The Impact of Climate Change on Canopy Growth

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AP Biology
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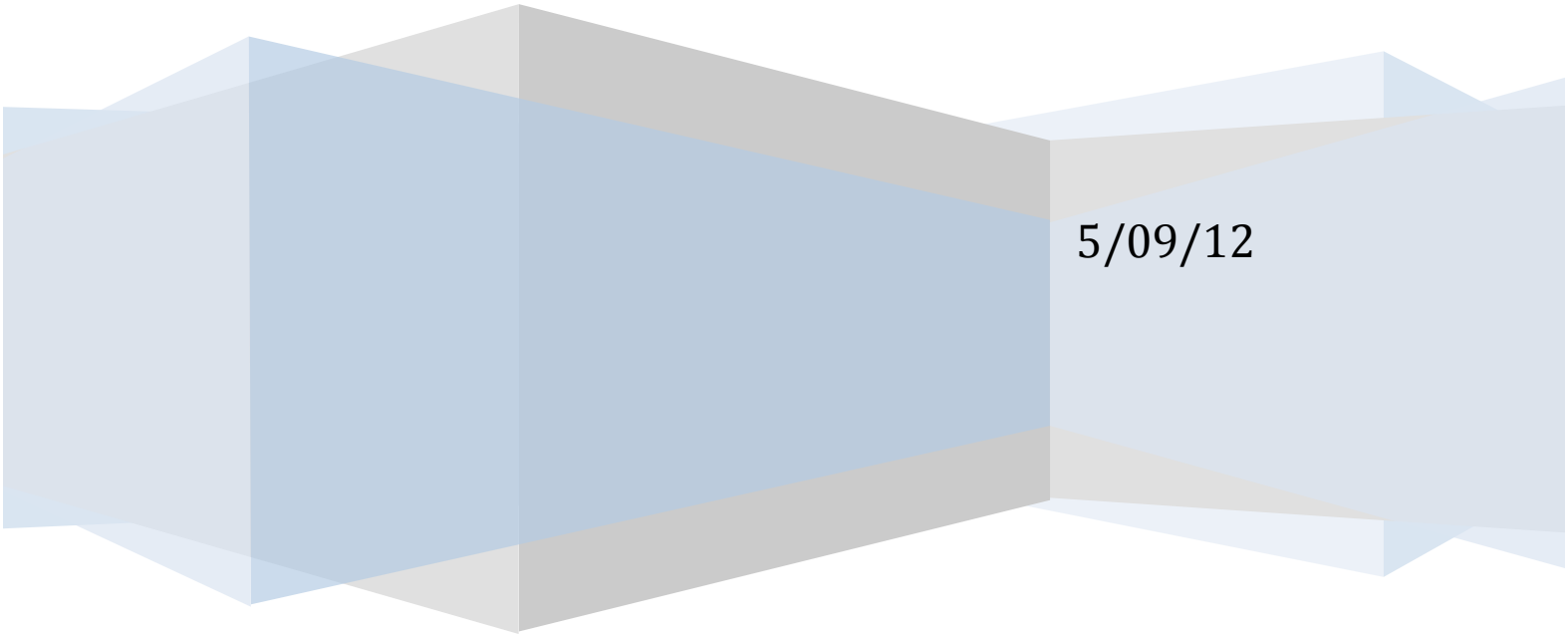

5/09/12

Introduction

When discussing a forest biome, canopy refers to the upper layer or habitat zone, formed by mature tree crowns and including other biological organisms. The forest canopy is one of the chief determinants of the microhabitat within the forest. It affects plant growth and survival, hence determining the nature of the vegetation, and wildlife habitat. Canopy cover is usually measured visually from above on a percentage or an ordinal scale. An analogous measurement is used a lot in forestry. For example, each measurement point the forester looks vertically upwards and records whether or not the forest canopy obscures the sky. The proportion of points where the sky is obscured gives an estimate of forest canopy cover. A densitometer is used to measure the amount of light that penetrates the forest canopy. A simple densitometer is a device with a mirror apparatus inside that reflects the canopy above. The viewer sees a mirror image above, which allows him/her to estimate how much of the sky above is blocked by tree canopies. A heavy or dense canopy results in a small amount of available sunlight that reaches the forest floor. At Cove River, for the past 6 months canopy covers have been measured. This is done to determine the amount of light that penetrates areas of the canopy.

Forest microclimate is influenced by canopy cover and the presence of tree stems. Forested areas generally cool down less during night and limit daytime air warming. This is partly because turbulence and thus mixing of air are reduced when compared to the surrounding open area. Forest influences the quantity and patterns of precipitation and light reaching the ground. Increasing global temperature and changing frequency of extreme weather events will impact below-canopy microclimate. It is thus essential to gain deeper insight into how forest structure and projected climate change alter below-canopy microclimate.

