

LAND-USE, LAND-COVER CHANGES AND BIODIVERSITY LOSS

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Summary

During Earth's history, species extinction has probably been caused by modifications of the physical environment after impacts such as meteorites or volcanic activity. On the contrary, the actual extinction of species is mainly a result of human activities, namely any form of land use that causes the conversion of vast areas to settlement, agriculture, and forestry, resulting in habitat destruction, degradation, and fragmentation, which are among the most important causes of species decline and extinction.

The loss of biodiversity is unique among the major anthropogenic changes because it is irreversible. The importance of preserving biodiversity has increased in recent times. The global recognition of the alarming loss of biodiversity and the acceptance of its value resulted in the Convention on Biological Diversity. In addition, in Europe, the challenge is also the implementation of the European strategy for biodiversity conservation and agricultural policies, though it is increasingly recognized that the strategy is limited by a lack of basic ecological information and indicators available to decision makers and end users.

We have reached a point where we can save biodiversity only by saving the biosphere. Conservation planners should expand their policy approach to include action responses in lands far outside the main loci of biodiversity concentrations. Nature conservancy must be understood as a tool to provide the maintenance of diversity of our natural heritage through the promotion of economic, social, and cultural activities, which at the same time enhance diversity and local development.

1. Introduction

Biodiversity can be defined as the variety and variability among organisms and their ecological complexes. Three fundamental levels of organization are considered: genetics, organisms, and ecosystems.

The importance of preserving biodiversity has increased in recent times. The global recognition of the alarming loss of biodiversity and the acceptance of its value resulted in the Convention on Biological Diversity. We are obviously much more concerned with the species living on Earth today than in a scale of thousands or millions of years. We realize that an unknown number of species did become extinct since the first *Homo sapiens*. We do not know how many species do exist today, but several studies estimate between 10 and 30 million different species in the world, of which we know around 1.7 million. From these, 1.4 million are insects, the huge group of arthropods that dominates the world diversity.

Pressures on natural systems are increasing and we will probably never have the time to learn everything we could about the diversity of species in the world. With particular emphasis since 1980, the recognition that species may play an important role in ecosystems functioning, as well as the fast-growing interest in the preservation of biodiversity, has driven ecologists to discuss other questions on the relation between diversity and ecosystems function. These questions are increasingly relevant as the pressure of anthropogenic effects is causing biodiversity loss.

During Earth's history, the reasons for species extinction were probably caused by modifications of the physical environment after impacts such as meteorites or volcanic activity. On the contrary, the actual extinction of species is mainly a result of human activity, namely land use (the conversion of vast areas to settlement, agriculture, and forestry) and habitat destruction, degradation, and fragmentation (global climate change and biological invasions). The loss of biodiversity is unique among the major anthropogenic changes because it is irreversible.

In fact, anthropogenic factors, mainly land development, constitute the primary causes of endangerment and extinction. Human population growth and expansion and economic activity cause the conversion of vast areas to settlement, agriculture, and forestry, resulting in habitat destruction, degradation, and fragmentation, which are among the most important causes of species' decline and extinction.

2. Primary Causes of Biodiversity Loss

2.1. Habitat Degradation and Destruction

The size and distribution of the human population over the near future will be a crucial factor in determining the loss of biodiversity, pushing animal and plant populations past critical threshold of tolerance and renewal.

An example comes from the Mediterranean basin, a biome that was identified as one of the biodiversity hotspots, rich in endemic species and particularly threatened by anthropogenic impacts. The population growth rate in the hotspots between 1995 and

2000 was estimated to be of 1.8% yr⁻¹ (1.3% yr⁻¹ for the Mediterranean basin), substantially larger than the average world growth rate (1.3% yr⁻¹), and even larger than the developing countries growth rate (1.6% yr⁻¹). This obviously indicates that human population expansion will be the main leading force affecting biodiversity conservation in the future.

Habitat conservation is affected by human demands for housing, arable land, freshwater, and industries, spreading land degradation and climate change and consequently threatening ecosystem functioning, raising the risk of further extinctions. In particular, the driving forces in dry areas are rainfall variability and human disturbances rather than density dependence or competition. Dry areas include 45% of the land surface, and support 50% of the world's livestock. Overgrazing and fires together with episodic drought result in accelerating land degradation and desertification.

The way these factors affected the north and south Mediterranean environment is different. During the last half of the twentieth century, the evolution of population in north and south Mediterranean countries present different trends. Population in the Maghreb has increased 300% leading to an overexploitation of rangelands and to desertification, while in northern countries the increase is only 30%. However, the relocation of population to the coastal border, in northern Mediterranean countries, and the intensification of agriculture are leading to increased land degradation at both shores. On the other hand, land abandonment in the interior is in some cases allowing soils and vegetation to recover. In many cases, soils are so exhausted and degraded that their recovery is no longer possible in the near future.

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Biographical Sketch

Helena Freitas is Associate Professor of Ecology at the University of Coimbra, Portugal. She develops research in different areas, from microbial ecology to conservation biology, and her main interests are biodiversity and ecosystems functioning. She is involved in several national and European projects on ecology, management, and conservation of Mediterranean species, habitats, and landscapes. As President of LPN (Liga para a Protecção da Natureza), the Portuguese nongovernmental organization for the Conservation of Nature, she has developed a number of conservation projects involving local populations and authorities.