

# Connecting Clim-Activism Practices: A Collaborative Platform for Mapping Urban Heat Islands

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# Clim-Activism



## What is Climate Activism?

Bridging science and activism to tackle the climate crisis.



## Our Mission:

Empower communities with science-based tools to drive systemic change.



## Team:

Collaboration of activists, Ph.D. students and researchers from different Italian universities.



## Focus:

Addressing urban heat islands (UHIs) through participation and transdisciplinary approaches.

RECLAIM  
THE  
TECH



# Open Data and Accessibility

- Open-source tools
- The opportunity to replicate and adapt the work
- Integrate geospatial statistical analysis capable of detailing the distribution of surface temperatures
- User-Friendly Website



# Why Urban Heat Islands (UHIs)?

- Rising Urban Populations: Two-thirds of the global population in cities by 2050.
- Public Health Impacts: Vulnerable groups face increased heat-related illnesses.
- Climate Change Amplification: Urban areas intensify greenhouse gas emissions.
- Environmental Consequences: Ecosystem and air quality degradation.
- Economic Costs: Higher cooling demands and infrastructure damage.

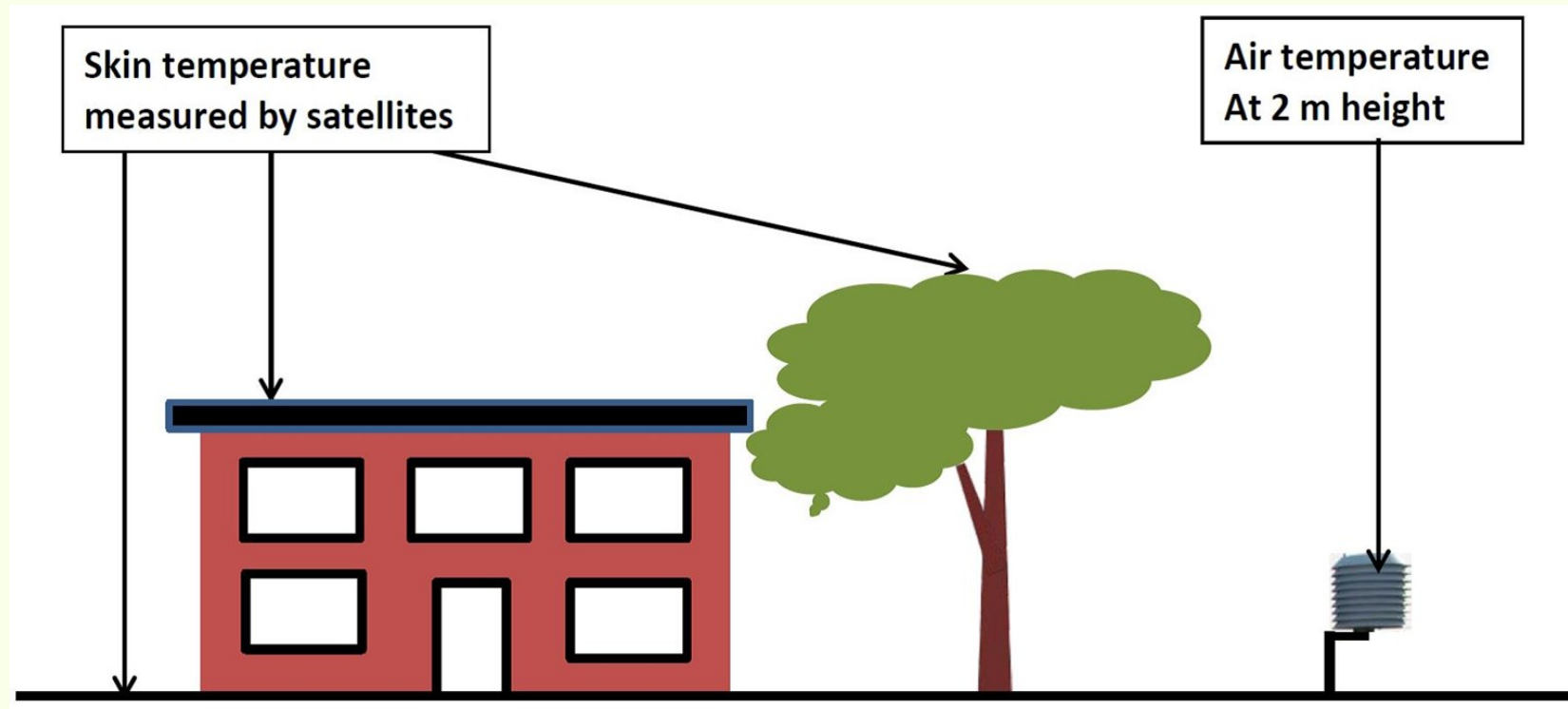


# Thermal comfort measurements

Thermal comfort is given by **air temperature**, humidity, wind speed, solar radiation and **thermal radiation of surfaces**



Measurement of thermal radiation emitted by surfaces ( $\lambda$  3–14  $\mu\text{m}$ ): *Land Surface Temperature (LST)*



Source: EUSTACE

Air temperature measurement ~ 2 m above ground ( $T^{\circ}\text{C}$ )

