Graduate Student Jorge Pinzón: Coral Sleuth
Summer is a season of great productivity in the natural world, and this summer has been no exception for energy and environment at Penn State. Many faculty and students have been on exciting research expeditions at far-flung corners of the world; others have been on internships or advancing their professional careers. While summer can be a time for individuals to pursue their interests, it can be a time for collective action as well. This issue highlights team efforts on water, climate change, renewable energy, and sustainability, but there is more. Here are a few other major collective efforts at Penn State that have recently seen dramatic success.

As many of you know, last fall Penn State, in partnership with Carnegie Mellon, Pitt, West Virginia University and Virginia Tech, became part of the University Research Alliance of the National Energy Technology Laboratory (NETL). NETL is our closest member of the DOE national lab system, and has primary responsibility for fossil energy research. We have done many individual projects with NETL over the years, but with this regional alliance we are now focusing teams of university and NETL researchers to tackle the grand challenges of fossil energy research. Prominent among these are carbon capture and sequestration, advanced combustion systems for energy efficiency and pollution control, fuel cells for stationary and mobile power, and unconventional sources... including natural gas from shales.

Marcellus Shale. I was on a drill site tour a few weeks ago and was given a piece of this black, flinty rock from 7000 feet underground. It is hard to imagine the extraordinary impacts this slice of geology will have on Pennsylvania in the decades come. Advances in horizontal drilling technology are beginning to unleash an estimated trillion dollars of economic opportunity. As with all energy resources, challenges abound, and Penn State experts are involved in every dimension: energy, environment, and community. To coordinate and leverage these many disciplines and activities, this summer Penn State launched the Marcellus Center for Outreach and Research (MCOR). MCOR is co-directed by Mike Arthur (Geosciences) and Tom Murphy (Cooperative Extension). MCOR has already launched a seed grant program that is funding the first round of what will be a growing research and outreach portfolio. One of the key functions of MCOR is to be a single point of contact both internally and externally for all things Marcellus. If you are or would like to be working on Marcellus related activities, or if you have interactions with stakeholders in these areas, please make sure to let Mike and Tom know.

Penn State is poised to make some very exciting impacts on urban Pennsylvania as well. In the last year we received multi-million dollar DOE awards for clean energy, smart grid, and solar workforce projects based in Philadelphia and Pittsburgh. And in August we were awarded $129 million for the Greater Philadelphia Innovation Center on Energy Efficient Buildings. Executive leadership and project management will be provided by Office of the Vice President of Research (especially Hank Foley and Paul Hallacher), while Jim Freihaut (a PSIEE co-funded professor in Architectural Engineering) will lead the technical thrusts. Their modest proposal: to transform the building industry to radically reduce energy use in both new and existing buildings, and make the Philadelphia Navy Yard the hub of energy efficient building technologies for the 21st century.

With these projects and others we are demonstrating the power of the “we” in our favorite cheer. We are...

Best regards,

Tom
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Shark cruising over several colonies of Pocillopora spp. taken near La Paz, Baja California Sur, Mexico. (Photo courtesy Jorge Pinzón)
Sustainability Seed Grant Program awards announced

PSIEE formed a partnership with Outreach, Office of Physical Plant, and several colleges to establish a significant source of funds to support a one-time Sustainability Seed Grant Program. These seed grants are meant to foster basic and applied research, practice, education, and outreach to enhance our collective expertise on sustainability, initiate or further initiate collaborations across disciplines and units at PSU, and set the stage for recipients to receive larger external grants. Project titles and investigators for the thirteen seed grants awarded are listed alphabetically by title below. Abstracts for the projects are online at: http://www.psiee.psu.edu/news/2010_news/june_2010/seedGrant.asp

Building-Integrated Wind Energy: Connecting Aesthetics and Performance
Ute Poerschke, associate professor of architecture; Jelena Srebric, associate professor of architectural engineering; Susan W. Stewart, research associate, Applied Research Lab; Sue Ellen Haupt, senior scientist, Applied Research Lab

China’s Monopoly on Rare Earth Elements and the Sustainability of Green Technologies
Andrew N. Kleit, professor of energy and environmental economics; Seth Blumsack, assistant professor of energy and environmental economics; R.J. Briggs, assistant professor of energy and environmental economics; Jeffrey Brownson, assistant professor of energy and environmental economics.

Wordle “word cloud” generated from text of all proposals submitted. The graphic gives greater prominence to words that appear more frequently in the source text.
mineral engineering; Zhen Lei, Assistant professor of energy and environmental economics; Antonio Nieto, associate professor of mining engineering; Denis Simon, professor of international affairs.

Conceptualizing Forestry Biomass Feedstock Supply Chain and Macro-Level Scenario Models
Kusumal Ruamsook, visiting research associate, Center for Supply Chain Research; Evelyn Thomchick, associate professor of supply chain management; Susan Purdum, administrative director, Center for Supply Chain Research; Gregory W. Roth, professor of agronomy; Marc E. McDill, associate professor of forest management; Jude Liu, assistant professor of agricultural and biological engineering; Martin T. Pietrucha, professor of civil engineering and director of The Thomas D. Larson Pennsylvania Transportation Institute.

Consortium for Sustainable Business Development (CSBD) at Penn State Great Valley
Barrie E. Litzky, associate professor of management and organization; John M. Mason, associate professor of economics; Denise Potosky, associate professor of management and organization; Matthew E. Sarkees, assistant professor of marketing – all Penn State Great Valley.

Designing Markets for Ecosystem Services
James Shortle, Distinguished Professor of Agricultural and Environmental Economics and director, Environment and Natural Resources Institute; Patrick Reed, associate professor of civil engineering; Kristen Saacke Blunk senior extension associate, Cooperative Extension.

Expansion and Continuation of Behrend College Composting Initiative
Ann Quinn, lecturer in biology, Behrend School of Science, and director, Greener Behrend initiatives; Bob Light, senior associate dean for research and outreach and chair, Lake Erie-Allegheny Earth Force board of directors.

Implementation of LED Technology to Reduce Energy Consumption in Greenhouses, Plant Growth Rooms, and Growth Chambers
William Kenyon, head of lighting design, School of Theatre; Robert Berghage, associate professor of horticulture; W. Blair Malcom, electrical engineer, Office of Physical Plant; Daniel Frechen, M.S. candidate in lighting design.

