

Commercialisation of Forests, Timber Extraction and Deforestation in Uttaranchal, 1815-1947

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Abstract: *This article discusses the process of deforestation during the nineteenth century and the first half of the twentieth century in Uttaranchal. Deforestation in this article is not only identified in terms of the declining vegetational cover but also as extracting more wood than the regenerative capacity of forests. Unsustainable extraction of forest resources does not directly lead to denudation, but to a slow degradation not likely to be apparent until a long time. Thus deforestation has also been linked to the production of wood - a connection which has not yet been carefully analysed by scholars. An analysis of wood production will not only help in historicising the process of deforestation but also in identifying various factors responsible for it. We have analysed in three phases, the extent of wood extraction, which intensified since the late nineteenth century. An attempt has been made to study the changing nature of demand for forest produce. We have discussed how new demands emerged and thereby increased the pressure on forests.*

Also discussed is the argument that the forest department's management of reserved forests was far from sustainable. The felling prescriptions of the Working Plans, based on questionable data, were frequently violated by foresters for economic exigencies. The result was degradation and denudation of timberlands.

Keywords: deforestation, timber, firewood, railways, regeneration, commercialisation, sustainability.

INTRODUCTION

ALTHOUGH HISTORIANS in India have shown an increasing interest in environmental history in recent years, there are only a few works which seriously

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Conservation and Society, Pages 110 - 133

Volume 3, No. 1, June 2005

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examine deforestation.¹ Any discussion on forest policy and ecological changes will be incomplete without taking into account the changes in area under forests. This article is an attempt to explore the historical roots of deforestation in Uttarakhand.² In the discussion on deforestation, the growth of timber output is taken for granted and is not treated as a subject for analysis. Conventionally, the conversion of woodlands to other land uses has been seen as the only index of deforestation. This approach finds the expansion of arable land as being primarily responsible for deforestation and ignores the fact that extracting more wood than the regenerative capacity of forests leads to slow degradation, which consequently results in denudation in the long run. Thus deforestation in this article is not only identified in terms of the declining forest cover, but also in the function of extracting more wood than the reproductive capacity of forests. In this respect, the forest department's claim of managing the reserved forests on a 'sustainable' basis is questioned.

In this article, I first discuss the extent of wood extraction in three separate phases, then examine various demands made on forests and finally to examine whether this increased extraction of wood did indeed lead to deforestation.

Study Area

Uttarakhand mostly comprises hilly terrain (with the exception of the Terai and plain areas of Dehradun and Haridwar districts) within the Western Himalaya. The Terai, a narrow flat belt running along the southern border of the hills, separates the region from the great Gangetic plain. Until the early twentieth century, the Terai was mainly swampy and malarial, and thus largely uninhabited (Atkinson 1982) and constituted large grassy plains with limited patches of *sal* (*Shorea robusta*). North of the Terai is the Bhabar, a dry 5-8 km wide belt, which merges into the sub-Himalayan tracts. The sub-Himalayan ranges have an elevation up to 1200 meters and are dominated by *sal*, *khair* (*Acacia catechu*), *sain* (*Terminalia tomentosa*), *sissu* (*Dalbergia sissoo*), etc. The main Himalaya rises up to about 8,000 meters. The middle altitudes are dominated by *chir* (*Pinus roxburghii*) and *banjo* oak (*Quercus leucotrichophora*); other species are *deodar* (*Cedrus deodara*), *kharsu* (*Quercus semecarpifolia*), silver fir (*Abies pindrow*), etc. At higher altitudes is the alpine zone with few trees. These mountains are fed by rivers, whose valleys provide fertile land for wet cultivation. Dry land farming is carried out on the gentler slopes of mountains through terracing.

Uttarakhand was ruled by two dynasties for centuries till the Gorkhas replaced them. The brief period of Gorkha rule came to an end with the Anglo-Gorkha war in 1815. The British extended control over the region, except in the area west of river Alaknanda, which was handed over to the descendent of the last Raja of Garhwal, who ruled from Tehri. The population of the hills was constituted predominantly of peasant proprietors cultivating their own small holdings and who were heavily dependent on forests for their subsistence.

The British initially continued the pre-colonial policy towards forests, confining the role of the state only to the collection of certain forest dues along the foothills. As forests gained importance by the late 1840s due to the increased demand for timber and firewood, the government took over. In 1858, all forests were placed under the Commissioner of Kumaun. The Forest Acts of 1865 and 1878 facilitated the extension of control over these forests. In 1879, large tracts of sub-Himalayan forests were reserved. In these reserved forests, the rights of local people were redefined: they were granted only limited rights that were recorded and specified in the forest settlement. In 1893, all unassessed land outside the reserved forests was constituted as the District Protected Forests (DPF) to be managed and regulated by the Deputy Commissioner. Restrictions were imposed on cutting of certain species and on the clearance of any land for cultivation in the DPF. A large part of the DPF—5,298 out of 14,760 km² (36 per cent)—was declared reserved in 1911. The extension of control over a large forest area facilitated the commercial exploitation of forest land. People resented state control over forests and their protest culminated in the forest agitation of 1921-22 (Guha 1989; Dangwal 1999).

The Growth of Wood Extraction and Timber Trade

Wood extraction has increased over time from the early colonial period to 1947. Three phases are clearly discernible. In the first phase, timber extraction for trade had not acquired great significance, and some submontane forests were merely being exploited. In the second phase, beginning with the establishment of the forest department in 1864 and passing of the Forest Act in 1865, state control over forests was strengthened and most of the forests were made available for exploitation. This led to the rapid growth of extraction of timber. The third phase began with the First World War when the nature of the demands made on forests was changing. These three phases are discussed individually.

The First Phase, 1815-1865

The Himalayan forests always provided a variety of products for trade both within and outside the region. Singh (1991) suggests that even during the medieval period, herbs, tubers, dyes, gums, timber, firewood, etc. were extracted for trade, though the volume was small. Trade in bulky items like timber and firewood was limited as their transportation was difficult due to the nature of the terrain. The situation changed in the nineteenth century when the region was integrated into the colonial economy and the demand for forest products increased.

