PROOF OF CONTAMINATION

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Perch Creek and Alligator Bayou are tributaries to Dog River, both being similar in nature and close in proximity. The goal of this project is to determine whether Alligator Bayou contains a higher concentration of phosphorus and nitrates due to agricultural run-off. This question may be of interest due to the location of a local plant nursery upstream on Alligator Bayou. A comparative study of the plants along the banks of both creeks serves as an indicator to possible differing nitrate and phosphorus amounts in the waters. In conducting the research, plants along both creeks are chosen at random and then analyzed. Plant color, health, variety, thickness, and amount of buds and blooms are general indicators of expected growth and development, and these are the aspects of the plants that are compared between the creeks. Observations of the overall condition of both creeks, as well as specific testing of specific sites along the creeks, has proven that there is, in fact, an inarguable difference in the quality of vegetation along Alligator Bayou and Perch Creek. However, the reason for this difference is yet to be proven. This type of information is what the Dog River Clearwater Revival may need in order to propose that local plant nurseries do need assistance in the prevention and suppression of agricultural run-off.

Keywords: agricultural run-off, plant development, fertilizer

Introduction

The growth and development of plants can be stimulated or depreciated according to varying factors and conditions, internal and external. In fact, the growth of a plant, whether advanced or minimal, is a reflection of the conditions of its surroundings (Leopold and Kriedemann 1964). Specifically, growth is the process by which a plant increases in the number and size of leaves and stems, and development is the process of a plant changing from one growth stage to another (Rayburn 1993).

Deliberate fertilization is a means to control a plant's rate of growth and development. When a plant is fertilized, three essential elements are added to the soil to be absorbed by the root system: phosphorus, nitrogen, and potassium. Phosphorus is needed to make nucleic acids, nitrogen is needed to make amino acids, and potassium is needed to keep a correct a correct salt balance in the cells (Hewitson 2007). Fertilizer is

added for both agricultural and horticultural reasons (Wikipedia 2007).

While plants may grow at an accelerated rate with the application of fertilizers, the economic benefit is countered by environmental consequences. The over-application of chemical fertilizers can lead to surface run-off or leaching into groundwater. One of the adverse effects of excess fertilizer is algal blooms, which can lead to excessive mortality rates for fish and other aquatic organisms (U.S. EPA 2006).

The Dog River Watershed, which drains the majority of Mobile, Alabama, is fed by tributaries, one of which has a significant plant nursery located upstream from its banks. It is very likely that chemical run-off due to horticultural fertilization has made its way into the nearby tributary. Because the plants located along the bank of this creek absorb the chemicals that are carried by the water, their physical characteristics should be an indicator of what chemicals are being transported by the creek.

Research Question

Is there a difference between the growth and development of plants growing along the bank of Alligator Bayou and the growth and development of plants along the bank of Perch Creek? I have posed this research question because Alligator Bayou is located downstream from a local plant nursery, which may or may not affect the amount of phosphorus and nitrates in the water. In contrast, Perch Creek is a neighboring creek with similar characteristics that is unaffected by any downstream flow from the plant nursery.

Methods

In order to ensure completely objective research of the plants I studied, I first chose sites along the two creeks that were as similar in their salinity content as possible.

Figure 1 displays a map of Alligator Bayou and Perch Creek. If I had chosen a site that contained a higher concentration of salinity in one creek than in another, I would have gathered evidence that would have led me to a false conclusion. Just like a higher or lower concentration of fertilizer in the water, a higher or lower concentration of salinity influences the growth and development of plants. A high concentration of salinity has a very adverse affect on plants. It stunts growth and makes the uptake of water very difficult (Strogonov 1964). A consequence of choosing sites that differ in their salinity content would be confusion as to whether the plant growth was affected by low fertilization or high salinity in the water.

