Chapter 18

Ecosystems

End of Chapter Questions

Simple Review Questions

18.1 Terrestrial Biomes

1. What types of living things do scientists use to classify Earth's terrestrial habitats into biomes?

2. What climatic factors help determine the locations of different biomes?

3. Which biome includes more living things than all other biomes combined?

4. Why are fires important in savannas?

18.2 Aquatic Biomes

5. Describe the photic zone of ocean habitats.

6. What are some of the challenges that organisms face in the intertidal zone? What adaptations do intertidal organisms have for dealing with these challenges?

18.3 Biogeochemical Cycles

7. What is a biogeochemical cycle?

8. How does carbon enter the biotic world? How is it returned to the abiotic world by organisms?

9. What role do nitrogen-fixing bacteria and nitrifying bacteria play in the nitrogen cycle?

18.4 Energy Flow in Ecosystems

10. All organisms need energy in order to grow, reproduce, and perform the activities necessary for survival. Where does this energy ultimately come from?

11. How does sunlight energy enter the biotic world?

12. On average, how much of the energy at one level of the food chain becomes available to the next level? What happens to the rest of the energy?

18.5 Ecological Succession

13. How does primary succession differ from secondary succession?

14. Why are the later colonizers of a habitat dependent on earlier waves of colonizers?

15. What usually happens to the total biomass in an ecosystem during succession? Does the number of species present in an ecosystem usually change as succession continues?

16. How can regular disturbances contribute to the biodiversity of a habitat?

(CLICK TO CHECK YOUR ANSWERS)

Challenging Review Questions

18.1 Terrestrial Biomes

17. What are the major factors that determine what kind of biome is found in a habitat? Does the activity of living organisms affect the type of biome found in an area?

18. Explain why altitude and latitude affect the kind of biome that characterizes a habitat.

19. The map in Figure 18.1 shows the distribution of biomes on Earth. Strips of tundra are seen in both South America and the U.S. mainland. Is this an error? Explain.

20. Do tropical forests tend to provide good farmland when they are cleared? Why or why not?

21. Describe the tundra. Why are there no trees in the tundra?

22. Name a biome where regular fires occur. What role does fire play in this biome?

18.2 Aquatic Biomes

23. What is an estuary? What adaptations characterize organisms that live in estuaries?

24. What is an example of plankton? Of nekton?

25. This photo shows a bobbit worm living in the oceans near Indonesia. Does it live in the pelagic zone or the benthic zone? How can you tell?

18.3 Biogeochemical Cycles

26. Describe the water cycle. What are some of the important reservoirs for water on Earth?

27. Was every carbon atom in your body once part of a plant or another producer? Why or why not?

28. Name at least two different processes that return carbon to the atmosphere.

29. How is the carbon cycle relevant to global warming and climate change?

30. Why do legumes grow better in nutrient-poor soil than do many other plants?

31. How has human technology affected the nitrogen cycle?

18.4 Energy Flow in Ecosystems

32. What is primary productivity? What factors could affect primary productivity in a habitat?

33. If you eat a pound of pasta, will you gain a pound of weight? Why not?

34. Why are there more zebras than lions in the African savanna?

18.5 Ecological Succession

35. Why do you think most of the early animal colonizers of Krakatoa were flying insects and birds?

36. Once a habitat is occupied by its climax community, does its species composition continue to change? Why or why not?

37. Could a habitat that received regular mild disturbances be more diverse than one that received no disturbances? How would its biodiversity compare to a habitat that received regular, extreme disturbances?

(CLICK TO CHECK YOUR ANSWERS)

Apply & Discuss Questions

38. Why can't an ecosystem's energy pyramid be inverted (that is, be upside down)?

39. A single tree can sometimes support many insects and birds. Does this contradict the idea that all ecosystems are characterized by energy *pyramids*?

40. Different consumers vary in how efficiently they convert food into biomass. Insects use 10% to 40% of the energy they absorb (that is, energy not lost in feces) to build biomass. The rest goes to maintenance. Mammals and birds, on the other hand, use only 1% to 3% of their absorbed energy to build biomass. They use much more energy for maintenance. What accounts for this difference?

41. Would you expect to find more Type I or Type III species among the early colonizers of a habitat? Would you expect to find more Type I or Type III species in the climax community?

(CLICK TO CHECK YOUR ANSWERS)

End of Chapter Solutions

Simple Review Solutions

1. Each biome is occupied by specific types of biological communities and, particularly, by specific types of plant life.

