

## Forest transition curve of India and related policies, acts and other major factors

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**Abstract:** This paper analyses the factors accounting for forest transition in India, which has been characterized by a continuous decline of forest cover for about seven decades since the year 1900 and then increase since 1970s. It is argued that several forest policies and acts, economic growth, liberalization, dramatic increase in grain yield and stabilization of agricultural area in the country, promotion of plantation forestry and encouragement for timber import, global campaigns and protocols in areas of biodiversity conservation and ecosystem services, including carbon sequestration have given shape to the forest transition in India. It has been opined that India and other growing economies are likely to improve their forest cover further. However, it may involve deforestation associated with timber export from poorer economies such as the African underdeveloped and developing countries to other countries which have observed a shift towards increase in forest cover.

**Key words:** Forest cover, forest transition, plantation forestry, policy milestones, wood import, wood production.

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### Introduction

The shift from decrease in forest cover to a trend of increasing forest cover associated with economic development of a nation is referred to as forest transition. Forest transition (FT) is presently studied from the curve drawn using time series data on forest cover. It is used to describe the empirical regularity in the conditions of the forests as nations undergo economic development, industrialization and urbanization (Mather 1990; Mather 1992; Walker 1993) in historical perspective. It is evident that the modernization, urbanization and economic development have a complex relationship with the rate of deforestation. The phenomenon of the forest transition is explained in terms of an Environmental Kuznets Curve (EKC) by Culas (2012); Southworth *et al.* (2010); Mather (2007); Rudel *et*

*al.* (2005); which follows an economic developmental pathway. EKC suggests that the relationship between a country's economic development and its environmental degradation follows a path according to which as the level of economic development increases beyond a certain point in a country (Stern 2004), first its rate of deforestation stabilizes and then forests start gaining in cover and biodiversity. However, the relationship between deforestation and income, and associated policy and institutional factors is not straightforward (Arrow *et al.* 1995; Bhattarai & Hamming 2001; Culas 2008). Since the management of forests in most developing economies is under public ownership, it has been suggested that the EKC relationship is linked with various socio-political institutions, structural factors, and historical processes (Arrow *et al.* 1995). Culas (2012) has even analyzed

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alternative development paths for forest cover changes and forest transition for the Reducing Emissions from Deforestation and Forest Degradation (REDD) policy in the context of climate change initiatives under United Nations Framework Convention on Climate Change. The occurrence of forest transition in recent years could be seen in India and some other developing economies (DeFries & Pandey 2010; Mather 2007; Southworth *et al.* 2010). The environmental factors are responsible for species distributions, community structure, and ecosystem properties in the Nilgiris, Western Ghats (Srinivasan *et al.* 2015). This paper examines various factors affecting forest transition in India. It is hypothesized that forest transition is a result of a combination of social, economic, legal, policy and technical changes.

The main objectives of this article are to (i) develop a framework for analyzing forest transition in India and (ii) examine the relationship between various macro level processes and forest transition in India with special reference to national forest policy interventions.

#### *A framework for analyzing forest transition*

We identify five major categories of changes (Fig. 1) which seem to influence transition of forests in India. These interact with each other in a complex and intertwined manner forming a cluster. Notably, some of the factors within each category may overlap across categories. Therefore, these categories are not mutually exclusive.

Transition in attitude toward forests has happened primarily as a result of general increase in societal awareness towards environment and biodiversity and decrease in individuals' day-to-day dependence on forests for livelihoods. One of the key factors that has driven this decrease in dependence on forests is the rapid rural- to- urban migration. Globally, the urban population now exceeds 50 % and is expected to further rise more in coming decades. It is estimated that more than 95 % of net increase in global population will occur in cities of developing countries like India (Table 1). Already three Indian cities, Mumbai, Delhi and Kolkata are among the top 10 largest cities of the world (UN 2011).

