

The Fibonacci Sequence

By Kevin Riley, Five Rivers MetroParks

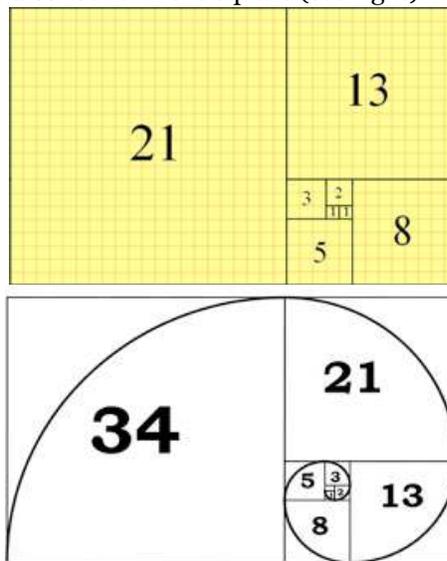
The sublime beauty of nature is derived from a very simple, yet elegant, series of numbers. This series is known as the Fibonacci Sequence, named in honor of Leonardo Fibonacci who was an Italian mathematician during the Middle Ages. He was also instrumental in bringing the Arabic numeral system to Europe. The first fifteen numbers are: 0, 1, 1, 2, 3, 5, 8, 13, 21, 34, 55, 89, 144, 233, and 377. Subsequent numbers are formed by adding the previous two integers. In addition to the sequence, there are also the ratio, the square, and the spiral.

The ratio is calculated by dividing two adjacent numbers. Using the numbers from above, examples are: $55/89$, $89/144$, $144/233$, and $233/377$. In each case, the ratio is approximately .62. This ratio is known as the Golden Mean (GM). In nature, the GM can be found in the ratio of various bones in the human body. It is also used in arranging leaves on a stem. Art, photography, and architecture use the GM in design because it is very pleasing to the human eye. A similar sequence is found in the pattern of a five-pointed star that Venus and Earth trace during their path around the sun. Segments of this trace also contain the GM.

The mathematics of the Fibonacci Sequence is also found in the square (see right) formed by placing individual squares adjacent to one another with the same ratios. The dimensions are equal to the numbers within the pattern of the sequence

The spiral is then derived from the square by drawing a curved line which joins the corners of the individual squares. This graceful spiral is found in Nature's patterns and engineering – from the swirl of the seed head of a sunflower or a pinecone, to the geometric curve of a seashell or the human ear.

The Fibonacci Sequence illustrates in mathematical terms the interconnectivity of various elements within Nature. It is also a manifestation of the truly marvelous simplicity and elegance found throughout the universe.



Save the Date

Find out more at
www.eeco-online.org

OEEF Grant

Letter of Intent due Jan 9, 2017
Grant Due Jan 17, 2017, by 5 pm
<http://epa.ohio.gov/oe/EnvironmentalEducation.aspx>

Future City Competition

January 14, 2017 Columbus State Community College, Columbus Ohio
<http://futurecity.org/ohio>

Winter Snow Conference

Feb 3-4, 2017 at Camp Nuhop, Perrysville, Ohio
<https://eeco.wildapricot.org/>

Project Learning Tree Workshop

Feb 12, 2107 Cox Arboretum, Dayton, Ohio
<http://forestry.ohiodnr.gov/plt>

Growing Up Wild Workshops

Feb 25, Butler County
March 15, Cuyahoga County
<http://wildlife.ohiodnr.gov/>

50th Annual EECO Conference

April 6-9, 2017, Deer Creek State Park
<https://eeco.wildapricot.org/>

1st Annual Ohio Student Wildlife Research Symposium

April 6, Deer Creek State Park (at the EECO conference)

Changing Places: Remembering Mary Sheridan

By Carolyn Watkins, Ohio EPA



Mary Sheridan was the teacher whose class you couldn't wait to get to. An art teacher with Pickerington Local Schools and past EECO board member, she was the creative spark behind four different Outstanding Project Awards from the Ohio Environmental Education Fund. Two of her grant projects were called "Changing Places," which is a wonderful way to sum up her life's work.

She used an Ohio Arts Council Artist in Residence grant to bring writer Ron Hirschi to see what could be learned from a fragment of wetland on the bare grounds of a new school, Tussing Elementary. Mary brought ideas to the OEEF that were way outside our science comfort zone. Soon we met the Mighty Big Belcher, a giant frog puppet who drank up all the water in the wetland. The students created masks and costumes of all the other

critters, birds and fish who come to protest the loss of their wetland home. (Spoiler alert: after some persuasion, the Mighty Big Belcher belched up all the water to restore the wetland.) The students also created mosaic tiles of wetland scenes that were installed at Pickerington Ponds MetroPark.

Mary kept challenging us at Ohio EPA to think beyond the box: in those days we usually received grantee reports in three-ring binders. Mary's report came in a repurposed pizza box painted bright green and black to match the Mighty Big Belcher. It is instantly recognizable in the grant archives, and hops off the shelf a lot as we share the contents with prospective grant applicants.



