Bank Stability and the Spreading of Invasive Plants in Swiftwater Creek Watershed, PA

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1. Introduction:

The Swiftwater Creek (SWC, Fig.1) is home to many landowners along its 44 mile stretch of beautiful landscape. Due to disturbances from natural processes and human activities, there are two major challenges in this small watershed: bank erosion and invasive plant spread. Bank erosion endangers private lands, roads and bridges (Fig 2). Invasive species are overtaking natives and changing the ecosystems. This study focuses on these two critical problems.

Fig.1 Location of the Swiftwater Creek

Fig. 2 Serious cutting of the stream bank

2. Methodology

A hand-held Geographic Information Systems (GIS) unit, GPS, digital camera, GIS software, and a bank stability assessment method called Pfankuch-Rosgen Channel Stability Evaluation were used in the field to examine the potential and future problems in SWCbWatershed. Two student volunteers from East Stroudsburg University collected the data in SWC and put them into GIS software for further analysis. When the survey is completed for Paradise Watershed, the data will be used for a management plan of invasive plants and future engineering projects to stabilize the banks.

3. Preliminary Analysis:

Bank stability analysis: Fig. 3 shows the bank stability index along the SWC. A higher index value indicates less stable banks, and a lower index value indicates more stable banks. Along the SWC, the middle reach section close to R314 bridge is very unstable with the highest index. The reason for the serious bank erosion in this section is that the bank is composed of loose sediment in a flood plain area (Fig. 4). The upstream also has some hot spots of unstable bank due to the steep bank slopes. The downstream section close to the lake is relatively stable since the backwater of Swiftwater Lake slows down the flow in the creek and there is no serious erosion in this section.

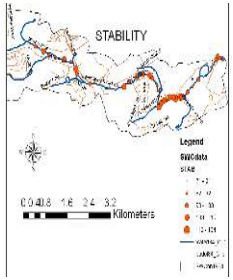
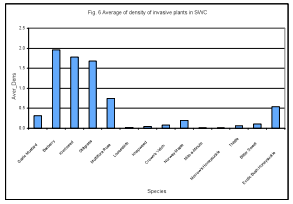
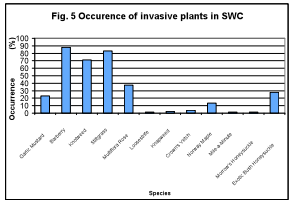
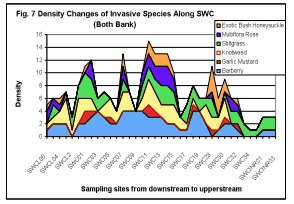


Fig. 3 Bank Stability Index along SWC

Fig. 4 Serious bank erosion site







Invasive plant analysis: Fig. 5 shows the top five invasive species in terms of occurrence in the watershed. Fig. 6 indicates the average density of each invasive plants. Fig. 7 shows the change of the additive density of invasive plants along the SWC. It is obvious that the midstream section along R314 is a heavily invaded area and needs invasive control. There are some hot spots of invasive plants downstream, and there are fewer invasive species in the upstream. These three figures disclosed that the top five invasive species in SWC Watershed are Barberry, Honeysuckle, Knotweed, Multifloral Rose and Stilt Grass. The distribution of each plant is mapped with ARC GIS as shown in Fig. 8 - Fig.12. The index means in In these figures means: 1= Rare, single plants; 2 = Small patches, easily counted; 3= Large patches; 4= Dense, continuous stretches.

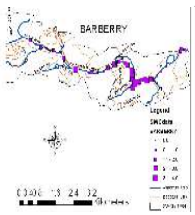


Fig. 8 Barberry

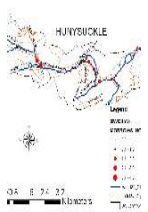


Fig. 9 Honeysuckle

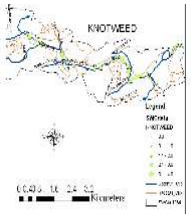


Fig.10 Knotweed

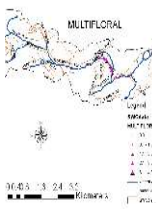


Fig. 11 Multifloral Rose

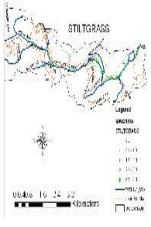


Fig. 12 Stilt Grass

These results indicate that there are a significant number of hot spots for invasive species in the entire watershed. Fig.8-12 is consistent with the distribution trend of Fig. 7, which suggests the middle stream has more invasive plants than both upstream and downstream. Only one exception is Stilt Grass, which are found everywhere in the watershed. There are some hot spots of Barberry and knotweeds in upper stream. Please note that the data gaps existed in some stream sections due to accessibility.

4. Conclusions:

GIS mapping results and spatial analysis show that there is serious erosion along both banks of SWC. It is very important to take engineering or biological measures to control these bank failures. Distribution of invasive plants indicates that the middle reach of SWC is the most seriously invaded area. Disturbance from R314 and R611 may be the source and loose sediment in this flood plain section provides a suitable habitat for the growth of invasive plants.

References:
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