Chapter 54: Community Ecology

54.1 Define a community and the main types of interspecific interactions.

54.2 Characterize the key components of species diversity and trophic structure in biological communities.

54.3 Describe the roles of disturbance and ecological succession in affecting species diversity and composition.

54.4 Describe the biogeographic influences of latitude and area on community diversity.

54.5 Define pathogens and explain how they influence biological communities.

This chapter focuses on interactions at the community level and will take you through concepts that you have studied before as well as introduce you to new and interesting ideas such as island biogeography, keystone species, and diversity indexes. The diversity of species within an ecosystem may influence the stability of an ecosystem and is affected by a number of factors, including human activities.

Study Tip: Use Figure 54.1 in the text to describe each of the factors below.

Factors That Influence the Structure of a Community		
Foundation Species	Interactions between Species	Disturbances

There are three primary factors that affect community structure and will be discussed throughout this chapter. List them below.

a.

b.

c.

Concept 54.1 Interactions between species can help, harm, or have no effect on the individuals involved

LO 54.1 Define a community and the main types of interspecific interactions.

1. What is a *community?*

2. This section will look at *interspecific* interactions. Be clear on the meaning of the prefix! To begin, distinguish between *intraspecific competition* and *interspecific competition.* Give an example of each.

Type of Competition	Explanation	Example
Intraspecific competition		
Interspecific competition		

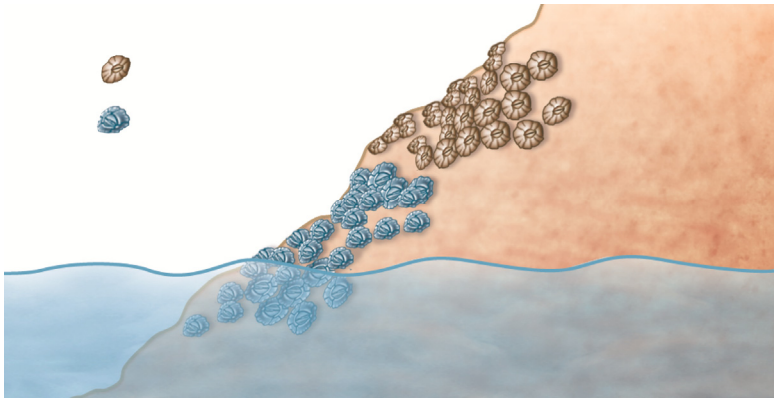
3. Competition is an _____ interaction. What is G. F. Gause's *competitive exclusion principle*? Give one example.

4. Define *ecological niche*.

5. Several species of *Anolis* lizards live in the same types of trees and have a similar diet. Discuss how evolution can lead to *resource partitioning* and the reduction of interspecific competition. (Study Figure 54.2 in your text.)

6. What is the difference between the *fundamental niche* and the *realized niche*?

7. Use Inquiry Figure 54.3 to determine the realized and fundamental niche of the two barnacle species. If *Balanus* has a fundamental niche that is equal to its realized niche, use arrows to show the area both species would cover for both types of niches. Your diagram will have a fundamental and realized arrow to show both niche types for both species.



8. Study Figure 54.5 in your text, and then explain what is meant by *character displacement*. (To do this, you will have to learn or review the difference between *sympatric* populations and *allopatric* populations. You will find this information in Chapter 24, Concept 24.2)

9. How does character displacement reduce interspecific competition? In your explanation, describe the role of natural selection in character displacement.

10. _____, is a term for any type of +/− interaction. Exploitative interactions include _____, _____, and _____.

11. *Predation* is a term that you probably already know. Can you give examples of some predator–prey combinations as listed in the following chart?

Predator	Prey	Example
Animal	Animal	
Animal	Plant	
Fungus	Animal	
Bacteria	Animal	
Fungus	Plant	

12. List three special adaptations that some predator species possess for obtaining food.

13. List three ways prey species might elude predators.

14. Compare the two types of mimicry.

Type of Mimicry	Description	Example
Batesian		
Müllerian		

15. What is *herbivory*?

16. Did you list any special herbivore adaptations for predation in your response to question 12? Or plant adaptations to avoid herbivory? List two adaptations for each category here.

    Animal adaptations for herbivory:

    Plant adaptations to avoid herbivory:

17. Describe and give an example of each of the following interactions:

Type of Interaction	Description	Example
Symbiosis		
Parasitism		
Mutualism		
Commensalism		

18. Which category in the previous chart includes the other three? Note that other texts may define this term more narrowly.

19. Your text uses +/–/0 symbols to indicate how interspecific interactions affect survival and reproduction of the two species. Use this notation for each of these interactions.

Type of Interaction	+/+, +/–, –/–, +/0
Competition	
Predation	
Commensalism	
Mutualism	
Parasitism	
Interspecific competition	
Herbivory	

You may find the chart in the Chapter Review on p. 1235 of the text helpful.

