



News from the International Biochar Initiative

IBI is a non-profit organization supporting researchers, commercial entities, policy makers, farmers & gardeners, development agents and others committed to sustainable biochar production and use.

Help put the Earth **Back in the Black**

July 2014 News from the International Biochar Initiative

IBI Announces a New Biochar Webinar Series

IBI is excited to announce a new Webinar Series starting in August 2014! The series, held every month or two, will allow IBI to connect you to leaders in the biochar field, from business professionals to producers to academics, who will present cutting-edge information, research and updates to our IBI membership. Each participant will have an opportunity to interact live with the presenter by submitting questions during the webinar, as time permits, for live responses.

You must be a dues-paying member to participate in these special events. (If you are not an IBI member and would like to join, please click here ([link to www.biochar-international.org/join](http://www.biochar-international.org/join)).

Our first webinar will take place on the evening of August 12th (New York time, but the morning of August 13th in Japan) with Steven McGreevy, assistant professor at the Research Institute for Humanity and Nature, Kyoto, Japan presenting “*Biochar in Japan: deep roots, cool landscapes*”. The webinar will trace the long history of charcoal use in Japan, its use in agriculture and other industries, its linkages with resource and traditional landscape management, and its modern reincarnation as biochar. It will highlight a number of contemporary activities that feature biochar as a tool for sustainable rural revitalization, including the eco-branding of climate-friendly vegetables grown with biochar as COOL VEGE™. The future of biochar in Japan as a retro-innovative technology and some lessons from the Japanese biochar experience will also be presented.



If you are interested in attending on August 12th at **7:00pm New York time (EDT)**, you can reserve your webinar seat now at:

<https://www3.gotomeeting.com/register/641472710>. For more information on this program, please see: http://www.biochar-international.org/webinar_series.

Preparing for the **2014 State of the Biochar Industry Report—Survey of biochar businesses coming soon!**

Building on the feedback and results from IBI's *2013 State of the Biochar Industry* report ([link to: http://www.biochar-international.org/State_of_industry_2013](http://www.biochar-international.org/State_of_industry_2013)), IBI is preparing an online survey to collect data to continue reporting on trends, growth and other data on the biochar industry in 2014. In the next week, we will release the survey to request feedback from companies currently operating in the biochar space. This year we are working to make the survey more streamlined and user-friendly in order to increase the response rate, expand our company database (for the 2013 version, please see: http://www.biochar-international.org/sites/default/files/company_list_2013.pdf), and to more fully capture the current state of the biochar industry. It is our intention to put out this survey of biochar business activity and a *State of the Biochar Industry* report annually to better highlight overall trends in the industry.

We encourage you to participate in this survey if you are part of the biochar industry—all data collected (other than company name and website) will be reported in aggregate format so that your information will remain private. If you are on our mailing list, you will receive an announcement when the survey is released; we will also post this announcement on our website.

IBI is also pleased to introduce Ms. Rita Ryan, an industry intern who is working with IBI this summer. Ms. Ryan is an expert in database management and after a long history in the IT Industry she is pursuing a Bachelors of Applied Science in Sustainability Science Management at the University of Hawaii. She has also worked with startup biochar non-profits and companies, and we are grateful for her knowledge on the current state of the biochar industry and her able assistance to IBI.

First Canadian Manufactured Biochar Approved for IBI Biochar Certification: Diacarbon Softwood Biochar

IBI is pleased to announce the certification of the first biochar manufactured in Canada in our *IBI Biochar Certification Program*. Diacarbon Energy Inc. has received IBI certification and can now utilize the *IBI Certified Biochar Seal™* on their product, Diacarbon Softwood Biochar.

To achieve IBI certification, Diacarbon submitted an application for Diacarbon Softwood Biochar that met all of the conditions of the *IBI Biochar Certification Program*, including passing all of the physicochemical testing requirements specified by the *IBI Biochar Standards* (<http://www.biochar-international.org/characterizationstandard>)—the foundation for IBI biochar certification. Although several biochar products manufactured in the United States have been certified, Diacarbon Softwood Biochar is the first Canadian-manufactured biochar to receive IBI biochar certification. The approval of Diacarbon Softwood Biochar signals that leading industry organizations recognize the market value in providing assurances to biochar end-consumers through the display of the *IBI Certified Biochar Seal™*.



