

B&ESD Newsletter
May 2012

Pubs and Products

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Cheng, C. L., Kang, M., Perfect, E., Voisin, S., Horita, J., Bilheux, H. Z., Warren, J. M., Jacobson, D. L., and D. S. Hussey. 2012. Average soil water retention curves measured by neutron radiography. *Soil Sci. Soc. Am. J.* Available online. DOI: 10.2136/sssaj2011.0313

Wright, L. L., Eaton, L. M., Perlack, R. D., and B. J. Stokes. 2012. Woody Biomass. In A. Sayigh (Ed.), *Comprehensive Renewable Energy, Vol. 5* (pp. 263-291). Oxford: Elsevier.

Notable Achievements

Upon the invitation of Tongming Yin of the Nanjing Forestry University in China, Gerald Tuskan presented and discussed possible collaborative efforts during April 27th-May 6th.

During April 30th-May 2nd the subsurface biogeochemical research staff participated the Subsurface Biogeochemical Research (SBR) Principal Investigator (PI) meeting in Washington,

DC. Scott Brooks, Baohua Gu, and Jeremy Smith made oral presentations. S. Brooks, B. Gu, and L. Liang co-organized three breakout sessions. Other staff that participated in the meeting included Feng He, Alex Johs, Jerry Parks, Dwayne Elias, Carrie Miller, Dave Watson, Guoping Tang, Demian Riccardi and Hao-Bo Guo.

The 34th Symposium on Biotechnology for Fuels and Chemicals was held April 30th – May 3rd in New Orleans, LA. The symposium was hosted by Oak Ridge National Laboratory (ORNL) and the National Renewable Energy Laboratory (NREL), and co-chaired by Jonathan Mielenz of the BioEnergy Science Center (BESC). Paul Gilna presented an overview of BESC science, research and accomplishments during the Wednesday evening single special topic session on U.S. and International Bioenergy Research that was chaired by Brian Davison. Mark Nimlos and Adam Guss served as chairs for two separate sessions at the symposium. Representations of BESC work were presented during the scheduled posted sessions.

Shahab Sokhansanj had the following contributions to the Society for Industrial Microbiology and Biotechnology conference in New Orleans, LA:

Lam, P. K., S. Sokhansanj, X. Bi, C. J. Lim, and Z. Tooyserkani. Kinetics of polysaccharides depolymerization and pseudolignin formation in steam treated softwood for torrefaction and pelletization.

Tooyserkani, Z., L. Kumar, S. Sokhansanj, J. Saddler, X. Bi, and J. Lim. Steam treatment of softwood particles to produce durable pellets for bioconversion.

On May 1st Shahab Sokhansanj participated in the site visit for review on the establishment of a Natural Sciences and Engineering Research Council of Canada (NSERC) Strategic Network on Bio-carbon. The reviewers were Stefan Czernik (NREL), Adriana Downie (Pacific Pyrolysis Pty Ltd., Australia), James Amonette (PNNL), Christopher Saffron (Michigan State University), Digvir Jayas (University of Manitoba), Chair, and Lynda Wood, NSERC Consultant. The objective of the network is to conduct research and development on solid fraction of pyrolytic reactions. Shahab Sokhansanj leads the Feedstock logistics and interface theme. The meeting was held in London, Ontario, Canada.

During May 1st-2nd Keith Kline made the opening presentation on "The Importance of Sustainability" as an invited speaker in the "Sustainable Energy Symposium" hosted by Kansas State University. He also served on an international panel discussion of the International Organization for Standardization (ISO) and other initiatives to develop standards for bioenergy sustainability. Symposium participants included private industry leaders, faculty and graduate students participating in a National Science Foundation Integrative Graduate Education and Research Training (IGERT) "I-STAR Bioenergy" Program (integrating Socioeconomic, Technical and Agricultural Aspects of Bioenergy).

Wellington Muchero and Jay Chen in collaboration with scientists at NREL were awarded beam time by the Lawrence Berkeley National Laboratory's Advanced Light Source (ALS) user facility to conduct experiments under a proposal titled "Imaging mass spectroscopy of tissue-specific plant cell wall composition using laser desorption and vacuum ultraviolet (VUV) photoionization."

