

# NSF GK-12: Environmental Science to Promote Sustainable Urban, Rural, and Indigenous Communities



State University of New York  
College of Environmental Science and Forestry



# Enriching K-12 Education through *ESF in the High School*



## **Integrating Scientific Research Into the High School Classroom**

The world of the 21<sup>st</sup> century is at a major crossroads. Never in the six billion years of earth's history has one organism dominated the landscape so completely. The human species now directly utilizes over 25-40% of the net primary production of the earth's biosphere (Vitousek et al. 1986). Humankind is confronted by a variety of seemingly unsolvable environmental dilemmas such as overpopulation, the depletion of natural resources including fossil fuels and soils, global climate change, and the loss of biodiversity. What can institutions of higher learning do to prepare society to face these challenges?

Our project's focus is two-fold. First, through our graduate education program, we seek to produce environmental science leaders who will be able to meet the extraordinary environmental challenges of the 21st century. Our project offers transformational opportunities for graduate students to become environmental scientists who possess the skills required to meet society's immediate and future challenges. We enhance their effectiveness as environmental science communicators and as research scientists who can actively engage and make a positive difference in their own communities through *Service-Research*, a variant of the *Service-Learning* concept.

*"We have become the central organizing  
reality around which non-human life will evolve."*

— Cincotta and Engelman (2000)



Second, we seek to increase the environmental knowledge and science literacy of today's high school and middle school students to produce citizens who will be able to make informed decisions regarding the environment. *Environmental Science to Promote Sustainable Urban, Rural, and Indigenous Communities* builds upon and extends two of our well-established college/school partnerships (*ESF in the High School* and the *ESF Science Corps*). These programs deepen student knowledge of science and develop young citizens who will contribute to a healthy environment and sustainable future. Using the environmental science theme of *Sustainable Communities*, we engage traditionally underrepresented and financially disadvantaged youth from our urban, rural, and indigenous educational partners.



# Road Shows: Graduate Student Research in the Classroom

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“Road Shows” are a major component of the program that promote inquiry learning and hands-on experiences for the students in *The Global Environment* class. From January 2009 to December 2009 Fellows provided 64 road shows in 18 schools.

These traveling lessons are often based on topics having roots in the graduate Fellows’ research area of expertise. Topics that Fellows present include stream bio-assessment, energy of flight, nitrogen cycling, human population growth, lifeboat philosophy and food miles.



How can we help to develop participatory citizens who understand the complex scientific and social issues behind the headlines, make informed decisions, and meet these environmental challenges?

*“I enjoy collaborating with my Fellow, and the students are learning much from him. It has been an asset to my teaching and the benefits are enormous for my students.”*

— Lisa Lowenberg  
Chittenango High School

*“The Fellows bring the latest and greatest ideas and techniques in the field. The fact that they are fresh in the field adds quality to their visits. They have great and ideas and captivating experiences.”*

— Dean Cirilla,  
Clyde-Savannah High School



*“Having a Fellow has expanded my scientific literacy and, consequently, that of my students. These very accomplished individuals serve as tangible role models, and they exhibit a high degree of competence, openness and willingness to go far beyond what is required.”*

— Myriam Ibarra  
Nottingham High School

# Keith Bowman

*Degree Program:* Ph.D. Ecology

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Keith is studying the bryophyte (moss) communities of northern white-cedar swamps in Central New York. Specifically he is interested in how the bryophyte communities are affected by their distance from agricultural edges. His work includes floristic and ecological sampling and also examines how the propagule bank and the propagule rain relate to the observed bryophyte community structure.

Keith views teaching as a dynamic and iterative process. In the high school classroom he uses those techniques that he and others have found to be successful, but he is constantly looking for and trying new techniques. It is Keith's goal that the students will learn to ask good questions, pursue answers, and follow through with appropriate responses in all aspects of their lives.