# Why use satellites?

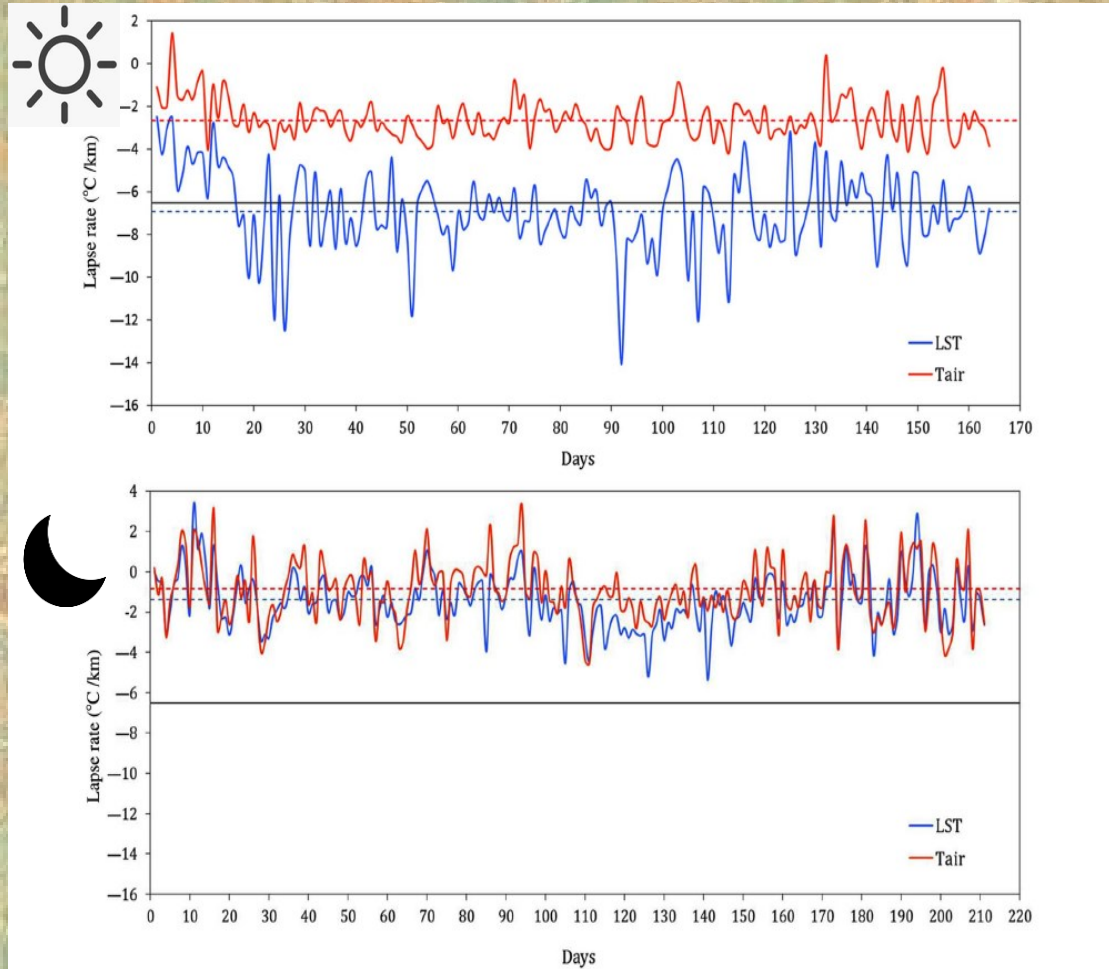
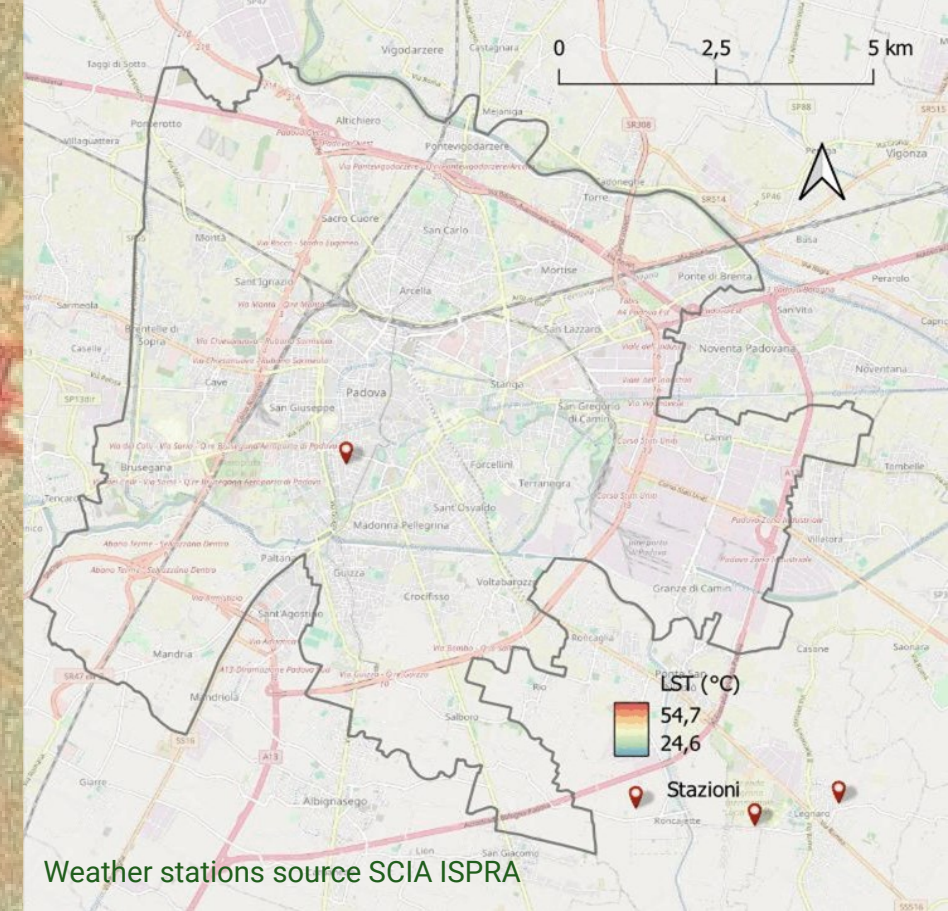


Fig. 5. Lapse rates of  $T_{air}$  and  $LST_{inst}$  at the time of MODIS Aqua daytime (top) and nighttime (bottom) overpass during 2012, at the Sheep Range. Note: there are missing days because of cloudy conditions or missing data in MODIS LST data. The dashed line marks the lapse rate overall means, and the solid line marks the  $-6.5$  °C lapse rate.

Satellites offer numerous advantages:

- $T_{air}$  and LST are strongly correlated
- satellites have continuous spatial coverage
- uniformly acquired data
- availability of time series



They make it possible to accurately characterise the urban thermal environment

Mutiibwa D., Strachan S. and Albright T., "Land Surface Temperature and Surface Air Temperature in Complex Terrain," in IEEE Journal of Selected Topics in Applied Earth Observations and Remote Sensing, vol. 8, no. 10, pp. 4762-4774, Oct. 2015, doi: 10.1109/ISTARS.2015.2468594

# The prototype...

```
RStudio
File Edit Code View Plots Session Build Debug Profile Tools Help
Go to file/function Addins
UHI_v3.R* x
Source on Save
46
47 #loading packages
48 for(package.i in list.of.packages){
49   suppressPackageStartupMessages(
50     library(package.i,character.only = TRUE))
51 }
52
53 #####
54 ##                               SETUP                               ##
55 #####
56 # SCRIVERE QUI LA CITTA DI INTERESSE
57 citta <- "Bologna"
58 # SCRIVERE QUI IL PERCORSO DELLA CARTELLA DI LAVORO (A SCELTA)
59 percorso <- "H:/shortcut-targets-by-id/1CL6-2-JcQe_EHEmXTKhTwfCNXBros6cc"
60 # IMPOSTA LA STAGIONE DI INTERESSE
61 stagione <- "estate" # oppure "inverno"
62 #####
63
64 ### Imposta e crea struttura cartelle
65 cartella <- file.path(percorso,citta)
66 input <- file.path(cartella,"Input")
67 landsat <- file.path(input,"Landsat")
68 output <- file.path(cartella,"output")
69 processing <- file.path(cartella,"Processing")
70 dir.create(cartella, showwarnings = FALSE)
71 dir.create(input, showwarnings = FALSE)
72 dir.create(landsat, showwarnings = FALSE)
73 dir.create(output, showwarnings = FALSE)
74 dir.create(processing, showwarnings = FALSE)
75
76 #### sezione 1 - Dati di input #####
77
```

an open platform based  
on a scientific and  
reproducible workflow  
through open data and  
technology hacking

