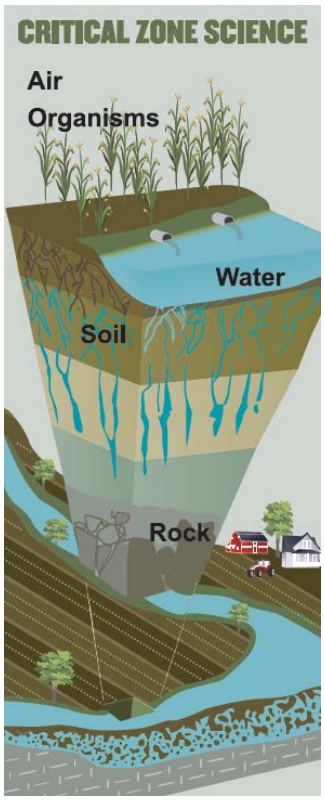
Conference and Workshop on Critical Zone Science, Sustainability, and Services in a Changing World

A Brief Meeting Summary

October 22 - 24, 2015,
Purdue University, West Lafayette, IN, USA

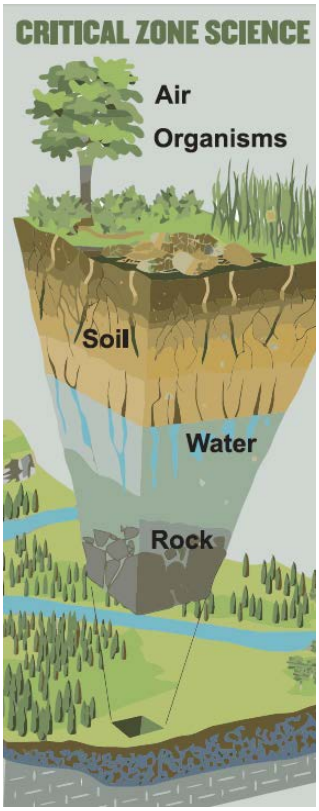
Organized by the U.S.-China EcoPartnership for Environmental Sustainability, the China-U.S. Joint Research Center for Ecosystem and Environmental Change, and the Working Group on Organic Matter Dynamics in the Critical Zone Observatory Network



Reported by Conference Chairs:
Timothy Filley (Purdue University)

and

Dali Guo (Institute of Geographic Science and Natural Resources Research, Chinese Academy of Sciences)



PROGRAM OVERVIEW

On Oct 20-24, 2015 Purdue University hosted a conference and workshop entitled Critical Zone Science, Sustainability, and Services in a Changing World. Organized by the U.S.-China EcoPartnership for Environmental Sustainability, the Intensively Managed Landscapes Critical Zone Observatory (CZO), and the Working Group on Organic Matter Dynamics in the Critical Zone Observatory Network, the gathering brought together over 150 leading researchers and their students, with 54 traveling from China, to share the latest science related to terrestrial ecosystem function and vulnerability, and to discuss and debate options for sustainable use of natural resources. The program included two regional field trips, a training workshop, 35 poster presentations and 54 oral presentations. The gathering provided an important venue for the next generation of critical zone scientists as nearly one third of the attendees were graduate students, post doctoral researchers, and research associates. The conference attracted broad institutional participation with 22 U.S., 1 U.K., and 16 Chinese academic and research institutions represented. Members of the newly funded China Critical Zone Observatory Network were also in attendance and engaged in discussions to promote bi-national, cross-CZO research.

