

Socio-economic Drivers of Forest Cover Change in Assam: A Historical Perspective

NARAYAN SHARMA, M D MADHUSUDAN, ANINDYA SINHA

This article analyses the historical context of forest cover change in the upper Brahmaputra Valley of Assam during the precolonial, colonial and the postcolonial periods, locating these changes within the political economy and demographic milieu of each regime. In the current context of rising populations linked to immigration from neighbouring regions, dwindling share of agriculture in the state's gross domestic product, and recent incentives to small tea growers in risk-prone agricultural landscapes, serious challenges remain to securing forests in this region. Empowering local communities and institutions, understanding tea plantation dynamics and managing the causes and consequences of recent demographic change are crucial to the conservation of forests there.

India's north-eastern region, counted among the world's 34 biodiversity hotspots, has remained a biological frontier well into the 21st century. Recent explorations into these forests have continued to yield discoveries of new species and range extensions for many faunal groups (Athreya 2006; Das et al 2006; Datta et al 2003; Mishra et al 2006; Pawar and Birand 2001; Sinha et al 2005). This region's upper Brahmaputra Valley harbours wet alluvial grasslands and lowland tropical evergreen forests, regarded among the most threatened forest types in the world. The valley also encloses, within its folds, a large human landscape of agricultural fields, human settlements, historical towns and one of the world's largest stretches of tea gardens. As a result, these lowland forests and alluvial grasslands are today broken up by vast tracts of tea plantations and human habitation into isolated fragments that are still very rich in biodiversity. These remnant habitats act as the last refugia for many of the region's 1,200 birds, 430 mammals, 520 reptiles and between 10,000 and 20,000 plant species (Anonymous 2007). For instance, seven species of wild cats occur in the forests of Jeyapore-Dehing alone (Hance 2010) while threatened floodplain habitats like those of Kaziranga protect several endangered mammals such as tigers and their prey at densities that are amongst the highest anywhere on earth (Ahmed et al 2010).

Once a vast stretch of contiguous forests less than a quarter of the upper Brahmaputra Valley remains under forests today (Forest Survey of India 2009). These far-reaching ecological changes are the consequence of major historical upheavals in the region's economy and polity. Indeed, even today, the forests of this region continue to experience widespread fragmentation and rapid degradation. Serious conflicts remain over land and natural resources, raising questions about the future of its forests and their wildlife.

Threats to the forests in this region stem from three broad causal factors. First, although predominantly an agrarian state, Assam's agricultural economy is in serious transition. In recent years, the share of agriculture – still the mainstay for 53% of the state's population (Government of Assam year unknown) – in the state's gross domestic product has declined from 35% in 2000 to 24% in 2010. A lowered per capita agricultural production pushes Assam's cultivators, especially the most marginal, onto the state's remaining forests to mitigate risk in agriculture. The recent expansion of tea, almost exclusively by smallholders (Singh and Ghosal 2011), is a good example of this threat. Second, Assam is a state rich in natural resources such as forests, oil, and coal and natural gas, all vital ingredients in the economic growth not only

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Narayan Sharma (narayansharma77@gmail.com) is with the National Institute of Advanced Studies, Bangalore. M D Madhusudan is with the Nature Conservation Foundation, Mysore and Anindya Sinha works at the National Institute of Advanced Studies, Bangalore.

of the region but of the entire country. Growing economic opportunities for extractive industries dependent on natural resources have compounded threats to the region's forests, especially in areas that continue to remain relatively pristine, such as the Jeypore-Dehing forests. Third, in comparison to Bangladesh, Nepal and other eastern Indian states, Assam continues to offer livelihood opportunities that promise relatively better prosperity. As a result, the state has seen a heavy influx of immigrants, who have increasingly turned to the remnant natural habitats for cultivation for their livelihoods as well as to meet their other daily resource needs. Besides adding to social conflict, most of these settlers have also added to the human footprint on the region's remaining forests and grasslands. Thus, the ecology of this region remains strongly entwined with the state's political economy.

Any analysis of the prevalent threats to the forests of Assam – which also hold the key to conserving them – is therefore incomplete without considering the wider sociopolitical and economic causes and consequences of changes in Assam's natural habitats. Examining the history of forest cover change in this region, for example, would help us to understand the dynamic nature of its landscapes and provide a useful frame of reference to assess contemporary patterns and processes (Swetnam et al 1999), particularly in the light of past data and insights. Only such an inquiry into the past can help us learn how we came to this turn in the road and, perhaps more critically, what options lie ahead (Rangarajan 2001).

Study Area, Period and Sources

The upper Brahmaputra Valley is enclosed by the hills of Nagaland, Karbi Anglong district of Assam and Arunachal Pradesh. It comprises the erstwhile undivided district of Sibsagar (current districts of Sibsagar, Golaghat and Jorhat) and of Lakhimpur (current districts of Dhemaji, Lakhimpur, Dibrugarh and Tinsukia), and covers an area of over 20 lakh ha. We retain the old district status, unless stated otherwise, in order to facilitate the comparative analysis across different historical periods. As our thrust was mostly towards the region south of the river Brahmaputra, supported also by its well-documented history, the districts north of the river – Lakhimpur and Dhemaji – are not as thoroughly represented in our analysis.

