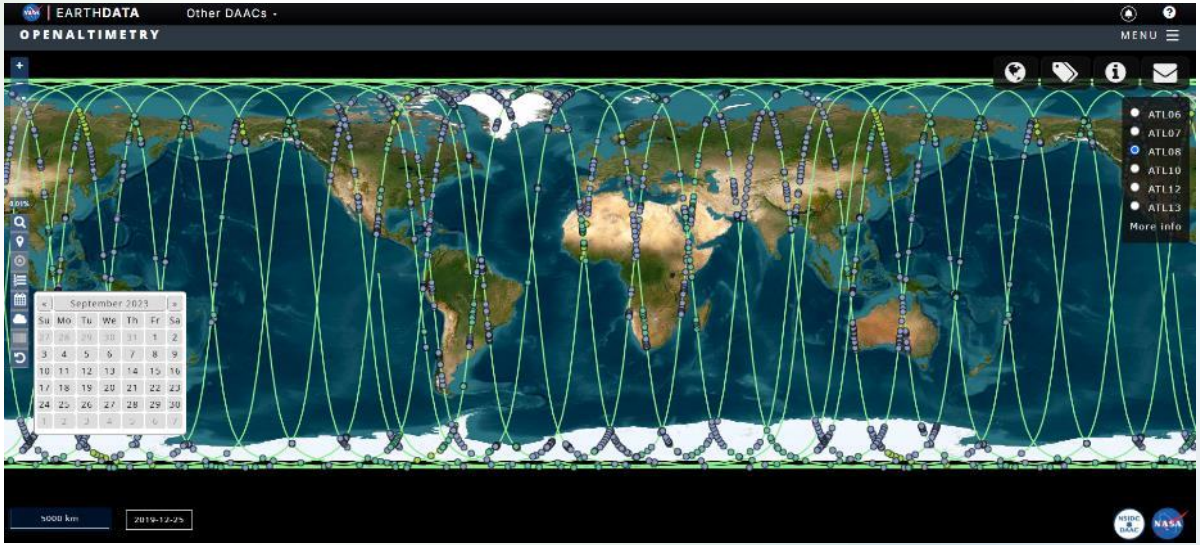
Analysis of biometry measurements in Karlovac Promenade



Students:

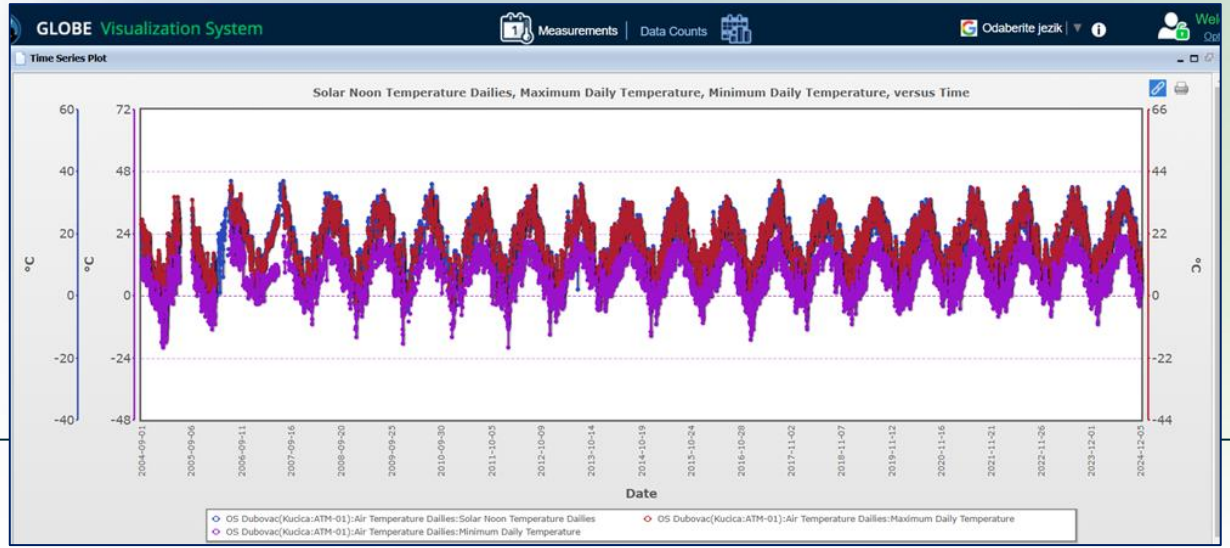
- Zoea Benković
- Esma Šabanović
- Lana Blažan

