

Unearthing the Roots of Colonial Forest Laws

Iron Smelting and the State in Pre- and Early-Colonial India

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This paper repositions iron smelting and the smelter at the centre of a revised narrative of pre- and early-colonial forest history and policy. In a medieval war economy the smelter shared a relationship of mutual interdependence with the feudal state as a provider of critical raw material for weapon manufacture. This, however, changed with the advent of the colonial state, interdependence giving way to competition over resources. It is through this multilayered perspective of environmental and military history intertwined with the anthropology of iron smelting that we can unearth one of the roots of statutory forest laws.

The consumption of charcoal for smelting of iron has been the chief cause of the great destruction of our ancient woods.¹

Across the world, charcoal production for iron smelting has been considered responsible for destroying large tracts of medieval forests, sometimes of entire regions (Sivramkrishna 2009). Did iron smelting also cause such devastation in precolonial India? Could this have been one of the earliest reasons for the East India Company to intervene with statutory laws to preserve, conserve and manage forests? Unfortunately, answers to these questions are not unequivocal; however, in attempting to find them we articulated a fundamental change in the relationship between the state and smelter that developed during early colonial rule. From one of mutual interdependence in precolonial India, the relationship between the colonial state and smelter turned into one of competition. It is in this transformation that we locate the origins of statutory forest laws in India through which the colonial state sought to legitimise their claim over forest resources. This, at the same time, fundamentally altered the environment of the smelter – both physically as well as the economic-social-political context in which they had to survive.

To appreciate the argument put forth in this paper, we need to first recognise the importance of charcoal-iron smelting in precolonial India – its scale and geographical scope, and the critical service it provided to the State. This is possible only with a conscious inclusion of military history into the narrative. Indian environmental history has, however, failed to do so, characterising medieval India as an agrarian economy organised through self-sufficient village communities which were “in approximate equilibrium with their environment, dominated by local production for local use” (Gadgil and Guha 1993: 39).

Such harmonious societies “have only moderate levels of impact in transforming landscapes” (ibid: 39); deforestation occurring only on account of extending the boundaries of cultivation. Smelters were marginalised to a small subset of this naive economy whose limited role was to supply implements for agriculture as well as material for utensils and other household products. This worldview completely overlooks the massive quantities of iron and steel required by the state for weaponry. It is in this latter role that smelters were able to forge a direct relationship with the state, acquiring independent access to forests for procuring ore and timber for manufacture of charcoal. Smelters, often belonging to specific tribal communities and castes, remained outside or were perhaps

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excluded from the precincts of the village economy, to a significant extent, both physically and with respect to customary village norms including those governing use of village-forest resources (Percy 1864; Elwin 1942).

By the third decade of the 19th century, the East India Company was consolidating its political power over India and with it a fundamental transformation of the economy and society was underway. Most pertinently, the decline of independent feudal states and the war-economy terminated the mutual interdependence that had existed for centuries between the smelter and the state. The only remaining market for iron smelters was agricultural implements, building materials and household wares. In order to survive, some strengthened or built a closer relationship with the village economy (Thurston and Rangachari 1909; Campbell 1894). With the expansion of settled agriculture, the market for iron and steel implements actually thrived throughout the 19th century. There even existed a preference for implements made from traditional indigenous iron and steel over imported products (Iyer 1899; Elwin 1942; Baden-Powell 1868). There were others, however, who failed to integrate with “mainstream” village societies, either choosing or perhaps forced into isolation.

In either case, the dependence of these communities on forests continued. It is here that their confrontation with the (colonial) state as competitor began. Not only did the Company, unlike its predecessors, stop procurement of iron and steel for weapons from traditional smelters but it also sought new avenues for increasing revenues and profits from the trade of Indian products. Iron and steel was considered as having a great potential for this. Archival records from the early decades of the 19th century reveal that it was concern over destruction of tree cover for charcoal production that induced them to assert control over forests, denying smelters of their unfettered access to its resources (see, for instance, Rice 1897). The demand for these resources intensified as the colonial state extended its domain to other sectors, including commercial agriculture, plantations, tea production (which needed large quantities of charcoal for drying), railway transport and communication. Traditional iron and steel smelting did not die soon; it continued to exist in many parts of the country well into the 20th century (Elwin 1942; Saravanan 1998; Roy 2009; Sivramkrishna 2009). The focus of this article, however, is to trace the roots of statutory forest law in early-colonial history.

Weapon Manufacture in Pre- and Early-Colonial India

“Iron and steel, although not cast-iron, appear to have been known to the Hindus beyond the reach of all record...the inventions of both iron and steel were made in India at several independent points of time” (Crawford 1864: 316). The corrosion and rust resistant iron pillars at Delhi, Dhar and Kodachadri dated anywhere between 1,000 and 2,000 years old, are testimony to the metallurgical achievements of smelters in the Indian subcontinent. Given its rich deposits of ore, iron and steel were also extensively smelted across the length and breadth of the country; from Kachchh in the west through the Central Provinces into Assam and the Khasi Hills in north-eastern India,

from Beypore on the south-western coast, across the Deccan plateau and through the Narmada Valley, into Kumaon and Garhwal in the Himalayas (Trevor 1858; Percy 1864; Elwin 1942; Bharadwaj 1982) and even further north. In the valley of Kashmir, Walter Lawrence (1895:62-63) recorded that “iron has been discovered and worked in several places in the valley, and there are extensive workings of iron ore in the neighbourhood of Sof”.²

While the indispensable role of iron and steel in hunting and agriculture has been recognised, it is in warfare that the function of these metals has been disregarded by Indian environmental history. And it is to this particular aspect that we draw attention to. The Iron Age commenced in India some 3,000 years ago and even the epic *Mahabharata* makes reference to iron weaponry. There are references in “the Rig-Veda of chariots armed with iron weapons, of coats-of-mail, arms and tools of various kinds, and of bright-edged hatchets” (Royle 1852: 163). By the time of Alexander’s expansion 300 BC we have evidence of steel making in India; Porus having gifted him some 30 pounds of it. Archaeologists have also found evidence of prehistoric weaponry including swords, daggers, tridents, spears, arrows, spades and rods in southern India dating to 250 BC (Mahmud 1988: 20). Excavations from Gujarat reveal that in the 4th century BC case-hardened iron had been developed for weapons and implements including arrowheads, spearheads, daggers, knives, parallel-sided swords, leaf-shaped spearheads, barbed arrowheads, chisels, etc (Hegde 1996: 358).

