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# BIODIVERSITY : LIFE TO OUR MOTHER EARTH

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## Abstract

*The term biodiversity refers to the wealth of the earth, viz., the millions of plants, animals and microorganisms that live on our mother earth, the genes they contain, and the intricate and often delicate ecosystems they formulate. Human beings can coexist only with the abundance and diversity of nature. Living things are interdependent, intricately linked in birth, death and renewal. Human beings are just one small part of this voluminous and vibrant mosaic, yet they inflict increasing pressure and pain on species and the environment. As a result, many plants and animals are at risk and under threat of extinction. They deserve our conservation.*

## INTRODUCTION

India has a geographic area of 329 million hectares. The country has almost all the climates found in different parts of the world, ranging from perpetual snow cover to near equatorial or tropical conditions and from mangroves to humid tropics, to hot and cold deserts and everything in between such extremes.

India is one of the World's richest countries in terms of its vast array of biodiverstiy. Biodiversity forms the foundation for sustainable development. It is the basis for the environmental health of our planet and the source of economic and ecological security for future generations.

The planet earth is under heavy human population pressure. India is the second largest country in the world in terms of population size. This population explosion represents a catastrophic scenario, as it exerts severe stress on our biological resources. The biological resources for our survival and sustainable development are increasingly being depleted or destroyed, because of man's greed. Improper management of the biological resources is having serious implications and it is evident from the reduced forest flora and fauna, intensive droughts and floods, depletion of ground water level, loss of grazing lands, degradation of healthy soil and the deterioration of the quality of air and water. There are millions of species of plants and animals; every single variety could be valuable one day or the other. Human beings cannot exist without the abundance and diversity of these biological resources. The biological resources of a country are of primary importance for the economic development; hence conservation of biological resources are very important for the economic life of a nation.

Biodiversity is a part of the biosphere supported by biological processes and organic evolution. Extinctions in the past have been the result of many cataclysmic changes on the Earth. However, the causes for the present perturbations arise from human activities.

## BIODIVERSITY

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Human beings can coexist only with the abundance and diversity of nature. Living things are interdependent, intricately linked in birth, death and renewal. Human beings are just one small part of this voluminous and vibrant mosaic yet they inflict increasing pressure and pain on species and the environment. As a result, many plants and animals are at risk and under threat of extinction. They deserve our role for their conservation.

All our food, many of our industrial materials and medicines are provided by plants, animals and microorganisms. Animals supply meat, leather and insulin. Plants give us rubber, timber, cotton and are used to manufacture diverse items such as glue, soaps, photographic film and plastics. Antibiotics like penicillin are derived from microorganisms. The wider the variety of species, the wider is the range of natural resources potentially available. We also rely heavily on these, many of which, being a variety of ecosystems, fulfill important environmental functions. Forests help to prevent the soil being washed away by rain and rivers, safeguard against flooding, absorb carbon dioxide, and produce oxygen. Wetlands and the life they contain, help to clean water by trapping sediments, nutrients and harmful bacteria.

Biodiversity has three components:

1. Genetic diversity (Genetic variations within species)

2. Species diversity (The variety of species)

3. Ecosystem diversity (The variety of ecosystems)

## 1. Genetic diversity

The physical and bio-chemical composition of all living things depend on genes inherited from their parents. Some species, such as rice, contain thousands of distinct genetic varieties. Genetic diversity allows different animals and plants to flourish in different conditions. **Absence of genetic diversity is very dangerous**.

### Biosphere reserve

Biosphere reserves are multi-purpose protected areas to preserve the genetic diversity in the representative ecosystem. The major objectives of biosphere reserves are:

- To conserve diversity and integrity of plants, animals and microorganisms.
- To promote research on ecological conservation and other environmental aspects.
- To provide facilities for education, awareness and training.

Some prominent biosphere reserves are Nilgiris, Manas and Sundarbans.

## 2. Species diversity

A species is a group of organisms that are so genetically similar that they can interbreed and produce fertile offspring. Species diversity refers to the number and variety of species that occur within a geographical region or ecosystem.

## 3. Ecosystem diversity

The wide variety in physical features and climate situations has resulted in a diversity of ecological habitats like forests, wetlands, grasslands, coastal, marine and desert ecosystems which harbour and sustain immense biodiversity.

