2019 Poster Abstract Submission Synthesis

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Volunteer

Natalie Ladd, Hiwassee River Watershed Coalition

Title: **Collecting Sediment Samples during a Rainstorm**

The goal of this project was to design and build a device that can be placed in a river before a rainstorm that will collect water samples to show the amount of sediment in the water. Collecting samples is often done by hand but the best time to collect them is during a rainstorm. This device would allow the samples to be collected without someone having to be out in the storm doing it by hand. Large rivers have expensive equipment that tests sediment levels but this would allow smaller rivers and streams to be easily tested as well. I used a metal fencepost, collection bottles, cable ties and stainless steel straws to build the device. It was placed in a local river before a rainstorm and I was able to collect water and sediment in each of the 8 collection bottles that were attached to the fencepost. It worked!

Graduate

Cassidy Lord, University of Georgia and Upper Oconee Watershed Network

Title: **Oconee Confluence Clean Water Alliance (OCCWA): Forestland Protection in the Upper Oconee River Basin to Protect Drinking Water Sources**

Across the Unites States, 180 million people rely on the forest-water connection to supply 26 thousand communities with high quality water for municipal use (USDAFS, 2000). Nearly two-thirds of the state of Georgia's 25 million acres are forested, 92% of which are privately owned (GFC, 2005). In the Upper Oconee River Basin of Northeast Georgia, forested lands constitute 55% of the landscape. Forested acreage has decreased 20% across the basin in the last 20 years.

Ninety-four percent of all drinking water in the basin is acquired from surface sources. Future population estimates project a 52% increase in the basin population by 2050 (NEGRC, 2017). That is two times the population of Athens. All of these people will need access to clean, adequate quantities of drinking water originating in forested upper basin source watersheds.

For two decades, the Upper Oconee Watershed Network has collected water quality data in the Athens area, which sits at the confluence of the Middle and North Oconee rivers. For years, this data has been used to support county decision making. Recently, UOWN has collaborated with county utilities, forest managers and other watershed stakeholders to develop and implement a payment for ecosystem services fund.

This project aims to protect source water watersheds through the conservation of forestland in the Upper Oconee River Basin. This work is supported through UOWN's vast database and monitoring efforts which will allow fund managers to track water quality changes using Adopt-A-Stream sampling methodologies.

Undergraduate

Blake Lindner, Georgia Institute of Technology, School of Civil and Environmental Engineering

Co-authors/project partners: Roth Conrad, Lizbeth Davila-Santiago, Brittany Suttner, Janet Hatt, Kostas Konstantinidis, US National Parks Service

Title: **Microplastic and microbial load along a rural-to-urban gradient within the Chattahoochee River**

The accumulation of plastic waste within water bodies is a recent worldwide pollution issue. As an emerging pollutant, understanding the fate and impact of plastics is essential in order to protect both public and environmental health. The majority of plastic contamination is transported to the ocean via rivers. A critical component of plastic contamination are those particles smaller than 5.0 mm, referred to as microplastics. The sources and total load of microplastics in freshwater environments as well as microplastic effects on the ecological health and microbial communities of these systems remain essentially under-studied. Herein, we investigated the impact of urbanization on river conditions with the specific aim to identify potential point and non-point sources of microplastic contamination and examine the microbial communities that are associated (attached) with these microplastics. Following guidelines established by NOAA, we have collected and quantified microplastic loads present before, throughout and following heavily urbanized stretches of the Chattahoochee river. Of specific interest was whether input from wastewater treatment plants presents a substantial point source of microplastic pollution. We quantified microplastic load in the river and its influence by changes in land use and rain events. Ongoing work aims to identify the microbes associated with microplastics using culture-independent techniques (metagenomics) and how their activities affect microplastic degradation and fate during transit period in the river. The long-term objective of this work is to establish interactions between river microorganisms, microplastic contaminants and the fate of these microplastics.

