

# Introduction: Factors and Processes in the History of Forest Resources

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## 1 Introduction

The beginning of the 21st century imposes a need for profound reflection on the way modern society is dealing with the issue of integrating socio-economic development and environmental conservation. Forest history investigations have shown that most of the forest ecosystems on this planet are affected by human activity. Unfortunately, environmental policies, especially forest policy, is still taking the results and suggestions of these studies into but little account. The limited awareness of forest history research, among both the general public and the scientific community, leads to a lack of knowledge of forest ecosystem dynamics and to a reduced capability for understanding the effects of today's political decisions and economic trends on the forest environments. The chapters in this book analyse some of the main issues concerning the interrelationships between human society and the forest environment, also presenting current debates in related disciplines such as environmental history and historical ecology.

Some of the most debated issues concern the extent to which the forest environment has been modified by man. The real effects of human activity seem alternately to be either over- or underestimated, according to the approaches and findings of the various studies (Balée, 1998). Increasing uncertainty about forest history in Europe has recently been cited by Watkins (1998) who reported on the results of investigations presented at a major conference held on the subject of forest and woodland history in Nottingham in 1996. Although we must agree on the variability of the effects of interference on local forest ecosystems, forest resources were often affected by

widespread economic, social and political changes causing similar effects on a large scale. According to this approach most of the authors in this book present studies related to large geographical areas, in order to define the factors and processes affecting forest changes using different temporal scales. However, the analysis of the evolution of man/forest relationships over time should also be supported by local investigations to clarify the extent to which general historical patterns can be applied to regions or countries. In the same way, the definition of a local model needs to be provided at a general level to evaluate its relevance and to present comprehensive pictures, which cannot be replaced by a number of microhistories. This approach suggests integrating methods in forest history as proposed by an increasing number of researchers, matching problems such as the traditional opposition between historians and those with backgrounds in the natural sciences (Agnoletti and Anderson, 2000).

## **2 Fuel wood and timber from the Middle Ages to the Enlightenment**

The importance of woodlands as a strategic resource in the Middle Ages has been already assessed by forest historians, but the real impact of medieval societies on forest resources is still unclear, even when considering only timber or fuel wood. Suttor's description of the growth of the timber trade along the Meuse River from the 11th to the 17th century reminds us that the need for fuel wood and charcoal for mining and timber for shipbuilding affected the history of many European forests. The need for charcoal seems the reason for the heavy exploitation of many forests, especially in countries like Germany, the leading country for metal production in the 16th century (Devèze, 1962). However, the results of historical research on this matter are quite controversial. Together with interpretations such as those by Dornic (1984) or Gabbrielli (1982), stressing the generalized destruction of forests for iron smelting, books like the one edited by Woronoff (1990) on France seem to demonstrate a lesser impact of metallurgy on the reduction of forests. This approach, which tends to diminish the oft-claimed destructive impact of industrial activities on forest resources, also appears in other chapters in this volume, but the metal industry was only one of the many activities that used large amounts of wood. The organization of forest utilization to supply fuel wood for mining and glassmaking as well as timber in the mountain region of the Vosges, is described by Garnier. However, to understand the effects of these activities on forest changes it is important to know what kind of wood was utilized. The preference for broad-leaved trees such as beech, oak or chestnut, rather than conifers, for producing charcoal had a great impact on forest successions. A change in the main species populating forests is reported for the 14th–16th centuries in the Vosges (Boithias and Brignon, 1985) and also in the Italian Dolomite alps (Agnoletti, 1998) as a result of forest succession,

alternating beech and spruce or fir. An economic interpretation of this succession, assessing the major role played by mining activities preferring beech to produce charcoal, as opposed to the timber industry favouring conifers, must take the ecology of beech and spruce into account. Management practices favouring the utilization of one species, progressively turning the forest into an ecosystem dominated by a single species, ends by promoting the regeneration of the other. Alternation of species dominating the same forest, beech and fir for instance, is a well known process in ecological studies, although rarely linked to human influence.

The presence of mines also led to significant social and political problems, partly because the forests surrounding the mines were often reserved, reducing the customary rights of local communities, and partly because of the workers engaged in this activity. The rise of mining activities in Trentino (north-eastern Italian Alps) around the 13th century brought thousands of miners from southern Germany who settled there, creating an important German community, strongly affecting the local forest ecosystems and the life of the mountain communities.