An increase in both affordability and availability of imported wood based products such as furniture can help alleviate pressure on local wood production and, in turn, on local forests. Wooden furniture has become a major component

of global wood based trade. The Government of India has brought timber import under open general license. As a result, timber import into India has increased rapidly, and is currently approximately worth \$6 billion per year. It is believed that additional timber worth at least as much value enters the Indian market via illegal routes. Indications are that a considerable amount of timber enters India from adjacent areas of Nepal (Midgley *et al.* 2007). However, by doing so, a country shifts its environmental demand to another country.

Additionally, local wood manufacturers have adopted better technologies and have increased their material use efficiency. Successive advancements in panel products and composite wood using lignocellulosic material has covered diverse range of product and variety, which were traditionally using solid wood (Shukla & Singh 1994). In the last twenty years, wood has also been substituted by plastic and other material such as medium density fiber board, high density fiber board, particle board, wood plastic composite etc., thus reducing pressure on natural forests (GOI 2004).

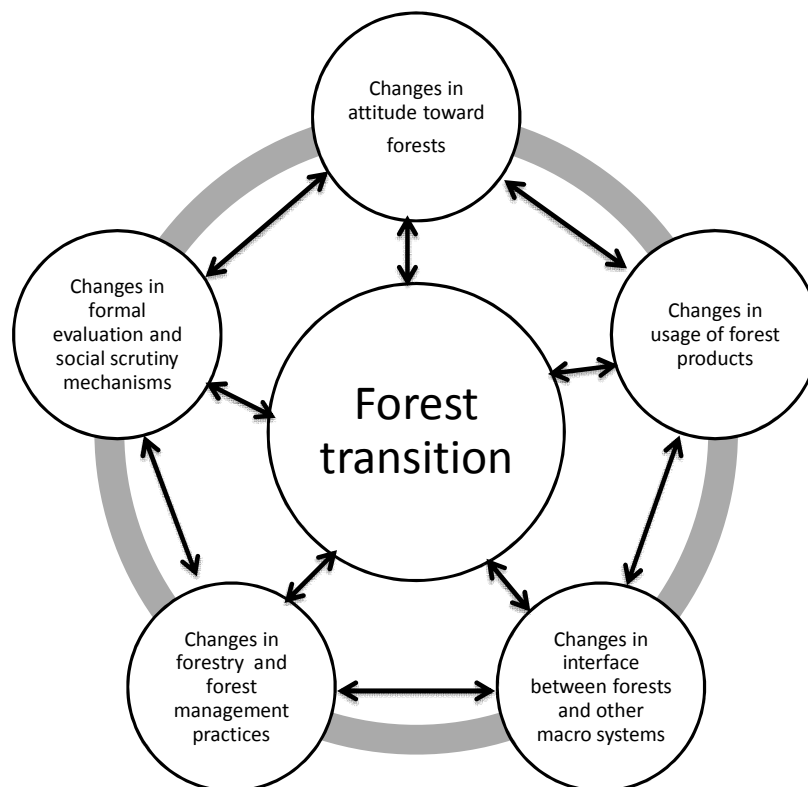
India has one of the oldest organized forest sectors in the world. In 1864, the Forest Conservator in the Presidency of Madras was instituted. Subsequently, forest policies were formulated and forest service was initiated. After India's independence, the Forest Conservation Act was enacted in 1980, prohibiting the diversion of notified forest areas for development or other non-forestry activities, and putting a break on forest degradation that had peaked during 1970s (Singh *et al.* 1990). This act also provides for Compensatory Afforestation (CA) in lieu of forest land diverted for nonforest use, for which the user agency pays. This money is being utilized for raising plantations of an adequate number of trees and associated species of herbs and shrubs. Additionally, the institution of community forestry represented through Joint Forest Management (JFM), has resulted in a reduced rate of deforestation. The rate of deforestation has also been stabilized with frequent and efficient monitoring of forests with the help of techniques such as remote sensing, geographic information system, etc. All these changes have led to a changed focus for skill development of forest officers (GOI 2009).

