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Abstract

To assess the role trees play in modifying microclimates, an investigation was developed to measure the size (height and DBH) of over 120 trees at a park in Dearborn, Michigan. With the help of a professional forester, trees were identified by names for future research. The GLOBE Observer App helped to collect and submit the data. In addition, two PASCO weather stations helped to determine how trees modified selective weather parameters like wind speed, temperature, and relative humidity of two different sites in Levagood Park. Site 1 was an area centered among a group of trees, while Site 2 was in an open short grass field without surrounding trees. Students would go to the sites, place their devices, and begin recording simultaneously for approximately 15 minutes. The data was then used to make graphs for comparing the two data sets. After analyzing the data, multiple correlations were found between them. We found several similarities and differences between the two sites. Although the data was collected during the winter with no leaves on trees, we hope to continue our research during the active growing season of 2020 to compare the effects with leaves to the data collected in the winter.

Site 1

Site 2

Research Questions

(1) What changes do trees make in modifying atmospheric parameters, such as temperature, wind speed, and wind chill?

(2) What causes these parameters to be different or similar in the two sites?

(3) How noticeable are the differences in the select atmospheric parameters between the two sites?

Hypothesis

If the amount of trees in an area plays a significant role in atmospheric conditions, then the site with surrounding trees will show a difference in atmospheric conditions when compared to the site with no trees.
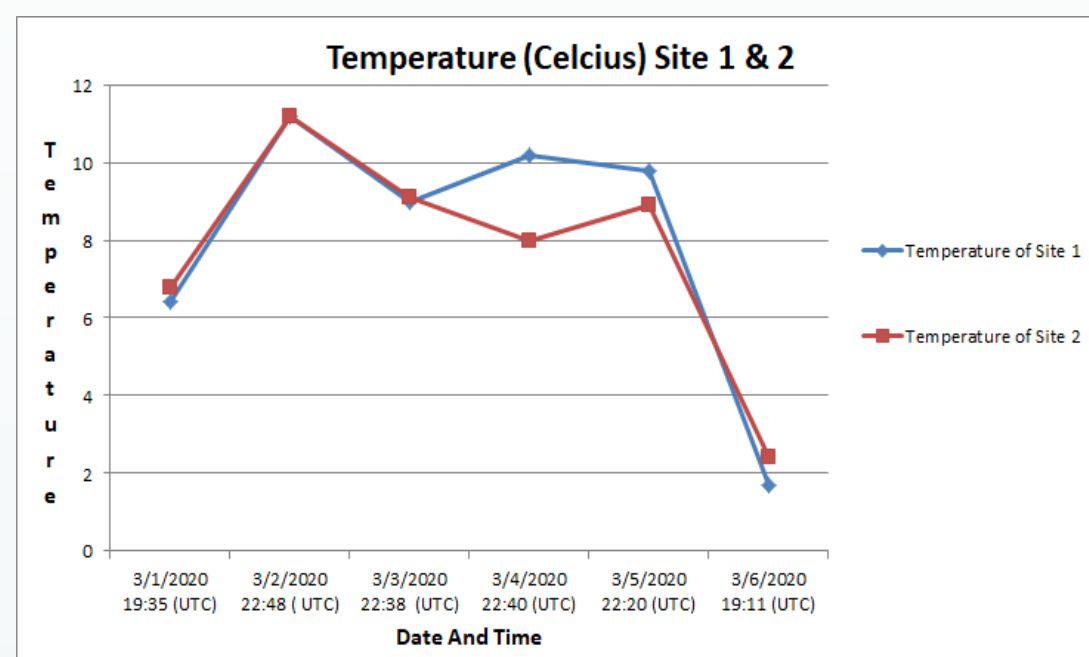