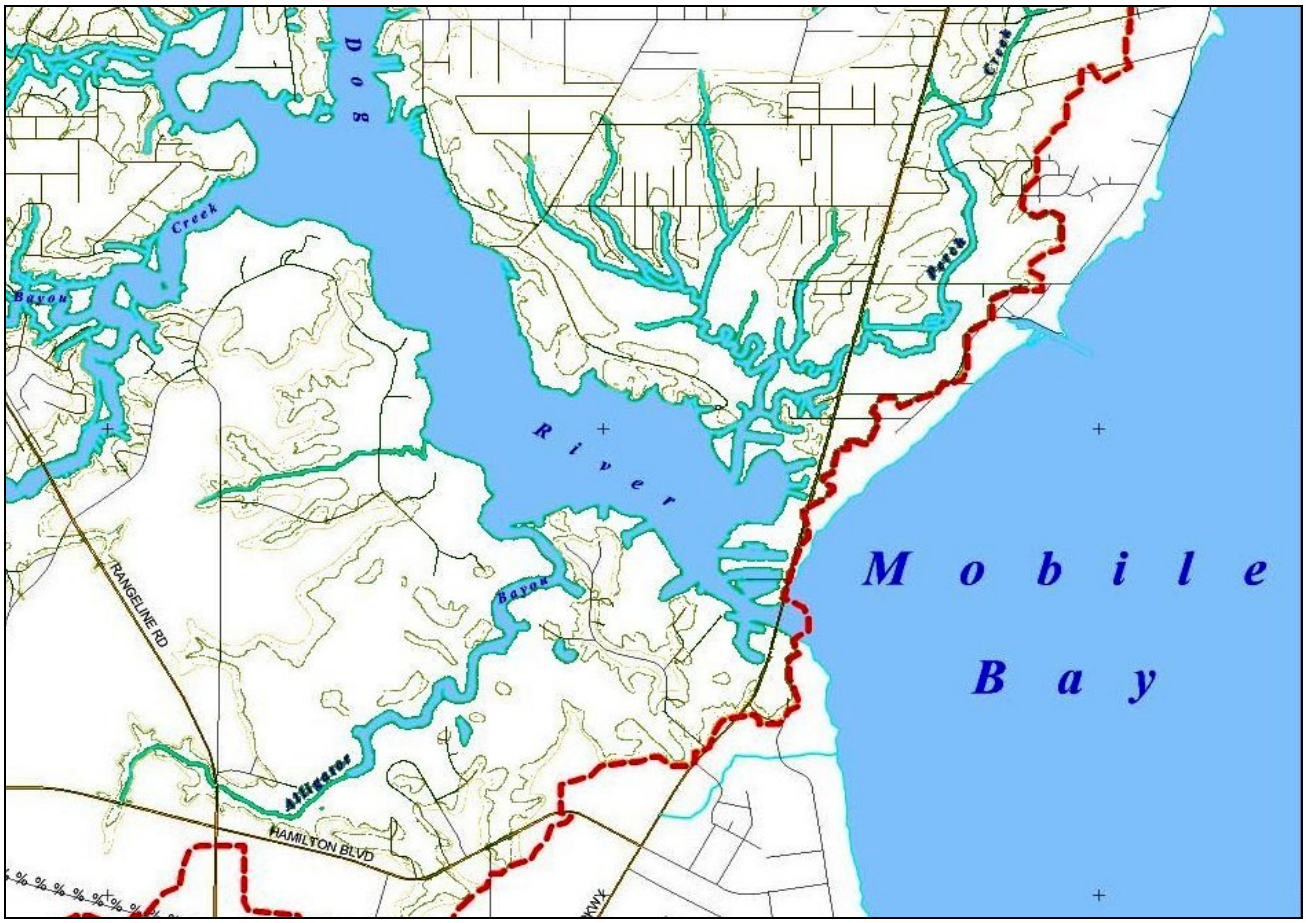

Figure 1: Alligator Bayou and Perch Creek

Beginning at the mouth of Alligator Bayou, my partner and I boated upstream until the Black Needle Rush growing along the banks (an indicator of a strong presence of salt water) had subsided and freshwater plants began to dominate the banks. I then began testing the water's salinity content by means of a refractometer. By measuring the extent to which light is bent when it moves through a sample of the creek water, the refractometer can determine the salinity concentration by comparing the sample's refractive index to a standard curve (Hanson 2003).

I chose three random locations along the creek in which to perform the test, and I recorded the results each time. At each location, we pulled the boat up to the banks, and I began the documentation and collection of the plants. Once again, to provide objective evidence, the plants that were studied at each site were chosen at complete random. A 3x3 foot frame made of PVC piping was tossed onto the banks, and whatever plants it captured were the ones studied. I took notes and several pictures of the general surroundings of each location, as well as of the specific plants caught by the frame. Specific characteristics that I took note of were: amount of new growth along the banks; color and health of the plants; thickness, or density of plants along the banks; and the presence of buds or blooming. After documenting what I saw, I then collected samples of every species of plant in the frame to bring back for identification. Mr. Major of the Biology Department is the one who helped me identify all of the plants that I collected. These steps were performed three times along Alligator Bayou. The location and identified species for each site can be found in Table 1.

