

Chapter 3 : Ecosystem Ecology

Reading Guide

Vocabulary

Learn the definition of each term. The **bold** words require you to know more than just the definition. For example: Ecosystem service - you should what they are, be able to name several types and describe how we benefit from those services.

Ecosystem	Standing Crop	Assimilation
Autotroph	Ecological Efficiency	Denitrification
Photosynthesis	Biosphere	Nitrification
Cellular Respiration	Biogeochemical Cycles	Leaching
Heterotroph	Hydrologic Cycle	Disturbance
Primary Consumer	Condensation	Watershed
Secondary Consumer	Precipitation	Resistance
Tertiary Consumer	Transpiration	Resilience
Trophic Level	Evapotranspiration	Restoration Ecology
Scavengers	Runoff	Instrumental Value
Detritivore	Carbon Cycle	Intrinsic Value
Decomposer	Macronutrients	Provisions
Gross Primary Productivity (GPP)	Limiting Nutrient (Limiting Factor)	Biomass pyramid
Net Primary Productivity (NPP)	Nitrogen Cycle	Energy pyramid
Biomass	Nitrogen Fixation	Numbers pyramid
	Ammonification	Chemosynthesis

Reading Outline

Reversing the Deforestation of Haiti

1. Covered in a warm-up in class

Module 6

Interactions between living and non-living

2. What is an ecosystem? Give 2 examples.
3. Why did scientists have to include land outside of Yellowstone National Park in the plan for managing the Yellowstone ecosystem?

Energy flows through ecosystems

4. What is the reaction for photosynthesis? Cellular respiration? What you notice about the two equations?
5. What kinds of organisms perform photosynthesis? What kinds of organisms perform cellular respiration?
6. What is the difference between a heterotroph and an autotroph?
7. Draw two food chains: one for a terrestrial ecosystem and one for an aquatic ecosystem. (note: "drawing" a food chain just means link words with arrows, not literally sketch the organisms)

8. Complete the following sentences by looking at Figure 3.6:
 - a. Grass is a primary producer because it performs ...
 - b. A zebra is a primary consumer because it eats ...
 - c. A lion is a secondary consumer because it eats ...
 - d. A hyena is a scavenger because it eats ...
 - e. A dung beetle is a detritivore because it eats ...
 - f. Bacteria, fungus and earthworms are decomposers because they ...
9. Define NPP and GPP. What mathematical equation links them?
10. Using Figure 6.8,
 - a. Which two continental ecosystems (also called terrestrial ecosystems) are the most productive?
 - b. Which three continental ecosystems are the least productive?
 - c. Which two marine ecosystems (ocean related ecosystems) are the most productive?
 - d. Which marine ecosystem is the least productive?
11. What is the relationship between biomass and NPP?
12. Explain why a slow growing forest can have a very low NPP and yet store a massive amount of biomass.
13. Explain why algae in the ocean can have a very high NPP and a very low amount of stored biomass.
14. Explain why a vegetarian diet is much more ecologically efficient than an omnivorous diet.

Module 7

Matter cycles through the biosphere

15. In cycles there are reservoirs (also called pools) and flows (also called processes). Matter is stored in reservoirs; flows are when matter is moved from one reservoir to another.
16. **The Hydrologic Cycle:** The water cycle is driven by GRAVITY and SOLAR ENERGY. All steps in the water cycle that flow downward are driven by gravity. All steps in the water cycle that flow upwards are driven by solar energy.
 - a. List three examples of reservoirs in the water cycle (places where water is stored).
 - b. Briefly explain the following steps in the water cycle (flows). Include whether it is driven by solar energy or by gravity.
 - i. Evaporation -
 - ii. Condensation -
 - iii. Precipitation -
 - iv. Transpiration -
 - v. Runoff -
 - c. What three things can happen to water that falls on land?
 - d. Name four ways humans alter the water cycle. Be sure to include how the change impacts the water cycle.
17. What are the 3 basic steps for all other matter cycles?
18. **The Carbon Cycle** - As Carbon is the basis of life, this cycle is extremely important. For environmental scientists, it is also very important because the carbon cycle helps us understand

global climate change by helping us understand where excess CO₂ in the atmosphere might end up and how we might be able to increase storage in reservoirs besides the atmosphere

- a. List three examples of carbon reservoirs (places where carbon is stored). Label whether the reservoir stores carbon for a short while or for a long while.

- b. Fill in the following chart

Flow	Description	Performed by	Why is this step important?
Photosynthesis	<i>Atmospheric CO₂ is converted into sugars</i>	<i>Autotrophs</i>	<i>Converts abiotic CO₂ to biomass (base of food chain)</i>
Respiration includes decomposition			
Exchange also called diffusion or flux			
Sedimentation			
Extraction			
Combustion			

- a. Name two ways humans alter the carbon cycle. Be sure to include how the change impacts the carbon cycle.

19. **The Nitrogen Cycle** - this is the trickiest cycle to learn, but frequently appears on the AP exam, so be sure you know it! It is a critical cycle because most of the nitrogen on earth is stored in the atmosphere, but plants can only absorb nitrogen through the soil. The nitrogen cycle allows atmospheric nitrogen to be converted into a form plants can use.

- a. Explain what is meant by a limiting nutrient. Why is nitrogen often a limiting nutrient?
- b. Where is most of the nitrogen on earth found? In what form? (provide the chemical formula and state)
- c. What two important macromolecules contain nitrogen?

- d. Fill in the following chart:

Name of Step	Chemical Change	Performed by	Why is this step important?
Nitrogen Fixation	$N_2 \rightarrow NH_3$ or NO_3	Nitrogen fixing bacteria (ie in legume roots) OR fires/lightning OR fertilizer manufacturing	Puts N in the soil, making it available for plants
Nitrification			
Assimilation			
Ammonification			
Denitrification			

- e. Excess nitrogen can also cause problems including fertilizer burn, weak plant tissues and eutrophication.
20. **The Phosphorus Cycle** - The only things you need to know about the phosphorus cycle are:
- a. Plants need phosphorus in the form of phosphate (PO_4^{3-})
 - b. Phosphorus does not cycle through the atmosphere
 - c. Phosphorus is typically a limiting factor for plants (along with nitrogen)
 - d. Excess phosphorus in aquatic ecosystems leads to eutrophication
21. **The Sulfur Cycle** - the only things you need to know about sulfur are:
- a. Hydrogen sulfide (H_2S) is poisonous gas that smells like rotten eggs and comes from anaerobic decomposition.
 - b. Sulfur dioxide (SO_2) is a colorless gas that comes from burning coal and volcanoes
 - c. Sulfuric Acid (H_2SO_4) is the main component of acid rain - forms when sulfur dioxide and water vapor mix in the atmosphere; often as a result of burning coal

Module 8

3.4 Ecosystems respond to disturbance

- 22. List 5 natural disturbances and 4 anthropogenic disturbances.
- 23. When studying Hubbard Brook, what did scientists discover (or confirm) about the impacts of deforestation?
- 24. What is the difference between resistance and resilience? Provide examples to support your answer.

3.5 Ecosystems provide valuable services

- 25. Provide 5 examples of provisions.
- 26. Provide 1 example of a regulating service.
- 27. Provide 2 examples of support systems
- 28. Provide 1 example of resilience
- 29. Provide 2 examples of cultural services

Additional Work:

Answer the MC questions at the end of each Module and Ch 3 and FRQ 2 for this chapter.