The ORNL Distributed Active Archive Center (DAAC) held its annual User Working Group (UWG) Meeting at the Goddard Space Flight Center (GSFC) in Greenbelt, MD, on May 1st-2nd. The UWG was supportive of the DAAC's current activities and had some recommendations (posted on the UWG Web site) for future activities.

Amy Wolfe served as a Site Visit Team member, charged with reviewing the National Science Foundation's Center for Nanotechnology in Society at Arizona State University. The Site Visit Team conducted its annual review in Tempe, AZ, during May 2nd–4th, and is finalizing its report. The Team was chaired by Bruce Seely (Dean, College of Sciences and Arts, Michigan Technological University). Other members were Rosalyn Berne (University of Virginia) and John Stone (Michigan State University).

Natalie Griffiths attended the Society for Freshwater Science annual meeting in Louisville, KY, where she presented on work conducted in the West Fork of Walker Branch (talk titled: Influence of dual nitrogen and phosphorus additions on nutrient uptake and saturation kinetics in a forested headwater streams). Co-authors on her presentation were Laura T. Johnson and Patrick J. Mulholland.

ORNL DAAC Manager, Chris Lenhardt, attended the Data-Enabled Life Sciences Alliance (DELSA) Workshop II in Bethesda, MD, on May 3rd.

On May 3rd and 14th Maggie Davis participated in ISO PC248 Expert Work Group 4 (WG4) planning meetings to develop a new work plan for WG4 under the updated mandate, "to inform the PC at the next plenary on new scientific research including issues surrounding definitions, system boundaries and responsibilities relevant to the issue of indirect effects." Seven webinars are planned from June to December 2012 to update the 60 page Annotated Bibliography with critical assessments related to indirect effects.

Suresh K. SanthanaVannan attended the Moderate Resolution Imaging Spectroradiometer (MODIS) Science team meeting in Silver Spring, MD, during May 7th-9th.

In 2010, Public Service Enterprise Group (PSEG) submitted to the U.S. Nuclear Regulatory Commission (NRC) an application for an Early Site Permit (ESP) at the PSEG ESP site in Salem County, NJ. The ESP site is located north of and adjacent to two existing PSEG nuclear power plants, Salem Generating Station (SGS) and Hope Creek Generating Station (HCGS), on Artificial Island on the east bank of the Delaware River. Staff from the Environmental Sciences Division (ESD) is assisting NRC staff with the environmental review of the proposed ESP, which would allow PSEG to "bank" the site for developing one or two new reactors within 20 years of ESP issuance (however, PSEG would still need to obtain a Combined License [COL] from the NRC to actually construct and operate the reactors). During the week of May 7th-11th, the ORNL team (which is led by ESD's Bo Saulsbury and includes nine other ORNL staff members, three Pacific Northwest National Laboratory staff members, and one staff member each from Argonne National Laboratory and Brookhaven National Laboratory) traveled to Salem, NJ, to join staff from the NRC, the U.S. Army Corps of Engineers, and various Federal and State agencies in conducting an Environmental Site Audit for the ESP application. Site Audit participants began the week by touring the PSEG ESP site and other areas that could be affected by construction and operation of the new nuclear unit(s), including the existing SGS/HCGS site. Participants then spent the rest of the week meeting with PSEG staff and consultants to discuss the ESP application and possible requests for additional information for the environmental review. The NRC/ORNL team will document the findings of its review in an Environmental Impact Statement (EIS) that will evaluate the potential environmental impacts of constructing and operating a new unit(s) at the ESP site. The draft EIS is scheduled for publication in the spring or summer of 2013.

From May 7th to May 15th a team from the Plant Microbe Interfaces Science Focus Area (SFA) took various samples from over 200 trees from experimental *Populus trichocarpa* plantations in

Clatskanie and Corvallis, OR. Over 600 personnel hours were recorded in the field for a team including Chris Schadt, Jerry Tuskan, Nancy Engle, Wellington Muchero, Jessy Labbé and Karuna Chourey from ORNL; three collaborators from Duke University; and another collaborator from the University of Washington. These samples are being processed for community ribosomal ribonucleic acid (rRNA) sequence analysis, as well as more limited metagenomic sequencing, by the Joint Genome Institute through the Community Sequencing User Program (CSP) as part of an ongoing collaboration led by Chris Schadt and Jerry Tuskan. Some results are already available. Dale Pelletier's group has isolated over 1700 bacterial colonies from the samples and Rytas Vilgalys and Greg Bonito (Duke) have verified a novel ectomycorrhizal fungal species of the genus *Tuber* (true truffles).