3. Tropical forests are famous for their biodiversity—more species are found in this biome than in all other biomes combined.

5. The photic zone is close to the water surface and receives plentiful sunlight, enough to power photosynthesis. The majority of pelagic species are found there.

7. Living organisms are made up of many different substances -- water, carbon, nitrogen, phosphorus, sodium, calcium, sulfur, chlorine, and others. All these substances move around Earth in a series of biogeochemical cycles, going back and forth between the tissues of living organisms and the abiotic world. The word biogeochemical emphasizes that substances cycle between living organisms (bio) and Earth (geo) -- specifically, Earth's atmosphere, crust, and waters.

9. Most of Earth's nitrogen exists as nitrogen gas in the atmosphere. However, nitrogen gas is not a form of nitrogen that most living things can use. Bacteria help convert nitrogen into a usable form. Nitrogen-fixing bacteria in soil convert nitrogen gas to ammonium, and then nitrifying bacteria convert ammonium to nitrates. Plants absorb nitrogen primarily in the form of nitrates, although they make some use of ammonium as well. Nitrogen then moves from plants up the food chain.

11. Sunlight energy enters the biotic world when plants and other organisms use it to build organic molecules during photosynthesis.

13. Primary succession occurs when bare land, devoid of soil, is colonized by successive waves of living organisms. Primary succession may begin when new land is formed by volcanic activity, or when a glacier's retreat reveals bare rock. Secondary succession occurs when a disturbance destroys existing life in a habitat but leaves the soil intact. Secondary succession may begin after a fire or when old farmland is abandoned.

15. During the entire process of succession, the total biomass of the ecosystem typically increases, as does the number of species present.

Challenging Review Solutions

17. The type of biome found in a habitat is determined primarily by climatic variables such as temperature, precipitation, and the presence or absence of distinct seasons. As a result, latitude and altitude are major influences on the distribution of biomes on Earth. Living organisms sometimes do affect the biome found in a particular area. For example, organisms help maintain savanna habitats, preventing them from growing into tropical forest. For example, elephants eat and kill trees, and humans burn forests for cropland.

19. Those strips of tundra occur in high altitudes, where climatic factors such as extreme cold result in tundra.

21. Tundra is found in areas that experience extreme cold and little precipitation. One of the defining features of tundra is a layer of permafrost, or permanently frozen subsoil, beneath the topsoil. Trees cannot survive in tundra because of permafrost and the short growing season.

23. Estuaries are habitats where freshwater rivers flow into oceans. Organisms that live in estuaries, such as marsh grasses and mangroves, need to have adaptations that allow them to live under changing salinity conditions.

25. The bobbit worm lives in the benthic zone. You can see from the photo that it lives on the ocean bottom, rather than in the water itself.

27. Yes. Humans are heterotrophs, and we get all our carbon from the food we eat. Ultimately, this carbon all comes from producers such as plants, diatoms or other oceanic plankton, seaweeds, etc.

29. Global warming and climate change are caused by increasing levels of carbon dioxide in Earth's atmosphere. The carbon cycle describes how excessive amounts of carbon dioxide is released—through the burning of fossil fuels.

31. Humans have affected the nitrogen cycle by inventing industrial processes for making nitrogen-rich fertilizers. This has made larger amounts of nitrogen available for growing crops than could otherwise be achieved. Although this has allowed humans to grow more food and to support larger human populations, fertilizers also pollute and damage natural environments.

33. No, much of the energy in that pound of pasta will go to feces and maintenance (supporting your body's activities).

35. Flying insects and birds had the easiest time getting to the island from the mainland.

37. Yes. According to the intermediate disturbance hypothesis, regular disturbances, if not too extreme, actually contribute to biodiversity because different species make use of different habitats, and periodic disturbances guarantee that there will always be habitat at varying stages of recovery. However, a habitat that received regular, extreme disturbances would probably always be found in the early stages of succession and would probably be less diverse.

Apply & Discuss Solutions

39. Energy pyramids describe the amount of energy at different levels of a food chain. They do not say anything about the number of organisms at each level of the food chain. It makes sense that a single tree, which is very big, and captures significant amounts of sunlight energy, would be able to support many much smaller consumers such as insects and birds.

41. You would expect more Type III organisms among the early colonizers of a habitat - these habitats are unstable and difficult. Producing many offspring is adaptive because it becomes more likely that at least some of these will survive. You would expect more Type I organisms in a climax community - those habitats are more stable. An offspring that receives a lot of parental investment is more likely to be able to compete with other members of the population and successfully survive and reproduce.