Results

Figure 1 (Above): The temperature in site 1 is higher than the temperature in site 2 is likely caused by the light-colored sidewalk near the forested area where we measured. The light-colored sidewalk has a high albedo which means it will reflect much of its sunlight off to the area around it. This isn't a factor in site 2 as it is a short grassy field.
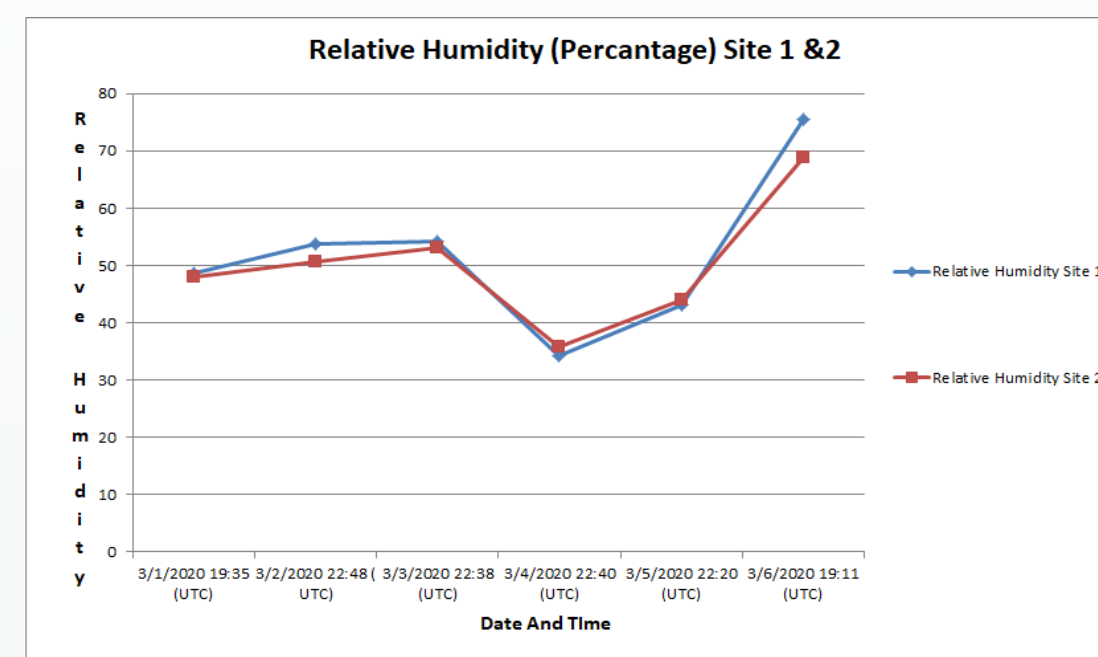

Figure 2 (above): The relative humidity in site 1 is higher than the relative humidity in site 2. This is due to the increased amount of evapotranspiration that occurs because of the trees.
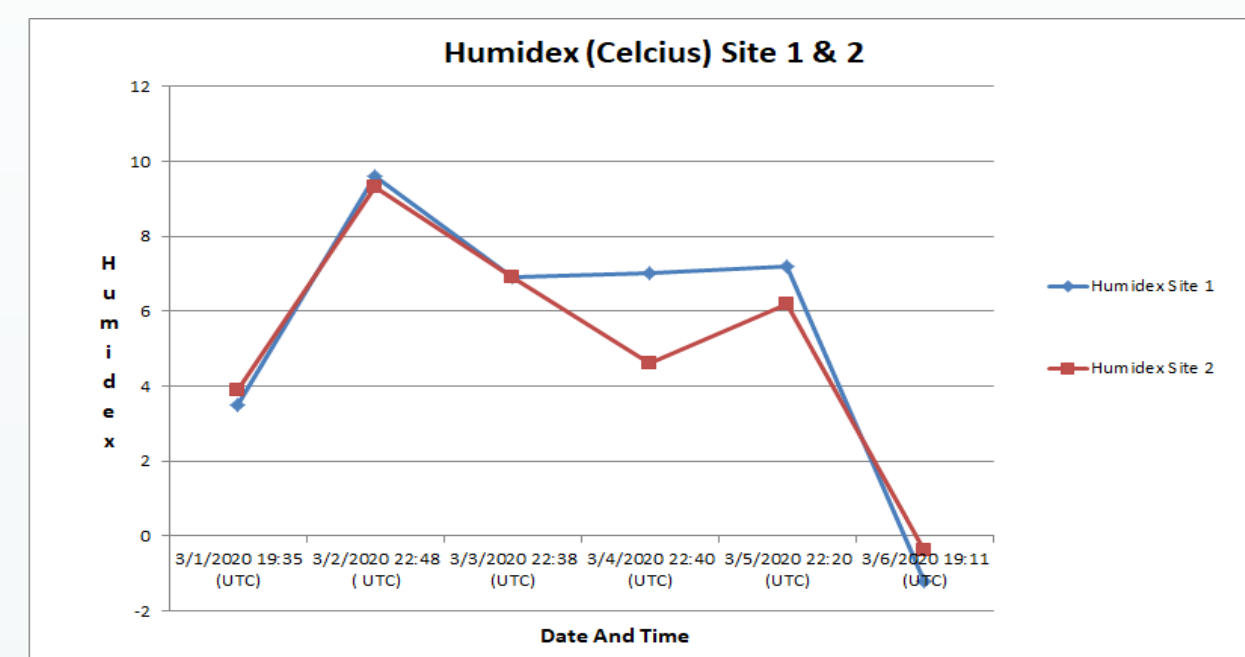

