

AP BIOLOGY SUMMER READING ASSIGNMENT

Name _____

INSTRUCTIONS: Read Chapters 52-56 on ecology. Use this guided reading to help you focus on the main ideas. This assignment is due on the first day of school. You may print it out and write it by hand or use a computer, but all diagrams must be drawn. You will have a test on the reading during the first full week of school in the fall.

Chapter 52: An Introduction to Ecology and the Biosphere

Adapted from Fred and Theresa Holtzclaw

1. What is *ecology*?

2. Study Figure 52.2. It shows the different levels of the biological hierarchy studied by ecologists. Notice also the different types of questions that might be studied by an ecologist at each level of study. Use this figure to define or explain the following terms:

organismal ecology

population ecology

community ecology

ecosystem ecology

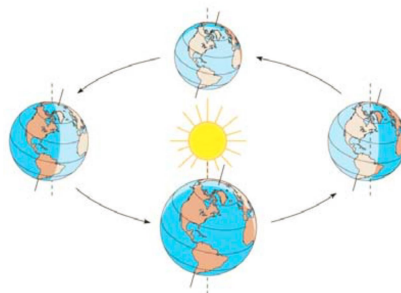
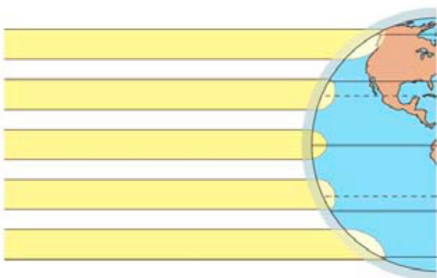
landscape ecology

biosphere

global ecology

3. What is *climate*? What factors are its components?

4. Study Figure 52.3 and 52.4, which summarizes Earth's climate patterns and how they are formed. Explain how Earth's curvature and axis of rotation influence the amount of sunlight reaching a given area, and how these factors influence the temperature and precipitation in that area.



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5. Look at factors that affect climate on a smaller scale. Begin by studying Figure 52.5. Why is the Pacific Northwest so rainy? What causes the Mediterranean climate?

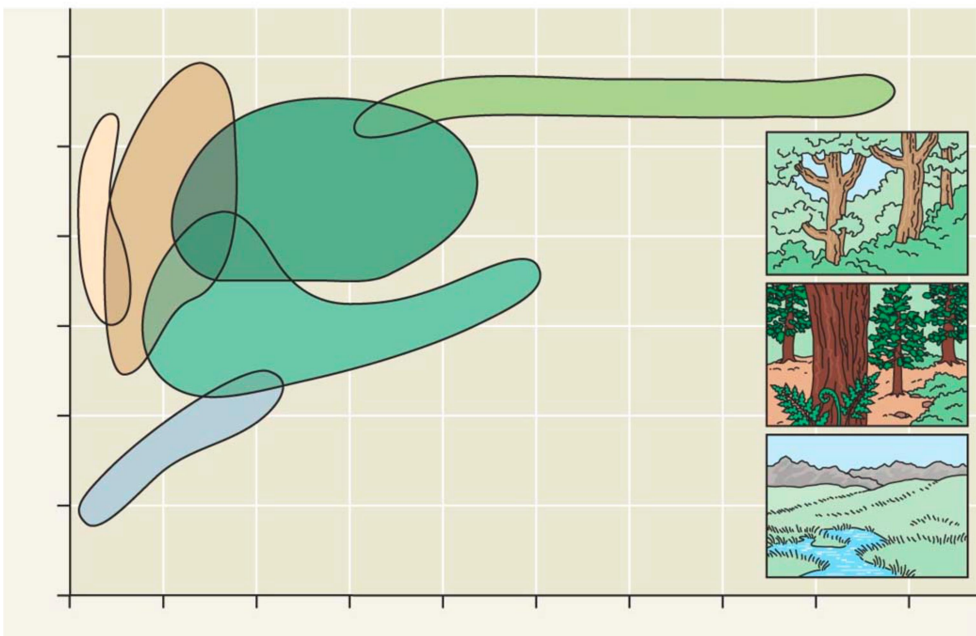
6. Explain the “rain shadow” effect.

7. What effect does elevation have on climate? Why do we say that hiking from Lone Pine, California, at 3727’ meters of elevation in the Smoky Mountains region, to the top of Mount Whitney, at 14505’ meters, is like traveling to Canada?