ORNL developed a set of 16 socioeconomic sustainability indicators that were the centerpiece for the Department of Energy (DOE) workshop, Social Aspects of Bioenergy Sustainability on April 24th in Washington, DC, and a subsequent webinar on May 8th. The workshop identified knowledge gaps and implementation challenges, as well as R&D recommendations for the suite of proposed indicators. In the webinar, Virginia Dale reviewed the proposed indicators of: social well-being (employment, work lost due to injury, household income, and food security), social acceptability (public opinion, transparency, effective stakeholder participation, and risk of catastrophe), and trade (energy security premium, fuel supply stability, terms of trade, trade volume). Rebecca Efroymson presented a summary of recommendations of the social acceptability subgroup at the workshop and webinar.

On May 8th Shahab Sokhansanj participated in a meeting with the Allis-Gleaner Corporation (AGCO) in Kansas City, MO. The purpose of this meeting was to review new data and discuss modeling efforts of DOE's High Tonnage Logistics project. Participants in this meeting were Pat Kendrick (AGCO), Maynard Herron (AGCO), Ed Brakesh (Kansas State University), Matt Darr (Idaho State University), Levi Powell (Idaho State University), Sam Tagore (Office of the Biomass Program [OBP]), Kevin Kenney (Idaho National Laboratory), Shahab Sokhansanj (ORNL) and Erin Web (ORNL).

On May 9th Shahab Sokhansanj met Al Womac at the University of Tennessee. They reviewed new data on harvest, handling, and storage of switchgrass. The work is part of the DOE-funded high tonnage logistics project handling switchgrass, and harvest of switchgrass has been completed. The harvested acreage has been around 200 acres yielding 1000 tons of switchgrass. A forage harvester achieved consistently a close tolerance in producing ½' length of cut. Average moisture content (m.c.) was 13% but some harvested at a maximum of 20% m.c. A bulk density of about 6 lb/ft³ in the high dump and in the forage truck was achieved. Two high dump filled one truck (52 cu yard). About 200 truckloads totaling 756 dry ton switchgrass were transported to Vonore site. Transport cost to the project averaged \$20/dry ton.

On May 9th, 15th, 22nd, and 24th Maggie Davis participated in ISO PC248 Expert Work Group 3 webinars and contributed to efforts to resolve issues about "transparency," "confidentiality," "legality," "respect for international norms of behaviors," and "flexibility/relevance" and finalize principles, criteria, and indicators on social aspects of bioenergy sustainability.

DAAC Manager, Chris Lenhardt, participated in a telecon of the Earth Science Information Partners (ESIP) Federation Executive Committee as the Interim Chair of the Constitution and Bylaws Committee on May 10th.

Wellington Muchero and Gerald Tuskan along with researchers from Michigan Tech University and the National Renewable Energy Laboratory (NREL) have been awarded funding for a

proposal titled “Functional gene discovery and characterization of genes and alleles affecting wood biomass yield and quality in Populus,” submitted in response to the “Plant Feedstock Genomics for Bioenergy: A Joint Research Funding Opportunity Announcement” by the United States Department of Agriculture (USDA) and DOE.

Bob Hettich and Steve Brown spent May 10th-11th at Dartmouth College with Lee Lynd’s group and at Mascoma. The goal of the visit was to pursue technical discussions on inter-laboratory BESC collaborative research for data analysis/manuscript preparations, as well as planning for specific research campaigns for BESC2. Significant collaborative research emphasis has been given to the application of "omics" approaches for characterizing ethanol tolerance in *C. thermocellum*, quantification of structural and enzymatic components of the *C. thermocellum* cellulosome, and deoxyribonucleic acid (DNA) and RNA characterization of *C. thermocellum* variants. Discussion was focused on remaining data analyses and manuscript writing needs in each case. Collaborative work for BESC2 was discussed in detail, directed at optimizing experimental design (types of samples, types of measurements needed, etc.) for both *C. thermocellum* (Dartmouth) and yeast (Mascoma).