In the early 19th century, trade in forest products in general and timber in particular, was confined to the Terai-Bhabar region and the outer hills. Statistics in terms of the volume of trade are not available, but the collection of duty on the export of forest products is indicative of the trend. The collection (excluding pasture dues) increased from Rs 6,302 in 1822-23 (Traill 1878) to Rs 6,958 in 1833 (Batten

1878a) and Rs 13,668 in 1846-47 (Batten 1878b). These nominal figures thus show stagnation in the 1820s and 1830s. This was partly because of the price depression and stagnation of the trade around this time in northern India (Siddiqi 1973). By the 1840s when the depression ended, the timber trade seemed to have picked up. Officials then began to feel that the contractors, who had leases of duty collection along the foothills, were getting good returns without the state getting an adequate share from it. This view prompted the takeover of duty collection and supervision of the extraction of forest produce by the state.³

At this point, the state began to claim a direct stake in the growth of the timber trade for two reasons: first, it was generating revenue; second, wood was required extensively for public works. As conveyance was the main hindrance in exploiting forests, the state strove to improve accessibility by building roads. This brought a large number of traders to the submontane tracts. So intense was the tree-felling activity that the large number of trees could not be transported out and were left to rot or be burnt in the forests (Atkinson 1982).⁴ As the demand grew, forests in the interior hills were also brought into the trade network. An English businessman Wilson had secured the lease of the forests of the Tehri kingdom and was floating timber down the Bhagirathi to railway depots as well as to markets in the plains.⁵ This growth is reflected in the increased revenue: between 1858 and 1867 the net revenue from forest reached Rs 1.5 million.⁶

Thus, by the middle of the 19th century, forests of the submontane tracts as well as some forests of the interior (the Bhagirathi, Yamuna and Alaknanda valleys) were slowly opened up for increased timber extraction. This process intensified in the late 19th century when the forest department extended its control over a larger territory.

The Second Phase, 1865-1913

By the 1870s and 1880s, when the demand for timber further rose, the forest department began searching for more timber-producing areas and started building roads to reach them. Hence forests were surveyed to estimate their resources. Henry Ramsay, the Commissioner of Kumaun, produced a report on the forests of submontane tracts in 1861; he identified rich *sal* forests and recommended the construction of roads to them.⁷ The government later deputed T.W. Webber, who was in charge of the construction of the road to Naini Tal, to survey hill forests with the objective 'to determine the position of all forests, and ascertain what extent existed within reasonable distance of land and water carriage'. He found rich and dense forests, spread over approximately 24,000 km², though many of them appeared to him 'valueless' as they were 'impenetrable' and 'inaccessible' (Webber 1902: 25, 38, 42-3). G.F. Pearson, the Conservator of Forests, North-Western Provinces, and Dietrich Brandis, who later became the first Inspector General of Forests in India, were also asked to investigate these forests.⁸ These surveys underlined the fact that there were extensive forests that needed to be made accessible for exploitation.

Roads and slides

There were a few instances of floating down timber, but large scale timber operations required roads.⁹ The forest department thus spent considerable money on the construction of roads. In 1860 alone, Rs 45,670 was earmarked for this.¹⁰ The Bhagirathi valley had rich *deodar* forests so the project of constructing a road of about 214 km linking Gangotri (near the source of the Ganges) to the plains was taken up. In 1869-70 and 1870-71, Rs 100,000 was spent on this road.¹¹ Similarly a 54 km road from Deoban to the river Tons below the rich Mundhol forests was built.¹² The process of road construction continued through the late nineteenth century until the twentieth century (Guha 1989).

Roads alone were not enough in the mountains, and so construction of slides was also taken up to speed up operations. Slides were also to save time and labour, the latter was difficult to procure, particularly in the winter. Many slides were constructed in Jaunsar forests of Dehra Dun district mainly to carry railway sleepers.¹³ Rivers were also surveyed to examine their suitability for floating timber. The obstructions to the smooth flow in the rivers were removed by blasts.¹⁴

By the end of the nineteenth century, a large part of the forests in Uttaranchal was made accessible, opening them up for timber extraction. The construction of roads itself is destructive to forests, but more than that, these roads opened up forests for further destruction (Guha 1989; Rangarajan 1996).

Timber extraction

Once potential timber-producing areas were identified and made approachable, timber extraction grew rapidly. Thus from the submontane tracts of Kumaun and Garhwal on an average 13,959 trees were felled annually in the 1870s.¹⁵ If the figures of Dehra Dun and the inner Himalaya are added, then the total number of trees felled annually during the 1870s in Uttaranchal would be in the range of 25 to 30,000.¹⁶ By the 1880s, the number of trees cut annually had increased significantly. Between 1880-81 and 1884-85 on an average 65,936 trees were felled annually in Uttaranchal,¹⁷ which was approximately double the average number of trees felled annually in the 1870s.

From the late 1880s, systematic data on the volume of timber and firewood extracted are available¹⁸ and shown in Table 1. This table indicates that timber turnout increased from 1.78 million cft in 1887-88 to 5.1 million cft in 1911-12 and 8.7 million cft in 1912-13. Reasons for the exceptionally high output in 1912-13 are not clear. In 1911-12 a large part of the DPF was reserved and the settlement of rights was to be carried out in these forests. People feared a loss of rights and therefore perhaps extracted large amounts of timber. Table 1, however, suggests that the timber turnout was increasing rapidly. The output of firewood on the other hand was relatively stable. From 3.5 million cft in 1887-88 it increased to 5.8 million cft in 1890-91 and then largely stabilised around these figures with occasional minor changes till 1912-13 (Table 1).

It would seem then, that timber production increased steadily from an average of 0.72 million cft annually in the 1870s to 1.58 million cft in the 1880s,¹⁹ 2.7-2.9 in the 1890s, to and around 4 to 4.5 million cft in the first decade of the twentieth century.

Table 1
Timber and Firewood Outturn in Uttarakhand, 1887-88 to 1912-13 (in 1000 cft)

| Year | Timber | Index | Firewood | Index | Total | Index |
|---------|--------|-------|----------|-------|-------|-------|
| 1887-88 | 1778 | 100 | 3509 | 100 | 5287 | 100 |
| 1890-91 | 2712 | 153 | 5831 | 166 | 8543 | 162 |
| 1894-95 | 1684 | 95 | 5876 | 168 | 7470 | 141 |
| 1901-02 | 2959 | 166 | 5680 | 162 | 8638 | 163 |
| 1908-09 | 4087 | 230 | 5877 | 168 | 9964 | 189 |
| 1910-11 | 4502 | 253 | 6032 | 172 | 10534 | 199 |
| 1911-12 | 5105 | 287 | 6228 | 178 | 11333 | 214 |
| 1912-13 | 8692 | 489 | 5402 | 154 | 14395 | 272 |

Note: To arrive at the figures of the outturn for Uttarakhand figures of the outturn of all Forest Divisions lying within Uttarakhand have been added. The figures, however, do not include the outturn of the non-leased forests of the Tehri Kingdom.

Source: *Annual Progress Reports of the Forest Department, UP*, for concerned years.

