UNIT 1 LAND

Structure

1.0 INTRODUCTION

Land is a natural resource that supports different aspects of human life. It serves as storage for water and nutrients required for plants and other organisms. Land is chiefly valued for its potential to grow food for humanity as well as for other terrestrial creatures. As per the environmental conditions and quality of the soil system, land is put in several uses that are often referred as land uses. Quality of land is often perceived in terms of productivity of the land. Human has been modifying land and soil system throughout the human history. However, in the last few decades, a number of unsustainable land use practices, particularly those involved in intensive agriculture, have negatively af fected the productive capacities of land across the world. Ensuring sufficient global food production to feed the huge world population is increasingly being perceived as a major challenge of the twenty first century. Maintenance of productive capacity of land is therefore a critical aspect of sustainable development.

The present unit provides a comprehensive picture of land resources while underpinning the currently prevailing unsustainable land use practices and subsequent land degradation. The unit also proposes that land use planning, evaluation and integrated land management are some of the options for sustainable land management.

1.1 OBJECTIVES

After reading this unit, you will be able to:

- describe and discuss the concept of land as a resource;
- discuss different unsustainable land use practices and consequent land degradation; and
- explain the ways of sustainable land management and the challenges associated to it.

1.2 LAND AS A RESOURCE

Land is the solid surface of the globe or is the part of the earth that is not covered by water. It usually supports biological production. Its components are soil, vegetation, animals and microorganisms. Terrain or the physical features of land is included in its description. When assessing land resources for agricultural development, the components also include climate, particularly rainfall and temperature, number and distribution of people, crops, domesticated animals, machinery, roads and markets. In fact land is a natural resource that supports different aspects of human life including economic activities, transports, communications systems, recreation, and waste disposal.

As it provide substrate for biological production particularly for plant and tree growth, land is used for producing food, fodder, medicine, fiber and other associated materials. The volume of production depends on the extent and yield of the cultivable land, which, in turn, is flexible according to human attitude. Land use describes how a piece of a land is managed or used by humans. Land cover is the observed physical or biological cover of land such as vegetation or man-made features. The physical limits of cultivable land are temperature, moisture, topography and soil. Land quality is also governed by past and present human activities, e.g. reclamation from the sea, vegetation clearance, and human induced land degradation.

Land is resource of multiple uses and hence its comprehensive valuation is too complex. Land pricing is one way of land valuation which calculates value of land on the basis of its biological productivity. There are different grades of land depending on their productivity. Value of wildlife habitat and aesthetic qualities is not easily determined by economic measures. Some lands are so special that they are protected and maintained as parks and wilderness areas to protect rain-forests, endangered species and other unique resources. Land management is the management of land primarily for agriculture. Land on which commercial production or subsistence agriculture is not possible, is left for construction, leisure activities, nature reserves or other purposes.

1.3 LAND USE CLASSIFICATION AND LAND CHARACTERISTICS

Several land use classification systems have been developed around the world. Commonly used land use classifications includes categories like forests, land not available for cultivation, other uncultivated land, fallow land and net sown area. Land not available for cultivation includes barren and waste land, and land put to non-agricultural uses, e.g. buildings, roads, factories, etc. Other uncultivated

land (excluding fallow land) includes permanent pastures and grazing land, land under miscellaneous tree crops groves (not included in net sown area), and cultruable waste land (left uncultivated for more than 5 agricultural years). Fallow land includes current fallow (left without cultivation for one or less than one agricultural year) and other than current fallow (left uncultivated for the past 1 to 5 agricultural years). Net sown area represent land presently occupied by certain crop and includes rainfed and irrigated agricultural land. Area sown more than once in an agricultural year plus net sown area is known as gross cropped area.

Major land use types and land utilization types are two successive hierarchy of describing land uses. A major kind of land use is a major subdivision of rural land use, such as rainfed agriculture, irrigated agriculture, grassland, forestry, or recreation. Major kinds of land use are usually considered in land evaluation studies of a qualitative or reconnaissance nature. A land utilization type is a kind of land use described or defined in a degree of detail greater than that of a major kind of land use. In detailed or quantitative land evaluation studies, the major land use types usually consist of land utilization types. They are described with as much detail and precision as the purpose requires. A land utilization type consists of a set of technical specifications in a given physical, economic and social setting. This may include current environment or a future plans for land improvement e.g. an irrigation and drainage scheme. Land utilization types are defined for the purpose of land evaluation.

