Collaborative research on potential impacts of green roof infrastructure in the city of Cincinnati

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Introduction

Modern cities face many challenges to sustainable growth including scarcity of reliable clean water resources. One of the most pressing water resource issues for American cities, including Cincinnati, are combined sewer overflows (CSO) caused by excess stormwater runoff into antiquated sewer systems, leading to nutrient pollution and eutrophication of surface waters. Climate change is expected to make this problem worse, and amplifies uncertainty around stormwater management. One proposed management approach is the implementation of vegetated or "green" roofs, due to their now widely acknowledged (but regionally variable) utility in mitigating stormwater runoff. Here we present examples of collaborative green roof research projects currently ongoing in the Cincinnati region.

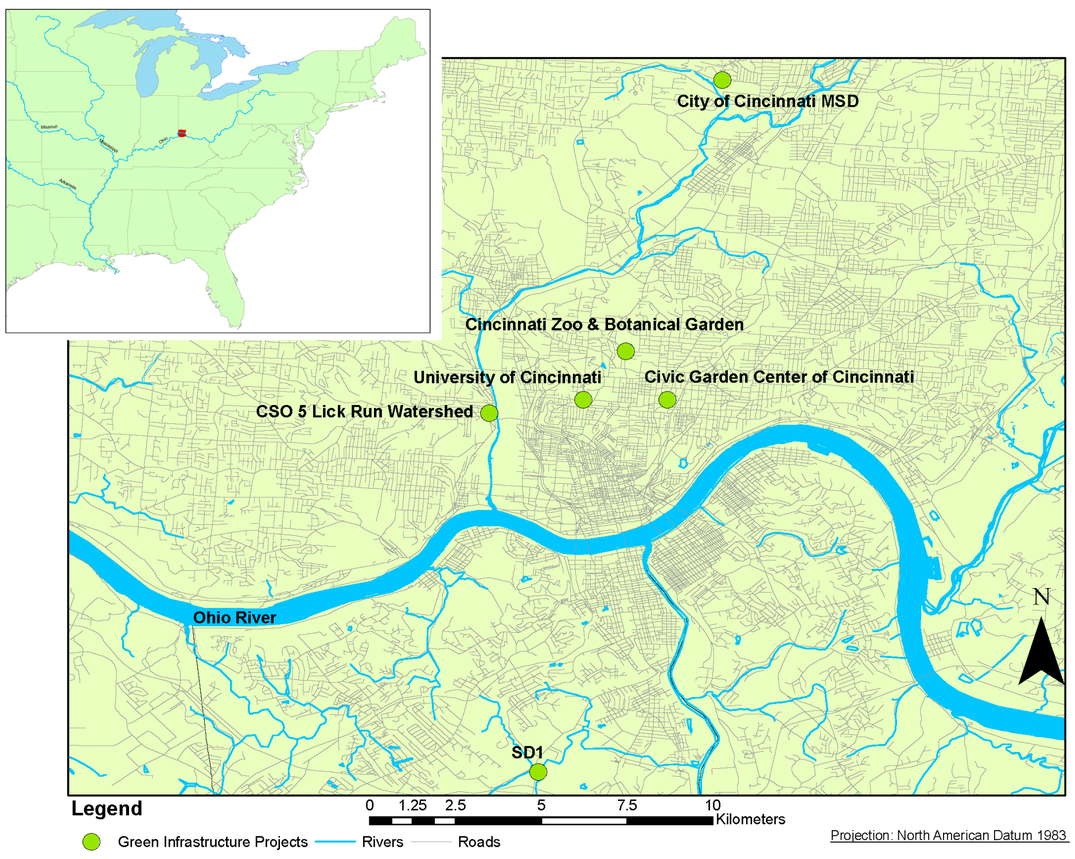


Figure 1: Location of several of the key organizations involved in green roof implementation and research for stormwater management in the city of Cincinnati, Ohio, U.S.A.

Research on Green Roof Stormwater Runoff

Project Aim: Investigate the rainfall, storage, and runoff relationships of green roofs and simulate the potential impacts of vegetated roofs for regional storm water management.