Camille Mosley, Emory University

Co-authors/project partners: Biologist Tamara Johnson (EPA)

Title: **Determining Aquatic Biodiversity and Stream Health of the Proctor Creek Watershed Using eDNA Technology and Citizen Science**

The Proctor Creek Watershed in West Atlanta is home to an array of aquatic and terrestrial species important for ecosystem and human health. This ecosystem has been negatively impacted by combined sewage overflow and pollution. It is unknown whether federal restoration plans have increased ecological health and biodiversity. The goal of this research is to investigate whether threatened species exist in these waters and signal pollution levels, such that measures can be taken to prevent illness of organisms in the ecosystem. The hypothesis is that Proctor Creek streams have fair water quality and pose positive to neutral risks to public health. Aquatic biodiversity will be measured through evaluating species richness with kick-net stream sampling, and eDNA detection of the presence of specific species. eDNA analysis of Proctor Creek locations will be performed to detect DNA evidence of the Georgia threatened Chattahoochee crayfish (*Cambarus howardi*) and freshwater fish species. Crayfish are bio-indicators that can help determine if chemical remediation may be needed. The United States Geological Survey's water gauge monitoring data will be collected for water quality assessment. Results indicate fair and optimal water quality parameters for aquatic organisms from stream gauge data, however the presence of the Chattahoochee crayfish (*Cambarus howardi*) was not detected in genetic sequencing results. These results signal that the structural and pollution problems may remain in the watershed. Future research can determine how to optimize streamline eDNA extraction protocol, determine bio-magnification in tissues of ecosystem inhabitants, and develop more universal primers for urban stream organism detection.

Devin Filicicchia, Young Harris College and Hiwassee River Watershed Coalition
Title: **Interwoven Community: A Framework for Restoring an Ecological Fabric**

Corn Creek, a small tributary that feeds the Hiwassee River basin, runs through the campus of Young Harris College in North Georgia. Corn Creek, in its current state, does not resemble the inspiration that it represents. Presumably from years of neglect, the riparian area of the creek became overgrown with invasive flora that suffocated native species. Several initiatives from the community resulted in a network of people coming together with a commitment to improve Corn Creek. Various individuals and groups have a vested interest in the creek, but the restoration initiative is only possible through the collaboration of their resources. Through diverse partnerships the project received the necessary funding, workforce, and restoration know-how to recondition the damaged riparian area. Since 2016, over three hundred yards of the riparian zone have been improved. The goal of the phase that is currently underway is to remove invasive species of plants along the creek bed and replace them with native species of trees and shrubs. The next phase of the project includes restoring a heavily eroded portion of the creek bed, which has been temporarily remediated using cement slabs. Each group involved has been integral in the success of the initiative restoring pieces to the ecological fabric of this biotic community. This project has become the epitome of successful partnerships and can serve as a framework potentially inspiring other restoration projects to arise.

Cody Beavers and Michael Cuprowski, Dalton State College

Title**: A two-year study monitoring macroinvertebrate assemblages and leaf litter breakdown rates to assess the impact of Dalton State College campus on College Creek**

Headwater streams are often heavily vegetated, allowing little light for instream photosynthesis and making leaf litter an important source of energy. Macroinvertebrate feeding behaviors play a key role in the processing of leaf litter and cycling of nutrients. Stressors associated with urbanization have been shown to decrease macroinvertebrate abundance and diversity. A stream's ability to process organic matter and retain nutrients may thereby be affected. This is the second year of a study investigating whether the Dalton State campus has had an effect on the macroinvertebrate community and leaf litter breakdown rate in the stream which passes through it. Potential stressors include non-point source pollutants, channelization, and reduction of riparian vegetation. Sampling was conducted at an undisturbed reference site upstream of campus and a site downstream of campus. Data were collected using a standard leaf-pack sampling method with leaf masses being tracked and all macroinvertebrates that colonize the packs collected and identified to family. In year 2, the amount of leaf matter was increased and the time between pulls decreased to accommodate the high rate of breakdown observed in the previous year. Temperature loggers were also added at each site to account for the effect of temperature on breakdown and ash free dry mass was determined to account for mineral deposits that may have accumulated while in the stream. In 2017, our first sampling year, higher macroinvertebrate abundance, better water quality parameters, and a higher leaf breakdown rate were observed upstream. 2018 results are presently being analyzed.

