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CONVEGNO
**LE GRANDI SFIDE URBANE: CAMBIAMENTI
CLIMATICI E QUALITÀ AMBIENTALE**
ROMA 31 marzo 2015



Climate Vulnerability Map of Rome 1.0

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The extreme rain event of 2014.01.31 in Rome

Cumulated mm. of rain in hours

Rilevamento di	12:00	18:00	21:00	24:00
Monte Mario	153,8	167,0	173,4	181,8
Flaminio	106,8	115,8	122,4	129,6
Massimina	135,8	150,0	157,4	166,0
Riano	139,0	160,0	167,2	177,6





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The extreme rain event of 2014.01.31 in Rome - Labaro





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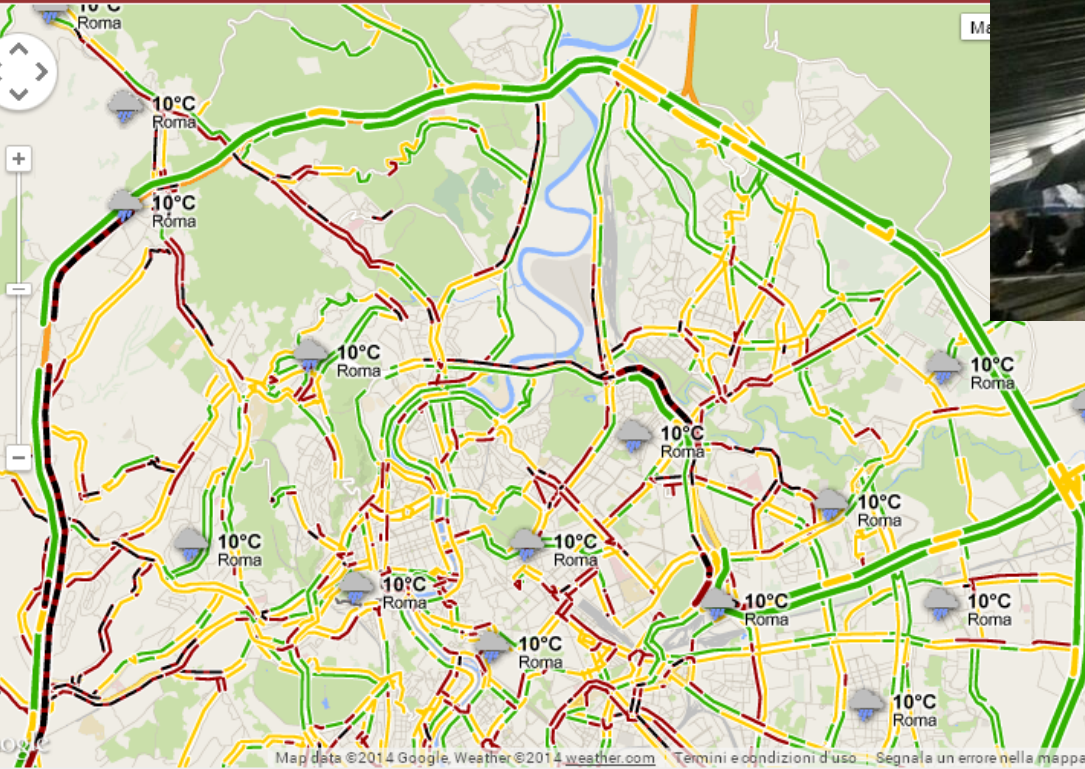
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The extreme rain event in Rome 2014.01.31

Map of the infrastructures blocked from floods and landslides www.automap.it



Grande Raccordo Anulare di Roma





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Climate Vulnerability Map of Rome 1.0



