Title: The Effects of Human Impacts on the Environment

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Table of Contents

Site Visits

Site Visit #1

Date: 7TH February 2017

Location: Chancery Lane

Map 1: Map Showing Chancery Lane Swamp and Nearby Beach in Barbados.

Objectives

The objectives for the site visit were:

- To determine vegetation succession of coastal environments (Chancery Lane Swamp) in Barbados
- To collect soil and water samples to determine nutrient and pH levels.
- To assess the impact of human activity on biodiversity.

Activities

When the lower sixth Environmental Science class arrived at Chancery Lane Swamp two activities had taken place. Soil and water samples were collected. In order to have water samples a make-shift ladle was made by taping a jug onto a meter rule. It was held by the meter rule and the jug collected the water. The water collected was then poured into bottles which were capped and labeled and were carried back to the lab for testing.

Soil sampling was carried out by using two plastic bags. One plastic bag was worn on the hand of a student from this environmental class and this and was used to collect the soil and place it in another bag. This bag of soil was tied, secured and stored in a bucket. This soil was also taken back to the lab for testing.

Observations

Litter was present at the swamp in several areas and in different amounts. Bones and decaying animals were also found at this site along with large amounts of vegetation as shown in Figure 1. The water in the swamp was murky and at some areas grass grew over it and the students were unable to see how far the swamp reached. The soil appeared to be between loamy and sandy soil. Dead leaves also covered some of the ground. As shown in Figure 3 tires were found near the swamp and this was a human influence on the swamp.

Figure 1: Photograph Showing Large Amounts of Vegetation at Chancery Lane

Figure 2: Chancery Lane Swamp

Figure 3: Photograph Showing Tires Found at Chancery Lane Swamp

Figure 4: Photograph Displaying Dead Animal Found Near the Swamp

Interpreted Comments

The litter present was most likely because of human activity. Humans probably chose this area to litter because it is far away from civilization. Bones were most likely present because of the dumping of dead animals. Since this was a secluded area this may have been a pull factor for people to dump large waste and dead animals here as shown in Figure 3 and 4. Vegetation could have been in large amounts as a result of no deforestation and successful seed dispersion in most cases. This vegetation is displayed in Figure 1. The grass growing over the swamp was floating vegetation and this is a form of aquatic life. This floating vegetation showed that eutrophication was occurring.

Follow-up Activities

The soil and water samples collected at the swamp were taken back to the lab for testing. They were tested for pH and nutrient levels.

Site Visit #2

Date: 7TH February 2017

Location: Chancery Lane (Long Beach)

Objectives

The objectives for the site visit were:

- To determine vegetation succession of coastal environments (Chancery Lane) in Barbados.
- To assess the impact of human activity on biodiversity.

Activities

When the lower sixth Environmental Science class arrived at the beach at Chancery Lane not much activities had taken place. On the eastern side of the beach a line transect of 200ft from the backshore to the shoreline was set up. Quadrats were placed every two meters along the line transect alternating on each side. These quadrats were examined on-site and results were recorded. Along with the line transect, the beach was observed and examined and photographs of vegetation were taken.

Observations

Litter was found on the beach however in small amounts and it was not frequently discovered. To the backshore of the beach at Chancery Lane a lot of vegetation was present. It was observed that the beach was used for recreational purposes. Kite surfing and the remains of a bon-fire, as well as a shack were seen at the beach. A hammock was also found (which is shown in Figure 4), these were all signs of human activity.

Figure 5: Photograph Displaying Hammock Seen at Chancery Lane Beach

Interpreted Comments

Litter was probably present at the beach because they were no garbage bins around and it was somewhat far away from society. Therefore some humans found it okay to litter there. However, the reason for finding small amounts of litter, was probably because only a small amount of the population who visited this beach, were unware of the side effects of littering at a beach and the advantages of having a litter free beach, especially in the Caribbean. Vegetation was most likely in large amounts because of successful seed dispersion and no deforestation. The shack present could have been a liming spot for young adults or even teenagers who went to this beach often and used this place to shelter. The hammock shown in Figure 4 would have to have been created by humans also and is likely to be a liming spot as well.

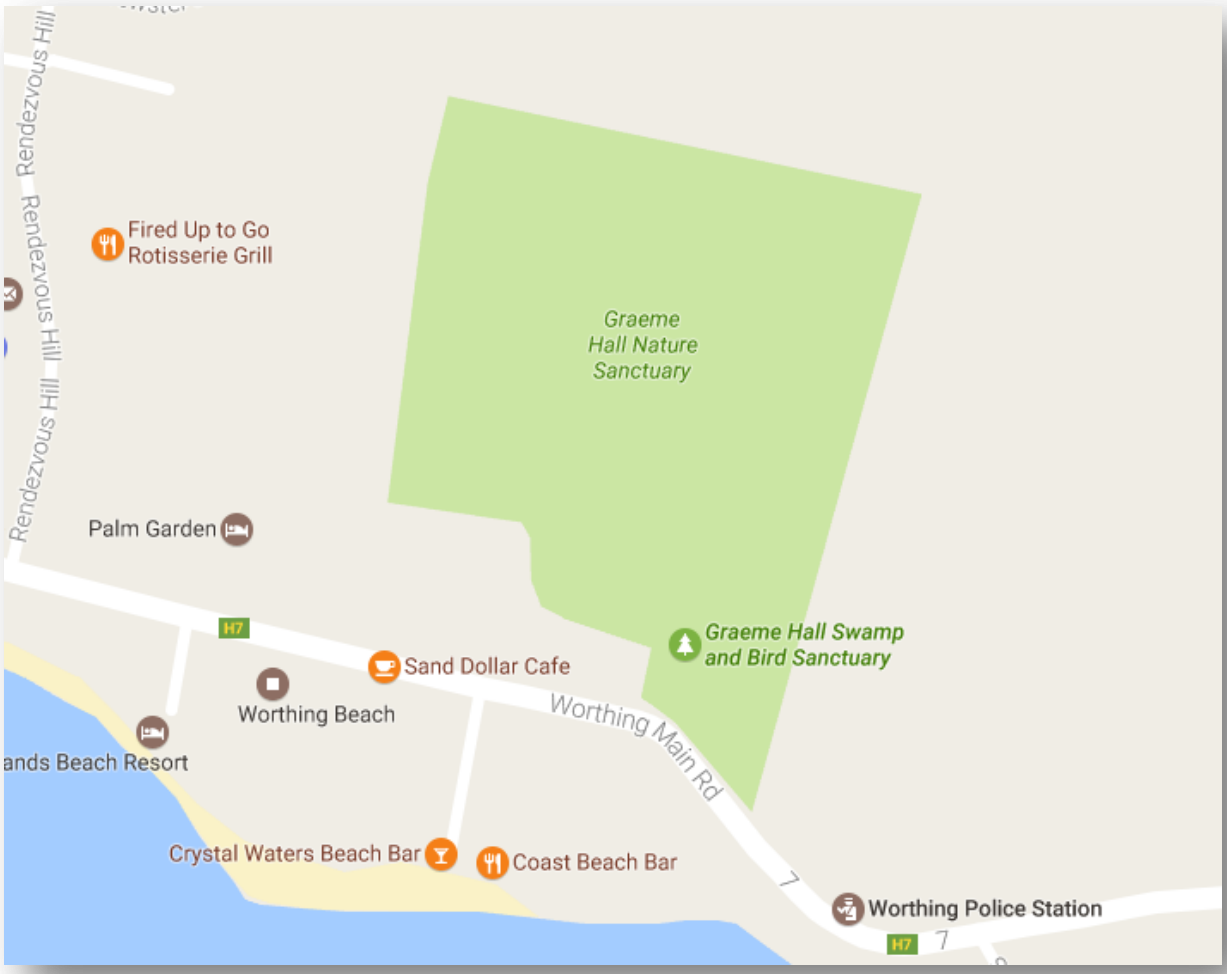
Follow-up Activities

Percentage cover and biodiversity were calculated off-site. The information gathered from the line transect at Chancery Lane was taken off-site and further examined. This information was calculated to find out biodiversity and how much of the ground was covered by vegetation in each transect.

