

## **HISTORY OF FORESTRY**

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## Summary

The management of forests has to deal with the problems of competition from agriculture, complex relations between their multiple uses and values, many users, and longtime frames. The history of modern forestry is one of changing ways of resolving these problems. The origins of modern forestry in Europe date from the eighteenth century, but its great scientific development occurred in Germany and later in France in the nineteenth century when silvicultural systems and methods of calculating the sustained yield were devised.

Concentration on maximizing the economic rent obtained from wood production led to many mixed European forests being converted to conifer monocultures. In reaction to this, a naturalistic silviculture was developed mainly in Switzerland. Modern forestry spread worldwide. An imperial forestry model was developed in India and extended through the British Empire and elsewhere. It relied on selecting the best forests, demarcating them as state forests, dispossessing the indigenous inhabitants, and managing them by state forest services.

Development forestry emerged as a new form in the 1950s and 1960s in response to the problems of underdevelopment. Large plantation and industrial projects in developing countries were encouraged and funded by international aid agencies in the hope that benefits would trickle down through multiplier effects. Results were largely disappointing. Social forestry emerged in the 1970s in response to the fuelwood crisis and the failure of development forestry to alleviate poverty. It is based on village or community level activity assisted by, or in partnership with, state forest services.

The rise of environmental concerns from the 1970s led first to a form of multiple-use forestry and from the 1990s to intense efforts worldwide to design a form of sustainable forestry. Although the principles of sustainability are embodied in these efforts, the greatest challenges for the future are to advance intragenerational equity and to translate the intents of sustainable forestry into operational practice.

## **1. Introduction**

### **1.1 Definition**

Forestry is defined as the art and science of managing forestland. It believes that forests can be managed rationally over long periods of time according to explicit objectives. It covers the protection of the forest, the growing of trees, or silviculture, the continuous production of wood and other products under a principle of sustained yield, watershed management, and the maintenance of all the other ecosystem services and values that forests provide to people. Its goals were enlarged and restated at the Helsinki conference in 1992 as being:

- maintenance and improvement of forest resources,
- maintenance of health and vitality of forest ecosystems,
- maintenance and development of productive functions (wood + nonwood products),
- maintenance, conservation, and improvement of biodiversity,
- maintenance and improvement of protective functions (soil + water), and
- maintenance of the other functions and socioeconomic conditions.

Forestry has a set of operational practices to achieve its goals that cover resource and environmental assessment, road building, fire protection, logging, regeneration, planting, and other matters. It is commonly undertaken by large organizations, often those of the state, and by individual forest owners and community groups.

### **1.2 Problems of Forests**

Forests pose a series of problems for long-term management. The most serious problem is competition from other land uses, notably agriculture. Although forestry and agriculture are interdependent in many situations, immediate pressures to produce food for increasing populations have been a major cause of deforestation. Generally, forests persist in areas less suitable for agriculture, where special measures have been taken to conserve them, or where plantations have been established. In many countries forests are still vast in extent. They are often found in mountainous, difficult, or remote areas which create survey, access, administrative, and security problems for their management.

Forests have to be managed over long planning horizons, as they are composed of living organisms, many of whose life cycles are much longer than human life. Thus management actions can have effects lasting over hundreds of years.

Forests have to be managed for multiple uses and values. Economists classify them as:

- **Use values.**

#### **Direct use values**

*consumptive uses*—these may be goods such as timber, pulpwood, fuelwood, or other products, or they may be indigenous nonmarket goods such as fuelwood, poles, fodder, litter, foods, and medicines.

*nonconsumptive uses*—recreation, education, and scientific studies.

**Indirect use values** include watershed protection, soil protection, protection against avalanches and landslides, gas exchange (oxygen and carbon dioxide), habitat and protection of biodiversity and species, aesthetic, cultural, and spiritual values.

- **Non-use values.** These include the option to use a forest in the future, its value as a bequest to future generations, or for its intrinsic value irrespective of human use.

Complementary, competitive, and contradictory relationships exist between the multiplicity of uses and values. For example, hunting can be complementary to wood production, but may not preserve endangered species. Wood and water values are complementary because forests protect water catchments, but are competitive when fast-growing, young trees decrease water runoff, or are contradictory if erosion from logging spoils water quality.

### **1.3 Resolutions in Forestry**

The problems inherent in these relationships are resolved at several levels. Legislation determines the resource regime of property rights. Government forest policies set the direction that forest bureaucracies implement or enforce on private owners. Forestry education and professional organizations advocate beliefs and practices for resolution. Public, professional, or industrial agencies declare codes of forest practice to guide operations.

### **1.4 Modern Forestry**

Forest-dwelling peoples have deliberately changed forests not only reducing or expanding their extent, but also changing their density, structure, and species composition. They have often done this for millennia by burning them, by encouraging the growth of food plants, and in places by cultivating them. The organized management of forests was well-developed in parts of medieval Europe, but forestry in its modern sense, with which this article is concerned, arose in Europe in the eighteenth century.

