

## ANDREW R. ZIMMERMAN - CIRRICULUM VITAE

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### Professional Preparation

The University of Chicago	Geological Sciences,	B.A. Honors 1987
The University of Michigan	Marine Geochemistry	M.S. 1989
College of William and Mary (Virginia Institute of Marine Sciences)	Marine Geochemistry	Ph.D. 2000

### Appointments

Associate Professor	University of Florida	2011 - present
Assistant Professor	University of Florida	2004 - 2011
Postdoctoral Research Associate	Pennsylvania State University	2002 - 2003

### Research Specialty

Examinations of organic matter-mineral-microbe interactions and carbon cycling in soil, sediments, surface and ground water, in the present and through the geological record. Black carbon in the environment, biochar and organic matter sorption and degradation.

### Selected Recent (past 10 years) Refereed Publications

- 1) Wang, S., Gao, B., Yuncong L., Zimmerman, A.R. and X. Cao (2016). Sorption of arsenic onto Ni/Fe layered double hydroxide (LDH)-biochar composites. *RSC Advances*, 6: 17792.
- 2) Jin, J., Zimmerman, A.R., Norton, S.B., Annable, M.D. and W.G. Harris (2016). Arsenic release from Floridan Aquifer rock during incubations simulating aquifer storage and recovery operations. Accepted. *Science of the Total Environment* 551–552: 238–245.
- 3) Kupryianchyk, D., Hale, S., Zimmerman, A. R., Harvey, O., Rutherford, D., Abiven, S., Knicker, H., Schmidt, H-P., Rumpel, C., and G. Cornelissen (2016). Sorption of hydrophobic organic compounds to a diverse suite of carbonaceous materials with emphasis on biochar *Chemosphere* 144: 879-887.
- 4) Inyang, M., Gao, B., Yao, Y., Xue, Y., Zimmerman, A. R., Mosa, A.; Pullammanappallil, P., Ok, Y.S., and X. Cao (2015). A Review of Biochar as a Low Cost Adsorbent for Heavy Metal Removal in solution. *Critical Reviews in Environmental Science and Technology*.
- 5) Wang, S. Zimmerman, A.R., Li,Y., Ma,L., Harris,W.G., Migliaccio, K.W. (2015). Physicochemical and sorptive properties of biochars derived from woody and herbaceous biomass. *Chemosphere*, 134: 257–262
- 6) Fang, J., Gao, B., Chen, J. and A.R. Zimmerman (2015). Hydrochars derived from plant biomass under various conditions: Characterization and potential applications and impacts. *Chemical Engineering Journal*, 267: 253–259.
- 7) Wang, S., Gao, B., Li, Y., Mosa, A., Zimmerman, A. R., Ma, L.Q., Harris, W.G., and K.W. Migliaccio (2015). Manganese oxide-modified biochars: Preparation, characterization, and sorption of arsenate and lead. *Bioresource Technology*: 181: 13–17.

