



Nutrient Cycling in the Serengeti

INTRODUCTION

In the card activity, you explored some ways that Serengeti plants get the nutrients they need. In this handout, you will learn more about the roles of nutrients and reflect on processes and organisms in the card activity. You will then take a closer look at how one nutrient, carbon, moves through an ecosystem.

PART 1: Nutrients and Their Roles

All organisms need certain compounds from the environment, called **nutrients**, to survive. Nutrients are used to build biological molecules needed for life, such as carbohydrates and proteins. They also help support cellular functions and life processes.

Depending on various environmental factors, nutrients can come in multiple forms. For simplicity's sake, scientists often refer to a nutrient using the essential element that is part of its compound. For example, the nutrient referred to as carbon (C) is often in the form of the compound carbon dioxide (CO₂).

1. The “How Savanna Plants Get Nutrients” handout from the card activity describes the nutrients carbon, phosphorus, and nitrogen and some of their common forms.
 - a. Name **one** compound that is a form of the nutrient phosphorus.
 - b. Name **two** compounds that are forms of the nutrient nitrogen.

Read more about how plants use carbon, nitrogen, and phosphorus below. Use this information to answer the question that follows.

- **Carbon** is the backbone of all organic molecules. It is part of all proteins, carbohydrates, fats, and nucleic acids, as well as many other important molecules that plants use for metabolism, growth, cell membranes, and reproduction.
 - **Nitrogen** is used to build amino acids, the building blocks of proteins, and nucleic acids, such as DNA and RNA. Nitrogen is also part of the chlorophyll molecule, which is needed for photosynthesis.
 - **Phosphorus** is important for the development of healthy root systems and seeds. Plants also need phosphorus for photosynthesis, cellular respiration, cell membranes, and other cellular processes.
2. List **three** biological functions or processes that these nutrients are needed for in plants.
 3. Which of the following statements best describes where plants get these nutrients? (*Hint: Review your “How Savanna Plants Get Nutrients” handout.*)
 - a. Carbon from the soil, nitrogen and phosphorus from the air.
 - b. Carbon, nitrogen, and phosphorus from the soil.
 - c. Carbon, nitrogen, and phosphorus from the air.
 - d. Carbon from the air, nitrogen and phosphorus from the soil.

PART 2: Nutrients in the Serengeti

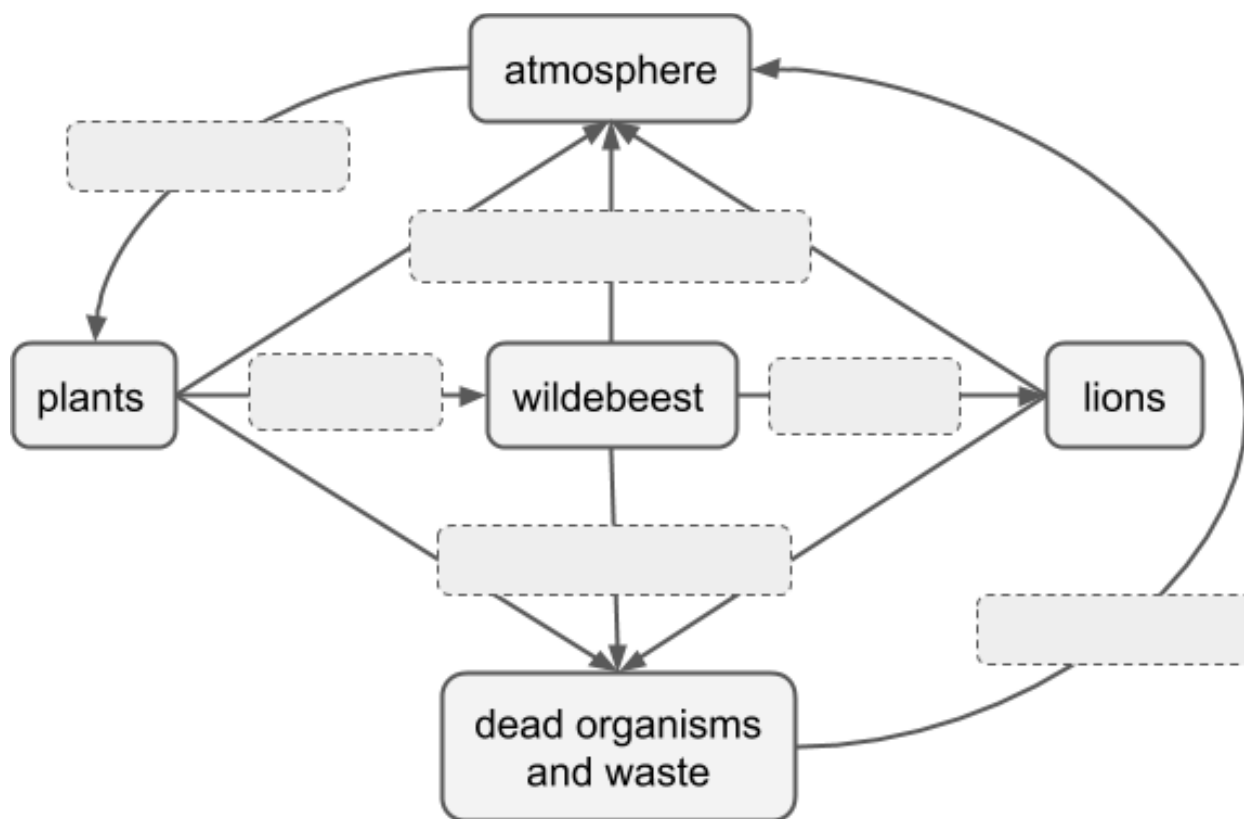
The card activity explored how nutrients move through the Serengeti. Think about your experiences with the card activity as you answer the following questions.