Table 1: Research Along Alligator Bayou

Site Number	Location	Salinity	Species Identified
1	N 30°33.214' W 88°7.232'	1.5	*Sagittaria lancifolia, Hypericum traichyphyllum, Pontederia cordata, Peltrandra sirgonic, Smilax walteri*
2	N 30°33.214' W 88°7.211'	2	*Peltandra virginica, Sagittaria graminea, Lamiaceae family*
3	N 30°33.217' W 88°7.215'	2	*Peltandra virginica, Sagittaria lancifolia, Pontedaria cordata*

After collecting all of the data along Alligator Bayou, I then headed directly across Dog River to Perch Creek. I began by locating three sites in which the salinity matched the concentration of that in Alligator Bayou within .5 units difference of each other. At each location, I followed the same procedures of documentation and collection. All coordinates and research findings for the sites at Perch Creek can be found in Table 2.

Table 2: Research Along Perch Creek

Site Number	Location	Salinity	Species Identified
1	N 30°35.075' W 88°5.787'	2	*Solidago, Hymenocallis caroliniana, Aster*
2	N 30°35.143' W 88°5.970'	2	*Sagittaria lancifolia, Rubus angutus, Zizaniopsas*
3	N 30°35.105' W 88°5.870'	2	*Sagittaria lancifolia, Cirata maculata*

Results

The results of my research can be supported by both trends that I took note and quantitative data that I collected. The most obvious difference between the two creeks was the variation in the amount of new growth. Alligator Bayou soon became completely impassable by boat due to the amount of new vegetation spreading into the

center of the creek, whereas the small amount of new growth that Perch Creek contained was patchy and sparse. Figure 2 shows the route along Alligator Bayou as well as the surrounding vegetation of the creek.

Figure 2: Route and Vegetation Along Alligator Bayou

Distinctions were easily made in the overall health and color of the growth along the creeks. As a whole, Alligator Bayou boasted a more lush environment: the vegetation was a darker green, the new growth was clearly more developed, and each site that I studied along Alligator Bayou contained a higher number of different species that that of the sites along Perch Creek. Figure 3 shows the route that I took along Perch Creek, as well as a picture of one of the samples along the creek.