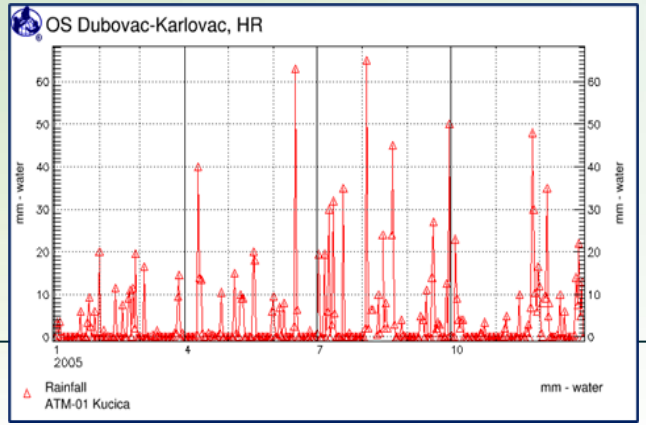
Mentors to students:
Snježana Marković – Zoraja, Kristina Fratrović
Dubovac Primary school, Karlovac, Croatia

We joined GLOBE in 2004

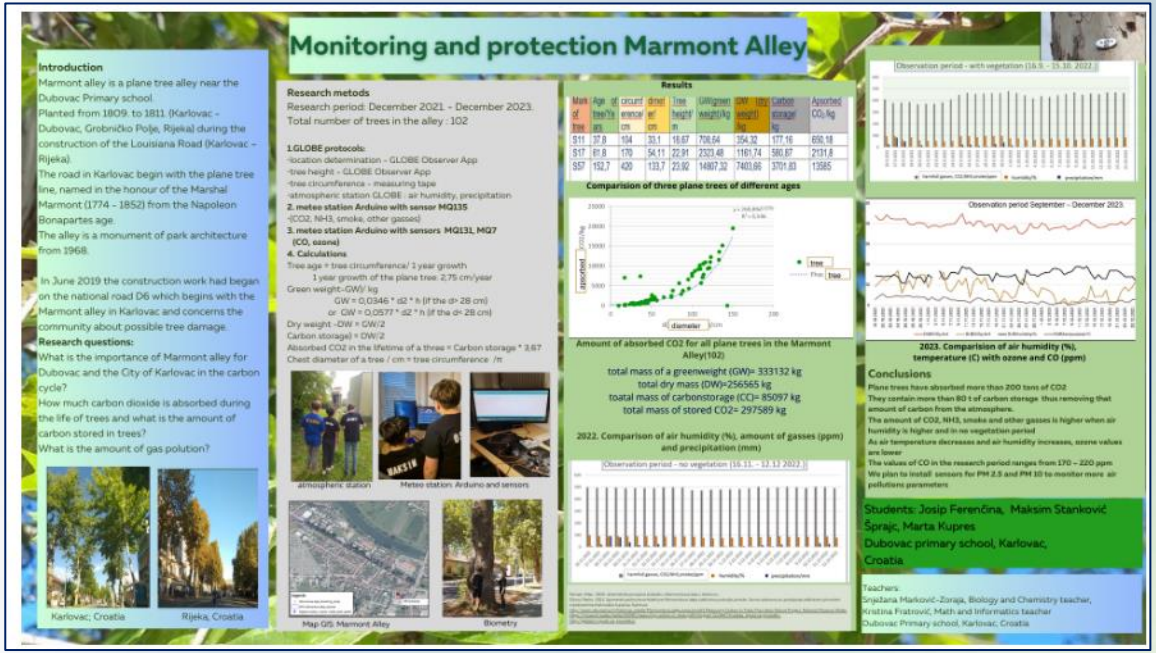
First GLOBE generation 2004.

- atmospheric measurements
- hydrological measurements

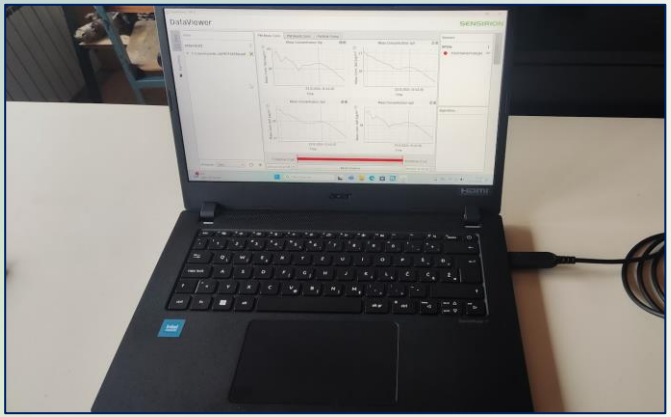




Last generation, 2024 – research projects in the alleys of the city of Karlovac



IVSS 2024.