More precise and reliable information is available on the use of iron and steel for weaponry in medieval times. While the size of armies ran into tens of thousands during the Mughal period, the use of heavy cannons and war elephants was also widespread. Cannons weighing close to 50 tons, in brass and/or iron were deployed across India; the ones at Ahmednagar, Bijapur and Thanjavur being some of the more well known of them. Irvine’s (1903) graphic account of heavy guns being drawn by up to 500 oxen and four elephants leaves us awestruck by the size and weight of Mughal artillery. The cast iron balls for such cannons weighed between two to three tons each (Allen 1856: 150). Irfan Habib (1980: 16) summarises the primary place held by artillery in technological development during the medieval period.

In several ways artillery represented the highest achievements of industrial technology during the sixteenth and seventeenth centuries. While the manufacture of cannon was then the real “heavy industry”, on the handgun were lavished all the fruits of the increasing mechanical sophistication attained during that period.

Indian iron cannons were usually made of wrought iron rings welded together into a barrel. To overcome the limitations in this technology, the Mughals even ordered the Dutch and English, in 1666, to recruit engineers for the manufacture of cannons (ibid: 20). European engineers were employed in state-run *kharkhanas* (manufactories) and *topkhanas* (ordnance factories) manufacturing heavy and light artillery (Singh 2006: 351). Another important component in the armies of feudal states was the elephant, which numbered from several hundreds to several thousands. Akbar, who ruled from 1556 to

1605, alone is said to have had more than 6,000 elephants in his army, many of them armoured and some even carrying light cannons or large muskets. The armour was made of steel plates covered with leather or cloth (Nossov 2008: 12, 14).

Apart from this heavy artillery, medieval Indian armies used a variety of metallic weapons including swords, shields, spears and javelins, arrows and daggers. Verrier Elwin (1942: xxiv) quotes the French gem merchant, Tavernier, who travelled India in the 17th century, on the steel industry in the “Kingdom of Golconda”:

...they carry a broad sword like the Swiss, with which they both cut and thrust, and they suspend it from a belt. The barrels of their muskets are stronger than ours, and the iron is better and purer. This makes them not liable to burst. As for the cavalry, they have bow and arrow, shield and mace, with helmet and a coat of mail.

Indian steel, called *wootz*, was considered legendary and much has been written about it; the Arab, Edrisi, summarises its eminence (ibid: xxiii),

...the Hindus excel in the manufacture of iron. They have also workshops wherein are forged the most famous sabres in the world. It is impossible to find anything to surpass the edge that you get from Indian steel.

While the scientific and metallurgical ingenuity of Indian arms and ammunition manufactured in ancient and medieval times has justifiably been portrayed with admiration, the environmental implication of this activity has not received similar attention. In fact, a reading of Irvine’s (1903) classic work on the Mughal army made us wonder how Indian environmental history could fail to consider the role of metallurgy and armament production in their studies.

Iron Smelting: Scale and Environmental Implications

Metallurgical history is replete with accounts of iron smelting from across India. To John Percy (1864: 254) “the large accumulations of slag which occur in various localities in India” was evidence of extensive production of iron through the ages. Verrier Elwin (1942: 239) in his classic work on the iron smelting tribe, the Agaria, asserts that although no precise figures can be given, “iron-smelting was at one time a widespread industry in India, and there is hardly a district away from the great alluvial tracts of the Indus, Ganges and Brahmaputra, in which slagheaps are not found”. According to one estimate, annual production in pre-colonial India c 1800 was around 2,00,000 tons (Agarwal nd).

Even as the smelting industry was in decline towards the close of the 19th century, there were more than a hundred furnaces operating in the Malabar, in North Arcot smelting was being carried out in 86 villages (Elwin 1942: 240). Elwin also refers to many other centres of iron smelting including Madura, Salem, Tiruchirappalli, across erstwhile Mysore State and the Deccan plateau, in Nellore, the Kappatgud Hills in Dharwar, Belgaum, Ratnagiri, Rewa Kantha, Kaira and Ahmedabad, Kathiawar and Kachchh, Bengal, Bihar and the Central Provinces, Assam and the Naga Hills. Using data from several sources including Buchanan (1807) and Rice (1897), Sivramkrishna (2009) mapped out the iron smelting locations in the Maidan³ region of the present state of Karnataka and

also found large heaps of slag and crucibles during his visits to some of these sites. According to Bharadwaj (1982: 223), “during the eighteenth century there were thousands of furnaces working in various parts of India and each were producing near ½ to 3 tons of iron per annum” although there were some of “unusual capacity” operating in Birbhum in 1852. Large furnaces were also found in the Central Provinces. Tendukera on the Narmada was a town “entirely engaged in iron making” in the mid-19th century (Trevor 1858: 15).

The essence of the iron-making process has remained the same over millennia. The ore, either mined or collected from sand, is melted and the oxygen in it burnt out. In traditional iron-making the fuel that performed this dual operation was charcoal.⁴ Charcoal burns at elevated temperatures of about 1,100 degrees Celsius, high enough to reduce the oxides in the ore. Such temperatures cannot be achieved by burning dry wood, thereby making charcoal an essential raw material in the smelting process.⁵

Traditional iron-making in India used about 16 kilograms of charcoal for a kilogram of iron⁶ and to produce a kilogram of charcoal requires four to seven kilograms of wet wood. Therefore, to produce a kilogram of refined iron would need about 60 to 100 times its own weight in wet wood. A more graphic estimation is that for the production of “2,500 tons of refined wrought iron, 1,40,000 tons of wood were required which could be obtained from 437 square miles⁷ of heavily wooded land”. Biswas (2007: 280) quoting Cleghorn’s report (1864) appointed to study the iron mines of the western Himalayas, states that native smelters used 28 trees to produce 1 ton of crude iron. Even more charcoal was needed as fuel to soften and transform refined semi-products into their final forms. If steel were to be produced from smelted iron, further melting and forging operations required even greater quantities of charcoal.

