

B&ESD Newsletter
April 2011

Pubs and Products

Dale, V. H., Kline, K. L., Wright, L., Perlack, R., Downing, M., and R. L. Graham. 2011. Interactions between bioenergy feedstock choices and landscape dynamics and land use. *Ecol. Appl.* 21: 1039-1054.

Garten, C. T., Jr., Iversen, C. M., and R. J. Norby. 2011. Litterfall 15N abundance indicates declining soil nitrogen availability in a free air CO₂ enrichment experiment. *Ecology* 92: 133-139.

Ghafghazi, S., Sowlati, T., Sokhansanj, S., Bi, X., and S. Melin. 2011. Life cycle assessment of base-load heat sources for district heating system options. *Int. J. Life Cycle Assess.* 16: 212-223.

Gilmour, C. C., Elias, D. A., Kucken, A. M., Brown, S. D., Palumbo, A. V., Schadt, C. W., and J. D. Wall. 2011. The sulfate-reducing bacterium *Desulfovibrio desulfuricans* ND132 as a model for understanding bacterial mercury methylation. *Appl. Environ. Microbiol.* Available online. DOI:10.1128/AEM.02993-10

Izaurrealde, R. C., Post, W. M. and T. O. West. 2011. Managing carbon: ecological limits and constraints. In D. G. Brown, N. H. F. French, B. C. Reed, & D. T. Robinson (Eds.), *Land Use and the Carbon Cycle: Science and Applications in Human Environment Interactions*. Cambridge University Press.

Lutz, B. D., Bernhardt, E. S., Roberts, B. J., and P. J. Mulholland. 2011. Examining the coupling of carbon and nitrogen cycles in Appalachian streams: the role of dissolved organic nitrogen. *Ecology* 92:720–732.

SanthanaVannan, S. K., Cook, R. B., Pan, J. Y., and B. E. Wilson. 2011. A SOAP Web Service for accessing MODIS land product subsets. *Earth Sci. Inform.* Available online. DOI: 10.1007/s12145-011-0079-2

Woodward, J., Kennel, S. J., Stuckey, A., Osborne, D., Wall, J., Rondinone, A. J., Standaert, R. F., and S. Mirzadeh. 2011. LaPO₄ nanoparticles doped with actinium-225 that partially sequester daughter radionuclides. *Bioconjugate Chem.* 22: 766-776.

Yazdanpanah, F., Sokhansanj, S., Lau, A., Lim, C. J., Bi, X., and S. Melin. 2011. Airflow pressure drop for bulk wood pellets. *Biomass Bioenerg.* 35: 1960-1966.

Zhang, M., He, F., Zhao, D., and X. Hao. 2011. Degradation of soil-sorbed trichloroethylene by stabilized zero valent iron nanoparticles: Effects of sorption, surfactants, and natural organic matter. *Water Res.* 45: 2401-2414.

Notable Achievements

Work by Gerald Tuskan and the BioEnergy Science Center (BESC) was highlighted in an article on the website *Encyclopedia of Earth*. View the article, “Changing Plant Characteristics to make Biofuels” at

http://www.eoearth.org/article/Changing_Plant_Characteristics_to_Make_Biofuels?topic=60605.

Yetta Jager attended the Office of Biomass Program’s (OBP) 2011 Program Meeting in Annapolis, MD, on April 3rd-6th.

Brennan Smith, Mike Sale, Bo Hadjerioua, Shelaine Hetrick, Bo Saulsbury, and Mark Bevelhimer attended the National Hydropower Association (NHA) Annual Conference in Washington, DC, on April 3rd-6th. Brennan Smith presented at the plenary session at the NHA meeting following Senator Murkowski and a panel of the Department of the Interior (DOI), the Federal Energy Regulatory Committee (FERC), the Department of Energy (DOE) and members of the U.S. Army Corps of Engineers (<http://hydro.org/wp-content/uploads/2011/04/110404-nha-conference-final-final.pdf>). Mark Bevelhimer participated in a panel discussion entitled “Using the Adaptive Management Tool: What Works?” on April 5th with panel members Douglas Hjorth, Gregg Carrington, and Keith Truscott. Michael Sale participated in a panel discussion entitled “\$200M and Counting, A Progress Report on the DOE Water Power Program” on April 5th.