Life Cycle Assessment of Sustainable Wastewater Treatment Strategies: Toward the Development of an Enhanced Water-Energy Infrastructure
Rachel Brennan, assistant professor of environmental Engineering; Wayne Curtis, professor of chemical engineering; Pete Romaine, professor of plant pathology; and Ming Tien, professor of biochemistry

Social Processes and Impacts of Initiatives for Sustainability Standards in the Agri-food System
Clare Hinrichs, Associate Professor of Rural Sociology; Dara Bloom, Ph.D. candidate in Rural Sociology

Sustainability Ethics
Lee Ahern, assistant professor of communications; Christian Becker, assistant professor of science, technology & society, and philosophy; Donald Brown, associate professor of environmental ethics, science, and law; David Macauley, associate professor of philosophy and environmental studies, Brandywine Campus; Janet Swim, professor of psychology; Nancy Tuana, DuPont/Class of 1949 Professor of Philosophy and director, Rock Ethics Institute

Sustainability in the Hospitality Industry
David Cranage, associate professor of hospitality marketing; Aruun Upneja, associate professor of hospitality finance; Elsa Sanchez, associate professor of horticultural systems management; Mike Orzolek, professor of horticulture and director of the Center for Plasticulture; Luke F. LaBorde, associate professor of food science; Peter Nyheim, senior instructor in hospitality technology; Nadine Davitt, research support associate, Organic Materials Processing and Education Center; Douglas Ford, assistant dean for undergraduate education, College of Health and Human Development.

Sustainability Literacy Project
Tom Keiter, director of creative development and new projects; David DiBiase, director, Dutton e-Education Institute.

Transformative Learning for Sustainability
Lorraine Dowler, associate professor of geography and women's studies; Greg Lankenau, Ph.D. Candidate, Department of Geography.

For more information please contact Denice Wardrop, PSIEE Assistant Director, at dbw110@psu.edu.
Graduate
STUDENT SPOTLIGHT
Jorge Pinzón: Coral Sleuth
by Mary Campbell, PSIEE Writing Intern
Jorge Pinzón always loved the ocean, but while playing with a hermit crab on a high school class trip to the beach he discovered his future career.

“I had a notion that I wanted to be a marine biologist, but that was the moment of truth,” said Pinzón. “I’ve always been attracted to the sea; it’s spectacular. I always wanted to be a scientist, but while playing with that hermit crab, I had the moment when I realized this is what I wanted to do.”

Pinzón, a native of Bogota, Columbia, is a doctoral candidate in marine biology. He is interested in the differences between corals and how those differences reflect the identity of the species. Corals are living organisms that thrive on algae that live inside the corals’ cells.

“I’ve always been attracted to these organisms because they look like rocks, everybody thinks they are plants, but they are animals,” Pinzón said. “It brings all the kingdoms of the world into one single animal organism.”

While completing his masters in marine science at the University of Puerto Rico-Mayaguez in Puerto Rico, Pinzón identified physical differences between coral species.

Now as a doctoral candidate at Penn State, he researches their genetic characteristics, which he hopes will provide more specific taxonomic categorization of corals.

“Something that you may be familiar with is flowers—one flower would have leaves larger than the other,” Pinzón said. “In corals it is the same thing, but it is hard to tell them apart. So the only way to do it is genetics, and genetics will resolve whether there is overlap between species.”

Pinzón’s advisor is Todd LaJeunesse, assistant professor of biology, who studies the symbiotic relationship between corals algae. LaJeunesse’s research focuses on identifying what species of algae associate with what corals; these specializations may help Pinzón identify differences in corals.

“I’m very excited about his work and seeing it published; it’s going to be a significant contribution to science, and I think it will be very well received,” LaJeunesse said. “I’m extremely happy that he did come to me and work with me for these several years.”

Pinzón says that aspects of coral biology have been overlooked by both scientists and the general public, and this research may help explain how reef ecosystems function and the role that corals play in the balance.

In addition to increasing general knowledge about corals, Pinzón hopes to provide better direction for conservation measures through his research.

“If we know the important units of an ecosystem, we can figure out which units we need to protect more than others, or if we need to protect the whole thing because all units are interconnected,” Pinzón said. “I think it’s going to make things easier in the future for conservation and restoration.”

Although many people may not be aware of the everyday importance of coral, Pinzón says that every day...
we are indirectly influenced by corals. The beaches we vacation on are created by corals, and the sushi we eat have benefitted from coral reefs.

“That’s simplistic, but corals are so interconnected with human activities that they are important to protect,” Pinzón said. “We don’t see it on a day-to-day basis because they happen to be underwater, so it is kind of like our blind side, but they are there.”

Pinzón’s research has given him the opportunity to travel extensively, but his favorite trips are to Cartagena, in his native Colombia.

I think that Cartagena is one of the most romantic and cultural places that I have ever been,” Pinzón said. “There are reefs close to Cartagena, so I purposely go there so that I can stay in the city overnight waiting for the next day of field work.”

Coming to Penn State has been nothing but an advantage to Pinzón’s research.

“I think that coming to Penn State provided me with great opportunities,” Pinzón said. “I feel that it is going to give me a competitive advantage after I graduate.”

After the completion of his doctorate, Pinzón plans on working in academia and continuing his research program.

Pinzón can be contacted by email at jhp148@psu.edu.
Penn State researchers among authors selected for Fifth Climate Change Report

The Intergovernmental Panel on Climate Change (IPCC) selected four Penn State climate scientists to participate in the 5th Assessment Report (AR5). The IPCC Working Group Bureau selected 831 climate experts from more than 3000 nominees on June 23, 2010. The number of nominees was an increase of more than 50% in comparison to the 4th Assessment Report.

Chris Forest, associate professor of climate dynamics in the Department of Meteorology, will be a lead author on Chapter 9, “Evaluation of Climate Models,” in Working Group I, which assesses the physical and scientific aspects of the climate system and climate change.

Petra Tschakert, assistant professor in the Department of Geography, will be a lead author on Chapter 13, “Livelihoods and Poverty,” in Working Group II, which assesses the vulnerability of socio-economic and natural systems to climate change, negative and positive consequences of climate change, and options for adapting to it.

Karen Fisher-Vanden, associate professor of environmental and resource economics in the Department of Agricultural Economics and Rural Sociology, will be a lead author on Chapter 6, “Assessing Transformation Pathways,” in Working Group III, which assesses options for mitigating climate change through limiting or preventing greenhouse gas emissions and enhancing activities that remove them from the atmosphere. “I’m excited to build on the excellent work of the IPCC to summarize the state of the science in the important issue of climate change. Although I expect the work to be time consuming, the experience I will gain from being involved in the IPCC will provide benefits both in the classroom and in my own research,” says Fisher-Vanden.

Richard Alley, Evan Pugh professor of geosciences in the Geosciences Department, will work as Review Editor on Chapter 13 “Sea Level Change,” in Working Group I.

The AR5 Report is scheduled to be finalized in 2013-2014.

The Intergovernmental Panel on Climate Change (IPCC) was established by the United Nations Environmental Programme (UNEP) and the World Meteorological Organization (WMO) in 1988 to assess the scientific, technical and socio-economic information relevant for the understanding of human induced climate change, its potential impacts and options for mitigation and adaptation. The IPCC has completed four full assessment reports, guidelines and methodologies, special reports and technical papers, based on peer reviewed and published literature.