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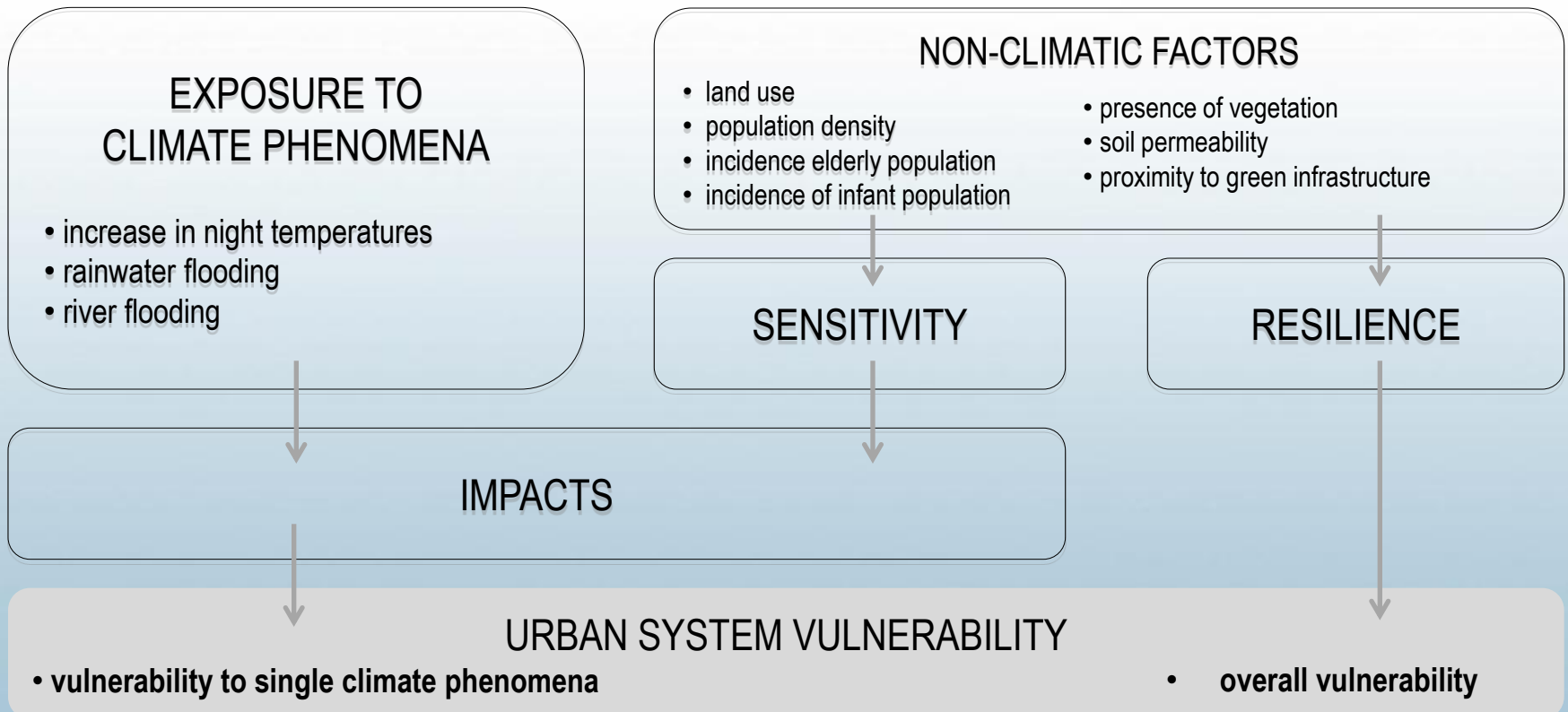
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Methodology

The chosen methodology is similar, though simplified and adapted to the urban scale, to the one used in the research *Climate Change and territorial effect on regions and local economies*, developed within the ESPON 2013 Programme





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Spatial Units (SU)

