CHAPTER EIGHT
DISCUSSION

Ecology of forest

Ecological significance of forests is well understood. Trivedi (1999) elaborates that they help in balancing CO₂ and O₂ levels in atmosphere, regulate earth's temperature regime and hydrologic cycle. Forests increase local precipitation and water holding capacity of soil and thus prevent drought situation. Vegetation cover provided by the forests impedes the velocity of runoff on soil surface checks soil erosion, silting and landslides; thus reducing the danger of flood. The litter derived from fallen leaves maintained fertility of soil by returning the nutrients. The forests also acts as refuse of wild animals and provide protection to them against strong cold or hot and dry winds, solar radiation, rain and enemies.

Economically also the forests are of great significance. Wood the chief forest product, is having various applications in domestic and industrial purposes. Its use as fuel brings pressure on the forests. Timber is employed in building construction and household uses. Forests provides raw material for various wood based industries viz., pulp and paper, composite wood, rayon, sports good, furniture, boat building, matches etc. Miscellaneous products like bamboos, resins, gums, oils, medicines are also obtained from forests (Trivedi, 1999).

Forestry in India

The growing human population and its increasing demands for food and materials have already taken a heavy toll of the earth's natural resources. The
growth of large urban areas, construction activities such as dams, buildings and roads, encroachment on vast areas of forestland for agriculture and mining approaches are examples of direct on slaughts on nature which have steadily degraded our natural resources. India is loosing more than 1.5 million ha of forest cover every year (Trivedi, 1999).

Unfortunately it was not until the later half of the present century that measures were initiated for the conservation and protection of wild life, even then while the rapid disappearance of some beautiful animals boosted efforts to save wild fauna; wild flora was given hardly any attention. It is estimated that there are 5-10 million species of plants and animals on earth. India has about 45,000 of species of plants (vascular plants 15,000, pteridophytes 600, bryophytes 2700, algae 5000, fungi 20,000 sand lichens, 1600) Recent studies indicates that about 35% vascular flora of India is endemic. About 900 taxa of plants are so far enumerated as rare or endangered in India (Jain, 1990).

India is having 67.441 million ha of land under forest cover (Kulkarni, 1992) consisting of various types of forests. These forests have been classified by various authors. Maharashtra State has various types of forests like dry deciduous, moist deciduous, montane evergreen forests etc. The distribution of forest is not equitable in all the parts of the state.

**Forestry in Marathwada**

Marathwada, presently comprising of 8 districts, viz., Aurangabad, Jalna, this area Beed, Osmanabad, Latur, Nanded, Parbhani and Hingoli of Maharashtra
State formed a part of Hyderabad State in earlier times. The botanical exploration of was neglected as compared to other parts of the country. The first exhaustive information about plant wealth of the area was furnished by Campbell (1898). Prain (1909) contributed to the knowledge of forest plants of the State. Patridge (1911), another forest officer, published a consolidated account of forest plants of the state.

After reorganization of States in 1956 the Marathwada region was merged into Maharashtra State. The floristic survey of Osmanabad district was carried out by Naik (1979). However exclusive study of forests of Osmanabad and Latur districts remained a neglected aspect. The present work is an attempt in this direction.

Forestry in Osmanabad and Latur districts.

Topography

Osmanabad and Latur districts form southern most part of Marathwada. The districts are situated at an average height of 600 m above mean sea level and are traversed by hill ranges originating from the Sahyadries, locally called as Balaghat ranges. The main rivers of the districts are Terna, Manjra, Bori, Bhogawati, Manyad and Gharni etc. Two rivers, Bhogawati and Bori, originate from the forest areas of Yedshi and Apsinga respectively. All these rivers dry up during summer and few lakes, ponds, dams serve the purpose of irrigation. The
river flow powerfully during monsoon and the soil cover is lost to a great extent exposing barren rocks at many places.

Soils

Various types of soils like black cotton soil, red, red sandy soil, corse gravel, clay loam are found at various places. In general the soils are rich in calcium and magnesium. Patunkar (1978) has made a similar observation during his studies and reported that the soils are deficient in nitrogen and phosphorous.

Climate and rainfall

The weather, in general, can be said to dry and moderately extreme. The average temperature ranges from 13°C to 40°C. There is great variation in the temperatures of winter and summer. Winters are cool while summers are hot. The rainy season is for about four months. The area receives rain from southwest monsoon and average rainfall is about 1020 mm.

