

**NIE** Connect with your environment  
Learn about environmental issues, in your community and how you can get involved.



ANNA McCARTNEY/Contributed photo

Greg Andraso, right, travels with Bob Wellington aboard the Gannon Enviro-naut on Presque Isle Bay. Andraso will speak at the Regional Science Consortium's Visiting Scientist Speaker Series on Feb. 17.

## Hear about new major at Gannon

By ANNA McCARTNEY  
Contributing writer

The Lake Erie watershed is home to about 13 million people, supports one of the largest freshwater fisheries in the world, and provides many recreational and tourism opportunities. There are more fish harvested annually from Lake Erie than all of the other Great Lakes combined.

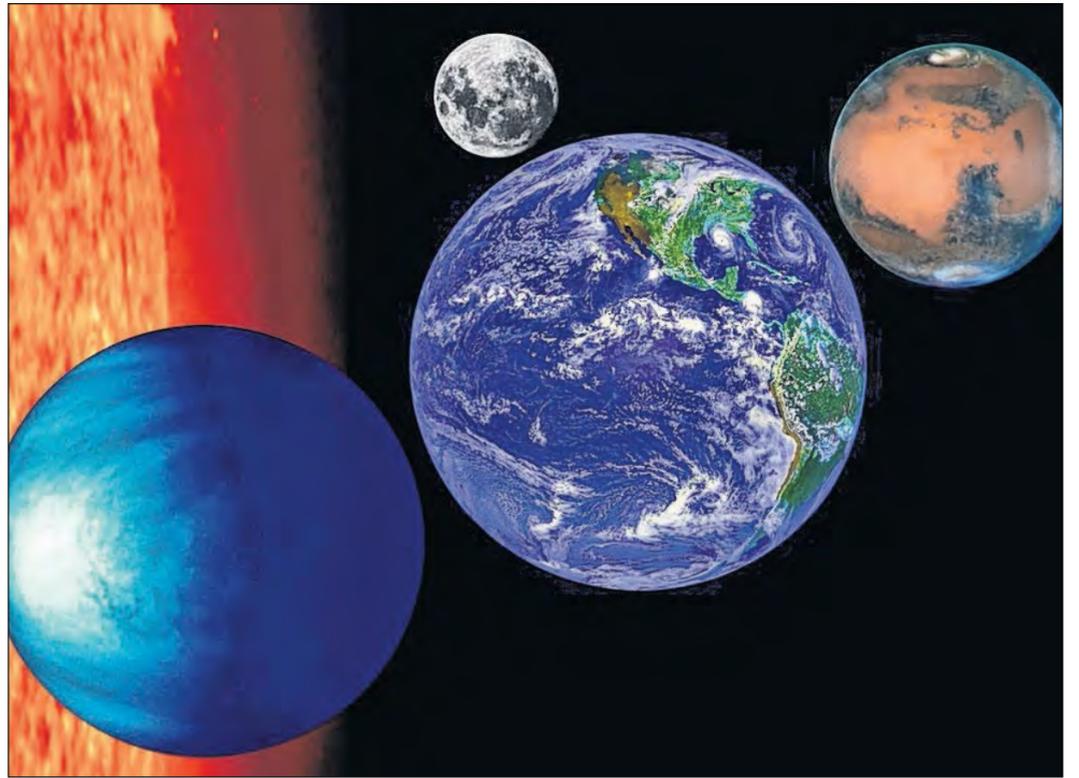
However, the Great Lakes, especially Lake Erie and Lake Ontario, face a number of stressors that threaten water quality, biological communities and recreational value. Invasive species, many of which have been introduced through ballast water discharge as a result of our increasingly globalized economy, have been identified as a major stressor of Lake Erie.

Recognizing the need to better understand invasive species and other stressors

in order to protect and remediate ecosystems of the Great Lakes and other waters, Gannon University has created a new academic major in freshwater and marine biology. You can learn more about this major and problems caused by invasive species at the Regional Science Consortium Visiting Scientist Speaker series on Feb. 17 at 7 p.m. at the Tom Ridge Environmental Center.