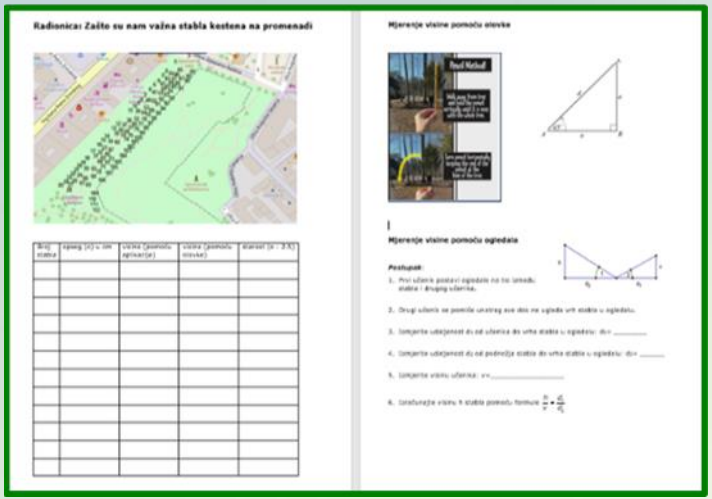
The beginning of measuring air quality with devices and Arduino systems

Introduction in research project 2024

- Karlovac Promenade – the alley located on the west side of Karlovac Star

- treeline consisting of wild chestnut trees (*Aesculus hippocastanum* L.) and a few linden trees (*Tilia* sp.)
- place of city manifestations
- place of citizen gathering who enjoy the city greenery

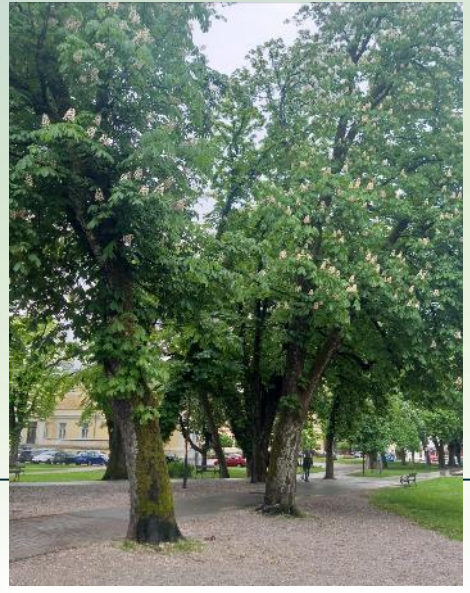
- on the manifestation „Karlovac carousel”, our GLOBE students with teachers have a biometry workshops on the Promenade ewery year



- because of student interest, the workshop became a research project of biometry for all 190 trees on the Promenade
- we worked on the project from March to May 2024 and it was presented at the National competition

