CHAPTER II: COLONIALISM AND FOREST RESOURCES

COLONIALISM AND FOREST RESOURCES

> "Thus the planting of trees, which in England is synonymous with afforestation, is in India is one of the least frequent duties of the forest officer...
> Afforestation in India therefore does not result growth and of ultimately yielding a harvest for the use of man. The Executive forest officer is, therefore, not a planter of trees by profession: he is rather a land agent for a vast estate that is mean as in England, the creation of forests. It implies rather that a certain area has been set aside for the practice of forestry, and the inference is, not that the area is to be sown or planted by artificial means, but that the nature will be aided in her work of covering the soil with woody chiefly concerned with the forestry[1]."

Eardly Wilmot's comments on the wider significance of the land management by the Indian foresters itself tells the true tale of the Forests in India during the British rule. The history of Indian forestry is, to a great extent, a story of the evolution of a system of intervention in the process of natural regeneration to conserve and plant what were perceived especially as useful species and thereby to upgrade the value of forests. In places where species with no direct utility prevailed, it sought to put them to use employing the best science possible[2]. Notably the issue of animal conservation figures only as beasts of burden and as means of game and hunting[3].

Wilhelm Schlich, author of the three volumes of the Manual of Forestry (basic text book for the Indian Forest Service Candidates) and

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[1] Eardly Wilmont, *Forest Life and Sport in India*, Oxford University Press, 1910, pg.14
[2] D Brandis, 'the Utilization of Less Valuable Woods in the Fire-Protected Forests of the CP, by Iron Making, *Indian Forester*, 5/2(1879),222 as quoted by S Ravi Rajan, *Modernizing Nature, Forestry and Imperial Eco- Development 1800-1950*, longman, 2006,p 9.
[3] For details see, M M Ledzion, *Forest Families* London,1991

responsible for the organization of the Imperial Working Plans Branch defines forest[4]:

> "As 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".

Implicit in this definition are the basics of the continental paradigm (which later is developed into the British Empire's forestry): 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[5].

Before analyzing the impact of British Forest policy in South and Central Gujarat, a brief outline of the human-nature interaction is needed in the pre British times. It would help as a background to the continuities and changes in the environmental policy of India.

The process of clearing the forests on a limited scale was initiated when humans began to settle down and follow a life of settled agriculture. The Harappan civilization in the river valleys of northwest India was a society based on settled agriculture along with conservation of various resources. The seals found during this period depict the *Peepal* tree, which belongs to the Genus ficus, members of which are widely considered sacred and spared axe not only in India but in many other parts of Asia and Africa[6]. The Harappan culture came to an end between 2000-1500 (B.C) either due to climatic changes or the Aryan invasion.

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[4] W Schlich, *A Manual of Forestry*, London, 1895, Vol I pp5-6

[5] *Modernizing Nature*, pg 88.

[6] Madhav Gadgil, Towards an Ecological History of India, *Economic and Political Weekly*, volume XX, 1985, pg. 1911

This is accepted by number of historians[7]. Iron was one of the key elements of technology brought by the Aryans. It contributed to a new pattern of resource use by making possible, the clearing of thicker forests of wetter river valleys. Iron, along with fire, made it possible to bring the middle Gangetic plains under intensive agricultural- pastoral colonization, with wet paddy cultivation as a key element[8]. Since the forests, with its animal populations, served as a resource base, began the process of clearing the land for the purpose of cultivation.

Supernatural powers now no longer resided in specific trees, groves or ponds, but in more abstract forces of nature, earth, fire, wind, water and sky, whose assistance was needed to colonize the resource base. Fire was required to clear the forests, and water to nourish crops in the fields, therefore Agni and Varuna became the major deities. The main ritual was the fire worship and the Yajna, a ritual in which huge quantities of wood and animal fat was consumed.

A well-known incident is narrated in Mahabharata, regarding the burning of the Khandava forests on the bank of the river Yamuna by the Pandavas[9]. At the request of the fire God, Agni, Krishna and Arjun set fire to the entire forest driving back all the creatures that tried to escape. This included Nagas, presumably the indigenous population of this forest.[10] Pandavas then established human settlement at this site. This is an instance of an advanced agricultural- pastoral people completely replacing the indigenous people at a lower level of technology and establishing a new pattern of resource use. Ecologically it was a process of marginalisation of people living in a symbiotic relationship with nature

[7] D.D. Kosambi, *The Culture and Civilisation of Ancient India- A Historical Outline*, Vikas Publications, Delhi, 1970, pg.76
[8] *ibid*, pg. 89
[9] Madhav Gadgil and Ramachandran Guha, *This Fissured Land- An Ecological History of India*, Oxford University Press, 1991, pg. 79
[10] Towards an Ecological history of India, pg. 1911

but considered to be wild or savages by the others who had taken to the urban civilization.

The agricultural colonization of the fertile tracts of lower Ganga valley was completed by 6th century B.C. The next step was the development of empires. They witnessed prosperous trade and advancement in science and technology[11]. That gave an impetus to further and faster colonization. This is reflected in Arthashastra. It emphasized the need to bring new lands under cultivation by settling the hunter gathering tribes who generated little surpluses for the State. Commodification of forest resources is evident in the Arthashastra, which recommends that princes set apart large hunting reserves, as well as elephant forests. Elephants were an important element of the armies and Kautilya prescribes death penalty to anyone killing an elephant.[12] The process of empire building in the northern tracts along with a gradual process of forest clearing was completed by 1st century AD.[13] According to Romilla Thapar, the break up of the early empires was caused by a fall in the level of surplus that could be extracted from the agricultural production. As the frontiers closed, and the resource crunch mounted, there was perhaps an increasing social awareness of the need for readjustment through the more efficient and conservative use of resources. The response was the rise of unorthodox sects, Buddhism and Jainism. They played a significant role in reformulating and redesigning social conventions promoting the prudent use of resources by favouring abandonment of *Yajnas* and sacrifices.

The best-known ancient State sponsored conservation was undertaken by the Mauryan Emperor Ashoka, after his conversion to Buddhism. His

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[11] Romilla Thapar, *A History of India*, Vol. I, Penguin, Harmondsworth, 1990, pp. 118-124

[12] *ibid*, pg.2

[13] *ibid*, pg.2

edicts advocate a restraint in the killing of animals, protection and planting of the trees and use of water resources. One such edict, from the 3rd century B.C., in Dhauli (present day Orissa), goes in translation as follows[14];

> "The king with charming appearance, the beloved of the Gods, in his conquered territories and in the neighbouring countries, thus enjoins that; medical attendance should be made available to both man and animal; the medical herbs, the fruit trees, the roots and tubers, are to be transplanted in those places where they are not presently available, after being collected from those places where they usually grow; wells should be dug and shadowy trees should be planted by the roadside, for enjoyment both by man and animal.

The Mughal period presents a slightly different picture. For the Mughals, a civilized society was one primarily engaged in agriculture, alongside other more sophisticated commercial activity. [15] The conquest of territories by them also led to some extent the destruction of forests. At the time of Babar's campaign of Chanderi, his artillery was preceded by active overseers and a mass of spadesman to level the road and cut down the jungles.[16] During the time of Akbar, to facilitate the marching armies to Orchha, vast tracts of forests were cleared out[17]. However, there is other side to the story too. The Mughal taxed agricultural production and claimed a tax on the domesticated animals only if they exceeded a stipulated number[18]. There were no taxes on the forest resources. Their interest was only in maintaining hunting preserves as a sport but they did not promote the exploitation of the forests except when it came in the way of marching armies.

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[14] *This Fissured Land*, pp. 88-89
[15] *ibid*, pg. 106
[16] Chetan Singh, Forests, Pastoralists and Agrarian Society in Mughal India, in *Nature, Culture and imperialism- Essays on the environmental History of South Asia*, David Arnold and Ramachandran Guha (eds), Oxford University Press, Delhi, 1995, pp. 23-24
[17] *ibid*, pg.24
[18] *ibid*, pg.42

The ever-growing demand for elephants for the military purposes led to gradual decrease in their number in the wild. At the time of Kautilya Arthashastra, elephants were said to have inhabited certain parts of Punjab and Gujarat (Saurashtra and Rajpipla), but by the time of the Mughals, some 1000 to 1500 years later, these areas no longer had elephants.[19]

With the arrival of the English, that forests became a highly prioritized commercial commodity, and large-scale depletion of country's wooded resources began to take place. With the application of technological advances during the Industrial Revolution, a great range of natural resources were transformed into marketable commodities. For example, in a subsistence economy, wood was consumed on a limited scale as domestic fuel, in the construction of implements and for shelter. But during the industrial revolution, it was converted into paper, or burnt as a fuel for the steam engines of trains and ships. Thus at the time, the Europeans came to India, they were already experiencing at home far reaching revolution in patterns of natural resource use.

Around 1860, Britain had emerged as the world leader in deforestation, devastating its own woods and the forests of Ireland, South Africa and northeastern United States to draw timber for ship building, iron smelting and farming.[20] With Oak trees vanishing in England, a permanent supply of suitable timber was required for the Royal Navy. This was a period of fierce competition between the colonial powers, and the Indian teak, the most durable of ship building timbers, saved England during the war with

[19] Tapan Ray Chaudhary and Irfan Habib (eds.), *The Cambridge Economic History of India*, vol. I, Cambridge University Press, Cambridge, 1982, pg 6
[20] *This Fissured Land*, pg.180

Napoleon. It gave impetus to the later maritime expansion.[21] An indication of the escalating demand for wood for England's ship building industry can be seen from the fact that the tonnage of British merchant ships (excluding Royal Navy) increased from 1,278,000 tonnes in 1788 to 4, 937,000 tonnes in 1860.[22] Evidently the major part of this wood came from the colonies, especially India, and in later stages from Burma.

Among Britain's colonies, "India stood pre eminently by reason of its vastness, the density of population and the seemingly immeasurable extent of its natural resources."[23] Thus a process was hastily initiated to strip the country of its forests. To begin with, in the early 19th century, following the defeat of the Marathas, the East India Company razed to grounds teak plantations in Ratnagiri, which were nurtured and grown by the legendary Maratha admiral Kanhoji Angre.[24]

'Of all European nations', one of the early conservators of forests in India, Henry Cleghorn observed[25];

> " The English have been most regardless of the value of the forests, partly owing to their climate, but chiefly because England has been so highly favored by vast supplies of coal; and the emigrants to the U.S. have shown their indifference to this subject by needless destruction of forests in that country of which they now feel the want".

