CHAPTER TWELVE

Imperial Environmentalism or Environmental Imperialism? European Forestry, Colonial Foresters and the Agendas of Forest Management in British India 1800–1900

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> Forests are, in the economy of man and nature, of direct and indirect value; the former chiefly through their produce, and the latter through the influence which they exercise upon climate, the regulation of moisture, the stability of the soil, the healthiness of a country and allied subjects. The effects of forests may be looked at from the point of view of the owner, or from that of the state. The owner considers . . . the benefits which he personally derives from forests; the state appreciates the effects which they have upon the country and the nation as a whole.
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> W. Schlich (1889)[1]

The second half of the nineteenth century marked an important watershed in the history of British colonial forestry. The creation of a governmental forest service in India in the mid-nineteenth century set in motion a programme to change systems of forest management and recast them in the Continental mould. Over the next five decades, the Indian Forest

Department, partly staffed by personnel trained in Germany and France, systematically erected a framework of resource use modelled along European lines. Laws restricting resource use were passed, silvicultural systems inaugurated and new approaches to forest utilization launched.

By the last two decades of the nineteenth century, the Indian forestry community could claim success in supplying the government with its forest products needs. This ostensible success, combined with effective lobbying by forestry supporters in Britain and the empire, led to governments in other regions of the colonial periphery following the Indian model. Between 1876 and 1900, forest departments had been set up with the assistance of the Indian Forest Department in New Zealand, Mauritius, Cyprus, Ceylon, the Cape Colony, Nigeria, Sierra Leone, Gold Coast, Kenya, Uganda, the Straits settlements, Malaya and Australia. By the turn of the century a large pan-colonial scientific community was in existence, trained in the German and French tradition of forestry, and therefore sharing a common intellectual ethos and practical outlook.

Although there is a considerable body of historical literature on colonial forestry in India and other parts of the empire for the period 1850–1900, there has yet been no attempt to examine the agendas of forest science as seen from the point of view of the history of the discipline or the perspectives of the colonial forestry profession. The primary concern of historians of this period has been to describe colonial systems of environmental management in terms of advancing state power, the market imperative, statist aspirations to control and discipline, contests between the state and local communities and colonial attitudes to indigenous populations. An important consequence of this historiographical focus has been the construction of the ideal-type *state forestry* to understand the agendas and policies of colonial forest departments. While this category is useful for an analysis of aspects of the politics of conflicts over resource use between colonial governments and local populations, it is inadequate for an understanding of the agendas and ideologies of British colonial forestry. This is so because the disciplinary ethos of forestry science, stemming from its European roots, was as important to the development

of colonial agendas of forest management as were factors such as state expansion and the market imperative.

Despite this importance and the existence of a rich body of literature on various facets of German and French forest history, the question of the influence of Continental systems of forest management on the development of forestry in the British empire remains totally unaddressed.[2] An important recent study of colonial forestry in India, for example, devotes no more than three pages to forest science.[3] Even this brief discussion totally ignores Continental traditions and, moreover, makes no attempt at examining the agendas of forest management in the empire in light of what is known about the disciplinary ethos of German and French forestry.[4] It is this important gap in the historiography of British colonial forestry that the present chapter attempts to bridge. In doing so, it seeks to examine two main issues: the impact of European traditions on the British empire and the agendas and ideologies of natural resource management implicit in colonial forestry.

The chapter begins by drawing on work on the history of German and French forestry, to understand what they meant in terms of attitudes to forest use and ideologies of natural resource management. It argues that Continental forestry was basically a system of environmental control which systematically redefined human relations with forests, legitimating the needs of industries at the expense of the subsistence needs of agrarian resource users. The emergence of the Continental forestry tradition, it argues further, led also to the creation of a technological, and often, technocratic elite with a monopoly over decision-making on forest use.

The second part of the chapter examines the impact of the onset of Continental forestry in India in the second half of the nineteenth century. It argues that the ecological and social relations engendered by British colonial forestry in this period were by no means distinctively colonial or unique to the British empire. It contends that they reflected what had happened with the onset of scientific forestry in Europe previously and that they were extremely similar to developments in other contexts where Continental forestry took root, such as the USA.

It argues further that an understanding of the human and ecological impact of Continental forestry in Europe and other

non-colonial contexts forces a reconceptualizing of the politics of colonial ecological intervention. It thus claims that the nature of colonial forestry, and especially the conflicts it engendered between the state and local resource users on forest use, was not necessarily a product of the economic and political priorities of colonial civil administrators or the colonial state, as contended by some historians.[5] Rather, they were the product of the transfer to the colonial world of the structures of ecological appropriation and control endemic to Continental forestry. The carriers of the Continental forestry tradition, the professional foresters of colonial forest departments, it argues, became an important interest group in imperial environmental politics.

The Continental Forestry Tradition

Modern Continental forestry originated in eighteenth-century Germany, and was a product of the cameralist economic outlook.[6] In a nation devastated by the Thirty Years War and impoverished by the discovery of the sea route to India and the fall of Constantinople, cameralism as a practical policy attempted to reconstruct the economic foundations of the country by providing state support to industries and banks, extending and improving infrastructure (canals, bridges, harbours and roads), promoting modernization and strictly regulating trade, commerce and the agricultural sector.[7]

An important element of this drive to improve administration and resource management was a perception that such a policy required a science of state finances. Various economic, administrative and social practices of the state were therefore vigorously scrutinized in order to subject 'scattered pieces of knowledge . . . into systems' and to transform 'all sorts of activities previously left to habit into a science.'[8] Underlying these various cameral sciences, as the resultant new disciplines of knowledge came to be known, was a commitment to quantification and economic rationalization.

The inclusion of forestry among the cameral sciences was a result of a perceived shortage of wood in Germany in the aftermath of the Seven Years War (1756-63). A small group of state officials, concerned about the rapidly increasing prices of

forest products and having seen actual physical evidence of severe deterioration of woodlands, began to fear that a crisis in the supply of wood was impending. Although their initial response was to pursue economy in the use of wood, these officials realized that the alternative, of expanding the *supply* of wood by complex forest management, promised larger long-term gains.[9] The skill to realize this potential was however lacking – the vast majority of foresters were caretakers, game wardens and masters of the hunt, with no theoretical or practical training in forestry. The first step towards a new science of forestry therefore was the establishment of a number of schools of training and research. By the middle of the century forestry schools had been established and books and journals devoted to forestry began to be published.[10] The key people involved in the creation of this new discipline were the *Holzgerechte Jäger* (game wardens versed in forestry), the *Kameralisten* (students of finance and administration) in the government and the Kameralisten in the universities.[11]

By the nineteenth-century the methods and approaches of German forestry had undergone a considerable degree of metamorphosis since its early days as a cameral science. Despite this change, the basic agenda of German forestry remained more or less the same. To quote a historian of German forestry, it consisted in describing 'the living forest quantitatively before subjecting it to economic reason'.[12] An understanding of these methods and approaches as they evolved over the years offers a great deal of insight into the priorities and resource-management ideologies of modern Continental forestry, and indeed of British colonial forestry in the second half of the nineteenth century and later.

Stages in the Development of German Forestry: A Brief Overview

German cameralist forestry initially built on forest practices already prevalent among local forest communities. The areal method, one of the earliest frameworks of forest management developed by cameralist foresters, was thus based on a traditional practice of forest use that involved the setting of annual cutting schedules. Foresters demarcated and measured the acreage

covered by woods and estimated the numbers of years that the dominant types of trees needed to grow between cuttings and clearings. They then partitioned the forest into a number of divisions equal to the number of years in this growth cycle and derived annual yields on the assumption that equal areas yielded equal amounts of wood for harvest each year.[13]

Although this method worked well for relatively short growth periods typical of traditional forestry practices, it was soon abandoned. The reason for this is in itself indicative of the direction in which German cameralist forestry was to develop in the decades to come. The areal method was rejected because it proved insufficient for fiscal or forest officials imbibed with *Wissenschaft* and a conception of forests as cash crops. Their goal, cash-crop forestry, envisaged the systematic harvest of high (old and mature) timber. Such forestry was difficult to achieve using the areal method, because the irregular topography and uneven distribution of German woodlands made areal computations extremely complicated. Besides, a correlation of acreage with actual distribution of lumber and firewood required principles not formulated and measurements not routinely executed under this method of forestry. The area-based system was also inadequate to respond to the fluctuations produced by nature over the many decades of a single forest cycle. Moreover, it could neither provide a flexible way of directly adjusting the harvest from year to year, nor predict annual yields over the long cycle from the outset.[14]

Methods involving area-based approaches to forest economy therefore gave way to those based on mass or volume of wood. In the early 1760s Johann Gottlieb Beckmann from Saxony, a game warden turned forest inspector turned university professor, developed a method which involved a team of assistants, each supplied with birch nails of various colours, walking side by side through the forest at intervals of few yards.[15] Each member of the group concentrated on one side of the forest, noted every tree he passed, made estimates of the size categories in which each tree fell and marked individual trees with nails of an appropriate colour. When the operation was completed, the unused nails were counted and subtracted from the original supply, thus yielding an estimate of the number of trees in each size category. Since the approximate yield of wood from trees

of each size category was known from experience, the amount of standing wood in a forest could, with appropriate multipliers, be determined easily.[16]

Empirical approaches such as Beckmann's were further developed by a generation of mathematically inclined foresters, such as Karl Christoph Oettelt, Johann Vierenklee and Johann Hossfeld.[17] These foresters assigned the task of making measurements in the forest to the *Forstgeometer*, a surveyor who in addition to making such measurements, demarcated the borders of the forest, prepared maps and carried out other prescribed tasks for a set fee. A division of labour then evolved, with the forest geometer along with a team of marching assistants gathering the data, and the chief forester and his superiors undertaking the work of calculation, analysis and planning.

The activity of data-analysis was inspired by a new confidence in the ability of mathematical principles and techniques to ascertain wood mass, the crucial variable of the new forestry. Several methods of mathematically calculating the mass of wood were developed. While some used tree heights as the basis for calculations, others deployed integral calculus to handle the irregular shapes of standing trees, while yet others idealized the shapes to truncated cones. The techniques developed by Oettelt, Vierenklee and Hossfeld enabled the calculation of the quantity of wood in a tree without felling it. A new abstract mathematics-based forestry thus evolved. In this framework forestry science supplied the necessary principles to organize the data gathered on the field, and thereby ascertain the mass of wood which could be found at any given place and time. Tables were compiled based on the carefully constructed and controlled field measurements.[18]

In this tradition of *Forstwissenschaft* the forester's idea of a forest was gleaned from the conceptual framework of his manual. The manual provided an outline of exemplary tables which needed to be instantiated with details, such as the location, type and yield of each of its tree species, for particular forests. Once filled in, it helped the forester decide how best to manage the forest. Foresters thus 'planted, grew and harvested this construct of tables, geometry and measurements in their treatises and on it based their calculations of inventory, growth and yield'.[19] Most foresters conceptualized forests not as they existed

in nature, but as ideal aggregated mathematical entities. An important concept was the *Normalbaum*, a standard tree, to which the natural specimens could be approximated.[20] Although most treatises on forestry contained instructions for averaging measurements made on a test plot, many foresters preferred the Normalbaum. Tables of numbers representing measurements and calculations provided data on specific classes of trees under specified conditions. These tables rationalized across space, and were indifferent to regional variations.[21]