An ecosystem is made up of communities of plants, animals, microorganisms and the non-living elements of their environment (soil, water, minerals, etc.). Ecosystem diversity describes the number of species and their relative abundance within a community. Low diversity means that there are few species or unequal abundance, while high diversity means that there are many species or balanced abundance.

**Reasons for the Loss of Biodiversity**

The major reasons for the loss of biodiversity are:

- Newly introduced species in the environment
- Over - exploitation of natural resources
- Pollution
- Inappropriate agricultural practices
- Global warming
- Population explosion and poverty
- Habitat destruction
- Over-hunting /Commercial exploitation
- Environmental degradation
- Lack of knowledge
- Poor management
- Industrialization
- Urbanization
- Damage to farmlands

The current loss of biodiversity is so rapid that urgent action is necessary.

**Convention on Biological Diversity (CBD)**

The UN Conference on Environment and Development (**UNCED**) held at Rio De Janeiro in 1992 engendered the 'Convention on Biological Diversity' **(CBD)**.

India is a party to the Convention on Biological Diversity (1992). Recognizing the sovereign rights of States to use their own biological resources, the Convention expects the Parties to facilitate access to genetic resources by other Parties subject to national legislation and on mutually agreed upon terms (Article 3 and 15 of CBD). Article 8 (j) of the Convention on Biological Diversity recognizes contributions of local and indigenous communities to the **conservation and sustainable utilization of biological resources** through traditional knowledge, practices and innovations, and provides for **equitable sharing of benefits** with such people arising from the utilization of their knowledge, practices and innovations.

Biodiversity is a multi-disciplinary subject involving diverse activities and actions. The stakeholders in biological diversity include the Central Government, State Governments, Institutions of local self-governmental organizations, Industry, etc. One of the major challenges before India lies in adopting an instrument, which helps realize the objectives of equitable sharing of benefits enshrined in the Convention on Biological Diversity.

**World Wide Fund for Nature (WWF)**

WWF's works (1994) to conserve biological diversity through six strategies. They are:

- ✶ Creating and maintaining systems of effective and sustainable protected areas
- ✶ Promoting sustainable development practices, thereby linking conservation with human needs
- ✶ Conserving species of special concern
- ✶ Reducing consumption and pollution by influencing public policy and the practices of consumers and business/industry
- ✶ Promoting the establishment and implementation of international treaties, national policies and legislation
- ✶ Promoting environmental education and building capacity to enable people to sustainably manage the natural resources on which life depends

**Food and Agriculture Organisation (FAO)**

**FAO** helps to provide policy guidelines that regulate the conservation and sustainable use of biological diversity.

The **Code of Conduct for Responsible Fisheries**, adopted in 1995, sets out principles to conserve, manage and sustainably use living aquatic resources. The Code works to protect the world's marine, coastal and inland waters with due respect for biodiversity and the ecosystem. FAO encourages all countries to implement this voluntary Code including provisions with binding effects.

A Model **Code of Forest Harvesting Practice** was published in 1996 to encourage improved management to help conserve forests. Codes have been developed for the Asia-Pacific and, West and Central African regions.

The aim of the **International Plant Protection Convention** is to protect plants by setting standards for pest control. The convention protects biodiversity by preventing the introduction of pests including invasive alien species that may out-compete local plants or animals.

**FAO International Treaty on Plant Genetic Resources for Food and Agriculture (2004)**

This legally binding instrument is crucial for sustainable agriculture. It provides a framework for national, regional and international efforts to conserve and sustainably use

plant genetic resources for food and agriculture and for sharing the benefits equitably, in line with the Convention on Biological Diversity. The Treaty contains two important and unique elements. First, it recognizes the enormous contribution made by farmers in all regions of the world towards the conservation and development of plant genetic resources and identifies ways of protecting and promoting Farmers' Rights. Second, it establishes a multilateral system of access and benefit sharing. This will ensure that countries have access to some of the most important plant genetic resources needed for food security. It identifies a range of benefits to be shared on a multilateral basis – benefits like information exchange, technology transfer and access, building capacity at local levels, monetary and other benefits of commercialization. Benefits are targeted mainly to developing countries and countries with economies in transition to help ensure that they will have the capacity to conserve and sustainably use their own genetic resources as well as any benefit they may obtain under the multilateral system.