IBI's biochar certification program—the first of its kind globally—is a voluntary, self-certifying program created and administered by IBI and fully accessible through an online portal. It enables biochar manufacturers to certify that their product meets industry-accepted standards and is safe and effective for use as a soil amendment. Phase 1 of the *IBI Biochar Certification Program* is being implemented with biochar manufacturers in the United States and Canada. IBI is actively exploring the expansion of the *IBI Biochar Certification Program* to other regions in the future and we will keep our membership abreast of developments.

For further information on Diacarbon Energy Inc. please see: <http://www.diacarbon.com/biochar>.

For further information on the IBI Biochar Certification Program and to view a list of IBI certified biochar manufacturers please see: http://www.biochar-international.org/certification/manufacturere_directory.

Update on Policy Revision of the *IBI Biochar Standards*

In late 2013, IBI initiated a process to conduct a policy revision of the *IBI Biochar Standards*, the leading global biochar characterization standard. Following a public comment period and informational webinars, four proposed policy revisions—addressing biochar weathering, post-processing, sampling, and the use of biomass ash from bioenergy production facilities—were amended this spring and shared with a group of biochar experts for additional feedback. In the coming weeks, IBI will finalize changes to the draft *IBI*

Biochar Standards Version 2.0 based on expert input, and then post the final proposed revisions and a draft V2.0 for public review and voting by IBI membership in the late August timeframe. At that time we will also publish a summary and tally of all comments received during the public comment period and webinars, including an IBI response to each comment.

IBI welcomes all feedback on the proposed revisions—**available for review here** [hyperlink http://www.biochar-international.org/sites/default/files/Public_Comment_IBI_Biochar_Standards_V2.0%20clean.pdf]—as well as general comments on the *IBI Biochar Standards* and invites you to email us your thoughts to standards@biochar-international.org. We are grateful for the constructive feedback received from our members, stakeholders, and the biochar community in this important effort to support the growing biochar industry.

Update on the ACR Methodology for Emissions Reductions from Biochar Projects

The [voluntary carbon offset Methodology for Emissions Reductions from Biochar Projects](#) continues to advance through the final stages of the review process at the American Carbon Registry (ACR), a leading voluntary carbon offset registry. Following a public comment period earlier this year, the methodology—developed by a team comprised of The Climate Trust, The Prasino Group and IBI—is now in the scientific peer review stage. The development team recently responded to nearly 100 comments submitted by an anonymous panel of peer scientists convened by ACR, which are now being transmitted back to the panel, together with a revised version of the Methodology, for another round of review. Upon completion of the peer review and approval by ACR, the final methodology will be published on ACR's website and available for use by project proponents. For more information on the methodology please visit ACR's website [<http://americancarbonregistry.org/carbon-accounting/methodology-for-biochar-projects>] or contact IBI at info@biochar-international.org.

IBI Business and Organization Member Profiles

A listing of all current IBI [Business](#) and [Organization](#) Members can be found on our website. For more information on membership opportunities and benefits, or to join, please see: <http://www.biochar-international.org/join>. Please note, Business and Organization descriptions are submitted by each individual entity, and are not developed or written by IBI.

Business Member, Wakefield Agricultural Carbon

Wakefield Agricultural Carbon LLC, a U.S. based company, focuses on the application of biochar for home and industrial markets. Its work is devoted to finding innovative ways to reduce our global carbon footprint and improve the abundance of great farm fresh food, beautiful garden flowers, and a healthier environment for everyone to enjoy.

Currently in its start-up phase, the founder of Wakefield, Dr. Thomas R. Marrero P.E., continues his research on the optimization of biochar-based products. Additionally, Wakefield is identifying ways to educate the public of its use and establishing a clear plan for the distribution of biochar.



Wakefield is cultivating partnerships with manufacturing and investments groups to expedite its business strategy. All inquiries should go to tony@wakefieldbiochar.com. Visit www.wakefieldbiochar.com to watch us grow!