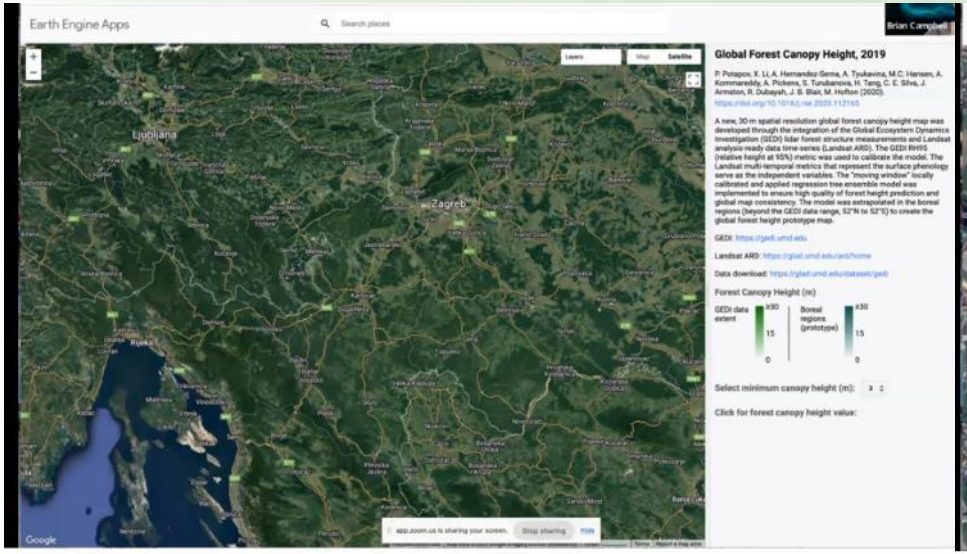
Research questions

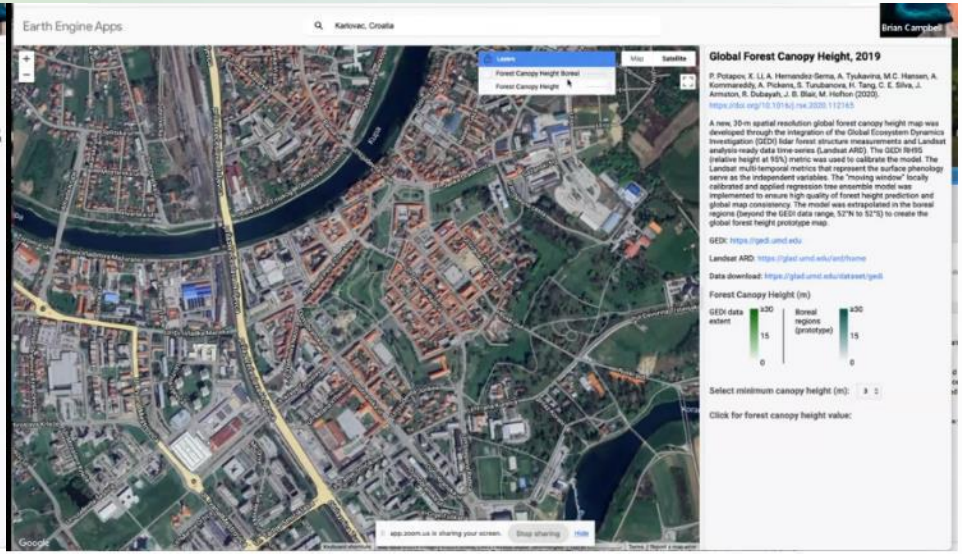
- Can we read the height of the trees in the satellite measurement databases?
- How old are the trees in the Karlovac Promenade and when were they planted?
- How much carbon did the trees in the Karlovac Promenade store?
- How much CO_2 did the trees in Karlovac Promenade absorb?



Research methods – working on databases

The students explore the database on platform:
Earth Engine apps
(GEDI satellite - **Global Ecosystem Dynamics Investigation,** measures canopy height)



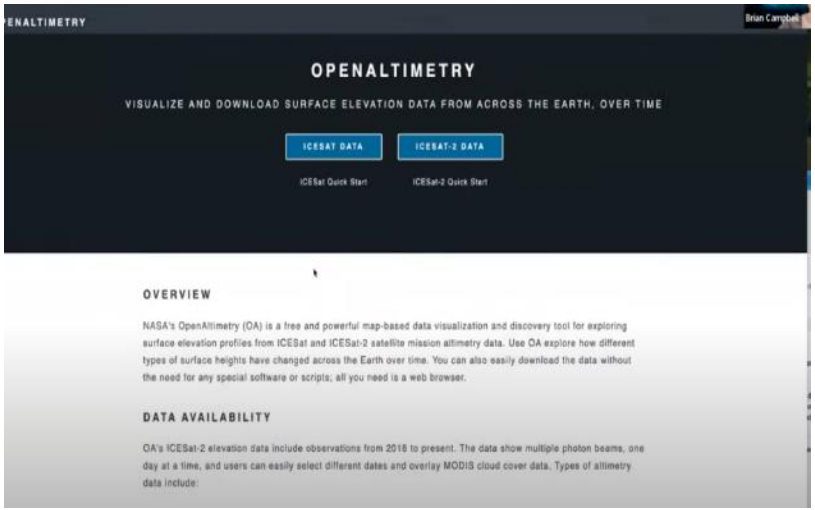


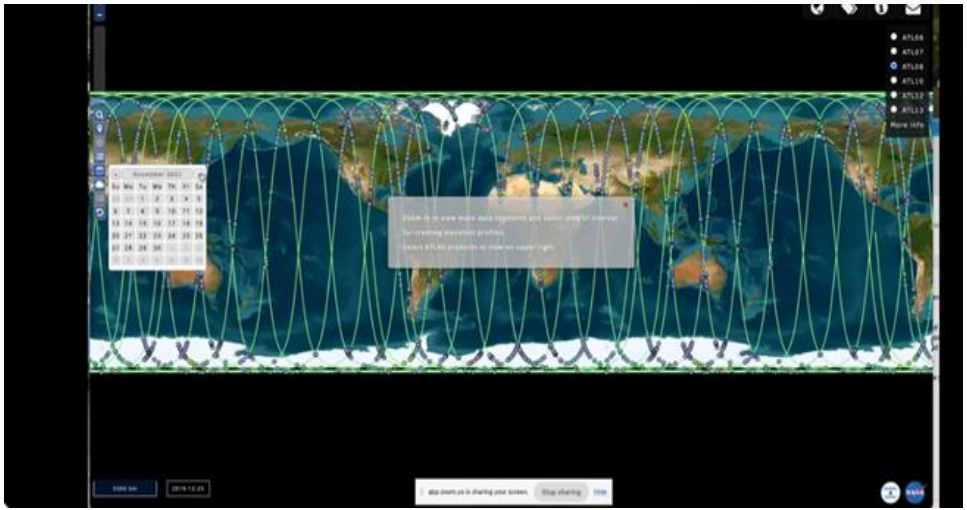
https://glad.earthengine.app/view/global-forest-canopy-height-2019