Forest officials face increased internal and external pressure for periodic monitoring and reporting of the state of forests in the country. The Forest Survey of India (FSI) publishes biannually a report on the status of forest. This report clearly

**Table 1.** Trend of Indian population (million).

Year	1951	1961	1971	1981	1991	2001	2011
Total	361.1	439.2	548.2	683.3	846.4	1028.7	1210.2
Urban	62.5	78.9	109.2	159.4	217.5	286.1	377.2
Rural	298.6	360.3	439	523.9	628.9	742.6	833
Growth rate	13.3	21.6	24.8	24.7	23.9	21.5	17.64
Urban %	17.31	17.96	19.92	23.33	25.70	27.81	31.17
Rural %	82.69	82.04	80.08	76.67	74.30	72.19	68.83

Source: Registrar General and Census Commissioner, India.

**Fig. 1.** Interacting agents of change (peripheral circles) that are shaping forest transition in India.

shows the extent of forests in different parts of India and includes data to the level of district administration units. However, still FSI data have not been used meaningfully by states to chalk out plantation activities. As a result of an increased focus on participatory forest management and sustainable utilization of forest resources for rural employment generation, the forest department now has annual targets to achieve (FSI 1987; FSI 1989; FSI 1991; FSI 1993; FSI 1995; FSI 1997; FSI 1999; FSI 2001; FSI 2003; FSI 2005; FSI 2009; FSI 2011) to address these issues. The 20-Point Programme

(TPP) specifically prioritised afforestation and tree planting and all rural employment generation programmes had certain percentage earmarked for afforestation. Progress of tree plantation is monitored by the ministry of statistics and programme implementation; government of India.

Civil society pressure and increased media attention on forestry issues have intensified public scrutiny of forest protection. Emphasis on stakeholder engagement processes has added pressure on forest bureaucracy for increasing public participation in forest management decisions and

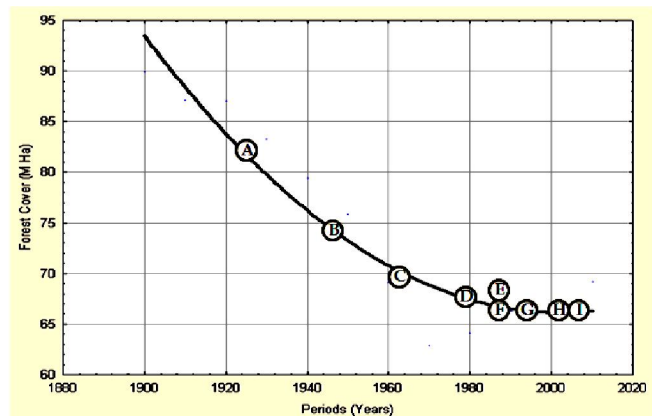
for improving transparency in information dissemination (Haripriya 2000).

The forest transition curve in terms of forest cover is the net result of such aspects as deforestation, degradation of forests, conservation, sustainable management, rehabilitation and afforestation, all operating at different scales during different stages of economic development. Each stage is generally characterized by dominance of one of these aspects over the others. For example, deforestation dominated the first phase of the forest transition curve; it started in a big way with the advent of colonial rule and continued unabated till the early decades of Independent India (FRI 1961). Changes in land use such as agricultural expansion and infrastructural projects have taken a toll on forest land. India's agricultural area, however, more or less stabilized due to intensification of agriculture by the 1970s. There have been several other factors which have influenced land use scenario of India from time to time. Moreover, there have been several milestones in the realm of legal and policy framework in Independent India since the enactment of Indian Forests Act in 1927 in the British India (Fig. 2). There are other indirect drivers of forest cover change, which include general economic development, urban population growth, an emergence of secondary and tertiary sectors in economy, higher opportunity cost of land, import substitution of forest products and change in attitude towards forests of general masses.