## **Road Shows**

Design-a-farm: The Impact of Agriculture on the Environment

Moss Water Relations:  
An Introduction to Biodiversity and Hypothesis Testing

## **Student Projects**

Evaluation of Laptops for Ecological Impacts

Virtual Water and Human Diets



# Shannon Buckley



*Degree Program:* Ph.D. Ecology

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Shannon's research is looking at levels of CO<sub>2</sub> within the city of Syracuse, focusing on two sampling sites in a residential and a commercial neighborhoods. She eventually plans to explore relationships with local urban forests and impacts on city planning and forest management recommendations.

Shannon uses her research as an example for the students to refer to when beginning their projects. She finds that students tend to respond better knowing that she is currently going through a similar process. What she finds most rewarding are the moments when you see the students become excited about a topic.

## **Road Shows**

The Air you Breathe: Understanding Air Quality Locally and Nationally

Climate Change: Past, Present and Future

## **Student Projects**

Assessing Soda Machine Energy Use at Fowler High School

Tons Served, Billions Wasted: Potential for Recycling at McDonalds



# Emily Byrne

*Degree Program:* Masters Forest and Natural  
Resource Policy

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Emily's research focuses on the use of cap and trade as a policy tool in mitigating pollution. Specifically, Emily is focusing on the US market for SO<sub>2</sub> permits studying the life of a typical permit.

Emily incorporates her research into the classroom through the discussion of the role of policy tools and economics in the creation of environmental law. Students are given the opportunity to engage in simulated markets to learn how different policy tools can effect pollution emissions as well as think critically about future implications of environmental policy.

## **Road Shows**

To Carbon Tax or Cap and Trade,  
That is the Question

Putting a Price on Nature:  
Environmental Valuation

## **Student Projects**

The Footprint of Piano Production

Nutrient Content and  
Environmental Impacts of  
Silage Leachate



# Mitchell Graves

*Degree Program:* Masters Bioprocess Engineering

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Mitchell's research looks at the use of residual biomass from hemicellulosic ethanol production as a feedstock in the pellet fuel industry. He looks at using willow crops as a more sustainable feedstock option than forest harvests.

Mitchell uses his experience in the pharmaceutical industry, and his experiences studying abroad in China, to teach students about the importance of effective experimental design. It is his goal to use student research to create an environment in the classroom that fosters creativity and critical thinking.



## **Road Shows**

The Biofuel Debate

The Ins and Outs of China

## **Student Projects**

The Environmental Impact of Students Choosing to Drive to School Over Use of the Provided Bus Transportation

Exploring the Possibilities of Using Alternative Fuels in Today's Commercial Airlines

# Daniel Gurdak

*Degree Program:* Ph.D. Conservation  
Biology

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Daniel's research interests can be broadly categorized under conservation biology. These interests were fuelled by ecological fieldwork, laboratory research, and personal observations in urban and natural areas around the world. By providing necessary ecological data, his current research contributes to the conservation and management of *Arapaima*, a valuable food resource and one of the largest freshwater fishes in South America.

Daniel shares his interdisciplinary research experience in the classroom at various stages of the research process. He teaches about project planning and design by incorporating his own research into the learning environment and gives students the opportunity to think about the topic critically and create their own methodologies.



## **Road Shows**

Designing a Sampling Methodology  
for a Research Project

What Can Statistics Tell Us About  
the Class?

## **Student Projects**

Observing the Effects of Pesticides  
on Plant Growth

Effects of Different Water  
Temperature on the Growth of  
Guppies

# Catherine Landis



*Degree Program:* Ph.D. Ecology

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Catherine's research interests focus on biocultural restoration of degraded landscapes—how scientific studies can thrive in a cultural matrix where metaphor, story inspire and direct our relationship to place.

Her research has given her tools to take into the classroom, where she encourages students to “get curious,” ask their own questions, and find ways they can be answered. In this process students learn that science is not just about people in lab coats and goggles, but also about exploring the fabric of life, getting to know and care for our “neighbors” and ourselves.

