

SOS CLIMATE WATERFRONT



Rome
29 march 2022

MAKE THE ANIENE VISIBLE and REDISCOVER RIVER LANDSCAPES

NEW PROJECTS FOR INDUSTRIAL SITES

Water- and heat- resilient built environment

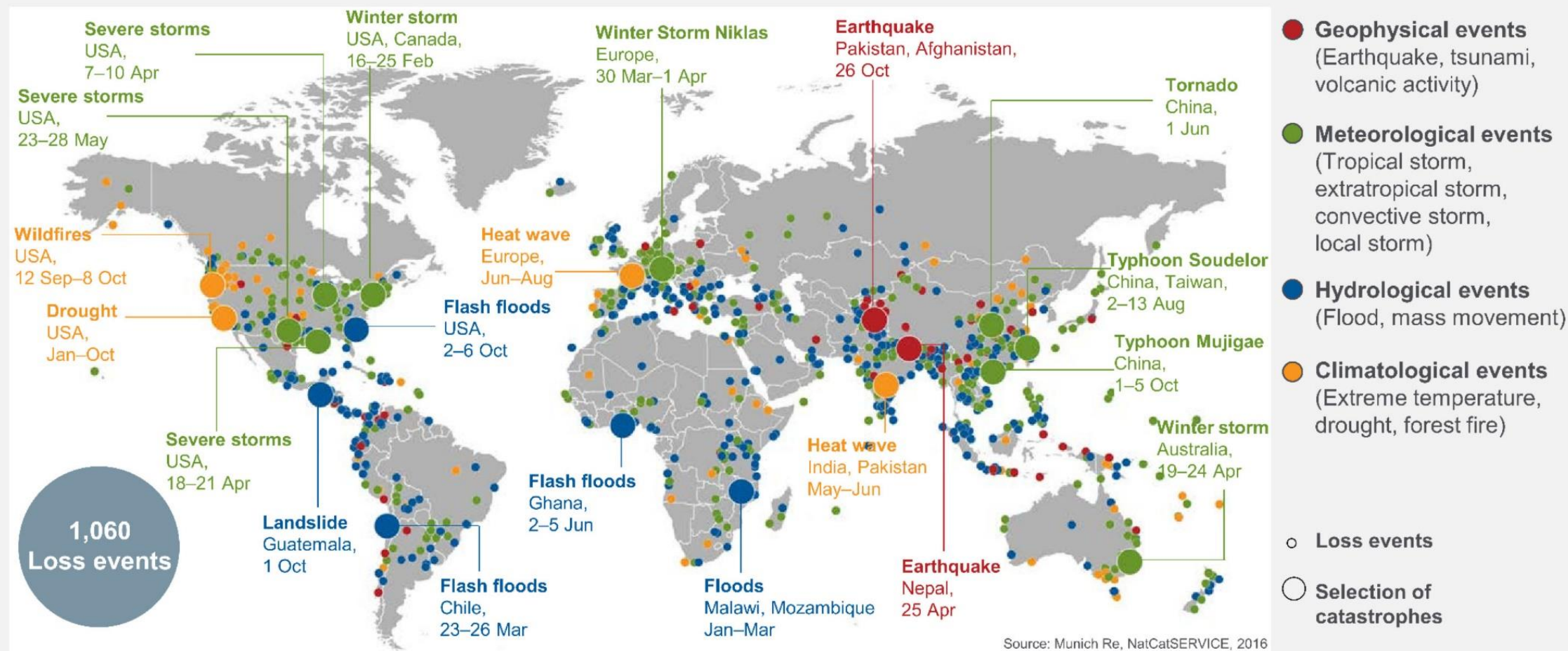


Index of the presentation

- Intro
- Challenges related to flooding
- Strategies for resilience to flooding
- Challenges related to heat
- Strategies for resilience to heat
- Common strategies

