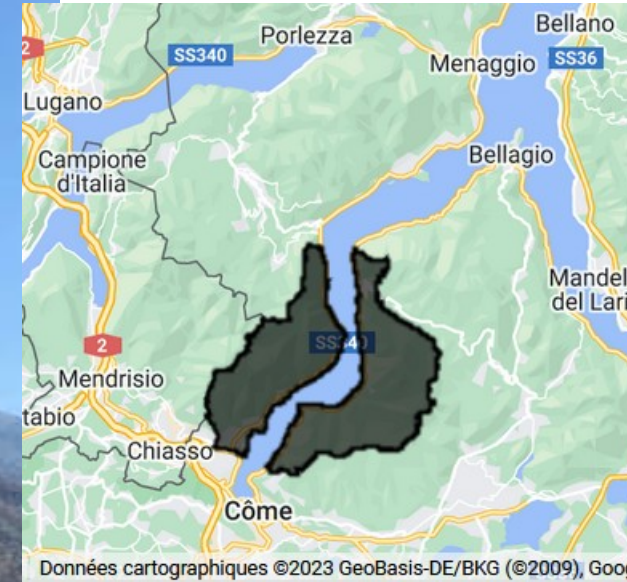


A study of the hyperspectral stress response of vegetation to drought situation.

A project for the examination of the Earth Observation
course, of Pr. G. Venuti

Author of the project : Mrs Madeleine Abbès

Case of study Como lake, summer 2022.

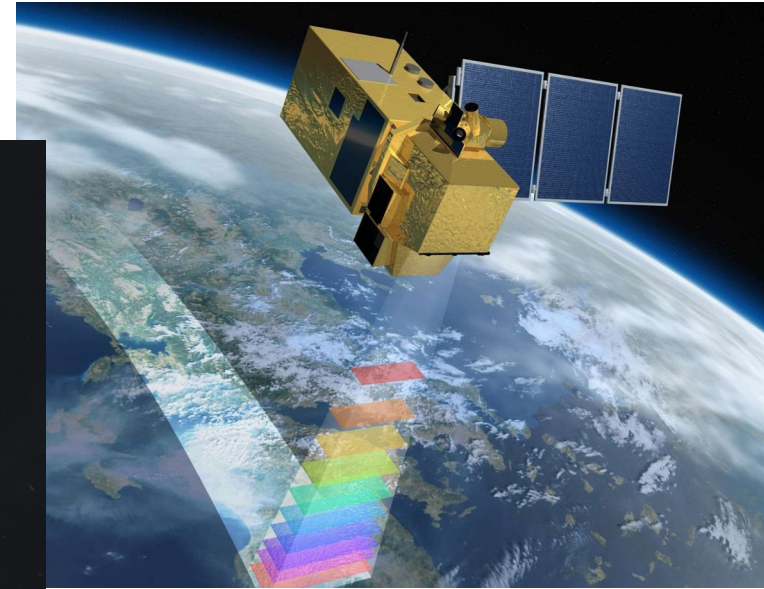
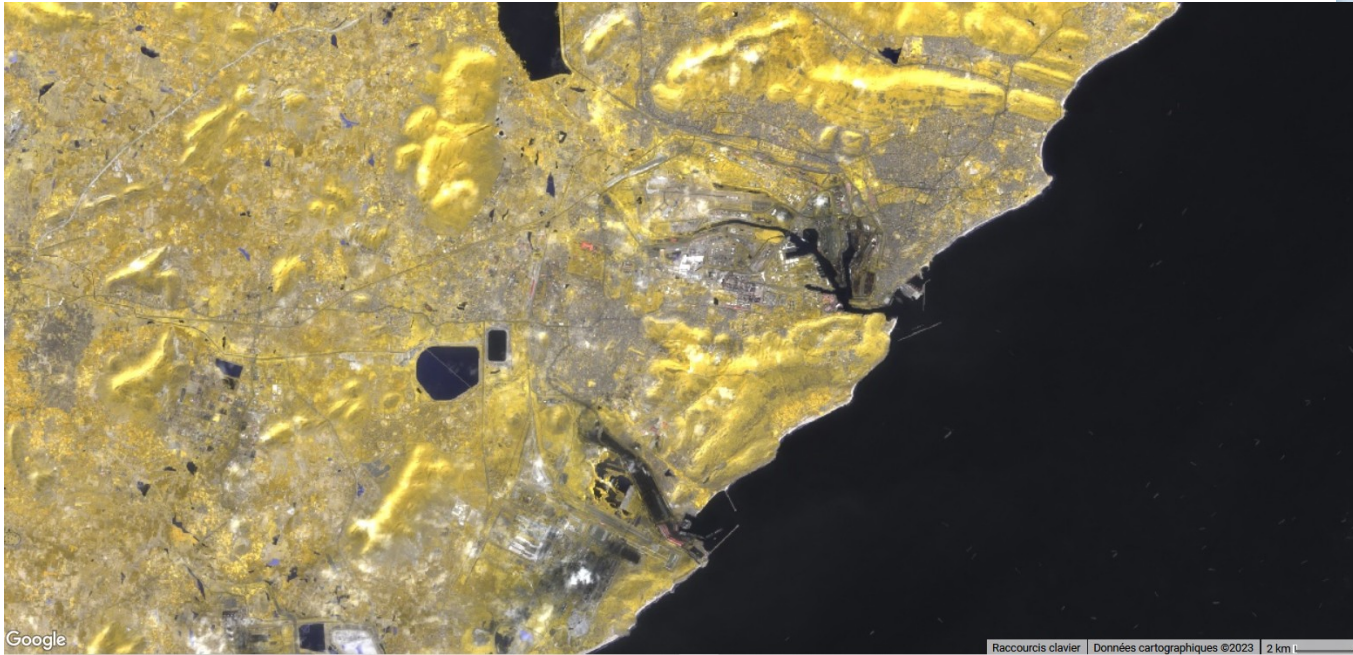