Another major issue affecting not only the forests in Europe, but also those in several tropical countries is definitely shipbuilding, to which Suttor's chapter also refers. Generations of historians have dedicated their time to studying the development of maritime powers such as Venice, Holland and England. However, very few studies focus on the effects shipbuilding had on the forest of the countries and regions from which timber was collected. As reported by several authors, timber played an important strategic role for countries like Holland or Venice (Lane, 1973; North, 1996), but very little is known about the organization of forest utilization and transportation, or the role played by different wood species in shipbuilding. The decrease in Venetian power and the rise of Holland in the 16th and 17th centuries had much to do with the availability and the price of oaks, while the supply of conifers did not seem to be a major problem. In the 14th century Venice had already established an efficient timber industry for collecting conifer wood from the Alps for building galleys, while a severe shortage of oak wood was already being reported on the plains. From the 15th century, Venice reserved all the oaks in its dominions for shipyards, and drew up forest cadastres where each oak tree was marked and measured. This policy led to the development of conflicts with local populations that opposed the Republic's control of oak forests; furthermore, the Republic imposed the duty of carrying out utilization on these people. Although the demand for nearly 50,000–55,000 m<sup>3</sup> of oak wood every year created a major problem for Venice, it was little indeed compared with Holland's wood requirements: that country, in 1697 had 10,000 ships, almost half the entire world's fleet (Silvy-Leligois, 1962). The building of a Dutch galleon required at least five to six times more wood than a Venetian galley, but the amount of forest cut for this purpose could differ according to the species composition, ecological conditions and management system. In

Venice, in order to build one galley almost 300 ha of oak forest and 122 ha of conifer forest, managed with selective cuttings were cut, while 2–3 ha and 2 ha, respectively were needed if the clear cutting method was adopted (Agnoletti, 1999). This information gives us a rough idea of the problem related to supplying wood for all the major European maritime powers, and how the impact of cuts in different types of forests could vary. Holland imported wood, not only from the Baltic countries, but also from all the regions crossed by the Rhine River as far as Switzerland. The forest history of these areas from the 15th to the 18th century was affected by the timber trade. This was a lucrative business but often created a reason for conflict since the local populations needed oak woods to support their own farming and livestock-raising activities.

Human pressure on wood resources was already heavy in the old continent, but only began in the New World at the time of the Spanish colonization. As reported by Amodio and Hatzenberger, the environment that the first European settlers found was already modified by indigenous populations, so the idea of a 'natural environment' cannot be correlated with South America's forests. The approach of a very traditional Catholic culture that applied European categories of knowledge to a completely new environment, alternately considered a paradise or an inferno, posed many problems including lack of knowledge of the quality of different wood species. However, the initial feeling of uncertainty and wonder regarding the natural resources of the area rapidly changed as the Spanish quickly began exploiting wood resources, first using dye wood for the clothing industry and later timber.

According to several authors, pressure on European forest resources increased until the late 17th and early 18th century when the area of woodlands seemed to reach its lowest level (Kirby and Watkins, 1998). However, this time scale can probably only be applied to some parts of the continent, as the factors causing the reduction of forests did not appear everywhere at the same time. In Italy the deforestation rate increased rapidly during the 18th century, not as the result of the farmers' need to extend grain cultivation for their own consumption, but rather due to the actions of other forces, such as the landowners' desire for increased profits from expanding agriculture (Vecchio, 1974). As reported by Nanni, in Tuscany deforestation took place mostly at the end of the 18th and the beginning of the 19th century as a result of the expansion of agriculture. This process originated from the Grand Duke's free trade policy liberalizing the grain and wood markets, and eliminating former restrictions on wood cutting. However, with regard to the 18th century, several authors criticize the interpretation of terms such as tillage and deforestation that are often used as synonyms, and they also question previous analyses of official documents concerning the reduction of woodlands (Corvol, 1995).

If the old continents offer a great variety of interpretations regarding the late 18th century, the situation described in South America is quite different. A new cultural view of nature that matured during the Enlightenment and the

growing need for timber favoured a more rational approach to the tropical forest environments which, in turn, led to dramatic changes in the landscape. The colonial impact on those territories increased steadily, but it would be accelerated even more by the North American approach in the 19th century. A typical expression of the 'manifest destiny' doctrine, also applied to South America, was reported by Sedrez. As a result, the native forest in the south and south-east sections of Brazil, covering 75% of the land in the 16th century, would be reduced to 13% by 1980, and this is just one example among many for that area (Dargavel and Kengen, 1992).

This progressive increase of human pressure on the forest resources of the New World was backed by the rise of scientific forestry in Europe, due to growing concerns about the wood supply and its rising costs. The development of forestry was initially expressed in France by the works of Duhamel du Monceau and then later in Germany, at the beginning of the 19th century, through the foundation of forest schools that replaced customary forest practices based on traditional local knowledge. This shift from the old to the new forest culture may well be illustrated by the situation of the Venetian shipyards in 1797, on the advent of the French army. The French were shocked by the poor conditions of the shipyards that once had dominated the world. Venetian silvicultural knowledge also appeared disappointing as it was based only on the practical experience of the shipwrights who had no scientific background. The real issue was that Venice, like many other Italian states, had lost its political and economic power, especially in sea trade.