NEW PROJECTS FOR INDUSTRIAL SITES

Challenges

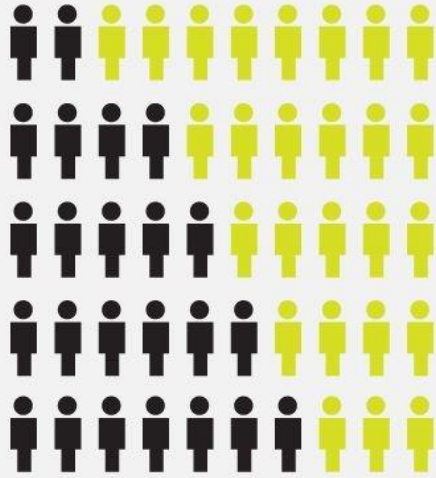




Future Land Consumption Challenges

Urbanization

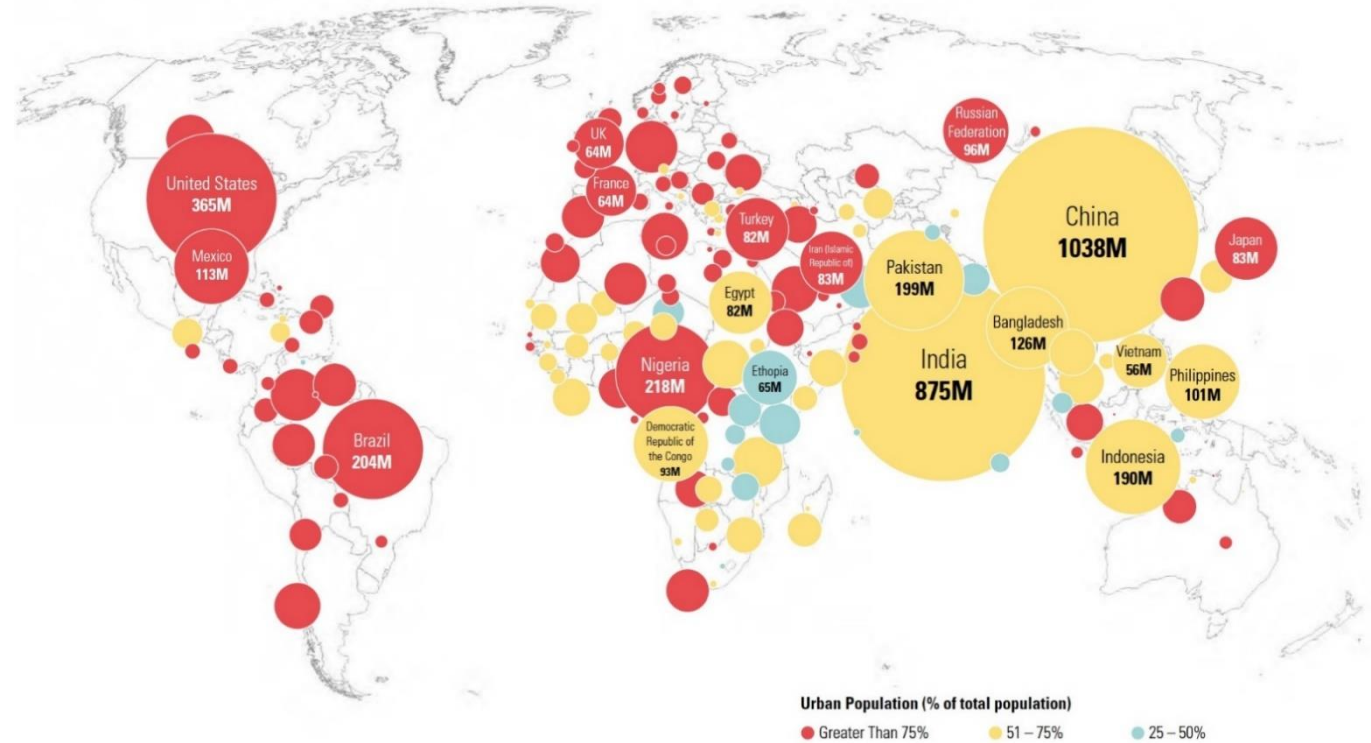
- 1900** | 2 out of every 10 people lived in an urban area
- 1990** | 4 out of every 10 people lived in an urban area
- 2010** | 5 out of every 10 people lived in an urban area
- 2030** | 6 out of every 10 people will live in an urban area
- 2050** | 7 out of every 10 people will live in an urban area



Defined by UN HABITAT as a city with a population of more than 10 million

Urban Populations 2050

This graphic depicts countries and territories with 2050 urban populations exceeding 100,000. Circles are scaled in proportion to urban population size.
Source: UNICEF (2012).



