Chapter 11-11: The Nitrogen Cycle

An important process in ecosystems is the recycling of nitrogen through its living (biotic) and nonliving (abiotic) components. The living components, or biota, of the ecosystem participate in the nitrogen cycle in a number of ways, as you will see in this plate.

If you look closely at the plate, you will notice that we show the various ways in which nitrogen cycles through nature. As you color the plate, the arrows should be emphasized.

Approximately 78% of the air is composed of diatomic nitrogen. Nitrogen is essential to life because it is a key component of amino acids and nucleic acids. Even ATP, the basic energy currency of living things, contains nitrogen.

Neither plants nor animals can obtain nitrogen directly from the **atmosphere (A)**. Instead, they must depend on a process called **nitrogen fixation (B)**. Key players in nitrogen fixation are **legumes (C)** and the symbiotic bacteria that are associated with their root nodules. Legumes include clover, peas, alfalfa, and soybeans. The bacteria associated with their root nodules are **nitrogen-fixing bacteria (D)**. These bacteria convert nitrogen in the soil to ammonia (NH_3), which can be taken up by some plants. The bacteria and the plant are in a symbiotic relationship. Cyanobacteria are also nitrogen-fixing bacteria; they are prominent in aquatic ecosystems.

We have seen how nitrogen is brought into the biotic component of the ecosystem via nitrogen-fixing bacteria. We will now focus on how nitrogen is cycled through the living aspects of the ecosystem.

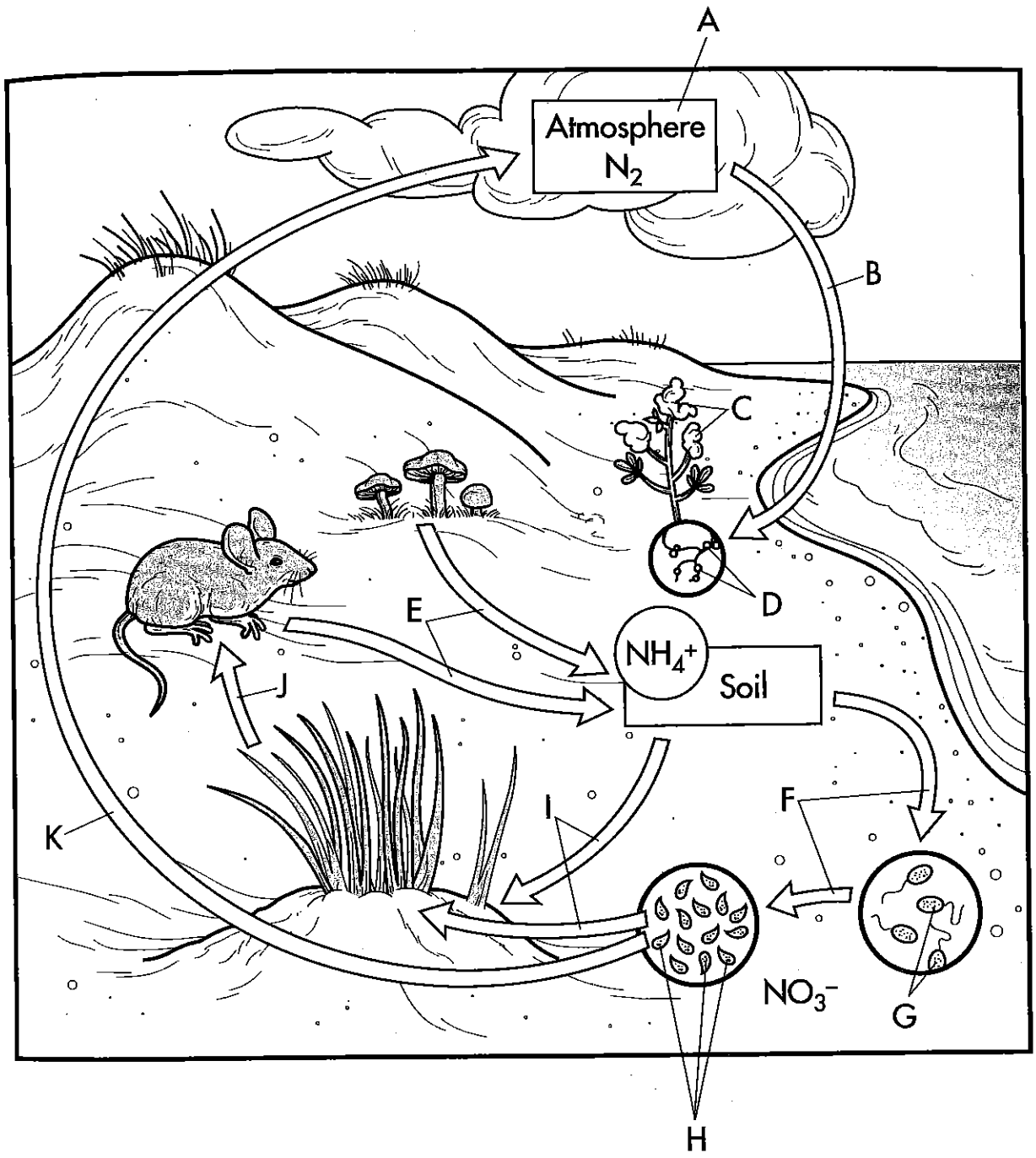
Nitrogen is fixed into the soil through the actions of free-living bacteria and, as we mentioned above, through bacteria that's associated with root nodules of legumes. Both of these methods of fixing nitrogen lead to its incorporation into ammonia (NH_3) in the process known as **ammonification (E)**. The soil is a major reservoir for ammonia and other nitrogen-containing compounds. After nitrogen has been fixed, other bacteria convert it into nitrate, in a process called **nitrification (F)**. In the first step of nitrification, ***Nitrosomonas* (G)** convert ammonia to nitrite (NO_2), and in the second step, nitrite is converted to nitrate (NO_3), by ***Nitrobacter* (H)**. The nitrate (NO_3) is then **consumed by plants (I)**, as the diagram shows.

But not all plants consume nitrate; as we mentioned before, some plants are able to use the ammonia from the soil. In both cases, nitrogen enters the primary producers in the biotic community. The plants may then be **consumed by animals (J)**. Herbivores are the primary consumers, and the nitrogen of the plants is used for the synthesis of key organic compounds such as amino acids, proteins, and nucleic acids.

We have seen how nitrogen is fixed in the soil and eventually utilized by plants and then animals. We will now complete the cycle of nitrogen by showing how it returns to the atmosphere. Continue your reading as you color the final aspects of the plate.

The final aspect of the nitrogen cycle is the process of **denitrification (K)**. This process is performed by a variety of microscopic bacteria, fungi, and other organisms. Nitrates in the soil are broken down by these organisms, and nitrogen is released into the atmosphere (A). This completes the nitrogen cycle.

The Nitrogen Cycle



The Nitrogen Cycle

- ○ Atmosphere .....A
- ○ Nitrogen Fixation.....B
- ○ Legume Plant C
- ○ Nitrogen-Fixing Bacteria .....D
- ○ Ammonification .....E
- ○ Nitrification.....F
- ○ *Nitrosomonas* .....G
- ○ *Nitrobacter*.....H
- ○ Consumption by Plants I
- ○ Consumption by Animals.....J
- ○ Denitrification.....K