

Unit 4 Lecture 1

Biodiversity

Definition holds that biodiversity is a measure of the relative diversity among organisms present in different ecosystems. "Diversity" in this definition includes diversity within a species and among species, and comparative diversity among ecosystems.

The word 'biodiversity' is a combination of two words: biological and diversity. It refers to the variety of life on Earth. Biodiversity encompasses all the living things that exist in a certain area, in the air, on land or in water: plants, animals, microorganisms, and fungi. The area considered may be as small as your backyard compost heap — or as big as our whole planet.

Animals and plants don't exist in isolation. All living things are connected to other living things and to their non-living environment (earth forms, rocks and rivers). If one tiny species in an ecosystem becomes extinct, we may not notice, or think it's important. But the biodiversity of that ecosystem will be altered, and all the ecosystems that the species belonged to will be affected.

Three types of biodiversity

There are three aspects to biodiversity: species diversity, genetic diversity and ecosystem diversity. All three interact and change over time and from place to place. Species diversity refers to the variety of different living things.

Genetic diversity refers to the variations between individuals of a species — characteristics passed down from parents to their offspring.

Ecosystem diversity refers to the great variety of environments produced by the interplay of the living (animals and plants) and non-living world (earth forms, soil, rocks and water).

Species diversity

Species diversity refers to the variety of different types of living things on Earth, such as bacteria, fungi, insects, mammals, plants and more. Different species have different roles to play within ecosystems. To remain healthy, most ecosystems require thousands of different species making up their food webs.

A species can be defined as a group or population of similar organisms that reproduce by interbreeding within the group. Members of a species do not normally reproduce with members of any other species. Human beings, for example, belong in a single species — *Homo sapiens*. Although there are different populations of humans, with different characteristics in different parts of the Earth, they can all successfully interbreed with each other and produce normal offspring. So, even though no two human beings are exactly alike, humans make up a single species because they reproduce among themselves.

All the different breeds of dogs, from Great Danes to Chihuahuas, belong in a single species, because they can interbreed and produce fertile offspring. Dogs and foxes, however, are different species because they can't interbreed.

Similarly, all horses belong in one species because they can interbreed. But horses and donkeys are different species because, although they can interbreed, their offspring (mules) are sterile.

Genetic diversity

If you think of a group of people in your street, or within your own family, no two will be exactly alike. All are humans, but all are different. These differences are due to genetic diversity, that is, the variety of genes within a species.

Each species consists of individuals with their own particular genetic composition. When the individuals interbreed, their offspring have new combinations of the genes, resulting in new mixtures of the characteristics of the species.

This diversity of characteristics is essential for the survival of healthy populations in natural communities. When the environment of a community changes, as they do all the time, some individuals will have characteristics that suit the new environment. They are more likely to survive and produce offspring that are also suited to the new environment. As a result, the whole population may change. This is how the process of **adaptation** occurs.

The story of the peppered moth (*Biston betularia*) provides a good example of a species adapting to changes in its environment. In pre-industrial England, almost all peppered moths were grey with dark flecks. However, there were also a few peppered moths that were black. During the day, moths rested on greyish, lichen-covered tree trunks. The grey peppered moths were well camouflaged on the grey trunks, but the black moths stood out and tended to get eaten by birds.

This situation was reversed by the industrial revolution in England. The pollution from factories killed the lichens on the tree trunks, leaving the dark bark exposed. With this change in the environment, the black moths were better camouflaged than the grey ones. Birds ate many more of the grey peppered moths, so most of the moths that survived to produce offspring were black. After many moth generations, almost all of the peppered moths in industrial areas were black. The species had changed to suit the new environment.

The peppered moths were able to adapt to environmental change because of their genetic diversity — there were genes for grey and also for black in the population. This is not always so. If a small population of a species becomes isolated from the larger group, the small population is forced to reproduce by breeding within itself — to inbreed. Inbreeding can result in a loss of genetic diversity, making it harder for the species to adapt to changing conditions.

This loss of genetic diversity can eventually result in the extinction of the population.

Ecosystem diversity

Ecosystems are the combination of communities of living things with the physical environment in which they live. There are many different kinds of ecosystems, from deserts to mountain slopes, the ocean floor to the Antarctic, with coral reefs and rainforests being amongst the richest of these systems.

Each ecosystem provides many different kinds of habitats or living places. The living things and the non-living environment (earth forms, soil, rocks and water) interact constantly and in complex ways that change over time, with no two ecosystems being the same.

Although ecosystems are ever-changing and complex, some universal principles apply. One of these is that matter constantly cycles and recycles. Another principle is that energy moves through the cycle, being used, absorbed and stored.

For example, forests act as filters for air, absorbing carbon dioxide and releasing oxygen. Seas are the great stabilizers of climates, with warm currents moderating temperatures on the land masses they pass. Mangroves and seagrass beds are the nurseries for marine creatures. While the sun is a constant source of Earth's energy, energy is also available from geothermal processes. So while each ecosystem generates its own relationships, the Earth's environments are interrelated — they all rely on the sun and the Earth's oxygen and water to survive.

You can begin to appreciate how the elements in each ecosystem are connected to each other and the diversity that exists amongst Earth's ecosystems. Maintaining this ecological diversity is important for the health of the planet.