Variance of Particulate Organic Carbon Flux in Small Appalachian Watersheds

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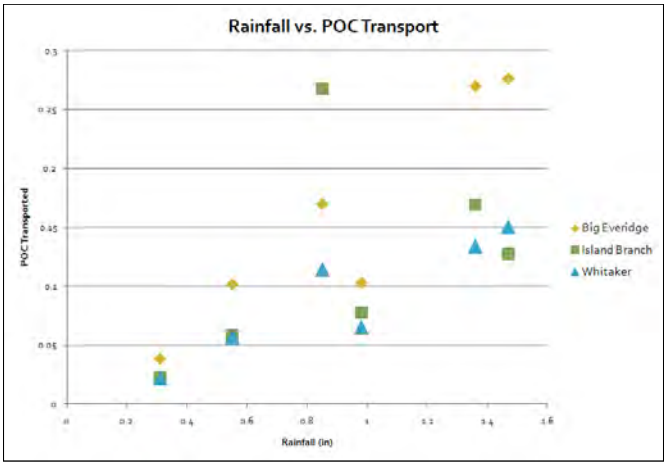
Overview and Methods

On a large scale, processes that occur in rivers and streams have an important impact in the global carbon cycle. However, the role that small streams play is not understood as clearly.

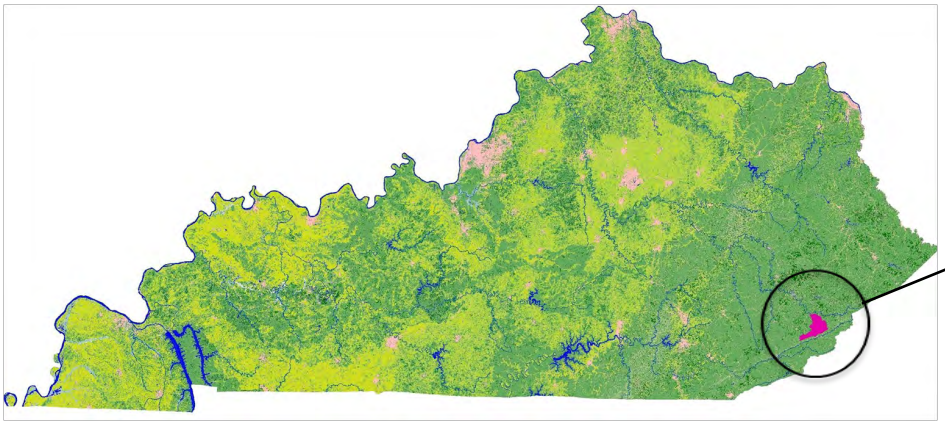
This research was performed with the objective of understanding the relationship between mining disturbances in small Appalachian watersheds and the amount of sediment and particulate organic carbon (POC) transported out of these watersheds. The transport of sediment and particulate organic carbon was analyzed by individual rainfall events and the flow caused by these events, as found through a simple runoff model. Flow and concentration data are correlated with the carbon content from sediment samples collected in each watershed in order to calculate the amount of sediment and particulate organic carbon leaving each watershed per event.

Sites of Interest

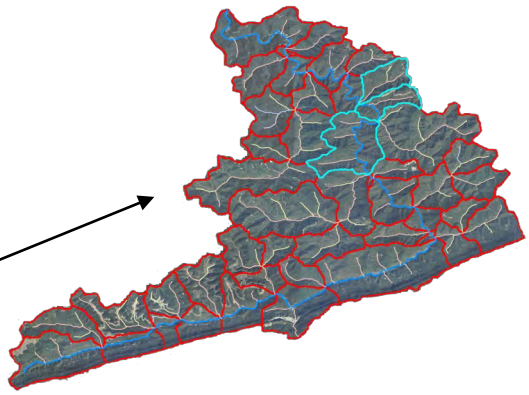
The study sites were located in Letcher County in southeastern Kentucky. Three sub-watersheds were studied, each with varying extents of mining. The Big Everidge watershed is part of an old growth forest and has no area mined. The Whitaker Branch watershed area is about 8% mined and is the only included watershed with low-density residential activity. The Island Branch watershed area is about 11% mined.