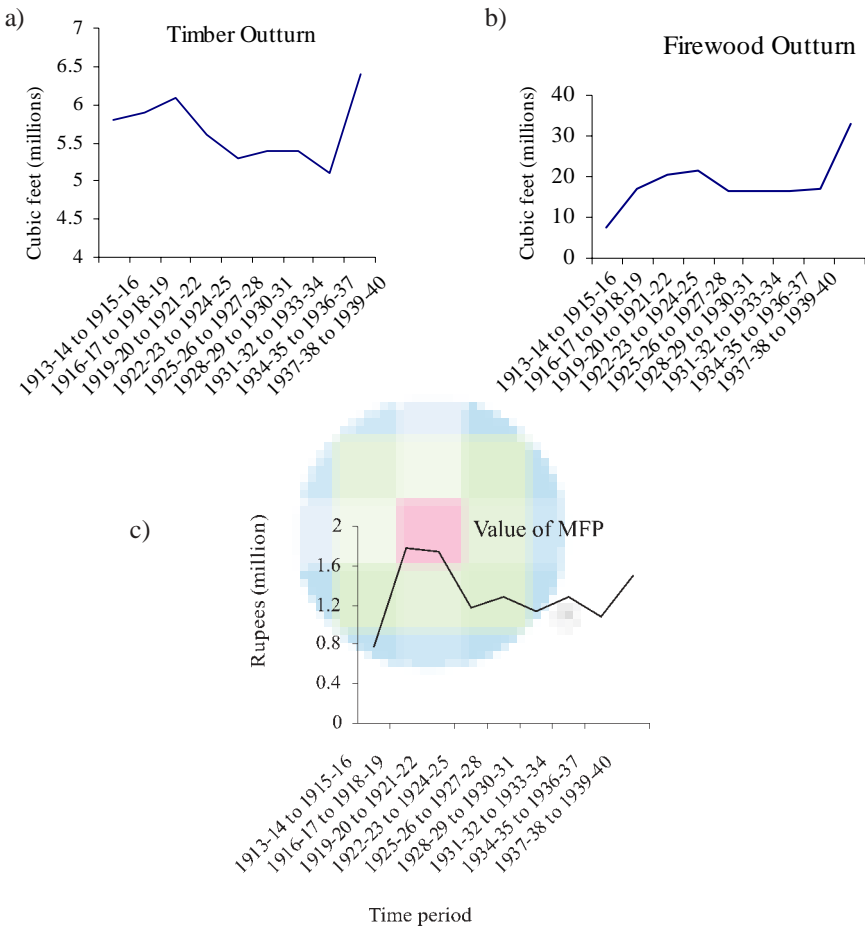
The Third Phase, 1913-1947

In the third phase, wood extraction started fluctuating rapidly under the impact of changes in demand and prices. This phase was dominated by the two World Wars and the world wide Economic Depression of 1929-32 (which resulted in the lowering of demand and fall in prices), these were events that defined the nature and magnitude of forest outturn. Industrial expansion also created new demands on forests.

The pattern of forest yield in Uttarakhand, from 1913-14 to 1939-40, is shown in Figure 1. Timber production slowly increased during the war and culminated during the period between 1919 and 1922 (Figure 1a). Subsequently, it declined and remained low from the mid 1920s to the mid 1930s, initially due to the crash in post-war timber prices and later due to the Great Economic Depression. The output however picked up in the late 1930s and culminated during the Second World War. Firewood yield saw a slightly different pattern (Figure 1b). Before the First World War, it was largely stable, grew rapidly during the War, peaked in the early 1920s, then declined and stabilised around 16.5 million cft for about a decade till the mid 1930s. After that it grew rapidly again in the late 1930s. The nominal value of the output of the ‘minor forest produce’ increased rapidly during the First World War, remained approximately the same immediately after the war (Figure 1c), declined and stabilised between Rs 1.17 and 1.28 million in the early 1920s to mid 1930s, and finally increased in the late 1930s.

Figure 1

(a) Timber, (b) firewood, and (c) minor forest produce in Uttaranchal from 1913 to 1940



Notes: Figures are averaged for three years. Figures were not available for 1924-25, 1925-26, 1929-30, 1931-32 & 1934-35, figures for the remaining years were used to calculate an average. Two forest circles, Kumaun and the Western circle, which largely covered the hills, were combined to derive the figures for Uttaranchal. Between 1912-13 and 1914-15 Haldwani Forest Division was in the Eastern circle of the Province. The outturn of this division is thus included in the figure of the Western circle only since 1915-16. All figures have been converted into million cft and million rupees.

Source: Annual Progress Reports of the Forest Department of United Provinces, concerned years.

Various factors affected the extraction of wood from forests. The First World War generated new demands for forest products thereby giving a boost to output, however, at the same time the war created a shortage of labour in the hills as many forest officials and local people joined the army (Stebbing 1983; Tucker 1988a). After the war the timber prices, particularly that of *chir* crashed, adversely affecting the yield. According to Osmaston, adoption of the new silviculture system that changed the felling cycles also led to a decline in output during the 1920s. The post-war low prices continued through the 1920s and the Great Economic Depression and well up to 1939 (Stebbing 1983).

For the Second World War, the *Annual Progress Reports of the Forest Department, UP*, do not provide the quantitative data on the volume of output in the hills. Data on the nominal value of the outturn show an increase from Rs 3.8 to 9.9 million (161 per cent) between 1940-41 and 1945-46.²⁰ The Working Plans, however, provide quantitative figures indicating a sharp increase in the yield. In the West Almora Forest Division, the timber output increased from 0.39 to 0.640 million cft between 1934-35 and 1942-43 and firewood from 4.38 to 10.19 million cft between 1933-34 and 1943-44.²¹ The timber outturn of the Dehradun forests increased from 0.6 to 2.4 million cft between 1939-40 and 1942-43 (Robertson 1946). Other forest divisions of Uttarakhand also registered similar growth (Coombs 1942).²²

The above discussion suggests that timber and firewood extraction started increasing rapidly from the mid-19th century. It peaked in the early twentieth century. The output remained low from the mid-1920s to the mid-1930s, and reached new heights during the Second World War.

The Nature of Demands and Pressures on Forests

It is difficult to single out any one or two factors that drained the forests most of their resources. Various pressures had worked on the forests: increased population both within and outside the region; and consequently the growing demand for timber and firewood; the demand for raw material and fuel by industries; and the demand for wood for sleepers and fuel by the railways. The forest department however always held people responsible for deforestation.²³ This view is supported by Tucker (1988a) and Rawat (1991), who however, do not attempt any analysis of the local or commercial demands on forests.

