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BIODIVERSITY AND SPECIES EXTINCTION

BY

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ABSTRACT

A rapid reduction in biological diversity is occurring worldwide resulting in depletion of sources of medicinal, agricultural and industrial products. Out of many human activities, habitat destruction has emerged as the most significant cause of declining biodiversity. This paper discusses the causes of loss of biodiversity and delineates various approaches needed for the protection and conservation of species. The need for advancement in genetic engineering is emphasized to enhance the genetic diversity within a species.

INTRODUCTION

One of the most striking features of life on earth is its diversity. The term "Biodiversity" or "Biological Diversity" refers to the number and variety of living organisms. It encompasses three different aspects: genetic diversity within a species, species diversity (number of different species) and ecosystem diversity (variety within and between ecosystems). Biological diversity contributes towards a sustainable environment which enables human and other species to survive. A `species' here can be defined as a group of organisms that are capable of interbreeding with one another in the wild but do not interbreed with other sort of organisms.

Species are grouped in 5 kingdoms: animals, plants, fungi, algae and bacteria. Estimates of species on the earth range from 4 to 40 millions. Currently about 1.5 million species are documented, i.e., labelled with genus and species name (Runyan, 1997). Insects (invertebrate animals) and plants make up most of the species. There are around 500,000 insects species and 400,000 plants species identified so far (Botkin and Keller, 1995). Mammals comprise a small group of about 4630 known species (Runyan, 1997). The number of bird species is close to 10,000 (Middleton, 1995). Tropical forests provide habitat for 50-90 percent of the world's species.

Unfortunately anthropogenic activities, most notably the destruction of habitat are contributing to the extinction of large numbers of species. The problem is most critical in tropical areas. The rate at which the species are becoming extinct due to human action is unprecedented in history. It is estimated that about 100,000 species are being lost every year (Middleton, 1995). Some scientists believe that 60,000 to 240,000 known plant species will be lost over the next 30 years as a result of deforestation alone.

Biological diversity is a vital part of the earth capital that sustains all life. The earth's identified species and their genetic materials provide humans with industrial, agricultural and medical products. No one knows what unidentified species might offer in terms of food, clothings, housing and medicine. It is therefore necessary that biodiversity on earth be preserved. It's reduction will certainly result in lost opportunities and lost solutions to the

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future problems. The preservation of biodiversity thus becomes an important environmental issue of the present time.

IMPORTANCE OF BIODIVERSITY

Biodiversity on the earth must be saved for several important reasons. Some of these are discussed below.

Economic Importance

Around 90% of todays food crops were domesticated from wild tropical plants. As many wild species have potential as a source of food and development of new crop strains, so they must be preserved. There is also need to conserve wild strains of grains and other crops. Crops such as wheat, corn, rice, banana, papaya need continuous introduction of fresh genetic characteristics from the wild strains to make them disease resistant. This may be impossible should wild species be lost. Eighty percent of the world's 1330 cultivated crops species (including fruits, vegetables, beens and legumes, coffee and tea, cocoa and spices) are pollinated by wild and semi-wild pollinators. It has been recently discovered that microbes deep in the planet crust are even responsible for generating oil and mineral deposits such as gold (Brown et al, 1997). A reduction in biodiversity can severely increase the poverty of indigenous people of less developing countries who depend on forests and other ecosystems for all their needs of livelihood.

Medical Importance

Most of the commercial pharmaceutical products such as antibiotics, tranquilizers and cancer fighting drugs come from plant extracts and about 75% of the world's population depends directly on plants for their medicine. For example, 2100 plants have been found to contain cancer fighting chemicals (Miller, 1994) Taxol, a medication for breast and ovarian cancer comes from the bark of pacific Yew tree. The Rosy Periwinkle, a plant has proved of enormous value in combating childhood leukemia. Aspirine is a derivative of willow bark whereas penicillin is obtained from moulds. Steroids come from Mexican Yams. Shark cartilage is used in cancer treatment and to make artificial skin in burn victims. Microorganisms have been the source of more than 3000 antibiotics. Antiviral compounds have been found in corals and antitumour agents are available from sponges in marine ecosystems. Sea snails are the source of highly refined pain killing chemicals now being tested for human use (Brown et al, 1997). Many animal species are used to test drugs, vaccines, chemical toxicity and surgical procedures. Certain beetles produce steroids with birth control potential and fireflies produce antiviral compounds that may be used for treating viral infections. Centipedies secrete fungicide that would help control fungus attack on crops. (Raven et al, 1993). The genes of human insulin have been placed in bacteria which now produce insulin for use by diabetics. About 90% of all insects have not yet ben identified and may prove very important potential biological resource.

