Development and application of mitigation and adaptation strategies and measures for counteracting the global Urban Heat Islands phenomenon

Climate-Conscious Development of an Urban Area in Budapest, Hungary

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The Main Objectives

Directly:

- To set up suitable strategies for mitigation of UHI phenomena.

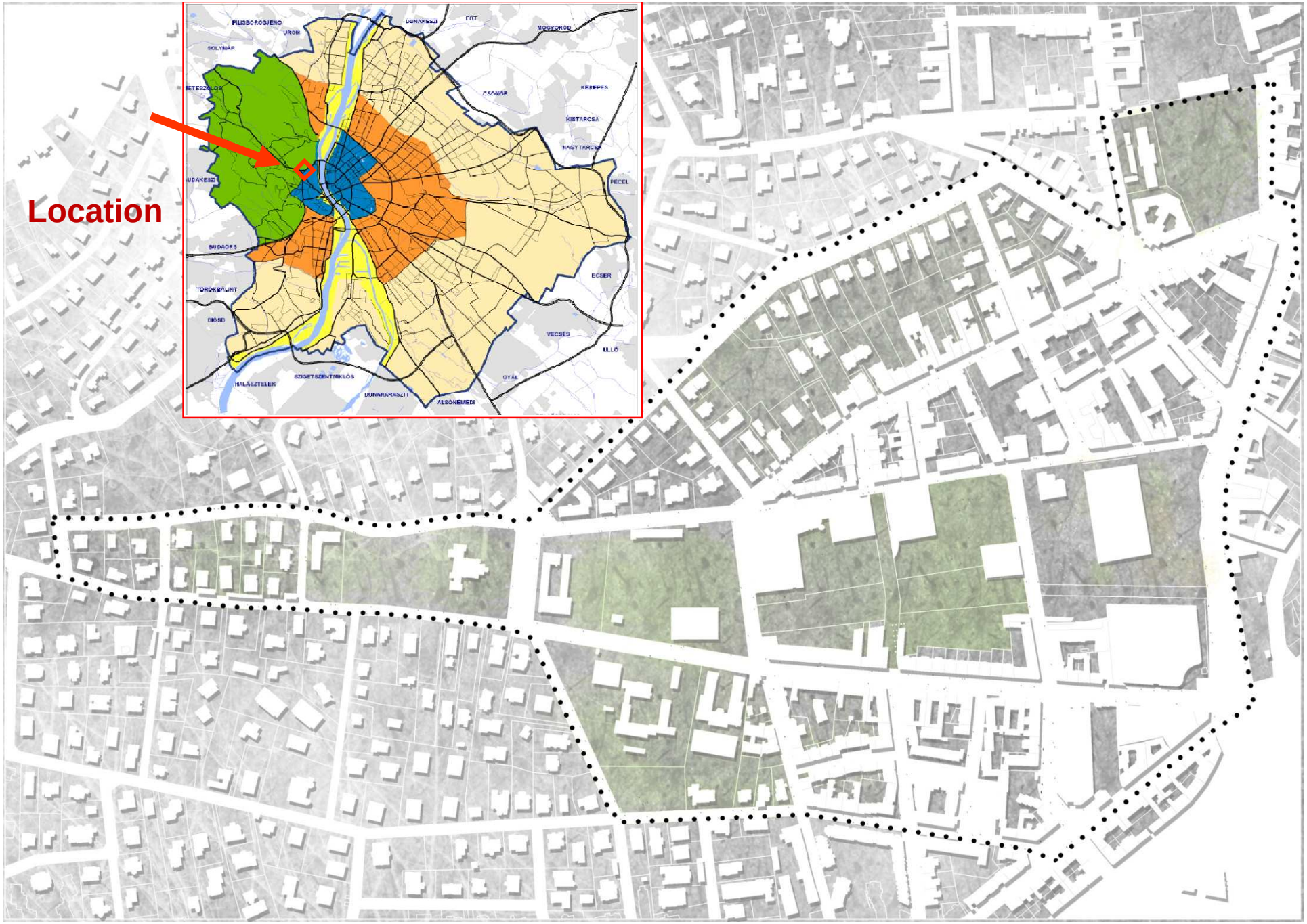
Indirectly:

- Find better solutions for the climate and energy effective urban planning, especially on the field of open space design,
- forecastable and calculable impact of the used design elements on the human wellbeing, and
- more successful result of the renewal of public spaces with
- respect of the demand of the citizens, as the main element in the
- formulation of the decision makers, local politicians.