Local Demands

The growth of population in the hills slowly increased the pressure on forests. Between 1821-22 and 1901, the population of Garhwal and Kumaun increased from 289,000 to 10,43,593.²⁴ Although the population grew rapidly in the 19th century it was still sparsely distributed in the hills and their timber and firewood requirements were small. Brandis wrote in 1881 that 'population is as a rule scanty' and supply

of their requirements 'has not yet acquired any great practical importance'.²⁵ These requirements increased as the population grew during the first half of the 20th century; the population of Garhwal and Kumaun reached 1.75 million in 1951 (GOI 1951).

Villagers, however, got timber and firewood from the reserved and protected forests according to the prescriptions of the forest settlement. It was noticed in the hills that villagers often took less timber than granted to them under the forest settlement from the reserved forests.²⁶ An analysis of the figures of timber production shows that rightholders got less of the share in the total output. Between 1930-31 and 1939-40, an average of only 14.7 per cent of the timber produced in Uttaranchal was given to rightholders annually. On the other hand, firewood was mainly consumed locally; the share of rightholders was 86 per cent of the total output in the hills.²⁷ Local consumption of firewood increased as the population grew, but it is to be noted that figures of the firewood of rightholders are based just on estimates. It included dead, fallen and refuge wood; trees were rarely felled for firewood.²⁸ The local population, therefore, cannot be held responsible for degradation of the forests under the forest department.

The reliance of local people on unclassed or civil forests was, however, very high. If local consumption did lead to degradation of the civil forests it was largely because the increasing population was compelled to overuse them as their access to the reserved and protected forests was severely curtailed. If the demands existed more evenly, in a large area, the possibility of the degradation of civil forests would have been lower, if not averted.

Demands of Cantonments and Hill Stations

New emerging cantonments, hill stations and administrative centers created a marked pressure on the forests in their surroundings. Considerable amounts of wood was required for the construction of barracks and firewood requirements of troops. For instance, the Chakrata cantonment generated a significant demand for firewood for troops and timber for the construction of barracks. The average annual firewood consumption at Chakrata between 1870-71 and 1885-86 was 154,068 cft solid.²⁹ As the pressure increased on the surrounding forests,³⁰ the forest department took over the supply of firewood arguing that the private supply of firewood was resulting in a 'denudation of surrounding forests'.³¹ Similarly other cantonments and hill stations were also posing significant demands on the forests in their surroundings.

External Demands

The adjoining plains were also supplied timber and firewood from Uttaranchal forests. The shortage of timber and firewood in the plains was the result of large-scale deforestation in the early 19th century (Whitcombe 1971; Grove 1994; Flint

1998; Mann 1998). This kind of denudation forced traders to move up to the submontane forests, opening them up for large-scale timber extraction and even, as Wallich wrote, to 'wanton destruction'.³² In the late 19th century, this pressure increased further. A.O. Hume, Secretary Government of India, argued that timber operations in the hills helped to overcome timber scarcity in the markets of the North Western Provinces.³³

As industries began to grow in the country after the First World War, they began to pose increasing demands on forests for raw material and fuel. An increasing number of sugar factories in the United Provinces were drawing firewood from hill forests for fuel due to problems in obtaining coal from distant places.³⁴ Glass factories at Ferozabad alone consumed several wagons of firewood daily. Various forest divisions in the hills supplied charcoal for household purposes as well. Several other industries also drew raw material from the forests of Uttaranchal.³⁵

Demands of the Railways

However, it was the demand for sleepers and fuel by the railways that exerted constant and relentless pressure on the forests of Uttaranchal from the middle of the 19th century to the early 20th century. The railway system was potentially significant for imperial power, hence its expansion was accorded top priority and securing wood supply for this purpose was very important. Wooden sleepers were used to lay tracks. These were preferred to metal ones because they were light and easy to work with, and were cheaper, although less durable than metal sleepers. After experiments with various timber species teak, *sal* and *deodar* were found most suitable for sleepers. Other species required creosoting for durability, which initially was not seen as being cost effective. The high price of teak confined its use only to some of the places where it was found. In the provinces along the coast, cheap imported creosoted pine sleepers from Europe were available, but transportation to the interior increased their cost. The use of indigenous sleepers was also encouraged as a defense against contingencies like the war in Europe which might have interrupted the supply of sleepers. Therefore the railways relied mainly on *sal* and *deodar* for their operation and expansion in northern India. Experiments on the cheap creosoting of various other species continued (Brandis 1878-79), but could not succeed until the 20th century.

With the introduction of the railway system in 1853, a large number of contractors had come to the forests of the submontane tracts of Garhwal and Kumaun in search of timber, felling trees far in excess of what they could have transported out.³⁶ Ramsay had estimated in 1862 that 100,000 to 150,000 sleepers could be supplied annually from the submontane forests.³⁷ But the execution took time. Thus, initially there was a shortage of *sal* sleepers in the NWP, which was affecting the expansion of railway tracts and was compelling the authorities to rely on metal and imported sleepers.³⁸ Local officials were asked to ensure that there was always a sufficient supply of sleepers.³⁹ The supply of sleepers improved by

the late 1860s when many timber operations started in the hills. For the Delhi-Rewaree line, timber operations were in progress in the Tons and the Bhagirathi valleys in Uttaranchal. In 1869-70, 40,000 sleepers were prepared in the Tons and 50 to 60,000 were planned to be prepared in the Bhagirathi valley. From the *chir* forests of Agustmuni in Garhwal 37,000 sleepers were supplied in 1868-69 and 44,000 in 1869-70 to the East Indian Railway.⁴⁰

Timber operations to supply sleepers intensified further in the 1870s when the work on the Rajputana railways in northwestern India gained momentum. In July 1869 the Government of India asked the Forest Department of the NWP to provide sleepers to the railways of princely states in that region. Uttaranchal had emerged as one of the most important suppliers of sleepers for the railways. Between 1870-71 and 1877-78, 1,834,927 sleepers were supplied by the forest departments of various provinces to the state railways, of which 1,364,251 (about 73 per cent) were supplied by the NWP alone (Brandis 1878-79: 384-85). These were mainly *deodar* sleepers from the hills. Large-scale timber operations were carried out for this. The overexploitation of *deodar* forests later caused much concern and the Inspector General of Forests criticised the Conservator of Forests, North Western Provinces for carrying out these timber operations carelessly.⁴¹

In spite of the criticism there was no let-up in the supply of sleepers. Timber operations continued to facilitate railway expansion, although the forest department suffered losses.⁴² The forest department possibly carried out these operations because this led to its expansion and strengthened its control over the forests. In fact, over the years demand increased as the railway network expanded. *Chir* forests were also surveyed in the hope that cheap impregnation would become possible shortly.⁴³ A. Smythies, after the survey of *chir* forests on the left bank of the Tons river in Tehri kingdom and Jaunsar, estimated that 100,000 broad gauge sleepers could be supplied annually from those forests on a long term basis.⁴⁴

