Title - Mapping and measuring trees in St.Michael School

Organization: St Michael School, St Venera Malta
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Grade Level: Secondary School
GLOBE Teacher: Joseph Savona
Report Type(s): International Virtual Science Symposium Report
Protocols: Biosphere, Atmosphere
Presentation Type: StoryMap
Optional Badges: I am a STEM Storyteller, I am a Data Scientist, I make an Impact

Abstract

In the Maltese Islands trees are not a very common sight especially in the central part of the island which is taken up by buildings. In this study, GLOBE students attending St Michael School decided to investigate the type of trees growing in the school garden. Trees, in this study are categorized in two groups; indigenous trees and non-indegenous trees. Using the GLOBE Observer App students measured tree height and tree circumference. Air temperature, precipitation, surface temperature, air humidity, barometric pressure and the GLOBE Observer App and Observation Cloud chart to measure the cloud cover following the steps of the GLOBE Protocols (GLOBE, 2014) were also measured. Data was collected over the first months of scholastic year, during the autumn and winter months. The study also included building a story map using ArcGIS StoryMaps.

Keywords: tree height, tree circumference, indigenous trees, non-indigenous, surface temperature, urban area

Research Questions:

How do trees affect our school environment?

Is there any difference between indigenous and non-indegenous trees?

Does the tree location affect their growth rate?

Do trees have an impact on lowering urban surface temperatures?

Introduction

The aim of this study is to collect data of different trees within the school premises. The students selected the trees and defined them according to species. The trees have been grouped as indigenous and non-indigenous trees. Indigenous trees are trees related to a particular region. In our case Malta, which is a Mediterrenean country and indigenoues trees are adapted to the Mediterrenean climate. Introducing non-indigneoues trees will have an effect on competition between type of trees in height, water absoption, sun and photosynthesis, rate of growth.

Research Method

Study Site: The area identified for research was in the school premises.

Figure 1 Map of the Maltese Islands and the location of St.Venera

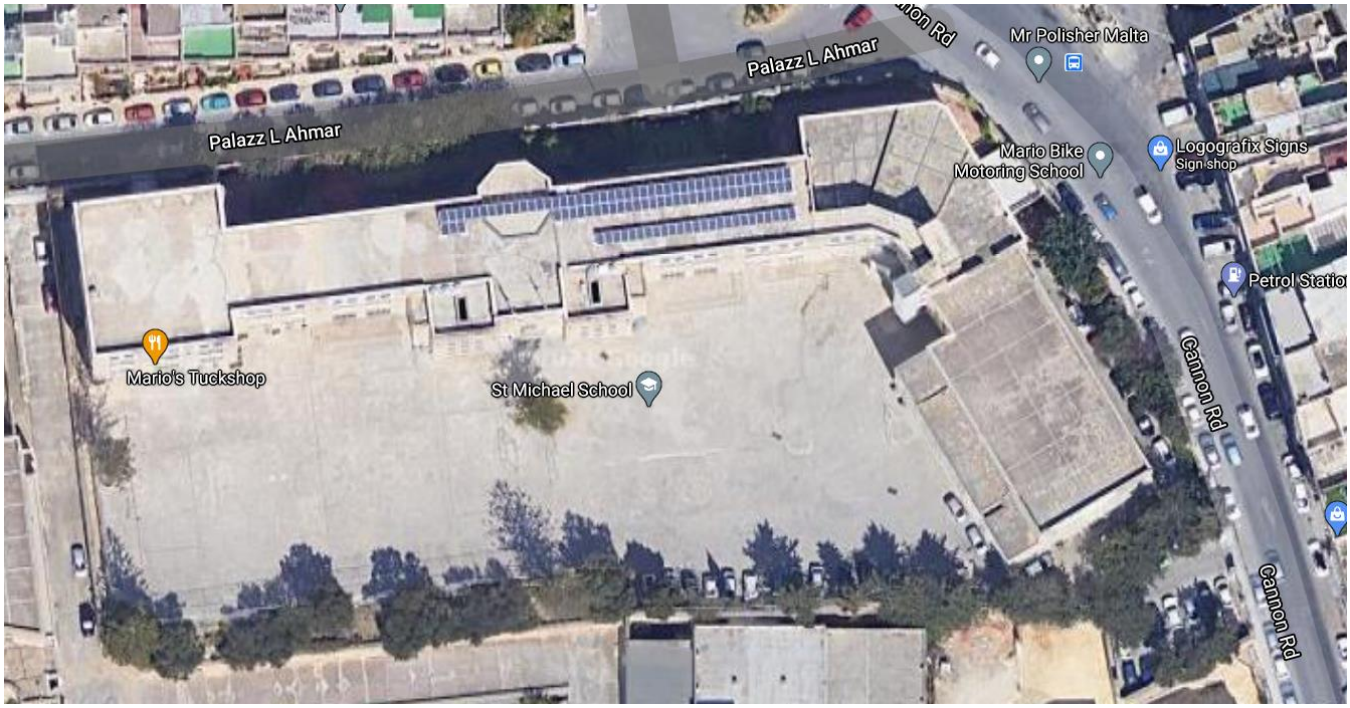


Figure 2 Aerial view of St Michael School

Methodology

Tree Heights were taken using the GLOBE Observer App. Circumference of tree trunk was taken by using a measuring tape. Using the Labdisc almost everyday we collected air temperature, relative Humidty and barometric pressure. Also on each visit the cloud cover was also observed and recorded using the GLOBE Observer App and Cloud data sheet. Rain precipitation was collected by a rain guage. Urban Surface Temperature was taken during a period of time using an Infrared Thermometer.

Figure 3 Students taking tree measurements using Tree Height on GLOBE Observer App

Figure 4 Students collecting surface temperature and precipitation data together with sky conditions.

Results

The screenshots below show data uploaded on GLOBE website during observation period between November 2020 and February 2021. Besides tree height and circumference, the students collected daily readings of air temperature, precipitation, barometric pressure, humidity, surface temperature and cloud cover and type together with surface conditions following GLOBE Protocols guide.

