Chapter 4
The Organization of Life

4.1 Ecosystems: Everything is Connected

Objectives

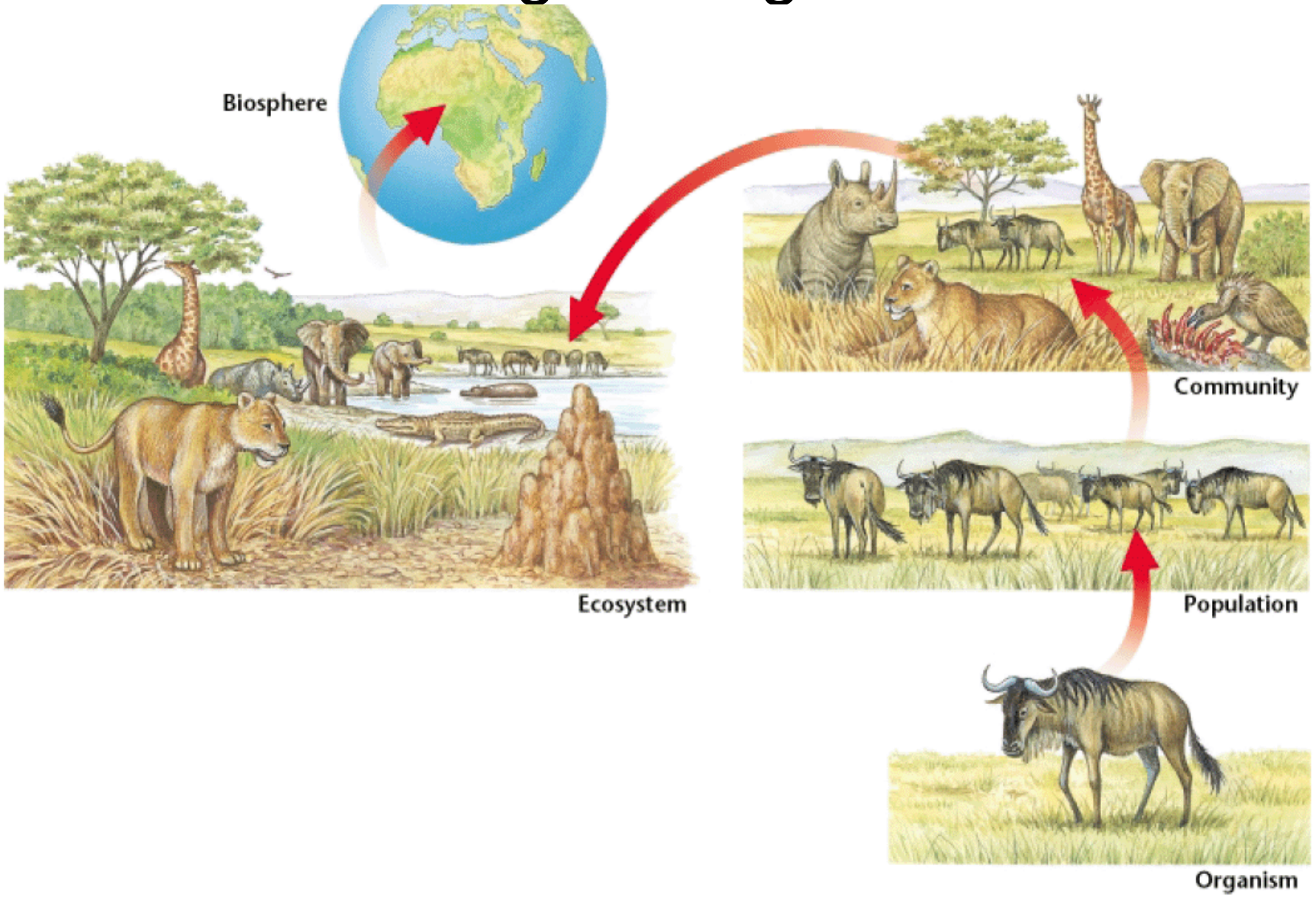
- **Distinguish** between the biotic and abiotic factors in an ecosystem.
- **Describe** how a population differs from a species.
- **Explain** how habitats are important for organisms.

Defining an Ecosystem

- **Ecosystems** are communities of organisms and their abiotic environment.
- Examples are an oak forest or a coral reef.
- Ecosystems do not have clear boundaries.
- Things move from one ecosystem to another. Pollen can blow from a forest into a field, soil can wash from a mountain into a lake, and birds migrate from state to state.

Give 3 examples of ecosystems

Levels of Ecological Organization



The Components of an Ecosystem

- In order to survive, ecosystems need five basic components: energy, mineral nutrients, water, oxygen, and living organisms.
- Plants and rocks are components of the land ecosystems, while most of the energy of an ecosystem comes from the sun.
- If one part of the ecosystem is destroyed or changes, the entire system will be affected.

