
UNIT 9 FORESTRY IN INDIA: LINKAGE WITH AGRICULTURAL SECTOR

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9.0 OBJECTIVES

After going through this unit, you will be in a position to:

- explain the importance of planned development of forestry for the Indian economy;
- indicate India's position in forestry in a comparative international perspective;
- describe the policy initiatives that has shaped the development of forestry in India;
- delineate the inter-linkages between the agricultural sector and forestry;
- outline different types of social forestry practices pursued in India; and
- discuss the alternative institutional mechanism of Joint Forest Management (JFM).

9.1 INTRODUCTION

In unit 2 we noted that over the years 1950 to 2008 the proportion of forest land in India increased from 14.2 percent in 1950 to 22.8 percent in 2008. We also noted that protecting and expanding the forest area is important from the point of view of maintaining a healthy ecological balance. In this unit, we will focus more on issues related to forestry expansion. Beginning with an outline of the various economic and other benefits from forests, we will know about some of the policies/schemes which have been implemented for promotion of forests in India. We will then discuss the scheme of 'social forestry' which was implemented both as a means of expanding the forest cover area and also promote a 'forestry culture' in the general public and institutions at large. Finally, as a further measure of a new institutional mechanism introduced in this direction, we will learn about the benefits and features of joint forest management. But before we proceed to study these aspects, we shall take a quick look at India's position in total forest area vis-à-vis other countries in the world. This comparative profile will set the perspective required for appreciating the importance of expanding forestry in India.

As per the UN's global forest resource assessment (FRA 2010) report, in 2010, India's total forest area was 68 million hectares (mha). As a proportion to its total geographical area (328.73 mha), the percentage of forest cover is 20.7 percent. As a percentage of global forest area, however, India's share is low at 1.7 percent (Table 9.1). Notwithstanding this, India is among the 10 top countries in the world which together account for two-thirds (66.6 percent) of total global forest area, the remaining countries taken together sharing the rest of one-third of global forest cover. This does not by itself accord an equitable position or a place commensurate with its global population share as smaller countries might have greater forest cover in relation to their total population on the one hand and extent of geographical area on the other. In other words, since the forest resources carry an important

Table 9.1: India's Position in the World in Forestry

Country	Forest Area (mha)	Global Share (%)	Population (millions)	Forest Per Capita (ha)
Russian Fedn.	809	20.1	142.9	5.66
Brazil	520	12.9	190.7	2.73
Canada	310	7.7	34.6	8.96
U. S.	304	7.5	312.3	0.97
China	207	5.1	1339.7	0.15
Congo	154	3.8	66.0	2.33
Australia	149	3.7	22.7	6.56
Indonesia	94	2.3	237.6	0.40
Sudan	70	1.7	30.9	2.27
India	68	1.7	1210.2	0.06
Others	1347	33.4	3376.0	0.40
World	4032	100.0	6963.6	0.58

Note: The countries are the *top ten countries* in terms of their forest area as per the Global Forest Resources Assessment Report, 2010 published by the FAO (link: <http://www.fao.org/forestry/fra/en/>). The source for population data is wikipedia and the figures relate to a year close to 2010.

bearing on the total population of a nation and their needs, the per capita forest area is a more relevant indicator to understand its variability over countries. In this, notwithstanding the fact that India occupies a place in the top 10 countries in the world, India's position is dismal. While the global ratio in this respect is 0.58 hectares [with the corresponding ratio for all remaining countries leaving out the top 10 also being as high as 0.40 hectares], for India it is the lowest at 0.06 hectares. Evidently, with a share of 17.4 percent of global population, India's forest cover is critically small to make this ratio anywhere near to the comparable ratios of other countries. The country has also a high tribal population who reside on the fringe of forests depending on its resources for their livelihood. In realisation of all these factors, the government of India had set a target of increasing its total forest cover to 33 percent of its total land area. Considering that this target was set by the country's first National Forest Policy of 1952, the achievement of 21 percent by around 2010 speaks of a far lower realisation of its targets. The contribution of forestry to GDP has also declined from about 2 percent in 1950-60 to 0.9 percent in 2000-08. In recent times, the importance of forests is seen not merely from its economic contribution but also from the environmental and ecological aspects. Nonetheless, the declining share of forestry in GDP does indicate a relative lower priority accorded to the sector in India. This is more so because of the importance given to 'green accounting' these days. There is, however, a silver lining amidst this gloomy scenario. As per the FRA 2010 report, in terms of annual net gain in forest cover, India has improved its ranking from 5th position during 1990-2000 to 3rd position during 2000-2010, the percentage increase in the annual net gain having increased from 0.22 percent in the first period to 0.46 percent in the second period. This speaks of the country's position during the recent years as there are very few countries (almost nil) which are managing to increase their forest cover. However, it may not be realistic to sustain the relatively high rate of growth of forests achieved in the last decade or of achieving 33 percent forest cover by 2012.