01/29/2021 **Tree Heights**

Tree Photo

Date/Time (UTC): **01/29/2021 10:11:00**

Data Source: **GLOBE Observer App**

Latitude/Longitude: **35.8872, 14.4733 (35° 53' 13.92", 14° 28' 23.88")**

Organization: **St.Michael School**

Site Name: **33SVV524715**

Height (m): **7.86**

Circumference (cm): **75.0**

Surface Conditions: **Snow/Ice: No; Standing Water: No; Muddy: No; Dry Ground: Yes; Leaves on Trees: Yes; Raining/Snowing: No**

Show on Map

02/12/2021 **Tree Heights**

Tree Photo

Date/Time (UTC): **02/12/2021 10:25:00**

Data Source: **GLOBE Observer App**

Latitude/Longitude: **35.888, 14.4732 (35° 53' 16.8", 14° 28' 23.52")**

Organization: **St.Michael School**

Site Name: **33SVV524716**

Height (m): **11.94**

Circumference (cm): **30.0**

Surface Conditions: **Snow/Ice: No; Standing Water: No; Muddy: No; Dry Ground: Yes; Leaves on Trees: Yes; Raining/Snowing: No**

Show on Map

02/12/2021 **Tree Heights**

Tree Photo

Date/Time (UTC): **02/12/2021 10:18:00**

Data Source: **GLOBE Observer App**

Latitude/Longitude: **35.8879, 14.4744 (35° 53' 16.44", 14° 28' 27.84")**

Organization: **St.Michael School**

Site Name: **33SVV525716**

Height (m): **14.67**

Circumference (cm): **68.0**

Surface Conditions: **Snow/Ice: No; Standing Water: No; Muddy: No; Dry Ground: Yes; Leaves on Trees: Yes; Raining/Snowing: No**

Show on Map

02/12/2021 **Tree Heights**

Tree Photo

Date/Time (UTC): **02/12/2021 09:25:00**

Data Source: **GLOBE Observer App**

Latitude/Longitude: **35.8879, 14.4741 (35° 53' 16.44", 14° 28' 26.76")**

Organization: **St.Michael School**

Site Name: **33SVV525716**

Height (m): **12.59**

Circumference (cm): **50.0**

Surface Conditions: **Snow/Ice: No; Standing Water: No; Muddy: No; Dry Ground: Yes; Leaves on Trees: Yes; Raining/Snowing: No**

Show on Map

11/20/2020 **Tree Heights**

Tree Photo

Date/Time (UTC): **11/20/2020 09:43:00**

Data Source: **GLOBE Observer App**

Latitude/Longitude: **35.8877, 14.4742 (35° 53' 15.72", 14° 28' 27.12")**

Organization: **St.Michael School**

Site Name: **33SVV525716**

Height (m): **14.3**

Circumference (cm): **120.0**

Surface Conditions: **Snow/Ice: No; Standing Water: No; Muddy: No; Dry Ground: Yes; Leaves on Trees: Yes; Raining/Snowing: No**

Show on Map

11/06/2020 **Tree Heights**

Tree Photo

Date/Time (UTC): **11/06/2020 10:08:00**

Data Source: **GLOBE Observer App**

Latitude/Longitude: **35.8877, 14.4738 (35° 53' 15.72", 14° 28' 25.68")**

Organization: **St.Michael School**

Site Name: **33SVV525716**

Height (m): **6.51**

Circumference (cm): **36.0**

Surface Conditions: **Snow/Ice: No; Standing Water: No; Muddy: No; Dry Ground: Yes; Leaves on Trees: Yes; Raining/Snowing: No**

Show on Map

11/20/2020 Tree Heights

Tree Photo

Date/Time (UTC): **11/20/2020 10:03:00**

Data Source: **GLOBE Observer App**

Latitude/Longitude: **35.8876, 14.4728 (35° 53' 15.36", 14° 28' 22.08")**

Organization: **St.Michael School**

Site Name: **33SVV524716**

Height (m): **20.44**

Circumference (cm): **170.0**

Surface Conditions: **Snow/Ice: No; Standing Water: No; Muddy: No; Dry Ground: Yes; Leaves on Trees: Yes; Raining/Snowing: No**

Show on Map

11/05/2020 Tree Heights

Tree Photo

Date/Time (UTC): **11/05/2020 09:38:00**

Data Source: **GLOBE Observer App**

Latitude/Longitude: **35.8876, 14.4742 (35° 53' 15.36", 14° 28' 27.12")**

Organization: **St.Michael School**

Site Name: **33SVV525716**

Height (m): **12.06**

Circumference (cm): **106.0**

Surface Conditions: **Snow/Ice: No; Standing Water: No; Muddy: No; Dry Ground: Yes; Leaves on Trees: Yes; Raining/Snowing: No**

Show on Map

11/10/2020 Tree Heights

Tree Photo

Date/Time (UTC): **11/10/2020 10:23:00**

Data Source: **GLOBE Observer App**

Latitude/Longitude: **35.8898, 14.4729 (35° 53' 23.28", 14° 28' 22.44")**

Organization: **St.Michael School**

Site Name: **33SVV524718**

Height (m): **7.2**

Circumference (cm): **73.0**

Surface Conditions: **Snow/Ice: No; Standing Water: No; Muddy: No; Dry Ground: Yes; Leaves on Trees: Yes; Raining/Snowing: No**

Show on Map

11/10/2020 Tree Heights

Tree Photo

Date/Time (UTC): **11/10/2020 09:30:00**

Data Source: **GLOBE Observer App**

Latitude/Longitude: **35.8878, 14.4741 (35° 53' 16.08", 14° 28' 26.76")**

Organization: **St.Michael School**

Site Name: **33SVV525716**

Height (m): **14.47**

Circumference (cm): **40.0**

Surface Conditions: **Snow/Ice: No; Standing Water: No; Muddy: No; Dry Ground: Yes; Leaves on Trees: Yes; Raining/Snowing: No**

