver

A forest is a community of trees, shrubs, herbs, microorganisms and animals, the trees being the most obvious living structures. Trees can survive under a wide range of climatic conditions, but forests generally occupy the moister, less frigid parts of the terrestrial biosphere. To different human cultures at different times, forests have been regarded as places of danger, security, economic opportunity, recreation and aesthetic pleasure. They take part in natural processes of nutrient cycling and water purification, and otherwise help maintain a clean environment. Forests are important sources of many products. Forestry is the science, art and technology of managing these forest resources.

Forests

The large size and slow growth of trees make forests appear stable and permanent, but in fact they are dynamic sites of ongoing processes such as tree growth and death and soil formation. The tree species in a particular area are also constantly changing as species migrate and new trees invade disturbed areas. Climates themselves change, but this generally occurs so slowly—over tens or hundreds of years—that a given forest area appears to contain a constant group of species.

Ecology. The inhabitants of forest communities interact in complex ways. Trees compete with each other for sunlight, moisture and mineral nutrients. These materials are necessary for photosynthesis, the process by which green plants produce organic compounds for energy to live and grow. As trees photosynthesise, they absorb carbon dioxide from the air and extract moisture from the soil. Trees help to retain water; heavy rains do not run rapidly off forest land. Natural or human activities that destroy forests result in increased runoff and in temporarily higher levels of carbon dioxide in the atmosphere. After this the growing forest increases the oxygen content of the atmosphere. A mature forest adds less oxygen to the atmosphere. A global research project designed to measure the overall influence of forests on the atmosphere of the Earth is in progress.

Trees also serve as temporary repositories for mineral nutrients in ecosystems; these nutrients accumulate in tree roots and thus are not easily washed away. Natural or human destruction of forests alters the nutrient cycles, especially in the case of the nitrogen cycle, where plants play a substantial role. Regrowth of young forests may increase the nitrogen added to the ecosystem. Trees take up the nutrients they need from the soil and from dead organic matter with the assistance of mycorrhizae (fungi that grow symbiotically on tree roots, obtaining food from the tree).

The process of soil development, aided by soil organisms, occurs in all forests. Microorganisms break down minerals in the soil and create passages for air and water movement, decomposing the remains of plants and animals and extracting and releasing nutrients. Depending on the climate, decomposition occurs at different rates. In cool or dry climates, organic matter will decompose slowly and a thick layer will develop, whereas in warm, moist climates, organic matter will decompose rapidly, releasing minerals that are quickly absorbed by plant roots. Little organic matter will accumulate.

After all or part of a forest is destroyed by a disturbance, such as fire or wind or avalanche, trees and other plants reinvade the area, halting erosion and nutrient loss and maintaining water quality. This series of changes in vegetation structure, known as ecological succession, will make the forest more suitable for some animals and plants and less suitable for others.

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Depending on environmental conditions, different tree species will be dominant at different successional stages. The characteristic group of tree species in a given area is referred to as a forest type. Within each type, certain species may be found most commonly under specific soil and climate conditions and at certain times after a disturbance; these species are best evolved physiologically to compete under these conditions. In areas of recurrent fire, for example, fire-resistant trees will likely predominate.

Types of Forests. Tree species can be divided into six groups based on their evolutionary origins: Holarctic (originating in the Northern Hemisphere), Neotropic (originating in Central and South America), Paleotropic (originating in Africa and tropical Asia), Capensis (originating in southern Africa), Australian, and Antarctic. A species is found naturally only where it first developed or where it migrated thereafter. Pines are found naturally in the Northern Hemisphere and thus belong to the Holarctic group. Many species, however, have been deliberately introduced into other areas with similar climates; for example, pines are planted in many parts of the Southern Hemisphere, and eucalyptus, a tree genus native to Australia, is planted in other places.

Forest communities with different genetic backgrounds that grow under similar soil and climate conditions in different parts of the world have many of the same structural characteristics. Thus forests can be classified as major parts of many biomes. Taiga and boreal forests are coniferous forests with few species in areas of cool climates. Temperate deciduous forests are predominantly broadleaf forests in areas of moderate temperature and rainfall with cold winters. Subtropical evergreen forests are a combination of broadleaf and conifer forests in areas of sufficient rainfall and mild winters. Tropical rainforests are lush forests of complex structure with many species in warm, moist regions. Chaparral or sclerophyllous forests are thicketlike forests of shrubs and small trees in areas with mild winters and warm, dry summers. Tropical grasslands and savannas are grasslands with scattered trees that occur in warm regions with seasonal drought.