Research Project: SHA/UMBC/1-1
February 2016

RESEARCH SUMMARY

SUSTAINABLE LANDSCAPING PRACTICE FOR ENHANCING VEGETATION ESTABLISHMENT

Problem

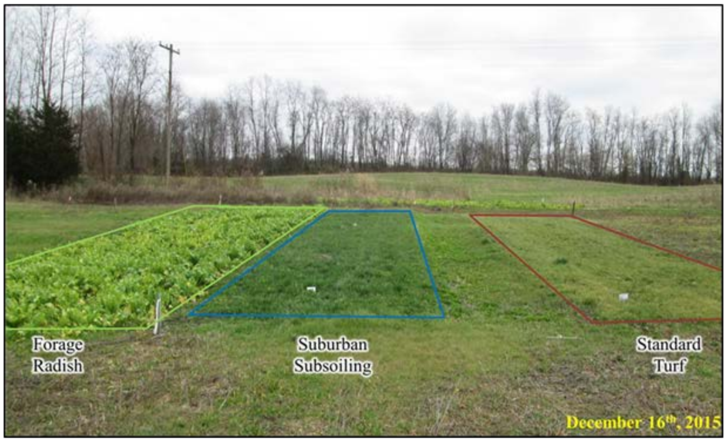
Grading and landscaping practices commonly produce compacted soils within highway medians and roadsides. This results in limited capacity to support healthy vegetation and afforestation efforts, and causes stormwater, nutrient, and sediment runoff into the streams and tributaries of the Chesapeake Bay. The Maryland State Highway Administration (SHA) recognizes the need to explore the use of alternative, sustainable practices to improve soil structure, vegetation establishment, and stormwater runoff within medians and project staging areas.

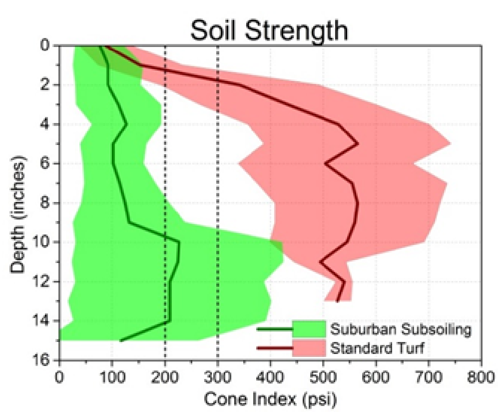
Objective

This research supports the integration of new practices and procedures to improve soil structure that will help turf, meadow, forest and landscape plantings to thrive. It sought to (1) demonstrate the effectiveness of innovative soil decompaction and amendment practices to improve compacted soils; (2) evaluate benefits of SHA deer compost; (3) evaluate effectiveness of forage radish to biodrill compacted soil; and (4) develop revised specifications to avoid and mitigate soil compaction on SHA projects.

Description

The project established experimental test plots in Taneytown, Maryland, and field-scale soil decompaction and amendment practices were evaluated alongside standard SHA practices for turf establishment. The Taneytown site was heavily compacted on the old MD 853 roadbed, and has been identified for a future afforestation project. The research team compared soil properties related to vegetation success and stormwater infiltration on plots treated with (a) suburban subsoiling (deep ripping and soil amendment using SHA deer compost); and (b) standard turf establishment using current SHA specifications. Replicate plots were also treated by planting forage radish to explore the feasibility of bio-drilling to loosen and improve compacted soils on the site. Plots were prepared and planted in Fall 2014 and reseeded in Summer 2015. Soil density, organic matter, infiltration, and soil strength were quantified before and after replicated treatments across the site.





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Results

The results demonstrated significant improvements to the compacted soils on the project site, resulting in successful turf establishment and increases in storm water infiltration.

(1) Suburban subsoiling resulted in a permeable soil profile with higher organic matter and infiltration compared to standard turf establishment practices. The median soil strength (a surrogate for compaction) with depth for the two treatments was shown in below figure. A soil strength above 200 PSI is generally considered to be limiting and above 300 PSI restrictive for vegetation growth. Suburban subsoiling improved stormwater infiltration and the success of vegetation and afforestation efforts.
(2) The mature deer compost used in this project provided stable soil carbon with nutrients and minimized the risk of nutrient losses or leaching when properly applied and soil-incorporated.
(3) The radish development on plots with successful germination demonstrated the potential for biodrilling as a multi-year strategy to mitigate compaction.

These findings are appropriate to apply to SHA projects as a low cost, low risk approach to revitalizing compacted soils. Abandoned roadbeds of sufficient size and scale will benefit from subsoiling and biodrilling techniques to ameliorate soil compaction prior to planting or revegetating the site. Application of forage radishes will be more suitable for existing meadows and other appropriate roadside landscape management areas.

Cultivating deep permeable organic soil profiles by adapting these land development practices can result in reduced life-cycle costs for green asset maintenance. SHA can include these techniques in the designer's toolbox for consideration on a site by site basis to promote long term landscape sustainability.

Report Information

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Link to Final Report

http://www.roads.maryland.gov/OPR_Research/MD-16-SHA-UMBC-1-1_Sustainable-Landscaping-Practice-for-Vegetation-Establishment_Report.pdf