



Nutrient Cycling in the Serengeti

INTRODUCTION

In the card activity, you explored how savanna plants in the Serengeti get three nutrients they require for growth: carbon, nitrogen, and phosphorus. As you saw in the activity, different processes cycle these nutrients between multiple reservoirs in the Serengeti ecosystem.

PROCEDURE

Using your experiences from the card activity and what you've learned about nutrient cycling, answer the following questions in the spaces provided.

Nutrients and Compounds

- Which nutrient's requirement was the most difficult for your group to complete? (This nutrient is called a "limiting nutrient" because it limits growth of the plant.) _____
- Describe some of the ecological factors that influenced how quickly each nutrient was obtained.
- Plants get essential nutrients from their environment. Which of the following statements best describes where plants get carbon, nitrogen, and phosphorus? _____
 - They get carbon from the soil, and nitrogen and phosphorus from the air.
 - They get carbon, nitrogen, and phosphorus from the soil.
 - They get carbon, nitrogen, and phosphorus from the air.
 - They get carbon from the air, and nitrogen and phosphorus from the soil.
- Carbon, nitrogen, and phosphorus rarely exist as single atoms in nature. They are typically found in compounds. Some of these compounds can be taken up by plants from the environment, and others are produced by plants. Sort the following compounds into the two columns below.

ammonium (NH_4^+)

glucose ($\text{C}_6\text{H}_{12}\text{O}_6$)

phosphate (PO_4^{3-})

amino acids

nitrate (NO_3^-)

phospholipids

carbon dioxide (CO_2)

nitrogenous bases

Compounds plants take up from the environment	Compounds produced by plants

- Compounds can be categorized as organic or inorganic.
 - What is the difference between an organic compound and an inorganic compound?

- b. Label each of the following compounds as organic (**O**) or inorganic (**I**).
- | | |
|---|--------------------------------------|
| ___ ammonium (NH_4^+) | ___ nitrate (NO_3^-) |
| ___ amino acids | ___ nitrogenous bases |
| ___ carbon dioxide (CO_2) | ___ phosphate (PO_4^{3-}) |
| ___ DNA/RNA | ___ phospholipids |
| ___ glucose ($\text{C}_6\text{H}_{12}\text{O}_6$) | ___ water (H_2O) |

Carbon Cycling

6. Think about the metabolic process that breaks down organic compounds and produces carbon dioxide.
- What is this process called? _____
 - The carbon dioxide produced by this process is released into the _____.
 - Which of the following organisms perform this process? Select all that apply.
☐ plants ☐ animals ☐ decomposers (fungi and some bacteria)

Nitrogen Cycling

7. Summarize three major roles of microbes in nitrogen cycling in the Serengeti.
8. Nitrogen gas (N_2) makes up 78% of Earth's atmosphere. Why are so many ecosystems limited by nitrogen even though it is so abundant?
9. Describe one way in which the cycling of nitrogen (and phosphorus) might be affected by human agriculture.

Putting It All Together

10. Based on everything you've learned about nutrient cycling in the Serengeti, make a checkmark next to the term in each pair of parentheses that best completes the statements below.
- Wildebeest consume (☐organic/☐inorganic) carbon by eating plants.
 - Wildebeest obtain energy by breaking down (☐ $\text{C}_6\text{H}_{12}\text{O}_6$ /☐ CO_2) and releasing (☐ $\text{C}_6\text{H}_{12}\text{O}_6$ /☐ CO_2) into the atmosphere in a process known as (☐respiration/☐photosynthesis).
 - Some soil bacteria can transform (☐organic/☐inorganic) nitrogen from the atmosphere into a form that plants can then use to build compounds such as (☐ammonia/☐amino acids).
 - Plants take in (☐organic/☐inorganic) carbon in the form of (☐ CO_2 /☐ $\text{C}_6\text{H}_{12}\text{O}_6$) from the atmosphere and convert it into (☐organic/☐inorganic) carbon in the form of (☐ CO_2 /☐ $\text{C}_6\text{H}_{12}\text{O}_6$) in a process known as (☐decomposition/☐photosynthesis).
 - When plants and animals die, nitrogen is returned to the soil by the process of (☐nitrogen fixation/☐ammonification). Carbon is returned to the atmosphere as (☐ $\text{C}_6\text{H}_{12}\text{O}_6$ /☐ CO_2).