More puppets followed, along with many community volunteers who helped create a new wetland next to the school classrooms. "Somebody" then decided to make a movie about how a trash monster evolves from a single piece of litter to eventually take over the school, and how people change places and places change people. The next Artist in Residence was filmmaker Steve Bognar, who had second graders writing scripts, fifth graders behind the camera, and teachers doing Claymation. We started using Mary's example in our grant writing workshops of how to leverage one grant to bring in another. Mary told us about the many different languages spoken by students at the school. The Changing Places theme evolved as a deliberate effort to give the students a sense of place and an understanding of the history of the land where the school is located. Several other student-produced films include Picture Day and a wonderful student fantasy about what teachers do at school at the end of the day after all the students leave. The films were shown at the Pickerington metroplex, breaking local attendance records, and some went on to film festivals in places like Nova Scotia and Sundance. Yes, THAT Sundance.



The third Outstanding Project award came for Changing Places Phase II: Interweaving Sound Connections. Mary's students asked Dr. Jan Straley's humpback whale listening station in Alaska to send them sound recordings of humpbacks. The students reciprocated, sending Dr. Straley their own recordings of frogs and water songs from the school's wetland. Then "Somebody" got the idea of calling the humpbacks to Ohio. Mary wrote another grant to another funder, and metal artist Linda

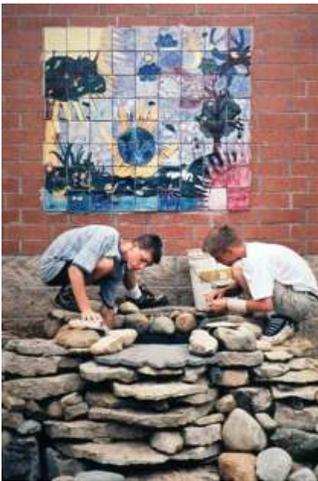


Anspaugh got to work designing a giant whale's tail. With another OEEF grant, mural painter Amy Yaich helped the students decorate the school walls and corridors with murals of postcards showing the whale's journey down the California and Baja coasts, through the Panama Canal, up the Mississippi, Ohio and Scioto Rivers, where it leaped a few waterfalls and eventually made a big leap





into the school's playground. Fabric artists Susan Shie and James Acord of Green Quilts helped the students weave A Rainbow Reunion, and Quiltmaker Kate Gorman helped the students piece together free standing mosaic quilts of the wetland and the whale's journey for the school library. Dancer Margot Greenlee and Musician Hal Walker helped the students prepare a performance for the whale's arrival.



Steve Bognar remembers how Mary could talk school administrators into almost any new idea with a "Couldn't we...." attitude. While she was changing people and places, she certainly changed how we now understand the enormous power of the arts in environmental education.

Dirt and Worms

Mary Sheridan,
From Tussing Elementary's Changing Places
Cookbook and EECO's Exploring Excellent
Culinary Opportunities Cookbook

- 1 lb. Oreo cookies
- 8 oz. cream cheese, softened
- 1/4 C. margarine, softened
- 1/4 C. powdered sugar
- 12 oz. Cool Whip topping
- 3 C. milk
- 2 pkg. instant pudding, any flavors
- Gummi worms

Fill ziplock bag with cookies. Use rolling pin to crush the cookies into crumbs. Repeat until all cookies are crushed. Combine cream cheese, margarine and sugar in a mixing bowl. Beat with the mixer on medium until fluffy. Add Cool Whip and beat on low until smooth. In a second bowl, combine milk and instant puddings, and mix until slightly thick. Add this mixture to the cream cheese mixture and blend until smooth. Pick either a large, deep bowl or a clean new flower pot about 2-3 quart size. Pour about a third of cookie crumbs in the bottom of container. Spoon in half the pudding mixture. Add another third of cookie crumbs, then rest of the pudding mixture. Sprinkle remaining cookie crumbs on top. Cover and refrigerate several hours or overnight. Then decorate with gummi worms and fake flowers. This can also be made into individual cups or smaller flower pots for snacks at kids' parties.

Winter Snow Conference Creative Ways to Teach STEM!

February 3 & 4, 2017

Camp Nuhop

1077 Hanover Twp. Rd. 2916, Perrysville, OH 44864

Registration Information is online www.eeco-online.org

Conference Fees:

- Full conference (Friday-Saturday, 3 meals, snacks, and lodging) : Member \$110 and Non-member \$135
- Saturday Only (3 meals no lodging): Member \$75 and Non-member \$100
- Student Full Conf.: \$85 ; Sat Only \$65
- Saturday Night Lodging: \$25

Topics are diverse and may or may not relate to winter, but should relate to one of the following:

- STEM
- Arts
- Environmental Literacy
- 21st Century Skills
- Careers and the Environment



Online Math Resources

“Chesapeake Exploration” from NOAA (Grades 6-12)

Lessons designed around real-time observational data from the Chesapeake Bay Interpretive Buoy System.

<http://buoybay.noaa.gov/investigations/data-classroom>

“Cookie Mining – Rebaked” from Women in Mining Education Foundation (Grades 3-8)

Students extract chocolate chips from cookies to simulate the process of removing a metal from ore, and calculate costs and profitability based on mining techniques, environmental considerations and reclamation requirements.

www.womeninmining.org/activities/

“Dendrochronology” from the National Park Service

This simulation allows students to calculate how old a tree is from a core sample, and match other wood grain samples against the core to date the object. This activity pairs well with reading “Good Oak” from the Leopold Education Project/A Sand County Almanac.