We present the history of the upper Brahmaputra Valley over three broad periods – precolonial, colonial and postcolonial. We define the period from the fifth century to the first quarter of the 19th century as precolonial, dominated largely by the six centuries of Ahom rule until the region's annexation to the East India Company in 1826. The period under British rule, from 1826 to 1947, has been defined as the colonial period whereas the period after 1947 has been treated as the postcolonial period.

The rationale behind choosing these periods, instead of centuries, was to facilitate a comparative analysis of three distinct political regimes. Transitions between these periods mark a major shift in the political economy, social order as also, rather importantly for our purpose, their ecological fallouts. In this study, we will analyse how broad changes in socio-economic order during these political periods influenced the survival and dynamics of

the forest cover of the valley. We also consider these changes against the backdrop of episodic geological events like earthquakes and periodic events such as annual floods that have and continue to work, together with anthropogenic factors, to sculpt this remarkable landscape.

Our study draws heavily on secondary sources, including scholarly articles from peer-reviewed journals, books, old and new working plans and manuals of the Assam forest department, travelogues by British travellers, newspaper and magazine articles and the worldwide web. Interactions and discussion with scholars, historians, social scientists, ecologists and social activists from non-governmental organisations from the regions also greatly enhanced our understanding of this landscape, its history and present-day challenges.

The Precolonial Period

Although the native vegetation across most of upper Assam was perhaps forest, alluvial grassland and marsh, the frontier between farmland and forest has shifted considerably over its human history. Pollen of *Areca catechu*, a domesticated species associated with settled agriculture, for example, was recovered from a sediment core dating back to 1,000 years BP in the Lekhapani reserve forest of Tinsukia, where no such trees can be found today (Bera and Basumatary 2008). This thus suggests the historic presence of human settlements in areas that, today, are entirely forested.

The prehistoric accounts of this region are largely based on classical texts such as the *Mahabharata*, Puranas and the Tantras (Gait 2005). The history of this region between the fifth and 13th centuries, largely reconstructed on the basis of copper plate inscriptions (Guha 1984; Lahiri 1984, 1990), provide clues to the rather sparse human populations in the valley and to landholding by a powerful class of brahmins. Since the 13th century, the arrival of the Ahom – a Shan tribe of upper Burma – into the valley and their history have been well-documented in their *buran-jees* (historical chronicles). After successfully establishing their kingdom with Garhgaon (presently Sibsagar) as their capital, the Ahom expanded their territories in the valley and, by the year 1700, had conquered regions, earlier included within the kingdom of Kamarupa. In upper Assam, they expanded their territory by either assimilating the native Moran and Borahi communities of Sadia or by annexing the Chutia and Kachari kingdoms of Dimapur. As a result, the once-scattered and independent political centres of the valley were unified under the single power structure of the Ahom kingdom. Much later, however, a long-term civil conflict – the Moamoria rebellion (1769-1806) – led by the Moran, the adherents of the Moamara Sattrā (Assamese Vaishnavite monasteries), weakened their roots and led to the downfall of the kingdom. Subsequent Burmese invasions (1824-26) and eventually the annexation of Assam under British rule, following the Yandaboo treaty with the Burmese in 1826, ended 600 years of Ahom rule in the valley.

The major production system during the pre-Ahom period was shifting cultivation, which made a transition into largely settled agriculture during the Ahom rule when wet rice cultivation was introduced in the valley. There, however, exist ambiguities

amongst historians on the major mode of production during this time (Guha 1984; Lahiri 1984, 1990). Although the nature of institutions, taxation, regulation and incentive structures of pre-Ahom period are largely rather vague, the inscriptions found during this period established the role of kings and the powerful class of brahmins in land regulation and taxation. While consolidating their power through territorial expansion, the Ahom also transferred the technology of wet rice cultivation to other tribes of the valley (Guha 1966). Agricultural expansion was aggressively promoted and tax incentives offered to open up any forested land for agriculture (Saikia 2005). With such a mode of production (Gadgil and Guha 2008), forests, marshes and natural grasslands were soon replaced by cropfields. The main motive of this expansion, however, was to produce surplus yield in order to sustain, besides other non-agricultural populations, a formidable naval infantry – the main agents of state formation under the Ahom.