8. How does ecology relate to environmentalism?

9. What are some consequences of global climate change?

10. Label the axes of this figure, and identify each biome shown here. Try to do this based on your understanding of the figure, and then use the text to check your answers. You will use these biomes: *temperate grassland*, *temperate broadleaf forest*, *tropical forest*, *northern coniferous forest*, *desert*, *tundra*.



11. What is a disturbance in a terrestrial biome? Are disturbances all human-caused?

12. Describe each major terrestrial biome as to rainfall, temperature, location, and representative flora and fauna.
tropical forest

desert

savanna

chaparral

temperate grassland

northern coniferous forest/taiga

temperate broadleaf forest

tundra

13. The aquatic biomes are listed in the chart. Give a description of the biome below its name, and then complete the other parts of the chart.

Aquatic Biome	Typical Autotrophs	Typical Heterotrophs	Human Impact
<i>Lakes</i>			
<i>Wetlands</i>			
<i>Streams and rivers</i>			
<i>Estuaries</i>			
<i>Intertidal</i>			
<i>Ocean pelagic</i>			
<i>Coral Reefs</i>			
<i>Marine Benthic Zone</i>			

14. List 5 biotic factors and give an example and a description of each.

Biotic Factor	Example and Description

15. List 5 abiotic factors and give an example and a description of each.

Abiotic Factor	Example and Description

Chapter 53: Population Ecology

Adapted from Fred and Theresa Holtzclaw

1. What two pieces of data are needed to mathematically determine *density*?
2. What is the difference between density and *dispersion*?
3. Work through Figure 53.2, doing the math to make sure you get the same answer as the text. Note and understand what the letters of the formula mean. Next, try the following problem.

A population ecologist wished to determine the size of a population of white-footed deer mice, *Peromyscus leucopus*, in a 1-hectare field. Her first trapping yielded 80 mice, all of which were marked with a dab of purple hair dye on the back of the neck. Two weeks later, the trapping was repeated. This time 75 mice were trapped, out of which 48 of the mice

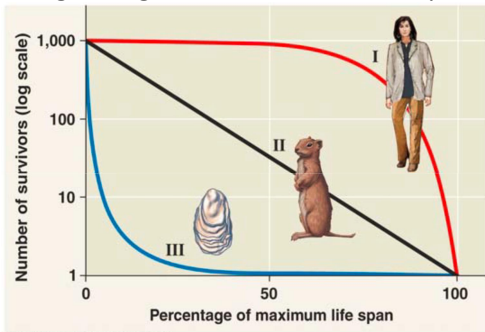
were marked. Using the formula $\frac{x}{n} = \frac{s}{N}$, what is the population of mice in the field? (Change font color for the answer:)

4. Explain the impact of *immigration* and *emigration* on population density.

5. What do each of the following dispersion patterns tell us about the population and its interactions?



6. *Survivorship curves* show patterns of survival. In general terms, survivorship curves can be classified into three types. Using the figure below, label and explain the three idealized survivorship patterns.



7. In the natural world, many species show survivorship curves that are combinations of the standard curves. How would an open nesting songbird's survivorship curve appear if it was Type III for the first year and then Type II for the rest of its life span? Sketch this curve on the survivorship curve graph in question 6.

8. What does a *reproductive table* show?

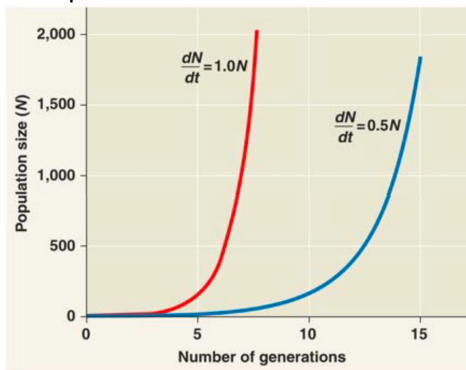
Do not let the math in Section 53.5 be a problem. Instead of trying to understand the calculus involved, concentrate on the idea of exponential growth, how it is graphed, and what this type of growth indicates about a population.

9. What is the advantage to using per capita birth and death rates rather than just the raw numbers of births and deaths?

10. What will the per capita birth and death rates be if a population is demonstrating *zero population growth*?

11. What does it mean for a population to be in *exponential population growth*?

12. In the graph below, explain why the line with the value of 1.0 shows a steeper slope that reaches exponential growth more quickly than does the line with the value of 0.5. On this graph, add a third line that approximates a population with an exponential value of 1.25.