Show on Map

11/05/2020 Tree Heights

Tree Photo

Date/Time (UTC): **11/05/2020 09:31:00**

Data Source: **GLOBE Observer App**

Latitude/Longitude: **35.8879, 14.4741 (35° 53' 16.44", 14° 28' 26.76")**

Organization: **St.Michael School**

Site Name: **33SVV525716**

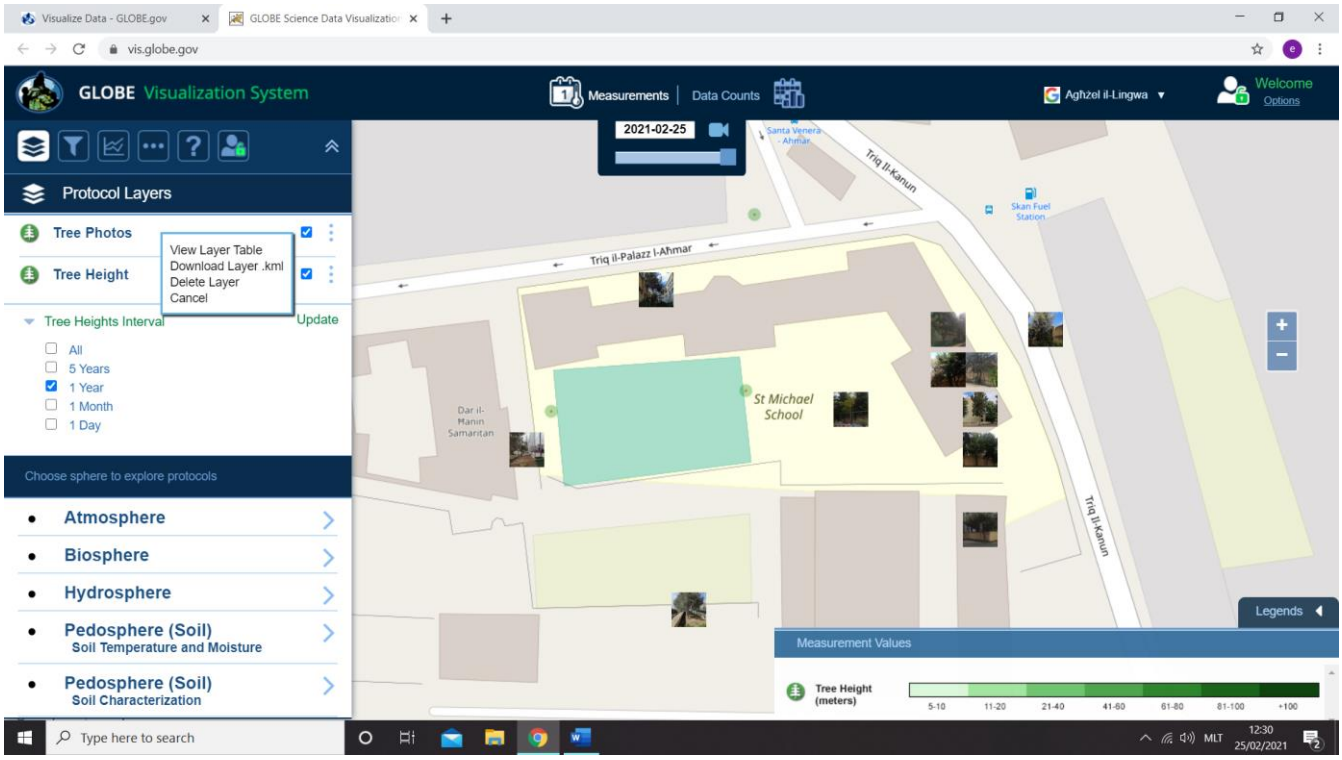
Height (m): **10.19**