<https://www.nps.gov/webrangers/activities/dendrochronology/>

“How Big Is A Tree?” and other activities from the U.S. Forest Service (Grades K-4)

Students measure the height and circumference of trees and create a database to upgrade each year.

www.na.fs.fed.us/spfo/pubs/uf/lab_exercises/table.htm

“Virtual Boat for Environmental Education (VBEE) Game” for Youtube and iPad from Ohio University (Middle and High School)

Students can use the Data Sonde to pull real sampling data from the Ohio River between Marietta and Gallipolis.

<http://vital.cs.ohio.edu/?p=3346> and https://www.youtube.com/watch?v=TUmlz_OFOIA

50th Annual EECO Conference Honoring Our Past, Looking to the FUTURE

April 6-9, 2017

Deer Creek State Park Lodge

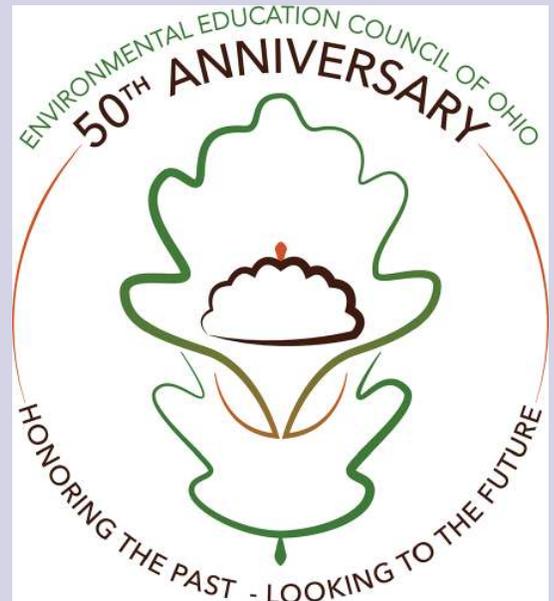
The Environmental Education Council of Ohio is seeking proposals for presentations for the 2017 EECO Annual Conference to be held at Deer Creek State Lodge and Conference Center, April 6-9, 2017. The theme for the conference is “Honoring our past, looking to the FUTURE.”

Deer Creek Room Rates: for Queen, King and Bunk \$111.00 per Night Per Room; A Loft is \$229.00 per Night Per Room; A Cabin Rate is \$159.00 per Night per Cabin. And a Conference Special for EECO attendees \$79.00 Room Rate for all Room Types on Sunday Night. Contact Deer Creek State Park Lodge and Conference Center to make your room reservations **before February 17, 2017**, this is the date when the lodge will release the rooms we have held. When you call make sure you mention “EECO” to get the conference room rate. You can call now at 1.800.AT.A.PARK (282.7275) or 740-869-2020 to make your reservation.



Registration: Check the EECO website <https://eeco.wildapricot.org/> for Registration information as well as information for nominating a friend or colleague for an EECO Award; having an exhibit or display, sponsoring the conference and more!

The Keynote Speaker for the EECO 50th Anniversary Conference is Judy Braus, the Executive Director for the North American Association for Environmental Education. Judy will be speaking at the conference on Saturday, April 8th.



Ohio Environmental Education Fund



The OEEF grant program is administered by Ohio EPA and awards general grants up to \$50,000 and mini grants between \$500 and \$5,000, with application deadlines every January 15 and July 15. Grants are funded from civil penalties collected by Ohio EPA for violations of air and water pollution control laws. Eligible recipients include local governments, non-profit organizations, public and private schools.

Application information is available at <http://epa.ohio.gov/oeef/EnvironmentalEducation.aspx>.

Applicants are invited to contact the OEEF staff at oeef@epa.ohio.gov or 614-644-2873 to discuss project ideas.

Grant Writing Workshops

The Ohio EPA Office of Environmental Education offers grant writing workshops around the state throughout the year. If your organization would be interested in hosting a local workshop, please contact oeef@epa.ohio.gov.

- **Grant Writing 101: Finding the Right Funder** (format: half-day interactive workshop) Prospecting tips to help you identify foundations, corporations, and government grant programs, and how to approach different kinds of grantmakers.
- **Grant Writing 102: Writing a Winning Proposal** (format: half-day interactive workshop) How to avoid common mistakes applicants make, and develop realistic objectives, activities and budgets. OEEF will be referred to during this session.

New General Grant Awards, Fall 2016

In the Fall 2016 application cycle, Ohio EPA awarded the following seven new general grants, for a total of \$ 247,874.

Boardman Local School - Boardman Glenwood Junior High School, "School Cafeteria Waste Reduction Stems Community Compost Education," \$16,053

Audience: Pre-School-University (Grades 7-8), Mahoning County

Contact: Laura Kibby, laura.kibby@boardmanschools.org, (330) 726-3414

Approximately 700 junior high students will reduce their waste cafeteria waste by as much as 35%. Students will sort their waste during lunch and compostable waste will be placed in an EarthTub composting system. Teachers will also use the compost generated in science classes and connect composting to issues facing the local park's lakes. A compost day will educate school staff and members of the community about the project and benefits of using compost. Bags of compost will be donated to community members, including parents, teachers, business owners, and urban/community gardens.

