What's Growing in the Water?

Setting the Scene: Plants in the Water

Have you ever noticed that some of the canals, lakes, and ponds in your community have more algae and plant growth than others? They change over time, too. Sometimes they have thick covers of algae or weeds, and sometimes they look pretty clean.

The reason has to do with the fertility of the water, its ability to nourish the growth of plants, and algae.

The Basic Science: Nutrients

Plants grow better when they are nourished by nutrients, which we generally call fertilizers. The two most common naturally occurring nutrients are nitrates and phosphates. These chemicals are the basis for plant growth, so they are extremely important. They are the reason why some people's tomatoes grow so much better than others.

These nourishing minerals are essential building blocks of plant life. As plants grow, they are nourished by these minerals. When the plants die, the chemicals are returned to the soil, and future generations of plants use them again and again. The entire process of using nutrients from the soil to grow and then returning them to the soil after death is part of the nitrogen cycle.

As with many good things, though, too many nutrients can quickly become a big problem. Too many nutrients in the environment can cause uncontrolled plant growth. That excessive plant growth can destroy ecosystems, choke out healthy plants, kill fish, and even destroy whole bodies of water.

Aquatic Plant Growth In Your Community

The amount of algae you see in a body of water increases and decreases depending on the amount of nutrient entering the water. Plants use up the available nutrients very quickly. As they use the nutrients, they grow. Then, when the flow of nutrients declines, they soon stop flourishing.

Rich plant growth also means that a lot of plants are dying. As plants die, bacteria consume and decompose the dead material. The action of these bacteria release the nutrients from the dead plants and actually clean up the water! Bacteria need oxygen, too. The more dead material there is to decompose, the more active the bacteria become and the more oxygen they need. If there is not enough oxygen to support these bacteria, they too begin to die. Then there is even more dead material, and fewer cleaner-uppers. You get the picture. If water is overfertilized, it quickly becomes oxygen deprived. The water gets murky, stagnant, and stays dirty. It might soon begin to smell like rotten eggs. (That smell is given off by a different type of bacteria – called "anaerobic" bacteria – that live in oxygen-poor conditions.) The scientific process is called "eutrophication," and it can eventually destroy a body of water.

One way to keep the ecosystem in balance and keep the water clean is to be sure there is plenty of oxygen. You may have noticed that many golf courses have fountains in their ponds. Golf courses

use a lot of fertilizers to keep the grass thick and green. However, those fertilizers may build up in the ponds on the golf course. The fountains play an important role in keeping these nutrient-rich water bodies healthy. The spray of the fountains continually adds oxygen to the water. Adding oxygen to water is called aeration, and it keeps the populations of helpful bacteria strong and healthy. In that way, even plant growth from excess nutrients can be managed without hurting the water's ecosystem. (Water treatment and wastewater treatment plants also aerate to speed the cleaning up of organic material in the water.)

Sources of Nutrients

Nutrients in your community generally come from two primary sources: chemical fertilizers and organic waste, such as fallen leaves and droppings from pets and wild animals. Waste materials are most likely to enter a local body of water after a heavy rain, when the rainfall washes waste materials on the ground into the local waterways. This process is called non-point-source pollution.

Fertilizers become non-point-source pollution only when they are over-applied. As long as they are applied in the right amount, the plants they are fertilizing use up all the nutrients, so the rain has nothing to wash away. If too much fertilizer is applied, though, the plant uses all it can. The rest sits on the ground waiting for rain to wash it away. When that happens, the excess nutrients enter a local body of water and encourage plant and algae growth.

Observing Nutrients

You cannot see nutrients with your eyes. However, you can measure them chemically and you can observe their effects: When plants grow dramatically and quickly, you can be sure there has been a release of nutrients.

Suggested Projects

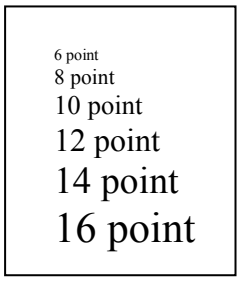
1. Observe the effects of nutrients on a body of water in your neighborhood. Observe the level of algae growth in the water, and record it along with other pertinent information, such as rainfall. When you see changes in the algal growth, develop a hypothesis to account for what may have caused that change, and then test it.

