Semi-Annual Progress Report

Transportation Infrastructure Durability Center AT THE UNIVERSITY OF MAINE

Project Number and Title: #C5.2018: Leveraging High-Resolution LiDAR and Stream Geomorphic Assessment Datasets to Expand Regional Hydraulic Geometry Curves for Vermont: A Blueprint for New England States
Research Area: Thrust 1 Develop improved road and bridge monitoring and assessment tools
PI: *Kristen Underwood, Ph.D.; University of Vermont*
Co-PI(s): *Arne Bomblies, Ph.D.; Donna M. Rizzo, Ph.D.; University of Vermont*
Reporting Period: *6/1/2019 – 9/30/2019*
Date: *9/30/2019*

Overview: (Please answer each question individually)
Provide overview and summary of activities performed during previous six months…. PI Underwood has recruited a Civil & Environmental Engineering Masters student (Roberge) to work on this project beginning September 1. We have compiled basin characteristics for 15 USGS streamflow gauging sites and 6 additional sites used by VT Agency of Natural Resources (VTANR) to produce regional hydraulic geometry curves for Vermont, published in 2001 and updated in 2006 (Jaquith & Kline, 2001; Jaquith & Kline, 2006). We have obtained an up-to-date spatial data file of stream geomorphic assessment (SGA) data by river reach from the VTANR (Figure 1), and filtered these data to select reaches assessed to be in Reference or Good condition (i.e., geomorphically stable). New observation sites for expansion of regional hydraulic geometry curves (RHGCs) are being selected from these, based on their proximity to a USGS streamflow gauging station with peak-flow discharge record of sufficient length (>10 years) and quality (e.g., excluding reaches affected by streamflow regulation or floodplain/channel manipulations that have significantly affected runoff). From a literature search of RHGCs developed for other humid temperate regions, we have identified a list of predictor variables, additional to drainage area, that may relate to the bankfull channel width, depth, cross-sectional area, and discharge – including, but not limited to main-channel slope, elevation, mean annual precipitation, mean annual runoff, mean annual snowfall, percent carbonate bedrock, percent basin storage (lakes, ponds, wetlands), and percent land cover. Additionally, observation sites may be stratified by biogeophysical region, hydrologic landscape region, EPA Level III Ecoregion, or reach-based geomorphic stream type.

Provide context as to how these activities are helping achieve the overarching goal of the project… By relying on SGA datasets to expand the number of observations, and by exploring additional predictor variables that may better refine regression estimates, our objective is to improve the prediction ability and reduce estimation uncertainty using RHGCs.

Describe any accomplishments achieved under the project goals…
Task 1: Compile expanded set of observation sites.
1A: Compile locations and delineate catchments for 21 sites used in original VTANR RHGC publications (Shayne & Jaquith, 2001, 2006) - completed
1B: Compile and filter VT SGA data for reaches classified in stable condition – completed.
1C: Compile USGS active or historic continuous and crest-stage streamflow gauging sites – completed
1D: Select subset of USGS gauges meeting criteria – partially complete
1F: Conduct flow frequency analysis – partially complete

Task 2: Compile regression variables.
2A: Literature Review – completed
2B: Define list of possible additional predictor variables – completed

Describe any opportunities for training/professional development that have been provided…
Beginning on September 1, a Masters student in Environmental Engineering (Roberge) is being advised and mentored by the PI, and has been performing GIS analyses and data compilation tasks. Roberge is currently enrolled in graduate classes which are providing training in GIS analyses, and geostatistical analyses.

*Describe any activities involving the dissemination of research results (be sure to include outputs, outcomes, and the ways in which the outcomes/outputs have had an impact during the reporting period)…*The PI and her Masters student presented a poster of this research at the VTrans Innovation Showcase on 11 Sept 2019 in Berlin, VT. Several fellow researchers, VTrans professionals, scientists and practitioners from state agencies and NGOs, graduate students and regional high school students were in attendance. A representative from The Nature Conservancy of Vermont and a

Semi-Annual Progress Report

VTANR River Management Engineer expressed anticipation of and need for the updated hydraulic geometry curves that will be generated under this TIDC project.

.