Area of interest

Como lake during the summer 2022. Credits : Giovanni Di Leo

Data

Multispectral satellite imagery from ESA Copernicus Sentinel 2 mission



Example of multispectral NIR visualisation from sentinel 2 mission

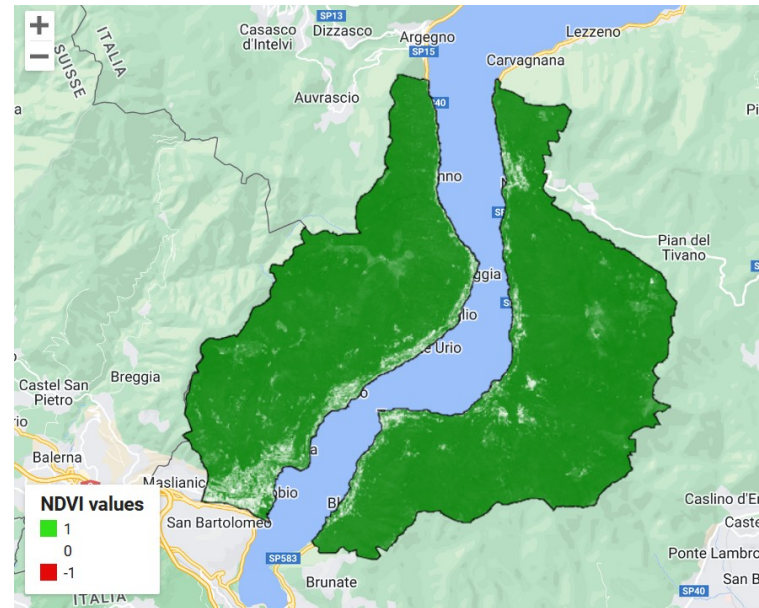
NDVI

$$\text{NDVI} = (\text{NIR} - \text{VIS}) / (\text{NIR} + \text{VIS})$$