In 2007 the authors of the 4th Assessment Report (AR4) shared the Nobel Prize with former Vice President of the United States Al Gore. Five Penn State scientists participated in the Nobel Prize-winning AR4 report: Richard Alley, William Easterling, dean of the College of Earth and Mineral Sciences and former PSIEE director, Klaus Keller, associate professor of geosciences, Michael Mann, professor of meteorology, and Anne Thompson, professor of meteorology.
Ramping up biofuels production to provide a significant portion of the nation’s energy will require nothing short of a transformation of the U.S. agricultural, transportation and energy sectors in the next few decades, according to Tom Richard, director of PSIEE and a bioenergy expert in Penn State’s College of Agricultural Sciences.

Major changes will be needed to grow, handle, transport and store the immense quantities of biomass -- mostly lignocellulosic feedstocks such as switchgrass, crop residues and forest wastes -- necessary to continually feed electric power generation stations and produce biofuels for transportation, noted Richard.

In an article, titled “Challenges in Scaling Up Biofuels Infrastructure,” published in the Aug. 13 issue of the journal Science, Richard contends that converting to a system in which biomass provides much of the country’s energy will require new ways of thinking about agriculture, energy infrastructure and rural economic development.

"It is estimated that bioenergy has the potential to provide up to 60 percent of the world’s primary energy, and biomass seems poised to provide a major alternative to fossil fuels,” he wrote. "The International Energy Agency estimates that a 50 percent reduction in greenhouse gas emissions by 2050 will require an exponential increase in bioenergy production, to 20 percent of our total energy supply in less than 40 years.”

But the massive demand for lignocellulosic biomass will require major changes in supply chain infrastructure, Richard warned. "Even with densification and preprocessing, transport volumes by mid-century are likely to exceed the combined capacity of current agricultural and energy supply chains, including grain, petroleum and coal," he wrote. "To reach the International Energy Agency 2050 target for primary energy from biomass would require 15 billion metric tons of biomass annually."

To gain some perspective on the quantities involved, consider the volumes of related commodities currently being managed. For agricultural commodities, the sum of rice, wheat, soybeans, maize and other coarse grains and oilseeds will approach 2 billion metric tons in 2010. Current global volumes of energy commodities are somewhat larger, with 6.2 billion metric tons of coal and 5.7 billion metric tons of oil transported in 2008.

"Thus, the combination of expected growth in energy demand and the lower density of biomass imply that by 2050, biomass transport volumes will be greater than
the current capacity of the entire energy and agricultural commodity infrastructure,” Richard wrote.

If managed poorly, Richard noted, this additional traffic could degrade rural roadways and increase safety concerns. But increased demand for biomass could also provide a strong incentive to improve rural transportation infrastructure, facilitating agricultural and economic development in concert with renewable energy.

The size and efficiency of bioenergy-conversion facilities will determine how far these huge volumes of biomass and biofuel will need to travel, and thus influence transportation’s contribution to the energy, economic and environmental impacts of biomass use. Decentralized systems have the potential to source feedstock locally with minimum infrastructure costs.

The delivery of finished biofuel also would stress transportation systems, Richard wrote. “For example, a large biofuel plant would require 16 to 20 tanker trucks or railcars per day to move the fuel to market, increasing both traffic and costs.”

But regardless of the fuel product, massive investments in new pipe, rail and highway infrastructure are needed to move those fuels from a new biorefinery network dispersed across the landscape, Richard wrote. Densification strategies including baling systems for grasses, crop residues and forest trimmings, as well as higher-density pellets and cubes, will be key.

Biomass-production operations must occur year-round because it is difficult to amortize capital costs for facilities that are used for only a few months of the year. However, many biomass feedstocks have optimal harvest periods that may run for only a few weeks.

“There are likely other seasons during which harvesting should not occur due to weather or various ecosystem constraints,” Richard wrote, adding that agricultural producers have demonstrated how to store biomass.

“Livestock farmers have been facing a similar problem supplying forages to their 24-hours-a-day, seven-days-a-week, 365-days-a-year milk- and meat-producing animals for over a thousand years, and have developed effective wet (silage) and dry (hay) storage systems for grasses and crop residues,” he wrote.

The amount of nearby land dedicated to energy crops also will greatly affect the costs of feedstock supply, Richard suggested. Even short supply chains can significantly increase the cost of some biomass resources between the field and the biorefinery gate.

“The push-pull between economies of scale for conversion facilities and diseconomies of scale for feedstock supply...
chains suggest three distinct business models for biomass feedstock supply: independent local suppliers, large contiguous plantations and regional or global commodity markets," Richard wrote.

Independent local feedstock suppliers can work well for smaller biomass energy facilities, including combined heat and power plants that require a few truckloads of biomass each day or week. Such operations would have relatively short haul distances and little need for specialized equipment, and the extra expense required for densification would not be required.

"Local supply chains are currently common throughout the world, supplying everything from firewood for charcoal to waste oil for biodiesel," he wrote. "A second model of biomass supply chains is the plantation approach, where a single company controls a large contiguous land area. Plantations have long provided concentrated production of agricultural and forest products for high-volume processing and international markets."

This strategy is being used today for bioenergy crops in many regions of the world, including sugar cane and soybeans in South America, oil palm in Malaysia, and canola in Ukraine, according to Richard. "Most plantation systems have been structured so that the company needing the feedstock directly owns the land."

The third business model is the commodity biomass market, which would parallel the trading operations for other agricultural commodities (such as grains and livestock) as well as energy resources (such as petroleum and coal).

"The transformation of American society to one in which biomass produces a major fraction of our energy is daunting but possible. It will require an innovative, informed and motivated citizenry -- entrepreneurs, farmers, foresters, neighbors and a host of new workers throughout the feedstock supply chain," says Richard.
Bill McKibben will speak on the University Park campus on Monday October 4, 2010 as part of the annual Colloquium on the Environment speaker series. His lecture, “The Most Important Number in the World,” is scheduled for 6:00 p.m. in the Auditorium of the HUB-Robeson Center. A book signing will immediately follow his lecture. Event is free and open to the public.

Bill McKibben is an American environmentalist and writer who frequently writes about global warming and alternative energy and advocates for more localized economies. In 2010 the Boston Globe called him “probably the nation’s leading environmentalist” and Time magazine described him as “the world’s best green journalist. In 2009 he led the organization of 350.org, which coordinated what Foreign Policy magazine called “the largest ever global coordinated rally of any kind,” with 5,200 simultaneous demonstrations in 181 countries. The magazine named him to its inaugural list of the 100 most important global thinkers, and MSN named him one of the dozen most influential men of 2009.

“Penn State continues on its path to achieve a 17.5 percent reduction in greenhouse gas emissions by 2012 and is currently working on the next plan. We are looking forward to Bill McKibben’s presentation and hope to be inspired to do even more,” explained Steve Maruszewski, Assistant Vice President of Physical Plant and Manager of the Finance & Business Environmental Key Initiative.