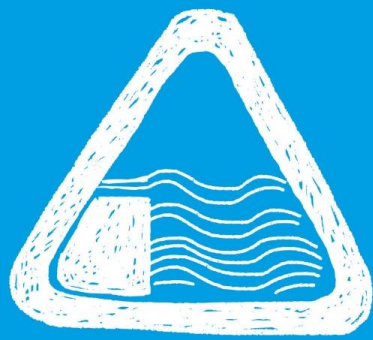


Future Land Consumption Challenges



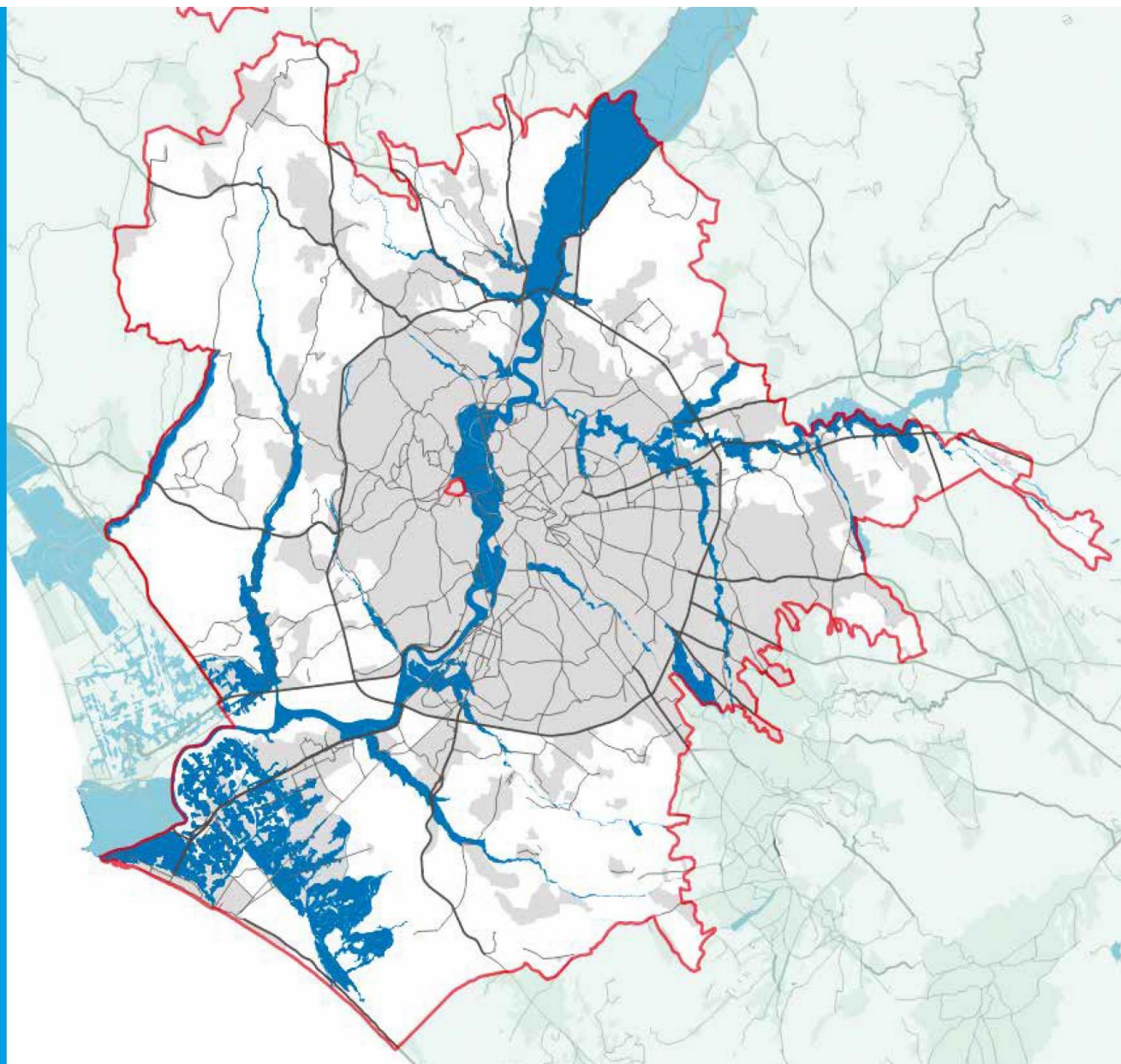
NEW PROJECTS FOR INDUSTRIAL SITES

Challenges related to flooding



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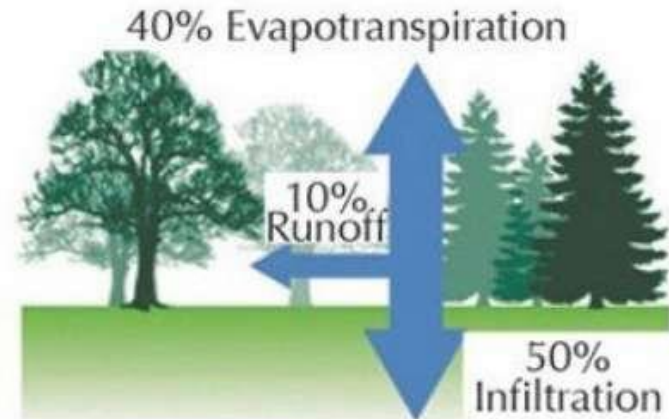
