



Penn State to Lead Atlantic Slope Consortium with a \$6 Million Grant from the EPA

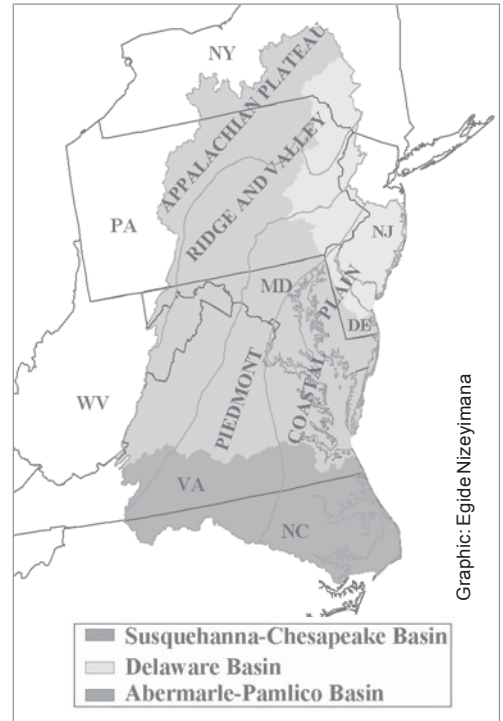
More than fifteen Penn State researchers will join colleagues from the Smithsonian Environmental Research Center, Virginia Institute of Marine Sciences, East Carolina University, Environmental Law Institute, and Ford, Thornton, and Associates, Ltd. (FTN) to conduct an integrated assessment of the watersheds and estuaries across the Atlantic Slope from the Appalachian Mountains to the coastal beaches of the Mid-Atlantic States. Natural scientists and social scientists will join forces with environmental managers from the region to develop, test, and apply a set of biological, chemical, physical, and socioeconomic indicators to measure the health of wetlands, streams, rivers, and estuaries in the region.

The Atlantic Slope Consortium, one of four programs funded nationally by the U.S. Environmental Protection Agency's Science to Achieve Results (STAR) Program, will garner \$6 million over four years to conduct the work. Dr. Robert P. Brooks, director of the Penn State Cooperative Wetlands Center will serve as Project Director for the Consortium. "We have assembled a talented team of

researchers to develop the indicators necessary to conduct this integrated assessment. We are excited about the opportunities to collaborate across so many disciplines and to apply these assessment tools across a very large geographic area," says Brooks.

Other researchers from the Environmental Resources Research Institute include Denice Wardrop, assistant director of the Cooperative Wetlands Center, James Shortle, professor of agricultural economics and rural sociology, Robert O'Connor, assistant professor of political science, and Egide Nizeyimana, ERRI senior research associate.

The population explosion along the coasts of the United States has put enormous pressure on estuarine ecosystems and their supporting watersheds. In order to develop the sound science required to monitor these important areas, STAR developed the Estuarine and Great Lakes (EaGLe) program to conduct assessments along the Great Lakes, East Coast, West Coast and Gulf Coast. Taking a unique ap-



Graphic: Egide Nizeyimana

Study areas to be assessed through the Atlantic Slope Consortium research project.

proach, the Consortium members will define an appropriate and relevant unit of assessment that is applicable to all aquatic ecosystems. An estuarine seg-

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International Ozone Bioindicator Research

Ozone occurs naturally in the Earth's upper atmosphere and provides a protective layer that shields the Earth from harmful ultraviolet rays. Concern over the "hole in the ozone layer" refers to the loss of ozone found in this layer. However, ozone is also present near the earth's surface and above certain concentrations this ground-level ozone is responsible for human respiratory ailments and damage to plants. Ground-level ozone is one of six principle pollutants that serve as indicators of air quality and is formed when nitric oxides and volatile organic compounds, originating primarily from gasoline

engines and the burning of other fossil fuels, react in the presence of sunlight. Ground-level ozone causes more damage to plants than all other air pollutants combined.