The user has to provide  
only three inputs  
Additional customization  
planned

Automation of:  
Download  
Processing  
Visualisation



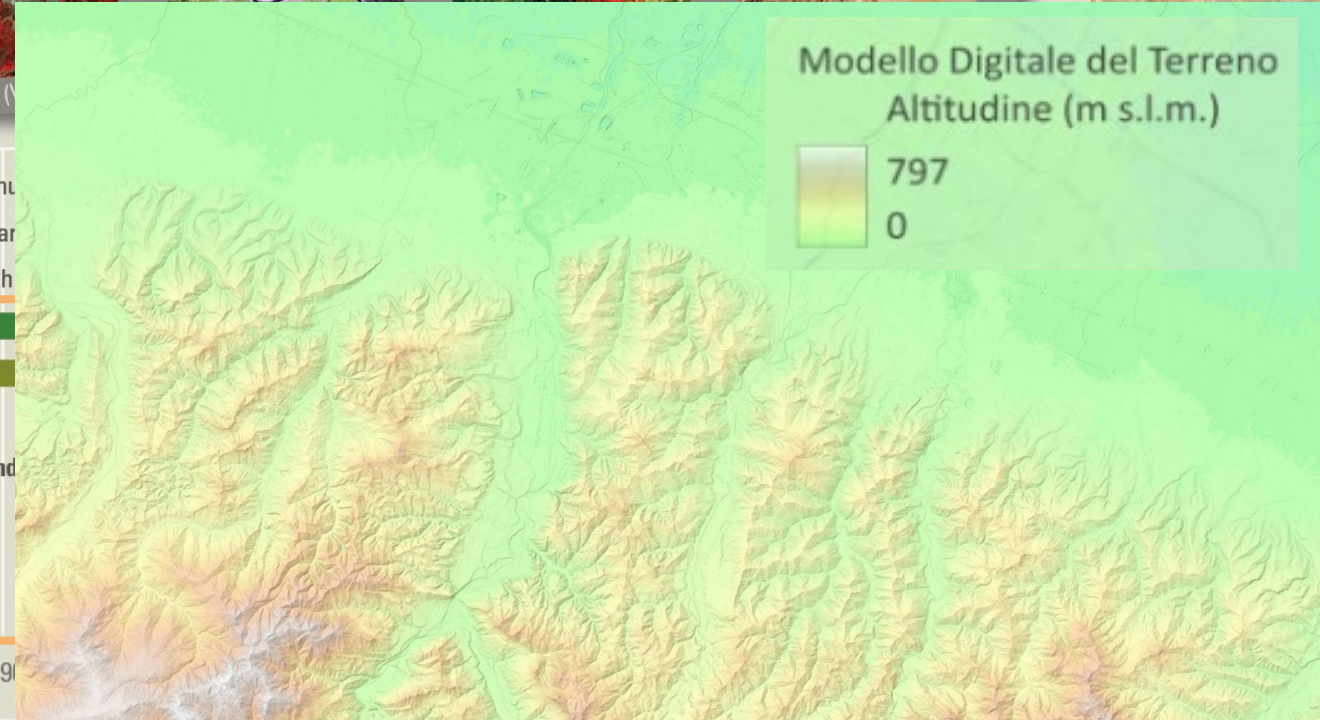
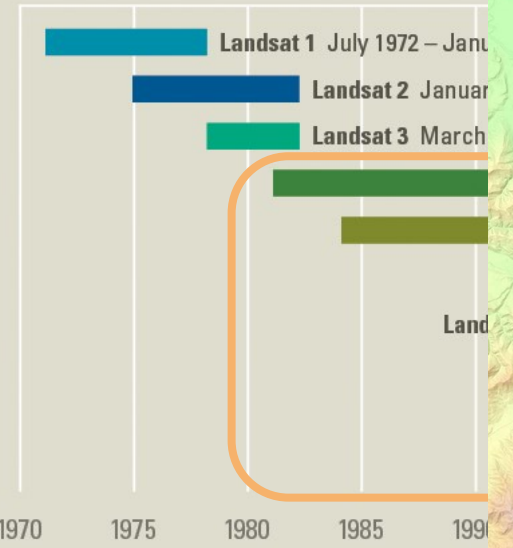
# The data used

OpenStreetMap    Tracciati GPS

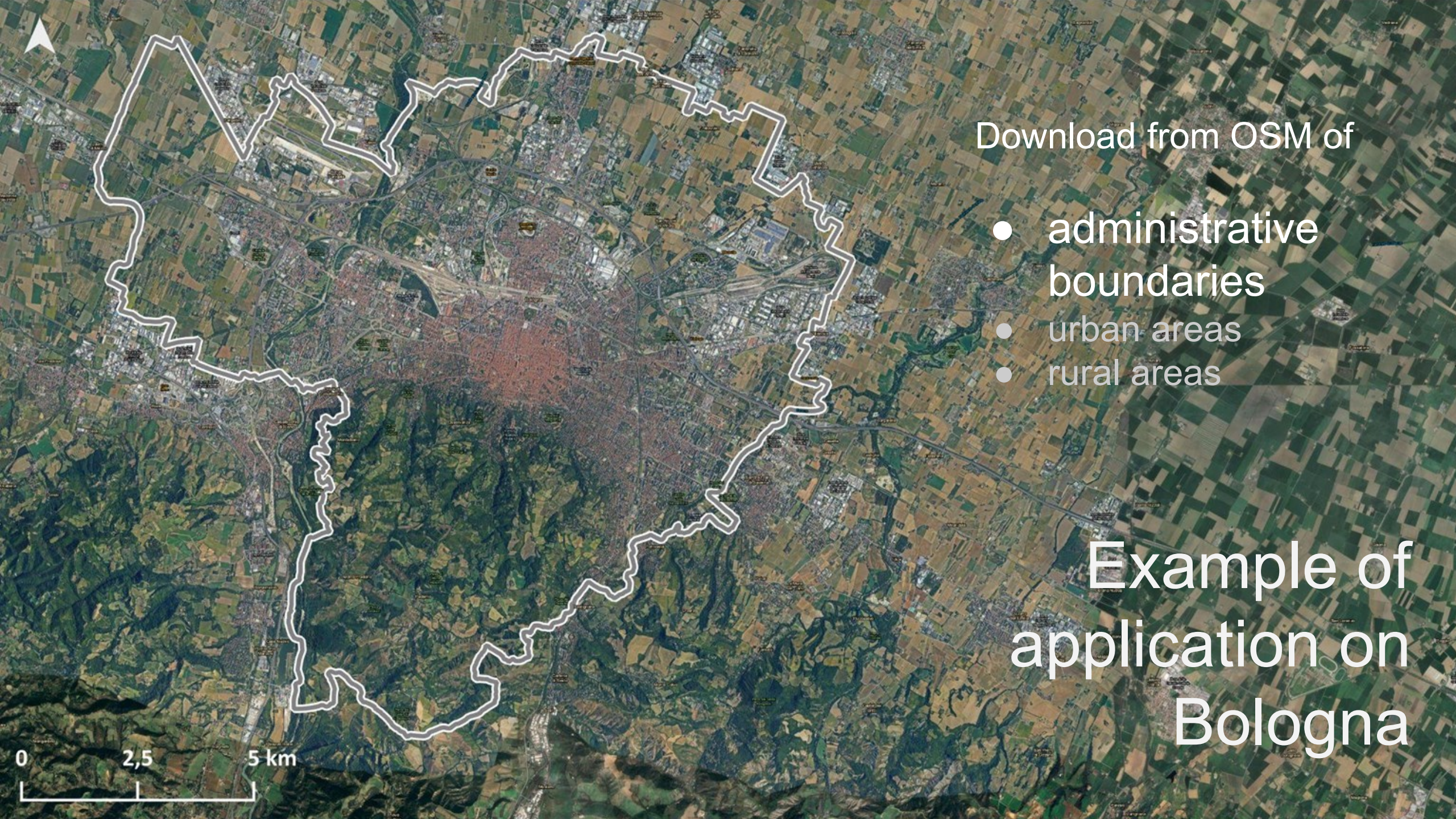
Cerca  Dove si trova?