### **3 The scarcity of wood: a key issue**

The relationships between industrial development and forest resources present different patterns according to the ecological features of the forests and the socioeconomic environment. Although in countries like England from the early 18th century on, nearly 90% of fuel requirements were met by coal (Collins, 1996), wood was still the most important source of energy and the need for timber was increasing. In poor regions, such as southern Italy or Spain (Armiero, Torrente), the presence of industry in areas with limited amounts of forests required an organization that also took the needs of local populations into account in order to avoid deforestation and social conflicts. Armiero suggests that industrialization promoted the development of silviculture as a science supporting production, but for Italy very little evidence can be found to confirm this assumption until the second half of the 19th century. The situation in the Vosges mountains or the Alps could be considered completely different from that of the southern regions. Here the organization of forest utilization to produce fuel wood, charcoal and timber was more effective in supporting industrial development. This was due to the availability of large forests – permitting important technological developments rarely described in

either forest history or the history of technology – and to reduced demographic pressure.

The issue of wood scarcity seems to attract the attention of recent approaches, arguing overestimation of forest destruction often ascribed to industrial needs versus traditional interpretations that present the destruction of forests as a general feature of our history. This reductive interpretation of negative human influence should be clearly separated from the approach proposed by historical ecologists suggesting that human actions did not necessarily lead to the degradation of the forest environment (Balée, 1998; Agnoletti and Anderson, 2000). A different appraisal of wood shortages is probably the result of greater attention given to investigative methods that try to avoid the spread of what Oliver Rackham called pseudo-histories having no connection with real facts. Nevertheless, it probably also reflects a cultural tendency that tried to attenuate the idea of the ‘destructiveness of man’, in the words of George Perkins Marsh (1985), reducing the sense of guilt, but also promoting some kind of reevaluation of the role economics played in its relations with the environment. This sort of historical revisionism, that comes mainly from historians, seems to be a crucial issue in the current debate on forest policy: some foresters assess the opposition between economics and ecology as one of the main problems in managing environmental resources (Ciancio and Nocentini, 2000).

In her chapter, Corvol-Dessert strongly criticizes the interpretations of wood shortages at the beginning of the 19th century, which are due to misleading interpretations of sources and a lack of consideration of the features of the wood market. This same approach is presented from a different angle in the chapters by Armiero and Grewe, which link France, Italy and Germany to opinions already expressed by Collins in 1996 regarding England. In his chapter Grewe deals with this topic by focusing his attention on who is complaining about wood shortages and who benefits from these claims, concluding that the matter was often an excuse for excluding local people from using the forest resources. Sometimes the state forest administrations seemed to promote this public feeling in order to maintain their power, as Corvol describes for France. These actions probably prevented a real shortage of timber and fuel wood, but induced a crisis in the availability of resources for the populations as reported by Modert and Grewe. From a general standpoint the situation seems to reflect the advantages the state could obtain from producing and selling timber for financial gain, thereby reducing or even impeding local uses according to an economic and silvicultural system devoted to maximizing wood production that was typical of Germany in the mid-19th century. Johann presents a different perspective for the Austrian Alps. There, population growth in the 18th–19th century reduced the amount of land available for each family, causing a profound crisis since survival was not possible without integrating wood resources with agriculture and livestock raising. According to the author, this integration was more important than timber



production as a local resource, however heavy grazing and litter utilization could permanently reduce soil fertility. This is also the reason for degradation in the Italian Apennine mountains and in many other Mediterranean countries, where grazing and agriculture caused deforestation leading to progressive reduction of soil fertility through erosion and dry climate.

## 4 The role of technology

The purported scarcity of wood was often an effect of the increasing price of timber assortments, due to higher transportation and labour costs, making cuts too expensive. The issue of transportation is quite crucial when considering the availability of the wood supply. The establishment of effective forest utilization systems was often linked to the possibility of floating timber. In the Baltic Sea, special ships were designed to transport timber, while on the Rhine River 350-m-long rafts travelled to Holland, while much smaller ones were used along the alpine streams (Agnoletti, 1995). Here, the need to harvest timber not too far from waterways forced dealers to make cuttings almost in the same areas thus degrading the forests. The technical systems based on water as a source of energy and means of transportation lasted until the development of efficient road systems. Nevertheless, until the end of the 18th century in northern Italy, horse-drawn transportation could still cost 30% more than water-borne means. In the second half of the 19th century the railways brought about a great innovation and opened entire regions to forest exploitation, facilitating foreign competition and the development of a market economy as reported by Björklund. This pattern of development can be seen in many areas according to the periods when the roads and railways were built. In the case reported by Gangemi for Calabria in southern Italy, the lack of suitable roads and rivers made wood transportation from the mountains to the coastal ports nearly impossible, although local people were forced to provide labour for this purpose. In the early decades of the 20th century when a railway was built connecting northern and southern Italy, it was still more convenient for northern Italian dealers to purchase timber in Austria because the railway tariffs were lower.

