

## A4. Identify impacts of human action on species survival and variation within species, and analyze related issues for personal and public decision making

A4.1 describe the relative abundance of species on Earth and in different environments (e.g., note the overall abundance of insect species; note that in harsh environments there are relatively fewer species found than in temperate and tropical environments)

### Distribution of Life on Earth

The existence of life on Earth is made possible because of water and the presence of an atmosphere containing oxygen. Biologists have identified around 1.5 million species of plants and animals.

The species on Earth are not evenly distributed. Tropical rain forest in equatorial regions have the greatest biological diversity. The arctic and antarctic regions contain the least biological diversity. This is because these environments have very cold temperatures and little food. This makes the region inhospitable to many plants and animals.

A.4.2 describe ongoing changes in biological diversity through extinction and extirpation of native species, and investigate the role of environmental factors in causing these changes (e.g., investigate the effect of changing river characteristics on the variety of species living in the river; investigate the effect of changing land use on the survival of wolf or grizzly bear populations)

### Extirpation and Extinction

Biological diversity is gradually decreasing as a result of urbanization, industrialization, agriculture and forestry. In fact, certain species of plants and animals are disappearing from the planet completely. This poses a threat to these living resources.

When an animal or plant species becomes so rare that it is threatened with extinction, it is called an **endangered species**. Some species that were once quite common have been hunted until few remain. Harsh environmental conditions, epidemic diseases, or other natural disasters can lead to the extinction or extirpation of endangered species. An example of an endangered species is the whooping crane. The whooping crane population has been affected by habitat loss.

**Extinction** means the disappearance of every individual of a species from the entire planet. Often, extinction of a species occurs over a long period of time. Catastrophic events, such as climate change, earthquakes, floods, or volcanic eruptions, are likely to have been the cause of mass extinctions. Scientists believe that it may have been an extreme climate change that resulted in the disappearance of the dinosaur.

**Extirpation** means local extinction, that is, the disappearance of a species from a particular area. While that species is not found in that region, there are still populations of the species elsewhere on the planet. The swift fox had been extirpated from the grasslands of southern Alberta. It is only through conservation practices that the swift fox population is now recovering.

## Natural Causes of Extinction and Extirpation

There are some natural causes of extinction and extirpation. Variation within species is important, but natural selection is a very slow process. A harsh change to the environment may be too quick for a species to develop variations and adapt. Changes that result from floods, volcanic eruptions, and earthquakes can cause species extirpation.

## Human Causes of Extinction

Human activities have a great impact on biological diversity. Urbanization, overhunting, construction of dams, roads, and buildings, agricultural development, pollution, and excessive use of pesticides, herbicides, and fertilizers can cause a decrease in biological diversity. Humans have also put certain animals and plants in danger of becoming endangered or extinct by introducing non-native species that compete for resources with species already in the ecosystem.

## Effects of Extinction and Extirpations

Extinction and extirpation of a species have a tremendous effect on the biological diversity in an area. When a species disappears from an area or from Earth, many other species are affected. For example, when one species becomes extinct, other animals that have relied upon it as a food source decrease in numbers. These animals must find another available food source or risk becoming endangered or extinct themselves.

A4.3 evaluate the success and limitations of various local and global strategies for minimizing loss of species diversity (e.g., breeding of endangered populations in zoos, development of seed banks, designating protected areas, development of international treaties regulating trade of protected species and animal parts)

## Preserving Biological Diversity

Biological diversity should be preserved worldwide, and various groups are taking action. The focus is on promoting the sustainable use of resources and managing human activity.

These are some of the steps the Canadian government has taken to conserve biological diversity:

- Developed protected areas like national parks such as Banff and Jasper.
- Monitors and controls the spread of non-native, invasive species.
- Implemented restoration programs that aim to protect endangered species and restore their damaged habitats.
- Created policies and laws on hunting of endangered species.
- Set up seed banks to preserve genetic material in case of catastrophe.