Figure 3 (above): The humidex in site 1 is higher than in site 2. This is because site 1 has increased temperature and humidity compared to site 2.
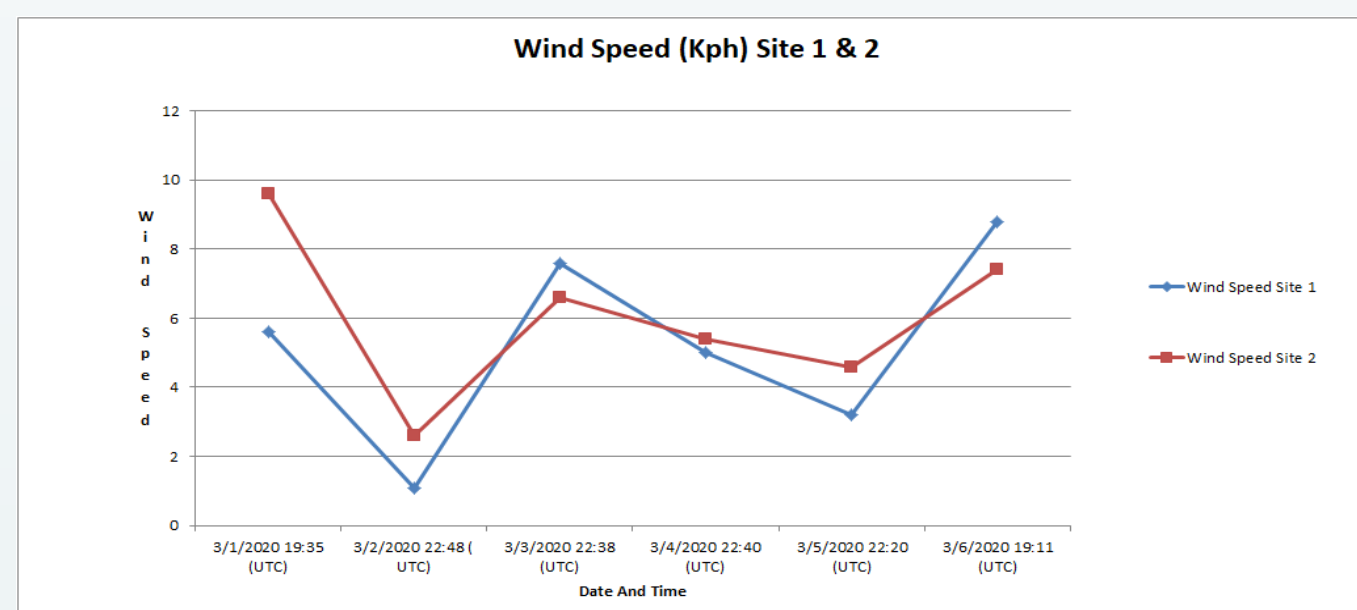