Site Visit #3

Date: 7TH February 2017

Location: Graeme Hall Swamp



Map 2: Map Showing Graeme Hall Swamp and Nearby Beach in Barbados.

Objectives

The objectives for the site visit were:

- To determine vegetation succession of coastal environments (Chancery Lane Swamp) in Barbados
- To collect soil and water samples to determine nutrient and pH levels.
- To assess the impact of human activity on biodiversity.

Activities

When the lower sixth Environmental Science class arrived at Graeme Hall Swamp two activities had taken place. Soil and water samples were collected. In order to have water samples a make-shift ladle was made by taping a jug onto a meter rule. It was held by the meter rule and the jug collected the water. The water collected was then poured into bottles which were capped and labeled and were carried back to the lab for testing.

Soil sampling was carried out by using two plastic bags. One plastic bag was worn on the hand of a student from this environmental class and this and was used to collect the soil and place it in another bag. This bag of soil was tied, secured and stored in a bucket. This soil was also taken back to the lab for testing.

Observations

At Graeme Hall Swamp not as much vegetation was seen on land when being compared to Chancery Lane Swamp. However Graeme hall had way more floating vegetation in the swamp. Two swamps existed at Graeme Hall and were separated by a trail. In one swamp it was almost completely covered by floating vegetation (this is displayed in Figure 5). The swamp water was murky and didn't differ much in appearance from Chancery Lane. The soil type was between sandy and loamy soil. A small amount of litter was found on this site.

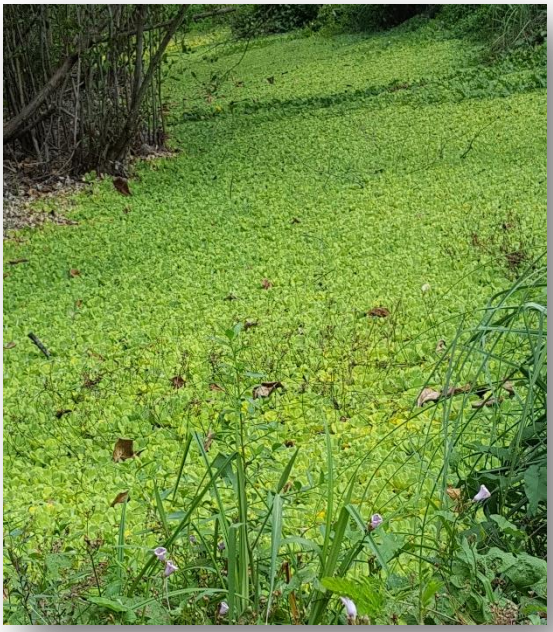


Figure 6: Photograph Showing Floating Vegetation at Graeme Hall Swamp.

Interpreted Comments

Not much vegetation was present on land at Graeme Hall probably because it was very close to a road and civilization, so some deforestation had to occur. As shown in Figure 5 the swamp was heavily populated with vegetation. The reason for this in the swamp here, was probably because of more phosphates being in the water. Or, if this swamp water is lacking in phosphates currently, it probably had a high amount in the past leaving this amount of floating vegetation as the result. With more phosphates in the water more plants are able to grow on the surface of the swamp. Possibly, a small amount of litter was found at this site because it is a built up area. It is residential, people are doing business and frequenting these areas on a daily basis. Also, there is a popular beach across the street. When beach cleanups are done the swamp is probably cleaned to some extent as well, to ensure that areas surrounding the beach are appealing to the eye.

Follow-up Activities

The soil and water samples collected at the swamp were taken back to the lab for testing. They were tested for pH and nutrient levels.

Site Visit #4

Date: 7TH February 2017

Location: Graeme Hall

Objectives

The objectives for the site visit were:

- To determine vegetation succession of coastal environments (Graeme Hall) in Barbados.
- To assess the impact of human activity on biodiversity.

Activities

A line transect of 200ft was set up at Graeme Hall. Quadrats were placed every two meters along the line transect alternating on each side. These quadrats were examined on-site and results were recorded. Photographs of vegetation were taken.

Observations

Vegetation was low. The grass which came in contact with the line transect was short. It was also not dense.

Interpreted Comments

The grass at Graeme Hall swamp probably was not able to survive with the amount of nutrients in the soil. The soil could have been in fertile or not as fertile as it should be. Seed dispersion and growth could have been unsuccessful in many cases also.

Follow-up Activities

Percentage cover and biodiversity were calculated off-site. The information gathered from the line transect at Chancery Lane was taken off-site and further examined. This information was calculated to find out biodiversity and how much of the ground was covered by vegetation in each transect.

Lab Reports

Title: Phosphates in Soil

Aim: To determine phosphate levels in soil from Chancery Lane and Graeme Hall Swamp

Materials & Apparatus: Test tubes, soil, spoon, filtering device, scoop, plunger, P1 test solution, P1 pipette and filter discs.

Procedure:

When the filtering device was prepared, the cap was unscrewed and the plunger was removed. One filter paper was placed in the bottom of the plunger and a neat fit was ensured by using the end of a spoon. The barrel was filled to the 0.5ml mark with the dry soil and the P1 test solution to the 2ml mark. Afterwards, the plunger was inserted just inside the barrel of the device and the mixture was gently shaken for 30 seconds. The plunger was pressed down slowly until it touched the mixture, then the cap was screwed down slowly until the solution filtered into the plunger. As much of the solution as possible was compressed out without forcing the cap. This was followed by the cap being unscrewed and the solution being poured into a test tube to the 1ml mark. After the solution was poured into a test tube, 1/2 spoon of P2 was added to it using the narrow end of the spoon. The test tube was capped then shaken gently for 5 seconds and immediately the color reading was taken. This was done by placing the test tube onto the white part of the card and look down the tube to access the color against the reading chart.

Data Collection/ Results:

On testing the soil for phosphates at both Chancery Lane and Graeme Hall Swamp the sample from Chancery Lane had a slight change in color from brown to a lighter brown. However, on testing the soil at Graeme Hall Swamp, the water changed from brown to almost transparent.

Chancery Lane Swamp	70mg / L
Graeme Hall Swamp	40mg / L

Table 1: Table Showing Phosphate Levels in Soil at Both Swamps

Discussion:

Phosphates, a major source of water pollution are inorganic compounds which come from phosphorous. They are sometimes used in fertilizers for plant nutrient and for other purposes such as in detergents. When phosphates are excessive in lakes, ponds and swamps they

encourage the life of phosphate-dependent organisms such as: explosive algae and duckweed and other floating vegetation. This results in the deaths of many other aquatic lifeforms. These deaths are caused because duckweed and explosive algae deplete water-dissolved oxygen. They use great amounts of oxygen and prevent sunlight from entering the water thus killing other animals within the water. This phenomenon is known as eutrophication. Phosphorous is usually found in rock formations and ocean sediment such as phosphate salts. These phosphates are released from the rocks through weathering and dissolve in soil water which will be then absorbed by plants. These plants are then eaten by animals and when decomposers breakdown this dead matter the phosphates then go back into the soil and eventually into rock again. This is broken down millions of years after from weathering. The cycle then continues. Phosphates are a major factor in plant growth since they help them to grow faster, however plants get slow and limited access to them since this cycle is very slow in transporting these phosphates. Aquatic plants are even more neglected in this cycle since only few forms of phosphates are soluble leaving the majority to come from rocks and soil. Human activities on the other hand can accelerate the rate at which these nutrients travel. As shown in Figure 4, this dead animal and previous ones (since bones were present also) could have been a factor why Chancery Lane's soil sample had a greater concentration than Graeme Hall. Also, from detergents entering this environment by nearby housing and even from those who frequently visit the beach if they have to wash their hands and use soap to do so (e.g. those who kitesurf and use the shack and hammock found nearby). Phosphates have to be present in this ecosystem as a result of seeing floating vegetation. In order for it to reach the swamp it first has to be present on land. With phosphates being present on land it could easily get into the soil or some could have been absorbed into plants. When animals eat these plants and then die these same phosphates go back into the soil when the animals are broken down. It is a fact that many animals die in these areas because along with figure 4, this area is a nesting ground for birds and bats who also live in a nearby cave. When these animals eventually die they all are broken back down into the soil, if they have consume any phosphates from the earth, which most likely they did, the phosphates re-enter the soil once again. Without these animals dying, they also leave phosphates in their feces. Additionally, from having a nearby cave (bats also live in caves and when they die they add to the nutrients in the earth) and phosphorous starting their cycle from rock, as years went by in the past and erosion occurred in the cave it probably had some deposits of phosphorous which then brought phosphates in the environment. Even though the Ministry of Agriculture is located somewhat near to the Graeme Hall swamp the chemicals in the fertilizers are probably intercepted during surface runoff causing them to not reach the swamp. Or, those who work there and control this sector are probably educated on the lives at stake if the chemicals reach the area around Graeme Hall and continue to travel into the beach, so, they probably put things in place to stop the chemicals from travelling so far. So, these are all logical reasons of why Chancery Lane's soil sample had a higher concentration of phosphates than Graeme Hall. No cave is located near Graeme Hall and evidence of dumping animals was not found. However, some living organisms can be living on land at this area and eventually they die, but the inhabitants are most likely lesser than what is at

