Chapter- I

Introduction

1.1 Introduction

Forests are one of the most valuable natural resources of a global interest. It is a complex ecosystem which is predominantly composed of trees, shrubs and is usually a closed canopy. Knowledge about the variations in vegetation species and community distribution pattern, alteration in vegetation phonological (growth) cycles, and modifications in the plant physiology provide valuable insight into the climatic, edaphic, geologic and physiographic characteristics of an area (weiers S. et al 2004, Jackson M. et al 2005). Forests forms a habitat for a large variety of life forms that are adapted to live in it, such as plants, mammals, birds, insects and reptiles etc. Also the forests have abundant microorganisms and fungi, which do the important work of decomposing dead organic matter thereby enriching the soil. Nearly four billion hectares of forests cover the earth’s surface, roughly 30 percent of its total land area.

Forests are known to be one of the most important renewable natural resource. Forests ecosystem is a dynamic complex of plant, animal and microorganisms and their abiotic environment interacting as functional unit, where trees are a key component of the system. The forest ecosystem has two basic components- the living (biotic) and the non-living (abiotic). Living component includes plants, animals and other life forms while climate, soil and other various minerals are part of the non-living component. Plants include the trees, shrubs, climbers, grasses and herbs in the forest. Forest type differs according to the physical, geographical, climatic and ecological factors. There are different types of forest like evergreen forest (mainly composed of evergreen tree species i.e. species having leaves all throughout the year) and deciduous forest (mainly composed of deciduous tree species i.e. species having leaf-fall during particular months of the year).

Climatic conditions all over the world vary from cold (polar areas) to hot (tropical climates with heavy rainfall) to very dry and hot deserts (that are able to maintain only a minimal amount of plant life). Climatic factors mainly temperature and precipitation determine the distribution of the major forms of natural vegetation of the particular region. The world vegetation zones are called biomes meaning that major vegetation types extend over large areas in different parts of the world. The
significant diversity of forest resources or forest ecosystems is due their presence in a wide range of environments.

The pressure on India’s forest resources is increasing mainly because of rapidly increasing population. The rapid population growth in last few decades has put additional demands on forests for infrastructural developments. Since last few years there is an increasing demand for diverting forests lands for the construction activities like roads, railways, dams, power stations, townships etc. There has been a significant reduction in the natural forest cover in India during the recent past. The main causes of this have been clearing of forests for agricultural development, shifting cultivation and settlements. At present, a moratorium has been imposed on all harvesting activities in natural forests in the country until management plans are prepared for them. Preparation of these management plans has been started recently.

India is situated in tropical latitudes and has diverse temperature and rainfall regimes. The overall climate of India is ideal for the growth of diverse vegetation pattern. Vegetation developed in correspondence with the environmental conditions of a region is known as the natural vegetation. Natural vegetation in India is influenced by a few factors like topography, soil, amount of rainfall and temperature. The rural population of India, as well as much of its urban population, depends on forests. Trees are the main source of energy and provide timber for roofing and building. In rural India, the extensive benefits derived from forests include grazing, hunting, shade, forest foods in the form of tree leaves, wild fruits, nuts, tubers and herbs, tree bark for medicinal purposes, and non-wood products such as honey and gum arabic. In addition, the commercial lumber industry is a small but growing source of employment.

1.2 The concept of forest

The word “forest” is derived from the Latin word “foris” which means out of doors, and etymologically it is “large uncultivated tract of land covered with tress and under wood (Chamber’s twentieth century dictionary, 1943, p.359). Forests denote a group of or stand of trees in closed canopy. In the British Commonwealth forests terminology (1953) forest is defined as “a plant community predominantly trees and other woody vegetation usually with a closed canopy”. Therefore forests are areas covering practically all uncultivated lands covered with rather tall and dense trees. “A forest is a community of living trees and associated organisms covering a
considerable area”. A forest is a large track of land considering woody grounds and pasture. With the decline of the feudal system, forest began to mean natural woodland.