John Skelly, professor of plant pathology, is investigating native plant species from Switzerland, Spain, and the U.S. to identify plants that can be used as bioindicators of ozone injury. Bioindicators are plants that exhibit a well-defined and consistent foliar response to elevated ground-level ozone concentrations under natural conditions and can be used to obtain a biological measure of ozone air quality. "The U.S. has a fairly well established set of bioindicator

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Teodora Orendovici, graduate student in environmental pollution control from Romania, labels plants being grown for ozone fumigation studies. The Continuously Stirred Tank Reactor (CSTR) chamber system is shown in the background.

Photo: P. Craig

plant species and Switzerland and Spain are extremely interested in establishing a set of bioindicators based on plants native to their countries. Southern Switzerland and Spain typically have very high ozone exposures due to their Mediterranean climate. They frequently have exposures above 100 parts per billion (ppb) and exceedances up to 150 ppb – so the ozone levels get very high,” explains Skelly.

“The three projects have a common thread – to identify ozone injury on native plant species. We have a lot of growth and yield studies, a lot of crop studies, and forest effect studies, which have focused mainly on productivity, but simply identifying and documenting visible foliar injury on native plant species is the objective of these projects. As we identify more and more plant species showing injury from exposure to ambient ozone levels, the more important controls for ozone become,” says Skelly. Through these projects, Skelly’s research team will identify plants that Switzerland and Spain potentially can use as bioindicators of ozone injury and add to the list of bioindicators currently being used by the U.S. Forest Service Forest Health Monitoring (FHM) Program.

The most common visible foliar symptom exhibited by plants sensitive to ozone is stipple – small darkly-pigmented areas approximately 1 to 2 millimeters in size found between the veins on the upper surface of the leaf. “The external visible foliar injury serves as an indicator of the internal

physiological changes occurring in the plant after exposure to ozone. Ambient ozone exposures have been shown to reduce photosynthesis, decrease transpiration, and perturb carbon dynamics of sensitive plants. Ozone injury is dependent on several factors including duration and concentration of exposure, weather conditions, and plant genetics,” explains Marcus Schaub, research associate with the Swiss Federal Institute for Forest, Snow, and Landscape Research and former ERRI graduate student in ecology.

Skelly’s team is investigating native plants from each country that have exhibited ozone-like foliar symptoms to verify that the symptoms are caused by exposure to ozone and can be used as bioindicators. Plantlets and seeds provided by the FHM Program and those sent to Penn State by Switzerland and Spain, after being cleared by the USDA Plant Introduction Station, were grown in Penn State’s Air Pollution-Forest Effects Greenhouse located adjacent to the Forest Resources Laboratory. The plants are currently being exposed to four ozone exposure treatments:

30 ppb to represent normal background ozone in “clean” air; 60 ppb to represent the growing season 7–8 hour average ambient exposure under natural forest conditions; 90 ppb to represent the first level of higher ozone exposure to induce symptoms; and 120 ppb to represent the screening level to induce symptoms without general collapse of plant tissues. The ozone fumigations are being conducted in a Continuously Stirred Tank Reactor (CSTR) chamber system, which allows the researchers to control environmental conditions and ozone exposures. At the end of the fumigations, plant response will be evaluated to document the sensitivities of suspect ozone-sensitive plant species.

Skelly is collaborating with Norbert Kraeuchi, section leader for air quality studies, and Marcus Schaub, research associate, from the Swiss Federal Institute for Forest, Snow, and Landscape Research on the Swiss bioindicators project; with Maria-José Sanz, research scientist from the Centro de Estudios Ambientales del Mediterráneo (CEAM), on the Spanish bioindicators project; and with Gretchen Smith, ozone bioindicator lead for the National FHM Program, on the U.S. bioindicators project.

Graduate students involved with these projects include Kristopher Novak, graduate student in ecology, and Teodora Orendovici, graduate student in environmental pollution control from Romania. Jim Savage, ERRI research assistant, is involved with the culture of plants and Jon Ferdinand, ERRI research assistant, and Richard Stevenson, senior research assistant, are involved with instrumentation of the CSTR chamber system.