2. Develop a unit of measurement for determining the level of plant and algal growth in a body of water. For example, you could estimate the percentage of the surface area of the water that is covered with algae or plant growth.

3. Purchase a "Secchi disk" from a water quality supply house. It is a white and black disk that enables you to measure the clarity of the water. You use it by lowering it slowly into a body of water, then measuring the depth at which it becomes invisible. As more algae grow in the water, the Secchi disk becomes invisible at smaller and smaller depths. Measure the clarity of a body of water in your community. Observe changes over time, then develop a hypothesis to explain those

changes and try to devise a test that hypothesis. You can learn more about Secchi disks by looking up the term on the Internet.

4. Develop your own measuring system for "opacity," or water clarity. For example, you could create your own standard solutions to use to compare samples from your body of water every few days. You could do this by filling five or six jars with tap water. Add one drop of green food coloring to the first one, two drops to the second one, and so forth. Then create pieces of paper on your computer that shows type at different sizes… like this…



Tape the paper to the back of each container, so you are reading the type through the green solution. Adjust the type sizes and the concentrations of food coloring so each subsequent container allows you to see and read one type-size larger.

When you test your water samples, you can use a jar that has the same numbering system taped to it. Then when you look through the water, you will know the level of clarity based on the numbering system you have created yourself.

Since water clarity is affected by many different factors, and algae growth is only one of them, you will also want to consider other causes, such as high winds and the effect of heavy rains.

5. Buy a nitrate test kit from a supplier such as The LaMotte Company. (http://www.LaMotte.com. Their kit #3354 costs about $40 and will enable you to test the amount of nitrogen in the water.) Test the nitrogen every few days, and graph the nitrogen levels and the rate of plant growth. See if you find any relationships. Be sure to measure nitrogen levels immediately before and after rainstorms to see if there is a difference. If there is, develop a hypothesis about what may have caused the difference and try to devise a way to test it.

6. Call the Parks Department in your neighborhood or the maintenance office of a local golf course. Ask about their fertilizing schedule and the fertilizing practice. Are they careful to use only the precise amount of fertilizer needed for their purpose?

7. Experiment with the role of nitrogen in plant growth by growing plants. Plant three plants in sterilized soil and three in rich soil from outdoors. You can sterilize soil by baking it in a hot oven (with the help of an adult!). Water one of the plants in each experimental group with

distilled water (from the grocery store). Water one of the plants from each group with tap water (which is rich in minerals from the aquifer. Water one of the plants in each group with tap water and a soluble plant fertilizer mixed according to the instructions. (Plant fertilizers are readily available at nurseries and home supply stores.) Measure and compare the results over a period of time. You may want to try the same experiment using water from a pond or canal that is high in visible algae and observe the changes in algal growth over time.

8. Research the *nitrogen cycle* and create a poster showing it and its effect on nature.

9. Research *eutrophication* and create a poster showing its stages and the chemical changes that take place in the environment. Check out the St. John's River Water Management District website (http://sjr.state.fl.us) and research their water quality testing results regarding nutrients, especially nitrates and phosphates.

7th Grade Science Standards from the Sunshine State Standards

Processes that Shape the Earth

- Knows the relationship between run-off and the development of a river system
- Knows the way in which the Earth's surface is eroded and reshaped (for example, weathering, erosion, deposition).
- Understands that changes on the surface of the Earth affect living systems.
- Knows the ways in which living things reshape the landscape (for example, bacteria, fungi, worms, rodents, and other organisms add organic matter to the soil, increasing soil fertility, encouraging plant growth, and strengthening resistance to erosion.
- Know ways to conserve and recycle resources (for example, develops and uses a personal action plan to use recyclable materials whenever possible).
- Knows roles of various public and private environmental agencies (for example, Florida Water Management Districts, Environmental Protection Agency).

Processes of Life

- Understands that the systems within living things respond to changes in the environment.

How Living Things Interact with Their Environment

- Understands how the carbon dioxide-oxygen cycle, water cycle, and nitrogen cycle are important for the survival of organisms.
- Knows the interrelationships in a local ecosystem.
- Understands the importance of informed use of natural resources.
- Knows the biotic and abiotic components in a small, local area and ways they interact (for example, field, pond).
- Understands that changes in one part of the ecosystem will affect other parts of the ecosystem.