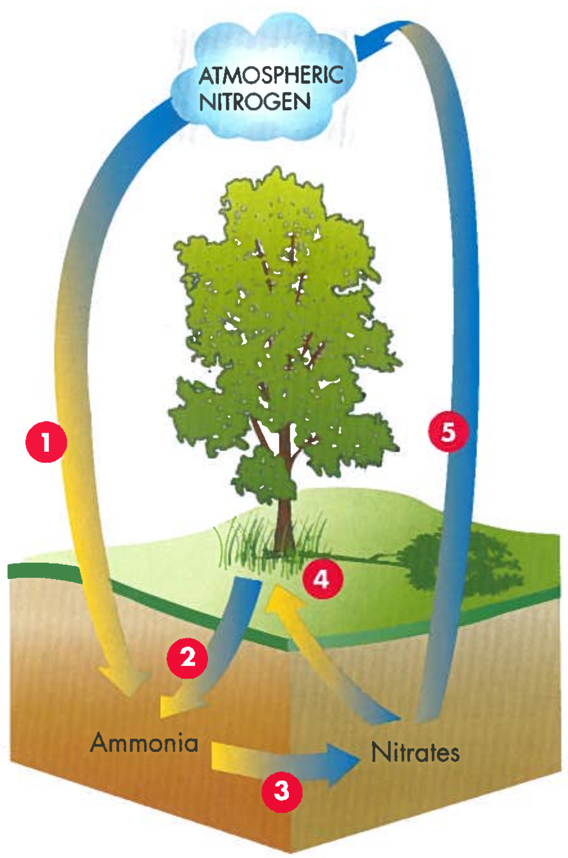

1. Nitrogen fixation
2. Ammonification
3. Nitrification
4. Assimilation
5. Dentrification

Figure 1.5.10 The nitrogen cycle. Examine this diagram carefully. Why might adding nitrogen-based fertilizers to some areas of the soil be necessary?

mineralized nitrogen. Thus, ammonia must be converted from organic to mineralized nitrogen.

2. In ammonification, ammonia is converted to ammonium ions (NH_4^+).
3. In nitrification, ammonium ions are oxidized into nitrite (NO_2^-) and then to nitrate (NO_3^-) ions. Ammonium, nitrite, and nitrate ions are deposited in the soil. As a result of human activities, atmospheric ammonium and nitrate ions are also deposited in soils through precipitation. There, all these ions are bound to soil particles.
4. In assimilation, the ions are taken up from the soil by plants.
5. In dentrification, unused mineralized nitrogen compounds make their way back into the atmosphere through a process in which nitrate is converted back to gaseous nitrogen.

Within the last century, humans have become as important a source of fixed nitrogen as all the natural sources combined. The burning of fossil fuels, the use of synthetic nitrogen fertilizers, and cultivation of legume crops, such as alfalfa and beans, all fix nitrogen. Through these activities, humans have more than doubled the amount of fixed nitrogen that is pumped into the biosphere every year, the consequences of which are discussed in the pages that follow.

The Phosphorus Cycle

Phosphorus is another nutrient that is an essential element for life. Many important molecules within cells contain phosphorus. For example, adenosine triphosphate (ATP) is a phosphorus-bearing compound found in every living cell, where it plays a key role in energy storage and supply. These phosphates are also important components of the nucleic acids DNA and RNA, which store genetic material. Phosphorus is also found in bones, whose strength is derived from calcium phosphate.

Unlike many other biogeochemical cycles, the atmosphere does not play a significant role in the movements of phosphorus because phosphorus and phosphorus-based compounds are usually solids on Earth. The largest reservoir of phosphorus is found in sedimentary rock.

It is in these rocks that the **phosphorus cycle** begins. When it rains, phosphates are removed from rocks via weathering and are distributed throughout soils and water. Plants take up the phosphate ions from the soil to make organic compounds

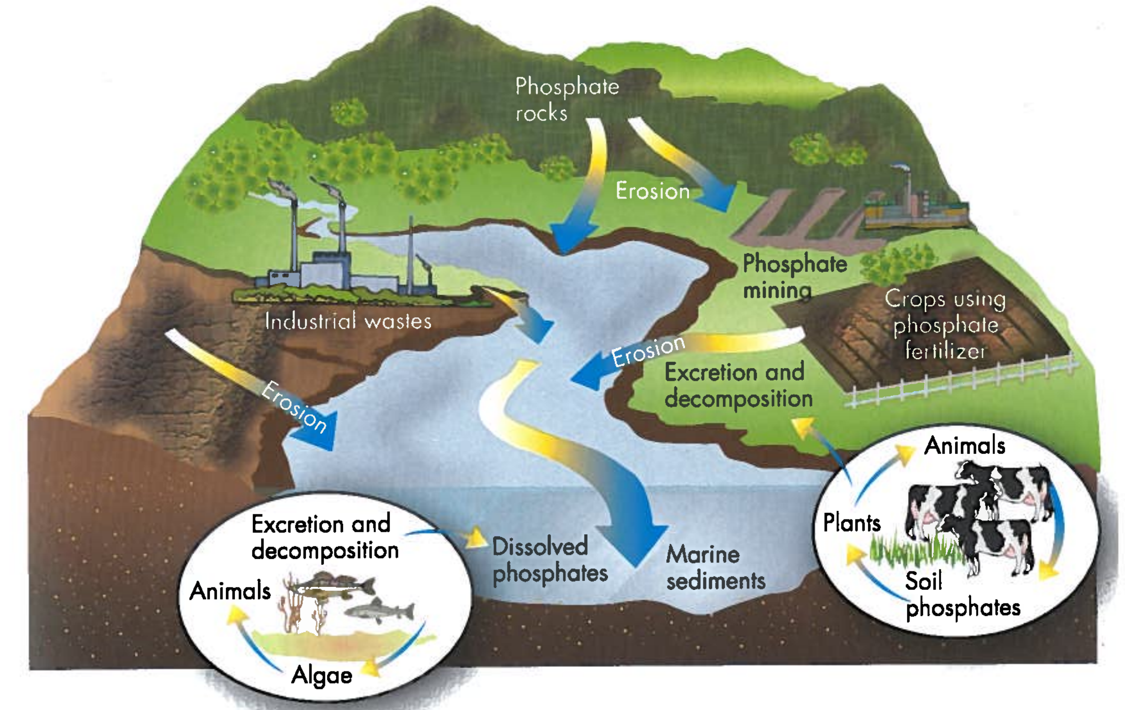

Figure 1.5.11 The phosphorus cycle. How does it differ from other biogeochemical cycles?

such as ATP. When animals eat plants, phosphorus is passed on to them. The phosphates absorbed by animal tissue through consumption eventually return to the soil through the excretion of urine and feces and from the final decomposition of plants and animals after death.

The same process occurs within a marine ecosystem. Phosphorus attached to soil particles reaches large bodies of water during run-off, and tends to settle on ocean floors and lake bottoms. As sediments are stirred up, phosphates may re-enter the phosphorus cycle. Water plants take up the waterborne phosphate, which then travels up through the stages of the aquatic food chain. Phosphates move quickly through plants and animals. However, the processes that move them through the soil or ocean are slow, making the phosphorus cycle one of the slowest biogeochemical cycles.

REVIEW AND REFLECT

1. List and briefly describe in one sentence each of the five main biogeochemical cycles.
2. Why is the energy cycle more appropriately described as a balance, while the water cycle is more accurately described as a circle or wheel?
3. Why is knowledge of biogeochemical cycles important in the understanding of environmental and resource management? Use one or two examples to justify your answer.