The technological revolution affected not only transportation, but also saw-milling. Water-powered sawmills were replaced by steam power, but the change took place at very different rates. In countries like the United States, steam-powered saws were already widespread in the mid-19th century (Stanger, 1967) and they were also common in Great Britain, Scandinavia and Central Europe. At the same time, water-powered mills were still popular in the Alps, the Black Forest, the Vosges and Eastern Europe. During the 19th century Venetian sawmills, or the two- or three-stage transmission mills so popular in France and Germany could still compete with steam saws, but the development of more productive mills with circular or band saws reduced their

numbers (Agnoletti, 1994). In the long run, there was no way to compete with the North American or Scandinavian production that already dominated the timber market in the beginning of the 20th century. Nevertheless, particular economic and market conditions – in Italy, for example – allowed small hydraulic mills to continue to exist until 1960. Since the beginning of the century the country had been importing most of its lumber from Austria, reducing saw-milling and developing a furniture industry that achieved a leading market position. This underlined the destiny of a country with no raw materials that was compelled to turn to processing industries.

## 5 Social conflicts

Many chapters (Armiero, Cowell, Cruz, Garnier, Grewe, Modert, Ortega, Rawat and Serovayskay) report on how changes in management forms due to property variations, legislation or the imposition of different management regimes often led to conflicts with local populations. Conflicts cannot be regarded simply as political and social matters, they are also evidence of disturbances at the ecosystem level, deeply affecting forest evolution. Traditional cultures and early agrarian societies often established complex systems of practices that were frequently described as ‘activation practices’ (Moreno *et al.*, 1998) to enhance the availability of environmental resources as reported by many anthropologists (Netting, 1981). If not affected by excessive population growth, these agroforestry systems could maintain a certain stability in forest ecosystems, but disturbances generated by the imposition of different political and economic systems could break this often uncertain equilibrium, provoking the local populations to react. The cases presented in the chapters by Ortega and Cruz very clearly describe how a rural society, based on the traditional agricultural/forestry/grazing systems, was modified by the commercial forestry policy that destroyed these. These dramatic changes generated a crisis in the local ecosystems, interrupting energy flows and food chains, and also stimulated the reactions of local populations expressed through the spread of forest fires and other forest crimes, leading to further upheavals in the forest ecosystems. As reported by Cowell, citing Freeman (1997), the conflicts among different social groups over forest resources did not automatically lead to ecological instability as long as there was a body of laws and regulations to settle claims and provide sustainable management. This could be the case represented by several alpine communities, which freely established a body of rules on how to use forest resources, regulating their relationship with the environment and often leading to fights with external forces that threatened their rights. In other contexts, the ability of outside authorities to achieve control of forest resources seems questionable, especially when legislative acts tended to exclude people from using the forests, as described also by Grewe. The wide range of reactions of local communities to



the creation of royal reserves, and the imposition of noble authorities on forest lands in England from the 11th to the 19th century, as discussed by Serovayskay and Cowell, is an example that can also be applied to other countries. In this case it was not industrial utilization that caused the conflicts, but rather, the reduction of common rights in forests reserved for hunting, considered a key element of aristocratic power and prestige (Watkins, 1998).

An interesting comparison with the European situation, taking colonialism and the development of industrial silviculture into account, is presented in the chapters by Rawat and Dargavel. Rawat stresses the paradoxes of English policy in India, promoting agriculture at the beginning of the 18th century and stimulating an economy of self-sufficiency for the local populations. Towards the end of the century, with the introduction of modern silviculture and the development of an imperial model of forestry which would also be applied in other parts of the Empire, limitations were imposed on the use of forests and grazing, provoking violent reactions on the part of the population. An issue linked to the same problem and quite typical of the approach of European settlers colonizing new lands, is presented by Dargavel for the Australian continent. The application of modern management forms by the Australian colonists often resulted in a destructive impact on any previous forest patterns established by pre-colonial societies creating what Dargavel calls the 'wood of neglect', a very degraded forest territory. The legal reservation of the best forests for the new settlers, the dispossession of the original inhabitants, the decrease in their traditional rights and management by professional foresters seem to be the main elements of the imperial model of forestry as applied in Australia. According to the author, the contrast between well planned forestry conducted on the basis of European forestry and the wood of neglect, symbolizes the current situation of many forests in developing countries when compared with temperate forests. This problem has not been solved in either forest use or social terms and it also represents the main reason for the development of modern environmentalism. More generally, chapters such as that by Rawat confirm a tendency to politicize forest history in India, whose features and dangers have been clearly reported in Grove's introduction to *Nature and the Orient* (Grove *et al.*, 1998).