Columbus Green Building Forum, "Green Energy and Sustainable Construction Technologies," \$46,332

Audience: Pre-School-University, Licking County

Contact: Meera Parthasarathy, meera@cgbf.org, (614) 805-9946

A curriculum for high school and adult education program students in green building and environmental technologies will be created in collaboration with Career and Technology Education Centers (C-TEC) of Licking County. The project will bring students face to face with green industry experts on specific areas of green building to educate them on technical issues relating to those specific areas. Students will receive hands on knowledge of green technologies through panel discussions featuring building industry professionals, workshops led by technical experts and field trips to see cutting edge projects and green construction practices. The knowledge from the green building experts will be developed into the curriculum and equip Ohio's Career Technical schools with job readiness tools to support green development.

Earth Day Coalition, "Reducing Greenhouse Gas Emissions through Alternative Fuels," \$42,779

Audience: Regulated Community, Ashtabula, Cuyahoga, Geauga, Lake, Lorain, Medina, Portage, and Summit Counties

Contact: Christina Yoka, cyoka@earthdaycoalition.org, (216) 281-6468

Three Fuel for Thought workshops will be held for vehicle operations personnel to convey the benefits and challenges of alternative fuel and advanced vehicle technology. Workshops will include a panel discussion of industry experts and a representative of the National Alternative Fuels Training Center to assist EDC staff in developing a Career Path Guidelines. After each workshop, Career Path Guidelines materials will be produced and presented at a workshop specifically designed for science teachers and career counselors. Visual communication materials that are consistent with the demand for electronic and social media outreach will also be produced. Overall, the project objectives will improve local air quality by assisting fleets convert to alternative fuel technology and engaging youth in career opportunities. Cuyahoga County Department of Public Works, the City of Cleveland Office of Sustainability, Cuyahoga Community College and the Northeast Ohio Areawide Coordinating Agency will collaborate on the project.

New General Grant Awards, Fall 2016 Continued

Lake Erie Nature & Science Center, “Bringing Local Relevance to Climate Literacy Principles,” \$25,000

Audience: Pre-School-University, Cuyahoga County

Contact: Darci Sanders, darci@lensc.org, (440) 471-8351

The project will expand on an existing Climate Expedition field trip program that has successfully served teachers and students at Stone Laboratory over three years. Stone lab materials will be adapted to create a Weather and Climate exhibit at Lake Erie Science and Nature Center, modeled after existing stations that are part of Ohio State University Stone Laboratory’s Climate Expedition Field Trip program. Approximately 1,800 students from Bay Village Schools will visit seven hands-on stations to explore the science behind and issues related to climate change. A second component of the project is the addition of supplemental lessons and various professional development opportunities to support K-8 Bay School teachers as they incorporate climate change education into standards-based classrooms. Local content and examples will be used, allowing students (and all Center visitors) to see relevance in their understanding of climate change, and to encourage environmentally responsible behaviors.

Oberlin College - Environmental Studies Program, “Pilot integration of Environmental Dashboard in Ohio: Teacher Training and Curriculum Development,” \$49,689

Audience: Pre-School-University, Cuyahoga, Lorain, Lucas, and Summit Counties

Contact: John Petersen, jpetersen@oberlin.edu, (440) 775-6692

The project will expand curricular integration of Environmental Dashboard technology in four school districts that have existing dashboard metering technology. Environmental Dashboard technology provides real-time feedback on water and energy use. Teachers and curriculum managers will participate in full day workshops providing them with an understanding of how the Environmental Dashboard has been used in the classroom. Teachers will develop lessons that use the Environmental Dashboard and implement them in their classrooms. The goal is to develop, deploy, assess and disseminate instructional modules that integrate environmental education into multiple subject areas while supporting topics and skill aligned with Ohio learning standards and Ohio EPA priorities.

Ohio University - Voinovich School of Leadership and Public Affairs, “Rain to River Education Program,” \$23,721

Audience: General Public, Statewide

Contact: Jen R Bowman, bowmanj2@ohio.edu, (740) 597-3101

The stormwater education program is designed to help people connect their actions to their local waterways. Storm drain stenciling will initially take place on 1,500 drains and 10,000 information doorknob hangtags will be distributed in those areas. An interpretive portable stormwater exhibit will also be created and displayed at the Athens and Nelsonville Public Libraries to increase awareness of how individual actions impact local and regional water quality. Water quality sampling will be conducted at the Athens Library stormwater outfall and other community events. Informational webinars for Soil and Water Conservation Districts will share the project information and strategy development. Athens County Public Library, Local Soil and Water Conservation Districts and Rural Action will collaborate on the project.

The Toledo Zoo, “The Toledo Zoo Urban Watershed Education Initiative,” \$44,300

Audience: General Public, Lucas County

Contact: Ryan Patrick Walsh, ryan.walsh@toledozoo.org, (419) 385-5721

The project aims to educate Toledo Area residents on water quality issues in the Lake Erie watershed while presenting actions individuals can take to make a difference in local and regional water quality. The Toledo Zoo and its partners seek to create 10 acres of demonstration rain gardens and engage area residents in cleaning urban waters. Monthly educational workshops will also be held during lunch on Monday’s for visitors to the zoo, when all Lucas County residents receive free admission to the zoo. Visitors will receive complimentary Clean Water Garden seed packets with the opportunity to register their own Clean Water Garden through the Wild Toledo website. Each community clean water garden will reach approximately 100 households and an estimated 1000-1500 people.

New Mini Grant Awards, Fall 2016

In the Fall 2016 application cycle, Ohio EPA awarded the following seven new mini grants, for a total of \$27,030.

