# B&ESD Newsletter
# August 2011

## Pubs and Products

On August 16th Abhijeet Borole and Choo Hamilton were awarded a U.S. Patent (7,998,724) for their new process, Removal of Mercury from Coal Via a Microbial Pretreatment Process.

On August 2nd Baohua Gu, Chuanmin Ruan, and Wei Wang were awarded a U.S. Patent (7,989,211) for their new process, Functionalized Gold Surface-Enhanced Raman Scattering Substrate for Rapid and Ultra-sensitive Detection of Anionic Species in the Environment.

Jager, H. I., Bevelhimer, M. S., King, R. L., and K. A. Smith. 2011. Landscape influences on headwater streams on Fort Stewart, Georgia, USA. *Environ. Manage.* 4: 795-807.

Johs, A., Harwood, I. M., Parks, J. M., Nauss, R., Smith, J. C., Liang, L., and S. M. Miller. 2011. Structural characterization of intramolecular Hg2+ transfer between flexibly linked domains of mercuric ion reductase. *J. Mol. Biol.* Available online. DOI: 10.1016/j.jmb.2011.08.042

Kao, S.-C., and A. R. Ganguly. 2011. Intensity, duration, and frequency of precipitation extremes under 21st-century warming scenarios. *J. Geophys. Res.* 116: D16119.

Mani, S., and S. Sokhansanj. 2011. Granulation of lignocellulosic biomass powders. ASABE Paper No. 1111728. Presented at the ASABE Annual Meeting in Louisville, KY, August 7-10: ASABE.

Norby, R. J., and D. R. Zak. 2011. Ecological lessons from free-air CO2 enrichment (FACE) experiments. *Annu. Rev. Ecol. Evol. Syst.* 42: 181-203.

Shao, X., Raman, B., Zhu, M., Mielenz, J. R., Brown, S. D., Guss, A. M., and L. R. Lynd. 2011. Mutant selection and phenotypic and genetic characterization of ethanol-tolerant strains of Clostridium thermocellum. *Appl. Microbiol. Biot.* Available online. DOI: 10.1007/s00253-011-3492-z

Sokhansanj, S., Peng, J., Bi, X., Lim, C. J., and J. S. Tumuluru. 2011. Physical characteristics of pellets made from torrefied wood. ASABE Paper No. 1110464. Presented at the ASABE Annual Meeting in Louisville, KY, August 7-10: ASABE.

Sokhansanj, S., Tooyserkani, Z., and P. S. Lam. 2011. Physical characteristics of pellets made from steam exploded biomass. ASABE Paper No. 1110465. Presented at the ASABE Annual Meeting in Louisville, KY, August 7-10: ASABE.

Sokhansanj, S., Tumuluru, J. S., Wright, C., and R. Boardman. 2011. Simplified design equations for a moving bed biomass torrefaction process. ASABE Paper No. 1110463. Presented at the ASABE Annual Meeting in Louisville, KY, August 7-10: ASABE.

Tooyserkani, Z., Sokhansanj, S., Bi, X., and C. J. Lim. 2011. Steam explosion of bark and stem wood to produce pelletized feedstock for bioethanol production. ASABE Paper No. 1111642. Presented at the ASABE Annual Meeting in Louisville, KY, August 7-10: ASABE.

Tumuluru, J. S., Boardman, R., Wright, C. T., and S. Sokhansanj. 2011. A review on issues and pretreatment methods to successfully cofire biomass and coal. ASABE Paper No. 1110458. Presented at the ASABE Annual Meeting in Louisville, KY, August 7-10: ASABE.

Tumuluru, J. S., Boardman, R., Wright, C. T., and S. Sokhansanj. 2011. A review on torrefaction process and product properties and design of moving bed torrefaction system for biomass processing. ASABE Paper No. 1110459. Presented at the ASABE Annual Meeting in Louisville, KY, August 7-10: ASABE.