Hannah Walker and Caroline Cox, Young Harris College

Co-authors/project partners: Aubery Crowell, Robert Moser, Mallory Downs, Mark Howington, Darrien Henson, Harrison Scott, David Thompson. (Students from Young Harris College)

Project Partner: Hiwassee River Watershed Coalition

Title: **The Southern Appalachian Snorkeling Trail: Preserving Water Quality in Appalachian Communities by Promoting Native Fishes**

Students in Young Harris College's Ichthyology course, as part of the Appalachian Teaching Project, collaborated with the Hiwassee River Watershed Coalition to address the issue of sustainable water quality in Appalachian communities by developing the Southern Appalachian Snorkeling Trail. The project linked fish biodiversity to the water quality of local streams, through the recreational and experiential learning activity of snorkeling. The project was designed to encourage the intersection of fisheries science, environmental sustainability and ecotourism in the region. The central focus of the first year of this project was to create the snorkeling trail. To accomplish this, students conducted field research and used findings to develop informational materials including a guidebook that contains maps, directions, site descriptions, and fish descriptions. The guidebook reviews eight sites spread across five watersheds in northeast Georgia and southwest North Carolina, each of which contains a unique assemblage of fishes. Sites were chosen based upon public access, safety considerations, and water clarity. These materials will be made available to the public, both online and through community partners, to promote the snorkeling experience and highlight the need for preserving and protecting water quality in southern Appalachian streams. The project hopes to increase appreciation for the waters of Appalachia as a unique natural and cultural asset while providing economic opportunity. Future research will seek to add additional sites for the snorkeling trail and create interdisciplinary opportunities that enhance community engagement with the project.

High School

Renee George, Rockdale Magnet School for Science and Technology

Title: **Optimizing Water Filtration Using Biochar and Polymer Additives**

The problem being addressed in this study is the issue of contaminated water sources and enhancing how those issues are being addressed. The purpose of this project was to optimize water filtration using biochar and polymer additives that are either currently in use in water filtration or not currently in use. The research hypothesis stated that when the polyethylene glycol is used in water filtration that the pH will be affected the least as well as the lead concentration will be lower compared to other samples. The procedure involved using bamboo biochar, corn starch, polyethylene glycol, and potassium iodide in the filtration process. In order to make this bamboo biochar, bamboo stakes were placed inside a paint can with a hole bore through the top. The paint can was then placed above an open flame where it was heated until a clear smoke escaped through the top, indicating that the combustion process was complete. Then the bamboo stakes were ground into finer pieces using a mortar and pestle. Each additive was filtrated in conjunction with the bamboo biochar. Once filtration was finished, the pH and lead concentrations were measured in each sample using a pH probe and lead tester. The data was analyzed using ANOVA and T-Test. There was significance found using the T-Test. It was concluded that polymer additives work best in the filtration of contaminants from household biological agents and polymer additives do not work as well in the filtration of contaminants from retention ponds.

Luke Morneault, Oconee County High School and Oconee Waters

Title: **Impact of Upgraded Wastewater Treatment Plant on Water Quality**

There were two issues that led to this citizen science experiment that focused on ensuring good water quality in my local community. The Calls Creek Wastewater Treatment plant was cited for multiple sewage spills in 2016. Soon after, the Georgia Adopt-a-Stream monitoring began to show an increase in conductivity downstream from the plant. I, along with others in the community, met with the Calls Creek Wastewater Treatment manager to discuss a full upgrade of the facility that would upgrade capacity and provide for denitrification. In order to assess the impact of the upgrade to the treatment plant, I began monitoring one physical (temperature) and two chemical (conductivity and nitrates) impacts the treatment effluent has on Calls Creek to compare before versus after. The upgraded wastewater treatment plant did indeed lower the amount of nitrates into the creek, but the conductivity remained high. The increase in water temperature downstream did not vary, but likely will once the new plant begins to increase to its new capacity since more effluent will be flowing into Calls Creek.