Toledo Botanical Garden, “Water Pollution & Runoff Training,” \$1,282

Audience: Pre-School to University (grades 2-9), Lucas County

Contact: Hannah Halfhill, hannah.halfhill@toledogarden.org, 419-720-8714

Toledo Botanical Garden (TBG) will host a one day, six-hour training for 25 elementary school teachers from grades 2-9 that will provide hands-on lessons about pollution in waterways, and how to manage runoff in an urban environment. These lessons will utilize key aspects from Project WET as well as resources at TBG, and teachers will be given curriculum materials to take back to their classrooms in order to effectively teach water management and best practices for keeping the local watershed clean. A rain garden demonstration and a “take action” project are planned for each classroom.

Eastgate Regional Council of Governments, “You are Here – A Snapshot of the Yellow Creek Watershed,” \$5,000

Audience: Pre-School to University (grades 3-12), Mahoning County

Contact: Stephanie Dyer, sdyer@eastgatecog.org, 234-254-1520

Provides permanent, educational watershed signage at strategic locations within the Phase II urbanized areas of the Yellow Creek watershed, Mahoning County. Signs will provide target audiences with 1) a sense of understanding and place by identifying what a watershed is and where they are located within the Yellow Creek watershed, 2) a sense of responsibility in order to protect surface waters, especially the watershed’s surface drinking water lakes, from nonpoint sources of pollution and 3) simple solutions (“good housekeeping measures”) to help improve the watershed’s water quality and protect the surface drinking water sources. This project is an educational component of the 2015 state endorsed Yellow Creek Watershed Action Plan and targets the Phase II regulated communities of Poland Village and Poland township, as well as Mill Creek MetroParks. Project has the potential to reach over 1,966 students and 35,000 visitors to the municipal forest and Yellow Creek Park. A number of local jurisdictions, park and school districts are collaborating on this project.

Kamm’s Corners Development Corporation, “Kamm’s Corners Public Parking Lot Green Infrastructure Retrofit,” \$5,000

Audience: General Public, Cuyahoga County

Contact: Ben Cambell, ben.cambell@kammscorners.com, 216-252-6559

Kamm’s Corners Development Corporation (KCDC), a nonprofit dedicated to the betterment of the Kamm’s Corners neighborhood in urban Cleveland, will modify their existing neighborhood public parking lot located behind their popular “town center” with 2,700 square feet of bio-retention areas. These will be installed within existing low spots of the 1.26 acre lot. KCDC will perform long term maintenance/education during and after construction. KCDC will train local businesses & residents on the potential installation of similar cost-effective stormwater Best Management Practices on their properties, and how to benefit from the Northeast Ohio Regional Sewer District’s stormwater fee credit program. Project includes design, printing and installation of 2 interpretive signs, fact sheets, infiltration testing and “bioretention bags” containing plants/seeds and copies of residential raingarden guides, for distribution at the local farmers’ market.

Light on the Land Services, LLC, “Using Biochar to Recover Excess Nutrients in Dairy Wastewater,” \$5,000,

Audience: Regulated Community, Statewide

Contact: Scott Bagley, scott@llsathens.com, 740-818-4017

This project will introduce dairy farmers to the various ways biochar can be integrated into their farming operations in order to reduce the nutrient contents of effluents so they can be safely dispersed on local pastures and fields. We will develop case studies and a website that highlights how biochar works for manure management, as well as the ways it improves soil productivity and long-term carbon sequestration. We will engage dairy farmers through an exhibit at the Ohio Spring Dairy Expo. Our goal is to use resources developed during the project as a foundation for proposing talks and presentations at additional workshops, conferences, and expos (Ohio State Fair, Manure Science Review, and Farm Science Review, etc). We would also intend to build on this to provide educational content related the role biochar can play in other animal farming operations such as poultry houses and feed lots. Project could reach all of Ohio’s 2,500 plus dairy farmers.

Ohio Northern University – Chemistry and Biochemistry, “Blanchard River Report Card,” \$800

Audience: General Public, Allen, Hancock, Hardin and Putnam Counties

Contact: Christopher Spiese, c-spiese.1@onu.edu, 419-772-2365

Supports a one-day sampling event by ONU and Blanchard River Watershed Partnership volunteers, using EPA methods to test current levels of nitrogen and phosphorus. The results will be used to update a 2012 watershed Report Card, to see whether best management practices installed are having the desired effect. The new Report Card brochure will be distributed to at least 500 residents at county fairs and other events in the four counties (Hardin, Allen, Putnam, and Hancock), to help them understand that the Blanchard River faces many of the same issues as Lake Erie: high nutrient levels, reduced biodiversity, and excess sediment loads. The brochure will also be mailed to elected officials and policymakers.

Ohio University, Department of Geography, “Stormwater to Smartphone: Digital Rain Garden Monitoring for Stormwater Education,” \$4,948,

Audience: General Public, Athens County

Contact: Amy J. Lynch, lyncha@ohio.edu, 740-593-1100

This project will provide unique and valuable information on the impact of rain garden installations as stormwater management strategies. It uses the first low-cost digital sensors designed for rain garden monitoring to make real time water quality and quantity information available to the public on an associated website, along with information on its interpretation and importance and links to Project WET EE to facilitate classroom education. The project will include videos on stormwater, rain gardens, and the sensor design and installation process and an interpretive sign and posters that detail the function of the rain gardens and invite visitors to pull out their smartphones to access the monitoring website. Project has the potential to reach 180 daily rain garden visitors and over 24,000 local residents, students, developers, property owners and local government leaders.

