Alyson Rairan
Mr. Dickson
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The Effect of Increased Water Temperature, Air Temperature, and Canopy Cover on the Amount of Increased Severe Weather Patterns

Introduction

This lab will be conducted to study the change in severe weather patterns in West Haven, CT over the years. Changes in weather patterns are due to an increased amount of pollution and greenhouse gases collecting in the atmosphere. Some signs of changed weather patterns include increased air and water temperatures and the increase of canopy cover over an extended time through fall and winter. Connecticut does not usually receive tropical storms or hurricanes, but during August 2011, Hurricane Irene went through West Haven, CT due to the warmer temperatures of the North Atlantic. Hurricane Irene was able to maintain its width and power because of these increased temperatures in the north. Warmer temperatures on land and water may lead to severe weather patterns becoming more common and frequent in areas where they usually are not. Even small increases in air and water temperature can lead to bigger changes in the atmosphere and then more severe weather patterns across the globe. Due to the increase of there factors, trees and plants will bloom earlier in the spring and canopy cover will extend longer into the fall and winter. When canopy cover is mentioned this refers to early budding of plants and trees and extended canopy cover into fall and winter.

All of the research for this lab will be conducted at Cove River in West Haven, CT. Cove River is 15.28 acres long and belongs to the City of West Haven. For about 7,000 years, Cove River was inhabited by local Native Americans. Cove River is a watershed, covered by many deciduous trees and shrubs. Cove River is a freshwater body

from the salt water of Long Island Sound and water will be collected from 3 sites running north to south.

The hypothesis is if there is an increase in air temperature, water temperature, and canopy cover increases earlier in the season and stays prevalent later in the season then those warming weather patterns will continue to change into more severe weather patterns. This evidence will show how weather patterns are changing on a local level, and can help one understand how weather patterns are changing on a global level ultimately due to global warming.

Materials

-Vernier Data Equipment

-LaMont Water Chemical Analysis Equipment

- 2 Measuring Tapes for Canopy Cover

- 4 Flags

-Thermometer

-Buckets for collecting Water

Procedure for Canopy Cover

1) Gather Measuring Tapes

2) Place Flags at 4 Sites measured 30m x 30m and placed at N, S, E, and W.

3) One person holds the paper clip, while another records data in the data book.

4) The person holding the paper clip takes one step towards the opposite flag and looks up, if the person sees Canopy Cover, the second person writes a "+", if there is no canopy cover then the second person writes a "-".

5) This will continue until the first person has reached the second flag diagonally across

from the first.

6) This will again be done is the opposite diagonal direction.

7) The number of "+" and "-" will be counted and recorded.

8) Flags will be removed and measuring tapes and flags will be out away.

Procedure for Water Temperature

1) Buckets, thermometers, and data equipment will be collected.

2) Water will be collected from 3 sites of the river: upstream, downstream, and in between.

3) The bucket will be thrown into the water and then pulled back up bringing water.

4) As soon as the water is collected, the temperature and amount of dissolved oxygen will be tested before its temperature can equalize with the environment.

5) Record the temperature and amount of dissolved oxygen.

6) Water samples will be brought back to the lab to be tested using Chemical Analysis Kits.

7) Record the data from the Chemical Analysis Kit.

8) Dump water that has not been chemically tested down a sink or outside and place any water that has been chemically treated in a chemical safe container to be given to a safety coordinator for disposal.

Procedure for Air Temperature

1) When at Cove River, take a thermometer and hold it outside in the air.

2) Read and record the temperature.