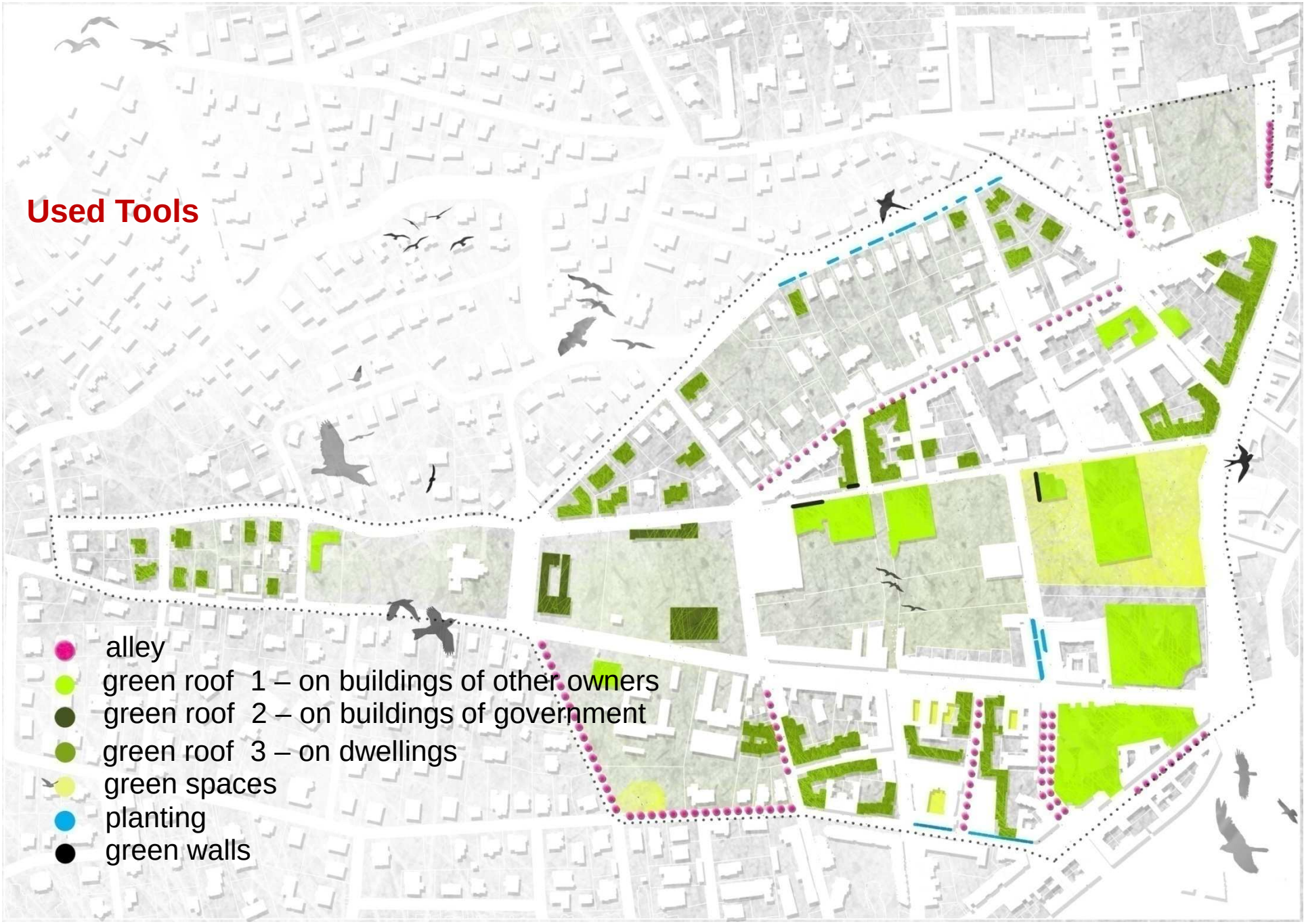
What can we do?

1. Green areas, bodies of water
2. Green roofs, green facades
3. White roofs, facades
4. Pervious surfaces
5. Built area reduction
6. Traffic reduction
7. Energy use and emission reduction

Vegetation Buildings and pavement Energy consumption


Location
PILISBOROSJENO
UROM
SOLYMAR
PETESZALLAS
DUNAKESZI
FOT
MOGYOROD
CSOMOR
KEREPES
KISTARCSA
NAGYTARCSA
PECEL
BUDAORS
TOROKBALINT
DIOSD
ECSER
VECSES
ILLO
HALASZTELEK
SZIGETSZENTMIKLOS
DUNAHARASZTI
GYAL
ALSONEMEDI

Used Tools


alley
green roof 1 – on buildings of other owners
green roof 2 – on buildings of government
green roof 3 – on dwellings
green spaces
planting
green walls