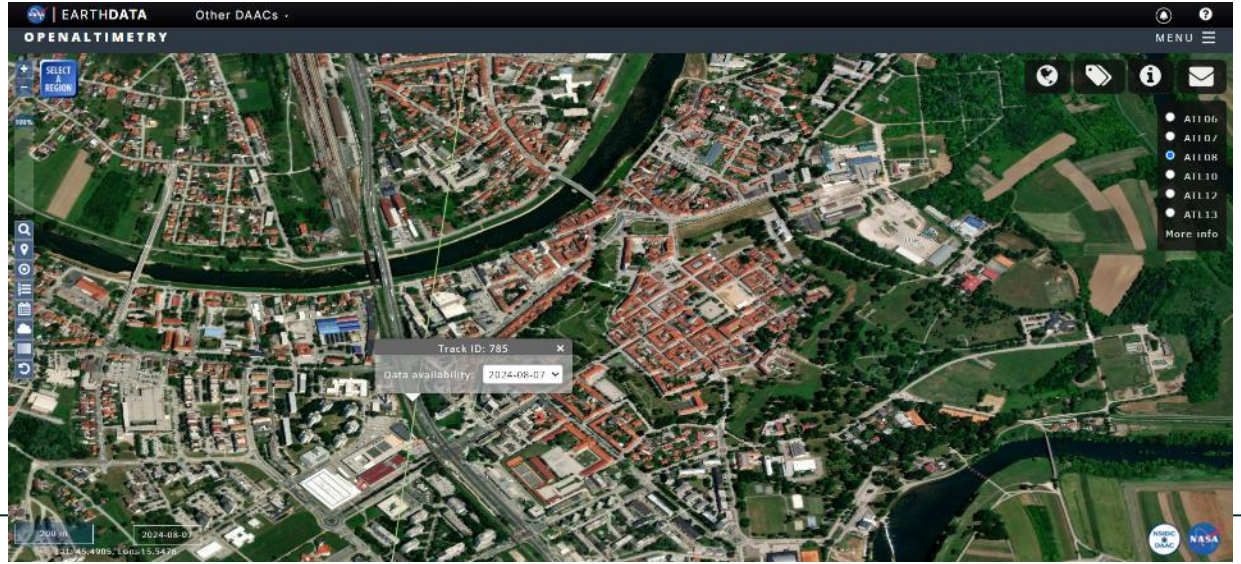
By zooming in on the map, pixels in varying shades of green appear, representing canopy height

By selecting and marking a pixel, only the average height of the entire pixel is obtained, not that of specific tree

The students explore the database on platform: OPENALTIMETRY (ICE Sat 2)