McKibben is the author of numerous books. His first book, The End of Nature, was published in 1989 is regarded as the first book for a general audience about climate change. In March 2007, McKibben published Deep Economy: the Wealth of Communities and the Durable Future. It addresses what the author sees as shortcomings of the growth economy and envisions a transition to more local-scale enterprise. In April of 2010, he published Eaarth. In Eaarth, he insists, we need to acknowledge that we’ve waited too long, and that massive change is not only unavoidable but already under way. Our old familiar globe is suddenly melting, drying, acidifying, flooding, and burning in ways that no human has ever seen. We’ve created, in very short order, a new planet, still recognizable but fundamentally different. We may as well call it Eaarth.

He is a scholar in residence at Middlebury College and lives in Vermont with his wife and daughter.

The Colloquium on the Environment is sponsored by the University’s Finance and Business Environmental Stewardship Strategy and the Penn State Institutes of Energy and the Environment. This year’s event also is sponsored by the Center for Sustainability and Penn State Outreach. The event has brought numerous high-profile guests to campus including Robert F. Kennedy Jr., Christine Todd Whitman, William McDonough, Amory Lovins, and David Suzuki.

For more information contact Patricia Craig (email: plc103@psu.edu) or Paul Ruskin (email: pdr2@psu.edu).
Matthew Rydzik: Tornado Chaser

by Mary Campbell,
PSIEE Writing Intern

Matthew Rydzik traded in his computer for a tornado pod this summer to travel the country chasing tornados.

“Most of the time hopefully we’re chasing it, but sometimes it ends up chasing us,” said Rydzik, who left for Boulder, Colo. at the end of April for his second summer in the study.

The Penn State senior was a part of the Vortex2 project, a tornado field study funded by the National Science Foundation (NSF) and the National Oceanic and Atmospheric Administration (NOAA). The study focuses on how, why, and when tornados form.

Most of my research before had been computer-based and purely theoretical—sit behind a computer and plug through numbers,” said the Binghamton, New York native. “This is a once in a lifetime opportunity, different field work to help round out my education.”

For the first season, Rydzik’s team, which was made up of approximately 130 people including seven Penn State students and two Penn State professors, visited states all over the Midwest deploying pods in front of oncoming tornados.

These tornado pods, which weigh 120 pounds to keep them from blowing away, record temperature, pressure and relative humidity. This information provides researchers with a better understanding of what happens near the ground during a tornado, which is where people reside and buildings stand.

Rydzik had only one chance to chase a tornado last year because of a record-low year for severe weather patterns. A lack of moisture from the Gulf of Mexico being absorbed into the atmosphere prevented the development of energetic storm systems. This year, he is hoping for more energetic storms and chances to chase them.

In addition to research done on the Vortex2 project, Rydzik has done climate research related to his meteorology major.

Rydzik worked with Professor Raymond Najjar, an oceanographer, on evaluating climate change models. Najjar had heard of Rydzik’s abilities in programming, and asked him to join his research team.

“You find some undergraduates that are extraordinarily talented, and I would put Matt in that category,” Najjar said. “We have a very good meteorology program here, so our best students, like Matt, are truly superb.”

For the past two years, Rydzik analyzed global climate change models released in a 2007 report from the International
Panel on Climate Change (IPCC). Rydzik’s research provides localized and regionalized projections on precipitation, temperature and other environmental factors.

“Probably the best example is we worked on a Pennsylvania climate report last year, and provided climate projections for the next 100 years to people that were studying agriculture, energy, recreation, tourism, and human health,” said the dean’s list student. “We’re providing base knowledge that other people can base their research off of and get more localized impacts besides just the weather.”

For example, that climate report, titled Pennsylvania Climate Impact Assessment Report, helped to predict that there will be a shift in tree species found in North American forests, including an increase in some species and a decline, or even disappearance, of other species.

The research provided opportunities for Rydzik to round out his education at Penn State, including building relationships and being able to interact with professors.

Rydzik said that working with the professors on a more personal level has given him a greater appreciation of what professors do outside of the classroom.

“You have more understanding of that interplay between teaching in the classroom and doing the research,” Rydzik said. “Doing research is interacting with people that know a lot about the field; you’re bouncing ideas off of them, they can bounce ideas off of you, and it’s just good for the learning environment.”

Rydzik said his interest in weather began at an early age. “Like most people in my field, I’ve always had a lifelong passion for weather,” said Rydzik. “My mom used to always tell me when I was growing up, I used to watch the Weather Channel all day long.”

Rydzik also said that the motivation he learned from being an Eagle Scout helps him continue with the research and academic experiences.

In high school, Rydzik realized that he could transform his hobby into a career that he would enjoy. He said Penn State was the best decision for him because it has a superior undergraduate meteorology program.

“I had that moment when I visited Penn State—it was a beautiful day here, and it just felt like the right place after visiting,” Rydzik said. “Penn State is world-renowned; everybody knows them, there are tons of professors with a wide range of interests, lots of courses to take, and big programs which give a lot of opportunities.”

After graduating with “high distinction” in May, Rydzik will be going to graduate school this fall at the University of Wisconsin to continue his education. There he will study the effect of snow cover on storm tracks.

“It’s something that’s very popular in today’s age and I want to be on the leading edge of what I can add to the field,” Rydzik said.

For more information:
- The Weather Channel: The Great Tornado Hunt - Vortex2
- Meteorology Department: Spotlight - Vortex 2
‘I’ve been a creek kid all my life,’ comments Matt Royer, Penn State Extension’s recently-appointed project coordinator for the Conewago Creek Conservation Initiative (CCCI). “My parents still live in the Conewago watershed.” It was during a hunting outing on his family’s property in 2001 that Matt observed the increased sedimentation and algal growth—typical indicators of stream impairment—in the shallows of the Conewago, which he did not remember seeing as a child.

Aware of the growing emphasis on, and assistance available to, community-based watershed groups, Matt and his father, Hal Royer, resolved to “do something for the Conewago.” In 2002, with guidance from the Dauphin, Lebanon and Lancaster County Conservation Districts and Pennsylvania’s Department of Environmental Protection (DEP), the Royers organized a community meeting and the Tri-County Conewago Creek Association (TCCCA) was born. “We had more than 50 people at our first meeting. From the outset we were blessed with a diverse group of interests—professors from Elizabethtown College, educators from the Milton Hershey School, active farmers, and other residents who enjoy the recreational aspects of the watershed,” said Royer.

When Conewago Creek was assessed in 1994 and 1997, DEP found that approximately 30 percent of the watershed’s 152 miles of streams were classified as impaired by nutrients (primarily nitrogen and phosphorous) and sediments carried by runoff from multiple sources. This official designation on the state’s “impaired list” made it eligible for federal and state funding, which TCCCA used to develop a watershed implementation plan—a blueprint for restoration. “More than 100 sites were identified,” said Royer, “and we were moving forward with parts of our plan when we learned of Penn State’s watershed pilot project.”