ABOUT THE CRITICAL ZONE

The Critical Zone (CZ) is defined as the portion of the Earth's land surface that extends from the top of the vegetation canopy to the lowest limit of circulating groundwater. Critical zone science views the ecological, geological, and hydrological processes taking place in this zone as an integrated and interconnected system that acts over broad spatial (primarily at the catchment level) and time scales. To advance this kind of integrated research, the U.S. National Science Foundation (NSF) has created and supports a network of Critical Zone Observatories (CZOs) in the United States. Each CZO has unique attributes in climate, lithology, land use, biology, and topography that can be leveraged to study fundamental questions about how the structure and function of the Critical Zone evolves, including how it will respond to climate and land-use change. The CZO network, which began in 2007, currently consists of 10 sites (http://criticalzone.org/national/). Collaborative research within each CZO, as well as across the CZO network, engages a diverse and growing scientific community to advance knowledge of Earth surface science including the study of important CZ processes, like soil formation, stream flow generation, landscape evolution, and the biogeochemical cycling of elements essential for life.

CONFERENCE HIGHLIGHTS

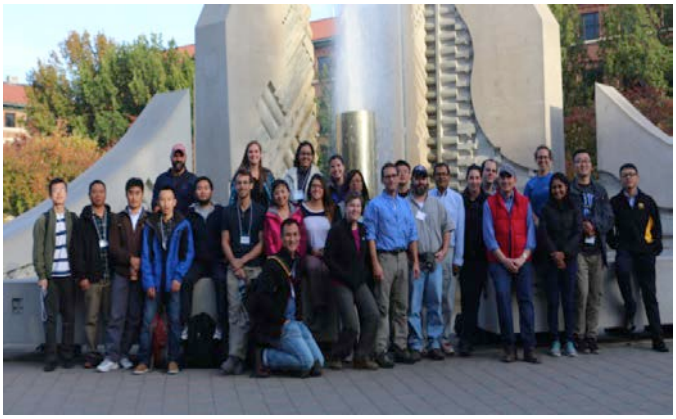
The conference included many distinguished invited lecturers, as well as panel discussions, workshops, and opportunities for informal networking. We were honored to have delegations from Nanjing University, led by their Vice President Pan Yi, and Shenyang Agricultural University, led by their Vice President Jicheng Wang. At the conference, the delegations completed cross-institutional, bi-national education agreements and initiated plans for the 2017 EcoPartnership-Joint Research Centers China-U.S. conference to be hosted by Nanjing University. Among the many notable lectures, the organizers were particularly pleased to have Dr. Hailiang Dong, Program Director of the U.S. National Science Foundation Geobiology and Low-Temperature Geochemistry Program in the Division of Earth Sciences, discuss the state of the NSF CZO Network and Dr. Sonny Ramaswamy, Director of the National Institute of Food and Agriculture, United States Department of Agriculture, who addressed the importance of critical zone concepts in food security. Additionally, Dr. Dali Guo, Institute of Geographic Science and Natural Resources Research, Chinese Academy of Sciences, discussed the developing China Critical Observatory Network and its relationship to the China Ecological Research Network (CERN). Their presentations and the ensuing discussions highlighted the important role of networked global science for solving key societal issues.

Dr. Sonny Ramaswamy, Director of the National Institute of Food and Agriculture, United States Department of Agriculture, addressing the conference.

Through field trips, demonstrations, and short courses, the gathering provided opportunities for enhanced training and instruction on important CZ processes. Twenty-five of the forty-two graduate student and post-doctoral attendees participated in a Consortium for the Advancement of Hydrological Science Inc. (CUAHSI - https://www.cuahsi.org/) Instrument Training Short Course on "The Role of Runoff and Erosion on Soil Carbon Stocks," held Oct 20-21, 2015 and led by Dr. Thanos Papanicolaou-University of Tennessee. The training course was designed to inform its participants about the state of-the-art instrumentation and measurements that are available for quantifying carbon dynamics in Intensively Managed Landscapes (IMLs) from the soil profile scale to the landscape scale. The course examined the key processes that define carbon budget in IMLs, which include erosion, litter incorporation into the soil profile, microbial activity/ respiration, and stabilization in aggregates. Thanks to generous contributions from our corporate sponsors, we were able to provide additional travel and lodging assistance to three early career scientists to attend the CUAHSI training course. Drs. Sylvie Brouder and Jeff Volenec of Purdue University hosted a field-based demonstration on the importance of subsurface hydrological modification in U.S. Midwest agriculture at the Purdue Water Quality Field Station. The final day of the conference offered a field trip to the Intensively Managed Landscapes (IML) Critical Zone Observatory sites in Illinois