Encouraged to add figures that may be useful (especially for semi-annual reporting by the project manager and management team)…

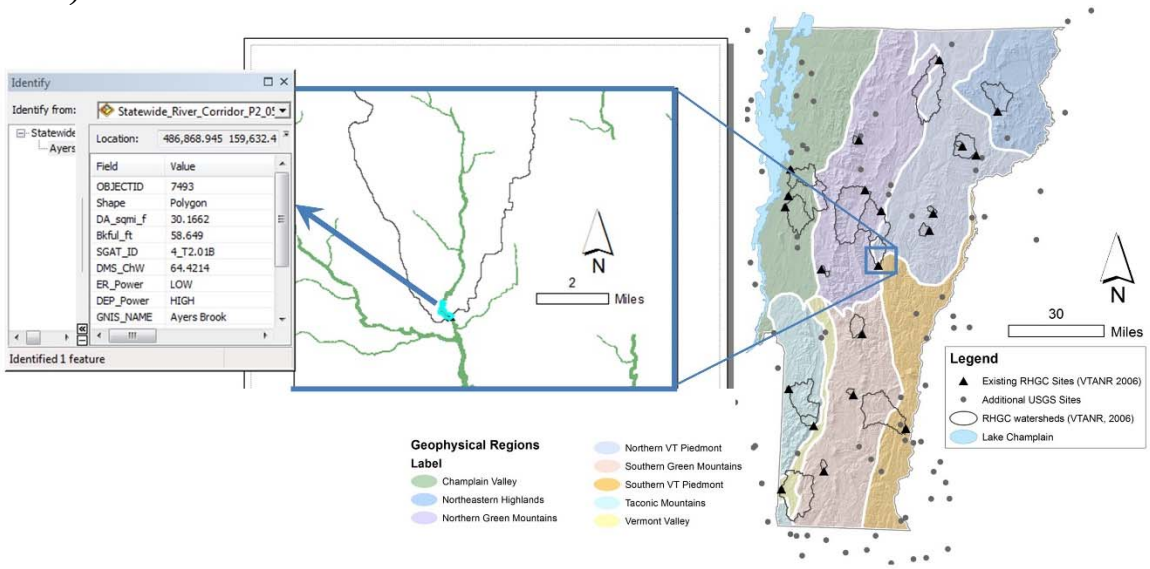

Figure 1: Existing RHGC and proposed USGS gauging sites are being related to statewide stream geomorphic assessment data to inform selection of possible additional RHGC sites.

Participants and Collaborators:

List all individuals who have worked on the project.

Kristen Underwood, PI; Arne Bomblies, - co-PI; Donna Rizzo – co-PI; Sienna Roberge – Master's student

List all students who have participated in the project. (Include name, email address, class standing, major, and role in the research): Sienna Roberge, Sienna.Roberge@uvm.edu, 1st year accelerated Masters student, Environmental Engineering, half-time Graduate Research Assistant.

What organizations have been involved as partners on this project? What was their role?

VT Agency of Natural Resources: Staci Pomeroy, River Scientist – supplied location information and characteristics of gauging sites that comprised the original 2001 and 2006 Regional Hydraulic Geometry Curves.
VTrans – project champions: Nick Wark and Cassidy Cote
The Nature Conservancy of Vermont – see next section

Have other collaborators or contacts been involved? If so, who and how?

Shayne Jaquith, The Nature Conservancy – as a former VTANR employee and primary author of the original RHGCs; supplied information about the location and characteristics of original RHGC sites.

Paul Marangelo, The Nature Conservancy – as a current user of RHGCs to support analysis of aquatic organism passage; provided feedback on ultimate use of RHGCs and has offered to provide geomorphic assessment data collected during AOP assessments of structures; we have planned a collaborative meeting for the coming months to share data.

Changes:

*Discuss any actual or anticipated problems or delays and actions or plans to resolve them…*None at this time.

Discuss any changes in approach and the reasons for the change… None at this time.

Planned Activities:

Description of future activities over the coming months.

Finalize selection of new RHGC sites. Complete flow frequency analyses. Continue compiling values of potential predictor variables, and response variables for future regression analysis.