*Historical changes: From harvesting and control to production from plantations and valuing ecosystem services*

The trends for over a century in India indicate that (Table 2 and Fig. 2) forest area continuously declined from 1900 to early 1970s; more steeply after independence. Expansions of railways during the later part of the nineteenth century and early decades of the twentieth century (Singh & Singh 1992; Tucker 1983), needs of world wars and forest conversion for agriculture were probably some of the major causes of forest loss (Negi 1994; Singh *et al.* 2011). The use of *Sal* and *Deodar* for railway sleepers and unregulated cutting of trees for wars were particularly damaging. Forest regulations and policies formed during the British Empire facilitated inclusion of rich forests into government property and consequently alienated the people by denying access to these forests for their routine

needs (Lal 1990). Consequently, all concessions and rights that were not explicitly granted by the state were withdrawn; paving the way to facilitate absolute control of the state over forest resources. Moreover, the objectives advocated in the first forest policy in India in 1894 could not be implemented in all categories of forestlands and its application was limited to supply of valuable timber from India to England for the imperial strategic and commercial interests. Some of the efforts made under the scientific management of forests under the concept of sustained supply of timber; could not make a mark on the overall condition of forests in the country and the subsequent two world wars further deteriorated the forests of India due to over exploitation of timber (Gadgil & Guha 1995). Areendran *et al.* (2013) addressed the rate of deforestation and forest fragmentation in the mining areas of Madhya Pradesh.



**Fig. 2.** Legal and policy milestones of India (Bhojvaid *et al.* 2013).

A: Indian Forest Act 1927; B: The National Forest Policy 1952; C: Advocating Social forestry; D: Forest Conservation Act 1980; E: National Forest Policy 1988; F: Joint Forest Management 1990; G: Liberalization of the Import of Wood 1996; H: Biological Diversity Act 2002; I: Forest Rights Act 2006.

*Legal policy forest dynamics in India*

The National Forest Policy of 1952 after India's Independence from British Empire recognized the functional classification of forests as protected forests for environmental consideration, national forests for strategic requirement of defense, communications and industry, and village forests for local needs. Apart from these functional forest types, tree lands for extension forestry to meet the

**Table 2.** Decadal forest cover trend.

Years	1900	1910	1920	1930	1940	1950	1960	1970	1980	1990	2000	2010
Forest cover (M Ha)	89.9	87.1	87.0	83.3	79.4	75.8	69.1	62.9	64.1	66.3	66.9	69.2
Percentage of geographical area	27.35	26.49	26.46	25.34	24.15	23.06	21.02	19.13	19.50	20.17	20.34	21.05

Source: FAO 2005, FSI 2011, Singh 2011.

growing needs of the people were also recognized (Negi 1994). It was also recommended that 33 % of the total geographical area of the country should be under the forest cover. Consequently, more and more areas were declared notified forestlands and forest consolidation took place in the first two decades after independence. Though the extent of notified forests showed continuous increase due to inclusion of more land into the category of legal forests, the status of forests in terms of forest cover in the country showed continuous decline (Fig. 3).

In 1950-51 the forest area in India was 40.48 Mha. It increased to 66.80 Mha in 1976-77 and 76.52 Mha in 1996, i.e. an increase of 36.04 Mha. However, the intervening period witnessed large scale tree felling by private owners to get maximum returns as their properties (forests) were acquired by government orders as national property. Forests, being legally on the provincial/state list under the "separation of powers between the provincial and central governments", continued to be diverted recklessly for all non-forestry purposes. Moreover, large scale developmental activities were initiated immediately after independence leading to a rapid industrialization (including the production of paper, plywood, and saw milling), expansion of railways, network of highways and road broadening, varied construction activities, river valley hydro projects, expansion of agriculture etc., claiming large areas of forests (nearly 4.13 Mha until 1976) (GOI 1999; GOI 2004). Forests were thus considered a land bank for meeting the land needs for other land use purposes and a resource for earning revenue. Further, the subject 'Forest' was legally brought under the concurrent list of the Constitution from the State subject by the 42nd Amendment of the Constitution in 1976. Subsequently, a Central Act - Forest Conservation Act 1980, was enacted to regulate the diversion of forest land for non-forestry purposes. It is important to mention here that prior to the enactment of the Forest Conservation Act 1980, the diversion of forest land for non-forestry purposes during 25 years (1951-