Details of results – Landscape architecture

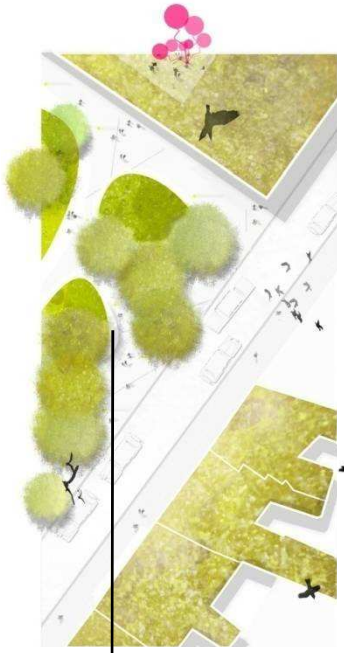
Double alley | combined with parkings | 11,5 m planting distance

Details of results – Landscape architecture

Details of results – Landscape architecture

Planting in containers: perennials and grasses

Details of results – Landscape architecture



New park

Decreased stormwater runoff with new green surfaces

Details of results – Landscape architecture

Extensive | green roof & green wall | for cooling the street and reduce the energy use

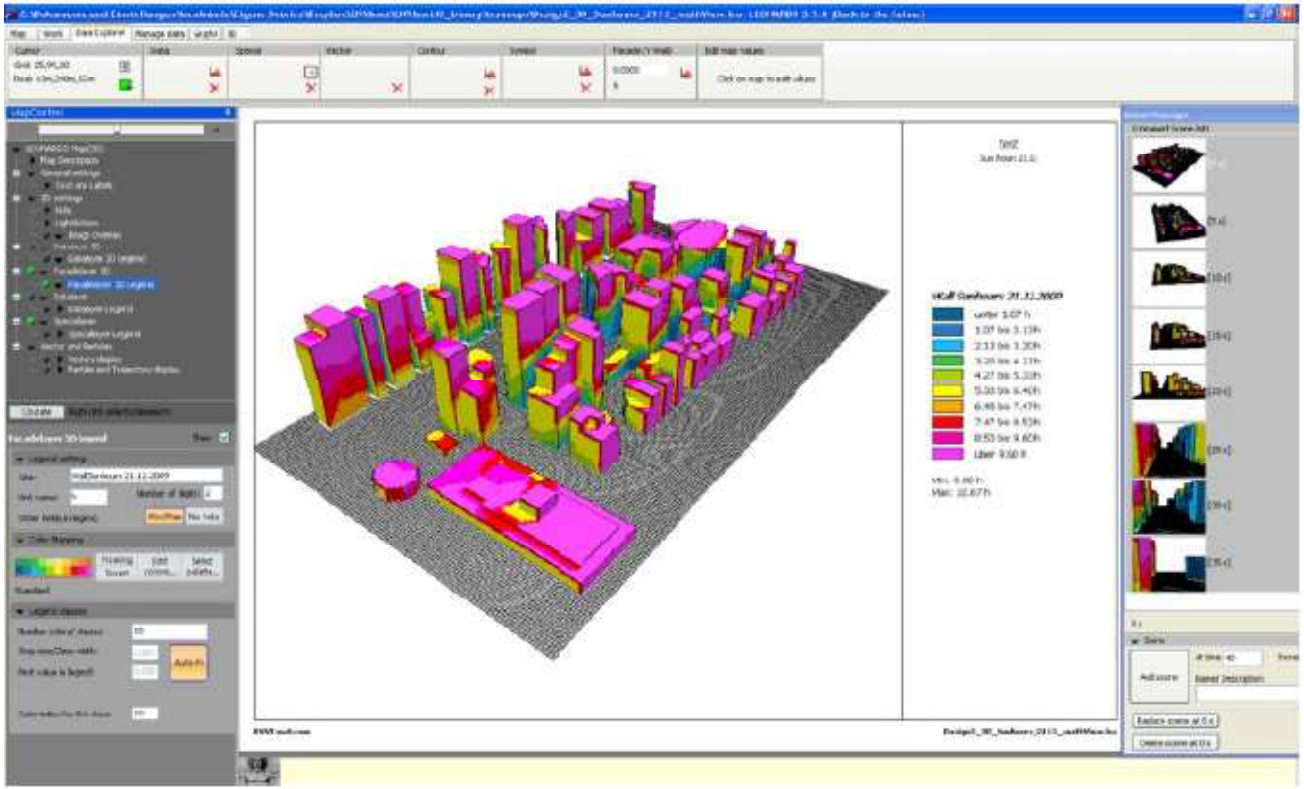
Details of results - Climate

Characteristics of the territory

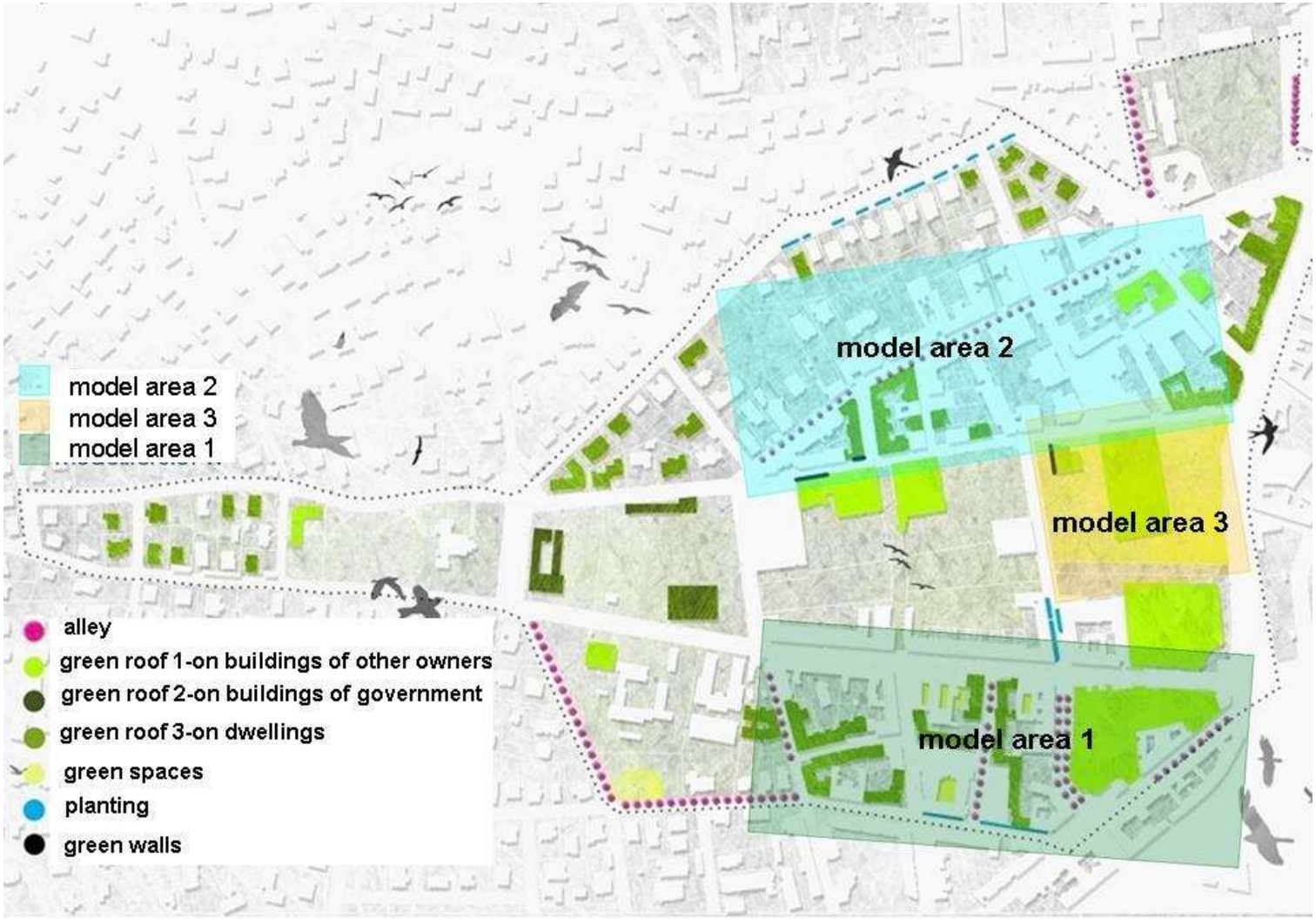
- The territory has quite a lot of trees, so we couldn't achieve such a big change in microclimate
- Quite a few roads were too narrow to be able to plant alleys, although from a microclimatic point of view it would have been a must.
- The dominant wind direction is northwest
- There are some urban canyons.