A correlation between rainfall and type of forest has been established by Trivedi (1999). The areas having highest rainfall in the country (around 2500 mm/year) like western ghats and hill areas of Assam and North eastern regions have tropical wet evergreen forests. The rain regimes of 1900-2500 mm/year holds tropical semi-evergreen forests. Tropical moist deciduous forests occur in the regions having annual rainfall of 1250 – 1900 mm. The next below rainfall regime 750 – 1250 mm holds the tropical dry deciduous type of forests. As Osmanabad and Latur districts receive average rainfall of 1020 mm/year the
forests are of tropical dry deciduous type. Campian and Seth (1963) have also made a similar observation.

In India legal classification of forests is done under the Indian forest act, 1927. Forests are grouped into 1) Reserve forest, 2) Protected forests, 3) village forests and 4) Unclassed forest (Trivedi, 1999). Such classification indicates the statutory control of the Government.

Trivedi (1999) gave an account of administrative classification of forests in India. The forests are treated as the property of the states under the constitution, under the State list. Recently in 1976 they were brought under the Concurrent List for better direction by the Centre. The States have managed forests lands at times rather from short-term interests, particularly since Independence. The Centre has generally only advisory powers in the matter and handles subjects like policy, education, foreign aid for development, etc. The forest matters are included under Ministry of Agriculture in the Centre, but States have separate Forest Departments. The Central Board of Forestry, where all the Ministers of State Forest Departments are member, decides all the policy matters regarding the forests in the country.

At the state level the department is looked after by the Minister alone or he may have Minister of State and Deputies, and a Secretary to administer the forests. The executive head of the department is the Chief Conservator of Forests. In recent years more than one CCF are being appointed to look after functional sub divisions of responsibilities. There are number of forest Circles under CCF. The
Circles in turn are divided into Divisions, Ranges and Beats, for the territorial administration.

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Forest is managed as per the provisions of a sanctioned Working Plan. Working Plan is a written scheme of management aiming at continuity of policy
and action and controlling the treatment of forests. The working plan is written after considering the condition of the Forests, its capability, administrative convenience, demand for the forest produce, local customs, effect of past treatments, etc. has the sanction of the government for its implementation. A work in plan is generally prescribed for a period of ten years and is revised from time to time. All activities are carried out as laid down in a working plan and deviations are generally not done.

General characteristics of the forests

Osmanabad and Latur districts have 69.902 sq. km area under forest cover. The forests in both the districts are scattered at different places. In Osmanabad district the forest are confined to the Yedshi, Apsinga, Ghatangri areas; and in Latur districts the areas are confined to Shiradhone, Kasarshirshi, Nitur etc. Forest in this area are grouped as reserve forest, protected forest and unclassed forest. Small trees and shrubs are the chief woody components of these forests. In present study they are classified as timber plants, fruit plants, fuel wood and medicinal plants.

Timber plants

In all, twenty timber plants have been recorded from the forests of Osmanabad and Latur districts. Because of the less rainfall and dry climate the timber plants have not attained the size as found in evergreen forests of the
country. The quality of the timber depends on seasoning by which the moisture present in the wood is removed. The moisture is present in intercellular and interfibrilar spaces and also in the cell walls. If proper seasoning care is not taken the wood may undergo unequal shrinkage (warping), cracking and splitting. Various methods are employed for seasoning like air seasoning, kiln-seasoning etc.

The important timber plants of the forests are Teak (*Tectona grandis*), Dhawada (*Anogeissus latifolia*), Kate sawer (*Bombax ceiba*), Babul (*Acacia nilotica*), Neem (*Azadirachta indica*), Jamun (*Syzygium cumini*), Arjun sadada (*Terminalia arjuna*), Maharukh (*Ailanthus excelsa*), and Lenda (*Lagerstromia parviflora*).

Teak is the most dominant tree and occupies the same importance as in other parts of the country. The timber of neem is preferred next to teak as it is available in large quantity. Negi (1992) has stated that a properly seasoned wood of neem is better than teak. The timbers are used for various purposes like house building constructions, furniture, agricultural implements like cart, poles etc.

Neem is another important tree of the forest. Apart from its wood and timber, Thimakarupa(1993) has described several other uses of Neem. Various plant parts of Neem are used in Ayurvedic medicine since ages. In present times various Neem based formulations are available in the market as pesticides, which are reported to be rapidly degradable, safe and effective. If more plants of Neem are planted in the forest, it may help to meet the demand of the time.
Maity (1989) reports that annual potential of tree borne oil exceeds 12 lakh tonnes, while the actual production is approximately 1.38 lakh tonnes. He therefore, suggests that full exploitation of this product from trees like Neem and 85 other trees is essential.