Highlights So Far: Preliminary simulations for a small Ohio River tributary watershed suggest that replacing 10, 20, or 50% of impervious areas (i.e., rooftops) with pervious green roofs can reduce peak flows of a 25-yr storm event by 9, 18, or 47%, and combined sewer overflows by 8, 15,or 40%. Work with experimental test plots is ongoing at the University of Cincinnati.

Figure 2. Prototype of experimental green roof test plots.

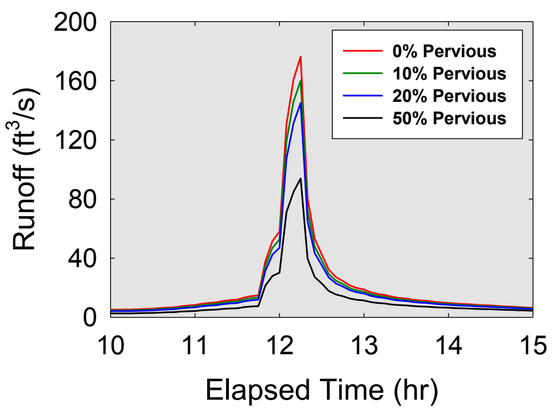
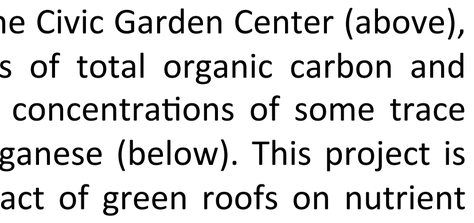


Figure 3. Simulated runoff by converting 10, 20, or 50% of impervious to pervious area for an Ohio River tributary watershed.

Figure 4: Green Roofs at the Metropolitan Sewer District of Greater Cincinnati (MSD) (left) and Sanitation District #1 of Northern Kentucky (SD1)(right). These sites have monitored stormwater runoff and energy balance of the roofs.

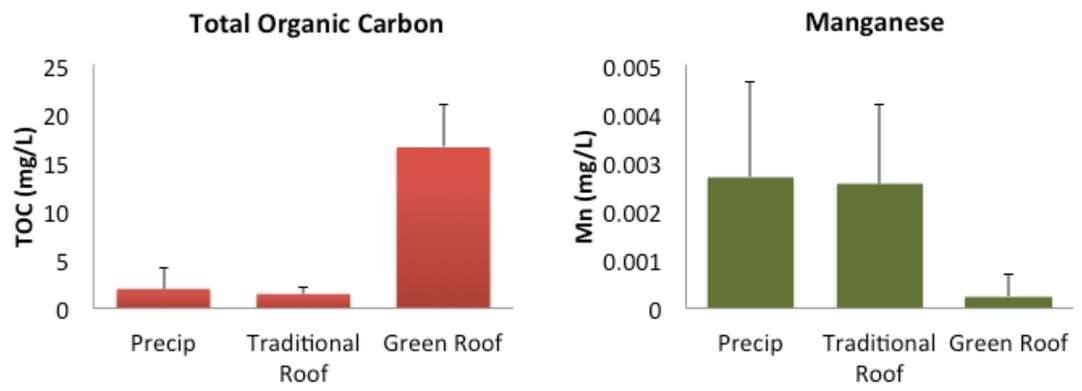
Research on Green Roof Runoff Water Quality

The non-profit Civic Garden Center is transforming an old gas station into the Green Learning Station, a learning laboratory for applying sustainable practices to gardens and the systems that support them. A typical urban expanse of asphalt and roof is replaced by a site that allows most of its rainwater to stay where it falls. Included are five green roof demonstration areas, including one (right) currently monitored for runoff water quality in collaboration with University of Cincinnati scientists.



Project Aim: Compare runoff water quality and greenhouse gas fluxes from green roofs to traditional roofs, and quantify the potential impact of green roofs on regional water quality.

Highlights So Far: For a green roof at the Civic Garden Center (above), runoff water has higher concentrations of total organic carbon and most other major elements, but lower concentrations of some trace metals including Copper, Zinc and Manganese (below). This project is ongoing and will also examine the impact of green roofs on nutrient (nitrogen and phosphorus) and greenhouse gas fluxes.



Acknowledgements

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