Increasing Precipitation and Runoff Interact With Land Use Change Over the Last 70 Years, the Winooski River Basin, Northern Vermont

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Analysis of 72 years (1936 to 2008) of discharge and weather data in the 2,704 km^2 Winooski River Basin of Vermont shows statistically significant increases in precipitation and river discharge, as well as regular periodicity. 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.

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; with half being significant trends. 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 ~7-8 year periodicity in total annual precipitation and discharge, well correlated with the behavior of the North Atlantic Oscillation (NAO). Inconsistent peak flow trends between stations could be evidence of the factors associated with changing land use, which affects the way the sub-basins respond to precipitation.

To quantify land-use change over time in the Winooski River Basin, we analyzed aerial photographs from four different times (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.