The Impacts of Sustainable Grounds Design on Water Infiltration Rates

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INTRODUCTION:

Impervious surfaces resulting from urbanization increase flooding through runoff and introduce pollutants into water bodies. Because of these negative effects, mitigation strategies aim to slow the flow of water into streams and filter out pollutants.

Sustainable grounds design, such as bioretention basins, slow runoff and allow it to absorb into the soil (infiltration). **The effectiveness of different grounds designs in absorbing water can be evaluated by comparing infiltration rates.**

OBJECTIVE:

Contrast soil infiltration rates between three sites with varying levels of sustainable design around the Science Learning Center

METHODS:

Study Sites: The grounds around the Science Learning Center (SLC), RC Wilson Pharmacy (Pharmacy), and DW Brooks Mall (lawn) were selected for their varying levels of sustainable design. The SLC is surrounded by sustainable landscaping, whereas lawns do not have sustainable design.

Infiltration Rate: Soil infiltration rate was measured using a 2 ft. wide double ring infiltrometer placed at least 2 inches in the soil. Water was poured into the infiltrometer, and the rate at which it was absorbed into the soil was recorded periodically for between 45-60 minutes.

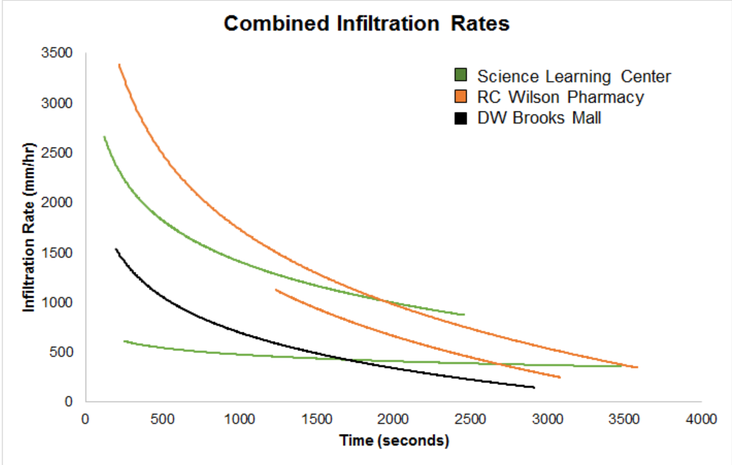


Figure 1. Infiltration rate (mm/hr) over time at the SLC (n=2), RC Wilson Pharmacy (n=2), and DW Brooks Mall (n=1) is fit to a logarithmic curve.

Dry soil can absorb a large amount of water initially, then the infiltration rate declines as the soil becomes saturated. This infiltration curve reflects the rate of water absorption over time, and it eventually reaches a steady state.

The SLC had the highest steady state infiltration rate, followed by the pharmacy, then the lawn.

CONCLUSIONS:

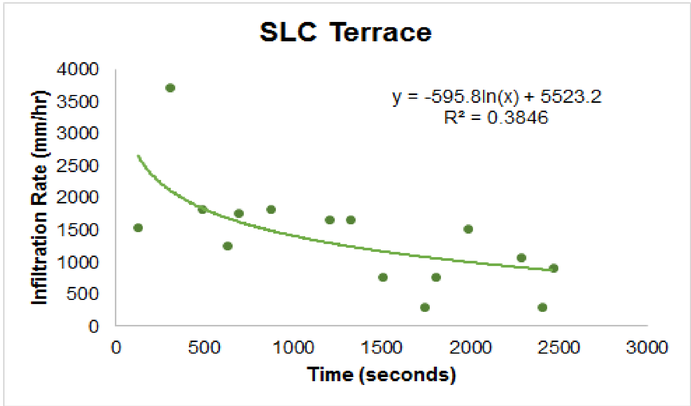
Steady state infiltration rates around the SLC were higher than for the pharmacy or lawn. The sustainable landscape design around the SLC may be the cause of its high infiltration rate.

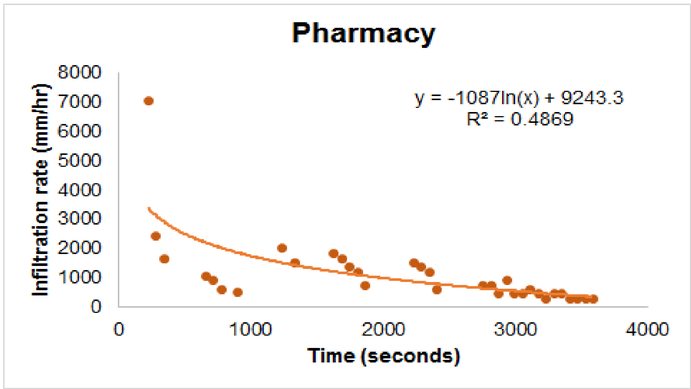
The turf grass lawn was too compacted to measure, suggesting that these lawns have a very low infiltration rate. Our infiltration measurement for lawn sparse in grass also showed that the steady state infiltration rate for the lawn was low.

Figure 2. Compacted soil and turf grass on the DW Brooks Mall.

One limitation of this study is the length of infiltration measurements - we took data for up to an hour, but most of our curves did not reach their absolute steady state infiltration rates. We are also limited by sample size, so we are unable to compare mean infiltration rates or variances. Because this study is still in progress, we will be able to make more robust conclusions in the future.

Infiltration Rates for SLC, Pharmacy, and Lawn Sites





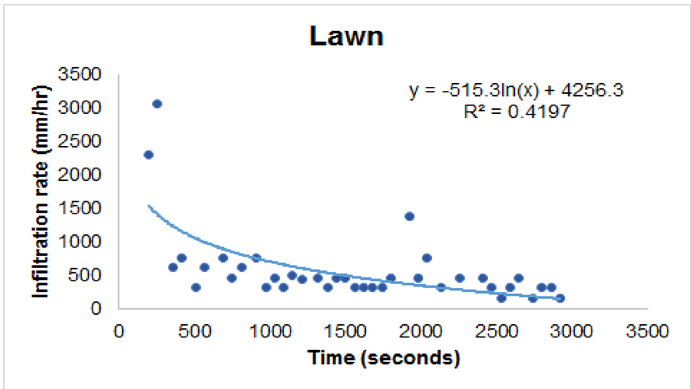


Figure 3. Infiltration rate data for one SLC, pharmacy, and lawn site fit with a logarithmic curve. Curve equation and R^2 is displayed.

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