The Conewago Creek Collaborative Conservation Initiative
A Confluence of Communities and Engagement

By Barbara B. Kinne, Research Assistant, Energy and Environment Outreach Task Force
Launch of the Penn State Agriculture and Environment Center

In the spring of 2007, Penn State’s College of Agricultural Sciences announced its plan to establish the Agriculture and Environment Center (AEC), part of the Environment and Natural Resources Institute and Cooperative Extension, for the purpose of fostering and disseminating cross-disciplinary research on the many environmental issues of consequence to agriculture. Chief among these issues is the Chesapeake Bay; agriculture assumes a heavy share for the management of nutrient and sediment loads that are contributors to the Bay’s imbalance.1

“Agriculture and environment are really a very delicate, intricate balance. There are a lot of different variables that influence the health of any system,” says Bruce McPheron, Dean of the College of Agricultural Sciences. “Agricultural practices have a direct impact on the health of a watershed. And so finding a way to balance the inputs of all the different aspects of these very, very complex systems is an exceptional challenge.”2

Kristen Saacke Blunk, Director of the AEC and Cooperative Extension state program leader for natural resources, said the AEC was established to help bridge some gaps between agricultural research developing sound practices related to environmental protection and the policies that are being developed at the state, regional, and national levels.

“We have all of this amazing research that is taking place around environmental impacts that are associated with human disturbances across the landscape. Agriculture, like any other human activity, has environmental consequences,” said Saacke Blunk. “The research from Penn State is essential for influencing sound decision making and policies at all levels.”

The AEC officially launched in January 2008 and as one of its first tasks, convened a broad group of stakeholders to develop a vision for what agriculture ‘in balance’ would look like in Pennsylvania. State municipal associations, legislators, agricultural and environmental leaders from across the state, Pennsylvania’s Department of Agriculture and Department of Environmental Protection (PDA and DEP respectively), the Pennsylvania Natural Resources Conservation Service (NRCS), and many others came together for this vision-building exercise.

The vision they built was the basis for a joint Penn State-PDA-DEP-NRCS-Chesapeake Bay Foundation ‘Agriculture and Environment: Achieving Balance’ conference in June of 2008. “We structured the conference so that small work groups unpacked this vision for Pennsylvania’s “agriculture-in-balance”, and identified barriers to, and opportunities for,

Conewago Selected as Chesapeake Showcase Watershed Project

The Conewago Creek watershed recently was selected as one of three watersheds part of the U.S. Department of Agriculture’s Chesapeake Showcase Watershed Project. The three showcase watersheds, designed to demonstrate what can be achieved by combining strong partnerships, sound science and funding to solve natural resource problems in a targeted area in the Chesapeake Bay Watershed, were unveiled in June by Agriculture Deputy Secretary Kathleen Merrigan. The showcase watersheds are designed to demonstrate water quality improvements in a confined geographic area through expanded producer outreach efforts, use of innovative conservation practices and intensive conservation planning, implementation and monitoring. Conewago Creek watershed covers 33,606 acres in Pennsylvania, 44% percent is in Dauphin County, 37% percent in Lebanon County, and 18% in Lancaster County.

Source: USDA. Photo left: Eby-Patterson Farm; USDA photo: http://www.flickr.com/photos/usdagov/4721942996/
the creation of new solutions to the old, yet challenging issue of nutrients in the environment,” said Saacke Blunk.

The conference produced overarching themes that were integral to the subsequent development of a discovery watershed improvement project, a demonstration of how organizations accomplish more working collaboratively than independently:

- Pennsylvania has to identify and communicate the value of agriculture’s ‘ecosystem services’ (think carbon sequestration, permeable surfaces for aquifer renewal, nutrients for the land when not in surplus, aesthetics of wide, green spaces);

- Partnerships are critical to local, regional and state success in resolving environmental problems, and while there are many examples of good working partnerships, they need to increase in number and they need to be renewed and built among non-traditional partners; and

- Agriculture needs to have a better understanding of what technologies and practices are available to help farmers help the environment.

Saacke Blunk continued: “Another theme that emerged was that we needed a success in Pennsylvania. We needed a place where we could put our finger on a map and say here, here is where we did everything right, tapping the strengths of each of organizations in partnership, to address the problem, fix local water quality impairments and ensure that the loads coming out of the watershed were no longer compounding the Bay’s impairment.”

Throughout the summer of 2008, Penn State Cooperative Extension met with major partners to identify the criteria that would make a watershed most likely to be fully restored through a collaborative effort. The watershed ideally would be an area small enough in size where practices could be aggregated to a level where results and environmental condition responses could be measured. Ideally it would have more of a surface water system and be less influenced by ground water, and be a hot spot for phosphorous, nitrogen and sediment loading on the Chesapeake Bay map. It would have a progressive, proactive conservation district and a community-wide level of self-awareness and interest in the watershed.
President Obama issued his executive order for the protection and restoration of the Chesapeake in May of 2009. The CCCI proposal received its funding three weeks later.

A Holistic Approach

And so the Conewago Creek Collaborative Initiative was born. Its mission, ultimately, is to remove the Conewago from the impaired stream listing, thereby helping to restore the watershed and the Chesapeake Bay and, in the process, build a better model for adjacent and higher order watersheds to do the same.

With a total of $1.5 million in funding from the National Fish and Wildlife Foundation, and in-kind services from each of the lead partners, Penn State will be coordinating the initiative to reduce nutrient and sediment loads using a holistic landscape and stakeholder approach.

"This is a whole community approach, neighbor by neighbor, farm by farm, municipality by municipality," said Saacke Blunk. "There have been pockets of unique successes throughout the Commonwealth and our plan is to aggregate and accelerate the benefits of these successes within [the Conewago's] dynamic environment."

"It is important to realize that restoration is not a farm initiative or a farm problem. It is a watershed initiative and a watershed problem..."

Mike Hubler, DCCD

Concurrent with the identification of the Conewago, the National Fish and Wildlife Foundation announced a new grant opportunity targeting innovative nutrient and sediment reduction programs for the Chesapeake Bay and specifically calling for new partnerships to accelerate the process as part of the criteria for an award.

“You can only do so much as a small volunteer group. The idea of building a partnership, to get these resources and agencies to work cooperatively was a perfect opportunity,” said Royer. Echoes Hubler, Part of what we are and will be doing is focused on the non-farmer.”

The grant opportunity with NFWF provided $750,000 funding with a one-to-one match requirement, and a further requirement that overhead charges could not be part of the match, an unusually tight structure. From October 2008 to February 2009, there were many meetings, much consensus-building and dialogue as the partnership coalesced and a proposal response was built. Ultimately, Penn State submitted the proposal on behalf of the initiative, a remarkable and substantial investment that demonstrated its commitment to the team and the importance of the project.

CCCI is strengthening relationships and proceeding with four basic thrusts:

1. BMPs: Accelerating the adoption of Best Management Practices (precision feeding regimes for dairy and poultry operations, no-till practices, innovative manure application and treatment application are examples);

2. Stewardship Development: Understanding the social networks within the community and how best to increase the likelihood to integrate behaviors or adopt certain practices into their lives based on what their cultural norms and desires are;
3. Assessment: Conducting assessments of whole farm systems and forest lands and monitoring early signals and long term improvements toward environmental goals;

4. Environmental Markets: Increasing local awareness of ecosystem services that result from well-managed lands and waterways, and understanding of the value these lands have in addition to the products they produce.