Environmental Career Ambassador Initiative 2016 Update

In 2013 Ohio EPA and the Environmental Education Council of Ohio (EECO) joined forces with The Ohio State University School of Environment and Natural Resources to launch a statewide network of volunteer career ambassadors in environmental science and engineering.

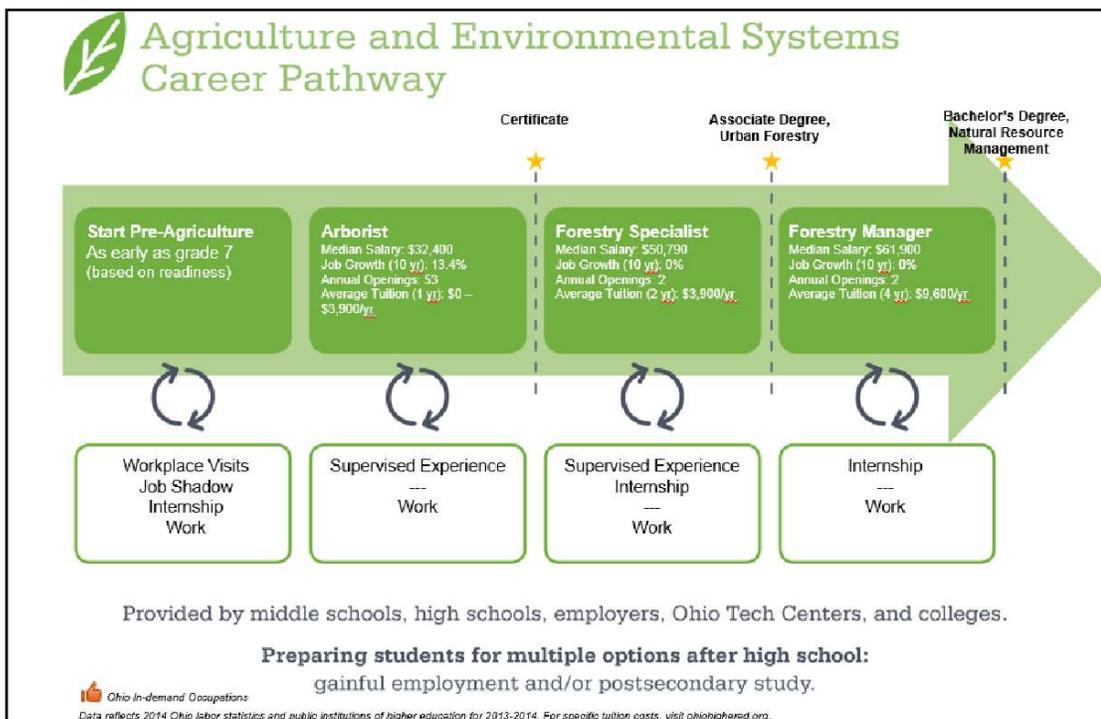
To date, 466 professionals in 72 Ohio counties have volunteered, indicating their willingness to:

- Make classroom presentations
- Participate in school Career Days
- Host field trips
- Offer internships
- Offer job shadowing opportunities
- Mentor young professionals, and
- Recruit additional career ambassadors



Careers roundtable for college students at the Water Management Association of Ohio annual conference

This year the volunteer career ambassadors spoke with more than 8,500 middle school, high school and college students at 32 career fairs and career exploration days. The partners also gave 55 classroom presentations about careers to another 1,376 students. Six high school and college students had the opportunity to shadow Ohio EPA employees to observe them at work.



In addition, the partners worked with the Ohio Department of Natural Resources Division of Forestry, Project Learning Tree and Ohio Department of Education to develop a new career pathway for arborists and urban foresters. This effort has received the “Ohio In-Demand Job” designation and been posted on the Ohio Department of Education and Ohio Means Jobs websites, to show students and parents potential salaries and high school and college coursework needed. This joins previously created pathways for environ-

mental scientists, geoenvironmental scientists, water plant operators/utilities directors, and petroleum engineers.

<http://education.ohio.gov/Topics/Career-Tech/Career-Connections/Career-Pathways>

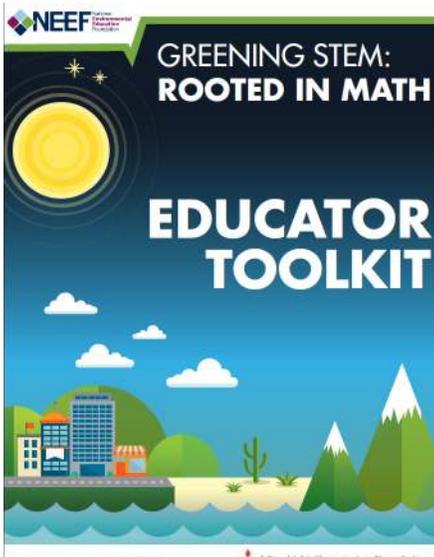
EECO’s regional directors work closely with teachers and environmental educators at the local level to offer workshops, share teaching resources, and match environmental career ambassadors with schools seeking speakers. Interested professionals can volunteer as career ambassadors through the Environmental Professionals Network <http://epn.osu.edu/>, or by contacting Brenda Metcalf, EECO Executive Director, at director@eeco-online.org.



