Invited International Workshop

URBAN WETLAND INFRASTRUCTURE: PAST, PRESENT AND FUTURE

Virtual

May 27-28, 2021

Sponsors:

U.S. National Science Foundation, Project FEWSUS
The University of Tennessee, USA
Northeast Normal University, China
Czech University of Life Sciences Prague, Czech Republic

1. BACKGROUND

Urban systems, including cities and surrounding regions, occupy less than 4% land surface area on earth but support 66% of population and contribute more than 80% of gross domestic product and more than 70% of greenhouse gas emissions in the world. Wetlands can act as big sponges to soak up and store heavy rainfall, then release it slowly over time, lessening impacts of extreme climate events and solving urban water scarcity problems. Rapid loss of valuable wetland ecosystems or lack of constructed wetland infrastructure makes cities increasingly vulnerable to the impacts of various grand challenges, such as extreme weather events, population growth, and accelerating demands of food, energy and water (FEW) resources. Research has demonstrated that wetland conservation and construction create livable and resilient cities and can mitigate FEW losses and wastes. Unfortunately, wetland infrastructure development in cities always encounters various barriers at technological, social, policy, and economic levels. This problem is mainly caused by lacks of transdisciplinary collaborations, disengagement of stakeholders, and multisectoral policies. Therefore, a systematic discussion on the status and challenges of urban wetland engineering among researchers, stakeholders, and policymakers are essential for creating stakeholder-acceptable and policy-effective opportunities that support sustainable urban development under the United Nations' Sustainable Development Goals 6, 11 and 13.

2. GOAL AND OBJECTIVES

This meeting aims to exchange research and perspectives and establish an international working group for transdisciplinary collaborations of research and education in the area of conservation and construction of urban wetland infrastructure. Specific objectives are to:

- Summarize research and management practices of urban wetland infrastructure
- Identify opportunities at technological, sociological, and policy levels
- Develop a research menu of urban wetland engineering

3. WORKSHOP CO-CHAIRS (in alphabetical order)

- Dr. Lianxi Sheng, Northeast Normal University, China
- Dr. Jan Vymazal, Czech University of Life Sciences in Prague, Czech Republic
- Dr. Jie (Joe) Zhuang, University of Tennessee, USA

4. MEETING AGENDA

THURSDAY, MAY 27, 2021 8:00-10:00 am (U.S. Eastern Time), 2:00-4:00 pm (Central European Time) 8:00-10:00 pm (Beijing Time), **Zoom link: https://tennessee.zoom.us/j/99048594815** **Chairs:** Jie (Joe) Zhuang, The University of Tennessee, USA Jan Vymazal, Czech University of Life Sciences, Czech Republic	
8:00-8:05 am	Introduction of Speakers and Key Participants
8:05-8:20 am	**"Workshop Focus: Transdisciplinary Research Network Development"** Jie (Joe) Zhuang, The University of Tennessee, USA
8:20-8:40 am	**"Urban Constructed Wetlands for Stormwater Runoff"** Jan Vymazal, Czech University of Life Sciences, Czech Republic
8:40-9:00 am	**"Balancing Biodiversity Conservation and Mosquito Threats in Freshwater Urban Wetlands"** Jayne Hanford, The University of Sydney, Australia
9:00-9:20 am	**"Role of Wetlands in Green Transition of Agriculture towards Sustainable Development"** Shubiao Wu, Aarhus University, Denmark
9:20-9:40 am	**"Sustainable Urban Runoff Management: The Rise of Green Infrastructure"** Jon Hathaway, University of Tennessee, USA
9:40-10:00 am	**"A Framework for Identifying Reference Wetland Conditions in Highly Altered Landscapes"** Marinus Otte, North Dakota State University, USA
FRIDAY, MAY 28, 2021 8:00-10:00 am (U.S. Eastern Time), 2:00-4:00 pm (Central European Time) 8:00-10:00 pm (Beijing Time), **Zoom link: https://tennessee.zoom.us/j/99048594815** **Chairs:** Jie (Joe) Zhuang, The University of Tennessee, USA Chunguang He, Northeast Normal University, China	
8:00-8:20 am	**"Experiences and Case Studies of Constructed Wetlands for Sustainable Management of Municipal Wastewater in Different Climates"** Alexandros Stefanakis, Technical University of Crete, Greece
8:20-8:40 am	**"Biogeochemical Perspectives of Sustainability in Urban Wetlands"** Qiang He, University of Tennessee, USA
8:40-9:00 am	**"The Context of the Research of Constructed Wetland Technology for Wastewater Treatment in Latin-America and the Caribbean"** Marco Rodriguez-Dominguez, Aarhus University, Denmark
9:00-9:20 am	**"Ecological Restoration of Polluted Water in the urban Area of Yitong River, Changchun, Northeast China"** Chunguang He & Lianxi Sheng, Northeast Normal University, China
9:20-9:30	**"Potential Opportunities for International Collaboration"** Jie (Joe) Zhuang, University of Tennessee, USA
9:30-10:00 am	Group Discussion & Summary

