

A SEARCH FOR THE SOURCE OF SEDIMENT DEPOSITS IN BOLTON BRANCH

Jennifer L. Reynolds, Department of Earth Sciences, University of South Alabama, Mobile, AL 36688. E-mail: jl312@gmail.com.

The depositing of large amounts of sediment is a serious and ongoing problem for the tributaries of the Dog River Watershed. Factors influencing this problem of sedimentation include increased development and construction projects, which add to the amount of impermeable surfaces and thus enhance runoff and erosion into the streams, leading to sediment accumulating in certain areas. I studied one example of a significant and relatively new sediment deposit within a tributary of the Dog River Watershed, with the goal of discovering a valid cause of the problematic sediment deposits downstream. The site I focused on was Bolton Branch at Halls Mill Road. Observations and a photo survey were completed for the site, from the base of the sediment load upstream to the probable source. The results of my study show that the probable causes of sediment deposits in Bolton Branch are due to stream bank erosion from a stream maintenance project upstream within the last six months. This research can aid in showing the long-term effects of certain projects and conditions affecting streams, as well as to promote a greater understanding of the causes behind sedimentation of stream channels.

Keywords: sedimentation, stream bank erosion, Bolton Branch

Introduction:

The Dog River Watershed drains most of the city of Mobile, Alabama, and has experienced serious problems over the years, including sediment, sewage, and trash. These problems have affected the overall water quality of the streams, and loss of riparian vegetation along the tributaries in certain areas, due in part to urban development and channelization, has added to the problems.

A riparian vegetation zone is an area of trees, shrubs, and other vegetation located along the banks of a body of water. These vegetative buffers play an important role in the water quality and ecosystems of a healthy stream, as they perform the critical functions of floodplain inundation, groundwater recharge, and nutrient exchange (Moerke, 2004). Riparian zones are crucial in the stabilization of stream banks, aiding in

reducing erosion and movement of sediment, and as they provide shade, they regulate water temperatures and dissolved oxygen levels. Increased riparian zones result in slower runoff rates and increased absorption, which acts as a filter to improve water quality (TVA, n.d.).

Stream channelization, while a common practice, is detrimental to all characteristics of the stream environment. Human channelization is usually implemented in an area to control flooding and drain wetlands (Huff, 1992). One of the major problems channelization creates is that it can remove the natural vegetation from the stream banks, which initiates severe erosion within the channel, and increases the sediment yield by an order of magnitude (Shields Jr., *et al.*, 2001).

Riparian zones along the tributaries of the Dog River Watershed are decreasing as urbanization increases, leading to further channelization, including concrete channels and gabions, which separate the vegetative areas from the streams. Active development and construction leads to an increase in impermeable surfaces, which quickens runoff downstream. Without riparian zones to filter and absorb sediment and nutrients, the water quality of the streams becomes poorer (Simmons, 2004). In Mobile, rainfall events lead to increased runoff on more impermeable surfaces, and large amounts of sediment get washed from the higher areas of the watershed directly to the bottom of the Mobile basin, which ends at Dog River (Mobile Press Register, 1998).

Studies involving the restoration of stream ecosystems and water quality have shown some improvement in small-scale study areas, and focuses on the urgent need to repair these stream ecosystems so they can regain their capacity to perform their critical functions (Moerke, 2004). Studies have also looked into the importance of smaller

streams, as they usually account for a great majority of the total channel length within a watershed in humid areas. These smaller, flowing streams, which are sometimes left off topographic maps, can be unique habitats for certain organisms, compared to the areas of larger stream channels found in the watershed. Also, these smaller channels are responsible for delivering important sediment, water, and nutrients downstream to larger channels within the stream's network (Moore, 2003).

Research Question:

It is apparent that piles of sediment have been building up within creeks of the Dog River Watershed. My research involves the study of one particular site experiencing recent sediment deposition, Bolton Branch at Halls Mill Road. The goal of my project will be to answer the following question: where and what is the source of this sediment?

Methods:

To begin this project I first chose my study site (Fig. 1). While there are many creeks in the Dog River Watershed showing varying levels of sediment deposition, I decided to focus on Bolton Branch at Halls Mill Road near Satchel Paige Drive (Fig. 2), an area experiencing recent significant sediment buildup. I used a Mobile 7 1/2' quadrangle map and a digital camera to conduct my field research.



Figure 1: Map of Dog River Watershed, with study site boxed in red.



Figure 2: Google Earth image of sediment deposit in Bolton Branch at Halls Mill Road circled in red.

At each location along the creek, I documented my observations through photos. I began at the base of the sediment pile, and worked my way upstream to Highway 90, essentially where this tributary begins. I stopped at six locations within my study area, which was approximately three-quarters

of a mile long (Fig. 3), and took my observations from both the bank as well as from in the creek at several sites.

In order to compare the site today with its previous state, I acquired photos of my locations which were taken by previous field work students during their reconnaissance of the Dog River Watershed. I used photos dating back from 2001 to compare with my own.

Since I had been told that the sediment deposit had only appeared in the last few months, and since the slopes of the creek upstream had been cleared, I used the City of



Figure 3: Google Earth image of Bolton Branch, from Highway 90 downstream to location of sediment deposit. Also shows the six study sites used in this research.

Mobile's website to find possible projects which took place within the past six months, in order to discover a likely reason for the sediment deposit occurring downstream.