The project and the details of how it will work are underway. The entire “discovery” watershed process will be a way to understand the linkages and be able to tell the story in a manner that will be beneficial for other watersheds. Watch for the continuing development of the Conewago in future issues.

For More Information

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Kristen Saacke-Blunk, College of Agricultural Sciences Director, Agriculture and Environment Center and Senior Extension Associate (814) 863-8756 Email: ksaackeblunk@psu.edu

Penn State Agriculture & Environment Center USDA Unveils Showcase Watersheds Designed To Increase Use of Voluntary Conservation Practices in the Chesapeake Bay Basin

Map produced by the Land Analysis Laboratory, Penn State Department of Crop and Soil Sciences.
YING GU is an assistant professor of biochemistry and molecular biology in the Eberly College of Science. Her main objective is to characterize the molecular and cellular mechanisms controlling cellulose biosynthesis in higher plants. Her lab uses live cell imaging to visualize the cellulose synthesis machinery in living plant cells. Considering cellulosic biomass is expected to become one of the main sources of biomass for the production of renewable biofuels in the near future, the data generated through our research may be of great interest for energy producing agents.

ARMEN KEMANIAN is an assistant professor of production systems and modeling in the College of Agricultural Sciences. He develops and applies comprehensive agricultural and natural systems simulation models with the goal of improving productivity and environmental stewardship. His research program emphasizes the quantitative understanding of vegetation, soil and landscape processes including crop growth and yield, and the cycling of water, carbon, and nutrients. New knowledge is incorporated in a mathematical framework – simulation model – that aggregates the effects of all contributing subsystems to field, whole-farm, and catchment systems.

ALLEN KLAIBER is an assistant professor of agricultural and environmental economics in the College of Agricultural Sciences. His research broadly falls within the fields of environmental and natural resource economics. A large portion of his research focuses on understanding household decisions by linking housing choices to public goods through housing markets. Similarly, individual land use choices affect farmland and forests, natural gas development, wind, solar, and biomass energy, all of increasing interest.

BEN LEAR is an assistant professor of chemistry in the Eberly College of Science. Lear’s research focuses on both fundamental and applied problems involving electron transfer in inorganic systems with an emphasis on biosensors, molecular electronics, and photovoltaics - applications geared towards the fields of materials and energy science. Current research thrusts include electron transfer for solar energy capture, molecular conductance, and dynamics of electronic coupling.

LI LI is an assistant professor of petroleum and natural gas engineering in the College of Earth and Mineral Sciences. Her current research focuses on understanding reactive transport processes relevant to geological carbon dioxide sequestration, microbiologically enhanced oil recovery, and bioremediation of radionuclide-contaminated sites. She uses both numerical models and experiments to understand the coupling between multiple processes at different spatial scales and how the characteristics of natural systems affect thermodynamics and kinetics of reactions.

HOWARD SALIS is an assistant professor of agricultural and biological engineering in the College of Engineering and College of Agricultural Sciences. His research focuses on the development of rational design methods for engineering synthetic biological systems - metabolic pathways, genetic circuits, and genomes. His goal is to make engineering biology as reliable as building planes, trains, and automobiles. His lab develops kinetic and thermodynamic models of genetic regulation and test their predictions in industrially and medically useful microorganisms to gain a quantitative understanding of genetic function.

To view all of our cohort please visit the PSIEE web site at: www.psiee.psu.edu/psiee_people/cohires.asp.
As Mike Hickner is quick to tell you, if you drop a sheet of metal into the ocean around Florida and wait a week to pull it up, it's going to be covered in algae, bacteria, and all other manner of crusty, clinging creatures.

No one knows this better than the United States Navy, which spends tens of millions of dollars each year on “anti-fouling services” to keep its boats ship-shape. When Hickner began developing a paint that could inhibit unwanted growth, the Navy came calling.

Hickner is an assistant professor of materials science in the College of Earth and Mineral Sciences, and, though his tenure at Penn State has been less than three years, he has already demonstrated that his recruitment was a wise investment. This past year he was one of 100 young scientists named by the White House to receive the illustrious Presidential Early Career Award for Scientists and Engineers (PECASE), which provides five years of...
funding
and recognizes extraordinary
researchers pushing the frontiers of scientific
investigation at the start of the 21st century. He
was also selected as an Office of Naval Research
Young Investigator (one of twenty-seven) by the
U.S. Department of Defense, again for demonstrating
“exceptional promise” in his research and teaching.

But it all started with water—and plastic. Hickner is a
polymer scientist, but he prides himself on making things
with an environmental purpose, not just more plastic
bags. With a bachelor's degree and doctorate in chemical
engineering from Michigan Tech and Virginia Tech,
respectively, Hickner also spent some time at Los Alamos
and Sandia National Laboratories studying fuel cells.
His goal there was to create membranes to promote ion
motion (e.g., protons), though he soon realized that this
was basically the opposite of a membrane created for water
treatment where the goal is to inhibit ion motion (e.g.,
salts) while allowing water to pass through.

Flash-forward to Penn State where Hickner and his
co-investigator Qing Wang, an Associate Professor in
MATSE, recently hypothesized that the mechanisms
for fuel cells and water-treatment membranes were very
similar—the NSF agreed and awarded them a grant of
$300,000 entitled “Engineering Selective Fuel Cell and
Water Treatment Membranes.”

It takes a lot of energy to
make clean water.

“Both of these are energy applications,” explains Hickner.
“Water treatment is an efficiency problem. It takes a lot
of energy to make clean water.” Of course, in simple
practice this is nothing new. Hickner is the first to
admit that reverse-osmosis kits are available at stores like
Home Depot. But the key to his membranes is that they
operate in extreme conditions, which is what interests the
Department of Defense.

Oceans of
seawater are a boon and
a bane for the Navy. An aircraft carrier has to treat a lot of
water, which is traditionally done with abusive chemicals
(like chlorine) or high temperatures, both of which the
military would like to avoid. So Hickner is creating tough
but effective plastic sheets that go inside the devices
that treat the water—whether for decontamination or,
potentially, more efficient desalination. In California, for
example, seawater is desalinated by filtering, chlorinating,
de-chlorinating, running through reverse osmosis, and
then re-chlorinating for storage and drinking. In contrast,
Hickner’s materials take out most of those steps to
provide clean water or sailors. In a separate enterprise,
he is working towards hull paints for ships that have
revolutionary chemical contours with specific roughness
and chemistry that provide an environmentally friendly
way of inhibiting barnacle and bacteria attachment (as
opposed to the traditional use of copper, which leaches
into the water). Suffice it to say that the Navy is now
funding fully a third of Hickner’s work.

Hickner is quick to share his success with his academic
home. Regarding his most recent award from the
Department of Defense, he posits that “it was an easy
choice for the DOD because they know I’m at a great
school.” At the same time, human support from the
PSIEE and technical experts and lab resources from the
MRI provide “the perfect setting for what I want to do.”