The expanding railway system meant increased demand for sleepers, not only to lay new tracks but also to re-lay old ones. Within the country there were 1,349 km of tracks in 1860, which increased to 7,678 in 1870, 25,495 in 1890, 56,980 in 1920-21 and 65,217 in 1946-47 (Hurd 1983).⁴⁵ The total length of tracks in 1910 was 51,385 km for which the annual requirement of sleepers was 4 million. Only 1.5 million sleepers were required for new lines, the rest were for renewal of the existing tracks (Troup 1913). Thus renewal of railway lines posed most of the additional demands from the early 20th century.⁴⁶

Railways required not only sleepers but also fuel and timber for carriage and wagons. In areas which were distant from the source of coal, railways mainly used wood as fuel. There was a search for sources of firewood. G.F. Pearson, after surveying forests of Dehradun suggested that these could supply fuel to the Delhi Railway. However the Forest Department was unwilling as it was not cost effective.⁴⁷ In many instances the Railway Department was allowed to cut fuelwood from forests along the tracts.⁴⁸

The enormous demand thrust by the railways on forests was leading to deforestation. Elizabeth Whitcombe writes: 'Perhaps the most disturbing

consequence of the railways—most disturbing because least capable of remedy—was the widespread use of local timber as fuel for the locomotives’ (Whitcombe 1971: 94-6).⁴⁹ Private forests were being cut on a large scale to supply fuel to railways;⁵⁰ the firewood supplied by villagers being cheaper than that supplied by the Forest Department. This was leading to a disappearance of village groves, which had caused serious concern (Whitcombe 1971).⁵¹

This long discussion on railways was to emphasise the point that the timber and firewood supply to railways was crucial in changing the extent of market-induced exploitation and of the general integration of forests into a wider trade network. Sources indicate that the Railway Department was the main purchaser of timber from the forests of Uttarakhand.⁵² However, we lack figures to systematically work out the exact share of the railways in the total outturn. But we can make some rough estimates. From the discussion above it follows that on an average the number of sleepers annually supplied from Uttarakhand varied approximately between 0.2 and 0.3 million (at a minimum) and 0.2 million sleepers would be about 1.4 million cft of wood.⁵³ Since the timber outturn in Uttarakhand in the 1890s was around 2.7 to 2.9 million cft, the railways seem to have claimed around 50 per cent of the supply. In the first decade of the 20th century the outturn was around 4 to 4.5 million cft, the share of the railways was around one-third. Some other estimates indicate similar patterns: according to one estimate (made in 1928), railways used one-third of the total timber outturn of the country (Anon 1928).⁵⁴ According to another estimate, the railways annually utilised about 2 million cft of *sal* and the same quantity of *deodar*, which was about half of the total outturn of those species in the country in the 1920s (Kamesam 1928).⁵⁵ The demands by the railways slackened when its expansion slowed down in the inter-war period.

Deforestation

Did the increased extraction of wood, as discussed above, result in deforestation? Conventionally, deforestation means land cleared of trees and put to other uses. As far as the forest department is concerned, deforestation only occurs when the department transfers forestland for other purposes. The land under the forest department even when overexploited or clear felled is not considered as undergoing deforestation because it can always regenerate and thus re-forest itself. Here, forest is a legal category, and any land so defined is forest area, irrespective of tree cover. Hence, department lands face deforestation only when that land is transferred to others through disforestation, i.e. declared as non-forest land. In this definition of deforestation, there is no place for the fact that a dense forest can become sparsely forested and can finally be reduced to scrub due to overexploitation and lack of regeneration.

When the forest department realised that the quality of forests was declining rapidly, canopy cover began to be treated as an important measure of the quality of forests. This has also become possible due to the availability of satellite imagery

of forests. The Forest Survey of India began analysing the satellite images of forest cover in the 1980s. Now, forest department land is categorised as dense (crown density above 40 per cent), open (crown density between 10 and 40 per cent) and degraded or scrub forests (crown density below 10 per cent). This recognises that forest degradation can result in denudation of the forestland due to overexploitation and lack of regeneration. Since this recognition was not there prior to the 1980s, data on the quality of forest cover are not available.

Since there is no data on the declining forest cover during the colonial period, it is difficult to systematically separate deforestation from exploitation. On forestland we have two main sources of data for the colonial period; one set of figures was provided by the Forest Department and another by the Department of Agriculture, Government of India, which annually publishes *Agricultural Statistics* for the country. Both provide figures of legally defined forest areas and were not concerned with the quality of forests.⁵⁶

Thus if we want to argue that the overexploitation of forests resulted in degradation and deforestation, we need to establish that extraction of wood from forests was more than their regenerative capacity. This is however not easy to establish for a large area because degradation is a site-specific phenomenon and also because regeneration is difficult to estimate. Further, although the forest department claimed that its management of forests was sustainable, a careful study of the practices of the department suggests that this was not the case. Here it is not possible, due to lack of space, to minutely examine practices of the department, this has been attempted elsewhere (Dangwal 2004). It is hence sufficient to say that the forest department lacked systematic data to workout 'sustain yield'. The department first fixed 'sustain yield' and then frequently overlooked it while exploiting forests. Its assumptions on regeneration were frequently proved wrong.⁵⁷ Therefore the quality of forests declined over time. We get frequent references of overexploitation, denudation and deforestation in colonial official writings, some of which are discussed below.

Forest cover first began to recede along the border of the plains. At the beginning of the British rule in Uttaranchal G.W. Traill, the Commissioner of Kumaun, reported that the forests nearest the plains were 'now totally exhausted of timber' (Traill 1878: 47). By the late 1830s, reports of massive felling of *sal* forests began to appear but J.H. Batten, the District Officer of Garhwal and later Commissioner of Kumaun, felt that this was confined to only some accessible areas (Batten 1878b). Officials also took note of 'fast disappearing' of large *sissoo* trees (Batten 1878b: 210-11).⁵⁸ By the mid-nineteenth century pressure on the submontane forests mounted.⁵⁹

As the demand for railway sleepers increased, the Himalayan *deodar* forests along the river basins began to be felled on a large scale.⁶⁰ The Mundole *deodar* forests in Jaunsar- Bawar were 'sadly mutilated' by the railway contractor Soda Singh.⁶¹ The Working Plan Officer of the Uttarkashi Forest Division writes similarly about the systematic overfelling of the *deodar* forests by Wilson.⁶² The

Government of India expressed concern over large scale felling of *deodar* forests.⁶³ Cheap creosoting of *chir* became possible by the early 20th century, leading to the use of *chir* for sleepers, and consequently their overexploitation (Champion 1983).