Hypothesis

If climate changes over time then canopy growth is affected because in turn it impacts the percentage of light obstructed by tree canopies. The IV is the change in climate while the DV is the growth of the canopy.

Materials

- Densitometer
- Measuring tape
- 4 Flags
- Data Journal
- Calculator

Procedure

1. Using measuring tape measure out an area 30 meters by 30 meters. Use the four cardinal compass points as corners.
2. Starting from one end to another after each step you take use the densitometer to check canopy coverage.
3. If something in the instrument hits on or between the "X", mark that step you took as a (+). If nothing hits the X then mark that step (-).
4. Do this from the starting point to the ending point and back. Record your results in a data table.
5. Once you are done find the canopy cover percentage by dividing the number of (+) by the number of (-). Record this calculation as well in a data table.

Results

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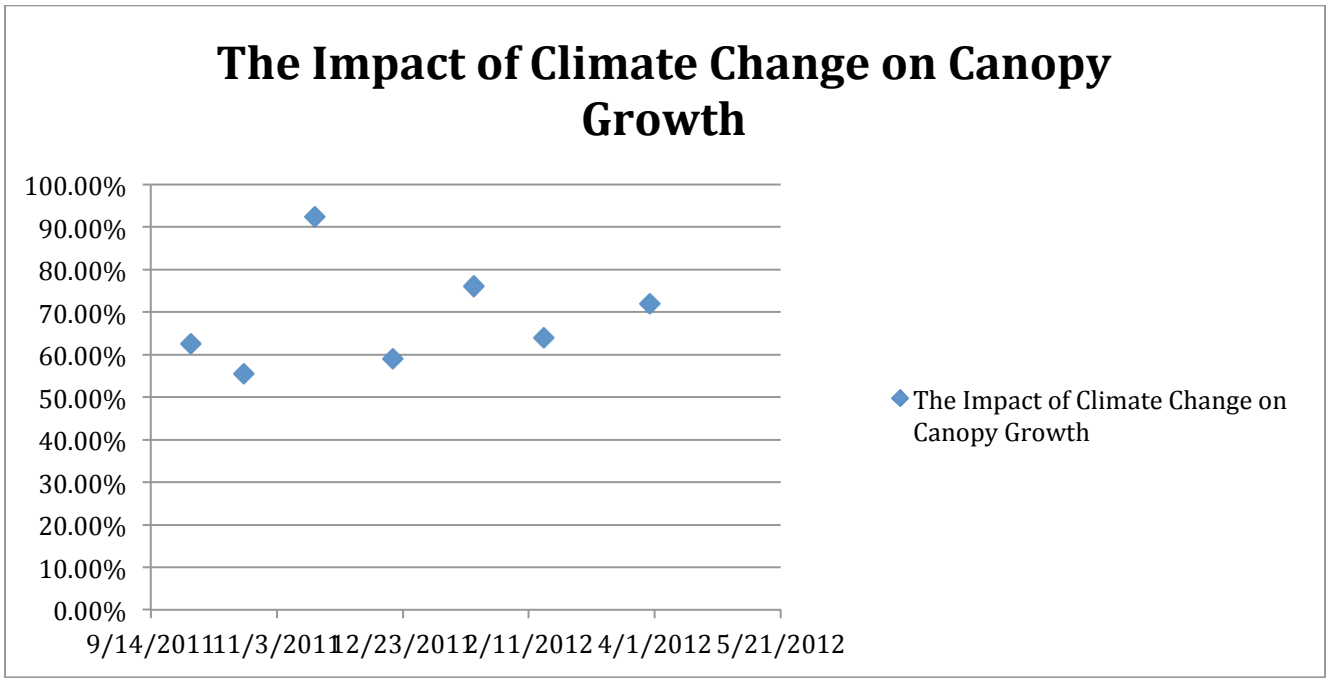
Date	Plus	Negative	Canopy Cover Percentage
9-30-11	15	24	62.5 %
10-21-11	25	45	55.5 %
11-18-11	25	27	92.5%
12-19-11	32	22	59%
1-20-12	51	67	76.1%
2-17-12	81	46	64%
3-30-12	41	57	71.9%



Observations

- 9/30/11- It rained a lot last night. The temperature was cool and warm. The sky was blue, clear, and the canopies are full.
- 10/21/11- There was about 5% to 10% cloud coverage. It was very windy, but sunny and the fall weather was starting to show. The leaves on the trees started to change colors. The canopy cover was 41m and 25 in. . . .
- 11/18/11- It was about 45 degrees Fahrenheit outside and there were no clouds in the sky. The leaves were falling of the trees and the leaves didn't have bright colors.
- 12/9/11- It was 50% cloudy and cold.