Greg Andraso, Ph.D., Gannon professor of biology, will provide an overview of the new major and of the work he and his colleagues and students have been conducting on aquatic invasive species. The event is free and open to the public. No registration is required.

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NASA

The differences between Earth and its nearest planetary neighbors, Venus and Mars, have been termed the "Goldilocks Principle" — Venus is too hot, Mars is too cold, but Earth is just right. Earth is rare in the solar system because its atmosphere can support life. The sun, far left, and its inner planets, Mercury, Venus, Earth and its moon and Mars, are shown here.

# No fairy tale

Science reveals big increase in greenhouse gases

By ANNA McCARTNEY  
Contributing writer

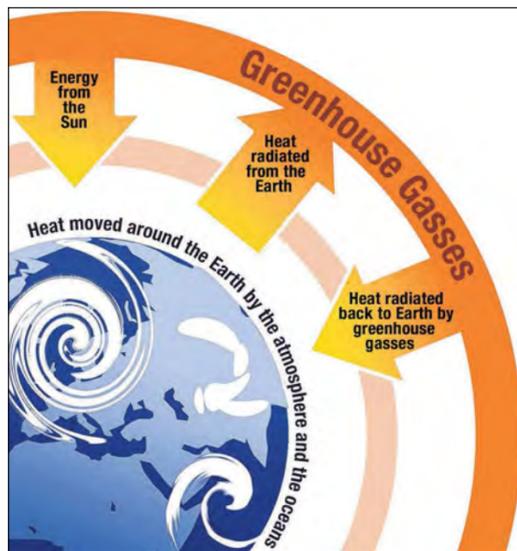
Faced with a choice of which planet to inhabit, Goldilocks would certainly pick the Earth over Venus, which is too hot, or Mars, which is too cold.

Like the story of "Goldilocks and the Three Bears," poor choices have consequences. So understanding how the Earth stays in balance can help keep Goldilocks and us from damaging its delicate systems.

Earth absorbs just the right amount of solar radiation because it orbits at just the right distance from the sun. It also has just the right kind of atmosphere, which includes an insulating blanket of just the right thickness. Its atmospheric gases trap sufficient solar energy to maintain a pleasant global average temperature of 15 degrees Celsius or 59 degrees Fahrenheit — just right for humans and other earthly life.

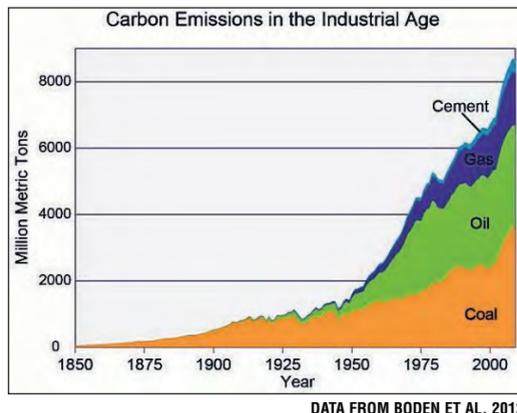
On Mars, this blanket is too thin, and on Venus it's way too thick, making these planets uninhabitable. Temperatures on Mars can drop from 21°C (70 °F) at midday to -78°C (-110 °F) the same night. Venus, with its rich carbon dioxide (CO<sub>2</sub>) atmosphere and thick clouds of sulfur dioxide (SO<sub>2</sub>), generates the strongest greenhouse effect in the solar system, causing surface temperatures to exceed 460 °C (860 °F).