Naik (1998) has stated that about 90 species of plants as timber trees from Marathwada of which the wood of eight species is widely used. Of these Dalbergia sisoo (Roxb); Leucaena latifolia (L.), Guir Haldina cordifolia (Roxb.) Rdsd., Meila azederach L. and Soymida febrifuga (Roxb) A. Juss. were not observed in the forest area of these districts during the present investigation.

Indian Council of Forestry research and education, Deharadun has published brochures on timber plants viz., Teak, Babul, Shisam, Khair, Bijasal, Semal, Sirish etc. The brochures provide an useful information about these timber plants.

Fruit plants

A small number of wild edible fruit plants are recorded from the study area. They include, a Sitaphal (Annona squamosa), Karwanda (Carisa congesta), Anjir (Ficus carica), Phalsa (Grewia subenaquis) Amla (Phyllanthus emblica), Jamun (Syzygium cumini) and Bor (Zizyphus spp.). Of these Sitaphal, Karwanda and Bor plants are found in more number than the others. Naik (1998) listed 27 fruit plants from Marathwada region.
Some of these fruit plants like Sitaphal, Anjir, Bor, Jamun, Amla have been brought under cultivation by the local people. The fruit collection from the forest is done by the people residing in adjacent villages and the fruits are sold in the local market. Thus they get some income for their families.

Fuel plants

A major source of energy in the villages is fuel wood. During the studies it was found that 17 plant species from the forest area are used as fuel wood by the local people. The widely used plant species are Vedi Babul (*Acacia campbellii*), Hiwar (*A. leucophloea*), Hekal (*Flacourtia indica*), Lokhandi (*Ixora pavetta*) etc. Naik (1998) has reported 11 plant species useful as fuel wood from Marathwada, while Ghate *et al.* (1990) have reported 38 fuel wood species commonly used by village communities from area of western ghats of Maharashtra.

The most powerful threat to forests is fuel wood, as it is widely used by the villagers. Plants like vedi babul, Lokhandi etc. are used as conventional fuel woods of the area. However it was found that if these plant species are not available any other species is used by the villagers as fuel wood. This is the major reason of forest denudation. The foresters are faced with a situation in which forest frontiers are receding, tree growth outside forests is diminishing fast and demand on fuel wood are increasing substantially (Shah, 1981).

Therefore if some plant species like Vedi babul (*Acacia campbellii*), Ranpangara (*Erythrina suberosa*), Hekal (*Flacourtia indica*), Bor (*Zizyphus*
*mauritiana*, Karanj (*Pongamia pinnata*), Nepati (*Cappari decidua*), Hiwar (*Acacia leucophloea*), Khair (*A. chundra*), *Parkinsonia aculeata* etc. are planted on the borders of the forest, they will serve the purpose of fuel wood of the villagers and other forest plants will be saved to be used for this purpose. The fuel wood characteristics of these plants are mentioned in the Table 13. Moreover the plants like Bor, Hiwar, Khair, will also provide fodder for the goats and cattles, thereby the other plant species of the forest will be saved from grazing. Mahendra *et al.*, (1992) has also stated that easy availability of fire wood increased its consumption.

It was found during the course of present investigation that valuable timber species like *Acacia nilotica*, *Albizia lebbeck*, *Anogeissus latifolia*, *Azadirachta indica*, and fruit plants like *Syzygium cumini* etc. are used as fuel wood during the period of scarcity.

The pressure of wood supply for fuel wood is increasing day by day, and if proper attention is not paid, a large number of forest cover will be lost near future. The statistics of wood demand and supply, hint not only at the future fuel wood crises, but also at a serious ecological disaster that the developing countries are heading for (Hegde, 1987).

