Global biodiversity and population

The term *biodiversity* encompasses all terrestrial and freshwater organisms at the levels of genetic diversity, species diversity and community diversity. Biodiversity occurs not only at the level of species, but embraces both species subunits and ecosystems.[1] To most people, the existence of many species is important because their physiological differences furnish a variety of food, clothing, shelter and medicine for humans.

As a response to rapid, human-induced changes in the global environment, global biodiversity is changing at an unprecedented rate. Taxonomic and genetic diversity — essential for human health, agriculture and ecosystem functioning — is being eroded as natural habitats are converted by humans to other uses. Many species have already become extinct as a result, and thousands, perhaps millions, of other species are facing a similar fate.

Equally alarming is that the rate of habitat conversion is accelerating along with the extinction of species. As population pressure increases, and more and more people must make use of other species or their habitats for subsistence, managing these resources in a sustainable manner will become increasingly difficult. Some species populations will be better equipped than others to adapt to the swiftly-changing environmental conditions of the foreseeable future.

Terrestrial biodiversity

Biodiversity is located in small areas of the planet. As much as 20 per cent of plant species, and a still higher proportion of animal species, are confined to 0.5 per cent of Earth's land surface.[2] These species are endemic to their areas so, if their local habitats are eliminated, these species will suffer extinction. The areas in question are indeed threatened with imminent habitat destruction. It is these two attributes of limited species-range and habitat destruction in combination that cause these areas to be designated 'biodiversity hotspots'.

While tropical forests are shrinking, wildlife habitat in general is being lost at an astounding rate throughout the world. Tropical forests are rich in biodiversity and contain an estimated half of the world's 1.5 to 3 million species.[3] Due to the rise in human population and consumption, and subsequent increased demand for resources, one-third of the acreage of the world's tropical forests has already been lost.

In many developing countries, forest habitat is disappearing in response to increased human need for land on which to farm and graze livestock, or the need for wood to burn for energy. In the developed countries, pollution of fresh and ocean water habitat is destroying wildlife's potential for reproduction.[4] In the United States alone, over 50 per cent of wetland

habitat has been lost, and only five per cent of primary forest remains.[5]

Land-use changes in the terrestrial ecosystem are the most severe driver of changes in biodiversity.[6] The conversion of temperate grasslands into croplands, or tropical forests into grasslands, results in local extinction of most of the area's plant species and associated animals.

Aquatic biodiversity

A number of lake and river ecosystems are unusually rich in biodiversity. Worldwide, lakes and rivers contain at least 8,400 fish species, or roughly 40 per cent of all species of fish identified to date.[1]

Freshwater areas overall are probably being degraded and eliminated globally at a rate even faster than that of tropical forests — i.e. the fastest rate in the world for extensive biological systems. Aquatic organisms serve as an indicator of water quality and ecosystem health.[7] Aquatic biodiversity is declining at an alarming rate; around 40 per cent of amphibians and 20 per cent of freshwater fishes are imperilled, meaning they are either extinct, endangered, threatened, or of special concern.[7]

Impact of rising human population

The deterioration of wetlands is a direct result of human population growth and increased development pressure. For example, coastal and riverside sites are prime locations for housing and commercial development properties. Moreover, industrial agriculture, overharvesting of fish, disposal of industrial effluents into the water stream and the construction of dams and bridges have altered the trajectory of aquatic plants and animals. This has resulted in the isolation, destruction and pollution of aquatic habitat and, as a consequence, reduction in aquatic species biodiversity.

The loss of aquatic biodiversity is not only a direct loss to our environment but also a loss to humans. The UN Food and Agriculture Organisation estimates that about 35 million people are directly engaged in fishing practices, while approximately one billion people in the world rely on fish as their staple food.[8] This means that reductions in aquatic biodiversity will have a direct influence on the livelihoods and subsistence of people across the world.

Genetic biodiversity

As wild plants, animals and microbes retreat into the remaining fragments of their habitats, their population numbers are already declining. That loss entails the termination of many family lines within a species, and the extinction of the peculiar genes they carry. In other words, there is a significant loss of genetic biodiversity.[7,9] We tend to think of extinctions in terms of species, but the loss of wild genetic variability is at least as important in the challenge it poses for sustaining our planet and ourselves.

The practical benefits of genetic biodiversity range from economic benefits in agriculture to uses in medicine. More than half of all prescription drugs are modelled on natural compounds, and about a quarter are taken directly from plants. In the context of genetic diversity, it is important to note that it is not the plant species per se that provides us with our medicines, but the chemical compounds produced by the genes in individual plants.

Capuchin monkey in the Venezuelan tropical rainforests[10]

Equally crucial is the diversity among animals. In the tropic forests of Venezuela, for example, capuchin monkeys rub themselves with a particular type of millipede, which carries certain chemical compounds that repel insects.[7] This knowledge could help mankind in developing medicinal ointments that could protect us from insect bites. Given the fact that we are diminishing the diversity of tropical rain forests across the world, we are increasingly losing the ability to obtain such insights.

Biodiversity and population

Although human population growth in the last century has been paralleled by advances in agricultural techniques and energy extraction, the expansion of Earth's human-carrying capacity has come at the cost of biodiversity loss. Many species are already extinct, meaning that we have lost the insights and knowledge that studying live populations can provide. Extinction of many more species is inevitable. The growth of our human population appears set to continue unabated for many years. Even if we immediately went to replacement rate (two offspring per couple), the world's population would continue to grow due to the population age structure and declining mortality.[11]

The impact of human population on biodiversity loss is worsened through socioeconomic factors such as rising per-capita consumption.

Both extinction and population growth are natural phenomena. What is unnatural is the magnitude of both trends in today's world. And what is unusual is that one species has the choice of altering the course of things to come. Thus, if we are to look forward to a future that offers sustainability to humans and other species, two measures are necessary — active conservation of biodiversity, and proactive promotion of smaller families.

Climate change is largely an anthropogenic phenomenon that directly impacts biodiversity in several ways. Rising population growth and expanding energy demand entail sustained loss of biodiversity through increased extraction of natural resources like oil, firewood and timber. In addition to this, overconsumption of these resources results in an increased level of atmospheric carbon dioxide, which is primarily responsible for increasing global temperature through climate change. The increase in global atmospheric temperature thus caused by rising carbon dioxide levels has resulted in a steady decline in biodiversity of plant and animal species across the world.

Conclusion

Humans use thousands of species in their daily lives for food, shelter, medicines, and diverse forms of commerce. If the depletion of biodiversity continues unabated, we shall lose around 50 per cent of all species and 90 per cent of the surviving populations, and perhaps 70 per cent of their genetic variability.[7] Laissez-faire public policies regarding the management of natural ecosystems were once considered benign, but are now seen to carry serious societal consequences that seldom can be reversed, and then only at substantial expense. The continuing loss and degradation of the world's biological resources compromises society's ability to create a sustainable future for its citizens. Managing these resources will necessitate an increased commitment by the world community to support the biodiversity sciences, especially in the species-rich countries where scientific capacity is least developed.

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