The forest is a dense growth of trees together with other plants covering a large area of land. The word “Jungle” denotes whole range of trees and shrub growth with a suggestion of wildness. Forest is defined as an area set aside for the production of timber and other forest products and under woody vegetation, conferring certain indirect benefits to the society.

In India, ‘Forest’ is regarded as any land; including the vegetation growing on it that, has been declared under a legal enactment. Many of Indian civilizations and culture grew under the greenwood trees. Therefore, forest has a major influence on India’s social, economic, political and philosophical life and development.

Ecologically the term ‘forest’ signifies complex organisms composed of distinct biological units called forest communities. Forest has a striking feature of the land surface. Forest of a country is a natural asset of great value, which is renewable and can be perpetually protected, productive, and useful under proper management.

1.3 Significance of forests

1.3.1 Ecological significance

Forests are the most widely distributed ecosystem on the surface of the earth, affecting the lives of most humans daily, either as an economic good or an environmental regulator. Forests and woodlands are the most widely distributed vegetation ecosystem on the planet, covering approximately 40% of the global land surface (Westoby J. 1989). Impact of forests upon the global environment through the processes such as the regulation of the global climate, storage of carbon, conversion of carbon dioxide to oxygen and energy exchange with the atmosphere is less clear. For example, it is known that deforestation and the combustion of fossil fuel contribute more than 7 billion metric tons of carbon to the atmosphere each year above the natural flux, mostly in the form of CO₂ (Jarvis P. G. et al 1993).

The forest also tends to increase the relative humidity of the area and to record evaporation; they tends to increase local precipitation at least to the extent of increasing the number of rainy days. Forest enriches soil with fallen leaves on the ground debris and increases its depth, porosity and water holding capacity. Forest
helps to prevent soil erosion, landslides, shifting sands and sitting up and consequent over flowing of river thus reducing the flooding.

Through the process of photosynthesis, forests renew the oxygen supply in the atmosphere by absorbing atmospheric CO$_2$ and moderating the greenhouse effect. Forest as an ecosystem plays a major role in carbon sequestration. Green plants in the presence of sunlight, chlorophyll and water converts atmospheric CO$_2$ to energy and release oxygen, which is the basic tenet of the process of photosynthesis. Green leaves of the plants are the major source of gaseous exchange. In this gaseous exchange process CO$_2$ is absorbed from the atmosphere and oxygen is released. The source of this oxygen is molecule is water. As per the report published by Ministry of Environment and Forests during August 2009, the annual CO$_2$ removal by India’s forest and tree cover is enough to neutralize 11.25 % of India’s total GHG emissions (CO$_2$ equivalent) at 1994 levels. This is equivalent to offsetting 100% emissions from all energy in residential and transport sectors; or 40% of total emissions from the agriculture sector. Clearly, India’s forest and tree cover is serving as a major mode of carbon mitigation for India and the world.

Some species of trees have the ability to return nitrogen to the soil through their root decomposition or fallen leaves. Such trees are planted to increase the nitrogen content of the soil. They play vital role in maintaining healthy watershed. Rivers originate in a forest area, carry the organic matter from forest to the downstream and support variety of aquatic animals. The richness of forest in upstream decides the biological value of the river ecosystem supported by it. Forests act as hydrologic flow modulators and also help in maintaining microclimate of the area.

Forests annually produce 70% of the net global terrestrial carbon accumulation which results in the uptake of carbon from the atmosphere and the conversion of the greenhouse gas CO$_2$ to O$_2$ (Peterson D. L. 1989). Sustainable forest management policies have been initiated to reconcile the competing aims for the use of forests (Toman M. A. 1995). Inter-generational responsibility dictates a need for monitoring of forests, as anthropogenic forces are potentially responsible for significant changes in ozone levels, desertification, deforestation and loss of biodiversity.