## **Road Shows**

This is Your Watershed

The Birds Around Us

## **Student Projects**

Storm Water Management Plan for  
Corcoran High School

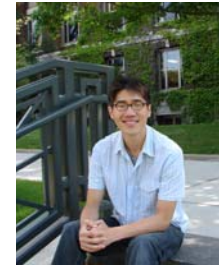
Spatial Patterns of Vertebrate Road  
Kill in Onondaga County



# Peter Song

*Degree Program:* Masters Water Resource  
Engineering

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Peter's research focuses on statistical prediction of low stream flow discharge based on watershed characteristics, particularly in ungauged sites. He studies the likely watershed conditions which contribute most to low stream flow discharge for NYS watersheds.

Peter brings his background as a fellow city school student along with experiences in NYC's drinking water supply to the classroom. He finds the importance in relating back to a student's background as a catalyst for environmental interest. His goals include empowering students to take a personal stake in issues and approaching the problems from a variety of viewpoints.

## **Road Shows**

Regression Analysis: Predicting  
Real Life?

Storm Water Management:  
A Collective Responsibility

## **Student Projects**

Spatial Distribution of Nitrification  
For the Black Locust

Effects of Elevated Night Soil  
Temperatures and Fertilizer on Lima  
Bean Growth



# Jessica Spiese



*Degree Program:* Ph.D. Chemistry

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Jessica's thesis research involves the study the structure and morphology of cellulose, the largest biopolymer produced on the planet, and its relationship with enzymatic digestion as well as lignocellulosic ethanol production. She hopes to better understand the underlying structural features of cellulose. Other interests include wood products, X-ray diffraction, microscopy, biodegradable polymers, energy, and public policy.

Jessica brings her chemistry background into the classroom to help students better understand environmental science and also performing a successful research project. She hopes to show her students the importance of scientific research and also to help them prepare for their college careers.

## **Road Shows**

Plastics vs. Biodegradable Plastics:  
A Student Investigation

Yearly Bedroom Power Consumption:  
An Introduction to Electricity

## **Student Projects**

Lifestyle changes and the Effect on  
Day to Day Life

Ecological Footprint of Lunch Trays  
at West Hill High School and Their  
Biodegradability



# David Taylor

*Degree Program:* Ph.D. Ecology

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David is interested in the habitat use and community ecology of amphibian populations. In the past, he has studied behavioral decisions that salamanders make in situations with high predation risks.

David uses his previous experiences of teaching at the college level to help science students understand what will be expected of them once they leave high school. David stresses collaboration and a strong experimental design in his classroom.

## **Road Shows**

Seasonal Cycles in  
Temperate Lakes

Detrital Food Webs in New York  
Forests

## **Student Projects**

Acid Snow in Solvay, New York

Effects of Road Salt Pollution on  
Native Plants



SUNY-ESF resides in a unique region where urban, rural, and indigenous communities are all located within a 10 mile radius of the campus. ESF is leading research that directly touches local students' lives such as land reclamation and restoration projects including urban "brown field" sites, as well as socially, historically, and culturally important sites such as Onondaga Lake and Creek. ESF is a leader in future energy sustainability and is the *SUNY Center for Sustainable and Renewable Energy*. Our theme of "*Sustainable Communities*" focuses our training of Fellows into environmental professionals who can affect real change in their own communities. Our project's innovation stems from both its *Sustainable Communities* theme and its goals in producing environmentally literate citizens and environmental change-agents.

Located in Syracuse, New York, ESF is one of only nine doctoral-granting institutions in the 64 campus State University of New York (SUNY) system. ESF is an urban campus with eight regional campuses and field stations distributed across 25,000 acres in Central and Northern New York, ranging from the Appalachian highlands and Great Lakes basin to the St. Lawrence River and the Adirondack mountains. As a result, ESF is one of the largest campuses in the U.S. dedicated to education, outreach, and research related to environmental science and natural resources.





**For more information on the NSF  
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