Jose Ayala and Jorge Chavez, Rockdale Magnet School for Science and Technology

Title: **Effect of Environmental Conditions on Algal Biofuel Production**

The purpose of this project was to figure out which environment would be best to grow algae in. Fossil Fuels harm the environment and using an alternate source to produce energy can reduce the dependency on fossil fuels. There would be 4 different environments that have different environmental conditions. One would include Manure, Soil, Pond, and the control distilled water. The hypothesis stated that the manure environment would produce the most amount of energy and pond water would produce the least amount of energy. The procedure included getting four Erlenmeyer Flask and placing 250 mL of each environment into each flask. Then add the algae to the Erlenmeyer Flask. For the following two weeks add Algae Grow to the Algae to allow it to grow and allow for fermentation. Extract the algae from the Erlenmeyer flask and place into a test tube. Centrifuge the test tube and allow for all the algae to sit at the bottom. Extract the algae with a pipette and place it into another test tube. Once into another test tube place the test tube into a beaker. Place the Bunsen burner under the beaker and allow for it to heat up. Place thermometer in the beaker and allow it to see how much the temperature has gained. The data was analyzed through the T-Test. The results showed that the hypothesized was accepted because the results showed that the Manure environment was the most effective.

Gloria Bradley Rockdale Magnet School for Science and Technology

Title: **The Effect of Mass of Trametes versicolor on Lead (II) Nitrate Concentration in Riverbank Soil**

Bioremediation is defined as ‘use of biological organisms to solve an environmental problem such as contaminated soil or groundwater’ (Cornell University) Lead II nitrate negatively affects most of the body systems in organisms, impairs growth and development of children, and causes learning, behavior, hearing, and speech problems. (CDC) White rot fungi are known to degrade compounds such as PCBs, PAHs, and PCPs. The aim of this study was to determine if White rot fungi species Trametes versicolor degrades lead (II) nitrate in soil. 0mg, 20mg, 40mg, and 60mg of fungi were put into four 250 ml beakers filled with 100 g of soil. The Spectro-vis was calibrated with known concentrations of 6.79E-09 mol/ml, 1.8E-11 mol/ml, 9.8E-09mol/ml and 1.8E-08 mol/ml. The Spectro- vis then calculated the unknown concentrations of lead (II) nitrate in soil. The difference and the change in percentage between Reading 1 and Reading 2 were then calculated. The lead nitrate concentration differences ranged from 0.00 to -2.63E-7. The trend in the trials were lead (II) nitrate concentrations in soil showed an increase in Reading 2. Analysis of ANOVA showed the trials had a p-value of

0.490. Since p-value > 0.05 the null hypothesis was true and the research hypothesis was false. The data shows there is no statistical relationship between mass of fungi and lead (II) nitrate concentration in soil
Keywords: Bioremediation, Lead (II) Nitrate, Trametes versicolor

Annabelle Renner, Melinda Downey, Destini Chambers, Montgomery Blake, South Paulding High School

Title: **The Viability of Soil Near a Wetland for Vegetation**

The purpose of our experiment was to determine the disparity between the pH of the water and soil and how this difference has affected the health of the plants. Through a semester long study of various factors of the wetland water, the acidity of the water was consistently found to be between 5.5 and 6.5. Since the water in the wetland is naturally acidic, the question was how the acidity of the water affected the soil and how that in turn affects plant life. Through a soil sample, it was shown that the soil in the wetland was also highly acidic, at 4.9. This data was discovered by sending a sample to the Soil, Plant, and Water Laboratory that is a part of the University of Georgia Cooperative Extension office. Through our procedures, our goal is to determine what changes need to be made to the soil to make it suitable for agricultural land. According to the sample report, our soil needs 8-8-8 or 10-10-10 fertilizer to plant perennial flowers to accommodate the lack of essential nutrients in the soil and raise the pH to between 5.5 and 6.5. Through multiple tests, we will determine the viability of using wetland soil to grow perennial flowers near the wetland water. We will compare how these plants grow when compared to the controlled soil that lacks any additives.