Forests are the home of wildlife, and afford important aesthetic and tourism value. They have a vital biological importance, forest maintain balance of flora and fauna associated with them. Forest cover is also important as it helps the water
percolation in the soil and increases level of underground water. Forests support food and various medicines. Forests increase the productivity of barren, non-agricultural and dry land capability with the help of leaching action of leaves.

1.3.2 Economic significance

The economic importance of forests is clear, as through either consumption or utilization of some product or service forests affect the everyday life of most humans. Forest meets nearly 4% of the energy needs of the country. Forest resources constitute one of the most prominent geo-ecological features in the world. Forest resources are restricted to parts of the earth and are most important on the local as well as the global scale for the following points. Forest is a major factor for environmental conservation and control extremes of heat and cold rendering the climate more equable.

Forests supply timber, fuel, pulpwood and other varied products, which in turn support major industrial activities in various sectors and provide large-scale employment. Forests provide firewood, timber for agricultural implements, house construction, fencing material, bamboos for basket and huts, sericulture industry, minor forest products such as honey and wax. They provide employment particularly to tribal and generally add to better agricultural yields.

As far as recreational significance of forests is concern, they provide picnic resorts and opportunity for sports like hiking, trekking, wildlife watching etc. Forests supply the shelter for wild animals and birds. Forests protect watershed, catchments of rivers and streams against erosion by decreasing the velocity of running water and control the flood. Forests help for to make soil fertile. Forests put the stability of environmental balance, control the wind speed and reduce the soil erosion. Forests supply the humidity for the atmosphere. Forests are major source of fundamental needs of human as they provide food for man, fodder for the cattle and help to supply the raw materials for many industries. The tenth plan has set a monitor able target of achieving 25% forest and tree cover by 2015.

1.4 Present status of forests in India

India with its varied climate, high mountains in the north and sea on the other three sides supports a rich flora of tropical, subtropical, temperate and alpine vegetation. The latitudinal extent of India has ensured a great variety of vegetation types from south to north and west to east. There is also a great regional variety in
The variety of soil conditions and climate, differences of physiography into plains, valleys and mountains, the multi effect of other natural and biotic factors has been resulted in the stabilization in different areas of a particular type of vegetation. The biodiversity in the forest ecosystem is an important natural pool. India is third largest country in the world after Brazil and USSR in the number of plant species. A wide range of forests and related vegetation types is found in India. The vegetation is scattered mainly in four geographical regions namely Himalayas, Vindhyas, Western Ghats and Eastern ghats. Almost 46% of the total forests found in the country are dry-deciduous in nature. India has been divided into broadly sixteen forest types by Champion H. G. (1968) based on rainfall and altitude. However, with changing climate and man's impact on environment particularly in forests, change in the composition of tree species resulting spatial disturbances on the occurrence of forest types. The total area under forest cover in India has shown a constant trend. The National Forest Policy of India (1952) has emphasized to maintain one third of the country under forest. According to the Forest Survey of India (FSI), State of the Forests Report (SFR) 2013 (2011 assessment), the total forests area and tree cover is 7,69,538 km$^2$ or 21.02% of the countries geographical area. According to the 2001 assessment it was 757010 km$^2$ or 23.41%. Among the states and union territories, Madhya Pradesh with 77,700 km$^2$ of forest cover heads the least followed by Arunachal Pradesh with 67,410 km$^2$ and Chhattisgarh with 55,674 km$^2$. In Maharashtra 50,646 km$^2$ area is under forest. In terms of percentage of forest cover with respect to total geographical area Mizoram with 90.68% has the highest area under forest, followed by Lakshadweep (84.66%), Andaman and Nicobar Islands (81.51%) and Arunachal Pradesh (80.50%).

The forests in India are managed under the direct control of the governments of states and union territories, but the central government has the sole discretion and jurisdictional powers. Three “National Forest Policies” (1894, 1952 and 1988) have been formulated over the years on the basis of five conceptual cornerstones.