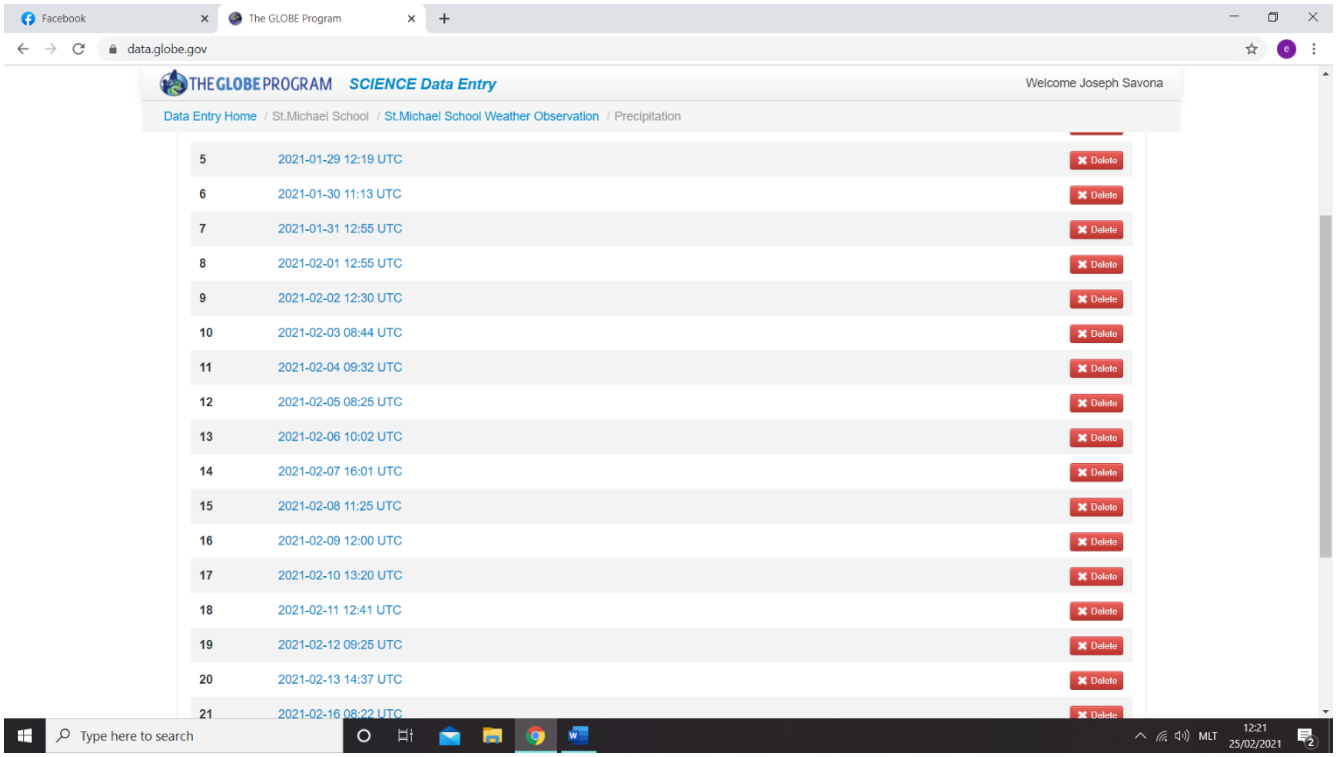
Circumference (cm): **106.0**

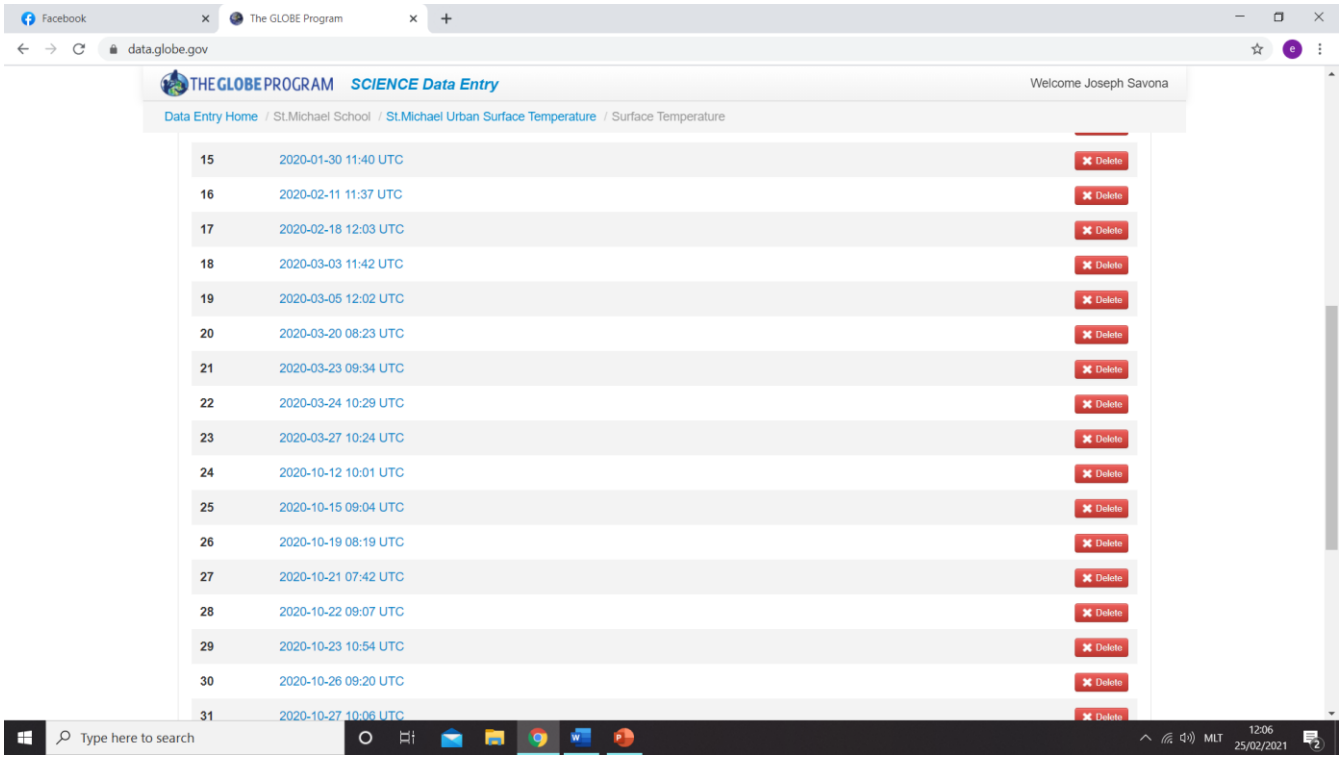
Surface Conditions: **Snow/Ice: No; Standing Water: No; Muddy: No; Dry Ground: Yes; Leaves on Trees: Yes; Raining/Snowing: No**

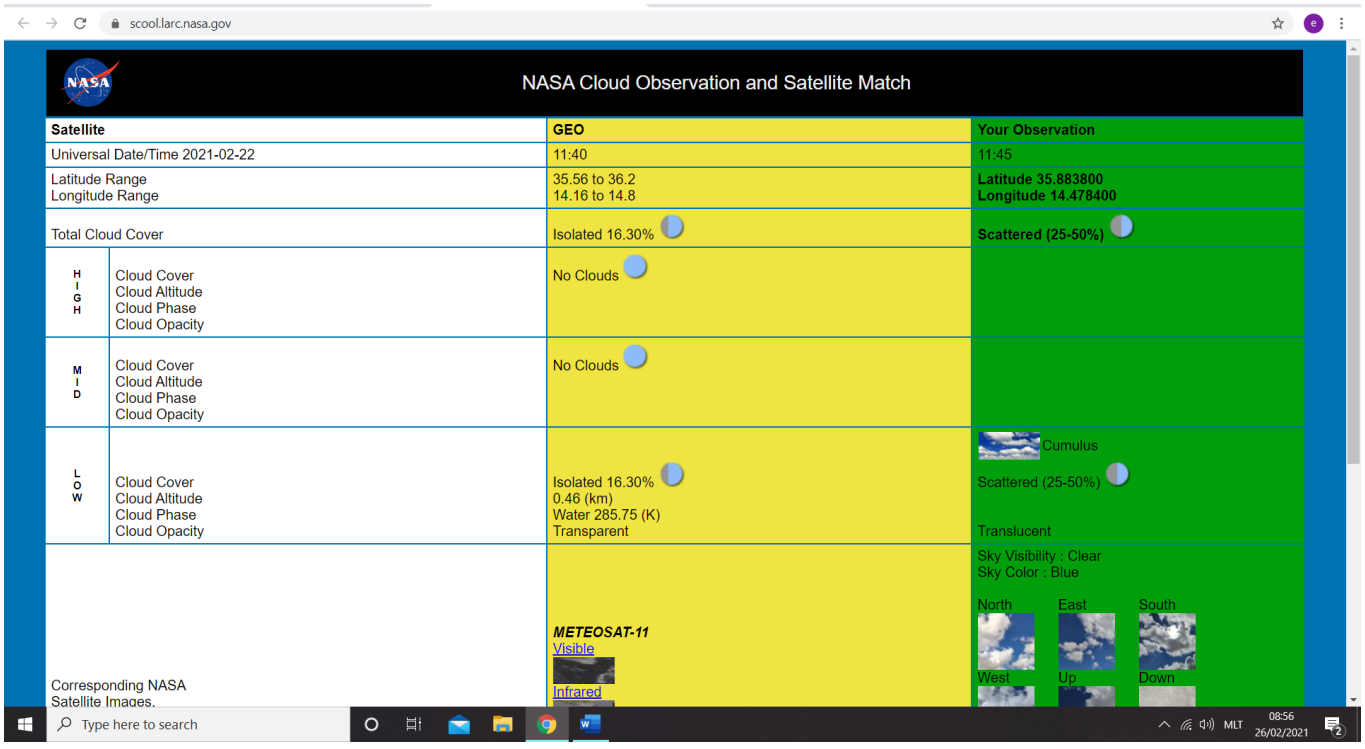
Show on Map

All data collected was logged on the GLOBE website as per screenshots below.

