CHAPTER 10 – BIODIVERSITY

E.Q.: ***What is the diversity of species on Earth and why are they important?***

SEV3. Students will describe stability and change in ecosystems.

b. Explain succession in terms of changes in communities through time to include changes in biomass, diversity, and complexity.

c. Explain how succession may be altered by traumatic events.

Section 1: What Is Biodiversity?

Preview

- **Bellringer**
- **Objectives**
- **A World Rich in Biodiversity**
- **Unknown Diversity**
- **Levels of Diversity**
- **Benefits of Biodiversity**
- **Species Are Connected to Ecosystems**
- **Species and Population Survival**
- **Medical and Industrial Uses**
- **Agricultural Uses**
- **Ethics, Aesthetics, and Recreation**

Objectives

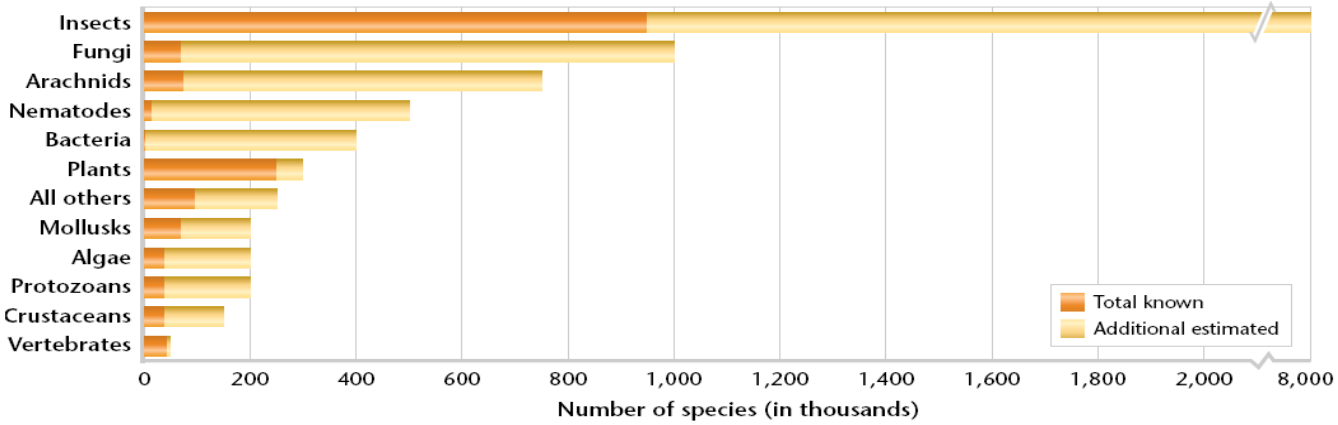
- ***Describe the diversity of species types on Earth, relating the difference between known numbers and estimated numbers.***
- ***List and describe three levels of biodiversity.***
- ***Explain four ways in which biodiversity is important to ecosystems and humans.***
- ***Analyze the potential value of a single species.***

A World Rich in Biodiversity

- **Biodiversity, short for biological diversity, is the variety of organisms in a given area, the genetic variation within a population, the variety of species in a community, or the variety of communities in an ecosystem.**
- **Certain areas of the planet, such as tropical rainforests, contain an extraordinary variety of species.**
- **Humans need to understand and preserve biodiversity for our own survival.**

Unknown Diversity

- **The study of biodiversity starts with the unfinished task of cataloging all the species that exist on Earth.**
- **The number of species known to science is about 1.7 million, most of which are insects. However, the actual number of species on Earth is unknown.**
- **Scientists accept an estimate of greater than 10 million for the total number of species.**



- **New species are considered known when they are collected and described scientifically.**
- **Unknown species exist in remote wilderness, deep oceans, and even in cities.**
- **Some types of species are harder to study and receive less attention than large, familiar species.**

Levels of Diversity

- **Biodiversity can be studied and described at three levels: species diversity, ecosystem diversity, and genetic diversity.**
- **Species diversity refers to all the differences between populations of species, as well as between different species.**
- **Ecosystem diversity refers to the variety of habitats, communities, and ecological processes within and between ecosystems.**
- **Genetic diversity refers to all the different genes contained within all members of a population.**
- **A gene is a segment of DNA that is located in a chromosome and that codes for a specific hereditary trait.**