Data for Water Temperature

Date	Water Temperature (C)
9/30/11	N/A
10/21/11	14.4 C
11/18/11	6.2 C
12/9/11	7.0 C
1/20/12	3.0 C
2/17/12	7.3 C
3/30/12	6.0 C

Data for Air Temperature

Date	Air Temperature
9/30/11	22.2 C
10/21/11	14.7 C
11/18/11	12.0 C
12/9/11	6.0 C
1/20/12	1.0 C
2/17/12	11.0 C

3/30/12	N/A

Data for Canopy Cover

Date	Canopy Cover
9/30/11	N/A
10/21/11	N/A
11/18/11	N/A
12/9/11	36.8
1/20/12	50.0
2/17/12	38.8
3/30/12	50.0

Conclusion

This evidence supports the hypothesis if there is an increase in water temperature, air temperature, and canopy cover, then the warmer weather may change into severe weather patterns. The hypothesis cannot be ruled completely valid or not because more data must be taken, however, the given temperatures compared with past temperatures, are slightly higher than previous years, meaning the air and water has been warmer and therefore, there is more canopy cover. When the air and water temperatures increase, this makes more possibility of tropical storms and hurricanes occurring in this area, where they are usually less common.

Some possible error in this lab may have been water temperature was not taken immediately after the water was removed from the river, therefore that would not be sufficient data. Also, when taking air temperature, if the thermometer was too close to someone's hand or body, it may read a slightly higher temperature than the actual air temperature due to the excess body heat. Another possible error may be when measuring canopy cover, a person may have misjudged if there was canopy cover or not. Also, a person may have taken too large of a step, resulting in missed data or too small of a step as too overlap the data.

This research provides baseline data for further research of climate change in Cove River. If these methods are continued through a longer time span, climate change can be determined more accurately. Research can also be done to study previous severe weather at Cove River and discover at what temperatures does severe weather occur in this area. This experiment could also be improved by taking the air and water temperatures with multiple thermometers at once as to provide a more accurate temperature. Also, two people should look up at the canopy cover as to have comparable data, so it is more accurate. If groups researched more than once a month the data would be more sufficient and accurate as well.

This lab relates to AP Biology because this will support or not support the idea of global warming on our planet. In AP Biology, we learn of our environment and ecology, so this lab will help us better understand the reasons why there is warmer weather, an increase and/or decrease of species due to habitat stress, and possibly more or less plants and trees in the area.

Amanda Miller

Mr. Dickson

AP Biology

13 April 2012

The Effect of Temperature and Pollution on Severe Weather Patterns

Background

There have been significant changes in severe weather patterns over the past several years. There are many factors contributing to this, such as pollution and the collection of greenhouse gases in the atmosphere. As the air temperature warms, the water temperature also warms, creating perfect conditions for an increase in severe weather patterns. These conditions have recently been observed with the track of Hurricane Irene. The hurricane was able to travel up the entire Atlantic Coast because of warmer water temperatures, and still maintain its massive width. This indicates climate change. This climate change needs to be further studied so that we will be better equipped to explore ideas on how to reverse its effects and prevent other tragic severe weather occurrences. This can be done by testing water quality.

High levels of phosphate is an indicator for pollutants in water, as a result of runoff. Therefore, if there is a high level of phosphate in the water, then it can be inferred that the water is polluted. Another source of high phosphates in water can be air pollution. Large buildup of phosphate and other ozone depleting elements create holes in the atmosphere. These holes allow dangerous solar rays to hit the earth and to also be trapped in the atmosphere.

In turn, this global warming has detrimental effects on the anthroposphere, "the biosphere including and modified by such human activities as agriculture, forestry, animal husbandry, urbanization, and industrialization" ("anthroposphere"). The warmer temperatures are melting the polar ice caps. They are also creating stronger, more severe weather more frequently, which is the focus of this research. This more severe weather includes hurricanes, tornadoes, thunderstorms, and droughts. There is locally a drought,

as well as across most of the United States, because of the very mild winter from November 2011 to March 2012, which produced almost no snowfall. Because there was no snow to melt, the ground is now dry, creating an increased fire danger. Because there is already a general consensus that global warming does exist, it is necessary not to prove that it does exist, but research its causes so that there is a chance they can be reversed.

