

Quantifying Gully Erosion and Potential for Sediment and Phosphorus Pollution Reductions Achieved by Erosion Remediation Projects on Vermont's Roads

PROJECT TITLE

Quantifying Gully Erosion and Potential for Sediment and Phosphorus Pollution Reductions Achieved by Erosion Remediation Projects on Vermont's Roads

STUDY TIMELINE

July 2019 – July 2021

INVESTIGATORS

Beverley Wemple, Geography
Mandar Dewoolkar, Civil &
Environmental Engineering
Emma Estabrook, Rubenstein
School
Scott Hamshaw, Civil &
Environmental Engineering
University of Vermont

Contact bwemple@uvm.edu

VTRANS CONTACTS

Jennifer Callahan, Stormwater
jennifer.callahan@vermont.gov
Joel Perrigo, Municipal
Assistance Bureau
joel.perrigo@vermont.gov

KEYWORDS

Erosion, phosphorus, gully,
mitigation, lidar

More information about the VTrans Research Program, including additional Fact Sheets, can be found at:
<http://vtrans.vermont.gov/planning/research>

Introduction or Problem Statement

This study documented rates of gully erosion at road drainage outfalls and culvert outlets in northern Vermont, quantified phosphorus content of eroded soils, assessed efficacy of erosion mitigation practices, and provided a first-order estimate of the magnitude of gully erosion relative to base loads for phosphorus contributions to receiving waters.



Methodology or Action Taken

We used terrestrial LiDAR scanning to conduct ground surveys at 13 intensively monitored sites and multi-date airborne LiDAR data to conduct GIS-based assessments at culverts in 35 northern Vermont towns. Soil sampling at the 13 intensively monitored sites was used to quantify soil bulk density and phosphorus concentration. The efficacy of erosion mitigation projects was assessed through the installation and monitoring of experimental "treatments" at a set of the intensively monitored sites and through the retrospective assessment of a larger set of sites where erosion mitigation projects had been installed in the past.

Conclusions

We found that the rate of gully erosion varies widely across sites studied and relates to both site conditions and weather. Erosion mitigation practices were highly effective in reducing gully erosion at the experimentally installed sites and appear to remain largely intact, functioning to provide water quality benefits at the retrospectively assessed sites. Where the incidence of gullies is high and rates of gully erosion large, erosion mitigation can provide valuable water quality benefits and contribute to the resilience of valuable transportation infrastructure in the face of climate change.

Potential Impacts and VTrans Benefits

This study demonstrated the utility of LiDAR technology for erosion monitoring on Vermont's transportation network. Data collected through this study may help inform Lake Champlain phosphorus reduction strategies and opportunities to improve resilience of the transportation network to extreme storm events.