Botkin & Keller- 8th Edition

**Chapter 8- Biological Diversity and Biological Invasions**

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1: What is **biological diversity**?

Biological diversity refers to the variety of life-forms, commonly expressed as the number of species or the number of genetic types in the area.

2: What is a **population**?

A population is a group of individuals of the same species living in the same area or interbreeding and sharing genetic information.

3: What is a **species**?

A species is all the individuals that are capable of interbreeding, made up of populations.

4: What are the 9 reasons why people ***value biodiversity***?

The 9 reasons why people value biodiversity are utilitarian, public-service, ecological, moral, theological, aesthetic, recreational, spiritual, and creative.

*Define the following:*

**\* Genetic Diversity:** The total number of genetic characteristics of a specific species, subspecies, or group of species.

**\* Habitat Diversity:**  The different kinds of habitats in a given unit area.

**\* Species Diversity:** Number of species, which has 3 qualities:

**\* Species Richness:** The total number of species

**\* Species Evenness:** The relative abundance of species

**\* Dominant Species:** The most abundant species

5: What are the **3 main domains** of life?

Eukaryota/Eukarya, Bacteria, and Archaea.

6: What is **biological evolution**?

Biological evolution refers to the change in inherited characteristics of a population from generation to generation.

7: What causes **mutations**? *Explain how this affects biological diversity.*

Mutations are caused by changes in genetic code that changes the genotype of an individual. Mutated characteristics cause more diversity in a population in the form of entire species, if this characteristic is widespread.

8: What is **natural selection**? What are the **4 primary factors** involved in natural selection?

Natural selection is the process of increasing the proportion of offspring, which is caused by mutations that may either benefit or hinder the individual’s abilities. The 4 primary factors of natural selection are:
-Inheritance of traits from one generation to the next and some variation in these traits

-Environmental variability

-Differential reproduction (differences in numbers of offspring per individual), which varies with the environment

-Influence of the environment on survival and reproduction

**A Closer Look 8.1**

**Natural Selection: Mosquitoes and the Malaria Parasite**

1: Discuss the issue with Malaria, Mosquitoes and DDT resistance and *how this demonstrates natural selection.*

Malaria-carrying mosquitoes in Africa were an ongoing problem in the area until DDT, a pesticide, wiped out the majority of the mosquito population. However, over time, a variation of genes In certain mosquitoes soon made a small community of mosquitoes immune to DDT and other pesticides. While the DDT-vulnerable mosquitoes died off along with their offspring, the invulnerable variation repopulated and spread throughout.

The mutation of genes that allowed the mosquito to be protected from Malaria is an example of natural selection, where mutations benefited the organism by giving it qualities that insured better performance and living. While the newly born DDT-immune mosquitoes thrived, the regular, DDT-vulnerable mosquitoes died off.

**Migration and Geographic Isolation**

1: How does Darwin’s Finches demonstrate the idea of **Adaptive Radiation**?

Darwin’s finches developed traits that suited the living conditions of the areas in which they resided, and new species were born from these adaptations. These adaptive roles demonstrate the process of adaptive radiation.

2: Define: **Genetic Drift**

Genetic drift refers to changes in frequency of a gene in a population due not to mutation, selection, or migration, but simply to chance.

3: What is the **Founder Effect** and how does it demonstrate Genetic Drift?

The flounder effect occurs when a small number of individuals are isolated from a larger population. The individuals usually possess less genetic variation than the original species, and the characteristics that develop within the community are affected by chance.

The flounder effect demonstrates genetic drift because the limited genetic variation within the separated communities causes little change to be made to its genetic traits and adaptations, and chance may be the only way any changes will happen.

**Biological Evolution as a Strange Kind of Game**

In summary, ***the theory of biological evolution*** tells us the following about biodiversity:

1: Since species have evolved and do evolve, and since some species are also always becoming extinct, biological diversity is always changing, and which species are present in any one location can change over time.

2: Adaptation has no rigid rules; species adapt in response to environmental conditions, and complexity is a part of nature. We cannot expect threats to one species to necessarily be threats to another.