Two terms, multiple and compound land utilization types, refer to situations in which more than one kind of land use is practiced within an area. A multiple land utilization type consists of more than one kind of use simultaneously undertaken on the same area of land, each use having its own inputs, requirements and produce. For example- timber plantation used simultaneously as a recreational area. A compound land utilization type consists of more than one kind of use, undertaken on areas of land which for purposes of evaluation are treated as a single unit. The different kinds of use may occur in time sequence (e.g. as in crop rotation) or simultaneously on different areas of land within the same organizational unit. For example, mixed farming involves both arable use and grazing.

A land characteristic is an attribute of land that can be measured or estimated. Examples are, slope angle, rainfall, soil texture, available water capacity, biomass of the vegetation, etc. Land mapping units, as determined by resource surveys, are normally described in terms of land characteristics. A land quality is a complex attribute of land which acts in a distinct manner in its influence on the suitability of land for a specific kind of use. Land qualities may be expressed in a positive or negative way. Examples are, moisture availability, erosion resistance, flooding hazard, nutritive value of pastures, accessibility etc. Where data are available, aggregate land qualities may also be employed, e.g. crop yields, mean annual increments of timber species.

A land quality is not necessarily restricted in its influence to one kind of use. The same quality may affect different land use types. There are a very large number of land qualities, but only those relevant to land use alternatives under consideration need be determined. A land quality is relevant to a given type of land use, if it influences either the level of inputs required, or the magnitude of benefits obtained, or both. For example, capacity to retain fertilizers is a land quality relevant to most forms of agriculture, and one which influences both

fertilizer inputs and crop yield. Erosion resistance affects the costs of soil conservation works required for arable use, whilst the nutritive value of pastures affects the productivity of land under ranching.

1.4 UNSUSTAINABLE LAND USE PRACTICES

The failure to manage land resources in an integrated, holistic manner has led to a number of serious problems and barriers to sustainable development. Unsustainable land use practices include the overexploitation, pollution and destruction of natural resources. No society intentionally destroys its future well-being or survival by engaging in unsustainable practices. However, economic pressures as well as simple necessities driven by needs for short-term survival can lead to the degradation or destruction of the resource base needed for long-term survival and economic well-being. Government pricing structures, subsidies, tax incentives, and trade policies relating to food, wood, energy, and mineral resources may encourage or even force land users to deplete natural resources and thus to undermine their own livelihood. Both national and international economic policies can drive land users toward unsustainable practices.

Land degradation can occur when the land's carrying capacity is reduced by extreme weather, such as droughts, or by overgrazing or erosion. Some regions are much more susceptible to these problems because of their climate, soils, topography, or other factors. Inequitable distribution of land and other resources can also effectively reduce the carrying capacity of the land. Land degradation accelerates when people are forced to use marginal lands. Lack of long-term land tenure or lack of the technology needed to determine and assign land tenure can lead to land degradation by users who have no incentive to improve or conserve resources for the future.

The concentration of population in urban areas has the advantages of increased efficiency and reduced costs for social and physical infrastructure, but the expansion of urban areas also has a direct effect on the adjacent environment. Critical thresholds may be exceeded in the environment's self cleansing potential. The water and energy resources may be insufficient to meet the needs of urban development, industrialization, and domestic use. For example, firewood is a common energy source for cooking and heating in most developing countries. The need for firewood in urban areas can easily exceed annual production. An increase in the cost of energy is not the only consequence. Deforestation decreases the buffering capacity of the adjacent environment and leads to erosion and less efficient agriculture, transportation, and industry. Industrial and urban effluent can make surface water unsuitable for agricultural irrigation.

One of the causes of the self destruction of a society' s resource base is overpopulation. The situation is particularly difficult, if the local or regional soil and climate are too poor to guarantee profitable and sustainable use of external inputs in agriculture and a low supply of qualified labour and other economic conditions hinder the creation of nonagricultural employment, such as in desert margins and semi-arid regions. Large scale technological investments in these regions are economically unfeasible because of the lack of purchasing power of the local population and the lack of opportunities to increase production. In the long run, however, neglect of marginal regions will threaten the more productive ones because the deterioration or loss of the marginal regions' ecological, social,

and economic functions, may be critical to the well-being of the more productive regions.