By the end of the eighteenth century German forestry metamorphosed into a systematic science of determining, predicting and controlling wood mass. It reached a climax in the work of Heinrich Cotta, Georg Ludwig Hartig, Friedrich Wilhelm Leopold Pfeil, Johann Christian Hundeshagen and Carl Justus Heyer, who wrote the first 'classics' and to whom is attributed the birth of the modern science of forestry.[22] Writing at the turn of the century Cotta enunciated a three-pronged approach to forest management. The first step was a geometric survey, which would supply information about the extent of forests. The second step involved calculations of wood mass of individual trees and stands and finally of the forest as a whole with growth rates calculated for each level of organization. The third step involved linking the forest balance sheet to the monetary budget by treating the standing forest as capital, its yield as interest and then completing a chain of conversions from wood to units of currency.[23]

The fundamental problem of forest management for Cotta and his colleagues was the determination of the 'standing value' of the forest, given uninterrupted maintenance costs and full harvest some 100 to 150 years hence. Their science therefore consisted of inventory and prediction. Cotta, for example, championed the use of 'experience tables' which reinforced the notion of the Normalbaum, or a forest filled with standard trees. The forester was to instruct his assistants in the use of these tables so that a mental picture of a tree encountered in a forest corresponded to an entry in the tables. A well trained forester could therefore make an instant association from the mental picture triggered by the tree to the value of wood mass contained in the tree. He was trained to be able to see the archetypical standard tree and become a computer of wood

mass. The head forester dictated principles. He determined growth rates, prepared maps and calculating tables, and delegated to his staff routine measurements and the mechanical application of tables.[24]

The forest science of Cotta and his colleagues had thus evolved considerably from the days of Beckmann and his army of assistants with coloured nails. The new forestry combined the practical experiences of several generations of artisan-trained, empirically schooled Holzgerechte Jäger with the natural scientific and cameralist principles taught at universities.[25] The empiricism of the earlier era was thus replaced by a more sophisticated approach of sampling and generalization. The work of the assessment and management of the forest in this tradition required only standard trees and the experience tables. Instead of getting the data needed for determining fellings or predicting monetary yield from direct measurements of wood mass or volume, the forester could now employ new analytic tools developed for forest computation, the 'standard tree', the 'size class', the 'age class' and the 'sample plot'. Forestry was now a mathematical science, its crucial quantities determined mathematically from the premises of the science, not by direct measurements.[26] An important aspect of this new forestry was the development of a specialized body of literature on forest botany and zoology.[27]

German Forestry as an Ideology of Resource Use

Three key concepts characterized the ideology of resource use implicit in this new approach to forest management. The first was the idea of minimum diversity. The chief purpose of the mathematical approach was to economize effort by producing approximations that would level across the diversity of nature. Johann Wilhelm Hossfeld, a leading proponent of stereometrical and geometrical methods in the determination of wood volume and the inventor of methods to calculate the value of the forest, argued that a series of multiplied averages based on one or two easily observed characteristics, such as the height of a stand of trees, was as good as an exact summation of all the individual cases.[28] Again, Hartig advocated strict adherence to results drawn

from a few sample plots. He advocated the application of simple rules and the discarding of 'arbitrary' details of nature.[29] Similarly, Cotta argued that selective measurements should be used to generate acceptable values for quantities like typical yield or growth. These could then become the characteristics of ideal types presented in tables and other summations and multiplications of data from test plots. He argued that one did not have to worry about the cumulation of errors, claiming that individual differences cancelled out in the aggregate, thus giving the forester freedom from the need to poll every tree without increasing the risk of error.[30]

The second key concept governing cameralist German forestry was that of the balance sheet. This concept stemmed from the imperative to convert the amount of wood to its value. The forest scientist was required to prepare a *Forst-etat*, a budget that compared the yield to what the forest could bear over time. Underlying the forest budget was the idea that a balance-sheet of forest use based on mathematics and natural philosophy was necessary to prevent either under- or over-utilization of wood. Terms such as 'forest use budget' and 'natural forest budget' were therefore used to describe the related components of planning and biological growth that concerned the forester in his attempt to balance supply and demand. In drawing up a balance-sheet the forester would evaluate disturbances to the equilibrium of the forest caused by both natural causes, such as fires and pests, and by man-made causes. Having done so, and having calculated the magnitude of these disturbances, the forester could prescribe means for restoring the equilibrium of growth and yield over time. Forests could thus be managed according to books which consisted largely of numbers concerning consumption, production and distribution of wood arranged so that ultimately the balance in every forest, district, administrative region and province could easily be reviewed at a glance.[31]

Related to the idea of the balance-sheet was the third key concept underlying German cameralist forestry – sustained yield. The idea of sustained yield was fundamental to calculating for the future. As early as 1767 Johann Ehrenfried Vierenklee had argued that the forester must know how to divide up a forest into a definite number of annual cutting areas from which he

should obtain a definite amount of wood each year. Vierenklee had used mathematics to obtain formulae to achieve this distinction and had based his work on growth calculations for high timber. The idea of sustained yield became the cornerstone of the Forstwissenschaft of the late eighteenth century and thereafter. From a series of quantities and qualifiers such as growth rates, mass of wood in a forest, and quality of soils, the scientific forester could determine a schedule of cuttings for the forest of standard trees under the 'particular aspects of each system of culture' such as timber forest, coppice or a mixed form.[32]

The methods of 'forest regulation' developed were predictive and prescriptive. They offered a long-term framework of forest management based on the mathematical forest and standard practices for application in the wooded forest. Scientific forest regulation also exercised many aspects of the forester's art, from cartography, description and techniques for regeneration to silviculture and assessment. Although the methods varied greatly, they resulted in the visual arrangement of age-classes and plots, linked with the quantities of wood and cuttings over time. Fold-out tables were common and, like modern day business projections, paid great attention to graphic clarity and had a great faith in numbers. The concept of sustained yield brought into forestry science the concept of time: it forced the forester to ask how much wood a forest could deliver, not only immediately but over a century or two, and how this yield could be harvested in one year so as to ensure that the same yield could still be available a hundred years hence. It also made a forester a curator as opposed to a measurer of forests.[33]

During the nineteenth century, this tradition persisted in German forestry circles. Forstwissenschaft advanced along the lines established by the early forest mathematicians: sustained yield, regulation according to age-classes and wood mass, and the construction of the 'normal forest'. It eventually produced monocultural, even-aged forests. The Normalbaum was thus transformed from abstraction to reality.[34]

German Forestry and Society

The tradition of forestry first established in cameralist Germany and which continued into the nineteenth century, had a clear

conception of the importance and utility of forests. Forests, according to this view, had a direct importance in that they produced raw materials for consumption. These included fuelwood and products for industrial consumption, such as pulp, poles and timber for construction railroad ties and mines. They also included minor products, such as bark, resin, seeds and nuts, forest litter and forest pasturage.[35]

In addition forests were perceived as having an indirect importance in helping regulate the natural environment, especially climate and watersheds. In this the German tradition of scientific forestry was clearly influenced by the scientific debate on the effects of deforestation in Europe.[36] From its earliest days practitioners of German forestry perceived forests as having a significant influence in regulating the physical environment.[37] As early as 1764 there was thus mention in the German forestry literature of the influence of forests on precipitation.[38] By 1788 the reboisement of torrents had been recognized as a proper public measure in German Austria.[39] In 1790 a lecture before the Academy of Sciences dealt with the importance of the forest for conserving water.[40] By the second half of the nineteenth century forest experimental stations had been established in all the German states and outside, including Sweden, Bohemia and the East Indies.[41]

An important aspect of the German forestry tradition was its commitment to a strong, autocratic control over forests and forest enterprises. This commitment had its roots during the mid-eighteenth century in a context of acute crisis in the supply of timber and other forest products. By the end of the eighteenth and the beginning of the nineteenth centuries two major schools of economic thought dominated the public life of Germany. The first was cameralism, an offshoot of mercantilism. The term 'cameralism' originated in the management of the state's treasure (*Kammer, caisse, camera principis*), seen as the principal instrument of economic and political power. In an age of enlightened absolutism, cameralism emphasized the paternalistic character of the government's fiscal policy, the idea that the state ought to be a regulator of development and thereby serve the general happiness of the subjects.[42] Such a philosophy clearly supported state control of forests. The second tradition of economic thought, however, was the English school of free trade. Some

free-traders repudiated all state interference in forestry, particularly private forestry, and even advocated the sale of state forests. Most of the influential foresters, however, took the opposite view and advocated state control of forest enterprises. They were joined in this by many otherwise radical free-traders who considered forestry an exception, and who argued for and demanded state supervision of this branch of the national economy.[43]

An important corollary to the commitment of German foresters to state control over forests was a move to diminish the rights of traditional forest users over their resources. As more and more areas came under their control the question of the definition of forests became increasingly significant to foresters. Although traditional privileges and the continued use of the forest for agricultural purposes such as grazing had long discouraged a conceptually precise demarcation of the forest, the Kameralisten foresters promoted the notion that it could be defined precisely and studied objectively.[44] This idea was born out of a belief that most rights of forest use were harmful and their regulation, highly desirable.[45] The German forestry tradition therefore devised explicit tools for regulating rights. There were four different kinds of regulation, defined as 'the definite restriction in respect to time or duration of rights, or with respect to the areas subject to them'.[46] They included conversion (*Umwandlung*), in which the 'beneficiary' was assigned another product in place of the one taken; reduction (*Einschraenkung*) or diminution (*Ermaessigung*), a temporary reduction below the normal use-quota in cases when the encumbered forest could not produce the necessary material as a result of changes in system of management, such as deterioration of soil, fire and insect attacks; settlement (*Fixierung*), in which the extent of rights, hitherto vaguely defined, was fixed definitely on the basis of the need for the material; and transformation (*Verlegung*), according to which the rights of use were shifted to another part of the forest.[47] In addition to regulation, German forestry also allowed for extinction (*Abloesung*), which involved the complete abolition or annulment of rights in return for suitable compensation paid to the 'beneficiary'.[48] German forest law gave forest officials the right to enforce these provisions, which they did with a great deal of force and authority. Their uncontrolled

harshness engendered a great deal of resentment among local populations and led to many protests over access to forest resources.[49]

To conclude this discussion of German forestry, modern German forestry emerged within the social and economic milieu of cameralist Germany. The cameral sciences, of which forestry was one, were 'a branch of learning bound like no other to the development of the modern system of state administration'.[50] It is important to note here that the origins of German forestry lay in rationalism and not romanticism. Cameralist forestry was essentially a 'bureaucratic-scientific approach to resource management'.[51] It was concerned with the production of timber and other forest products, and with meeting the needs, especially industrial, of the national economy. Its oldest branches therefore included forest utilization, the preparation of forest working plans, silviculture, forest valuation or forest finance, and forest protection. These branches emphasized respectively the systematization and regulation of forest use, the determination of periodical production and the regulation of yield, artificial forest regeneration, the valuing of forest products and the protection of forests from man, naturally destructive phenomena such as insect attacks, and noxious plants such as fungi. An important element of the protective aspect of German forestry was its concern with the influences of the forest, especially the effect forests had in regulating the natural environment.

In addition to its productive and protective dimensions German forestry was also concerned with controlling and restricting forest use. This concern was reflected among other things in the disciplinary emergence of forest laws and regulations which attempted to legally institutionalize modes of forest use devised by foresters; and forest policy which addressed broader questions such as whether and to what extent forests ought to be maintained in any country and whether forest ownership should rest with the state, individuals, communities or private enterprise.[52] The historical evolution of these branches reflected the tensions between foresters, who had emerged as an interest group on the issue of forest resource use and various other interest groups, including agriculturalists and pastoralists. This tradition of forestry, as will be shown in the next section, played a major role in shaping French forestry which, along

with the German, was instrumental for the development of the British colonial forestry tradition in the nineteenth century.