Introduction

The purpose of this research is to observe how increased temperatures and pollution affect severe weather patterns. The hypothesis is that if there are above-average temperatures and sufficient levels of pollution, then the weather patterns will become more severe. The independent variable is the change in temperature and water quality. The dependent variable is the effect of these changes on severe weather patterns. There are no constants in this research, with the exception of the materials used, because it is virtually impossible to control outside factors when the research is being conducted outside of a laboratory.

Materials

- Thermometer
- Chemical testing kits
    - Nitrate test kit
    - pH test kit
    - Nitrite test kit
    - Phosphate test kit
    - Salinity test kit
    - Ammonia test kit

- ❖ Water bucket attached to rope
- ❖ Sample water container
- ❖ Vernier Probe ware with temperature, nitrate, nitrite, phosphate, and salinity probe sensors
- ❖ Lab notebook

Procedure

1. Gather all of the materials.
2. Use the water bucket attached to a rope to collect water from the river. Be sure not to get any sand/dirt from the bed of the river in the bucket. This should be done at three points along the river: upstream, midstream, and downstream.
3. Immediately use the thermometer to take the temperature of the water and the probe ware to take the dissolved oxygen of the water. These measurements should be taken immediately because they change quickly once the water is taken from the river, as water adjusts to atmosphere temperature and dissolved oxygen adjusts to atmosphere and higher temperatures.
4. Fill the water sample container with the water from the water bucket. This can be taken back to the laboratory to be further examined. The rest of the water can be dumped back into the river.
5. When back at the laboratory, the water sample can be tested for pH, salinity, nitrate, nitrite, phosphate, and ammonia levels using the instructions recommended by the chemical test kits. These results can be double-checked using the probe ware.

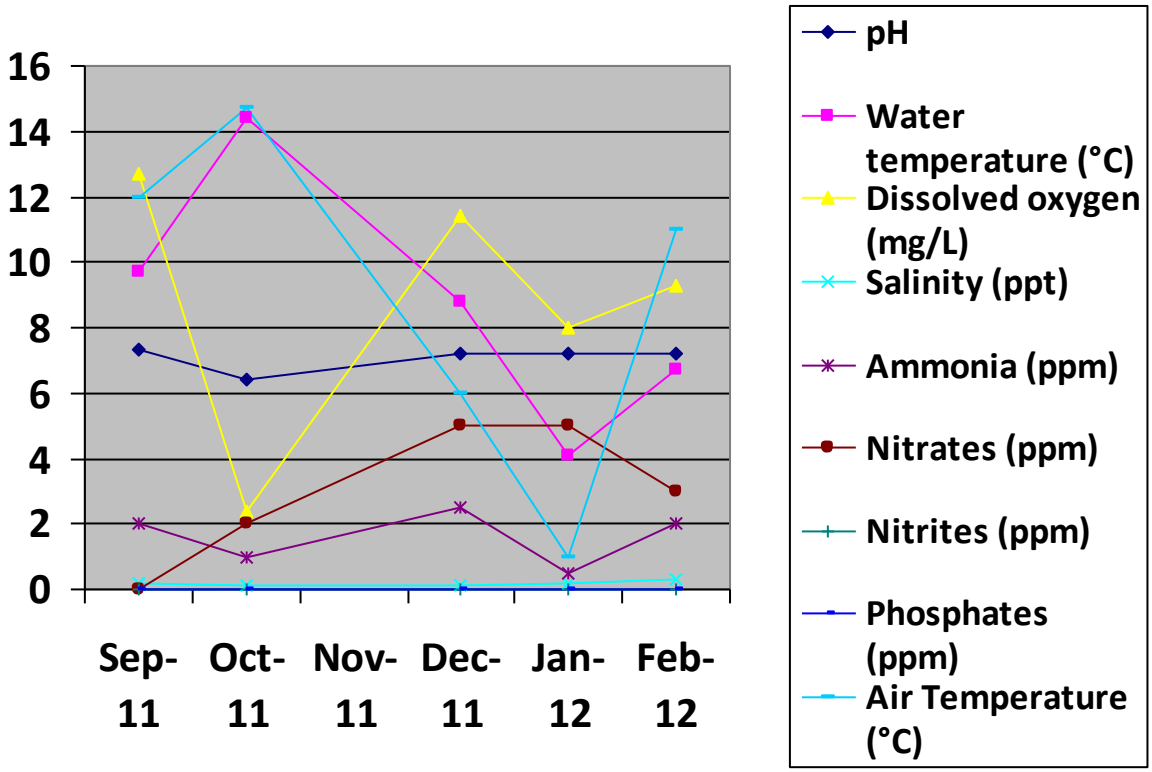
6. Record the results in a data table. Contains used chemicals in a sealed container to be disposed of as required and clean up the lab station. Repeat steps every time a measurements is taken.