Environmental problems are inevitably linked to social and economic problems, including unemployment, poverty, disease, and starvation. Permanent destruction or degradation of the land's capacity to provide economic and environmental benefits is a major problem. Throughout the world, in both developed and developing countries, examples can be found of erosion, desertification, collapse of fisheries and other resource stocks, depletion of groundwater, salinization of soils, dumping of toxic mine wastes and the extinction of species and loss of biodiversity. Degradation of the land's capacity to support human populations can also lead to uncontrolled urbanization, mass migration, and social conflicts.

Inefficient use of resources is another grave problem. Without an integrated approach to land management, technologies are often used that are inappropriate for a particular region or type of land. For example, irrigation projects are developed in dry regions where agricultural production is actually limited by a lack of soil nutrients rather than by a lack of water. The use of valuable resources, such as fertilizers and pesticides, can be excessive, unnecessary, or even detrimental to agricultural efficiency and can lead to pollution and health problems in both rural and urban areas. Increasing costs for water purification and treatment of pollution-caused diseases are often borne by sectors of society that have had nothing to do with causing the pollution. The inefficient use of energy resources is a major impediment to sustainable development in all its aspects. Experience throughout the developing world has demonstrated that the most effective solutions to many land-use problems draw on a combination of local knowledge and advanced technologies.

1.5 LAND DEGRADATION

Land degradation may be defined as the loss of actual or potential production of biomass from a land or loss of its capacity to regulate the environment as a result of natural or anthropogenic factors. Loss of productive land adds to the difficulty of feeding an increasing world population. Almost one-sixth of the land area of the world has already been degraded to a greater or lesser extent. Natural processes such as erosion, soil acidification and soil salinization are exacerbated by man's activities. These activities include cultivations, irrigation and the use of nitrogen fertilizers, techniques on which agricultural production depends and will continue to depend in the future.

Estimates indicates that about 13% of the total land is affected to some extent by degradation. About 38% of the degradation is described as 'light', 46% as 'moderate' and 16% as 'strong' and 'extreme'. Of the various forms of degradation, water and wind erosion affect 84% of the degraded area, chemical degradation 12%, and physical degradation 4%. The continental areas that are most affected are Africa and Central America, although all are affected to some extent.

There are two general reasons for man-made degradation of land, which tends to occur particularly during periods when countries are undergoing economic development. First, an increase in the population leads to cropping of less suitable land, overgrazing and increased demand for wood as fuel and timber for buildings. Fallows are replaced by continuous cultivation, steeply sloping land is brought

into cultivation, and plant nutrients are removed and not replaced, a phenomenon also known as nutrient mining. The second reason is that, national policies usually encourage industrialization and create pricing structures for agricultural products, that favour urban populations at the expense of farmers; cheap food is imported. The infrastructure in rural areas is neglected, investment in agriculture is insufficient, and farmers receive too little information to improve their techniques.

The effects of land degradation are two fold: on-site effects, that reduce crop yields, and off-site effects such as the deposition of silt in storage dams and river beds, and acidification and eutrophication of surface waters. Reduction or prevention of land degradation is therefore essential for economic reasons as well as to preserve natural ecosystems. Over the last few decades, it has been shown that degradation can be prevented on land that is cultivated. Techniques for its control and for the recovery of damaged land are economically viable, but are not sufficiently applied. The careful planning of land use, using the knowledge and techniques now available, including land surveys, should allow us to conserve our limited land resources.

Land degradation involves soil erosion, desertification and several changes in chemical and physical properties of soil. Soil erosion means removal of part or all of the soil by the action of water or wind and deposition of its components elsewhere. Loss of topsoil by erosion reduces crop yields because of the attendant loss of nutrients, water storage capacity and structural aggregates. Desertification refers to land degradation in dryland areas, with the implicit assumption, that it is caused by both a run of years of low rainfall and inappropriate forms of land use and management. Chemical changes in soil or land include nutrient depletion, salinization, acidification, pollution etc. Physical changes in soil include compaction, surface sealing, crusting and water logging. All these changes make the soil system less productive, vulnerable and less resilient in different spatial and temporal scale.