On April 5th comments, capabilities, and Oak Ridge National Laboratory (ORNL) contact information were submitted to the National Renewable Energy Laboratory (NREL) and the United States Agency for International Development (USAID) to support the USAID workshop and the State Department initiative for Low-Emission Development Strategies (LEDS). A program to support multi-disciplinary assessments and planning (integrating energy, agriculture, land-use and other goals), LEDS combines development goals with climate change mitigation and adaptation strategies. The initiative focuses on developing nations and others (e.g., Brazil, Mexico and Colombia). On April 7th Keith Kline met with Dan Bilello (NREL) and USAID staff regarding collaborations and capacities to support specific needs in LEDS countries where ORNL has relevant contacts and experience.

On April 5th and 6th the DOE Radiochemistry Workshop was held. ORNL had the following posters:

- In-situ Monitoring of Plant Structure and Signaling via SPECT Imaging: Delivery of Proteins to Plant Vasculature
Authors: Timothy E. McKnight (Measurement Science and Systems Engineering Division [MSSSED]), Justin S. Baba (MSSSED), Udaya C. Kalluri (Biosciences Division [BSD]), Sandra Davern (BSD), Saed Mirzadeh (Fuel Cycle and Isotopes Division [FCID]), and Robert F. Standaert (BSD)
- Understanding Plant Signaling through Radiochemical Imaging of Vascular Peptide Traffic
Authors: Sandra M. Davern (BSD), Joanna Jelenska (University of Chicago), Robert F. Standaert (BSD), Timothy E. McKnight (MSSSED), Justin S. Baba (MSSSED), Udaya C. Kalluri (BSD), Poornima Sukumar (BSD), Jean T. Greenberg (University of Chicago), and Saed Mirzadeh (FCID)
- In-situ Monitoring of Plant Structure and Signaling via SPECT Imaging: Plant Imaging
Authors: Justin S. Baba (MSSSED), Marcus Allegood (MSSSED), Benjamin Bale (MSSSED), Lorenzo Fabris (Global Nuclear Security Technology Division [GNSTD]), Udaya C. Kalluri (BSD), Sandra Davern (BSD), Timothy E. McKnight (MSSSED), Saed Mirzadeh (FCID), Robert F. Standaert (BSD)

On April 5th-6th BSD research was represented in “Bridging the Gap,” a unique opportunity for entrepreneurs and investors to hear about six promising ORNL technologies and engage with researchers at ORNL. The BSD technology presented was “Low cost nanoparticles for solar cells and semiconductors.” The multidisciplinary, multi-division team was represented by Tommy Phelps, Lonnie Love and Renae Speck.

The following are short presentations from the DOE Radiochemistry Workshop (April 6th):

- Sandra M. Davern (BSD), "Understanding Plant Signaling through Radiochemical Imaging of Vascular Peptide Traffic: Defense Peptide Mobility"
- Robert F. Standaert (BSD), "Understanding Plant Signaling through Radiochemical Imaging of Vascular Protein Traffic"

On April 6th-8th Shahab Sokhansanj, along with other ORNL staff, participated in OBP's Feedstock Platform Review held in Annapolis, MD. Projects on sustainability were presented on April 6th followed by projects on feedstock on the 7th and commercial projects on the 8th. This platform review facilitated interaction with collaborative laboratories and industrial partners.

Keith Kline coordinated with the Council on Sustainable Biomass Production (CSBP) Field Testing Task Force and Sam Jackson (UT/Genera) to develop recommendations on moving forward in a manner emphasizing continual improvement while reducing transaction costs for producers. ORNL also participated in the April 14th Climate Change Task Force discussions and drafted a memo describing a two-tiered approach for Integrated Resource Management Plans and steps to incorporate input from growers. The final memo was submitted to Council members on April 21st, and was discussed in the April 27th-28th meetings.

Brennan Smith, Mike Sale, and Shih-Chieh Kao met with DOE Headquarters and the U.S. Army Corps of Engineers on April 7th-8th to update the current progress of climate impact assessment on federal hydropower.

On April 8th ORNL provided a press release “Bacterial genome may hold answers to mercury mystery”

(http://www.ornl.gov/info/press_releases/get_press_release.cfm?ReleaseNumber=mr20110408-00) on work including Steve Brown, Dwayne Elias, Craig Brandt, Mircea Podar, Miriam Land, Loren Hauser, Tony Palumbo and other, non-BSD collaborators, on the newly sequenced and released genome on the bacterium *Desulfovibrio desulfuricans* strain ND132. The publication on this sequencing work, “Genome Sequence of the Mercury-Methylating Strain *Desulfovibrio desulfuricans* ND132” can be read online in the *Journal of Bacteriology* at <http://jb.asm.org/cgi/content/short/193/8/2078>.