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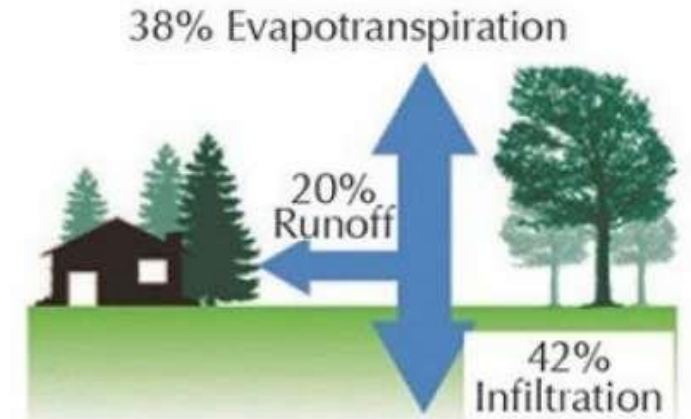
NEW PROJECTS FOR INDUSTRIAL SITES

Challenges
related to
flooding

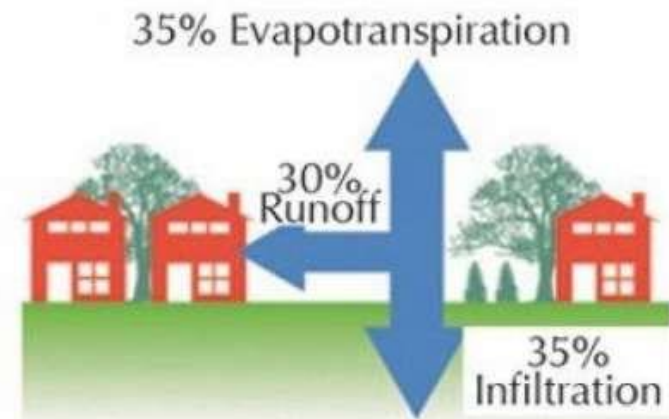
EFFECTS OF IMPERVIOUSNESS ON RUNOFF AND INFILTRATION



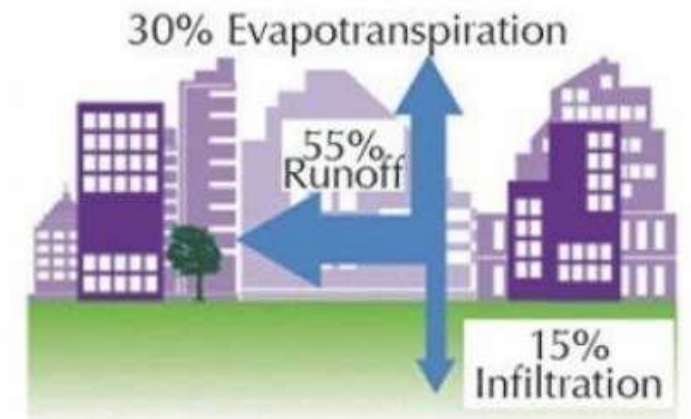
Natural Ground Cover
0% Impervious Surface



