EGU General Assembly
Vienna, Austria
14–19 Apr 2024

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Outstanding Student & PhD candidate Presentation contest

MULTISCALE MAPPING AND MONITORING OF GREEN BIODIVERSITY IN URBAN AREAS

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OBJECTIVE

Designing a web-app tool based in Google Earth Engine to explore the relationship between **Urban Tree Cover** and **Land Surface Temperature (LST)** in European cities. In-depth tests were conducted over the city of Milan, Italy.

WORKFLOW in Google Earth Engine

SATELLITE IMAGERY & PRE-PROCESSING

Image collections:
- Landsat 8, 9 T1L2 (L8-9)
- Sentinel 2 L2A (S2)

LST DOWNSCALING & MODEL PERFORMANCE

Random Forest regression
L8-9 TIR (30 m) to a predicted 10 m LST using all S2 bands as predictors + analysis of residuals

LAND COVER MAP & TREE COVER MASKING

ESA World Cover 10m v200
+ City boundaries from the **Functional Urban Area** boundaries dataset (2021)

VEGETATION ANALYSIS

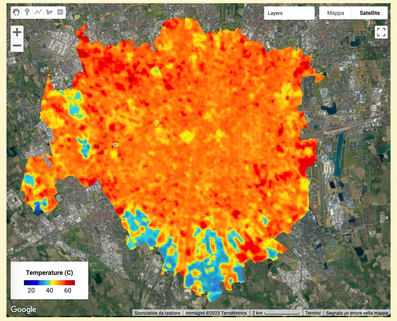
- **Tree cover area %** over the city
- Observed L8-9 vs Predicted S2 **LST on vegetation**
- **NDVI map**

TRY THE APP!

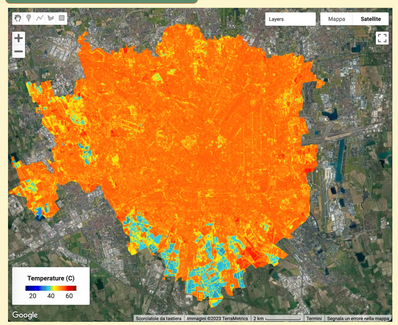
Please keep in mind that this is just a **prototype**! For several European cities, the app provides access to:
- Landsat LST map at 30 m
- Downscaled LST map at 10 m
- Tree cover map
- NDVI map

LST DOWNSCALING & MODEL PERFORMANCE

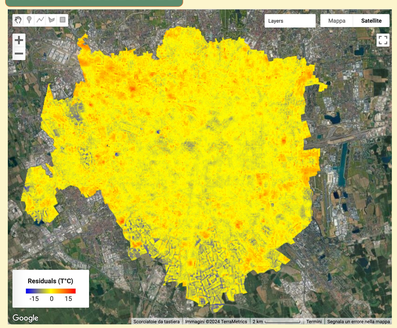
NATIVE LANDSAT LST 30 m



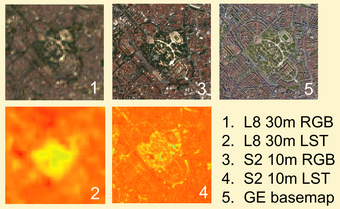
PREDICTED LST 10 m



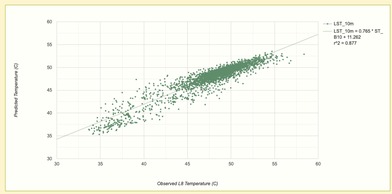
MODEL RESIDUALS

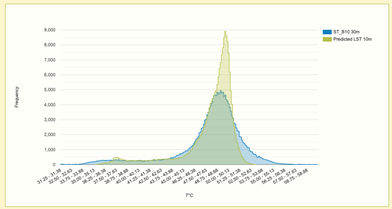


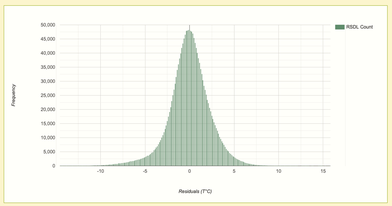
- The downscaling model achieved a R^2 of 0.87 and a RMSE of 1.40°C.
- The residuals are normally distributed and peak around 0.
- In general, predicted LST was coherent with surface type.



