

WHAT IS BIODIVERSITY?

Biodiversity found on Earth today consists of many millions of distinct biological species, the product of four billion years of evolution. However, the word “Biodiversity” is relatively new, and was coined by American biologist Edward O. Wilson in 1986.

Biodiversity is the measure of the number, variety and variability of living organisms. It includes diversity within species, between species, and among ecosystems. The concept also covers how this diversity changes from one location to another and over time. Indicators such as the number of species in a given area can help in monitoring certain aspects of biodiversity. Biodiversity is everywhere, both on land and in water. It includes all organisms, from microscopic bacteria to more complex plants and animals. Current inventories of species, though useful, remain incomplete and insufficient for providing an accurate picture of the extent and distribution of all components of biodiversity. Based on present knowledge of how biodiversity changes over time, rough estimates can be made of the rates at which species become extinct.

The status and trends in biodiversity reflect the health of the ecosystems that support and enrich human life, So in general **Biodiversity** is the variety of life on Earth, it includes all organisms, species, and populations; the genetic variation among these; and their complex assemblages of communities and ecosystems. It also refers to the interrelatedness of genes, species, and ecosystems and in turn, their interactions with the environment.

1. Definitions

SOME FORMAL DEFINITIONS

- 1- According to the **World Wildlife Fund (1989) biodiversity is:** the millions of plants, animals, and microorganisms, the genes they contain, and the intricate ecosystems they help build into the living environment.
- 2- According to the **UN (1992, in the Convention on Biological Diversity) biodiversity is:** the variability among living organisms from all sources including terrestrial, marine, and other aquatic ecosystems and the ecological complexes of which they are part; this includes diversity within species, between species, and of ecosystems.

2. What are the components of biodiversity?

Biodiversity refers to the variety of life found on Earth. It includes diversity at different levels:

Genetic diversity - the genetic variation within a species. For example, variation in fur color among rabbits.

Species diversity - the variety of species found within an ecosystem or region. For example, the many species of plants, animals, fungi and microorganisms in a tropical rainforest.

Ecosystem diversity - the diversity of ecosystems and habitats in a geographic area. For example, deserts, forests, wetlands, rivers, mountains, etc.

Functional diversity – biological and chemical processes or functions such as energy flow and matter cycling needed for survival of species and biological communities.

Greater biodiversity indicates a healthy ecosystem with many complex interconnections and balances between species. It provides stability, productivity, adaptability and resilience to environmental changes.

Biodiversity has ecological importance - different species perform various roles in ecosystem functioning like pollination, nutrient cycling, carbon sequestration etc.

It also has social, economic and scientific value for humans - providing food, medicines, industrial products and knowledge.

A) GENETIC DIVERSITY

Another important component of biological diversity is the genetic variation that exists both within and among species. This genetic variation is the basis for evolutionary change, and without it future change will not occur. In some cases, genetic variation can also play a role in determining whether a population will persist or go extinct .

Genetic variation exists in a number of forms, and can be measured in several ways. E.g., the number of polymorphic genes (i.e., genes with multiple alleles), the number of alleles each gene has, the number of heterozygous individuals in a population. Genetic diversity is not just of intrinsic value, but also can be important for humans too. For example, genetic variation is the basis for crop breeding. In some cases the introduction of genetic variation from ancestral

(wild) stocks has improved the productivity of existing crops. The development of genetically modified organisms also depends on the presence of genetic diversity.

B) SPECIES DIVERSITY

The units that we tend to focus on are species, because they are most tangible and easiest to study.

There are morphological, behavioral, life-history, physiological, and taxonomic, aspects to diversity at this level.

Species diversity can also be considered to include variation in the numbers of species (= **species richness**), the relative abundance of species (= **evenness**), and variation in the distribution of species in space (= **turnover**, or **beta-diversity**).

A healthy biodiversity offers many natural services



Ecosystem services are the benefits people obtain from ecosystems. Biodiversity plays an important role in the way ecosystems function and in the many services they provide. Services include :

1- Ecosystem services, such as

- Protection of water resources
- Soils formation and protection
- Nutrient storage and recycling
- Pollution breakdown and absorption
- Contribution to climate stability
- Maintenance of ecosystems
- Recovery from unpredictable events

2- Biological resources, such as

- Food
- Medicinal resources and pharmaceutical drugs
- Wood products
- Ornamental plants
- Breeding stocks, population reservoirs
- Future resources
- Diversity in genes, species and ecosystems

3- Social benefits, such as

- Research, education and monitoring
- Recreation and tourism
- Cultural values

This “biodiversity” is the result of more than 3 billion years of evolution includes:

- The millions of different species
- The diversity of their genes, physiologies, and behaviors
- The multitude of their ecological interactions
- The variety of the ecosystems they constitute

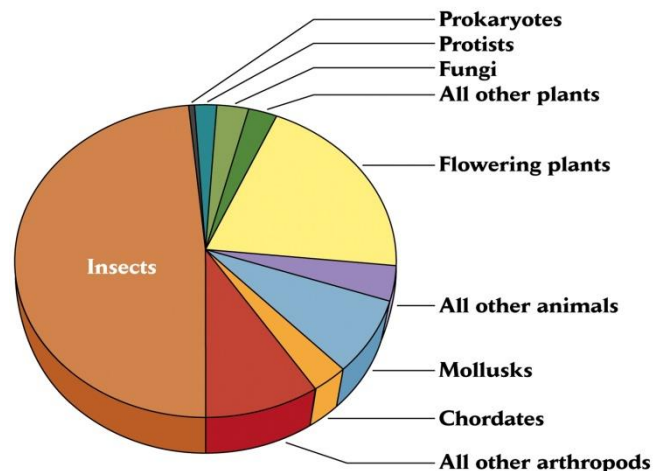
is under serious threat today.