NDVI is directly linked to chlorophyll content of the vegetation

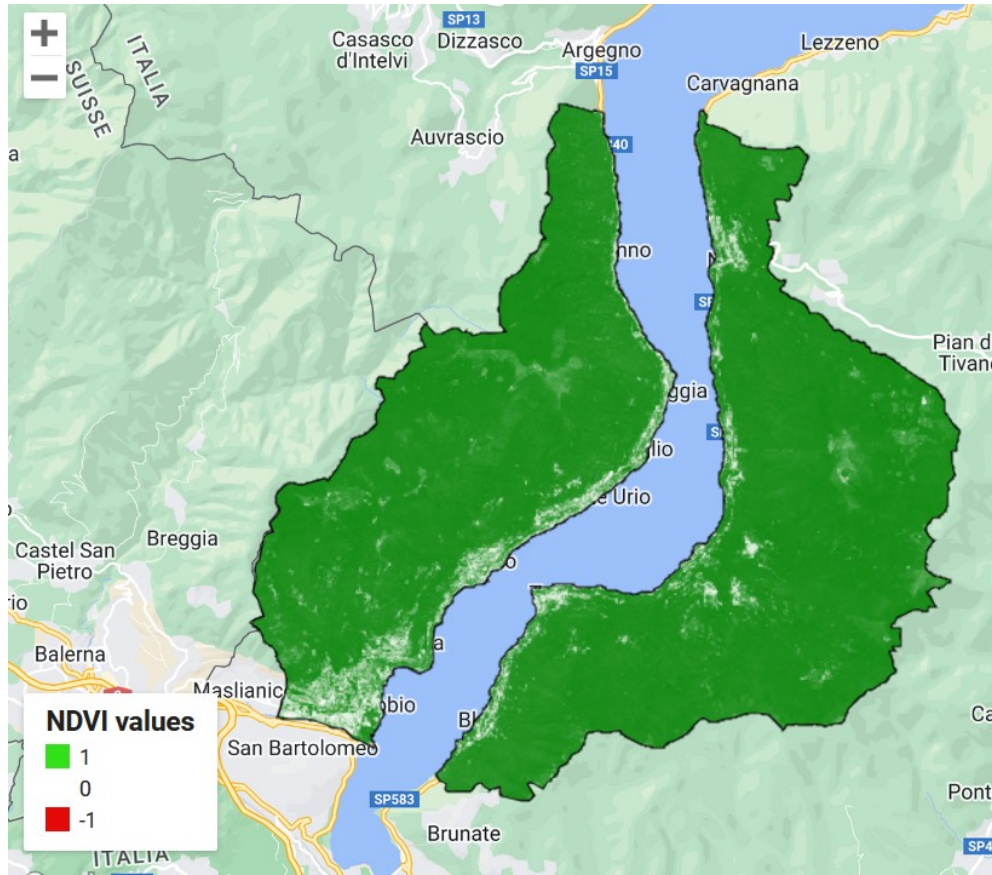


RGB visualisation

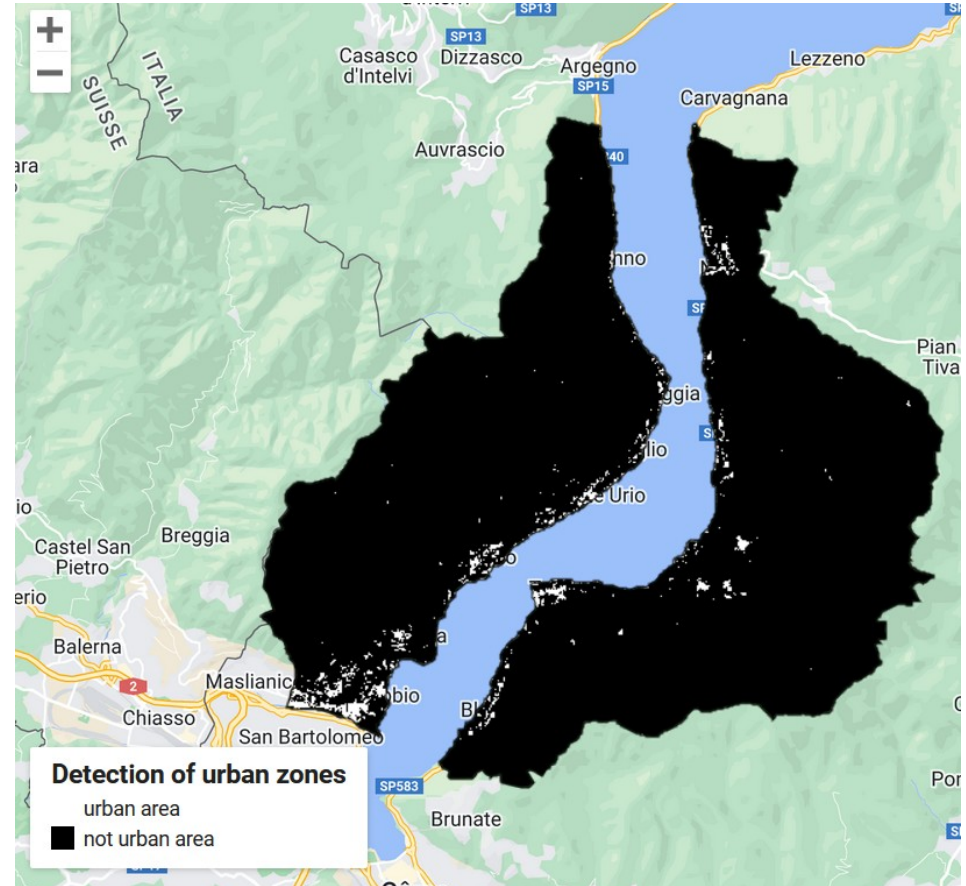


Respective NDVI map

Impact of urbanisation on NDVI



NDVI map

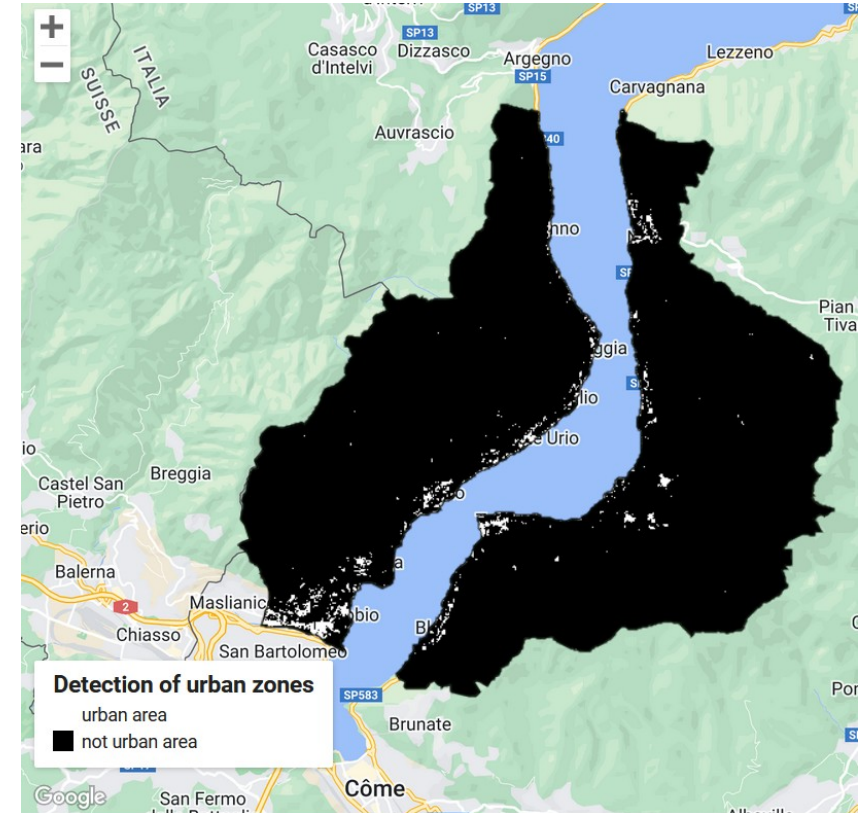