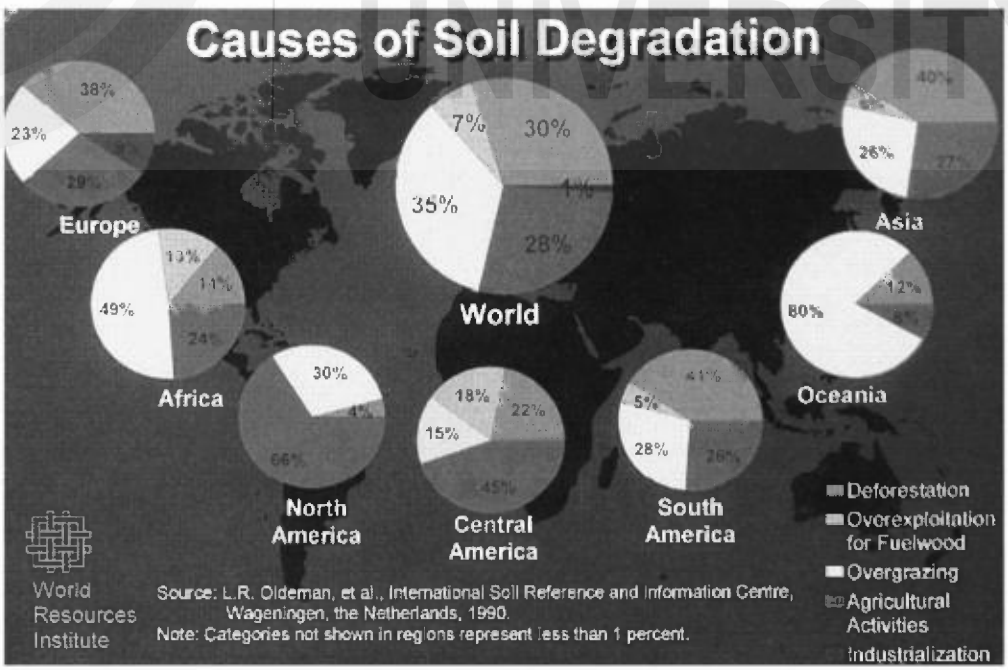

Fig. 1.1: Causes of Soil Degradation around the world

(Source http://www.globalchange.umich.edu)

Check Your Progress 1

Note: a) Use the space given below for your answer.

b) Compare your answers with those given at the end of the unit.

1) Why is land considered a resource?

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2) What are the major reasons of land degradation?

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1.6 SUSTAINABLE LAND MANAGEMENT

Sustainable land management (SLM) is defined as a knowledge based procedure, that helps integrate land, water, biodiversity, and environmental management (including input and output externalities) to meet rising food and fiber demands. while sustaining ecosystem services and livelihoods. SLM is necessary to meet the requirements of a growing population. Improper land management can lead to land degradation and a significant reduction in the productive and service functions.

In simple terms, SLM involves preserving and enhancing the productive capabilities of land in cropped and grazed area; sustaining productive forest areas and potentially commercial and non commercial forest reserves; maintaining the integrity of watershed for water supply and hydropower generation needs and water conservation zones and the capability of aquifers to serve the needs of farm and other productive activities.

SLM also includes actions to stop and reverse degradation or at least to mitigate the adverse effects of earlier misuse. Impacts of misuse of the natural resources (land, water, vegetation) and loss of the heritage in land management (indigenous crops, cultivation and animals) are mainly related to the population pressure and the migration of people from rural areas to the urban i.e. from the upstream to the downstream in an intra basin as well as an inter provincial scale. This process leads to the degradation of the prime lands adjacent to the settlement areas and the rural areas by abandonment.

SLM do not operate in isolation from other environmentally strategic interventions. For example, SLM will clearly overlap with, and to some extent

be dependent on, progress in improving the sustainability of agriculture, as well as associated soil conservation efforts; responsible water management; and accountable livestock management and reduced impact logging practices. However, there are manifestly important aspects of SLM, that singularly pertain to the most significant land issues, namely sustaining soil productivity and averting land degradation.

The causes of the more obvious kinds of degradation have been fairly well documented. These causes can be grouped, in general terms, into three categories. First category includes degradation owing to chemical and physical processes resulting from interaction between the prevailing agricultural and industrial technologies and the surrounding land resource base. Second category includes degradation of a grander or "macro" nature, such as global warming or volcanic eruption, whose consequences can be anticipated even if the onset of damage cannot be forecasted with precision. Third category includes degradation whose roots are of behavioral nature. These can be deliberate, which are result of improper private incentives ultimately linked to market failure; or stemming from lack of knowledge or from technologies.

Decisions regarding use of land resources are governed by a complex set of socio-economic, developmental and environmental parameters. Land use planning, land evaluation and integrated land management are the major elements which play important role in sustainable land management. In the following sections these have been described in details.