Chancery Lane since it is much bigger. It must also be added that people do not frequently visit this area of Graeme Hall swamp as much as those at Chancery Lane, not long enough to erect a shack. Lastly, the soil tested at Chancery Lane was very close to where the decaying animal were found and bones of other organisms, this could have been a factor in having such a big difference in the results.

Sources of Error: What made testing not accurate was the fact of the soil being wet while it was tested. Also, the color of the water was hard to determine and opinions on the color varied from person to person.

Conclusion: In conclusion, the concentration of phosphates in soil at Chancery Lane Swamp (70mg / L) measured higher than what was found at Graeme Hall Swamp (40mg / L). Even though the lab was successfully done, some factors existed which reduced accuracy.

Title: Nitrates in Soil

Aim: To determine nitrate levels in soil from Chancery Lane and Graeme Hall Swamp

Materials & Apparatus: Test tubes, soil, spoon, filtering device, scoop, plunger, N1 nitrate test solution, N2 nitrate reactant, filter discs.

Procedure:

When the filtering device was prepared, the cap was unscrewed and the plunger was removed. One filter paper was placed in the bottom of the plunger and a neat fit was ensured by using the end of a spoon. The barrel was filled to the 1ml mark with the dry soil and the N1 test solution to the 2.5ml mark. Afterwards, the plunger was inserted just inside the barrel of the device and the mixture was gently shaken for 30 seconds. The plunger was pressed down slowly until it touched the mixture, then the cap was screwed down slowly until the solution filtered into the plunger. As much of the solution as possible was compressed out without forcing the cap. This was followed by the cap being unscrewed and the solution being poured into a test tube to the 1ml mark. After the solution was poured into a test tube, 1 level spoon of N2 powder was added. The test tube was capped then shaken gently for 10 seconds. Lastly the test tube was put to stand for 5 minutes and was compared with the reading chart.

Data Collection/ Results:

When the soil at both swamps were tested (Chancery Lane and Graeme Hall Swamp) for nitrate levels, Chancery Lane had 0 mg / L while Graeme Hall had 10 mg / L.

Sites	**Nitrate Level (mg / L)**
Chancery Lane Swamp	0
Graeme Hall Swamp	10

Table 2: Table Showing Nitrate Levels in Soil at Both Swamps

Discussion:

Nitrogen is the most abundant element in the earth's atmosphere. Nitrogen compounds are present in many materials, foods, fertilizers, explosives and poisons**.** Nitrates come from nitrogen and they are used for many purposes. Along with nitrates being added to the earth by fertilizers, they are also sourced from the earth. These nitrates come from the nitrogen compounds which are found in the earth. Nitrates are formed in the earth by bacteria breaking down nitrogen due to chemical reactions. Nitrification is the process which converts the ammonia in the atmosphere into nitrate ions which the plants can use as nutrients. Nitrates can enter the soil from livestock waste (feces) and commercial waste. Therefore making agriculture a

very big factor on the amount of nitrates in the environment. When farmers rare animals their feces are broken down into the earth and provide nitrates. Also, when farmers use organic fertilizers – manure for example, provides the soil with nitrates and makes it very fertile. Additionally when farmers use chemical fertilizers to supply their crops with enhanced nutrients, nitrates are once more found in these chemicals. These chemical fertilizers are the number 1 contributor to the nitrogen in the global cycle. These fertilizers can increase nitrogen so much that soil fertility actually decreases because it off balances the nutrient levels in the soil. Rainfall after the application of nitrate fertilizers causes leaching of nitrates from the soil. Farmers then typically use twice the amount of which they actually need to counter this potential loss this excess nitrate pollutes the drinking water supply when surface runoff occurs and vastly changes the nitrogen cycle. The Ministry of Agriculture could have been the possible reason for the soil sample at Graeme Hall to have more nitrates than what is at Chancery Lane. This is because of people using many chemical fertilizers on this large area of land to enhance plant growth for mass production. Surface runoff could have been what transported these nutrients so far. At Chancery Lane no sign of commercial agriculture nearby was seen. This could have been why their nitrate level was so low it had no reading. Even though many organisms lived at Chancery Lane, they probably were not able to produce as much nitrates in the soil as the organic and inorganic fertilizers used at the Ministry of Agriculture.

Conclusion:

In conclusion, Graeme Hall had a higher nitrate level than Chancery Lane in the soil probably because of the Ministry of Agriculture being nearby the swamp at Graeme Hall. Chancery Lane on the other hand had no sign of nearby agriculture as large as at Graeme Hall. Chancery Lane had no sign of nearby agriculture at all. Even though Chancery Lane was the home to many more organisms, the farming practices at the Ministry of Agriculture probably had a greater impact on the soil surrounding it.

Title: Phosphates in Water

Aim: To determine phosphate levels in water from Chancery Lane and Graeme Hall Swamp

Materials & Apparatus: Test tube, test tube rack, water sample, exact eco check and phosphate strip.

Procedure:

One PO_4 strip was removed from the bottle before beginning the test. The strip was set in a dry, convenient place and the bottle was recapped immediately. The zero/on button was pressed to power on the meter. When it came on the meter showed all annunciators, then the current menu selection, followed by the last reading. The menu button was pressed and re-pressed until the display showed the parameter PO8. The cell was rinsed with at least three times with the water sample which was tested. This was done to minimize the potential for cross-contamination from a previous test. Finally, the cell was filled to capacity (4mL) with the water sample. Afterwards, the zero/on button was pressed and when the display showed 0.00 PPM, the sample is ready for testing. The strip was dipped into the cell and immediately 'read' was pressed. This started the 20 second countdown timer. During this time the strip was moved in a gentle back and forth motion. After "1" on the display disappeared the strip was removed and discarded. When this was done the meter automatically counted up to 120 seconds. After 120 seconds, the cursor moved across the display while the meter prepared to measure the sample. The result displayed was recorded and after testing the cell was rinsed immediately.

Data Collection/ Results:

On testing the water samples for phosphates, it was recorded that Chancery Lane's Swamp had a higher phosphate concentration than what was found in the swamp water at Graeme Hall. Chancery Lane's water sample measured to be 1.25ppm while Graeme Hall's water sample when measured was 0.04ppm.