Benefits of Biodiversity

- **Biodiversity can affect the stability of ecosystems and the sustainability of populations.**
- **We depend on healthy ecosystems to ensure a healthy biosphere that has balanced cycles of energy and nutrients.**
- **Species are part of these cycles.**

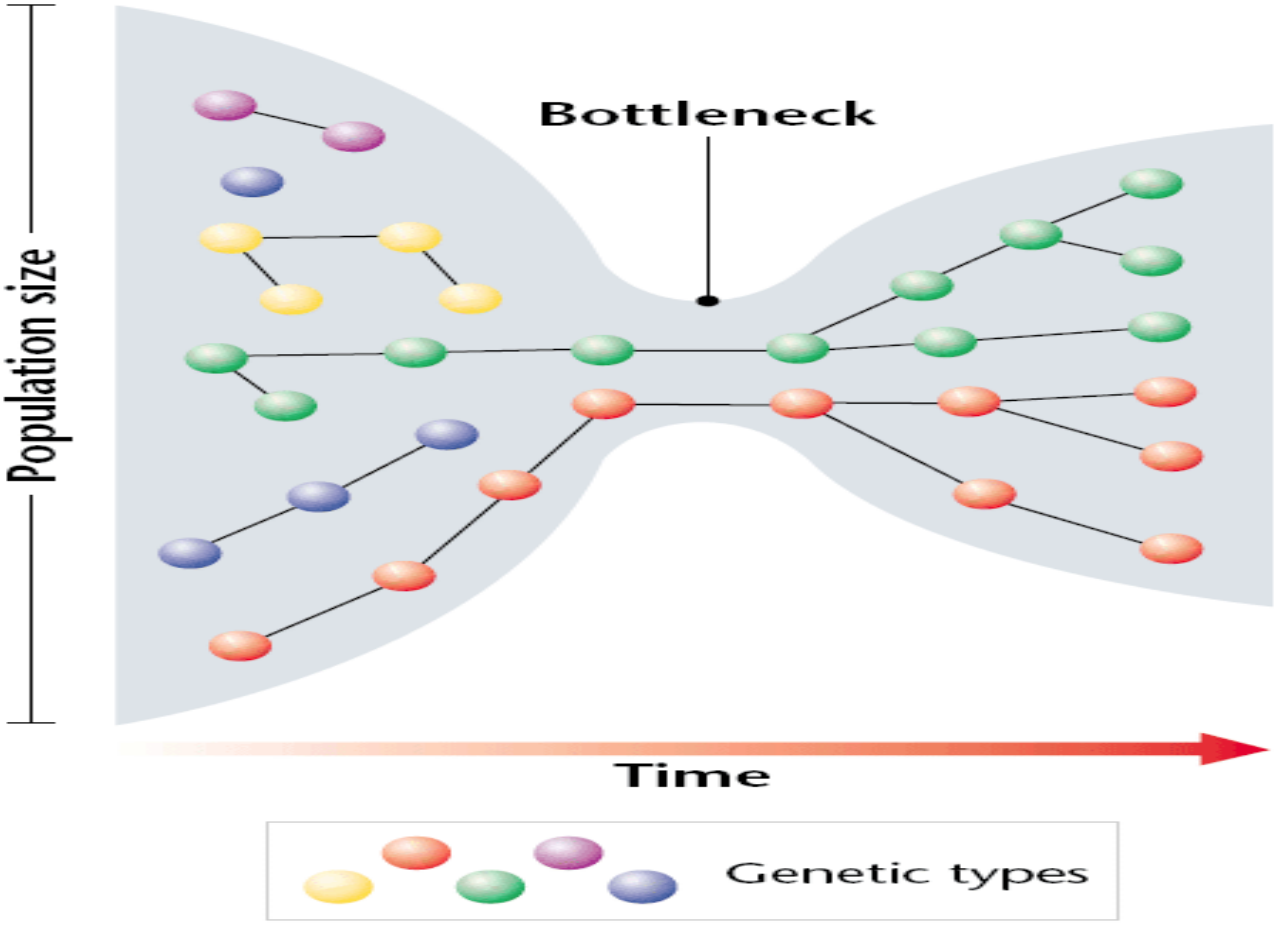
Species Are Connected to Ecosystems

- **When scientists study any species closely, they find that it plays an important role in an ecosystem.**
- **Every species is probably either dependent on or depended upon by at least one other species in ways that are not always obvious.**
- **When one species disappears from an ecosystem, a strand in a food web is removed.**
- **Some species are clearly critical to the functioning of an ecosystem.**
- **A keystone species is a species that is critical to the functioning of the ecosystem in which it lives because it affects the survival and abundance of many other species in its community.**

- **An example is the sea otter. The loss of the sea otter populations led to an unchecked sea urchin population, which ate all the kelp leading to the loss of kelp beds along the U.S. Pacific Coast.**

Species and Population Survival

- **The level of genetic diversity within populations is a critical factor in species survival.**
- **Genetic variation increases the chances that some members of the population may survive environmental pressures or changes.**
- **Small and isolated populations are less likely to survive such pressures.**
- **When a population shrinks, its genetic diversity decreases as though it is passing through a bottleneck.**
- **Even if such a population is able to increase again, there will be inbreeding within a smaller variety of genes.**
- **The members of the population may then become more likely to inherit genetic diseases.**



Medical and Industrial Uses

- **About one quarter of the drugs prescribed in the United Sates are derived from plants, and almost all of the antibiotics are derived from chemicals found in fungi.**
- **New chemicals and industrial materials may be developed from chemicals discovered in all kinds of species.**

- **The scientific community continues to find new uses for biological material and genetic diversity.**

Common Medicines Derived from Plants		
Medicine	**Origin**	**Use**
