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Abstract

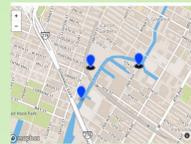
The Gowanus Canal is one of the most contaminated waterways in America. Contaminated waterways could create an atmosphere where harmful organisms thrive. We took plant samples from two different sites of the canal, one with native planting by the Gowanus Canal Conservancy and one untouched site, in order to understand which species thrive in such a toxic environment. With this information we can gain insight as to how we can use plants to our advantage to help our ecosystem be balanced. This experiment can help the conservancy site understand whether planting native species only, is enough as invasive species might take charge. Our hypothesis was that both areas would share common species, but the conservancy site would have native plants because invasive species can affect the ecosystem negatively, which they are aware of. After we collected the samples we identified the species by executing DNA extractions, then proceeded to do Polymerase Chain Reaction and gel electrophoresis. Results showed that there were exotic, native, and invasive plants in both sites while some species were shared by both sites. The results also displayed invasive species in the conservancy site which is alarming as it can cause the ecosystem to become unstable.

Introduction

The Gowanus canal wasn't always a canal, as it served its purpose as a stream first. Due to the commercial advancements that was occurring during the 1800's, the Gowanus stream began to be altered by the community into a canal for better transportation which could lead to a better economy in the field of manufacturing. The project began in 1849, meaning that there was little to no awareness or actions taken at the time for the waste, such as coal tar, mercury and lead that was being deposited in the canal by factories nearby (NYC.gov). We wanted to identify the different species of plants in two locations of the canal, one untouched from any invasion of plants by humans and another that is continuously being monitored and modified by the Gowanus canal conservancy site which is an organization of environmental stewards for the canal Conservancy site (Superfund site profile) through planting native plants. The plant's tolerance to the toxic environment on the untouched site will be examined to see what type of species are able to thrive there. Additionally, plants from both sites will be compared in order to identify which plants within the categories of exotic, invasive and native are a common choice both by the environment and the conservancy group. Although the complications this canal has to the environment, has been identified by engineers and city planners in the 20th century and actions have been taken to reduce its impact, it is still one of the most contaminated waterway in NYC, which enables this research to retain its independent variable. We hypothesized that both sites will contain native species because the untouched part of the canal had no known invasion and the canal conservancy site referenced their use of native plants on their website. By reporting the data, the conservancy can interpret what additional plants they can plant to avoid harming the ecosystem/biodiversity negatively. Some plants can cause an abundance in desired species, which can improve biodiversity or ecosystem, however this goal wasn't mentioned in the conservancy's website so the results and data can help analyze the effects of planting in a biodiversity. To prove this hypothesis, we have collected different specimens from a section of the Gowanus canal conservancy on 5th ave 2nd street Brooklyn NY 11215 and Smith Huntington near Gowanus canal in Brooklyn NY 11213. On November 15th 2017, twenty-five plants had been collected every 5 ft interval for each location so that our experiment is constant. We used gloves to collect the plants and stored them each in a plastic bag until we reported to class, where we observed its characteristics, recorded their characteristics and began the experimentation. Our results had 3 species that were shared, and 6 species for each site. One of the results was very compelling when we discovered that the Conservancy site had invasive plants.

Materials and Methods

Area surveyed: The area where we acquired the samples was on public land around the Gowanus Canal. The two location that was surveyed was around the area of the Gowanus canal, one specifically near the canal itself and another area where the canal was affected by Gowanus Canal Conservancy. This included a location on 5th Ave 2nd Street Brooklyn NY 11215 of the Gowanus canal conservancy and Smith Huntington near Gowanus canal in Brooklyn NY 11213.



Process of collecting plants: For our methods we collected, documented, identified, and stored specimens. We documented the species by taking photographs in its habitat and its noting their characteristics such as size of leaf and type of leaf. We collected 25 species originally but one of the species wasn't sequenced, therefore there were 12 species each for the untouched canal and the canal that is supported by the Canal Conservancy. We wore gloves and used a measuring tape so that we collected a plant every 5 ft. along the way. The samples was placed in a plastic Ziploc and stored in freezer to prevent them from decaying.