The process of destruction greatly intensified in the early years of the building of the railway network after about 1853. The early years of the railway expansion saw an unprecedented assault on the more accessible forests. Great tracts of forests were destroyed to meet the demands for the railway sleepers and no supervision was exercised on

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[21] Ramachandran Guha, Forestry in British and post British India, *Economic and Political Weekly*, vol. XVIII, No. 44, October 29, 1983, pg. 1883
[22] *ibid*, pg. 1883
[23] Elizabeth Whitcomb, *Agrarian Conditions in Northern India*, Vol.I, Berkeley, 1972, pg. IX
[24] *This Fissured land*, pg. 118
[25] H. Cleghorn, *Forests and Gardens of South India,* W.H.Allen, London, 1860, pg.ix

the felling operations and a large number of trees being felled whose logs could not be utilized[26]. The sub Himalayan forests of Garhwal and Kumanyu for example were all felled, which were never removed, nor their removal possible.[27] Private contractors both Indian and European were chiefly responsible for this devastation. This depletion finally awoke the colonial authorities to the fact that India's forests were not inexhaustible. Railway expansion however, continued unabated.

The following table shows the expansion of railways in the 19th and the 20th centuries.[28]

Table II A

The Railway Expansion in India, 1853-1910;

Year	Kilometers	Outlay (Rs Millions)	Net Earnings (Rs Millions)
1853	32	3.8	0.05
1860	1,349	266.6	3.0
1870	7,678	900.0	30.3
1880	14,745	1285.7	63.9
1890	26,395	2,136.7	103.6
1900	39,834	3,296.1	164.5
1910	51,658	4,390.5	239.9

The expansion of railways became directly proportional to the depletion of the forests. This fact could be ascertained from the table given which shows the consumption of the railway sleepers.

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[26] E.B. Stebbing, *The Forests of India*, London, vol.I, 1922-27, pg.14

[27] G.I. Pearson, *Sub Himalayan Forest of Kumaom and Gharwal*, in " Selections from the records of the Government of the N.W.P.", second series, vol.II, Allahabad, 1869, pp.132-133

[28] Forestry in British and Post British India, pg.1883

Table II B

Consumption of the Railway Sleepers 1853-1928[29];

Year	Total Running Miles	Increase in running miles after every 5 years	Number of sleepers required with increase in running miles
1853	40	40	70400
1853	40	40	70400
1858	491	159	279840
1863	2642	187	329120
1868	4338	189	332640
1873	6457	367	645920
1878	8858	899	1582240
1883	11063	216	380160
1888	15073	370	651200
1893	18940	680	1196800
1898	22502	991	1744160
1903	27179	953	1677280
1908	31167	566	996160
1913-14	35625	1260	2217600
1918-19	37984	316	561440
1923-24	39645	440	774400
1928-29	42624	1234	2171840

[29] Railway Administrative Report, Railway Administrative Department, Rail Bhavan, New Delhi.

Sleepers in railway track perform two important functions;

1. Hold the track to gauge, and
2. Transmit and distribute the oncoming loads to the ballast underneath.

Wooden sleepers are made from the logs of the woods. One to three sleepers are taken out of a single log, depending upon the girth of the log (a mature tree of a large size). So one can estimate the quantity of timber required to provide sleepers of a standard size and quality. Timber obtained from deciduous, broad leaved trees (teak and sal) is generally hard, while that obtained from coniferous, needle shaped leaved trees (pine and *chir*), is usually soft. Timber most commonly used for sleepers in India is *sal* (hardwood), *chir* and *deodar* (softwood).

The development of the forest policy was slow in India.[30] It was only when the British realized that a fast depletion of Indian forests is taking place and the methods by which private enterprise were working the forests forced the state to step into safeguard "their long term imperial interests". [31] The Governor General had in 1862 called for the establishment of a department that could ensure the regular availability of the enormous requirements of the different railways for sleepers. The crisis was all the more acute since only three Indian timbers- teak, Sal and deodar- were strong enough in their natural state to be utilized as railway sleepers. Sal and teak, being available near railway lines in the peninsular India, were heavily worked out in early years while deodar forests were felled in the North Western Himalayas.

[30] *The forests of India*, vol.I, pg.61
[31] K.P. Sagreya, *Forest and Forestry*, National book Trust of India, Delhi, 1979, pg.8

It was in this situation that the Forest Department was formed in 1864 with the assistance of the German foresters. It was then realized by them that without extending the government's monopoly over the forests, the forest department could not effectively manage the forests. So to extend state control over forests various Forest laws were passed. Hence the first attempt at asserting state monopoly right was through the Indian forest Act of 1865, (see the Appendix II A). Within a few years, 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[32] .In 1878 a new forest Act was passed except for Burma, the Hazara district in Punjab, Coorg, Ajmer, Madras, Berar, and Baluchistan. By 1890 many provinces passed their own forest Acts modeled on the 1878 Act. These Acts divided the forests into three main categories: reserved, protected and village/communal. The provisions of the 1878 Act ensured that the State could demarcate 'valuable' tracts of forest, needed especially for railway purposes and retain enough flexibility over the remaining extent of forestland to revise its policy from time to time. The Act emphasized that the customary use of forests by the villagers was based not on 'right' but on 'privilege', which was exercised only at the mercy of the local rulers. Since the British were now the rulers, the rights of absolute ownership were vested in them, against which there could be no appeal. This was contrary to the pre modern forest policy. All these 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*'[33].

[32] *Modernizing Nature*, pg. 93

[33] Ribbentrop B, *Forestry in British India*, Government Press, Calcutta, 1900, pg.114.

History of Gujarat forests

Gujarat was a part of the Bombay Presidency (except the state of Baroda and princely states) during the British rule. The State did not have a large forest area compared to Bombay, Madras, NWFP, and other northern parts of the country. The Kutch and the Kathiawar peninsula present a desert ecology, while South Gujarat has been known for its forests (Dangs, Valsad and Dharampur) and consequently high rainfall. As the difference between the Kathiawar and 'inland' Gujarat are substantial, they have played a major part in the economic, political and ecological history of the province. The complex and the lengthy coastline of Gujarat (a probable reflection of the remote tectonic collision of the Kathiawar peninsula with the Indian mainland) has had major role in conditioning the history of the region. The major centers of the civilization and wealth that developed in Gujarat and have dominated the province's history have been coastal rather than inland centers. From the protohistorical 'Harappan port city of Lothal (active as late as circa 1600 B.C.), through Roman commercial contacts at Baryagza (Bharuch), Cammoni (Surat) or Monglosson (Junagadh?), to some of the first European mercantile footholds in the western India at Diu (1535), Daman (1559) and Surat (1604). What could be noted is that while agriculture maintained a level of importance through out most of Gujarat, its extent (and the level of its impact on natural vegetation) arose largely in response to demographic pressures rather than constituting the corner stone of the overarching fiscal structure. Thus we can perhaps conclude that much of the province remained comparatively unaffected by the revenue demands of either regional or central powers, and the economic pressure to degrade natural vegetation and habitats seems to have remained comparatively slight.

South Gujarat compared to Central region has always been more wooded. In Dangs and Valsad, it is teak (tectona sissoo), which cover

30% of the forest areas besides *Shisham* (Deilberaria latifolia), *Tiwas* (Ougeinia dalbergioides), *Khair* (Acacia catechu), *Sadad* (Terminalia tomentosa) and *Sewan* (Salmalia malabarica).

In Bharuch the major varieties of woods are *Amli* (Tamarindus indica), *baval* (Acacia arabica), *Chandan* (Santal imalbum), *Khair* (Acacia catechu), *Mahuda* (Madhuca latifolia) and *Sag* (Tectona grandis).

Surat has Ashoka (Polyaltha longfolia), *Shitafal* (Anona squamosa), *Sag* (Tectona grandis), *Pipal* (Ficus tsieta), *Kokam* (Garcinaia indica) *Gulmohar* (Poinciana regia) and *Khajuri* (Phoenix sylvestris).

Kheda, though does not have forests,[34] but some major trees are Teak (Tectona grandis), *Timuri* (Diosphyros melanoxylon), *Sadad* (Terminalia tomentosa), *Khair* (Acacia catechu), *Mahuda* (Madhuca latifolia), and *Babul* (Acacia arabica).

Main trees in Ahmadabad are *Baval* (Acacia arabica), *Siras* (Albizia lebbeck), *Gulmohar* (Delenix regia), and *Nilgiri* (Eucalyptus l'Hent).
In Baroda, *Sag* (Tectona grandis), *Sadad* (Terminalia mentosa), *Sisam* (Dalbergia latifolia), *Khair* (Acacia catechu), *Babul* (Acacia arabica), *Limbda* (Melina azadirchta), *Kakad* (garufa pinnata) are chiefly found.

In 1843, Colonel Jervis, the chief Engineer at Bombay gave a brief account of the Bombay forests. A part of his minute dealing with the Gujarat forests are as under[35];

> "On the Eastern skirts of the Goozerat province, from Deesa downwards to the Narmada, are forests of various breadth. These forests are the broadest and

[34] *The Economy of Bombay Gujarat*, pg. 120
[35] *Forests of India*, vol.I, Pg.108

> the trees in them the largest where the country streches towards Malwa. The more useful timber of these tracts are chiefly Pullus, Sissoo, Tunnus and Mohwa. The whole tract of these forests were said to belong to thakoors and petty Rajas, some independent but most feudatories of the Gaekwads. Crossing, the Narmada are the Rajpeepla jungles, stretches towards the Lautpura Range, thinning as they approach the Tapti. Teak is found here in addition to the woods already mentioned above. On the Ghats, leading to Khandesh are some teak forests, but the most extensive portion is below, in the hilly and jungle tract skirting the Surat district. Westwards are the Dharampur Raja's jungles, where teak was formerly plentiful, but the quantity has been much reduced."

It was in 1841 that the government Timber Agent at Surat, Mr. Boyce, facing difficulty in procuring good-sized timber for the government of India, paid a visit to the Dangs forests to enquire in to the further exploitation of forests. In the outer parts of the forests, the teak were poor and scattered, but the further, he penetrated, the larger and more numerous became the trees. From his inspection Mr. Boyce wrote[36];

> "Forests producing splendid teak extend north and south from the southern bank of the Tapti River, in the Beara Pergannah; to the territory of the Vansda Raja. Other forests continue to the southward, but owing to some peculiarities of the soil, the trees after attaining a moderate size become hollow; this is particularly observable in the timber obtained from the Dharampur Forests".