**Biological Diversity Act, 2002 (INDIA)**

After an extensive and intensive consultation process involving the stakeholders, the Central Government has brought Biological Diversity Act, 2002, with the following salient features:

i. To regulate access to biological resources of the country with the purpose of securing equitable share in benefits arising out of the use of biological resources; and associated knowledge relating to biological resources.

ii. To conserve and sustainably use biological diversity.

iii. To respect and protect knowledge of local communities related to biodiversity.

iv. To secure sharing of benefits with local people as conservers of biological resources and holders of knowledge and information relating to the use of biological resources.

v. Conservation and development of areas of importance from the standpoint of biological diversity by declaring them as biological diversity heritage sites.

vi. Protection and rehabilitation of threatened species.

vii. Involvement of institutions of state governments in the broad scheme of the implementation of the Biological Diversity Act through constitution of committees.

**National Biodiversity Authority (NBA), INDIA**

The **National Biodiversity Authority (NBA) was set up under the Biological Diversity Act, 2002**; it also deals with request for access to genetic resources by foreigners. The NBA is a regulatory body, protecting the country's extensive resources and ensures economic benefits to local communities.

Professor S. Kannaiyan is presently the Chairman of NBA; the NBA office is housed at 475, 9th South Cross street, Kapaleeswarar Nagar, Neelangarai, Chennai -600 041, Tamil Nadu.

**India - the Mega Biodiverstiy Country**

India is one of the 12 mega biodiverstiy countries in the world. India is rich in endemic species. **With only 2.5% of the land area, India already accounts for 7.8% of the global recorded species. India is also rich in traditional and indigenous knowledge, both coded and informal.** It has immense natural and genetic resources. Other mega diversity countries are:

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|---|---|---|
| **1. Mexico** | **2. Colombia** | **3. Ecuador** |
| **4. Peru** | **5. Brazil** | **6. Zaire** |
| **7. Madagascar** | **8. China** | **9. Malaysia** |
| **10. Indonesia** | **11. Australia** | |

Endemic species are species that have restricted distribution due to their rare presence in number, i.e., the uniqueness of the flora and fauna in the given region. These areas are called Hotspots. Among the twenty five hotspots identified in the world, two are in India; they are **Eastern Himalayas and Western Ghats**. There are also other rich areas such as North East India and Andaman and Nicobar islands in India.

**Biodiversity Indexing**

The process of correctly identifying organisms, mapping their distributions to understand their ecological position and process of evolution, vouchering the identified organism and integrating this information into internationally accessible database is called **Biodiversity Indexing.** Indexing organisms set the stage for investigating their relationships to other organisms and for organizing knowledge into classification system. These systems, in turn, are powerful tools that help us to understand, maintain and effectively utilize the great biological wealth that we have inherited.

**Why is biodiversity essential to people?**

Biodiversity is essential because we depend on other species and the ecosystems they create. Biodiversity gives us:

- Ecosystem services, such as the fresh air, clean water and productive soils that we need to survive.
- Food**,** medicines and natural products that keep us healthy.
- Economic benefits that maintain a healthy economy.
- Natural beauty that we enjoy improves our quality of life.

- A community of life, with which we share planet Earth, and the opportunity to practice thoughtful stewardship.

## LAND: A LIMITED NATURAL RESOURCE

Land is the true and the most important resource inherited by human beings. Land means different things to different people as space, nature, gene resource, production factor, consumer goods or commodity, source of pleasure and recreation, location, property and capital.

The basis of agriculture and civilization mainly depends on the soil of an area. The soil, which serves as the natural home for all plants, animals and human beings, directly or indirectly depends upon plants for their food supply. Soil provides mechanical support for plants. It is the crucial life-supporting system, since the bulk of all food production depends on it.