The plants are used as fuel for cooking and heating directly in the form of wood or indirectly as coal since centuries. The advent of industrial age saw the great development of coal for the production of heat and power. The coal resources of the world, though large, are being used many thousands of time faster
<table>
<thead>
<tr>
<th>St. No.</th>
<th>Name of the Plant</th>
<th>Local Name</th>
<th>Family</th>
<th>Fuel Properties</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Acacia chundra</td>
<td>Khair</td>
<td>Mimosaceae</td>
<td>Burns fast in open dry areas. Good commercial fuel wood. Grows fast in dry regions.</td>
<td>Grows very fast and good coppicing capacity, suitable for dry areas.</td>
</tr>
<tr>
<td>2</td>
<td>Acacia campbellii</td>
<td>Vedi-bahul</td>
<td>Mimosaceae</td>
<td>Burns steady with good heat. Popular domestic fuel wood available everywhere and grows in dry areas.</td>
<td>Suitable for dry region. Grows well near hill slopes.</td>
</tr>
<tr>
<td>3</td>
<td>Acacia leucophloea</td>
<td>Hivar</td>
<td>Mimosaceae</td>
<td>Fast to dry and also burns fast.</td>
<td>Grows fast in dry region.</td>
</tr>
<tr>
<td>4</td>
<td>Erythrina suberosa</td>
<td>Rampangara</td>
<td>Moringaceae</td>
<td>Burns steady with slight smoke.</td>
<td>Suitable in dry areas. Not eaten by animals.</td>
</tr>
<tr>
<td>5</td>
<td>Flacourtia indica</td>
<td>Halal</td>
<td>Flacourtiaceae</td>
<td>Wood burns with good flame and gives long lasting heat.</td>
<td>Many branched fast growing tree. Grows in all conditions.</td>
</tr>
<tr>
<td>6</td>
<td>Capparis decidua</td>
<td>Napati</td>
<td>Capparidaceae</td>
<td>Good fuel wood and burns without smoke.</td>
<td>Fast growth and good coppicing capacity.</td>
</tr>
<tr>
<td>7</td>
<td>Parkinsonia aculeata</td>
<td>Karanj</td>
<td>Caesalpiniaaceae</td>
<td>Fast to dry and burns with steady heat.</td>
<td>Fast growth and good coppicing capacity.</td>
</tr>
<tr>
<td>8</td>
<td>Pongamia pinnata</td>
<td>Ningudi</td>
<td>Moringaceae</td>
<td>Better fuel wood, burns with good flame.</td>
<td>Grow well in dry region and commonly found in the forest area.</td>
</tr>
<tr>
<td>9</td>
<td>Vitex negundo</td>
<td>Bor/Bor</td>
<td>Vitaceae</td>
<td>Burn fast with good heat.</td>
<td>Good fuel wood and makes excellent charcoal. Burns slowly without smoke.</td>
</tr>
<tr>
<td>10</td>
<td>Zizyphus mauritiana</td>
<td></td>
<td>Rhamnaceae</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
than they can be replaced by natural processes. At the present rate of use all the workable coal will be consumed within a few decades. Other methods of providing heat and power must, therefore, replace coal (Hutchinson and Melville, 1948). In recent years successful attempts have been made by our country to generate electricity from water, by constructing hydroelectric power stations. However, still coal is used in thermal power stations to generate electricity to meet the increasing demand of electricity. In railways also, steam engines which were running by using coal have been replaced by either diesel or electric engines, thereby reducing pressure on coal. For household purposes also fossil fuel gas in the form of LPG is used for cooking in place of fuel wood. However, with increasing population still there is need to employ non conventional energy sources, like solar energy, wind energy, biogas etc. to reduce the pressure on forest wood, either directly or indirectly.

The researchers all over the world are trying for non conventional energy sources. One such attempt is extraction of liquid fuel from some plants. Bhatia (1994) has reviewed this aspect and states that the dried plant material of Calotropis procera gives 4.35% Hexane extractable and 16.14% Methanol extractable hydrocarbons. The former is rich in hydrocarbons with the C:H ratio, almost similar to that of crude oil. The energy provided in burning is also comparable to that of crude oil, fuel oil and gasoline. This plant is found in large number in the forests of Osmanabad and Latur. Therefore, it is felt that more research on this plant on these lines is essential.
Fruit plants

Fruits are used as a source of carbohydrates, vitamins, Amino acids etc. by the humans since time immemorial. Fruits are either eaten raw or their fermented products like wine are used since ancient time. In the forest area of Osmanabad and Latur, only a few fruit plants like Amla (*Phyllanthus emblica*), Sitaphal (*Annona squamosa*), Anjir (*Ficus carica*), Bor (*Zizyphus* ssp.) Jamum (*Syzygium cumini*), Karwanda (*Carisa congesta*), Phalsa (*Grewia subinaequalis*) are found while Naik (1998) reported about 27 fruit plants from Marathwada including some cultivated fruit plants. It was observed that the plants of *Zizyphus* ssp., *Carisa congesta*, *Syzygium cumini* are present in dominant proportion. The fruits collected from the forest are collected by tribals and villagers and sold in the market. Thus it generates employment for those people.