A great deal of timber was obtained from the Pipri and Khambhoja areas, which were at the time, were in the Bhil areas. When Mr. Boyce, visited the area, he noted the wasteful felling of the timber. He observed that the several large blocks of fine teak timber 4 to 5ft. in length and 2ft. in diameter were lying close to the newly felled trees. Further he noticed that the coolies felled the trees without first branching them, and cut off a

[36] *ibid*, pg. 108

piece at each end to reduce the trunk to the length most convenient for being carried. The axe men then, chopped down each end of the log to reduce it to a comfortable weight and thus, in the process, at least one half of the valuable tree.[37] This confirmed his opinion that all the first sort of timber brought down had been originally double the size. Mr. Boyce's observations were submitted to the Government of Bombay, and later he suggested that political officers should be asked to exert their influence on the Native chiefs to protect their forests. Thus we all see that here forests became a center of power. So valuable were they, that it defined the extent of political relationship amongst the native rulers, the British and the ruled in the heavily forested areas. The latter, most of the time emerged as a powerful gainer on the basis of their superior negotiable skills and the military might. This fact almost proved to be true to the territory of the Dangs.

History of the Dangs forests

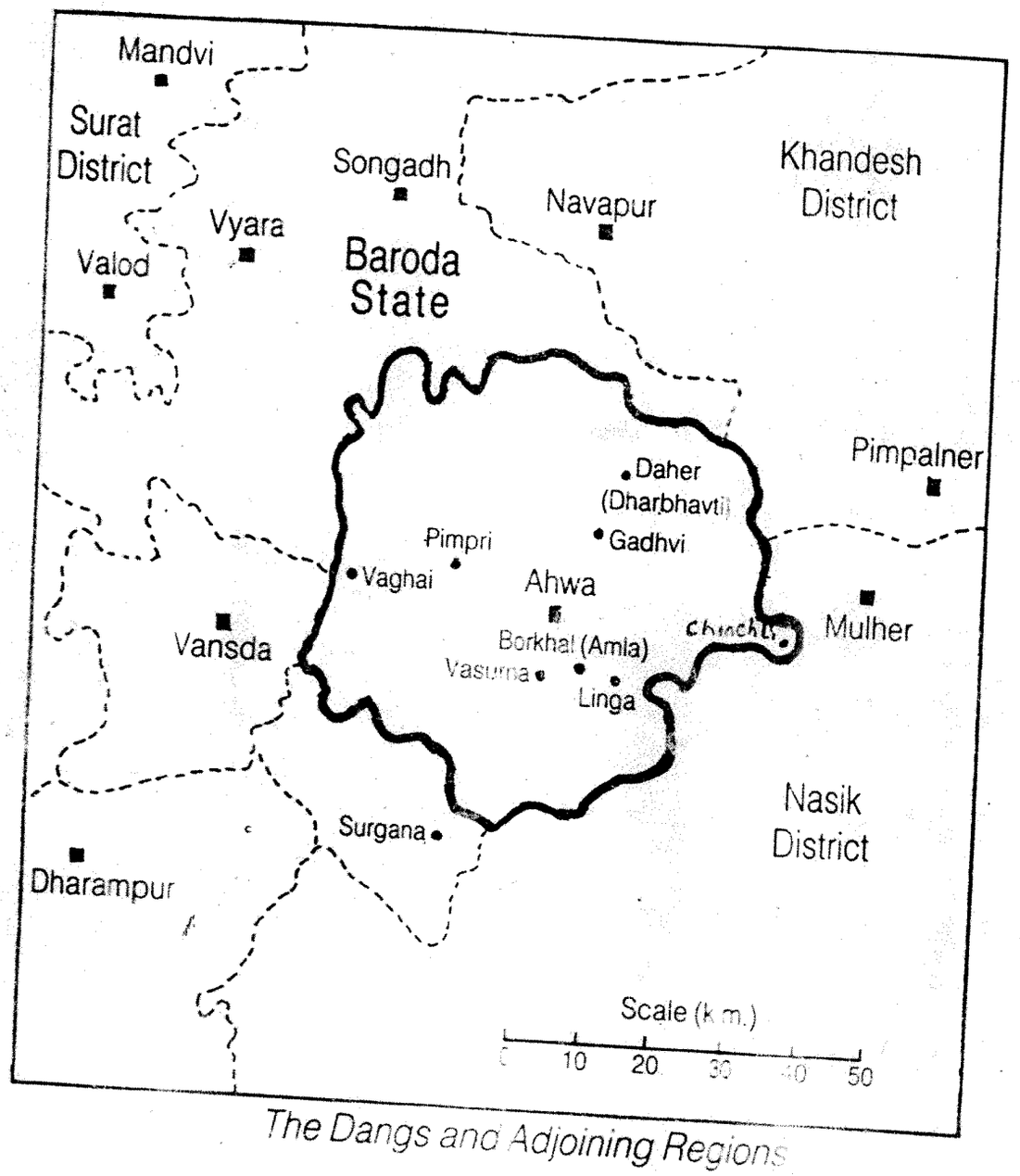
It's only of late that Dangs forests and its tribal struggles have come into the limelight. The Dangs consisted of a series of foothills between the flat alluvial plains of South Gujarat and the high mountains of the Sahayadris- the range, which divides the coastal belt from the rugged pleatue of the Maharashtrian Deccan (See map IIA). It was a country of thick forests and deep river valleys, which in the medieval times was considered almost impenetrable by the armies of outside states. In the pre-colonial period this area was under the control of the Bhil chiefs. In 1830, it was conquered by troops under the command of James Outram and brought under the overall paramountcy of the British, with Bhil chief allowed certain degrees of autonomy.

As discussed earlier, Mr. Boyce had visited the Dangs forests in 1842 and there, he managed to persuade three leading chiefs- Gadhvi,

[37] *ibid*, pg. 109

Map II A

The Dang Territory



The Dangs and Adjoining Regions

Border of Dangs

Other Administrative Borders

Source: D. Hardiman, Power in the Forests: The Dangs, 1820-1940, Subaltern Studies, Vol. VIII, OUP, 1984

Vasurna and Pimpri to sign leases for the timber extraction. Raja of Ghadvi was given Rs.2300 per year and the Naik of Pimpri Rs.1800 per year for their more extensive tracts.[38] The leases were one-sided with the British having all the advantages. During this time the value of forests had increased considerably as supplies of teak from other areas had declined in quality and quantity. British could now send men into forests to cut timber and the lease was to continue as long as the British might 'deem proper', with chiefs having no rights to revoke it. Later the leased money was increased by the British on the account of the protests of the chiefs. Then the Raja of Gadhvi received Rs 2700 during the first year and Rs 50 extra each year (increase from Rs 2300/annum). The Raja of Vasurna was given Rs 1600/annum-against the earlier amounting of Rs. 850. The British assumed the full and the sole power to cut conserve and plant trees in the Dangs. The chiefs were allowed to cut timber for their own use only and in return they were required to give full assistance to the government timber agents. Though, the chiefs were granted more money now, the sum was still less than the market value of the woods. As an official said[39],

> "Such leases... obtained at a marvelously cheap rate from the rude and uncivilized owners by the means of persuasion."

By this time, the demand of teak for the shipbuilding was superseded by a much larger demand for the railway sleepers. Number of railway lines was laid leading to the exhaustion of the trees. Different branches of Dabhoi railway station were laid opened for the traffic. In April1873, the lines from Miyagam to Dabhoi with a mileage of 20.00 m: Goyagate to Vishwamitri (Jan.1881, 1.63 mileage), Vishwamitri to Padra (July 1897; 12.77 miles), and Padra to Mahoba (July 1903, 6.49 mileage) were laid

[38] Ajay Sakaria, *Hybrid Histories*, Oxford University Press, Delhi, 1999, pg.182
[39] W.H. Propert to E.P. Robertson, 26 March, 1878, *Bombay Archives*,(hereafter BA), Revenue Dept., 1878, 58/127

down.[40] Tapti valley line was perhaps the largest in the area. This railway line opened up the highly cultivated portion of Gujarat lying between Surat and Vyara and the rich fertile valley of the Tapti River placing districts which were formerly isolated in communication with Bombay, Gujarat and Kathiawar.[41] Initially the demand for sleepers had been met from the thinner and more accessible forests of Thane and Surat districts, and the princely states of Dharampur and Vansda. By 1850's the forests were showing signs of exhaustion and on the other hand timber dealers were demanding that they be given access to the Dangs. After signing of the leases, the British had taken direct control of cutting, hauling and sale of timber from the tract using peasant labour hired from the plain region,[42] when the Dangis refused to cooperate. During the 1860's the British adopted a system of giving a contract of Dangi timber to private dealers. For example, one private dealer was given a contract to supply sleepers to the Great Indian Peninsular Railway. This private dealer invested his own capital in building roads to carry wood from the tract.[43] In 1869, British introduced a system whereby the right to cut and transport timber from a particular area was auctioned out to the timber merchants. The wood species and amount to be cut was mentioned in the contract.[44]

To help the contractors, the British constructed a new road into the heart of the Dangs, which provided access to fresh tracts of untouched forests. As a result the volume of timber exported rose considerably during the 1870's.

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[40] *Baroda Administrative Report*, 1904-05, 1905, pg.252
[41] *ibid*, pg. 253
[42] R. Oliver to G. Arthur, 5 October 1843, *National Archives of India*, (hereafter NAI), Forest dept., Political, 16 March 1844, 3-7
[43] C. Pritchard to L. Ashburner, 15 October 1870, *Baroda Record Office*, dufter no. V/432, file no. 12, pg.172
[44] *Forest Report of the Bombay presidency for the year 1869-70*, Poona, 1870, pg.49

As Dangs forests were taken over by the forest department, efforts were made to demarcate the area. It was in 1893, that 34% of the Dangs was demarcated as the reserved forests. Due to the greater efficiency of the administration and the opening of the Dangs through better communications, the earnings from the forests increased. During the decade 1892-3 to 1902-2 the average annual earnings were Rs.63, 965; and during 1902-03 to 1911-12 was Rs.86, 670.[45]

The British also paid attention towards the minimizing of the forest fires, natural and man made. E.M. Hodgson was appointed as an Assistant Political Agent and was given judicial powers to try all but the most serious criminal cases in the Dangs. He tried to persuade the chiefs to dissuade their subjects from starting fires. He promised to give rewards and turbans to minor chiefs and village headman who managed to prevent fires.[46] In 1907, a complete ban was placed on the burning of grass under the Mahowa trees (though it had some ecological effects, discussed in chapter no. IV), the smoking out of the rats and other animals, and the use of fire torches to provide illumination at the night.[47] As a result, whereas in 1905-06, 93% of Dangs had been burnt, in 1906-07, only 17% loss was reported.[48]

The beginning of the First World War proved to be a great event, which engulfed most of the major Europeans and the Asian nations. Contributions were made by the colonies directly or indirectly. India also made contributions to the war by sending thousands of men on the war front. Indirectly, she contributed by supplying food, fuel, and timber to the military. A special department called the Timber Branch was established in India for the purpose of supplying woods to the war front. The table on

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[45] C.W.A Turner to Bombay Government, 30 Jan. 1933, *NAI*, Forest Dept. pg.20
[46] *Administrative Report of the Forest Dept in the Bombay Presidency including Sind,* for the year 1903-04, Bombay 1905, pg.12
[47] *ibid*, pg.12
[48] *Annual Administrative Report on Dangs*, 1906-07, *BA,* Education Dept, 1908, 63/739

the following page shows the amount of wood provided by the colonies of the British towards the war efforts.