13. What are two examples of conditions that might lead to *exponential population growth* in natural populations?

14. What is *carrying capacity*?

15. Give examples of limiting resources that can influence carrying capacity.

16. In the *logistic population growth* model, the per capita rate of increase approaches zero as the _____ is reached.

17. What three variables form the life history of a species?

18. Explain the difference between *semelparity (big-bang reproduction)* and *iteroparity (repeated reproduction)* as life history strategies.

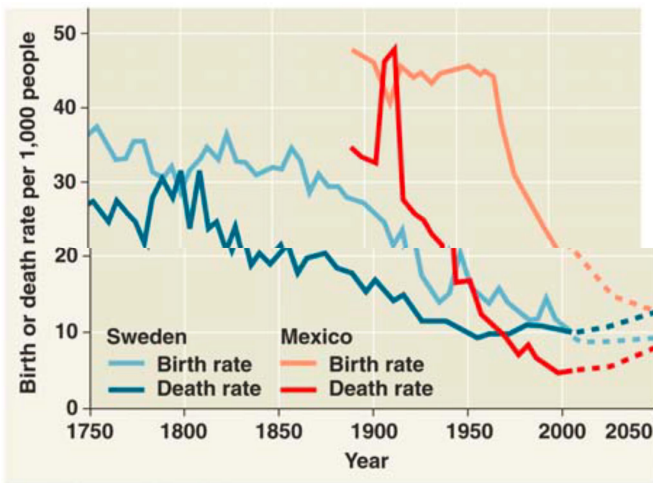
19. Explain what factors influence whether a species will evolve toward K-selection or r-selection.

20. Compare and contrast these two terms:
density-independent regulation

density-dependent regulation

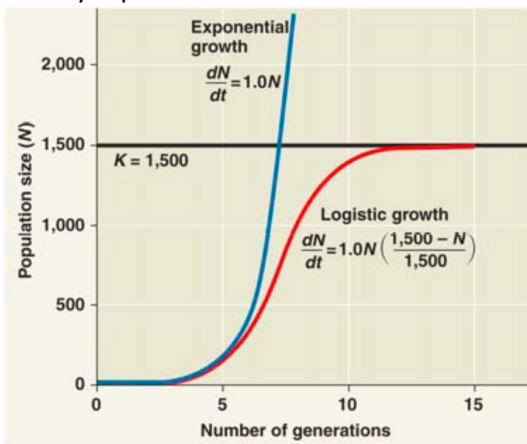
21. Summarize human population growth since 1650. (Of all the reported statistics, which one surprises you the most?)

22. What is *demographic transition*? Use the figure below to explain the process in Sweden and Mexico.



23. If the carrying capacity (or K) is 1,000 and N is 10, the term $(K - N)/K$ is large. Explain why a large value for $(K - N)/K$ predicts growth close to the maximum rate of increase for this population.

24. In the graph below, explain why the logistic model predicts a sigmoid (S-shaped) growth curve when the population density is plotted over time. Hint: The critical part of this answer concerns why growth slows as N approaches K .



25. You should be able to look at *age-structure graphs* and make predictions about the future growth of the population. Using Figure 53.24, describe the key features for the three age- structure graphs and predict how the population of each country will grow.

Country	Key Features	Predicted Future Growth
Afghanistan		
United States		
Italy		

26. Why do *infant mortality* and *life expectancy* vary so greatly between certain countries?

27. Can the world's population sustain an *ecological footprint* that is currently the average American footprint? Explain.

Chapter 54: Community Ecology

Adapted from Fred and Theresa Holtzclaw

1. What is a *community*? List six organisms that would be found in the Jesuit campus community.

2. Explain and give an example of intraspecific competition and interspecific competition.

Type of Competition	Explanation	Example
Intraspecific competition		
Interspecific competition		

3. What is principle of *competitive exclusion*? 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 *resource partitioning* to explain how interspecific competition is reduced. (See Figure 54.2)

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

7. Study Figure 54.4, 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. See Chapter 24.)

8. List three adaptations that predator species possess for obtaining food.

9. List three ways prey species elude predators.

10. Complete the table below regarding ways animals display morphological and physiological defensive adaptations.

Morphological Adaptation	Description	Example
<i>Aposematic coloration</i>		
<i>Müllerian mimicry</i>		
<i>Batesian mimicry</i>		

11. Summarize the different interspecies relationships.

Type of Interaction	Description	Example
<i>Symbiosis</i>		
<i>Parasitism</i>		
<i>Commensalism</i>		
<i>Mutualism</i>		
<i>Facilitation</i>		