Low Density Residential (e.g. rural)
10–20% Impervious Surface



Medium Density Residential
(e.g. subdivision)
30–50% Impervious Surface



High Density
Residential / Industrial / Commercial
75–100% Impervious Surface





NEW PROJECTS FOR INDUSTRIAL SITES

Strategies for resilience to flooding

Hazard	Retain		
	Relieve		
Exposure	Resist		
	Retreat		
Vulnerability	Accommodate		
	Prepare		



NEW PROJECTS FOR INDUSTRIAL SITES

Strategies for resilience to flooding

green roofs

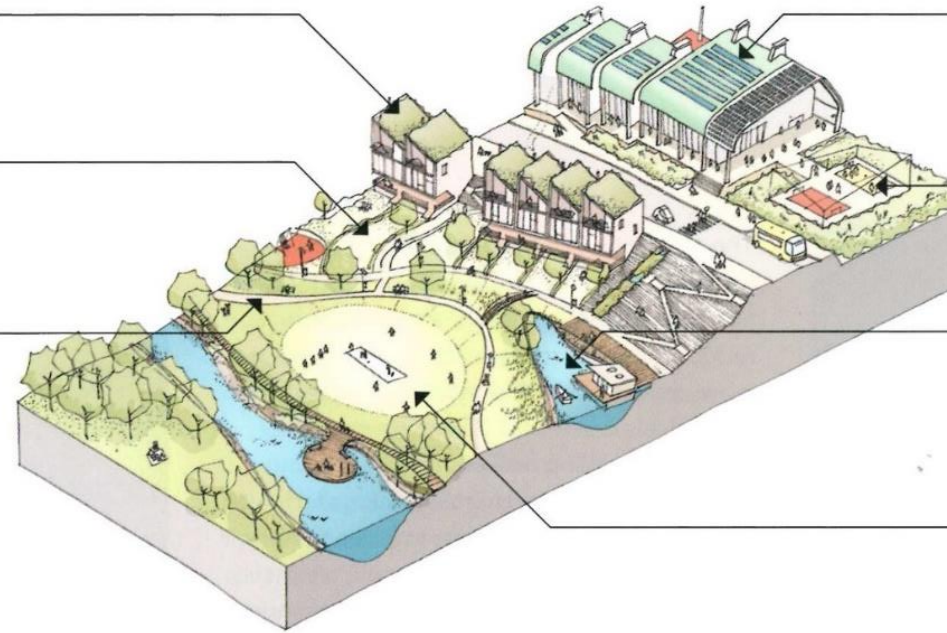
green roofs can slow down the flow of rainwater, easing flooding

flood gardens/safe houses

flood water can pass through the garden without affecting the houses

canal paths

planted pathways are designed to channel flood water away from homes



safe havens

resilient schools and community buildings provide safe spots to gather and centres for renewable energy

rain gardens

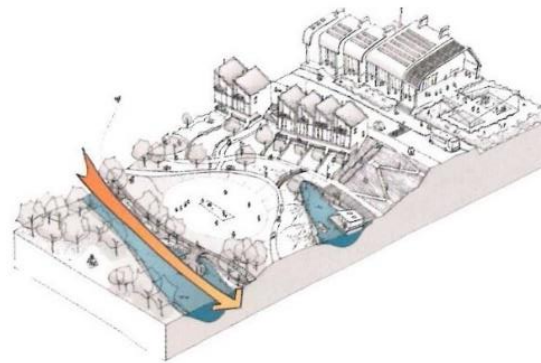
communal gardens collect and store rainwater away from rivers

village blue

small ponds are designed to expand during a flood. The rest of the time they can be used for boating, fishing and swimming