The 2011 Genomic Science Contractor-Grantee Meeting was held in Arlington, VA, at Crystal City from April 10th-13th. Twenty-six different BioEnergy Science Center (BESC) science posters were presented covering the topics of biomass formation, deconstruction, conversion, characterization and modeling. The abstracts are located at: <https://www.ornl.gov/gtl2011/postedabstracts.htm>.

Glenn Cada participated in the International Conference on the Status and Future of the World's Large Rivers, in Vienna, Austria, April 10th-15th. He made two presentations: (1) Using Fish Morphological Characteristics to Improve Hydroelectric Turbine Designs, and (2) Hydrokinetic Energy Conversion in Large Rivers: Opportunities and Challenges. Participation in the conference permitted Dr. Cada to highlight DOE's support of research in both conventional and

marine and hydrokinetic (MHK) waterpower areas, and to learn about international experiences that will be useful to the Water Power Program.

The 34th International Symposium on Remote Sensing of Environment was held April 10th-15th at the Sydney Convention and Exhibition Centre. ORNL Distributed Active Archive Center (DAAC) Manager and 2011 Earth Science Information Partnership (ESIP) President, Chris Lenhardt attended.

On April 13th Shahab Sokhansanj participated in the Stage Gate Review of the General logistics project “Development of a Bulk-Format System to Harvest, Handle, Store, and Deliver High-Tonnage Low-Moisture Switchgrass Feedstock.” This review was through 4.5 hours of teleconference. The University of Tennessee’s team, Al Womac, Kelly Tiller, Sam Jackson, and DOE’s Sam Tagore, Roxanne Dempsey and Steve Thomas, were the participants.

Robin Graham visited the University of Wisconsin in Madison and was a guest lecturer at the Great Lakes Bioenergy Research Center (GLBRC) seminar series. She met with research staff associated with GLBRC and discussed current ORNL research and opportunities for collaboration. Her seminar reviewed the progress of bioenergy resource assessment over the past two decades and the increasing inclusion of environmental and economic factors in such assessments. Her seminar was titled “Potential? Economic? Sustainable? – A reflection on the evolution of estimating future U.S. Ligno-cellulosic biomass feedstock.” A video of her presentation and her presentation slides will be made available through the GLBRC website <http://glbrc.org/2011seminar-graham>. Robin also met with Molly Jahn, former dean of the University of Wisconsin School of Agriculture and former Acting Undersecretary for the United States Department of Agriculture (USDA) for Research and Education. Molly is spearheading an effort to create a national Infrastructure of integrated data, models and decision tools for evaluating the tradeoffs of managing land. Her initiative is called “Information Infrastructure for Sustainability Sciences initiative” (IISS).

On April 15th Allen McBride, Meghan Drake, and Virginia Dale provided an innovation story to DOE on ORNL’s sustainability activities. Alison Goss Eng requested this information for the Communications and Outreach (C&O) office at DOE Energy Efficiency and Renewable Energy (EERE) in order to gain exposure for its programs and their successes. The stories are given a high priority by DOE’s Office of Public Affairs.

Representatives from the Commonwealth of Kentucky Division of Renewable Energy, Kate Shanks (Assistant Director) and Tim Hughes (Director of Biofuels), visited the Lab on April 18th to learn more about ORNL’s bioenergy research. Research staff participating in the visit included: Erin Webb, Mark Downing, Robin Graham, Bob Perlack, Laurence Eaton, Brian West, Virginia Dale, Brian Davison, Rahul Ramachandran and Aaron Myers. Special thanks to Katherine Ragle for coordinating the visit.

Virginia Dale participated in a survey on merging issues for the United Nations Environment Programme (UNEP) Foresight Process at the invitation of UNEP’s Chief Scientist: Prof. Joseph Alcam.

On April 18th Shahab Sokhansanj met with Dr. Franco Berruti, Director of the Institute for Chemicals and Fuels from Alternative Resources (ICFAR) at the University of Western Ontario. The discussion concerned developing joint research projects on torrefaction of biomass.

Also on April 18th several members of the Center for BioEnergy Sustainability (CBES) took part in a presentation for the State of Kentucky Division of Renewable Energy and the Department for the Energy Development and Independence. Robin Graham, Bob Perlack, Laurence Eaton, and Virginia Dale presented on various topics pertaining to bioenergy and sustainability.

Three Tennessee Governor's Academy students completed research internships in the Environmental Sciences Division (ESD) in April. Bethany Vanhooser, Sara Ivy, and Lenzie Howell participated in a poster session on April 20th to present their work from the past year. Their mentors were Mark Downing, Erin Webb, and Misha Krassovski.

ORNL DAAC Chief Scientist, Bob Cook, presented a guest lecture on data visualization at the School of Information Sciences at University of Tennessee, Knoxville (UT-K), TN, on April 21st.