(http://criticalzone.org/iml/infrastructure/) where participants could tour the field sites and laboratories, and engage the IML scientists and partner landowners and farmers. The participants were shown the methods by which the IML CZO team, led by Dr. Praveeen Kumar-University of Illinois, is investigating their central hypothesis that the critical zone of IMLs have passed a tipping point resulting from human modification, and has gradually shifted from being a *transformer* with high nutrient, water, and sediment storage to being a *transporter* with low nutrient, water and sediment storage.

Bus rides between the hotel and the Beck Agricultural Center were transformed into mobile class rooms where Dr. Darrell Schulze-Purdue University, demonstrated the Integrating Spatial Educational Experiences (ISEE) visualization software (http://isee.purdue.edu/) he and his team developed to help agricultural and Earth Sciences researchers and educators visualize information about the soils, landscapes, and natural and man-made features using mobile, wireless, computer devices.



Some of the graduate students, postdoctoral researchers, and faculty in attendance at the CUAHSI instrument training short course (top) and the conference and

During the conference, three NSF-funded workshops were convened by the Cross CZO Working Group on Organic Matter Dynamics, including: 1) multivariate/ chemometric methods for large and complex data set analysis in CZ science; 2) organic matter dynamics as controlled by erosion and deposition; and 3) mineralogical and microbial controls on soil and sediment organic matter reactivity and persistence. The goal of the workshops was to identify important knowledge gaps and opportunities for partnering strategies with an eye towards making recommendations for common questions, common measurements, common methods, common laboratories, and common experiments to support cross-U.S. CZO and international CZ science in the area of organic matter dynamics. Participation in these workshops also included scientists from China who are either already engaged in China CZO development or directly working in CZ-related science.

The conference concluded with an inspiring riverboat cultural event showcasing the rich history, architecture, and food of the City of Chicago.

CONCLUDING THOUGHTS

Colleagues enjoying the final conference dinner aboard the Chicago River and Lake Michigan boat cruise

Throughout the technical sessions, working groups, and conference social events. the benefits of linking, leveraging, and aligning networks to develop solutions that address major societal challenges related to CZ functions were explored. The conference also provided an important platform for the next generation of CZ scientists to actively consider international implications of their work and explore new connections. New and exciting bi-national peer-to-peer and cross-CZO network collaborations are sure to develop from this gathering, which will be a testament to the participants' shared vision of connected scientific networks to advance CZ science.

Photo and Document Access

Low-resolution photos from the conference can be downloaded from the following directory (High resolution photos available upon request): http://www.purdue.edu/discoverypark/ecopartnership/critical-zone-conference/gallery.php. If you have photos from the conference or any of the events that you would like posted to the gallery please contact Tim Filley (Filley@purdue.edu).

The full conference program (abstract and attendee list) can be uploaded at: http://www.purdue.edu/discoverypark/ecopartnership/critical-zone-conference/CriticalZone_Program_web.pdf

Organization Web Sites

US-China Ecopartnership for Environmental Sustainability
English Language - http://www.purdue.edu/discoverypark/ecopartnership/
本网站中文版 - http://www.purdue.edu/discoverypark/ecopartnership-cn/
China-US Joint Research Center for Ecosystem and Environmental Change
http://jrceec.utk.edu

Conference and Workshop Sponsors

The conference and workshop program was funded by the U.S. National Science Foundation, Purdue University's College of Agriculture, Global Engineering Program, and College of Science, as well as the Confucius Institute, and corporate sponsors FuturaGene, Faegre-Baker-Daniels LLP, and the Tianjin Economic Development Area.

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