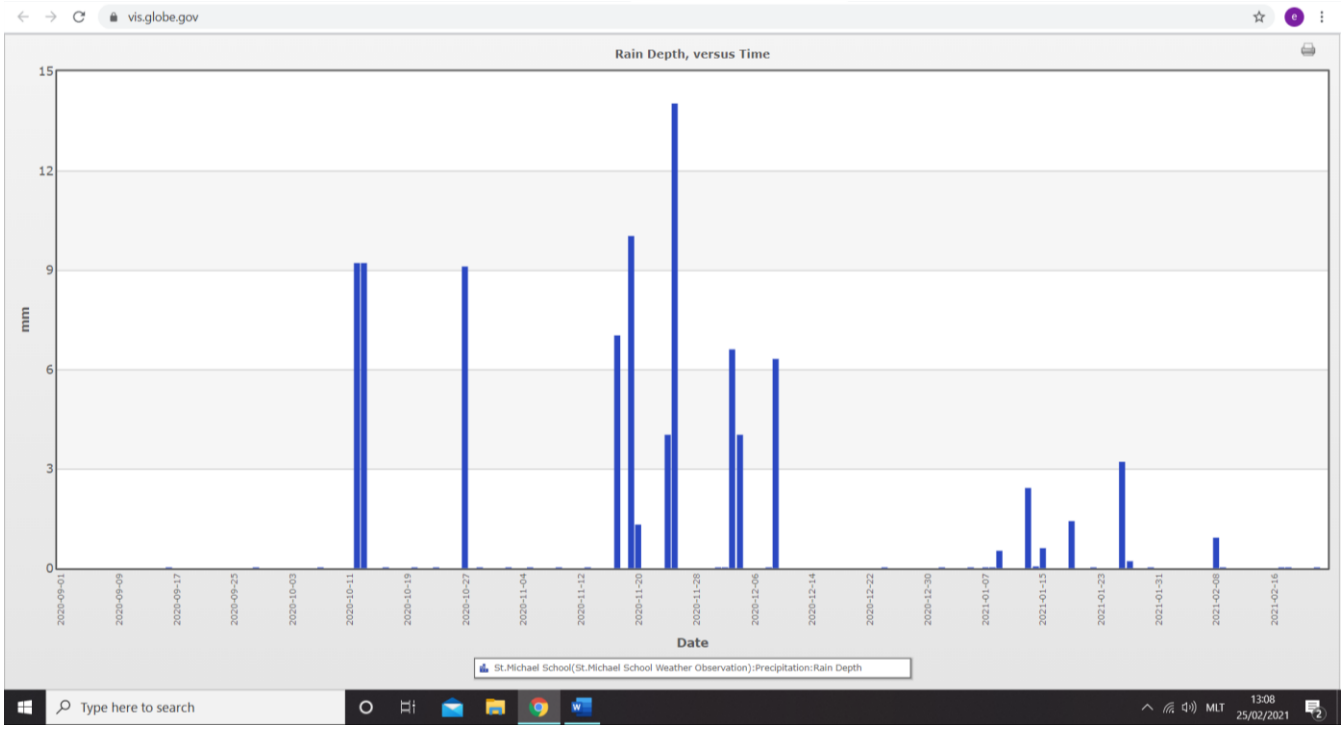








Data analysis: Mapping of trees and average temperature and precipitation was calculated. Also all data and report was presented in a Story Map using ArcGis StoryMaps. To read more about it go on the link: https://storymaps.arcgis.com/stories/ea72ce0f2ea043b78337281009746f82


vis.globe.gov
Rain Depth, versus Time
mm
Date
St.Michael School(St.Michael School Weather Observation):Precipitation:Rain Depth
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MLT
13:08
25/02/2021


GLOBE Science Data Visualizatio
Mapping and Measuring Trees in
GLOBE Visualization Plot
vis.globe.gov
Daily Average Temperature, versus Time
°C
Date
St.Michael School(33SVV524716):Air Temperature:Daily Average Temperature
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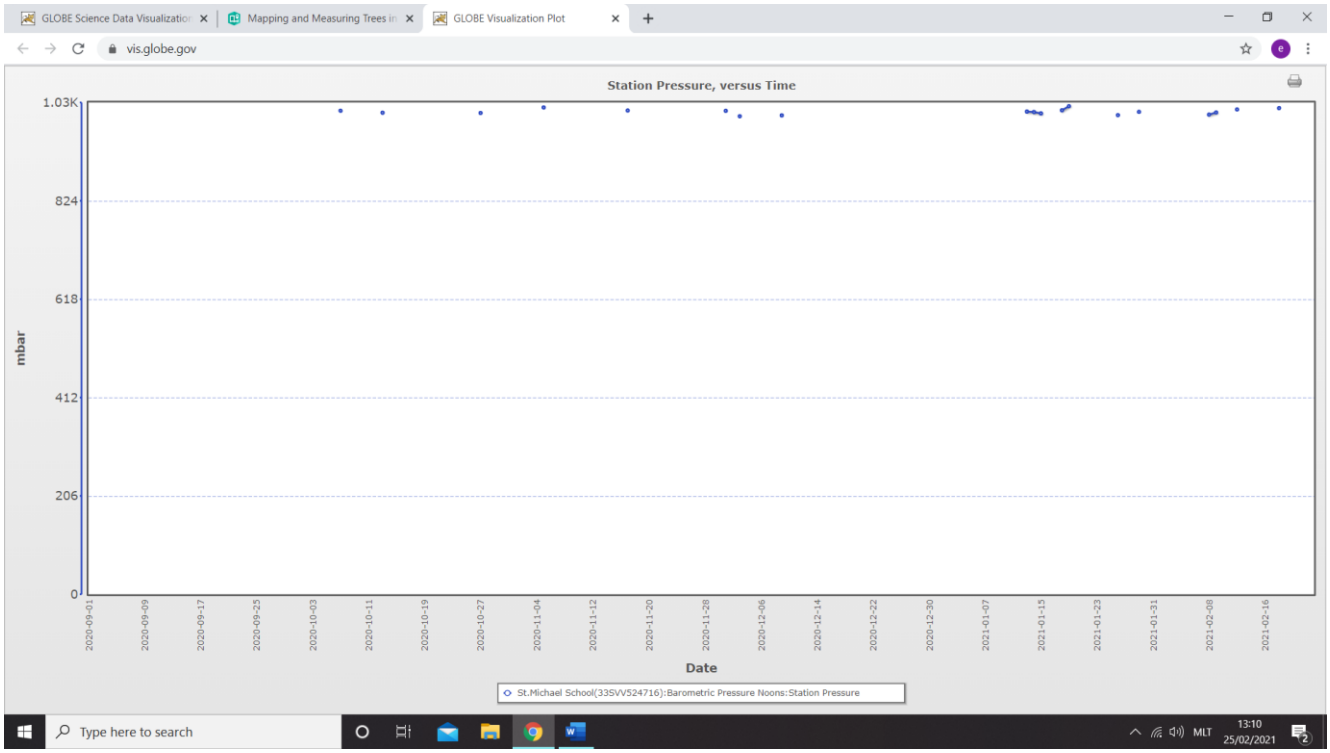
MLT
13:09
25/02/2021