4. Briefly describe **two** ecological factors that affected how quickly your plant was able to get nutrients.
5. Which nutrient requirement (carbon, nitrogen, or phosphorus) was the most difficult for your group to complete? (This nutrient is called a "limiting nutrient" because it limits growth of the plant.)
6. The **process cards** showed ways in which nutrients can be taken up by plants. Choose **two** different process cards that describe plants getting nutrients from **wildebeest**.
 - a. Do your two cards differ in the amount of carbon (C), nitrogen (N), and phosphorus (P) they make available to a plant? If so, how?
 - b. Why do you think your two cards differ (or do not differ) in the way you described?
 - c. Do you think the processes on your cards would apply to animals other than wildebeest? Explain your answer.
7. The **soil microbe** cards represent microorganisms such as bacteria. Based on the activity, summarize how microbes help cycle nutrients in the Serengeti.
8. The **detritivore** cards represent organisms that eat decomposing matter and feces (dung). Based on the activity, summarize how detritivores help cycle nutrients in the Serengeti.
9. Do you think other ecosystems cycle nutrients using similar processes or organisms? Explain your answer.

PART 3: Carbon

The card activity showed some of the processes that move nutrients between the environment and organisms, such as plants. Let's take a closer look at processes that move carbon in particular.

10. One process that moves carbon between organisms and the environment is **cellular respiration**.
- In the card activity, which **two** process cards directly represent cellular respiration?
 - Describe how cellular respiration moves carbon in particular. Where, and in what form, does the carbon used in cellular respiration come from? Where, and in what form, does the carbon end up after cellular respiration?
11. Another process that moves carbon between the environment and organisms is **photosynthesis**. Photosynthesis does not appear in the card activity, but you can learn more about it by watching the [Photosynthesis: Overview](#) animation.
- Summarize photosynthesis in one or two sentences, indicating the inputs and outputs.
 - Describe how photosynthesis moves carbon in particular. Where, and in what form, does the carbon used in photosynthesis come from? Where, and in what form, does the carbon end up after photosynthesis?
12. The following diagram summarizes how carbon moves through the Serengeti ecosystem. Fill in the missing labels with the following processes: **cellular respiration**, **photosynthesis**, **decomposition**, **death/defecation/urination**, and **feeding**. Some processes may be used in more than one label. (*Hint: Most of these processes are represented in the card activity, so you can refer to the cards for help.*)



Most healthy ecosystems are in a balance where the effects of each species are regulated by other species in the ecosystem. Human activities can disrupt that balance, which may have a negative effect on the number and diversity of other species.

13. Predict how a decrease in the number of predators — due to hunting, for example — might affect the cycling of carbon in the Serengeti. Use your diagram from Question 12 to support your answer.