1.7 LAND USE PLANNING AND EVALUATION

Decisions on land use have always been part of the evolution of human society. In the past, land use changes often came about by gradual evolution, as the result of many separate decisions taken by individuals. In the more crowded and complex world of the present, they are frequently brought about by the process of land use planning. Such planning takes place in all parts of the world, including both developing and developed countries. It may be concerned with putting environmental resources to new kinds of productive use. The need for land use planning is frequently brought about, however, by changing needs and pressures, involving competing uses for the same land.

The function of land use planning, is to guide decisions on land use in such a way that the resources of the environment are put to the most beneficial use for man, whiles at the same time conserving those resources for the future. This planning must be based on an understanding both of the natural environment and of the kinds of land use envisaged. There have been many examples of damage to natural resources and of unsuccessful land use enterprises, through failure to take account of the mutual relationships between land and the uses to which it is put. It is a function of land evaluation, to bring about such understanding and to present planners with comparisons of the most promising kinds of land use.

Land evaluation is concerned with the assessment of land performance when used for specified purposes. It involves the execution and interpretation of basic surveys of climate, soils, vegetation and other aspects of land in terms of the requirements of alternative forms of land use. To be of value in planning, the

range of land uses considered, has to be limited, to those which are relevant within the physical, economic and social context of the area considered, and the comparisons must incorporate economic considerations.

Land evaluation, often answers the questions like: How is the land currently managed, and what will happen if present practices remain unchanged? What improvements in management practices, within the present use, are possible? What other uses of land are physically possible and economically and socially relevant? Which of these uses offer possibilities of sustained production or other benefits? What adverse effects, physical, economic or social, are associated with each use? What recurrent input e are necessary to bring about the desired production and minimize the adverse effects? What are the benefits of each form of use?

Certain principles are fundamental to the approach and methods employed in land evaluation. Land is often classified in terms of land capability and suitability. Land capability is viewed by some scientists as the inherent capacity of land to perform at a given level for a general use, and suitability as a statement of the adaptability of a given area for a specific kind of land use. Evaluation requires a comparison of the benefits obtained and the inputs needed on different types of land. Evaluation is made in terms relevant to the physical economic and social context of the area concerned.

1.8 INTEGRATED LAND MANAGEMENT

An integrated approach to land management identifies the social, economic, and environmental requirements of all stakeholders in society; develops possible land use options; and indicates the combination of options needed to optimally meet these requirements for the long term. It is a comprehensive approach to deal with the complexity associated to land resource. Integrated land management (ILM) is an interdisciplinary approach which visualizes use of land with different perspectives and identifies the best combination of land management option for the given piece of land or landscape. The logical sequence of procedures in an Integrated land management (ILM) approach includes the following:

- Provide opportunities for stakeholders, including decision makers, land management planners, land users, land owners, and beneficiaries of land services, to identify their requirements and needs.
- Collect information about the physical, social, and economic conditions of the land area, and use this information to evaluate current and potential land conditions.
- Identify spatial planning units for the land area, as well as options for each unit in terms of use; long term economic returns; input–output relationships; and predicted social, economic, and environmental impacts.
- Provide opportunities for the stakeholders to discuss and reach a consensus on the optimum land use and management system for each planning unit.
- Establish the institutional, legislative, and cadastral infrastructure needed to implement the agreed upon land uses and long term land management.

The ILM approach is not a fixed procedure but a continuous, iterative process of planning, implementation, monitoring, and evaluation, that strives to meet as many of society's economic, social, and environmental needs as possible without penalizing any sectors of society or sacrificing future benefits. The essential components of this approach are independent of scale and are therefore applicable at the global, national, district, village, and farm levels. However, although the basic technical ILM methodologies are already available, their application in many parts of the world is limited by training, financial, and institutional constraints. Access to appropriate technologies is a key to effective ILM on a global scale.

1.9 CONTRIBUTION OF SCIENCE AND TECHNOLOGY IN LAND USE MANAGEMENT

The solutions to the complex, interacting issues of land management require contributions from the physical, biological, and social sciences. Fortunately, most of the basic scientific knowledge and applied technologies needed for land management are already available. These include global satellite surveillance systems and powerful computer based GIS, as well as other methods for planning and evaluating land use, reducing wind and water erosion, and increasing the productivity of the land. Some of these technologies have been well developed for many years, whereas others are currently undergoing rapid development. Several are already being applied to land management problems around the world. However, in many cases, the critical technologies that are widely used in developed countries are not available in the developing countries, where they are most needed, which contributes to many of the environmental and socioeconomic problems currently experienced around the world. Even where technology and information are already available in developing countries, they are not at present optimally used because of ineffective information storage, retrieval, or sharing.