9.2 BENEFITS OF FORESTS

In section 9.1, we noted two broad benefits of forests viz. (i) its usefulness in maintaining ecological balance and (ii) providing resources for livelihood of poor tribal people living in and around forests. There are a number of other economic and non-economic benefits of forests. For instance, they provide the raw material for various industries like railways, defence, construction, handicrafts, and domestic use. Through this, they also generate employment, and contribute to country's exports. The various benefits from forests can alternatively be grouped under broad heads as follows.

- i) **Production of clean air, generation of energy and inducement of rain:** Forests generate oxygen, prevent environmental pollution, provide shelter to wild life and birds and add to the aesthetic beauty of the country. Through photosynthesis, they convert solar energy into various forms of energy like food and fuel. It is estimated that in less developed countries like India, forests contribute to nearly 40 percent of our total energy needs. They also help in bringing rains through its influence on changing the moisture content of the atmosphere. Taken together, therefore, these benefits can be clubbed under *environmental benefits* of forests.

- ii) **Prevention of soil erosion and retention of moisture:** Forests are useful in prevention of soil erosion and retention of moisture in the soil as well as in the atmosphere. They are helpful in preventing an area from being turned into barren land and are particularly helpful in preventing floods during rainy seasons. These benefits are referred to as *hydrological benefits* of forests.
- iii) **Providing the source of income and livelihood needs of tribal poor:** Forests are estimated to supply 30 percent of fodder needs of animals besides supplying the much needed firewood for human consumption. The supply of large number of minor forest products (MFPs) are a source of employment and income to many poor tribals living in and nearby the forests. Forests are thus a source of *income and livelihood* for the poor and a major source of food for animals.
- iv) **Medicinal Plants and Other Varieties of Economic Value:** It has been estimated that close to 40 percent of the needs of prescription drugs have active ingredients derived from wild plants, animals, micro organisms, etc. freely growing and residing in forests. In realisation of this benefit to mankind from forests, forests have been described as the natural '*great chemical factory*' of the world. Traditional products of forests include timber and firewood to meet the needs of building material, furniture and rural energy.
- v) **Recreational and revenue yielding benefits:** Forests can be used for bringing about an *effective interface with the urban population* through the establishment of recreational opportunities like wild life sanctuaries and national parks. Besides generating revenue they help in creating an awareness among people, particularly the children, about wildlife conservation. We will read more on this benefit under 'social forestry' later.

In the light of the above benefits, investment in forest development and expansion is undoubtedly justified. Compared to the concrete jungle created by man in the urban areas, the natural forests are described as the treasure house of knowledge and peace. What has ailed the sector from active policy measures by the government? We now turn towards a brief review of the policy dimension of promotion of forests in our next section.

Check Your Progress 1

- 1) In which range would you place the current percentage of total forest cover in India?
(a) 20-25 percent; (b) 25-30 percent; (c) 30-35 percent.
- 2) What is the India's share in the global forestry cover?
(a) 1.1 percent; (b) 1.4 percent; (c) 1.7 percent; (d) 2 percent.
- 3) Mention any six benefits of forests to mankind.