1976) was 4.13 Mha about 60 % of which was for agricultural purposes. Before the Act came into force, the diversion rate of forest land was 165,200 ha yr<sup>-1</sup>, which came down to 36,560 ha yr<sup>-1</sup> after the enforcement of the act (GOI 2004). A new National Forest Policy was promulgated in 1988. It marked a major departure from the 1952 policy by laying prime emphasis on environmental stability and conservation of forests. Furthermore, the new policy laid emphasis on meeting the domestic requirements of fuel wood, fodder, minor forest produce and construction timber for rural and tribal population and their participation in protection and management of forests. Consequently, the forests were no longer a source of revenue for finance required for development activities (Negi 1994). While earlier the focus was on sustainable harvest of timber and earning revenue, in the new policy importance was given to the conservation of natural heritage in the country by preserving natural forests with their vast variety of flora and fauna and rich genetic resources (GOI 1991). Participatory arrangements have existed in Indian forestry since long in some form or the other. However, these were formalized with a declaration from the Ministry of Environment and Forests, Government of India in June 1990, which provided to the state governments a framework for involvement of village communities in protection, regeneration and development of degraded forests situated in the vicinity of the forest villages. Structured JFM has been in operation for almost 20 years and till March 2010, an area of 24.6 Mha has been brought under the JFM regime (ICFRE 2010).

#### *Implications of legal and policy shifts*

As a consequence of the enactment of Forest Conservation Act 1980, Policy of 1988 and the subsequent intervention of the Supreme Court of India in 1996, (i) presently there is a ban on felling of trees in all forests over 1000 m altitude, (ii) high priority has been given for raising fuel wood and leaf fodder producing trees in the government

forests resulting in almost complete exclusion of raising industrial trees, (iii) industrial wood production has been restricted to only on farm lands or on waste lands and (iv) a ban on all operations in national parks and sanctuaries has been imposed. All these factors have resulted in decline of timber production from natural forests. Alongside there have been increased plantations in various agroforestry models in agriculturally advanced provinces of the country (Table 3 and Fig. 4) to meet demands of wood based industries. Interestingly, the wood from eucalypts, poplars, casuarina etc. has been declared as agricultural produce and is marketed through agricultural market committees and even enjoys exemption from federal income tax.

**Table 3.** Recent trend of plantations in Haryana in Mha.

Year	Forest land	Common <sup>1</sup> / Institution <sup>2</sup> land	Farm/Private land	Total
2006-07	14.0	0.4	32.19	46.90
2007-08	14.0	2.0	28.06	45.00
2008-09	16.0	2.8	32.75	52.20
2009-10	13.0	2.2	35.29	50.78
2010-11	17.0	1.3	32.60	50.66
Total	75.0	8.7	160.00	245.63
Average	15.2	1.7	32.20	49.10
Percentage	31.0	4.0	65.00	100.00

<sup>1</sup>Community land, <sup>2</sup>Land available in premises of government institutions.

In brief, there has been a major shift in the very purpose of managing forests and hence their uses. While earlier the focus was on how to harvest timber sustainably and regenerate major timber species, now forests are to be conserved for their biodiversity and ecosystem services, particularly carbon sequestration. In the present conservation strategies local people depending on forests for their subsistence living are considered very much a part of forest management. While earlier, the forests were regarded as a revenue source, now governments are generating finance to reduce forest degradation, conserve biodiversity and enhance the ecosystem services occurring for their ecosystem. India must be among the few developing countries, which pay compensation to states with higher forest areas for providing ecosystem services to the rest of country (Singh

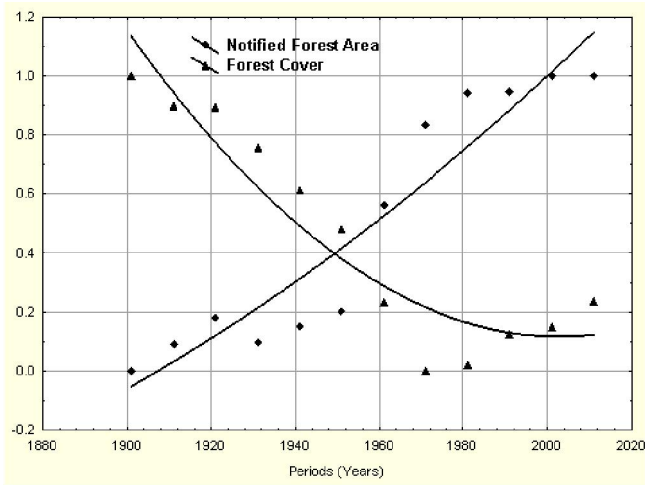
2007). Importance has been given to the eradication of invasive alien species like *Lantana camara*, which have spread in much of the degraded forest areas of India and are regarded threat to biodiversity and regeneration of native species (Kumar & Mathur 2014; Manzoor & Shah 2014; Sharma & Raghuvanshi 2010).