During the Second World War the pressure on forests increased manifold. F.C. Ford Robertson, the Conservator of Forest, Fuel and Transport Circle, United Provinces, wrote in alarm about the merciless exploitation of Dehradun forests (Robertson 1946). Plan prescriptions were disregarded in fellings for war purposes and by the end of the war most of the large trees, mainly *sal*, had been felled in the United Provinces (Davis 1983).

CONCLUSION

A study of deforestation not only informs us of the scale of environmental changes but also opens up possibilities for further research. Deforestation leads to wider agro-ecological changes with serious consequences for the natural resource base of the communities.⁶⁴ Establishing these linkages is not a simple task but overlooking them is to undercut the significance of an environmentally informed history. An exploration into how these changes affected the economies of communities on the one hand and ecology on the other can give insights into the intricate relationship between man and nature.

The study of this relationship throws significant light on the process of commercialisation of forests and their integration into the wider trade network. Although market forces have made inroads into woodlands across the world in similar ways, there were crucial differences as well. Recognising and understanding these differences will prevent simple generalisations about the process of deforestation.

This article suggests that unlike the Gangetic plains, which saw a long historical process of deforestation,⁶⁵ Uttaranchal remained largely well wooded until the early 19th century. Although some products were extracted for trade from certain areas even during the medieval period, a large part of the forests was inaccessible. Forests began to be opened up for a large-scale wood extraction from the 1840s and 50s. Around this time traders moved to the hills in large numbers because forests in the plains had already shrunk considerably. Increased demand for timber by the railways and the Public Works Department encouraged the state to take over forest management. The revenue from forests was increasing and a large part of this was invested in building roads to forests to make them further accessible for exploitation.

State control over forests was strengthened when they were reserved after the passing of the Forest Acts in 1865 and 1878. The forest department now systematically surveyed forests and made them accessible for large-scale timber operations. The extraction of wood grew rapidly in the late 19th century and the process continued till the early 1920s. For a decade, the timber market slumped first due to the post-war crash of timber prices and then due to the Great Economic

Depression. The scale of wood extraction reached new heights during the Second World War.

Growing population both within and outside the region, the emerging demands of new cantonments, hill stations, and other urban areas made more and more demands on forests. However it was the demand for wood by the railways that dramatically increased the scale of extraction. The expansion of railways in northern India was considerably dependent on the supply of *sal* and *deodar* sleepers from the sub-Himalayan and Himalayan forests. The demand for wood by the railways began to decline from the 1920s when railway expansion slowed down. Around this time, industrialisation began in the country and new industries made demands on forests for raw material as well as for fuel. Industrial demand however peaked in the post-independence period. The two world wars also exerted considerable pressure on forests.

Did this increased extraction of wood result in deforestation? Answering this question is difficult unless we study the various signs of forest degradation. The forest department maintained that its management of forests was sustainable. Forests were managed according to the prescriptions of the Working Plans and that only 'maximum sustainable yield' was removed from the forests. However, ensuring sustainability was not easy, given the quality of data collected for preparing Working Plans and the way silvicultural practices were carried out. Regeneration of felled areas was never up to expectation. Further, there was pressure of generating revenue and meeting the strategic demands of the colonial administration. This often resulted in overexploitation of forests, a process which continued even after independence. The forests of Uttarakhand were continuously over-cut after independence. Shaha (1982) argued that timber and firewood outturn in Uttarakhand in the recent years has substantially exceeded the annual regeneration capacity of the forests. This is reflected in the poor condition of forests. Singh (1992) suggests that less than 4.4 per cent of the geographical area has forests with crown density over 60 per cent; 15.1 per cent has crown density of 40 to 60 per cent; and in 9.2 per cent of the geographical area, the crown density is 20 to 40 per cent. This picture is substantially different from the mid-nineteenth century descriptions of the forests of Uttarakhand as 'quite natural and untouched' and large tracts as 'almost impenetrable' (Weber 1902:25, 201).

Acknowledgements

This article is an improved version of a chapter of my unpublished Ph.D. thesis (Dangwal 1999). I am grateful to Neeladri Bhattacharya for his guidance and constant encouragement. An earlier version of this paper was presented at a seminar at the Nehru Memorial Museum and Library, New Delhi, in November 1998. This paper has benefited from the comments of Mahesh Rangarajan and two anonymous referees. Comments on my thesis by Ramachandra Guha and Sumit Guha also helped me in revising this paper. Constructive suggestions by the editorial team of the journal enabled finalising the article for publication.

Abbreviations Used

APRFD= Annual Progress Report of the Forest Department; Cft= Cubic feet; Commr= Commissioner; Coll.= Collector; Cons.= Conservator of Forests; COR= Commissioner Office Records; *DCHB*= District Census Hand Book; Dept.= Department; DFO= Divisional Forest Officer; Dy.= Deputy; ERR= English Record Room; FD= Forest Department; For.= Forest; For. Div.= Forest Division; GO= Government Order; GOI= Government Of India; Govt.= Government; *HDNWP*= Himalayan Districts of North Western Provinces; KFGC= Kumaun Forest Grievances Committee; Lt. Govr.= Lieutenant Governor; MFP= Minor Forest Products; NAI= National Archives of India; NWP= North Western Provinces; NWP& O= North Western Provinces and Oudh; Offgs.= Officiating; PMR= Post Mutiny Records; Progs.= Proceedings; PWD= Public Works Department; RAC= Revenue, Agriculture and Commerce Department; RAD= Regional Archives Dehradun; RAN= Regional Archives Naini Tal; Repr.= Reprinted; Rev. and Agri.= Revenue and Agriculture Department; Rev. For.= Revenue Forest Department; RKFGC= Report of Kumaun Forest Grievances Committee; RLI= Revenue Letters Issued; SAC= Senior Assistant Commissioner (district officer in the hills); Secy.= Secretary; Supdt.= Superintendent; SR= Settlement Report; UPSA= Uttar Pradesh State Archives Lucknow; WP= Working Plan.