GLOBE Science Data Visualizatio
Mapping and Measuring Trees in
GLOBE Visualization Plot
vis.globe.gov
Station Pressure, versus Time
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2020-12-14
2020-12-22
2020-12-30
2021-01-07
2021-01-15
2021-01-23
2021-01-31
2021-02-08
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Date
St.Michael School(33SVV524716):Barometric Pressure Noons:Station Pressure
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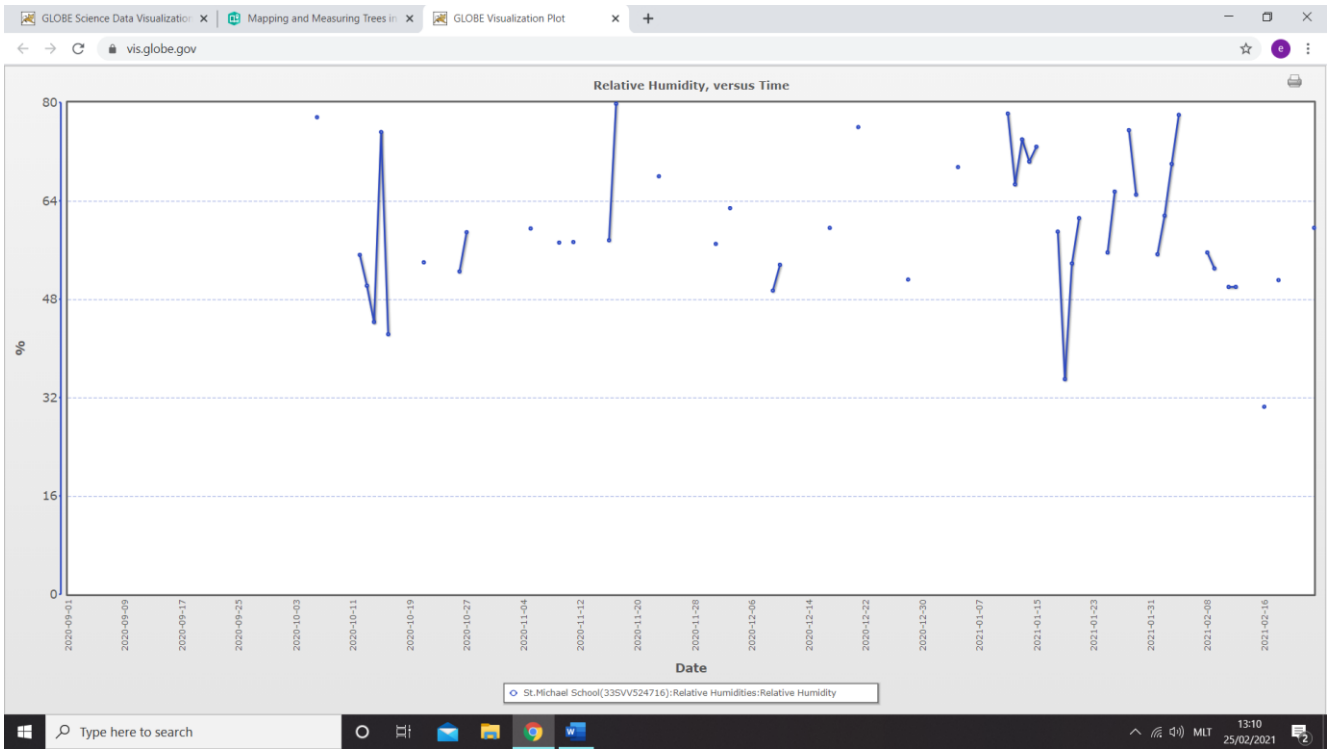
25/02/2021


GLOBE Science Data Visualizatio
Mapping and Measuring Trees in
GLOBE Visualization Plot
vis.globe.gov
Relative Humidity, versus Time
80
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2020-09-01
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2020-09-25
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2020-12-14
2020-12-22
2020-12-30
2021-01-07
2021-01-15
2021-01-23
2021-01-31
2021-02-08
2021-02-16
Date
St.Michael School(33SVV524716):Relative Humidities:Relative Humidity
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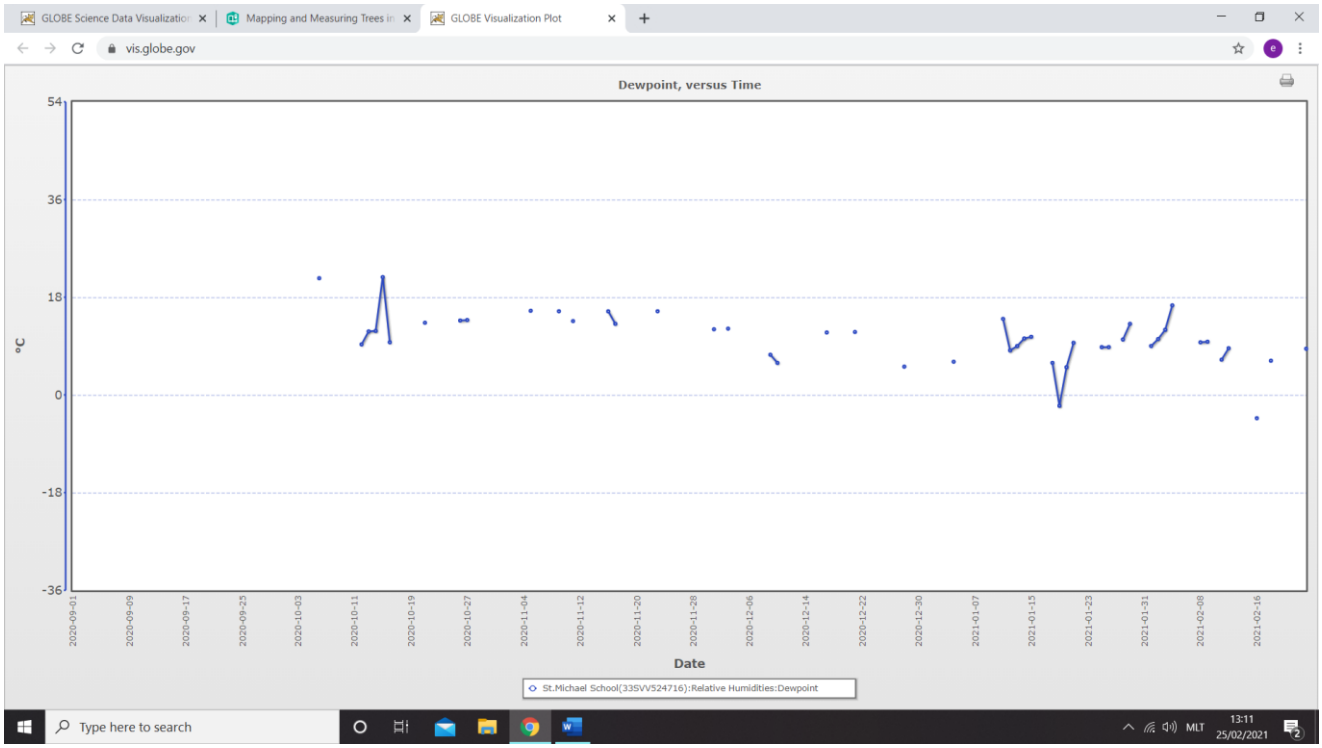
MLT
13:10
25/02/2021