DNA extraction: We then isolated the DNA from each species by placing their tissues in centrifugation tube, adding lysis solutions to break open the cell by destroying the membranes that kept it enclosed, and grinding the solution which contains the DNA released from breaking the membrane. We stored it or incubated it for 10 minutes at 65 degree Celsius and used a centrifuge- a device that is used to separate any states of matter based on density. This caused a layer of liquid or supernatant and solid to be displayed, where the liquid was the DNA. The liquid access was added to a new tube and silica resin was added to bind the DNA. The solution was mixed and incubated at 57 degree Celsius for 10 minutes. This procedure was repeated with removing supernatant, adding wash buffer to remove access protein, mixing, and centrifuging. We made sure that final DNA solution does not contain silica resin and stored it at -20 degree Celsius.

PCR/Amplification of DNA: We then proceeded to amplify the DNA through PCR in order to make multiple copies of that DNA. PCR reagents was added to the solution in order to get the segments of the DNA that was needed to be tested. We added 12.3 pu Tag mix and 10.5 ol primer mix. DNA solution was added and we used thermal cycler to amplify the DNA. The solution was stored at -20 degree Celsius.

Gel electrophoresis and Sequencing: We analyzed the DNA by pouring the gel in a container and letting it set for 20 minutes. We proceeded to load the gel in the gel electrophoresis machine where it had 130 volts for 30 minutes. The data was sent for sequencing at Genspace and our results included several sequences that corroborated to several species.

Results

In total, 11 of the species were exotic, 8 were invasive, and 4 native, with 2 unknown throughout the two sites we had been comparing. Both sites shared 3 common invasive species. Most of the plants had a low number of mismatches with a bit-score of over 1000, but they all had the same e-value, 0. Some species such as *Artemisia Vulgaris* naturally thrived in the canal because of the contaminated soil.

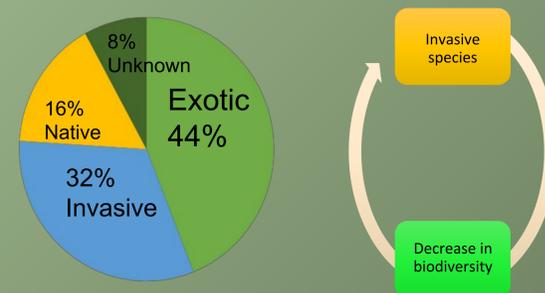
INVASIVE		Setaria viridis	
	Setaria Viridi	Erigeron breviscapus	
	Symphyotrichum eatonii	Artemisia Vulgari	
	Setaria Viridis	Symphyotrichum eatonii	
		Euphorbia maculata	

Discussion

The experiment consisted of common invasive species in both sites. This could portray that, even though the Gowanus Canal Conservancy program may be aware that invasive species can cause harm to biodiversity and ecosystem, it can be very strong when disseminating. Our data didn't support our hypothesis as there were more invasive species.

Although there were only 2 invasive species in the gowanus canal conservancy it shows the aggressive behaviour of it. The *Setaria Viridis*, *Artemisia Vulgaris*, and the *Symphyotrichum eatonii* were the common species and are invasive, however, it has had a strong impact on the sites due its durability in toxic environment. The results show that most of the organisms are exotic, while very few are native, changing the life cycle for any other organisms that live in the habitat. *Digitaria Sanguinalis* commonly known as weed can affect the characteristic of the soil by making it heavy in nutrients, however it can kill the carnivorous plants that may reside there. This could potentially lead to a decrease or increase in a certain species.

This project is important for the reason that it can help the Gowanus Canal Conservancy group, do any additional projects relating to our research such as interpreting which species modify best to this ecosystem. Precaution needs to be taken for the invasive species that is interfering the conservancy's project of planting native plants. Actions such as raising awareness can help decrease the amount of invasive species that can cause a decline in different organisms that feed on species that are getting replaced. It can foster harmful organisms such as algae which could lead to a decrease in oxygen, thus biodiversity. Overall, our hope is for our research to be of use for the Gowanus Canal Conservancy.



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