Sites	**Chancery Lane Swamp**	**Graeme Hall Swamp**
Phosphate Content	1.25ppm	0.04ppm

Table 3: Table Showing Phosphate Levels in Water

Discussion:

Phosphates are a major source in water pollution. They are sometimes used in fertilizers for plant nutrient and for other purposes such as in detergents. When phosphates are excessive in lakes, ponds and swamps they encourage the life of phosphate-dependent organisms such as: explosive algae and duckweed and other floating vegetation. This results in the deaths of many

other aquatic lifeforms. These deaths are caused because duckweed and explosive algae deplete water-dissolved oxygen. They use great amounts of oxygen and prevent sunlight from entering the water thus killing other animals within the water. This phenomenon is known as eutrophication. Phosphates are most commonly found in rock formations and a small amount in ocean sediment which are called phosphate salts. Only a small amount of phosphates are found in liquid form because they are not that many forms of soluble phosphates. A possible reason for this is because they are no gaseous forms of phosphorous, only in rock, soil and small amounts in water. Phosphates get into water after the rocks which contain them and are weathered and eroded. Since these phosphates are attached to soil particles, they eventually end up in groundwater and surface runoff. Phosphates are important to plants since they help them grow faster. Plants have limited and slow access to these phosphates, however human activities change the norm. The water sample from Chancery Lane had more phosphates than the sample from Graeme Hall swamp. One reason for this could have been weathering and erosion of the nearby cave and cliff at Chancery Lane. These rocks at Chancery Lane probably contain a fair amount of phosphates along with the soil according to Table 1. If they do, when these rocks endure the process of weathering and erosion, then these phosphates will end up in surface runoff and groundwater. The phosphates most likely find their way traveling in surface water which lead to the swamp and enriching it in its nutrients. Also, soil erosion could have been a factor. The water sample collected from Chancery Lane was relatively close to the area where evidence of decaying animals was found. This nearby soil could have easily eroded and slid into the swamp providing the swamp with the phosphates which once belonged to the soil now belonging to the swamp at Chancery Lane. Also, from detergents entering this environment from nearby housing and even from those who frequently visit the beach if they have to wash their hands for example and use soap to do so. When these substances end up in the swamp they will all add in the phosphates measured in the water sample. Additionally, with this area being a nesting ground for birds, and bats living in the nearby cave, when they fly over the swamp and drop feces this can also be a factor in Chancery Lane having more phosphates in their swamp. At Graeme Hall, there was no knowledge of a cave being near the area. Therefore, weathering would not have more influence there than at Chancery Lane since there is a nearby cave with potential phosphates in the rocks. No cave with rocks potentially containing phosphates was known of that is nearby Graeme Hall. Also, it was not drawn to the students that the same conditions at Chancery Lane with dead animals being close to the swamp were at Graeme Hall. Graeme Hall was probably as not as inhabited as Chancery Lane swamp and this could have been another reason why Graeme Hall’s water sample measured less phosphates than the sample from Chancery Lane. Lastly, if soil erosion did occur at Graeme Hall and some of its phosphates in the soil entered the water, it still would not have been enough to have more than Chancery Lane because Chancery Lane had more phosphates in the soil to begin with.

Conclusion:

In conclusion, Chancery Lane swamp had a higher reading for phosphates than Graeme Hall swamp when the water samples were tested. This was probably because of many reasons which fell into two categories human activities natural activities.

Title: Nitrates in Water

Aim: To determine nitrate levels in water from Chancery Lane and Graeme Hall Swamp

Materials & Apparatus: Test tube, test tube rack, water sample, exact eco check and nitrate strip.

Procedure:

One NO_3 strip was removed from the bottle before beginning the test. The strip was set in a dry, convenient place and the bottle was recapped immediately. The zero/on button was pressed to power on the meter. When it came on the meter showed all annunciators, then the current menu selection, followed by the last reading. The menu button was pressed and re-pressed until the display showed the parameter NO3. The cell was rinsed with at least three times with the water sample which was tested. This was done to minimize the potential for cross-contamination from a previous test. Finally, the cell was filled to capacity (4mL) with the water sample. Afterwards, the zero/on button was pressed and when the display showed 0.00 PPM, the sample is ready for testing. The strip was dipped into the cell and immediately 'read' was pressed. This started the 20 second countdown timer. During this time the strip was moved in a gentle back and forth motion. After "1" on the display disappeared the strip was removed and discarded. When this was done the meter automatically counted up to 600 seconds. After 600 seconds, the cursor moved across the display while the meter prepared to measure the sample. The displayed result was recorded and after testing the cell was rinsed and cleaned with a brush.

Data Collection/ Results:

When testing was over for nitrates in water, the Chancery Lane water sample was less concentrated with nitrates than the water sample from Graeme Hall. Chancery Lane had a concentration of 0,331ppm and Graeme Hall carried a concentration of 1.25ppm.

Sites	**Chancery Lane**	**Graeme Hall**
Nitrate Content	0.31 ppm	1.25ppm

Table 4: Table Showing Nitrate Levels in Water

Discussion:

Nitrogen is the most abundant element in the earth's atmosphere. Nitrogen compounds are present in many materials, foods, fertilizers, explosives and poisons**.** Nitrates come from nitrogen and they are used for many purposes. Along with nitrates being added to the earth by fertilizers, they are also sourced from the earth. These nitrates come from the nitrogen compounds which are found in the earth. Nitrates are formed in the earth by bacteria breaking down nitrogen due to chemical reactions. Nitrification is the process which converts the

ammonia in the atmosphere into nitrate ions which the plants can use as nutrients. Nitrate enters the soil mainly from agriculture and natural processes. From the soil they then find their way into water ways and waterbodies on the earth's surface and even underground. This is because of the water cycle. When water travels over the earth's surface it is known as surface runoff and this is a factor which helps get nitrates in water. Graeme Hall had a higher reading for nitrates in the water than Chancery Lane. This could have been because of chemical and natural fertilizers from the Ministry of Agriculture nearby ending up in the water cycle and traveling downhill directly into the swamp at Graeme Hall. This factor is probably why Graeme Hall had a higher reading than Chancery Lane for nitrates in the water. Since no commercial farming was known of to be close to Chancery Lane and its swamp.

Conclusion:

Concluding, Chancery Lane swamp had a weaker concentration of nitrates in the water than Graeme Hall swamp. The reason for this was most likely because of the Ministry of Agriculture being nearby to Graeme Hall, their fertilizers being part of surface runoff and traveling to Graeme Hall swamp.

Title: Vegetative Succession at Chancery Lane and Graeme Hall Swamp

Aim: To determine how successive vegetation was at Chancery Lane and Graeme Hall swamp.

Materials and Apparatus: Ranging pole, tape measure, quadrats and a calculator.

Procedure:

A line transect was done at all four of the sites listed earlier in this SBA. First 200m was marked out using the tape measure and two ranging poles were used to represent the start and finish of this 200m. Quadrats were placed in intervals of 2m, alternating on each side along the tape measure. Photographs of these quadrats were taken and vegetation cover was recorded through observation. Vegetative succession was then calculated off-site by using a calculator.

Data Collection/ Results:

These results were calculated off-site. Site 1 had 100% sporobolus virginicus (Crab grass) from quadrat 1-7. Sixty percent sporobolus virginicus (Crab grass) and 40% euphorbia mesembrianthemifolia for quadrat 8. Fifty percent sporobolus virginicus (Crab grass) and 50% euphorbia mesembrianthemifolia for quadrat 9. Seventy percent sporobolus virginicus (Crab grass) 20% euphorbia mesembrianthemifolia and 10% ipomoea pes-carpae from quadrats 10-13. Quadrats 14-20 had 0% vegetation. This information is provided in Table 5.

Site 2 had 100% coccoloba uvifera (sea grape) from quadrat 1-8. One hundred percent sporobolus virginicus (Crab grass) from quadrat 9-12 and 0% of anything from quadrat 13-20. This information is shown in Table 6.

Site 3 had 100% paspalum vaginatum – grass from quadrat 1-7. Seventy percent paspalum vaginatum – grass and 30% UNKNOWN SPECIES B for quadrat 8. 70% paspalum vaginatum – grass, 20% UNKNOWN SPECIES B and 10% UNKNOWN SPECIES C for quadrat 9. One hundred percent paspalum vaginatum – grass was calculated for quadrat 10. Forty percent paspalum vaginatum – grass and 60% UNKNOWN SPECIES B for quadrat 11, and 0 percent of vegetation from quadrats 12-20. This information is provided in Table 7.

Site 4 had 100% vegetation cover of paspalum vaginatum – grass from quadrats 1-3. From quadrats 4-8 90% paspalum vaginatum – grass and 10% UNKNOWN SPECIES B was calculated. Seventy percent of paspulum vaginatum – grass and 30% UNKNOWN SPECIES B was calculated for quadrats 9-13 and quadrats 14-20 had no vegetation. This information is shown in Table 8.

Quadrats	Vegetation
1-7	100% sporobolus virginicus (Crab grass)
8	60% sporobolus virginicus (Crab grass) 40% euphorbia mesembrianthemifolia
9	50% sporobolus virginicus (Crab grass) 50% euphorbia mesembrianthemifolia
10-13	70% sporobolus virginicus (Crab grass) 20% euphorbia mesembrianthemifolia 10% ipomoea pes-carpae
14-20	0%

Table 5: Table Showing Vegetation at Site 1.