Figure 4 (Above): Wind speed was generally lower in Site 2 due to no trees there, though the wind speed sometimes was higher in Site 1. For example, on March 3rd the wind speed was higher to the possibility that the wind was coming from a direction where there was not a lot of leaves on the trees, so the wind speed did not decrease until it went through the other trees. This can be proven by further research in a season where leaves are present on the trees. Also, another possibility is the funneling of the wind around the trees increasing the speed of the wind.
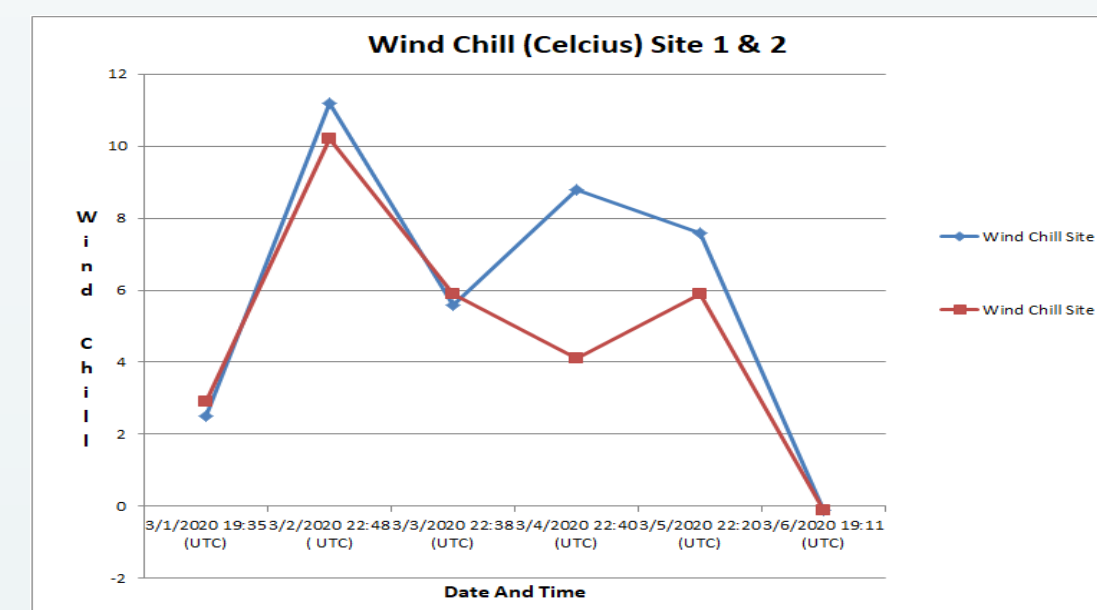

Figure 5 (above): Wind chill directly correlates with wind speed. The higher the wind speed the lower the wind chill. Higher winds speed absorb more heat causing there to be colder temperatures in the atmosphere.
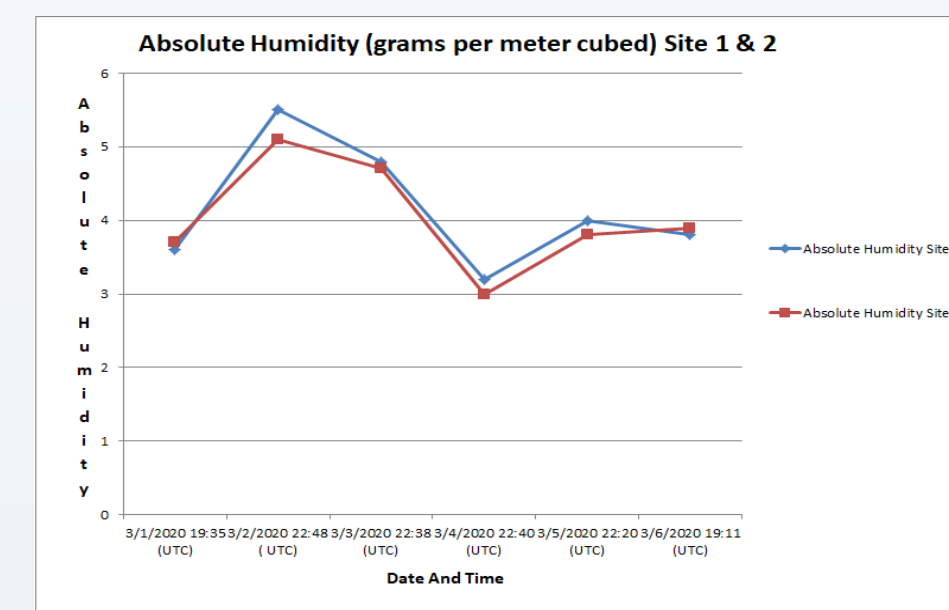

