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Challenging assumptions

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Science teacher James Sutter and his AP environmental science students at Wellston High School take measurements and GPS coordinates in the school's land lab to determine where to set up birdhouses for tree swallows.

Science teacher Vames Sutter and students in his AP environmental science class at Wellston High School walk along a trail in the school's land lab

Challenging assumptions

IN WELLSTON, CLIMATE SCIENCE LESSONS OFFER A LEARNING OPPORTUNITY FOR EDUCATORS, STUDENTS AND THE COMMUNITY

On an unseasonably warm late November day, **James Sutter** and students in his AP environmental science class head outside to a section of formerly strip-mined land on which Wellston High School is located.

In this outdoor lab—a large expanse of forest, fields, strip-mine ponds, and scrub—they have conducted environmental studies of climate and weather, surface and groundwater, soil and biodiversity.

The students survey a field area, taking measurements and GPS coordinates to determine where to set up birdhouses for tree swallows. The class will set up at least 10 birdhouses, a few of which will include a false wall or roof in which they will install sensors to track the birds' development and other readings. Because tree swallows are migratory, Sutter explains, they are a good species to study.

"We don't always see all of the effects of climate change here that are occurring in other places," Sutter says. "Tree swallows migrate to southern Mexico and Central America, so anything that is happening in those places affects their population." he students' research is particularly relevant at a time when the impacts of climate change unprecedented heat waves, increasingly destructive hurricanes, epic drought, and the inundation of coastal cities—are increasingly evident.

According to the recent National Climate Assessment, considered the United States' most definitive statement on climate change science, global average temperatures have increased 1.8 degrees Fahrenheit over the past 115 years, leading to recordbreaking weather events and extreme temperatures. The Earth has set temperature highs for the past three years, the report says, and 16 of the last 17 years are the warmest on record for the planet.

The report says there is "no convincing alternative explanation" that anything other than humans—the cars we drive, the power plants we operate, and the forests we destroy—are to blame for the global warming trend.

As more educators seek to integrate climate science into the curriculum, many are grappling with a subject that has skeptics both inside and outside the classroom.

In the small, southeastern Ohio city of Wellston, where coal mining has been a way of life for generations, teaching and learning about issues like climate change has added challenges.



Sutter pours hot water into a canning jar in which geology students have added sugar, food coloring and flavoring. Over the course of a few weeks, the super saturated solution will form crystals that students will measure and study. In preparation for creating a grid for tree swallow birdhouses, Sutter and his students review an aerial photo of the school's land lab.

"Around here, one of the challenges we have is that coal is what we have relied on," says Jamiee Bixler, a junior in Sutter's class. "Coal is in our blood. People want to stick with coal, they don't think about finding another thing to replace it."

Both teacher and students acknowledge the contrast in which a former Wellston Coal Festival queen and several festival court attendants are now studying environmental science.

But most notably, Sutter's classroom offers an example of how understanding and valuing differences, and adjusting teaching methods as a result, has created a unique learning opportunity for students, educators and the Wellston community.

Sutter, who has a graduate-level certificate in environmental science from the University of Akron and worked as an environmental geologist assessing environmental risk for corporations, took an untraditional path to teaching. Both his private sector work, in which he encountered individuals who focused on short-term gain and limiting liability rather than concern for environmental or human health, and a series of personal events, led to his interest in becoming a teacher.

Sutter came to Wellston from the Woodrow Wilson program at Ohio University's Patton College of Education that recruits science professionals into teaching. The fellowship earned him a degree in science education in exchange for a three-year commitment to teach in a high-needs Ohio school district.

Sutter says his experience as a scientist has greatly influenced his teaching, both from his concern from an environmental human standpoint as well as working with data and 'proof.'

"How to you show something that sometimes people do not want to hear or see? How do you convey the importance of information?," Sutter says.

I try to give my students the tools to both observe the world around them and to critically evaluate their observations and then, combined with this. data collected by others. I want them to develop environmental, among other, values. I want them to value the environment, not only as a resource to be used, but also as one that has a great enough importance to be conserved, protected, and improved.

I start by working with very specific local issues. For instance, where I teach, there is a tremendous impact from former coal mining activities. The primary visible impact is Acid Mine Drainage (AMD) in the surface bodies of water—ponds, wetlands, and streams.



(Clockwise from top left) Angel Sharp helps take measurements to determine where to set up birdhouses. Sutter and his students discuss what they learned at a recent climate workshop. Derek Brown prepares a solution of sugar and hot water as part of a geology lesson on crystal formation. Justin Anderson speaks about global warming during his environmental science class.

"More data, more available information, and greater involvement are all part of it, but developing values on environmental issues is just as important."

Soon after he began teaching in Wellston, Sutter realized that he needed to relate to his students' experiences in his science lessons.