Anthropology of Iron Smelting

The objective of this section is to cull out pointers from the literature that establish the mutual interdependence between smelters and the state and the independence of smelters from the agrarian village economy. These relationships were influenced by one important technological element – without transport networks, smelting had to be located close to the ore, as well as timber for charcoal production. This often meant that iron smelting was carried out in dense and remote forests tracts, spatially distant from the agrarian village economy. As Elwin (1942: 13) reports, the “movements” of the Agaria, an iron smelting tribe, “were controlled by two chief factors, a supply of ore and a forest of *sarai* trees, from which charcoal suitable for use in the furnaces can best be made”. They were a “very unsettled people, leaving a place as soon as the neighbouring jungle fails to satisfy their requirements” (ibid: 52).⁸

Extending east from Nagpur, northwards towards Ranchi, the Agaria were considered as one of the most significant iron smelting tribes in India. “[A] people absorbed in their craft and their material; they seem to have little life apart from the roar of the bellows and the dang of hammer upon iron” (Elwin 1942: xxvii). Although Elwin’s observations related to the

mid-20th century, they do indicate the “separateness” of the Agaria from caste Hindus (ibid: 11),

...[W]e can see the entire social process at work in Raipur. A group of Gond takes to iron-smelting. Despised by their brethren they become a separate group under the name of Agaria.

The iron smelting tribes were distinct from caste Hindu blacksmiths; distinct not only occupationally but also socially. For instance (ibid: 50),

...the Mirzapur Agaria confine themselves almost entirely to mining and smelting iron. He does no blacksmith's work: all he does is to smelt the iron and work it up into rough ingots, which are afterwards converted into axe-heads and agricultural implements by the Lohar, who is admittedly a recent immigrant into the hill country and utterly repudiates any connection with the iron-smelter of the jungles.

Like elsewhere in the world, from Africa to Europe, iron smelters were both reviled and feared. In India, the Agaria were despised socially but at the same time considered to possess supernatural powers; “If a Hindu touches an Agaria bellows, he is penalised. The Agaria house is usually apart, away from the rest of the village” (ibid: 133). There is little in Elwin's work which tells us of the life of the smelters in medieval India. However, in spite of it being situated in a period when this tribe was drawn closer to village communities on account of their dependence on the market for agricultural implements (which too was in decay by this time), the sense of separateness and isolation of the Agaria from village communities is stark and indisputable.

Wandering Blacksmiths

The work by John Percy (1864: 261) on early modern metallurgy carried out almost a century before Elwin's describes a similar first-hand account of iron smelters in Bengal.

The village of Kunkerai...like all such villages is inhabited exclusively by the iron smelters, and is distinguished from the agricultural villages by the filth, poverty, and degraded condition of the inhabitants. The iron smelters of Orissa, as I believe, generally in Bengal form a class apart from the agricultural inhabitants, belonging, indeed, to the isolated aboriginal tribes which, under varying names, are found in all the hilly tracts of the peninsula...In Orissa there are several of such tribes, differing in their relative degrees of civilisation: the iron smelters of Talcheer and the neighbouring districts belong to the large tribe of the Kols or Coles. They are to a certain extent nomadic in their habits, remaining in one spot only as long as plentiful supplies of ore and wood are obtainable in the immediate vicinity...The heavy rains and increasing jungles soon obliterate the remnants of the deserted village, with the exception of the large accumulations of slags, which remain for centuries, monuments of an unprogressed art. Such lumps of slag are frequently found in the jungly districts, where no iron manufacture has been carried on within the memory of the inhabitants.

There are other references that reinforce the point that iron smelters had a distinct existence from agrarian village communities. Balfour refers to “the *Taremook* or wandering blacksmith” also called by different names in different parts of the country, *Ghisari* in *Dekhani* (Deccan), *Lohar* by the *Mahratta* and *Bail-Kumbar* by the *Kanarese* (Elwin 1942: 67). In their study of Orissa, Stirling and Peggs (1846: 9) mention that

in the wilder tracts the necessities of life are not attainable, and frequently subsistence of any sort is only procurable with the utmost difficulty. Many of the natives (here) are iron smelters and charcoal burners.

The fact of iron smelters in India being distinct from the agrarian economy had percolated even to more popular writing. In a book on the varieties of trees found in forests, the author incongruously mentions (Taylor 1845: 72)

in India there is a particular caste, or rank, of the natives, who live entirely in the woods, and gain their subsistence by burning charcoal. The other inhabitants, however, who are very particular in such matters, never have any personal dealings with them; though, in an indirect way, they purchase their commodities.

In the same vein, *The Penny Magazine* (1842: 435) reported that

...in India charcoal is manufactured by a particular caste, who dwell entirely in the woods, and have neither intermarriage nor intercourse with the Hindoo inhabitants of the open country. They bring down their loads of charcoal to particular spots, whence it is carried away by the latter people, who deposit rice, clothing and iron tools – a payment settled by custom.

In an archived volume of the *Scientific American* (1921) we discovered an interesting passage that once again pointed to the separateness of Indian smelters from the agrarian community:

...in Lower Bengal, in which portion of our Indian empire there are entire villages exclusively inhabited by iron smelters ... There are whole tribes in India who have no other occupation than iron smelting. They, of course, sink no shafts and open no mines, and are not permanent in any place. They simply remain in one place so long as plentiful supplies of ore and wood are obtainable in the immediate vicinity. In many cases the villages formerly inhabited by them have passed out of existence, but the waste, or rather wasted products, of their operations remain.

Colonial records, although a majority of them are from the latter part of Company rule or early years of British Raj when the military apparatus of many native states had already been disbanded, indicate the close relationship between the smelter and the state for production of weapons. Dobbs (1908: 5) draws an interesting link of a nomadic community of blacksmiths in Bundelkhand to their “military” past, which:

at certain seasons migrate from Rajputana...wander about from place to place with their families, goods, and chattels, and forged ploughshares for a fee. According to community lore, they had left Chittore when that city fell to the Mughals, vowing never to return until Chittore was liberated with the swords that they would themselves make and sell to the prospective liberators.

Baden-Powell in his handbook of the economic products of Punjab (1868: 1) begins with iron ore

in the hills due north of Peshawur, is the source of the Bajaur iron, which is of fine quality, and is used in the manufacture of the gun barrels of Kuhat and Jammu, and not a little also, it may be presumed, in the formation of steel for the blades of the Bukhara and Peshawur.

In Mandi (ibid: 3), he finds that

The iron produced by this rough industry is paid for by the Raja (of Mandi), at the rate of one rupee per *pucka* maund. The natives only work these mines, so lucrative to their master, and so unproductive to themselves.

In the hill states of Shimla, a passage from the work of a certain Marcadieu (ibid: 4) once again points to the direct ownership of mines by the local Raja:

...passing from the Kot Khai district to Jubal you arrive at Cheel...and in the possession of the Raja of Rampur...ten small smelting furnaces

work irregularly for the Raja's profit, and produce small quantities of iron, mostly consumed in the Raja's territories.