MultiNet road network database

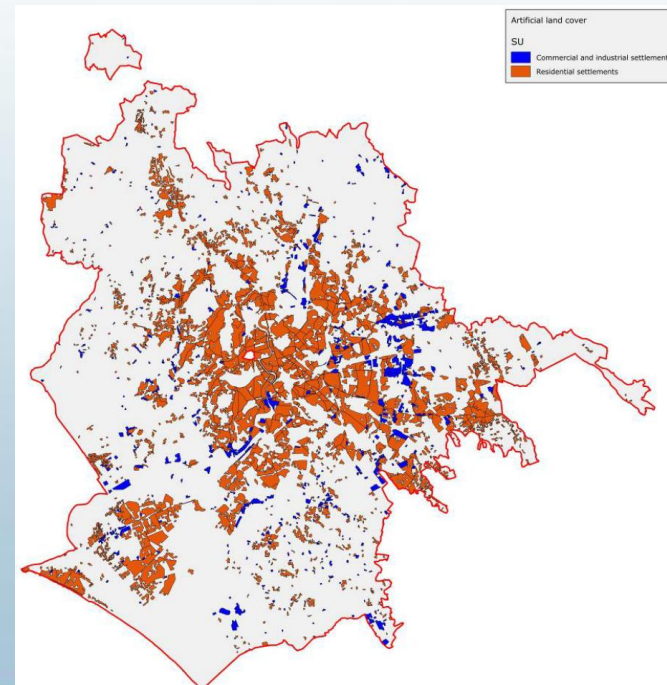
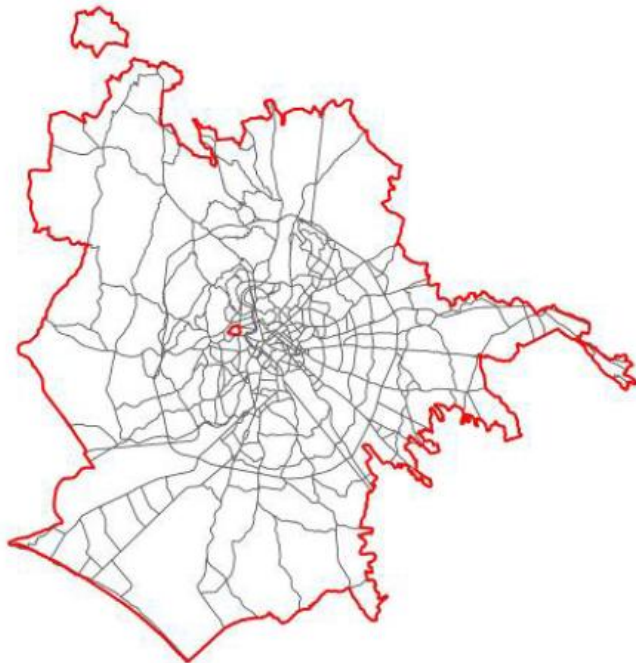
The identified Spatial Units to build up the CVMR 1.0 are the minimum spatial subdivisions of the built-up environment of Rome.

They are obtained intersecting:

-the Land Cover Map of Regione Lazio, able to render the building density and continuity characteristics;

- the MultiNet road network database, useful for further subdividing the above land cover units in order to obtain a finer result.

Land Cover Map of Regione Lazio





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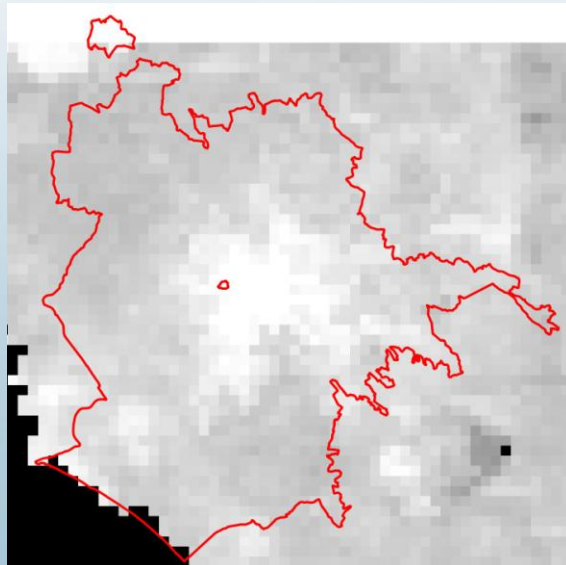
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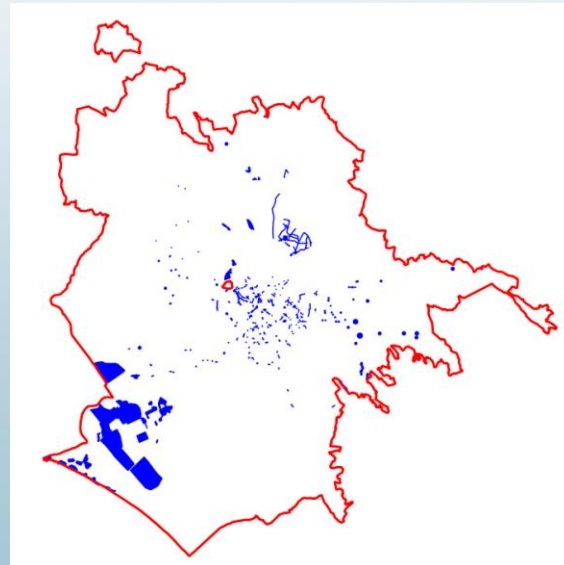
CVMR 1.0