Hickner looks forward to an even brighter future career
at the University. “Penn State has a great environment for
young faculty,” he smiles. “I have the job I want in the
place I want and I’m surrounded by very good students,
excellent staff, and engaging faculty colleagues.”

For more information:
Michael Hickner’s Department of Material Science and
Engineering’s Faculty webpage
Hickner’s Research web site
A dry streambed in a small wooded valley near Penn State’s Stone Valley Recreation Area became a “living” laboratory this August for a group of State College Area High School students getting an early taste of earth science.

Using soil moisture probes and water-level sensors, the teens sampled 16 sites to determine the depth of the water table and the moisture content along a streambed that was so dry in parts that it was almost dusty. The laboratory was the 20-acre Shale Hills watershed in the Penn State Stone Valley Experimental Forest in Huntingdon County.

Instructing the students was Chris Duffy, Penn State professor of civil engineering, who is the lead researcher in the NSF-sponsored Susquehanna Shale Hills Critical Zone Observatory (CZO). Critical Zone science explores the complex physical chemical and biological processes that shape and transform the life-sustaining Critical Zone stretching from the top of vegetation to the bottom of groundwater.

Researchers in three Penn State colleges, Engineering, Earth and Mineral Sciences and Agricultural Sciences, are involved in examining water flow patterns and rates as it moves through the subsurface of the Shale Hills watershed.

In Pun, a rising 9th grader at State College high school, gets help from George Holmes, graduate student in civil engineering, on how to read an electronic water-level sensor as part of the district’s new Summer STEM Academy.
A new initiative for the State College Area School District, the STEM (Science, Technology, Engineering and Math) academy is emphasizing hands-on activities with students building instruments, conducting experiments and analyzing data.

“Doing experiments and seeing how it works in person helps me learn it better,” said 14-year old In Pun, one of the 10 students in the State College Area School District’s week long STEM Summer Academy. “I’m really understanding how the water cycle works and how everything affects it.”

“When kids see and do hand-on things, they remember it far better than being told what it is and how it works,” said Wendy Watts, who teaches physics in the school district and who also took a turn measuring soil moisture with the students.

The students’ measurements confirmed their hypotheses: Soil on the banks of the stream was drier than the soil in the streambed, and soils are drier closer to stream headwaters.

“Doing experiments and seeing how it works in person helps me learn it better,” said 14-year old In Pun, one of the 10 students in the State College Area School District’s week long STEM Summer Academy. “I’m really understanding how the water cycle works and how everything affects it.”

Amer Sible, 14, said, “This helps me make connections between the everyday things you see and the science behind them.”

Dave Klindienst, the district STEM coordinator, said the district is looking to build more collaborations with Penn State, a goal that also fits well with Duffy.

“If we want to move Critical Zone Observatories forward as a national network, we need education at the K-12 level in the mix,” Duffy said. “Today was an opportunity for students to learn about ecology, geology and hydrology with mentors.”

Chris Duffy, professor of civil engineering, who is the lead researcher in the NSF-sponsored Susquehanna Shale Hills CZO, talks to State College Area High School students.

All photos: Margaret Hopkins
The Penn State Advanced Vehicle Technologies team showed nothing but their Nittany Lion pride and spirit underneath the Arizona desert sun and San Diego blue sky while at the 2010 EcoCAR: The NeXt Challenge Year Two competition.

The Penn State EcoCAR team placed third overall out of the 16 North American universities that competed in the second year of the three-year competition, proving that their long hours in the garage truly paid off. “We couldn’t be any happier,” said Mike Zahradnik, team leader for Year Three. “This past year was a team effort with a lot of hard work in the garage and labs. All of our all-nighters were definitely worthwhile.”

Sponsored by General Motors (GM) and the Department of Energy, the EcoCAR competition challenges university engineering students across America and Canada to re-engineer a GM-donated vehicle with goals to improve fuel efficiency and reduce emissions while retaining performance and consumer appeal.

“We’re thrilled to have placed in the top three with our design,” said faculty adviser Gary Neal. “The students worked countless hours to design and build the vehicle that would exceed emissions standards and consumer acceptability.”

The Penn State vehicle is a series architecture design with an estimated electric range of 30 miles from the 330V Li-Ion battery pack. Once the battery is depleted, a 1.3L GM diesel engine kicks on to drive a 75 kW electric generator that produces electricity to power the vehicle.

For this second year of competition, students implemented the designs that were simulated in Year One to create a fully functional vehicle. In the first phase of the ten-day Year Two competition, teams underwent dynamic vehicle testing at the GM Desert Proving Grounds in Yuma, Arizona. The second phase in San Diego, California was packed full of presentations and awards.

“Watching the desert sunrise at 5am while doing emissions testing was a really unique experience,” said Ben Koch, team mentor for Year Two. “It was...”

by Allison Lilly, Campus Sustainability Office Intern and member of EcoCAR Outreach Team
In addition to placing third overall, the team also won Best Social Media, Best AVL Drive Quality, Best Technical Report, placed third in Outreach, placed second in A123 Battery Design, and were runner’s up in Well-to-Wheel Greenhouse Gas Emissions, Best Tailpipe Emissions and Best Fuel Consumption.

Spreading the word to the Penn State and State College community and beyond was the main goal of the EcoCAR outreach team, which placed third overall. Throughout the year, the outreach team participated in 50 events, reaching out to youth, the community and government.

“It’s a great feeling to go out into the community and show what the EcoCAR team is all about,” said Dana Bubonovich, outreach coordinator for Year Two. “Families and kids of all ages seem to enjoy learning about hybrid technologies, greening the earth and sustainability.”

Outreach events included tailgates (one with football rival Ohio State’s EcoCAR team), family festivals, a Girl Scout event, Blue and White parade, Earth Day events, non-profit organization presentations, STEM fairs, a borough council meeting and numerous visits to elementary, middle and senior high schools in the school districts surrounding State College.

Outreach also won the Best Social Media award for their efforts using the popular social networking sites like Facebook, Twitter and YouTube.

The Penn State EcoCAR team has started their planning for Year Three, which is focused on completing the vehicle to create a 99% buyoff vehicle that meets current consumer acceptability expectations and improved fuel economy.

Be sure to keep an eye out for the Penn State EcoCAR driving around campus in Year Three!

For more information:
EcoCAR site: http://www.ecocarchallenge.org/
Penn State EcoCAR: http://www.hev.psu.edu/
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Ecological Literacy
by Katie Gloede, Sean McGrath, and Morgan Wardrop

The following excerpt is from a report drafted by the students that is intended to generally describe the level of ecological literacy and the range of approaches that they observed while traveling through Peru, and is intended to be the internal product (i.e., shared with their colleagues and peers). The accompanying external product was a lesson plan/brochure for educators in rural Peruvian schools describing the concept of ecological literacy and some recommended best practices for integrating it into the formal educational process.