Topsoil is necessary for the growth of plants. Topsoil is a living world in itself. It is woven through with organic life, inhabited by billions of organisms. Man is dependent for his food upon this invisible living world within the soil. Land is a limited natural resource that cannot be expanded but that can be put to use more than once by introducing short duration, high yielding varieties of crops. The use of fertilizers in the recent years and also modern mechanical methods for high yield have modified the fertility of soil. If current rates of land degradation continue, most of the arable land may be destroyed in the coming years. Hence, this trend should be rectified by proper soil management. Productive land is the source of human sustenance and security.

## CLIMATE AND LAND - SURFACE SYSTEMS

Climate and land-surface systems are dynamically coupled through the physical processes of energy and water fluxes. Vegetation plays a major role in regulating water transport to the atmosphere. Changes in land use, such as conversion of forests to agricultural land, affect the physical aspects of the climate system.

Climate change threatens countless species of plants and animals. Global warming, increased intensity and frequency of extreme weather events are predicted to have dramatic and damaging effects on the biodiversity. Many ecosystems have already been identified as specially vulnerable to climate changes.

## FOREST: A NATURAL ASSET OF GREAT VALUE

Forests are self sufficient energy-rich ecosystems. They are not merely groups of trees but large communities of diverse organisms which interact with living and non-living components of the environment. We depend on forests for every need of our life and all basic requirements. Forests continue to supply us with vital natural resources, produce oxygen, absorb carbon dioxide and prevent the soil from erosion. We are

dependent on them not only for food, medicine, shelter, fuel and other products but also for wildlife.

Forests form a major factor of environmental conservation and have an appreciable effect on the climate. They offer protection to the wide array of animals. Forests tend to increase local precipitation, enrich soil with fallen leaves, and regulate water flow in hills and prevent soil erosion. Forests supply timber, fuelwood, pulpwood and support varied industrial activities, offer employment and are gene reserves for both flora and fauna. Each forest type has its own distinctive features with its own flora and fauna, life form structure and habitat. Forests have many beneficial influences on mankind, both direct and indirect. It is a natural asset of great value, which is renewable and the most self generating of all ecosystems.

## WILDLIFE: OUR BIOLOGICAL HERITAGE

The term wildlife is commonly referred to represent the non-domesticated animals living in a natural habitat. But, in its widest sense, it includes all flora and fauna of the natural habitat. Our country is endowed with a particularly rich biological heritage. It is a great natural wealth. Some of them are the mighty elephant, the spotted deer, the black buck, the one horned rhinoceros and the prestigious lion and the tiger. But today our wildlife wealth is poorer than ever. Our wildlife resources need serious economic management; only then there will be a suitable platform upon which to build our conservation programme. Our wildlife is our greatest heritage and if once destroyed, wild life can never be restored.

## ENDANGERED FLORA AND FAUNA OF INDIA

Endangered (E) are taxa in danger of extinction and whose survival is unlikely if the causal factors continue operating. These are taxa whose numbers have been so drastically reduced that they are deemed to be in an immediate danger of extinction.

The main causes of extinction are due to natural phenomena, such as land upheavals, volcanic eruptions, glaciation, protracted periods of rain or drought, desertification of lands, forest fires and eutrophication in the geological past. While such natural processes in the past had no doubt led to the extinction of flora and fauna, the resulting new environmental conditions have also resulted in the evolution and speciation of newer floral and faunal species and their migration. But, in recent times, man with his anthropogenic associates and other factors or practices such as fire or **"slash and burn"** for shifting cultivation, grazing by cattle and by several other mechanical means, has suddenly accelerated disastrous conditions in natural ecosystems. Besides, commercial exploitation of entire plants, roots, rhizomes, tubers, bulbs, seeds and fruits has been the prime cause of depletion of more important wild economic plants throughout the world for lucrative financial gains in the trade which flourishes both by legal and illegal means.

## MEDICINAL PLANTS: A BASIC RESOURCE FOR HUMAN HEALTH

Medicinal plants have always been a basic resource for human health. Without plants, most medicines we take would not exist. India has immense wealth of medicinal plant resources and a knowledge system of their utilisation.

Forests are repositories of valuable gene pool. It is estimated that around 95% of the medicinal plant species occur in the wild. In the area of conservation of natural resources, preservation of medicinal plants in the wild and their cultivation outside their natural habitat has assumed significance.