Finally, while describing some indigenous varieties of steel, we find clear references to former times when the output of this industry was used for weaponry (ibid: 7).

Guleri comes from Gwalior in Hindustan, it is a tenacious metal and used for wire drawing, gun barrels, &c....Faulad or steel, used to be imported from Hindustan for the manufacture of armour, shields, &c., ...at the present day when the manufacture of such armour is not carried on... The *bajauri* from Bajaur, north of Peshawur, is not much exported to the Central Plain districts, though it was formerly used for gun making.

Hugh Cleghorn (1864: 85), first commissioner for the conservancy of forests and later inspector-general of forests, in his report on the forests of the western Himalayas provided an interesting first-hand account of his journeys through the hills and valleys amongst which one comment markedly substantiates our argument. On the mountainous tracts from the Sutlej to the Ravi, iron was found in great abundance; "under the Sikh rule, this iron was extensively used for gun barrels".

In a study of iron and steel smelting in West Bengal, Sanyal (1968: 103) reported that iron and steel smelted by tribes was of high quality – tough, soft and malleable all at the same time. This even prompted two Englishmen, Farquhar and Motte

...to establish their factory in Birbhum in 1779 to produce shot and shells, cannon, etc. In fact in their application to the government they stated that for this quality of softness Birbhum iron was eminently suitable for almost every work in cast iron particularly for the fabrication of cannon.

Bharadwaj (1982: 223-24) informs that in the 15th century, Assam was considered "the seat of iron smelting" where "cannons and small arms were the chief products of this industry". Here "smelting of iron has always been a chief branch of industry amongst the hill-tribes" (Royal Geographic Society 1856: 393).

Unlimited Demand

Apart from tribes, there are references to a section of smelters and refiners, particularly in Bengal who were Hindus and even Muslims. Large furnaces (*kotsal*) were located close to *aurangs* (market) from where ore was procured and converted into *kutchra* (crude) iron. This was further converted into *pucka* (refined) iron in *kamarsals* where *lohars*, *kamars* and other caste Hindus were employed. Larger furnaces, sometimes 80 or 90 of them located close to an *aurang*, employing 7,000 to 8,000 people, used Muslim artisans to produce the *kutchra* iron and caste Hindus to refine this to *pucka* iron. This would be then used for making "garrisons, gun carriages, shots, shells, artilleries" (Singh 2006: 356).

These large iron works were often under the control of the urban and rural aristocracy like the "Choudhuries of Ganpur" (Sanyal 1968: 105) who had "an unlimited demand for military hardware" (Singh 2006: 356), including arms and ammunition, knives, swords, daggers (Sanyal 1968: 105). However, what is more striking is that socially these caste Hindus and Muslims employed in the large furnaces and refineries were not tied to the village economy. Singh (2006: 354) categorically states, "the work group were no longer familial but a

group of free craftsmen, generally of the artisan caste, sometimes headed by a master craftsmen". The output from these industries was not specifically for local consumption; "the iron is frequently sent for sale to considerable distances from the places of manufacture" (Percy 1864: 258).

The separateness of iron smelting from the agricultural economy is evident when we understand, in contrast, the role and position of the village blacksmith, the *lohar*. The blacksmith would be supplied with raw material procured from smelters to produce agricultural implements for which he would receive a fixed share in proportion to the number of ploughs owned by each household in kind. The *lohar* was also expected to repair agricultural implements free of charge (Singh 2006: 355). This "interdependence and reciprocity in economic exchange served to maintain the cohesiveness of the village community" (Vani 2002: 21).

In southern India too remnants of traditional iron smelting can be found across different landscapes; from the coastal belt over the Western Ghats and across the Deccan plateau. The name Mangalore is believed by some to be from the word *mikala* or charcoal, which used to be made on the banks of the river Netravati, the wood obviously collected from nearby forests. The Gazetteer of Canara reports that iron was formerly manufactured in different parts of the Sahyadris (the Western Ghats), although by 1882 there was no ore smelted here (Enthoven 1883: 262). There is also reference to smelting being carried out by the "Hill Tribes of the Ghats" (Percy 1864: 257).

Across the plains of the Deccan plateau (Maidan), it seems more likely that iron smelting was carried out by caste Hindus. In the iron-rich Sandur ranges in the present state of Karnataka, blacksmiths were of the *kammara* caste. But here too their separateness from the village community is apparent (Thurston and Rangachari 1909: 141),

They have a temple of their own, dedicated to Kali, in the village, where the worship is conducted by one of themselves. The name of *Baita Kammara*, means *outside* blacksmiths, is applied to Kamsala blacksmiths, who occupy a lowly position, and work in the open air or outside a village (emphasis added).

There are other scattered references from southern India which indicate a nomadic form of life adopted by iron smelters. In 1822 at Nersa, Belgaum district, "iron was worked by a wandering tribe who came yearly in the fair season from Goa or the Savantvadi state...the villagers were wholly unacquainted with the nature of the process by which the metal had been extracted" (Campbell 1894: 53fn). Another report mentions that "furnaces could be carted from place to place" (Agarwal nd).

Under the Vijayanagar empire, which ruled over southern India between the 14th and 16th centuries, permission for cutting down trees for charcoal and for digging ore was regulated with a yearly fee called *hommal gutta* which was proportioned to the quantity of iron made in the district (Rice 1897: 1.477). This system may have continued into the 19th century. The system was neither a fully commercial one nor "communal"; it had elements of both. The ironsmith, probably of the prosperous and once wealthy *Salahuva Vakkalu* mining caste, extracted

ore as well as traded iron to towns and directly to the state for the military (Elwin 1942: 240). At the same time the smelters were also linked to workers and the village through a system of reciprocity. They would exchange some produce with farmers in return for which they received allowances of grains and sometimes land for cultivation at low rents. The smelter-blacksmith would also sell for cash some of the output to village people for non-agricultural purposes like construction of houses (Campbell 1894: 233).