DAAC Scientist, Bob Cook, participated in a DataONE workshop during May 13th – 19th.

On May 14th Shahab Sokhansanj and his research team held their fourth meeting with Vattenfall in Vancouver, Canada. Vattenfall is one of Europe’s largest generators of electricity and the largest producer of heat. In electricity and heat, Vattenfall works in all parts of the value chain: generation, distribution and sales. The group has slightly more than 38,000 employees. Vattenfall is planning to develop and install several plants in North America to produce torrefied pellets. This meeting was attended by Peter Kontny, Daniel Hultquist, and Stefan Dusan. They would like us to initiate and conduct research on feedstock quality: wood species, particle size of wood chips, moisture content of wood chips, torrefaction temperature, torrefaction time. Our research team is preparing a proposal to be submitted to Vattenfall.

Tatiana Vishnivetskaya gave the invited talk "From fire to ice: life in extreme environments" at the University of Nebraska Department of Biochemistry and Molecular Biology on May 14th.

During May 14th-15th Keith Kline presented “Indicators to support sustainability assessment of energy systems and biodiversity” as an invited speaker at the World Renewable Energy Forum (WREF) in Denver, CO (www.ases.org/conference/). He participated in the session titled, “Impacts of Renewable Fuels: Environmental, Social and Economic Sustainability” and contributed to a lively debate on issues surrounding land-use change estimation. Virginia Dale, Rebecca Efroymsen and Latha Baskaran contributed to the talk.

The seed proposal, High-Performance Computer Simulation Study of the Mechanism of Nerve Agent Degradation by an Enzymatic Bioscavenger, by Jerry Parks with Co-PIs Jeremy Smith and Paul Langan, has been funded.

Aloki Kumar presented proposal S12-048, entitled, “The role of geometric structures and hydrodynamics on microbial adhesion and colonization.” S. T. Retterer, D. A. Pelletier, and M. J. Doktycz were co-authors. The Committee recommended that the proposal be funded for the requested amount of \$189,639.

DAAC Manager, Chris Lenhardt attended the National Oceanic and Atmospheric Administration (NOAA) Environmental Data Meeting in Adelphi, MD, on May 15th.

Loukas Petridis presented the a talk "Computer Simulation of Lignocellulosic Biomass" at the Graphics Processing Unit (GPU) Technology Conference on May 15th in San Jose, CA.

During May 15th-16th Esther Parish and Virginia Dale participated in a workshop that addressed modeling aspects of the 5-year Integrated Biomass Supply System (IBSS) Program. The workshop was sponsored by the Department of Agricultural & Resource Economics and the Center for Renewable Carbon at the University of Tennessee.

DAAC Manager, Chris Lenhardt participated in the Alaska Satellite Facility (ASF) User Working Group (UWG) meeting held in Washington, DC, on May 16th and 17th.

Brennan Smith traveled with Mike Sale and Shih-Chieh Kao to Denver, CO, to attend the Small Hydropower Association Meeting (May 16th-May 18th). Brennan presented a summary of the non-powered dams (NPD) resource assessment effort and new site development effort.

Gerald Tuskan was a keynote speaker at the 28th New Phytologist Symposium Functions & Ecology of the Plant Microbiome (May 16th-22nd in Rhodes, Greece). He presented the talk, "Plant microbe interactions in the Populus rhizosphere."

On May 17th Virginia Dale and Keith Kline discussed the Multiyear Program Plan (MYPP) of OBP with Kristen Johnson and Ranyee Chiang and shared a written summary of key points from the discussion on May 25th.

DAAC Manager, Chris Lenhardt helped to give a briefing on ESIP to the United States Global Change Research Program (USGCRP) National Coordinating Office on May 17th in Washington, DC.

On May 18th Keith Kline participated in ISO PC248 Expert Work Group 2 webinar #10 (held 3AM-5AM to enable participation of representatives from Australia, China and Pakistan) and contributed to efforts to resolve issues surrounding treatment of "waste" versus "residue," reference case and counterfactual scenarios, opportunity costs and rotation periods, as they affect greenhouse gas (GHG) accounting for bioenergy. Keith also joined three separate webinars organized by Work Groups 1 and 2 to address a list of comments received on the draft Standard.