- 1/20/12- It was about -1 degrees Celsius outside, but sunny. It was very brisk with no cloud coverage.
- 2/17/12- It was a sunny, warm, and cool day. There was 100% cloud coverage in the morning. Clouds were moving in different directions coming in and out.
- 3/30/12- It was relatively warm last week. A little bit of haze, no cloud coverage, and it rained 2 days ago. Spring is early this year.

Conclusion

In conclusion, the hypothesis that the change in climate affects the percentage of light obstructed by tree canopies is neither accurate nor inaccurate. This is because more research has been done over the past 5 years. For example, a research project was done in Los Angeles, Baltimore, and New York City. In Los Angeles, the existing TCC is 20.8 percent, which is close to the 20 percent TCC in Baltimore and 23 percent in New York City. This was said to be surprising given Los Angeles's Mediterranean climate, which makes irrigation essential for establishment and growth of many tree species. This lab can go on for many more years. From the data we can see that when the weather is nice outside the percentage is higher meaning the canopies are closed. When it's not as nice out the percentage is lower meaning that the canopy is open. From 40% to 70% the canopy is moderately closed. For example, on September 30th it was a clear sky with little to no cloud coverage and the percentage came to be 62.5% meaning the canopy was moderately closed. Also, on January 20th there was no cloud coverage but sunny and the percentage came to be about 76 % meaning the canopies were closed. A possible error in this research project could have been that the steps taken are more than others. Instead of taking steps from both ends it may have only been taking from the starting point to one end and not back. Also, the calculations for percentages are off and the densitometer could've been used the wrong way. A way this project may have been changed is if there was more time to collect data over the months and if Cove River was visited more often and not once a month. Canopy coverage relates to Biology because it is part of an ecosystem. Also, organisms live in the canopies.

Resources

- Fennica, Silva. "Estimation of Forest Canopy Cover:." Web. 4 May 2012
- Jennings, S.B. "Assessing Forest Canopies." Web. 1 May 2012.

Globe Project: Canopy Covers

By: Breyonnia Duggins

Date: May 9, 2012

Period: 4 + 5

Introduction:

For over the past 2011-2012 school year, Advanced Placement Biology would walk over to the Cove River. The Cove River is located in West Haven, CT. The 15.8 acres of the Jesudowich farm was purchased by the City of West Haven in 2003 for Open Space. At that time, it was noted that Native American artifacts had been found and over two hundred of them are now a part of the collection at the Yale Peabody Museum. Many of the artifacts dated back over 5000 years. It is believed that this site has been used by the Quinnipiac Indians for over 10,000 years.

Canopy Cover in the Cove River is a variable that has been researched over many years. Canopy coverage is basically the testing of clouds and other objects that might be in the sky. Canopy covers are in relations to the weather, climate, and overall environment. In this experiment, there were observations for canopy coverage during a series of months. If the climate is warm then there will be an increase

in canopy covers because the climate affects the rate of trees. The independent variable is the canopy cover percentage and the dependent variable is the date of each observation.

Materials:

- 2 Measuring Tape
- 4 Two Flags
- Densitometer
- Data Journal
- Calculator

Procedure:

1. Get two flags and separate them 30 meters by 30 meters in a horizontal position. Use the four cardinal compass points as corners.
2. Walking down the line, use the pipe with the string to see whether or not there is something that crosses the X mark.
3. Record data in a table, using + and – marks for each sighting. The + mark is used to represent if there is something seen through the X mark. The – mark is used to represent if there is nothing seen through the X mark.
4. Repeat experiment.

Observations:

- September 30, 2011 – The day had a cool warm temperature. It had rained the night before. It was sky blue and it was clear. There are hurricane salt spray on leaves and stripping coves.
- October 21, 2011 – There is 5-10% cloud coverage, very windy, and lots of rain the night before. It's a sunny day with fall weather. Leaves on trees haven't really started changing colors.
- November 18, 2011 – The leaves were falling. The colors of the leaves were not that bright and pretty. It's about 45 degrees outside. There are no clouds outside.
- December 9. 2011 – It is 50% cloudy.
- January 20, 2012 – It is no cloud coverage. It is a brisk day.
- February 17, 2012 – It is a warm, cool temperature. It is very sunny. It had rained earlier and last night. 100% cloud coverage in the morning. The clouds are moving at different heights in different directions.
- March 30, 2012 – It was relatively warm last week. A little bit of haze and no cloud coverage. It rained two days ago. Spring is early this year.