Green Fire Farm: Using Restorative Farming to Improve Soils and Produce Biochar

Michael Low first heard about biochar in 2007 from a story in the magazine, *Acres USA*. The article sparked his interest and he began researching the use and production of biochar to see how he could utilize it on his farm, Green Fire Farm, in rural Vermont (United States) to improve the soil's health. When Low and his wife, Hart Brent, started working the land at Green Fire Farm in 2002, they encountered roadblocks to establishing a viable commercial farming enterprise—mainly due to soil health. They found the soil fertility severely depleted after more than a dozen families struggled to farm the hilly land over the course of 200 years. They also struggled with how to ethically and intelligently export any large quantity of farm



products, without further compromising the already weak living systems. To overcome these difficulties, they started using restorative farming practices—adding more to the system than they removed—to build a deep reserve for challenging natural events and the inevitable extremes inherent in farming. This reserve is essentially an investment in the land, and biochar is a major key to this investment. In addition to using the biochar on the farm, Low and Brent now sell their product under the name “*Dynamic Biochar Preps*” at the Montpelier Farmers Market and online through their website, as well as on Amazon.com.

The Origin of Dynamic Biochar Preps

In 2009, after deciding to proceed with biochar on the farm, Low procured plans from Chris Adam to build an Adam retort. The Adam retort was initially designed as a low cost retort for developing countries as it is scaled to animal and human power—which turned out to be the perfect biochar making solution for Low and Brent. Instead of using tractors for power, they have a pair of *Devon* oxen, Will and Abe, who pull wood from the land as the biochar feedstock. To ensure the most sustainable operation, Green Fire Farm utilizes “worst first” logging of their land by harvesting the biomass that is not well suited for other purposes.

Producing Biochar on the Farm

Once Will and Abe bring the wood to the kiln area, it is chopped to a smaller size. The kiln uses about one cord of wood per load. The day prior to firing, the feedstock is stacked neatly inside the kiln for premium gas flow during pyrolysis. The kiln firing is an all-day process, starting about 7:00 in the morning. Over the next 4 – 5 hours, the kiln heats up with the feeding of the firebox. Once most of the moisture in the wood is cooked off and the volatile gases are released, it is ready to switch to the gasification mode. This mode lasts about five hours and then the kiln is shut down and cools overnight. The biochar in the kiln is unloaded into metal cans the morning after the original firing.

Low and Brent use a simple chipper-shredder to grind the biochar into the perfect consistency for use in soils. Prior to grinding, the material is wetted and inoculated with a blend of microbes and mycchoryzae and once ground, it is ready for farming and gardening applications.

Using Biochar on the Farm

After being inoculated and mixed with compost, the biochar is added to fields through discing, or spread with a manure spreader and allowed to sink in. Low and Brent have seen great improvements in field crops with the addition of the inoculated biochar. Since starting to adapt carbon farming practices such as mob grazing and biochar they have seen the actual carrying capacity (number of animals they can

support on their farm) rise 450%. In the gardens, they have experienced better drought resistance and higher volume yields.

Green Fire Farm also uses biochar throughout the winter. They practice a bedding pack system with their chickens and dairy goats—adding fresh hay and straw bedding daily. Into this pack system they periodically add a layer of biochar which is further 'charged' up with beneficial nutrients from the animal manure and urine. They have found that the biochar also reduces the smells of ammonia from the animal urine. The draft animal stalls in the main barn are cleaned daily and with each wheelbarrow load of manure that goes out to the compost pile, they add 1 – 2 gallons of biochar. Like the pack system utilized for the chickens and goats, mixing the biochar with the compost 'charges' up the biochar with nutrients and also stabilizes the compost giving it a much longer shelf life once it is put in the gardens or spread in the hay fields.

Says Low: “The ‘*green fire*’ in our farm name refers to the life force within the soil that with care will reflect in vibrant health for plants, animals, and us. We cultivate this fire with restorative farming practices that we hope will inspire others to also feed the Earth's green fire.” Low and Brent are planning a modular teaching program on the farm to raise awareness and knowledge of restorative farming, permaculture, biochar, and carbon farming via one and two day courses. These small-scale farm courses are aimed primarily at college-age students to provide hands on learning opportunities on a working farm.

For more information on Green Fire Farm, please see: <http://vermontbiochar.com/biochar>.