It was coincident with the Enlightenment, the rise of science, and the expansion of industrial capitalism. It spread worldwide during the nineteenth century as a hegemonic set of ideas and practices. Modern forestry was significantly changed from the 1950s to emphasize industrial development, from the 1980s to emphasize social development, and from the 1990s to emphasize ecological and social sustainability.

## 1.5 Forestry and Life Support

Forests support life through the ecological services they provide on global to local scales, and through material support for shelter and food. The history of modern forestry is one of attempts to deal with the problems of equity, risk, conservation, externalities, and institutional design.

## 2. Concepts of Modern Forestry

### 2.6. Relationship with Agriculture

Forests were, and in many developing countries still are, closely linked to agriculture and human nutrition. Browsing, harvesting litter and leaves, shifting cultivation, fuelwood collection, and timber harvesting were the essential economic components of rural farming. These long-lasting uses had considerable impacts on the forests. Periods of forest destruction were characterized by increases in population or industrial demands for fuelwood. The close connection between rural farming and forestry ended with general agrarian reform and the rise of modern agriculture (see *Forests and Grasslands as Cradles for Agriculture*). In the temperate zone, agricultural use neither destroyed nor even lastingly diminished the productive capacity of the forests; but deforestation combined with the effect of natural climatic conditions often started irreversible land degradation in the tropics.

### 2.7. Protection

In the course of history, people have protected forests for hunting, obtaining wood, for military purposes, securing farmers' rights, spiritual purposes, and for aesthetics, recreation, and the preservation of biodiversity. The great movement to protect forests for the public interest started early in the nineteenth century (see *Ancient Forestry Practices*). Major damage from torrents, landslides, erosion, and storms had increased markedly and was followed by insect and fire damage in many parts of the world where serious deforestation and browsing had occurred. Public awareness of the beneficial functions of the forests for maintaining quality of life led to the legal establishment of protection forests, national parks, and nature reserves.

### 2.8. Silviculture

At its simplest, silviculture is the cultivation of forests, analogous to the cultivation of fields in agriculture. Like agriculture, its origins are lost in time and its practices varied (see *Tree Domestication and the History of Plantations*). The manipulation of some tropical forests by hunter-gatherer societies to increase the proportion of food trees can be regarded as a form of silviculture, and some medieval societies in Europe had highly developed silvicultural systems to produce crops of wood on regular rotations and timber when required. In modern forestry, silviculture is concerned with the range of practices that manipulate stands of trees through time. It alters their biological characteristics and the mix of benefits they provide.

In native forests silviculture includes methods of regenerating stands after felling, and in

plantations it includes methods of raising seedlings in nurseries and of planting and tending them. The dynamics of stand growth is a central component of silvicultural understanding. Trees can be spaced out at regeneration or planting, and they can be thinned out at intervals so that the remaining trees grow to particular sizes or shapes. In mixed species or uneven-aged stands, the frequency distribution of species or tree sizes and their spatial distribution can be controlled.

Silvicultural techniques have been directed to different ends according to social, economic, and political conditions. The progress of modern silviculture was driven by the potential of economic gain from wood production, taking into account the requirements of particular natural sites. At present, silvicultural theory for natural forests aims to match natural trends with human demands for forest products. It encourages a free style of management in which methods are selected according to the conditions of stand and site, rather than in a schematic way imposed over large areas.

## **2.9. Yield Regulation**

The concept of regulating the total quantity produced, or yield, over a period of years applies to whole forests or forest districts, rather than to particular stands which is the concern of silviculture. In determining the rate at which forests should be exploited, it is designed to counter the free play of short-term market forces, which in many cases would liquidate the assets without replacing them. The general aim of regulating the yield is to sustain it over long periods, often expressed as an aim to do so in perpetuity. The concept was originally based on the realization that the amount of wood a forest can supply is not inexhaustible. If a continuous and permanent supply is to be assured, a forest can only be utilized at a rate corresponding to its natural rate of growth. The concept was extended in the 1990s to cover all the functions of a forest and the maintenance of its soil, biological diversity, and productivity. Its current definition includes elements of time, change, social function and duty, economical and ecological use, economic principles, and ethical obligations.

Forestry theory posited the steady state ideal of a “normal forest” containing such a distribution of ages of stands or sizes of trees that a quantity equivalent to the growth of the forest might be harvested each year.

## **2.10. Property Regimes and Organization**

The state takes a prominent role in most of the forest property regimes. State ownership of forests has developed in all countries, although the proportion varies from 94% in Canada to 42% in Japan and to 15% in Norway, for example. State-owned forests are either managed directly as state forests controlled by a government forest service or indirectly through concession holders supervised to varying extents by the state. The state exerts control over the use and management of privately owned forests to varying extents. In parts of Europe, private owners have to manage their forests strictly in accordance with long-term plans approved and supervised by the state. However, state control may be minimal or recent in many lands of new settlement, such as Australia, or may be absent or ineffective in many developing countries. Common property regimes were extinguished in most of Europe and large parts of former European empires, but

they persist in many countries and exist strongly as customary and clan rights in Melanesia and Polynesia. The state has frequently tried to encourage modern forestry practices to control overexploitation in common property regimes.