Shih-Chieh Kao attended the Hydro-Climate Symposium at the World Environmental & Water Resources Congress in Albuquerque, NM. He presented at "Modeling projections of climate change at the regional scale I" and the title of his presentation was "A Quantitative Assessment Framework for Potential Climate Change Impacts on Regional Hydropower Generation."

Ami Riscassi is mentioned in a May 21st article, "CHS students study larvae for mercury analysis," appearing in the *Cherokee One Feather*. Read more online at <http://theonefeather.com/2012/05/chs-students-study-larvae-for-mercury-analysis/>.

During May 21st-25th ORNL hosted a visit from Marcello Moreira, a representative from the Brazilian Institute for International Trade Negotiations (ICONE), to compare parameters of the Global Trade Analysis Project (GTAP) for Dynamic Energy Policy Simulations (DEPS) and ICONE Brazilian Land Use Model (BLUM) models for improved land-use change (LUC) modeling and analysis. Marcelo gave an introductory presentation titled, "Coupling GIS and

economic data into land use models: The Brazilian Land Use Model experience,” to ORNL and University of Tennessee (UT) participants at a special Center for BioEnergy Sustainability (CBES) forum. His presentation can be accessed at the CBES website under “forums”:
<http://www.ornl.gov/sci/ees/cbes/forums.shtml>.

Mike Reed, DOE-HQ Chief Engineer of Water Power Technologies visited ORNL and met with Gary Jacobs, Brennan Smith, Mike Sale and PIs on May 22nd to discuss DOE and ORNL Water Power Technologies activities.

During May 23rd-24th Shahab Sokhansanj participated in a meeting with the Auburn high tonnage logistics team at Auburn University. The participants in this meeting were Steve Taylor (Auburn), Oladiran Fasina (Auburn), Tom Gallagher (Auburn), Robert Rummer and Dana Mitchel (USDA Forest Operations), Frank Corely (Corely Land Services), members of the DOE logistics modeling team: Sam Tagor (OBP), Kevin Kenney (Idaho National Laboratory [INL]) and Shahab Sokhansanj (ORNL). The Auburn project involves harvesting short rotation plantations (12-14 years old) using shear cut (instead of saw cut) in a feller buncher, skidder with a large grapple, disc chipper producing prescribed size chips, and an extended chip van to hold a larger volume of chips. The project also is testing transpirational drying. In this natural system a tree is cut from stump and laid on the ground to dry. The cut tree dries from 45-55% moisture content to 30-35% in about 6 weeks. The performance study is done and calculated in two ways: gross time study where overall system performance (number of trees harvested, areas covered, fuels consumed, etc.) is recorded over a long period of time. Detailed time study is also conducted where machine performance (time-motion study) is evaluated over a few hours of operation. The ratio of Productive Machine Time (PMH) over the Standard Machine Time (SMH) represents utilization of equipment. This utilization ratio has been measured and calculated for a feller buncher at 65%, skidder at 59%, loader at 50%, chipper at 59%. On May 24th the team observed field demonstrations of working equipment around Greenville, AL.

On May 24th Allen McBride and Keith Kline submitted peer review comments on the draft paper, “Indirect Impacts of biofuel production and the RSB Standard” (dated April 13th, 2012) to the Roundtable on Sustainable Biofuels (RSB). The comments and feedback on the specific options proposed were also shared with OBP, Argonne National Laboratory (ANL) and NREL in preparation for a June RSB Chamber 7 meeting.

During May 24th-26th Bo Hadjerioua visited with Vanderbilt university professors, graduate students, and the Corps of Engineers in Nashville, TN, to discuss the “Water quality modeling project.”

On May 25th Debo Oladosu, Maggie Davis, and Keith Kline helped OBP to organize and facilitate a webinar discussion on “Land-Use Change: Current Research, Practices, and Processes for Sustainable Bioenergy Production.” The webinar included presentations by Oladosu improvements to the ORNL GTAP model and by ICONE's Moreira on BLUM. The researchers from ORNL, ANL, INL, Pacific Northwest National Laboratory (PNL), NREL and OBP discussed input parameters and assumptions that influence LUC modeling results to identify options that can address differences and overcome a DOE Sustainability barrier on the “Representation of Land Use (data and model limitations).”