## Landsat Missions: Imaging the Earth Since 1972





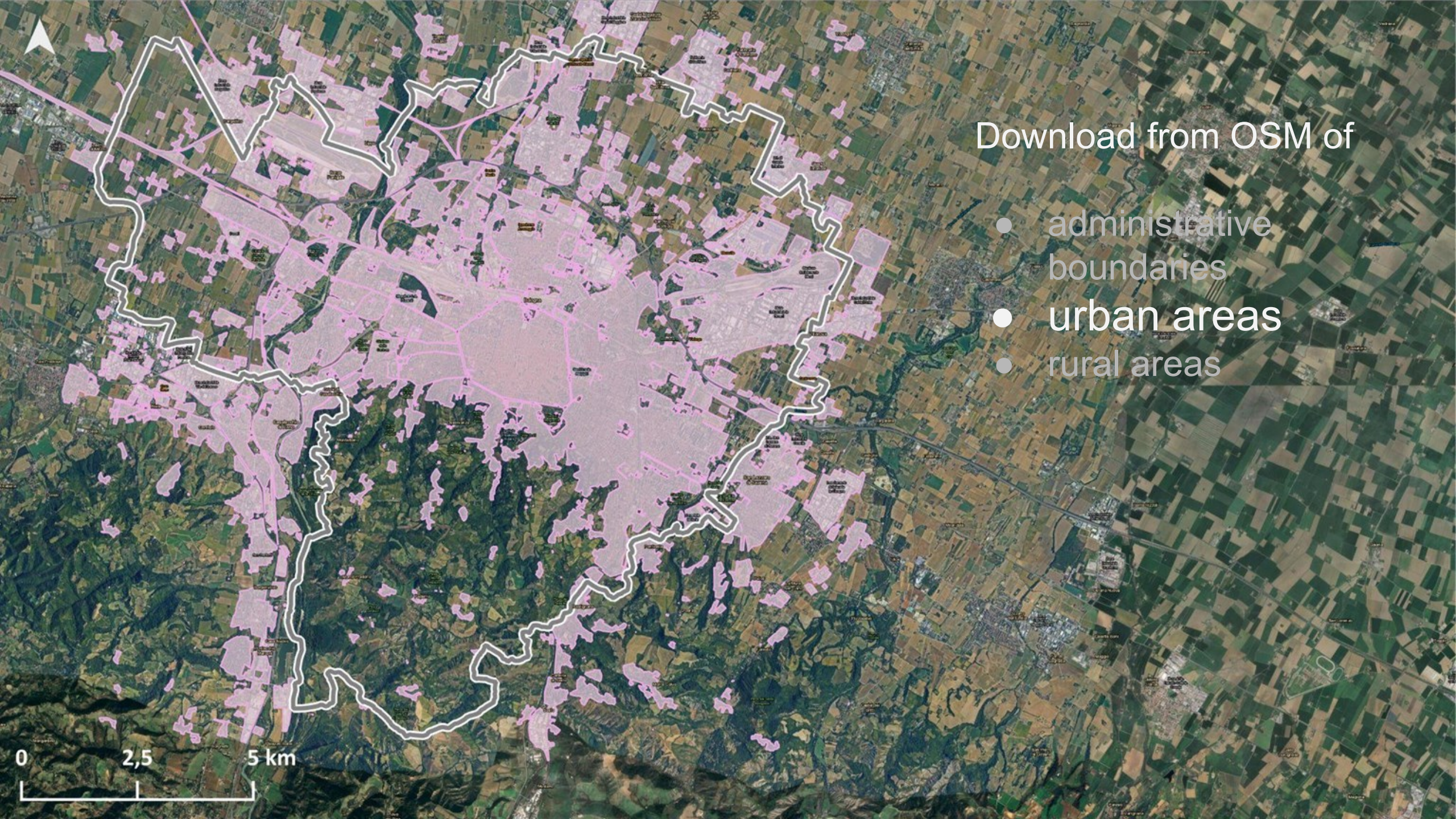


Download from OSM of

- administrative boundaries
- urban areas
- rural areas

Example of  
application on  
Bologna

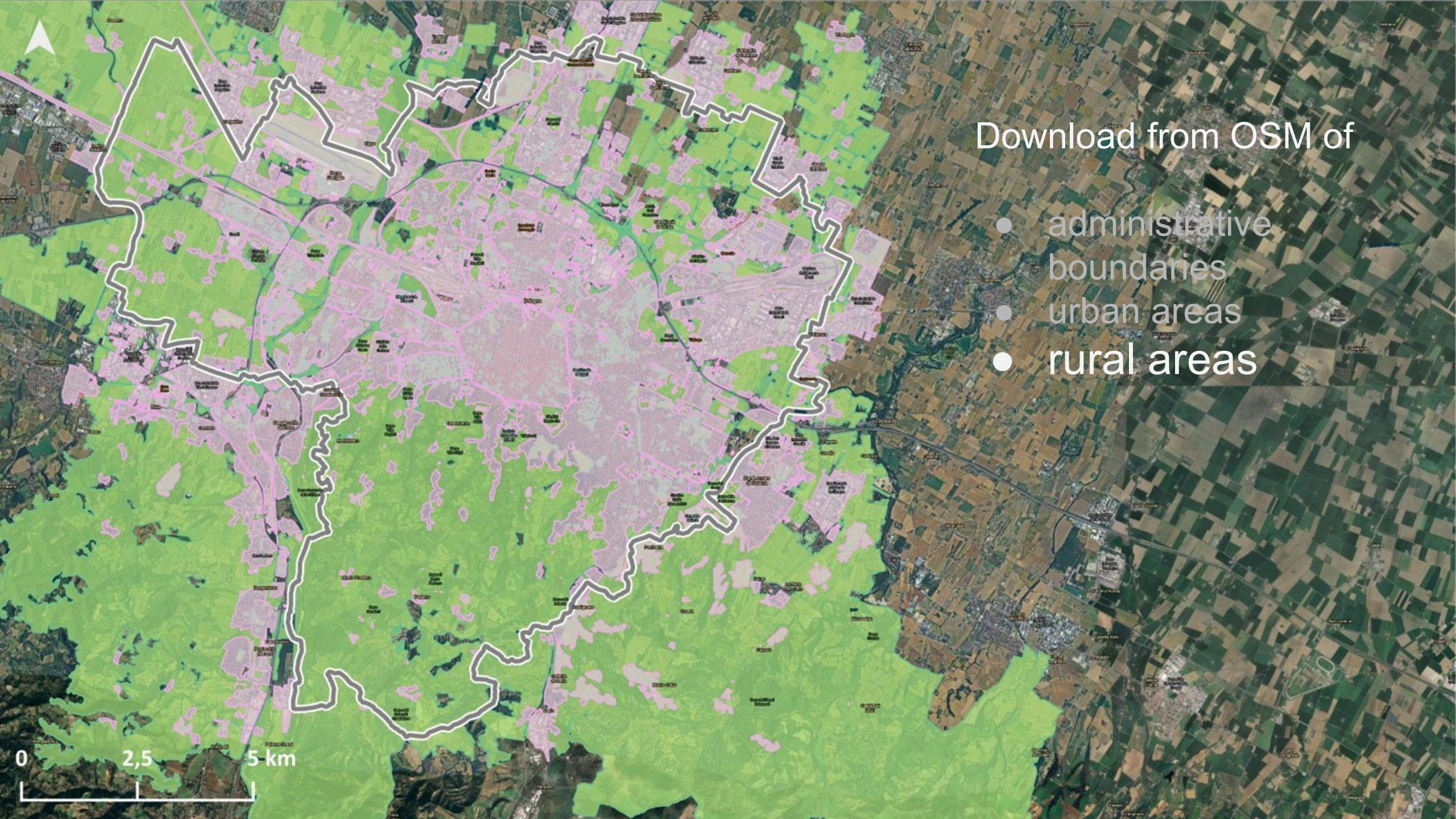
0 2,5 5 km



Download from OSM of

- administrative boundaries
- urban areas
- rural areas