The World Health Orgnisation (**WHO**) has been promoting a movement for **"Saving Plants for Saving Lives"**. This is because of the growing understanding of the pivotal role medicinal plants play in providing herbal remedies to health maladies. India is the home of several important traditional systems of health care like Ayurveda, Siddha and Unani. All these systems depend heavily on herbal products. Over 800 medicinal plant species are currently in use by the Indian herbal industry.

Medicinal plants contain a variety of organic compounds, many of which are pharmacologically active. Medicinal plants are flowering plants in great majority, but ferns, mosses, lichens, fungi and bacteria are also known for their medicinal use in traditional medicine. Medicinal plants, mostly from the wild, have been collected traditionally. Rural areas still have a wealth of resources and knowledge about medicinal plants. The so-called system of native medicines has come into existence by compilation of such health care tradition in the rural population of the ancient times.

Some such significant medicinal plants that have emerged from India are *Rauwolfia serpentina, Centella asiatica, Adhatoda vasica, Andrographis paniculata, Asparagus racemosus, Azadirachta indica, Curcuma zedoria, Emblica officinalis, Garcinia indica, Gymnema sylvestris, Indigofera suffruticosa, Phyllanthus amarus, Psoralea corylifolia, Saraca indica, Sida acuta, Santalum album* and *Withania somnifera.*

## DESERT ECOSYSTEMS

Desert ecosystem is characterised by low precipitation, arid lands with expanse of sands, rock or salt, which are largely barren except for sparse or seasonal vegetal cover. Species in this habitat are adapted to extremely harsh, water-scarce environment.

Deserts in India are classified into three distinct types, they are

- The sandy desert
- The vast salt desert
- The high altitude cold desert

**WATER: MAN'S PRECIOUS NEED**

The planet earth is made up of land and water, and three-fourth part of it is constituted by sea. The oceans hold 97.61% of the total water available and 2.08% is bound in the form of ice caps. The balance of 0.31% constitutes the freshwater of the earth. Out of this, about 40% is lodged in the deeper strata of the earth, i.e., below 300 m and hence we are left with only 0.124% of total earth's water, which is present in rivers, streams, lakes, wells and tubewells.

Agriculture is the backbone of India's economy; hence, water is the most valuable natural wealth. An idea about the present and future demands for water for irrigation, industries, thermal power generation and public health, is necessary. Fresh water is man's precious need. The freshwater present on the surface of the earth is put to multifarious uses. It is used for drinking, domestic purpose, agricultural irrigation, industries, recreation, etc. After being used in the above mentioned human activities, the water flowing out becomes contaminated and is called as waste water. The escalating human population and its mounting pressure on natural resources result in the amplification of the waste products. The pollutants are thus generated as domestic wastes, sewage, industrial effluents and agriculture effluents. Domestic and industrial wastes emanating from the houses and industries find their way ultimately to rivers. The pollutants meeting the rivers or ponds or lakes cause increase in temperature (thermal pollution), change in chemical composition of water (chemical pollution), spreading oil over the surface, causing depletion of oxygen and reduction in the free exchange of gases between the atmosphere and water (oil pollution). Radioactive wastes also enter into water and cause damage to plant and animal life inhabiting it (radioactive pollution). This pollution is capable of bringing mutagenic changes in plants, animals and even in humans.

Demand for water is increasing day by day, whether it is for agriculture, industry or drinking. The growing need for water to man even in areas with adequate rainfall has posed water problems in recent years, which resulted in the level of water table being depleted. Streams were abundant and flowed throughout the year once upon a time, but now they are dry most of the time. In areas, where natural vegetation is removed for urbanization and agricultural purposes, floods are of common occurrence in the rainy season. The rainwater, which is absorbed into the soil now, runs off rapidly causing great damage to cropland and property. **For sustained human activity, water resources such as ground water, surface water and rainwater should be harnessed.**

## WETLANDS: THE MOST PRODUCTIVE AND MOST THREATENED ECOSYSTEM

Wetlands are among the most productive and most threatened ecosystems. India has a wealth of wetland ecosystems distributed in different geographical regions. Most of the wetlands in India are directly or indirectly linked with major river systems. Some of our wetlands like Chilka lake in Orissa, Keoladeo Ghana National park in Bharatpur, Loktak lake in Manipur, Wular lake in Jammu & Kashmir are included in the list of **wetlands of international significance or commonly known as Ramsar sites.**

Wetlands are present all over the world; some wetlands are fresh water, some are marine (Swamps, Marshes and Estuaries). A wide range of fish, birds, reptiles and mammals make their homes in wetlands, some permanently, others temporarily. Many fish breed and mature in rivers and estuaries before going out to spend the rest of their lives at sea. Around two-thirds of all the fish consumed by people depend on coastal wetlands at some stage of their life cycle.