#### *Liberal wood import policy*

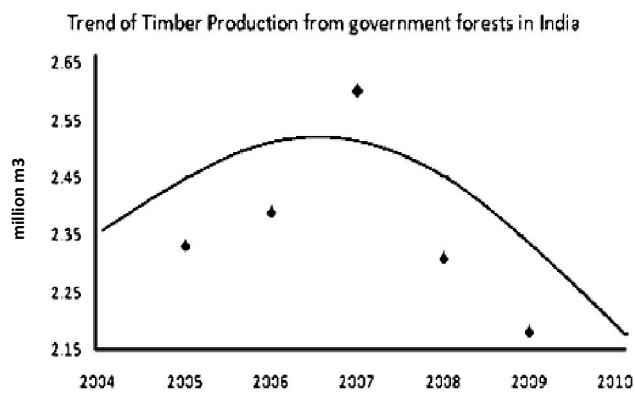
In India, until 1970s the natural forests remained the main source of timber. The total production of timber from forests was about 10 million m<sup>3</sup> per year although the country's requirement was estimated to be about 15 million m<sup>3</sup> (NCA 1972). Part of the requirement was met by harvesting trees from private lands outside forests. The National Forest Policy 1988 also laid emphasis on conservation of forests and biodiversity, and discouraged production of timber from natural forest for industries. The annual production of timber from forests had declined to about 4 million m<sup>3</sup> by 1990. In view of increasing emphasis on conservation of forest, the Government of India took a policy initiative in 1996 to liberalize the import of wood and wood products by bringing wood/timber under Open General License (OGL) category to reduce the demand supply gap and protect existing forests. Since then the import of wood and wood products has been steadily increasing (Fig. 5). The current level of import of wood is about 6 million m<sup>3</sup> of which round logs alone constitute more than 93 %. Teak constitutes an important timber species and forms about 15 % of the total annual imported volume. Most of the imported teak is from Myanmar, Ivory Coast, Ghana, Ecuador, Costa Rica and Benin. The value of the imported wood and wood products has gradually increased from INR 33,220 million in 2003-04 to INR 76,880 million in 2009-10, which is approximately \$ 6 billion as on date. However, such trends in import may result into deforestation and degradation of forests resources in poor and emerging economies a phenomenon akin to leakage as observed in clean development mechanism. The shifting of such burden needs to be examined in detail by conducting a separate study (Midgley *et al.* 2007).

#### *Agro-forestry and trees outside forests*

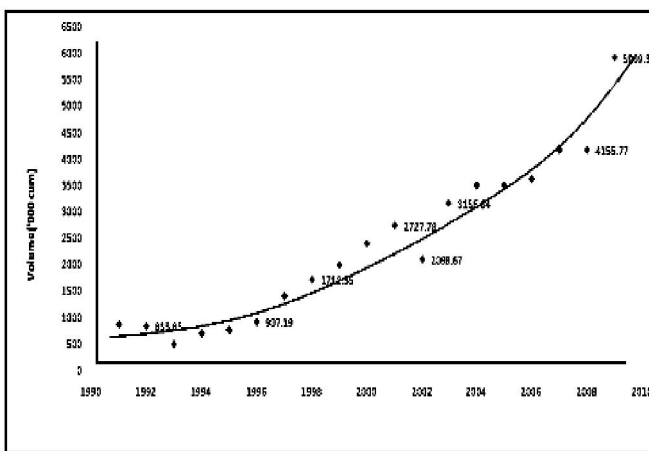
National Commission on Agriculture in its interim report in 1972 has emphasized importance of production forestry (man-made forests) and recommended creation of Forest Development Cor-