0 2,5 5 km

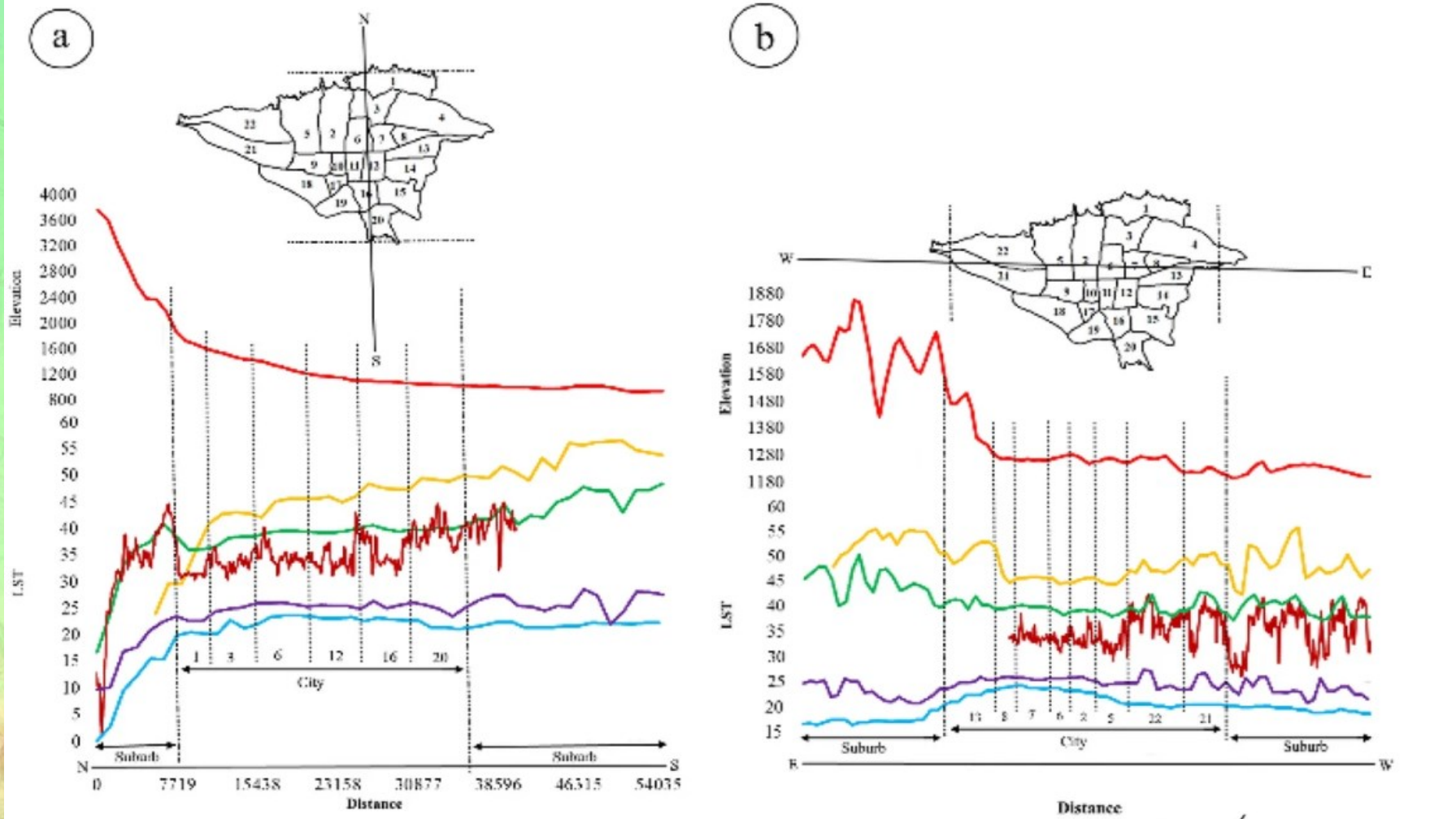


Download from OSM of

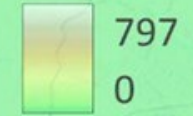
- administrative boundaries
- urban areas
- rural areas

0 2,5 5 km

# The relationship between altitude and two variables, LST and UHI



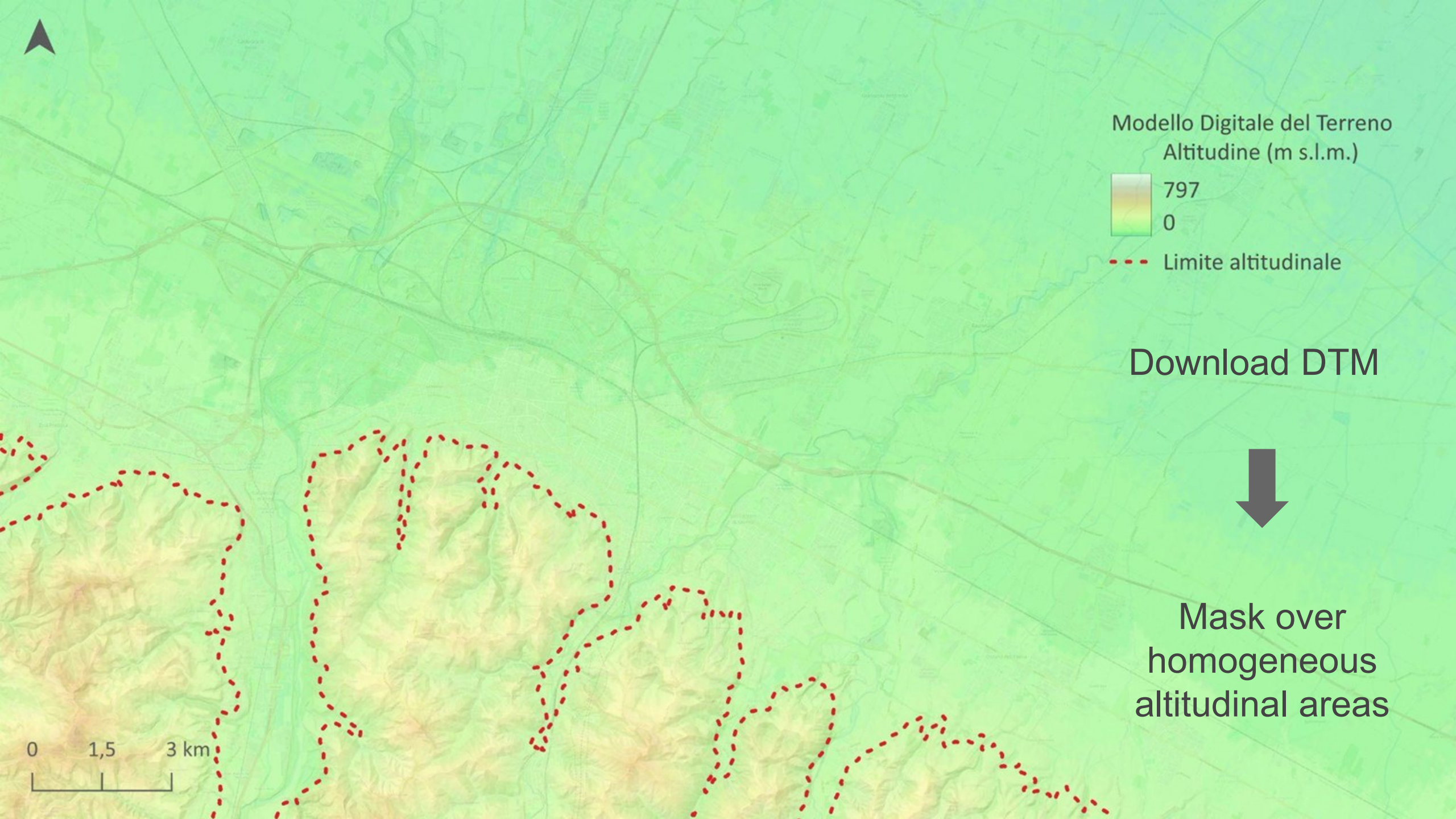
Modello Digitale del Terreno  
Altitudine (m s.l.m.)