During May 28th-31st Keith Kline and Virginia Dale attended the Pan American Research Coordination Network (RCN) for Biofuels and Bioenergy Sustainability in Merida, Mexico. Keith chaired a session on the Water-Energy Nexus and made an oral presentation on ORNL research related to land-use change analysis. Virginia gave a presentation on sustainability

indicators. Six ORNL posters were presented at the meeting and research collaboration linkages were strengthened. This meeting represented the kick-off of a four-year RCN project led by Michigan Technological University and funded by the National Science Foundation (NSF).

During May 29th-30th the Mercury SFA went through a triennial review. Katherine Ragle helped with the printing materials and posters. The participants were Liyuan Liang, Scott Brooks, Baohua Gu, Dwayne Elias, Jeremy Smith, Jerry Parks, Demian Riccardi, Alex Johs, Carrie Miller, Steve Tomanicek, Balaji Anandha Rao, Ami Riscassi, Tony Palumbo, and Gary Jacobs.

Xiaofeng Xu has been selected as one of scholars attending the Dissertations Initiative for the Advancement of Climate Change Research (DISCCRS) VII Symposium that will be held in Colorado Springs, CO, during October 13th-20th. The goal of the symposium is to develop international, interdisciplinary collegial networks among scholars likely to become leaders in their chosen fields. DISCCRS is supported by NSF and the National Aeronautics and Space Administration (NASA), and is sponsored by the Association of American Geographers (AAG), the Association of Environmental and Resource Economists (AERE), the American Geophysical Union (AGU), the American Meteorological Society (AMS), the Association for the Sciences of Limnology and Oceanography (ASLO), the Ecological Society of America (ESA), the Environmental Studies Section of the International Studies Association (ESS-ISA), the Science, Technology & Environmental Politics section of the American Political Science Association (STEP-APSA), the Oceanography Society (TOS), and the United States Society for Ecological Economics (USSEE). Detailed information about DISCCRS can be found at <http://disccrs.org/>.

During May 29th-June 1st Brennan Smith attended the International Energy Agency (IEA) Hydropower ExCo meeting (Washington, DC) and led the technical tour of Conowingo/Muddy Run hydropower facilities. Brennan presented during the Hydro Optimization Workshop, and participated as the U.S. alternate delegate for Annex II, IX, XI and XII meetings. Brennan also acted as the U.S. alternate delegate for the Executive Committee meeting.

BESD New Arrivals

Joel Keedy arrived in May to work as a post-Bachelors research associate with Aleisa Bloom.

Aaron McClellan is a Higher Education Research Experiences (HERE) student with Bo Hadjerioua. He will be doing data analysis and statistical analysis, quality control, and downloading information about New Site Development resource assessment project. He will also be involved in data collection and analysis for the Total Dissolved Gas (TDG) project. Aaron will further help with reports and presentations.

Clement Oigbokie is a HERE student with Shih-Chieh Kao. He will assist with and gain experience from several DOE-funded hydropower research activities. His work will mainly include collection of hydropower related data from asset owners.

Evan Robinson is a HERE student with Brennan Smith. He will help with analysis of siting issues (geology) for new hydropower development studies. He will also be learning some geographic information system (GIS) skills.

Andrea Rocha arrived in May to work as a postdoctoral research associate with Terry Hazen. Andrea will determine subsurface keystone bacteria species differences in gradients of pH,

nitrate, uranium, and conductivity to enable modeling of microbial community resiliency differences at contaminated sites.

Victoria Sloan arrived in May to work as a postdoctoral research associate with Rich Norby. Victoria will work in the Climate Change Science Institute & Environmental Sciences Division in a Next-Generation Ecosystem Experiment (NGEE) in the Arctic.

Svetlana Stekovich is a HERE student with Vince Neary. She will help in developing and testing the ORNL acoustic Doppler velocimeter (ADV) and acoustic Doppler current profiles (ADCP) post-processing guide and MATLAB algorithms for marine and hydrokinetic (MHK) site flow and turbulence analysis.