CFAES OHIO STATE UNIVERSITY EXTENSION

PROJECT IDEA STARTER

Field to Faucet: What Determines Water Quality

By Jacqueline Krieger, Extension Educator, 4-H Youth Development, and Greg LaBarge, MS, Field Specialist Agronomic Systems, Ohio State University Extension. Reviewed by Joe Bonnell, PhD, Program Director, School of Natural Resources, Ohio State University Extension, and Chris Winslow, PhD, Associate Director, Lake Erie Area Research, The Ohio State University.

Ohio has an abundance of water with more than 118,000 acres of publicly owned lakes and 23,000 miles of streams—all fresh water. Ohio's northern border includes 321 miles of Lake Erie shoreline. The southern border is 451 miles of the Ohio River (Ohio EPA, 2012). Private ponds and lakes also dot the landscape. Residents and visitors depend on these bodies of water for recreation, energy production, agriculture, and drinking water. Protecting this valuable resource is essential for healthful living and for keeping Ohio's economy strong (OEPA, 1998).

Humans live, work, and play on the land here in the state of Ohio. Through our activities we sometimes expose soil to the erosive effects of rainfall. Have you ever ridden a four-wheeler or walked along a well-worn path on your property? What is the result? Usually, the path becomes a bare area where no vegetation grows. Do you have a construction site in your neighborhood that leaves bare ground exposed? When it rains, does soil get washed into adjacent roads, parking lots, stormwater drains or ditches? Does the water look clear or cloudy? Do you ever wonder where that soil goes or what is being carried with it?

Human activities such as road and building construction, mining, and farming often leave soil uncovered for long periods of time, exposing it to the power of raindrops hitting the earth. Yes, even raindrops dislodge and move soil particles! "During rainfall, millions of water drops fall at **velocities** reaching 30 feet per second. They explode against the ground, splashing soil as high as three feet in the air and as far as five feet from where they hit" (Oklahoma Cooperative Extension Service, 2014). Excess water from rainfall runs over the surface of these disturbed areas, carrying with it sediment and nutrients that affect water quality downstream.

Soil itself can become a problem when it is deposited as sediment in streams, lakes, and ponds, sometimes filling them in and covering rocks and pebbles—important habitat for many aquatic organisms. The

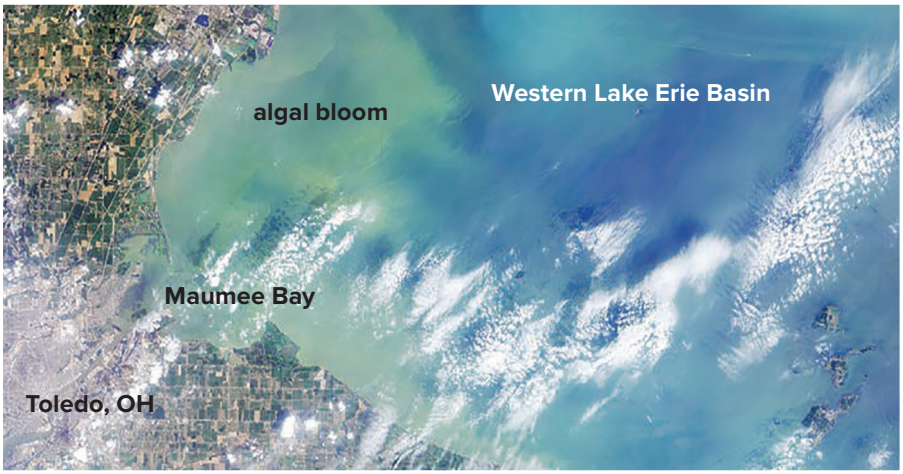
PLAN YOUR PROJECT

Use this idea starter AND publication 4-H 365 *Self-Determined Project Guide* as the starting place for your 4-H self-determined project. The *Self-Determined Project Guide* is available from your county OSU Extension office or on the Web at **ohio4h.org/selfdetermined**. You may choose to do a little or a lot depending on your level of interest. Be sure to register your project with your county OSU Extension office.

nutrients carried in soil runoff are a problem too. Only small amounts of nutrients, mainly nitrogen and phosphorus, are necessary for plant growth. In aquatic systems, these nutrients help promote the growth of plankton that is the basis of the aquatic food web. The plankton feed on aquatic insects like mayfly nymphs, and the nymphs are eaten by fish such as perch. Bigger game fish, such as walleye, eat the perch (NOAA, 2009). Small amounts of nutrients are necessary for healthy streams, lakes, and wetlands.

