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Biodiversity

Biodiversity refers to the variety of life on Earth, and definitions of biodiversity generally encompass measures of diversity at the genetic, species, and ecosystem levels. Assessing changes in biodiversity—including both losses and gains—at all three of these levels and the causes, or *drivers*, of these changes is of interest to many scientists and other stakeholders. Addressing biodiversity, including biodiversity loss and the potential consequences for humans, is also of interest to some Members of Congress. Some Members have introduced legislation in the 117th Congress that aims to conserve species and ecosystems.

Definition of Biodiversity

There are many definitions of biodiversity. Many include similar concepts to the definition provided by the United Nations Convention on Biological Diversity (CBD): *biological diversity* is “the variability among living organisms from all sources including, inter alia, 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.” Some definitions also consider fluctuations to levels of biodiversity. For example, the Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services (IPBES) definition of *biodiversity* includes both concepts of biotic variety and “changes in abundance and distribution over time and space within and among species, biological communities and ecosystems.”

Biodiversity decline is a concern for many stakeholders and policymakers due to the relationship between biodiversity, ecosystem services, and human welfare. For example, agricultural crops can be derived from wild species; plants are often sources of natural medicines and contribute to prescription drug development (e.g., the rosy periwinkle found in Madagascar is the basis for medicine treating Hodgkin’s disease and childhood leukemia); wildlife provides essential nutrition and recreation; and ecosystems provide services for humans (e.g., flood control, carbon sequestration, pollination, and water filtration).

Measuring Biodiversity

How many species of plants, animals, fungi, and microorganisms exist on Earth is a fundamental, yet complex, question. As it is not currently possible to quantify every living species, scientists have used extrapolations to estimate total species richness. Due to different scientists’ different methods and assumptions, estimates for the number of species on Earth have varied, sometimes widely. To date, scientists have directly described approximately 1.5 million species. Many estimates place the actual number of species between 8

million and 15 million, though estimates have ranged from below 5 million to over 100 million species.

In addition to assessing species diversity, biodiversity often incorporates concepts of genetic and ecosystem diversity. *Genetic diversity* is a measure of genetic variation among individuals of the same species. *Ecosystem diversity* is a measure of the variety of ecosystems, defined as the community of organisms and their physical environments interacting together, in a given location.

Changes in Biodiversity

The number of species on Earth is not static, and extinctions and speciation constantly occur through natural processes. Humans also influence biodiversity, and many scientists assert that biodiversity is currently being lost at a rate unprecedented over human history. Some counter this assertion by arguing that extinction is part of evolution and that all species are somewhere on the road to extinction; they note that there have been five mass extinctions in Earth’s history without anthropogenic pressure.

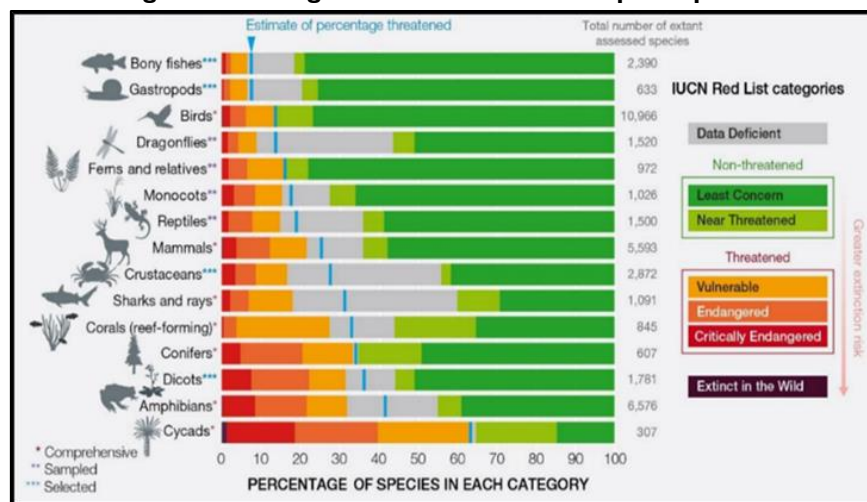
Status of Biodiversity

The IPBES published a 2019 study on global biodiversity that assessed past, present, and potential future trends in biodiversity and ecosystem services. In the study, scientists found that societal effects on land, freshwater, and oceans have accelerated in the past 50 years and are contributing to an increase in the number of species threatened with extinction and the alteration of ecosystems and the services they provide to humans. Some scientists, however, argue that changes in biodiversity at the global scale may not reflect changes at the local scale, where biodiversity could be stable or increasing in some regions.