The Ahom kingdom had complete control over forest resources. Besides opening up the forests for agriculture, collection of items like agar wood and ivory also attracted taxes. There were administrative officers such as *Kathkatiya Barua* who oversaw the harvest of forest products and *Habial Barua* who supervised the extraction of forest timber (Handique 2004). Vast tracts of forests were exploited heavily in order to build numerous boats, important components of naval warfare, particularly between the rivers Dikhow and Dhansiri. This region, located strategically for boat building, lost so much of timber in its adjoining forests that, in 1881, the colonial forest department could barely find quality forest patches in northern and central Sibsagar to create reserve forests (Talukdar and Barua 2005). In a settled cultivation mode of production, local resources from the forests were used as fuel, fodder, manure, building timber and in implement-making (Gadgil and Guha 2008). As the population in the valley congregated increasingly in villages and opened up forests for agriculture, it may be speculated that the natural vegetation surrounding settlements were gradually depleted over time. Markets were largely local (Guha 1983) although the Ahom had established trade ties with adjoining tribes and indirectly with China and Burma through the Bhutanese and the Singpho (Misra 2005). The materials traded were restricted to rice, *tussar* (coarse silk) woven by Assamese women, iron and lac, buffalo horns, pearls and coral (Misra 2005). Markets for forest produce were, however, not well-developed and hence, the forests and their produce could not be fully commodified. The localised market, with limited linkages outside the valley, ensured that the region's natural resource economy could not yet establish linkages with a wider, external market system.

From the sparsely-populated pre-Ahom period, human populations are likely to have increased during the Ahom period as agricultural societies tend to maintain high population densities (Gadgil and Guha 2008). During the reign of the Ahom king Rajeswar Sinha (1751-69), the population of Assam was 24,00,000 (Guha 1966). The population of upper Assam, however, declined from the mid-18th century because of internal conflicts and was reduced by two-thirds during the Burmese invasion in the first quarter of the 19th century (Bose 1993). Much later, in the year 1835, the estimated population of the entire valley was 7,99,519

and that of the native states of upper Assam, 2,20,000 (Gait 2005). These demographic changes have had significant effects on the forests in the valley. While the population growth during the peak of the Ahom reign decreased forest cover through the process of agricultural expansion and intensification, agriculture was badly affected when populations declined in the aftermath of the Burmese invasion and forests were able to reclaim abandoned agricultural lands (Butler 1855; Shakespear 1914).

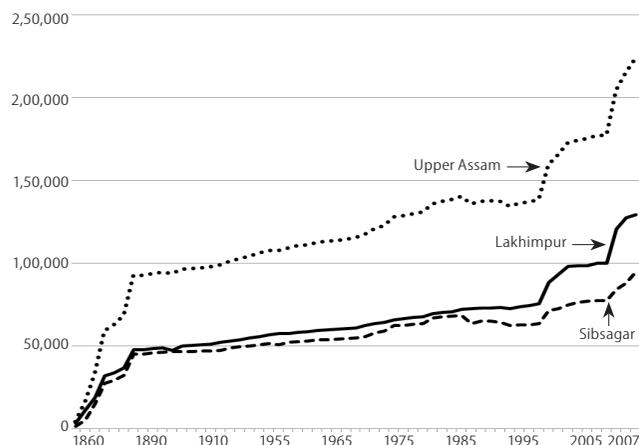
The Colonial Period

Assam was annexed by the British East India Company after the Yandaboo treaty with the Burmese in 1826 while upper Assam continued under the Ahom kings until 1839. When tea was discovered in upper Assam in 1823 and successfully produced in 1837, the British sensed an enormous economic opportunity and formally annexed this region too. Many colonial policies favouring European investors were promulgated to encourage tea planters to establish new tea gardens and occupy vast expanses of forested land in the valley. Due to the scarcity of local labour forces to work in these tea gardens, however, indentured labourers were brought from central India from 1859 onwards (Jha 1996). This marked the beginning of a demographic watershed in the history of this region. In 1874, Assam was upgraded to a chief commissioner's province and a provincial forest department established. Subsequently, many forested areas were mapped. Armed with several regulations and taxation laws, the forest department went about its mandate of exploiting forest resources systematically. In the meantime, coal and mineral oil, discovered beneath the forests of upper Assam during the 1880s, enriched the British crown. In order to transport these commercial materials to tea factories and to remote markets, an extensive network of railways was established along the length of the valley from 1881. These linkages ensured that the region was no longer economically isolated and its natural resources began to service demands from national and global markets. During the first half of the 20th century until Indian Independence, upper Assam witnessed continuous expansion of tea gardens, increasing human density and escalating conflict over the use of its natural resources. Many forests were brought under the reserve forests network and a few were also denotified, to implement the colonial policy of agricultural expansion through colonisation.

Under the Ahom, the main economic thrust was surplus production to sustain a military-led state formation. However, the colonial period saw the emergence of two distinct variants of the production system, a commerce-driven system based on plantation economy as well as the extraction of natural resources, and another based largely on settled subsistence agriculture. The main motive of both of these production systems, at least in Assam, was to maximise revenue. In the upper Brahmaputra Valley, commercial plantations were encouraged as its topography and climate were highly conducive for this form of land use while settled agriculture was promoted in the low-lying regions of central and lower Assam. The cultivation of tea was promoted through many attractive incentives (Guha 2006). Two sets of rules pertaining to the tea sector, in particular, are worth mentioning, as they brought about significant changes in the landscape. The first

were the Wasteland Rules of 1838, under which areas categorised as wasteland (grassland, marshes and forests) were leased at nominal prices to planters. These terms were further liberalised in 1861 under Charles John Canning's fee-simple rules to facilitate further expansion of tea in the valley. To increase revenue through agriculture production, settlement and agriculture policies that encouraged peasants to colonise and transform forested lands into agriculture fields were devised (Saikia 2005). Of these policies, the Assam Land Revenue Settlement, 1886 and the Assam Forest Regulation of 1891 were particularly important in