U.S. Department of Energy. 2011. U.S. Billion-Ton Update: Biomass Supply for a Bioenergy and Bioproducts Industry. R. D. Perlack and B. J. Stokes (Leads), ORNL/TM-2011/224. Oak Ridge National Laboratory, Oak Ridge, TN. 227p.

Vishnivetskaya, T. A., Raman, B., Phelps, T. J., Podar, M., and J. G. Elkins. 2011. Cellulolytic microorganisms from thermal environments. In R. P. Anitori (Ed.), *Extremophiles: Microbiology and Biotechnology*. U.S.A.: Caister Academic Press.

Wang, S., Chang, Y., Guo, J., Zeng, Q., Ellis, B.E., and J.G. Chen. 2011. Arabidopsis ovate family proteins, a novel transcriptional repressor family, control multiple aspects of plant growth and development. *PLoS One* 6(8): e23896.

Weber, C. F., Zak, D. R., Hungate, B. A., Jackson, R. B., Vilgalys, R., Evans, R. D., Schadt, C. W., Megonigal, J. P., and C. R. Kuske. 2011. Responses of soil cellulolytic fungal communities to elevated atmospheric CO2 are complex and variable across five ecosystems. *Environ. Microbiol.* Available online. DOI: 10.1111/j.1462-2920.2011.02548.x

Weston, D. J., Karve, A. A., Gunter, L. E., Jawdy, S. S., Yang, X., Allen, S. M., and S. D. Wullschleger. 2011. Comparative physiology and transcriptional networks underlying the heat shock response in *Populus trichocarpa*, *Arabidopsis thaliana* and *Glycine max*. *Plant Cell Environ.* 34: 1488-1506.

Yang, X., Li, T., Weston, D., Karve, A., Labbé, J., Gunter, L. E., Sukumar, P., Borland, A., Chen, J.-G., Wullschleger, S. D., Tschaplinski, T. J., and G. A. Tuskan. 2011. Innovative biological solutions to challenges in sustainable biofuels production. In M. A. dos Santos Bernardes (Ed.), *Biofuel production – recent developments and prospects* (pp.375-414). Croatia: Intech.

## Notable Achievements

Bob Cook was highlighted in the July issue of Oak Ridge National Laboratory's (ORNL) Climate Change Science Institute (CCSI) Newsletter. See http://www.climatechangescience.ornl.gov/ to learn more about the CCSI.

On August 1st Andy Lawson (supported by Keith Kline, Allen McBride and Laurence Eaton) presented an overview on "How U.S. biofuel policies have affected land use trends in the U.S" to the bioenergy bi-weekly meeting.

Also on August 1st Esther Parish provided a newly formed K-12 educational organization, the Tennessee Youth Environmental Network (TennYEN), with information about general and

ORNL-specific resources related to bioenergy and climate change. TennYEN's overall goal is to empower Tennessee's youth to transition their communities towards sustainability.

On August 1st, 8th and 15th Keith Kline participated in conference calls led by Kathy Halvorsen (Michigan Tech University) on the Research Coordination Network on Pan American Biofuels and Bioenergy Sustainability (RCN). The RCN project is supported by a National Science Foundation (NSF) grant approved in July 2011 and aims to: develop coordinated research programs and new knowledge on social, environmental, and economic sustainability implications of large-scale biofuels/bioenergy production in the Americas.

On August 2nd-3rd Virginia Dale attended the Environmental Protection Agency's National Center for Environmental Assessment (NCEA) Scenario Workshop for Development of Future Scenarios for Biofuels to 2050 in Arlington, VA.

On August 2nd, 11th, 23rd and 29th Keith Kline and Maggie Stevens participated in planning and management of International Standards Organization (ISO) Project Committee 248 (Sustainable Criteria for Bioenergy) Work Group 4 webinars, developing a draft sub-report and accompanying annotated bibliography to help determine how to address food-fuel issues and direct versus indirect effects. On August 31st a draft biofuels and food-security report was completed with significant ORNL contributions.

Rich Norby participated in a workshop at the University of Sydney (Australia) on "Forest Sensitivity to $CO_2$."

