

# Muddy Hands

Soil and Water Information for Educators Brought to You by the Lake and Geauga County Soil and Water Conservation Districts



## Cycles

Much of the natural world is driven by cycles. Energy flow through an ecosystem can be represented by a cycle, as simple or complex as the students want to make it. Younger students can see the water cycle happening around them. Many of Earth's elements move through their own cycle. They may get changed chemically, by being bound to other atoms, or physically, by evaporating or condensing, but the total amount on the planet remains relatively stable. When viewed as a whole, Earth is a closed system, with the exception of solar energy coming in and radiant heat leaving the planet.

By studying various cycles, students can begin to understand why the different branches of science are important. Each



cycle includes some biology in studying how a living organism uses a certain element and possibly changes it. Chemistry is often necessary to understand what goes on in the atmosphere, or within an organism. Most nutrient cycles also involve geological processes, that serve to store or concentrate a resource.

A cycle is a dynamic thing. It lends itself to interactive modeling, movement, and non-traditional methods of classroom instruction. Cycles can also be thrown off balance, and changed or altered by human activity. Human interaction and interference with natural processes can be better understood by looking at the effects on the relevant cycle. In this issue of Muddy Hands, we will look at several types of cycles, and ways to approach classroom instruction.

## Calcium, From Seawater to Synapses

What do sea shells, Plaster of Paris, and your muscles all have in common? They are part of the Calcium Cycle. Calcium is the fifth most abundant element on the planet. It shows up in limestone (Ca CO<sub>3</sub>) and animal shells, as well as in our bones, teeth and muscles.

To follow the cycle, we can start with calcium ions and carbonate ions in a saturated seawater solution. They are combined, either inorganically or by a hard-shelled sea creature, and precipitate, collecting on the ocean floor. A small amount of calcium returns to land in the form of marine organisms (say, a salmon) being eaten by terrestrial organisms (say, a bear). The precipitate that falls to the bottom of the ocean lithifies into limestone.

Now the processes of geology take over and push the limestone bedrock up out of the ocean. Simple weathering of the rock by precipitation carries calcium into freshwater, and small particles of limestone in soil release calcium to the surrounding plant roots. In areas where calcium has been leached from the soil, farmers and gardeners will often add crushed limestone to the soil.

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### Special Points of Interest:

- Uniting curriculum topics using cycles
- Teacher of the Year Contest
- 2005 Conservation Poster Contest
- Lake SWCD looking for volunteers





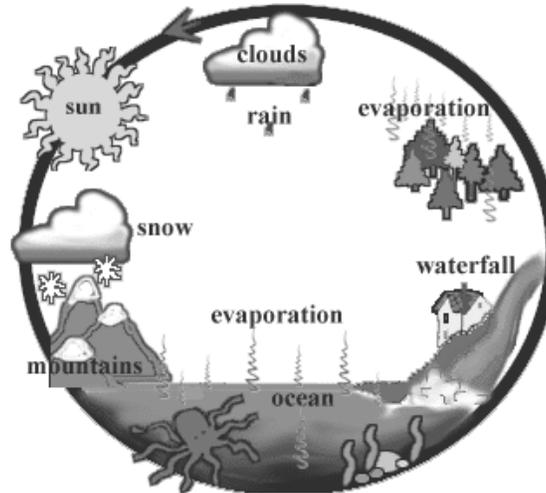
## The Water Cycle

The water coming out of your faucet has been on planet earth forever- since the beginning of time! Throughout its long journey, the water has changed forms and locations time and time again. This continuous cycle is known as the *Water Cycle* (also known as the *Hydrologic Cycle*). People often visualize the water cycle as a continuous circle. This is true, in part, but the paths that a water droplet takes on its journey are variable.

Heat energy directly influences the rate of motion of water molecules. When the motion of the molecule increases because of an increase in heat energy, water will change from solid to liquid to gas. With each change in state, physical movement from one location to another usually follows.

Gravity further influences water's ability to travel on, under, and above the earth's surface. When water is in any state it is subject to the earth's gravitational force.

The most visible state of water is its liquid form. It is seen moving in streams, rivers, and oceans. Water also travels underground, seeping through the soil particles and rocks.



Water moves through the atmosphere in the gaseous state. It is constantly evaporating, or changing from a liquid to a gas. Water vapor surrounds us all of the time, and it travels through the atmosphere over the earth's surface. Where it condenses, or becomes liquid again, depends upon loss of heat energy, gravity, and the structure of the Earth's surface. Water condensation can be seen as dew or water droplets on a glass. In clouds, water molecules collect on tiny dust particles, and when they become too heavy they fall to the earth's surface.