Successful Completion of IBI International Training Course on Biochar for Environmental Sustainability and Economic Development, in Spain

From June 26-28, IBI and course co-developers delivered a training course titled, “*Biochar for Environmental Sustainability and Economic Development*” hosted by the University of Santiago de Compostela, Spain. The objective of the course was to provide an in-depth understanding of biochar for the target audience of government officials, policy makers, financiers, and entrepreneurs in the European region. IBI collaborated with biochar researchers and engineers from Massey University, New Zealand; Fraunhofer Institute for Environmental, Safety, and Energy Technology UMSICHT, Germany; and the Spanish National Research Council to design and present the course. A researcher from the University of Edinburgh, Scotland also delivered some course segments. Nearly 40 participants from 13 countries attended.

Topics presented over the two and a half day course included production technologies; physicochemical properties; standards, classification and certification; biochar effects when used as a soil amendment; biochar carbon persistence in soils, carbon accounting and climate change; and commercialization of the biochar industry. IBI intends to deliver and/or adapt this intensive training course for future training opportunities in order to facilitate best-science updates on biochar and to promote the uptake of biochar production and use as well as proactive public policies in support of biochar production and utilization systems.

A Trip to the Japan Biochar Association Meetings

By Daniel Chapman, IBI Membership Coordinator

It's hard to believe it was already over a month ago, but after I finished work on Thursday June 12, I hopped onto a train bound for Kyoto eager to hear about the latest biochar research in Japan and also to meet some other biochar enthusiasts and researchers from around the country.

I headed to the annual conference put on jointly by the Japan Wood Carbonisation Society and the Japan Biochar Association (JBA). What is the difference? The Wood Carbonization Society is more interested in non-agricultural uses of charcoal, such as cooking, water/ air filtration, and therapeutic uses. The JBA is

more focused on agricultural uses for biochar. Although both groups see different end uses for the material, much of their research and many of their needs overlap so it's a good fit for a joint conference.

I made it in time for an evening event on Thursday and was introduced to several researchers by Shibata Sensei, Vice President of the JBA, and one of the conference organizers. We all swapped stories about how we got interested in biochar and discussed where we see it going.

Although I missed most of the daytime talks on Thursday from the Wood Carbonisation Society, I was in attendance for the Friday sessions from the JBA presenters (the details of these talks will be covered in a post on IBI's website in the next month). The highlights for me were presentations on the effects of adding biochar to compost; the continued success and challenges of the Cool Vege project and convincing consumers to purchase premium food grown with biochar; and a talk about the current state of the biochar industry. I also got to attend my first JBA general meeting, which was scheduled during one of the breaks in the conference.

After the end of proceedings on Friday we headed out to Kameoka by train and spent the night at a beautiful Onsen (hot springs) hotel. We had a full dinner with interesting conversations focusing almost entirely on biochar.

On Saturday morning, we got up bright and early for a bath in the hot spring, then piled onto a bus for a day of touring around Kameoka. We first visited a composting facility which was mixing up batches of biochar and compost for use in the Cool Vege farms. This experience is very difficult to describe, as the facility was a huge shed full of enormous piles of fresh and composting animal manure. The aroma will be burnt into my memory until the end of my days. The smell aside, I was a little jealous at how much good quality compost they were producing. I would have loved to have brought some home, but I think the other passengers on the train would not have been impressed.

We next traveled to some Cool Vege experimental farms, which were growing tomatoes and other vegetables in side by side plots, some with biochar and some without. It was only early in the season at that time so we couldn't do any reliable size comparisons between the two trials, but it was impressive to see the size and scope of them. After the farms, we went to a supermarket in Kameoka city which sells Cool Vege vegetables, and we looked at how they were advertising and setting them apart from the other vegetables.

In the afternoon, we traveled into the mountains to a research station that is conducting experiments with traditional bottom lit pit style char manufacture. We saw a massive pit with a chimney connected to the bottom to both remove the smoke from the pyrolysis and to bring in fresh air through the upper layers of the feedstock to keep the pyrolysis going.

I was completely exhausted by the time I dragged myself onto the train on Saturday afternoon, but it was a great couple of days where I was able to meet fantastic people, learn many new things about biochar, and see innovative farming and biochar projects.

I am already looking forward to next year's event.

Biochar Briefs: News Roundup for July

We update the website daily with new articles on biochar. For more information, please see: <http://www.biochar-international.org/newsbriefs>.

