Biodiversity is variety among living things. But biodiversity means more than just the number of species. There are three levels of biodiversity.

1. Genetic diversity—Genetic diversity is the variety of genes within a species.
2. Species diversity—Species diversity is the variety of species within a habitat or a region.
3. Ecosystem diversity—Ecosystem diversity is the variety of ecosystems in a given place.

Biodiversity contributes to the overall health of ecosystems. Healthy ecosystems provide a range of services to human beings and the planet.

The principal framework for expressing the ‘usefulness’ of biodiversity is through the concept of ecosystem services.

1. **Provisioning services**, or the supply of goods of direct benefit to people, and often with a clear monetary value, such as timber from forests, medicinal plants, and fish from the oceans, rivers and lakes.
2. **Regulating services**, the range of valuable functions carried out by ecosystems which are often of great value but generally not given a monetary value in conventional markets. They include regulation of climate through the storing of carbon and control of local rainfall, the removal of pollutants by filtering the air and water, and protection from disasters such as landslides and coastal storms.
3. **Cultural services**, not providing direct material benefits, but contributing to wider needs and desires of society, and therefore to people’s willingness to pay for conservation. They include the spiritual value attached to particular ecosystems such as sacred groves, and the aesthetic beauty of landscapes or coastal formations that attract tourists.
4. **Supporting services**, not of direct benefit to people but essential to the functioning of ecosystems and therefore indirectly responsible for all other services. Examples are the formation of soils and the processes of plant growth.

Let’s find out about biodiversity in forests. **Forest biodiversity** refers to all forms of life found in forests, including trees, plants, animals, fungi and micro-organisms, and their roles in nature.

People have come to realize that forests offer much more than just timber. Forests provide recreational opportunities and contribute to our health and well-being. Not only do they regulate local temperatures and protect drinking water supplies, they also act as carbon sinks and mitigate climate change. Forests also play important economic, social, and cultural roles in the lives of many people, especially those of indigenous communities.

The following human actions are having negative impacts on forest biodiversity. This loss and degradation of forests makes landscapes more fragile and diminishes the services provided by forests to humans.
1. conversion of forests to agricultural land,
2. overgrazing,
3. unsustainable management,
4. introduction of invasive alien species,
5. infrastructure development,
6. mining and oil exploitation,
7. man-made fires,
8. pollution and climate change

Over the last 8000 years about 45% of the Earth’s original forests has disappeared, most of which was cleared during the past century. Approximately 13 million hectares of the world’s forests are lost to deforestation each year, an area the size of Greece

Next, let’s explore biodiversity in marine ecosystems. **Oceans cover 70% of our planet and represent over 95% of the biosphere.** Marine and coastal habitats cover a diverse spectrum—from those near terrestrial environment such as coral reefs, mangrove forests, seagrass beds, and estuaries, to those deep below the surface, such as open ocean, hydrothermal vents, seamounts and soft sediments on the ocean floor.

This tremendous wealth of biodiversity and ecosystem services is not, however, infinite. Today, human activities are greatly threatening the seas and coasts through overfishing, destructive fishing practices, pollution and waste disposal, agricultural runoff, invasive alien species, and habitat destruction. Global climate change adds additional pressures by raising the sea level, increasing the water temperature and leading to more storms and natural disasters. **Seawater is acidifying** due to increasing levels of atmospheric CO2, with significant implications for marine biodiversity.

Not all species contribute to biodiversity. Some actually cause overall biodiversity to decline. These are called **invasive species.**

**America’s Silent Killer: How Invasive Species Threaten America’s Unique Wildlife Heritage**

Foreign plants, animals and pathogens make their way into the United States every day. Some are imported intentionally as crops or ornamental plants, or pet animals. Others arrive accidentally as riders on produce, nursery stock, timber or in ballast water. Freed from their natural predators or other limits on their populations, some alien species spread rapidly. These invasive plants and animals can harm our native wildlife directly through predation or indirectly through degradation and destruction of crucial habitat.

Experts believe that **invasive plants already exist in all 50 states on more than 100 million acres of land and water – an area roughly the size of California** – and that they continue to spread at a rate of about 14 million acres per year. At least 4,500 species of foreign plants and animals have established free-living populations throughout the country, and at least 15 percent of these are known to be harmful. The worst invasive species caused documented losses of $97 billion from 1906 to 1991.
The environmental havoc alien species wreak is staggering. *Forty-six percent of all federally-listed threatened and endangered species are considered at risk primarily due to competition with or predation by invasive species.* Alien invaders are considered the top threat to wildlife refuges across the United States.

**Putting a Face on the Problem**

At **Blackwater Refuge** on Maryland’s eastern shore, nutria, a beaver-like rodent species native to Central America that was originally brought to the United States for its fur, has destroyed *thousands* of acres of tidal **marshes** by feeding on the **tender roots** of marsh plants. The refuge loses 500 to 1,000 acres every year as a result of nutria damage, and the entire estuary loses several times that amount. As nutria chew up the marsh, they also **displace** native muskrats and shrink the wetlands needed by more than 250 species of birds, including migratory waterfowl. The marsh loss also affects **animals**/creatures living in the Chesapeake **Bay**, including commercially valuable crabs and finfish.

With each passing year, the planet is losing biodiversity.

*We are in an extinction crisis.*

The Living Planet Index measures changes in biodiversity in animals with backbones (vertebrates).

The main statistic from the report is the global LPI which shows a **58% decline** between 1970 and 2012. This means that, on average, animal populations are roughly half the size they were in 42 years ago.

The LPI can be divided into terrestrial, freshwater and marine indices to show how trends vary in different ecosystems. Freshwater species populations have suffered an **81% decline**, an average loss much greater than that of land and marine species.
How many species are we losing?
Well... this is the million dollar question. And one that’s very hard to answer.

Firstly, we don’t know exactly what’s out there. It’s a big complex world and we discover new species to science all the time.

"Scientists were startled in 1980 by the discovery of a tremendous diversity of insects in tropical forests. In one study of just 19 trees in Panama, 80% of the 1,200 beetle species discovered were previously unknown to science... Surprisingly, scientists have a better understanding of how many stars there are in the galaxy than how many species there are on Earth." - World Resources Institute (WRI).

So, if we don’t know how much there is to begin with, we don’t know exactly how much we’re losing.

But we do have lots of facts and figures that seem to indicate that the news isn’t good.

Just to illustrate the degree of biodiversity loss we’re facing, let’s take you through one scientific analysis...

- The rapid loss of species we are seeing today is estimated by experts to be between 1,000 and 10,000 times higher than the natural extinction rate.*
- These experts calculate that between 0.01 and 0.1% of all species will become extinct each year.
- If the low estimate of the number of species out there is true - i.e. that there are around 2 million different species on our planet** - then that means between 200 and 2,000 extinctions occur every year.
- But if the upper estimate of species numbers is true - that there are 100 million different species co-existing with us on our planet - then between 10,000 and 100,000 species are becoming extinct each year.