Living organisms also help move water. Humans and animals carry water in their bodies, transporting it from place to place. Plants also move water - their roots absorb it. Some of this water is used within the body of the plant, but most travels through the plant to the

leaf surface. When the water reaches the leaves, it is exposed to the air and the sun's energy and is easily evaporated. This process is called transpiration.

All of these processes work together to make up the water cycle, as water makes it's journey around the earth.

*Information provided by [The Incredible Journey](#) from Project WET Curriculum and Activity Guide, pages 161-165.*

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Thus, the calcium enters the food web, following the pathways through producers, consumers, and decomposers. Within our bodies, calcium is vital to several processes. A 150 lb. human has approximately 2.25 lbs. of calcium in his or her body. Only 1% of that calcium is not bound into teeth or bones, but that 1% allows your heartbeat to remain regular, your muscles to contract, your nerves to fire, and your blood to clot. It is also vital in other organisms to form hard body

coverings, and eggshells.

Calcium makes other appearances in our lives. Some calcium precipitates out of ocean water as calcium sulfate. This is what we know as gypsum. Gypsum is used in wallboard, some cements, fertilizers, and paint filler. If it is heated, it becomes Plaster of Paris. Fine-grained, pure gypsum is known as alabaster and has been used as a carving medium for thousands of years.



## Lake SWCD to Create Resource Kits

Lake County SWCD is seeking input for resource kits in several natural resource areas. These kits will contain teaching tools, student resources, and activity ideas that build upon each other and are based on the Ohio Science Standards. Kits will be available for loan to teachers within Lake County. Possible topics and grade levels would include: Ohio Wildlife for K-1, Soils for 3rd Grade, Landforms, Erosion and Deposition for 4th, and Land and Resource Use for 10th. If you would like to suggest a topic, or are interested in helping to create or gather resource materials, please contact Beth at (440)350-2730.

## **Classroom Activity: Modeling the Carbon Cycle**

For Grades 4-8

Elements such as nitrogen, phosphorous and carbon bridge the gap between biology and geology and even cross over into chemistry. One of the simpler nutrient cycles to understand is the carbon cycle. Carbon is unique in that it can bond to four other atoms at a time, or double or triple bond to another carbon atom. This versatility enables carbon atoms to form many different compounds. Diamonds and graphite are two well-know inorganic carbon compounds. All organic compounds contain carbon. Plants and animals rely on carbon for respiration, as well as protein synthesis.

Carbon in the atmosphere is considered a greenhouse gas and contributes to the trapping of heat in the lower atmosphere. There is an ongoing debate as to whether human activity is increasing the amount of carbon in the atmosphere and the implications that that might hold for future climate change.

Portions of the carbon cycle take place on a geological time scale. An atom of carbon that was used to form a cell wall in a fern in the Mississippian Period over 300 million years ago may have been converted into coal and buried deep within the mountains of West Virginia until two days ago when it was fed into a coal-fired power plant along the Ohio River. Places that store carbon for long periods of time are called 'sinks' and include coal, crude oil deposits, limestones, and even long-lived trees and ocean water.

Carbon release happens via respiration, combustion, and weathering of exposed rock. Volcanic activity can also bring carbon from deep within the crust up to the surface. These processes release the carbon into the air, most often in the form of CO<sub>2</sub>, where it can be used by plants again. Carbon also travels through the food chain.

This activity demonstrates the different carbon sinks and pathways that a carbon atom can follow between the sinks. It also shows the relative amounts of carbon held in each sink. You will need at least 24 black balloons, plus 4 blue balloons and 6 red balloons, all inflated. If the balloons are inflated with helium and tied, designate a student to stand at each station. Large baskets, boxes, or clear bags will also help keep things contained if you choose not to use helium.

- Start by designating 5 separate areas of the room as various carbon sinks. The five carbon sinks are: Atmosphere, Land Biomass, Ocean, Fossil Fuel, Rock.
- Place one balloon at the Atmosphere station, making sure the students understand that atmospheric carbon is the CO<sub>2</sub> that they breath out and release by burning biomass or fossil fuels.
- There is four times as much carbon in the Land Biomass as the atmosphere, so send four balloons there. This represents the carbon bound up in living organisms.
- Seven black balloons are then places at the Fossil Fuels sink to represent the plant remnants that have become coal and oil deposits. At this point, you can then begin discussing how carbon moves between the different sinks. Signposts with arrows, placed at each station, can identify the pathways that carbon atoms will follow between the sinks.
- Moving on to the Ocean and Rock sinks, the model becomes a bit more complicated because this is where most of the carbon storage takes place. Since you would need about 50 balloons at the Ocean station, simplify it by using a balloon of a different color to represent 10 carbon atoms. Therefore you would need 10 black balloons and 4 blue balloons at the Ocean sink.
- The Rock sink would need 66,000 black balloons! Designate a different color balloon to represent 11,000 carbon atoms. It is helpful to write the unit on the balloons with a permanent marker. Also put a few black balloons at the Rock sink. Now let the students finish identifying paths between the sinks to complete the cycle.