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Stipple occurs between the veins on the upper leaf surface of ozone-sensitive plants. Above: Ozone-sensitive milkweed with stipple on upper leaf surfaces – middle leaf shows underside of leaf with no stipple. Right: Ozone-sensitive Black cherry with stipple.

Photos: J. Skelly



Two Fulbright Scholars from Damascus University, Syria will be at Penn State for six months studying with **Jean-Marc Bollag**, professor of soil microbiology. **Ibtissam Hamad**, professor and head of biology, will be researching phytoremediation, and **Farouk Fares**, professor of soil science and head of soil sciences and land reclamation, will be investigating the impact of wastewater on the physical, chemical, and biological properties of soils.

Mary Ann Bruns, assistant professor of agronomy and soil microbiology, published the article "Isolate PM1 Populations Are Novel and Dominant Methyl Tert Butyl Ether-Degrading Bacteria in Compost Biofilter Enrichments" in the *Journal of Environmental Microbiology* (3:220-225). Bruns also was invited to present the paper "Fate of Fecal Bacteria Following Land Application of Municipal Sludge" at the NSF-funded US-Egypt Planning Workshop on Microbial Ecology held May 6-10 in Cairo, Egypt.

William Burgos, assistant professor of civil and environmental engineering, was an invited speaker at the Department of Energy Natural and Accelerated Bioremediation Research Program annual PI meeting held March 12-14 at Warrenton, Virginia and presented the paper "Reaction-Based Modeling of Quinone-Mediated Bacterial Iron (III) Reduction."

Fred Cannon, associate professor of civil and environmental engineering, coauthored the paper "Changes in GAC Pore Structure During Full-Scale Water Treatment in Cincinnati: A Comparison Between Virgin and Reactivated GAC." (*Carbon* 39:789-807). Cannon also presented the paper "Reactivated Versus Virgin Performance, Pore Structure, and Surface Charge" at the American Water Works Water Quality Control Conference held in Salt Lake City, Utah.

Andrew Cole, associate director of the Center for Watershed Stewardship and research associate in the Cooperative Wetlands Center, was appointed editor of the *Bulletin of the Society of Wetland Scientists*. Cole, **Robert Brooks**, director of the Cooperative Wetlands Center, and **Denice Wardrop**, assistant director of the Cooperative Wetlands Center, published the article "Assessing the Function in Created Wetlands: The Relationship Between Biomass

and Organic Matter" in *Ecological Engineering* (in press). Cole and Brooks also coauthored the paper "A Comparison of Created And Natural Wetlands in Pennsylvania, USA" published in *Wetlands Ecology and Management* (in press).

Christopher Duffy, associate professor of civil and environmental engineering, coauthored the paper "Dimension Reduction and Source Identification for Multispecies Groundwater Contamination," recently published in the *Journal of Contaminant Hydrology* (48:151-165). The article discusses how principal components analysis was used to develop a new strategy for assessing the correlation structure of groundwater contamination at an industrial site.

William Easterling, professor of geography and agronomy, was quoted in the April 9th issue of *Time Magazine* in an article concerning global warming ("Life in the Greenhouse," Vol. 157 No. 14). Easterling is one of the lead authors of the United Nations Intergovernmental Panel on Climate Change Report, "Climate Change 2001: Impacts, Adaptation, and Vulnerability," referenced in the article.

Bruce Logan, Kappe Professor of environmental engineering, received a patent for his design to treat perchlorate-contaminated water. His design uses a filter bed inoculated with perchlorate-respiring microorganisms that decontaminate the water by reducing perchlorate to chloride. Logan also was an invited speaker at two seminars. He presented "Fractal Coagulation Processes" at the Great Lakes Program Seminar held April 27th at the State University of New York and "Molecular-Scale Analysis of Interaction Forces Between Bacteria and Surfaces Measured Using Atomic Force Microscopy" at a Princeton University seminar held April 22nd.