The *Gydda Cavila* or what Buchanan (1807: 1.391) refers to as “keeper of forests” or “renter of forests” would take forests on rent by paying a certain sum of money to the government and thereon grant permission to various stakeholders for the right to collect forest produce for a fee. In Madhugiri, the share “to the keeper of the forest, for permission to make charcoal” was 100 *Fanams* out of a total cost of 276 *Fanams*, i.e., more than 36% of the cost (not including labour costs). In Doray Guda, where ore was collected, the payment “to the renter of mines and woods” was 130 *Fanams*, or 30% of the total expenses (excluding labour costs). Though a steep fee was charged, strict control and monitoring of forest resources hardly seemed to be a concern of the *Gydda Cavila*. This is made clear in a remark by Buchanan, “the renter has no occasion to come near the mine. He knows the men that get a supply of ore, and each pays yearly a certain sum, and takes as much ore as he pleases” (ibid: 2.18, 2.40).

Implements of War

Precolonial south India was also rife with war. Just as an indication, in erstwhile Mysore alone, the three decades between 1767 and 1799 saw four major wars fought between the British East India Company and the erstwhile State of Mysore under the rule of Hyder Ali and later his son, Tipu Sultan. These Anglo-Mysore wars employed tens of thousands of soldiers. Apart from conventional arms like swords, daggers, armours and helmets, guns, muskets, cannons and even rockets were used by Tipu Sultan’s army. The Mysore Gazetteer reports that within the old fortifications at Ramnagaram iron was worked into “implements of war” (Rao 1929: 231). Where did all the feedstock for weapons come from? Buchanan (1807: 1.173, 1.180) makes explicit reference to the Sultan having purchased iron from smelters of the Maidan giving them “great employment; as he made his shot of this iron, by hammering...”. He reiterates,

According to the iron-smelters’ own account, the Sultan gave them a high price for their iron, and by his great demand afforded them constant employment. It is probable, however, that he compelled them to work much harder than they were inclined to do...

In his revenue regulations, Tipu Sultan ordered a doubling of iron foundries: “If there are ten iron foundries in your district, you are, by encouragement, to increase them to double the number” (Parthasarathi 2008: 10). The intermittent wars and battles in Mysore would have created enormous needs for iron and steel, a “boom” for iron smelters of the Maidan.

We conclude from these observations made at various points of time and place that it is inappropriate to simply subsume

iron smelters under the agrarian village economy. In fact what seems to clearly emerge here is that customary norms actually sustained the separateness of smelters from the village economy. In parts of India this was also reinforced by the technological necessity of smelters to be nomadic and in proximity to forests for ore and timber. Although excluded from the village economy, there was a mutual interdependence between smelters and the state, arising from the production of weaponry.

One contemporary source (Rao nd) succinctly captures the close relationship between them,

The nomadic wanderers, Vanjaras tribe of Rajput origin came into the Sikh fold quite early during travels of Guru Nanak Dev. For their livelihood, the Vanjaras had been trading in all types of human consumables along with weaponries for rulers of the time by traveling in big caravans from one corner of the country to another. The Sikligars among the Vanjaras were excellent iron smiths capable of manufacturing all types of weapons. Few of their families from Marwad first came into contact with Guru Hargobind for the first time (1595-1644), when they offered services for weapon manufacturing and recruitment as Sikh soldiers. The Vanjaras still consider Sri Hazoor Sahib as their highest place of worship.

Customary norms, inextricably linked to the caste system and tribal communities insofar as India is concerned, has often been viewed as providing rules for the allocation of natural resources amongst competing stakeholders in society. There is a critical presumption here that may easily be overlooked – the existence of chronic scarcity of such resources in the first place that makes rationing and allocation necessary. More than natural resources, medieval India in reality faced a persistent scarcity of labour. Bose (1993: 17), for instance, while discussing Bengal at the time of the Great Famine of 1770 explicitly states that labour scarcity was not merely an outcome of famine; the famine actually occurred in the context of a “relative deficit of labour”. From the Midnapur District Records he noted that Chittagong district, which escaped the famine, had a mere quarter of its land cultivated in 1761 on account of “labour scarcity” (ibid).

More pertinent to us, however, are the hill districts of India where iron smelting was more extensively practised. From Assam, Bonsall (1860:446) reported that in 1841 “the country was almost entirely covered with a dense jungle, and with such a sparse population, that it became necessary to procure several thousands of coolies from China and Bengal...”. Similarly, from Dehradun Thornton (1858:485) found that in the hill-districts the “evils of uncertain seasons, an inconceivably sparse population, poverty of soil, distance of markets” prevailed. Further south, towards the Satpura hill ranges and north of the river Tapti, a region where iron smelting was widespread, large continuous tracts of jungle that were “either uninhabited or contain a sparse population, chiefly of Bheels (tribes)” were reported (Select Committee 1858: 79).

Such labour scarcity would have necessitated allocation of occupations and strict adherence to it without inter-occupational mobility. Furthermore, in a resource-abundant economy, the independent smelters may not have come into conflict with village communities and the destruction of forests observed by officers of the East India Company in the early

1800s (as we will see later in this article) may have merely been localised phenomenon and of little consequence to the rest of the economy. Instead, in a resource-abundant but labour-scarce war economy, customary norms to “separate” smelters⁹ would have been more important than rationing of forest resources between village communities and smelters. In other words, these norms acted as a “marker of autonomy from the plains more than a mechanism to set forth rules and regulations for land use” (Menon 2006: 11).

Modernised Iron Manufacture and Deforestation

The East India Company in the early phase of colonial expansion was ardently interested in exploring new prospects for commerce and revenue, for which many extensive surveys were conducted. Amongst several possibilities, India’s abundant resources for iron and steel production received their attention. The Company was keen to exploit these resources using modern industrial production techniques and technology that had already been adopted in Europe and England (Littel 1845: 382-83).

We have heard that some of the superabundant wealth of this country is likely to be appropriated to the development of a vast field of enterprise in the south of India. Some of the provinces in that part of the country abound in iron ores of various kinds, of the richest and purest descriptions...a small association of gentlemen in India engaged in the prosecution of it, some years ago, and by their labours and at their cost, results of unexampled value have been established...With the improvements now in the course of introduction at their works in India, there is now no doubt that iron may be made there, and sold at very large profit, for the consumption of the whole of the markets of Asia, so as to supersede foreign importations; and that it can be disposed of in this country (England), at a great profit, to replace the produce of Sweden and Russia, for conversion into steel, and for use in all purposes where a superior quality of iron is required...

But here they encountered traditional Indian smelters as competitors for the same resources. It is around this period that we find a proliferation of reports on the wasteful nature of traditional Indian iron smelting methods. Deforestation on account of charcoal smelting was widely reported from all across India with calls for putting an immediate stop to this activity. Statutory forest laws were seen as a solution to ensure that their objective is met; a virtual monopoly over natural resources including both iron ore as well as timber for charcoal production. The traditional Indian smelter not only confronted a competitor but rather a competitor possessing complete regulatory powers.