1. L8 30m RGB
2. L8 30m LST
3. S2 10m RGB
4. S2 10m LST
5. GE basemap



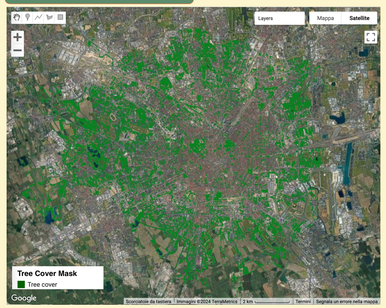


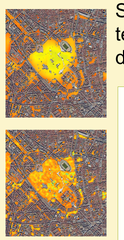


To compute residuals, Landsat LST was resampled at 10m with Nearest Neighbour technique.

VEGETATION ANALYSIS

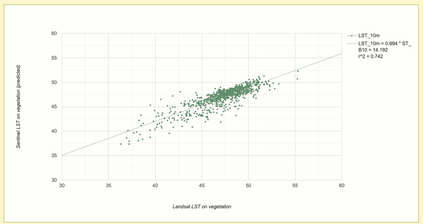
TREE COVER MASK





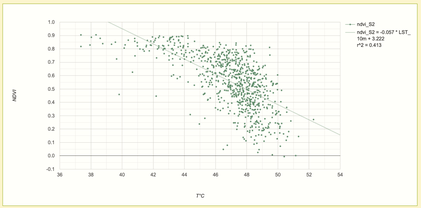
Detail of L8-9 and S2 LST on tree cover

The tree cover mask was used on both L8-9 and S2 LST maps to check the accordance between temperatures on vegetation. The R^2 slightly decreases if compared to the general model.



NDVI MAP

The Tree Cover NDVI dramatically decreases with increasing T°C. The images besides shows the visual difference between a managed urban park and two former industrial sites where spontaneous vegetation colonized back the area.



TAKEAWAYS & FUTURE WORK

- The downscaling model allows to better visualise LST patterns over smaller urban features.
- A more thorough analysis on vegetation is needed to assess specific variations of LST and NDVI connected to the green area type and its surroundings.
- How to implement the analysis of vegetation biodiversity?
  → The application should allow the upload of a point data shapefile containing individual tree species (e.g., coming from municipal tree registers, open street map or ground surveys).

Gorelick, N., Hancher, M., Dixon, M., Ilyushchenko, S., Thau, D., & Moore, R., 2017. Google Earth Engine: Planetary-scale geospatial analysis for everyone. Remote Sensing of Environment, 202, 18–27.
Označillová, K., Gallay, M., Paluba, D., Péliová, A., Tokarčík, O., & Laubertová, D., 2022. Combining Landsat 8 and Sentinel-2 Data in Google Earth Engine to Derive Higher Resolution Land Surface Temperature Maps in Urban Environment. *Remote Sensing*, *14*(16), Article 16.
Geoportal of the European commission, 2022. Urban Audit 2021-Area Management-Dataset. *Administrative boundaries: ©EuroGeographics ©FAO (UN) ©TurkStat.*

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MUR Ministero dell'Università e della Ricerca
Finanziato dall'Unione europea NextGenerationEU

Funder: Project funded under the National Recovery and Resilience Plan (NRRP), Mission 4 Component 2 Investment 1.4 - Call for tender No. 3138 of 16 December 2021, rectified by Decree n.3175 of 18 December 2021 of Italian Ministry of University and Research funded by the European Union NextGenerationEU;
Award Number: Project code CN_00000033, Concession Decree No. 1034 of 17 June 2022 adopted by the Italian Ministry of University and Research, CUP, H43C22000530001 Project title "National Biodiversity Future Center - NBFC"