French Forestry

France had a tradition of systematic state forestry prior to the introduction of German methods in the late eighteenth century. In the mid-seventeenth century Jean Baptiste Colbert, a minister in the court of Louis XIV, declared the forest of state importance and passed an *Ordonnance des eaux et forêts* in 1669 which gave the king significant new rights over French forests.[53] The ordinance was enacted after an eight-year study by a commission consisting of administrative officials, lawyers and people familiar with forestry problems. It arose out of a realization, following an acute shortfall in timber for ship construction in France, that maintaining a domestic source in the face of international competition for wood was vital to the future of that country.[54] The main goal of the ordinance was to systematize forest management based on economics with the purpose of determining the productivity of forests and clarifying disputes over ownership and land tenure.[55] Colbert's ordinance gave water and forest superintendents power to levy heavy fines for violations, while recognizing the importance of forests for the resource needs of agrarian populations.[56] Forest law, according to the principles of Colbert's ordinance, was, however, not systematically spelled out until 1752, when the Chief Forest Master of Rouen, Antonie Pecquet, wrote *Loix forestiers de France*.[57]

Following the French Revolution, and in the wave of expropriation and public distribution of state and church properties, Colbert's system of forest management, which had assigned an important role to the state and the king, came under severe attack. Leading the attack were the French Physiocrats, who had been attempting to suppress the influences of the mercantilist Kameralisten from the middle of the eighteenth century.[58] In 1770 a leading French Physiocrat, G.F. Le Trosne, wrote *De l'ordre social*, which was an open attack on the Colbertian system and which advocated private property ownership in the forestry realm. His criticisms however had no immediate effect, and the ordinance remained in force until the revolution in 1789.[59]

At the National Convention of 1792, however, the question of what to replace the Colbertian scheme with was an important topic of discussion and philosophical debate. The basic issue was whether royal forests should be alienated and put into private hands, or kept and managed by the state for the national interest. A related issue for debate was the role of public property in a democracy and specifically how a democratic forest administration could be organized.[60] There was no clear consensus on these issues until 1801 when, with the reestablishment of the Administration of Water and Forests under the finance ministry, a definite perspective emerged. Forests were seen as national resources to be managed on the basis of the emerging science of silviculture. Soon after its inception the Administration of Water and Forests promulgated 123 regulations concerning forest management. These regulations included applying principles of modern forest management to communal forests, the reassertion of state management of forest plantations, and the adoption and application of scientific survey techniques.[61]

In 1820 the French national government established an independent forest administration agency, the *Corps des Eaux et Forêts*, charged with developing forest management policy. In 1824 a school of forestry was established at Nancy to train personnel for this professional corps. Its ranks were soon filled by foresters trained at the school. The Nancy Forestry School was one of the Grandes Écoles of the nation, along with the École des Mines, École des Ponts et Chausées, the École Polytechnique, the École Navale, the École Centrale des Arts et Manufactures, and the École Normale Supérieure.[62] These schools were designed to provide an educated, scientific, modern, technocratic elite: engineers, scientists, planners, educators and politicians who would systematically and rationally address the planning needs of the nation as it entered the modern period.[63]

The first director of the Nancy school was J. Bernard Lorentz, a German-trained forester who had published the *Lorentz Manuel du Forestier* in 1801.[64] His successors as Directors of the Nancy school were de Salomon (1830-8), Adolphe L.F. Parade (1838-65) and H. Nanguette (1864-80), all of whom were foresters trained in Germany.[65] The German training was necessitated because there was very little forestry of note done in France in the late eighteenth and early nineteenth centuries, due to war and

unrest.[66] Together, Lorentz and his successors ardently promoted German forestry techniques that favoured tree plantations – monocultural 'high-forests', composed of species suitable for construction and industrial needs. The state *corps forestier* subsequently undertook reforestation programmes in consonance with the Germanic forestry agenda.

Under their schemes, forests across France were cut and replanted with monocultural stands of species, such as pines, that were deemed economically important, replacing mixed forests.[67] As in Germany, this new forestry destroyed the traditional coppice system which yielded timber and products more varied in size and kind than did the high-forest, but which had been more suitable to the myriad requirements of local inhabitants besides sustaining the biological complexity required for the forest's health. In promoting the demands of construction and industry over those of local populations, the new German system entailed a revolution in French silviculture. It also resulted in the long-term presence of a professional group of foresters to manage the desired high-forest woods. The locals who had traditionally managed the coppiced woodlands for their daily needs had to abide by the forest management regimes set by professional foresters.[68]

Modern French Forestry and People

The forest that the French Forestry Corps protected, rehabilitated and developed was very different from the historic forest managed by local peoples for their needs. The Corps envisaged the forest as a place of national interest that should produce for the nation rather than for local or regional needs. Like in Germany, this new forestry replaced communal forest management systems, rights of forage, pasturage, gleaning and coppicing practices. The forest became an element of France's infrastructure, like a bridge or a road, and at the service of the state's general political and economic policies.[69]

The new forestry placed the blame for forest degradation on the traditional systems of natural resource management. This reflected the on-going struggle for control over natural resources between traditional resource users and the new class of people, the bourgeoisie, whose commercial interests in

unified, industrial nature required access to wood for fuel needs.[70] A scientific crusade developed to save the forest from local populations. Led by engineers, agronomists and other scientists, this campaign asserted that whereas forest resources remained static, the size of local populations 'abusing' them continued to grow. An important aspect of this campaign to save the forest from local people was the conception that forests were needed to prevent erosion, land slides, avalanches and floods in the mountains and for agriculture in the lowlands.[71] Here, French foresters worked along with the engineers and others who were concerned with the impact of deforestation on watersheds.[72] The connection between forest cover, healthy watersheds and agricultural productivity coincided with and was influenced in part by the work of the environmental scientists described earlier.

The claims of the forest protectionists received an added credence in the aftermath of a series of serious floods in 1840 and 1843. Following a massive ecological discourse about mountains which played on the environmental vulnerability of the state, a law was enacted in 1860 which permitted the state to impose zones in mountainous areas. This law allowed for the forcible expropriation of land for the environmentalist cause. There were a number of revolts in the face of this enforced land alienation. In some cases, such as in peripheral mountain communities of the Mediterranean Alps, the Pyrénées, Alsace, Lorraine, Franche Comté, and Bourgogne, the army had to intervene.[73]

Although the law was modified because of the violence it provoked among local people, foresters continued to blame local inhabitants for the degradation of resources and to press for authority to intervene. Mountain people were described by professional foresters as 'incapable of managing the mountain, preserving its soil and conserving its vegetative cover' and as being so 'unconscious of their own interests that they persevere in exploiting their mountains in the least advantageous manner' — a testament to their 'inertia and deplorable egotism'.[74] The reasons for deforestation and the increase in natural disasters such as flooding and avalanches lay in a complex mixture of issues. These included the break-up of traditional forest holdings due to large-scale economic transformations caused by the

industrial revolution, privatization and capitalism, and economic and demographic changes which caused the soil in these poor, isolated regions to become unstable. French foresters, however, turned cause and effect around and claimed that the reason for the economic underdevelopment and growing pauperization of mountain regions was that the local people had wantonly caused deforestation and erosion.[75] They saw themselves as the protectors of resource against the local populations. They argued that the panacea for these problems was sound scientific forest management and reforestation based on state control over forest lands.

To conclude, a new relationship between forest and society, and between man and nature had been formed in France by the first part of the nineteenth century. As in Germany earlier, forests began to be regarded as a territory special to the economic vitality of the country as a whole and a legitimate subject for state intervention. Forests thereby became a part of the national infrastructure, a state resource. The purpose of forestry was to serve the economic and especially industrial needs of the national economy. In keeping with the German tradition French foresters sought to convert all forested lands into commercially viable monocultural forests through systematic application of silviculture, based on the principles of minimum diversity, the balance sheet and sustained yield.

This system had no place for local forest inhabitants in forest management. Local knowledge systems were consequently discredited and replaced with an approach that was based on long-term biological cycles that suited the nation's economic and, especially, industrial needs. The underlying philosophy was to restrict access to forests, subsidize private landowner replantations, take over and replant communal mountain lands and implement an intensive agricultural policy. In moving towards this foresters, as scientific experts, increasingly sought and acquired control over policy-making on forest resource use. In this foresters were supported by other sections of the national elite, including members of the artistic community who argued for forest conservation for aesthetic reasons.[76] Decision-making thus moved from the local to the national level and was made by a domain of experts trained in elite schools.[77]

The Development of British Colonial Forestry 1850–1900

The creation of a forest service in India and the subsequent appointment of its members to set up forestry agencies in other parts of the empire led, as argued earlier, to the creation of a large colonial forestry community by the end of the nineteenth century. An important feature of this community was its homogeneity, brought about by the shared professional ethos of its members, all of whom had been trained either in the Nancy forest school or in forestry institutions in Germany until the mid-1880s.[78]

The purpose of this section is to examine the impact of this professional ethos on the development of forestry in India and other parts of the British empire in the second half of the nineteenth century. It seeks to demonstrate that the agendas and ideologies of colonial forestry in this context closely mirrored those of its Continental parent. It does this by focusing on the two key aspects of forestry: its agendas on forest management and its attitude to society, especially local peoples. Since India was the central theatre in which professional forestry emerged in the British empire in the nineteenth century, the argument in this section will concentrate on this context. It will however seek in conclusion to briefly locate the Indian case in the wider context of empire forestry as a whole.

Indian Foresters and Forest Management

In order to understand the objectives of the Indian forestry profession on forest management in the second half of the nineteenth century, it is important to appreciate at the outset, the outlook of its founder, Dietrich Brandis. Dietrich Brandis (1824–1907) studied botany in Copenhagen under Schow, at Gottingen under Grisebach and Lantzius-Benings, and at Bonn where he got his Ph.D. under Treviranus. In 1854 he married Rachel Marshman, who was a sister of the wife of General Havelock, a close friend of the Governor-General of India, Lord Dalhousie. On Havelock's recommendation, Brandis was put in charge of the forests of Pegu in Burma in 1856. He was appointed Inspector-General of Forests of India after success in Burma. During 1863–5 and 1868–70 he toured extensively and

established forest management in northern India. While on furlough in 1866 he arranged for the Continental training of prospective Indian foresters. In 1878 he established the Dehra Dun school for Indian foresters. He also trained the prospective foresters of the US Forest Department. He retired in 1883 and wrote some major books on botany, the most important of which is *Indian Trees* (1907).[79]

The primary objective of Brandis since his early days in Pegu in Burma was to recast Indian forests along European lines. Thinking back about his work of setting up the Indian Forest Department, he thus wrote:

> The formation of the government forest domains in India and the organisation of their management, has been a large undertaking and the progress which has been made in this work could not have been accomplished had the experience gained in forest administration in Europe not been utilised; and in the future it will be necessary to maintain an intimate connection between forest administration in India and in those countries of Europe where scientific forestry is based upon the experience of centuries. Climate and the species of trees are different in India but the principles upon which systematic forestry is based, are the same in all countries, and the aim in the future must be, as it has been in the past, to build the system of forestry in India, not upon the ideas and theories of individual men, but upon the results which long experience has furnished in those countries of Europe where scientific forestry is oldest and best understood.[80]

Like the foresters of Germany and France Brandis argued that forests offered direct and indirect benefits. Forests benefited society, he wrote, by providing timber and other forest products to meet the needs of industry and agriculture. Forests also had an environmental utility – they helped regulate climate and protect soils, thereby preventing destructive phenomena such as floods and torrents.[81]

In his years in charge of Indian forests, Brandis systematically set about applying to the tropical forests of the Indian subcontinent the principles of forestry developed within the Continental tradition. Echoing European foresters Brandis stated that the objectives of forest management involved ensuring effective protection of forests against natural and human destruction, devising a good system to secure the regeneration of the forest,

either naturally or artificially; the development of a well-considered and methodically arranged form of working; and the installation of good lines of communication to facilitate protection, the working of the forest and the expansion of produce.[82] The aim of forestry, he wrote, was 'to steadily improve their condition [of forests], and never to cut more than the annual production by natural or artificial means will justify'.[83] Implicit in this mandate were the three basic principles of German forestry – minimum diversity, the balance-sheet and sustained yield. The essence of Brandis's work therefore was to organize forestry in India and Burma along these principles.

