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Bedload Analysis of Wilkins Creek

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Bedload Analysis of Wilkins Creek

Abstract
Wilkins Creek is a significant source of sediment to Conesus Lake. Spring Creek is the largest tributary to Wilkins Creek and flows through the village of Livonia, whereas above the confluence Wilkins drains predominantly agricultural lands. This study seeks to evaluate the impact of land use on the sediment transport in the streams. Thirty gravel to cobble sized rocks were collected from the bed of Wilkins Creek. Their dimensions and mass were measured and then each rock was marked to be easily identifiable. Rocks were paired based on size, shape and mass, and then split into two roughly equal sets. One set was returned to Wilkins Creek and the other set to Spring Creek in a similar stream setting. The location of each rock was recorded. The movement of the rocks is being monitored after precipitation and meltwater events throughout the Spring. The total distance traveled by each rock is being recorded to determine if one stream moves sediment farther. The results of this study will ascertain if the developed Spring Creek watershed contributes more sediment to Conesus Lake than Wilkins Creek. Ideally, this study will help inform future Conesus Lake storm water management efforts.

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Abstract

Wilkins Creek is a tributary of Conesus Lake near its northeastern end and transports sediment from both rural and suburban areas to the lake. The Wilkins Creek watershed is 75 square miles and accounts for 3% of the water that drains into Conesus Lake. The total annual sediment load of the Wilkins Creek watershed is estimated to be 118,640 pounds today, increased from 81,273 pounds of sediment annually in the 1990s. The largest tributary to Wilkins Creek is Spring Creek, which joins Wilkins at a confluence in Livonia Community Park. While Wilkins Creek predominantly flows through agricultural land, Spring Creek flows through suburban areas including the village of Livonia.

Wilkins Creek is of particular interest because there has been significant flooding damage and sediment deposition from storm events downstream near the lake. More sediment is transported to Conesus Lake than Wilkins Creek. Ideally, this study will help inform future Conesus Lake storm water management efforts.

Introduction

Methods

Thirty-two gravel, cobbles, and pebbles were collected from Wilkins Creek downstream from the confluence with Spring Creek. The rocks were then painted and numbered to make them easy to identify and distinguish. Bright pink rocks were placed upstream of the confluence in Spring Creek and fluorescent yellow rocks were placed upstream of the confluence in Wilkins Creek. The rocks were numbered from largest to smallest, hence the larger the number on the rock the smaller in dimension and mass the rock was. The rocks were paired in their placement within the two creeks based on their dimensions and placed nearest to the thalweg as possible. The largest rocks were placed furthest from the confluence. The initial locations of each rock were marked by ribbons that hung on string that crossed the streams perpendicular to their channels. The distance each rock traveled along the bed of the stream was measured twice to three times a week and following every midwater or precipitation event. The distances traveled were recorded and compared to determine which stream has a higher rate of bedload travel.

Figure 1. All 32 rocks after painting prior to being placed in the creek (left) and a sample rock marked under a ribbon at its starting position (right).

Figure 2. All pink rocks placed in Spring (left) and yellow rocks placed in Wilkins (right) with a new channel forming in the center.

Figure 3. A watershed map of Wilkins highlighted in black. Yellow lines indicate the stream network of the watershed. The stars represent the mouth of the stream and the confluence of Wilkins and Spring. Wilkins Creek is digitized in blue and Spring in red.

Figure 4. Spring Creek above the confluence showing a tree blocking the flow and causing 3 new channels to form.

Figure 5. Wilkins on the left and Spring on the right merging at the confluence.

Figure 6. Precipitation within Wilkins Creek watershed and the recorded transport of specific rocks within Wilkins Creek (left) and Spring Creek (right).

Figure 7. Transport distance of all 32 rocks in Spring and Wilkins creeks.

Results

Over the 31 days of rock monitoring three rocks had significant movement. Rock 2 in Wilkins moved 40 centimeters, Rock 12 in Wilkins moved 109 centimeters, and Rock 15 in Wilkins moved 47 centimeters. Four rocks from Spring Creek and four rocks from Wilkins Creek moved less than 20 centimeters immediately after placement and then remained stationary the rest of the month. This movement happened over a month in which 1.21 inches of rain fell. That rainfall is 67% below average for that time in this watershed. The largest single rain event was 0.43 inches of rain on March 10th and resulted in no significant movement of rocks.

Interpretation

The eight rocks that moved less than 20 centimeters within the first week of being placed were likely a result of the stream moving the rocks into a settled position, after which they would require a higher discharge to transport. All significant movement of rocks occurred in Wilkins Creek. Due to the lower than average precipitation during the study, it could not be concluded how the bedload of the streams responded to rainfall. However Wilkins Creek’s watershed is much larger and encompasses agricultural land that would allow more snow to accumulate. Spring Creek includes the village of Livonia which would blow more snow out of the watershed. Therefore the movement of rocks 2, 12 and 15 likely resulted from snow melt, indicating that higher discharge in these streams will transport more bedload. The transport of rocks in Wilkins Creek suggests a larger discharge in Wilkins compared to Spring Creek resulting from snow melt.

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References