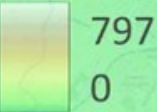
Download of a  
Digital Terrain  
Model (DTM)

Zargari, M., Mofidi, A., Entezari, A. et al. Climatic comparison of surface urban heat island using satellite remote sensing in Tehran and suburbs. *Sci Rep* 14, 643 (2024). <https://doi.org/10.1038/s41598-023-50757-2>





Modello Digitale del Terreno  
Altitudine (m s.l.m.)

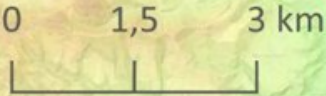


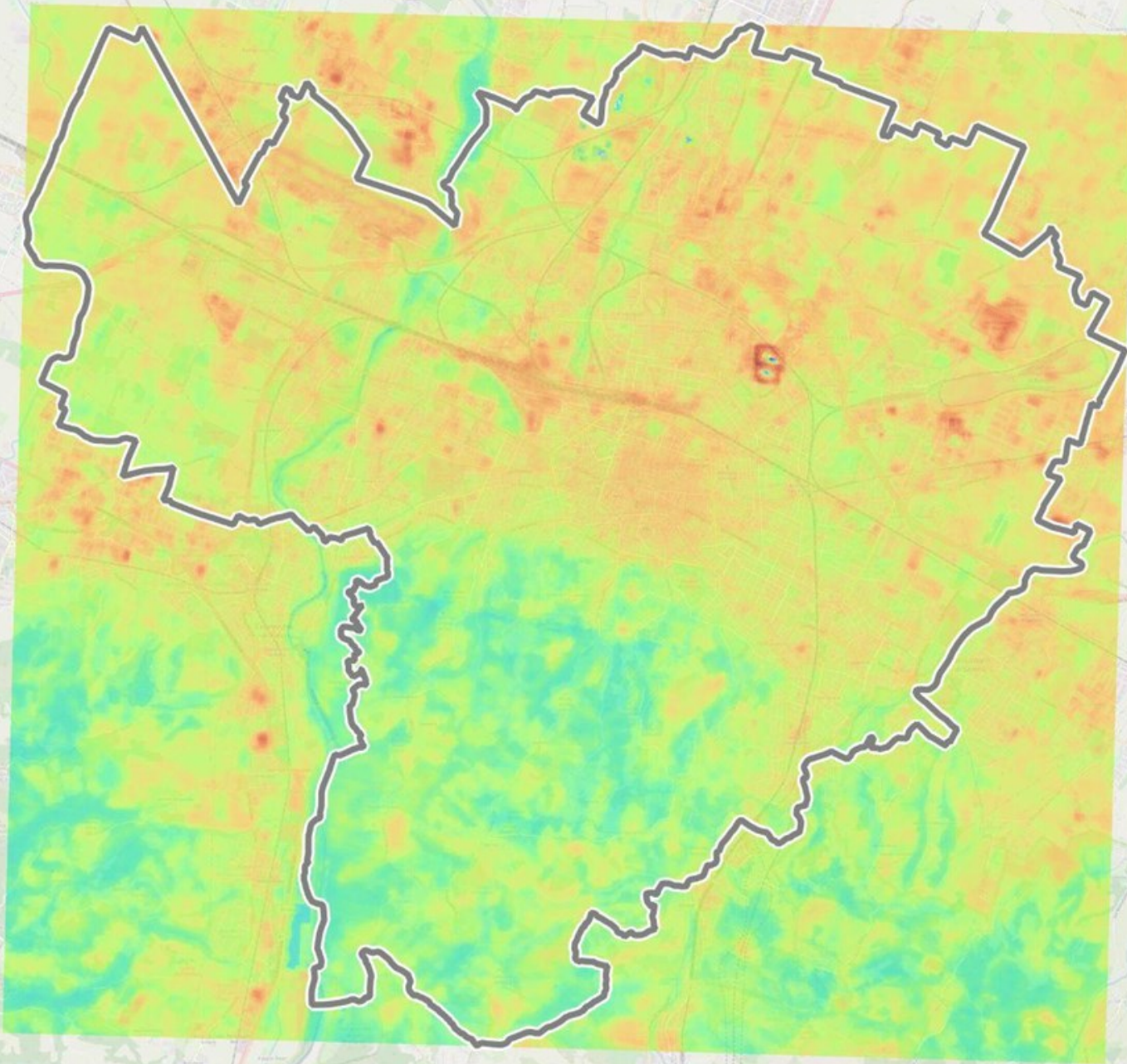
--- Limite altitudinale

Download DTM



Mask over  
homogeneous  
altitudinal areas

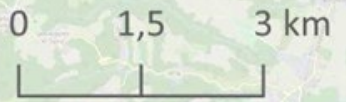


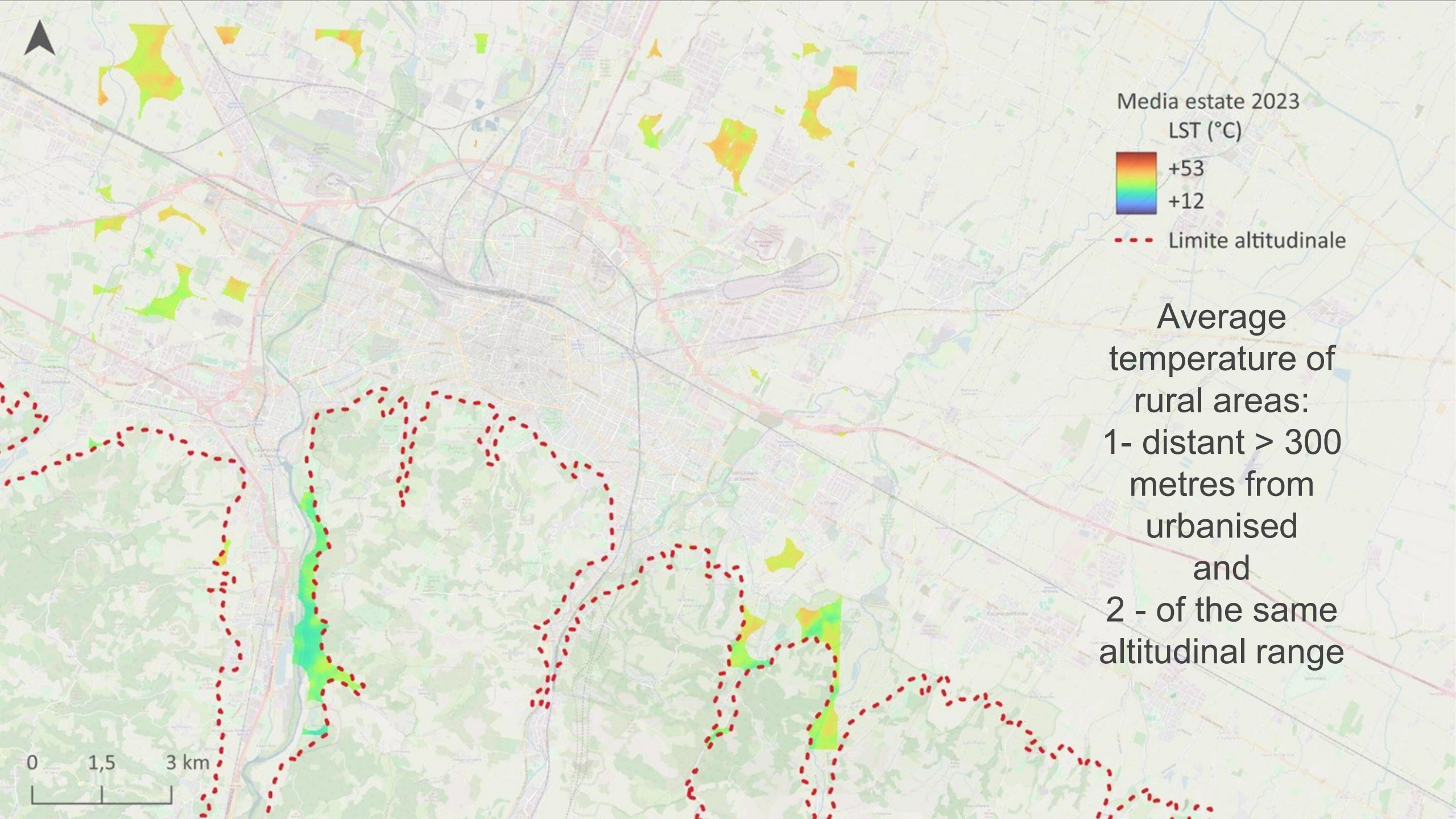


Media estate 2023  
LST (°C)



Download and  
processing from NASA  
portal of  
**Landsat**  
Collection 2 Level 2



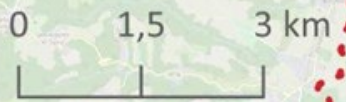


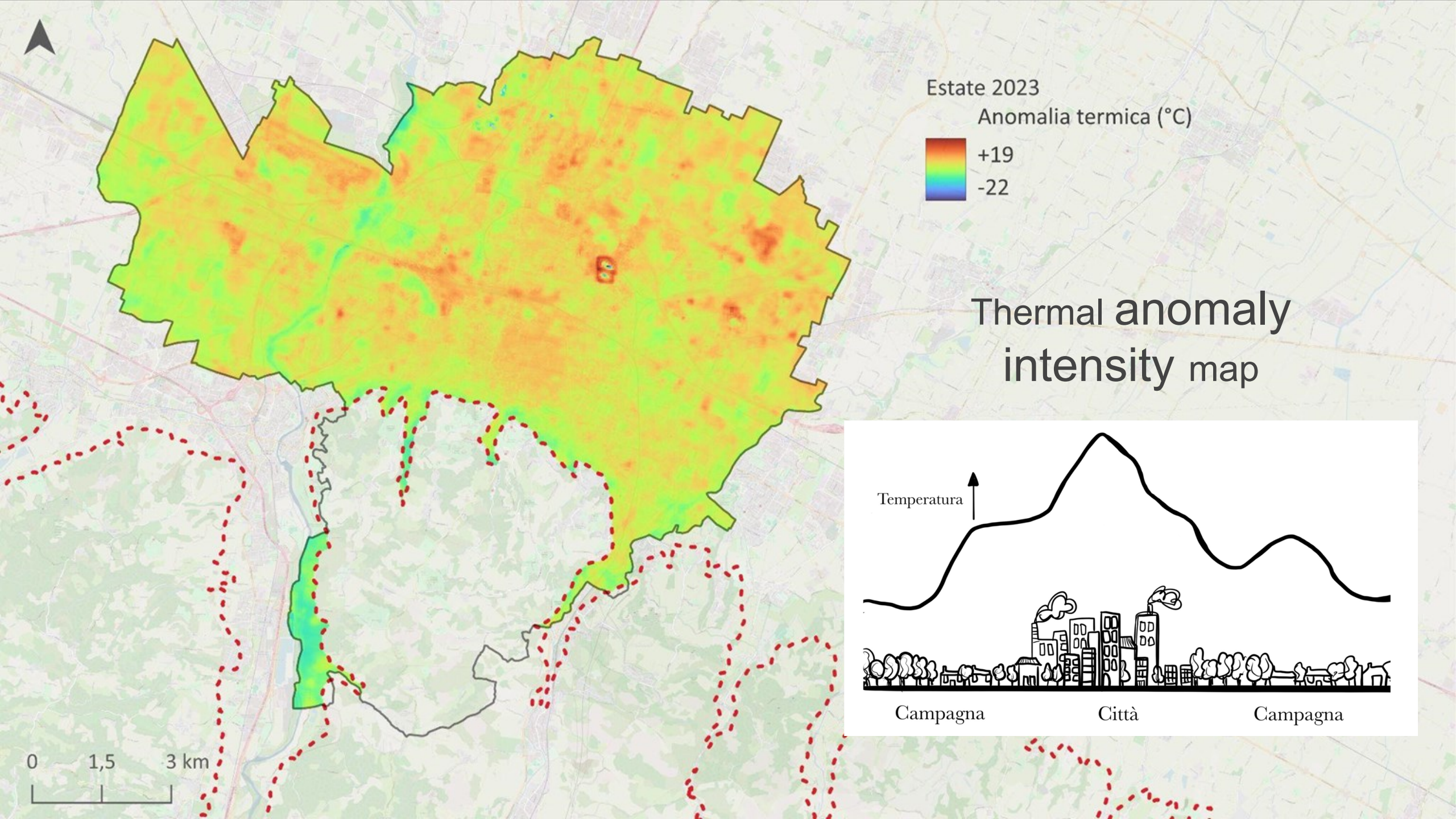
Media estate 2023  
LST (°C)