Quadrats	Vegetation
1-8	100% coccoloba uvifera (sea grape)
9-12	100% sporobolus virginicus (Crab grass)
13-20	0%

Table 6: Table Showing Vegetation at Site 2

Quadrats	Vegetation
1-7	100% paspalum vaginatum – grass
8	70% paspalum vaginatum – grass 30% UNKNOWN SPECIES B
9	70% paspalum vaginatum – grass 20% UNKNOWN SPECIES B 10% UNKNOWN SPECIES C
10	100% paspalum vaginatum – grass
11	40% paspalum vaginatum – grass 60% UNKNOWN SPECIES B
12-20	0%

Table 7: Table Showing Vegetation at Site 3

Quadrats	Vegetation
1-3	100% paspalum vaginatum – grass
4-8	90% paspalum vaginatum – grass 10% UNKNOWN SPECIES B
9-13	70% paspulum vaginatum – grass 30% UNKNOWN SPECIES B
14-20	0%

Table 8: Table Showing Vegetation at Site 4

Discussion:

As shown in Tables 4-8, vegetation is very dominant in one species in the quadrats closer to the start of the line transect. As you travel further down the line transect the species begin to vary. A reason for this could have been seed dispersion. Species who are not present early in the line transect probably do not have any seeds dispersed in that area. Another reason could be these species simply can't survive in this area. This can be so because a few reasons, which are: availability of space, food, water, sunlight and nutrients.

Conclusion:

Concluding, species of plants do not vary both at Chancery Lane and Graeme Hall swamp in the early stages of the line transect. However further down the 200m some variation occurs then no vegetation is present.

Final Report

Problem Statement: Human activities have a major impact on the nutrient levels in soil and water in the environment.

Purpose of Project: To study the phosphate and nitrate levels in the soil and water at Chancery Lane and Graeme Hall Swamp. Also to study vegetative succession at these sites.

Aims and Objectives: To determine the phosphate and nitrate levels in the soil and water at Chancery Lane and Graeme Hall Swamp. Also to calculate vegetative succession from these sites.

Methods of Data Collection:

On the 7TH of February, 2017 a total of four sites were visited over 2 locations. Two sites were visited at each location. These two locations were Chancery Lane and Graeme Hall. The two sites visited at Chancery Lane were the swamp and the nearby beach called Long Beach. The two sites visited were at Graeme Hall. When the Lower Sixth Environmental Class arrived at these sites the same activities were carried out in order determine nutrient levels in the soil and water and to also calculate vegetative succession from these sites. In order to do this, water and soil samples had to be taken and a line transect was done. These soil and water samples were taken off site to be tested for the amounts of phosphates and nitrates which they contain. Information from the line transect was also calculated and tabulated to study vegetative succession. This was the primary data collection methods done. All records were documented and with the aid of other sources (such as books and websites) conclusions were drawn from results. These were the secondary data collection methods carried out.

Presentation of Data

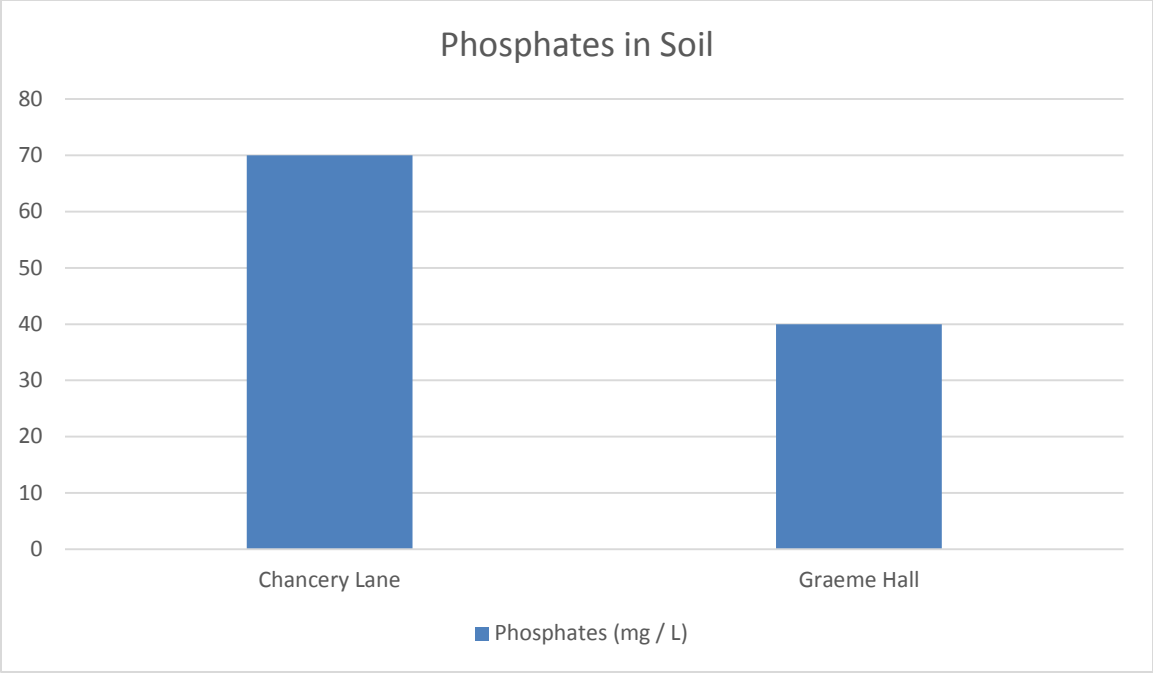


Figure 7: Column Chart Showing the Difference in Phosphates in Soils between the Two Locations

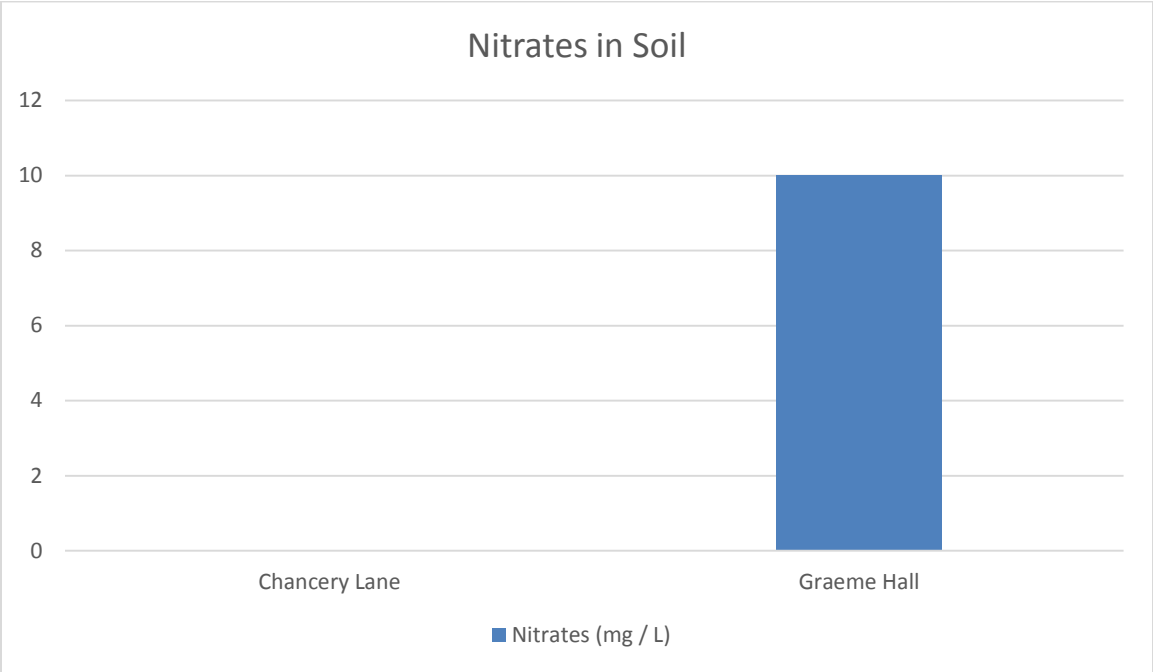


Figure 8: Column Chart Showing the Difference in Nitrates in Soils between the Two Locations

