A8 - LEEDing Green Interventions 3: Greenskins

Presentation title: GREEN SKINS INTERVENTIONS IN CITIES Environmental Benefits Achieved by Green Roofs, Green Streets and Green Facades

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Abstract
This research focuses on the environmental benefits derived from an overall 'green skin' intervention [roofs, facades and streets] in the city core of Downtown Vancouver, Canada. It analyzes previous precedents conducted in cities such as Berlin, Germany; Malmo, Sweden; Toronto, Vancouver, Canada; Chicago and Seattle, USA; and applies the data to a particular case study area in Downtown Vancouver. It then applies the Seattle Green Factor to the area, and quantifies the contribution of the green skin intervention towards ameliorating the environmental impacts of cities in terms of reducing stormwater runoff, CO2 emissions, and building energy demand. It also investigates the potential of green roofs and green facades for food and energy production. The selected case study area in Downtown Vancouver is comprised of two residential neighbourhoods - the West End and Downtown District neighbourhoods. It includes high rises over 30 stories and townhouses of 3 stories. By measuring the case study area, this research applies the Seattle Green Factor and proposes an overall green skin intervention of greening 30% of streets, 30% of flat roofs, and 15% of existing facades, in order to achieve the value of 0.3 suggested by the Seattle Green Factor. Calculated results from the case study area show that the addition of green roofs, green facades and green streets would reduce stormwater runoff by up to 13% (4% by green roofs, 3% by green streets and 6% by green facades), reduce building energy demand by 9%, and CO2 emissions by 12%. With these findings, the research proposes a new Vancouver Green Factor for the selected area, which introduces new concepts to these types of green factors, such as the volumetric value of urban surfaces. It is also found that local precipitation and temperature, soil type, growing medium thickness and plant selection play an important role in the efficiency of a green roof in reducing stormwater runoff. Therefore, the methodology is applied to Kelowna, BC and Shanghai, China, whose climatic conditions are distinctly different from those of Vancouver. In order to calculate the runoff reduction, daily climate data of precipitation and temperature are applied and the SCS-CN method, crop coefficient method and a soil water balance model are used. Specific design recommendations related to the local climate of each city are given to maximise runoff reduction and minimize irrigation requirements on green roofs. Results show that green roofs can be more efficient in Shanghai than in Vancouver. As more than 80% of precipitation falls in winter, only 29% of annual runoff could be reduced in Vancouver. Due to the lack of rainfall during the summer period, irrigation might be required in summer in Vancouver even for drought tolerant plants such as sedum. Shanghai has a similar annual precipitation to Vancouver, but in Shanghai, most precipitation occurs in summer instead of winter. As a result, high water use plants can be used on green roofs and no irrigation will be required, as it rains frequently and water content in soils could be complemented quickly. In Kelowna, the precipitation is so low that all runoff can be retained by green roofs. In order to minimize irrigation use, it is recommended that green roofs cover a maximum of 44% of roof area, and that rainwater generated from adjacent impervious roof areas should drain into this vegetated section of the roof. The research also looks at the potential of rain gardens and bio-swales in Vancouver. By considering subsoil conditions and construction cost, it intends to develop appropriate, efficient, cost-effective and site-specific green street strategies for downtown Vancouver. Currently, the methodology is used to quantify the effects of the laneway house applying the EcoDensity strategy on stormwater runoff. Results show that combining green roofs with storage tanks could significantly reduce runoff by 54% per year.

Speaker Biography

Daniel Roehr is an assistant professor at UBC, Vancouver, a registered landscape architect in Berlin and Vancouver, and horticulturalist. In 2007 he founded the Greenskins Lab (www.greenskinslab.sala.ubc.ca) under the umbrella of the Design Centre for Sustainability at UBC, where his current research focuses on monitoring the holistic environmental performance of green roofs, green facades and green streets in cities. He has published refereed papers with his international team of researchers on this topic in Europe, North America, Asia and Australia. He has also published articles on urban planning and urban agriculture in Vancouver, education in landscape architecture and two books with his students titled Sketching Iran and Sketching Italy. One of his main focuses in teaching at UBC is combining free hand sketching and digital media to observe, analyze and represent architecture and landscape architecture.

Yuewei Kong is a core researcher at Greenskins Lab. He obtained his B. Arch degree at South China University of Technology (SCUT) in Guangzhou, P.R. China in 2004, and completed his Master of Advanced Studies in Landscape Architecture (MASLA) at UBC in 2008. His research focuses on rainwater harvesting and stormwater management in the urban environment, particularly the effects of green roofs and rain gardens on stormwater runoff. With Professor Roehr, Kevin developed a methodology to quantify the potential of green roofs to reduce stormwater runoff in different locations with disparate climatic conditions, using local climatic data, the properties of soil materials, and plants.