12. Use +/- symbols to indicate how interspecific interactions affect survival and reproduction of the two species for each of these interactions. + beneficial to organism, - harmful to individual

Type of Interaction	+/, +/-, -/-, +/-0
<i>Predation</i>	
<i>Commensalism</i>	
<i>Mutualism</i>	
<i>Parasitism</i>	
<i>Interspecific competition</i>	
<i>Herbivory</i>	

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

14. What does an ecologist summarize in a *food web*?
15. Know the levels of trophic structure in food chains. Give a food chain here, including four links that might be found in along the American River, and tell the level for each organism.
16. According to the *energetic hypothesis*, why are food chains limited in length? How much energy is typically transferred to each higher level?
17. What is a *dominant species*? For the area where you live, what would be considered a dominant tree species?
18. How is a *keystone species* different from a dominant species?
19. Name one keystone species, and explain the effect its removal has on the ecosystem.
20. *Ecological succession* is the changes in species that occupy an area after a disturbance. What is the difference between *primary succession* and *secondary succession*?
21. What is the *intermediate disturbance hypothesis*? Give an example of a disturbance event, and explain the effect it has on the community.
22. Renowned American ecologists Robert MacArthur and E. O. Wilson developed a model of *island biogeography*. While 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?
23. What two physical features of the island affect immigration and extinction rates?
24. Why do small islands have lower immigration rates? Higher extinction rates?
25. Closer islands have _____ extinction rates and _____ immigration rates.
26. What is a *zoonotic pathogen*? List three examples.
27. What is a *vector*? List three examples.

Chapter 55: Ecosystems and Restoration Ecology

Adapted from Fred and Theresa Holtzclaw

1. What is an *ecosystem*?

2. Where does energy enter most ecosystems? How is it converted to chemical energy and then passed through the ecosystem? How is it lost? Remember this: *energy cannot be recycled*.

3. Besides the energy flow that you described in question 2, chemicals such as carbon and nitrogen *cycle* through ecosystems. So energy _____ through an ecosystem and matter _____.

4. Both energy and matter can be neither _____ nor _____.

5. Where does energy enter most ecosystems? How is it converted to chemical energy and then passed through the ecosystem? How is it lost? Remember this: *energy cannot be recycled*.

6. We can measure the efficiency of energy conversion in an ecosystem, as well as whether a given nutrient is being gained or lost from an ecosystem. Let us take a second look at *trophic levels*. What trophic level supports all others?

7. What are *trophic levels*? What is always at the first trophic level?

8. What are *detritivores*? What is their importance in chemical cycling? Give some examples of detritivores.

9. State the trophic level of each of the following:

cow _____ grass _____ man _____ mushroom _____

10. What is *primary production*? Distinguish between *gross primary production* and *net primary production*.

11. Which ecosystem would tend to have a greater biomass/unit area, a prairie or a tropical rain forest? Explain.

12. What are some factors that limit primary productivity in aquatic ecosystems?

13. What is a *limiting nutrient*? What is the limiting nutrient off the shore of Long Island, New York? In the Sargasso Sea?

14. What is *eutrophication*? What are factors that contribute to eutrophication?

15. What is *trophic efficiency*?

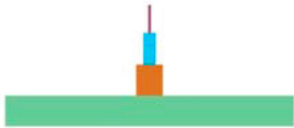
16. Generally, what percentage of energy available at one trophic level is available at the next?

This is important! Remember it!!!!



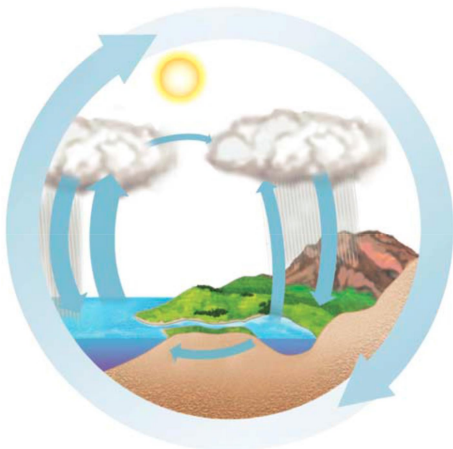
17. Consider a food chain with 1,000 *joules* (an energy unit) available at the producer level. If this food chain is grass → grasshopper → lizard → crow, how much energy is found at the level of the crow? (See answer at the end of this Reading Guide.) Show your work here.