- 8) Hu, X, Ding, Z., Zimmerman, A.R., Wang, S., and B. Gao (2015). Batch and column sorption of arsenic onto iron-impregnated biochar synthesized through hydrolysis. *Water Research*, 68: 206-216.
- 9) Hale, S. Endo, S., Arp, H.P.H., Zimmerman, A.R., and G. Cornelissen (2015). Sorption of the monoterpenes  $\alpha$  pinene and limonene to soil and carbonaceous geosorbents including biochar. *Chemosphere* 119: 881–888.
- 10) Jin J., Zimmerman, A. R., Martin, J. B., and M.B. Khadka (2015). Spatiotemporal variations in carbon dynamics during a low flow period in a carbonate karst watershed, Florida, USA. *Biogeochemistry*, 122: 131-150.
- 11) Leorri, E., Zimmerman, A.R., Mitra, S., Christian R. R., and A. Cearreta (2014). A 700 year record of combustion-derived pollution in northern Spain. *Science of the Total Environment*; 470–471: 240–247.
- 12) Zhou, Y., Gao, B., Zimmerman, A.R., and X. Cao (2014). Biochar-supported zerovalent iron reclaims silver from aqueous solution to form antimicrobial nanocomposite. *Chemosphere*: 117: 801–805.
- 13) Mukherjee, A., Lal, R., A.R. Zimmerman (2014). Impacts of 1.5-year field-aging on biochar, humic acid, and water treatment residual amended soil. *Soil Science*, 179: 333-339.
- 14) Mukherjee, A., Lal, R., A.R. Zimmerman (2014). Impacts of biochar and other amendments on soil-carbon and nitrogen stability: A laboratory column study. *Soil Science Society of America Journal*. Vol. 78 No. 4, p. 1258-1266.
- 15) Ding, Z., Hu, X., Zimmerman, A.R., B. Gao (2014). Sorption and cosorption of lead (II) and methylene blue on chemically modified biomass. *Bioresource Technology*, 167: 569-573.
- 16) Mukherjee, A., Zimmerman, A. R., Hamdan, R., and W. T. Cooper (2014). Physicochemical changes in pyrogenic organic matter (biochar) after 15 months field-aging. *Solid Earth*, 5: 693–704.
- 17) Mukherjee, A., Lal, R., Zimmerman, A.R. (2014). Effects of biochar and other amendments on the physical properties and greenhouse gas emissions of an artificially degraded soil. *Science of the Total Environment*, 487: 26–36.
- 18) Jin, J. , A. R. Zimmerman, P. J. Moore, and J. B. Martin (2014), Organic and inorganic carbon dynamics in a karst aquifer: Santa Fe River Sink-Rise system, north Florida, USA, *J. Geophys. Res. Biogeosci.*, 119: 340-357.
- 19) Inyang, Mandu; Gao, Bin; Zimmerman, Andrew; Zhang, Ming, and H. Chen (2014). Synthesis, characterization, and dye sorption ability of carbon nanotube-biochar nanocomposites. *Chemical Engineering Journal*, 236: 39-46.
- 20) Zhou, Y., Gao, B., Zimmerman, A.R., Chen, H., Zhang, M., and X. Cao (2014). Biochar-supported zerovalent iron for removal of various contaminants from aqueous solutions. *Bioresource Technology*, 152: 538-542.
- 21) Mahmoudi, N., Porter, T.M., Zimmerman, A.R., Fulthorpe, R.R., Kasozi, N., Silliman, B.R. and G.F. Slater (2013). Rapid degradation of *Deepwater Horizon* spilled oil by indigenous microbial communities in Louisiana salt marsh sediments. *Environ. Sci. Technol.* 47: 13303–13312.
- 22) Zhou, Y., Gao, Bin, Zimmerman, A., Fang, J., Sun, Y., Cao, X. (2013). Sorption of heavy metals on chitosan-modified biochars and its biological effects. *Chemical Engineering Journal*, 231:512-518.