International

The World Bank recently released a report entitled *Biochar Systems for Smallholders in Developing Countries: Leveraging Current Knowledge and Exploring Future Potential for Climate-Smart Agriculture*. The report provides an overview on biochar science and highlights opportunities and risks of biochar systems. IBI staff and board members were key authors of this report and we thank those members who

contributed information on their projects to help produce this document. The report is free to the public and available to download. (link to: <https://openknowledge.worldbank.org/handle/10986/18781>)

New research from a team from the Universidad Politecnica de Madrid (Spain) and colleagues from the Chinese Academy of Science has shown that biochar improved drought resistance to soil communities such as bacteria and fungi. In a lab the researchers simulated drought conditions on soils from a subtropical area of southern China. They tested soils with and without added biochar and measured the resistance and resilience of the soil microbial populations. (link to: <http://environmentalresearchweb.org/cws/article/news/57897>)

Israel

Dr. Ellen Graber received the “Scientist of the Year” award for 2013 from the Academic Committee of the Volcani Center (the Israeli Agriculture Ministry’s research arm) for her work in biochar. Her laboratory there is studying how biochar impacts crop yields, as well as plant health, and how well it can help remediate contaminated soils. Dr. Graber is also the founder of the Israel Biochar Research Network. (link to: <http://www.jpost.com/Enviro-Tech/American-Israeli-scientist-recognized-for-excellence-in-biochar-research-361031>)

New Zealand

The Timaru District Council (TDC) in New Zealand is studying the feasibility of using existing residual waste to produce biochar. A recent audit found that 18% of their waste is comprised of timber which could be used as a biochar feedstock. The TDC waste minimization manager Ruth Clarke said, "We did an analysis of the landfill and up to 18% is an assortment of different timber. There's pallets, untreated timber, windows and furniture, so we need to look at how we can sort it." (link to: <http://www.stuff.co.nz/timaru-herald/news/10270709/Biochar-plan-could-cut-waste>)

United States

The Portland Development Commission and Oregon BEST are funding trials with an Oregon State University research team to confirm that Sunmark Environmental’s product, EarthLite Stormwater Filter Media (made from biochar), can sufficiently remove toxic metals that reach the water system from leaching off of metal roofs, from brake linings, brake fluid and other sources. The biochar is a lower-cost alternative to activated charcoal systems currently in use. (link to: <http://www.bizjournals.com/portland/blog/sbo/2014/07/lumber-waste-hazelnut-shells-and-oyster-shells.html?page=all>)

Opportunities in Biochar

- Job postings in biochar (as well as research/educational opportunities) can be accessed at: <http://www.biochar-international.org/network/jobs>.
- The Belfer Center for Science and International Affairs is collecting nominations for the 2015 Roy Family Award for Environmental Partnership; due September 15. For more information, see: <http://www.biochar-international.org/node/5204>.
- The U.S. Department of Agriculture (USDA) announced funding availability for turning biomass material into energy. For more information, see: <http://www.biochar-international.org/node/5153>.
- Looking for potential grant funding? Check out the Terra Viva Grants Directory which develops and manages information about grants for agriculture, energy, environment, and natural resources in the world's developing countries at: <http://www.terravivagrants.org/Home>.

Upcoming Calendar Events

- August 8: 2014 Midwest Biochar Conference. Location: Champaign, IL, USA. For more information: <http://www.biochar.illinois.edu/conference>

- August 26 – 28: International Biomass Energy Exhibition. Location: Guangzhou, China. For more information: <http://www.biochar-international.org/node/5014>
- September 2 – 5: Symposium on Thermal and Catalytic Sciences for Biofuels and Biobased Products. Location: Denver, CO, USA. For more information: <http://www.biochar-international.org/node/4582>
- September 5 – 7: Bio-charfest 2014. Location: Mullumbimby, Australia. For more information: <http://www.biochar-international.org/node/5156>
- September 22 – 25: Biochar Session at ELS 2014 Conference: The Biochar Effect along the soil-rhizosphere-plant-atmosphere continuum. Location: Italy. For more information: <http://www.biochar-international.org/node/4704>
- October 3 – 5: Bio-Char Workshop at Quantum Leaps Lodge. Location: British Columbia, Canada. For more information: <http://www.biochar-international.org/node/5149>
- October 5 – 8: Special Symposium on “Biochar: Production, Characterization and Applications” at CLEAR 2014 Conference. Location: Chuncheon, Korea. For more information: <http://www.biochar-international.org/node/4828>

See the [IBI Calendar page](#) for more events. To add an event to the calendar, send the information to info@biochar-international.org.