Wetlands are vitally important to human beings, fulfilling many of the subsistence needs of local people and providing numerous saleable products. They can supply food, building materials, fuel and clean water, recharging of aquifers, stabilization of shorelines against wave erosion and **help to protect coastal homes and farmland from storms and floods**. So it is very vital to conserve the wetlands. To keep the wetlands and all the benefits they provide intact, people must use them sustainably and not to pollute them with solid and liquid wastes. Appropriate management of the country's wetlands, valuation of wetlands in economic terms and the involvement of local stakeholders, the corporate sector and other user agencies will go a long way in protecting and sustainably managing this invaluable resource.

## AGRICULTURE : THE ECONOMIC LIFE OF THE PEOPLE OF INDIA

For farms to be sustainable, it must produce adequate amounts of high quality food, protect its resources and be both environmentally safe and economically profitable. Instead of depending on purchased materials such as chemical fertilizers and pesticides, a sustainable farm relies on beneficial natural processes and renewable resources drawn from the farm itself, encompassing **Integrated Pest Management (IPM), Integrated Nutrient Management (INM)** and **Integrated Agroforestry Systems.**

## AGROFORESTRY

According to **ICRA**, Kenya, Agroforestry systems perform a multitude of services for farmers, for farms and for the environment as a whole. Agroforestry also provides a wealth of products and because agroforestry is a holistic use of land, it is often difficult to separate services from the many products coming from such systems. No

agroforestry system produces just one product or performs just one service. Agroforestry performs a multitude of services such as providing food security, conserving and enhancing soil fertility, stabilizing water sheds, protecting biodiversity, providing living fences for crops and fruit trees, demarcating boundaries, controlling weeds and reclaiming degraded lands.

## SUSTAINABLE AGRICULTURE

From the ancient periods of human civilization the demand for fuel, food, fruit, fodder, fertilizer, fibre, etc., was met in a sustainable manner from the farmland. But the difference between the present trend and earlier methods in the use of land brings us to understand the concept of Sustainable agriculture. Sustainability basically refers to the capacity of the resource base to maintain continuous productivity. It embraces several variants of non-conventional agriculture that are often called organic, alternative, regenerative, ecological or low-input.

According to FAO "Sustainable Agriculture should involve the successful management of resources for agriculture to satisfy changing human needs while maintaining or enhancing the quality of the environment and conserving natural resources".

Biological nitrogen fixation is the key to sustain agriculture productivity. Biofertilizers or living fertilizers composed of microbial inoculants or groups of microorganisms have an ability to fix atmospheric nitrogen from non-usable to usable form through the biological process. These microorganisms are known as biological $N_2$-fixers. Apart from $N_2$ fixation these microorganisms are known to produce growth promoting substances which favour better growth of crops. Earthworm castings are highly rich in plant nutrients. Earthworms are used in converting garbage or organic wastes into wealth called vermicompost. This is an excellent source of nitrogen and hence acts as an alternative to the costly synthetic nitrogen fertilizers.

The role of small animals such as honey bees in the pollination of crops, insects that feed on plant pests, birds and snakes that control rodents in fields, and earthworms that enrich the soil, all these play a very important role in preserving the ecological balance. Thus we see the need for biodiversity where different organisms and plants depend on each other for survival.

## BIODIVERSITY IS FUNDAMENTAL TO AGRICULTURE AND FOOD PRODUCTION

A rich variety of cultivated plants and domesticated animals serve as the foundation for agricultural biodiversity. Yet people depend on a few animals and plants for their food supply.