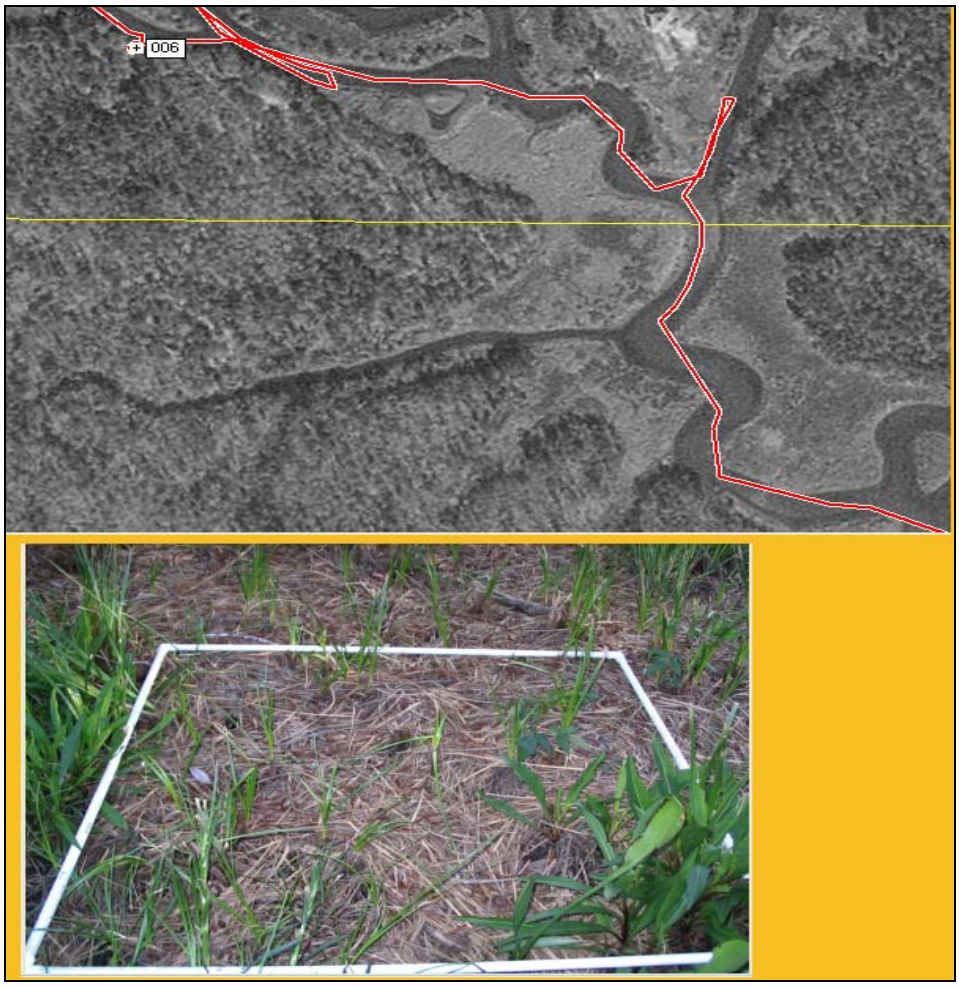

Figure 3: Route and Sample Along Perch Creek

In addition to the overall conditions of the two creeks, my individual study sites along the banks rendered a trend in results as well. The three 3x3 foot square sections that I studied along Alligator Bayou were uniform in plant quality and quantity. I gathered at least four different species from each site, and the density of the plants within the frame was very thick. The results of the study sites along Perch Creek were also quite unvarying. I gathered less variety of species; the plants were also smaller, less vibrant, and patchier.

After arranging my results into an organized table, as seen in Table 3, I then compared the overall conditions of Alligator Bayou and Perch Creek to the general

affects that fertilizers have on plants. I found that the conditions of plants from Alligator Bayou are characteristic of plants treated with fertilizers. Phosphorus, a common element found in fertilizers, encourages rapid growth and blooming; both of these traits were evident of the vegetation along Alligator Bayou, whereas the opposite was seen along Perch Creek. Another common element among fertilizers, nitrogen, is responsible for a deeper pigment of the plant, as well as rapid growth (North Carolina Department of Agriculture and Consumer Services 2007). Once again, Alligator Bayou exemplified these characteristics in the obvious higher amount of new growth and deeper green vegetation.

Table 3: Overall Conditions of Alligator Bayou and Perch Creek

	Alligator Bayou	Perch Creek
Amount of Growth	abundance of new growth; very rapid	spotted areas of new growth
Color/Health	bright green; lush	faded green; yellow at bases of plants
Variety of Species	average 4-5 species per area studied	average 2-3 varieties per area studied
Thickness of Plants	extremely high density along banks and into center of creek	no plants growing into the interior of the creek; bare patches along banks
Buds/Blooms	flowering vines; water flowers	little to non-existant

Discussion and Conclusion

The goal of my research is to provide the public and Dog River Clearwater Revival with possible proof of contamination to the Dog River Watershed due to agricultural run-off. This hypothesis is supported by obvious trends in the differences in the quality of vegetation between Alligator Bayou and Perch Creek, however, trends

require a great deal of follow up. Even though it is evident that the vegetation along Alligator Bayou is healthy and flourishing, as compared with the struggling vegetation along Perch Creek, I propose that a more in-depth study of the chemical make-up of the waters in Alligator Bayou be conducted, along with a greater range of samples taken along both creeks for more comparison.

The inarguable evidence in differences between Alligator Bayou and Perch Creek that my research provided give reason for further research and concern. If, in fact, the abundant growth and pronounced health of the vegetation along Alligator Bayou is due to a higher concentration of fertilizers in the waters, then there is sufficient proof for the lack of containment of agricultural run-off. Additional research concerning the comparison of Alligator Bayou and Perch Creek could be the final step in providing enough evidence for the Dog River Clearwater Revival to propose working with local plant nurseries to aid in the prevention and suppression of fertilizer run-off.

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