Exposure

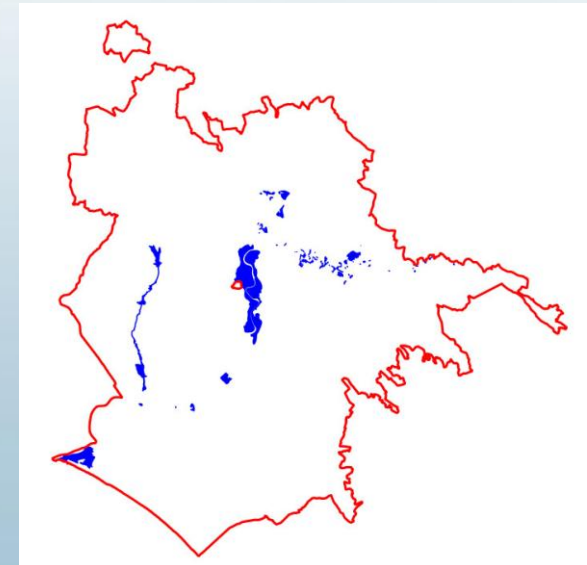
Ground temperatures observed by MODIS satellite on 14th-08-2003 at 9,30 pm. Approximate value of exposure to UHI.



Heavy rainwater flooding observed by the civil protection department between 2004 and 2007. Approximate value of exposure to extreme rainwater flooding.



Flood risk according to the Basin Authority of the Tiber river. Approximate value of exposure to river flooding.





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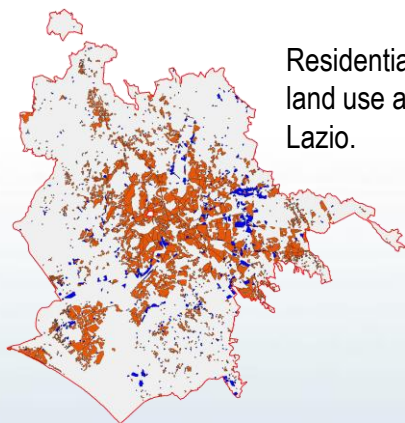


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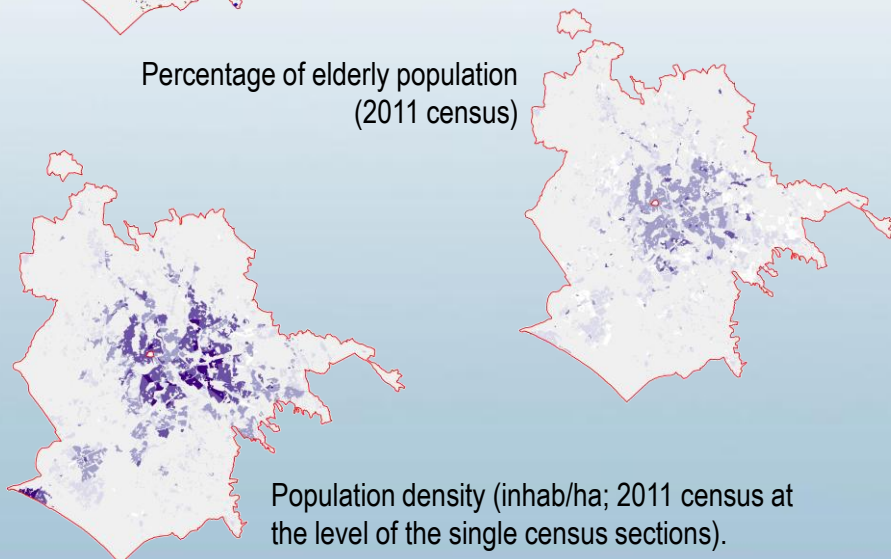