- 23) Ling Zhao, Xinde Cao, Ondřej Mašek, and Andrew Zimmerman. (2013). Heterogeneity of biochar properties as a function of feedstock sources and production temperatures. *Journal of Hazardous Materials*. 256– 257: 1– 9.
- 24) Mukherjee, A., Zimmerman, A.R. (2013). Organic carbon and nutrient release from a range of laboratory-produced biochars and biochar-soil mixtures. *Geoderma*, 193-194: 122–130
- 25) Yao, Y., Gao, B., Zhang, M., Inyang, I., and A.R. Zimmerman (2012). Effect of biochar amendment on sorption and leaching of nitrate, ammonium, and phosphate in a sandy soil. *Chemosphere*, 89: 1467-1471.
- 26) McMichael, C. H., Piperno, D. R. Bush, M. B., Silman, M. R., Zimmerman, A. R. Raczka, M. F. and L.C. Lobato (2012). Sparse Pre-Columbian Human Habitation in Western Amazonia. *Science*, 336, 1429-1431.
- 27) Silliman, B. R, van de Koppel, J., McCoy, M. W., Diller, J., Kasozi, G. N., Earl, K., Adams, P. N., A.R. Zimmerman (2012). Degradation and resilience in Louisiana salt marshes after the BP–Deepwater Horizon oil spill. *Proc. of the Nat. Academy of Sciences*. 109: 11234-11239.
- 28) Kasozi, G.N., Nkedi-Kizza, P., Li, Y. and A.R. Zimmerman (2012). Sorption of atrazine and ametryn by carbonatic and non-carbonatic soils. *Environmental Pollution*, 169: 12-19.
- 29) Hale, S.E., Lehmann, J., Rutherford, D., Zimmerman, A.R., Bachmann, R.T., Shitumbanuma, V., O'Toole, A., Sundqvist, K.L., Arp, H.P.H., Cornelissen, G. (2012). Quantifying the total and bioavailable polycyclic aromatic hydrocarbons and dioxins in biochars. *Environ. Sci. Technol.* 46, 2830-2838.
- 30) Rajkovich, S., Enders, A., Hanley, A., Hyland, C., Zimmerman, A.R., and J. Lehmann (2012). Corn growth and nitrogen nutrition after additions of biochars with varying properties to a temperate soil. *Biol Fertil Soils*, 48: 271 – 284.
- 31) Inyang, M., Gao, B., Pullammanappallil, P., Ding, W., Zimmerman, A. R. and X. Cao (2012). Removal of heavy metals from aqueous solution by biochars derived from anaerobically digested biomass. *Bioresource Technology*, 110: 50–56.
- 32) Harvey, O., Kuo, L-J., Zimmerman, A.R., Louchouart, P., Amonette, J., Herbert, B.E. (2012). An index-based approach to assessing recalcitrance and soil carbon sequestration potential of engineered black carbons (biochars), *Env. Sci. & Tech.*, 46: 1415-1421.
- 33) McMichael, C.H., Bush, M.B., Piperno, D.R., Silman, M.R., Zimmerman, A.R. and C. Anderson (2012). Spatial and temporal scales of pre-Columbian disturbance associated with western Amazonian lakes. *The Holocene* 22: 131-141.
- 34) Hale, Sarah; Hanley, Kelly; Lehmann, Johannes; Zimmerman, Andrew; Cornelissen, Gerard (2011). The effects of chemical, biological and physical aging as well as soil addition on the sorption of pyrene to activated carbon and biochar. *Environmental Science & Technology*, 45: 10445–10453.
- 35) Inyang, M., Gao, B., Pullammanappallil, P., Ding, W., Zimmerman, A. R. and X. Cao (2011). Enhanced Lead Sorption by Biochar Derived from Anaerobically Digested Sugarcane Bagasse. *Separation Science and Technology*. 46: 1950-1956.
- 36) Yao, Y., Gao B., Inyang, M., Gao, B., Zimmerman, A. R., Cao, X., Pullammanappallil, P., and L. Yang (2011). Removal of phosphate from aqueous solution by biochar derived from anaerobically digested sugar beet tailings. *Journal of Hazardous Materials*, 190: 501-507.

- 37) Mukherjee, A., Zimmerman, A.R. and W. Harris (2011). Surface chemistry variations among a series of laboratory-produced biochars. *Geoderma*, 163:247-255.
- 38) Zimmerman, A.R., Gao, B., and M.-Y. Ahn (2011). Positive and negative C mineralization priming effects in biochar-amended soils. *Soil Biology & Biochemistry*, 43: 1169-1179.
- 39) Yao, Y., Gao B., Inyang, M. and Zimmerman, A.R., Xiao, C., Pullammanappallil, P., and L. Yang (2011). Biochar derived from anaerobically digested sugar beet tailings: Characterization and phosphate removal potential. *Bioresource Tech.*, 102: 6273-6278.
- 40) Khodadad, C.L.M., Zimmerman, A.R., Uthandi, S., and J.S. Foster (2010). Taxa-specific changes in soil microbial community composition induced by pyrogenic carbon amendments. *Soil Biology & Biochemistry*, 43: 385-392.
- 41) Hyun, S., Park, H., Ahn, M.Y. and Zimmerman A.R., C.T. Jafvert (2010). Fluxes of PAHs from coal tar-impacted river sediment under variable seepage rates. *Chemosphere*, 80: 1261-7.
- 42) Kasozi, G.N., Zimmerman, A.R., Nkedi-Kizza, P. and B. Gao (2010). Catechol and humic acid sorption onto a range of laboratory-produced black carbons (biochars). *Environmental Science & Technology*, 44: 6169-6195.
- 43) Inyang, M., Gao, B., Pullammanappallil, P., Ding, W. and A.R. Zimmerman (2010). Biochar from anaerobically digested sugarcane bagasse. *Bioresource Technology*, 101: 8868-8872.
- 44) Zimmerman, A.R. (2010). Abiotic and microbial oxidation of laboratory-produced black carbon (biochar). *Environmental Science and Technology*, 44: 1295–1301.
- 45) Jin, J. and A.R. Zimmerman (2010). Abiotic dissolved organic matter-mineral interaction in the karstic Floridan Aquifer. *Applied Geochemistry*, 25: 472-484.
- 46) Ahn, M.Y., Zimmerman, A.R., Comerford, N.B., Sickman, J. and S. Grunwald (2009). Carbon mineralization and labile organic carbon pools in the sandy soils of a north Florida watershed. *Ecosystems*, 12: 672-685.
- 47) Mitra, S., Zimmerman, A.R., Hunsinger, G.B., Willard, D. and J.C. Dunn (2009). A Holocene record of climate-driven shifts in coastal carbon sequestration. *Geophysical Research Letters*, 36: L05704.
- 48) Hyun, S., Ahn, M.Y., Zimmerman, A.R., Kim, M. and J.G. Kim (2009). Implication of hydraulic properties of bioremediated diesel-contaminated soil. *Chemosphere*, 71: 1646-1653.
- 49) Zimmerman, A.R., Kang, D.-H., Ahn, M.Y., Hyun, S. and M.K. Banks (2008). Influence of a soil enzyme on iron-cyanide complex speciation and mineral adsorption. *Chemosphere*, 70: 1044–1051.