James Lynch, professor of forest hydrology, received the Gamma Sigma Delta Agricultural Honor Society faculty research award and **William Sharpe**, professor of forest hydrology, received the faculty extension award. Sharpe also coauthored the paper "Forest Floor Plant Response to Lime and Fertilizer Before and After Partial Cutting of a Northern Red Oak Stand on an Extremely Acidic Soil in Pennsylvania, USA," published in *Forest Ecology and Management* (144:239-244).

Egide Nizeyimana, senior research associate, Gary Petersen, professor of soil and land resources, and scientists from NASA Goddard Space Flight Center, and USDA-NRCS National Soil Survey coauthored the paper, "Assessing the Impact of Land Conversion to Urban Uses on Soils with Different Productivity Levels in the USA." The paper was published in the May-April issue of the *Soil Science Society of America Journal* (65: 391-402) and was featured on the front cover.

Raymond Regan, professor of civil engineering, **Paul Tikalsky**, associate professor of civil and environmental engineering, **Robert Voigt**, professor of industrial engineering, and **Jamie Dunkleberger**, former graduate student, received the Environmental, Health, and Safety Division Best Paper Award at the American Foundrymen Society's 105th Casting Congress for the paper "Beneficially Using Foundry Residuals: Case Studies, Experiences, and Related Issues."

Paul Robillard, associate professor of agricultural and biological engineering, recently received the W. LaMarr Kopp Faculty International Achievement Award in recognition of his significant contribution to the advancement of the University's international mission. Through his work, Robillard has established linkages between Penn State and several universities as well as international conservation foundations, including the Polytechnic University and the University of San Francisco in Ecuador, Boston University, the Center for Tropical Agriculture in Columbia, the European-Latin American Research Institute in Chile, the International Conservation Data Center, the Agency for International Development, and the International Center for Water Engineering in Canada.

Ken Tamminga, associate professor of landscape architecture, is lead author of a chapter in the book *Ecology and Design: Frameworks for Learning*. Tamminga and his coauthors present a rationale for, and approaches to, heightened integration of ecological science in design and planning curricula. The book is being published by Island Press and will be available mid-summer.

ERRI Hosts Science Symposium

As a part of ERRI's outreach program, 120 high school students and 25 teachers, on campus for the Pennsylvania Junior Science and Humanities Symposium (JSHS), were given an opportunity to discover the many research projects and activities that ERRI is involved in. JSHS is a statewide event where high school students present their research projects to judges and compete for prizes. The winners of the Pennsylvania competition advance to the national competition, held this year in Florida, and then on to the international competition held in Britain.

The students and teachers were presented with information on various research projects and activities by ERRI affiliates. The event was coordinated by Patricia Craig and participants included: Tony Buda, Remegio Confesor, Lula Grebremichael, Angela Happel, Zach Henderson, Susan LeFevre,

Dave Lehning, Egide Nizeyimana, Tonya McGowan, Stephanie Odenwald, Mike Rubano, Eric Spielvogel, and Eric Warner.

In addition, the teachers were given a course on environmental teaching tools for use in the classroom. Instructors and topics included: Wayne Myers: GAP Project; Tracy Walrath: PASDA Education Initiative; Scott Dane: Spatial Data and GIS; and Paul Robillard: Citizen Water Quality Monitoring. Robillard also presented "The Global Crisis in Water Resources: Problems and



Graduate student Stephanie Odenwald explains her research project to JSHS students.

Photo: P. Craig

Solutions" for the keynote address of the symposium.

Research Exhibition Award Winners

Paula Rotenberg and **Stephanie Odenwald** won awards in the Physical Sciences category of the University's 16th Annual Graduate Exhibition. Rotenberg, graduate student in soil science and advised by Jon Chorover, won second place for the poster "Cesium and Strontium Binding by Hanford Sediments at High pH and High Ionic Strength." Stephanie Odenwald, graduate student in environmental pollution control and advised by William Sharpe, won third place for the poster "Effects of Watershed Acidification on Dendrochemistry and Growth of Selected Tree Species in West Virginia."