Table II C

Operations of the Timber Branch (India) from April 1917 to October, 1918.[49]

Destinations	Indents received (Tons)	Amount shipped or dispatched (Tons)	Balance to be Supplied (Tons)
Egypt	64,116	56,904	7,212
Salonkia (Greece)	131,406	121,386	10,020
Other Places (East Africa, Persian Gulf, Aden, etc.)	10,106	3,744	6,362
Total	225,252	197,681	27,571
India	46,052	30,395	15,657
Grand Total	271, 304	228,076	43,228

The forests of Dangs had provided good profits to the British during the War. It was in 1907-08 and 1913-14, that expenditures exceeded profits not because the income from the timber fell, but because the high cost of the construction of the Ahwa town (the capital of the British Dangs), along with its other public works. The war brought an urgent demand for timber, which led to the large scale cutting and extraction of timber from the Dangs. In 1914-15, the income from the Dangs was Rs.154, 133; by 1918-19 it was 460,021.[50] With the completion of much of the public

[49] *The Forests of India*, Vol. III, pg. 533

[50] David Hardiman, Power in the Forests: The Dangs, 1820-1940, *Subaltern Studies*, David Hardiman and David Arnold (eds) vol. VIII, pg.141

Works in 1920's, expenditure fell, while income remained high. The Dangs provided to the British an excellent source of income.

Table II D

Profits / loss from the Dang Forests.[51]

Years	Rupees
1892-93 to 1901-02	+22,071
1902-03 to 1911-12	-21,012
1912-13 to 1921-22	+25,766
1922-23 to 1931-32	+154,917

Thus the history of the Dangs forests is the story of ruthless destruction of its wooded treasures making the eco system fragile for the living and the non-living world. Apart from Dangs, Gujarat did not have a dense forest cover. The state has vast river plains, few high lands and fewer tracts under forests.

During the colonial times only two districts, Surat and Panchmahals had major forests. (Both these forests had been acquired by the government on lease.) Surat was regarded as a heavily forested area as it included the forests of Dangs, Valsad and Dharampur. The following table gives the statistics of areas covered by forests in the different districts of Gujarat in1940-41.[52]

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[51] Figures given by C.W.A. Turner to Bombay Government, 30 January 1933, *NAI*, F.D., 20-P, 1933

[52] J.M. Mehta, *The rural Economy of Bombay Gujarat, containing possibilities of Reconstruction*, Baroda State Press, Baroda, 1930, pg.39

Table II E

Area under the Forests in Gujarat , 1940-41

District	Revenue Department (Acres)	Forest Department (Acres)	Total Area Under Forests (Acres)	Area of Forest in Acres Per 100 Acres of Cultivated Land (Acres)
Ahemadabad	8,634		8,634	0.5
Bharuch & Panchmahals	2,384	2,01,785	2,04,169	15.7
Surat	8,103	50,852	58,852	7.4
Total	19,121	2,52,637	2,71,754	23.6

The total forests under the Revenue and the Forest department together in the above districts covered 2, 71,758 acres in 1940-41. In the British Gujarat the area of reserved forest was largely situated in the Panchmahals, Mandavi, and in patches in Pardi, Valsad and Chikhli talukas in Surat districts.[53]

In Gujarat, the teak wood was supplied by the Surat Dangs and Panchmahals, which had been acquired by the government on lease. The British fostered greater exploitation of the forests by the introduction of new machines such as small transportable saw mills which helped in

[53] *ibid*, pg.121

felling the best timber.[54] These mills were engaged in the depletion of woods primarily for the railway sleepers, as there was a constant demand for it. The management of these saw mills were entrusted to the Engineering Branch which was responsible for the supply of stores, upkeep and equipment, while the financial matters were looked after by the Divisional forest Officers[55]. These sawmills were transported from place to place depending on timber demands and removed when they showed a continuous decline in profits. In the Dangs, the Chikhalda saw mills did some profitable business. Its output showed a steady increase. In 1928-29, the mill showed a profit of Rs.49, 465, which shows that higher rise in the supply of timber, was directly proportional to deforestation.

Table II F

Timber Output of the Chikhalda Saw Mills[56].

Mill	**Output during the year in Cubic Feet**		
Year	1925-26	1926-27	1927-28
Chikhalda Mill	43,229	53,410	59,370

A Sawmill also came up near the Subir road (11 miles) in Surat Dangs leading to the Nawapur station. It provided teak pillars for railway wagons, meter gauge sleepers and scantling boards for the Gujarat markets. It is estimated that this sawmill saved for the government Rs.14, 000 a year in the reduced cart freight along with the greater output of timber.[57] The places where roads were opened (as feeder lines) along with the extension of Gaekwad Baroda state railways, profits from timber soared in direct proportion to destruction of forests. For example, with the extension of railway line to Jharia in 1925-26, the Dang teak began

[54] Dr. Aruna Awasthi Environmental degradation: A case study of Railways and Deforestation in India in the 19th and 20th centuries, Indian History congress, Calicut, 1999, pg.576

[55] *The Economy of Bombay Gujarat*, pp. 122-123

[56] *Economic Life in the Bombay Gujarat*, pg. 123

[57] *ibid*, pg. 123

to be sold for over Rs.100 a ton standing in the forest, for which, at one time, contractors would not pay more than a rupee a tree. As a result the British amassed forest revenues of the Surat district went up from Rs.482, 487 in 1923-24 to Rs.600, 435 in 1928-29 – a clear indication of colonial maximizing of natural resources for its own benefit[58].

Laissez faire to Scientific Forestry

It is significant to note here, that by the late 18th and the early 19th century, a shift had begun to take place in the forest policies of the government. It could be termed as a shift from the 'Laissez faire to the scientific forestry'. The early proponents of forest conservancy in India were all East India Company employees, working either in the botanical gardens, the medical service, or the army. Reasons for the need for the scientific forestry arose because the leading surgeons of the East India Company believed that the extraction of the timber on an unregulated scale could cause ecological disaster not only on a regional but also on a global scale. Then there was the desire to gain a complete control over the forests belonging not only to India but also of the other colonies. Lord Dalhousie, the Governor General of India in 1850's, had promoted the railways, the telegraph, and a unified postal system for the Indian subcontinent. Equally important, however, he promoted a modern system of forest management. He had appointed Deitrich Brandis as Superintendent of Forests in Pegu in 1856 and also wrote his famous 'Minute on Forest Policy of 1855' which signaled the dawn of the scientific forestry in the British Empire.[59] In his Minute, he strongly supported State intervention in the forest policies of the colonies. He saw utility in the State intervention, and it was in Pegu that an organized system of forest management first took place.

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[58] Environmental Degradation, pg.576
[59] *Forests of India*, vol. 1, pp.256-60.

The Dalhousie's Minute on the forest policy is noteworthy for its strong criticism of the private enterprise. It was felt that the policy of laissez faire would actually deprive the government of the 'full value of its forests'[60]. Thus Dalhousie's Minute ordered the Forest Department to implement State controlled teak extraction in Pegu. Later the Forest Departments in the other colonies followed the same principles. The creation of the Indian Forest Department and the enactment of Indian Forest Act in 1865 illustrated the government of India's growing interest in scientific management of the forests. Therefore the management of the forests in the British Empire in the Indian subcontinent and in the other colonies shows the signs of a shift from the Policy of Laissez faire to the scientific management.

The scientist- conservationists of the mid- 19th century were worried that the capacity of the Indian forests to supply timber had severely diminished and were showing signs of exhaustion. They diagnosed that the causes of deforestation were: growing demand for forest produce; increasing unregulated commercial extraction; extension of cultivation; onset of railways; and the ignorance of human beings[61].They also began to express concerns about the physical and environmental effects of deforestation. They began to lead a campaign for forest conservation and for a wider commitment to efficient resource use. The colonial scientist campaigning for forestry in the early 19th century stressed the commercial potential of the Indian forests whereas the founders of the Indian forestry in the second half of the 19th century, including H Cleghorn, D Brandis, and F Bailey were bio-prospectors who sought to exploit the riches of the subcontinents forests and unlike their predecessors embraced the continental tradition.

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[60] Raymond L Bryant, 'The Political Ecology of forests in Burma: 1824-1994', University of Hawaii Press, Honolulu, 1997, Pg.44

[61] *Modernising Nature*, pg.70-71

Consequently the second half of the 19th century marked a significant turn in the history of British colonial forestry with the creation of the Forest departments in various regions of the country. The British government being impressed by the French and the German system of forest management, employed personnel trained in above nations to help in designing efficient framework of resource use modeled along the European lines. In other words we can say that probably this was the beginning of an awareness of ecological imbalance and some efforts to introduce the concept of sustainable use though only in colonial terms. By the last few decades of the 19th century, the forest department in India was wholly responsible for fulfilling government's timber demands. This so called successful forest management along with the effective lobbying led the other European governments to follow a similar policy in their colonies. Between 1876 and 1900, forest departments had been set up with the assistance of the Indian forest department in New Zealand, Mauritius, Cyprus, Ceylon, Nigeria, Sierra Leone, Kenya, Uganda, Malaya and Australia.[62]

In brief, the years 1860 to1900, saw Brandis (he was appointed Inspector –general of Forests in India) and his successors implementing the principles of forest management:

- Forests across India were surveyed and inventories of forest species made
- Working plans and silvicultural operations were devised and implemented for the entire country along the guidelines established by Brandis
- Manuals with tables indicating yield and volume of different species over time were compiled

[62] Ravi Rajan, Imperial Environmentalism or Environmental Imperialism? European Forestry, Colonial Foresters and the Agenda of Forest Management in British India, 1800-1900, in *Environmental history of South and South East Asia*, pg. 325

- Regimes for protecting forests from natural and human destruction were established
- Communications were improved and infrastructure for exploiting forests-roads and railways developed
- Establishment of forest industries to exploit various kinds of 'Minor Forest Produce', such as pine-resin , paper pulp, tanning materials, essential oils, lac, gum-resin, drugs and medicinal herbs, oil seeds, cane and fibers.