Selected Recent (past 10 years) Non-Refereed Publications

- 1) Whitman, T., Singh, B. P., and A. R. Zimmerman (2015). Priming effects in biochar-amended soils: implications of biochar-soil organic matter interactions for carbon storage. In: *Biochar for Environmental Management: Science, Technology and Implementation*, p. 455, 2<sup>nd</sup> Edition; Lehmann, J., Joseph, S., Eds.; Earthscan: London, UK.
- 2) Lehmann, J., Abiven, S., Kleber, M., Pan, G., Singh, B.P., Sohi, S. and A. R. Zimmerman (2015). Persistence of Biochar in Soil. In: *Biochar for Environmental Management: Science, Technology and Implementation*, p. 235, 2<sup>nd</sup> Edition; Lehmann, J., Joseph, S., Eds.; Earthscan: London, UK.
- 3) Green, A.E. and A.R. Zimmerman (2013). Energy: Solid Waste Advanced Thermal Technology, *Encyclopedia of Environmental Management*, Taylor & Francis.

- 4) Zimmerman, A.R. and B. Gao (2013). The Stability of Biochar in the Environment. In: *Biochar and Soil Biota*, (N. Ladygina and F. Rineau, eds.), CRC Press, Boca Raton, FL.
- 5) Mitra, S., Zimmerman, A.R., Hunsinger, G.B, Woerner, W.R. (2014). *Black carbon in coastal and large river systems*. In: Biogeochemical Dynamics at Large River-Coastal Interfaces: Linkages with Global Climate Change, edited by T.S. Bianchi, M.A. Allison, and W.-J. Cai, Cambridge University Press. New York, NY.
- 6) Budai, A., Zimmerman, A. R., Cowie, A. L., Webber, J. B. W., Singh, B. P., Glaser, B., Masiello, C. A., Andersson, D., Shields, F., Lehmann, J., Camps Arbestain, M., Williams, M., Sohi, S. and Joseph, S. (2013). Biochar Carbon Stability Test Method: An assessment of methods to determine biochar carbon stability. International Biochar Initiative Document.
- 7) Zimmerman, A.R. and M. Smith (2006). Engaging the Remote-Control Generation in the Gen. Ed. Earth Science Classroom. *EOS, Transactions, American Geophysical Union*, 87: 339-344.
- 8) Santiago, R., Oyuela-Caycedo, A. and A.R. Zimmerman (2006). Preliminary report on the findings in the archeological site of Quistococha, Peruvian Amazonia. *Boletín de Estudios Amazónicos* Unidad de Grado de Ciencias Sociales/Universidad Nacional Mayor de San Marcos, 1: 79-97.

#### Selected Activities

University of Florida Core Undergraduate Education Program Task Force (2016 – present):

Working to improve the educational experience for all undergraduate students by developing an outstanding, distinctive, unique General Education Program

Leading development and implementation of a course on Climate Change to serve as a signature core courses for all incoming University of Florida undergraduates.