Figure 1: Total Area under Tea in the Upper Brahmaputra Valley (1860 to 2007)
(Area in ha)



their effects on the forest cover of the valley. The intensity of such colonisation processes reached new heights after 1928 as several professional grazing reserves were opened up to cultivators from the adjoining areas of eastern Bengal and in this process, large tracts of forests cleared of cover (Saikia 2005). Tucker (1988) estimated that, between 1930 and 1950, immigrant peasants brought approximately 6,07,072 ha of forestlands under agricultural operations. The immigrant peasants often settled on forestland as they found it difficult to go through elaborate administrative process of getting agricultural land (Saikia 2005). Deforestation further accelerated during the 1940s as the provincial government decided to de-reserve forests and distribute them among landless peasants under the war-time grow more food campaign in the British colonies. The surplus reserve in all the submontane areas and in Sibsagar and Lakhimpur were thus opened up for the settlement of landless indigenous peasants (ibid). An estimated 13,646 ha of land were taken up for cultivation in the district of Nowgong, Lakhimpur and Sibsagar during 1943-44 alone (ibid).

Riding on the back of liberal colonial policies, tea planters now attempted to grab more land than they required or could manage (Behal 2006; Guha 2006). Although about 2,83,280 ha of land had been with the tea-planters in Assam during 1870-71, the area under tea was only 22,662 ha or 8% of the total area (Guha 2006). The industry grew phenomenally during the last quarter of the 19th century with the total land area under the industry doubling and covering around one-seventh of the entire settled area in the Assam plains (Guha 2006). By the end of 1920, one-fourth of the total acreage settled with planters had come under actual cultivation while, by 1938-39, the area under tea in Assam (including Assam

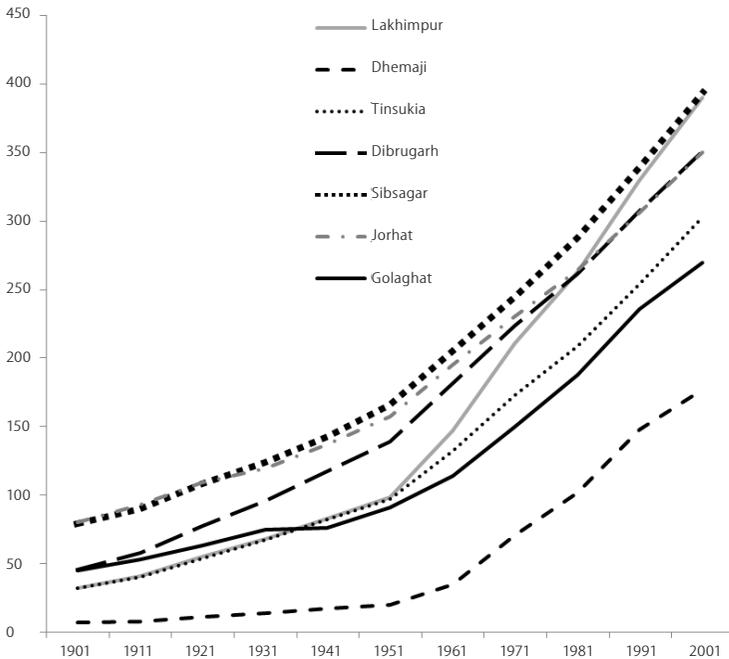
proper and Sylhet) was 1,79,137 ha, which steadily increased even further after Independence (Figure 1). The Assam Tea Company was the sole company in 1858 but, by 1865, as many as 62 companies had been registered in India; there were only nine tea gardens in 1853 but this number had reached 51 in 1859 (Rungta 1970). The tea industry of Assam had finally come of age.

Since 1881, many saw mills were established to supply storage chests to the tea industry (Sen 1995) and, by the end of 1901, 14 saw mills were functioning in the valley (Guha 2006). The plywood industry started in the Dibrugarh district of upper Assam for this same strategic reason. The first plywood factory was established in 1914 and subsequently, the Assam Railways and Trading Company opened its factory in 1924 to supply tea chests, and sleepers to the railways. The forests adjacent to these industries began to disappear to fulfil this prolific need for timber.

In order to transport tea, coal, timber and oil out of the valley, a railway network was established. The first railway was started in 1884 from Dibrugarh to Makum (Anonymous 1981) but had increased from 114 miles in 1891 to 715 miles by 1903 (Guha 2006). Each mile of railway required 860 sleepers and the average effective life of each sleeper was calculated between 12 and 14 years (Gadgil and Guha 2008). To lay 400 miles of railways in the valley would have thus required approximately 3,44,000 sleepers (Handique 2004) and most of these sleepers came from forests such as those in Nambor (Saikia 2008a). The railway system in Assam thus exerted enormous pressure on the forest resources of the province.