18. Notice that most biomass pyramids have greatest biomass on the bottom of the pyramid. Label the trophic levels on the figure. Explain why the second pyramid of biomass is inverted.



19. Why do people who have limited diets in overpopulated parts of the world eat low on the food chain?

20. Use the figure below to describe the water cycle. Specify the roles of *evaporation*, *transpiration*, and *rainfall*.



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21. Use the figure below to describe the carbon cycle. In doing so, explain how carbon enters the living system and how it leaves, indicate the role of microorganisms in the cycle, and identify the reservoir for carbon.

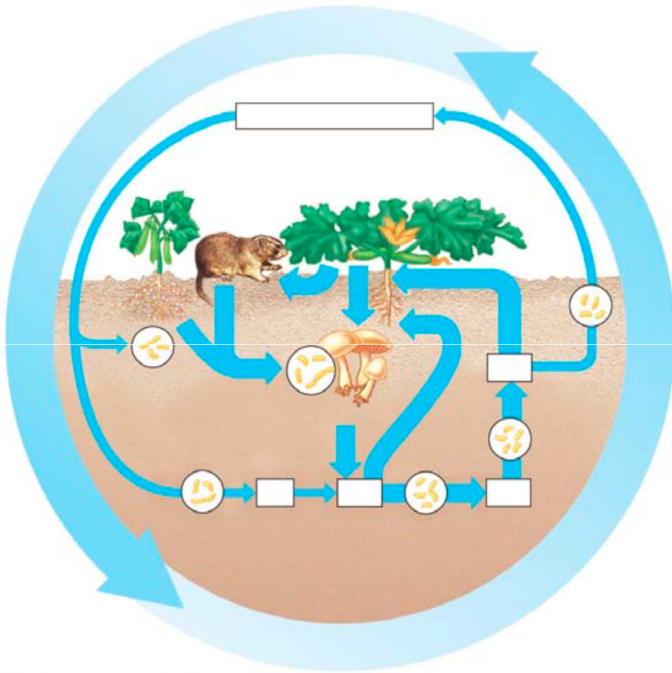


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Write the equation for photosynthesis here: _____

Write the equation for cellular respiration here: _____

22. Use the diagram below to describe the nitrogen cycle. In doing so, indicate the role of microorganisms in *nitrogen fixation*, *nitrification*, and *denitrification*.



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23. What is the goal of restoration ecology?

24. Restoration ecology uses two key strategies. Explain how each strategy works:

bioremediation

biological augmentation

Solution to Question 17: Grass (1,000 J) → grasshopper (100 J) → lizard (10 J) crow (1 J)

Chapter 56: Conservation Biology and Global Change

Name _____ Period ____

Adapted from Fred and Theresa Holtzclaw

1. Compare and contrast **conservation biology** and **restoration ecology**.

2. Ecologists organize biodiversity on three levels. In the table below, explain the impact of decreasing diversity in each division.

Level of Biodiversity	Impact
<i>Genetic diversity</i>	
<i>Species diversity</i>	
<i>Ecosystem diversity</i>	

3. How are humans benefitted by having greater genetic and species diversity?

4. Use this table to organize your thoughts on how the following four threats affect biodiversity.

Threat to Biodiversity	How it reduces biodiversity
<i>Habitat loss</i>	
<i>Introduced species</i>	
<i>Overharvesting</i>	
<i>Global Change</i>	

5. Do some research and list two *introduced species* that present a serious threat to the Sacramento community. Explain the damage done by each introduced species.

6. What do conservation biologists who adopt the *small-population approach* study?

7. Explain what an *extinction vortex* is.

8. Why is genetic variation the key issue in the small-population approach?
9. What is the emphasis for study in the declining-population model?
10. What are the causes and effects of forest fragmentation?
11. What are potential positive and negative effects of *movement corridors*?
12. Explain the concept behind a zoned reserve.
13. How has agriculture affected nitrogen cycling? What are some negative consequences of nutrient enrichment?
14. In what ways have human activities contributed to acid precipitation? What are some negative consequences of acid precipitation?
15. Explain the process of biological magnification. Discuss at least one example.
16. What is meant by the *greenhouse effect*? What would life on Earth be like without this effect?
17. What is contributing to the great increase in atmospheric carbon dioxide? What are potential effects of this increase?
18. How is atmospheric ozone depleted? What are projected effects of this depletion?
19. Explain the concept behind the phrase "sustainable development."