On August 4th Virginia Dale participated in conference calls with Steve Kelly (North Carolina State University) and others who are a part of the Southeastern Partnership for Integrated Biomass Supply Systems (IBIS) project regarding ways to implement measures of environmental sustainability and to incorporate them into models as part of the project.

On August 5th Keith Kline participated as an invited expert in a renewable fuel strategy discussion with representatives from industry, academia, government and civil society, focusing on research needs and publications that could be "additive and influential" in the evolving debate about 2nd generation biofuel technologies. The current state of sustainability science and key gaps related to analysis of emerging empirical data, food/fuel issues, and international development, were discussed.

Jerry Parks Served as a member of the Committee on Proposal Evaluation for allocation of Supercomputing Time for the Study of Molecular Dynamics, National Academy of Sciences, Washington, D.C., August 5th-6th.

Dr. Robert (Bob) O'Neill has won the Distinguished Career Award in Landscape Ecology from the International Association for Landscape Ecology (IALE - http://www.landscape-ecology.org/). The award was presented at the IALE World Congress in August in Beijing, China. Bob began his work at ORNL in 1967 and become a Corporate Fellow in 1996. He is recognized for his pioneering research in ecosystem theory, ecological modeling, error analysis, hierarchy theory, and landscape ecology and for the development of basic applications in risk assessment and regional environmental analysis. He is now retired from ORNL but still lives in Oak Ridge and is engaged in consulting related to landscape ecology. For more information about Bob, see http://www.ornl.gov/info/awards/cf/cfcitations/cfbios/oneill.htm.

Rich Norby chaired an organized oral session at the Ecological Society of America annual meeting (August 7th-12th, Austin, TX) on "Measuring and Modeling Roots, the Rhizosphere, and Microbial Processes Belowground."

During August 7th-10th Shahab Sokhansanj and Erin Webb attended the annual international meeting of the American Society of Agricultural and Biological Engineers (ASABE) in Louisville, KY. Shahab authored or co-authored several papers that were presented at this meeting.

On August 9th Keith Kline and Virginia Dale talked with Myrna Lopez regarding her interest in energy and environmental security in Latin America. Ms. Lopez is a part of the U.S. Southern Command (SOUTHCOM), which directs U.S. military activities throughout Central and South America and much of the Caribbean.

On August 9th-11th Mark Downing attended the 6th Annual Southeast Bioenergy Conference at Tifton, GA (http://www.sebioenergy.org/). Mark also attended the side meeting on August 11th regarding the organization of the United States Department of Agriculture (USDA) Southeast Regional Biomass Research Center.

On August 10th Matt Langholtz organized a demonstration of a biobaler at the University of Tennessee (UT) Arboretum.

Also on August 10th Shahab Sokhansanj participated in the stage gate review of the Department of Energy (DOE) logistics project "Development and Deployment of a Short Rotation Woody Crops Harvesting System Based on a Case New Holland Forage Harvester and SRC Woody Crop Header." The project is conducted by the State University of New York (SUNY) in partnership with GreenWood Tree Farms and the Farm equipment manufacturer CNH (Case New Holland). The project develops and tests a single pass cut and chip harvester combined with a handling, transportation and storage system for a range of different short rotation (SRWC) willow and hybrid poplar. The project will also evaluate the impact of harvesting improvements on the economics of SRWC feedstock supply systems on delivered cost and environmental impact of logistics of supplying SWRC to a specific biorefinery. The test sites are willow plantations in the Eastern U.S. and poplar plantations in Oregon and Washington. GreenWood operates more than 24000 tree farms in Oregon and more than 6000 acres in Washington. CNH is the second largest farm equipment manufacturer in the United States. The DOE Stage Gate Review took place in Boardman, WA.

On August 11th Andy Lawson presented his poster on "How U.S. Biofuel Policies Have Affected Land Use Trends in the U.S." at the annual ORNL Summer Poster Session attended by approximately 350 people.