The penetration of the market into the valley and its linkages with global markets meant that, to some degree, the fate of the local economy was linked to the uncertainty of international markets. During the first world war, the demand for tea increased in Europe and the existing gardens were expanded or new gardens established, all at the cost of the local forests. After the war, however, the global depression of the 1930s hit the tea industry heavily and the demand for tea dropped sharply. In order to reduce production, the planters laid off many plantation workers and most of them moved into adjacent government forestland and in the char (river islands) areas of the river Brahmaputra to begin agriculture in a clumsy imitation of local cultivation, and in their economic desperation, seriously damaged forests even more (Tucker 1988). The extent of government lands taken up by such labourers for cultivation increased from 45,325 ha in 1906 to 1,06,028 ha by 1921 (Guha 2006).

Increased connectivity, employment opportunities and vast fertile lands along the riverine tracts and islands, coupled with the state's policy of colonisation, also began to change the demographic composition of the valley. In 1872, the population densities of Lakhimpur and Sibsagar districts were 47 and 15 persons per square kilometre (Waterfield 1875), increasing by 46% and 24%, respectively, in 1901 (Risley and Gait 1903). The rate of population increase can be gauged by the fact that, during 1901-51, the population growth rate of Assam was second highest in the world (Figure 2, p 68), exceeded only by that of Brazil (204%; Dass 1980). Intensive cultivation of tea and agriculture also demanded the input of labour in these production systems. The scarcity of the local human resources, particularly in the tea

Figure 2: Demographic Trends in the Upper Brahmaputra Valley (1901 to 2001)Human population density (individuals per km²)

sector, due to “unwillingness” of the native populace to work in the tea gardens, however, forced the colonial rulers to bring indentured labourers from central India to work in various tea gardens of the valley. These labourers transformed the demographic composition of the valley and also exerted serious pressures on the forest.

The provincial forest department took over the control of the forested land and curtailed the rights and privileges of the natives and restricted the usage of resources through regulations and taxation. Although established as the state’s apparatus to systematically exploit forest resources, the forest department in Assam has also played a significant role in buffering the effect of planters, imported labourers and migrants on the forests of Assam. Nevertheless, the forest department, being a part of the provincial government, was bound to give priority in land allocation to meet the need of the peasants (Ribbentrop 1889, in Tucker 1988). It, however, soon realised that, in the long run, such prioritisation would threaten the supply of timber and hence, extensive surveys and mapping exercises of the forests were undertaken to particularly delineate the important *sal Shorea robusta* forests belts. Most reserved forests were established post-1874 and remarkably, continue to survive even today (Saikia 2005). During 1925 to 1929, the acreage under the reserve forest increased by 400%, largely in the *sal* belt area of the states. The second world war, however, brought major changes in forest production as demand for timber grew with their use in warfare and for infrastructure. Between 1939 and 1945 therefore timber production in the reserves more than doubled while fuelwood cutting increased more than thrice (Tucker 1988).

In conclusion, the drastic change from a quasi-feudal economy to a market economy under the British colonial rule was marked by an unprecedented and unparalleled ecological degradation across the upper Brahmaputra Valley. Baruah (2001) has observed,

for example, that in “the late 19th century Assam has witnessed nothing short of an economic revolution accompanied by massive ecological destruction”. However, this economic prosperity did not translate into an overall development of the valley and a century later, the region still remained underdeveloped, a phenomenon which the economic historian Amalendu Guha (1974) aptly termed as “a big-push-without-a-take-off”. The population of the valley began to increase during the late 19th century resulting in escalating conflicts over resources as these were now under the complete control of the British. The large-scale deforestation, which had started in the late 19th century, increased in intensity and acquired a new feverish pace in the next century, particularly during the 1940s, when amidst complex politicisation of the land problem in Assam, the provincial government decided to distribute land from the reserved forests to landless peasants (Saikia 2005).

The Postcolonial Period

The land-distribution movement, which started during the early 1940s, continued to grip the region and gained new fervour after 1947. Since then, the issues of escalating conflicts over land and resources have dominated the socio-political narratives of the region. However, the major earthquake of 1950 and the equally devastating floods of 1954 changed the landscape of this region to a great extent. Post-independence, the population of the region rose exponentially in the valley, with migrating people from adjoining regions contributing significantly to its growth. The Assam Movement (1979-85), a mass agitation, was fought on the issues of this sharp rise in the population of migrants, which accompanied serious economic underdevelopment. The agitation culminated in the signing of the Assam Accord in 1985. The year 1979 also marked the emergence of armed civil unrest in the valley that has had an important bearing on its socio-economic and political history as well. The economy of Assam has traditionally remained stagnant and, despite being the largest producer of tea, oil, plywood and forest products, it continues to be a relatively underdeveloped state in India.