Western ghat of India has a crucial role to play in determining the climate and physiography of the India in general and Maharashtra in particular. This range forms the most important drainage basin for the river systems of western and central India. The Western Ghats form the most dominating structure in Maharashtra. It is also known as the ‘Sahyadri Range’ and has created very peculiar physiographic and
climatic condition in the state. Maharashtra forests are rich and diverse in flora and fauna. There are about 3500 flowering plant species covering 1200 genera and 150 families. About one fifth of the State’s geographical area is under recorded forests. Maharashtra is one the states which lost more than 2,000 km\(^2\) of dense forest for some reason or the other.

**1.5 Necessity of forest appraisal**

Forests are an essential part of the surface of the earth, and constitute a powerful ecological unit having vital effects on the environment. Adverse changes in the quality and extent of forests are responsible for environmental degradation and deterioration, resulting in several long ranging effects e.g. changes in microclimate, reduction in producing capacity of agricultural land and desertification, and in frequent floods and natural hazards.

Forest degradation is one of the most significant global environmental problems faced by world community. Deforestation is the removal of forest cover to an extent that allows for alternative land use (FAO-1995). According to FAO (2000) the loss of forest cover in India between 1990 and 2000 was 380.89 km\(^2\) per annum. Deforestation is both, a type of degradation by itself, and a cause for other types of degradation, principally, water and soil erosion. Deforestation causes degradation first, when the land is cleared on steeply sloping, or has shallow or easily erodible soils; and secondly, where good land management does not follow the clearance. The major causes of deforestation in India are the conversion of forestland into agricultural land, shifting or Jhuming cultivation, transformation of forests into pastures, overgrazing, forest fires, lumbering and multipurpose river project.

Forests in India are also subjected to heavy grazing as vast herds of cattle are maintained by the local people not only for domestic production in many parts but also as a status symbol. This is of course a socio-economic problem, hence it has been sought to be dealt with in a pragmatic manner by prescribing rotational grazing and partial closure of some forests including the pasture lands, intensification of planting efforts to regenerate the denuded areas. The protective role of these forests has also been duly recognized and measures have been prescribed to improve stocking in protection forests and to enhance their capacity to produce at least minor forests, which can be exploited without any adverse effect on tree cover and deterioration of forests. Guidelines are also laid down for afforestation, soil and moisture conservation.
measures to set right the deterioration in site quality due to heavy onslaught by human and cattle population.

In India, deforestation has given birth to several and severe problems encompassing environmental degradation through accelerated rate of soil erosion, increase in the sediment load of the rivers, siltation of reservoirs and river beds, increase in the frequency and dimension of floods and drought, changes in the climate, agricultural loss due to floods, drought and declined status of soil.

National Commission on Agriculture (NCA-1975) has been estimated 150 million ha out of the total geographical area (TGA) of 328 million ha is subjected to serious soil and water erosion. Several tanks and dams in India are filled with silt, which was carried in by soil displacement of catchment area. Government of India has spending billions of rupees every year for silt removal from dams, breached tanks, canal, bunds, riverbanks, and streams for land protection.

According to Forest Survey of India (FSI -2003) estimates, the impact of grazing has affected approximately 78% of India’s forests. Overgrazing and over extraction of green fodder, both lead to forest and land degradation through a loss of vegetation and physical deterioration in the form of compaction and reduced infiltration, and increase in soil erodibility. Shifting cultivation, which is practiced in tribal lands of 10 million ha, also causes harmful effect on ecological systems. The forest department has taken very serious steps in reclaiming forestlands. The exposed land surfaces due to extreme deforestation are being treated by measures like vegetative bunding, agroforestry, and hedgerows.

The occurrence of frequent forest fires is also a major cause of degradation of forestland in many parts of the country. Apart from the destruction of vegetation, high intensity forest fires alter the physio-chemical and biological properties of the surface soil and leave the land prone to erosion and with a lowering of soil quality therefore.