The result being that Indian forestry by the end of the century increasingly became a profitable enterprise for the colonial state[63]. The environmentalist ideology in the 19th made a clear conception of what conservancy meant in terms of attitude to nature. According to John Passmore conservation is harnessing of nature for man's economic purposes but in should not involve carelessness and wastefulness in doing so. Conservation is "careful husbandry". Whereas preservation is "the attempt to maintain in their present condition such areas of the earth's surface as do not yet bear the obvious marks of man's handiwork and to protect from the risk of extinction those species of living beings which man has not yet destroyed.[64]

During 1863-5 and 1868-70 Brandis toured India extensively and implemented the forest management on continental lines. He arranged for the training of prospective Indian foresters in Germany and France in 1866 and set up a continental- style training school for Indian subordinate foresters in Dehra Dun in 1878.[65]

He was also involved in the training of the future foresters of the U.S. Forest Department. He wrote some major books on botany, the most

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[63] *Modernising Nature*, pg.86; *Forestry in British India*, pg.126-204; E A Smythies, *India's forest wealth*, london, 1925,pp 80-116; D. Brandis, *Progress of Forests in India*, Mc Farlane and Erskine Press, Edinburgh, 1884. pg. 400

[64] Passmore J., *Man's Responsibilities for Nature: Ecological Problems and Western Traditions*, Charles Scribner's Sons, New York, 1974, pg. 74 & 101.

[65] *Modernising Nature*, pg 83.

important of which is Indian Trees (1907). [66] His contribution to the Indian forests in terms of its wide knowledge is immense. His efforts to catalogue and map Indian Forests laid the foundation of Forest Studies in India. In 1878, he established the Dehradun School for the Indian foresters. To him, forests offered both direct and indirect benefits. They were a source of timber and other forest products to fulfill the requirements of industry and agriculture. Indirectly they played a larger role in regulating climate and protection of soils, consequently preventing destructive phenomena, such as floods and torrents.

After the formation of the forest departments in various parts of the country, process also began to promulgate some kind of working plan in the respective regions, under the forest department. A working plan deals with the details of scientific management of forest for a prescribed period. Before the working plan of an area is drawn up, a detailed survey of growing stock is conducted. On the basis of the data collected, plans are drawn upon for felling, regeneration, silvicultural treatments and the protection of forests with the provision for the due exercise of rights and privileges of people including grazing for cattle. The areas exploited every year are indicated in the Working Plan. Such regions once exploited were either regenerated artificially or naturally depended upon the prescription of the working plan. The credit of having introduced a forest working plan in India is ascribed to Mr. Munro, Conservator of forests of Travancore in the early decades of the 19th century.

The working plans in Western India were also drawn up in the late 19th and the early 20th centuries. The forests of Rajpipla were already exhausted by 1850's due to the commercial demands of timber in the market. They were spread over Nandod, Vagra, Hansot, Dediapada, Jhagadia, Sagbara, Ankleshwar and Valia talukas of the Bharuch district.

[66] Imperial Environmentalism or Environmental Imperialism? pg.344.

Till 1885, the forests of ex- state of Rajpipla were managed by the ruler on 'Dan' or 'Royalty system'. According to the royalty system, any individual or trader could remove the forest products including timber in large number to an undefined extent by obtaining a pass from one of the nakas or depots after paying royalty at scheduled rates[67]. Inspite of the continued exploitation of forest little attention was given to the management and protection of forests. In 1920, a plan for cyclic felling of the trees was proposed, but was never put into practice, though during this time felling generally became of selective nature with the best trees being removed[68].

In Rajpipla, the forests of Nanchal and Vakal-tappa of the ex state of Baroda, have distinguished history of their own. Prior to 1877, there was the practise of '*ijaradari*' system, where '*ijaras*' (leases) were given to *ijaradars* to cut trees and remove any quantity of timber. This resulted in heavy destruction of forests. In 1877, Mr. Ukidway, a forest officer of the Bombay Forest Service was deputed to this area. According to his instructions only dead and fallen woods were to be extracted. Inspite of this the illicit felling continued. Between the years 1891-94, '*Abadi*' rule was introduced, which encouraged cultivators to cultivate anywhere in India. This let to a sudden spread of cultivation at the expense of rapidly reducing forests in certain areas. The Nanchal tract[69]witnessed large scale clearing of the forests by the cultivators. In 1922-23, Warden introduced a working plan for a systematic felling of trees. It included a system of clear felling system of trees followed by artificial regeneration (rotation was fixed at 20 years), prescribing of silvicultural system in certain areas, provision for planting of species which would yield

[67] *Working Plan for Rajpipla East and West Forest division*, the Government of Gujarat, 2005, pg. 20. Data collected from Working Plan Circle, Surat Forest Office, Surat.
[68] *ibid*, pg.20
[69] *ibid*, pg.21

firewood in as short time as possible and finally laying down of certain provisions for safeguarding animal life.

Dharampur forests also have a similar history as that of the Rajpipla forests. These forests had already been depleted by 1850's. Before 1894, the exploitation was carried out under the permit system under which, license had to be obtained before cutting the trees. In 1894, began the contract system whereby contract was given to public and private contractors to cut as many trees of teak as they liked. Under teak contracts certain marketable species, such as *sadad* (Terminalia tomentosa), *shisham* (Deilberaria latifolia), *khair* (Acacia catechu) and bamboos (Poaceae bambusoidea) were exploited. [70] This system continued up to 1922 and then replaced by regular felling in 1922. Under the regular felling coupes were worked under the coppice with standard system. However the reserved areas were few and apart. The defect with this system was that the contractor felled and removed indiscriminately (even the young saplings were removed) which proved to be detrimental for regeneration of the forests and the advance growth. Crooked and diseased stems of valuable species were left behind along with the unmarketable species.[71] Separate felling of the injali trees also undertaken for the supply of firewood to the three distilleries established at Fatepur, Mandva and Dharampur.

In addition to these, in Dharampur *Khair* (Acacia catechu) trees were also removed for the Katha manufacture and *samar* (Bombax ceiba) trees for the supply to matchstick industries. During the period from 1943 to 1945, teak was extracted on a large scale for the Second World War.[72]

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[70] *Working plan for Valsad North and South forest division*, I.F.S, Deputy Conservator of forest, Valsad, Valsad, vol.I, Govt. of Gujarat, 2005, pg.16
[71] *ibid*, pg.16
[72] *ibid*, pg.16

The area between Par and Nar rivers up to Vahiyal had abundance of natural bamboo. These were also removed by the contractors as both the above rivers afforded rafting facilities during the monsoons.

In 1942, Mr. Sampson (Retired Forest officer of the ex- Bombay state) was appointed as President of Council of Dharampur forests. He formulated the Sampson Forest Plan which was put into force from 1945-46. It prescribed selection –cum –clear felling. Its main tenets were as follows[73]:

- Felling of all inferior trees (of poor and stunted growth) interfering with the valuable growth on steep and precipitous slopes.
- Retention of sound promising stems of teak and of better class of species as standards and felling of all inferior and unmarketable species interfering with the valuable growth in all the remaining areas.
- Clear felling was to take place in areas having immature or unsound teak mixed with *injali* and bamboos having no scope for advanced growth.
- Bamboos were extracted on permits and were removed in annual or periodical farms.

The above tenants of the working plan show that the scientific management of the forests based on the dessicationist policy.

It was clear that for Forest Department the value of forest was only limited to the extraction of the timber for the commercial purposes. Concepts of biodiversity and ecology eluded them as they were yet to be developed and their relevance to be fully comprehended. The colonialists were also unaware of the cultural values attached to forests by the indigenous people.

[73] *ibid*, pg. 17

Dangs Working Plan of 1913:

The forest-working plan for north Dangs forests was prepared in 1913. It prescribed fellings on a single coup of about 10 sq kms and was to be worked departmentally. A forty year felling cycle of trees was adopted. Sowing and plantation of teak was carried out in the old cultivated areas and on slopes, where natural regeneration was deficient.[74]

Under the South Dangs Working Plan of 1916, exploitation was carried on following principles.[75]

- A few selected areas were clear felled and then artificially regenerated.
- The felling was organized in Central Dangs.
- To allow the areas containing rich growth to develop into mature forests by removing old and unsound trees and inferior species.

This is an example of disciplining and ordering of nature.

Combined Working Plan for Dangs was designed by a British officer Mr. Majoribank in 1926.[76] Under this plan; the entire forest were divided into blocks and compartments as permanent management units. The plan envisaged the clear felling in the areas where bulk of crops was mature or unsound. The places where unsound trees were less in number and bulk of crops had large proportion of teak poles were to be worked under the improvement fellings.[77]

Though the working plans in general were laid down by the government, the principal motive of forest department in every presidency and region was to earn maximum profits. The forests were fast depleting, and the

[74] *Working Plan for Dangs Forests*, Working Plan Division, Surat, Govt. of Gujarat, vol. I, 1996-97, Surat, pg.64
[75] *ibid*, pg.59
[76] *ibid*, pg. 64
[77] *ibid*, pg.65

working plans could not do enough to even reduce the withering areas under the forests. Forest officials made the cutting of trees by the people of villages illegal; but it continued to entertain and fulfill the repeated requests of the British government to supply them with timber in huge quantities. Even the policies adopted under the working plan for the management of the crops, resulted in the alteration of crops (saplings). For example, in the forests of South Gujarat, it was noted that the system of selection felling and the artificial regeneration resulted in the reduction of species like *Kadaya*, *Sadad*, *Mahuda*, *Shisham* etc[78]. It was also observed that teak plantation which was raised, was promising in the initial stages but subsequently their growth retarded as they were not naturally planted. Further it was noticed that in teak plantation areas, the growth of other species was gradually reducing. The bamboo areas, which had flowered in the past, did not regenerate to a desired extent resulting in the reduction of the area under the bamboo plantation. Therefore we could perhaps observe that working plans disturbed the natural balance of the eco- system. They became the basis of systematic official deforestation manifesting into Eco Imperialism based on the so-called "Scientific Management of Forests".