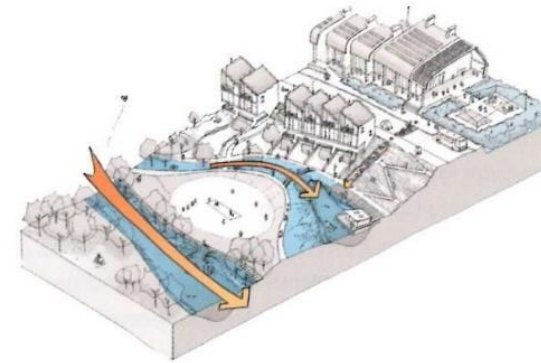
village green

play areas are designed to flood when a severe flood occurs



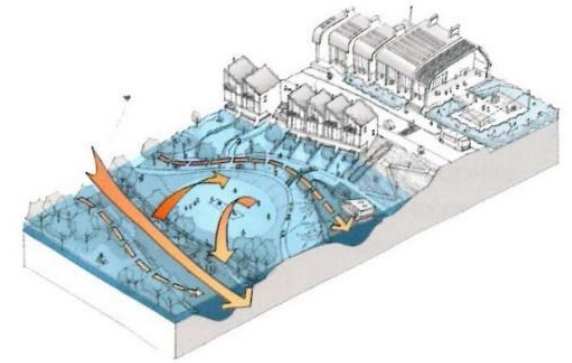
Everyday

For the majority of the time the river contains the flow of water.



During a storm (5% probability)

Rainwater is held in dedicated rain gardens and on the roofs of buildings; the river expands into channels, away from homes, in a predetermined way.



During a very big storm (1% probability)

Rainwater is held in dedicated rain gardens and on the roofs of buildings; flood water is directed into multi-use recreation areas and gardens designed to cope with flood water.



NEW PROJECTS FOR INDUSTRIAL SITES

Strategies for resilience to flooding

Table 1 Flood and runoff volume control characteristics of drainage system components.

Infrastructure	Rainfall Interception	Runoff Volume Reduction	Runoff Volume Control	Large Floods Reduction	Peak Runoff Reduction
Rainwater Harvesting	Y	Y	N	SD	Y
Green Roofs	Y	N	N	N	Y
Infiltration Features	Y	Y	N	SD	Y
Permeable Pavements	Y	Y	Y	Y	Y
Subsurface Storage	N	N	Y	Y	Y
Filter Drains	Y	Y	Y	SD	Y
Swales	Y	Y	N	SD	Y
Subsurface Conveyance	N	N	Y	N	N
Filter Strips	Y	N	N	N	SD
Treatment Systems	N	N	N	N	N
Bio-retention systems	Y	Y	N	SD	Y
Detention Basins	Y	N	Y	Y	Y
Retention Ponds	Y	N	Y	Y	Y
Wetlands	Y	N	Y	SD	Y

Y - Yes (where design allows); N - No; SD - Scale Dependent.

Table 3 Water-quality control and improvement properties of drainage system components.

Infrastructure	Large sediment Reduction	Fine Sediment Reduction	Hydro-Carbon Reduction	Metals Capture	Nutrient Control
Rainwater Harvesting	N	N	N	N	N
Green Roofs	N	N	Y	N	N
Infiltration Features	Y	N	Y	Y	Y
Permeable Pavements	Y	Y	Y	Y	Y/N
Subsurface Storage	N	N	N	N	N
Filter Drains	N	Y	N	Y	Y
Swales	Y	Y	Y	Y	Y
Subsurface Conveyance	N	N	N	N	N
Filter Strips	Y	N	Y	Y	Y/N
Treatment Systems	Y	Y	Y	Y	Y
Bio-retention systems	N	Y	Y	Y	Y
Detention Basins	Y	Y	Y	Y	Y/N
Retention Ponds	N	Y	Y/N	Y	Y/N
Wetlands	N	Y	Y/N	Y	Y

Y = Yes (where design allows); N = No; Y/N = performance dependent on soil characteristics.