Urban area (white), vegetated area (black)

NDBI

Urban index :

$$\text{NDBI} = (\text{SWIR} - \text{NIR}) / (\text{SWIR} + \text{NIR})$$



In white : pixels with NDBI > 0

Difference between 2021 and 2022



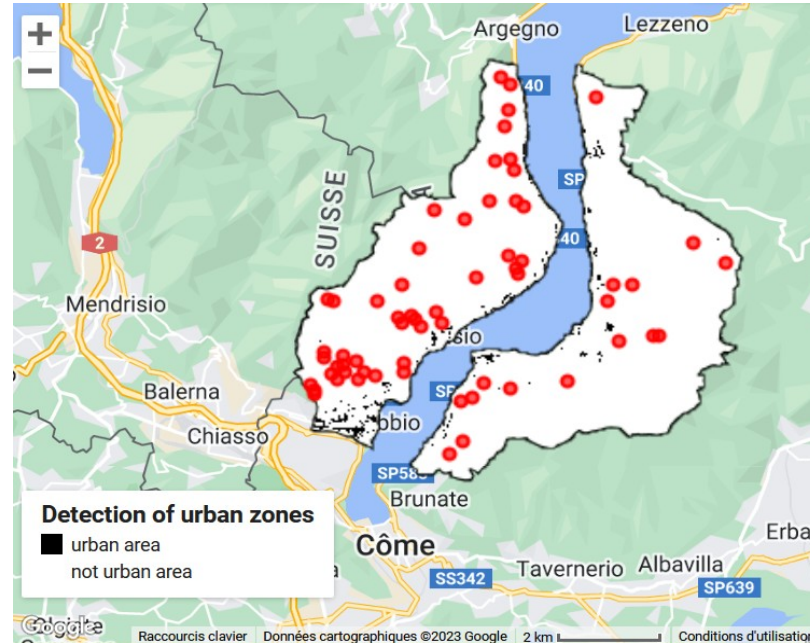
2021 RGB visualisation



2022 RGB visualisation

Data sampling :