Archival sources clearly show concerns over destruction of forests by smelters and the need for preservation and conservation. Below are some of the remarks we have extracted from archival sources pertaining to different parts of India.

The Central Provinces (Hughes 1851: 8):

There are few large trees at present; the demand for charcoal to supply the wants of the numerous iron-furnaces and refineries leading to a great destruction of timber. The only locality where wasteful cutting is not allowed is on Maudih hill; and the timber is yearly improving; the yield, however, will never be great enough to form a permanent supply for any great smelting works.

Kunjamullay hills of Salem (King and Foote 1865: 384-5):

The jungles of Salem district are being thinned, and in many places ruined, by the careless and wasteful way in which wood is cut down for wasteful purposes; more still, perhaps, by the miserable native

method of making charcoal...the Forest Conservancy Department have as yet had little power in materially diminishing this evil.

Malabar, Kerala (Gibson 1857: 5):

I may here, in passing, allude to the importance of keeping up a source of supply for both these products in Malabar, seeing that the charcoal used in the extensive Ironworks at Beyyore has risen in price...in the course of time the cost of chief smelting material – charcoal – will be so great as to preclude the works being carried on to a profit.

The Deccan plateau (Maidan) (Rice 1897: 1.477):

The third and by no means the least harmful was the practice of iron smelting ... The wasteful methods employed led to an enormous consumption of fuel and a corresponding denudation of jungles in the Maidan and regions bordering on the Malnad abounding in iron ore. The late General Dobbs, then Superintendent of the Tumkur District, thus graphically describes in 1854-1855 the damages wrought to tree vegetation by iron smelters:

The district generally is very bare of trees. The jungles were however extensive when I first assumed charge in 1835, but these are disappearing fast under the axe of the iron and steel manufacturers. When I first visited the beautiful range of hills running between Chiknayakanahalli and Hagalwadi, they were clothed in trees from top to bottom; not a tree now remains except a few unfit for burning. In the immediate neighbourhood of Tumkur (Davaraidrug Hills) where three-fourths of the wooding has disappeared. I stopped the progress of destruction by prohibiting iron forges altogether...no one who has not witnessed the process can conceive the destruction made by these forges.

Even greater ruin was caused in the Chitaldrug District from the same cause. Almost barren waste has taken the place of former wooded tracts, and that too in a district with but scanty rainfall. Luckily some forests were preserved by not being easy of access and *they are now most carefully preserved* [emphasis added].

The coastal regions of Canara (Townsend 1859: 189):

One of the difficult questions connected with forest conservancy is regarding the making of charcoal for iron smelting...Not only is there great waste in the making of charcoal, but there is great waste when made, the charcoal being inferior. The blacksmiths insist upon the wood being either of bamboo or jambay. Europeans make good charcoal from common wood. Engineers and Surveyors should inform the Forest Assistant of cases of destruction of timber with which they meet.

At Kangra¹⁰ (Baden-Powell 1868: 4):

The obstacles to be contended in attempting to extend the manufacture (of iron) are...the reckless destruction of forests without any measures being adopted for their renewal, the extravagant waste of wood in the manufacture of charcoal and of the ore in the smelting and refining, owing to the rudeness of the furnaces and other appliances...measures are being adopted for the conservation and renewal of the forests.

In general, Indian methods of charcoal-making were considered particularly wasteful (Balfour 1862: 76),

...charcoal so prepared is of little value in reducing iron ore, and the process is wasteful...native iron smelters only employ fuel from one to three inches in diameter; and, to procure this, they take the saplings, or the tops and branches of the largest hardwood trees, allowing the trunks to decay. For, large trees are not adapted for fuel for native smelting, as the cost of splitting them adds greatly to the expense; and, unless the logs are split the inner wood is not carbonised.

Dietrich Brandis (1897: 138), the first inspector general of forests and the person responsible for setting up the Indian Forest Service as well as formulation of the Forest Act of 1866, also carried the same view;

In order to produce the large quantities of charcoal required (for production of native iron and steel), wood formerly was cut in an irregular and wasteful manner, without any regard to the regeneration of forests...where however reserved forests have been formed and have been efficiently protected, the position of matters has become completely altered.

Caution must be exercised here before reaching any final conclusion from British reports. The destruction of forests reported may have been only localised phenomenon that, however, served to justify the preconceived plans of the colonial regime. This can be contended on the basis of reports and statements which speak of abundant forest cover not far from cleared tracts. For instance, in the Kumaon ranges (Selections of the Home Department 1855: 13-14),

Within a few miles of the mines, undoubtedly, there is not much timber, and I doubt whether there ever was any very great quantity; but Mr. Henwood was evidently unaware of the existence of the extensive and untouched forests of oak and pine which cover the sides of the Doodatolee, Doorga Dee, Byansee, Budhangurh, Bhutkot, and Doona-giree ranges, within five to twelve miles from the mines.

Priorities of Colonial State

Indigenous iron smelting and need for conservation was one side of the coin. As seen above, the colonial administration was simultaneously propagating their own iron and steel industries to exploit forest resources. Iron produced in India would compete with iron imported from England and perhaps even prove to be an alternative source to Swedish and Russian iron being imported into England. While it is true that even in the 16th and 17th centuries, European technology and manufacturing units did “create intense competition with [the] indigenous armament proto-industry” of India (Singh 2006: 352), there is no evidence that the state turned hostile towards their domestic suppliers. The priorities of the colonial state were, however, fundamentally different.

Consider, for instance, the Nerbudda Coal and Iron. Registered under limited liability with a capital of £250,000, the company was formed with the sanction of the Secretary of State for working of iron mines at Mopani and Tendukera, where the latter, as we have seen above, was the seat of many traditional iron smelters. The company would further “receive from the government a concession on the mines upon favourable terms” including nominal rents for the first five years, followed by royalties and carriage of the produce at moderate rates. The directors of the company were, not surprisingly, all British (Bradshaw 1867: 473).