During present days, demand for fruits is increasing day by day. In agroforestry programme implemented in this area, fruit plants like Karwanda, Amla, Bor, Sitaphal are cultivated by the farmers on a large scale. It is suggested that if more number of fruit plants are planted in the forest area, that will meet the demand as well as will generate revenue for the forest department and also generate employment for the people. It is also felt that new hybrid varieties of fruits, which are easily available, should be planted as they are high yielding and drought resistant.
Medicinal plants

Our country is rich natural source of medicinal plants, having about 2000 species documented for medicinal value, of these about 150 species are used commercially. During the studies, 24 species of medicinal plants have been recorded which are present in large number in the forests.

Naik (1998) in his book “Marathwadyatil Samanya Vanaushadhi” has stated that there are about 500 plant species of medicinal plants present in Marathwada region. He further states that in last decade about 25 species have been vanished and an equal number of species are on the verge of extinction from the region. The reasons for this are many. Because of the advancement in the field of allopathy, the traditional medicinal plants have been neglected. Another important reason is the people prescribing Ayurvedic medicine are also less in number.

The over exploitation of herbal resources in unscientific manner by unskilled labour and poor natural or artificial regeneration have resulted in virtual extinction of certain vital species of medicinal plants. While collecting the medicinal plants, the collector uproot the whole plants. Sometimes they gather plants before maturity of fruits and seeds (Pande and Bisaria, 1998).

Most of the medicinal plants are to be collected in particular season, time of the day and preserved in specific ways. Therefore, the local people must be trained for authentic identification and scientific collection of medicinal plants from the forest areas.
In Latur district a small hill Wadwal is known as treasure of medicinal plants. Every year during ‘Uttara Nakshtra’ of rainy season hundreds of people from different parts of country visit this place and stay there for consuming medicinal plants to get ridoff from ailments they have. It is their belief that if the medicinal plants of that area are consumed during this specific period they get the benefit. It was observed that the people eat the leaves and bark of plants indiscriminately. Therefore, if proper guidance is given to them by an expert in ayurveda after due diagnosis, that will help the patients in better manner and the vegetation will be saved to a great extent. At the same time a follow up of these patients, with respect to the benefit received should be made so that authenticity is maintained. The pharmacognostic study, analysis of soil samples and detailed study of ecological features should be taken up. Some weeds like Parthenium hystophorus, Lantana camera were also observed, a care of these should also be taken.

Ethnobotanical studies are gaining importance in present time. The Ethnobotanical study of North western U.P. has been carried out by Husen et al. (1987); of Assam and Meghalaya by Biswas and Ahmad (1987); of Kerala by Pushpangadan and Atal (1986), of Nilgiris by Lakshmanan et al. (1986); of Orissa by Das and Misra (1987); of Jammu and Kashmir by Sand and Badola (1987); of Bihar by Chandra et al. (1987), of Kumaun hills by Kalakoti and Pangtey (1988) etc. Such type of work is also being carried out in other countries like U.S.A(Schultes, 1987; Booner and Gereau, 1988), Greece (Tammaro and
Minor forest products

Minor forest products specifically include leaves, bark, gums, resins, tannins etc. During the course of present investigation six gum yielding plants and 12 tan and dye yielding plants were observed. The two species of *Acacia*; *A. arabica* and *A. nilotica* and *Anogeissus latifolia* yield gum and tan both. The gum of this species and *Boswellia serrata* is collected by local people and sold in the market. The bark of *A. nilotica*, *Cassia aurigulata*, fruits of *T. arjuna* are sold in the local market for tanning the leather. Local people use the leaves of *A. latifolia* and *Carissa congesta* for tanning.

A small population of the nearby villages around the forest use different plant parts for cottage industry. Tendu (*Diospyrous melanoxylas*) leaves are of prime importance as they are used in ‘Bidi’ preparation. It not only generates revenue for forest department but also has a potential for self employment. Leaves of *Bauhinia racemosa* are also employed for Bidi preparation locally. It is felt that more number of these plants should be planted, as the market is readily available. Broom and basket making are also carried out by small sector of the population using branches of *Vitex negundo* and *Pongamia pinnata*. Shindi collection from
*Phoenix syvstris* is also done locally. The fibres exploited from *Agave vera*, fruits of *Semicarpus anacardium* and honey collected from the forest gives opportunity to earn the bread for tribals. Industrial utilization of *Agave* has been discussed by Srinivasulu *et al.*, (1985) for paper and cardboard manufacture. Large scale cultivation of this species in forest area will generate revenue for the forest department. The plantation on hill slopes will be useful from the point of view of soil erosion. They may also be used as hedges in the forest.