Note: 17 minutes for live talk and 3 minutes for Q&A

5. BIOGRAPHY OF INVITED SPEAKERS AND WORKSHOP CHAIRS

(in alphabetical order)

Dr. Jayne K. Hanford has been involved in the field of freshwater science for nine years, both as an environmental consultant focusing on mitigating and monitoring the impacts of development on freshwater streams, rivers and upland swamps, and more recently within academia researching the role of freshwater urban wetlands in urban mosquito issues, and how to design and manage these systems for multiple purposes and benefits. She completed her PhD at The University of Sydney, and is currently serving as Secretary for the Oceania Chapter of the Society of Wetland Scientists. Many of the projects she has been involved in, both through consulting and research, have used aquatic macroinvertebrates as an indicator of ecosystem health and function, drawing links between ecosystem condition and physical traits such as wetland features and surrounding urban land uses. Dr. Hanford has also conducted large scale observational and manipulative field studies to reveal general trends in the drivers of urban aquatic biodiversity, how these drivers interact with mosquito diversity and abundance, and how urban wetland management regimes influence mosquitoes of pest and public health concern. Due to the potential for mosquitoes to pose significant threats to human health and wellbeing through disease transmission and nuisance biting, she is a strong advocate for taking an integrated, interdisciplinary approach to wetland planning and management. This is essential if wetlands are created in urban areas that fulfil biodiversity and water management functions, without increasing or creating risks to human health and wellbeing.
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Dr. Jon Hathaway is an associate professor in the Department of Civil and Environmental Engineering at the University of Tennessee, Knoxville, Tennessee, USA. He received his PhD from North Carolina State University in 2010, where he studied the fate, transport, and removal of indicator bacteria in urban stormwater runoff. After a brief research fellowship at Monash University in Melbourne, Australia, and nearly two and half years at one of the nation's leading ecological design and consulting firms, he joined the Department of Civil and Environmental Engineering at the University of Tennessee. Dr. Hathaway is a recipient of the National Science Foundation CAREER award and serves as an Associate Editor for the Journal of Environmental Engineering. He is an elected member of both the ASCE EWRI Urban Water Resources Research Council Core Group and the International Water Association Joint Committee on Urban Drainage.
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Dr. Chunguang He is a professor of School of Environmental Science, Northeast Normal University, China. He received his Ph. D degree in Environmental Science from Northeast Normal University. Dr. He is currently Vice Director of State Environmental Protection Ministry's Key Laboratory of Wetland Ecology and Vegetation Restoration, and the Director of Jilin Province's Science and Technology Innovation Center for Wetland Restoration and Functionalization. He is a member of the 3rd Decision–making Advisory Committee of the Changchun Municipal Committee. Dr. He studies for two years as a UNESCO Researcher in Tokyo Institute of Technology during 2004-2005 and visited as a visiting professor at the University of Wisconsin Madison from 2010 to 2011. His research interests cover both fundamental and applied aspects of wetland ecological engineering and restoration, including (i) ecological engineering and hydrological regulation for the conservation and restoration of waterfowl habitat, (ii) ecological restoration and management of polluted water in urban river, and (iii) wetland ecosystem services. Dr. He has led more than 50 research projects, including National Science and Technology Development Project, National Special Funds of Science and Technology for Control and Remediation of Polluted Water System, Special Research Projects of the State Environmental Protection Ministry, National Natural Science Foundation of China. He has published more than 40 refereed articles in international SCI-indexed journals.