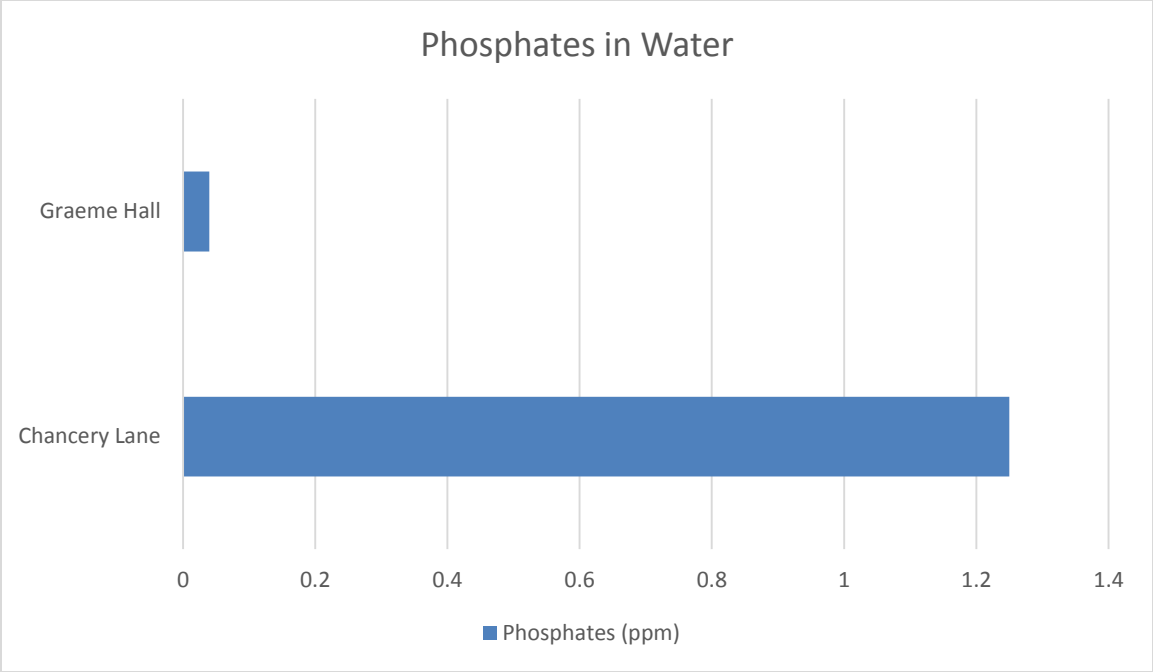


Figure 9: Bar Chart Displaying the Difference in Phosphates in Water Samples between the Two Locations

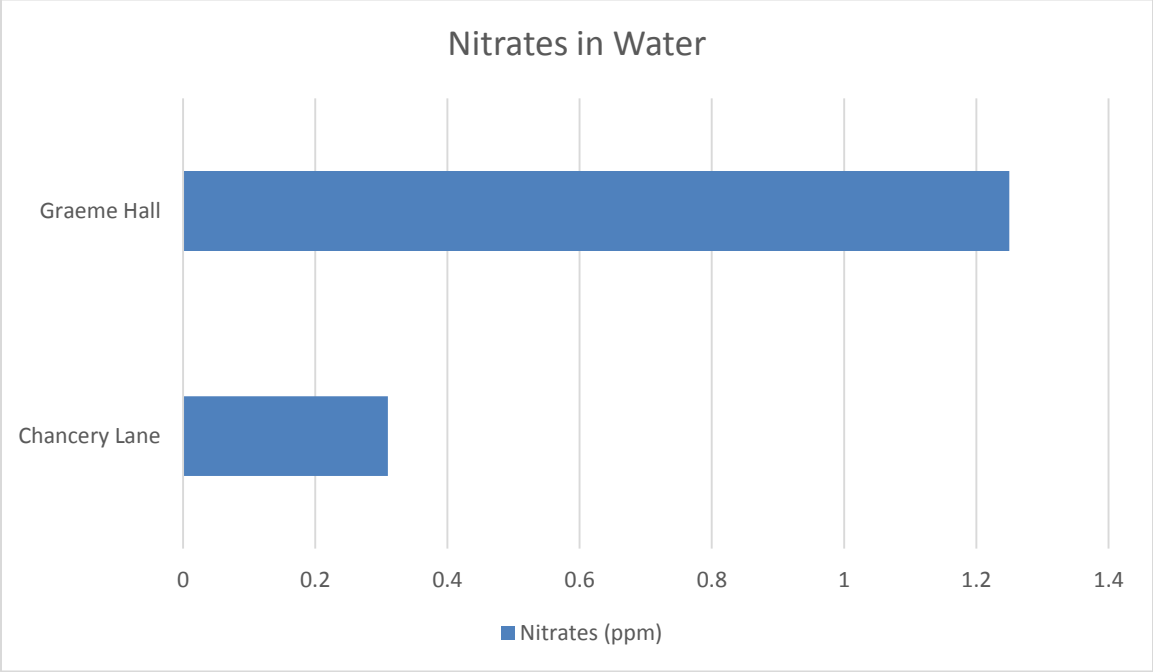


Figure 10: Bar Chart Displaying the Difference in Nitrates in Water Samples between the Two Locations

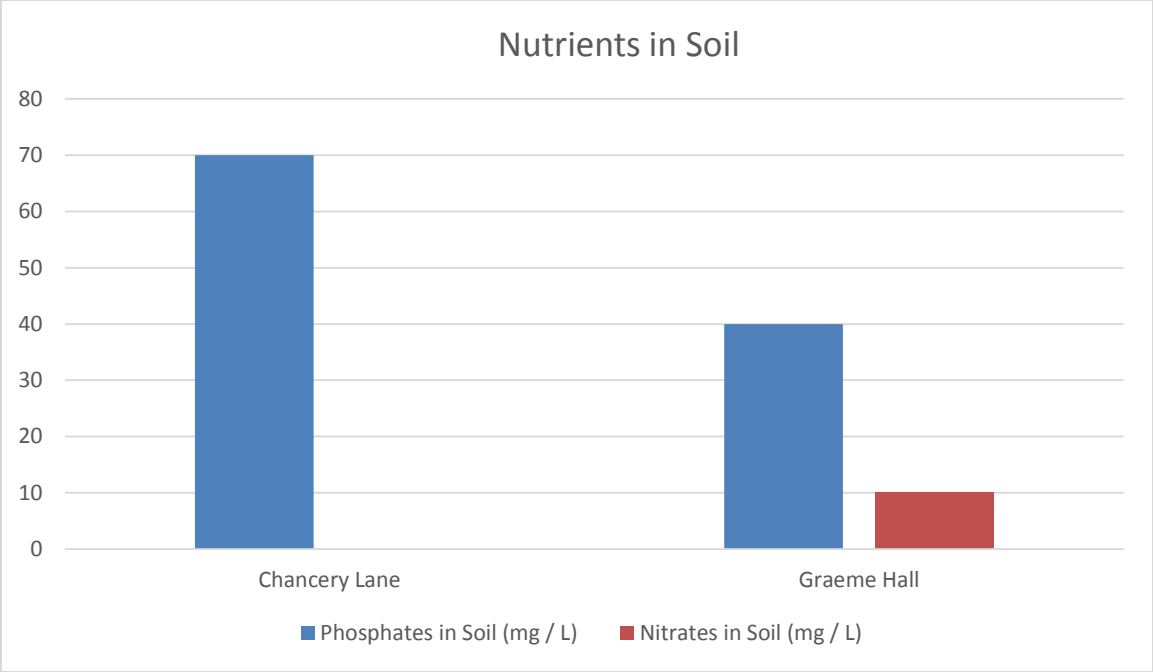


Figure 11: Column Chart Displaying the Difference in Nutrients from Soil Samples between the Two Locations

