2009 Black Dirt Region
Riparian Buffer Assessment

Background

The Wallkill River watershed drains an area of nearly 800 square miles stretching from Sussex County, NJ to Ulster County, NY (Wallkill River Management Plan 2007). The Wallkill River, the watershed's main stem, has its headwaters at Lake Mohawk in Sparta, NJ and flows 93 miles north to its mouth on the Roundout Creek in Rifton, NY. The Roundout eventually flows into the Hudson River, making the Wallkill River a vital tributary to the Hudson River.

On its way north, the River flows through the Black Dirt Region, an area of extremely fertile, black soil found in Sussex County, NJ and Orange County, NY. Some 12,000 years ago, as the last of the glaciers melted, a great shallow lake flooded the area, giving the region its nickname "the Drowned Lands". Cycles of flooding and succession deposited thick layers of organic matter on the lake bottom. Eventually the waters receded, leaving only the rich soil found there today (Myker 1998).

Although initially ignored for farming due to the soil's poor drainage and tendency for large scale flood events, eastern European immigrants saw the land's potential and began working it in the early 19th century. The rich soil was found to be a spectacular growing medium for onions, lettuce, radish, potatoes and sod. However, its full potential was not harnessed until the area was drained through a series of hydrological changes (Snell 1881) such as a network of drainage ditches (small in-field and larger commission ditches), dikes and the Cheechunk Canal.

The hydrologic changes have impacted the river system and contributed to exacerbated natural processes such as erosion and sedimentation. Erosion rates in the Black Dirt Region are accelerated with some areas losing up to 29 inches per year of stream bank (Knapp 2005). Control of stream bank erosion is often related to the presence of vegetated riparian buffer zones. The absence of vegetated riparian buffers can result in unstable river banks and reduced water quality (Luke et. al 2007).

Introduction

A riparian buffer zone is a vegetated area of land bordering a water body (i.e. stream, river, lake, or pond) which provides many ecosystem services such as flood control, water purification, erosion control, protection from non-point source pollution, in addition to providing both aquatic and wildlife habitat. Stream shading is extremely important for certain fish species as it is directly related to water temperature and dissolved oxygen which can effect fish populations (Boulton 2003). Farming practices such as cropping to the stream bank allow runoff from fertilizer and herbicide to enter directly into surface waters in the absence of a vegetated buffer (Otto et. al 2008). Generally, a vegetated buffer of at least 50 feet will provide the most benefit to water quality (NCDEHNR 1997). However, width of a functioning riparian buffer should be determined by the surrounding land use and purpose of the buffer (Gilliam etal. 1997).

As evidence by previous studies, well vegetated riparian zones have great value to functioning watersheds. Riparian planting is an effective way of naturally restoring a riparian buffer. Vegetated banks have dense root systems that act to anchor soil to the bank which helps to control erosion and filter pollutants (Pollen and Simon 2005). Stream bank stabilization is another effective erosion control technique in which various eco-friendly materials can be used to restore and stabilize a stream bank.

The need for a comprehensive understanding of riparian buffers in the black dirt region is crucial to implementing effective management practices. Documenting stream bank stabilization and riparian planting sites will facilitate the easy design and implementation of such projects and speed up the process to provide the greatest benefit to the watershed.

Objectives

This study had three chief objectives. The first was to ground-truth remote sensing findings by comparing them to an in-field riparian buffer assessment. The second aimed to characterize elements of at least 50 percent of prioritized riparian areas. The characterization employed a spread sheet based lay out, compartmentalized by riparian buffer length, land cover width and type, natural land cover type, and percent shade over channel. The third sought to prioritize “shovel ready” riparian planting and stream bank stabilization sites for the Wallkill River Task Force by photographing and plotting sites on a GIS created map.

Methods

Our study area was the Black Dirt Region as it occurs in Orange County, NY. We focused on the sub-watersheds of the Wallkill River and its three largest tributaries; the Rutgers, Quaker and Pochuck Creeks as they flow through the Black Dirt Region. Assessment of the Black Dirt Region’s Wallkill River riparian buffer zones was divided into two phases. First, a remote sensing assessment of the buffer zone along the Wallkill River, Pochuck, Rutgers and Quaker Creeks was completed using Arc Map GIS software. On a parcel by parcel basis, length and width of woody vegetated buffer were recorded through examining orthoimagery and utilizing the measuring too. Parcels with vegetated buffers less than 50ft were prioritized for the second phase.

The second phase consisted of a detailed buffer assessment in the field; an effort to prioritize sites with the greatest need for restoration. Field assessment was done on foot and by vehicle. Measurements consisted of riparian buffer length, land cover width and type, type of natural land cover, and percent shade over the channel. Microsoft Excel was used to create a riparian buffer assessment form which had the following categories; riparian buffer length, land cover width and type, natural land cover type, and percent of channel shaded. Land cover was broken into three categories; agricultural, natural and managed vegetation. Natural land cover was described as either forest, shrub, herbaceous or mix. Field notes further described what comprised mixed vegetation.