On August 12th the ORNL press release, "Single microbial gene linked to increased ethanol tolerance," was made available. It highlights work led by Steve Brown and completed by a team at the BioEnergy Science Center (BESC). Read the press release online at http://www.ornl.gov/info/features/get_feature.cfm?FeatureNumber=f20110812-00. This press release corresponds to a journal article in the *Proceedings of the National Academy of Sciences* (PNAS): Mutant alcohol dehydrogenase leads to improved ethanol tolerance, including coauthors from the Biosciences Division (BSD) and BESC. Read the full paper online at http://www.pnas.org/content/early/2011/08/03/1102444108.full.pdf. The news was also highlighted on the DOE website (http://energy.gov/articles/single-key-gene-discovery-could-

streamline-production-biofuels) and was commented upon by U.S. Secretary of Energy Steven Chu.

ORNL Distributed Active Archive Center (DAAC) Chief Scientist Bob Cook participated in the 2011 DataCite Summer Meeting in Berkeley, CA.

On August 14th-18th Keith Kline presented "Indicators to support environmental sustainability of agricultural production and bioenergy crops" at the Brazilian Bio-Energy Science and Technology (BBEST) Conference in São Paulo, Brazil.

Also during August 14th-18th and in conjunction with the BBEST Conference in São Paulo, Brazil, Keith Kline participated in parallel meetings of the Executive Committee of the Global Sustainable Bioenergy Project, met with Jose Goldemberg of University São Paulo to brief him prior to meetings related to the U.S.-Brazil Strategic Energy Dialogue (http://energy.gov/articles/us-and-brazil-launch-strategic-energy-dialogue), and met with Luis Cortez, Marcelo Galdos, and other potential Brazilian partners about proposed collaboration in a bilateral Biofuel Sustainability agreement.

Shahab Sokhansanj is responsible for reviewing and updating ASABE Standard S269, Cubes, Pellets, and Crumbles- Definitions and Methods for Determining Density, Durability, and Moisture Content. This standard was originally developed for testing the durability of densified animal feed and is being updated to include measurement of durability and density of densified biomass. The ASABE Committee on Forage & Biomass Engineering reviewed the proposed update modifications during the ASABE meeting in Louisville, KY. The Standard will be balloted for a final approval by December 2011.

On August 16th Virginia Dale, Matt Langholtz, and Esther Parish met with John Schwartz, Sam Jackson, and Tim Rials (UT) to discuss a proposal for analyzing watershed implications of bioenergy. Jon Philipsborn participated via a conference call and will help in drafting the ideas.

Stan Wullschleger, Rich Norby, and David Graham visited Alaska to evaluate potential field sites for the Next-Generation Ecosystem Experiments (NGEE Arctic) project. The trip took place in mid-August with ORNL and other partners from Los Alamos National Laboratory (LANL), Lawrence Berkeley National Laboratory (LBNL), Brookhaven National Laboratory (BNL), and the University of Alaska Fairbanks visiting sites on the Seward Peninsula and the North Slope. The team uploaded daily postings to the NGEE Arctic blog (http://ngee-arctic.blogspot.com/). Stan and a team from LBNL will return to Barrow in late September to conduct an initial geophysical survey of an area that looks promising for a field site. The team anticipates posting daily blogs during this trip.

On August 18th Steve Kelly (North Carolina State University) visited ORNL and met with Virginia Dale, Esther Parish and Allen McBride as well as Tim Rials (UT) to discuss plans for the Southeastern Partnership for Integrated Biomass Supply Systems (IBIS) project.

John Sorensen and Barbara Vogt were coauthors of a paper, The September 29, 2009 Earthquake and Tsunami in American Samoa: A Case Study of Household Evacuation Behavior and the Protective Action Decision Model, presented at the Global Risk Forum (GRF) in Davos, Switzerland. Coauthors included Emma Jane Isobel Apatu, Chris Gregg, Michael K. Lindell and Joel Hillhouse.

Listed on 7 invention disclosures this year, Tim Tschaplinski was awarded the inaugural "Most Prolific BESC Inventor" award at the BESC annual science review meeting in Chattanooga, TN.