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Sensitivity

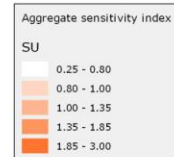
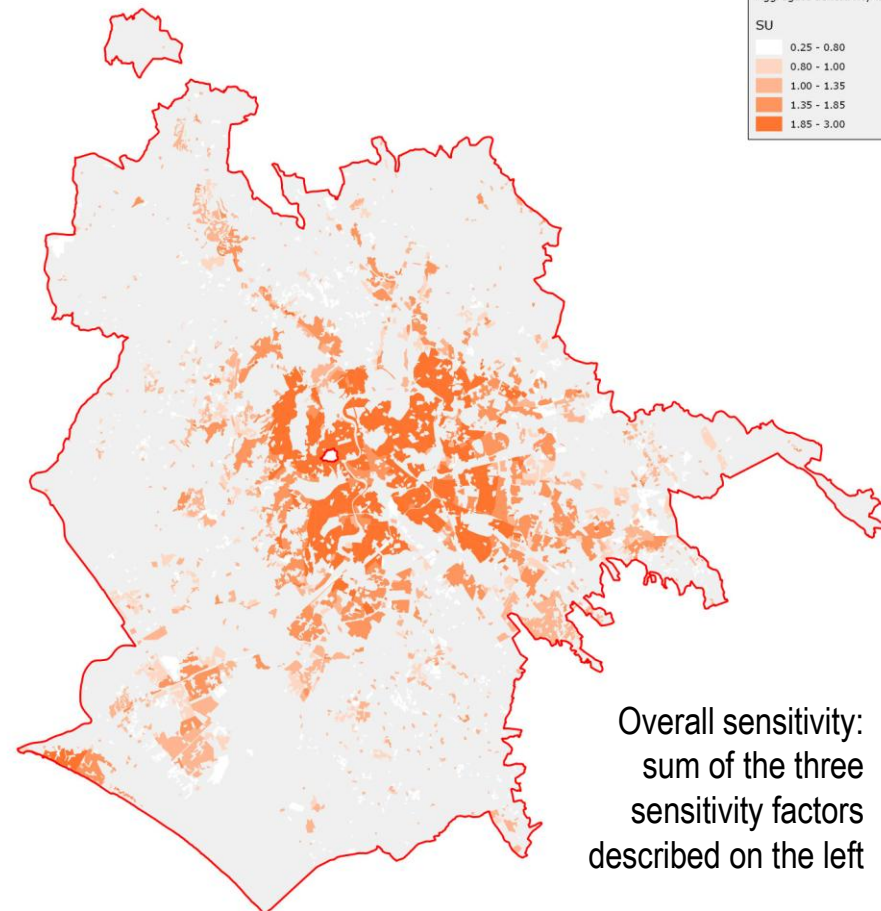


Residential, commercial and industrial land use as shown in CUS Regione Lazio.



Percentage of elderly population (2011 census)

Population density (inhab/ha; 2011 census at the level of the single census sections).



Overall sensitivity: sum of the three sensitivity factors described on the left



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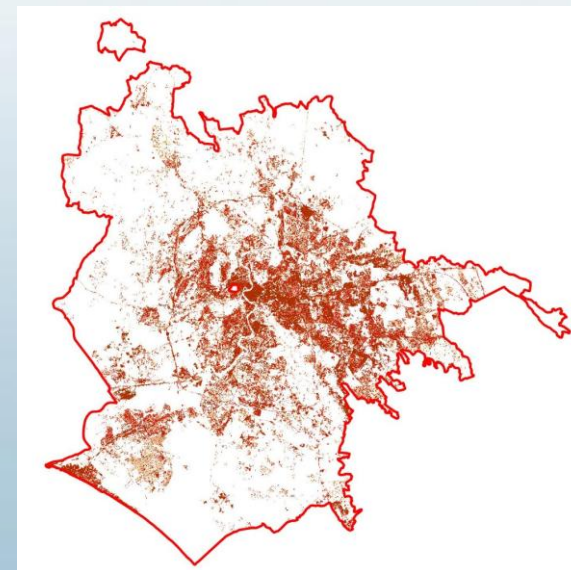
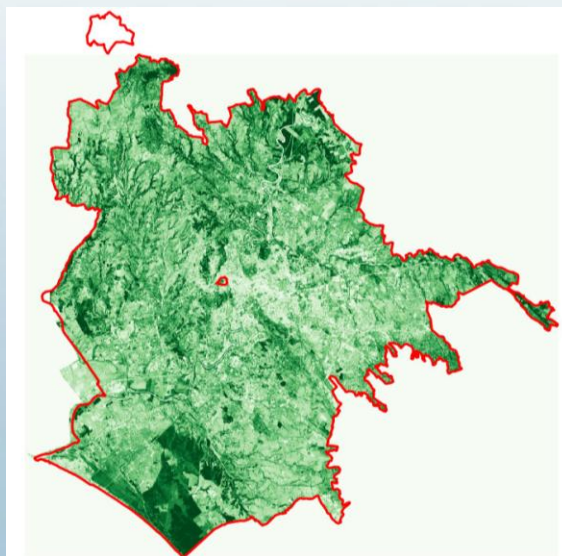
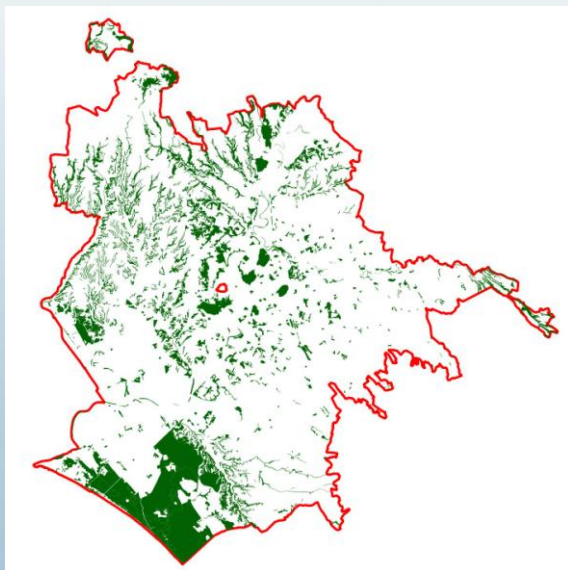
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Resilience

Green infrastructure: green core areas as shown in CUS Regione Lazio. Calculated as **proximity** of SUs to green areas.