From the millions of genes that serve as life's building blocks to the thousands of plants and animals that inhabit the Earth to the almost limitless combinations of

organisms that make up natural ecosystems, biodiversity makes an essential contribution to feeding the world.

Biodiversity will be a key ally in fighting malnutrition. It deserves our protection

**RICE CULTIVATION: A MICROCOSM OF THE WEB OF LIFE**

Rice fields are an extremely rich reservoir of biological diversity – in one rice field FAO found more than 700 species of insects and other organisms. At the bottom of this food chain are bacteria and tiny aquatic plants. These organisms are eaten by microscopic animals, which in turn, are eaten by mosquito and midge larvae. The larvae provide nourishment for larger predatory insects, whose presence ebbs and flows as rice is planted, grown and harvested. During the Green Revolution in Asia, heavy insecticide use was introduced along with modern high-yielding rice varieties. But after devastating infestations by the brown planthopper, farmers realized that the chemicals also knocked out natural predators. Through farmer field schools, integrated pest management techniques help farmers to recognize insects and treat only those that threaten their crop. As a result, chemical use is down and rice yield is up. FAO welcomes the continued use of ecological methods of growing this essential crop.

**BENEFICIAL INSECTS**

Honey bees are social insects which are beneficial to man in many ways. They are also called as productive insects. Honey bees are the best cross pollinating agents of the plants. They produce valuable products, which are economically important. The valuable products are nutritious honey and wax. Apiculture is a beneficial industry, which gives profit, if managed properly.

Sericultrue is an agro-based cottage industry, which generates gainful employment opportunities; the end product is silk. The silk producing machine is an insect called the silk moth. The silk worm, in its life cycle after the caterpillar stage, stops feeding and secretes a sticky fluid through a spinneret which takes the form of a long fine thread of silk. This is a cottage industry, which involves 60% of the women labour force, thus improving the social status of women. Silk industry plays an important role in the economic development of a nation.

Lac is the resinous protective secretion of the tiny lac insect. Lac insect (*Kerria lacca*) previously known as *Laccifer lacca* is a minute, resinous, crawling scale-insect which inserts its proboscis into plant tissues, sucks juice grow and secrete lac from lac glands. The lac secreted by the insect is actually for its protection and not for the food of the insect. Lac insects and their products have beeen known to naturalists since very early times. Lac is one of the most versatile natural resinous material. It has a unique combination of properties, which renders it useful for a variety of applications in the plastics, electrical, adhesive, leather, wood finishing and other industries. In Ayurvedic

medicine, lac is widely used both for external application as well as internal administration. Lac cultivation can be carried out in forest and sub-forest areas where suitable host trees grow.

## LIVESTOCK WEALTH

India has the world's largest diversity of domesticated animals, with some 26 breeds of cattle, 40 of sheep, 20 of goats, 8 of camels, 6 of horses and 18 of poultry, apart from yak, the mithun, and several species of birds including geese, ducks, pigeons, and doves (CSIR 1970; Mohapatra and Panda 1981; Khanna 1993; and Sahani 1993).

In India, livestock sector is a crucial component of the agricultural sector, though often it is considered as secondary to the latter. Cattle, in particular are the backbone of Indian agriculture. Sheep, cattle, horse, pigs and poultry contribute to several products of economic value like hides, skin and products rich in proteins like milk and meat. Animal husbandry generates wealth and employment in the agriculture sector. Development of animal husbandry, poultry and dairying has received a high priority in the efforts of diversifying agriculture, increasing animal protein availability in the food basket and for generating exportable surpluses. Animals are food factories converting vast quantities of crop residues, which have little value, into valuable food. Animals are vast Power Houses generating an enormous quantity of energy. Animals are huge "fertilizer plants" producing enormous quantity of organic manure to protect soil health and promote crop production. Livestock can generate a large quantity of energy, which can improve the quality of life. India's economy is closely knit with her livestock and it is of utmost importance to implement proper management of livestock wealth, protecting them against diseases and parasites.