Central Gujarat is not as heavily forested area as that of South Gujarat, though it contains the fertile tracts suitable for agriculture. Territorially it comprised largely of the Baroda State (under the Gaekwad) and Ahemadabad, governed by the British (Bombay Presidency). By 1875 the British had begun to consolidate their rule in India, to become a paramount power. Some princely states were allowed to exist, but in a subordinate alliance.

The Gaekwad State of Baroda was divided broadly into four distinct blocks quite apart from each other. It included Navsari, the southern district of the state, which lies near the mouth of the Tapti River,

[78] *ibid*, pg.24

interlacing with the British territory. To the north of river Narmada is the central district of Baroda, the capital city including the areas such as Sankheda, Miyagam Karjan, Savli etc. Further up to the north of Ahemadabad, lies the rich district of Kadi, with its busy towns and numerous industries. And far to the west, in the penimsula of Kathiawar, lie tracts of land, isolated and separated from each other, which comprised the district of Amreli. (See map IIB). By the end of 1904, the area of the State was approximately eight thousand sq. miles with the population near to two million.

Table II G

Population of the State of Baroda by the end of 1904.[79]

Districts	Area in sq. miles	Population (in millions)	No.of towns	No.of Villages
Baroda	1,887	6,44,071	14	924
Kadi	3,015	8,34,744	16	1,187
Navsari	1,952	3,00,441	5	979
Amreli	1,245	1,73,436	6	310
Total	8,099	19,52,692	41	3,400

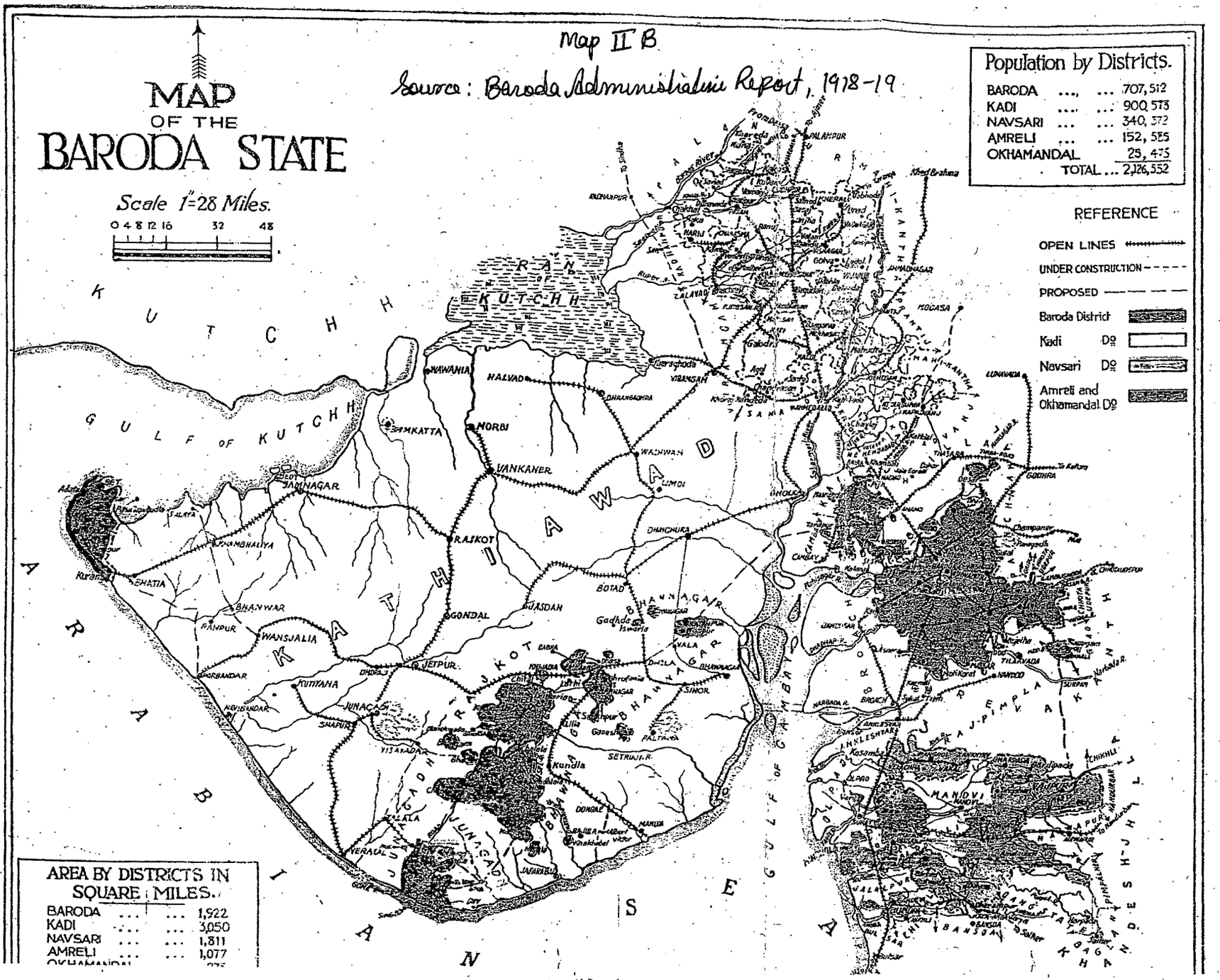
The total area of the forests stood at 680 sq. miles in 1904 and the total area of the Baroda State was 8,099 sq miles. It is an established fact that forests should occupy one third of any territory. One third of 8,099 sq miles is 2,700 sq miles. Thus we can say that even in 1904 the forest cover in the State of Baroda was meager.

Prior to 1873, there was a practice of 'Farm System' in the State. Land revenue was realized by persons to whom Revenue was farmed out. But

[79] *Baroda Administrative Report*, (hereafter BAR), 1904-05, Times Press Bombay, 1905, pg.1

Map II B

Source: Baroda Administration Report, 1918-19



the farmer was free to use resources of the forests of his talk under a lease obtainable from the ruler. The State in return realized the forest revenues by locating its nanas or forest depots at several places. From 1884 to 1890, the forests remained under the charge of several Nib Scubas of the Revenue Department. The officers during this time, followed the system introduced by a British forester, Mr. Oak, via... selling green timber from the forest, at the will of the contractors, who undertook to pay certain fee per handy (about 12.5 cubic ft.) of timber removed [80]. Thus the system was leading towards the maximum denudation of the forests of every kind of timber species available in that particular area.

The forest department in the Baroda State was created in January 1877, and Late Gusted Medially had been appointed the head of the Forest Department in 1894.[81] The forests under the department were situated in Navarre, Baroda and the Amelia district.

[80] *ibid*, pg. 168
[81] *ibid*, pg. 169

Table II H

Reserve Forests in the State of Baroda on July 31, 1905[82] .

Name of the forest range	Name of talk	Area of range In bights	Total area of each range in bights
Maui	Maui Navarre	11,457 1,810	13,273
Viagra	Viagra	91,803	91,803
Saddle	Singed	73,631	73,631
Patti	Viagra Singed Vapor	1,945 11,091 275,955	288,994
Vocal	Vocal Vapor Dari	19,296 106,850 1,168	127,314
Snakehead	Snakehead Soil Pagoda	13,514 24,651 18,966	57,131
Total			739,223 or 680 sq. miles

In Baroda, under the permit system, forest depots were established at the chief outlets, keeping an account of timber and other resources removed from the forests by the permit holders.

[82] *ibid*, pg.170

Table II I

The Following quantity was removed in the year 1903-4[83]:

Items	1903-04	Rupees
Dry Timber		
Cartload	996	2,532
Number (no.)	33,303	878
Fuel		
Cartload	15,584	5322
Number	877	27
Bamboo		
Cartload Head log	346	173
Produce sold at depots	11,49,233	24,520
		9,693

Financial Results: - The arrears outstanding from the previous years (1895-1900) were reduced from Rs.14, 603 to Rs.12, 098.

[83] *ibid*, pg.181

Table II J

Realizations from the timber (removed for various uses)[84]:

Year	Rs (Demand)	Rs (Actual Realization)
1901-02	91,152	83,364
1902-03	58,582	54,828
1903-04	89,177	88,552
1904-05	1,21,039	1,18,303
1905-06	1,54,426	1,52,519

It is evident from the above figures that in the Baroda State, the exploitation of forests was taking place rapidly, even though the Working Plans had already being formulated and were put into operation. As a result of nearly complete destruction of mature and healthy trees unsupported by the recuperation period followed by selective regeneration could never bring back the natural growth of vegetation and trees for a self-rejuvenating eco- system.

The Gaekwads and the British were two chief powers in Gujarat sharing boundaries, rivers and forest areas. In 1895, the Bombay government had forwarded the papers related to a Project related to desalting and deepening of the bed of the river Amice, so as to make it suitable for floating timber from the Dings to the coast[85]. They had sought an approval of the Gekas, as a part of river was then also running through their territory, which they willingly acceded to.

[84] *BAR*, 1906-07, 1907, pg. 126

[85] Huzur English Office, revenue Dept, Section no. 227, File no.3, No.6473 of 1895, 1895, *Baroda Record Office* (*BRO*).

There were also the cases of thefts of wood from the forests as a result of taking away of people's rights of using forest wood on the subsistence level. In a letter, E.M. Hodgson (Divisional forest officer, Surat) to the Joint Revenue commissioner, Baroda State, draws the attention of the latter towards the destruction of thousands of green trees being cut and stolen in Maui and Viagra ranges. He further pointed out that the forest subordinates, inspire of being informed are not taking any cognizance of this injury, as a result all the Mahwah and Viagra forest ranges are suffering[86] or in other words leading to the depletion of Forest Reserves for the British. Consequently the forests actually began to deplete in Central Gujarat region. Neither the British nor the Gekas would actually let their revenues suffer, when it came to the forest revenues. Forests to them were huge source of income. Working plans were formulated by the government whereby the trees were systematically planted only to be cut and exploited later for their own benefit. For example, two coupes in the Maude forest range and three in the Viagra range were worked in 1907-08, fetching Rs.14, 066.[87] In Saddle, and five coupes yielded the revenue of Rs.12, 191. These ten coupes had resulted in the cutting of 85,959 trees from the reserved forests for their commercial needs.[88] It was further expected by the Forest Conservators that at the time of next rotation, these coupes would fetch about four times of the present yield.[89] When trees of the forests are felled regularly on a rotation basis after they mature, replaced by the new saplings, there are far reaching effects, such as soil erosion, because by the time, the trees become strong and mature enough to hold the soil, they are cut and new saplings are planted. The heavy rains then erode the topsoil containing important nutrients away, gradually resulting in the loss of fertility, which over a period of time may hinder the growth of trees.