## 6 The legislative aspects

Some of the chapters seem to confirm the opinion expressed by Trifone in 1957, that the rise of forest laws expressed mostly the need of the dominant classes to keep forest resources under their control. However, the extent to which the promulgation of a law was effective in preserving a forest is not clear, as no law was able to achieve full control of forest resources, as all the chapters on social conflicts show. The establishment of the royal forests in England was meant to reserve their use for the Crown, excluding the common

rights of the local inhabitants, but the history of these forests shows that it was not sufficient to preserve them. The officials paid to protect the trees of Sherwood Forest were the first to make deals to cut them (Watkins, 1998), while the forest crimes listed by Serovayskay show how little the institutions could do to prevent local populations from using the forest. This history is very close to that of the oak forests reserved for the shipyards by the Venetian Republic from the 15th to the 18th century: no threats of the death penalty or other punishment were successful, either in stopping abuses or even in saving the forests from destruction. Not all the forests reserved for the Venetian shipyards were destroyed, but those that were left were located in the mountains where human pressure was much lower than on the plains, and these forests comprised conifers and beech, not oak.

The mountain community of the Alps actually developed a more balanced approach to the forest environment and maintained the forests in fairly good condition through the ages. However, it is worth noting that in the 16th century, in the Dolomite Alps, in order to achieve at least a minimal repression of forest crimes, the law stated that one-third of the income from forest fines should be kept by the wardens charging the fine. A similar situation can be found in the Medici laws in Tuscany, as described in Salvestrini's chapter, which extended state control over almost all the forest resources, but did not prevent the Apennines from being deforested in the 16th century. According to Gallo, writing about the Calabria mountains in southern Italy, when the forest came under state administration this limited the application of common rights and reduced deforestation conducted for extending agriculture. But the conservation of the pine forests of the Sila and Aspromonte ranges was the result of the impossibility of carrying out forest utilization at economic prices, as illustrated by Gangemi.

Although the possibility of applying restrictions to forest use also depended on the state's ability to achieve effective control of the territory, forest laws seemed to be much more effective when they liberalized forest cuts. The application of the free trade policy in late 18th century Tuscany, as well as permission for private owners to enclose their lands, caused the rapid expansion of cultivated lands and the rapid reduction of forest. This led the authorities to worry about forest conservation, a growing concern for nearly all Italian regions, where the forest only covered 17% of the land as opposed to the estimated 75% in pre-Roman times. The foundation of the Forest School of Vallombrosa near Florence soon after the unification of Italy marked the beginning of a national forest policy. This policy aimed at promoting forestry to control erosion and prevent flooding, and to increase timber availability for the birth of Italian industry, as reported by Raffaelli. The rise of state forestry, as in England, Spain and the British Empire was supported mostly by the knowledge expressed by the German rather than the French school which also had a long tradition. In Italy, the years straddling the two centuries marked the shift from an economic culture based on free trade hegemony protecting private

property, to a new wave of interventionist and protectionist ideas which led to the creation of a state forest agency in 1910. The aims were to achieve self-sufficiency in timber production, to provide an example to private owners as to how a correctly managed forest could become a profitable business, and mainly – though questioned by some economic historians – to improve soil conservation through afforestation and watershed management. Initially, state-owned forests were good business, but the idea of becoming self-sufficient in timber production was merely wishful thinking. This goal was never achieved, not even under the autarchy of the fascist regime, despite forest plantations and acquisitions of forest territory at the end of the First World War. These disappointing results seem quite similar to the policies in force in Spain during the same period as reported in the chapters by Blanco and Rico Boquete where the state's efforts to increase forests were devoted more to protection than to production. From this standpoint, Italian and Spanish policies differ markedly from the example given by Mitchell-Banks who discusses a timber-exporting country with a strong timber industry that is quite reluctant to accept limitations on forest exploitation in order to enhance environmental protection.

The drop in fuel wood and charcoal production after the end of the Second World War due to the use of new energy sources affected the history of most Italian forests, as well as the destiny of the state forest administration under the impact of growing economic problems. In general, the turn-of-the-century positivist culture which made the forest an object of scientific management, had to face the fact that timber production and land preservation could not always coexist. The latter involved expenditures that differed markedly from the economic investments that would bring a direct return sooner or later. The history of forest policy as described by Freschi shows increasing bureaucracy and inefficiencies affecting Italian forest policy after the Second World War, when forests progressively reduced their economic value. The transfer of administrative functions to the regional governments in the 1970s marked the end of a concept of state intervention. This led to uncertainties and ineffectiveness in environmental policy that was incapable of preventing conflicts concerning the utilization of forest lands.