On April 25th Keith Kline submitted comments to the State Department, OBP, and the United States Department of Agriculture (USDA) on proposed Global Bioenergy Partnership (GBEP) Indicator #8 on Land Use and Land Use Change (LUC), noting that the metrics proposed will need further revision to be practical, science-based, relevant and implementable with consistency.

On April 26th – 27th Shahab Sokhansanj participated in the Stage Gate Review of the FDC Enterprises logistics project “Design and Demonstration of an Advanced Agricultural Feedstock Supply System for Lignocellulosic Bioenergy Production.” The review was held in Pella, Iowa. Fred Circle, project PI, Kevin Comer, Bill Bilden, Jason Wimpey, Gary Kelderman, Dave Jordan, and Bill Blankenship, project Co-PI’s, participated in the review and made oral presentations. Sam Tagore, Steve Thomas, William Schroed represented DOE. An additional 10 people involved in the project were present.

ORNL is associated with two of the eight winning proposals to the FY10 DOE- United States Department of Agriculture (USDA) Biomass Research and Development Initiative call. ORNL (Paul Leiby, Rocio Urias-Martinez, Erin Webb and Robin Graham) will be providing bioenergy resources and risk assessment expertise to Excelus, Inc., while Erin Webb will be providing feedstock logistics expertise to the University of Kentucky. The respective winning proposals are

- Exelus, Inc., Livingston, NJ, \$5,185,004. Exelus will work to develop energy crops with improved tolerance to drought and salt stress to enhance yields on marginal lands. The project will also redesign a process to make hydrocarbon fuels using new catalysts and chemistry that avoids the high temperatures and large energy inputs required by current processes.
- University of Kentucky, Lexington, KY, \$6,932,786. The purpose of this project is to improve the economics for biorefineries by using on-farm processing to convert biomass to a mixture of butanol, ethanol, acetone and organic acids. The product can then be easily transported to a biorefinery for further processing. The project will integrate input from experts in a variety of disciplines, including plant and soil scientists, horticulturists, chemical engineers, and economists.

Hector Castro was awarded a travel grant by the Enzymes in the Environment Research Coordination Network to attend the conference Ecology of Soil Microorganisms: Microbes as Important Drivers of Soil Processes from April 27th to May 1st in Prague, Czech Republic. He presented a poster entitled "Effect of switchgrass cultivar type, nitrogen fertilization and land management in microbial abundance and processes" authored by H. F. Castro, J. H. Campbell, M. K. Kerley, C. T. Garten, and C. W. Schadt.

ORNL DAAC manager, Chris Lenhardt, participated in a briefing on ESIP Federation activities with representatives of the Geosciences Directorate of the National Science Foundation on April 28th.

Vince Neary attended the Global Marine Renewable Energy Conference in Washington, DC, on April 28th-29th. Vince will represent ORNL in an expert panel discussion on MHK technology research and development by DOE labs organized by DOE headquarters and chaired by Mike Reed.

Also on April 28th-29th Laurence Eaton attended the Council on Sustainable Bioenergy Production work group and Task Force meeting, followed by an open board meeting in Washington, DC.

Throughout the month, ORNL provided contributions and guidance for the development of a draft Vision and Action Plan document for the Global Sustainable Bioenergy Project (GSB) Stage 2, which was presented to the GSB Board April 29th.

On April 28th-30th Mark Downing attended the Woody Biomass Energy Research Symposium for the Northern Forest at the University of Vermont that brought together researchers, community members, policy-makers, agency representatives, funders, non-profits and interested businesses to present current research, identify information needs, and build relationships among those working on woody biomass energy issues in the Northern Forest Region. Mark presented the results of the Energy Efficiency and Renewable Energy (EERE) DOE Biopower Technical Strategy Workshop Summary Report from a Meeting held in Denver, CO, in December 2009. The report is available online at the OBP Website: <http://www.eere.energy.gov/biomass>.

On April 29th Shahab Sokhansanj met with Professor Anton Friedl, Head of the Research Division, Thermal Process Engineering and Simulation at the Institute of Chemical Engineering, Vienna University of Technology. The discussion was on developing joint research projects on standardization of biomass quality for Bioenergy.

BESD New Arrivals

Laurence Eaton reported to work in April, working as a Natural Resource and Environmental Economist with Mark Downing in ESD's Renewable Energy Systems Group. Laurence will be working on the economics of Biomass feedstock sources. He has spent the last two years on a post-Masters appointment in ESD working with Bob Perlack on the Update to the Billion Ton Study.