By analyzing the proportion of known species currently threatened by extinction (see **Figure 1**), the IPBES extrapolated that roughly 1 million species—including both known and unknown species—could be threatened with extinction. The IPBES estimated that 25% of noninsect plants and animals and 10% of insects, which account for 75% of all species, could be threatened with extinction; it used 8.1 million as the estimate for total species. Some stakeholders contend this figure may be overinflated, because it is based on an inflated estimate of the total number of species on Earth. Other research also has quantified currently threatened species and potential biodiversity loss, though these findings have varied in extent and severity. For example, one study estimated that nearly 40% of wild plants were threatened with extinction. Another study estimated that some vertebrates’ population sizes had declined by an average of 68% over the last five decades. Further, a 2017 study concluded that, out of 177

mammal species studied, more than 40% had experienced “severe population declines.”

Figure 1. Endangerment of Selected Groups of Species



Source: IPBES, Summary for Policymakers of the Global Assessment Report on Biodiversity and Ecosystem Services, 2019, p. 26.

The IPBES assessment also reported that ecosystems’ ability to provide services is declining. For example, the assessment stated that human beings have severely altered 75% of the land-based environment and approximately 66% of the marine environment, which has resulted in a decline of ecosystem services. The assessment noted that, absent transformative changes, the negative trends in biodiversity and ecosystem function and services are expected to continue through 2050 and beyond.

Drivers That Affect Biodiversity

Several factors may affect biodiversity. The IPBES assessment stated that changes in land and sea use, direct exploitation of organisms, climate change, pollution, and invasion of alien species all can lead to declines in biodiversity. Another study linked declining marine biodiversity with overfishing and climate change. The IPBES and the Intergovernmental Panel on Climate Change reported that climate change also alters biodiversity and can exacerbate the negative effects of other drivers.

Some scientists argue that land use change, including agricultural expansion and deforestation, is the primary driver of biodiversity decline. For example, the IPBES assessment found that over one-third of the world’s land surface and three-fourths of its freshwater resources are dedicated to crop or livestock production.

Some scientists note that certain drivers could benefit biodiversity. For example, one study found that non-native plant species may contribute to biodiversity. Other scientists note that climate change may alter ecosystems and may result in species geographically shifting, which could increase biodiversity in some locations.

Global and U.S. Efforts to Address Biodiversity

Global efforts to address biodiversity are organized, in part, under the CBD. The CBD’s main objectives are conserving biological diversity, sustainably using components of biological diversity, and ensuring the fair and equitable sharing of benefits arising from the use of genetic

resources. There are 196 parties to the CBD; the United States is not a party. Other international agreements address biodiversity, including the International Union for the Conservation of Nature and the Convention on International Trade in Endangered Species of Wild Fauna and Flora.

The United States does not have a federal program to address biodiversity holistically, and there is no national biodiversity assessment for the United States. Several federal agencies track and compile data on certain species and ecosystems, including the U.S. Geological Survey and U.S. Fish and Wildlife Service (FWS), among others. Internationally, the United States provides funding for biodiversity through several international conservation programs run primarily through the U.S. Agency for International Development and FWS.

Role of Congress

Some in Congress argue that existing U.S. laws and policies are sufficient to address biodiversity issues. Others call for new authorities or additional funding to address these issues. Stakeholders and policymakers note several avenues that Congress might consider:

- Conducting oversight over the implementation and funding of existing laws and programs that address biodiversity, such as the Endangered Species Act
- Establishing a biodiversity program to holistically address biodiversity in the United States that includes a biodiversity strategy, as called for in H.Res. 69 in the 117th Congress, and a national biodiversity assessment
- Considering ratifying the CBD and other agreements, such as the Convention on Migratory Species
- Enacting and funding the America the Beautiful initiative, which aims to conserve at least 30% of U.S. lands and waters by 2030
- Enacting biodiversity-related legislation in the 117th Congress, such as the Critically Endangered Animals

- Conservation Act of 2021 (H.R. 1569) and the Protect the Global Amphibians Act (H.R. 2026)

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