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[86] Huzur political office, Revenue Dept., Section no. 225, File no. 4, no.45/8 of 1909, *BRO*, pg. 169
[87] *BAR*, 1907-08, Times press, 1909, pg. 109
[88] *ibid*, pg.109
[89] *ibid*, pg.110

Railways at this time had already opened vast tracts of lands to cultivation. As discussed earlier, the demand of sleepers was fast responsible for the denudation of the country's wooded resources. In 1910-11, the Baroda state witnessed the deforestation of 35 bights of the total reserved forests of 698,468 bights due to the construction of the Osama -Ankara Railway.[90] Later, the proposal to extend this railway line to Sara in the Amerada Peat Mahan was approved by the Gekas with a view to open the Nichol region. This area was known for its valuable forests, large reserve stock of fodder and grazing plains. It was also felt that this project would also stimulate expansion of cultivation in the large rich arable tracts. Further, this extension would also pass through will also pass through the Handed, and tap the timber and grain traffic of the Dediapada Mahal[91]. The Baroda State Railways especially the Dabhoi railways switched to the use of wood fuel of babool as it was costing them only Rs.15 a ton as compared to Rs.27 a ton of coal, with an annual saving of Rs.2250[92]. Using wood fuel however was dangerous as the train would be carrying cotton in the open wagons placed next to the locomotives and it could easily catch fires.[93] Later the villages along the line were willing to fell and cut up fire wood into suitable lengths for the value of the bark would save upto Rs.4000 per annum.[94] Further, in 1920-21, the railway extension of the Billimora Kala Amba line to Jeluria across the river Ambica, a distance of about 3 miles in the British Dangs was sanctioned as it was expected to bring in a large accession of timber traffic from the region, which was then finding its outlay towards Valsad in carts by the road.[95] The state had also obtained permission

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[90] BAR, 1910-11, 1912, pg. 106
[91] *BAR*, 1919-20, 1921, pp.221-22
[92] Huzur Political Office, Section C, Correspondence related to railway extensions, Dabhoi to Bahadarpur, Chanod and Baroda, 1877, Letter no. 1/5017, *BRO*
[93] *ibid*, 1877, Letter no. 4795/12600, *BRO*
[94] *ibid*, Letter no. 538 of 1877, *BRO*
95 BAR, 1920-21, 1921, pg. 213

from the government of India to extend the railway line from Billimora station to Billimora bunder, so as to serve as an alternative sea route for timber and other traffic towards Bombay, where extensive urban construction operations were generating immense demands.

Table II K

Financial results of the Forest Department of the Baroda State 1914-1936.[96]

Year	Revenues (Rs.)	Expenditure (Rs.)	Surplus (Rs.)
1914-15	1,74,764	74,797	99,967
1915-16	1,92,026	78,696	1,13,330
1916-17	2,47,966	85,111	1,62,855
1917-18	3,24,170	88,077	2,36.093
1918-19	3,83,119	95,545	2,87,571
1919-20	4,50,536	1,04,821	3,45,705
1920-21	3,78,986	1,22,235	3,45,705
1921-22	4,64,256	1,29,252	3,35,004
1922-23	4,96,008	1,24,132	3,71,876
1923-24	4,61,485	1,30,580	3,30,905
1924-25	4,61,485	1,30,580	3,30,905
1925-26	6,46,371	1,15,155	4,95,216
1926-27	6,61,592	1,27,804	5,33,788
1927-28	4,07,62	1,30,580	3,12,980
192829	5,20,686	1,37,754	3,82,932
1929-30	4,05,600	1,43,232	2,62,368
1930-31	3,17,109	1,34,711	1,82,398
1932-33	3,41,639	1,58,640	1,82,999
1933-34	3,34,931	1,36,750	1,98,181
1934-35	3,65,403	1,43,614	2,21,789
1935-36	4,26,031	1,32,521	2,93,510

[96] Compiled from various Annual *Baroda Administrative Reports*, from the year 1914-1915 to 1936-37, *BRO*

During the war years when the demand of fuel and wood was at its peak, leading to the rise in the prices of wood, the Forest Department of Baroda, was extracting maximum revenues from the forests. In 1914-15, the revenues from 1, 74,764 had jumped to Rs.4, 50,526 by end of 1919-20. The profits too increased from Rs.99, 967 (1914-15) to Rs.3, 45,705 (1919-20), thus higher the profits greater the exhaustion of the forests.

The dominant form of human intervention in the natural environment of Gujarat has been agriculture. From approximately 32% of the total provincial area in the arable (the sum of area under temporary crops, permanent crop and fallow) in 1890, arable land increased to 36% in 1910, 43% in 1930, 45% in 1950, and 52% in 1970.[97] This represents an expansion of arable land from 1910 to 1970 of approximately 3.9 million hectares, a increase of 61%. If we only look at the area under temporary crops (jowar, bajra, rice, wheat etc.), it expanded by 4.5 million hectares (an increase of 86%) suggesting not only a conversion of non-arable land to agriculture but also a decrease in the area allowed to lie fallow.

This agricultural area had to come from somewhere. New productive taxable land could come into being only at the expense of other, non-agricultural vegetation. In Gujarat, as in most other regions, the easiest areas to bring under agriculture would have been open grasslands and shrubs lands and forests. In most of the South Asia, the area under forests or woodlands is often complicated by the nature of official statistics, which report 'forest' largely as under governmental control, known as 'restricted' or 'protected'. However the statistics shows that they were hardly reserved or protected. From around 31% of the total area of Gujarat in 1890, the wooded areas had reduced to 11% by 1910

[97] Edward S. Haynes,The Natural and the Raj: Customary State Systems and Environmental Management in Pre-integration Rajasthan and Gujarat, in "*The Essays in the Environmental History of South and South East Asia*", pg. 742.

and continued a steady decline of 9% in1930, 8% in 1950 and 6% by 1970[98], already crossing the thresh hold of a sustainable environment in 1911(See the table IIL).

[98] *ibid*, pg.747

Table III.
Land Use in Gujarat 1880-1980

Gujarat	1880	1890	1900	1910	1920	1930	1940	1950	1960	1970	1980	%change
Arable	6834.7	7070.1	7030.8	7615.8	8302.7	8645.6	9112.5	9328.3	10321.2	10314.7	10073.3	47.40%
Settled,Built-up etc	249.8	260.5	244.2	232.4	241.5	256.2	298.1	339.4	413.4	523	648.7	159.70%
Forest	791.9	752.6	718.9	674.3	621.4	572.4	517	424	364.7	330.9	294.6	-62.80%
Interrupted Woods	1756	1638.2	1557.1	1454.4	1237	1196.5	4097.1	961.1	751	678	582.2	-66.80%
Grass/Shrubs complexes	3790.7	3716.9	3916.2	3529.1	3212.5	3087.7	2881	2761.2	2438.4	2424.8	2529.9	-33.30%
Semi Desert Scrub	1588.5	1587.7	1577.1	1547.5	1465.2	1396.6	1314.3	1385.5	1069.9	1075.5	1175.5	-26.00%
Desert communities	813.3	820.2	832.4	817.6	789.6	765.1	740.3	774	655.8	666.3	688.6	-15.30%
Unvegetated	387.3	379.6	375.6	394.1	383.3	379	364.3	356.3	339.3	342	370.6	-4.30%
Desert and Tundra	2789.1	2787.5	2785.1	2759.2	2638.1	2540.7	2419	2515.9	2065.1	2083.8	2234.7	-19.90%
Major Wetlands	1035.4	1022	995.4	982.4	954.5	948.4	922.9	917.7	893.8	892.4	884.2	-14.60%
Surface Water	1738.8	1738.8	1738.8	1738.8	1738.8	1738.8	1738.8	1738.8	1738.8	1738.8	1738.8	0.00%
Total area	18986.4	18986.4	18986.4	18986.4	18986.4	18986.4	18986.4	18986.4	18986.4	18986.4	18986.4	0.00%
Total Population	10132.8	10679	9023.6	9726.8	10088.5	11392.5	16127.4	16127.4	20485.1	26491.9	33962.8	235.20%

Therefore much of the destruction of Gujarat's forested areas had taken place in the late 19th and the early 20th centuries. In terms of degradation, Gujarat's forests from 1910 to 1970 represent a loss of 766,000 hectares, a decline of 41%. Similarly the dry scrub vegetation of the state declined by 538,100 sand hectares from 1910-1970. The major coastal wetlands also dropped over this period, with 68 thousand hectares, with 36 hectares of this drop coming in the province's coastal mangrove woodlands, a decline of 57%. Hence, by studying the alterations in land use due to the impact of human intervention (mainly expanding agriculture at the cost of reducing natural habitats) the picture which emerges is of a shift from a stable to a fragile and unsustainable ecology. The greatest encroachment on natural forests had been the process of settlement and urbanization involving creation of spaces for residences, offices, recreation, cremation grounds, cemeteries, roads, railways and the canal works etc. It is estimated that this 'settled area' land use expanded from 3.9% of the total provincial area in 1820 to 5.5% in 1870. In the next thirty years there is a drop of 2% in the rate of settlement, indicating not only depopulation but also abandonment of villages due to recurring famine and diseases. By 1930, area under such direct human use had dropped further to 1.4% of total area, with only slight expansion to 1.8% in 1950. By 1970, some 523,000 hectares of Gujarat were in settled area, and only 2.7% of the total area of the province, was in forest and woodland areas.

Such alterations in an eco system may prove harmful for the survival of flora and fauna of the region resulting in Habitat Conversion. It implies that when natural landscape is converted to agriculture or colony or road by humans, it becomes extremely difficult for the species to survive. The process of urbanization also affects the sourrdings of an eco system and its natural resources. (See Appendix II B).

