# Shumate Middle School / ICESat-2 - Tree Height Comparisons


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**Shumate Middle School – Gibraltar School District**
**Gibraltar, Michigan (United States of America)**


## Abstract


This research study was conducted by Shumate Middle School students Lilyannah Dunigan (Sixth Grade), Thomas Hamilton (Eighth Grade), and Brady Jaskula (Seventh Grade). Shumate Middle School (Gibraltar School District) is located in Gibraltar, Michigan (United States of America). For this project, we chose to measure the tree height of various trees found on the Shumate Middle School campus. Our goal was to compare our average tree height measurements to the tree height measurements taken by NASA's ICESat-2 satellite. Our hypothesis for this project is we believe that the our tree height measurements will be close to the tree height measurements taken by the ICESat-2 satellite, and vary by no more than 1 meter in length. We collected tree height data from September 2018 through March 2019. All data was uploaded to the GLOBE Program's website, and shared with various scientists from around the world. However, our group was not able to compare our average tree height measurements to that of the ICESat-2 satellite as the ICESat-2 data was not readily available at the time of this report. Please enjoy the tree height measurements taken by our research team.


## Research Question

Our research team decided to measure the heights of various trees found on the Shumate Middle Campus for this environmental study. Last year, group members Thomas Hamilton and Brady Jaskula were involved in a GLOBE Program tree height measuring pilot program at Shumate Middle School. To build upon the work started last year, our group decided to continue identifying and measuring trees on our campus and to help calibrate the recently launched NASA ICESat-2 satellite. With this in mind, we developed our research question, *"**How close are the average tree height measurements taken at Shumate Middle School in comparison to the tree height measurements taken by the ICESat-2 satellite?**"*

## Introduction

According to the GLOBE Program's Biometry - Graminoids, Tree Height and Shrubs training module, it is important to measure trees as this allows us to assess various land cover on our planet.

**Hypothesis:**

We believe our average tree height measurements will align closely to the measurements taken by the ICESat-2 satellite and vary by no more than 1 meter in length. It is our belief that our measurements will be accurate as we have good tools and technology needed to take accurate and precise measurements.

## GLOBE BADGES

We would like to apply for the following GLOBE International Virtual Science Symposium Badges:

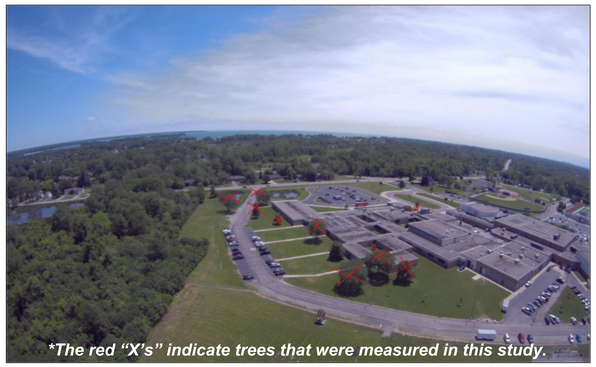
- **Collaborator** - During our research, we connected with Mr. Brian Campbell (NASA and The GLOBE Program). We discussed how to take accurate tree height measurements. We also discussed how our tree height measurements help calibrate the ICESat-2 satellite.
- **Make an Impact** - We hope that NASA will utilize our tree height measurements to help calibrate the ICESat-2 satellite. Additionally, during our measurement campaign, our group shared our tree height measurement best practices during a December 3, 2018 GLOBE webinar called "Trees Around the GLOBE Student Research Webinar - Getting Tree Science Done: Live From Shumate Middle School in Gibraltar, Michigan." We hope that other schools will learn from our methods.

## Research Methods

**Study Site:**

**Shumate Middle School – Gibraltar, Michigan (United States of America)**

***Latitude 42.085501, Longitude -83.21121, Elevation 176.7m***



**The red "X's" indicate trees that were measured in this study.*

**GLOBE Protocols Utilized in this Study:**

- Biosphere - Biometry - Graminoid, Tree and Shrub Height Protocol
- Study Sites - Shumate Middle School Campus
  - *Please see GLOBE Study Sites below.*
- Time Frame - Wednesday, September 19th, 2018 - Friday, March 1st, 2019

**Materials:**

- Clinometer - Used to measure a 45 degree angle required for tree height measurement.
- Komelon 300 Foot Tape Measure - Used to measure distance from tree.
- Plastic Stake - Used to hold the Komelon 300 foot measuring tape in an exact location while taking measurements.
- Stanley Measuring Tape - Used to to find the distance from the clinometer to the ground.
- Forest Tree Identification App - Used to help identify trees.
- Data Sheet - Used to record the data that is collected.
- Pencil/Pen - Used to record data.
- Google Chromebook - Used to send the data to the GLOBE Program and store the data on a Google Spreadsheet.