Figure 6 (Above): The absolute Humidity in site 1 is higher than in site 2 because of the increased evapotranspiration in site 1 due to the trees.
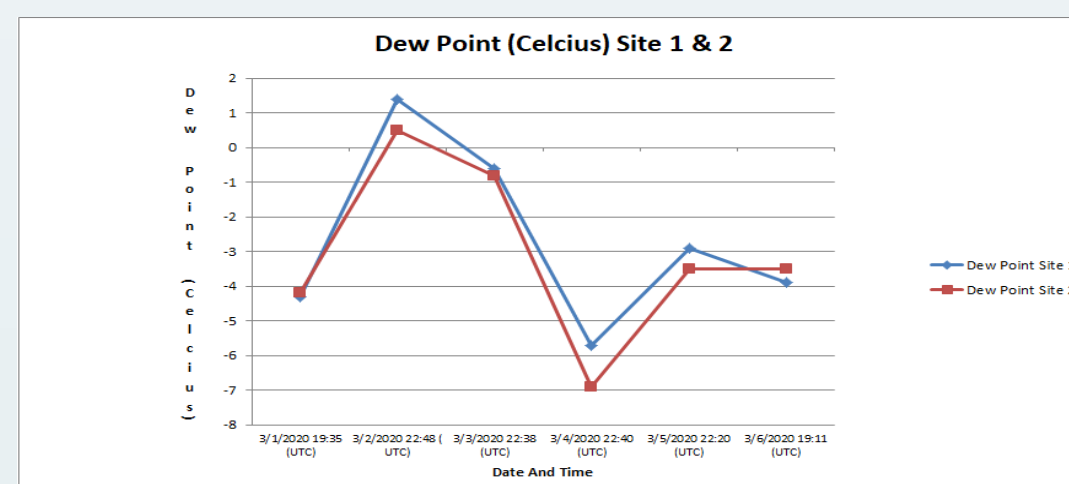

Figure 7 (Above): The dew point is increased because of the increased temperature and humidity. The temperature and humidity is increased by the trees because of the albedo of the asphalt near the trees and the increased rates of evapotranspiration by trees, leading to increased humidity.
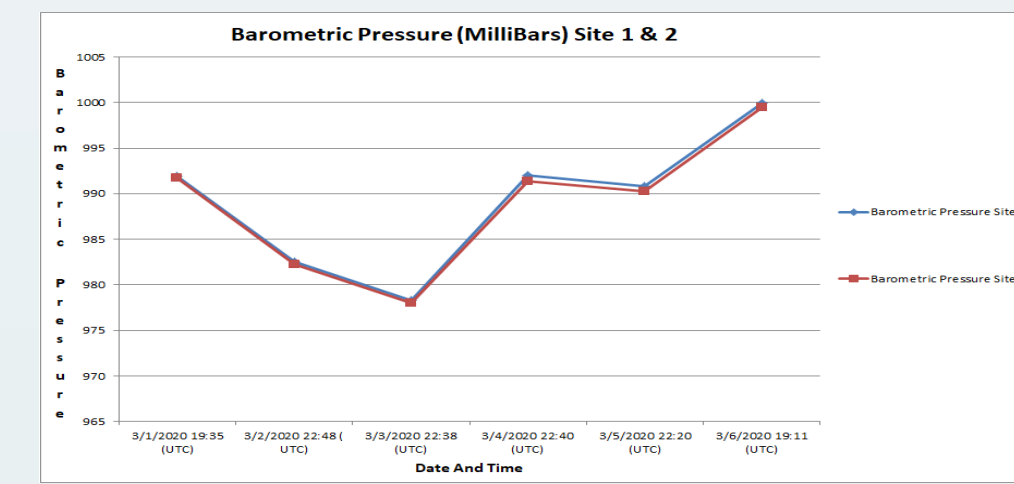

Figure 8 (Above): Site 1 and site 2 had similar barometric pressure, due to trees having no effect on the barometric pressure.

