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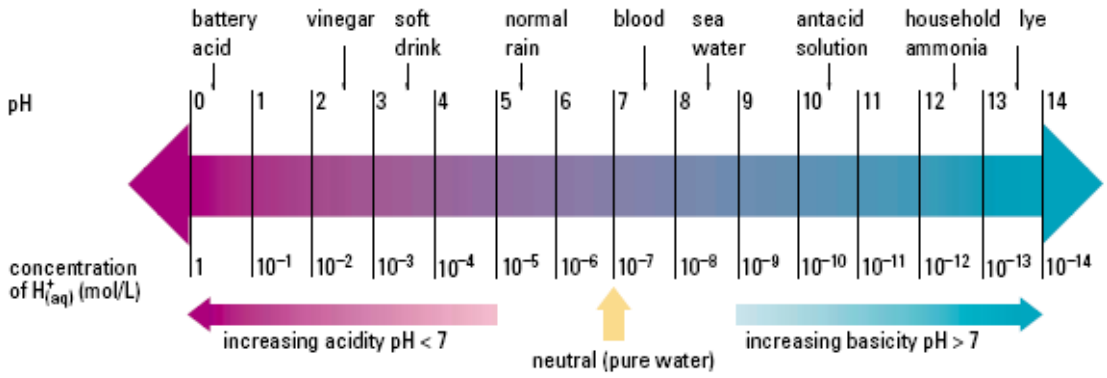
1.6 Should We Interfere with Natural Cycles?

We eat plants – seeds, leaves, flowers, fruit – for the valuable nutrients they contain. When plants are harvested, their valuable nitrogen does not return to the field or orchard. The nitrogen cycle is broken, and the soil becomes depleted unless the farmer replaces the missing nutrients.

Fertilizers are materials that restore or add nutrients to the soil. They are used to increase production from the land, and may be natural (manure) or synthetic (made from chemicals). Yields of cereal crops such as wheat and barley can be doubled using fertilizers. However, fertilizers must be used sparingly. More is not always better.

In the soil, bacteria convert the nitrogen contents of fertilizers into nitrates. Too much of these nitrates may result in high levels of nitric acid. This decreases the pH of the soil. **pH** is a measure of how acidic or basic a substance is. Changes in soil acidity affect all living organisms, including decomposer bacteria.

Most grassland soils have a pH near 7 (neutral). If the pH of a soil drops to 6, some sensitive crops like alfalfa and barley don't grow as well. A drop to a pH of 5 will affect almost all commercial crops. Acid rain and snow add to this problem.



Fertilizer and Ecosystems

Fertilizer accumulation also harms the environment. Spring runoff carries decaying plant matter and dissolved fertilizer to streams and lakes. These nutrients allow algae in the water to grow more rapidly in what is called an algal bloom. Dead algae are decomposed by bacteria that use oxygen. Oxygen levels in lakes drop quickly, killing fish and other organisms. This makes the problem worse as the populations of decomposers grow even larger and use still more oxygen.

Other bacteria convert nitrates into similar compounds called nitrites. But nitrites are dangerous to animals, like humans, that have hemoglobin in their red blood cells. Nitrites can attach to the hemoglobin, reducing the ability of red blood cells to carry oxygen around the body.

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Worksheet 1.6: Natural Cycles

1. Why does the nitrogen level in fields decline when crops are harvested?

2. How do excess fertilizers affect decomposers in soil? How do excess fertilizers affect decomposers in water?

3. List the benefits and risks or fertilizer use.

4. Human waste contains nitrates and nitrites. Before sewer systems were developed, the backyard outhouse collected human waste. Outhouses can still be found at some cottages. Outhouses consist of a small building over a hole in the ground. Using the information you have gained about the nitrogen cycle, explain why outhouses pose a risk to nearby lakes.