Brandis's commitment to the concept of minimum diversity is evident from his earliest work as a colonial forester in Pegu in the 1850s, where he developed a method known as the 'Linear Valuation Survey'. In a system reminiscent of Beckmann and his army of marching assistants with coloured nails, Brandis and his men walked along certain pre-determined lines – roads, ridges or streams. As they walked they carefully observed the forest 50 feet on either side of the line they traversed. The object of this exercise was to count the number of teak trees (chosen because it was the most remunerative of the local species) in different size classes in the area observed, and on the basis of this extrapolate the total quantity of teak in the forest. The observations were carefully recorded by carving pieces of bamboo representing different size classes.[84] Having thus obtained figures on the size-composition of teak trees of the Pegu forests, Brandis proceeded to calculate the rate of growth of the diameter of trees in each of the size categories. In addition, he estimated the proportion of trees of every class likely to attain the dimensions necessary to be grouped in the category above it. Armed with data on the size-composition, rate of diameter growth and the probability of the survival and maturity of the forests, Brandis devised a schedule for cutting and exploitation.[85]

The Linear Valuation Survey was clearly based on the German principle of minimum diversity. Prior to the arrival of Brandis the forests of Pegu were 'typically polyspecific, all-aged, "natural" wildwood, with the full tropical rainforest complement of weed-trees, stranglers, lianes, epiphytes, bamboo, canes and palms, and a dominantly broad-leaved undergrowth'.[86] What Brandis's method achieved was to enable the forester to ignore these

'arbitrary details of nature' and concentrate on producing approximations of the extent of teak, the predominant commercial species. Like German forestry it thus levelled across the inherent diversity of forests and produced an efficient scheme to exploit them. It also led eventually to the transformation of these forests into commercially marketable monocultures. Brandis applied his method in other parts of India where he worked, such as the North East Provinces and Oudh from whence it spread to various parts of the equatorial tropics.[87]

Brandis was also committed to the principles of the balance-sheet and sustained yield. In enunciating his approach to silviculture, he laid down strict rules that governed felling. Merchants, lessees and contractors engaged in felling had to adhere to a minimum felling diameter set by the Forest Department. The process of felling had to be supervised by professional foresters on the ground, to ensure that forests were not destroyed. Moreover, forests had to be 'treated' prior to felling to ensure the economy of labour, access and supervision.[88] In addition to enunciating ground rules on felling, Brandis also formulated guidelines for the management of forests. He thus advocated regular repair, tending and pruning. He also suggested the replacement of felled trees by dibbling seed or planting seedlings in the gaps, landings and other forest openings. Where such methods of diffuse replacement failed, Brandis recommended the establishment of plantations of commercial species such as teak and sal.[89] Another aspect of the guidelines for management enunciated by Brandis was the mitigation of factors that would be inimical to forest growth, such as grazing, fire and vicious weeds.[90]

Brandis's silvicultural guidelines were calculated explicitly to prevent either under- or over-utilization of wood. In his first working plan for Pegu, he stipulated that the exploitation of forests in a given period should not exceed their increment. The annual yield, he thus laid down, should be based on the amount of growth they put on.[91] This principle subsequently became the cornerstone of all Indian forest working plans.[92] Like their German counterparts foresters in India were expected in Brandis's scheme to evaluate the magnitude of the disturbances to the equilibrium of the forest caused by both natural and human causes. Having done so they were meant to prescribe

means for restoring the equilibrium of growth and yield over time.

In the period 1860–1900 Brandis and his successors went about implementing these principles of forest management. Forests across India were surveyed and inventories of forest species made.[93] Working plans and silvicultural operations were devised and implemented for the entire country along the guidelines established by Brandis.[94] Regimes for protecting forests from natural and human destruction were established.[95] Communications were improved and infrastructure for exploiting forests, such as roads, developed.[96] The upshot of the adoption of all these measures was that Indian forestry by the turn of the century increasingly became a profitable enterprise for the state. Whereas revenue and expenditure respectively had been £360,000 and £220,000 in the period 1864–5 to 1868–9, they had climbed to £950,000 and £600,000 by 1882–3.[97]

An important culmination of the system of forest management practised by the Indian forestry community in the second half of the nineteenth century was the publication between 1889 and 1895 of the first three volumes of the *Manual of Forestry* by William Schlich, who succeeded Brandis as the head of the Indian Forest Department.[98] The *Manual* was the basic textbook for candidates for the Indian Forest Service who, since 1885, began to be trained at the Royal Indian Engineering College at Coopers Hill. Its publication marked the crystallization and institutionalization of the approach to forest management adopted by the Indian Forest Department over the preceding four decades. Being one of the first forestry manuals to be written in the English language it also served in many respects as the basic textbook of foresters in the empire.[99] Moreover, as a paradigm of forest management, the *Manual* went totally unchallenged. It in fact formed the basis, two decades after it was first published, for the *Concise Manual of Sylviculture* published and distributed by the Indian Forest Department for all its employees.[100] Schlich's *Manual* thus offers an excellent insight into the nature and character of the Indian and, indeed, empire forestry community in the period 1850–1900.

The essence of the framework enunciated in the *Manual* is contained in its first few pages, where Schlich grappled with the definition of 'forest'. Rejecting a variety of definitions that

ranged from descriptions of forests as areas containing wild-growing trees and deer to those subject to special forest laws, he defined the forest in the following terms:

> An area which is for the most part set aside for the production of timber and other forest produce, or which is expected to exercise certain climatic effects or to protect the locality against injurious influences; such areas are frequently subject to special forest laws and legislations.[101]

Implicit in this definition were the basics of the Continental paradigm: a conception of the direct and indirect uses of forests and the idea of the forest as a timber mine. The three volumes of the *Manual* gave this conception a philosophical and practical shape.

The first volume was divided into two parts. The first of these, which took up almost hundred pages, was a treatise on the utility of forests. The discussion mirrored the perspective of Continental forestry on the direct and indirect utility of forests. Forests, Schlich thus stated, had a number of effects. They supplied timber, fuel and other forest produce; offered an 'opportunity for the investment of capital and for enterprise' and generated employment. They also reduced the temperature of the air and soil, regulated climate, increased the relative humidity of the air, increased rainfall and regulated water supply. In addition they helped reduce violent floods, prevented the occurrences of land slips, avalanches and the siltation of rivers and arrested the velocity of air currents and thus protected agricultural fields. Moreover, they assisted in the production of oxygen and ozone and thus helped improve the health of the country.[102]

The second part of Volume 1 was on the fundamental principles of silviculture. Here again, the basic approach was explicitly modelled on the Continental forestry paradigm. An object of silviculture, Schlich wrote, was to 'yield produce of a definite description', such as trees giving a certain kind of timber. Another purpose was to produce the 'greatest possible quantity of wood, or other produce, per acre and year'. A third objective was to produce the 'highest possible money return per acre and year', and the 'highest possible interest on the invested capital'. In addition to these economic ends silviculture was also

meant to enable certain indirect effects, such as regulating the drainage of a country and preventing phenomena like avalanches.[103]

The second and third volumes of Schlich's *Manual* proceeded to translate these fundamental principles into a set of practical instructions on forest management. Volume 2 was a technical handbook on the formation and tending of woods. It dealt with topics such as choice of species, artificial and natural forms of forest regeneration and the protection of forests.[104] Volume 3 adumbrated the techniques involved in implementing the agenda of forest management. Its first part was on forest mensuration. It described the instruments used in forest mensuration, the techniques of measuring felled trees, the measurement of standing trees, the method of determining the age and volume of whole woods and the analytical tools used to determine increment. Its second part was on how to evaluate the cost and sale values of soils, the growing stock and rent of whole forests and the financial results of forestry. The third and fourth parts of Volume 3 were on the principles and practice of forest working plans, the basis of sustained-yield forestry.[105] Between them Volume 2 and the two main parts of Volume 3 embodied the three basic features of German forestry, minimum diversity, the balance-sheet and sustained yield.

On the issue of forest management, therefore, Schlich's *Manual of Forestry*, the epitome of forest practice in the India and the rest of the British empire in the second half of the nineteenth century, explicitly mirrored the German paradigm. It is important to note here that the principal sources cited by Schlich in his *Manual* were the 'classics' of forestry, the works of Hartig and his successors, such as Schlich's teacher, G. Heyer.[106] Volumes 4 and 5 of the *Manual*, that followed the publication of the third volume, were explicit translations of two German books on forestry.[107]

As an attitude to nature the approach to forest management adopted by Indian foresters in the second half of the nineteenth century was, in terms of the distinction between conservation and preservation,[108] clearly conservationist in character. The main emphasis was on conserving and planting what were perceived specifically as useful species. In places where species with no direct utility prevailed, they were sought to be put to

use, using the best science possible.[109] Significantly the issue of animal conservation figures very little in the writings of members of the Indian Forest Department. In as much as animals entered their official debates, it was either in the context of debates about farm-forest conflicts, or discussions about hunting and sport.[110]

Members of the Indian Forest Department were closely in touch with the American conservationist, George Perkins Marsh, the author of *Man and Nature*. A version of *Man and Nature* was issued with notes on forests and rainfall in Madras by A.J. Stewart, an Indian forester.[111] The Marsh connection enables us to understand the attitude of the Indian foresters to the natural world better. Marsh was perfectly content with the idea of human domination of nature, provided it was careful and far-sighted. More than a third of *Man and Nature* was about forests and forest management. Based on a survey of European forestry practices, Marsh recommended a mix between preserving forests in their natural state where they were necessary to preserve soil moisture and plant cover, and the substitution of artificial for natural forests where they were necessary for timber.[112] He was, however, greatly concerned with the complex interrelatedness of animal and vegetable life and warned that this was too complicated a problem for human minds to solve: 'We can never know how wide a circle of disturbance we produce in the harmonies of nature when we throw the smallest pebble in to the ocean of organic life'.[113]

Marsh therefore proposed as corrective to previous human carelessness, a 'geographical regeneration', a great healing of the planet beginning with the control of technology. He also proposed that the human custodianship of the planet was an ethical or moral issue and not just an economic one.[114] Indian foresters clearly accepted his advocacy of management. It is, however, not very clear if they also accepted his moral argument. None of the writings of Brandis, Schlich, or any one else, for that matter, raise ethical questions of this nature. Moreover, some members of the Indian forest service did not even accept Marsh's contention that Man can have a lasting adverse impact on nature:

> Mr Marsh will hardly carry us with him when he states that 'Nature is wholly impotent against his energies,' for with Nature centuries are

but moments, and after man has exerted all his destructive powers and produced a desert, Nature by his forcible exclusion will be enabled in time to recover her normal condition.[115]