Forests have come to play a dominant role in the development of forest based industries. The available forest resources are used in pulp and paper including plywood and match industries and also as the fuel wood. The good explanation and available statistical material on forest resources has been systematically presented by Sharma (1977).

**Aquatic and other plants**

Seven aquatic angiosperms have been collected from the forest area of Osmanabad and Latur districts. These were found in small ponds, ditches etc. Of these *Hydrilla verticillata* and *Potomogeton nodosus* are of wide spread occurrence and are the dominant species. In these ponds 36 algae were recorded. The members of chlorophylla were found in dominant proportion, followed by the members of cyanophyta. *Spirogyra* is the most dominant genus and was observed in all the locations.
During the studies it was observed that certain algae were growing in a particular habitats, while others were no specific. This has been noted by number of workers. The different habitats are difficult to classify as they merge into one another. However an attempt has been made here to enlighten algae habitatwise as follows:

1) Temporary ponds and pools – *Chlamydomonas*, *Spirogyra*, *Oedogonium*, *Oscillatoria*, *Nostoc*, *Rhizoclonium*.


5) Running water - *Hydrodictyon*, *Spirogyra*, *Closterium*, *Cosmarium*.

Algae of Marathwada were studied earlier by Ashtekar (1980), who recorded 618 taxa; and by Sarode and Kamat (1983) who recorded 31 diatoms. In our studies phytoplanktons of algae were not observed in the forest area.

Recently *Spirulina* is used as protein source in human diet. It contains 46-65% protein (Aronson *et. al.*, 1980; Tipnis and Pratt, 1960). This alga is also used
for therapeutic properties. It is found useful in lowering cholesterol level (Mathe et al., 1977). Various preparations are available in the market for well being of human population. One such preparation “Eufit” (manufactured by New Ambadi Estates Pvt. Ltd., Chembarambakkam, Tamilnadu) containing Spirulina is prescribed in diabetes, Hypertension, Atherosclerosis, Carcinogenesis, Anaemia, Optic dysfunctions and stress. Work on Spirulina, Scenedesmus, Chlorella is being carried out at CFTRI, Mysore (Venkataraman and Becker, 1985). As these algae are found in the area under study it is suggested that biotechnological work of these algae should be carried out.

Because of the climatic conditions prevailing in these districts, a few cryptogams have been observed. They include one bryophyte (Riccia) and three pteridophytes (Equisitum, Marsilia and Actinopteris).

Social Forestry

Social forestry aims at fuel wood, fodder and small timber supply; and protection of agricultural fields from wind erosion. With these objectives social forestry programme is implemented in the Osmanabad and Latur districts and some area has been brought under cultivation under this programme. The planting species include wood, fodder, food and medicinal plants, suitable for the region as per the climatic conditions. The response is encouraging, however, it is felt that with the participation of local authorities like Grampanchayats; the gayrans, roadside lands, banks of canals should be brought under social forestry by cultivating suitable plant species. Individual participation of farmers should also
be encouraged by promoting them to cultivate plants on the border of their fields. There is sufficient scope for the social organizations to work in this area. In all the districts of Maharashtra, nurseries have been established by the government of Maharashtra at different locations. Therefore, the planting material is easily available for social forestry programme.

Patil et al. (1988) while discussing on future of Marathwada in 2001, states that out of 6.4 million ha area of Marathwada, 1.4 million ha land is not under cultivation. If 1600 trees/ha are planted, even on the 50% of this barren land (0.7 million ha), about 11.2 crore plants can be grown. For this purpose fast growing drought resistant, disease resistant and plants having multipurpose use should be used. For this, plants like Subabul, Nilgiri, Kashid, Babul, Neem, Sisso can be used. Fruit plants like Jamun, Bor, Sitaphal, Dhamoda, Moha, Palas, Tendu can also be planted. At Kinwat and Bhokar of Nanded district Teak plantation can be undertaken, as this area receives comparatively more rain. In Osmanabad, Beed and Aurangabad districts mango plantation can be increased. For fuelwood trees like Babul, Saroo, *Glyricidia* will be more useful. For fodder Anjan, Subabul, *Glyricidia*, should be planted. This work should be carried out through social forestry. On the borders of these forests, plants like Karwanda, *Parkinsonia* and Bor should be planted. This will help in increasing forest cover of Marathwada area in next millenium.
Pathological stress factors