Two students placed at the College of Agricultural Sciences' Gamma Sigma Delta Undergraduate and Graduate Research Exhibition. **Isis Mullarky** won 5th place in the Biological Sciences division for the poster "Oxidant Stress Alters Vascular Homeostasis by Modifying Cytokine Production." Mullarky is a graduate student in pathobiology and is advised by Lorraine Sordillo. **Wendy Mahaney** won honorable mention in the Environmental and Natural Resources division for the poster "Impacts of Human-Mediated Disturbances on Wetland Plant Community Development." Mahaney is graduate student ecology and is advised by Robert Brooks and Denice Wardrop.

In addition, many ERRI graduate students won awards at the Fourth Environmental Chemistry Symposium. Awards for the Oral Presentation Session were as

follows: First Place – **Tonya McGowan**, Advisor: William Sharpe; Second Place – **Jonathan Dietz**, Advisor: Brian Dempsey; **David McNear**, Advisor: Jon Chorover; and **Sanjai Parikh**, Advisor: Jon Chorover; and Honorable Mention – **Byong-Hun Jeon**, Advisor: Brian Dempsey.

Awards for the Poster Session were as follows: Grand Prize – **Stephanie Odenwald**, Advisor: William Sharpe; First Place – **Angela Fisher**, Advisor: William Burgos; **Paula Rotenberg**, Advisor: Jon Chorover; and Honorable Mention – **Mi-Youn Ahn**, Advisor: Jean-Marc Bollag; **Keith Goynes**, Advisor: Jon Chorover; **Angela Happel**, Advisor: William Sharpe; **Tara Leas**, Advisor: John Vanden Huevel; **Amy Shober**, Advisor: Richard Stehouwer; **James Stone**, Advisor: William Burgos; **Mark Stryner**, Advisor: Jean-Marc Bollag; **Masami Tonegawa**, Advisor: Jean-Marc Bollag; and **Husen Zhang**, Advisor: Bruce Logan.

Strong ERRI Presence at Air Pollution Workshop

ERRI was well represented at the 33rd Air Pollution Workshop held April 9–12 in Riverside, CA. John Skelly, professor of plant pathology, along with other six researchers from the Forest Air Pollution Laboratory were presenters at the workshop. Skelly, Jon Ferdinand, ERRI research assistant, and Dan Yuska, graduate student in environmental pollution control, presented the paper, "Monitoring Ozone Concentrations in Forests of Central Pennsylvania: Relationship to Bioindicators." Ferdinand, Yuska, Caimiao Wei, Ph.D. candidate in plant pathology, Jim Savage, ERRI research assistant, Kristopher Novak, graduate student in forest science, and Teodora Oredovic, graduate student in environmental pollution control, presented posters.

In addition, Skelly chaired the Development of Passive Samplers session of the Air Pollution Workshop's Passive Sampler Symposium.

This publication is available in alternative media upon request.

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PASDA Update

PASDA Enhances Accessibility of Spatial Data

Pennsylvania Spatial Data Access (PASDA) is the official spatial data clearinghouse for the Commonwealth of Pennsylvania, providing free Internet access to approximately 180 gigabytes of geographic information systems (GIS) data and metadata. To facilitate the use of spatial data from its web site, PASDA has developed two interactive, online applications, each containing a selected number of datasets. The two applications, *Pennsylvania Atlas* and *Pennsylvania Watershed Explorer*, serve two primary purposes: (1) to enable users to view and use data online without downloading, and (2) to enable clipping and reprojecting of data on PASDA's web site before downloading. These applications allow users without the appropriate hardware and software resources access to use and process data.

The *Pennsylvania Atlas*, developed using Environmental Systems Research Institute's (ESRI) ArcIMS software, is a WebGIS application that includes several statewide datasets and GIS functions. Users can view the datasets online, overlay data layers, identify features, and manipulate the view using standard zooming and panning tools. To download data, users first zoom to the area to where they would like the data clipped; second, users select any number of data layers they would like to download; and third, users select a projection for the data. The selected datasets are clipped and reprojected on the server, exported as ESRI shapefiles, and compressed into one Zip file for download. No resources on the client's machine are required.