Recently Published Biochar Research

- Abdel-Fattah, Tarek M.; Mohamed E. Mahmoud, Somia B. Ahmed, Matthew D. Huff, James W. Lee, Sandeep Kumar (2014) Biochar from woody biomass for removing metal contaminants and carbon sequestration. *Journal of Industrial and Engineering Chemistry*
- Al Shra'ah, Ahmad Q. (2014) Low temperature microwave materials for renewable fuels and chemicals pyrolysis of lignocellulosic. Thesis: Memorial University of Newfoundland, Faculty of Science; <http://research.library.mun.ca/6289/1/MSc%20Thesis.pdf>
- Bai, Mo; Burkhard Wilske, Franz Buegger, Esben Wilson Bruun, Martin Bach, Hans-Georg Frede and Lutz Breuer (2014) Biodegradation measurements confirm the predictive value of the O:C-ratio for biochar recalcitrance. *Journal of Plant Nutrition and Soil Science*
- Bird, Michael I.; Jonathan G. Wynn, Gustavo Saiz, Christopher M. Wurster, Anna McBeath (2014) The Pyrogenic Carbon Cycle. *Annual Review of Earth and Planetary Sciences*
- Brennan, Aoife; Eduardo Moreno Jiménez, José A. Albuquerque, Charles W. Knapp, Christine Switzer (2014) Effects of biochar and activated carbon amendment on maize growth and the uptake and measured availability of polycyclic aromatic hydrocarbons (PAHs) and potentially toxic elements (PTEs). *Environmental Pollution*
- Cely, P.; A. M. Tarquis, J. Paz-Ferreiro, A. Méndez, and G. Gascó (2014) Factors driving the carbon mineralization priming effect in a sandy loam soil amended with different types of biochar. *Solid Earth*; <http://www.solid-earth.net/5/585/2014/se-5-585-2014.pdf>
- Chintala, Rajesh; Thomas E Schumacher, Sandeep Kumar, Douglas D Malo, James A Rice, Bruce Bleakley, Gabriela Chilom, David E Clay, James L Julson, Sharon K Papiernik, Zheng Rong Gu (2014) Molecular Characterization of Biochars and Their Influence on Microbiological Properties of Soil. *Journal of Hazardous Materials*

