Modelling versus Measurement: Error and Scaling Impacts on Sustainable Urban Design

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Environmental Informatics (EI) is present in every stage of truly sustainable research in environmental engineering and sustainable urban design. EI forms the basic support structure for effective i) data monitoring and collection; ii) processing; iii) modelling; iv) interpretation; and v) dissemination of the information/outcomes. Inherent in all stages of the design process is the accumulation of error, and rigorous EI science is always cognizant of error. Sustainable urban infrastructure for urban water resources management is undergoing a continual revolution in many countries, in which new methods are being implemented as quickly as they are being proposed. In practice, effective engineering design often involves much more emphasis on modelling and monitoring, than any of the other stages of design noted above; and with the latter activity being more and more de-emphasized because of the growing costs associated with monitoring. Both modelling and monitoring produce errors, which are not only very often ignored in the design process but these errors propagate and are magnified when scaling up. Scaling up is typical when implementing engineering designs based on prior knowledge that is often obtained at the micro or mesocosm scale. This presentation will examine the perils of ignoring scaling consequences and errors when monitoring and modelling that leads to sustainable urban infrastructure designs with focus on two Low Impact Development (LID) options including: bioretention cells (a.k.a rain gardens) and permeable pavements. Designs for bioretention cells and permeable pavements are often available through local municipal guidelines. The EI science that should form the basis of those design guidelines is often patchy, with little attention to error and scaling implications. This presentation provides examples of the implications to design from the non-rigorous application of EI science.

Caterina Valeo is a Professor in the Department of Mechanical Engineering at the University of Victoria and a Professional Engineer in the Province of British Columbia. After receiving undergraduate degrees in Physics and later, a second one in Civil Engineering, both from the University of Toronto, she went to McMaster University to complete a Masters degree and eventually a PhD specializing in urban water resources in 1998. She has also worked as an Academic at various other universities in Canada in the areas of Civil Engineering and Geomatics Engineering over her 22 year plus career. These eclectic roles have allowed her to develop a unique foundation and develop her interdisciplinary research program that merges information science with environmental science and engineering. Her research interests and areas of application are wide and varied and range from researching the impacts of global scale changes on forestry and water supply to developing sensors and models to describe the role of bacteria and biofilm in treating polluted water. She has more than 200 publications including 3 co-authored books on topics as diverse as Environmental Hydraulics and Digital Terrain Modelling. She has collaborated with over 100 researchers across the globe, has received and participated in several millions of dollars in grants and is the recipient of numerous accolades including the 2014 Award of Distinguished Scientist from the International Society for Environmental Information Sciences. Today Dr. Valeo runs the Bioretention Research Laboratory and the HAL Lab at the University of Victoria and continues to conduct multi-collaborative research that uses Environmental Informatics tools to create sustainable solutions to society's modern problems.