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9.3 DEVELOPMENT OF FORESTRY IN INDIA

Development of forest by legislative and other measures have taken place in India right from the 19th century. These can be classified under Acts and measures before the independence period and after the independence period. While the pre-independence initiatives laid the ground work for technical administration and management of forests, the post-independence initiatives revitalised them to achieve the national objectives.

9.3.1 Pre-independence Period

There was extensive commercial exploitation of Indian forests during the East India company rule. But, it was soon realised that the destruction would reach a point of unsustainability unless measures to protect and promote regeneration of forests are initiated. The Indian Forest Act was first passed in 1865. The Act classified forests into two classes viz. preserved and protected. In 1866, the Department of Forest was created with the objective of protecting the forest resources in the country. The 1865 Act was revised in 1878 reclassifying the forests into three classes viz. (i) reserved forests, (ii) protected forests and (iii) village forests. The same year, the first Forest School was started in Dehradun. The provincial forest services, for recruiting forest officers, commenced in 1891. In 1894, the government issued a notification proclaiming forests as property of state to be administered to fulfil the objectives of providing benefits to the taxpayers and regulate the benefits to the people living within and in the vicinity of forests. All these developments during the greater part of the later half of the 19th century marked for the dawn of scientific forestry in India. During this period, forestry was organised on commercial lines with *sustained yield principle* at the core of its management. The practice of preparing Forest Working Plan [a medium term plan of 10 to 15 years covering the whole of forest in a *division* (a unit of forest administration)], spelling out the technical and economic aspects of forest management and development, was introduced for the management of forests. The establishment of these institutional mechanisms paved the way for organizing the forest management on technical lines. However, extraction of timber was considered as the primary function of the forests. Of all the uses, timber for strategic defence use was given priority.

In 1921, forests were made into a provincial subject. To a substantial extent, this diluted the national character of forest administration. Following the re-enactment of the Indian Forests Act, 1927 [which further specified a fourth category viz. non-government (private) forests to the earlier three classifications], the earlier Act of 1878 began to be referred to as the 'old forest policy'. Under the new Act of 1927, unauthorized felling of trees, quarrying, grazing and hunting in reserved forests was made punishable with a fine and imprisonment. The practice of scientific forest administration based on Working Plan continued with prescribed guidelines on minimum girth limit for marking a tree for felling, the number of trees to be felled per hectare, etc. The management of forest in this manner continued till the time of second world war. The two world wars, particularly the second, took a heavy toll on the progress made in the earlier decades in forest management. During the war period, charcoal production was increased and forest based industries cropped up in good numbers. Forests were cleared for making roads and for laying down railway lines. Timber from forests were extensively used for

making wooden sleepers. The working plan regulations were neglected and sustained yield principle could not be followed. Over exploitation of timber and poor regeneration resulted in loss of forest area both under the public and private ownership/control. Further developments to promote forestry management are mainly traceable to the post-independence years.

9.3.2 National Forest Policy, 1952

The first national forest policy (NFP) in the post-independence period was formulated in 1952. Acknowledging that many of the provisions contained in the old forest policy were good and therefore should be continued, the first national forest policy retained most of the elements of the old forest policy but incorporated some changes which had become necessary due to developments in the intervening time period. Most notably, for instance, the new policy discouraged the indiscriminate extension of arable land by cutting of forests. Towards this end, the re-classification of forests made by the new Act based on their functional criteria is notable. The reclassification designated the types of forests as: (i) protected forests; (ii) national forests; (iii) village forests; and (iv) tree lands. Emphasizing the evolving of a system based on *balanced and complementary land use*, the policy laid stress on:

- i) persuading the tribal people from the harmful elements of practicing ‘shifting cultivation’ [which is a method in which an area of forest is felled and burned to allow for crops to be grown on the cleared land];
- ii) giving requisite training to the forest staff of all ranks;
- iii) increasing the efficiency of forest administration by having adequate provisions in forest laws;
- iv) controlling grazing in forests; and
- v) encouraging research in forestry and forest products utilization.