- The effect of permeable pavement couldn't be simulated in ENVI-met

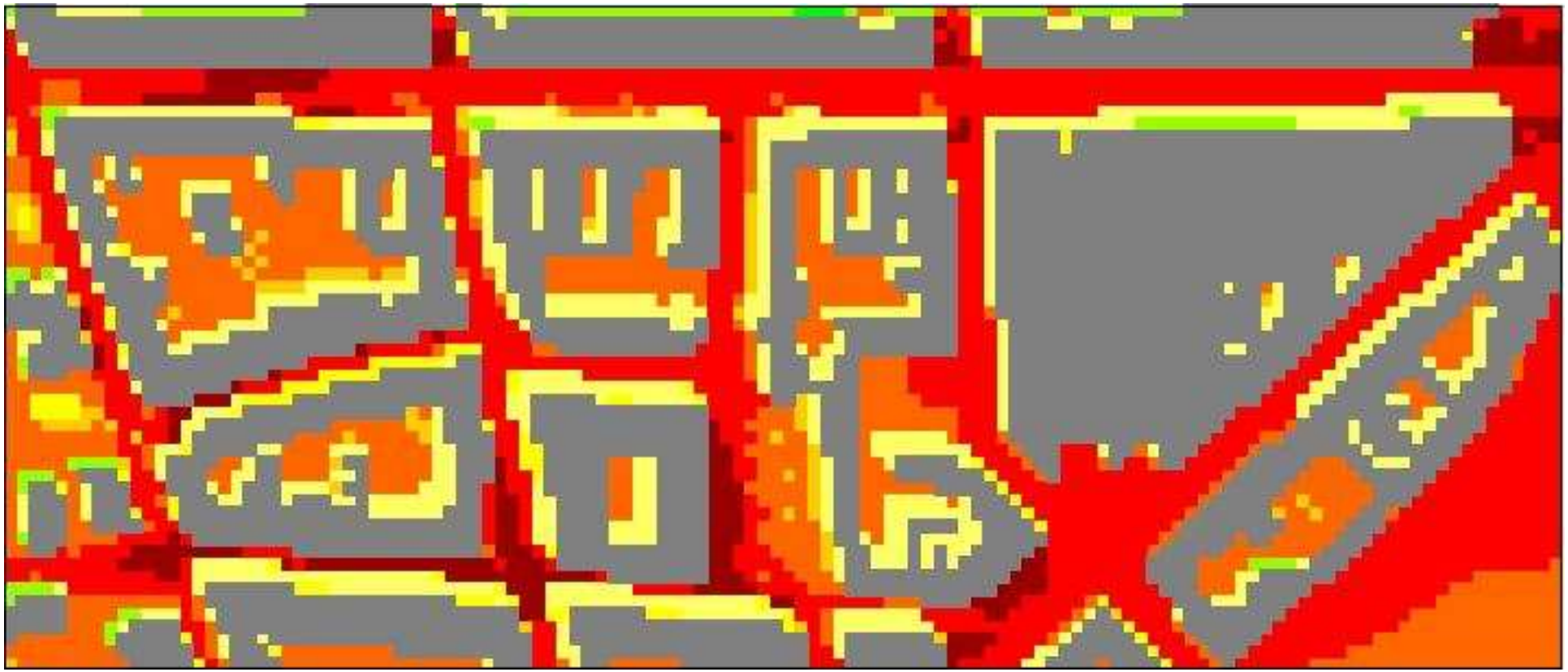
How can we evaluate effectiveness of mitigation measures?



ENVI-MET (Huttner és Bruse, 2009)