Typical examples of advanced information technology are the satellite images of the Earth, that indicate the conditions of the land and clarify the connections between different regions. Analysis of digital information from satellites and aerial photography allows us to accurately monitor land conditions over large areas and increases the value of traditional ground based surveys of soil properties, land use, crop productivity, mineral resources, and land ownership. Dissemination of this type of information in a form useful to all land use stakeholders requires a number of different approaches. The basic form of information needed for ILM is the map, either printed on paper in traditional formats or contained in computer based GISs. Obtaining and analyzing this information, are the first steps in identification of options for land management.

Remotely sensed data have proven indispensable for undertaking accurate soil surveys; evaluating deforestation, desertification, mining impacts and other forms of land degradation; evaluating the response of natural vegetation and agriculture to variations in climate, such as droughts, monsoons, low temperature and determining actual land use patterns, including urbanization and industrialization, as well as agriculture. Satellite imagery provides a powerful vehicle for guiding land use policies at the national, regional, and local levels. This information makes government policymakers aware of the large scale impacts of local

activities and provides a means of integrating local knowledge about effective land use practices into a regional or national land management framework.

1.10 CONSTRAINTS ON INTEGRATED LAND MANAGEMENT

Numerous barriers impede the effective implementation of ILM at both local and global scales. Some of these barriers can be removed by technology, but many result from the fact that existing technologies are unavailable where they are most needed. Removal of many of the barriers to ILM requires decisions about resource allocation at national and international levels. Barriers to ILM are of four general types: limited access to appropriate information and technology; weaknesses in institutional infrastructure; unsustainable land use practices; and conflicts between land use goals.

The starting point for ILM is information on the quality of land resources and their actual land use. This includes information on basic land properties, such as the potential for forestry, agricultural production, mineral extraction, and biodiversity; inherent limitations to the various forms of land; susceptibility to desertification, erosion, groundwater pollution, and other forms of degradation; distribution of land uses and ownership; regulatory constraints; and urban and industrial impacts. Unfortunately, for many critical land management situations in the developing world, the needed information either does not exist or is not available in a usable form.

A primary reason for the lack of basic information is the difficulty of obtaining access to the technological tools needed to collect and analyze information. Tools and scientific methods for evaluating the information needed to make land use and development decisions already exist, but they are not uniformly available in all parts of the world. In some cases, the funds to acquire the technology are insufficient; in other cases, the infrastructural and educational base to support the technology after it is acquired is inadequate. Effective transfer of specific technologies and knowledge from one country to another is hampered by the lack of common methods and definitions for basic land properties, such as soils, climate, land uses, and types of land cover. Standardized definitions for these properties are being developed through joint efforts of UNEP and FAO.

Lack of cooperation and communication between agencies may lead to duplication of effort and waste of resources. Inadequate institutional mechanisms for transferring information about market conditions and business opportunities may be as damaging as a lack of information about agricultural technologies. In some cases, technologies have been introduced without emphasizing their drawbacks, such as the toxic side effects of an overuse of biocides. Without a two way transfer of information, extension services are unable to create the required link between the farmer's needs and the research findings. Research institutes that concentrate on the well-endowed regions may produce results that have little relevance to the less-endowed regions. A rich fund of indigenous knowledge built up over generations can be quickly lost, reducing opportunities for sustainability. Hybridization of ecologically sound, indigenous farming and modern, high input agriculture may result in the most efficient use of inputs and create the best chance for economic feasibility, with minimal ecological side effects.

1.11 LAND USE PATTERN AND LAND MANAGEMENT IN INDIA

Geographical area of India is 32.87 lakh square kilometers which represents only 2.4% land of the world. India accommodates over 17% world population. Due to high population, per capita land availability in India is less than 0.3 ha, which is lowest in the world. About 72% population in India lives in rural areas while the world average of rural population is about 50%.