The NFP-1952 thus emphasized on the optimum use of available forest land. While it laid special attention on promotion of protected forests (in view of their vital role in checking soil erosion, controlling floods and promoting physical and climatic balance of the country), the policy also emphasized on the expansion of tree cover in land owned by the government, public and private agencies.

9.3.3 National Forest Policy, 1988

During the intervening period of the enactment of first NFP and 1980s, there had been far reaching changes affecting adversely the environmental stability and ecological balance in India. Also, one of the major changes that had taken place was the enactment of 42nd amendment of the Indian Constitution in 1976 which once again brought forestry under the ‘Concurrent List’. Besides restoring the national character of maintaining and developing forests, the amendment (vide entry 48 A) required the state to protect and improve the environment by safeguarding forests and wildlife. Further, by another clause (viz. entry 51 A) the amendment mandated all citizens to protect and improve the natural environment including wildlife. In the light of these developments, the NFP of 1988 in its objectives laid emphasis on:

- i) Protection of existing forests and forest land;

- ii) Increasing forest and vegetation cover on hill slopes, catchments of rivers/lakes/reservoirs/ocean shores and semi-arid, arid and desert tracts;
- iii) Discourage diversion of good and productive agricultural land to forestry;
- iv) Encourage planting of trees alongside roads, railway lines, rivers/streams/canals, and other unutilized land under institutional and private ownership; and
- v) Raising green belts in urban and industrial areas.

9.3.4 Changing Nature of Forestry in India

In the beginning of planning era, the importance of forestry was mainly commercial. The main aim was to supply raw materials to forest based industries. In the later years, particularly after 1988, the emphasis has shifted towards ecological and environmental benefits besides the social and economic benefits. While the national aim was to achieve one-third of total land area to be brought under forests, in hills/mountainous regions the aim was to have two-third of the area under forest. Towards this objective, a national time-bound programme of afforestation and tree plantation on all degraded and denuded lands in the country was adopted as the national objective. The policy also required that all projects of construction like dams/reservoirs, mining, industrial development, etc. which involved diversion of forest land must provide in their investment budget for regeneration of denuded land by re-afforestation. A system of biannual mapping of forests (by using remote sensing technology of visual interpretation technique through satellites) by the National Forest Survey of India (established in 1981) was also introduced for monitoring the progress made in this respect. The establishment of two other institutions viz. the national wasteland development board (NWDB) and the national afforestation and eco-development board (NAEB), for promoting schemes to enhance forest cover, are also major developments of the post-1980s. Many schemes like: (i) integrated afforestation and eco-development projects (IAEP), (ii) fuel-wood and fodder project scheme, (iii) non-timber forest produce scheme, (iv) seed development scheme, (v) national afforestation programme, etc. have been implemented to increase the forest cover in the country. There was also an action plan called national forestry action plan (NFAP) launched in 1999 with the objective of bringing 25 percent of land area under forest cover by 2007 and 33 percent by 2012. However, as noted before this achievement by the end of 2011 has been about 22 percent.

Check Your Progress 2

- 1) During the pre-independence period in India, how many Forest Policies had been enacted?

(a) one; (b) two; (c) three; (d) four
- 2) Mention any three objectives of National Forest Policy, 1952.

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- 3) What was a major change of historical significance that had taken place before the enactment of National Forest Policy, 1988? Which two major clauses had been included in our directive principles in this regard?

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- 4) Would you say that the targets for achieving the forest cover by different policy statements since independence have been achieved? Explain in about 50 words.

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9.4 FOREST AGRICULTURE INTER-LINKAGES

The term forest is traditionally used only for natural vegetation widely spread over vast stretches of land. It is used in the sense of 'wilderness' by which is meant the abundance of growth giving shelter to many wild animals as their natural habitat. But in the context of declining forest area and the need felt to expand its growth, the natural feature has been extended to include manmade cultivation called 'tree cropping'. The term agriculture, on the other hand, also refers to a wider form of cultivation, much beyond mere crop cultivation. In this extended sense, it includes livestock breeding, fishery, forestry, dairy, poultry farming, etc. Loss of forest is felt in a multi-dimensional manner i.e. through (i) loss of bio-diversity, (ii) ecological imbalance and (iii) environmental degradation. The practice of forestry promoted to bridge this loss includes practicing of agriculture in areas such as non-forest land, village commons and private lands. Forestry is, thus, complementary to agriculture in two main ways: (i) ecologically by way of regulation of soil, soil nutrient, moisture content in soil and microclimate; and (ii) economically through efficient utilisation of underemployed rural youth and tribal human power. We can elaborate this agriculture-forest interface from three angles viz. (a) land use pattern; (b) human ecosystem; and (c) ecological ecosystem.