Hannah O'Driscoll and Jessie Turner, Villa Rica High School

Title: **Exploration of Wildcat Creek**

Wildcat creek is an intermittent stream that runs through the property of Villa Rica High School. The creek flows next to the student parking lot and under a road into the woods. Until last year, it was unknown where the creek began or ended, but students in AP environmental science would test the water quality of the stream monthly. Last year, with help from Jess Sterling from the Chattahoochee Riverkeepers, we were able to walk the stream and find that began near the I-20 off ramp into Villa Rica. This year, we have continued our exploration of the creek and the area around it by following it further downstream. We have collected samples from a nearby retention pond as well as samples from the downstream to see how the area around the creek affects its health. We have also had the opportunity to test for phosphates and nitrates, as we explored new ways to test the health of the stream.

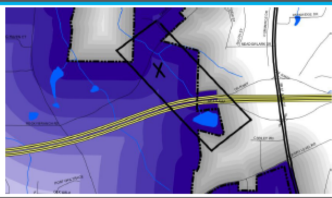
Exploration of Wildcat Creek

Jessie Turner and Hannah O'Driscoll | Stephanie Miles | Villa Rica High School

Objective

Our research this year was focused on exploring new sections of the stream and using new testing methods to further our understanding of the water quality of Wildcat Creek.

Location of Wildcat Creek



Project Overview

Every month, Mrs. Miles's AP Environmental classes test the dissolved oxygen, pH, and conductivity levels of the creek. This spot is know as the "Typical Testing Location." We used this data as our base line and then over a week, tested the water from a location downstream and from a retention pond next to the creek. We compared this data to see how the data changed, we looked at the surrounding area to see what could have caused the changes.

New testing methods

Last year, our testing included dissolved oxygen levels, pH, conductivity, and bacteria levels. This year, we had new ways to test for nitrates and phosphate levels, and we also used a new test for bacteria levels. Instead of using 3m plates to incubate samples of water, we used a total coliform indication test.

Sampling locations

Site 1, our typical testing location

Site 2, the retention Pond

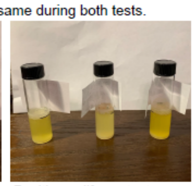
Site 3, downstream

Data/ Observations

Location	D.O	pH	Conductivity (μS/cm)	Phosphate (ppm)	Coliform
Site 1, typical	10.5/10 8.9/9.2	6.5, 6.8	70 90	1.5 2	Positive Positive
Site 2, Retention Pond	9.8/9.4 4.2/4.4	6.4, 6.5	40 50	2 1	Positive Positive
Site 3, Down-stream	11/10.5 8.6/8.8	6.5, 6.8	80 90	2/1.5 2/1.5	Positive Positive

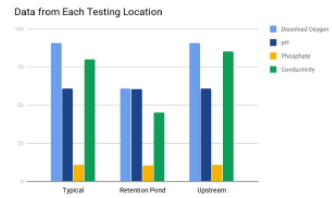
We tested for Nitrates but every test came back as zero, so we did not include this value. The top row was from the first day (1/13) we tested while the second row was from the last day (1/15) we tested. Every test was performed twice. If there is not a slash between two values, then they were the same during both tests.

Positive coliform tests from 1/13 from all locations



Positive coliform tests from 1/15 all locations

Results



Dissolved oxygen, pH, and phosphate data multiplied by ten for easier viewing.

Conclusion

Overall, our creek is healthy for its size. The downstream sampling location runs through a cow pasture, which caused the positive total coliform results. The positive results from upstream have been attributed to the abundant wildlife that surrounds the school. Last year's creek walk revealed no sources for coliform other than wild animals. Since we only tested for the presence of coliform, we were unable to determine the level of the bacteria in the water. Other than the coliform results, the retention pond served as an interesting comparison for the tests from the creek. The retention pond is located across the street from the parking lot and the typical testing site. While we would not advise for anyone to drink or play in this water, the creek and the area around it are healthy and have no negative impacts on each other.

Works Cited

Carroll County, Ga. [Cartographer]. (2006). Carroll County, GA Commission District 003 [Map]. Retrieved from https://carrollcountyga.com/DocumentCenter/View/351/Commission-District-3-Map-PDF.