

Chapter VI: Terrestrial and Marine Ecosystems

Introduction

An ecosystem is a biological community of interacting organisms and their physical environment. It includes all living things (plants, animals, microorganisms) and non-living parts (soil, water, air, minerals) in a specific area, working together as a system.

These ecosystems provide vital services, including climate regulation, oxygen production, water purification, food production, and biodiversity conservation. They are crucial for sustaining ecological balance and supporting human communities.

Human activities such as urbanization, industrialization, deforestation, and overfishing increasingly threaten these ecosystems. Effective management strategies are essential to protect species, restore habitats, and promote the sustainable use of natural resources.

I. Terrestrial Ecosystems

I.1. Forests

Forests, covering approximately 31% of the Earth's land area (Fig. 1), host more than 80% of terrestrial species. They play a vital role in carbon sequestration, soil protection, and regulating the water cycle.

I.2. Grasslands

Grasslands are essential ecosystems that offer grazing areas for herbivores, support a diverse range of plants and animals, and help maintain ecological balance (Fig. 2). They aid in preserving soil fertility, prevent erosion with their extensive root systems, and serve as important carbon sinks, helping to reduce climate change.

I.3. Deserts and Tundra

Deserts and tundra are delicate ecosystems marked by severe climate, scarce water, and low primary productivity (Fig. 3). Despite their seeming barrenness, they support a wide variety of specialized plants and animals that have developed unique adaptations to endure extreme heat, cold, and nutrient-poor soils. These ecosystems provide vital ecological services, including regulating the global climate, sequestering carbon, and supporting distinct biodiversity. However, they are susceptible to disruptions, and even small human activities can cause long-term damage.



Figure 1 : Forests



Figure 2: Grasslands habitats.



Figure 3: Desert and Tundra.

II. Marine Ecosystems

II.1. Oceans and Coastal Waters

Marine ecosystems cover more than 70% of the Earth's surface and play a key role in regulating the global climate, producing oxygen, and supporting human livelihoods (Fig. 4). Oceans absorb large amounts of carbon dioxide, acting as natural climate stabilizers, while coastal waters sustain fisheries that provide protein for billions of people around the world. However, overfishing, plastic pollution, and industrial activities have put these ecosystems under severe stress.

II.2. Coral Reefs

Coral reefs, often called the "rainforests of the sea," are biodiversity hotspots supporting about 25% of all marine species despite covering less than 1% of the ocean floor (Fig. 5). They provide coastlines with protection from storms, help fisheries, and attract millions of tourists each year, bringing significant economic benefits. However, coral reefs are facing a concerning decline due to coral bleaching, destructive fishing practices, and unmanaged tourism.

II.3. Wetlands and Estuaries

Wetlands and estuaries are some of the most productive ecosystems (Fig. 6). They naturally filter water by trapping sediments and pollutants, serve as nurseries for fish and shellfish, and help protect against floods and storm surges. They also provide habitats for migratory birds and unique plant species. Despite their importance, wetlands are being drained, polluted, and converted for agriculture or urban development.

Management practices aim to ensure their conservation through habitat restoration (replanting native vegetation and reintroducing hydrological cycles), runoff regulation (reducing agricultural fertilizer use and urban wastewater discharge), and community monitoring, where local populations actively participate in protecting and sustainably managing these ecosystems.



Figure 4: Ocean and Coastline.



Figure 5: Coral Reefs.



Figure 6: Wetlands and estuaries.

Conclusion

Terrestrial and marine ecosystems provide essential ecological, social, and economic services. Protecting and managing them involves scientific monitoring, conservation efforts, habitat restoration, and community participation. Sustainable management guarantees the continued health of biodiversity, ecosystem services, and human well-being for future generations.