How many different species are there?

The number of species identified and named is more than 1.7 million, including:

- 950,00 species of insects
- 270,000 species of plants
- 19,000 species of fish
- 10,500 species of reptiles and amphibians
- 9,000 species of birds
- 4,000 species of mammals

The rest includes mollusks, worms, spiders, fungi, algae, and microorganisms



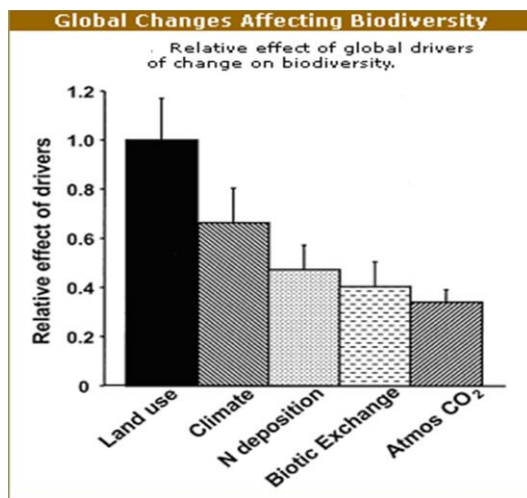
Most estimates of the total number of species on Earth lie between 5 million and 30 million. of this total, roughly 2 million species have been formally described; the remainder are unknown or unnamed.

Principal causes of extinction:

Virtually all of Earth’s ecosystems have been dramatically transformed through human actions and ecosystems continue to be converted for agricultural and other uses. The current loss of biodiversity and the related changes in the environment are now faster than ever before in human history and there is no sign of this process slowing down. Many animal and plant populations have declined in numbers, geographical spread, or both. Species extinction is a natural part of Earth’s history. Human activity has increased the extinction rate by at least 100 times compared to the natural rate.

Extinctions can be caused by natural processes (e.g. fires, hurricanes, droughts); excessive harvesting of particular species of economic value; impacts of alien invasive species including diseases; the impacts of various environmental pollutants; changes in climate;

- 73% - Destruction of habitat
- 68% - Displacement by introduced species
- 38% - Alteration of habitat by chemical pollution
- 38% - Hybridization of species (plants)
- 15% - Over-harvesting



What factors lead to biodiversity loss?

1. Habitat Destruction and Fragmentation:

- **Deforestation:** The conversion of forests into agricultural land, urban areas, and infrastructure projects results in the loss of critical habitats for countless species.
- **Urbanization:** Expanding cities and infrastructure fragment natural habitats, isolating populations and reducing gene flow among species.
- **Land Use Change:** Changes in land use, such as conversion of grasslands or wetlands, can lead to habitat degradation and loss.

2. Overexploitation of Natural Resources:

- **Overfishing:** Unsustainable fishing practices, including overfishing and bycatch, can deplete fish populations and disrupt marine ecosystems.
- **Overharvesting:** The unsustainable harvesting of plant and animal species for food, medicine, and trade can lead to declines in populations and even extinction.

3. Pollution:

- **Water Pollution:** Pollution of rivers, lakes, and oceans with chemicals, heavy metals, and nutrients can harm aquatic life and ecosystems.
- **Air Pollution:** Airborne pollutants can damage vegetation and affect species, especially those sensitive to changes in air quality.
- **Soil Pollution:** Contamination of soil with pesticides, heavy metals, and other pollutants can harm soil organisms and plant life.

4. Climate Change:

- Climate change disrupts ecosystems by altering temperature and precipitation patterns, leading to shifts in the distribution and behavior of species.
- Rising temperatures can lead to the loss of polar ice habitats, coral reefs, and the spread of diseases affecting wildlife.

5. Invasive Species: Non-native species introduced intentionally or accidentally can outcompete or prey upon native species, disrupting ecosystems and leading to declines in native biodiversity.

6. Habitat Degradation: Even if habitats are not completely destroyed, degradation due to factors like pollution, soil erosion, and invasive species can harm native species and reduce biodiversity.

7. Unsustainable Agricultural Practices:

- Monoculture farming and excessive use of pesticides and fertilizers can lead to soil degradation and a loss of biodiversity in agricultural landscapes.
- Land conversion for agriculture can result in the loss of natural habitats.

- 8. Infrastructure Development:** Roads, dams, and other infrastructure projects can fragment habitats and disrupt wildlife movement, contributing to biodiversity loss.
- 9. Lack of Conservation Measures:** Insufficient protection of critical habitats, weak enforcement of conservation laws, and inadequate resource allocation for conservation efforts can exacerbate biodiversity loss.
- 10. Human Population Growth:** As the global population continues to grow, the demand for resources and space increases, often leading to more habitat destruction and pressure on ecosystems.
- 11. Poaching and Illegal Wildlife Trade:** Poaching for the illegal trade in wildlife products, such as ivory, rhino horns, and exotic pets, threatens many species with extinction.
- 12. Lack of Public Awareness:** Insufficient public awareness about the importance of biodiversity conservation and the consequences of biodiversity loss can hinder conservation efforts.