There have, however, been several small initiatives that have made attempts to improve the local economy in different parts of the valley. In order to mitigate the risk of agriculture production, for example, a new economic initiative began in upper Assam during the 1970s and took momentum during the 1990s with a huge increase in small, independent tea growers who currently contribute one-fourth of the total production of Assamese tea. But such initiatives have also taken their toll on the local forests.

Sensitivity to conservation issues became stronger following our independence from colonial rule. The Wildlife (Protection) Act, 1972 was implemented in Assam in 1977 and conservation concerns began to permeate public discourse. With the 42nd Amendment of the Indian Constitution in 1976, forests came on to the concurrent list, and the centre assumed key law and policy-making functions in the forest sector. The Forest (Conservation) Act, 1980 was implemented to restrict dereservation of forests

and conversion of forestland for non-forest purposes, which again brought the issue of land rights to the fore. This legislation was followed by an order from the Supreme Court in 1996 whereby a blanket ban on tree felling was imposed in the entire north-eastern region of the country.

The main thrust of independent India was on economic growth and nation building, and hence, agriculture expansion and industrial growth occupied top priority in the agenda of successive central and state governments. Even the National Forest Policy of 1952 clearly asserted that priorities of forest management must be made subordinate to the larger national goal of industrialisation (Guha 1983). These development strategies, adopted by the Indian state, are critical in comprehending the forest cover change in upper Brahmaputra Valley in association with the socio-economic and political issues of the region.

Assamese Economy in the Post-Independence Period

One of the major economic thrusts in Assam, immediately after Independence, was on increased productivity in the agriculture sector. This is reflected in the total outlay allocated to agriculture in successive five-year plans of the state: 23.7%, 26.8% and 17% during the First Plan (1951-56), Second Plan (1956-61) and Third Plan (1961-66), respectively (Sarma 1966). In Assam, there was greater expansion of activities under the grow more food campaign as a result of attaching the highest priority to agriculture by the state government under the First Five-Year Plan, beginning 1950 (Government of Assam year unknown). Assam was, however, beyond the purview of another major agriculture intensification drive – the green revolution. There was neither agricultural intensification nor expansion, with a mere 2% increase in the arable land during 1950-70 (Richards and Hagen 1987). The resident and immigrant population (from East Pakistan, currently Bangladesh, and other Indian states) increased by 84.4% during the same period, largely driven by economic and political factors (Dass 1980). Consequently, the per capita holding of arable land reduced from 0.299 to 0.165 (Richards and Hagen 1987) putting tremendous pressure on the land. The net sown area in Lakhimpur and Sibsagar districts increased by 18% and 31% from 1960-61 to 1996-97 with a concomitant decrease in forest cover by 11% and 45%, respectively. Sibsagar has also experienced a steep growth rate in urbanisation and industrialisation, with the relatively highest share (about 29%) of its area under the non-agricultural sector (Goswami 2002).

Industry was another sector that was given priority after Independence, particularly those components that focused on tea, coal and oil. However, the region witnessed an acute economic underdevelopment post-Independence, as some sub-nationalist narratives have argued (Sarma 1966), due to the continuation of the colonial extractive tradition by the Indian state and Indian capitalists. Moreover, these sectors failed to facilitate the growth of the necessary ancillary industries (Misra 1980). Although one could expect that the pressure on forestland would not have significantly increased under these circumstances, such an effect, even if present, was masked by the growing population of the region. Coupled with the marked inability of the industrial sector to absorb local, unemployed

segments of the population, socio-economic pressures clearly shifted to the land and its resources.

The growth of small tea plantations, mentioned above, exerted immense pressure on the forest cover, which can be gauged by the sharp increase of area under plantations since 1992 (Figure 1). The Assam government promoted the expansion of small tea gardens by opening up patches of forested lands, primarily from unclassified forests, to prospective tea planters (Saikia 2008b). Small tea growers currently contribute approximately 29% of the total tea production of the state and 14% of that of the country.

The plywood industry that developed in the state also clearly affected the forests until 1996, when the Supreme Court slapped an order on tree felling in north-eastern India. Until then, the industry had heavily exploited the lowland rainforests of upper Assam. The growth of this industry was rather slow till 1950-51 but made steady progress subsequently; indeed, it was the fastest-growing industry in the state then (Sen 1995). The nature of production also changed from during this period. There were thus only two units producing about 1.5 million cubic metres of tea chests while other sophisticated, commercial plywood units were absent in 1950-51. By 1985-86, however, there were 14 units that were producing only 0.55 million cubic metres of tea chests but 38 units that produced 41.2 million cubic metres of commercial plywood (Sen 1995).