Ecological literacy is a new movement in American education that aims to give children the ability to discern the dependency of human beings on nature and as a result instill a sense of respect for the natural world. This is achieved through experiential outdoor education, food and food systems knowledge, and natural history interpretation. One outstanding observation to many of us was the incredible diversity of the country. The culture in Lima (on the Pacific coast) was drastically different from that in Cusco, which in turn was different than the culture in the Amazon. Even within these areas, differences existed between indigenous and urban societies.

These differences stayed true in terms of ecological literacy as well. In Lima, ecological literacy was nearly non-existent as the city relies almost exclusively on Cusco for its food. Additionally, the city is distant from the amazing biodiversity which makes Peru famous and many inhabitants are incapable or unwilling to experience this natural wealth first hand. In contrast, people in Cusco are much closer to their natural surroundings and there was a higher degree of ecological literacy. This was especially true in the Quechua culture surrounding the city. However, this changed as we traveled down into the Amazon basin into more rural and isolated communities. Ecological literacy was scant in this region for two reasons. The first is an issue that affects the whole country: teaching. Teachers in Peru are now a product of westernized education and are often unwilling to incorporate environmental
issues into the curriculum. Second, many of the people in the Amazon basin of southeastern Peru are not originally from there. Logging and mining operations attract many people from other regions in the country. As a result the people cannot relate to the environment of the jungle and as such do not understand or care about it. We did find ecological literacy at work in the region, but only in extreme cases, like that in the community of Boca Amigos, where the teacher took it upon himself to incorporate the jungle into the classroom.

Two forces appear to be at work here, and merit additional assessment. The educational system in Peru appears to be moving away from its traditional learning approaches, which often incorporated the local ecosystem as a living laboratory, towards a westernized system, that focuses on math, writing, and reading. In addition, ecological literacy approaches were often provided by teachers associated with non-governmental organizations (NGOs), instead of those trained in the traditional manner. It is crucial for Peru to cease relying on NGOs to provide its environmental education and provide training and information to teachers so they can see the benefit of this type of education.

“The problem is the training of teachers for environmental education. In recent years environmental education has made considerable progress, in a large part, with the support of NGOs. ... The government supports their efforts and recognizes their contribution. They are present throughout the country and their contribution is enormous.”

- Antonio Brack Egg, Peru’s Minister of the Environment

(Answers to questions that were submitted by students of this course)

Gold Mining
by Matthew Avedesian, Alina Mackenthun, Ainsley Woolridge, and Zachary Zabel

Small-scale gold mining is a significant presence on the Madre de Dios River, one of the last great wild rivers on the planet. The contrast is stark: an unregulated river flowing through a continental-sized forest, yet peppered with small barges actively processing sediment. One of the primary impacts of this activity is mercury contamination of water, sediments, and air. Travel through this portion of Peru involves long stretches of boat travel, which offers an opportunity to educate tourists, scientists, and other visitors about the current mining activities, and the environmental, social, and economic impacts of current practices. The following text is directly from a brochure prepared by the students to be carried on the boats and available for “in-travel” outreach and education, and represents their external product.

Welcome to the river Madre de Dios! This stretch of river will take you through a rainforest region known as the biodiversity capital of Peru. Other than the countless wildlife species

Photos: (above) High in the Andes a community prepares the soil for potatoes using an ancient ceremonial technique; (upper right) School in the community of Boca Amigos.
that thrive here, the Madre de Dios River is also known for its teeming gold mining activity both in the river and in the forest. This extraction industry has a dominating influence on the region, and has given way to mining towns and economic centers like Puerto Maldonado and Laberinto.

Whether you live here or are just visiting, it is hard to overlook the effects and influences that gold mining has on the region. Be it a shop in town that advertises the sale and purchase of gold or the countless mining operations that line the river's banks, it does not take long to realize that gold is king in Madre de Dios. A large percentage of people that inhabit the region support their families directly through mining; the rest are indirectly involved through business via the sale of gas, oil, tools, alcohol, transportation, food, etc. It affects every aspect of people's lives in this region and efforts are now being made to research and understand it better because it presents major environmental and public health problems.

It may not be immediately obvious that a lot of gold exists in the Madre de Dios River because the gold here is no bigger than very fine grains of sand, but a boat ride a few hours upstream will reveal that business is booming. Countless balsas mineras (mining boats) line the river banks, each attempting to separate the gold particles from the sediment. Unfortunately, mineral extraction is an extremely taxing activity on the environment. Small-scale mining operations are responsible for greater releases of mercury to the environment than any other sector globally.

Gold mining has very extensive negative effects, which are not only caused by the use of mercury, but also by the way the operations are run and implemented. The most apparent issue is that of habitat disturbance because in especially gold extraction from the forest floor, a degree of forest must be cleared in order to open a new operation. Trees must be cut and burned down, taking away from the habitat of species specific only to this region. So far, over 18,000 hectares of forest have been destroyed, and if changes are not made, another 400,000 hectares could be destroyed. Moreover, the amount of noise created by the operation, which can run up to twenty-four hours a day is a startling disturbance and further perturbs the wildlife that normally reside by the river. Damage to the rainforest by mining operations is so extensive that it can be clearly identified in satellite images.

A less obvious but perhaps more pressing issue is the one surrounding the use of mercury. When the sediment is treated with the chemical, it is washed back into the river, which, when...
combined with other substances like oil and debris from daily mining, contaminates the water. The mercury accumulates in the food chain, starting in fish and other species that live in the river and ultimately ends up in the markets and on the dinner tables of the local families. The problem mainly lies in the fact that the mercury is used inefficiently, and many times carelessly, because not much of a known incentive exists to alter methods. Moreover, mercury is cheap, and can be found in local markets for less than 8 Soles for a bottle. Each gold mining operation vaporizes around 1-2 kilograms of mercury each week (the size of one 16 oz. soda can), coming to what a 2002 World Wildlife Fund study approximated to be 10-30 tons of mercury that are released in the Madre de Dios region each year.

Mining has social impacts as well. The women and children are largely affected by the gold mining industry. The fabulous magnetism of getting rich quick in the gold mining industry lures many Peruvians into the Amazon from all over Peru. Single men come down from the mountains to try their hand at mining and others bring their business expertise to work in merchant shops but they are unfamiliar with the landscape and culture in Madre de Dios. They are abundantly paid cash-in-hand, which has created a prominence of bars in these gold mining towns. Commonly, gold mining towns are made up of three distinct industries excluding mining itself: mining supplies and services, markets with food and clothing, and bars, which are also a hotbed for prostitution.

In some towns, primary school girls are prostitutes that can be found and bought along the row of cantinas.

Some data on mining in the region include:

- 20% of Peru’s gold is mined from the Madre de Dios region (figure based on the reported legal extraction);
- At least 80 tons of mercury is dumped into the Madre de Dios River each year;
- About 20% of the world’s gold is produced by small-scale operations like the ones in Madre de Dios;
- Small-scale mining operations are responsible for the largest release of mercury to the environment of any sector globally; and
- The level of informality is a leading problem (i.e., no mining/land titles held or environmental impact studies approved may be as high as 90% in this region.)
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