Deforestation is the process of changing land use pattern from forestry to non-forest use such as arable land, urban use, logged area, or wasteland. Deforestation for wood, for agricultural land and for developmental projects can provide numerous benefits but can have damaging environmental impacts on forest ecosystems and can affect local and regional climate. Forest renders the climate more equable, prevent soil erosion and landslides, and help in flood control.
The above discussed scenario and status of the forests in India poses a serious challenge for foresters and the management. Despite the growing public concern and increasing political rhetoric, most actions have been relatively ineffective in dealing with the problem of deforestation. The depletion of natural forest cover due to excess and unsustainable removal resulted in spiraling-down effect, causing degradation of other natural resources like land, air, water, watersheds and biodiversity. Thus there is a need to strengthen the planning and forestry management processes with sustainable technological inputs funneled into the system. Deforestation is mainly due to the conversion of forests areas to agricultural land, and it continues at an alarmingly high rate of about 13 million hectares per year.

As far deforestation in Western Ghats which is also known as Sahyadris is concern, due to the mining, tourism, infrastructure and hydro power projects are main drivers of deforestation. In the Sahyadris annual deforestation of 57% between the years 1920 to 1990 has resulted in the loss of 40% of natural vegetation. The loss of 25.6% of the forest cover was during the year 1973 to 1995. The government of Maharashtra has proposed to set up new power projects for a total capacity of 19240 MW along the narrow Konkan coastal strip in future. Due to such power projects sizeable chunks of forest lands may convert for transmission lines. This huge transmission line and network furthermore leads to destroying the forest cover, fragmenting the forests, and opening up the thick forest cover to accelerated deterioration.

1.6 Review of literature

For the present study, various studies on the similar work and other work have been reviewed. Some of the scholars and their research work are mentioned below.

The Forest Survey of India (FSI) is a premier national forest resources survey organization in the country, formed on June 1st 1981, as successor to Pre-investment Survey of Forest Resources (PISFR) to furnish data through country-wide comprehensive forest resources survey at regular interval. The FSI is working under the Union Ministry of Environment and Forest. (FSI) carries out assessment & monitoring of forest cover of the country on two-year cycle and publish the findings in the form of ‘State of Forest Report’ (SFR). According to it, anthropogenic factors have affected much of the forest area of the country. In north-eastern states of India between 2001-2003 an area of 5476 km² with forest cover was affected by shifting
cultivation. Maximum effect is found in Nagaland (1,332 km\(^2\)) & minimum is found Tripura (384 km\(^2\)).

NRSC (formerly NRSA) is one of the leading institutions working on management and conservation of natural resources in India. According to latest estimates carried out by NRSC (2002), the country is losing about 1.3 million ha of forests cover every year.

Forest in the western parts of Pune districts has attracted the attention of botanist from the 19\(^{th}\) century. A good deal of information was given in the Bombay flora by Dalzell and Gibson (1861), which includes the study of Lonavala and Khandala. Further Garland (1932) described six stages of succession in the Deccan trap tract. His report expressed a concern about increasing biotic pressure and its effect on vegetation. In recent years, Razi (1952), Jain and Puri (1957), Puri and Patil (1957) and Chandras and Kulkarni (1970) have studied the vegetation patterns in the eastern part of the Pune districts. Gadgil & Vartak (1973, 1976) and Gole & Tetali (1985) reported the different concerns about a big threat to the plants, wildlife and people due to the construction of a dam with a social emphasis on the Panshet Dam catchment area.

Remote sensing and Geographical information system together have potential to provide comprehensive information on various facts of forests management in India (Roy, 1999). Research of immense magnitude has already been carried out using RS as a tool for the generation of valuable outputs as forests cover, vegetation type and land use changes (Houghton and Woodwell, 1981). Large numbers of researchers have adopted visual image interpretation technique to generate maps illustrating land cover changes (Howarth and Wickware, 1981). A recent review on assessment of large scale deforestation in Sonitpur district of Assam (Srivastava et al.2002) strongly reveals the potentials of Remote sensing and GIS for estimating land cover changes.