**Fig. 3.** India's Forest cover and Notified forest area based on normalized values.

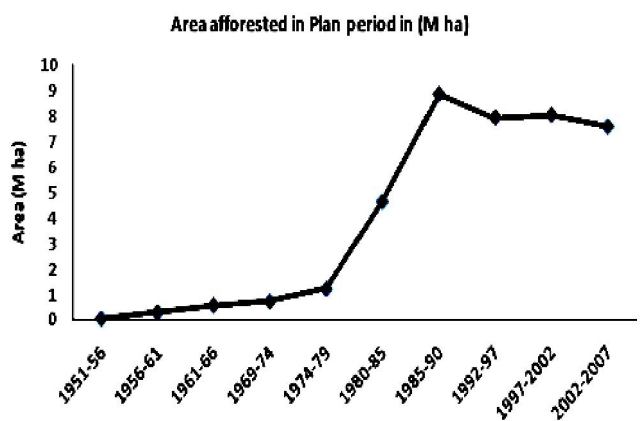


**Fig. 4.** Trend of timber production from government forests (generally native forests) in India. Source: ICFRE 2010.



**Fig. 5.** Import of wood and wood products in India. Source: ICFRE 2010.

porations in different states for enhancing the investment through bank financing and raising of large scale plantations through social forestry. The report of the commission was instrumental in promoting large scale social forestry programmes in India. Subsequently, India has had large scale social forestry programmes with the aim of producing fuel wood, fodder, small timber and other products from the plantations on wastelands, degraded forests, private marginal lands, village common lands and agricultural farms (Fig. 6 ). These efforts were made with general assistance from externally aided projects from donor agencies such as World Bank, Swedish International Development Cooperation Agency (SIDA), Danish International Development Agency (DANIDA), Department for International Development (DFID) and Japan International Cooperation Agency (JICA) to meet the needs of rural communities. In the first three decades after Independence i.e. 1950-80, the total plantations done by the State forest departments was 3.54 Mha with an investment of INR 2,400 million, while in the Sixth Five Year Plan (1980-85) alone, 4.64 Mha of plantations was raised with an investment of INR 9,260 million. This substantial increase was due to internationally aided social forestry projects. Plantations were established outside forest reserves on wasteland owned by the governments and communities on private lands. It was estimated that 5.94 Mha of public lands were covered under block plantation and 2.92 Mha were covered in private areas (GOI 1999).



**Fig. 6.** Trend of forest plantation in India of National Five Year Plans.

During the Ninth Five Year Plan (1997-2002), a flagship programme of the central government under the name of National Afforestation Pro-

gramme (NAP) was launched to institutionalize people's participation in project formulation and implementation. The Forest Development Agency (FDA) was constituted in all the districts of the country as an autonomous federation of Joint Forest Management committees and registered under the Societies Act 1860 is the implementing agency at the divisional level. Large scale plantation continued with onset of NAP and support from the Twenty Point Programme (TPP) through Forest Development Agency (FDAs) in all districts of India (Singh *et al.* 2011).

### Conclusions

The discussions in the preceding sections indicate that the policy and legal framework provided active support for the conservation forestry in the form of acts, afforestation/social programmes and the judicial interventions of the Supreme Court of India leads to conservation oriented management of forests. This has also resulted in changes in attitude toward forests, usage of forest products, interface between forests management practices and formal evaluation and social security mechanism thereby significantly contributing towards the forest transition in India. In the recent past, the "Green India Mission" (GIM) of the Ministry of Environment & Forests of GOI has set a target of creating an additional 5 Mha plantations in the country outside forests by 2020, as a part of mitigation option in the context of climate change. Since 1988 India has signed many international instruments which mandate-sustainable forest management in India. Consequently, the forest policy of 1988, the GIM document and National Climate Change Action Plan of GOI require synergy to facilitate most of the forest cover of the nation. Therefore, it is essential that work is initiated to revise the forest policy of 1988 to accommodate such interventions.

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