While Talcher in Orissa is well known for its coalfields today, Thomas Oldham (1859: 11), superintendent of the Geological Survey of India, provides a comprehensive account of traditional iron smelting that was extensively carried out there, the need for its “replacement” and conservation of forests. Beginning with a word of praise, Oldham states “the iron produced in the Talcher District has long been known as of excellent quality and highly priced for its tenacity...charcoal iron of the best quality”, but the tone of his study thereafter turns critical. He criticises the methods used as “rudest” by castes which are the “poorest” and “wretched”, exploited by mahajans (moneylenders) literally

as slaves. From here Oldham once again makes the familiar argument; “the wasteful consumption of fuel often compels them to remove to spots where it is more abundant...the description is applicable to all jungle districts which I have seen” (ibid: 12); “in many districts, however, this timber (sal) has been nearly exhausted and other trees are used” (ibid: 13); “the ingenuity with which they seem to have adopted a process for obtaining the very smallest possible amount of useful fuel from the greatest amount of timber” (ibid: 14).

After a complete description of the indigenous methods of charcoal-making and smelting, the geologist comes to his proposed solution. First, develop the industry of this district with “simpler means adopted for obtaining a better result...with the experience of other countries to guide in such trials...with skilled labour and practical experience from Europe or elsewhere” (ibid: 21). Second, this valuable material (fuel) must be economised as far as may be possible with “strict care taken to cut the forest systematically, and to renew its growth steadily and constantly” (ibid: 29). The kind of plant that would achieve these objectives was to have an annual capacity of 6,000 tons with an investment of £60,000 to £70,000. The iron would “be manufactured at a cost equal to, if not less than, that at which it is produced in England” (ibid: 30).

“On the subject of preserving our forests from destruction” (Selections of the Home Department 1855: 10-11), Ramsay, senior assistant commissioner of Kumaon in a note to Batten, commissioner, contends that

If the miners cut fuel judiciously, the forests in the vicinity of Semul Khet and Khetsaree would furnish a permanent supply of fuel. If a Company took a lease of the mines, the forest attached to them ought to be under the management and protection of the said Company, but if, hitherto, the mines were worked by a native lessee, it would be hopeless to expect the charcoal-burners to observe any organised system...(this) is applicable to all parts of the District where iron or copper mines exist.

In the valley of the Giri river in the western Himalayas, Cleghorn (1864: 1, 3) informs us

There is a great consumption of wood and charcoal in the connection with the iron smelting, for which the locality is famous...on our way, we passed in two days fifty mules, and nearly a hundred coolies laden with iron...We ascended the Giri [to an elevation of] 7,500 feet, where iron smelting has long been practiced.

Observing the practices of the local charcoal burners, Cleghorn (ibid: 4) supports William Hay, previous superintendent of the Shimla Hill States who

...attempted to initiate conservation rules for charcoal burning, levying a small rate according to the girth of the trees felled. Charcoal makers should cut only in such places as are assigned to them in Government forests...all existing wood will be required for the successful working of the iron mines.

In Bir taluka, he supports the report made by a committee which recommended that

If iron were made on an extensive scale by the native processes...no extent of forest would be sufficient...if measures were not taken to renew the supply by means of plantations, and a proper forest conservancy...and improved methods of manufacture both for charcoal and iron.

Cleghorn (ibid: 88) further articulates the need for forest regulation with the appointment of an assistant conservator

on the Beas to effectively address through “strict conservancy management”, the conflicting interests of various stakeholders. The latter included

...the enormous indents for railway sleepers...the pressing demands for other public works; the great consumption of fuel for iron manufacture; and the prospective want of wood for tea-boxes in Kangra valley.

Writing on the industrial resources of India, Montgomery Martin (1868: 161) avers that although it has “inexhaustible supplies of the richest ores...the want of fuel has always been a great difficulty”. The blame is levelled against the “people who in India live by charcoal-making have desolated thousands of square miles of forestland, by wantonly wasteful treatment of the trees, to their own great loss, and to the serious disadvantage of the native iron trade”. This problem arose with the modern plants at Porto Novo as well as the Beerbhoom Iron Works. The proposed solution was similar once again – large-scale plants with a capacity of at least 2,000 tons per week and “skillful management of forests...over which the proprietor has control” (ibid: 162).

In a rare article J M Heath (1847: 77), founder of the Porto Novo Iron Works on the south-east Indian coast in the present state of Tamil Nadu, candidly discusses the priority afforded by the government towards modern iron works,

...with a view to encourage the undertaking I have engaged in, the Court of East India Directors have, in consequence of the earnest recommendation of the Madras Government, granted me certain privileges: such as the power of cutting fuel, and raising ore in Government lands, rent-free, for a certain time.

Saravanan (1998: 130) goes on to point out that at the time of renewal of his licence, Heath was turned down by the collector on account of the fact that “...it would...only interfere with the supply of the country furnaces and other manufacturers”. Moreover, “very many make their livelihood by burning charcoal and bringing it for sale to the iron smiths and it was his (Collector’s) duty to protect these livelihoods” (Roy 2009: 595). Heath, as we have seen, was not the only one contemplating investment in India’s iron and steel sector; the slow and definite decline in the Company’s monopoly powers attracted a number of British entrepreneurs to explore possibilities in this sector.

Praising English efforts at establishing smelting plants in southern India, Littel (1845: 383) appreciates the local Indian government, under the sanction of the East India Company, having

granted them considerable pecuniary assistance, and has conveyed to them rights and privileges, which, with those obtained from private proprietors of lands, give them complete and exclusive possession of all the materials for iron making in the provinces.

Decades later, Brandis (1897: 139) speaks of the “repeated attempts made to carry on charcoal iron smelting on a large scale in Salem district” between 1824 and 1867 that failed on account on the lack of “efficiently protected and regularly managed” forests. He therefore sought the “efficient protection and good management of a sufficient area of forest in the vicinity of the old Native Iron works,¹¹ so as to enable them to continue their operations”.

Going back several years before British enterprises commenced operations in India, Benjamin Heyne (1814: 226) described traditional techniques of iron smelting in great detail from several locations in the Northern Circars¹² and threw light on the state of mind of the British in exploiting India’s iron ore resources. At Ramankapetta, he remarked that “if the Company were inclined to establish any large iron works, there is no doubt that this place would be eminently worthy of notice”. Their concern, however, was availability of fuel (ibid: 223),

Were the manufacture of iron to be established here upon a large scale, the greatest difficulty would probably be the introduction of powerful blowing machines in place of these puny bellows. No doubt the East India Company, if it thought proper, might easily establish such a manufactory in different parts of their extensive dominions; and altogether supersede the necessity of the importation of iron from Europe. But I have strong doubts whether the establishment of extensive iron manufactories, in countries destitute of pitcoal, be a prudent measure.