By the end of the nineteenth century this utilitarian conservation sentiment became a developmental ideology in its own right. Indian foresters at the turn of the century were particularly impressed by increasing support for forestry in America and were ardent supporters of the Progressivist Conservation movement which linked conservation with the gospel of efficiency.[116]

Indian Forestry and Society

Like their counterparts in Germany and France colonial foresters in India developed a commitment to strong, autocratic control over forests and forest enterprises. As was the case with forest management, the thinking of the Indian forestry community on the subject of control over forests was encoded in Schlich's *Manual* which declared: 'History has proved that the preservation of an appropriate percentage of the area as forests cannot be left to private enterprise in India, so that forest conservancy in that country has for some time past been regarded the duty of the State.'[117]

The reason for this, Schlich argued, was that it was only the state that could appreciate the importance of the indirect benefits of forests and which could think in the long term.[118]

This conception had its origins in two main influences. The first of these was the long history of experience in India and Burma on the impact of private enterprise on forests. A central thesis of the colonial scientist-conservationists of the first half of the century had been that the onset of private commercial interests in the realm of forest management inevitably led to a tragedy of the commons.[119] The thrust of the early 'colonial foresters' from Captain Watson to Cleghorn and Gibson had therefore been to exclude private operators from forests.[120] The early experience of Brandis in Burma had led him similarly to look at private firms with a great deal of suspicion. Much of his time in Pegu and other parts of Burma in the late 1850s and early 1860s was therefore spent fighting mercantile firms, a battle that was only partially successful.[121]

The second main influence behind the Indian forestry community's commitment to state control over forests in the second half of the nineteenth century was, predictably, the European tradition. A number of issues of the *Indian Forester* in the period 1875–90 thus reproduced sections of writings by French and German foresters on the issue of the importance of state forestry. The debate over the proposed forest bill in 1875 in particular drew strongly from both European history and ideas on the importance of state control implicit in Continental forestry.[122]

An important manifestation of the commitment of the Indian forestry community to state control over forest management was the enactment of forest laws. The first Indian Forest Act was passed in 1865 and, based on it, a number of local rules were promulgated. Within a few years of its enactment, however, foresters began to complain that the 1865 Act did not give them and the state adequate control over forest lands. They argued in particular that it did not provide for the 'definition, regulation, commutation and extinction of customary rights' by the state.[123] A protracted debate on a new forest act ensued. In 1878 a new Forest Act was passed which extended to all provinces except Madras, Burma, the Hazara district in Punjab, Ajmer, Coorg, Berar, and Baluchistan.[124] By 1890 these provinces passed their own forest acts modelled on the 1878 Indian Forest Act. These acts divided forests into three main categories: reserved, protected, and village/communal. As in Germany and France, the Indian Forest Act gave foresters power to determine how forests were to be managed. All the forest acts provided for control, not only of state-owned lands but over forests and lands not belonging to the state, 'if such control appears necessary for the public weal, or if the treatment such forests have received from their owners injuriously affects public welfare or safety'.[125] In doing so the Indian Forest Act defined and restricted rights in a manner very similar to that in Germany and France earlier.

Like their counterparts in France, the members of the Forest Department in India deemed the demands of the state well-founded and those of the local people (settled agriculturalists and nomadic tribes who were perceived as wasteful, ignorant and blinded by short-term interests) as illegitimate. Practices

such as grazing animals in forests were therefore seen as ecologically blind:

> The sheep and the goat tear up the herbage instead of biting it clean off. They throw themselves greedily on all kinds of plants (when they do not eat them), they devastate the forest, ruin pasture lands, and cause damage greater and more irremediable than all other cattle put together. When they are very numerous, they ravage the country just as a flight of locusts would. They cleave the soil with their narrow pointed hoofs, render it thus more easily furrowed by the next rainfall, and thus promote the formation of ravines.[126]

The local people, they felt, needed therefore to be educated about priorities in resource use:

> As a preliminary to the real conservation and administration of the forests on the countryside the people with their Oriental conservatism and apathy had to be gradually weaned from their old methods of utilising – wastefully utilising – the forests and educated to a recognition of the fact that the work being carried out was in their true interests.[127]

From the point of view of the Indian forestry community, while forest resources were limited there was a great and growing demand and therefore competition for them. On the one hand there were the demands of the state. India was still a net importer of timber.[128] On the other, there was a great deal of pressure from the local population, in particular for grazing their goats and cattle. Given this overall scarcity of resources, they felt that forest use ought to be prioritized. As scientific experts they believed that they were the only agents competent to do this prioritizing.[129] As one of them put it: 'All that in India we can hope to do is from a stand-point of necessarily superior knowledge, to ascertain facts, and define our restrictions and the areas within which they are enforced, with strict justice.'[130]

The issue of resource allocation, principally political in nature, began thereby to be posed as a technical problem. The Forest Act and standpoints such as the above were seen as technical solutions. Moreover, what was perceived as ecological ignorance also began to be seen as moral backwardness. The technical solutions – the Forest Act and education for the local populations – were therefore seen simultaneously as acts of moral improvement. Nowhere is this conception better illustrated than

a poem written during the conference on the 1878 Forest Act, which posits a 'solution' to the environmental profligacy of the Bheel, a tribal community in central India.[131]

Although the Forest Act gave the Forest Department overall legal authority, their actual clout in local contexts was, however, often restricted by members of the civil administration whose priorities were sometimes different from those of foresters. This restriction was in fact sanctified by governmental policy. The Rules that governed the Indian Forest Act, for example, set out that:

- All Divisional Forest Officers and their subordinates shall in all but purely technical matters be subordinate to the Collector of the District, &c.
- No appointments to offices higher than that of the round guard shall be made by the Conservator . . . without consulting . . . the collector.
- In all matters relating to local supply or the rights and privileges of the people in or in respects of forests, orders shall be issued by the Collector alone and not by any Forest Officer.
- No forest compartment shall be closed, whether for planting or reboisement or for punitive purposes, except under the order or with the approval of the Collector.
- A breach of any of these rules carries the penalty of one month's imprisonment and Rs 500 fine.[132]

The members of the civil administration and especially local bureaucrats whose duty it was to collect revenue and maintain law and order, were perceived by the foresters as being ambivalent and not totally committed to forestry:

> In the official mind up to the highest, we find various degrees of disinclination towards vigorous conviction: and just as we find in the people the progress of conviction barred by self-interest, so is it with their rulers. Considerations of interest, such as the desire to have no complaints and have everything snug and quiet in the district, to shew a good revenue sheet by yielding forest produce . . . affect their capacity for the reception of a sure belief in forest economy.[133]

The nature of the science of forestry which allowed no crucial experiments, and in which truths were 'not evolvable from abstract considerations of chemistry or atmospheric law' but established only by repeated experience, made it difficult for them to convince government officials who, they believed, even

when not openly contradicting the established conclusion about the physical importance of forests, 'nevertheless nourish a silent and half-smothered distrust, which results in their being apathetic, coldly negative and very easily persuaded to inactivity in regard to the subject'.[134]

They therefore felt that forest officers

> not unfrequently find themselves in the position of people bound hand and foot and told to run. At one time surplus revenue is insisted on. At another the closing of forests and a strictly conservative treatment which in general forests is incompatible with the realisation of revenue, is directed.[135]

The emergence of a homogeneous professional community of foresters thus resulted in conflicts over forest management within the colonial administration. The roots of these tensions lay in the difference in backgrounds and training between foresters and other members of the civilian administration. They also lay in the differences in income and status between the civil and forest services.[136] Related to this was the fact that the forest officer, despite his training, was legally subordinate to his civilian counterpart:

> It will thus be seen that a senior Forest Officer in charge of a Division sometimes comprising more than one Collectorate, may be in any part of his charge practically subordinate to a mere boy civilian or a native deputy, and is actually at present less esteemed and feared than any revenue subordinate. In other words, a highly-trained and educated officer whose charge includes a dozen or more talukas, is practically subject to the authority as well as to the intrigues of each petty Revenue officer in charge of the taluka.[137]

Another cause for conflicts between foresters and law-enforcing officials was that while the former were interested in efficiency in the forestry realm, the latter were preoccupied with concerns about political stability.[138] Both, in addition, were straddled with the question of generating revenue. In this there was a great deal of similarity between forestry and other systems of environmental management in India in the second half of the nineteenth century. In irrigation, for example, plans for agricultural improvement by irrigation engineers

> were not – and could not be – developed in the context in which the province's administrators found themselves. They had to balance

the powerful expediencies of revenue and commerce at every turn; they were buffeted by gusts of disapproval from the supreme government in Calcutta or in London; and they were haunted by the nightmare of political upheaval should they disturb unawares the agrarian society whose loyalty was so precariously secured.[139]

By the last two decades of the nineteenth century, members of the Indian forestry community, from the top to the bottom, began to perceive that the colonial administration needed to be educated about the importance of forest conservation. One important manifestation of this realization was the production of official histories of Indian forestry which, among other things, emphasized the increased revenue for the state brought about by the policies of the Indian Forest Department.[140] In order to get their agenda on forest management firmly recognized by all sections of the administration, Indian foresters also began to organize themselves as a major pressure group. They systematically lobbied the government in India and, on return to Britain, became leading figures in the campaign for British and colonial forestry there.[141]

To conclude this section, the attitude of Indian foresters to forest management and society in the second half of the nineteenth century mirrored those of their European ancestors and counterparts. In the case of forest management the Indian forestry community introduced into the colonial context Continental principles of minimum diversity, the balance-sheet and sustained yield. These principles led to the eventual transformation of Indian forests along the lines of the forests of Germany and France previously. Again there was, as in the European tradition, a strong affirmation of the legitimacy of the needs of the national economy and of industrial interests and a negation of the requirements of local agrarian populations. Predictably the dismissal of the rights of local resource users was more pronounced among the generation of Indian foresters who had been trained at Nancy and the German forestry schools. Members of an earlier generation of foresters, especially Brandis, had held that the 'business of the forester is to produce not only timber, but . . . a great variety of other produce, among which cattle fodder is most prominent'.[142] However, for their successors, strongly imbued with the Continental tradition, the demands of peasants and other rural

resource users were, as argued earlier, part of the problem of efficient resource management.