62 points were selected by hand outside of the urban area



Map of the sampling cloud of points (red)

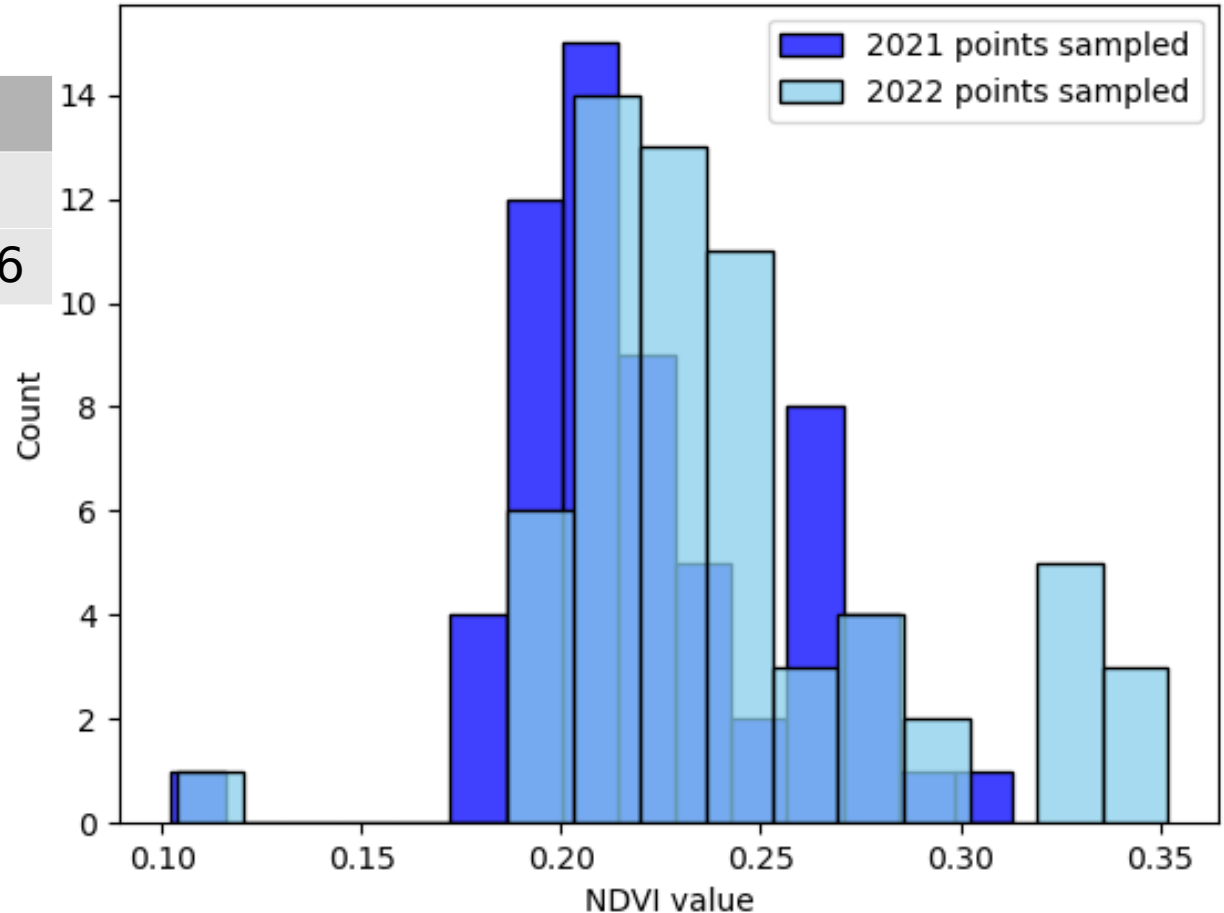
Results of NDVI sampling for both years

Year	2021	2022
Mean	0.22183	0.24205
STD	0.035049	0.045836

Table of the mean and std for NDVI sampling on both years

t-statistic	-2.7373
pvalue	0.0071209
df	122.0

Results of the Student's 2 samples t-test on the sampled data



Histogram of the repartition of NDVI values for both years

Conclusion

- We proved that NDVI can be an indicator of stress response to drought for vegetation
- We showed that NDVI is higher in case of drought
- We could validate the hypothesis that stress response to drought increases the chlorophyll content of plants