Attributing a Strategic Motive to Statutory Forest Law

Herein lies the earliest basis for statutory forest laws. The interests of the Company in securing access over the forest resources, once under unfettered access by smelters, was now brought under laws for their preservation and conservation although with the right for a rational and scientific exploitation by industry. William Hunter (1886: 522) has tersely presented the basis for the development of statutory forest laws:

Up to about twenty-five years ago, the destruction of forests by timbercutters, by charcoal-burners, and above all, by nomadic cultivation,¹³ was allowed to go on everywhere unchecked...But as the pressure of population on the soil became more dense, and the construction of railways increased the demand for fuel, the question of forest conservation forced itself into notice.

In 1844 and 1847 the subject was actively taken up by the Governments of Bombay and Madras. In 1864, Brandis was appointed inspector-general of forests to the Government of India, and in the following year the first Forest Act was passed (No VII of 1865). With this indiscriminate timber-cutting was prohibited, the burning of the jungle by the hill tribes was sought to be confined within bounds and forest conservation became a reality in India.

It has been argued that the motive of the British in restricting charcoal burning and shifting cultivation was essentially economic; to preserve trees and ores for the iron industry, teak trees for the railways, to create “free” labour in hilly regions for construction and plantations, and to widen the tax net. Could these restrictions have served a more strategic interest of the incipient British regime: control over manufacture of weapons?

Gadgil and Guha (1993: 118-19) mention that “in the early nineteenth century, and following the defeat of the Marathas, the East India Company razed to the ground teak plantations in Ratnagiri nurtured and grown by the legendary Maratha admiral Kanoji Angre”. This has rather spontaneously been attributed to the destructive energy of the British race all over the world. A more reasonable and rational possibility for the destruction of the trees may have been to exercise control over local iron and steel production for weaponry by deterring charcoal making; after all the plantation was raised by a military official.

Evidence of the dismantling of forts across India (East India Company 1800: 238) and purposeful destruction of arms and ammunition does support such a possibility. For instance, in 1857, the British government collected several thousands of weapons from the Moplahs of the Malabar and systematically destroyed them at the Beypore plant. Quoting Charles Wood, Krishnan (1954: 71) elaborates:

...these knives were all made out of the native iron from the Indian blast-furnaces, and wonderful material they were. To break them was impossible...the remarkable quality of the iron, and that it could so beautifully be tempered. These war knives were sent up to the works in native bullock-carts from Calicut, in charge of sepoy, in lots of about 1,000 to 1,500 at a time, until they were all destroyed.

The perceived threat of the British government in the proximity of tribes to defeated feudatories¹⁴ could have meant that control over forests also served a strategic, not merely economic purpose; this possibility has hitherto seldom been explored in the study of Indian history and the evidence presented in this article is an attempt to begin a debate on this.

Conclusion

Our study puts forth an altered narrative of Indian environmental history by turning the focus on traditional iron

smelting rather than the agrarian village economy. The relationship of mutual interdependence that had existed between smelters and the state in precolonial medieval India was severed with the advent of colonial rule. But this was only half the story; the colonial state in pursuing its own commercial and military objectives considered the traditional smelter as a competitor for resources and even perhaps a militaristic threat. Although, in some cases, a demand for iron and steel products for agricultural implements and household wares thrived in the colonial economy, the traditional smelters' access to ore and wood for charcoal was no longer unfettered. Smelters had to operate in a new context of resource scarcity and competition with the state, institutionalised through statutory forest laws. This reading of environmental history further provides a basis for understanding what is clearly discernible even today in many mineral-rich forest regions of India; the proximity between tribal communities and the state, although it has turned to one of tension and conflict in asserting rights over mines and forests. Meanwhile, the degree of separateness between tribal communities and the "mainstream village economy" continues to exist.

NOTES

- Holland and Hunt (1853: 44).
- A more detailed exploration from smelting locations across India follows in a later section of this article.
- The flat and open plains of the Deccan plateau.
- It is not charcoal per se that is the defining element of traditional iron and steel. Even today, large-scale manufacturers of iron and steel in Brazil continue to smelt iron and steel using charcoal rather than coke to reduce the oxides in the ore. The easy availability of wood is the determining factor in this choice. Utilisation of charcoal in iron smelting is, therefore, a necessary, but insufficient, condition in defining traditional iron and steel making.
- Abraham Darby replaced charcoal with coal in the 18th century.
- The manager of the Company's Porto Novo establishment (on the east coast) reported that they used 13¼ tons of charcoal for every 1 ton of iron produced (King and Foote 1865: 383).
- This is equal to ~1132 square kilometres or approximately twice the area of the present-day Rajiv Gandhi National Park at Nagarhole.
- Although beyond the scope of this study, it may be pertinent and interesting to explore the interrelationship between shifting agriculture and charcoal burning for iron smelting. It seems more than a mere coincidence that tribal communities have been associated with both these activities.
- As we have seen smelters did sell iron to village blacksmiths. But here too it was an arms-length arrangement with social segregation. The "separateness" of smelters would also ensure that the state's supply of weaponry in unaffected by social and economic changes in the village economy.
- Kangra district was then in the British province of Punjab but is now in the state of Himachal Pradesh.
- These old native iron works refer to the likes of the Porto Novo plant and not traditional smelting.
- This region includes some coastal parts of present-day Andhra Pradesh and Orissa.
- Nomadic or shifting cultivation may have a close relationship to iron smelting and charcoal-burning. It makes sense to clear the forests for

charcoal and then utilise the cleared land for cultivation. Both the smelter/charcoal-burner and shifting cultivator shared nomadic lifestyles. The possibility that these cultivators were primarily smelters requires to be further studied. The decline of the traditional iron industry may have meant that some tribes became dependant almost fully on agricultural produce from shifting cultivation.

14 The imposition of the "Criminal Tribes Act, 1871", classified the Vanjaras/Sikligars as criminals. The demonisation of their sect compelled them to make a mass migration into jungles in most backward tribal belts to save their lives (Rao nd).

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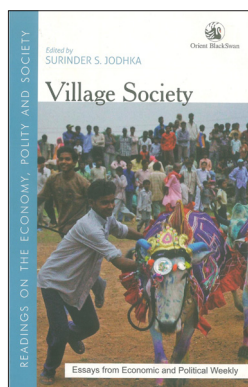
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