--- Limite altitudinale

Average  
temperature of  
rural areas:  
1- distant > 300  
metres from  
urbanised  
and  
2 - of the same  
altitudinal range

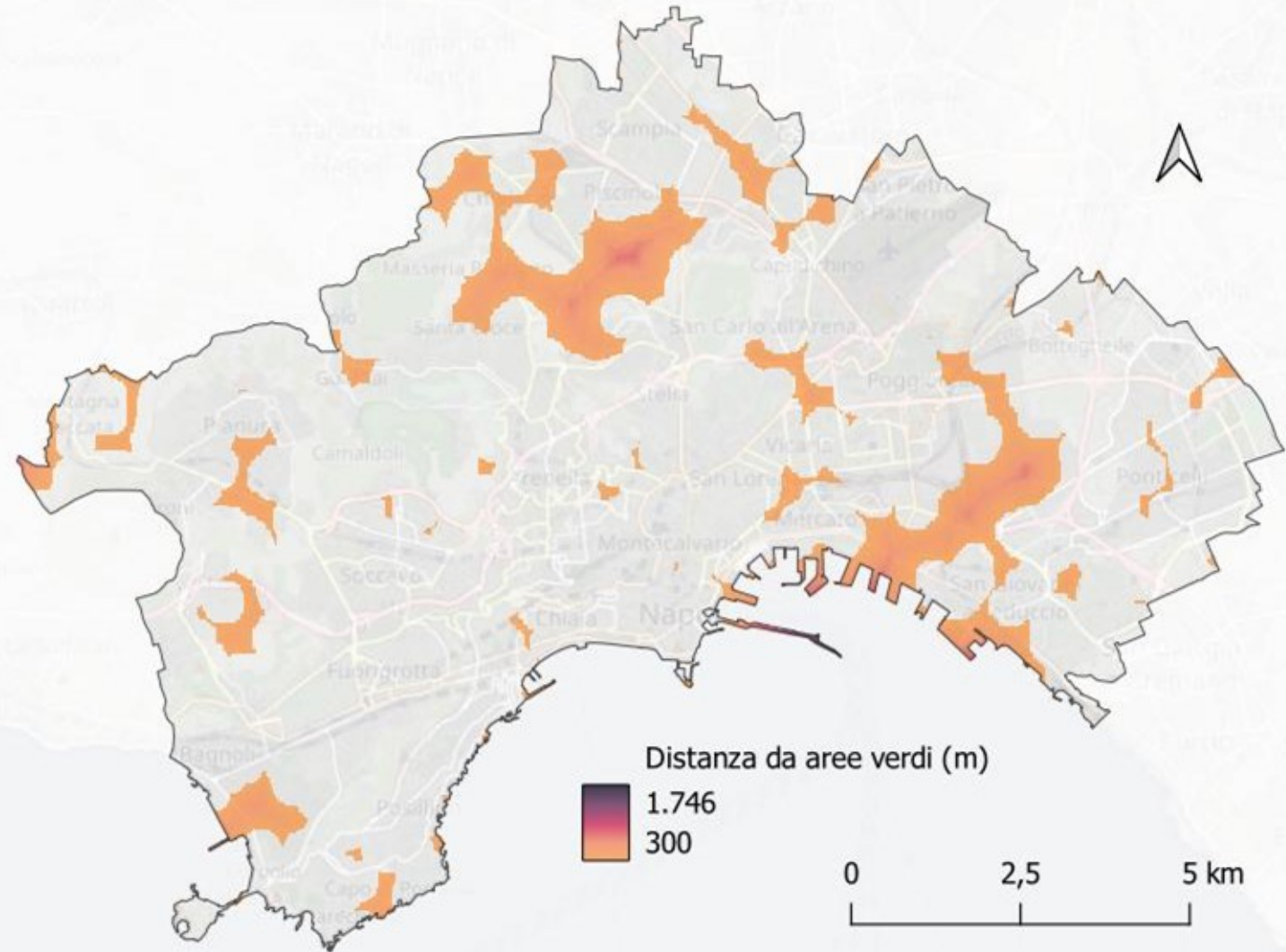
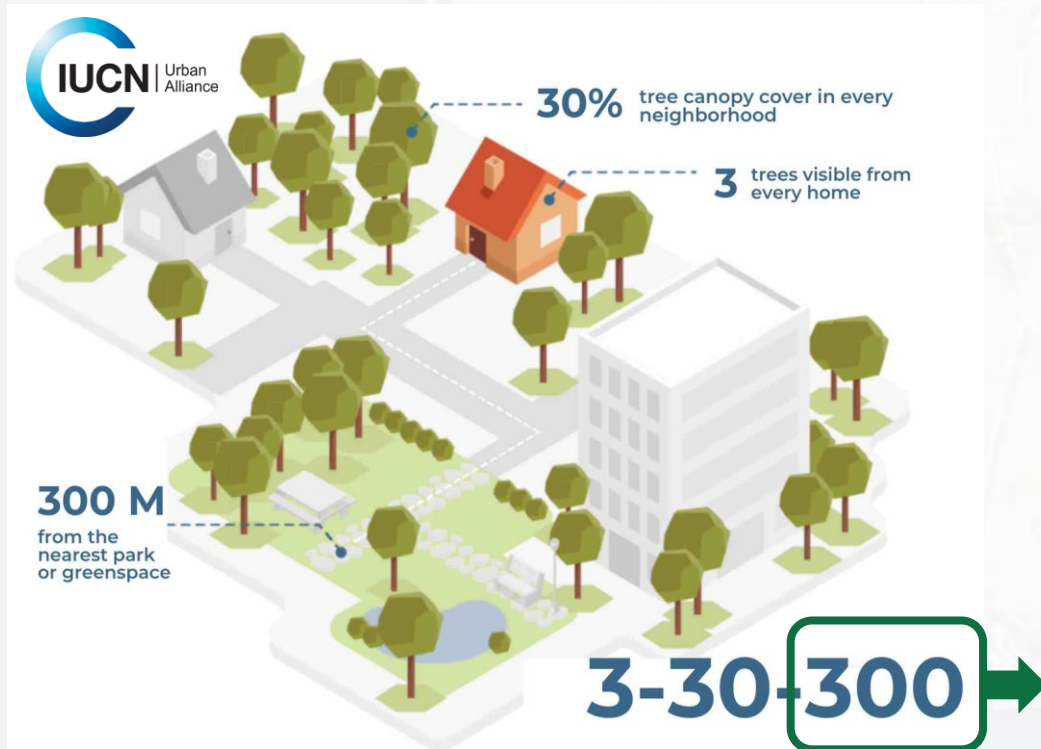






# A flexible of tools to guide planning...

Example on Naples



# Intersectionality and Social Impact

- Open-source tools
- The opportunity to replicate and adapt the work
- Integrate geospatial statistical analysis capable of detailing the distribution of surface temperatures
- User-Friendly Website



# Call to Action

The goal is to grow the network, adding new skills, data, and perspectives.

Our dream is to create a collaborative platform that not only maps urban heat islands but also becomes a reference point for climate adaptation and social climate justice.



**Thank  
you for  
your  
attention**

**Q&A**

**For suggestions /  
getting involved /  
synergies with other  
projects**

**Contacts:**

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[letizia.caroscio2@studio.unibo.it](mailto:letizia.caroscio2@studio.unibo.it)