Notes

1. Vicziany (1990) also underlines this fact. Some of the studies that examine deforestation in greater detail are: Richards *et al* (1985); Tucker (1988a, 1988b, 1993); Flint (1998); Mann (1988); and Saravanan (1998).
2. The hill districts of U.P. were constituted as a separate province named Uttaranchal in the year 2000. Earlier U.P. was known with different names: initially it was a part of the Bengal Presidency; in 1836 the region came to be known as the North Western Provinces, in 1856 renamed NWP & Oudh, in 1902 the United Provinces of Agra and Oudh, and in 1937 just the United Provinces. After independence came to be known as Uttar Pradesh. For convenience throughout the article I refer to the region of my study as Uttaranchal, although I have covered only the hill districts of the pre-independence United Provinces.
3. Anderson (1987) noted a similar process in Kenya. For the Western Ghats in India see Pathak (2002).
4. See also 'Report on Forests of Kumaun and Garhwal', Ramsay to Secy., Govt. of NWP, Railway Dept., February 21, 1862, A Prog 23, PWD (Agri.) NAI (hereafter Ramsay, 'Report on Forests of Kumaon and Garhwal').
5. *WP for Yamuna Forest Division, Tehri Garhwal State, 1932-33 to 1952-53*, compiled by P.D. Raturi, Meerut, 1932, pp. 45; 48-9; (Details of the Working Plan will be provided only in its first appearance, in the subsequent references only its title and year of publication will be given).

6. G.F. Pearson, 'Sub-Himalayan Forests of Kumaon and Gurhwal' in *Selections from the Government Records of the North Western Provinces*, (hereafter *Selections*), IInd series, vol. II, pp. 125-50, esp. pp. 140-41.
7. Ramsay, 'Report on Forests of Kumaun and Garhwal', p. 157.
8. Pearson, 'Forests of the Bhagirathi Valley', in *Selection*, IInd series, vol. II, pp.117-23; *idem*, 'Deodar Forests at the Head of Jamuna and Tons Rivers' in *ibid*, vol. III, pp. 129-37; Letter no. 547, 4-2-1863, February 1862. A Prog. no. 1, PWD (Agri.), NAI.
9. Even in places where rivers were navigable in Brazil, timber cutting was confined to a distance of 1 or 2 km of river basin (McNeill 1988: 20).
10. Strachey, 'Memorandum on Forests of Patlee and Kotree Dhooons'; letter no. 73, 6-11 1854, vol. XII and no. 179, 15-11-1860, vol. XV, RLI, PMR Coll. Pauri, RAD.
11. Statement on the Bhagirathi Valley Road, GOI, no. 4227; letter no. 39, 11-3-1871, both in May 1871, A Progs. nos. 23-6; Denmeade, 'Progress Report of the Bhagirathi Valley Road', 30-11-1870, May 1871, A Progs. nos. 59-60; All in PWD (Rev. For.), NAI.
12. Letter no. 105A, 15-12-1870, May 1871, A Progs. nos. 21-4, PWD (Rev. For.) NAI.
13. See a report on slides in Jaunsar by Dy. Cons., Jaunsar, 3-10-1872, October 1872, B Progs. no. 52, RAC (For.) NAI.
14. Pearson to Hodgson, 7-11-1879, *Selection*, IInd series vol. III, p. 113; Pearson, 'Deodar Forests at the Head of Jamuna and Tons Rivers', pp.131; 133.
15. D. Brandis, 'Suggestions Regarding Forest Administration in the North Western Provinces and Oudh', March 1882, A Progs. no. 17-9, Home, Rev. and Agri. (For.) NAI (hereafter Brandis, 'Suggestions Regarding Administration in NWP'), pp.59-60; 88; 98. Figures of different forests added together.
16. We lack systematic figures for Dehradun and the inner Himalayan forests for this period. However, the outturn figures for later years suggest that half of the production of Uttaranchal came from these forests. If this ratio was the same in the earlier period as well then we can assume that the total number of trees felled annually during the 1870s in Uttaranchal was in the range of 25 to 30,000.
17. *APRFD*, for concerned years. Average computed from annual figures.
18. Until the 1880s, only the number of trees felled are provided by the forest department, and details in terms of volume are not given. Hence comparing earlier and later figures becomes difficult. There is no simple formula for converting the number of trees cut into the volume of wood as the volume can vary according to the size and the species of tree. A first class tree usually having a girth of 6 feet yields wood ranging between 30 and 50 cft. This makes comparison of the early and later figures difficult. Thus the early figures have been compared in terms of the number of trees felled and the later figures in terms of volume.

19. It was earlier estimated that on an average 30,000 trees were felled annually in the 1870s in Uttaranchal. The assumption is that the 80 per cent of the trees felled were for timber and 20 per cent for fuel (as trees were mainly felled for timber and only occasionally for fuel). Fallen dry and refuge wood were mainly used for fuel), about 24,000 trees were felled for timber. Supposing each tree yielded 30 cft of wood (a first class tree yields 30 to 50 cft of wood but a large number of class II and III trees yielding much less wood were also felled) the outturn of 24,00 trees would be 720,000 cft. On similar assumptions on an average 1.58 million cft of timber was extracted annually in the early 1880s.
20. *APRFD*, for concerned years.
21. *WP for the West Almora Forest Division, 1951-52 to 1965-66*, compiled by N.P. Tripathy, Allahabad, 1952, pp. 58-61.
22. Outturn of the forests of the Tehri Kingdom also increased rapidly. See (Raturi 1942: 631-34).
23. McCarthy (2000) shows clear linkage between loggers, bureaucracy and political leadership in Indonesia and how they drained forests and exported timber, but in the forestry literature it is always shifting cultivation which degraded forests. Similarly Saberwal (1999) has shown how herders were blamed for degradation without any firm information. His own fieldwork did not find any such evidence.
24. The 1821-22 figures are not based on enumeration of the population but are only an estimate (Traill 1878: Appendices). For 1901 figures see *Census Report of the Northwestern Provinces and Oudh*, 1901. Figures of Tarai are not included.
25. Brandis, 'Suggestions Regarding the Forest Administration in NWP', p.2.
26. *WP for the West Almora Forest Division, 1952* p. 21. In Punjab there was a phenomenal increase in sale of wood to timber contractors and 'purchasers' while the amount of timber granted to 'rightholders' and 'free grantees' did not change. (Bhattacharya 1986:132).
27. Calculated from *APRFD*, for the concerned years. Figures of 1931-32 and 1934-35 were not available. First the annual average consumption has been calculated and then the percentage figures were computed. For similarly low local consumption in Africa see Amanor (1994).
28. In a fieldwork in Munglori village in Tehri Garhwal district in 1984 it was found that roughly half of the total wood fuel required came from small twigs remaining as a byproduct of fodder collection (Moench 1988:128). Amanor (1994:122) found in Ghana in West Africa that firewood obtained mainly from fallen and dead wood and branches lopped and pruned from large trees. Saikku (1996: 84) found similar practices among the native Americans.
29. 'WP for Deoban Forests' compiled by N. Hearle, dated 10-7-1888, April 1889, A Progs. nos.1-3, Rev. & Agri. (For.) NAI, p.41.
30. October 1872, A Progs. Nos. 26-8, RAC (For.) NAI.