Earth's normal CO<sub>2</sub> concentration is considered a trace gas. Its atmosphere is 99.8 percent nitrogen (N<sub>2</sub>) and oxygen (O<sub>2</sub>). The CO<sub>2</sub> and other trace gases, including water vapor (H<sub>2</sub>O), methane (CH<sub>4</sub>) and nitrous oxide (N<sub>2</sub>O), are called "greenhouse gases" because they trap heat in the atmosphere like the glass walls of a



CONTRIBUTED PHOTO

The Earth's atmosphere is composed of greenhouse gases of just the right types and in just the right amounts. Increasing these levels increases the heat retained, causing the Earth's atmosphere and surface to heat up.



DATA FROM BODEN ET AL. 2012

Global carbon emissions come from burning coal, oil and gas, and from producing cement. These emissions account for about 80 percent of the total emissions of carbon from human activities; land-use changes (cutting down forests) account for the other 20 percent in recent decades.

greenhouse. The energy from the sun is absorbed by land, oceans and vegetation during the day, and kept from radiating back into space and rapidly plunging the surface below zero at night.

Unfortunately, the

choices made by billions of people are increasing greenhouse gases. In just a century, we have created excessive amounts of CO<sub>2</sub> and other greenhouse gases by burning fossil fuels that were underground for millions of

years. These levels are scientifically measured and recorded by hundreds of stations across the globe, all reporting the same upward trend.

Since 2004, researchers in NOAA's Global Monitoring Division have released the Annual Greenhouse Gas Index to compare the total warming effect of heat-trapping gases to their 1990 levels. It shows the combined warming influence from greenhouse gases — including CO<sub>2</sub>, CH<sub>4</sub>, N<sub>2</sub>O, and chlorofluorocarbons — and reveals which ones contribute most to the index value each year. Combined global emissions of greenhouse gases increased their warming influence by about 34 percent from 1990 to 2013, with CO<sub>2</sub> by far the largest contributor in terms of both amount and rate of increase. It took 240 years, from around the beginning of the Industrial Revolution, for the index to increase by 100 percent, but only 24 years for it to increase by another 34 percent.

Because the system cannot absorb the increase naturally, we are seeing the consequences of these human-produced surplus greenhouse gases. Excess emissions lead to hotter conditions, more droughts and mass extinctions of coral reefs. The ocean is warming and becoming more acidic, and polar bears and many other species are in danger of extinction because they cannot adapt on such short time scales.

And this is not an appropriate ending for bears or for current or future Goldilocks readers.

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ANNA McCARTNEY/Contributed photo

Students, from left, Sedric Holt, Amber Carr and Zachary Oliver work on creating a comic strip.

## Students' comics have environmental theme

Perseus House School of Excellence students in Kathleen Ryan's science class are turning to comic strips for their stewardship project to educate their schoolmates, families and the public about water quality issues in their watershed.

Ryan is one of eight teachers participating in the Pennsylvania Sea Grant Great Lakes, Great Stewards project, which provides funding and support for field trips and stewardship activities through the Center for Great Lakes Literacy (CGLL), a partnership between the Great Lakes Sea Grant Network and the U.S. Environmental Protection Agency Great Lakes National Program office. For more information about CGLL, contact Marti Martz at [mam60@psu.edu](mailto:mam60@psu.edu) or 217-9011, extension 104.

Below are some student comments about their project:

We made comic strips to inform people about the dangers of the ingredients in care products used today so they can be more aware and be more careful in their choices.

— Zachary Oliver

We created comic strips to inform people about ingredients in some of the personal care products and the harm they cause to wildlife.

— Sedric Holt

The comics we made will be used to teach people about ingredients in our personal care products that can cause cancer and other sickness and that harm the environment.

— Amber Carr

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Check out these websites to learn more:

<http://climate.gov/>  
<http://climate.gov/teaching>  
[www.ncdc.noaa.gov/cag/](http://www.ncdc.noaa.gov/cag/)  
[www.paseagrant.org/](http://www.paseagrant.org/)

Start a collection of articles about climate change. Separate them into local, state and country. Do the articles provide facts or are they someone's opinion? Can you find scientific information that backs up the facts? It's important to make sure your source is knowledgeable and trustworthy.