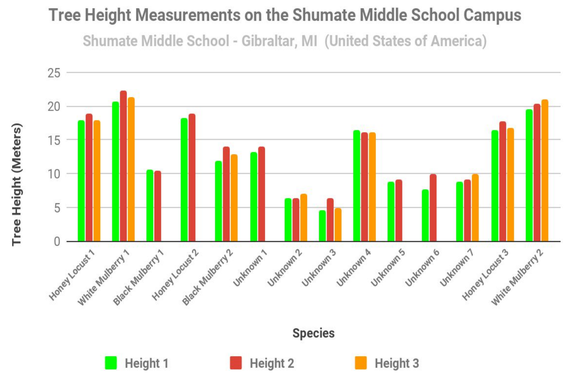
**Methods:**

- Gather your tools (clinometer, plastic stake, Komelon 300 ft tape, Stanley measuring tape, data sheet, pencil or pen).
- Travel to the tree that your GLOBE group has decided to measure.
- As a group, decide what part of the tree is the highest.
- Using the clinometer, back up until the top and bottom rings line up with the highest point. Make sure the clinometer is level at a 45 degree angle.
- Next, use the Stanley tape measure to measure the height of the clinometer to the ground. Record this measurement.
- Place the plastic stake in the ground where you were standing.
- Put the ring at the end of the Komelon measuring tape on the plastic stake.
- Pull Komelon tape measure to the base of the tree. Record this measurement.
- Next, use the Komelon measuring tape to measure the circumference of the tree base. Record this measurement.
- Repeat this process two more times (taking three measurements in all).
- Use the Forest Tree Identification app to identify the tree. Record the genus, species, and common name.
- Collect your tools and return to the classroom. Put the tools away.
- Finally, submit the tree height data to the GLOBE Program's website and store the data on the team's Google Spreadsheet.

## Results

**Data Table - All Tree Height Data Collected**

| Tree Type | Height 1 (Meters) | Height 2 (Meters) | Height 3 (Meters) | Average Height (Meters) | ICESat-2 Height (Meters) | Circumference (Meters) | Location |
|---|---|---|---|---|---|---|---|
| Honey Locust 1 | 17.98 | 18.9 | 17.98 | 18.29 | Not Available | 1.93 | Northwest corner by Mr. Hoover's room. |
| White Mulberry 1 | 20.73 | 22.25 | 21.33 | 21.44 | Not Available | 17.10 | Parking lot/pond. |
| Black Mulberry 1 | 10.67 | 10.36 | N/A | 10.52 | Not Available | 1.52 | 6th grade hallway door. |
| Honey Locust 2 | 18.28 | 18.89 | N/A | 18.59 | Not Available | 1.52 | 7th grade hallway Ms.Wright. |
| Black Mulberry 2 | 11.85 | 14.02 | 12.8 | 12.89 | Not Available | 1.52 | 7th grade hallway Ms. Wright. |
| Unknown 1 | 13.21 | 14 | N/A | 13.61 | Not Available | 1.52 | Parking lot by Mr. Bouwman's room. |
| Unknown 2 | 6.4 | 6.4 | 7.01 | 6.60 | Not Available | 0.914 | Near Carlson. |
| Unknown 3 | 4.57 | 6.4 | 4.88 | 5.28 | Not Available | 6.70 | Near Carlson. |
| Unknown 4 | 16.45 | 16.15 | 16.15 | 16.25 | Not Available | 6.09 | Near Carlson. |
| Unknown 5 | 8.83 | 9.14 | N/A | 8.99 | Not Available | 1.34 | Near Carlson. |
| Unknown 6 | 7.62 | 9.96 | N/A | 8.79 | Not Available | 0.91 | Near Carlson. |
| Unknown 7 | 8.84 | 9.14 | 10 | 9.33 | Not Available | 0.91 | Bus Loop. |
| Honey Locust 3 | 16.5 | 17.7 | 16.76 | 16.99 | Not Available | 1.82 | Northwest corner by Mr. Hoover's room. |
| White Mulberry 2 | 19.5 | 20.42 | 21.03 | 20.32 | Not Available | 17.4 | Parking lot/pond. |





**Tree Height Measurements Tools**

## Discussion

Overall, we believe that our study went well despite the fact that we could not compare our data to ICESat-2. Our group was able to measure 14 trees on our campus. We are also happy that our individual tree measurements did not vary that much from each other. This leads us to believe that our measurements were accurate.

Our group was unable to find a school for comparison purposes for our study. As previously stated, the ICESat-2 satellite tree height data is not readily available for public use (B. Campbell, personal communication, March 25, 2019). Our group can access tree height data collected by Citizen Scientists via the GLOBE Program's website. However, similar to our current situation, we would not be able to view a comparison of average tree height measurements (ground-truthing) collected by scientists to the tree height measurements taken by ICESat-2.

Our research team intends to continue our research for the remainder of the school year and throughout the summer. We have two goals that we'd like to accomplish. First, when available, we'd like to compare our measurements to those taken by the ICESat-2 satellite. Again, this will help us determine if we are taking accurate measurements. Secondly, we plan to use the GLOBE Observe app and the new Trees measuring program. We will continue to take measurements using the clinometer, Komelon 300 foot tape measure, and the Stanley tape measure. However, we will use the GLOBE Observer app to help verify the accuracy of our measurements.

## Conclusions

In conclusion, we were unable to determine if our hypothesis was correct as the ICESat-2 data was unavailable. Had the ICESat-2 data been readily available, our group would have included this in the ICESat-2 Height (Meters) column of our data table (see Data Table 1). We would have also calculated the difference between our average tree height and the ICESat-2 data. Again, this information would have been provide in the data table. To make use of data, we compared the average tree height measurements of the various trees we measured on the Shumate Middle School campus. Additionally, we found out that mulberry and locust trees are common on our campus.

To prepare this research report, our team had to stop taking average tree height measurements at the end of March 2019. We wish we would have been able to identify the unknown trees and include more tree height measurements in this study.

ICESat-2
ICE, CLOUD, AND LAND ELEVATION SATELLITE-2


## Bibliography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