- Díaz-Rey, M.R.; M. Cortés-Reyes, C. Herrera, M.A. Larrubia, N. Amadeo, M. Laborde, L.J. Alemany (2014) Hydrogen-rich gas production from algae-biomass by low temperature catalytic gasification. *Catalysis Today*
- Guo, Jianhua and Baoliang Chen (2014) New Insights on the Molecular Mechanism for the Recalcitrance of Biochars: Interactive Effects of Carbon and Silicon Components. *Environmental Science & Technology*
- Hammer, Edith C.; Zsuzsanna Balogh-Brunstad, Iver Jakobsen, Pål Axel Olsson, Susan L.S. Stipp, Matthias C. Rillig (2014) A mycorrhizal fungus grows on biochar and captures phosphorus from its surfaces. *Soil Biology and Biochemistry*
- Hass, Amir, and Gonzalez Javier M. (2014) Fertilizers: Components, Uses in Agriculture and Environmental Impacts, Chapter 4 : Biochar; https://www.novapublishers.com/catalog/product_info.php?products_id=50726
- Hassby, Oscar (2014) Biokol för rening av kväve och fosfor ur dagvatten i Segeåns avrinningsområde (Biochar for removal of nitrogen and phosphorus from stormwater catchment Segeåns); Thesis: Lund University, Environmental Science; <http://lup.lub.lu.se/luur/download?func=downloadFile&recordId=4467062&fileId=4467068>
- Hu, Ya-Lin; Feng-Ping Wu, De-Hui Zeng, Scott X. Chang (2014) Wheat straw and its biochar had contrasting effects on soil C and N cycling two growing seasons after addition to a Black Chernozemic soil planted to barley. *Biology and Fertility of Soils*
- Huang XD, Xue D (2014) Effects of bamboo biochar addition on temperature rising, dehydration and nitrogen loss during pig manure composting. *The Journal of Applied Ecology*
- Imran, Muhammad Ammar (2014) Integration of Biochar with Organic and Inorganic Sources of Phosphorous for Improving Maize Productivity. *Journal of Environment and Earth Science*
- Jin, Hongmei; Sergio Capareda, Zhizhou Chang, Jun Gao, Yueding Xu, Jianying Zhang (2014) Biochar pyrolytically produced from municipal solid wastes for aqueous As(V) removal: adsorption property and its improvement with KOH activation. *Bioresource Technology*
- Kabir, Mohammed J.; Kabir, Mohammed J.; Ashwath, Nanjappa.; Chowdhury, Ashfaque Ahmed (2014) Optimisation of Biofuel Production from Municipal Green Waste (MGW) Pyrolysis using ASPEN plus Simulation Model. Conference Paper: Proceedings of 12th International Conference on Sustainable Energy technologies. Hong Kong
- Kearns, J.P.; L.S. Wellborn; R.S. Summers; D.R.U. Knapp (2014) 2,4-D adsorption to biochars: Effect of preparation conditions on equilibrium adsorption capacity and comparison with commercial activated carbon literature data; *Water Research*. Volume 62, Pages 20–28; <http://www.sciencedirect.com/science/article/pii/S0043135414003765>
- Krapfl, Kurt J.; Jeff A. Hatten, Scott D. Roberts, Brian S. Baldwin, Randall J. Rousseau and Mark W. Shankle (2014) Soil Properties, Nitrogen Status, and Switchgrass Productivity in a Biochar-Amended Silty Clay Loam. *Soil Science Society of America Journal*
- Lashari, Muhammad Siddique; Yingxin Ye, Haishi Ji, Lianqing Li, Grace Wanjiru Kibue, Haifei Lu, Jufeng Zheng and Genxing Pan (2014) Biochar-manure compost in conjunction with pyroligneous solution alleviated salt stress and improved leaf bioactivity of maize in a saline soil from Central China: A two-year field experiment. *Journal of the Science of Food and Agriculture*

- Lawrinenko, Michael (2014) Anion exchange capacity of biochar. Thesis: Iowa State University, Agronomy; <http://lib.dr.iastate.edu/etd/13685/>
- Li, Tingqiang; Xuan Han, Chengfeng Liang, M. J. I. Shohag & Xiaoe Yang (2014) Sorption of sulfamethoxazole by the biochars derived from rice straw and alligator flag. *Environmental Technology*
- Li, Yunchao; Jingai Shao, Xianhua Wang, Yong Deng, Haiping Yang, and Hanping Chen (2014) Characterization of modified biochars derived from bamboo pyrolysis and their utilization for target component (furfural) adsorption. *Energy Fuels*
- Liao, Shaohua; Bo Pan, Hao Li, Di Zhang, and Baoshan Xing (2014) Detecting Free Radicals in Biochars and Determining Their Ability to Inhibit the Germination and Growth of Corn, Wheat and Rice Seedlings. *Environmental Science and Technology*
- Lu, Huanping; Zhian Li, Shenglei Fu, Ana Méndez, Gabriel Gascó, Jorge Paz-Ferreiro (2014) Combining phytoextraction and biochar addition improves soil biochemical properties in a soil contaminated with Cd. *Chemosphere*
- Ma, Ying; Wu-Jun Liu, Nan Zhang, Yu-Sheng Li, Hong Jiang, Guo-Ping Sheng (2014) Polyethyleneimine modified biochar adsorbent for hexavalent chromium removal from the aqueous solution. *Bioresource Technology*
- Machdar, Izarul; Firmansyah; Faisal, Muhammad; Fatanah, Umi; Hamdani (2014) Pengembangan Reaktor Fast Pyrolysis Kontinyu Penghasil Bio-Oil Dari Limbah Biomassa Industri Sawit (Continuous Pyrolysis Fast Reactor Development Producer of Bio-Oil Palm Industry Biomass Waste) UR-Proceedings: University of Riau; <http://103.10.169.96/xmlui/handle/123456789/6455?show=full>
- Meng, Cheah Poh; Ahmad Husni Mohd Hanif, Samsuri Abd Wahid, Luqman Chuah Abdullah (2014) Short-Term Field Decomposition and Physico-Chemical Transformation of Jatropha Pod Biochar in Acidic Mineral Soil. *Earth & Environmental Sciences*
- Muñoz, Cristina; Quilodrán, Carlos; Navia, Rodrigo (2014) Evaluation of Biochar-Plant Extracts Complexes on Soil Nitrogen Dynamics. *Journal of Biobased Materials and Bioenergy*
- Munoz, Laura C. V., "Spreading The Char: The Importance of Local Compatibility in the Diffusion of Biochar Systems to the Smallholder Agriculture Community Context" (2014) Pomona Senior Theses. Paper 102; http://scholarship.claremont.edu/pomona_theses/102
- Nanda, Sonil; Pravakar Mohanty, Janusz A. Kozinski, Ajay K. Dalai (2014) Physico-Chemical Properties of Bio-Oils from Pyrolysis of Lignocellulosic Biomass with High and Slow Heating Rate. *Energy and Environment Research*
- Pandey, Arjun; Van Trinh Mai, Duong Quynh Vu, Thi Phuong Loan Bui, Thi Lan Anh Mai, Lars Stoumann Jensen, Andreas de Neergaard (2014) Organic matter and water management strategies to reduce methane and nitrous oxide emissions from rice paddies in Vietnam. *Agriculture, Ecosystems & Environment*
- Pereira, R. Calvelo; S. Muetzel, M. Camps Arbustain, P. Bishop, K. Hina, M. Hedley (2014) Assessment of the influence of biochar on rumen and silage fermentation: A laboratory-scale experiment. *Animal Feed Science and Technology*