On the other hand, high levels of nutrients in a freshwater environment can lead to too much growth of some plants, like algae, and undesirable organisms, like **cyanobacteria**. Cyanobacteria are commonly called "blue-green algae," but they are actually bacteria and not true algae. The term harmful algal bloom, or HAB, is commonly used to refer to an outbreak of cyanobacteria in a body of water. HABs can produce poisons, or toxins, that cause illness or irritation—sometimes even death—in pets, livestock, and humans. Scientists are still researching how HABs affect other aquatic life, like fish and waterfowl.

The growth of HABs limits the use of water for drinking and recreation. The City of Toledo gets its drinking water from Lake Erie. In August 2014, HABs from Lake Erie were drawn into the drinking water plant and caused Toledo's city officials to issue a "do not drink" order for 54 hours. This left 500,000 citizens—that's half a million—without drinking water. Lake Erie is not the only lake in Ohio to experience HABs in the summer. The Ohio Environmental Protection Agency (EPA) tracks current observations on its website at **epa.ohio.gov/habalgae**.aspx. More than 26 lakes have been listed in recent years, with frequent postings for Grand Lake St. Mary's (Western Ohio) and Buckeye Lake (Central Ohio).



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Too many nutrients in water can also result in low or no oxygen, conditions called **hypoxia** and **anoxia**. Water is considered low oxygen when the concentration of oxygen is less than 2–3 milligrams per liter (mg/l). Lake Erie sometimes develops a hypoxic area in its Central Basin resulting from the decomposition of organic matter such as dead algae. Bacteria that feed on dead algae consume oxygen from the water. Few organisms can live in environments of no oxygen, so they are called "dead zones." Dead zones can be found in freshwater but they usually occur in estuaries (where freshwater meets seawater) and in coastal waters such as the Gulf of Mexico where a dead zone appears annually covering, on average, over 5,000 square miles (Ecological Society of America, 2012).

When talking about water quality, we have to look at the big picture. With **watersheds** the big picture includes all the land that drains into our storm sewers, ditches, streams, rivers, ponds, lakes, and reservoirs. Some of the water that falls as rain or snow flows downhill as runoff into a body of water. As this runoff flows downhill, it can pick up soil particles, nutrients, and pollutants and carry them into the nearest ditch, stream, pond, or lake. We call all the land that drains into a particular body of water a watershed. For example, a

Photo by Ken Chamberlain

typical farm pond will have a five- to ten-acre watershed, meaning it will receive runoff from five to ten acres of land uphill from the pond. Check out "All About Watersheds" at **allaboutwatersheds.org/poster** to learn more about how the environment can affect watersheds.

Water moving across unprotected soil is only one source of sediment and nutrients. As caretakers of our rich Ohio environment, we need to think about our presence in the watershed and how it affects water quality. Practical steps for looking at our surrounding property and checking for ways to ensure a healthy environment include these suggestions:

- Farmers can check to see that no runoff from livestock pens enters streams directly.
- Do some research to see if your local sewer systems and wastewater treatment plants have the capacity to effectively treat wastewater before it enters a stream or river.
- Homeowners with septic tanks and leach fields can have them inspected to make sure they are operating properly.
- Fertilizers should be used carefully so they have only a minimal effect on the environment.
- Everyone can watch for areas where soil is being washed off the land and into a storm sewer, ditch, stream, or lake through erosion.

Working together, raising awareness, and taking common sense steps on these issues is part of the key to protecting Ohio's remarkable water resources.

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AREAS OF INTEREST AND THINGS TO DO

Every self-determined project can be broken down into areas of interest. These are specific things members want to address during their project adventure. Using *4-H 365 Self-Determined Project Guide*, identify at least three areas of interest and at least three activities per area to explore. Take your ideas from the list below or make up your own.

Water Sources

☐ Plot on a map the water source for your home, or some other water user, and how it makes its way to you or the other user. Does your drinking water come from a private well or from a public water supplier?If it comes from a public water supplier, where do they get the water that is piped to your home?

☐ Tell the story of the benefits of a wetland, pond, stream, lake, river, or ocean. What are some potential sources of contamination? Consider creating a photo journal, scrapbook, a group of drawings, or write an essay.