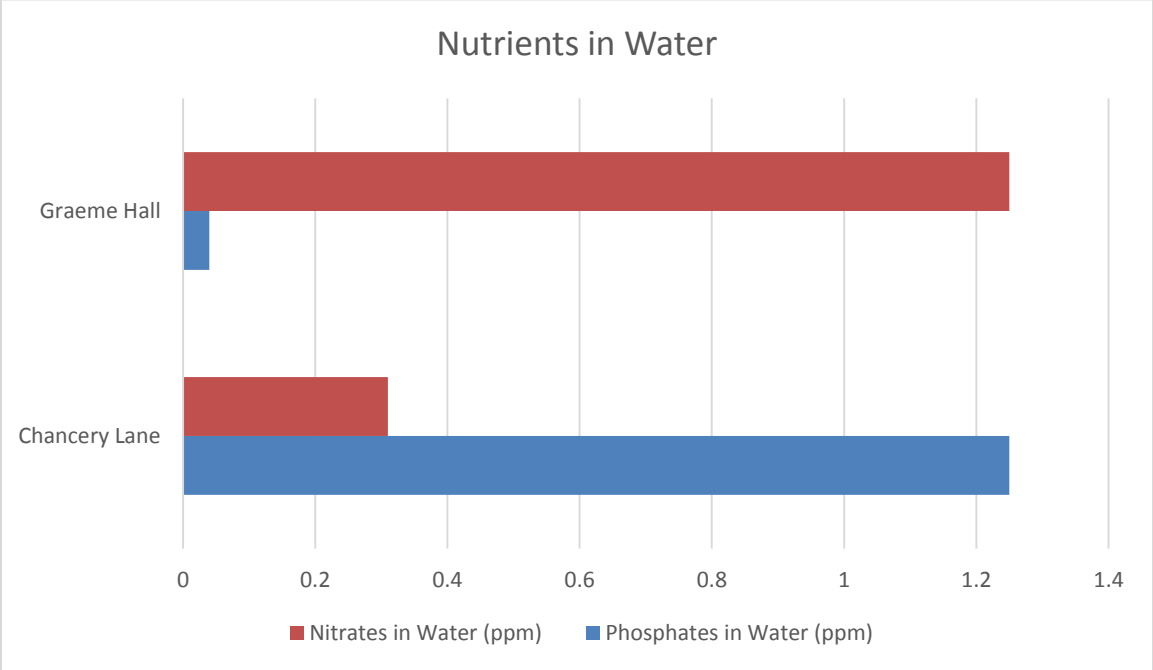


Figure 12: Bar Chart Displaying the Difference in Nutrients in Water Samples between the Two Locations

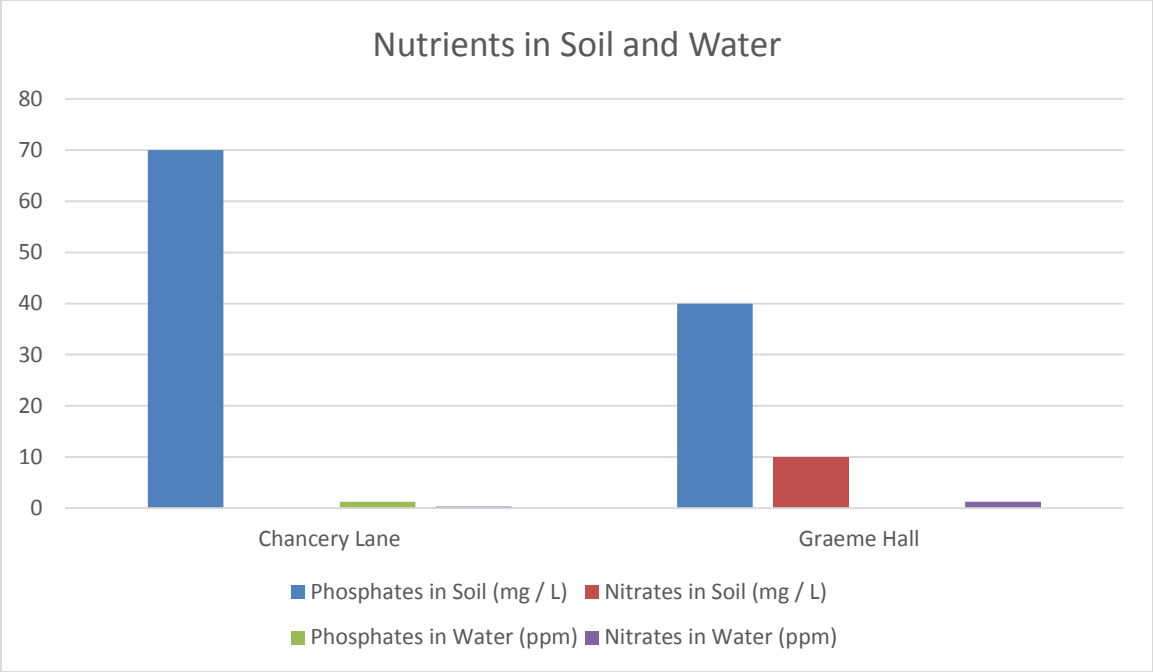


Figure 13: Column Chart Comparing Nutrients in Both Soil and Water Samples between the Two Locations

