Streambank Stability and the Presence of Invasive Riparian Vegetation in the Marshalls Creek Watershed, PA

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1. Introduction: Marshalls Creek flows for 10.5 miles through Middle Smithfield and Smithfield Townships before joining the Lower Brodhead Creek, just above where the Brodhead meets the Delaware. Only two major tributaries flow into the Marshalls Creek: Bear Swamp Run and Pond Creek, both second-order streams. The headwaters of Marshalls Creek flows in an easterly direction from the edge of the Pocono escarpment, like other headwaters tributaries of the Brodhead watershed. All runoff in this small watershed eventually flows into Brodhead Creek, and then into the Delaware River near Delaware Water Gap, Pennsylvania.

Three 100 year floods have affected the watershed in the past four years. The water from these floods seriously eroded the banks along Marshalls Creek and endangered the properties and private roads in the watershed. These floods may have also carried invasive vegetation downstream where no invasive plants were previously found. Exotic species such as Japanese knotweed and Japanese barberry began to spread all over the watershed. These exotic, invasive plants displace indigenous species and deplete biodiversity among the native vegetation. This study aims to show the condition of bank stability and the hot spots of invasive species for future management.

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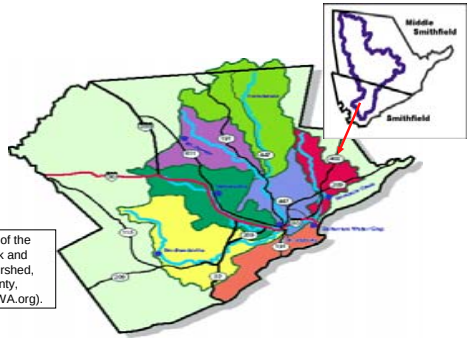


Figure 1: Map of the Marshall Creek and Brodhead Watershed, Monroe County, Pennsylvania (BWA.org).

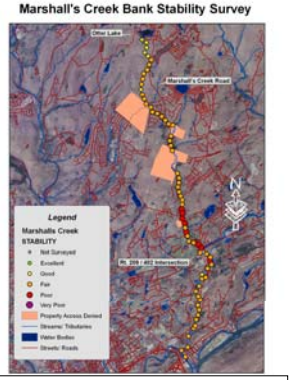


Figure 2: Marshall Creek Watershed bank stability map; each color indicates a specific stability level from excellent (green) to very poor (dark red)

2. Methodology:

Bank Stability: The stability of the stream banks was calculated using the *Pfankuch-Rosgen* Channel Stability Evaluation Method. A GPS unit was utilized to record waypoints every 250 meters. At each of these points, the upper banks, lower banks, and stream bed are assessed based on factors such as mass wasting, upper and lower bank cutting, bottom size distribution, and deposition. Total channel stability was calculated as the sum of all of these factors. If a portion of a stream had a high bank stability index this means the bank is less stable, or dangerous to properties in the vicinity.

Invasive Vegetation: The presence and density of invasive flora is noted using an estimated density method (Braun-Blanquette, 1932). Both left and right banks are observed with canopy cover and soil moisture being noted. Software: XY coordinate data is imported from the GPS unit into ArcMap software. This data is joined with DEM, bank stability, and invasive vegetation data to analyze the features of the river network and surrounding landforms.

3. Data Analysis:

Bank Stability: Preliminary analyses of the bank stability suggests that bank erosion is present in moderate to severe amounts from upstream to downstream. None of them shows excellent conditions. The upper stream seems in a good condition of bank stability. The section close to Route 209 shows great degradation of bank stability, which will be the first priority for bank stabilization in the watershed (Fig. 2). All the other sections indicate fair conditions, which need to keep it from further bank erosion.