Ohio EPA hazardous waste inspector Dan DiMeo discusses his career with students at Licking County’s combined career fair for all high school sophomores, at Denison University.



City of Dayton Water Department’s High School Water Career Conference.



Rooted in Math: Educator Toolkit

Math and environmental science units include National Weather Service formulas to calculate the strength of solar UN radiation, factoring in latitude, time of year, time of day, cloud cover, and elevation. Math and environmental engineering units show how NASA engineers calculate solar panel arrangements on satellites and spacecraft, based on distance from the sun, orientation toward the sun, the power needed for operation, the energy output of each solar cell, and the surface area available. Math and environmental technology units show how NOAA uses wireless technology and a network of buoys to collect real-time meteorological and oceanographic data, to track changes over time in water temperature, wind speed, air pressure, salinity, and water current. Math in nature units show mathematical concepts like a Fibonacci sequence in natural forms like the seed arrangement of a sunflower or the curve of a seashell. Quick calculations show gallons of water used by a shower head, and pounds of CO₂ emissions by common household electronics. www.neefusa.org/resource/rooted-math

What's Your Favorite Math Activity?

We asked a few environmental educators to identify some of their favorite math activities in curriculum guides that are in widespread use in Ohio. Here are their choices. Send us yours for upcoming issues of the newsletter! Email to director@eco-online.org

From Dennis Clement, Project WET State Coordinator, Office of Environmental Education, Ohio EPA:

“Macroinvertebrate Mayhem” in Project WET

With this activity, students simulate the effects of environmental stressors on macroinvertebrate populations. Totals are calculated from three rounds of doing this activity and graphs can be made to identify population increases/decreases and how the macroinvertebrates are good indicators of good or poor water quality.

“Blue Planet” in Project WET

Students estimate the percentage of the Earth's surface that is covered by water and land, by tossing an inflatable globe, take a simple probability sample to check their estimates.

From Carolyn Watkins, Office of Environmental Education, Ohio EPA:

“Setting the Standards” in Healthy Water, Healthy People (Grades 9-12)

Students simulate US EPA's risk assessment process to set MCLs, maximum contaminant levels for drinking water standards, using dose-response assessments based on the case of MTBE (methyl tertiary butyl ether) that EPA mandated as an additive to gasoline in 1992 to reduce carbon monoxide emissions. However, MTBE dissolves easily in water and was subsequently found to have migrated from leaking underground storage tanks to contaminate drinking water supplies. This activity pairs well with “Risk Assessment: Tools of the Trade” from Project Learning Tree's Exploring Environmental Issues: Focus on Risk secondary curriculum.

“Is the Hardpan Underfoot” and “Where Does Water Run?” from Project WILD's Science and Civics: Sustaining Wildlife (Grades 9-12)

Students measure and calculate the volume and weight of water falling on the school grounds, determine annual rainfall and runoff and effects of impervious surfaces. They calculate discharge rates from culverts based on velocity and volume of water. These activities pair really well with “Color Me a Watershed” and “Then and Now” in the same guide, to investigate the impacts of runoff and changing land use over time.

From Jen Dennison, Project WILD State Coordinator, ODNR-Division of Wildlife



“Bearly Growing” from Project WILD's K-12 guide (grades 5-8)

Students compare similarities and differences between the growth patterns of humans and bears. Students graph the weight of humans vs black bears at the same age to determine how quickly each species grows compared to the other. This activity can be enhanced by pairing it with Project WILD's K-12 activity “What Bear Goes Where?” where students compare the habitats of the three species of North American bears and why their body types are an advantage to them.



Continued on next page

Online Resources to Calculate Your Environmental Impact

Personal Greenhouse Gas Calculator, from the US EPA Global Warming Resource Center
http://epa.gov/climatechange/emissions/ind_calculator.html

US EPA 's **Green Vehicle Guide**
www.epa.gov/autoemissions

US Dept of Energy site, shows miles per gallon, fuel consumption, cost, greenhouse gas emissions in tons and EPA Air pollution score by vehicle.
www.fueleconomy.gov (click on compare Side-by-Side)

Local Governments for Sustainability software to help cities estimate GHG emissions
www.ICLEI.org

Canadian Government, ecoAction
www.ecoaction.gc.ca/index-eng.cfm

Earthday Network site calculates how many acres are needed per person based on lifestyle factors
www.earthday.org/footprint-calculator

The "**Ecological Footprint of Nations**" has a 15-question quiz used to calculate how much productive land and water you need to support what you use and what you throw away. Answers are metric, so this is a good activity for students to make the conversions.
www.ecologicalfootprint.org

The **Facing the Future** website has free downloads of lesson plans on global issues and sustainability. Three relevant to calculating environmental impacts are: "Watch Where You Step," "Now Hear This!" and "When the Chips are Down."
www.facingthefuture.org

The Global Footprint Network
www.footprintnetwork.org/en/index.php/GFN/

Greenhouse Gas Equivalencies Calculator from US EPA
www.epa.gov/energy/greenhouse-gas-equivalencies-calculator

Air emissions calculator
www.footprintnetwork.org/en/index.php/GFN/page/calculators/

"**What's My Carbon Footprint**" from the Nature Conservancy
www.nature.org/greenliving/carboncalculator/

Zero Footprint youth carbon calculator from National Environmental Education Week
www.eeweek.org/carbon_calculator

Favorite Math activity continued

"Net Gain, Net Effect" from Aquatic WILD (Middle School)

Students conduct a simulation to explore the evolution of fishing and the effects of changing technology on fish populations. Students use different mesh sizes and different prey sizes and calculate catch rates to determine the best fishing methods.