Potential stream bank stabilization and riparian planting sites were documented for the Wallkill River Task Force. Pictures of stream bank stabilization and riparian planting sites were taken and a photo location map was made in GIS to facilitate site location. Recommendations were made as to how these projects should be implemented.

Results

Through remote sensing via ArcGis, a total of 229 parcels along the four sub-watersheds were measured and recorded; 169 of the parcels were found to have river frontage with less than 50 feet of vegetated riparian buffer and were therefore prioritized for field assessment. We exceeded the objective of conducting in-field assessments of 50 percent of the prioritized parcels and successfully characterized 67 percent of the prioritized parcels. One hundred thirteen of the 169 prioritized parcels were visited, covering approximately 14.5 miles of collective river frontage.

The most common riparian buffer along the Wallkill, Pochuck and Rutgers Creek was 10-50ft of mixed land cover; thin strips of forested buffer zone filled in with shrubbery and herbaceous cover. We found overwhelming evidence to suggest that the Rutgers Creek was the most vegetated of the four sub-watersheds, followed by the Wallkill River, Pochuck Creek and lastly, the Quaker Creek (see Table 1). We also found sufficient evidence to confidently characterize the Quaker Creek corridor as being almost entirely buffered by thin strips (0-9 feet) of herbaceous vegetation surrounded by predominately agricultural lands.

Photo # 9: Quaker Creek; an example of agricultural land cover, with herbaceous natural cover and 0% shade over channel. An example of a recommended riparian planting site

Photo # 37: Wallkill River, an example of natural land cover, with forested natural cover and 40% shade over channel. The far side is an example of a recommended stream bank stabilization site. The near side shows an example of a recommended riparian planting site with managed vegetative land cover, herbaceous natural land cover, and 0% shade over channel

Regarding the objective of cataloguing “shovel ready” riparian planting and stream bank stabilization sites for the Wallkill River Task Force, we found a total of 97 parcels with *possible* riparian planting sites. These can be found in the notes section of the assessment data, complied in section three of the report. A total of 30 recommended riparian planting sites and 15 stream bank restoration sites were located and documented. All recommended sites were photographed and plotted in ArcGis. A photo location map and key were created to facilitate future location of the sites by the Wallkill River Task Force (see figure 1).

Figure 1: Example of photo location map

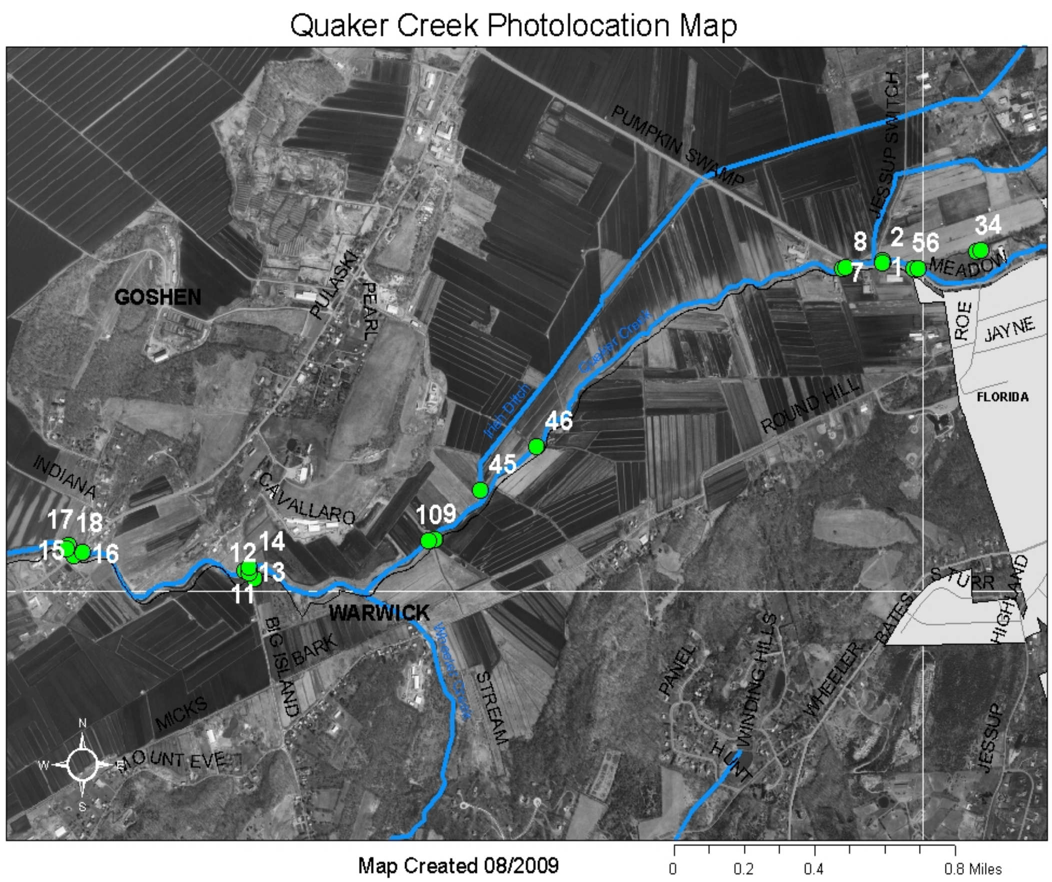

Table 1 – Distribution of vegetated buffer width in Orange County, NY’s Black Dirt Region