Introductions

With the rapidly growing global population, there is an increased demand for lumber. This has caused artificial phenomenon such as deforestation to become a major deconstructing problem in today's wasteful society. According to the World Wildlife Fund, "We're losing 18.7 million acres of forests annually, equivalent to 27 soccer fields every minute". Consequently, natural benefits acting as anchors to our biosphere have been, subsequently, lost . While there are arrays of academic journals concerning the role of trees in a diversifying system, ranging from published articles about the topics of trees to the effects they have on the environment, we focused on studies within a locality. For instance, a peer-reviewed journal from Bodnaruk and others addresses the benefits of trees in Baltimore, Maryland. Another peer-reviewed study alludes to the effects of trees in a park in Almada, Portugal. We hope to add to this area of study by researching our local park, offering much more comprehensive understanding of how trees affect the environment. Our studies will help set a path for future generations to improve our community by planting more trees. We can use our research to get the interest of our city and of deviating organizations to invest funds for further research opportunities, ultimately allowing us to better the number of vegetation (trees specifically) within our community.

Measurement Limitations

- The clinometer we used to measure is to the nearest whole number. This can lead to decreased accuracy in measurements as we have to round to the nearest whole number. In the future we may be able to get a more accurate clinometer for more precise readings.
- There was a lot of wind while we were measuring tree height. This made it difficult to straighten out the tape as it would be blown to the side because of the wind; consequently, we may have not gotten 30.48 meters exactly away from the tree.
- The GLOBE Observer app doesn't take into account tilt. This can lead to inaccurate measurements of some trees with extreme tilt.

Methods

Measure Out 100 Feet from the base of the tree.

Point the GLOBE Observer App to the top and base of the tree.

Calculate how many steps to the tree.

Measure the Circumference of the tree.

Calculate The Trees Height Using the GLOBE Observer App

Conclusions

Throughout the past years deforestation has been a major problem in the world. Millions of trees have been chopped down for lumbar or to make space for land. This has caused a multiple of problems. Ranging from climate change to glaciers melting. People around the world don't know the benefits of trees, and what they provide for the environment. This is what has pushed our GLOBE team to research how trees affect atmospheric parameters. After gathering measurements on different atmospheric parameters and analyzing them, we can see that trees have effects on certain atmospheric parameters. For instance humidex, wind chill, wind speed, absolute humidity, dew point, relative humidity, and finally temperature. Our hypothesis was correct in the sense that trees cause a change in the parameters. Trees cause a change in temperature, but it is not that noticeable. Also, in our area we had asphalt near our trees so that would have possibly increased the temperatures near our trees, by reflecting the heat of the sun to the trees. Also trees cause a major change in humidity, wind speed and chill. Trees higher relative humidity and absolute humidity through evapotranspiration, which releases more moisture in the air and evaporates the water in the area. We could clearly see this because site 1 had a higher amount of humidity compared to site 2. In regards to site 1 the relative humidity wasn't that much higher than site 2. But, in absolute humidity there was a noticeable difference between the two sites. Site 1 had a much higher absolute humidity than site 2, because of the increased evapotranspiration. Wind speed and wind chill are directly correlated. In site 1 it generally had lower wind speeds than site 2, because of this site 1 had generally higher wind chill then site 2. Trees decrease the wind speed with their leaves, when wind speed is higher it draws heat from your body, and decreases the wind chill making the atmosphere much colder. Trees help reduce wind speed causing an increase in wind chill and hotter temperatures. In the future we could take longer measurements to see the extended effects of a tree over hours. We could also try different types of trees and see how every type of tree affects atmospheric parameters. In addition, we could measure other parameters such as cloud formation, to see how the evapotranspiration of the trees affects cloud formation and rainfall, also we could test ground parameters to see how trees affect soil texture and moisture. By working Mr. Stanley Johns, we have learned so much. Mr. Johns has over 40 years of experience as a forester and has helped us better accurately measure tree heights. He has taught us how to use the clinometer with more precision and how to get more accurate results.

Acknowledgements

Works Cited

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