The *Pennsylvania Watershed Explorer*, a similar application with the same functionality as the *Pennsylvania Atlas*, includes additional data layers and functions relevant to watersheds. For example, the application contains a buffering tool that allows users to generate a buffer of a specified width around a watershed and identify the toxic release points that fall within the buffer area.

Over the next several months, data processing functionality will be expanded and integrated into the PASDA Web site, allowing users to clip and reproject data directly from the PASDA download interface. Both of these applications are available on the Internet at the PASDA Web site www.pasda.psu.edu. Follow the "Explore PA" link and look for "Pennsylvania Atlas"

and "Pennsylvania Watershed Explorer." PASDA is funded by the Pennsylvania Department of Environmental Protection and is a partnership between ERRI, the College of Agricultural Sciences' Land Analysis Lab, the Center for Academic Computing, and the Pennsylvania Geospatial Information Council.

PA JSHS Presentations

PASDA presented information regarding the use of GIS as a learning tool in the classroom to approximately 25 teachers attending the Pennsylvania Junior Science and Humanities Symposium (JSHS), which was held on March 11-13 at Penn State. PASDA also introduced GIS and demonstrated the PASDA web site to the student attendees.

PA Department of Education Grants

PASDA is involved in two PA Department of Education Digital Grassroots Grants. These competitive grants offer teachers and students the opportunity to digitize unique aspects of their community and place them online. The goal of these two projects is to provide students with high-tech skills in web page authoring, advanced technology training, programming, and new media design. An additional benefit is to provide a greater online presence for Pennsylvania's communities.

In the first project, PASDA will be assisting the Centre Learning Community (CLC) Charter School in State College. The CLC students will be collecting data pertaining to earth sciences and the PASDA staff will help develop a web GIS application for students to map their findings. In the second project, PASDA will assist McConnellsburg High School, located in the Central Fulton School District, compile data they will be collecting on Fulton County cemetery locations into a GIS database. When these projects are complete, the information will be posted in the Outreach and Education section of the PASDA website.



PASDA staff member Eric Spielvogel demonstrates GIS applications to JSHS student participants.

Photo: P. Craig

K-12 GIS Alliance

PASDA staff is a participating member of the Pennsylvania K-12 GIS Alliance. The PA K-12 Alliance is a "grass roots" effort of teachers, government agencies at the local and state level, businesses, and universities, working to promote the use of GIS technology in classrooms throughout Pennsylvania.

Tutorials Available

PASDA has completed online tutorials designed to show how to download spatial data and how to use it in ArcView or ArcExplorer GIS software applications. The tutorials are located in the Outreach and Education section of the PASDA website.

For more information on PASDA contact pasda@psu.edu.

Newsletter

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Atlantic Slope

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ment unit, composed of deepwater areas, vegetated and unvegetated shallows, tidal marshes, creeks, and adjacent uplands, will be used for downstream areas and the equivalent small watershed unit will be used for upstream areas. "These units make ecological sense, but they also are sized to facilitate management decisions at the local level," explains Brooks.

The researchers will assess small watersheds and estuarine segments throughout the Delaware, Susquehanna–Chesapeake, and Ablemarle–Pamlico basins with the overall goal of protecting, managing, and restoring the receiving waters, estuaries, and bays of the region. Using geographic information systems, the researchers will "stack" a set of indicators to assess the overall condition of the aquatic ecosystems for a given area. The selected indicators will link stressors, sources, and solutions between upstream watersheds and downstream estuaries. Indicators selected by this approach should help scientists, managers, and policy-makers document trends, prioritize issues, and target critical management activities.

The progress of the project can be tracked soon through the Pennsylvania Spatial Data Access website <www.pasda.psu.edu>. Brooks can be reached at (814) 863-1596 or by e-mail at rpb2@psu.edu.



Students often feel that their final grade is "up in the air" and for students of Jim Savage's Applied Arboriculture class it literally was! For their final exam, students first scaled trees to retrieve their exams and then completed them while up in the trees.

Visit ERRI on the Web at <http://www.research.psu.edu/erri/>