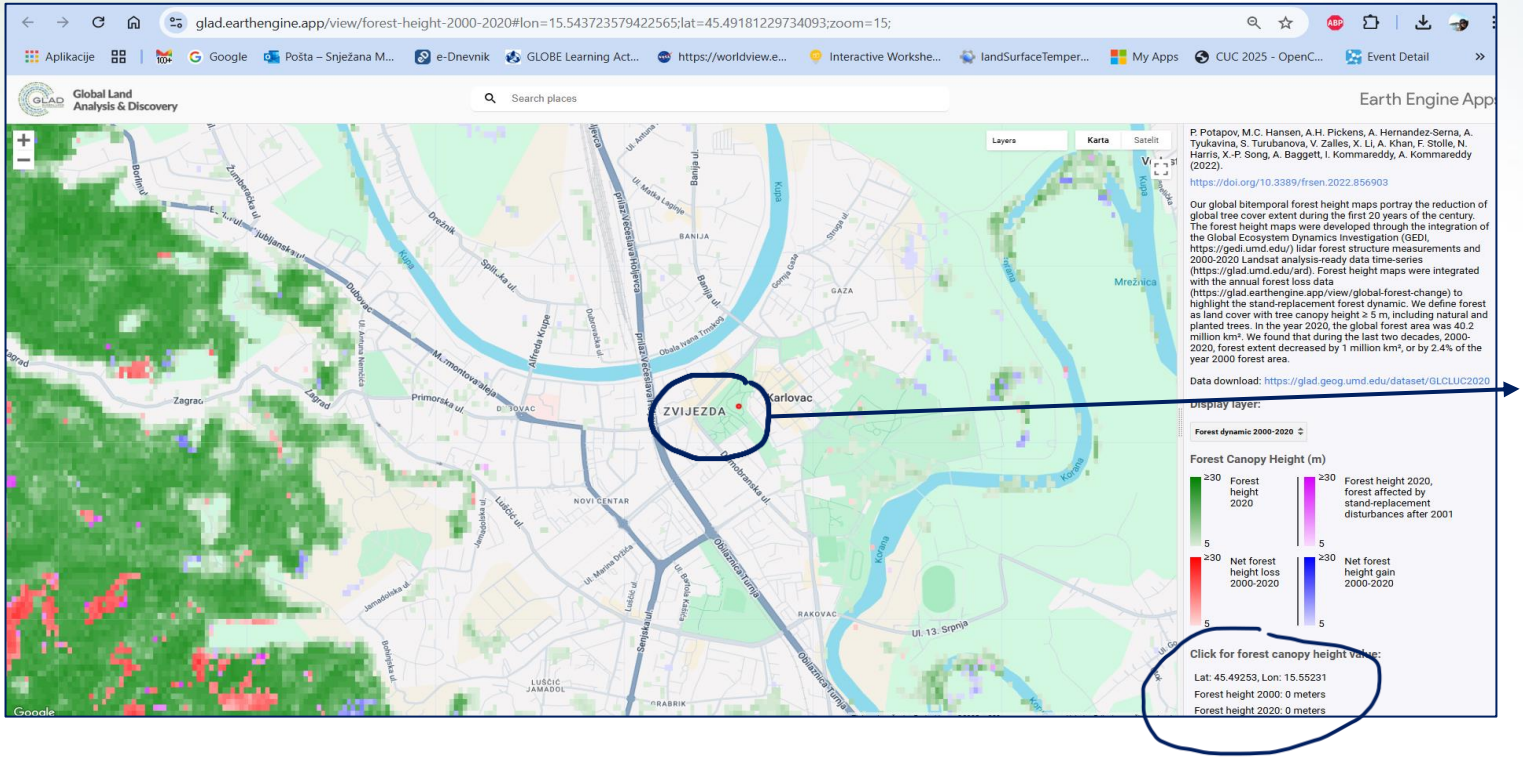




The satellite paths did not capture the canopy over the area of the Karlovac Promenade

The students explore the database on platform: Earth Engine apps

- the dynamics of the global tree cover 2000.- 2020



https://glad.earthengine.app/view/forest-height-2000-2020#lon=15.543723579422565;lat=45.49181229734093;zoom=15;

Did satellites capture and measure the height of trees n the Karlovac Promenade?

Talking with Brian Campbell (NASA scientist) on webinar how satellites record the Earth surface

ICE Sat 2 : **NO**, as the recording lines were not on the location.
GEDI: **PARTIALLY**, measuring the average canopy height per pixel.

Research methods on the field

Biometry measurements were conducted on all 120 trees on the Promenade

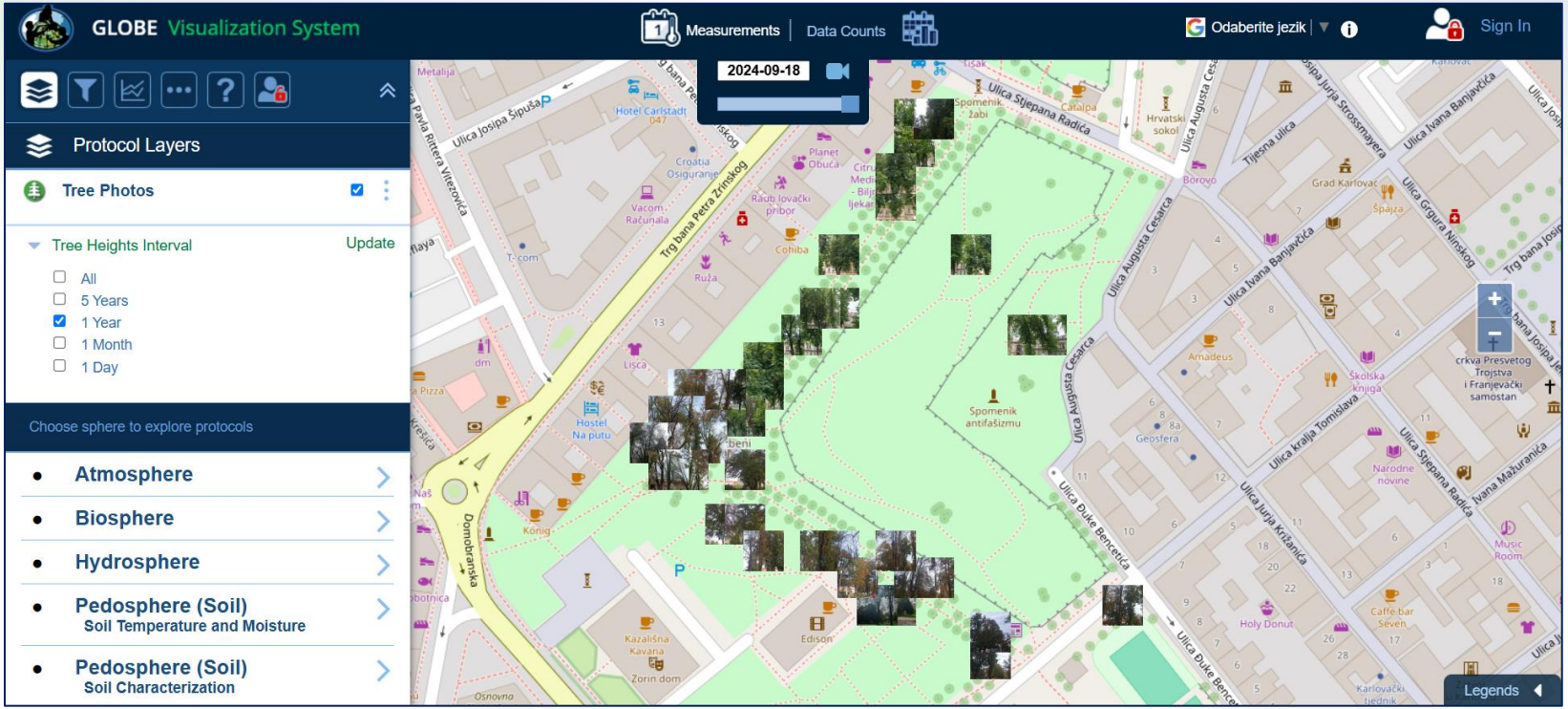
GLOBE protocols:

- tree circumference
- tree age

GLOBE *Observer*

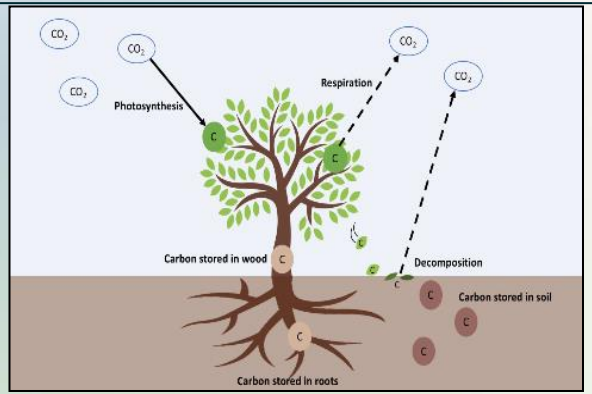
- tree height and location

The measured values can be accessed in the GLOBE database



The following values were calculated in the classroom

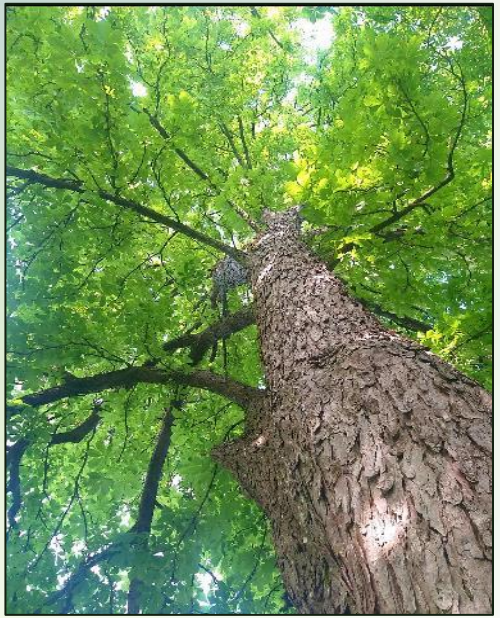
- **diameter/cm** = $\frac{circumference\ of\ tree}{\pi}$
- **green weight - GW/ kg**
  $\mathrm{GW} = 0.0346 \cdot d^2 \cdot h$ (if the $d > 28\ cm$)
  $\mathrm{GW} = 0.0577 \cdot d^2 \cdot h$ (if the $d < 28\ cm$)
- **dry weight - DW/kg** = $\frac{GW}{2}$
- **carbon storage - CC/kg** = $\frac{DW}{2}$
- **absorbed CO_2 /kg**
  Carbon storage · 3.67 jer je $\frac{Mr(CO_2)}{Ar(C)} = 3.67$



