

## **INCREASING PRECIPITATION, RUNOFF, FORESTS, AND PAVEMENT OVER THE LAST 70 YEARS, THE WINOOSKI RIVER BASIN, NORTHERN VERMONT**

[HACKETT, William R.](#)<sup>1</sup>, BIERMAN, Paul<sup>2</sup>, RIZZO, Donna M.<sup>3</sup>, and BESAW, Lance E.<sup>3</sup>, (1) Geology, University of Vermont, Delehanty Hall, 180 Colchester Ave, Burlington, VT 05405, [william.hackett@uvm.edu](mailto:william.hackett@uvm.edu), (2) Geology Department, University of Vermont, Perkins Hall, Burlington, VT 05405, (3) College of Engineering and Mathematical Sciences, University of Vermont, Votey Hall, 33 Colchester Ave, Burlington, VT 05405

Analysis of 72 years (1936 to 2008) of discharge and weather data in the ~3,000 km<sup>2</sup> Winooski River Basin of Vermont shows statistically significant increases as well as a regular periodicity in the records of precipitation (14% increase), river discharge (18% increase), and mean annual gage height on adjacent Lake Champlain. We analyzed data from six discharge stations, both on the mainstem Winooski River and its major tributaries, as well as data from five weather stations within the basin and two Lake Champlain stations.

At all five weather stations, average annual precipitation is increasing. At a 95% confidence level, this trend was significant at three of the five locations. Similarly, each of the six discharge stations showed an increasing trend in total annual discharge. Lowest annual daily flows increased significantly at all stations while highest daily discharges for each year increased at some stations while decreasing at others. In addition to the overall trends in the data, spectral analysis reveals a 7 to 8 year periodicity in the mean annual Lake Champlain gage height and total annual precipitation and discharge; this signal appears to be well correlated with the behavior of the North Atlantic Oscillation (NAO). While climate change has driven most hydrologic trends in the basin, changing land use, which affects the way the basin responds to precipitation, may also play a minor role in observed hydrologic changes.

To quantify land-use change over time in the Winooski River Basin, we analyzed aerial photographs from four different years (1937, 1962, 1974, 2003) using a random sampling of 30 sites in the Winooski River Basin. Each site contains 300 sample points that are manually classified into four landuse categories. We show how the abandonment of farmland, the coming of the interstate highway, and the subsequent suburbanization have changed landuse patterns over the past 70 years. On average agricultural land decreased by 23% while forested and developed area increased by 22% and 2%, respectively.

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