Another detrimental feature of urbanization is 'habitat fragmentation's

occurs when the ecosystem in which a species lives is broken down due to construction of roads/railways, buildings, agricultural fields, etc. Habitat fragmentation leads to following implications important for the species:

- Migration Path may be obstructed in the case of elephants and monkeys, as a result they are not able to reach the sources of water, food, or their breeding grounds. Therefore the species are not able to complete their life cycle.
- Roads and Railways form a barrier in movement of animals; even a two lane road with moderate traffic can deter animal movement so that the animals are not able to cross the roads and population on either side which may lead to obstruction in interbreeding. The result is the decline in genetic diversity in a population due to which recessive genes start appearing, many those are detrimental to the existence of the species. Most animal species with less than 200 to 250 individuals go into a genetic decline because of loss of variability. This is called interbreeding depression and may lead to the extinction of the species.

This is expected to happen in the case of Asiatic lions in Gujarat. Their number is already on a decline, and in the near future, may extinct in the state. Cheetahs are now not found in the Baroda State, which at one time were abundantly found. As mentioned in the earlier chapter, elephants during the Mauryan period were found in the forests of Rajpipla, but are now totally extinct in Gujarat. Thus the human encroachment in the jungles, deforestation in the favour of cultivation, building of Railway lines, have been playing their part in the complete alteration of the eco system and its habitat. This has resulted in the scarcity of some basic resources. The unregulated cutting of the forests since the pre- independence period has resulted in the phenomenon like, Global Warming, soil erosion, floods and the acute shortage of the

drinking water, the problem which has become so severe in Gujarat.

In conclusion one can say that as an attitude to nature, the agenda of British colonial forestry, like its continental parent and American counterpart, was utilitarian, linking conservatism with the gospel of efficiency. It manipulated and shaped the forest policy of India to optimize the use of forest resources for the benefit of Great Britain.

Appendix – II A

THE FOREST ACT OF 1865

The British to control the Indian Forests, drafted and promulgated an Act entitled 'The Indian Forest Act VII of 1865', which is as follows;

ACT No. VII of 1865

Passed by the Governor-General of India In Council

(Received the assent of the Governor-General on the 24the February, 1865)

An Act was passed to give effect to rules for the management and preservation of Government Forests.

Preamble

Whereas it is expedient that Rules having the force of law should be made from time to time for the better management and preservation of forests wherein rights are vested in Her Majesty for the purpose of Government of India.

Main tenets of the Act are as follows;

"Government Forests' shall mean such land covered with trees, brushwood or jungles, as shall be declared in accordance in various provisions of this Act, and subjected to its provisions.

For the management and preservation of any Government Forests or any part there of in the territories under their control, the Local Government may, subject to the confirmation here in after mentioned, make Rules in respect of the matters hereinafter declared, and from time to time may, subject to the like confirmation, repeal, alter and amend the same. Such Rules shall not be repugnant to any law in force.

Rules made in pursuance of this Act may provide for the following matters;

1. The preservation of all growing trees, shrubs and plants, within Government Forests or of certain kinds only- by prohibiting the marking, girdling, felling and lopping thereof, and all kind of injury thereto; by prohibiting the kindling of fires so as to endanger such trees, shrubs and plants; by prohibiting the collection and removing of leaves, fruits, grass, wood-oil, resin, wax, honey, elephant tusks, horns, skins and hides, stones, limes, or any other natural produce of such forests; by prohibiting the ingress into and the passage through such forests, except on authorized roads and paths; by prohibiting cultivation and the burning of lime and charcoal, and the grazing of cattle within such forests.
2. The regulation of the use of streams and canals passing through or coming from Government Forests or used for the transport of timber of other produce of such forests- by prohibiting the closing or blocking up for any purposes whatsoever of streams or canals used or required for the transport of timber or Forest produce; by prohibiting the poisoning of or otherwise interfering with streams and waters in Government Forests in such a manner as to render the water unfit to use; by regulating and restricting the mode by which timber shall be permitted to be floated down rivers flowing through or from Government forests and removed from the same; by authorizing the stoppage of all floating timber at certain Stations on such rivers within or without the limits of Government forests for the purpose of levying the dues or revenues lawfully payable thereon; by authorizing the collection of all timber adrift on such rivers, and the disposal of the same belonging to the Government.

3. The safe custody of timber, the produce of the Government Forests- by regulating the manner in which timber, shall felled or converted; by prohibiting the converting or cutting into pieces or burning of any timber by sale or otherwise, by any person not the lawful owner of such timber, or not acting on behalf of the owner; by regulating the manner in which property-marks shall be affixed to timber and other forest produce in Government Forests; by prohibiting within certain limits, the use property marks employed by the government, or fraudulent use of the property marks of private persons; by requiring the registry within certain territorial limits of implements for affixing property marks on timber; by directing the levying of fees for the registration of such implements.
4. The regulation of the duties of the Government officers and establishments charged with the management and conservancy of the government forests with the levy of forest dues and revenues; the reporting and preventing of offences against the rules made in pursuance of this Act and the collection of forest dues or revenues.
5. In cases where the penalty of confiscation is not provided by this Act, the Local government may prescribe punishments for the infringement of the rules made in pursuance thereof, by fine not exceeding five hundred rupees, or provide imprisonment of the offender for such term as mentioned in the sixty-seventh section of the Indian penal code.
6. Such Rules when confirmed by the Governor-General in council and published in the official Gazette shall have the force of law.
7. All implements used in infringing any of the rules, and all timber or any other forest produce marked, removed or converted, shall be confiscated.
8. Any Police officer or person employed as an officer of the government may arrest any person for the infringement of the set

rules may seize his implements, and any timber liable to confiscation under this Act.

9. Any person arrested in the case of infringement may be taken to a magistrate, who if he sees a reasonable cause, may order such person to be detained until the case is disposed off.
10. The causing or procuring a punishable act to be done is punishable in the same manner as the doing of the Act.
11. When any timber or any property seized as liable under this Act, any magistrate or officer empowered by this Act may summon the person responsible and may sell the seized property into the account of the government.
12. Any police officer or the officer of the government who would be found taking advantage of his position and unnecessary seize the goods, and arrest a person, shall be liable to a fine of not exceeding rupees five hundred or imprisonment for a term not exceeding three months.
13. A magistrate in the manner prescribed by the Code of Criminal procedure shall enforce all fines and penalties under the rules made in pursuance of this Act, and the rules therein contained for the trial of cases and for appeals shall be applicable to confiscations adjudged under this Act.
14. Property on confiscation shall belong and vest in Her Majesty, and a warrant shall be issued by the court to a police officer directing him to hold the property confiscated at the disposal of the Local government.
15. When the confiscation of any property shall be adjudged under this Act, the local government may, within three months after the final judgment, call for the proceeding of the case and on need, may seize any part thereof be restored, and may remit the penalty or may discharge the offender.

16. No suit or proceeding shall commence under this Act without one month neither of prior notice nor after the expiry of three months from the accrual of the case or the suit.
17. No charge of an offence under this Act shall be instituted except within six months after the commission of such offence.
18. This Act shall extend to all the territories under the immediate administration of the government of India.
19. This Act shall come into operation on the first day of May 1865, and may be cited as "The Government Forests Act, 1865".

Source: E.B.Stebbing, *The Forests of India*, Vol.2, London, 1922-27

Appendix – II B

Urbanization and its effects

The extent and the rate of global environmental keep on changing. Greenhouse gas-induced warming, deforestation, desertification, or loss in biodiversity, are driven largely by the rapid growth of the Earth's human population. Given the large and ever-increasing fraction of the world's population living in cities, and the disproportionate share of resources used by these urban residents, are key drivers of global environmental change. Following are the effects of the urbanization on the environment of the surrounding areas;

a) The Creation of Heat Islands:

   Cities are made of concrete, asphalt, brick, stone, and steel. These materials absorb and reflect energy differently than vegetation and soil. They absorb more radiant energy and radiate this energy back into the atmosphere at different times through the day. The result is that cities are warmer than the surrounding countryside, sometimes considerably. Furthermore, cities remain warm well into the night when the countryside has already cooled.

b) Changes in Air Quality

Human activities release a wide range of emissions into the environment including carbon dioxide, carbon monoxide, ozone, sulfur oxides, nitrogen oxides, lead, and many other pollutants. Some of these emissions are toxic and have claimed many lives in some cities.

c) Changes in Patterns of Precipitation

The dust and emissions released into the atmosphere alter patterns of precipitation over the cities and in areas downwind. Cities often receive more rain than the surrounding countryside since dust can provoke the condensation of water vapor into rain droplets. Dust carried downwind from cities and industry can increase rain in city shadows.

Pollution

Pollutants are often dispersed across cities or concentrated in industrial areas or waste sites. Lead- based paint used on roads and highways and on buildings is one such example of a widely dispersed pollutant that found its way into soil. But humans also bury tremendous amounts of waste in the ground at municipal and industrial dumps. These materials can severely contaminate soils.

Effects on the Hydrosphere and Water Resources

Urbanization has a great effect on hydrology, for a number of reasons.

a) Flow of Water into Streams

As cities grow, natural groundcover changes dramatically. Natural vegetation and undisturbed soil are replaced with concrete, asphalt, brick, and other impermeable surfaces. This means that, when it

rains, water is less likely to be absorbed into the ground and, instead, flows directly into river channels. Not only does more water reach the stream channels, but it arrives far more quickly after a storm. Natural vegetation slows run-off, concrete and asphalt speed the flow. The result diagrammed below indicates how urbanization speeds run-off and produces higher peaks of flow.

b) Flow of Water through Streams

Higher, faster peak flows change streams channels that have evolved over centuries under natural conditions. The result is a spread of the channel vertically and horizontally to carry the extra flow. Rapid erosion of stream banks and down-cutting of stream beds occurs. When the existing stream beds cannot handle the increased flow, they flood the surrounding urban area, particularly development within adjacent floodplains.

Flooding can be a major problem as cities grow and stream channels attempt to keep up with these changes.

c) Degraded Water Quality

These changes in the flow of precipitation into and through the urban watersheds hold a number of consequences of water quality.

- Increased sedimentation

  An increased area of exposed and soils and higher runoff speeds means that more sediments are carried into local and downstream watersheds. This leads to increased rates of sedimentation.

- Pollutants in runoff

  As water washes across urban surfaces, it dissolves and carries pollutants into streams and rivers. Toxic chemicals, oil, and other pollutants are all deposited in the watershed, sometimes in sediments. Also, most cities use rivers to dispose of the affluent from sewage treatment. It is common in India for the untreated sewage to be discharged into waterways.

Thus urbanization has its own negative impact on the environment.

Sources;

1. Sue Grimmond,Urbanization and global environment change: Local effects of urban warming, Dept. of Geography, London, 2007.
2. Sharon Ede, Do we fit the Planet? , Urban Ecology Australia, April, 2002