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## What is Biodiversity?



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The term “biodiversity” refers to the variety of life forms in a habitat, whether it’s a local environment or an entire planet. Most of the species making up our planetary biodiversity are still poorly studied or completely unknown; experts estimate that there may be at least four times as many complex (eukaryotic) species alive on our planet as the 1.9 million that have already been discovered and named, possibly more. Even as we are becoming aware of the massive biodiversity of Earth, we are also in the midst of a biodiversity crisis, with species going extinct at rates rivaling those of the major mass extinctions of Earth’s history. Therefore, while the definition of the term “biodiversity” is simple, it in fact encompasses some of humanity’s (and science’s) biggest challenges.

There are a number of reasons why understanding and preserving biological diversity is important. Above all, every species is unique in its combination of evolutionary history and ecological role, so taken together they are a global resource—like a library preserving the heritage of life itself.

### Ecological resilience

The continuation of life as a whole is dependent on the presence of a variety of different species able to perform a variety of roles under a variety of circumstances. In the first chapter of his classic work on biodiversity, *The Diversity of Life*, entomologist Edward O. Wilson describes a violent thunderstorm in the Brazilian rainforest and the way the forest revives itself after suffering physical damage—a process

that can occur because a diversity of species is present to capably adapt to the damage and rebuild the environment.

This function of biodiversity is also relevant in manmade systems, such as agriculture. When we depend on only one or a few types of crops, our food supply becomes vulnerable to disease, infestation, and extreme weather. A famous example of the danger of low agricultural biodiversity is the Irish potato famine of 1845, during which the single potato species that the population consumed was effectively wiped out by the late blight fungus. Environmental thinkers from Aldo Leopold to Michael Pollan have recognized the importance of biological diversity as insurance against famine. The more species that are available, the more likely it is that there will be some adapted to handle some new threat, disturbance, or human need.

### **Ecosystem services**

Ecosystem services are benefits that people receive from well-functioning ecosystems. Humans depend on natural ecosystems to purify water and air, structure landscapes and prevent soil erosion, and detoxify or decompose wastes, among other services. These benefits are enhanced by the diversity of the systems involved. Marine fisheries depend on diversity in order for fish populations to stay robust enough to provide a sustainable wild food source. Diversity and abundance of natural ecosystems allow for the flourishing of wild pollinator species, which can also pollinate crops.

### **Natural innovation**

History is full of examples of products and inventions useful to humans that originally came from other species. Penicillin, the first widely used antibiotic, was famously discovered when microbiologist Alexander Fleming observed that the mold contaminating one of his discarded experimental Petri dishes was killing the bacteria on the plate. (Note that in his Nobel lecture, Fleming refers to mold as a “plant”—we now know that molds are actually fungi, a completely different and diverse branch on the tree of life.) Today, the endangered venomous cone snails are being investigated for ideas on how to develop painkillers and other drugs, and observations of the slippery surfaces of pitcher plants have allowed engineers to invent new lubricating methods for medical devices and fuel transport. As more species are studied, more ideas for solutions to medical, scientific, and engineering problems are expected.

### **Culture and aesthetics**

Both societies and individuals value elements of biodiversity for being beautiful, interesting, inspiring, or thought provoking. Well-known species can have cultural significance, providing people with a sense of tradition and cultural history, for example, particular plant species used in regional cuisines (such as the chili pepper), national symbols (e.g., the bald eagle or giant panda), or community identifiers (e.g., sports team mascots). Less well-known species provide a sense of wonder and excitement through entertainment such as nature documentaries and recreational activities, including hiking and birding.

### **Intrinsic value**

Some believe in the philosophical and ethical principle that nonhuman living things have intrinsic value in and of themselves, independent of their usefulness to humans. From a conservation standpoint, this means that humans have a responsibility to protect the right of other species to exist on our planet. From a scientific standpoint, it means that other species are worthy of study simply because their status as living things makes them relevant.