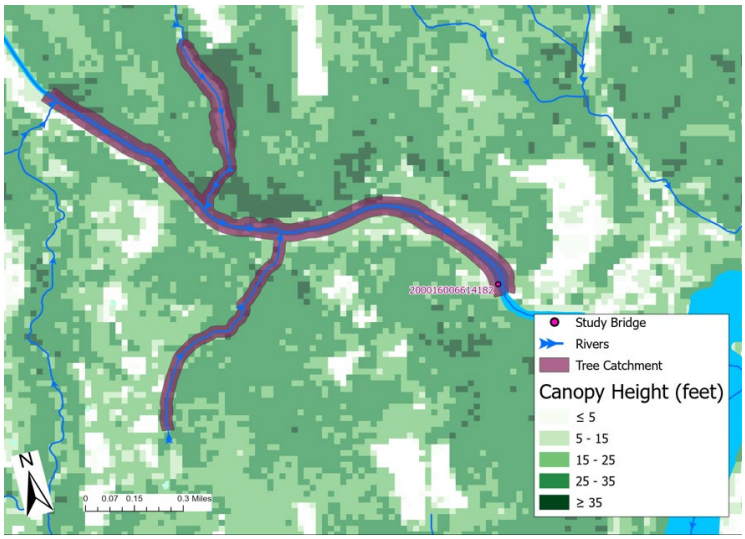
Bridge Tree Catchments in GIS for Multi-span Structures in Vermont

Students: Steven Matile, Alok Sharma, Binit Gautam – Dept of Civil Engineering UConn
Advisors: Wei Zhang, Ph.D., P.E., Nalini Ravishanker, Ph.D. (Dept of Statistics), Ramesh Malla, Ph.D.

Abstract

Large woody debris accumulation at the base of bridge piers can increase scour at footings and lead to catastrophic failures. This is especially prevalent during intense weather events like hurricanes and nor'easters. Geospatial asset management data can be used to sort structures which are at increased risk of debris and to analyze the upstream areas for the potential to accumulate debris at a structure's footings. Understanding which structures are at a higher risk of debris accumulation, and therefore scour, can help managers inspect and respond to severe weather events more efficiently. There is limited knowledge on where large debris accumulating at structures originates. Its reasonable to believe that the areas directly upstream would have a higher chance of contributing to accumulation and that canopy height data within the are can help determine the potential size of debris which may get trapped horizontally against a pier and begin accumulating other pieces of debris. Appending Vermont Agency of Transportation (VTRANS) structure data to hydrographic boundaries and buffering the area upstream provides a practicable starting point for predicting debris buildup potential. Accounting for parallel bridges can spare the program from redundancy and it is likely that inspectors will examine adjacent bridges when they believe one is at risk. Long-span bridges may be at a higher risk due to having larger upstream catchment areas due to crossing wider hydraulic flows.



Acknowledgements: US DOT Region 1 UTC - Transportation Infrastructure Durability Center (TIDC) under grant 69A3551847101 from the U.S. Department of Transportation's University Transportation Centers program and the University of Connecticut for funding. Thanks are due also to following organizations for in-kind support: Vermont Transportation Agency and Maine Department of Transportation

References

1. Hughes, W., Santos, L., Lu, Q., Malla, R., Ravishanker, N., and Zhang, W. "Probabilistic Risk Assessment Framework for Predicting Large Woody Debris Accumulations and Scour near Bridges," Structure and Infrastructure Engineering, 2023.
2. Kosič, M., Anžlin, A., and Bau', V. Flood Vulnerability Study of a Roadway Bridge Subjected to Hydrodynamic Actions, Local Scour and Wood Debris Accumulation. Water (Switzerland), 2023, 15(1). https://doi.org/10.3390/w15010129
3. Haehnel, R. B., & Daly, S. F. "Maximum Impact Force of Woody Debris on Floodplain Structures." Cold Regions Research and Engineering Laboratory, Army Corp of Engineers, 2002. http://www.ntis.gov/index.html
4. Anderson, I. Rizzo, D.M., Huston, D. R., and Dewoolkar, M. M., "Analysis of bridge and stream Conditions of over 300 Vermont bridges damaged in Tropical Storm Irene," Structure and Infrastructure Engineering, 2017, vol. 13, no. 11, pp. 1437–1450, http://dx.doi.org/10.1080/15732479.2017.1285329.