Ecological Importance

Wild species provide food, recycle nutrients, help maintain soil fertility, protect water sheds, regulate local climate, store solar energy and help absorb pollution. Many break down organic wastes, control potential crop pests and disease carriers. Without birds, leaf eating insects can grow in abundance and damage crops. Biodiversity makes up a vast gene pool from which humans can draw more in future for their benefit.

Aesthetic and Recreational Importance

Wild plants and animals are a source of beauty and pleasure and as such they must be saved. Ecotourism generates huge sums of revenues for many countries in the world.

Ethical Importance

As each wild species has an inherent right to exist, there is a moral justification to save biodiversity independent of human needs.

CAUSES OF BIODIVERSITY LOSS

Major factors which are responsible for species extinction include in descending order habitat destruction, hunting/poaching, introduction of exotic species and pollution of the environment. These are discussed below.

Habitat Destruction

The destruction of habitat is the most severe threat to biological diversity, particularly in areas where human populations are high. Most of the habitat destruction has been to provide farmland, rangeland, settlement and industry. In the tropical African countries, 65% of the original wildlife habitat has been lost. In the Indo-Malayan countries the overall loss is 68% with particularly severe losses reported for Bangladesh (94%), Sri Lanka (83%), Viet Nam (80%) and India 80% (Middleton, 1995). The destruction of tropical rain forests, coral reefs, wet lands and mangroves is particularly serious given the high biodiversity of these habitats. The World Conservation Monitoring Centre (WCMC) has reported that more than 6600 plants species are threatened in Asia. In Philippines alone half of the endemic plant species may have become extinct (ESCAP - UNEP, 1995).

Hunting/Poaching

Hunting and poaching of wild animals for support or commercial purposes poses a serious threat to biodiversity in many developing countries of the world. This practice has made many species such as tigers, gorillas, macaw, rhinos, lions and elephants endangered as their products fetch high price in the market. The Bengal tiger's fur sells for$100,000 in Tokyo. A mountain gorilla is worth $150,000; an Imperial Amazon macaw $30,000 and a snow leopard skin $14,000. Rhinoceros' horn sells for around $28,600 per Kg (Miller, 1994) and a Saker Falcon for Rs. 2.5 million in Pakistan. A full set of white shark jaws can

command more than $15,000 from collectors. In Africa, during the last 35 years there has been a loss of some 97% of rhinoceros species and more than 90% of the elephants. While the poaching for elephant tusks has been drastically reduced in Kenya and Tanzania, many of these operations have moved over to Zaire and Angola (Kirwin, 1994). The tiger is close to extinction in China and South-East Asia. Only 5000 tigers remain in the wild today and if not protected may vanish in the next 5 years.

Many countries support control of species such as wolves that can prey on livestock. Worldwide over 5 million live birds are captured and sold. Over 40 species mostly of parrots are endangered or threatened because of the trade (Miller, 1994). IUCN estimates indicate hunting as a cause of 42% extinction of the birds and 33% of mammals (Botkin and Keller, 1995). Recent investigations have revealed that 1096 of the 4630 known species of mammals and 11% of all bird species are facing the threat of extinction due to anthropagenic activities (Runyan, 1997).

Certain floral species like cacti and orchids are also at risk from collectors. Similarly many species of trees have been reduced by selective logging. (Middleton, 1995)

Exotic Species

In some cases the introduction of exotic species to a habitat may result in local extinction of numerous native species. For example, the brown tree snake introduced in Pacific Island pushed 10 endemic bird species to the point of extinction (Middleton, 1995). Similarly the American Chestnut trees have been severely damaged due to a fungus parasite of the European chestnut, inadvertently brought to America (Botkin and Keller, 1995)

Pollution of the Environment

Pollution of air, land and water through the discharge of industrial wastewaters and gaseous emissions has also been a significant cause for the loss of many wild species. Acid rains have caused deterioration of many forests particularly in European countries whereas industrial waste discharges have been the cause of reduction of many aquatic organisms all around the world (Middleton, 1995)

PRESERVING BIODIVERSITY

The protection of habitats is the most obvious approach to conserve biodiversity. Currently there are over 8600 protected areas in the world which cover about 6% (against 10% desired) of the earth's land area (World Bank, 1994).

Over 1100 national parks larger than 1000 ha each are located in more than 120 countries for global conservation of wildlife. The world's largest protected area is Greenland National Park which covers 972,000 Km^2 (Middleton, 1995). In addition to national parks, numerous sanctuaries, refuges and forests throughout the world help preserve biodiversity.

The lack of political and financial support limits the success of many protected areas, however. The national parks are invaded by poachers who kill animals to get and sell rhino

horns, elephant tusks, furs and other valuable parts. Poaching for skins and bone smuggling of tigers for example in India and Nepal is well known and many guards of tiger rescues have been killed in clashes with poachers. In many countries legislative bans on threatening activities have been implemented to safeguard certain species. However, any ban on hunting is, in practice, only as effective as the ability of the state to uphold it.