- Rahila. M. Yilangai, A. S. Manu, W. Pineau, S. S. Mailumo and K. I. Okeke-Agulu (2014) The effect of biochar and crop veil on growth and yield of Tomato (*Lycopersicum esculentus* Mill) in Jos, North central Nigeria. Current Agriculture Research Journal; <http://www.agriculturejournal.org/volume2number1/the-effect-of-biochar-and-crop-veil-on-growth-and-yield-of-tomato-lycopersicum-esculentus-mill-in-jos-north-central-nigeria/>
- Reddy, Krishna R.; F.ASCE, Tao Xie and Sara Dastgheibi (2014) Evaluation of Biochar as a Potential Filter Media for the Removal of Mixed Contaminants from Urban Storm Water Runoff. Journal of Environmental Engineering
- Scholz, Sebastian M.; Sembres, Thomas; Roberts, Kelli; Whitman, Thea; Wilson, Kelpie; Lehmann, Johannes (2014) Biochar Systems for Smallholders in Developing Countries: Leveraging Current Knowledge and Exploring Future Potential for Climate-Smart Agriculture. Washington, DC: World Bank; <https://openknowledge.worldbank.org/handle/10986/18781>
- Touray, Njagga; Wen-Tien Tsai, Ming-Hsuan Li (2014) Effect of holding time during pyrolysis on thermochemical and physical properties of biochars derived from goat manure. Waste and Biomass Valorization
- Wu, Y.; G. Xu, and H. B. Shao (2014) Furfural and its biochar improve the general properties of a saline soil. Solid Earth; <http://www.solid-earth.net/5/665/2014/se-5-665-2014.pdf>
- Yager Douglas B.; and Mark R. Stanton (2014) Metals sequestration by biochar in sulfide bearing mine waste leachate experiments: Implications for mine waste reclamation and carbon sequestration.
- Zhang, Lu; Xiang-yang Sun, Yun Tian, Xiao-qiang Gong (2014) Biochar and humic acid amendments improve the quality of composted green waste as a growth medium for the ornamental plant *Calathea insignis*. Scientia Horticulturae
- Zhang, Xiong; Shihong Zhang, Haiping Yang, Ye Feng, Yingquan Chen, Xianhua Wang, Hanping Chen (2014) Nitrogen enriched biochar modified by high temperature CO₂-ammonia treatment: characterization and adsorption of CO₂. Chemical Engineering Journal