Results:

The majority of my results came from the comparison of past and recent photos of my sites along Bolton Branch. Figures 4a and 4b show the location where the sediment



Figure 4a: Bolton Branch at Halls Mills Road in 2001.

Figure 4b: in 2008.

has recently been accumulating, in 2001 and April 2008. As I walked upstream from the sediment deposit, I observed slowly flowing water in the stream and lush vegetation along the slopes. Before point 2 on the above map (Fig. 3), I took notice of minimal erosion, and between points 2 and 3 the slopes of the stream had been lined with rocks. The drain which travels underneath Bolling Brothers Boulevard was experiencing a buildup of sand on its entrance and exit from the pipe. Between points 3 and 4, the slope of the creek lessened, the vegetation increased, and I observed

no significant erosion along the banks of the stream. Continuing along the stream after crossing Satchel Paige Drive, I noticed areas of extreme streambank erosion along both sides of the stream, from Satchel Paige Drive to Highway 90, essentially where the stream, and this problem, begins. In some areas, complete sections of soil were sliding

down the slope into the stream. Figures 5a, 5b, and 5c show the same area of the creek, behind Hollywood Theaters on Satchel Paige Drive, at different stages of vegetation along the slopes and banks of the creek's channel. Figure 5a is from January 2007, and shows abundant vegetation within and along the water. Figure 5b is from January 2008, weeks after the city's stream channel "improvements," and Figure 5c is from April 2008, and vegetation can be seen growing back along the banks of the stream.



Figure 5a: Bolton Branch between Satchel Paige Drive and Highway 90, January 2007
Figure 5b: same location, January 2008
Figure 5c: same location, April 2008

Discussion and Conclusion:

Erosion occurring along the sides of the stream channel is the primary source of the sediment depositing in Bolton Branch. While searching the City of Mobile's website, I came across several proposals during 2007 involving channel improvements. This was one of several, aimed at ultimately improving drainage in Mobile (City of Mobile, 2007). This was done using machinery which removed trash, debris, and important vegetation from the sides and bottom of the creek. By removing the vegetation, they removed the most important factor in stream bank stability, and thus increased the amount of erosion from the sides of the stream into the bottom of it. Figure 6a, 6b, and 6c shows erosion along the sides of the stream. Once we get a significant rain, the sediment from the bottom gets transported downstream, until the velocity of the water weakens



Figure 6a, 6b, 6c: Erosion occurring on the slopes of the stream.

or the weight of the sediment becomes too heavy to carry. It is important to note that

before the sediment pile in Bolton Branch, the channel is not concrete, but changes to a concrete channel shortly after. The slower movement of water in the natural channel compared to the increased movement once it reaches the concrete channel has influenced where the majority of the sediment has deposited, just before the concrete begins.

Because sedimentation is a serious and ongoing problem affecting the Dog River watershed, this research can potentially be beneficial to the city and the Dog River Clearwater Revival, as it will shed light on possible adverse effects of building or stream maintenance projects. Future research involving monitoring the extent of the sediment deposit in Bolton Branch, or looking into the possible causes for sediment deposits occurring in other streams, such as Spring Creek at Halls Mill Road, can be undertaken in order to better examine this matter. It is important to study the long-term effects of certain projects and conditions affecting the streams, as a greater understanding of the causes behind sediment deposits can be invaluable when trying to prevent their severity in the future.

Resources:

City of Mobile (2007). Drainage Improvements. Retrieved April 9, 2008 from <http://www.cityofmobile.org/cityofficials/drainage.php>.

Dog River Watershed (2007). Map of the Dog River Watershed. Retrieved April 17, 2008 from <http://www.usouthal.edu/geography/fearn/480page/MapColor.gif>.

Google Earth (2008). Images of Bolton Branch at Halls Mill Road.

Hupp, Cliff R. (1992). Riparian vegetation recovery patterns following stream channelization: A geomorphic perspective. *Ecology* 73(4): 1209-1226. Retrieved April 3, 2008 from JSTOR.

Mobile Register (1998). West Mobile's muddy waters. Section A, Page 1. Retrieved February 18, 2008 from University Library Archives.

Moerke, Ashley H. and Lamberti, Gary A. (2004). Restoring stream ecosystems: Lessons from a Midwestern state. Restoration Ecology 12: 327-334. Retrieved February 18, 2008 from EBSCO.

Moore, R. Dan and Richardson, John S. (2003). Progress towards understanding the structure, function, and ecological significance of small stream channels and their riparian zones. Canadian Journal of Forest Research 33(8): 1349-1359. Retrieved February 18, 2008 from EBSCO.

Shields Jr., F. Douglas, Morin, Nathalie, and Cooper, Charles M. (2001). Large woody debris structures for sand bed channels. Journal of Hydraulic Engineering 130(3): 208-209. Retrieved April 3, 2008 from EBSCO.

Simmons, Jessica C. (2004). Water quality and its dependency on the presence of riparian vegetation within the streambed and along the banks of tributaries in the Dog River Watershed. Department of Earth Sciences, University of South Alabama. Retrieved February 18, 2008 from <http://www.usouthal.edu/geography/fearn/480page/04Simmons/Simmons.htm>.

Tennessee Valley Authority (TVA) (no date). Benefits of riparian zones. Retrieved February 20, 2008 from <http://www.tva.gov/river/landandshore/stabilization/benefits.htm>.