## **7 Changes in forest ecosystems**

There is still little attention dedicated to the changes in the forest ecosystems due to human action, compared with the amount of studies considering human society and its relations with the forest environment. Even when taking into account the effects of different socio-economic and climatic conditions and the different species involved, it becomes progressively clear that a reduction in broad-leaved species, especially oaks, and a growth of conifers has affected the history of many European regions from the Middle

Ages to the present. Contrasting forces were involved in this process, speeding it up or slowing it down, and creating different patterns, if we compare Great Britain (Rackham, 1995) with some areas of France (Du Bois, 1996), Sweden (Nilsson, 1997), Germany (Brandl, 1992) or Italy (Susmel, 1994). However, the significant role played by man is unquestionable. On one hand, oaks were one of the most important trees in the Middle Ages, a crucial resource in agriculture as farmers used their wood and also leaves and acorns to feed livestock, mainly pigs. On the other hand, the large amounts of fuel wood and charcoal needed for cooking, heating and most proto-industrial activities such as mining, metallurgy, brick and lime kilns burned oak in addition to other broad-leaved species such as beech. Oak forests grew mostly on plains and hilly areas and, as more and more territory was converted into arable land and pastures, most of the oak woods were destroyed. The species and their respective distribution also made a great difference. *Quercus sessiflora* and *Quercus pedunculata* which were very good for shipbuilding and producing acorns for livestock, were heavily exploited, but they were much more widespread in northern countries. These species were less common in the drier, southern countries where xerophytic oaks, such as *Quercus ilex* were quite widespread but of little use for feeding livestock or shipbuilding, and were mostly used for fuel wood. As long as ships were made of wood (at least 50–60% of the wood needed to build a galley was oak), the need for these trees by the Italian maritime republics, Holland, France, Spain and England, from the 15th to 19th century marked the history of many regions. The reduction in oak forests concerned not only the countries where the ships were built, but also the countries that supplied the shipyards. Having no forests of its own, Holland had to acquire timber wherever possible, but Venice, Great Britain, France and Spain did the same, and even resorted to importing it from the New World.

Dutch timber dealers traded in oak with farmers of the Black Forest, near Switzerland and would float it down the Rhine (Carle *et al.*, 1988) or they bought it in the Baltic countries as did England; Venice did the same, acquiring oak from the Dalmatian coast, and France sought oak even in Albania and Italy as did Spain (Bamford, 1956). Some of the chapters discuss the matter of price, but there was no price question for Venice, which simply did not have enough oak and bought it from Dalmatia, or even had its ships built there. Corvol questions the assertions about reductions of timber for the navy, giving increasing prices and transportation problems as the reason, but she also admits to a scarcity of curved pieces that were always obtained from oaks. Nevertheless, the price of Italian oak in the port of Toulon in 1770 was higher than French products and the amount of timber imported from Italy and Albania exceeded the domestic output. The oak forests suitable for shipbuilding along the Tuscan coast, already sparse around the mid-18th century, were all destroyed during the following decades as were those in the Venetian dominions and the south. Although shipbuilding was not the primary cause,

since potash production, for instance, seems to have been another industry that consumed hardwoods in the Baltic regions, as was fuel wood production and later railway construction in Italy, the reduction of oak forests seems certain. The beech forests were also reduced in some areas like the Vosges, Baden-Württemberg and the Alps, but this has to be related also to the growing importance of conifers.