Jha C.S, (Forest & Ecology Division- NRSA), and Dutt C.B.S. & Bawa K.S., in their research paper entitled as ‘Deforestation and land use changes in Western Ghats, India’, has been estimated the change in forest cover area between 1975 and 1995 in southern Western Ghats using satellite data. According to them out of total study area of approximately 40,000 km\(^2\) showed the loss of 25.60% in forest cover in 22 years. The dense forest was reduced by 19.50% & open forests reduced by 33.20%. They outlined major reasons for this decline was agricultural expansion,
often state sponsored, overgrazing, rapid industrialization, urbanization, and growing consumerism.

The Western Ghats Ecology Expert panel, headed by ecologist Dr. Gadgil Madhav, has recommended that the Western Ghats be declared ecologically sensitive. Hundreds of shorter perennial monsoon-fed west flowing rivers originates and travel through steeper and more undulating topography before emptying in to the Arabian Sea. A rough estimate reveals that 245 million people in the five Western Ghats states directly depend on these rivers for their diverse water needs. Geographically the Western Ghats is the catchment for river systems that drain almost 40% of the land area in India. Recently ten important biodiversity hotspots in Western Ghats have been included in the list of world heritage sites by World Heritage Committee of the United Nations Educational, Scientific and Cultural Organization (UNESCO).

Menon and Bava have estimated the rate of deforestation in the western ghat to be 0.57% annually during the period 1920-1990, where as the United Nation Food and Agriculture Organization (FAO) estimated the annual rate of deforestation for India to be 0.60% during the period 1981-1990. ‘Flowering Plants of Western India’ was published by Nairne (1894). Many interesting papers on the western India were published by Woodrow (1897-1901).

India is a mega-biodiversity country where forest account for about 20% (64 million ha) of the geographical area SFR (2003) forest survey of India. More than 200,000 villages classified as forest villages, there is obviously large dependence of communities on forest resources. (Ravindranath N.H. and Sudha P. joint forest management in India (NRSC, Hyderabad).

One of the most important tropical forest classifications was developed for Greater India (Champion, 1936) and later republished for present-day India (Champion and Seth, 1968). This approach has proved to have wide application outside India. In it 16 major forests types are recognized, subdivided into 221 minor types, structure, physiognomy and floristic are all used as characters to define the types.

Floristic studies of Maharashtra were carried out by several workers, including Gibson, Graham, and Gibson etc. “Catalogue of Bombay Plants” was the first contribution by Graham in 1837. Later on various contribution like The Flora of Khandala (Santapau, 1953, 1967) and flora of Purandar (Santapau, 1958), “Flora of
Maharashtra State- Monocotyledon by Lakshminarasimhan et al. (1996) etc have thrown the light on vegetation diversity. Majority of this work is based in western Maharashtra.

Maharashtra state was a part of Bombay Presidency during the British rule; subsequently it formed part of Bombay state. Graham (1837) was the first to publish a ‘Catalogue of Bombay Plants’ which was followed by the ‘Flora of Bombay’ by Dazell & Gibson (1861).

Cooke’s ‘Flora of Presidency of Bombay’ (1901-1908) still continuous to be the most important floristic work for identification of the erstwhile Bombay Presidency viz, Parts of Gujarat, Maharashtra, Goa, North Kanada, and Sind which is now in Pakistan.

After the re-organization of Botanical survey of India, Western Circle, Pune, work on vegetations extended. In the early years (1956-1960), several papers were published on the ecology and vegetation of Pune districts (Puri and Jain, 1959-1960, Puri and Patil, 1960), Konkan (Jain, 1959), Khandesh (Jain and Deshpande, 1964) etc. Recently many district floras have been worked out by research workers of Pune in Botanical Survey of India.

