Perspectives from ecology and soil science on stormwater runoff and bioretention filter media

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Overview

From an ecologist's perspective, discharge seems to be the final step in a wide range of strategies and processes nature incorporates when managing stormwater. Strategies such as the slowing down of stormwater velocity, spreading of runoff volume across landscapes, sorption of water into plant bodies and soil media, and groundwater infiltration helps prevent eutrophication and pollution into receiving waters. These strategies also help to prevent the often overlooked but equally concerning consequences of downstream flooding and erosion which arise from excess stormwater runoff volume and velocity.

A great place to start the shift toward ecologically inspired stormwater management is to examine existing infrastructure which most closely resembles the full suite of aforementioned stormwater runoff mitigation strategies. Having closely examined the soil media recommended for bioretention systems, it seems the particle size distributions and organic matter content currently specified for filter media are biased toward discharge and avoiding perceived risks of nutrient leaching. Knowing this, it may be safe to assume that current filter media may not be taking full advantage of other important and equally viable strategies for managing stormwater entering the bioretention system.

This presentation will report on a review of the literature that has the aims of identifying research gaps and articulating hypotheses to be tested. Ideas and perspectives from ecology and soil science in the context of bioretention will be canvassed and discussions and collaboration encouraged in the spirit of the conference theme.

Objectives

This presentation will seek to:

- Highlight key findings from a review of the literature surrounding current best practice recommendation for soil media in bioretention systems, and soil organic matters influence on soil.
- Bridge gaps between disciplines surrounding bioretention soil media, conveying information regarding the role of organic matter in soil and how it influences soil hydrology to be more in line with stormwater runoff mitigation strategies found in natural systems.
- Address concerns with increasing soil organic matter in bioretention systems.
- Stimulate new ideas to explore when considering the soil and plant composition of bioretention systems.
- Highlight research gaps and future scientific endeavours that would seek to understand and address important research gaps and questions.

Methods

1 Approach

A systematic review of the literature will be undertaken, comparing data and theory from different strands of soil science, bioretention guidance, and research papers. The primary search engine will be google scholar, exploring:

- Scientific journal databases.
- Council websites which provide bioretention best practice guidelines.

Terms that will be primarily used to gather information are:

- Soil organic matter
- Bioretention filter media
- Bioretention systems
- Nutrient leaching
- Water holding capacity
- Sorption
- Evapotranspiration
- Stormwater runoff
- Soil carbon
- Field capacity
- Infiltration
- Soil fauna

2 Information inclusion criteria.

- Related to research topics.
- Peer review and published.
- Age of information must be less than 10 years old.
- Design of study being either quantitative and/or qualitative.

Results

From this review of the literature, different sets of hypotheses and proposed experimental designs will be generated. The sets of hypotheses generated will be exploring questions relating to:

- The effects or increasing soil organic matter in bioretention systems on water hydrology.
- The effects or increasing soil organic matter in bioretention systems on soil ecology.
- The effects or increasing soil organic matter with various organic matter sources in bioretention systems on soil chemistry.
- Generation of soil organic matter over time using potential plant species prospects.

Conclusion

From the perspective of an ecologist and soil scientist, it may be possible to increase the recommended soil organic matter content found in bioretention filter media without having the consequences of leaching. This could allow all the benefits found in having sufficient soil organic matter content in the soil media, which will then in turn further utilise overlooked strategies found in nature regarding the mitigation of stormwater runoff.