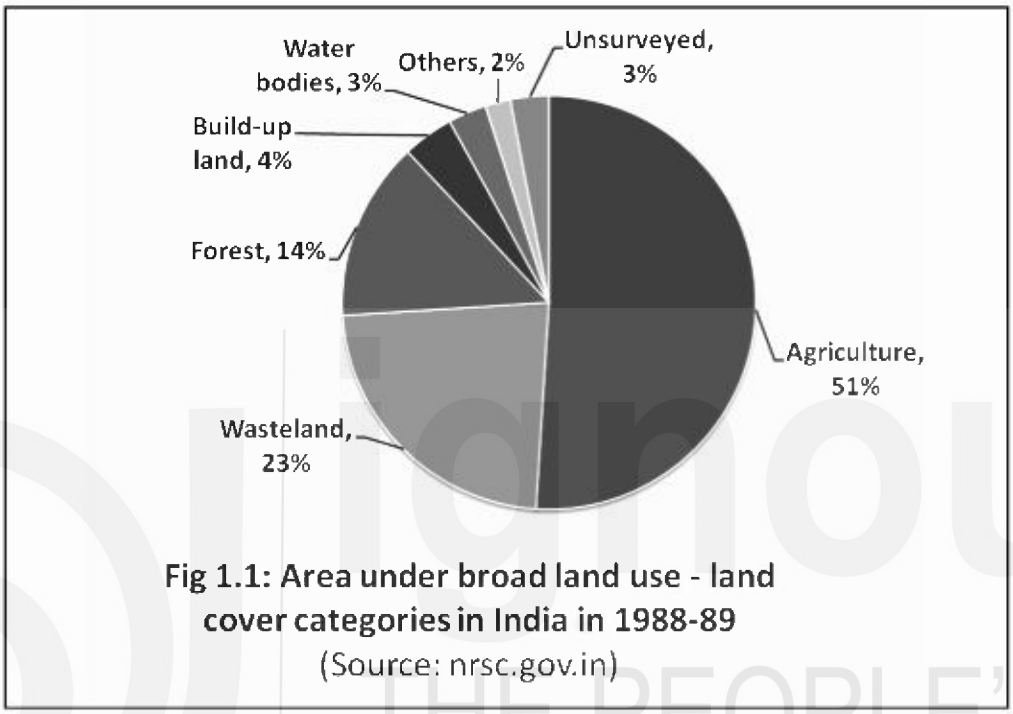

Fig 1.1: Area under broad land use - land cover categories in India in 1988-89
(Source: nrsc.gov.in)

Fig. 1.2: Area under broad land use – land cover categories in Indian in 1988-89

Source: nrsc.gov.in

The pattern of land use in the country is determined by geophysical, economic and institutional factors, i.e., the existing land use pattern in different regions have evolved as a result of interaction of these factors. Area under broad categories of land use- land cover in the years 1988-99 is illustrated in the given pie-chart. It shows, that agriculture occupies more than half of the total area of the country. A large part of the total land is rendered as waste land due to natural as well as anthropogenic reasons. Forest area is about 14% of the total land, which in fact represents the area occupied by dense forests. As per another survey done in 2001, total area under forests is about 20.55% in India. The variation in the figure is largely due to different survey criteria or methodologies used to measure area. Build up area is about 4% is which is gradually increasing year after year as a result of increasing urbanization.

India has a diverse agro-climate, topography and soil types, on the basis of which it has been categorized into various regions. Major part of the country is rainfed. Rainfall, therefore, constitutes an important parameter in the classification of the country into various regions for the purpose of planning. National and regional land use planning is facilitated by the Agro-Climatic Regional Planning Project of the Indian Planning Commission. The Commission has divided the country into 15 agro-climatic regions for allocation of technical and scientific inputs to

the agriculture and allied sectors. These zones have been created on the basis of climate, in combination with soil and other factors that affect the agriculture in the region.

Land use management is one of critical concerns for the country. In 1991, the National Consultation on the Prospective Plan for Conservation, Development, and Management of Land Resources identified major policy issues and called for an integrated, scientifically sound approach to the management of land resources in the country. Initiatives that have been taken include, comprehensive land use planning to govern mining, quarrying, industrial uses, and urban development; coordination of related sectoral policies, such as the National Forest Policy, National Water Policy, National Housing Policy, and National Land Use Policy; higher priority for protective and regeneration aspects of forestry; diversification of agriculture, with special attention to problems of soil salinity, water logging, acidity, and drought prone and desert areas; mitigation of hazards, such as floods and earthquakes, in susceptible areas; proper training of personnel; and continued updating of the information on land resources in India through remote sensing and computerized data banks.