Biotic and Abiotic Factors

- **Biotic factors** are environmental factors that are associated with or results from the activities of living organisms which includes plants, animals, dead organisms, and the waste products of organisms.
- **Abiotic factors** are environmental factors that are not associated with the activities of living organisms which includes air, water, rocks, and temperature.
- Scientists can organize these living and nonliving things into various levels.

Organisms

- **Organisms** are living things that can carry out life processes independently.
- You are an organism, as is and ant, and ivy plant, and each of the many bacteria living in your intestines.
- Every organism is a member of a species.
- **Species** are groups of organisms that are closely related can can mate to produce fertile offspring.

Populations

- Members of a species may not all live in the same place. Field mice in Maine will not interact with field mice in Texas. However, each organism lives as part of a population.
- **Populations** are groups of organisms of the same species that live in a specific geographical area and interbreed.
- For example, all the field mice in a corn field make up a population of field mice.

Populations

- An important characteristic of a population is that its members usually breed with one another rather than with members of other populations
- For example, bison will usually mate with another member of the same herd, just as wildflowers will usually be pollinated by other flowers in the same field.

Communities

- **Communities** are groups of various species that live in the same habitat and interact with each other.
- Every population is part of a community.
- The most obvious difference between communities is the types of species they have.
- Land communities are often dominated by a few species of plants. These plants then determine what other organisms can live in that community.

Habitat

- **Habitats** are places where an organism usually lives.
- Every habitat has specific characteristics that the organisms that live there need to survive. If any of these factors change, the habitat changes.
- Organisms tend to be very well suited to their natural habitats. If fact, animals and plants usually cannot survive for long periods of time away from their natural habitat.

Give an examples of an organism, population, community and ecosystem that you interact with.

Chapter 4
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4.2 Evolution

Objectives

- **Explain** the process of evolution by natural selection.
- **Explain** the concept of adaptation.
- **Describe** the steps by which a population of insects becomes resistant to pesticide.

Evolution by Natural Selection

- English naturalist Charles Darwin observed that organisms in a population differ slightly from each other in form, function, and behavior.
- Some of these differences are hereditary.
- Darwin proposed that the environment exerts a strong influence over which individuals survive to produce offspring, and that some individuals, because of certain traits, are more likely to survive and reproduce than other individuals.

Evolution by Natural Selection

- **Natural selection** is the process by which individuals that have favorable variations and are better adapted to their environment survive and reproduce more successfully than less well adapted individuals do.
- Darwin proposed that over many generations, natural selection causes the characteristics of populations to change.
- **Evolution** is a change in the characteristics of a population from one generation to the next.

Nature Selects

- Darwin thought that nature selects for certain traits, such as sharper claws, because organisms with these traits are more likely to survive.
- Over time, the population includes a greater and greater proportion of organisms with the beneficial trait.
- As the populations of a given species change, so does the species.