NEW PROJECTS FOR INDUSTRIAL SITES

Strategies for resilience to flooding

GREEN ROOF / WALL



RAINWATER HARVESTING



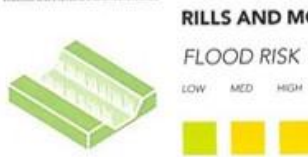
RAIN GARDEN



PERMEABLE PAVING



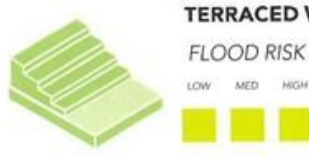
RILLS AND MOATS



FOUNTAINS AND WATER SQUARES



TERRACED WATERFRONT



SWALE



FLOODABLE PLAYGROUNDS AND SQUARES



WETLAND BUFFERS



POOLS AND PONDS



VERTICAL FLOW REED BED SYSTEM



URBAN FLOOD STORAGE



FLOOD PARKS



ARTIFICIAL BASINS



WATER MEADOWS, LAKES, RESERVOIRS



CITY WETLANDS FLOODPLAIN



WET WOODLANDS



MANAGED RETREAT



MANGROVES AND REEF REGENERATION



FLOOD RELIEF CHANNELS



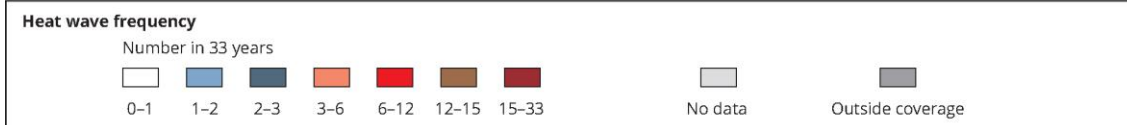
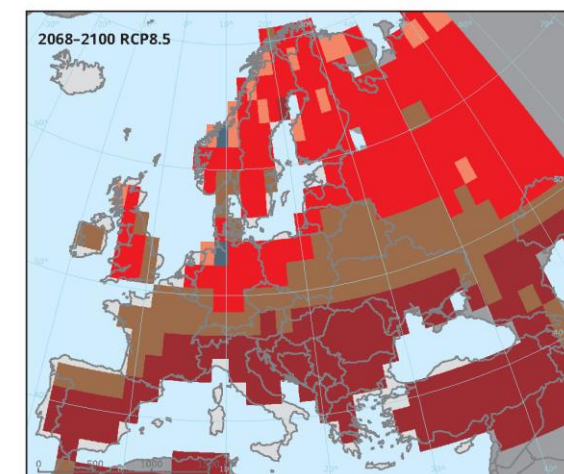
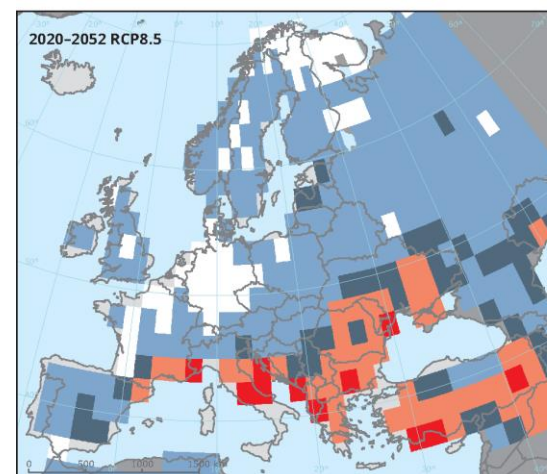
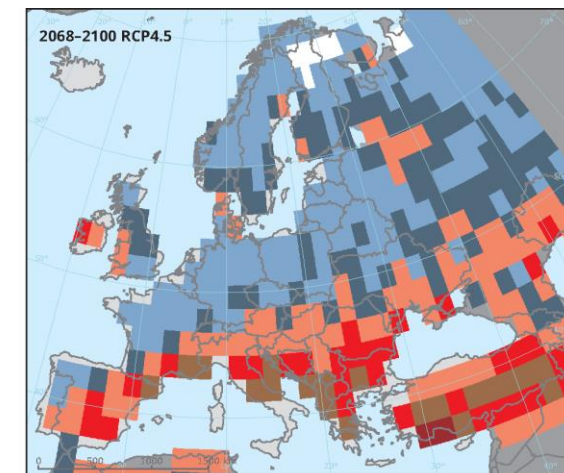
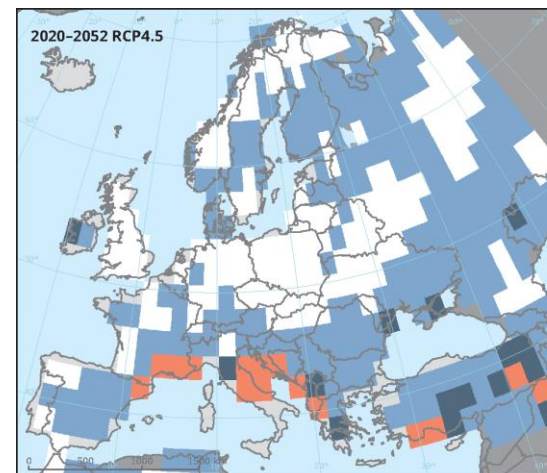
Use is appropriate
 Further investigation work required
 Use is not appropriate