Considering the multiplicity of factors, that govern land use decisions in the country like India, a holistic and integrated approach to land use planning and management is required for sustainable development. Both advanced and traditional technologies have an essential role in integrated land use planning and management. There is need to work for developing four basic components of integrated land management. These are information, involvement, empowerment and facilitation. Government policies will have to foster the above components, in order to cater the needs of huge population of the country whose economy largely depends on the productivity of its agricultural land.

At the time of independence, ownership of land was concentrated in the hands of a few. This led to the exploitation of the farmers and was a major hindrance towards the socio economic development of the rural population. Equal distribution of land was therefore an area of focus of Independent India's government, and land reforms were seen as an important pillar of a strong and prosperous country. Department of Land Resources under the Ministry of Rural Development is the nodal agency for matters related to land reforms including distribution of ceiling surplus land, computerisation of land records and updating of land records.

The system of land records management varies from State to State, often even within a State, depending upon their historical evolution and local traditions. Several departments are involved in managing land records in most of the States, and the citizen has to approach 3 to 4, or even more, agencies for complete land records, e.g., Revenue Department for textual records and mutations; Survey & Settlement (or Consolidation) Department for the maps; Registration Department for verification of encumbrances and registration of transfer, mortgage, etc.; the Panchayats (in some States, for mutation), and the municipal authorities (for urban land records), leading to wastage of time, exposure to rent seeking, and harassment.

In 2008, it was decided to merge the two existing Centrally-sponsored schemes of Computerization of Land Records (CLR) and Strengthening of Revenue

Administration & Updating of Land Records (SRA&ULR) and to replace them with a modified Centrally-sponsored scheme in the shape of the National Land Records Modernization Programme (NLRMP), with the ultimate goal of ushering in the system of conclusive titles with little guarantee in the country.

Check Your Progress 2

Note: a) Use the space given below for your answer.

b) Compare your answers with those given at the end of the unit.

1) How are science and technology helpful in land management?

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2) What are the major constraints in integrated land management?

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1.12 LET US SUM UP

- Land is a natural resource, that supports different aspects of human life including food production for huge world population.
- The failure to manage land resources in an integrated, holistic manner has led to a number of serious problems and barriers to sustainable development.
- Sustainable land management is defined, as a knowledge based procedure, that helps to integrate land, water, biodiversity and environmental management to meet human needs while sustaining ecosystem services.
- Science and technology play crucial role in integrated land management. Remote sensing technologies are particularly useful in land use evaluation and planning.
- Numerous barriers impede the effective implementation. These include unavailability of information, coordination and technology required for land management.
- Four basic components are required for integrated land management for most of the countries: information, involvement, empowerment and facilitation.

1.13 KEY WORDS

Soil : Layer of unconsolidated particles derived from weathered rocks, organic material, water and air that support plant growth.

Land Utilization Types : Typology to define land use in more details than major land use type and it consists of a set of technical specifications about land.

Land Suitability : Statement of the adaptability of a given area for a specific kind of land use.

Land Capability : Land capability is the inherent capacity of land to perform at a given level for a general use.

Integrated Land Management : An integrated approach to land management that balances the social, economic, and environmental attributes of a piece of land.

Remote Sensing : Technology to sense object from distance; for example using satellite imageries.

1.14 REFERENCES AND SUGGESTED FURTHER READINGS

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Relevant Websites :

- http://www.dolr.nic.in
- http://www.icar.org.in (To understand Agroecological zoning of the country)
- http://www.nrsc.gov.in (To understand use of remote sensing for land use management)
- http://www.fao.org/nr/land/use/(Food and Agriculture Organization)

1.15 KEY TO CHECK YOUR PROGRESS

Check Your Progress 1

1) Your answer must include the following points:
    - Land is used for growing agricultural crops (including horticultural and plantation crops as well as the medicinal plants and ornamentals)

- Land supports various social, economic, cultural aspects of human life

2) Your answer must include the following points:
   - Land use intensification for short term gains
   - Lack of proper land use management

Check Your Progress 2

1) Your answer must include the following points:
   - Science and technology provides information and technological support for land management
   - Remote sensing helps in land use planning and evaluation

2) Your answer must include the following points:
   - Unavailability of sufficient technologies
   - Lack of co-ordination between the management agencies