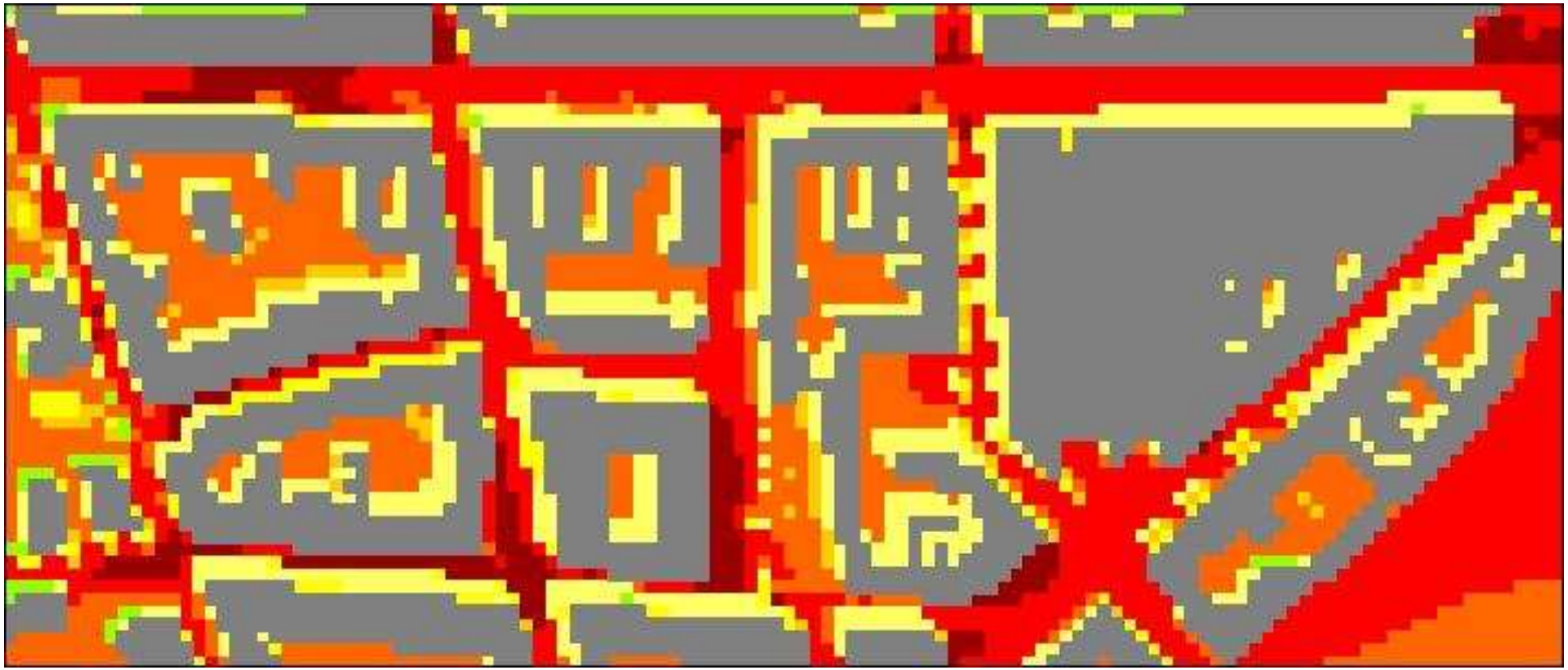

model area 2
model area 3
model area 1
alley
green roof 1-on buildings of other owners
green roof 2-on buildings of government
green roof 3-on dwellings
green spaces
planting
green walls
model area 2
model area 3
model area 1