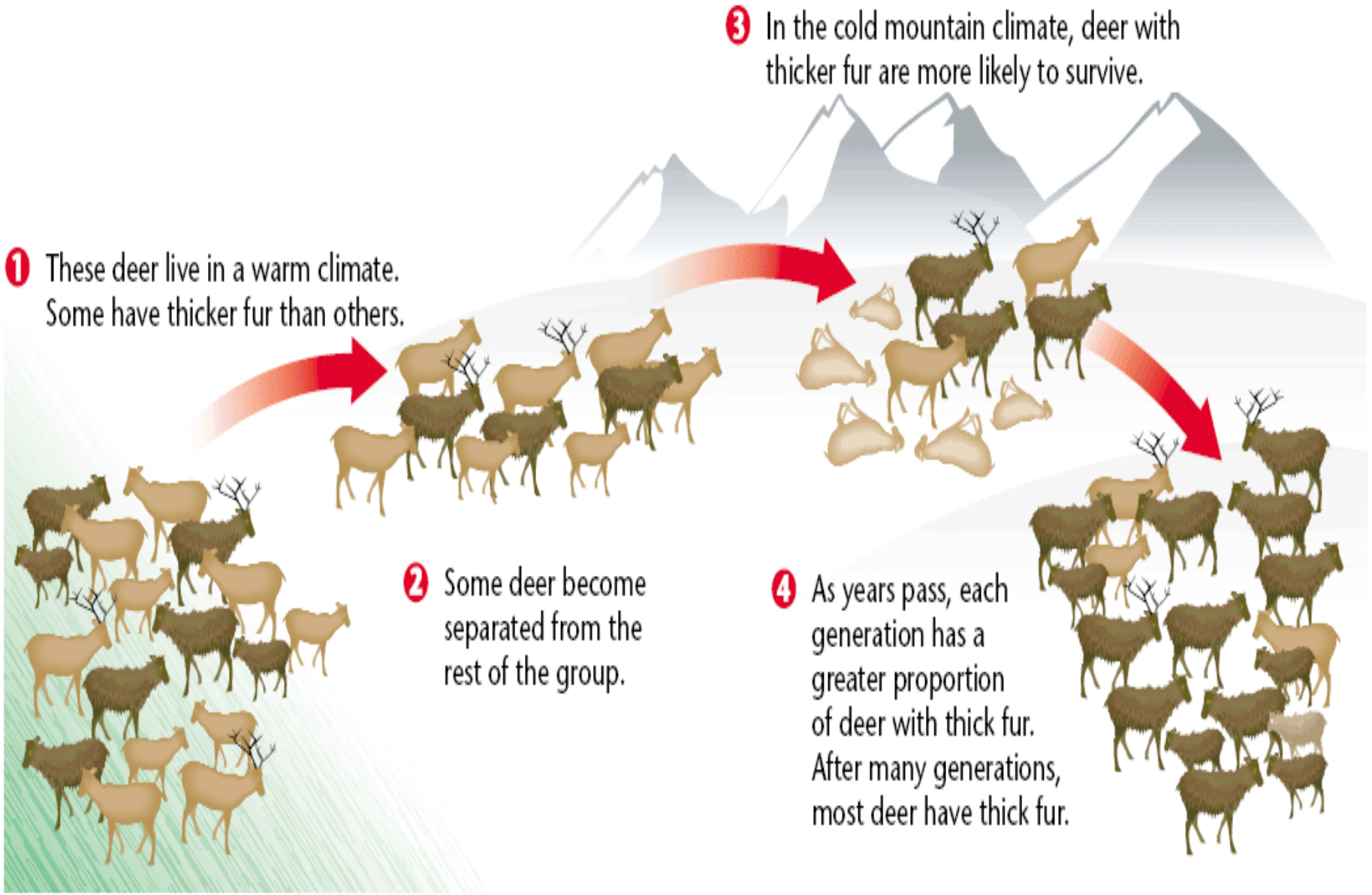
Evolution by Natural Evolution

Evolution by Natural Selection	
1. Organisms produce more offspring than can survive.	In nature, organisms have the ability to produce more offspring than can survive to become adults.
2. The environment is hostile and contains limited resources.	The environment contains things and situations that kill organisms, and the resources needed to live, such as food and water, are limited.
3. Organisms differ in the traits they have.	The organisms in a population may differ in size, coloration, resistance to disease, and so on. Much of this variation is inherited.
4. Some inherited traits provide organisms with an advantage.	Some inherited traits give organisms an advantage in coping with environmental challenges. These organisms are more likely to survive longer and produce more offspring; they are "naturally selected for."
5. Each generation contains proportionately more organisms with advantageous traits.	Because organisms with more advantageous traits have more offspring, each generation contains a greater proportion of offspring with these traits than the previous generation did.

Nature Selects

- An example of evolution is a population of deer that became isolated in a cold area.
- Some of the deer had genes for thicker, warmer fur. These deer were more likely to survive, and their young with thick fur were more likely to survive to reproduce.
- **Adaptation** is the process of becoming adapted to an environment. It is an anatomical, physiological, or behavioral change that improves a population's ability to survive.

Nature Selects



Why did the dear population change?

What is another example of natural selection?

Coevolution

Honeycreeper (bird)

Nectar producing flower

Coevolution

- The process of two species evolving in response to long-term interactions with each other is called **coevolution.**
- An example is the Hawaiian honeycreeper, which has a long, curved beak to reach nectar at the base of a flower. The flower has structures that ensure that the bird gets some pollen on its head.
- When the bird moves the next flower, some of the pollen will be transferred, helping it to reproduce.

Coevolution

- Two different species evolving together
- The honeycreeper's adaptation is along, curved beak.
- The plant has two adaptations:
- The first is the sweet nectar, which attracts the birds.
- The second is the flower structure that forces pollen onto the bird's head when the bird sips nectar.

Evolution by Artificial Selection

- **Artificial selection** is the selective breeding of organisms, by humans, for specific desirable characteristics.
- Dogs have been bred for certain characteristics.
- Fruits, grains, and vegetables are also produced by artificial selection. Humans save seeds from the largest, and sweetest fruits. By selecting for these traits, farmers direct the evolution of crop plants to produce larger, sweeter fruit.

Given 2 examples of artificial selection

Evolution of Resistance

- **Resistance** is the ability of an organism to tolerate a chemical or disease-causing agent.
- An organism may be resistant to a chemical when it contains a gene that allows it to break down a chemical into harmless substances.
- Humans promote the evolution of resistant populations by trying to control pests and bacteria with chemicals.

Pesticide Resistance