The chapter by Moriniaux offers an interesting account of the rise of conifers in France at the beginning of the 19th century, but similar evidence can be found regarding the forest history of other European countries in the other chapters. Part of the growing interest in conifers may be linked to the spread of some exotic species as reported by Moriniaux, but there is good evidence that their increased importance must also be related to the growing timber industry. Conifers such as spruce, fir and pines grow faster than oak, yielding straight logs that are easy to saw and process by sawmills and used by carpenters, while bark and litter could be used by farmers, and the branches used for firewood and charcoal. The growth of the European population also meant the growth of the construction industry, which preferred beams and planks made from conifers, while the development of scientific forestry promptly favoured the spread of these species. The leading theories of the German Forest School, based on economic and financial issues promoted geometrically shaped monospecific plantations, often using artificial regeneration. Even-aged forests replaced uneven-aged stands, while selective cuttings, not even considered a proper silvicultural method, were superseded by clear cuts or shelter wood felling. Conifers began to be planted by public and private owners, but the reason was not only economic. In fact, they were considered particularly suited for restoring soil fertility in degraded areas, a great problem in Mediterranean regions. The use of conifers for afforestation was also one of the most common silvicultural activities conducted by state forest services in all European countries, although this policy was implemented earlier in Germany, and later in countries such as England (see Tsouvalis and Watkins' chapter), Italy and Spain (Rico Boquete, Blanco, Manuel). In areas like the Alps and the Vosges, this process was already clear in the 17th–18th centuries, but the tendency seemed to accelerate at the turn of the 19th century. In the north-eastern Italian Alps, the percentage of conifers rose from 54% to 74% in almost 80 years from the end of the 19th century, and today, in high stands, the presence of broad-leaved species is just 2%, with a dramatic fall in beech and the disappearance of chestnut. The importance of chestnut from the Middle Ages and its reduction in the 19th and 20th centuries was related to the importance of chestnut flour as a food for mountain populations, while its reduction is being linked to the abandonment of mountain areas and decreases in agriculture. Along with afforestation, another reason for the expansion of conifers was the spread of these species deriving from the decrease in agriculture and successions taking place in former pastures and degraded areas, especially after fires. The expansion of larch in the Alps and of pine at lower

altitudes is also due to the conifers' ability to colonize poor soils, and this is a common trend from Scandinavia to the Mediterranean.

The technical changes in agriculture and reductions in cultivated land reported in recent years introduce another aspect of forest changes, which is the reduction of coppice woods. Coppice woods have been one of the most common forms of forestry practice associated with agriculture since Roman times (Di Berenger, 1859–1863), yielding a large number of assortments such as poles, branches, timber, leaves and fuel wood to support farming. The preference given to coppices was due to the higher number of assortments produced and to the short rotation systems adopted (as little as 6 years), allowing more frequent harvesting compared with the much longer time needed for a high stand. The flexibility of this management form was achieved through different techniques, such as coppice with standards, simple coppice and selective coppice. Roman civilization diffused coppice technique in many European countries and coppice woods became an important feature of the landscape, especially in wine growing areas (Ostermann and Reif, 2000). Coppice woods, especially coppice with standards, seems an increasing management form in medieval England (Rackham, 1995), while its growth seems to be associated with the progressive reduction of wooded pastures, as reported by Rotherham and Jones. Tsouvalis and Watkins and Rotherham and Jones report on the reduction in coppices in England, associated with the rising importance of coal in place of charcoal, and the change in farming techniques at the end of the 19th century. As the value of the timber assortments produced by high stands increased, there was a gradual tendency to turn coppice woods into high forests, a process stimulated also by the development of scientific forestry. The consideration that the long-term investments needed for a high stand could not be supported by private owners was at the basis of the rise of the state forest agency in Italy, and this policy is still being conducted by many public administrations. In this way, a valuable historic form of landscape will be lost and economic interest in fuel wood production seems to be the only reason for the existence of these woods.

If the development of the timber industry can be questioned as the reason for deforestation, one common effect of the growth of sawmill activities was the reduction in the average size of trees. As related by Björklund, this problem has been affecting the Swedish timber industry since 1880, but in the Italian Alps it was already noted in the early decades of the 19th century when sawmills reduced the size of the frames, adapting them to smaller dimensions (Agnoletti, 1994). The harvesting of big trees was due to the higher prices paid for large saw logs, but the reduction slowly changed the technological features of sawmills and affected market conditions. The elimination of big trees changed the features of most uneven-aged forests, reducing age classes and slowly turning them into almost even-aged stands. Today, the pulp and paper industries, and the mechanization of forest utilization favour small trees, even less than 30 cm. Although this certainly satisfies the current needs of production, it is



important to remember that this technological change was brought about by the heavy forest exploitation of the past. Different growing rates in northern and southern countries affect this as well, as the shorter growing season in Scandinavia means that it takes longer for a tree to attain large size, but certainly modern industrial plantations have shortened rotation times to meet industrial needs.

Compared with Europe and North America where the effects of industrial forestry profoundly modified the features of many forests (Langston, 1995), developing countries present a different situation. As reported by Amodio and Hatzenberger, the forest environments the European settlers found was already affected by the local populations, but the amount of change brought about by colonialism had a much more powerful impact. The export of Brazilian wood (*Caesalpinia echinata*) to Europe, not as timber, but because of its red dye, reduced the coastal forests of this species to a very small area by the 18th century although the inland forests were mostly untouched. Logwood (*Haematoxylon campechianum*), used for the same purpose met the same fate; it was exploited until the early 20th century when chemical dyes came to dominate the European market (Tucker, 1992). The 17th century mahogany trade also affected the Caribbean, which was compensating for the shipbuilding timber shortage that already existed in Europe. By 1800, mahogany was being used for furniture and became a more important commodity than dye wood; other species such as Spanish cedar were also heavily exploited. For Spain, and also for England, and later the USA, South America was merely an inexhaustible resource to exploit. The only 'problem' was how to do this since utilization was very difficult. Forests at great distances from the water remained largely untouched and only technological innovations in sawmills and transportation changed the situation in the early decades of the 20th century. Later, forest plantations of eucalyptus and pine were created in south-eastern Brazil to overcome wood shortages.