20. Many of the species interactions in this concept can be divided into *exploitative* and *positive interactions*. What are the criteria for placement of species interactions into the positive interaction category?

Concept 54.2 Diversity and trophic structure characterize biological communities

LO 54.2 Characterize the key components of species diversity and trophic structure in biological communities.

21. What is *species diversity*? What are its two components? Why is it important?

22. Your text presents a simple *Shannon diversity index* to demonstrate that community 1 is more diverse than community 2. Looking at the formula and what determines species diversity, explain why community 1 is more diverse.

23. Are more diverse communities more productive or more stable than less diverse communities? Cite data from results of the Cedar Creek Ecosystem decade-long study to answer one of these questions. Cite data from the Long Island Sound to answer the other question.

24. Summarize the positive effects increased diversity appears to have on communities.

25. What does an ecologist summarize in a *food web*?

26. Know the levels of trophic structure in food chains. Give an example food chain here, including four links that might be found in a prairie community, and tell the trophic level of each organism.

27. According to the *energetic hypothesis*, why are food chains limited in length? How much energy is typically transferred to each higher level?

28. What is a *foundation species*? For the biome where you live, what would be considered a foundation tree species?

29. How is a *keystone species* different from a foundation species?

30. Name one keystone species and describe the effect its removal could have on the ecosystem.

31. Explain the basic difference between a *bottom-up control* versus a *top-down control* model in the way trophic levels affect one another in an ecosystem. Why isn't one model the correct one for every ecosystem?

Concept 54.3 Disturbance influences species diversity and composition

LO 54.3 Describe the roles of disturbance and ecological succession in affecting species diversity and composition.

32. What is a *disturbance* and how does disturbance fit into the *nonequilibrium model*?

33. What is the *intermediate disturbance hypothesis*? Give an example of a disturbance event and explain the effect it has on the community.

34. Give an example of a major ecological disturbance you have seen. After the disturbance, how does the ecosystem respond?

35. *Ecological succession* is the change in species that occupy an area after a disturbance. What is the difference between *primary succession* and *secondary succession*? Describe an example of each type of succession.

Concept 54.4 Biogeographic factors affect community diversity

LO 54.4 Describe the biogeographic influences of latitude and area on community diversity.

36. Explain *latitudinal gradients* in terms of species richness. Where is species richness greatest?

37. There are probably two key factors in latitudinal gradients. List and explain both here and put a star next to the one that is the primary cause of the latitudinal difference in biodiversity.

38. *Evapotranspiration* is a function of light, temperature, and water and is highest in areas that have high temperatures and rainfall. Explain in terms of energy budgets why areas with high evapotranspiration tend to have the greatest species richness.

39. Explain what is demonstrated by a *species-area curve.*

40. Use species-area curves to predict the effect that habitat fragmentation has on extinction rates. Justify your prediction.

41. Renowned American ecologists Robert MacArthur and E. O. Wilson developed a model of *island biogeography*. Although the model can be demonstrated with islands, any isolated habitat represents an island. What are the two factors that determine the number of species on the island?

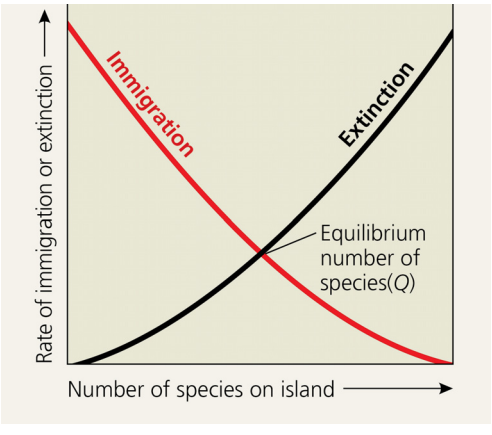
42. What two physical features of the island affect immigration and extinction rates?

43. Why do small islands have lower immigration rates? Why do they have higher extinction rates?

44. Closer islands have _____ extinction rates and _____ immigration rates.

45. What is the *island equilibrium model*?

46. The equilibrium number of species on an island represents a balance between the immigration of new species and the extinction of species already there. This graph illustrates the equilibrium point between immigration and extinction on an island. Draw lines to show what would happen *if the distance from the mainland doubled.* Add an arrow to indicate the new equilibrium point. Justify your response.



*Can you answer the three "*WHAT IF?*" questions associated with Figure 54.31? Always study the figures carefully, as they frequently contain a good deal of content.*

Concept 54.5 Pathogens alter community structure locally and globally

LO 54.5 Define pathogens and explain how they influence biological communities.

47. What is a *pathogen*? Why are pathogens so destructive when introduced into new habitats?

48. What is a *zoonotic pathogen*? List two examples.

49. What is a *vector*? List three examples.

Test Your Understanding, p. 1236

Now you should be ready to test your knowledge. Place your answers here:

1. _____ 2. _____ 3. _____ 4. _____ 5. _____ 6. _____

7. _____ 8. _____