Conservation of wildlife has also been made through breeding of captive species in zoos and the seed storage of genetically diverse plant crops in the gene banks. Zoos, aquaria and botanical gardens have proved helpful to save species that are on the brink of extinction. The world's 1500 botanical gardens hold about 90,000 plant species. It would be desirable that more botanical gardens are established to conserve plants. Similarly worldwide 500 zoos house about 540,000 individual animals. However, maintenance of animal species in zoos is limited by lack of space and funds. (Miller 1994). It would therefore be appropriate to use the limited funds for preserving those threatened species which are potentially useful for agriculture, medicine and industry.

The use of chemicals such as fertilizers and pesticides destroys the biodiversity available in soils and the soils gradually lose fertility. Chemical free farming, termed as `ecological farming' holds promise to improve soil fertility and for reappearance of natural predators of pests. Farmers should therefore be encouraged to shift to ecological farming as it is the only way to achieve food security without destroying the precious natural resources available in the form of biodiversity.

Women have a special role in relation to protection of biodiversity as population pressures are a major threat to this effect. A family planning programme may, therefore, form an integral part of the biodiversity protection. Other efforts that can help save biodiversity include increasing public awareness on the subject, supporting research on wildlife conservation and controlling pollution. Conservation organizations such as International Union for Conservation of Nature and Natural Resources (IUCN) and Worldwide Fund for Nature (WWF) have been created to boost the efforts being made to maintain biological diversity on the planet earth.

Preserving biodiversity is not enough. It needs to be known and used sustainably so that it remains for future generations. There is urgent need to make advances in genetic engineering to enhance the genetic diversity within a species. It is through genetic engineering that today more than 100,000 varieties of rice are available. To cope with the increasing demand for food for humans, it is necessary that genetic resources be preserved and the countries of origin of these resources be given access to technologies and research information to preserve and use these resources. It would, therefore, be highly appropriate that a worldwide network of seed banks be established. Developing countries should also strengthen the management of biodiversity through development of national schemes and research activities. To this effect tropical nations be provided with economic incentives for preserving the genetic resources which they own in the form of tropical forests. Through research, it may be possible to develop plants that resist particular disease, grow in sea water and have much higher productivity. Even entirely new kinds of plants may be grown. For example, it may be possible in future to grow nitrogen fixing corn to result in enormous savings in the use of fertilizers.

THE PAKISTAN CONTEXT

There is great biological diversity available in Pakistan. However, half of the wild species available previously have become extinct or are endangered. Presently Pakistan contains about 6000 plant species; 90% of them being restricted to North West mountainous region. There are about 2000 species of medicinal plants, 190 species of mammals, about 900 species of birds and around 175 species of reptiles available in the country. In addition 20,000 species of insects and 700 species of marine invertebrates are also present. (ODA, 1992).

Activities which threaten wildlife habitat in Pakistan include agricultural expansions, deforestation, monoculture afforestation, drainage of wetlands, pollution, new settlements, industrial growth, over exploitation of range lands, hunting and poaching. In Pakistan riverine and mangrove forests are endangered. In addition about 500 species are likely to be endangered in near future. Presently 31 species of mammals, 20 species of birds and 4 species of reptiles are facing local extinction.

Pakistan contains 10 national parks, 82 sanctuaries and 83 game reserves. Hunting and shooting of wild animals is allowed in game reserves.

The National Conservation Strategy lays emphasis on conservation of natural resources through preventing extinction of species, preserving crops, forage plants, trees and livestock, maintaining national parks, wildlife sanctuaries and gene banks of cultivated and pharmaceutical plants. It also emphasizes the need for captive breeding and artificial propagation of endangered medicinal plants (GOP-IUCN, 1992).

SUMMARY

1. Biological diversity refers to the number and variety of living organisms. A reduction in biological diversity is occurring worldwide, but the problem is more critical in tropical areas.
2. Living organisms are a source of medicinal, agricultural and industrial products. They provide many essential environmental services. Hence these resources must be saved.
3. Human activities that contribute to reduction in biodiviserity include habitat destruction, hunting and poaching, introduction of exotic species and pollution. Of these habitat destruction is the most significant cause of declining biodiversity.
4. To save endangered species, it is necessary to save its habitat. To that effect many protected areas and wildlife reserves have been established worldwide. However, many of these lack proper maintenance. Exsitu conservation of wildlife is done through captive breeding in zoos and through establishment of seed banks.
5. Other ways to conserve biological diversity include public awareness, enforcement of laws and regulations, supporting research activities, controlling pollution and providing economic incentives to tropical nations for preserving genetic resources.
6. A great biological diversity is available in Pakistan. Many anthropogenic activities, however, threaten wildlife habitat. The riverine and managrove forests are being destroyed and about 500 species likely to be endangered in the near future.

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