GLOBE Science Data Visualization
Mapping and Measuring Trees in
GLOBE Visualization Plot
vis.globe.gov
Dewpoint, versus Time
54
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18
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St.Michael School(33SVV524716):Relative Humidities:Dewpoint
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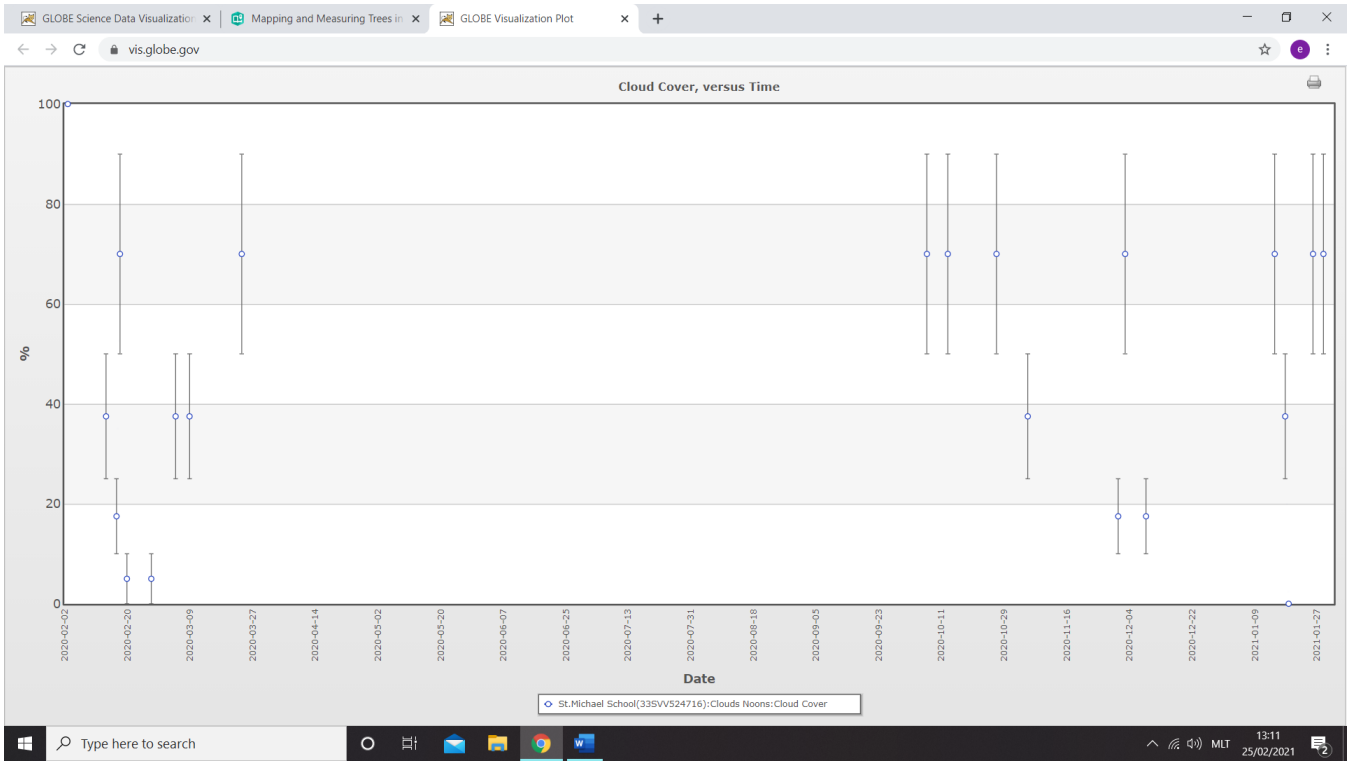
25/02/2021