Neostigmine	calabar bean (Africa)	treatment of glaucoma and basis for synthetic insecticides
Turbocurarine	curare vine (South America)	surgical muscle relaxant; treatment of muscle disorders; and poison for arrow tips
Vincristine, vinblastine	rosy periwinkle (Madagascar)	treatment of pediatric leukemia and Hodgkin's disease
Bromelain	pineapple (South America)	treatment to control tissue inflammation
Taxol	Pacific yew (North America)	anticancer agent
Novacaine, cocaine	coca plant (South America)	local anesthetic and basis for many other anesthetics
Cortisone	wild yam (Central America)	hormone used in many drugs
L-dopa (levodopa)	velvet bean (tropical Asia)	treatment of Parkinson's disease
Reserpine	Indian snakeroot (Malaysia)	treatment to reduce high blood pressure

Agricultural Uses

- **Most of the crops produced around the world originated from a few areas of high biodiversity.**
- **Most new crop varieties are hybrids, or crops developed by combing genetic material from other populations.**
- **History has shown that depending on too few plants for food is risky. Famines have resulted when an important crop was wiped out by disease. But some crops have been saved by crossbreeding them with wild plant relatives.**

Origins of Some Foods
North America, Central America, and South America
• corn (maize), tomato, bean (pinto, green, and lima), peanut, potato, sweet potato, avocado, pumpkin, pineapple, cocoa, vanilla, and pepper (green, red, and chile)
Northeastern Africa, Central Asia, and Near East
• wheat (several types), sesame, chickpea, fig, lentil, carrot, pea, okra, date, walnut, coffee, cow, goat, pig, and sheep
India, East Asia, and Pacific Islands
• soybean, rice, banana, coconut, lemon, lime, orange, cucumber, eggplant, turnip, tea, black pepper, and chicken

Ethics, Aesthetics, and Recreation

- **Some people believe that we should preserve biodiversity for ethical reasons. They believe that species and ecosystems have a right to exist whether or not they have any other value.**
- **People also value biodiversity for aesthetic or personal enjoyment such as keeping pets, camping, picking flowers, or watching wildlife.**
- **Ecotourism is a form of tourism that supports the conservation and sustainable development of ecologically unique areas.**