9.4.1 Land Use Pattern

Land is the primary requirement for both agriculture and forestry. Under classical methods like shifting cultivation, land under forestry used to make way for agriculture. Under the modern practices of 'social forestry', however, tree crops are grown in non-forest areas like private land and institutional premises. In this process, therefore, there is an element of agriculture making space for forestry. A range of agro-forestry possibilities have thus come into vogue in which the common aim is to: (i) conserve ecology; (ii) optimize land use; (iii) protect damages from external agents like wind and running water; and (iv) improve the aesthetic value of site/land. Trees, crops and livestock have thus come to be practiced symbiotically

each complementing the other for optimal utilization and conservation of the ecosystem.

9.4.2 Human Ecosystem

A large part of agricultural labour belong to the small and marginal farmer community. They are also of tribal community residing in and on the fringe of forests depending on forest resources like timber, MFPs and many non-timber forest products (e.g. medicinal plants, honey, spices, resins, seeds, nuts, etc.). for their income and livelihood needs. Agriculture is a seasonal activity not only for forest based tribal population but also for most others. Forests support them with off-season employment opportunities through plantation and other forest developmental activities undertaken by forest departments. Firewood, a main by-product of trees in forests and elsewhere, constitutes the largest source of fuel for cooking and heating in rural areas. It is in view of these reasons that forests have always been an integral part of the human eco-system. There is also the beneficial side of arresting the rural to urban migration by harnessing on the potential of forests.

9.4.3 Ecological Ecosystem

Forests sustain bio-diversity by: (i) reducing global warming; (ii) balancing oxygen and carbon dioxide ratio; (iii) increasing precipitation and causing rains; (iv) moderating local temperature; and (v) keeping the air cool and clean. The role of forests in slowing down the water run-off, distributing rainfall, preventing soil erosion, reducing wind damage and safeguarding water supplies is valued much more than their output of wood and other things. The cumulative influence of all these factors on agricultural production and growth has indeed been immeasurable. The positive influence of the forests on the ecological parameters has always been of extreme relevance, which is being realised more now than before particularly due to the damage to the ecological system caused by factors like indiscriminate industrial and urban expansion in the recent past.

9.5 TYPES OF SOCIAL FORESTRY

Consequent to increasing pressures from human population resulting in severe depletion of natural forests, the National Commission on Agriculture (1976) made an interim recommendation for considering the concept of social forestry. The concept mainly envisaged growing of trees and other vegetation on all land available, mainly outside the traditional forest areas, so as to result in a balanced land use. It was also aimed at minimising unsustainable withdrawals from forests. Agro-forestry was kept as an integral part of social forestry and thus covered production of food crops too. The scheme was not only aimed at helping alleviate rural poverty but also aimed at improving the socio-economic conditions of society as a whole. The basic objective behind the approach was to develop fuel-food-fodder production on uncultivable land minimising the pressure on forests. The other objectives of social forestry were:

- provide fuel wood supply in rural areas replacing cow dung which could be better used as manure;
- provide small timber supply for rural housing and agricultural implements besides timber for urban construction needs;

- provide green fodder to livestock; and
- protect agricultural fields from wind and wild animals.

Its application was to be made both in the urban and the rural areas along roadsides, school yards, community buildings, village common lands and village approach roads. The system was to cover different forms of farming like: (i) farm forestry; (ii) extension forestry; (iii) agro forestry; and (iv) recreation forestry.