The change in attitudes to local people and their needs arose partly out of a growing self-perception of colonial foresters as technical experts. This can be understood better by invoking the notion of technocracy, 'the exercise of political authority by virtue of technical competence and expertise in the application of knowledge', and examining its relation with politics.[143] In an article on the idea of technocracy John Gunnell has argued that the impact of technological systems on politics can be analysed at three distinct levels: political power gravitating towards technological elites in circumstances in which political decisions involve specialized knowledge or technical skills; technology becoming autonomous and politics therefore becoming a function of systematic *structural* determinants over which it has little or no control; and technology (and science) constituting a new legitimating ideology that subtly masks certain forms of social domination. In each of these levels, argues Gunnell,

> there is a concern about the depreciation of the political realm, the subversion of traditional bases of authority, and the ascendancy of instrumental power over political rationality. More specific concern usually centres on the problem of the circumvention or atrophy of democratic or representative political institutions.[144]

The emergence of a professional Forest Department in late-nineteenth-century India led to increasing demands for political power in the realm of forest management by its members, the technical elite in this context. The passing of the forest acts symbolized the acceptance of this claim for power by the state. With this, technology, in this case scientific forestry, and the foresters' belief in technological and moral (ecologically moral) superiority over the local population, began to constitute a new legitimating ideology. An important consequence of this was the growing demand by the forestry community to rigorously enforce the provisions of the forest laws and their increasing willingness to confront the civil administration on this. By the turn of the century, the forester as *technocrat* had thus become a very important figure in the politics of forest resource use in India.[145]

The Wider Context

The appointment of Indian foresters to set up forestry in other parts of the empire led predictably to the transfer of Indian ideas on forest management and on the relationship between forestry and society to these areas. In every context where Indian forestry was transferred forests began to be managed according to the principles of minimum diversity, the balance-sheet and sustained yield.[146] Again, in each of these contexts, lobbying by foresters resulted in the enactment of legislations setting out the legal basis for forestry reserves and providing for appropriate restrictions forbidding cutting, grazing or trespassing without permit. More significantly, in a number of colonial contexts, the forestry community increasingly confronted the state for greater political autonomy and, often, for retaining basic policies.[147]

Significantly, the agendas, concerns and dilemmas of British colonial foresters were by no means unique to the empire. In the last three decades of the nineteenth century a debate on forest use ensued in the United States of America which, like in India and the rest of the British colonial world, faced six main questions: are forests worth preserving; how should forests be managed, and who should manage them; who owns the forest; how much forest is left; how should the forest be protected; and how should the forest be used?[148] On each of these questions members of the American forestry community, some of whom had been influenced by Indian forestry and trained in the Continent, increasingly adopted perspectives similar to those taken by their counterparts in Europe and in the British empire.[149] In America, as in India and the rest of the British empire, foresters increasingly began to grow as an important lobby with the administration. For a variety of reasons, including the close personal relationship between Gifford Pinchot, the 'father' of American forestry, and President Roosevelt, the American forestry community was more successful in convincing its government to support its objectives. By the turn of the century, therefore, British colonial foresters, as pointed out earlier, began increasingly citing the American case as an example. Their agenda was to implant in the empire a regime of progressive conservationism within a context of technocratic politics.

Conclusion

This chapter set out to examine the impact of the Continental forestry tradition on the British empire and the agendas and ideologies of natural resource management implicit in colonial forestry in the period 1850–1900.

It has been argued that looked at as a framework of resource management, there was nothing particularly distinctive about forestry as practised in the colonial context. The agendas therein were very similar to those in Germany and France and, significantly, similar to those in the United States, which too adopted the Continental forestry tradition. In each of these cases, there was a strong commitment to building a regime of natural resource management that could cater efficiently to the industrial needs of the nation. The guiding principles underlying this commitment were minimum diversity, the balance-sheet and sustained yield. Again, as an attitude to nature, the agenda of British colonial forestry, like its Continental parent and American counterpart, was unambiguously utilitarian; conservationist, as opposed to preservationist.

In addition to adopting the forest management ethos of Continental forestry, British colonial forestry in the nineteenth century also inherited the Continental forestry attitude to other forest resource users, especially agricultural populations. Foresters in India and the rest of the empire, therefore, in the second half of the nineteenth century, like their Continental predecessors, had a clear bias against such communities, whom they viewed as ignorant, environmentally profligate and wasteful. In seeking to objectively define the forest for the purposes of scientific management, they therefore devised a system of curtailing traditional rights, which in time developed into a sub-discipline of forestry – forest law. The advent of the Continental system of forest management in the British empire thus resulted, to use Lewis Mumford's terminology, in the introduction of an authoritarian technics in the realm of forests.[151]

A critical element of the attitude of colonial foresters to local populations was the perception that their claims were illegitimate because of their ostensible scientific and technological backwardness. In an important book on the culture of colonial science and technology Michael Adas has argued that machines

were used by European colonizers 'as the measure of men'.[152] It is tempting to apply such an analysis to the case of British colonial forestry. Looked at from the perspective of the history of the development of forestry in the European (and especially French) context, however, it is clear that the process of judging human communities by their scientific and technological prowess began with the setting up of the forestry Corps in France. The origins of the process of judging human communities on the basis of their scientific and technological prowess was thus, at least in the realm of forestry, much earlier than the first contact between the colonial forester and his subjects, and in a context – Western Europe – that was far removed from the colonies.

The influence of the Continental tradition on colonial forestry has important implications for the conception of 'imperial' or 'colonial' state forestry. To begin with, the agendas of 'colonial' forestry in this period were not born out of any distinct policy of the colonial state that directed how forests were to be managed. Rather, they were brought forth by a community of technocrats who attempted to implement what they had imbibed during their professional training in the Continental forestry tradition. The modes of production and social relations defined by forestry in the British empire were thus not direct products of cultural or economic imperialism, as asserted by many historians of forestry in the British empire.[153] On the contrary the 'environmental imperialism' of colonial forestry was a result of the transplantation into a colonial realm of the social and political contexts that had defined forestry in Europe in the first place. The impact of the transplantation of Continental forestry in India was thus very similar to the effect of German forestry on France earlier, and that of Indian forestry on the rest of the empire subsequently. In all these cases technology was not a product of colonial expediency; it provided, as Daniel Headrick has argued, a context for colonial politics.[154] Similarly colonial foresters were not mere 'servants of the state'; they were carriers of culture of a technology that had its origins in another setting. An important corollary of this is that discussions about whether or not colonial forestry constituted a watershed in the environmental history of the British empire are trivial in the sense that as a regime of resource

management, scientific forestry was *designed* to be a major watershed even in Continental Europe, its place of birth.[155]

A second implication of the influence of the Continental tradition on forestry in the British empire is that it seriously questions the conception of 'state' forestry. The emergence of a professional forestry community trained within a defined tradition marked a significant disjuncture in the history of colonial forestry, in that it brought with it a rigid tradition of praxis with respect to natural resource management. This meant that although the ethos of empire foresters in the second half of the nineteenth century had some affinities with that of the preceding regime run by colonial scientist-conservationists, it was distinct in that it was marked by a coherence of perspective and purpose on what to do with colonial forests stemming from the tradition of Continental forestry. This argument is particularly significant as a qualifier to attempts by certain historians to characterize the development of forestry in the nineteenth century without giving cognizance to the impact of the Continental tradition.[156]

A more important implication of the emergence of a professional forestry community is that although forestry was sponsored by the colonial state, the agendas for forest management made by them were often opposed by other governmental agencies. This led, as argued earlier, to important conflicts between the forestry community and the state. The bone of contention was political authority for the forester. In debates within the colonial administration this was manifested in demands by foresters for greater political autonomy, a plea for freedom to devise and implement policy in the realm of the forest. Central to such demands by the colonial forestry community was their belief that as technical experts, they were the only people within the colonial administration competent to administer the imperial forest estate. For members of colonial administrations, on the other hand, the efficient management of forests was only one of many governmental priorities, not the least of which was to maintain social and agricultural stability.

An important consequence of this polarization was an attempt by the empire forestry community as a whole to lobby governments at the centre and in the periphery to recognize the importance of forestry. They therefore used their growing status

as scientists to widen the existing governmental perspective on forests and their utility. They also used their scientific expertise to demonstrate the utility of supporting Continental forestry and allowing foresters to take over all decision-making on forest use. It was only in the aftermath of the First World War, however, that their campaign began to have any serious effect on governmental policy.[157]

NOTES

Acknowledgements: I am greatly indebted to Dr Richard Grove and Dr John Darwin for their comments on an earlier version of this chapter.

1. *A Manual of Forestry*, vol. 1, Oxford, 1889, 13.
2. Important among historical works on European forestry are: B.E. Fernow, *A Brief History of Forestry in Europe, the United States and Other Countries*, Toronto, 1913; F. Heske, *German Forestry*, New Haven, 1938; K. Mantel, 'History of the International Science of Forestry with Special Consideration of Central Europe: Literature, Training, and Research from the Earliest Beginnings to the Nineteenth Century', in J.A. Romberger and P. Mikola (eds), *International Review of Forestry Research*, vol. 1, New York, 1964; H.E. Lowood, 'The Calculating Forester: Quantification, Cameral Science, and the Emergence of Scientific Forestry Management in Germany', in T. Frängsmyr, J.L. Heilbron and R.E. Rider (eds), *The Quantifying Spirit in the Eighteenth Century*, Berkeley, 1990; H.E. Lowood, 'Patriotism, Profit, and the Promotion of Science in the German Enlightenment: The Economic and Scientific Societies, 1760–1815', Ph.D. Thesis, Berkeley, 1987; and S. Pincetl, 'Some Origins of French Environmentalism: An Exploration', *Forest and Conservation History*, 37 (April 1993). While the writings of Fernow and Heske are the standard, if dated, histories of Continental forestry, the works of Lowood and Pincetl look at German and French forest history respectively from a contemporary perspective.
3. See R. Guha, 'The Agenda of Scientific Forestry', in *The Unquiet Woods: Ecological Change and Peasant Resistance in the Himalaya*, Delhi, 1989, 59–62. This trend is unfortunately true for colonial contexts other than the British empire as well. See, for example, N.L. Peluso, *Rich Forests, Poor People: Resource Control and Resistance in Java*, Berkeley, 1992, esp. ch. 3, 'The Emergence of "Scientific" Forestry in Colonial Java'.
4. Despite fleeting reference to the standard texts on Continental forest history, such as Fernow, *A Brief History of Forestry* and Heske, *German Forestry*, there has been no attempt, whatsoever, to draw on the historical literature on Continental forestry.

15. See R. Guha, 'Forestry in British and Post-British India: A Historical Analysis', in *Economic and Political Weekly* (29 Oct. and 5-12 Nov. 1983); and *The Unquiet Woods*; R. Guha and M. Gadgil, *This Fissured Land: An Ecological History of India*, Delhi, 1992; F. Hughes, 'Conflict over Use of Forest Resources in the Lower Tana River Basin of Kenya', in R. Grove and D. Anderson (eds), *Conservation in Africa: People, Politics and Practice*, Cambridge, 1987; R. Tucker, 'The Depletion of India's Forests under British Imperialism: Planters, Foresters and Peasants in Assam and Kerala', in D. Worster (ed.), *The Ends of the Earth*, Cambridge, 1990; M. Adas, 'Colonisation, Commercial Agriculture and the Destruction of the Deltaic Rainforests of British Burma in the Late Nineteenth Century', in J.P. Tucker and J.F. Richards (eds), *Global Deforestation and the Nineteenth Century World Economy*, Durham, 1983; J.P. Richards and McAlpin, 'Cotton Cultivating and Land Clearing in the Bombay Deccan and Karnatak: 1818-1920', in Tucker and Richards, *Global Deforestation*; R. Tucker, 'The British Colonial System and the Forests of the Western Himalayas 1815-1914', in Tucker and Richards, *Global Deforestation*; and D. Anderson, 'Managing the Forest: the Conservation History of Lembus, Kenya, 1905-63', in Grove and Anderson, *Conservation in Africa*.

16. The word 'Germany' is used here to designate German-speaking Central Europe, including the German client states of the Holy Roman Empire, the Hapsburg dominions and most of the Swiss cantons.

17. H.C. Recktenwald, 'Cameralism', in J. Eatwell, Murray Milgate and Peter Newman (eds), *The New Palgrave: A Dictionary of Economics*, vol. 1, London, 1987, 313-14.

18. Lowood, 'The Calculating Forester', 315-16.

19. Ibid. See also, Heske, *German Forestry*, 18-30.

20. Fernow, *A Brief History of Forestry*, 83. Among the earliest such works was W. Gottfried von Moser's, *Grundsätze der Forstökonomie*, published in 1757. The earliest forestry school was set up by H.D. Van Zanthier in the Hartz forest in 1763. Mantel, 'History of the International Science of Forestry', 14.