Invasive Vegetation Presence: Although eleven invasive species were identified in our study, there were three prevailing species. Figures 3-7 are maps that display where and how dense the species are in that area. Japanese Stiltgrass (Microstegium vimineum) was found in 74 % of sites, with an average density of 2.74 on a 1-4 Scale. Stiltgrass shows a heavy concentration in the middle of the watershed, but is absent upstream and not nearly as dense downstream. Japanese Barberry (Berberis thunbergii) is found throughout the entire watershed, although it does show some signs of concentration in certain areas, particularly in the upper and middle of the watershed. Japanese Barberry was found in 63% of sites with an average density of 1.8 on a 1-4 Scale. Multiflora Rose (Rosa Multiflora) was found primarily downstream, although very few dense areas were observed. Multiflora rose was found in 46% of sites, with an average density of 1.6 on a 1-4 scale (Figures 8-9).

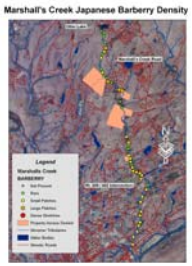


Fig. 3: Brodhead Watershed barberry densities

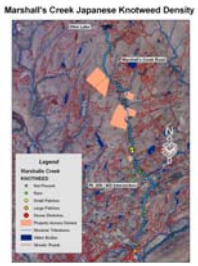


Fig. 4: Brodhead Watershed knotweed densities

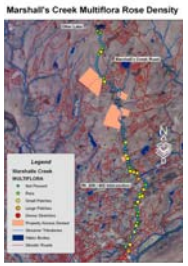


Fig. 5: Brodhead Watershed Multiflora rose densities

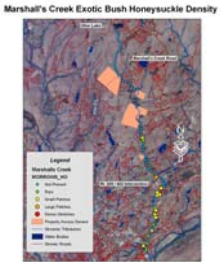


Fig. 6: Brodhead Watershed honeysuckle densities

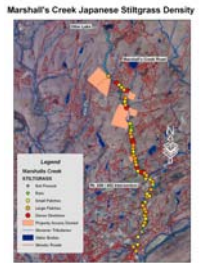
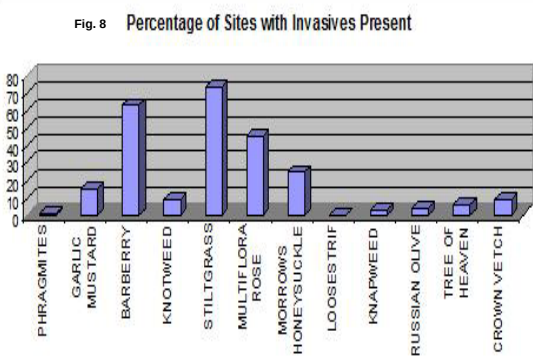
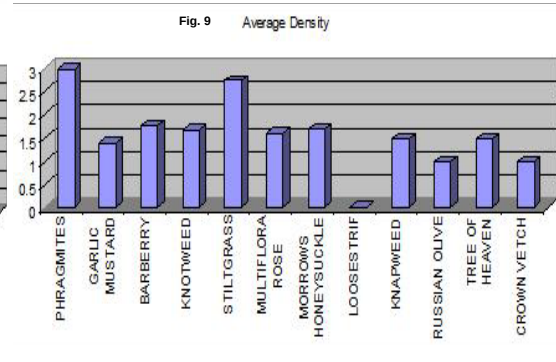


Fig. 7: Brodhead Watershed Stiltgrass densities





4. Conclusion:

Bank stability: Results indicate that 1) the banks close to Route 209 have been subjected to significant erosion due to the flooding events 2) this erosion has created instability in stream banks that endangers private property as well as municipal and state roads 3) future floods will cause extensive damage if no measures are taken to stabilize the banks in the middle and low reaches.

Invasive Species: Results indicate that the area and density of invasive plants continues to grow in riparian areas throughout the Marshalls Creek Watershed. If this trend continues, these invasive populations will continue to spread and replace native vegetations.

References: BWA, http:/www.brodheadwatershed.org/ (access on 10/05/2008)
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