Pathological stress factors of plants in forests are different than that of crop plants, in a way. The forest diseases occurring on trees are rather difficult to control. The most common problem in the forest area of Osmanabad and Latur district is grazing by goats and cattle. Therefore, it is felt that if species like Subabul (*Leucaena leucocephala*), Bor (*Zizyphus sps.*), Karwanda (*Carisa congesta*), *Acacia lutea* etc. are planted on the borders of the forests, that will help in saving the forest cover to a large extent. The problem of grazing in the forest has been discussed by Kushalappa (1992). He reported that heavy incidence of grazing has almost eliminated palatable species giving way to coarser not palatable inferior species, thus changing the species association in our natural forests. He has suggested that drastic steps should be taken to reduce the livestock population and the forest department should allow cutting and removal of dry grass (after its seeding) by nearby villagers free of cost.

Forest fires are commonly observed in all types of forests during summer. According to the reports available, the devastation caused by fire in Gharwal Himalayas this year is extensive, covering more than 80,000 hector. In 1995, fires in the UP hills of Himalayas had destroyed more than 3,75,000 hectares of forest wealth (Basu, 1999). Varman and Dange (1995) in his article “Mudumalai under threat” stated that, forest fires can be a great threat to biodiversity in tropical forests. In the dry season, friction caused by the rubbing of bamboos or other tree species may spark off a fire. Dried grass and leaves that accumulate on the forest
floor in this season catch fire easily and serve to spread it speedily. The frequent occurrence of fire in Mudumalai and its adjoining forest wipes out the ground layer of vegetation including seedlings and that prevents the regeneration of the forest. With increase in human intervention in the forest, the man made fires is also on the increase.

Singh (1998) stated that prevention of fire is better than cure, so take prophylactic measures which includes maintaining of fire lines i.e. cleared strips of sufficient width running criss-cross inside plantation to separate a compact block from other area, growing of evergreen species in fire lines and on the periphery of valuable deciduous species.

Campion (1954) illustrates the forestry in relation with forests and trees; the structure of forests; forest products. The factors that affect forests like fire, grazing, diseases etc. have been dealt by him with emphasis on forest conservation and protection.

Sharpe and Hendee (1976) gave a detail account of forestry including uses of the forest, measuring of forests, harvesting the forest crops etc. The accounts on forest protection from fire, insect diseases given by him are important.

In Gautala sanctuary of Aurangabad district, there were fires in the forest on 23rd March and 11th April, 1999 (Daily Lokmat). In the dry deciduous forest of Osmanabad and Latur districts, though great loss has not been caused, forest fires are common. Chief conservator of Forests, Bhopal, Mr. Kushalapa (1992) has opined that to protect the forest fires, co-operation of local people is essential. The
villagers could form a team of firewatchers to watch the forests and to prevent the occurrence of fire. The forest department could place the entire money they would have spent on the fire tracing, firewatchers etc. to village communities as an incentive.

In the study area diseases were observed on different plant parts of different plants. The major problem is of stem or wood rot, which is caused by wood rotting fungi and termites. Rust and Powdery mildew are next in order. Leaf spots, shot hole, shoot die back, leaf defoliation, Anthrachose, leaf galls were also observed. The diseases caused by fungi are more than bacterial diseases. Powdery mildews on different plants of Aurangabad districts have been earlier reported by Deshpande and Rajderkar (1964), while leaf necrosis of custard apple has been reported by Papdiwal and Deshpande (1978).

_Cusulta reflexa_ has been found of common occurrence in Marathwada area. Papdiwal and Pawar (1999) have reported 12 hosts from Aurangabad City. During our investigation, this parasite was observed on 3 hosts, while another angiospermic parasite Loranthus (_Dendrophthae falcata_) was observed on _Albizia_ alone.
From ecological point of view, as per the minimal world standard, at least 33% area of a country should be under forest cover. In our country, on an average, about 22% area and in Maharashtra State about 17% area is under forest cover. It is less than 3% in Osmanabad and Latur districts of Maharashtra. From this it is revealed that the forest cover in these districts should be increased.

In these districts the forests are located in scattered manner and they are of dry deciduous type. They are grouped as reserved, protected and unclassed forests. Recently Yedshi forest area has been declared as “Ramling ghat sanctuary”.