NDVI calculated from a Landsat 8 satellite image from 2013.07.27th. Calculated as an indicator of the presence of **green areas**.

Soil sealing elaborated by the EEA. The reversed value is calculated as an indicator of **soil permeability**.



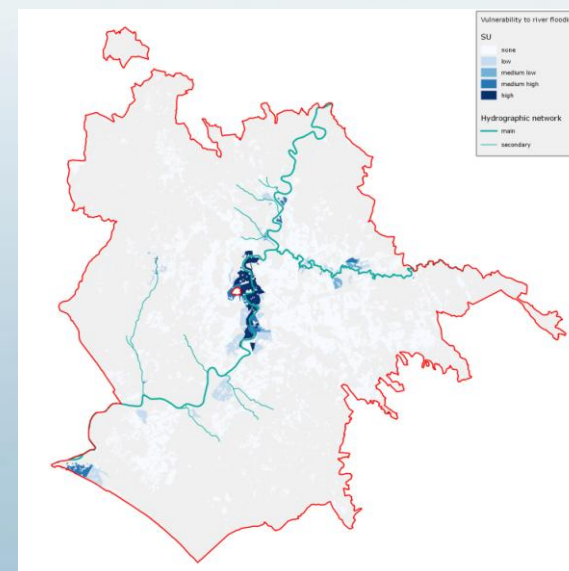
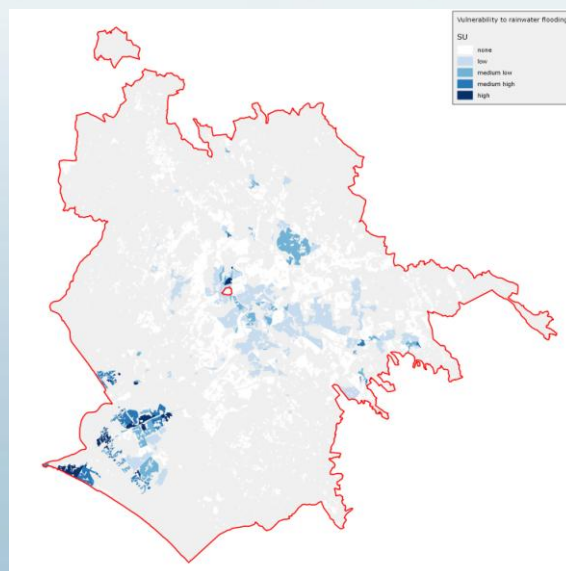
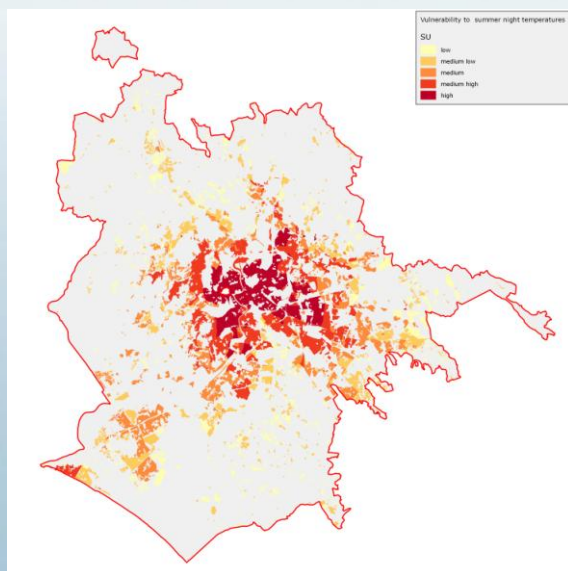
CVMR 1.0

Vulnerability

Vulnerability to high temperatures: calculated by multiplying exposure to high temperatures by overall sensitivity and resilience.

Vulnerability to heavy rainwater floodings: calculated multiplying exposure to rainwater flooding by overall sensitivity and resilience.