POC Transported by Rainfall Event



Letcher County, Kentucky



Watersheds Studied

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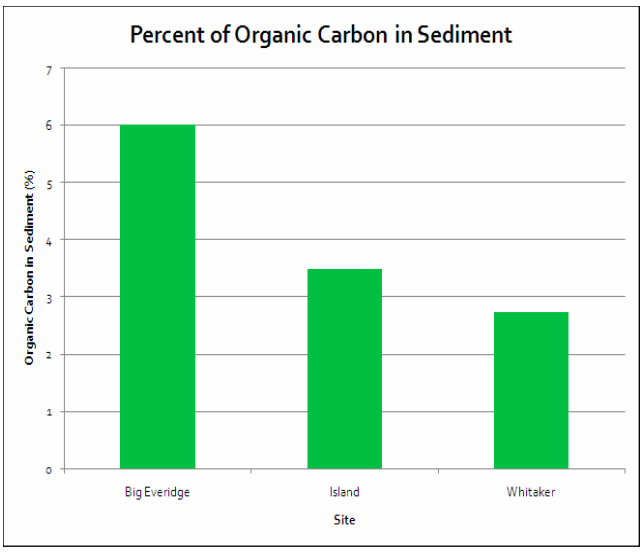
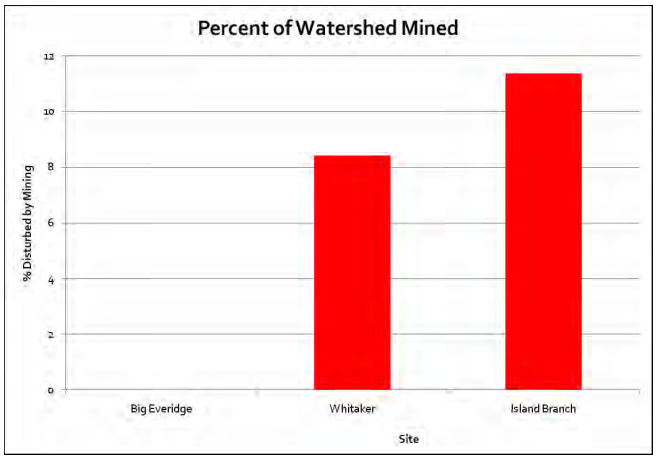
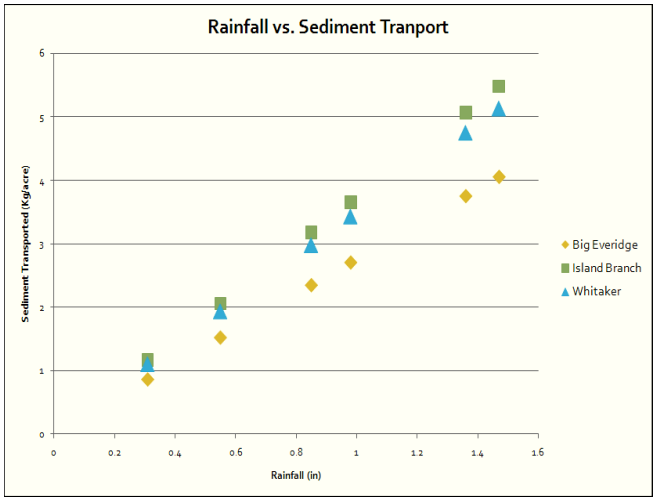


Soil Organic Carbon Levels in Sediments



Mining Disturbances by Watershed



Sediment Transported by Rainfall Events

Findings

A relationship was established between mining activity and sediment flux, POC, as well as soil organic carbon content. Mining increases the sediment flux in a watershed, showing signs of increased erosion patterns. Mining also decreases the amount of POC present in the soil and depletes the soil organic carbon content. In order to reduce and potentially reverse these detrimental impacts on a watershed, it is suggested that erosion limits be placed on reclaimed mine sites to reduce sediment pollution.

Areas of Further Research

This research can be continued through the use of hydrographs at each site. Real time sediment loads and flow rates could also be utilized to better illustrate and quantify the sediment and particulate organic carbon being transported out of the watershed. A greater number of data points may also be utilized, along with a wider distribution of mining disturbance levels. Specifically, the effects of active mining could be explored. An analysis of differences in sediment transport during base flow could also be performed.

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