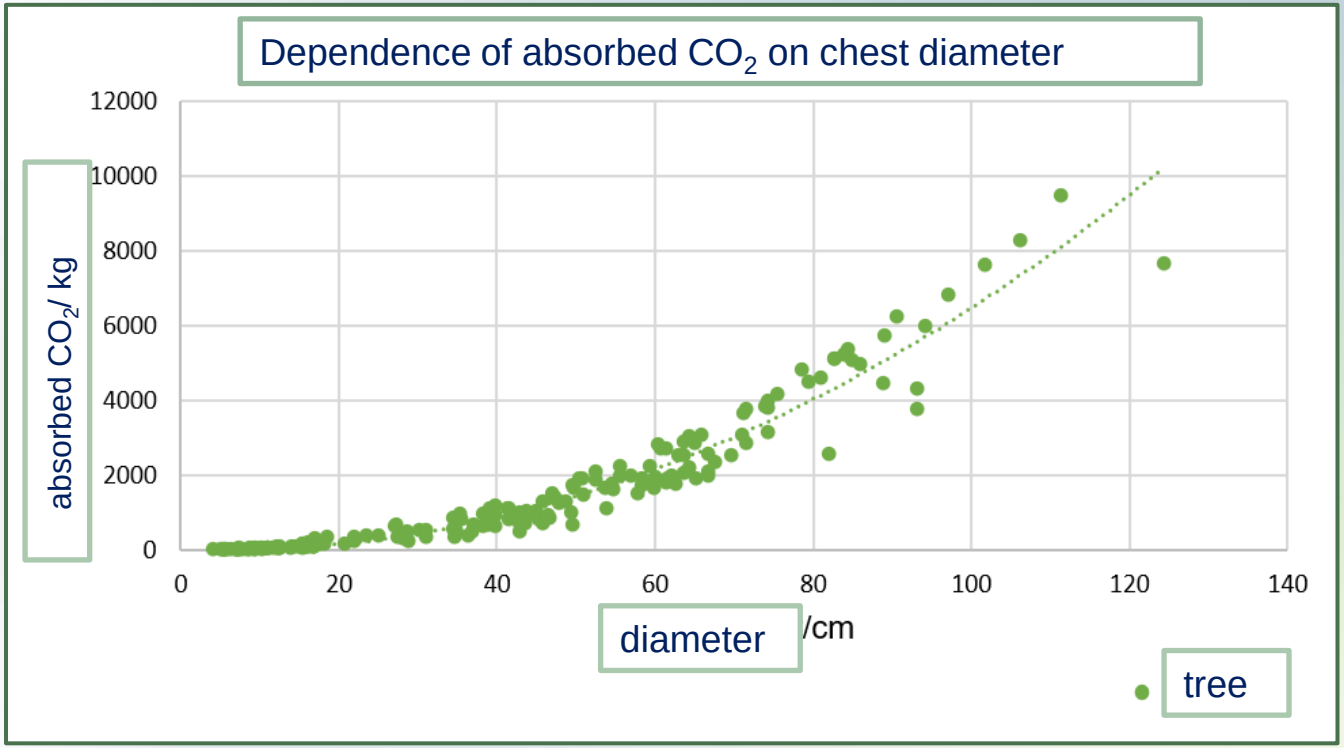
Results

- The stored carbon and absorbed CO_2 in the Promenade are presented in intervals based on tree diameter

interval of tree diameter /cm	interval of tree age /years	number of trees	stored carbon /kg	absorbed CO_2 /kg
1 - 50	1 - 62.5	120	12 896	47 328
51 - 100	63 - 125	66	54 571	200 575
101 - 150	> 125	4	8 966	32 906
		190	76 433	280 809

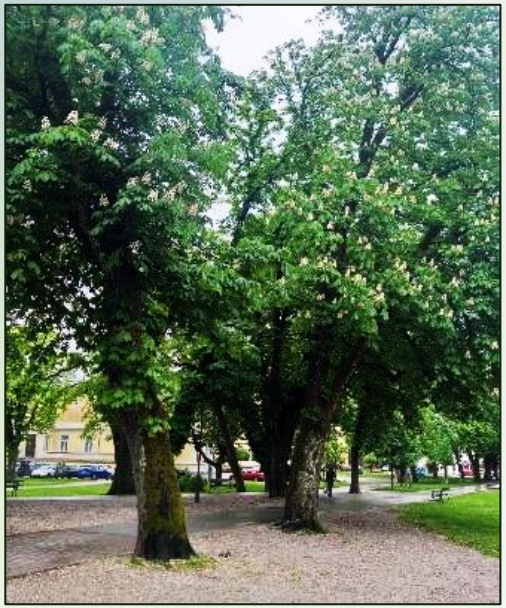


190 trees on the Karlovac Promenade)



Discussion and conclusion

- Trees in the Promenade absorbed more then 280 t of CO_2 and contain over 76 t of stored carbon
- 2% of the trees are over 125 years
- Field measurements are crucial because satellites cannot capture all surfaces on Earth, especially in urban areas



age	Promenade (190 trees)
to 62.5 years	64%
63 - 125 years	34%
more then 125 years	2%

- Karlovac promenade is a place for urban gatherings and events
- maintaining and caring for avenues is of great importance for the city

Generation of students 2024/2025

- GLOBE atmospheric measurements and tree monitoring
- monitors the amount of the main air pollutants in the city of Karlovac
- compares biometric measurements in the field and compares them with satellite measurement data