### 3. Origins of Modern Forestry

#### 3.5. The Birth of Modern Forestry: From Practice to Science

Modern forestry developed as the result of a process that originated in the Enlightenment when traditional practical knowledge was systematized in an effort to develop a body of scientific disciplines whose main purpose was to ensure steady wood supplies through time. Until then, forestry techniques had been based on information handed down by Roman authors. During the medieval period they were particularly well developed by the Venetian Republic whose dominant shipping power in the Mediterranean was tightly connected to the high technical level of its forestry and the strong control it exerted on forest resources through the most advanced forest legislation in Europe. Its forest management was based on selective cutting, uneven-aged stands, and repeated forest inventories, while its forest utilization and transport systems were highly organized. It established forest academies to improve forestry toward the end of its life as an independent Republic.

The development of forestry science occurred in the German territories at the beginning of the eighteenth century. Until then forestry and hunting were treated as part of agriculture, but the rise of forestry as an independent science was prompted by the expansion of mining, one of whose main problems was to secure the supply of the enormous amounts of wood that it consumed. Hans Carl v. Carlowitz, director of the mines in Saxony, wrote the first book on silviculture, *Sylvicultura Oeconomica*, in 1713. In addition to the mining industry, two distinct institutions, the systematic administrators or “cameralists” and the master hunters, were mostly responsible for developing forestry. The end of feudalism had left most forestlands in the hands of landowners who preserved them largely for hunting.

Their management was left to the *Jaeger*, or hunting masters, whose duty was surveillance and technical direction, while the administrative aspects were in the hands of the cameralists. The master hunters gathered around them the first groups of youngsters who wished to learn what was then called “the art of forestry,” and created the first forest schools, the so-called *Meister Schulen*. Among the master hunters, J.G. Beckmann became famous for the precept, “Ask the wood,” by which he meant the art of understanding the features of forests, a concept which stressed the need for a practical knowledge of the forest environment. The writings of the master hunters contain much practical information, but the writers rarely had the educational background that would enable them to provide an effective systematic treatment.

A change in the relative importance of the hunters and the cameralists in managing the forests occurred when the price of forest products, especially timber, started to increase while the contemporary area of forest land decreased. Landowners and governments pressured those in charge of the forests to develop methods to increase forest production, which stimulated a better knowledge of the features of woody species and

their cultivation. The cameralists were in a better position to do this because they had followed university courses within a wide scientific and literary culture and were able to consider forestry systematically as a science, rather than as an art. One of the most important was W.G. Moser, who founded the first journal of forestry, the *Forstarchiv*, and wrote a forestry book in 1757. He was also the first to connect forestry to social matters, proposing regular annual cuts, and the first to organize forestry into the branches of silviculture, protection, management, and utilization.

Although Germany had several scientists dedicated to forestry, the advance of forestry in other countries, such as France, was mostly due to the efforts of single scientists. In France, the great naturalists, Buffon, Reamur, and Thierrat, published on forestry in the first half of the eighteenth century. They were followed by one of the greatest silviculturalists of the eighteenth century, Duhamel de Monceau, whose works revolutionized forestry. He was a Forest Inspector of the French navy and a good botanist. Between 1755 and 1767, he published several important forestry books. They were translated into Italian and German and were widely circulated among foresters who considered them an important source of information.

### **3.6. The Leading Role of German Forestry: Toward Industrial Silviculture**

A great development of forestry occurred in the nineteenth century, when some important German foresters, particularly H. Cotta, G.L. Hartig, and C. Hundesagen, had a decisive influence on the progress of forestry management, silviculture, economics, and statistics or mensuration. They published several books and articles that were translated into other languages, such as Heinrich Cotta's *Principles of Forestry Science*, a sort of encyclopedia that was used as a textbook in many forestry schools and university courses of the period. Forestry became well developed and was organized into several branches: silviculture, protection, technology, management, watershed control, and forest mensuration and assessment, to list the main ones.

Compared to the eighteenth century, when forestry was limited to the study of better ways of ensuring natural regeneration or selectively cutting stands in shelter wood systems, forestry from the middle of the nineteenth century strongly favored the economic approach to attaining the maximum forest rent. Martin Faustmann published an elegant method of calculating this in 1849 that envisaged an infinite series of rotations of the same length. M.R. Pressler developed its application to silvicultural decisions in 1860. The creation of pure, even-aged conifer stands in the place of mixed broadleaf stands, area regulation, a balanced distribution of age classes in the normal forest ideal, a definite rotation length, and the search for a maximum, annual constant yield, became the canons of forest management.

The need to achieve the maximum economic yield favored tree species most suited for the construction timber market and led to an industrial silviculture specializing in plantations, thinning, and utilization. The preference it gave to conifers slowly changed the composition of many European forests, reducing the amount of broadleaf trees and the area of forests with mixed ages. The new pure conifer stands not only were heavily damaged by biotic and abiotic factors, but also were found to degrade the soil. After high yields and returns from the first crop, subsequent crops were found to grow much

more slowly in some regions.

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### Biographical Sketches

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