

DRIVERS OF BIODIVERSITY LOSS: ANTHROPOGENIC AND NATURAL PROCESSES

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Abstract

Biodiversity underpins ecosystem stability, human well-being, and planetary health, delivering vital services such as pollination, climate regulation, and water purification. However, it is declining at an unprecedented rate due to an interplay of natural and anthropogenic drivers, chiefly habitat loss, climate change, pollution, invasive species, and overexploitation. Habitat destruction and fragmentation disrupt ecosystem functions, while climate change alters species distributions, reproductive patterns, and survival rates. Pollution—air, water, soil, light, and noise—further degrades habitat quality, affecting organisms at all trophic levels. Invasive species outcompete, prey upon, or hybridize with native species, often triggering cascading ecological effects. Overexploitation of natural resources intensifies ecosystem degradation. Addressing these threats requires integrated approaches, including habitat restoration, invasive species control, in-situ and ex-situ conservation, green infrastructure, legal protections, sustainable resource use, conservation funding, and the active involvement of NGOs and communities. Coordinated global action is essential to safeguard biodiversity, as its preservation is not only a moral duty but a prerequisite for the survival and resilience of human societies and the natural world.

1. Introduction

Biodiversity forms the foundation of a healthy planet and is critical to the functioning of natural systems and the survival of all living beings, including humans. It supports essential services such as pollination, climate regulation, water purification and soil fertility. Despite its immense value, biodiversity is declining at an alarming rate across the globe. According to global assessments, species are disappearing rapidly than the natural background rate of extinction. This alarming trend is the result of multiple, interrelated factors, most of which are directly linked to human activity. These factors are categorized into natural and anthropogenic causes. Natural drivers are processes and events that happen without human involvement. They shape ecosystems over long periods. Examples include natural climate changes, volcanic eruptions, earthquakes, wildfires, disease outbreaks, and extreme weather events like floods, droughts, and hurricanes. Natural drivers often work in cycles, helping ecosystems recover and adapt through natural selection. For instance, periodic

wildfires in savanna ecosystems encourage the growth of fire-adapted species. However, in rare instances, catastrophic events like meteorite impacts have led to mass extinctions that permanently changed global biodiversity.

In contrast, anthropogenic drivers come from direct or indirect human activities. These include habitat destruction and fragmentation from urbanization, agriculture, and infrastructure projects, overexploitation of wildlife and natural resources, pollution, the spread of invasive species, and human-caused climate change. Unlike natural drivers, human-induced factors often happen much faster and at a scale that many species cannot adapt to. Additionally, anthropogenic drivers frequently interact, creating feedback loops that worsen ecosystem degradation. For example, deforestation not only destroys habitats but also contributes to climate change, which puts additional stress on species. Natural drivers have always played a role in Earth's ecological history. Yet, the unprecedented speed and scale of human impacts in recent centuries