## FISHERY: THE AQUATIC WEALTH

Marine as well as fresh waters, both constitute the fish resource. The wealth from the sea is immense and hence we should conserve this natural wealth wisely and not over-exploit it. 4/5th of the world's protein requirement are met by the sea animals. It is the most productive ecosystem in terms of energy in the world. An integrated approach to marine and inland fisheries has been designed to promote sustainable aquaculture practices. Man's demand upon fish diet is increasing and this has led to overfishing. The problems that we have encountered are clearly visible and forewarn us not to exceed the natural carrying capacity of an area in order to maintain a sustainable environment around us. A well planned strategy for fish culture, harvesting and management can considerably increase this potential aquatic wealth.

## MANGROVES : A TREASURE

Mangroves are salt tolerant ecosytems of tropical and subtropical intertidal regions of the world. Mangrove ecosystems are reservoirs of many species of plants and animals. The flora and fauna provide the source of livelihood and avenues to gainful

employment of the people inhabiting these regions. Some of the Mangroves are the source of flourishing apiary industry. **They prevent soil erosion and encroachment by the sea to the interior.** It is worth noting that the coastal vegetation like the algae including seaweeds and the mangroves play a significant part in enriching the coastal sea. They transport through their ecosystems dissolved organic matter, nutrients and thus, support the benthic population of the sea.

Mangroves are found all along the Indian coastline in sheltered estuaries, tidal creeks, backwaters, salt marshes and mudflats. It is well known that the resource of mangrove ecosystem comprises the swamp, forest and land within its water-spread areas. The management of mangrove forests should aim primarily at protecting, conserving and augmenting the compendium of natural resources to optimum use. The mangroves should be first realised and appreciated for their pivotal role in biodiversity and with judicious management, they will be a source of perennial benefit to the Nation.

## CORAL REEFS

Coral reefs are shallow-water tropical marine ecosystems, which are characterised by a remarkably high biomass production due to upwelling of water. These are areas of high biodiversity on account of rich availability of nutrients. Large varieties of fauna, especially corals and coral reef fishes, occur in these ecosystems. Coral reefs are divided into three major groups, they are

- Fringing reefs
- Barrier reefs
- Atolls

Four coral areas have been identified, viz., Gulf of Mannar, Andaman and Nicobar Islands, Lakshadweep Islands and Gulf of Kutch, for conservation and management.

## NEED FOR GENETIC CONSERVATION

It is most prudent to conserve all genetic resources since any genotype once extinct, cannot be restored to life.

### CONSERVATION STRATEGIES

- Population surveys and habitat assessments
- Information Networking
- Community-oriented approaches

**CONSERVATION TECHNIQUES**

The principal conservation methods for endangered species of animals are

- Keeping of live animals in reproducing herds
- Cryoconservation of semen
- Cryoconservation of embryo

## PRESERVING BIODIVERSITY

- In preserving biological diversity, we are simply insuring our own continued prosperity and survival.
- Involvement of local people is fundamental for biodiversity conservation.
- Reduced pesticide use.
- Organic agriculture and crop rotation.
- Scientific research has much to offer farmers and more of it should be directed to the needs of the poor.
- Better education will be the deciding factor in protecting biodiversity.
- Environmental awareness safeguarding biodiversity is important.

## CONCLUSION

It is the apt time to work together, participate and pay special attention to see that use of biological resources is sustainable now and in the longer run, for the benefit of all life on Earth. It is our duty to foster an integrated approach in all the uses of biological resources. We should educate and actively promote actions to reduce pollution and conserve biological resources.

The gap between the demand and supply can only be met through sincere efforts, proper managerial skills and implementation of policy decisions in letter and spirits; we will have to put on more resources for it, which will lead us to a sustainable development. Efficient and effective environmentally benign productive technologies that can serve and enhance the resource base of crops, animal husbandary, forestry and inland and marine fisheries, deserve much importance.

Biological resources management is very essential because man depends on plants, animals and other natural resources for his survival. Conservation of biodiversity can no longer be regarded as an exoteric exercise, on which the very existence of all life

depends. The interaction of microorganisms small insects, birds, reptiles and animals with that of the surrounding environment plays a very important role in preserving the ecological balance. Thus, we realise the need for biodiversity where different organisms and plants depend on each other for survival.

Earth is where we all live; so if any part of the planet is harmed, it affects all of us. Every minute there are forces at work that threaten the earth's health. So all of us should take care of it.

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