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Dr. Qiang He is a professor of environmental engineering at the University of Tennessee, Knoxville, Tennessee, USA. Working toward the goal of "a healthy and sustainable environment", his recent research endeavors have focused on the development of multidisciplinary research efforts to address issues of sustainability in both natural and engineered environments. Examples of his work include microbiomes of biological treatment processes, urban stormwater management, and resource recovery from waste materials.

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Dr. Marinus L. Otte is a professor at North Dakota State University, USA. He received his Ph.D in 1991 and M.S. degree in 1986 from Vrije Universiteit, Amsterdam, The Netherlands. Dr. Otte has a broad range of research interests, including wetlands, ecology, ecotoxicology, ecophysiology, and biogeochemistry. He was co-director and mentor of the North Dakota INBRE II Metal Analysis Core. He currently serves as Editor-in-Chief of *Wetlands*, the scientific journal of the Society of Wetland Scientists.

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Marco Antonio Rodríguez Domínguez is currently a Ph.D. candidate at Aarhus University (Denmark) working with the Department of Biology, the Centre for Water Technology WATEC, and the Department of Biological and Chemical Engineering - Process and Materials Engineering. He is young researcher and entrepreneur specialized in nature-based solutions for wastewater and waste treatment using constructed wetlands and biorefining processes. In 2009, he finished his bachelor on Environmental Systems Engineering at the Polytechnical National Institute in Mexico. In 2012, he obtained the Master Degree in Water Science at the Mexican Technological Institute of Water in Mexico. In 2020, he wrote the first Latin-American review about Constructed Wetlands, which was published in the Journal *Water*. In 2020 and 2021, he researches the use of biomass of constructed wetlands for the production of high-value products, like protein, cellulose, and bio-crude using the biorefining process. Marco is the founder of Green Growth Group México SA de CV where he leads projects related to constructed wetlands for wastewater treatment, biorefining and bioproducts projects, environmental consultancy, and water rights in Mexico. He has been an independent consultant since 2011, when he founded the firm S.I.S.A. Soluciones Integrales y Servicios Ambientales, which was absorbed by Green Growth Group México SA de CV in 2014. In Latin America, Marco promotes the constructed wetland technology through the Pan-American Constructed Wetland Network Association (Red Panamericana de Sistemas de Humedales), where he serves as the technical secretary.

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Dr. Lianxi Sheng is a distinguished professor of School of Environmental Science, Northeast Normal University, Changchun, China. He received his bachelor degree in biology from Jilin Normal University in 1975, master degree in animal ethology in 1988, and doctoral degree in botany from Northeast Forestry University of China in 1999. He was the former President of Northeast Normal University. Currently, he serves as the Director of State Environmental Protection Ministry's Key Laboratory of Wetland Ecology and Vegetation Restoration. Dr. Sheng's research interests include wetland ecological process and functional mechanism, wetland ecological restoration engineering, and biodiversity conservation and co-evolution. Dr. Sheng is a national well-known educator in the area of ecology. His textbook entitled "Environmental Ecology" has been mostly widely used in the universities and research institutions in China. He received numerous ecological research awards in China, including The Outstanding Contribution Award of Chinese Society of Ecology in 2019 and National Science and Technology Progress Award in 2018. Dr. Sheng has led more than 90 research projects, including 863 Project and 973 Project funded by the Ministry of Science and Technology, Major National Water Projects, National Natural Science Foundation of China. Dr. Sheng has published more than 100 research articles in SCI journals.

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Dr. Alexandros Stefanakis is an assistant professor at the School of Environmental Engineering, Technical University of Crete in Greece. He is a Regional Coordinator for Africa and Middle East for the 'Wetlands for Water Pollution Control' Specialist Group of the International Water Association. He is the Editor-in-Chief of the journal 'Circular Economy and Sustainability', and Associate Editor of other scientific journals. He is an Environmental Engineer and Researcher focusing on water engineering and specifically on nature-based solutions and ecological engineering. He is an expert on sustainable and decentralized water and wastewater treatment systems. He has designed, managed, and constructed several wastewater treatment facilities across Europe, Middle East, Africa, USA and South America using nature-based solutions such as constructed wetlands. He also studies the principles and content of circular economy and how this new growth model can be implemented to reach the goal of a sustainable society. In the past, he worked as Researcher and Lecturer at the University of Brighton in the UK, the University of Beira Interior in Portugal, the Helmholtz Center for Environmental Research – UFZ in Germany, and the Democritus University of Thrace in Greece. He also has extensive experience in the industry as he was employed by environmental companies (Ecosafe in Greece, Bauer in Germany & Oman) as Wastewater Specialist-Wetland Expert and Tender Manager. His publication record includes several articles in international scientific journals and conference proceedings, as well as three books and various book chapters. He is known internationally as an enthusiast of green technologies for water management and reuse, always trying to promote and disseminate such technologies and transfer his knowledge to young engineers and students.