Sub-Watershed	>200ft Buffer	199-50ft Buffer	49-10ft Buffer	9-0ft Buffer
Wallkill	32%	26%	12%	30%
Quaker	0%	5%	45%	50%
Pochuck	23%	13%	23%	41%
Rutgers	48%	25%	22%	5%
Summary	28%	21%	20%	31%

Discussion

Remote sensing with the use of ArcGIS was an effective tool for basic riparian buffer assessment. Measuring approximate riparian buffer length, width, as well as parcel length via the orthoimagery and overlayed County tax parcel information was simple with the GIS measuring tool. With this, it was possible to gain insight into general land use trends throughout our study area in the Wallkill River watershed. Using the orthoimagery we found evidence to suggest the Quaker Creek to have the least amount of natural land cover in the riparian area, as the orthoimagery strongly indicated agricultural activity in close proximity to the stream bank. Evidence was also found to suggest characterization of the Rutgers Creek as being the most vegetated of the four sub-watersheds; initial review of the orthoimagery indicated larger tracts of woody vegetation and less farmland than the others sub-watersheds.

It became apparent throughout this study however, that remote sensing has a few short comings. Orthoimagery allowed us to measure riparian buffer width and length, but only to a crude extent and it was difficult to differentiate between similar types of vegetation. For example, it was difficult to separate natural herbaceous vegetation, such as perennial grasses and flowering plants from managed vegetation such as a lawn or hay field. It was also difficult to differentiate between forest and dense shrubbery. Ground truthing however, did show that the measurements and data recorded with the remote sensing were fairly accurate, meeting our first objective.

The greatest challenge found during the field assessment was accessing the parcels. Almost the entire length of the Cheechunk Canal and the Pochuck Creek south until Transport Lane in Pine Island can be accessed by Indiana Road and Celery Avenue which are limited use highways meandering along the bank. Due to its large percentage of farm land, the Quaker Creek watershed has a few farm tracks that lead to its banks. However, it lacks a contiguous stretch of road and therefore accessing it involved quite a bit of hiking to link parcels together. The Pochuck and Rutgers Creeks were much harder to gain access to, which explains why less of their parcels have been assessed. Their banks are largely inaccessible by vehicle and lack any real network of paths. The parcels that were accessed were done so mostly by bridge crossings and one or two farm roads.

Throughout both the in-field and remote sensing assessments some trends in the sub-watersheds were noticed. As discussed earlier, we found evidence to suggest that the Quaker Creek had the least amount of vegetated riparian buffer; which, if left alone has strong likelihood to create water quality issues in the future. Considering that evidence was found to suggest the Rutgers Creek was the most vegetated of the four sub-watersheds and had the least amount of agriculture, one might hypothesize that the Rutgers Creek has the better water quality and supports more aquatic life than the other sub-watersheds, as previously discussed.

Sufficient evidence was also found to show a correlation between natural land cover and our recommended stream bank stabilization sites. We found that the majority of our stream bank stabilization sites are located in parcels with mixed vegetation and less than 50 feet of vegetated buffer. This suggests a correlation between forested buffer and stream bank stability as the most stable banks were found on parcels with riparian buffers greater than 50 feet wide, composed of entirely dense woody vegetation.

Recommendations on future steps

In order to provide the greatest possible aid to water quality in the Black Dirt Region, we recommend that our suggested riparian planting and stream bank stabilization sites be implemented by the Wallkill River Task Force. In addition, it could be beneficial to find a way to educate farmers and landowners on the benefits of vegetated riparian buffers. It was not uncommon throughout the Black Dirt Region to find that farmers and other landowners had been cutting vegetation up to the stream bank, for reasons unrelated to appropriate use. One farmer had even suggested cutting down the trees along the entire Cheechunk Canal as his model rockets continually were getting stuck in them on their way back to ground. This indicated a general misunderstanding of the need for and benefit of riparian buffers.

Due to its close proximity to NYC, Orange County's Black Dirt Region is an extremely valuable agricultural resource which supplies food to local and regional residents. As previously stated, vegetated buffers provide valuable water quality protection for a watershed and are of great importance to intensive agricultural areas like the Black Dirt Region. It would be extremely beneficial to the watershed if a riparian buffer management system were implemented. The Agroecology Issue Team of the Leopold Center for Sustainable Agriculture has designed and implemented a successful "riparian management system for intensively modified agricultural landscapes", which suits application in the Black Dirt Region perfectly. It can be accessed at http://www.buffer.forestry.iastate.edu/ and should be seriously considered for implementation in the Black Dirt Region, not only in the intensive agricultural zones, but where ever possible.