He began with a field trip to a wooded area and stream near the school, to show students how climate change was affecting their immediate environment, whether it was the prevalence of emerald ash borers, heavy rainfall, flooding, or vivid orange water samples, that, according to pH tests, were as acidic as vinegar.

Sutter believes the best way to teach environmental issues is to involve students in authentic projects that do not have known outcomes. "Students need to be involved with the scientific process to truly appreciate it," Sutter says.

One of the AP environmental science class's yearlong projects is the study of Acid Mine Drainage (AMD), the primary impact of former coal mining activities, in ponds, wetlands, and streams.

Students are assigned certain areas near water sources in Wellston in which to collect surface water samples that they then analyze. The information is shared with the Voinovich School at Ohio University that maintains a database on the Raccoon Creek watershed.

The students are able to see the impacts of AMD levels as a result of a chemical reaction with exposed pyrite and water and other associated dissolved heavy metals, most notable in the dearth of wildlife in and around the water.

"In our class, we talk about the information, but we also see what is happening outside," says Wellston junior Angel Sharp. "Anybody can say it, but that doesn't make it real sometimes. When you show someone, and it's consistent, they're more likely to believe it."

Another student mentions a creek near his home. "Sometimes, there would be orange residue floating on top of the water," he says. "Now everything is gone—there is no life. I didn't realize until I was in this class that these things are the result of Acid Mine Drainage."

Sutter is a strong proponent of 'in my backyard' projects in teaching.

"We often use these fantastic examples, such as the Aral Sea in Uzbekistan (part of the former USSR), but these are nowhere near us, and do not reflect the problems that the students are likely to see," Sutter says.

"I have these students for about 40 minutes a day, but they are outside for many more hours every week." Sutter says that because they are seeing the things talked about over and over, it reinforces their understanding much more than he can in the classroom.

Student Dalton Teasley says Sutter teaches in examples that help to relate the science concepts we're studying to daily life. "Taking a class like this, and learning the things I have learned both last year and this year, opens your eyes to so many things and makes you think about so many more things you can do," Teasley says.

Another long-term project for the Sutter and his students involves the renovation of the former coal strip mine site for a nature and educational trail for school and community use. Last year, the class conducted a feasibility study on repurposing the land. The goal of the project is to make the land usable to a wider group and to inform the public about environmental issues in the area.

"A lot of people just don't think it's their problem or that it's expensive or takes too much effort; but, in reality, everyone has to do something to be able to make any kind of change," says student Melena Nutt. "Something like composting food waste instead of throwing it in the trash helps the environment. Over time, the little things add up and make a difference."

When his biology, environmental science and geology classes discuss issues that aren't immediately in their backyard, Sutter finds ways to make direct connections.

"Our tree swallows that will migrate and return here are one example," says Sutter. "I also like to have someone from the areas we are learning about present information. It makes more of an impact coming from them than from me."

Bringing in professional scientists and graduate students is important to Sutter's teaching. When you present and discuss enough data and, more importantly, allow students to collect and interpret enough of their own, they are able to come to their own informed conclusions about what is happening in the world around us.

> JAMES SUTTER, SCIENCE TEACHER WELLSTON HIGH SCHOOL

The classroom guests have helped to catch and band birds, set traps for aquatic life, and discuss issues like local roads and their impact on wildlife habitat.

"I want my students to see what scientific studies are being conducted, meet the people doing the work, and hear about how they started on the path to where they are now," Sutter says.

If the guests have published scientific papers, students read them beforehand so that when the author visits, students are prepared for a question and answer session.

Last year, a graduate student from Ohio University helped Sutter's biology students in their investigation of the local fish population by introducing them to electro-shocking. After fish had been mildly stunned, students used nets to scoop them up to identify them

While learning scientific sampling techniques, the class discovered a species of non-native fish—the Western Mosquito fish—in the strip-mine ponds that had never before been documented in the area. The class reported the finding to the U.S. Geological Service that tracks such sightings. This fall, environmental science students attended a climate workshop sponsored by Rural Action and the U.S. Environmental Protection Agency that included speakers from around the globe.

"The speakers really put into perspective the global impact of climate change and the effect it has on life," says student Justin Anderson. "I talked with a person from Bangladesh who told me about Bengal Bay where the changing water levels are displacing people, and even affecting the immunity of the population by increasing the spread of disease."

Later this year, one of Sutter's friends who is working on a ship on the Ross Sea in Antarctica will participate in a video lesson with the class.

By learning new information and considering the impact of climate change for their generation, many of the students have become champions for the environment and sharing their knowledge with others.

"Many people don't believe in climate change, or they are ignorant of the facts, or don't want to be at fault," says Anderson. "Although many of our parents are beginning to see the repercussions, but they won't have to deal with it the same way that our generation will. We need to fix it. We can put into place policies and funding towards renewable energy sources like solar energy to slow down the burning of coals and fossil fuels that are ruining the environment." OS