Chair, UF College of Liberal Arts and Sciences Curriculum Committee (2015 - present)

Panel member: International Biochar Initiative (IBI) Biochar Expert Panel on 'Expert Panel to Develop Stable Biochar Carbon Test Methodology for a Carbon Market Protocol' (2013).

Panel Co-Chair: University of Florida Deepwater Horizon Oil Spill Task Force (2010).

Public School Outreach Program Founder and Coordinator (2005-present): *Geogators* delivers Earth Science lessons to public school classes (last year making 43 presentations at 12 public schools in Alachua County, reaching approximately 1950 public school students).

Oversight Board for the UF College of Liberal Arts and Sciences – Bachelor of Arts in Sustainability Studies

UF Department of Geological Sciences, Student Awards Committee, Chair

UF Department of Geological Sciences, 'Green Team', Faculty Advisor

Florida Museum of Natural History Public outreach event exhibit development and presentation (annual event, 2005 to present).

#### Selected Invited Seminars Presented - International

New directions in biochar research; pyrogenic soil carbon cycling and contaminant remediation, International Symposium and Annual Meeting of the Korean Society for Applied Biological Chemistry, Jeju Island, South Korea (2016).

Mutual priming of biochar and labile and refractory organic matter mineralization, Environment and Life Chemistry Dept., Kyunpook National University, Daegu, South Korea (2016).

New directions in biochar research, Korea Biochar Research Center, Kangwon National University, Chuncheon, South Korea (2016).

The Ups and Downs of Black Carbon (Biochar) Division of Environmental Science & Ecological Engineering, Korea University, Seoul, South Korea (2010).

A primer to Black Carbon and Environmental Applications). Division of Applied Biology and Chemistry, Kyungpook national University, Deagu, South Korea (2010).

Biochar stability in the environment. National Institute for Amazonian Research (INPA), Manaus, Brazil (2009).

The influence of mineral nanopores on organic compound preservation. Division of Environmental Science and Ecological Engineering, Korea University, Seoul, Korea (2006).

#### *Selected Invited Seminars Presented – U.S.*

Response to Arctic Rising, Imagining Climate Change Conference: Science & Fiction in Dialogue, University of Florida, February 17–18, 2016.

Brown Ground and Black Attack: Studies in Organic Matter Preservation and Degradation. Department Seminar, University of Miami - RSMAS. 2015.

Variations in the properties of laboratory-produced biochars. Geological Society of America Meeting, Denver, CO, 2010.

Deciphering the chemical properties of pyrogenic carbon: exposing a range of biochars to a range of characterization methods. American Chemical Society National Meeting, Boston, MA, Aug. 22-26, 2010.

Biochar research at the University of Florida. Green Liquid and Gas Technologies Open House, Gainesville, FL., Oct. 10, 2010

The ups and downs of black carbon: A brief primer. Agricultural Air Quality Task Force Meeting, U. S. Dept. Agriculture, Tallahassee, FL, Mar. 10, 2010.

Black carbon in the environment: Importance and Stability. Dept. of Geology. University of Georgia. Athens, GA, 2009.

Organic matter preservation/degradation: The refractory chicken or the labile egg? Symposium on the Future of Chemical Oceanography, Savannah, GA, 2009.

Organic matter preservation and the influence of environmental nanopores, UF Dept. of Environmental Engineering Sciences Graduate Seminar Series, Gainesville, FL., 2008.

Microbes, minerals and organic matter in the environment. UF Dept. of Microbiology and Cell Science, Gainesville, 2007.

Earth, The Microbial Planet. Florida Museum of Natural History. Gainesville, FL, 2006.

#### *Sessions Organized and Chaired – National Meetings*

The role of fire in the carbon cycle: quantification and characterization of emissions, fluxes and sequestration potential. American Geophysical Union, Fall 2016 Meeting, San Francisco, CA.

Black Carbon in the Environment (with Mead, R. and P. Loucheran), American Geophysical Union, Fall 2008 Meeting, San Francisco, CA, December, 15-19, 2008.

The Biogeochemical Cycling of Natural Organic Matter in the Coastal Zone (with S. Mitra). American Chemical Society Fall 2007 Meeting, Boston, MA, 2007.

Microbial activity on mineral and rock surfaces (with D. Barr). American Geophysical Union, Fall Meeting. San Francisco, 2003.