☐ Ohio is located on the southern border of the world's largest body of fresh water—the Great Lakes! Where does that water come from? Look for a map of the drainage area for the Great Lakes.

☐ Visit a drinking water treatment facility. Draw the process to explain how the water is treated to make it safe to drink. Share your drawing with others.

Water Conservation

☐ Investigate rain barrels as a way to collect rainwater from the downspouts of your house or garage. Build and connect a rain barrel. Record how much water it collects after a storm and how you use the water.

☐ Investigate water gardens as another way to use rainwater from the downspouts of your house or garage. Create a water garden. How can it reduce the amount of water and contaminants flowing into

Photo by Ken Chamberlain

the storm drain, ditch, or stream near your home?

- ☐ Monitor and record your personal water use for three days. Include all uses!
- ☐ Offer suggestions that you have implemented in your life and in your home for reducing water usage or runoff from your home and yard, including those suggested by your water department or other water-related organization.

The Water Cycle

- ☐ Build a terrarium and record your observations of the water cycle.
- ☐ Plot on a map where and how wastewater and rainwater leave your home, or a local manufacturing plant, or a commercial area, or agricultural land. Note that stormwater and wastewater sewer pipes don't go to the same place. Stormwater sewers usually flow to a nearby river or stream and wastewater (sewage) flows to a wastewater treatment plant or home septic system.
- ☐ Use photos, create drawings, or write a story to explain the challenges and possibilities of reusing water used to bathe your pets or to wash your family's cars.Organize a hunt for disabled hunters.
- ☐ Water exists as either liquid, solid (ice) or vapor (steam, for instance). Describe these different forms of water and how they fit into the water cycle.

Uses of Water

- ☐ Observe how water is used in your home. Use photos, drawings, or words to describe water's many uses. What are some simple things you can do to reduce your family's water use?
- ☐ Research and describe how water is used in agriculture in the United States or in another part of the world.
- ☐ Explain how water is used in a commercial facility, such as an office building or grocery store.
- ☐ Pick an industry such as coal, oil and gas, metal producers, paper products producers, or other industry and explain how it uses water.

Access of Water

- ☐ Describe the challenges to providing safe, clean drinking water in Ohio. Consider problems at the water's source and the quality of the water as it travels through the watershed and into a drinking water treatment facility.
- ☐ Around the world, access to safe, clean water is a challenge. Select a location in a developing nation and explain or show how and where locals find water for drinking, cooking, and washing. Tell this story with words, photos, or drawings.
- ☐ Identify an organization that is working to improve access to safe, clean water and outline their work and continuing challenges.
- ☐ Recently, it was announced that an awful tropical disease, Guinea worm, is near eradication! Education led to changes in behavior around water sources and made this possible. Research this disease or other waterborne diseases and steps being taken to find cures and solutions.
- ☐ Find out more about harmful algal blooms and hypoxic areas or dead zones. Are there any in lakes near you? What are the consequences? Do they ever affect your drinking water?What messages would you create

to inform the public about this problem?

Water-Related Careers

- ☐ Interview a person who has a career in some aspect of water use, conservation, research, regulation, or other water-related job.
- ☐ Create a poster board, scrapbook, video, or other means to share information about careers related to water.
- ☐ Shadow a person who has a career in water use, conservation, research, regulation, or other water-related job. What did you learn?
- ☐ Explore the educational requirements of three different jobs related to water.

RELATED RESOURCES

"Lake Erie Food Web," National Oceanic and Atmospheric Administration (2009), accessed September 2015, **www.glerl.noaa.gov/pubs/brochures/foodweb/LEfoodweb.pdf**.

"Ohio's Water Resources Report," Ohio EPA (2012), accessed September 2015, **epa.ohio.gov/portals/35/tmdl/2012IntReport/IR12SectionBfinal.pdf**

"The State of the Aquatic Ecosystem: Ohio Rivers & Streams," Ohio EPA (1998), accessed September 2015, **epa.ohio.gov/portals/35/documents/fs8mas98.pdf**.

"Hypoxia," Ecological Society of America (2012), accessed September 2015, **esa.org/esa/wp-content/uploads/2012/12/hypoxia.pdf**.

"Rain Drops and Bombs: The Erosion Process," Oklahoma Cooperative Extension Service (2014), accessed September 2015, **pods.dasnr.okstate.edu/docushare/dsweb/Get/Document-2217/F-2252web.pdf**.

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