In these forests the vegetation chiefly constitutes small trees and shrubs. They include timber, fruit, fuel and medicinal plants. During the present investigation twenty timber plants have been recorded, among them Teak (*Tectona grandis*) and Neem (*Azadirachta indica*) are present in dominant proportion. A small number of fruit plants have also been recorded from the forests, of this Bor (*Zizyphus sps.*), Jamun (*Syzygium cumini*), Karwanda (*Carrisa congesta*) are observed in large number than others. During the studies, it was found that 18 plants are used conventionally for fuel wood. For this purpose, vedibabul (*Acacia camphbellii*), *Parkinsonia aculata* are used in large number. However, it was noticed that during scarcity, any other plant species including timber plants from the forest are used by the local people as fuel wood. Twenty-four plants having...
their medicinal properties are used by local people. Wadwal bet in Latur district is known as treasure of medicinal plants.

It is felt that if more teak plants are grown, they will meet the increasing demand of timber of the area. Similarly, if more Neem trees are planted, their biomass will have a market in pesticide industries, manufacturing Neem based formulations. Cultivation of more number of fruit plants like Sitaphal (*Annona squamosa*), Anjir (*Carisa congesta*), Bor (*Zizyphus spp.*), Amla (*Phyllanthus emblica*), is also found essential. A large population in the areas around the forest was still found to use trees as conventional fuel. Therefore, to meet their increasing demand, plant species like Vedi babul (*A. campbellii*), Ranipangra (*Erythrina suberosa*), Hekal (*Flacourtia indica*), Karanj (*Pongamia pinnata*), Nepati (*Capparis decidua*), Hiwar (*Acacia leucophloea*), Dhamoda (*Cassine albens*) and *Parkinsonia aculeata* having natural regeneration should be planted on the borders of the forest, so that it will serve the need of fuelwood of the people as well as it will help in protecting other important plant species; present in the forest, to be used as fuel wood. To reduce the pressure of fuel wood from the forests, non-conventional energy sources should be tapped for the purpose.

Ethnobotanical studies are gaining importance during present times. Various uses of medicinal plants present in the area have been recorded by interviewing tribals and villagers. However, it is felt that more studies on these lines should be undertaken. Furthermore, these plants needs to be conserved from indiscriminate use, specially at the Wadwal bet.
Forest products like gum of *Boswellia serrata* Bark of *A. nilotica*, *Cassia auriculata*, fruits of *T. arjuna* are having economic value in the local market.

Trees of tendu (*Diospyrous melanoxylon*) are found in sufficient number in the forest area, which are used in Bidi preparation. This generates revenue to the forest department. The plants of Tendu along with *Bauhenia racemosa*, which was also found to be used in Bidi preparation, should be cultivated in the forest. Basket and broom making by using branches of *Vitex nugundo* and *Pongamia pinnata* provide a source of income for the villagers.

Studies on algal flora reveal that species like *Spirulina*, *Scenedusmus*, *Chlorella*; which are biotechnologically important, are found in local climatic conditions. It is felt that there is potential for their industrial use.

As per the policy of the Government, social forestry programme is implemented in these districts. This will be helpful in increasing the forest cover of the districts. Moreover, the cultivation of plants under this programme will have a positive effect on the ecology of the area. For this purpose, fast growing, drought and disease resistant plants having multipurpose use should be planted. It is felt that the plantation of fodder species like *Acacia luecocephala*, *Leucaena leucocephala*; fruit species like *Zizypus sps.*, *Carrisa congesta*; fuel plants like *Glyrycida*, *Erthrina suberosa* and medicinal herbs like *Semecarpus anacardium*, *Phyllanthus emblica*, *Adhatoda Vasica* etc. should be undertaken.

The trees in the forest were found to suffer from diseases caused by Bacteria, Fungi, Termites, insects etc. It is felt that a detailed study of biotic
diseases of trees present in this area should be undertaken. Major problem in the forest was found to be of grazing by the cattles and goats. Therefore, drastic steps should be undertaken to reduce the livestock population of the forests. For this purpose more number of fodder crops should be planted on the borders of the forests, so that it will serve the purpose of fodder for goats and cattle, and will also save the natural vegetation. Cutting of dry grass from the forest by the villagers for this purpose should be permitted.

Forest fires are common in the forest. Preventive measures for this should be undertaken. One important aspect is space planting. The trees in the forests either die, or used by people leaving the area naked. For this purpose, time to time space planting is essential. For this purpose fast growing plants like Erythrina suberosa, Cordia dichotoma, Butea monosperma, Diospyros melanoxyylon, Eucalyptus sps. should be used. The barren area in the forest should also be brought under cultivation of such type of plants.

Studies of this type are useful from ecological, economical, social and ethnobotanical point of view. Therefore, it is felt that similar studies should be taken up in all the districts of Maharashtra so that the information gathered will be useful in the preparation of future working plans of the district.