

Iowa Academy of Science

STATEMENT OF THE POSITION OF THE IOWA ACADEMY OF SCIENCE
ON BIODIVERSITY



BIODIVERSITY

The economic, aesthetic, and physical well-being of Iowans depend upon a great number of living species. The Earth supports a variety of organisms and systems that perform essential tasks such as fixing energy from the sun, distributing energy, and recycling nutrients. Increasingly, we realize that living systems are also important for ecosystem stability, moderation of severe environmental disasters, and cures for diseases. These ecosystem services are dependent on a wealth of living species.

Biodiversity Defined – *Biodiversity, as defined by E.O Wilson, is "all hereditarily based variation at all levels of organization, from the genes within a single local population or species, to the species composing all or part of a local community, and finally to the communities themselves that compose the living parts of the multifarious ecosystems of the world."* Biologists typically divide biodiversity into three types:

Genetic diversity – referring to the amount of genetic variation observed within a population or a species

Species richness – referring to the number of species occupying a defined region

Ecosystem diversity – referring to the variety of species and ecological processes that occur in different physical settings.

These scales of biodiversity are nested and interactive. High levels of genetic diversity contribute to a population's or species' ability to withstand environmental change, whether that change is an abnormally wet August, a newly formulated pesticide, or the introduction of a pathogen such as the West Nile virus. High levels of genetic diversity also increase the chances of population or species survival by counteracting the impacts of inbreeding depression. Higher levels of species richness in a community typically result in greater functional diversity within that community.

VALUE OF BIODIVERSITY

The ecological services provided by biodiversity benefit both humans and non-humans. The activities of bacteria, fungi, and invertebrates are essential to soil formation, waste decomposition, and nutrient recycling. Photosynthetic organisms provide energy for non-photosynthetic organisms and remove carbon dioxide from the atmosphere. Diverse insects pollinate plants, sustaining valuable crops as well as natural ecosystem producers. Predatory arthropods control crop pests. Microbes purify water. All of these natural processes sustain the lives of organisms upon which we rely. As ecosystems collapse, we may realize the value of these "ecological services" too late.

Biodiversity is valuable to us. The genetic resources of a species are beneficial, as evidenced when genes from a nearly extinct species of wild corn from Mexico were incorporated into domestic species to increase disease resistance. Humans are dependent upon other organisms for energy and nutrients and products for clothing, shelter, and medicines. In the United States, we rely most heavily upon domesticated species to provide our resources, but wild organisms also make important contributions to human wellbeing. Many medical compounds are based upon chemicals derived from wild organisms, primarily plants. At present, the medicinal value of only 0.3% of known plant species has been evaluated.

Loss of diversity threatens an ecosystem's ability to provide ecological services. For example a wetland's ability to absorb water and prevent flash flooding relies on its biodiversity. Ecosystems function because many species, from microscopic to the large plants and animals, play interrelated and complex roles.

Finally, humans appreciate and value biodiversity because of the satisfaction they derive from interactions with the natural world. Experiences in natural settings increase levels of relaxation, calm, and enhanced capacity for creativity.

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THREATS TO BIODIVERSITY

At present there are 1.7 million described species worldwide, with estimates of total species richness ranging from 5-15 million. But species are becoming extinct, both locally and globally, as humans destroy natural habitat through activities such as settlement, forest clearing, agriculture, pollution, climate change and the introduction of invasive species and diseases

Although extinction forces have occurred throughout life's history, the pace of these impacts has increased due to human activities. For example, as a result of human activities, Iowa has lost over 99% of its tallgrass prairie – prairie that required 10,000 or more years to produce. Remnants of ecologically functional prairie habitats are highly fragmented and degraded. Agricultural runoff into streams and rivers fouls the habitat of native fish and amphibians, and the number of Iowa's water bodies classified as "impaired" continues to grow. Changes from natural flood and fire regimes through water management and fire suppression interfere with spawning cycles of native fish and allow forest species to establish in prairie remnants. Additionally, Iowa has drained 90-95% of its original wetland basins, which has resulted in habitat loss, as well as reduction in natural water containment and filtration processes, and erosion control. On a global scale, similar combinations of human impacts erode biodiversity.

We know that species are disappearing before they can be studied. Some of those species in danger of extinction may play keystone roles in their ecosystems (i.e., the functioning of the ecosystem is dependent on one to a few species). If a keystone species is lost, the whole ecosystem can unravel.

IAS SUPPORT

As human populations grow and per capita resource consumption increases, human impacts on biodiversity are accelerating. Finding a balance between processes supporting human populations and protecting functionally diverse ecosystems is challenging but critical.

The Iowa Academy of Science supports the conservation of biodiversity in three ways:

- 1. Advancing education that informs citizens of Iowa (of all ages) regarding the importance of biodiversity and its conservation**
The Iowa Academy of Science supports education concerning all aspects of biodiversity at all levels in public and private schools, and colleges and universities. Non-formal education programs for the general citizenry are also strongly encouraged. Ecological field experiences and field-oriented education are important methodologies that must be encouraged.
- 2. Advancing public policy that protects and enhances natural habitats in the State of Iowa**
Public policies and laws should protect and enhance existing bits of natural habitat and native populations, should reduce all kinds of human-made pollution, and should avoid the introduction of invasive species. Policies can also support a rich assemblage of species in conjunction with other uses of the land, including agriculture, forestry, and human habitation.
- 3. Encouraging scientific research that contributes to our understanding and preservation of genetic, species, and eco system biodiversity.**
We are a long way from understanding the role various species play in ecosystems, including their role in the soil of our farms, potential for pollution remediation, and flood control mechanisms. The Iowa Academy of Science urges funding agencies, universities, and individual investigators to give priority to this important area of science.

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FURTHER READING

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