9.5.1 Farm Forestry

Farm forestry refers to growing trees by individual farmers on their farmland mainly as cash crops. The method was envisaged to integrate other farm operations with forestry in farms and village lands. The attraction for its implementation was generally confined to rich farmers with larger area of land and better resources for getting returns from short duration species. However, there was also scope for low input approach for relatively resource-poor farmers to enable them to achieve small yet attractive returns with minimal investment. A variant under this system was '*peripheral plantation*' for growing species like eucalyptus to provide supplementary income for meeting the urgent needs of the farmers. Peripheral plantation was expected to require less management skills and less space, hence more suitable to the small farmer segment. Parallel to this, for the rich farmers owing to their larger land ownership, the term '*block plantation*' referring to planting of trees with longer gestation period is in vogue.

9.5.2 Extension Forestry

The system envisaged the practicing of mixed forestry like raising of grass and leaf fodder and fruits on suitable wasteland including panchayat land village commons. Afforestation of degraded forest land, raising of plantations of quick growing variety on road sides, railway lines, canal and river banks, etc. also formed part of extension forestry. These activities were mainly carried out by government departments, NGOs, village communities, etc. with financial support from government and external funding sources. In view of the scope for plantation in lines (like railway lines, roadsides, river banks, etc.) or strips of land, the term '*strip plantation*' is also in vogue as a variant of extension forestry. Strip plantation was aimed at: (i) providing shade to travellers; (ii) enhancing the aesthetic values of roads, railway lines and river banks; (iii) augmenting the supply of fuel wood and fodder; and (iv) maintaining ecological balance and green house effect.

9.5.3 Agro Forestry

This is the interface of tree-crop i.e. forestry and agriculture being practiced on the same land concurrently. This is a concept of multiple or mixed cropping pattern falling under agro-silviculture. For a tropical country like India, this has special advantage in view of its ability to control soil erosion, enrich soil nutrient and fertility through litter fall, etc. One of the major considerations under this system is to identify compatible species suitable to the local variety of soil and agro-climatic conditions. Due importance is, therefore, given to species which complement productivity conditions suitable to local conditions.

9.5.4 Recreation Forestry

This refers to development of big parks in urban areas with deep wooded area

giving a feel of forest like condition to urban dwellers both for recreation and adventure. Development of trekking areas and other recreational facilities in addition to increasing the green cover of cities is the objective of this type of forestry.

Check Your Progress 3 [answer in about 50 words in the space given]

- 1) Mention the three major dimensions in which the loss of forests to mankind is perceived.

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- 2) Outline the two respects in which forestry can be argued to complement agriculture?

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- 3) Mention the five major headers under which forests are regarded as protective of our bio-diversity.

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- 4) What are the four major aims of 'strip plantation'?

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9.6 JOINT FOREST MANAGEMENT

The national forest policy of 1988 had indicated that people's involvement in the management of forests is necessary. However, it did not envisage any direct role for the people in the day-to-day management of forests. There has been an increasing awareness on the need to associate the local communities in order that their own ways of valuing bio-diversity could be respected and utilized in conservation measures. In this line of thinking, the joint forest management (JFM) approach initiated during the 1990s sought to develop partnerships between state forest departments as 'owners' and local community as 'co-managers' for sustainable forest management. The JFM was, thus, viewed as a step towards the democratic decentralisation of forest management in India.

In 1991, the government of India initiated a scheme in the name of 'eco-development of protected area management'. The policy aimed at integrating the objectives of local area economic development with the conservation of bio-diversity through increased opportunities for local participation in the management and decisions of the protected area. The other objectives of the project were to: (i) reduce the negative impacts of government's policy on the livelihood elements of affected people; (ii) ensure effective management of the project by developing more effective support for eco-development of protected areas; and (iii) prepare future bio-diversity projects in a manner as to be in consonance with the local area developmental needs. The eco-development activities were to be administered by village eco-development committees (VECs). The aim is to reduce the dependence on forests of the local people by facilitating access to alternative off-farm income generating opportunities. In other words, the scheme envisaged people's participation in natural resource management through empowerment. It is, however, being realised that it has been difficult to involve local people in conservation efforts as the earlier exclusionary approach failed to develop mechanisms for people's involvement with the result that there is lack of interest and trust among local communities. There is also a conflict of laws in that while the JFM seeks to provide a share of forest produce to the villagers, the wildlife laws prohibit the extraction of forest produce (except for some listed products) for human use from national parks and sanctuaries.