21. Important among the Holzgerechte Jäger were J.G. Beckmann and J.J. Büchting. The leading Kameralisten in government were J.F. Stahl, J. Pfeiffer, J. von Hazzi and H. von Brocke, and in the universities were Beckmann (who joined the University of Göttingen), J.J. Trunk and J.H. Jung (also named Stilling). Mantel, 'History of the International Science of Forestry', 30.

22. Lowood, 'The Calculating Forester', 323.

23. Ibid., 324-5. See also Heske, *German Forestry*, 26-30.

24. Lowood, 'The Calculating Forester'.

25. Beckmann, who wrote an influential work, *Anweisung zu einer pfleglichen Forstwirthschaft* in 1759, was the person who, in his 1763 work, *Beyträge zur verbesserung der Forstwissenschaft*, first used the word *Forstwissenschaft*.

26. Fernow, *A Brief History of Forestry*, 87.

27. Lowood, 'The Calculating Forester', 325. Also, Heske, *German Forestry*,

30-1. For a detailed description of Beckmann's method, see August Bernhardt, *Geschichte des Waldeigenthums der Waldwirthschaft und Forstwissenschaft in Deutschland*, Berlin, 1972-5, 2188-90.

17. Other important foresters of this genre were G.H. Werner, K.W. Hennert, J.H.L. Wiesenhavern and G. König. Mantel, 'History of the International Science of Forestry', 32.
18. Lowood, 'The Calculating Forester', 326-8. See K.C. Oettelt, *Practischer Beweis, dass die Mathesis bey dem Forstwesen unentbehrliche Dienste thue*, Eisenach, 1765, 1786, 1798 and 1803; and J.E. Vierenklee, *Mathematische Anfangsgründe der Arithmetik und Geometrie, in so fern solche denjenigen, die sich dem höchstnötigen Forstwesen auf eine vernünftige und gründliche Weisewidmen wollen, zu wissen nöthig sind*, Leipzig, 1767, 1797 and 1822.
19. Lowood, 'The Calculating Forester', 329.
20. J.L. Heilbron, 'Introductory Essay', in Frängsmyr, Heilbron and Rider, *The Quantifying Spirit*, 15.
21. Lowood, 'The Calculating Forester', 329. See also Heske, *German Forestry*, 31.
22. Mantel, 'History of the International Science of Forestry', 16. See H. Cotta, *Systematische Anleitung zur Taxation der Waldungen*, Berlin, 1804; *Naturbeobachtungen über die Bewegung und Function des Saftes in den Gewächen, mit vozüglicher Hinsicht auf Holzpfanzen*, Weimar, 1806; *Anweisung zum Waldbau*, Dresden, 1817; *Anweisung zur Forst-Einrichtung und Abschätzung*, Dresden, 1920; and *Grundriss der Forestwissenschaft*, Dresden, 1832; G.L. Hartig, *Anweisung zur Holzzucht für Förester*, Marburg, 1791; *Anweisung zur Taxation der Forste, oder zur Bestimmung des Holzertrags der Wälder*, Giessen, 1795; *Grundsätze der Forstdirection*, Hadamar, 1803; *Lehrbuch für Förster und die es werden wollen*, Tübingen, 1808; F.W.L. Pfeil, *Über die Ursachen des schlechten Zustandes der Foresten, und die allein möglichen Mittel, ihn zu verbesseren . . .*, Züllichau and Freistadt, 1816; *Vollständige Anleitung zur Behandlung, Benutzung und Schätzung der Forsten. Enn Handbuch . . .*, Züllichau and Freistadt, 1820-1; *Grundsätze der Forstwirthschaft in Bezug auf die Nationalökonomie und die Staatsfinanz-Wissenschaft*, Züllichau and Freistadt, 1922-4; *Neue vollständige Anleitung zur Behandlung, Benutzung und Schätzung der Foresten. Ein Handbuch für Forstbesitzer und Forstbeamte*, Berlin, 1929-33; *Die Forstwirtschaft nach rein praktischer Ansicht . . .*, Leipzig, 1831; *Die Forstpolizeigesetze Deutchlands und Frankreichs nach ihren Grundsätzen, . . .*, Berlin, 1834; J. Hundeshagen, *Encyclopädie der Forstwissenschaft systematisch abgefasst*, Tübingen, 1821; and C.J. Heyer, *Die Waldertragsregelung*, Giessen, 1841; *Anleitung zu forststatischen Untersuchungen*, Giessen, 1846; *Der Waldbau oder die Forstproduktenzucht*, Leipzig, 1854.
23. Lowood, 'The Calculating Forester', 330. See also Cotta, *Anweisung*, IV.
24. Lowood, 'The Calculating Forester', 331. See also Cotta, *Anweisung*, 8.
25. Mantel, 'History of the International Science of Forestry', 16.
26. Lowood, 'The Calculating Forester', 332. See also Fernow, *A Brief History of Forestry*, 73-7.
27. This literature developed simultaneously in Germany and France

Important among the forest botanists were H.L. Duhamel du Monceau, J.G. Gleditch, J.F. Enderlin, F.A.L. von Burgsorf, J.D. Reitter, F.A.J. von Wangenheim, J.M. Bechstein and M.B. Borkhausen. Mantel, 'History of the International Science of Forestry', 31.

28. Lowood, 'The Calculating Forester', 333. See also J.W. Hossfeld, 'Beantwortung der Frage: wei viél Mathematik auf einer Forstakademie gelehrt werden müsse?', *Diana*, 4 (1816), 230-78, 260.
29. Lowood, 'The Calculating Forester', 334. See also Hartig, *Grundsätze*, 47.
30. Lowood, 'The Calculating Forester', 333-5. Also, Cotta, *Anweisung*, 79-80.
31. Lowood, 'The Calculating Forester', 335-7. Also, Hartig, *Grundsätzel*, 64; and Hossfeld, 'Vollständiges System zur Taxation der Hölzer und Regulierung der Forste', *Diana*, 3 (1805), 108.
32. Lowood, 'The Calculating Forester', 337-40. Also, Hartig, *Grundsäte*, 64; and Cotta, *Anweisung*, 102, 104.
33. Lowood, 'The Calculating Forester', 339-40.
34. Ibid., 340-1.
35. Heske, *German Forestry*, chs 9-12, 120-61.
36. S.R. Rajan, 'Imperial Environmentalism: The Agendas and Ideologies of Natural Resource Management in British Colonial Forestry Community 1800-1950', Ph.D. thesis (unpublished), University of Oxford, 1994, ch. 2.
37. Ibid., 174.
38. Ibid., 173. The scientific document cited was Stahl's *Allgemeines occonomische Forstmagazin*.
39. Fernow, *A Brief History of Forestry*, 53.
40. Heske, *German Forestry*, 173.
41. Ibid., 176. The first experimental stations were set up in nine forests in Saxony between 1862 and 1869 by Dr Ebermayer, a professor at the University of Munich.
42. Recktenwald, 'Cameralism', 313.
43. Heske, *German Forestry*, 26.
44. Lowood, 'The Calculating Forester', 319.
45. Heske, *German Forestry*, 244.
46. Ibid., 244.
47. Ibid.
48. Ibid.
49. Fernow, *A Brief History of Forestry*, 52-3.
50. Lowood, 'Patriotism, Profit, and the Promotion of Science', 280.
51. Ibid., 278.
52. Schlich, *A Manual of Forestry*, vol. 1, 2-3.
53. See Fernow, *A Brief History of Forestry*, 215-18; Pincetl, 'Some Origins of French Environmentalism', 81; and C. Glacken, *Traces on the Rhodian Shore: Nature and Culture in Western Thought From Ancient Times to the End of the Eighteenth Century*, Berkeley, Califo, 1967, 491-4.
54. Mantel, 'History of the International Science of Forestry', 23.

55. Ibid., 23.
56. Pincetl, 'Some Origins of French Environmentalism', 81.
57. Mantel, 'History of the International Science of Forestry', 24.
58. Ibid. See also G. Vaggi, 'Physiocrats', in J. Eatwell et al., *The New Palgrave*, vol. 3, 869–76.
59. Mantel, 'History of the International Science of Forestry'.
60. Pincetl, 'Some Origins of French Environmentalism', 81.
61. Ibid., 82.
62. These schools were established by Napoleon Bonaparte in the early nineteenth century.
63. Pincetl, 'Some Origins of French Environmentalism', 84. See also, Lowood, 'Patriotism, Profit, and the Promotion of Science', 10.
64. Pincetl, 'Some Origins of French Environmentalism', 82.
65. Instruction at Nancy under Lorentz was based on the principles advocated by Hartig. Again, Parade had studied under Cotta in Tharandt. Mantel, 'History of the International Science of Forestry', 27. See also Pincetl, 'Some Origins of French Environmentalism', 83.
66. Mantel, 'History of the International Science of Forestry', 26.
67. Pincetl, 'Some Origins of French Environmentalism', 83.
68. Ibid.
69. Pincetl, 'Some Origins of French Environmentalism', 82, citing Bernard Kalaora and Antoine Savoye, *La Forêt Pacifiée, Les Forestiers del' École LePlay, Experts des Societés Pastorales*, Paris, Editions l'Hermattan, 1986, 17.
70. Pincetl, 'Some Origins of French Environmentalism', 82.
71. Ibid., 82.
72. Mantel, 'History of the International Science of Forestry', 27–8. See also Glacken, *Traces on the Rhodian Shore*, ch. 14.
73. Mantel, 'History of the International Science of Forestry', 82.
74. Ibid., 82, citing Larrère, M.C. Brun B. Kalaora, Nougrarède and Poupardin, 'Les reboisements en montagne depuis l'empire, 1860–1946', *Actes du Symposium International*, Tome 1, 254–78.
75. Pincetl, 'Some Origins of French Environmentalism', 83.
76. Ibid., 82, also 89. Important among the those who supported forestry included the Impressionist painters Théodore Rousseau and Camille Carit, who founded the Societé des Amis de la Forêt.
77. Pincetl, 'Some Origins of French Environmentalism', 84–6.
78. Of particular utility here is the ideal-type of 'profession' and 'professionalism' developed by sociologists who have attempted to characterize the concept by identifying traits common among different professions. Sociologists following such an approach have defined a profession as a full-time vocation marked by the following characteristics: the possession of skill based on systematic, theoretical and esoteric knowledge; the provision of exacting and specialized training; procedures for testing and certifying the competence of members; organizations, often self-regulating and state-sanctioned, to enforce standards, maintain a stru

sense of corporate identity and exert a degree of monopoly and adherence to the norm of altruistic, though remunerated, service to clients and to society at large. Professions, they argue, existed in part to deal with the 'vital practical affairs of the general public and of individual lay clients, via the application of esoteric knowledge'. J. Morell, 'Professionalisation', in R.C. Olby et al. (eds), *Companion to the History of Modern Science*, London, 1990, 981. The reason for using this definition of professionalism and not any other is purely heuristic: it eminently suits the analysis being carried out in this section. The question of the *type* of professional community the colonial foresters constituted is a topic of discussion in its own right and is beyond the scope of this thesis.

79. *Dictionary of National Biography*, 1901–17, 217–18. See also, A. Rawat, 'Brandis: The Father of Organised Forestry in India', in A. Rawat (ed.), *Indian Forestry: A Perspective*, New Delhi, 1993.

80. D. Brandis, 'Progress of Forestry in India', *Transactions of the Scottish Arboricultural Society*, 10, 3 (1994), 16–17.

81. Ibid., 25–6.

82. Ibid., 15–16.

83. Ibid., 15.

84. Carving information on pieces of bamboo ensured that it would not be erased in the event of rain or dew. D. Brandis, *Report on the Pegu Teak Forests, 1857-60*, Calcutta, 1861. See also A. Rawat, 'Brandis', 86–7.

