

# The Biodiversity Crisis

## Extinction Rates

Extinction is a natural phenomenon that proceeds at a “normal” or “background” rate

The biodiversity crisis exists because current rates of extinction far exceed background rates

By some assessments, human activities in the tropics have increased extinction between 1,000 and 10,000 times the background rate

According to the species-area concept, the number of species in an area is directly related to the size of the area

Rates of extinction, therefore, are directly related to rates of habitat loss

In tropical rain forests, it is believed that about 50% of the species will be lost in an area where 90% of the habitat is lost

Approximately 11% of the 9,040 known birds are endangered, and in the past 40 years, population densities of migratory songbirds in the mid-Atlantic United States dropped 50%

Approximately 3.4% of the 20,000 Known Plant Species in the United States are on the verge of extinction

About 20% of the known freshwater fishes in the world have become extinct in historic times or are seriously threatened

## Major Threats to Biodiversity

### Habitat destruction

Mainly brought about by agriculture, urban development, forestry, mining, and environmental pollution

Habitat destruction in part accounts for about 73% of the designations of species as extinct, endangered, vulnerable, and rare

About 93% of the earth's coral reefs have been damaged by human activity, and it is estimated that 40%-50% of the reefs could be lost in the next 30 to 40 years

## Competition by exotic species

Some nonnative species can displace native species, with few species replacing many species

Displacement by introduced species is considered at least partially responsible for 68% of the listings of extinct, endangered, vulnerable, and rare species

Mammal example – rabbits, which decimated vegetation in northern Australia

Bird Example – starlings, house sparrows, and rock doves (“pigeons”), which have replaced many native species

Fish example – the Nile Perch in Lake Victoria, which has caused the loss of 200-300 native species

Insect example – fire ants, which have caused the extinction of several benign ant species and threaten bird hatchlings

Plant example – kudzu, which has choked out native vegetation throughout the southeastern United States

## Overexploitation

Mainly caused by excessive commercial harvesting, sport hunting, or illegal trade in wildlife and wildlife products

Examples – whales, American bison, Galápagos tortoises, numerous fish, elephants, rhinos, grizzly bears, various birds, many orchids and cacti

## Biodiversity and Human Welfare

Plants provide foods we eat, medicines we take, air we breathe, and various products such as oils and fibers that we use

About 25% of all prescription drugs contain substances derived from plants

Important medicines include compounds from the rosy periwinkle of Madagascar, which are used to treat Hodgkin’s disease and a particular form of childhood cancer

Humans have evolved as part of the biosphere, and it is unclear how humans will fare in a biodiversity-depleted world

## Geographic Distribution of Biodiversity

Gradual variation in biodiversity correlates with geographical gradients

Biodiversity of birds and other species increases from the arctic to the tropics

Energy availability – increasing solar radiation toward the tropics leads to increases in photosynthesis providing an increased resource base and the capacity to sustain more species

Habitat heterogeneity – tropical regions experience more local disturbance leading to greater environmental patchiness, greater diversity of plant species, an increased resource base, and a greater capacity to sustain diverse communities of animals

Niche specialization – tropical climates may allow species to specialize on a narrower range of resources, reducing competition and permitting finer resource partitioning, which would foster greater species diversity

Population interactions – tropical regions are more stable, allowing more time for interspecific relationships to coevolve, which promotes diversity because populations do not become dominant over others

Biodiversity hot spots

Relatively small areas with high concentrations of species

Many organisms in hot spots are endemic species (i.e., they are found nowhere else)

Because endemic species are limited to specific areas, they are highly sensitive to habitat degradation

Many hot spots are tropical forests and chaparral, and islands tend to be hot spots

Migratory species

A special problem because they occupy more than one area

Migratory insects (e.g., monarch), birds, sea turtles, marine mammals

This lecture outline was prepared partly from *Biology*, by Campbell and Reece, 2002 (6<sup>th</sup> edition), and from *Botany – An Introduction to Plant Biology*, by Mauseth, 1998 (2<sup>nd</sup> edition), and may contain phrases or entire sentences taken verbatim from those sources.