Vulnerability to river flooding: calculated multiplying exposure to river flooding by overall sensitivity and resilience.





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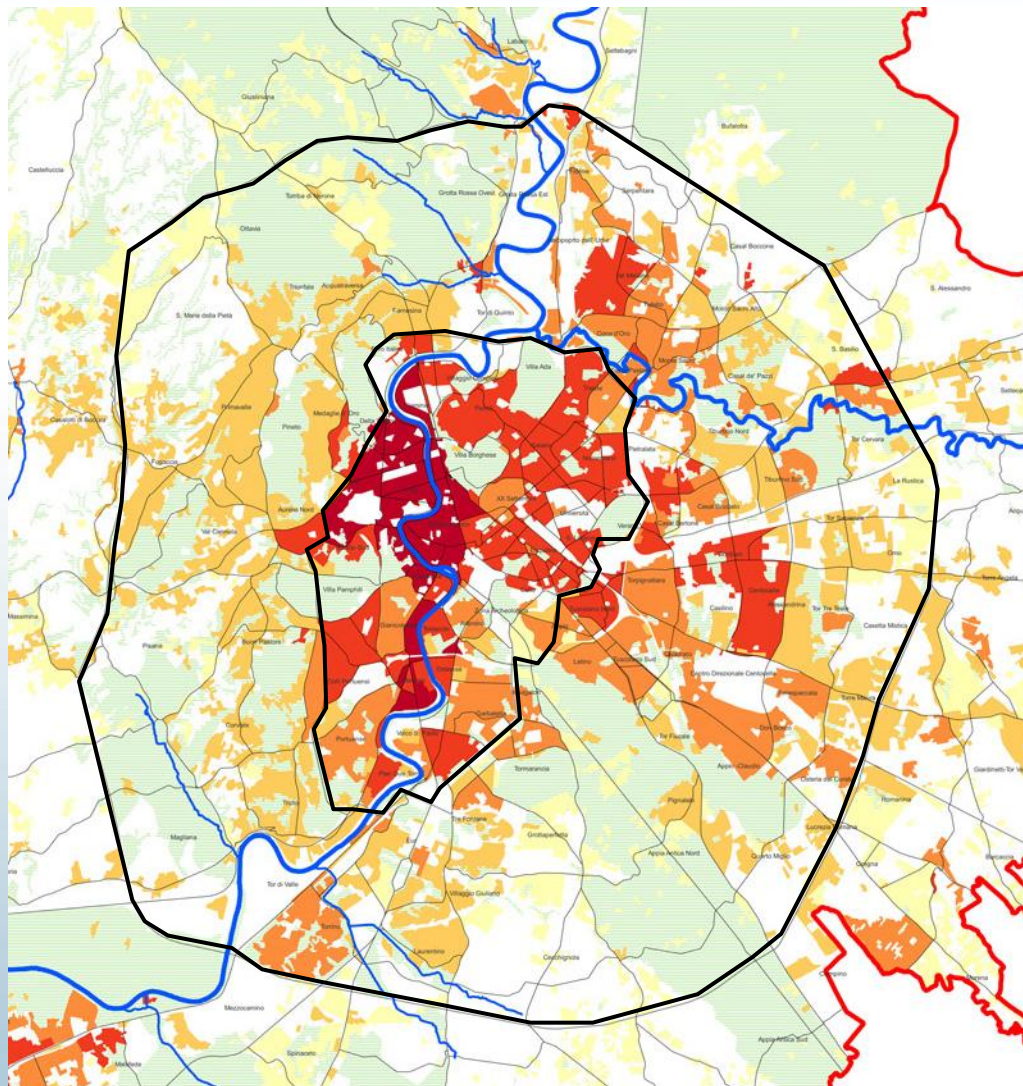
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Indice di vulnerabilità

Vulnerabilità delle Unità di Analisi

- bassa (0.0095-0.5980)
- medio-bassa (0.6045-1.2895)
- media (1.3135-2.2575)
- medio-alta (2.2693-3.7500)
- alta (4.1000-9.0000)