Predicted Mean Vote – summer conditions, 12 am, 1.6 m layout



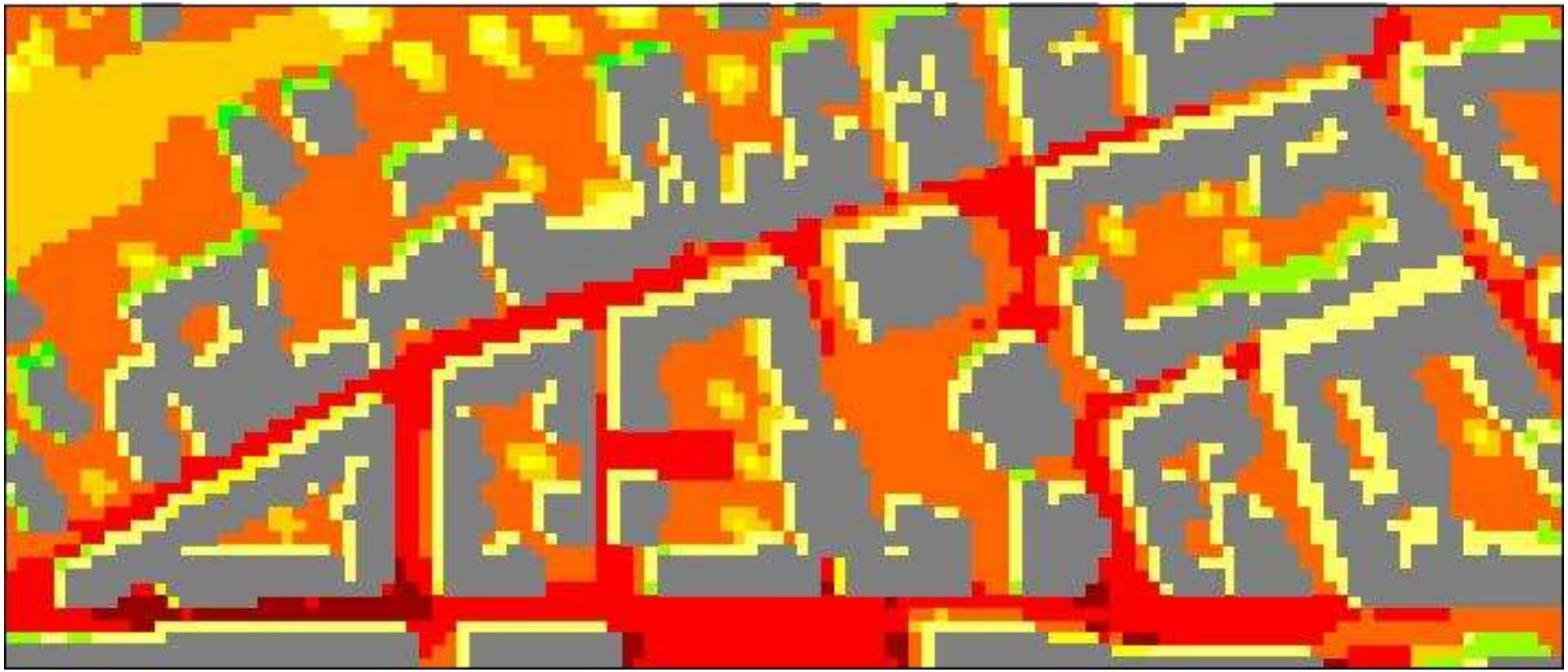
Lövőház utca – actual state

Predicted Mean Vote – summer conditions, 12 am, 1.6 m layout



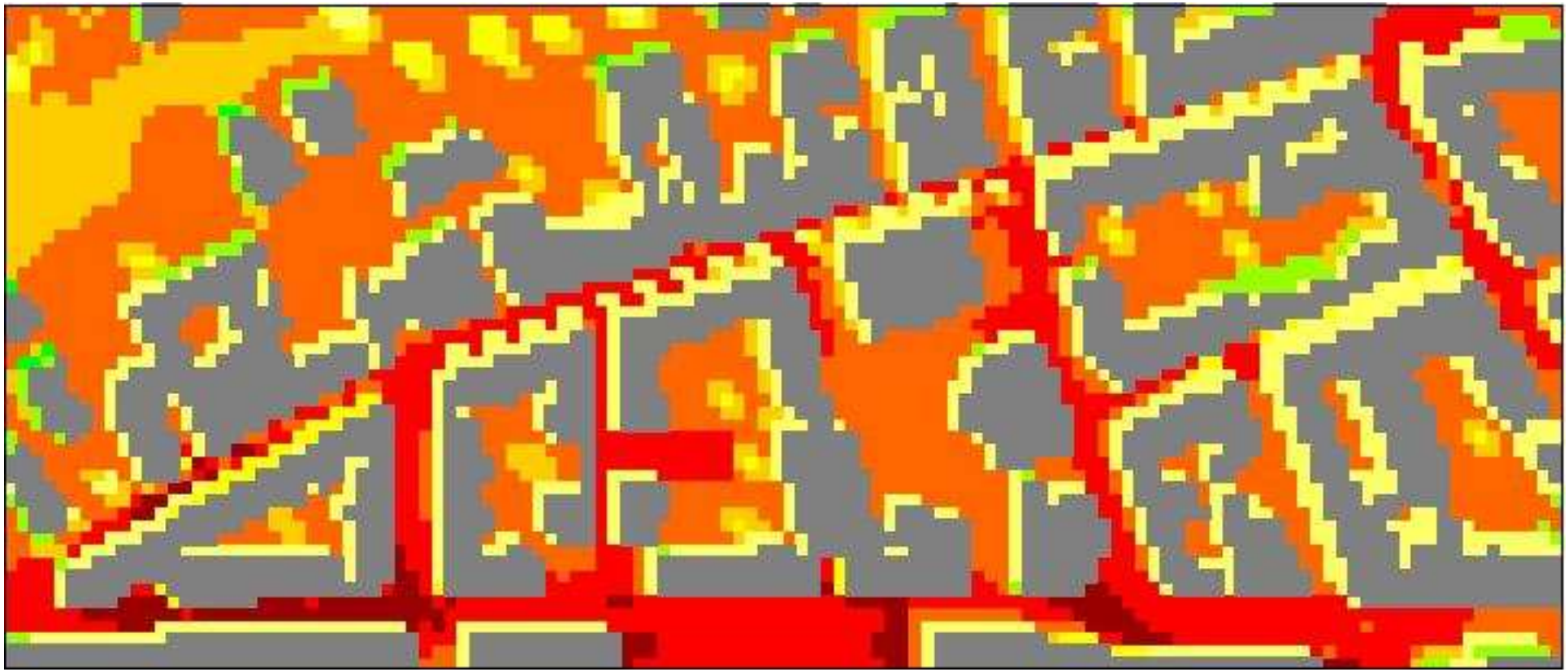
Lövőház utca – mitigated state

Predicted Mean Vote – summer conditions, 12 am, 1.6 m layout

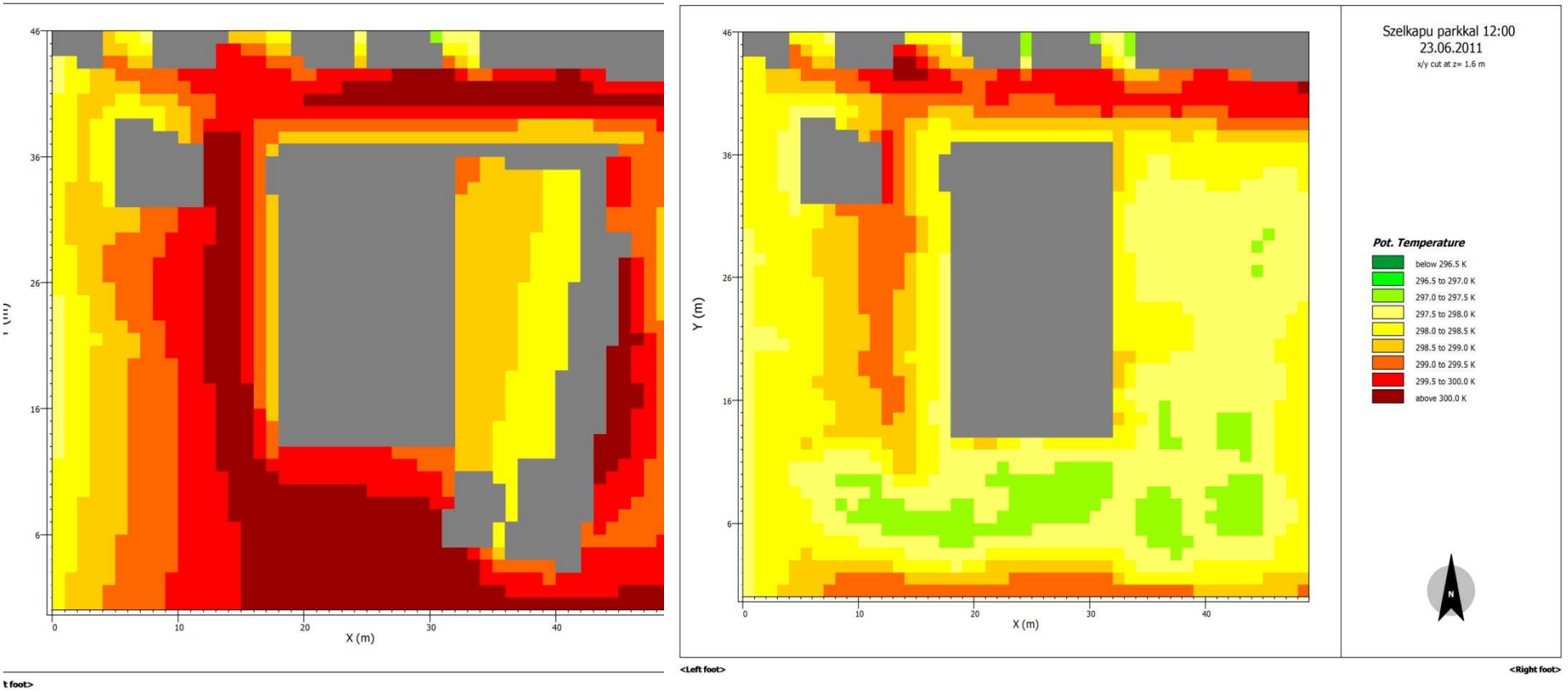


Keleti Károly utca – actual state

Predicted Mean Vote – summer conditions, 12 am, 1.6 m layout



Keleti Károly utca – mitigated state


Szelkapu parkkal 12:00
23.06.2011
x/y cut at z= 1.6 m
Pot. Temperature
below 296.5 K
296.5 to 297.0 K
297.0 to 297.5 K
297.5 to 298.0 K
298.0 to 298.5 K
298.5 to 299.0 K
299.0 to 299.5 K
299.5 to 300.0 K
above 300.0 K
Y (m)
X (m)
0
10
20
30
40
6
16
26
36
46
N
<Left foot>
<Right foot>

Summary of Results

Positive effects of the development of green infrastructure:

1. **Climate:**

- alleys improve thermal comfort parallel with dominant wind direction
- Urban cross ventilation is also can be enabled by the establishment by alleys in specific cases
- There is a slight mitigation of wind speed due to plantation of trees mainly in afternoon hours.
- It is only effective to plant trees were they have sufficient microclimatic conditions (air movements, sky-view factor)

2. **Water:**

- Storm water runoff was reduced

3. **Well-being of city dwellers:**

- PMV is improved by the establishment of alleys mainly in cases, where the dominant wind direction is parallel to the street.

Thanks for Your Attention!

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