3: Species and populations do become geographically isolated from time to time, and undergo the flounder effect and genetic drift.

4: Species are always evolving and adapting to environmental change. One way they get into trouble – become endangered – is when they do not evolve fast enough to keep up with the environment.

**The Competitive Exclusion Principle**

1: Explain how the introduction of the American Gray Squirrel into Great Britain demonstrates the **Competitive Exclusion Principle.**

The introduction of the American Gray Squirrel was thought to be a great method to beautify Great Britain, but unfortunately, the native squirrel species, the British Red Squirrel, had the same habitat requirements. Both are under competition for resources, with the Red Squirrel outnumbering Gray Squirrels 2.5 mil to 140k. This outcome is an example of the Competitive Exclusion Principle, which states that two species with the same requirements cannot coexist in exactly the same habitat.

**Measuring Niches**

1: What is an **ecological niche**?

An ecological niche concept explains how so many species can coexist with one another.

2: What is the difference between a **fundamental** and **realized niche?**

A fundamental niche is the condition in which an organism can thrive without conflict by other organisms, such as a certain temperature. A realized niche is the condition in which all organisms can thrive in together.

**Symbiosis**

1: In ecology, symbiosis describes a relationship between two organisms that is beneficial to both- each partner in symbiosis is called a: symbiont.

2: What is an **obligate symbiont**?

An obligate symbiont is a symbiont that benefits its host/partner for benefits in return.

3: Explain the symbiotic relationship between people and dogs.

In a symbiotic relationship, dogs are raised and nourished by humans, and dogs provide companionship in return. Both benefit one another and are both obligate symbionts.

**Predation and Parasitism**

1: Explain how predation and parasitism actually helps increase species diversity in an ecosystem

Parasites could limit the host’s ability to compete for resources against neighboring organisms, which would eventually lead to that species’ prosperity. Because the competition is wiped out, more diversity will be available, because organisms such as the plants that are fed on will be able to multiply.

**How Geography and Geology Affect Biological Diversity**

1: In general, greater diversity occurs: at lower latitudes.

2: What **geographic factors** affect species biodiversity?

Geographical features such as slope, aspect, elevation, and nearness to a drainage basin all affect species biodiversity.

3: How can **moderate environmental disturbances** increase diversity?

Changed environmental conditions from disturbances may benefit other species, so disturbances such as fires may make ecosystems more diverse.

4: How do **people** affect diversity? Explain.

Established cities are often located near previously biodiverse areas such as lakes, rivers, or coasts that harbored many organisms before. Because of this abrupt settlement and lack of living space, the area becomes less diverse.

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| **Factors That Tend to Increase Diversity** | **Factors That Tend to Decrease Diversity** |
| 1: A physically diverse habitat | 1: Environmental stress |
| 2: Moderate amounts of disturbance | 2: Extreme environments |
| 3: Small variation in environmental conditions | 3: Severe limitation in essential resources |
| 4: High diversity in at least one trophic level | 4: Extreme amounts of disturbance |
| 5: An environment highly modified by life | 5: Recent introduction of exotic species |
| 6: Middle stages of succession | 6: Geographic isolation |
| 7: Evolution |  |

**Convergent and Divergent Evolution**

1: *Define and give an example* of each of the following:

**\* Convergent Evolution**

Evolutionary traits that are shared between individuals that aren’t related due to being under similar living conditions.

**\* Divergent Evolution**

The event in which separated groups of a population both evolve to thrive in their respective areas, but still retain some traits that are the same.

**Invasions, Invasive Species and Island Biogeography**

1: What are the ***4 main principles*** in the **theory of island biogeography**?

-Islands have fewer species than continents.

-The two sources of new species on an island are migration from the mainland and evolution of new species in place.

-The smaller the island, the fewer the species.

-The farthest the island is from a mainland (continent), the fewer the species.

2: What is an **ecological island**?

An ecological island is a comparatively small habitat separated from a major habitat of the same kind.

**Study Questions**

1: Why do introduced species often become pests?

Introduced species often become pests because of risk of disease transmission within the population, added resource competition, and the probability that the organisms that are introduced do not contribute to any sort of process (such as having no predators).