The landscape change in the valley was also significantly affected by the demographic changes and the related sociopolitical developments that swept the region since Independence. Central amongst these were the issues of the growing populations of landless peasants and migrants in the valley, many strongly affected by the periodic floods and erosion that were a mainstay of the valley. The impact of human emigration into Assam can be assessed by the fact that approximately 1.5 million hectares of natural vegetation (roughly 19% of the state's area) were converted to croplands and human settlement in just a century, from 1870 to 1970 (Richards and Hagen 1987). The sustained movement of such migrants over the land and the exploitation of its resources, often with political patronage has thus profoundly affected the forest cover of the region. In Dibrugarh district of Assam, many forest villages were established under the rehabilitation programme for people affected by floods as well as those affected by the devastating Assam earthquake of 1950 (Sonowal 1997). This policy resulted in considerable land clearing within the confines of reserved forests (Richards and Hagen 1987). By the early 1970s, successive state governments had surrendered for cultivation and settlement most of the publicly-owned unoccupied lands not included in the reserve forest system (the "unclassified state forest system"; Richards and Hagen 1987). Recurrent natural calamities, particularly those related to annual floods in the Brahmaputra, also led to the proliferation of landless people, thereby aggravating the already enormous pressure on existing forest lands.

Under this backdrop of economic slowdown and rising migrant populations, the region plunged into civil unrest that virtually crippled the region politically and economically. Social unrest can have severe consequences on the forest, as exemplified by western Assam that witnessed large-scale deforestation during

1980s when the region was under civil unrest (Horwich et al 2010). Many of the forested tracts of the valley also served as ephemeral bases for insurgent groups and this has created problems for the protection and management of many of these tracts. The long-term civil strife in the region, for example, created opportunities for the unscrupulous exploitation of forest resources in areas that were now poorly protected. The interstate boundary disputes that Assam has had with Arunachal Pradesh and especially Nagaland has certainly also added its share of problems to the exploitation of forests. During 1972-99, therefore, the valley areas bordering Nagaland and Arunachal Pradesh were observed to be highly dynamic in terms of forest cover change (Lele and Joshi 2009), possibly due to conversion of forests to agriculture and human settlements.

At the same time, the creation of legal and governmental machineries to administer large stretches of forest (Rangarajan 2001) not only brought the issue of forest conservation to the fore but, at the same time, escalated conflict with the local people including tribal groups, whose rights and privileges over the land were curtailed. The role of the forest department in controlling the impact of these processes on the forestland and to check large-scale degradation of forest resources, under the existing legal framework, have been limited, given the continuous pressure from political regimes to open up forested lands for landless peasants. During the colonial period too, it may be recalled, the department had facilitated the settlement of landless immigrants in the fringes of reserved forests, although the motive then was to fulfil the regular supply of labour for the exploitation of forest resources.

Current Challenges and Opportunities

We thus see that, by the end of the 20th century, considerable forested areas in upper Assam have either been converted to other land-use forms or have been severely degraded. In spite of a long history of deforestation in the region, however, one-fourth of the area continues to remain forested though highly dynamic in nature (Lele and Joshi 2009). Moreover, there are encouraging trends in terms of forest cover gain between 1972 and 1999 and the fact that over 60% of forested areas of the state has remained unchanged during the same period (ibid). Although this may, at least in part, reflect limitations of remote sensing techniques in detecting qualitative change in forests, there continue to be pressing challenges to conserve the remaining forests of the region.

The remaining parcels of forested land in the upper Brahmaputra Valley must be managed efficiently as these are critical for future biodiversity conservation and livelihood issues. Many of the extant reserve forests and protected areas in the valley were established over a century ago indicating that strict protection of these forests may have resulted in their continuous existence in spite of systematic logging, pressures from the tea industry and burgeoning population growth. However, such a protective and, hence, exclusionary approach has led to severe conflict over these resources between the local people who have utilised these resources over centuries and the self-appointed guardians of the forest, represented by the state machinery. It is, therefore, unlikely that such strict protection would help sustain these

forests in the long run. It is possibly most pragmatic to set aside as inviolate certain forested tracts which are critical for biodiversity while resources in other areas should perhaps be used sustainably.

The agriculture sector of the state, which has traditionally supported a large population, is in decline. The natural resources of the state have been mined for over a century and its economy continues to be dependent on these resources, but clearly unsustainably in the future. Moreover, this sector supports only a minuscule of the population in terms of employment and livelihood. This social inequity could have serious repercussions on the state's natural resources, given the presence of a large migrant population which depends on agriculture for its livelihood. A closer inspection of the underdevelopment of the region points towards a phenomenon known as the "resource curse" or the "paradox of plenty", where areas rich in non-renewable resources tend to have less economic growth and worse development outcomes than do regions with fewer natural resources (Auty 1993). Assam seems to be such an example within India, where, in spite of abundant non-renewable resources like oil and coal, the state remains economically underdeveloped.

Economic development of a region is necessary and justifiable not only for the overall development of the region but also to release the pressure on its land with its forests. In Assam, however, the recent support provided by the state government to small tea plantations in the region, although hailed as an important step in alleviating widespread unemployment and rural poverty, could accelerate the rate of deforestation in the valley.