31. Grieg, the Cons., to Brandis, 19-6-1876 and other letters, July 1874, B Progs. nos. 136-37, RAC (For.) NAI.
32. Nathaniel Wallich quoted in Grove (1994: 413).
33. Comments by Hume, 5-4-1876, January 1877, A Progs. nos. 7-11, RAC (For.) NAI.
34. *WP for the Haldwani Forest Division*, 1950, vol. I, p.34.
35. *Ibid.*, pp. 27-33.
36. Ramsay, 'Report on the Kumaun and Garhwal Forests'.
37. *Ibid.*, p. 157.
38. See Report of Chief Engineer on the Operation of the East Indian Railway, for half year ending December 31, 1861, June 1862, A Progs. no. 1, PWD (Railway) NAI.
39. July 1862, A Progs. nos. 6-7, PWD (Railway) NAI.
40. APRFD, NWP&O, 1869-70, January 1871, A Progs. nos. 17-9, PWD (For.) NAI, pp.101.
41. Comments by Brandis dated 18-6-1877, July 1877, A Progs. nos. 149-50, RAC (For.) NAI.
42. Sleepers sometimes were supplied free of cost. The GOI arrived at an agreement with the Rohilkhand and Kumaun Railway on October 12, 1882 for providing sleepers free of cost from the Tarai forests. See File 1/1882, Box 20, COR, RAN.
43. Efforts were made to develop cheap methods of impregnation as creosoting was costly and made price of sleepers non-competitive. However there was limited success in developing cheap methods of creosoting till the early 20th century. See the following proceedings. In NAI: June 1872, B Progs. nos. 154-55 (comments by Brandis, 11-5-1872); November 1873, B Progs. nos. 36-8; Brandis, 'Memorandum on the impregnation of pine', 22-8-1879, September 1879, A Progs. nos. 21-4 and November 1879, B Progs. nos. 19-28, Home, Rev. and Agri. (For.).
44. A. Smythies, Assistant Cons., 'A report on *chir* forests on the left bank of the Tons river, situated in Tehri Garhwal and Jaunsar Bawar', in July 1888, B Progs. no. 4, Rev. & Agri. (For.) NAI.
45. For broad gauge railways nearly 1,800 sleepers were required per mile (Brandis, 'memorandum on the Supply of Sleepers to Railway of Himalayan Pines', p. 368), however, the general requirement varied and in all 2,200 sleepers were required per mile, including sidings. (Brandis quoted by Stebbing 1983: vol. II, pp. 311-13.) However, the railways were supplied a large number of sleepers than laid down on the tracts as rejection and wastage of sleepers was common. The low price of natural resources, which often have invisible subsidy, argue Gadgil and Guha (1992), result in profligacy rather than prudence in resource use. The entire process of sawing and preparing sleepers caused a lot of timber wastage. From the hewn timber only 33 to 66 per cent of wood, it was argued, was utilised for conversion into sleepers or planks. (See letter no. 116, 2-3-1877, November 1877, A Progs. nos. 16-7, RAC (For.) NAI.) Thus there was lot of wastage of timber.

46. The average life of the heart wood *sal* and *deodar* sleepers was 12 years while many other species had a very short life and required frequent renewal. See Brandis, 'Memorandum on the Supply of Railway Sleepers of the Himalayan Pines', pp.374-75 and A Note by Major H.Drumond, no. 655, 18-3-1862, June 1862, A Progs. nos. 12, PWD (Railway) NAI.
47. Pearson's report attached to letter no. 446, 5-4-1872, April 1872, A Progs. nos. 11-3, RAC (For.) NAI.
48. Letter no. 1793, 28-8-1880, September 1880, B Progs. nos. 57-8, RAC (For.) NAI.
49. In Brazil as well Railways also used wood as fuel in locomotives leading to disappearance of forests along the tracks (McNeill 1988:20).
50. June 1874, B Progs. nos. 32-5, RAC (For.) NAI.
51. January 1872, A Progs. nos. 17-8, RAC (For.) NAI.
52. *WP for Leased Forests of Tehri Garhwal*, compiled by J.C.Tulloch, Allahabad, 1907, p. 11; *WP for the Uttarkashi Forest Division, 1938*, p.23 ; *WP for Yamuna Forest Division, 1932*, p. 31.
53. The volume of an average sleeper of 10 feet by 10 inches by 5 inches is about 3.5 cft. According to Brandis, about 7 cft of rough wood was required for preparing a sleeper of the volume of 3.5 cft. Brandis is quoted in Stebbing (1983: vol. II, pp.311-13).
54. The term used is one-third of the output, I suppose it is timber outturn.
55. See also 'Wood Versus Metal Sleepers', a report in Capital, 18-5-1939, reproduced in *Indian Forester*, 65, 9 (1939), pp. 601-03. Flint (1998: 444) estimates that one-third of the sal outturn of the British India was used to make sleepers.
56. This problem is widespread and is applicable to other regions and countries as well. Richards and Tucker (1988) argue that most of the third world countries lack past figures on forest cover.
57. For critical analysis of the claims of scientific forestry see Guha (1989), Buchy (1996, 1998), Perry (1998: 435-66) and Dangwal (2004).
58. Traill (1878: 47) wrote that very few *sissoo* trees were found in the region and those left were disappearing fast.
59. Ramsay, 'Report on Forests of Kumaun and Garhwal', p. 156. Pearson, 'Sub-Himalayan Forests', p. 132; Brandis, 'Suggestions Regarding Forest Administration in the NWP', p.5.
60. Pearson, 'Forests of the Bhagirathi Valley', p.118; *idem*, 'Deodar Forests at the Head of Jamuna and Tons Rivers', pp. 129-30; *idem* to Hodgson, 7-11-1869, *Selection II series*, vol. III, p. 108.
61. Pearson, 'Deodar Forests of Jaunsar', p. 384.
62. *WP for Uttar Kashi Forest Division, 1938*, p. 36.
63. Secy., GOI, to Secy., Govt. NWP/Punjab, 14-6-1871, June 1871, A Progs. nos. 72-3, PWD (Rev. For.) NAI.

64. For an excellent discussion on various impacts of deforestation in the Gangetic plains see Mann (1998, 1999). I have also discussed elsewhere impact of deforestation on the agrarian economy of Uttaranchal (Dangwal 1998).
65. There were extensive *dhak* (*Butea frondosa*) forests in the Gangetic plains till the nineteenth century (Whitcombe 1971:83; Flint 1998; Mann 1998, 1999).

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