Data: Canopy Cover Percentages

Date	Plus	Negative	Canopy Cover Percentage
9-30-11	15	24	62.5 %
10-21-11	25	45	55.5 %

11-18-11	25	27	92.5%
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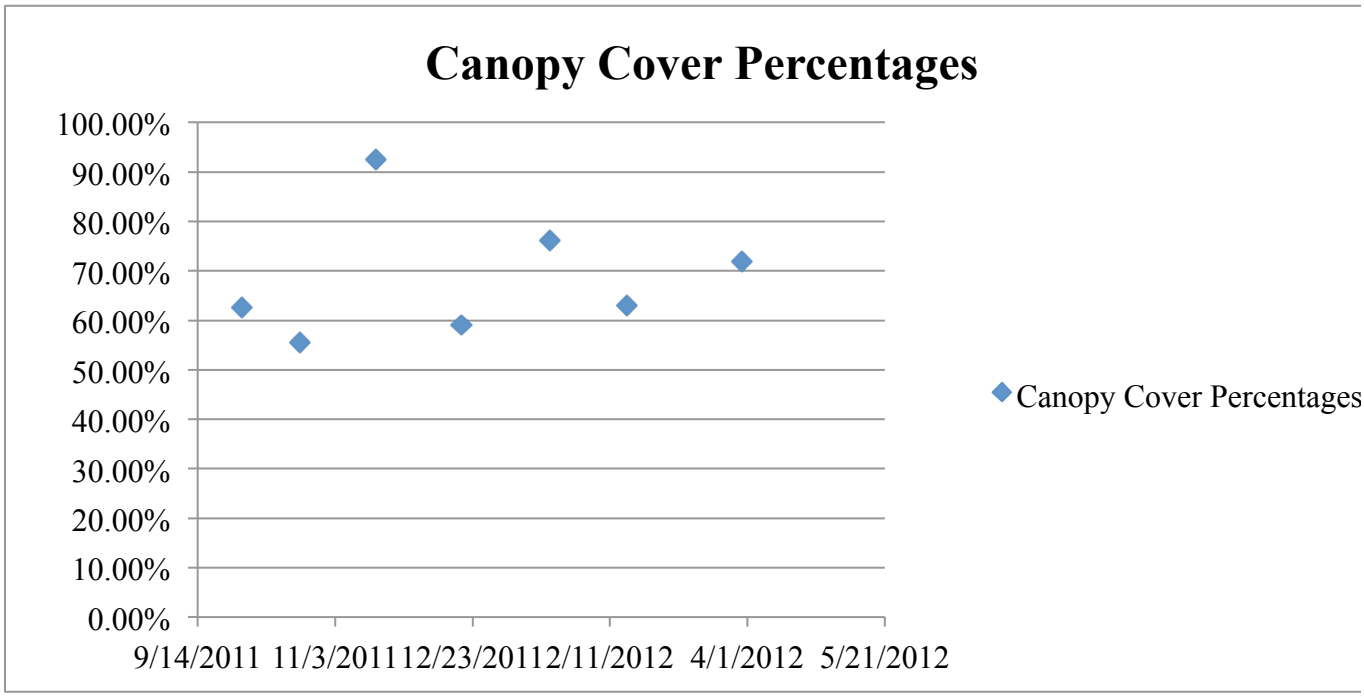

Conclusion:

In this experiment, there were observations for canopy coverage during a series of months. If the climate is warm then there will be an increase in canopy covers because the climate affects the rate of trees. The independent variable is the canopy cover percentage and the dependent variable is the date of each observation. In the overall experiment, there was no definite conclusion. However, in the hypothesis given it shows that the conclusion was false. Apparently, climate change doesn't have as much affect for the canopy covers than expected. The error in the experiment was the distance of each canopy cover wasn't exactly perfect each time. Also, another error included not writing the temperature of each day the experiment was taking place to see if the temperatures played a role in canopy coverage. Finally, the last error was not going out the same day each month to do the canopy covers. So, the results were a little tainted. A way to improve the experiment is to join a group that consistently goes out and checks the canopy coverage the same day every month and write down as many observations as possible.

Works Cited

Graves, Scott M.. "Cove River." *Cove River*. N.p., n.d. Web. 25 Apr. 2012. <http://coveriver.org/index2dw.html>.

" Cove River Historical Site in Fall." *Preserving Connecticut's Shoreline | The Land Trust of West Haven Connecticut*. N.p., n.d. Web. 25 Apr. 2012. <http://landtrustwesthavenct.org/cove-river-historical-site-in-fall/>.