That land and its ownership remains a contentious issue in the state is evident from the growing discontent over it in the recent past. In 2002, for example, an eviction drive carried out by the forest department, following the direction of the Supreme Court, had attracted statewide protests and condemnation from social scientists and human right activists (Gohain 2006). More recent conflict over forested land in the Rajiv Gandhi (Orang) National Park, initiated by the settling of alleged migrants, and the local peasants' movement for rights over forestland in Tengani, adjacent to Nambor forest, in the Golaghat district (Saikia 2008a) have exemplified the intensity of emotion and action that these issues raise. If not curtailed, these contests could potentially have serious ecological ramifications as has been seen in similar incidents in this region in the past. In the Sonitpur district of Assam, an unprecedented loss of approximately 23,000 ha of forested land from 1994 to 2001 (Srivastava et al 2002) starkly exemplifies the possible consequences of such conflicts.

With the implementation of the Scheduled Tribes and Other Traditional Forest Dwellers (Recognition of Forest Rights) Act, 2006 in the state, this debate is likely to become even more serious in the future. The border issue with Nagaland and Arunachal Pradesh has intensified over time and reports of clear-felling and establishment of settlements in the reserve forests along the border areas are appearing regularly in the media.

The Road Ahead

The biggest challenge to biodiversity conservation in upper Assam is to find ways that can incorporate social justice, and

political and economic objectives into conservation planning. We argue that such an approach should be pragmatic and well-planned as decisions resulting from such dialogue would carry greater legitimacy and wider acceptance. We have, therefore, identified three major threads, derived from our historical analyses, that can provide useful insights in understanding the genesis of contemporary issues of forest conservation in upper Assam and we hope that these observations would be useful in designing effective conservation strategies in the future.

Empowering Local Institutions: Large centralised institutions such as forest departments may be effective in bringing about change in land/resource use over relatively short time horizons, but sustainability of change is always in question without participation of local stakeholders. Historically, in upper Assam, people have been excluded from decision-making processes, particularly those concerning access to natural resources under the three broad power regimes studied so far. These resources were either under the jurisdiction of the royalty or an exclusive property of our colonial rulers, and under the control of the state, following Independence. Such an all-pervasive exclusionist policy, unchanging over time, has resulted in accentuated conflicts through the ages leading to severe ecological consequences because when communities are not involved actively in managing their resources, they use them destructively (Sponsel et al 1996). An attempt was made to decentralise and involve communities under the Joint Forest Management Programme but, so far, the progress has not been encouraging. In a given region, with multiple interests and actors within communities, empowering local institutions rather than communities would constitute ideal mechanisms for resource management (Agrawal and Gibson 1999). Such a model of natural resource management is likely to be effective in upper Assam if local institutions are empowered against the backdrop of the existence of diverse communities and decentralised institutions such as autonomous councils

(Singh 2008). Such a move could, however, be challenging in the light of the existing contentious issues of whom to empower: native residents or recent immigrants? It is critical that further immigration into the valley be discouraged and effective mechanisms instituted to empower resident populations who have traditionally relied heavily on the existing natural resources. It should, however, be noted that while executing such processes, marginalisation of the already-present migrants does not lead to the severe retaliatory exploitation of natural resources and escalated conflict over land.

Understanding Tea Plantation Dynamics: Labour and markets are important components of plantation economies and these invariably tend to affect natural resources. Currently, a significant population of tea garden labourers in the valley rely heavily on the forests adjoining their settlements for their daily resource needs. This is particularly accentuated in the case of temporary or retired labourers. Neither the Plantation Labour Act of 1951 nor individual tea estates have been able to guarantee their proper rehabilitation. A proper settlement policy would certainly help in releasing the pressure that this labour force exerts on the adjoining forest resources. The uncertainty in markets usually drives the nature and intensity of production, which, in turn, often translates into a potent force of forest destruction. As local institutions would be unable to check the invasive force of the market economy, the state should play a proactive role in regulating the functioning of the tea economy in an effort to protect existing habitats in the land-use mosaic of the valley.

Mitigating the Effects of Demographic Pressures: Demographic factors have adversely affected natural resources throughout the colonial and postcolonial history of Assam and continue to be a dominant cause of deforestation in the valley. In a landscape where agriculture production is risky and employment opportunities limited, growing populations will always

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remain a potent force of destruction. The production systems in a landscape characterised by floodplains provide limited options for agricultural intensification and flood control has always been a formidable task in Assam, given the highly dynamic nature of the Brahmaputra and its tributaries. Promotion of non-extractive industries, those that are not based on the region's natural resources, will certainly be able to improve the livelihoods of certain sections of the local population and, at the same time, release pressure on natural resources. Rural development programmes like the Mahatma Gandhi National Rural Employment Guarantee Act (MGNREGA) would be useful such

demographic and socio-economic pressures away from threatened natural resources.

Protected areas and inviolate forests are critical for the conservation of regional biodiversity while many of these tracts have historically supported the livelihoods of local human populations. To find ways and mechanisms that conserve our threatened biodiversity but also protect the livelihoods and aspirations of these people so as to make our forests ecologically and socially sustainable is the biggest challenge for the conservation of the last remaining rainforests of the Upper Brahmaputra Valley.

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