Infrastrutture verdi

- Parchi, ville e aree verdi urbane

Reticolo idrografico

- Reticolo principale
- Reticolo secondario

Strade principali

- Strade principali

Zone urbanistiche

Morena

Confine comunale



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Overall vulnerability



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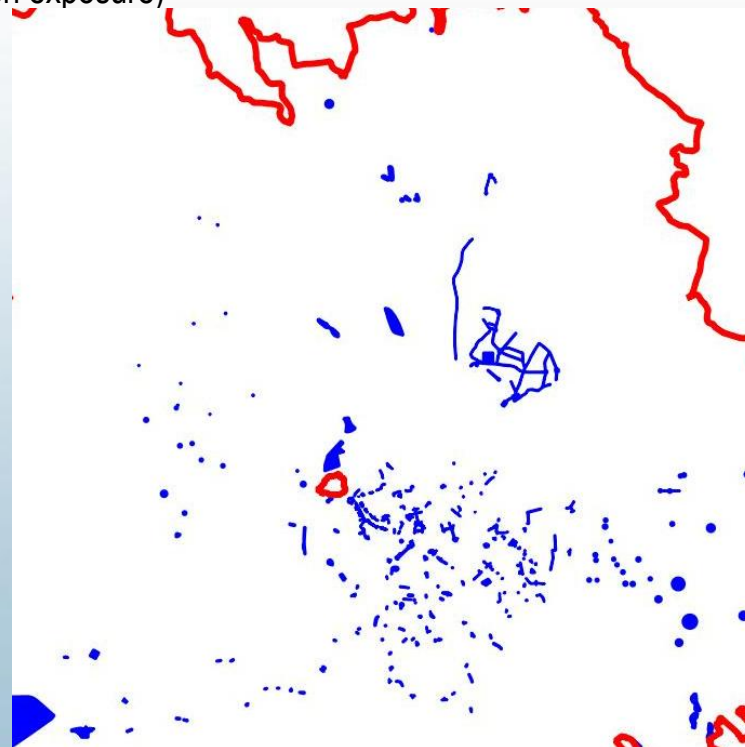
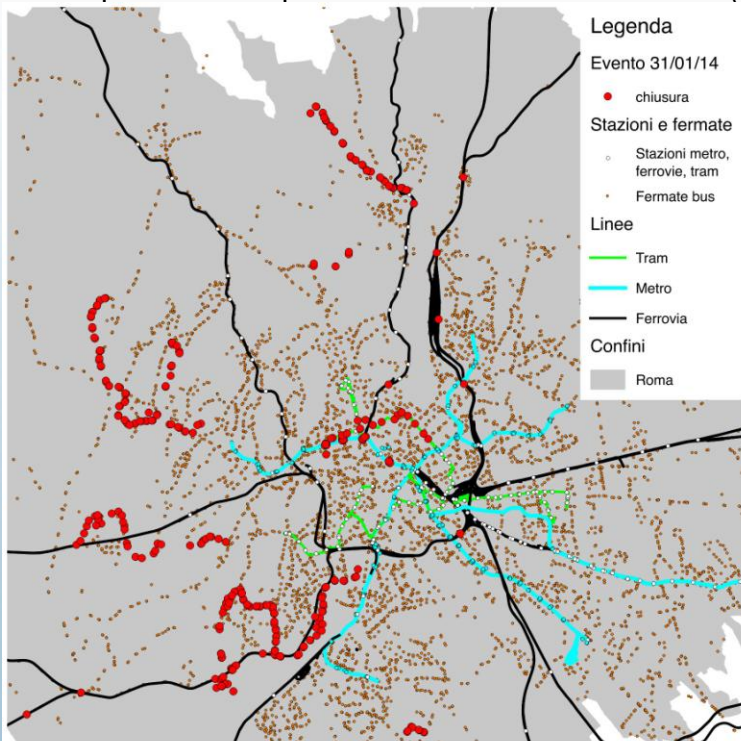
Focus on transport infrastructure

A strand of this research focuses on transport infrastructure vulnerability:

Based on the 31st Jan 2014 extreme rain event, which points of the public transport network were disrupted?

- Info retrieved through local transport agencies tweets (disruption warnings) we localised where the network was disrupted
- Between 6am and 10am (rush hour) more than 30 tweets

In the picture: Disrupted areas versus flooded areas (see slide on exposure)





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Focus on transport infrastructure

Climate issues for Rome's transport system:

- Flooding (roads, tracks, tunnels, cycle paths)
- Heat waves (melting road surface, rail buckling, overheating of tunnels)
- Storm surge (flooding of transport infrastructure located on the seaside)





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Focus on transport infrastructure

Possible adaptation options:

- Good maintenance (looks obvious but it's not)
- Retrofitting existing infrastructure where possible
- New climate-proof design standards (Crossrail in UK)
- Green infrastructure approaches (Edgware road tube station)
- Increase awareness

Next steps

- Joint work with ATAC (data retrieval)
- Finding good practices
- Suggest implementation of examples where applicable





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Thank you for your attention