



## Nutrient Cycling in the Serengeti

### INTRODUCTION

In this card activity, you will explore how nutrients cycle through the Serengeti ecosystem. The activity focuses on three major nutrients (carbon, nitrogen, and phosphorus) that savanna plants in the Serengeti need in order to grow.

### BACKGROUND

You probably know that water helps determine plant growth in many ecosystems. But water alone is not enough. Plants also need **nutrients**, substances from the environment that help them build biomass and perform cellular functions. Three nutrients that are essential to all ecosystems are carbon, nitrogen, and phosphorus. Plants combine these nutrients with other elements to form molecules that support growth. The nutrients are passed up through the food chain as plants are eaten by herbivores, which are in turn preyed upon by carnivores.

When an organism dies, its nutrients are returned to the environment. This exchange of nutrients between organisms and their environment is called **nutrient cycling**. Nutrient cycling involves sources of nutrients called **reservoirs**, which are either biotic (living) or abiotic (nonliving). For example, the atmosphere is an *abiotic* reservoir for carbon (in the form of carbon dioxide). Biomass is a *biotic* reservoir for carbon (in the form of organic molecules).

Reservoirs are connected by processes that cycle nutrients from one reservoir to another. For carbon, these processes include photosynthesis and respiration. Photosynthesis, the process that plants use to produce sugars, moves carbon from the atmosphere into biomass. Respiration, the process that organisms use to transform organic carbon into energy and new biomass, can move carbon from organic molecules back into the atmosphere.

Other nutrients, such as nitrogen, are cycled by different types of processes. Some of the processes that cycle nutrients are driven by **microbes**, such as bacteria in the soil, and **detritivores**, organisms that eat decomposing matter and feces.

### PROCEDURE

1. Form groups as directed by your teacher. Each group should get one set of cards and the “How Savanna Plants Get Nutrients” graphic.
2. Look over the savanna plant graphic with your group. The bubbles on the graphic represent the nutrients carbon, nitrogen, and phosphorus. The number of bubbles for each nutrient represents the relative amount of that nutrient in mature savanna plants. ***Your group’s goal is to fill in all the bubbles by following the directions on the cards***, which represents completing the plant’s nutrient requirements.
3. Shuffle your cards and place the deck where everyone in your group can reach it.
4. Take turns drawing one card at a time and follow the instructions on the cards you get. There are three types of cards:

- a. **Process** cards represent ways that a plant can get, or take up, nutrients from the environment. Each time you draw a process card, fill in the numbers of bubbles indicated at the bottom of the card to represent the nutrients your plant takes up due to that process. Note that some process cards cannot be used until the group gets certain soil microbe cards. ***Put each process card in a discard pile after you follow its instructions.***
  - b. **Soil microbe** cards represent microorganisms, such as bacteria, that help drive nutrient cycling. Some of these microbes enable nutrient uptake by breaking down organic matter. Their cards will help you activate process cards or give you other bonuses. ***Keep and use one card for each type of microbe you draw and put them in the space labeled “Microbe Cards” on your group’s plant graphic. Put cards for microbes you already have in the discard pile.***
  - c. **Detritivore** cards represent organisms that eat decomposing matter and feces (dung). These organisms can increase nutrient uptake through decomposition. Their cards will help you enhance process cards. ***Keep and use one card for each type of detritivore you draw, and put them in the space labeled “Detritivore Cards” on your group’s plant graphic. Put cards for detritivores you already have in the discard pile.***
5. Continue playing until all the bubbles on your group’s plant graphic are filled in. If you run out of cards, shuffle the discard pile and use it to draw more cards.