85. Brandis, *Report on the Pegu Teak Forests*. See also C. Dawkins, 'Sylviculture in the Tropical Rain Forest: An Historical Analysis of Success and Failure' unpublished manuscripts, 31–3.

86. Dawkins, 'Sylviculture in the Tropical Rain Forest', 31.

87. See Rawat, 'Brandis', 86–9; Dawkins, 'Sylviculture in the Tropical Rain Forest', 33.

88. Dawkins, 'Sylviculture in the Tropical Rain Forest', 27. Methods of treatment included climber-cutting, the felling of irreversibly strangled trees and the cutting of 'gross-impeders' and 'otherwise undesirable trees'.

89. Ibid., 28.

90. Ibid.

91. Brandis, *Report on the Pegu Teak Forests*. See also Rawat, 'Brandis', 93.

92. M. Buchy, 'Quest for a Sustainable Forest Management: A Study of the Working Plans of North Canara District (1890-1945)', in Rawat, *Indian Forestry*, 141–62.

93. F. Ribbentrop, *Forestry in British India*, Calcutta, 1900, 126–34.

94. Ibid., 134–42; 166–204.

95. Ibid., 145–66.

96. Ibid., 142–5.

97. D. Brandis, 'Progress of Forestry in India', *Indian Forester*, 10 (1884), 100.

98. Schlich was born in 1840 and educated at Darmstadt, Karlsruhe, and the University of Giessen, where he took a Ph.D. in 1866, the year

he was appointed to the Indian Forest Service. In April 1881 he succeeded Dietrich Brandis as the Inspector-General of forests to the Government of India, and was responsible for the organization of the Imperial Working Plans branch, which ensured the preparation of working plans on approved lines and their scrutiny by a central authority. He was the first Honorary Editor of the *Indian Forester*, a professional journal started in 1875. In February 1885 he was appointed to organize the forestry branch of the Royal Indian Engineering College at Coopers Hill where he trained candidates for the Indian Forest Service until 1905 when under his recommendation, the forestry branch moved to Oxford. While head of forestry at Coopers Hill and Oxford, he was responsible for training no less than 272 of the 283 officers who joined the Indian Forest Service during that period. Although he retired from his Oxford professorship in 1920 he continued to be actively involved in forestry until his death in 1925. R.S. Troup, 'Schlich, Sir William', in *Dictionary of National Biography, 1922-1930*, Oxford, 1937.

99. Its influence was in fact wider. See Ralph Sheldon Hosmer, 'Progress of Education in Forestry in the U.S.', *Empire Forestry Journal*, 2, 1 (April 1923), 83–106, where an American forester has claimed that it was the basic textbook in forestry in the US.
100. Government of India, *A Concise Manual of Sylviculture, for the Use of Forestry Courses in India*, Calcutta, 1906.
101. Schlich, *A Manual of Forestry*, vol. 1, 6. See pages 5 and 6 for the various definitions of 'forest.'
102. Ibid., 50–1.
103. Ibid., 99–100.
104. Schlich, *A Manual of Forestry*, vol. 2, London, 1891.
105. Schlich, *A Manual of Forestry*, vol. 3, London, 1895.
106. Schlich was also influenced by what was going on in German forestry at that time. Of particular importance was the school of forestry that emerged in the last quarter of the nineteenth century under the direction of Karl Gayer, professor of silviculture in Munich. While it was very much within the general tradition of German forestry, it was opposed to monocultures and argued for forestry based on mixed forests and in accordance with the biological laws of nature. Gayer's school was called the 'Back to Nature' movement. Heske, *German Forestry*, 40. While Gayer's influence is evident in Schlich's discussion of the advantages of mixed forests (vol. 1, 180-3), he is by no means an unqualified advocate of the 'Back to Nature' approach. He argues, for example, that 'pure woods are more easy to manage than mixed woods (vol. 1, 178).
107. The books were on forest protection and forest utilization, respectively, originally written by two contemporary German foresters, Dr Hess and Dr Karl Gayer.
108. See ch. 2 of Rajan, 'Imperial Environmentalism: British Colonial Forestry'.
109. See, for example, Brandis, 'The Utilization of Less Valuable Woods in

the Fire-protected Forests of the CP, by Iron making', *Indian Forester* (hereafter *Ind. For*, 5, 2 (1880), 222.

110. Almost every issue of *Indian Forester* during this period had an article or two on wild animals marauding into agricultural terrains, and occasionally, on maneating cats. The hunt was a major sporting pastime for foresters and their families. See M.M. Ledzion, *Forest Families*, London, 1991.

111. G.P. Marsh, *Man and Nature*, Madras, 1882.

112. D. Lowenthal, *G.P. Marsh – Venerable Vermonter*, New York, 1978, 261.

113. Marsh, *Man and Nature*, 279.

114. R. Nash, *The Rights of Nature*, Madison, 1989, 54–8.

115. Anon. 'Extracts from G.P. Marsh', *Ind. For*, 9, 2 (1884), 82.

116. A number of books written by Indian foresters in the period 1900–20 were dedicated to, or made glowing references to, leading American conservation figures. See, for example, T. Weber, *The Forests of Upper India*, London, 1910, a book dedicated to Theodore Roosevelt for his support of forestry. See also Sainthill Eardley-Wilmot, *Forest Life and Sport in India*, London, 1911, again dedicated to Theodore Roosevelt 'Forester and Naturalist in admiration of his success in the conservation of the natural resources of his country'.

117. Schlich, *A Manual of Forestry*, vol. 1, 95.

118. Ibid., 89–96.

119. Rajan, 'Imperial Environmentalism: British Colonial Forestry', ch. 2.

120. See Rajan, 'Imperial Environmentalism: British Colonial Forestry', ch. 2.

121. Ribbentrop, *Forestry in British India*, 73.

122. R. Guha, 'An Early Environmental Debate: The Making of the 1878 Forest Act', *The Indian Economic and Social History Review*, 27, 1 (1990), 75.

123. D. Brandis, cited in Guha, ibid., 67.

124. Ribbentrop, *Forestry in British India*, 109.

125. Ibid., 114.

126. 'Punjabi', 'Goats in the Forest', *Ind. For*, 2, 1 (1877), 86.

127. E.P. Stebbing, *The Forests of India*, vol. 1, London, 1922, 462.

128. Ibid., vol. 2, 235.

129. They often quoted well known scientific experts to establish their points. See, for example, J.Mc Kee, 'On Grazing', *Ind. For*, 1, 1 (1875), 100, which quotes Darwin on the evils of cattle-grazing.

130. B.H. Baden-Powell, 'Forest Conservancy in Its Popular Aspect', *Ind. For*, 2, 1, 1–15.

131. I am indebted to an unpublished paper on 'The Myth of the Environmentally Profligate Native' by Richard Drayton for the term 'environmentally profligate'.

132. Rules 2, 7, 8 and 9, Section 75 (a), Indian Forest Act.

133. Baden-Powell, 'Forest Conservancy', 10.

134. Ibid., 1.

135. Ibid., 11.

136. As of 1901, for example, a Collector, the chief civilian official, with a charge of approximately 10,000 square miles earned a monthly salary of Rs 1800-2325. A Conservator, the chief forestry official, with the change of 6-8 Collectorates and with 5000-6000 square miles of forest, however, earned Rs 1200-1600. F. Gleadow, 'Translator's Conclusion', in A. Me'lard, *Insufficiency of the World's Timber Supply*, trans. and applied to India by F. Gleadow, Allahabad, 1901, 39.
137. Gleadow, 'Translator's Conclusion', 38-9.
138. In addition, civilian officials were generally more interested in agriculture than forests. As late as 1894 orders from the Government of India stated that 'the claims of cultivation are stronger than the claims of forest preservation – whenever an effective demand for culturable land exists, and can only be supplied from forest areas, the land should ordinarily be relinquished without hesitation', Government of India, Resolution 22F, 19 Oct. 1894.
139. E. Whitcombe, *Agrarian Conditions in Northern India, Volume 1: The United Provinces under British Rule 1860-1900*, Berkeley, 1972, 99-100.
140. See, for example, Ribbentrop, *Forestry in British India*, 204-15. See also Stebbing, *The Forests of India*, vols 1-3.
141. James, *A History of English Forestry*, Oxford, 1981, 191-205.
142. Brandis, 'Progress of Forestry in India', 25.
143. J.G. Gunnell, 'The Technocratic Image and the Theory of Technocracy', in *Technology and Culture*, 23, 3 (1982), 392.
144. Ibid., 397. See also L. Winner, *Autonomous Technology: Technics-out-of-control as a Theme in Political Thought*, Cambridge, 1987, 133-72.
145. Of the total land mass of 944, 923 square miles under the British in India by the end of 1881-2, the Forest Department directly controlled 117, 648 square miles and had some say in the management of another 476, 664 square miles of private and other forest lands. The area under cultivation was 350, 611 square miles. Ribbentrop, *Forestry in British India*, 121.
146. See, for example, T.P. Ofcansky, 'Kenya Forestry under British Colonial Administration, 1895-1963', *Journal of Forest History*, 28 (July 1984); E.O. Egboh, 'British Control of the Forests of Lagos Colony and Protectorate, 1897-1902', *Journal of Afrıcal Studies*, 6, 2 (1979); and 'Background to the Forestry Legislation in Lagos Colony and Protectorate, 1897-1907', *Journal of the Historical Society of Nigeria*, 9 (1978), 45-69; L.T. Carron, *A History of Forestry in Australia*, Australia, 1985; T.R. Sim, *Forests and Forest Flora of the Cape Colony*, Aberdeen, 1907, 84-92.
147. See, for example, T.P. Ofcansky, 'Kenya Forestry under British Colonial Administration, 1895-1963', *Journal of Forest History*, 28 (3), (1984), 136-43. Also R.H. Grove, 'Chiefs, Boundaries and Sacred Woodlands: Early Nationalism and the Defeat of Colonial Conservationism in the Gold Coast and Nigeria, 1870-1916', unpublished paper, 1993.
148. M. Williams, *Americans and Their Forests: A Historical Geography*, Cambridge, 1989, 395.

149. See ibid., 395–465. Gifford Pinchot, a major figure in the American forestry movement, had been greatly influenced by Dietrich Brandis and, on his suggestion, had studied forestry at the Nancy forest school. G. Pinchot, *Breaking New Ground*, New York, 1947. It is important to note that the American forestry tradition was not influenced by the writings of George Perkins Marsh until early in the twentieth century.
150. Williams, *Americans and Their Forests*, 416–21.
151. L. Mumford, *Technics and Civilization*, London, 1934.
152. M. Adas, *Machines as the Measure of Men: Science, Technology, and Ideologies of Western Dominance*, Ithaca, 1989.
153. See especially Guha, 'Forestry in British and Post-British India', *The Unquiet Woods*; Guha and Gadgil, *This Fissured Land*.
154. D.R. Headrick, *The Tentacles of Progress: Technology Transfer in the Age of Imperialism*, Oxford, 1988, 5.
155. See M. Rangaraja.., 'Forest Policy in the Central Provinces 1860–1914', Ph.D. Thesis, Oxford, 1992, for a discussion of this problem.
156. See for e.g. R.H. Grove, 'Early Themes in African Conservation: the Cape in the 19th Century', where he encompasses in one contiguous explanation the emergence not only of forestry regimes but of concern with species extinction and the enactment of laws on animal conservation across the nineteenth century.
157. For a discussion of the post-World War I scenario, see my doctoral dissertation, 'Imperial Environmentalism: British Colonial Forestry', esp. chs 4–5.