In the Caribbean, Cuba's mahogany forests were totally cleared to make room for sugar cane plantations, and the same destiny touched Haiti, where coffee plantations were created on previously forested territories and lemon and orange trees were introduced by settlers. The detailed description of forest changes presented by Hatzenberger shows how the effects of exploitation caused the destruction of certain tree species, modifying the features of local ecosystems and inducing secondary successions favouring xero-mesophilous shrubby species. Still in Haiti, from the 19th century on, the reduction of broad-leaved species was followed by the expansion of pines, partly as a result of the colonization of degraded soils and partly because of afforestation.

Regarding Australia, along with the destruction of native forest ecosystems Dargavel reports an extension of afforestation with pine commencing in the mid-19th century. The population expanded rapidly and domestic production could not meet the demand for softwood, which was imported mostly from Europe and North America. Most plantations were established

using *Pinus radiata* and other species such as *Pinus pinaster*, but *Eucalyptus* spp. were also planted since the commercially usable hardwood timber from native eucalyptus forests was quite limited. Half of these forests were cleared or heavily modified for farming and much of the native wood destroyed.

A very brief account of forest changes is presented in Rawat's chapter. He reports on a progressive reduction of oak forests in the Central Himalayan region due to the spread of agriculture and the need for fuel wood, timber, leaves and litter. In this case commercial timber exploitation cannot be considered a reason for deforestation; if no alternative energy resources are found, the need for fuel wood will probably lead to deforestation.

## 8 Conclusion

Although a reduction in forested land over time seems certain, there is a growing number of historians who question the true extent to which deforestation or wood shortages actually occurred; they argue that the problem has been overestimated, especially when related to industrial needs. This trend is probably the result of the greater attention paid to the analysis of sources, trying to reduce the effects of misleading interpretations and misunderstandings that are quite widespread in environmental history, but it may also be due to a cultural trend that is trying to diminish the concept of human destructiveness. Even if the real meanings of terms such as 'forest' or 'deforestation' could be debated, and thus data about surface changes questioned, at issue is actually a better understanding of changes in species composition, structure and density as determined by forest practices carried out at different spatial and temporal scales. The reduction of broad-leaved species and the growth of conifers as a general trend affecting European forest history seem certain, due both to the effects of industrial needs and to secondary successions in areas subjected to fire or heavy grazing.

The growth of conifers is also the result of the application of silvicultural theories supporting the concept of maximizing forest production, which developed at the beginning of the 19th century and affected the actions of the national forest services in many countries throughout the world. From this viewpoint, countries with large forests, and leading wood markets, as in North America or Scandinavia, induced changes on a very large scale. This imposes a reflection on the meaning of terms such as 'sustainable management', taken into consideration also in the recent matters of ecocertification. It seems questionable to consider 'sustainable' management forms preserving forest extension, but reducing their composition to one or two conifer species, especially in respect to biodiversity issues. However, conifers were also used in afforestation due to their ability to grow on degraded soil, favouring the improvement of site conditions.

According to evidence from research, local communities in traditional, pre-industrial agrarian contexts often seem able to establish a more balanced relationship with the forest environment, improving biodiversity and maintaining more stable ecosystems. Although this model seems to be affected by demographic trends and the availability of sufficient forest resources, sudden political, economic and technological changes often trigger social conflicts and ecological crises. In wealthy societies, the decrease in farming and the general reduction in pressure on wood resources leads to an extension of forests as well as a decrease in certain management forms such as coppicing. However, the loss of the traditional features of the agro-forestry landscape is felt as a loss of an important part of the cultural heritage and it also reduces biodiversity. In a very broad sense, in rich countries forest management keeps forests in acceptable but often very artificial conditions, while in poor countries deforestation and degradation caused by industrial exploitation and demographic pressure are still continuing. One of the most important findings of the studies presented in this volume, is that the forest is not just a background against which human history developed, but an actor in this history, playing an active role in all the many different ecological environments. The debate on the relationships between society and forest resources is one of the crucial issues of our times. Hopefully, historical research will be able to make a substantial contribution to clarify these relations and to the definition of strategies for environmental policies at the beginning of the new millennium.

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