"First Impressions" the Growing Up WILD version (ages 3-7)

Students combine movement and math to show how they think and feel about animals. Students use facial expressions to determine how they feel about a particular animal and then graph the entire class's reaction to that animal.

From Linda Pettit, Environmental Education Specialist, Franklin Soil and Water Conservation District

"Storm Water" in Project WET (grades 3-8)

Students use household sponges to simulate how storm water runoff can be captured, stored and released. Sponges represent permeable surfaces (vegetated areas), sponges in plastic sandwich bags represent impermeable surfaces (paved areas). Students develop different land use scenarios with the sponges and baggies within aluminum pans, then measure and compare the run off from each scenario.



"Benthic Bugs and Bioassessment" in Healthy Water Healthy People (grades 6-12)

Students investigate the relative water quality of a stream by conducting a bioassessment of aquatic macroinvertebrates represented by ordinary household items. The students tally the numbers of each macroinvertebrate in their sample and from that calculate the water quality of their simulated stream.

From Gwen Roth, Education Specialist, Hamilton County Soil and Water Conservation District

"Grab a Gram" in Healthy Water Healthy People (grades 6-12)

Students use familiar materials to gain an introduction to basic water quality measurements like parts per million (ppm) and milligrams per liter (mg/L). Students compare these measurements to national drinking water standards to determine toxicity levels of a contaminant.

1st Annual Ohio Student Wildlife Research Symposium

at the EECO Annual Conference

April 6, 2017, 9 am - 4 pm

The 1st Annual Ohio Student Wildlife Research Symposium is a place for teachers and high school students to present their research in a professional and supportive environment. Presentations will be a mix of paper sessions, or a poster sessions. Paper sessions are half hour sessions in front of an audience. Poster sessions are in a group with other poster presenters.

Questions? Please contact Jen Dennison, Wildlife Education Coordinator, ODNR-Division of Wildlife. outdoor.education@dnr.state.oh.us or 1-800-WILDLIFE.

EECO January-March Meet-Ups

Unwind and build your professional network through EECO Meet-Ups! These events are where our members and future members can become more aware of Ohio's natural and educational resources, build skills, and make new friends! All meet-ups are unique, and are dependent on the program and host. For more info, feel free to contact the host directly.

Tuesday, January 24, Ohio Bat Working Group

Meeting at Department of Natural Resources

Meet-Up during Lunch

Learn more about EECO is, updates for the organization and upcoming conference to celebrate 50 years.

Host: Alli Shaw, shaw@metroparks.net, EECO Vice President

Thursday, January 19, 6-8 pm Teacher's Night Out: Schoolyard Birds (focus on birds & citizen science)

COX ARBORETUM METROPARK, Mead Westvaco Theatre, 6733 Springboro Pk.

Teachers will discover new ways to bring lesson plans to life through citizen science opportunities like the Great Backyard Bird Count, and encourage birds to make your school their home. Registration required. Register for free at:

www.metroparks.org/programs-events-finder/?program_number=S4&api=programs&type=program

Host: Joshua York, jyork@metroparks.org, EECO Board Member

Wednesday, February 8, 6:00-8:00 pm Teacher's Night Out: Starry Night (focus on astronomy)

COX ARBORETUM METROPARK, Mead Westvaco Theatre, 6733 Springboro Pk.

Let's explore the night sky together, and make connections to your curriculum! We will learn about the night sky with activities you can do with students, in your schoolyard or at a park! No matter what subject you teach, come out to discover ways you can use the night sky as a lens for student discovery! Weather Dependent. Registration Required. Register for free at:

www.metroparks.org/programs-events-finder/?program_number=T164&api=programs&type=program

Host: Joshua York, jyork@metroparks.org, EECO Board Member

Thursday, February 16th, Ohio Educational Technology Conference

Columbus Convention Center

Discover more about the conference at: <http://oetc.ohio.gov/>

Host: Brenda Metcalf, brendasmetcalf@aol.com, EECO Executive Director

February 27-28, Ohio Federation of Soil and Water Conservation District Meeting

Columbus Renaissance Hotel

Host: Denise Brooks, denisebrooks@lickingswcd.com, EECO Board Member & Past President

Thursday, March 2, 6:00-8:00 pm Teacher's Night Out: Busy Bees (focus on pollinators)

COX ARBORETUM METROPARK, Mead Westvaco Theatre, 6733 Springboro Pk.

Focus on bees, one of the most important pollinators! Teachers will discover new ways to bring pollination to life through citizen science opportunities, learn how to observe bees safely with students, and learn how to attract pollinators to their schoolyard garden, to make it easy to add pollinators to your curriculum, no matter what subject you teach! Weather Dependent. Registration required. Register for free at:

www.metroparks.org/programs-events-finder/?program_number=T165&api=programs&type=program

Host: Joshua York, jyork@metroparks.org, EECO Board Member

Tuesday, March 7th, 9:00a-3:30p Wildlife Diversity Conference sponsored by ODNR

Ohio State University Student Union

Join EECO members and interested individuals for a fun discussion about our upcoming 50th Annual Conference and other EECO updates

Host: Alli Shaw, shaw@metroparks.net, EECO Vice President