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Dr. Shubiao Wu is an associate professor at Aarhus University, Denmark. Shubiao has dedicated to exploring efficient natural-based solutions for pollutant mitigation in agriculture and approaches promoting nutrients recycling from wastewater to agriculture. He has a great research interest in biogeochemical interactions of various pollutants degradation pathways in wetland and soil systems. Shubiao has significantly improved the understanding of sulfur cycling in wetlands and its interactions with microbial carbon and nitrogen turnover. His findings strongly demonstrated the dynamics of sulfur transformations under change of pH and redox conditions in wetlands. He was the first to differentiate various bacterial sulfur transformations superimposing sulfate reduction, such as disproportionation of reduced sulfur compounds and re-oxidation of sulfide in treatment wetlands. Moreover, he quantitatively assessed re-oxidation of sulfide to sulfate by applying stable isotope investigation combined with hydro-chemical examination. Besides, he has explored various new intensification strategies in constructed wetlands and validated their promising performance. Shubiao has also deeply explored the mechanisms of nutrient recovery from wastewater via biochar adsorption and struvite formation. He also demonstrated the

beneficial effect of nutrient-enriched biochar land application that could partly replace chemical fertilizers and promote organic farming in a circular economy concept. Shubiao has an excellent publication record as he has published more than 100 papers in scientific peer-reviewed journals and many of those have been published in field-top journals such Water Research and Environmental Science and Technology.
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Dr. Jan Vymazal was graduated from the Institute of Chemical Technology in Prague, Czech Republic in 1980 and received the Ph.D. at ITC in 1985. Between 1985 and 1991 he was affiliated with Water Research Institute in Prague at the department of wastewater treatment. In 1991, Jan joined Duke University Wetland Center, North Carolina, USA as a visiting scholar. During his stay at Duke University until 1993 he focused on the wetland plant communities in Florida Everglades. Between 1994 and 2006 Jan worked as freelance researcher focusing mostly on constructed wetlands for wastewater treatment. In 2007, he joined Faculty of Environmental Sciences at the Czech University of Life Sciences in Prague. He is currently a head of Department of Applied Ecology and vice-rector for research and science. Jan has authored more than 150 papers indexed in Web of Sciences with over 9200 citations and H-index of 43. He wrote two books and edited nine books on natural and constructed wetlands. He is Editor-in-Chief of the journal *Ecological Engineering* and Associate Editor for *Science of the Total Environment* and *Wetlands*.
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Dr. Jie (Joe) Zhuang is a professor in Department of Biosystems Engineering and Soil Science and Center for Environmental Biotechnology at the University of Tennessee, Knoxville, USA. He received his B.S. in soil science and agrochemistry in 1987, M.S. in soil physics in 1990, and Ph.D in soil physics in 1993 from Shenyang Agricultural University, China. He is a co-founder and deputy director of China-US Joint Research Center for Ecosystem and Environmental Change since 2007. Dr. Zhuang created a US-China 100-PhD Program in the areas of Food, Energy and Environment in 2014 and has recruited more than 40 students for PhD study in the U.S. With the support of the U.S. National Science Foundation, Dr. Zhuang currently leads a project aiming to develop a global research network for creating transdisciplinary nodes of food-energy-water to support sustainable urban systems (FEWSUS). This research project involves researchers, students, stakeholders, and policy-makers of many countries of the world. Over the past two decades, Dr. Zhuang has worked on many challenging research projects in the U.S., Japan, and China. His research focuses on the fate and transport of contaminants (e.g., viruses, bacteria, colloids, emerging organic chemicals, radionuclides, and munitions constituents), physical foundation of soil viral ecology, soil hydrology modeling, and plant-water relations. He has served editorial boards or as guest editor for eight international journals. Dr. Zhuang has published more than 120 referred papers and book chapters and given more than 40 invited talks worldwide.
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