Observations

1. Most research was done following many days of rain.
2. Most research was done in dry weather and warmer than average temperatures.
3. Most research was done on windy days.
4. The leaves on the trees started to bud earlier than normal.
5. There was very little snowfall during the winter.

Data

Date	Water temperature	Dissolved oxygen	pH	Salinity	Ammonia	Nitrates	Nitrites	Phosphates	Air Temperature
October 21, 2011	14.4° C	2.4 mg/L	6.4	0.1 ppt	1.0 ppm	2 ppm	0 ppm	0 ppm	14.7° C
November 18, 2011	9.7°C	12.7 mg/L	7.35	0.2 ppt	2.0 ppm	0 ppm	0 ppm	0 ppm	12.0° C
December 9, 2011	8.8°C	11.4 mg/L	7.2	0.1 ppt	2.5 ppm	5 ppm	0 ppm	0 ppm	6.0°C
January 20, 2012	4.1°C	8 mg/L	7.2	0.2 ppt	0.5 ppm	5 ppm	0 ppm	0 ppm	1.0°C
February 17, 2012	6.7°C	9.3 mg/L	7.2	0.3 ppt	2.0 ppm	3 ppm	0 ppm	0 ppm	11.0° C



Conclusion

The data did not support the hypothesis that if there are above-average temperatures and sufficient levels of pollution, then the weather patterns will become more severe. The temperatures were above average; however, there were no signs of pollution in the examination of water from the river. This could, however, be an inaccuracy, since it rained the day before each research day. This could have diluted any pollutants. Even still, there was an increase in severe weather patterns. From this, one can infer that an increase in temperature is directly correlated with an increase in severe weather patterns. For example, March was the warmest March on record, throughout the more than fifty years of record-keeping by the National Weather Service (wunderground.com). The temperatures were also well above average during the winter, which resulted in a lack of snowfall. Because there was no snow to melt, the ground is

now dry. This increases the risk of brush fires/wildfires. The increased temperatures have also spawned a sudden increase in the severity and frequency of thunderstorms. 2012 has already seen hundreds of tornadoes, many of which were in January and February, as the result of the record high temperatures. Because pollutant levels in the water were undetectable, it cannot be determined exactly if pollution has an effect on the warming of the Earth. Because the results of this research are effectively inconclusive, one may be inclined to further investigate. One way this can be accomplished is by taking samples during different weather patterns. This research was done mostly on dry, windy days following days of rain. Therefore, one may want to research many days after rainfall, so that there is no chance of the water being diluted. One may also wish to examine how the canopy cover correlates with temperature, and therefore with changes in severe weather patterns. This can be done so that the results can be further analyzed by correlating the growth of plants due to polluted water. One may also wish to examine the soil to test for pollutants. This may be a better indicator than the water quality because soil more easily absorbs pollutants. Therefore, it can be more accurately determined whether human pollution affects climate change and severe weather patterns. This research is pertinent to the future of the human population, as these changes in severe weather patterns could have detrimental effects on the anthroposphere.

Works Cited

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