During August 21st-25th Virginia Dale presented "Integrating climate change with land-use change" at the 4th World Conference on Ecological Restoration of the Society for Ecological Restoration (SER) in Mérida, Mexico.

Stan Wullschleger was invited to participate in an upcoming Biological and Environmental Research (BER) Modeling Science Principal Investigator meeting in Washington, D.C. He was asked to talk about the new NGEE project, the goals of this project to understand ecosystem-climate feedbacks in the Arctic due to permafrost thaw and degradation, and representation of that knowledge in climate models. Stan was also invited by the Barrow Arctic Science Consortium (BASC) to give a community lecture in Barrow, Alaska, on the topic of "Climate change experiments: How do scientists study future environments?" as part of a BASC-sponsored Schoolyard Saturday program.

The "U.S. Billion-Ton Update Report: Biomass supply for a bioenergy and bioproducts industry" has been released to the public. Secretary Chu announced its release and the release of all the underlying modeling data through the Bioenergy Knowledge Discovery Framework (KDF) - an ORNL web site (https://bioenergykdf.net/). The report was lead by Bob Perlack at ORNL and has multiple contributors including 9 from ORNL and was 2 years in the making. The report provides estimates of the potential supplies (cost and quantity) of biomass in the U.S. from 2012 to 2030.

On August 23rd a presentation of the recently released DOE study "U.S. Billion-ton Update: Biomass Supply for a Bioenergy and Bioproducts Industry" was made to the Biomass R&D Technical Advisory Council in Champaign, IL, by Laurence Eaton upon the invitation of Eliot Levine, the Designated Federal Officer for the Committee. The presentation can be found on the ORNL Bioenergy Website (http://www.ornl.gov/sci/bioenergy/presentations.shtml).

During August 23rd-24th Robin Graham attended the Biomass Densification Workshop: Transforming Biomass into Feedstock sponsored by U.S.-DOE's Office of Biomass Program (OBP), Office of Science (SC), and the Advanced Research Projects Agency Energy (ARPA-E).

Brennan Smith visited with DOE headquarters contacts in Washington, D.C., during August 23rd-26th.

On August 25th Jay Chen presented an invited seminar entitled "Discovery and molecular characterization of regulators of biomass recalcitrance in Populus" at the Tennessee Plant Research Center.

On August 29th Dave Muth of Idaho National Laboratory visited ORNL to coordinate with the Environmental Sciences Division (ESD) (Laurence Eaton) and Geographic Information Science and Technology (GIST) researchers (Aaron Myers and Phil Nugent) to integrate the Biomass Sample Library with the Sun Grant Initiative Field Trial Partners Data. The result of this coordination will be available through the KDF in an interactive map of OBP-funded and leveraged sites of energy crop and crop residue field trials.

During August 29th–30th Chris Lenhardt, ORNL DAAC Manager and current Earth Science Information Partners (ESIP) Federation President, participated in meetings in Washington, D.C., related to ESIP interactions with agency partners including the National Science Foundation

(NSF), USDA, the National Oceanic and Atmospheric Administration (NOAA), and the National Aeronautics and Space Administration (NASA).

Brennan Smith traveled to Boulder, CO, to participate in discussions regarding the Mid-C RiverWare Model review and validation on August 30th–September 1st.

On August 31st Gangsheng Wang and Keith Kline submitted written comments regarding issues of uncertainty and data confidentiality for Work Group 2 (Greenhouse Gas [GHG] methods) for the International Organization for Standardization (ISO) draft working standard on criteria for sustainable bioenergy.

**BESD New Arrivals**

Shishi Liu arrived in August to work as a postdoctoral research associate with Bob Cook. Shishi will perform Geographic Information System (GIS) analysis to retrieve, store, manipulate, and process geospatial data, as well as deploy GIS data in the ORNL DAAC WebGIS environment.

Xiaofeng Xu also arrived in August to work as a postdoctoral research associate with Peter Thornton. Xiaofeng's research will include study of the biogeochemical response of permafrost soils to warming and changes in water content.