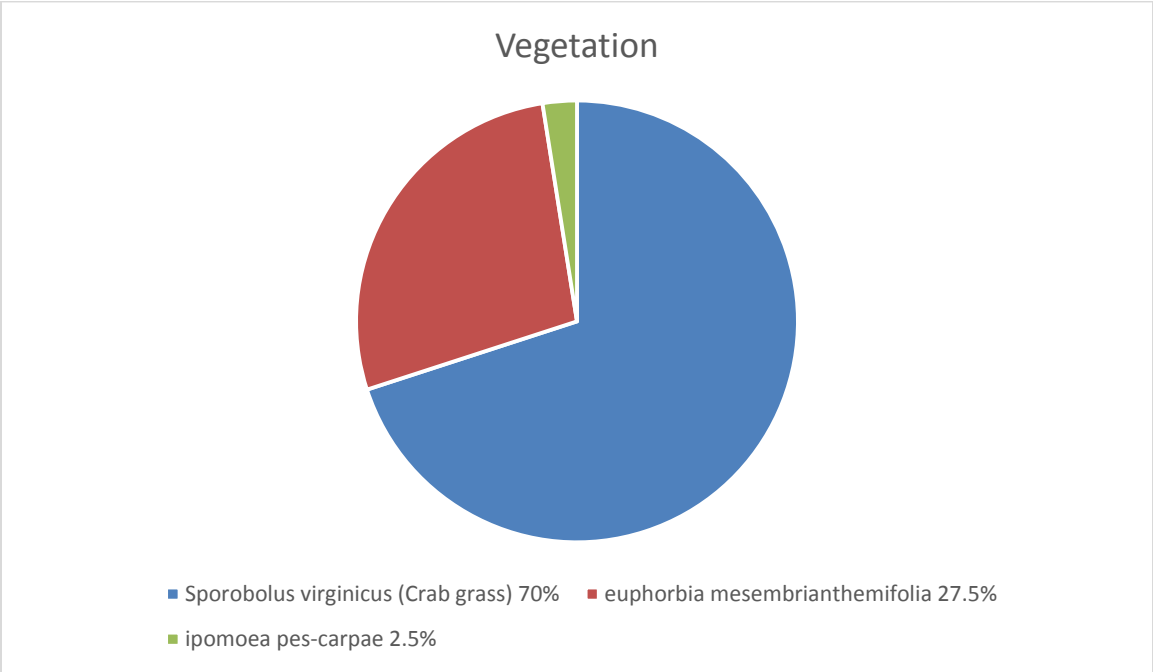


Figure 14: Pie Chart Illustrating Vegetation Variation at Site 1

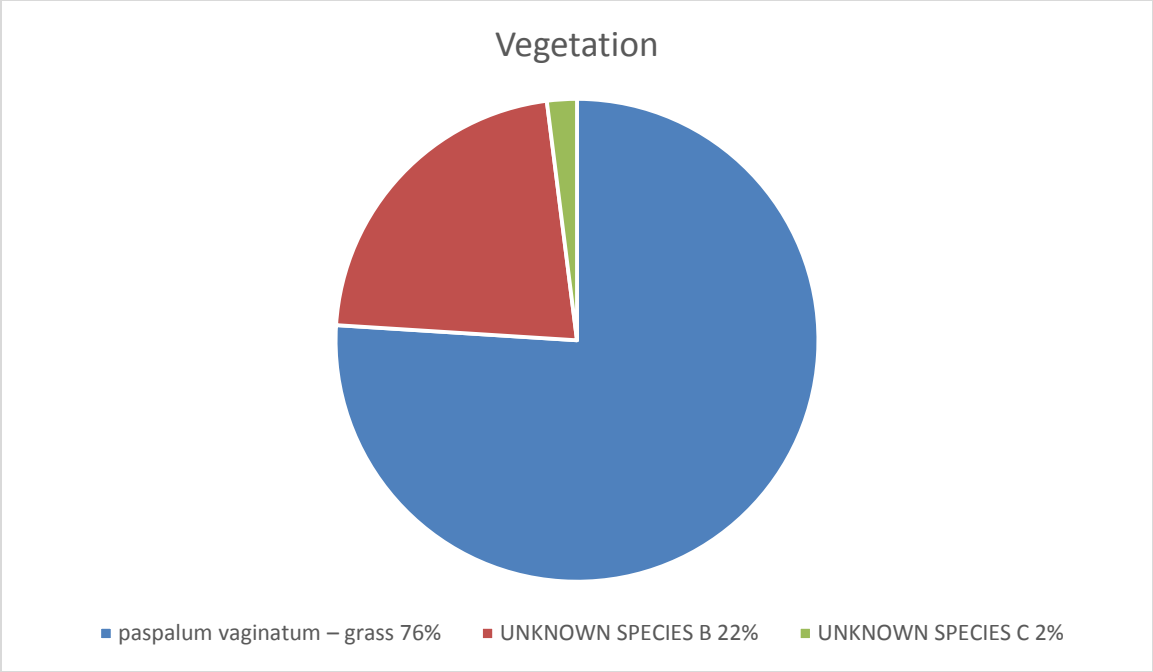


Figure 15: Pie Chart Illustrating Vegetation Variation at Site 3

Analysis of Data

According to Table 1 and as shown in Figure 7, the soil sample from Chancery Lane contains more phosphates than what was collected at Graeme Hall. However Graeme Hall has more nitrates than Chancery Lane as shown in Figure 8. Chancery Lane's sample had so little nitrates that the meter was unable to measure it. Chancery Lane's water sample had more phosphates than Graeme Hall with reference to Table 3. Once again, Graeme Hall has more nitrates than Chancery Lane but this time in the water. This is exhibited in Figure 10. According to all primary data collected, Chancery Lane has the highest amount of phosphates in both soil and water when compared to Graeme Hall. On the other hand, Graeme Hall has more nitrates than Chancery Lane in both water and soil. This information is displayed in Figure 13 where both locations are compared. When all line transects were calculated and tabulated, (Tables 5 – 8) it is official that Site 1 has more diversification in vegetation at Chancery Lane and Site 3 has more diversification in vegetation at Graeme Hall. At Chancery Lane sporobolus virginicus (Crab grass) without a doubt is the most dominant species in vegetation, according to Table 5. At Graeme Hall the same can be said for paspalum vaginatum – grass which is indeed the most dominant vegetation species, according to Table 8. Site 2 and 4 have the lowest diversification in vegetation at their locations. Ipomoea pes-carpae has the smallest population size recorded at Chancery Lane. UNKNOWN SPECIES C was recorded to have the smallest population size at Graeme Hall.

Literature Review

According to phosphatesfacts.org (2017) "phosphorus is one of the most common elements in our environment and is essential to human, animal and plant life." They go on to say "In many bodies of water, phosphorus is a limiting nutrient and controlling its level is an important step in preventing eutrophication, or an overabundance of nutrients." This statement implies that the amount of phosphates in an environment is very crucial. An overabundance can lead to a series of chain reactions. According to bbc.uk.co "A major problem with the use of fertilizers occurs when they're washed off the land by rainwater into rivers and lakes. The resulting increase of nitrate or phosphate in the water encourages algae growth, which forms a bloom over the water surface. This prevents sunlight reaching other water plants, which then die. Bacteria breaks down the dead plants and use up the oxygen in the water so the lake may be left completely lifeless." This phenomenon is known as eutrophication. Also an overbalance of nutrients in the soil can also cause plants to not function how they are to function. Thus causing plants to die and leaving animals without food and homes. This can then affect the animal population in this environment. Phosphorous is usually found in rock formations and ocean sediment such as phosphate salts. These phosphates are released from the rocks through weathering and dissolve in soil water which will be then absorbed by plants. These plants are then eaten by animals and when decomposers breakdown this dead matter the phosphates then go back into the soil and eventually into rock again. This is broken down millions of years after from weathering. The cycle then continues. Phosphates are a major factor in plant growth since they help them to grow faster, however plants get slow and limited access to them since this cycle is very slow in transporting these phosphates. Aquatic plants are even more neglected in this cycle since only few forms of phosphates are soluble leaving the majority to come from rocks and soil. Nitrates come from nitrogen and they are used for many purposes. Along with nitrates being added to the earth by fertilizers, they are also sourced from the earth. These nitrates come from the nitrogen compounds which are found in the earth. Nitrates are formed in the earth by bacteria breaking down nitrogen due to chemical reactions. Nitrification is the process which converts the ammonia in the atmosphere into nitrate ions which the plants can use as nutrients. Nitrate enters the soil mainly from agriculture and natural processes. From the soil they then find their way into water ways and waterbodies on the earth's surface and even underground. This is because of the water cycle. When water travels over the earth's surface it is known as surface runoff and this is a factor which helps get nitrates in water.

Discussion of Findings

The soil at Chancery Lane probably has more phosphates than Graeme Hall because of the animals which die in this area. It can also be the result of these animals having their feces broken down in this soil. Having a cave nearby can also be a factor in phosphates being added to the soil in Chancery Lane. This nearby soil can then easily get into the swamp and this is probably why the phosphates in the swamp are also higher than Graeme Hall. Surface runoff is probably the reason why Graeme Hall has more nitrates in their soil and water. Also, the use of

detergents nearby can also be a factor. The main possible reason for Graeme Hall having more nitrates than Chancery Lane is probably due to surface runoff. The Ministry of Agriculture is located uphill from Graeme Hall. Obviously, on this large area of farming land both chemical and organic fertilizers are used. These fertilizers that help speed up plant growth and maturity are very rich in nitrates. When the rain falls all of these nitrates can be washed downhill and into Graeme Hall or surrounding areas. As this keeps occurring the nitrates will build up and build up. Chancery Lane is not exposed to these same conditions and that is probably why they have lesser nitrates than Graeme Hall.

Conclusion

In conclusion, Chancery Lane has more phosphates in the environment than Graeme Hall. This is most likely because of the dumping of dead animals, weathering, more organism living in this area and from detergents used nearby and finding their way in the environment in Chancery Lane. Graeme Hall has more nitrates than Chancery Lane and this is most likely because of fertilizers used just up the hill by the Ministry of Agriculture, ending up in this ecosystem due to surface runoff. Site 1 has more diversification in vegetation at Chancery Lane and Site 3 has more diversification in vegetation at Graeme Hall. In the early quadrats of all line transects vegetation is very dense simple (one species existing). As you go further down the line transect the species of vegetation begin to vary. Eventually, there are no species living before the end of the line transect is reached.

Recommendations

- I recommend that the Ministry of Agriculture look into the ecosystem at Graeme Hall and control the nitrates entering the environments. These excessive nitrates are very dangerous to the lives of other organisms living within this swamp because of eutrophication.
- Secondly, I recommend more phosphates to be added to the ecosystem at Graeme Hall. Even though too much phosphates can lead to a very bad thing for organisms, the ecosystem still needs to be balanced.
- More nitrates should be added to the soil at Chancery Lane. This soil is lacking nitrates and it is not healthy for plants living there. If plants die out in this ecosystem due to infertile soil, many other organisms' lives would be at stake. This vegetation provides food and habitats for them and keeps the ecosystem balanced.
- Lastly, I recommend that the Ministry of Agriculture visit Chancery Lane and take measures to control the amount of phosphates entering the swamp. Excessive phosphates

lead to eutrophication which is very dangerous to organisms other that are not floating vegetation in swamps.