Once the balloons are in place, you can demonstrate how the cycle is affected by natural and human processes. Challenge the students to change the model to represent a volcanic eruption (move balloons from the 'Rock' sink to the 'Atmosphere'), or coal consumption for energy production (move balloons from 'Fossil Fuels' to 'Atmosphere'). What would happen next? What other activities might affect the balance of the carbon cycle?

# Muddy Hands

## Geauga SWCD and Lake Metroparks Will Host Winter Educator Workshop

Teachers of grades 7 through 12 from Lake and Geauga Counties are invited to participate in the *Science and Civics: Sustaining Wildlife* education workshop presented by Lake Metroparks and the Geauga Soil and Water Conservation District.

The *Science and Civics: Sustaining Wildlife* guide is the newest edition to the Project WILD curriculum. The guide provides a format and information for teaching individuals how to make informed decisions and take responsible actions concerning wildlife and the environment. It is specifically adapted for use in secondary education and integrates science, social studies, and service learning objectives while providing meaningful, hands-on learning opportunities for students.

The Science and Civics Educators' Workshop will be

packed with activities and background information about the Science and Civics initiative and will give teachers another tool to enhance their current curriculum in topics related to the environment and conservation. Participants will also receive the *Science and Civics* curriculum guide.

The activities in the Science and Civics guide are correlated to the new science curriculum standards and are in the process of being correlated to the social studies curriculum standards. Correlation information was compiled by the Ohio Department of Natural Resources Division of Wildlife for use in preparation of classroom curriculum.

Register soon!! Only 25 teachers from Lake and Geauga Counties will be accepted and registration is first come, first served. The \$10 registration fee can be sent with your registration or paid on the day of the workshop. Registration deadline is February 11, 2005.

### Ohio Conservation Teacher of the Year!!

The purpose of this contest is to recognize the outstanding conservation education efforts of Ohio's Teachers. Teachers in grades K-6 and grades 7-12 will be recognized in two separate categories. Details about the contest can be found on the Lake and Geauga SWCD websites at [www.lakecountyohio.org/soil/CTY.htm](http://www.lakecountyohio.org/soil/CTY.htm) or [www.geaugaswcd.com](http://www.geaugaswcd.com), or by contacting the District offices. Call 440-350-2730 (Lake SWCD or 440-834-1122 (Geauga SWCD) for contest guidelines and application information. There will be a local prize offered at the county level, and the winners of each category will move on to the state competition. Let's recognize our outstanding Lake and Geauga County teachers by nominating them today!

### Attention Science Teachers!

Exciting news from your Environmental Educators! Last year, the Geauga SWCD received a grant from the Ohio EPA's Environmental Education Fund to create the Environmental Education Program Guide and Curriculum Correlations Handbook, which aligns all of the District programs with the current science curriculum requirements. This handbook has been completed and will be delivered to you free of charge. The Geauga and Lake County SWCD's goal in creating this handbook was to make District programs relevant and accessible to teachers in order to ease their transition in adapting current classroom curriculum to meet the requirements of the new science curriculum standards. Keep an eye on your mailbox at school in order to take advantage of the free programs your local SWCD offers to educators!



## GETTING STUDENTS INVOLVED IN CONSERVATION

Once again, Lake and Geauga County SWCDs are sponsoring a Conservation Poster Contest. The contest is held in conjunction with the National Association of Conservation Districts and the Ohio Federation of Soil & Water Conservation Districts. "Celebrating Conservation" is the theme for Soil and Water Stewardship Week. The purpose of the contest is to instill in our youth an appreciation for the environment and the need to protect our precious soil and water resources.

Lake and Geauga County schools must submit posters to their District office on or before May 2, 2005, or call their local SWCD office by April 25, 2005 to arrange for the District to collect them by the deadline. Judges will consider neatness, choice of color, and adherence to the rules. Prizes will be awarded for local 1st and 2nd place winners! All posters become the property of Lake or Geauga SWCDs, unless otherwise requested. Please call Lake or Geauga SWCDs or visit their websites for contest rules before getting started!

### Your SWCD Contacts:

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All Lake and Geauga SWCD and USDA programs and services are available without regard to race, age, gender, national origin, political belief, color, religion, disability, sexual orientation, or marital or family status.

Lake County and Geauga SWCDs provide classroom and outdoor programs on several topics. Contact your SWCD for programs and how they can help you meet the Ohio Curriculum Standards.