GLOBE Science Data Visualization
Mapping and Measuring Trees in
GLOBE Visualization Plot
vis.globe.gov
Cloud Cover, versus Time
100
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Date
St.Michael School(33SVV524716):Clouds Noons:Cloud Cover
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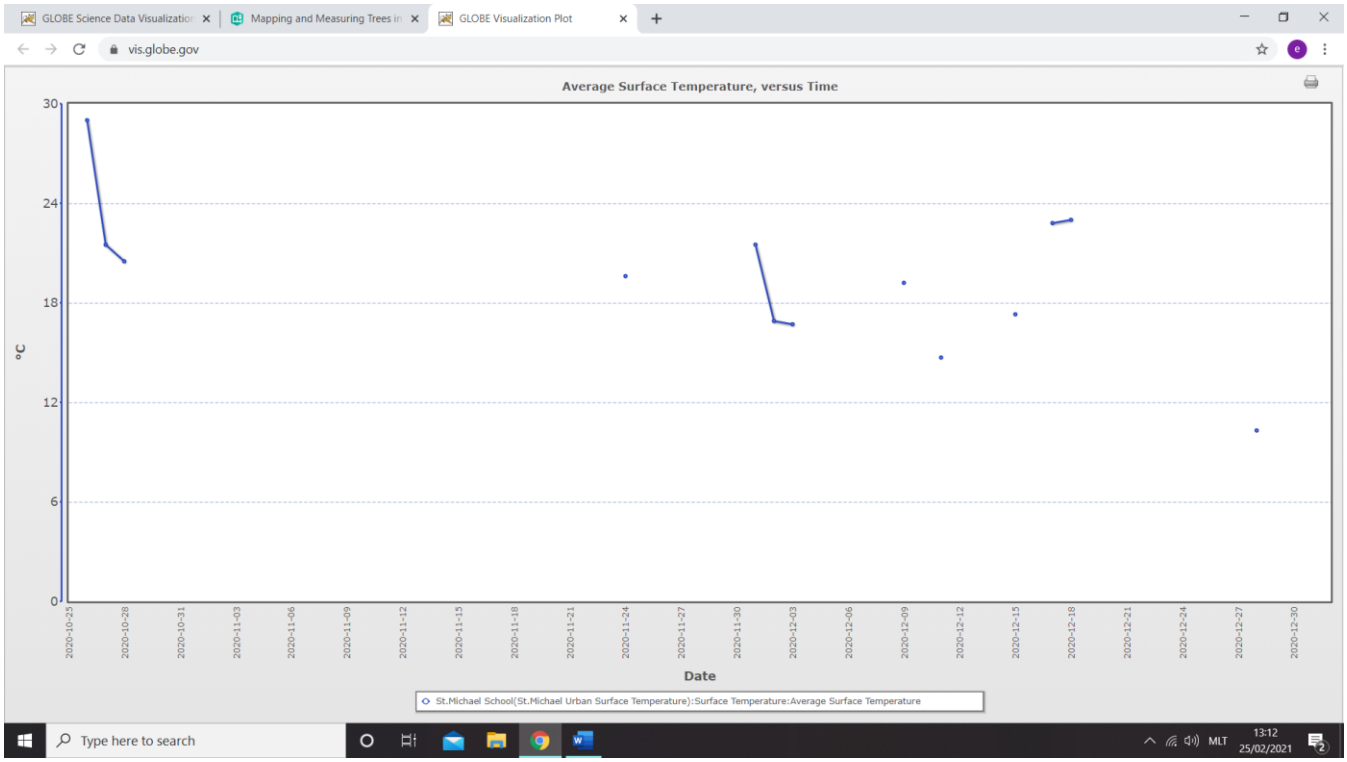
MLT
13:11
25/02/2021



Discussion:

Our school is situated in an urban area, surrounded by busy roads, an industrial area, building development and a petrol station. As a school it was built at around 1951. The trees surrounding the school and the trees in the school premises where all planted through the years. The oldest documentated tree that has been planted in the school is the Norfolk Pine Tree, which is also the highest tree in the area. Old photos of school taken during construction, is clearly visible as a small tree which had been just planted together with another 2 trees, today removed due to renovation of the school football ground.

In the school there are different types of trees. Through this study the students made a distinction between trees that are indigenous and others that are non-indigenous trees related to the Mediterrenean climate.

What effect there is terms of growth rate? Will that effect also light and photosyntheses? Would they grow faster than the indegenous trees or propogate more? Are these adapted to the hot and dry summer days of Malta? The area parallel to the street on the east side of the school has mainly all the indegnous trees planted and measured in this study. This are is humid and also one can find a well. This could be the reason why certain trees especially the carob tree which is situated beside the well grew fast and tall in few years. The carob fruit pods and leaves that fall create a fertile soil rich in nutirents which is helping the area and other trees planted nearby. One reason why this area is humid and shady if because of these trees which grew taller rather than spreading with an effort to reach sunlight. In summer this area of the school is shady and pleasant when compared to other areas of the school.

Altough the highest and oldest tree as mentioned before is the Norfolk Pine Tree, indeed it effects the surroundings. Infact contrary to the carob tree, it's leafs make it impossible for other plants to grow within its perimeter. Infact altough it is an evergreen tree it drops alot of leaves especially during the Summer months. Another tree which is non-indegenous for the Maltese Islands is the Droping False Pepper Tree. This is a fast growing tree and also an invasive tree. Infact, each year in the school garden alot of new seedlings from this tree start to grow and if left uncontrolled it will grow very fast and take over other vegetation.

This year compared to last year was a wetter winter altough still far from the average rainfall of 500mm. The anti-cyclone of February again effected the rainfall during the whole month. Infact during February 2021 minimal rainfall was recorded.

Conclusion:

What are the benefits of planting more trees? These trees offer shade in school days especially when summer will approach. We notice difference in urban heat surface temprature when there is shade of trees. Also trees serve as an artificial 'privacy' wall, being surrounded by other buildings. These trees contribute to the absoption of CO2 and also serve as a sound barrier from the adjacent busy streets around the school.

Through the Learning About Forest (leaf) Program the students are being agents of change. Having discovered the positive impact trees have on the natural environment they decided to work on different project related to Trees. Some of the projects the students worked on are;

- The importance of rubble walls and afforestation in Buskett Gardens;
- The importance of bees;
- The carob tree
- Planting of Mediterrenan shrubs and plants in school.

References:

https://www.globe.gov/

https://observer.globe.gov/

https://storymaps.arcgis.com

www.maltawildplants.com

https://www.youtube.com/watch?v=aIa4ueTTdz0&list=PLJCFrgsigkzaVy3mBHMJvtGUvNcTu9fAb

https://www.youtube.com/watch?v=iasE0BrXbU4&list=PLJCFrgsigkzaVy3mBHMJvtGUvNcTu9fAb&index=2

https://www.youtube.com/watch?v=ZrUWSF1rRYc&list=PLJCFrgsigkzaVy3mBHMJvtGUvNcTu9fAb&index=4

https://www.youtube.com/watch?v=qstiQFgMwJE

https://www.youtube.com/watch?v=OdQCtMLeZ2I&t=788s

Badge Descriptions/Justifications:

I am a STEM Storyteller (students presented this research in a different way through a StoryMap)

I am a Data Scientist (students collected and analysed data)

Make an Impact (with this research and other projects through the years we had on impact on the way one appreciate the importance of trees and surroundings. This project also was presented through a webinar organized by GLOBE in January 2021)