In spite of some setbacks, the need to further the JFM philosophy in future forest development efforts has been widely accepted. It is now kept central for getting the funding assistance by the government and external agencies to new projects for forest development. Almost all the states have started practicing JFM with the involvement of local communities in JFM being the maximum in the states of M. P., Bihar, W. B. and Orissa. As of 2005, 27 states of the Indian union had more than 63,000 forest protection committees involved in the joint management of more than 140,000 square kms of forest land in India.

9.7 LET US SUM UP

The unit has dealt with the importance of forests to the national economy. India figures among the top 10 countries in the world who together share two-thirds of global forest cover, but in terms of the per capita share of forest India is the lowest among these top ten countries. Although India set a target of bringing one-third (i.e. 33 percent) of its total land area under forests as far back as in 1952, even in 2011 the percentage of forest cover in India is around 22 percent. The forest-agriculture linkage is many-fold and this has been well recognised in all our forest policy documents. In light of this, many measures have been taken by the government to protect and enhance the forest cover in the country. While all these policies have yielded limited results, of late there is a widely acknowledged view that only a jointly managed systemic approach, in which the major stake holders to forests like the tribal poor and the small and marginal farming community are included in a major way, can work towards achieving the targeted results in this regard.

9.8 KEY WORDS

Green Accounting : In the traditional system of income accounting, changes in environmental resources used up

in current production of which forests are an integral part is ignored. In recent years efforts have been made to modify conventional measures of national income accounts like GDP by including the non-marketed benefits of forest resources. This is called as green accounting.

Forest land and forest cover : Forest land is defined as land statutorily notified as forest. It is possible that some of this notified land may not necessarily bear forest cover. Forest cover, on the other hand, is necessarily distinguished for the extent of 'tree cover canopy density' defined in terms of percentage cover.

Dense forest, open forest and mangroves : Depending on the extent of cover, forests are classified into three types viz. dense forest, open forest and mangroves. While dense forest refers to a canopy cover of more than 40 percent, open forest refers to a canopy cover in the range of 10 to 40 percent. Mangroves refer to area with a canopy cover of less than 10 percent.

Protected forests and reserved forests : Protected forests are those in which the rights of the community for collection of timber, fuel wood, minor forest products, etc. are either restricted or suspended. In reserved forests, on the other hand, the local community enjoys privileges of forest rights although certain restrictions may apply here also.

Agro-silviculture, silvipastoral system and agro-silvipastoral system : Practice of combining agriculture and forestry is known as agro-silviculture. Combination of forestry and livestock is known as silvipastoral system. Co-existence of all three i.e. agriculture, forestry and livestock is referred to as agro-silvipastoral system.

Social Forestry : Social forestry is a programme of action for greening of degenerated lands, stepping up of agricultural resources, generating employment in the rural sector, etc. all aimed at correcting the skewed ecological balance.

9.9 SOME USEFUL REFERENCES

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United Nations, 2010, Global Forest Resources Assessment 2010, <http://www.fao.org/forestry/fra/fra2010/en/>

**Forestry in India: Linkage
with Agriculture Sector**

Wikipedia, http://en.wikipedia.org/wiki/Joint_Forest_Management, Joint Forest Management.

9.10 ANSWERS/HINTS TO CHECK YOUR PROGRESS EXERCISES

Check Your Progress 1

- 1) (a)
- 2) (c)
- 3) See section 9.2 and answer.

Check Your Progress 2

- 1) (c)
- 2) See section 9.3.2 and answer.
- 3) See section 9.3.3 and answer.
- 4) See section 9.3.4 and answer.

Check Your Progress 3

- 1) See section 9.4 and answer.
- 2) See section 9.4 and answer.
- 3) See section 9.4.3 and answer.
- 4) See section 9.5.2 and answer.