Ravindranath N.H. & Joshi N.V., in their work ‘Impact of climate change on forest in India’ has outlined that he future welfare and prosperity of India would very much depend upon our ability, efforts and success in conserving, developing and proper utilization of our forest resources. It is therefore high time that the nation as a whole awakens to this burning problem for the sake of better future. Thus it is important to assess likely impacts of projected anthropogenic activities on forest and develop & implement adaptation strategies for both forest conservation and livelihoods of forest dependent people.

UNDP at the global level has worked closely with partners in 146 countries to develop a biodiversity and ecosystems Global Framework to accelerate international efforts to reverse biodiversity loss and ecosystem degradation. This framework takes into account the real value of biodiversity and ecosystems to society, in relation to secure livelihoods, food, water and health, enhanced resilience, preservation of threatened species and their habitats, and increased carbon storage and sequestration.

Vartak, at Agarkar Research Institute, Pune has contributed to a better understating to the flora of Maharashtra, particularly Pune, Satara, Raigad and
Ahmednagar district. An enumeration of plants of Matheran and Mahabaleshwar was published by Birdwood (1896, 1887, 1896, and 1897).

Chitwadgi S. S.(2003) has suggested the sustainable forest management on forest lands as well as waste lands at Bhopal. R.P. Singh (2003) remarked that, more effective and sustainable conservation of soil and water resources could be achieved through the use of agro forestry systems.

Van Mahotsava was launched in 1950 to make people aware of the importance of forests. Chipko Movement by Sundarlal Bahuguna is a living example of general public awareness about the forest. Efforts are being made to protect the forest in Western Ghats by various institution e.g. Ranwa, Wanarai, Protect Western Ghats by Jagdish Godbole, Devrayi (Sacred Grows) etc.

1.7 Hypothesis

The overwhelming and unprecedented population pressure, practicing of unscientific agricultural methods and the lack of awareness about the significance and importance of forests among the populace in general and tribal /village folk in particular are the prime causes for deforestation / degradation of forests. The rates of depletion, reason for the deterioration and remedial measures to restore it are the essential factors to assess the forest cover in any terrain. The inventory of forest resources and forest cover assessment / change detection in the rugged topography or hill sector is not an easy task and it is a time-consuming process. This can be made easier only through the high spectral, spatial and temporal resolution qualities of remote sensing techniques. Indeed, the precise data base pertaining to forest cover information is an imperative input of formulating various management plans and can be effectively utilized for change detection and monitoring of the these precious resources using remote sensing technology. It also implies a realistic approach for the monitoring, proper management and optimum utilization of the forest resources, therefore hypothesis can be stated as “Local level assessment of forest cover using remote sensing technique is indeed an indispensible component in the preparation and formulation of forest management plan and thereby conservation of forest resources”. 
1.8 Major objectives of the study

General aim of the present research work is to assess forest cover in the study area and to prepare a forests management plan for the conservation of forest ecology in the study area, therefore following objectives are outlined.

1. To ascertain Land use / Land cover (LU/LC) change dynamics in the study area to understand trend of its utilization and also to infer the various factors responsible for forest cover change through time
2. To acquaint with various vegetation parameters based on extensive field surveys which will be helpful to understand various characteristics of plant species and their nature.
3. To perform NDVI analysis to understand the current status of vegetation cover (forest cover) based on remote sensing data.
4. To assess the effect of terrain attributes, soil environment, LU/LC changes on the distribution of vegetation cover in the study area, in general and to infer & predict degradation status of the vegetation cover using Markov chain analysis which will help to understand major causes of degradation of vegetation cover.
5. To prepare a comprehensive Integrated Forest Resource Management Plan (IFRMP) at local level considering village as well as micro watershed as a basic unit of planning.

1.9 Rational of the study

The study area has undergone sharp and remarkable changes during recent time. Spatio-temporal remote sensing data along with the use of Geographical Information System (GIS) technology are one of the good sources and techniques to detect land use change. It is necessary to investigate the changes in land use / land cover pattern for better understanding of deforestation process. Present study also considers identification of the driving factors responsible for the change in land use pattern.