Challenges related to heat



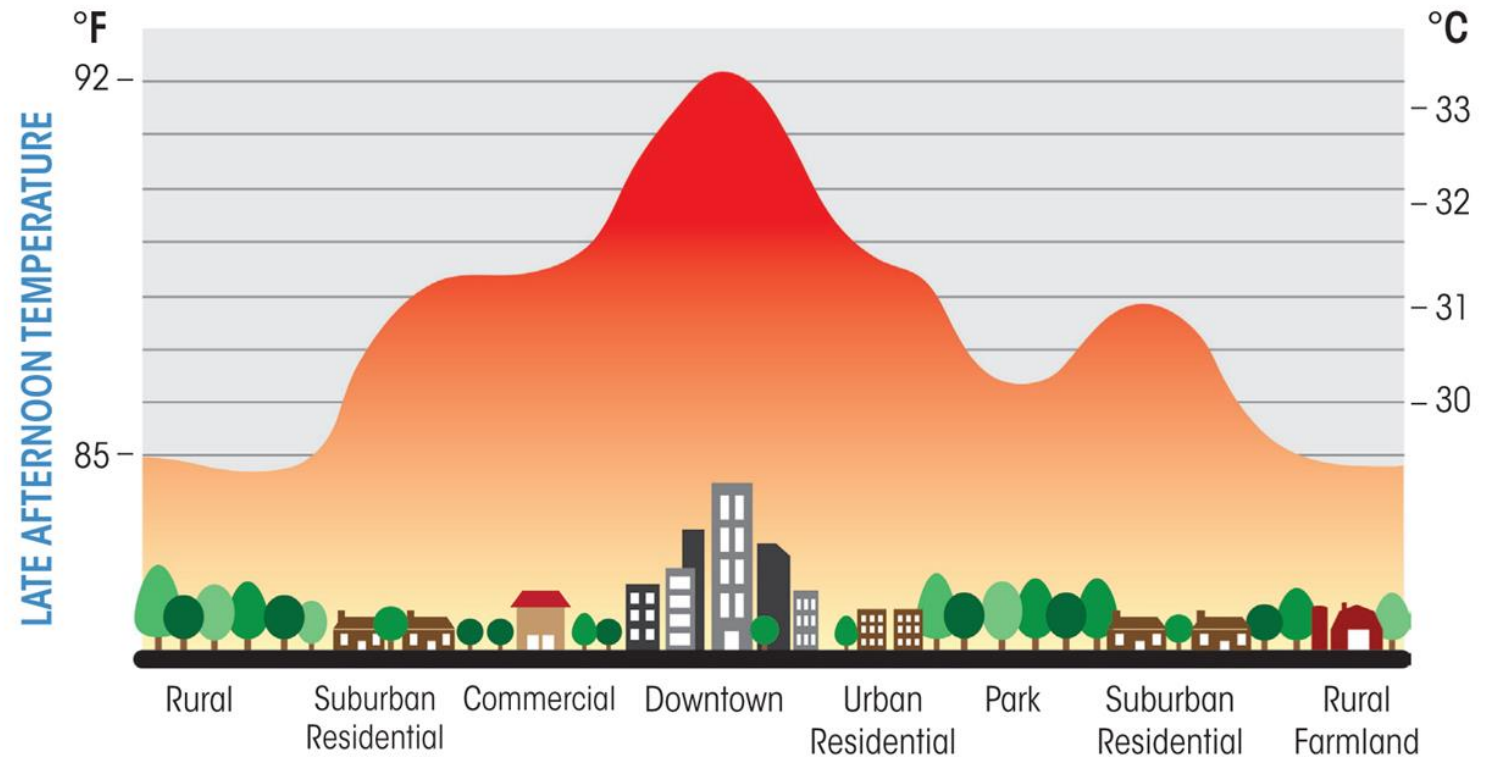
- Heatwaves
- 70,000 excess deaths (Europe, 2003)
- Increasingly exacerbated and frequent





Challenges related to heat

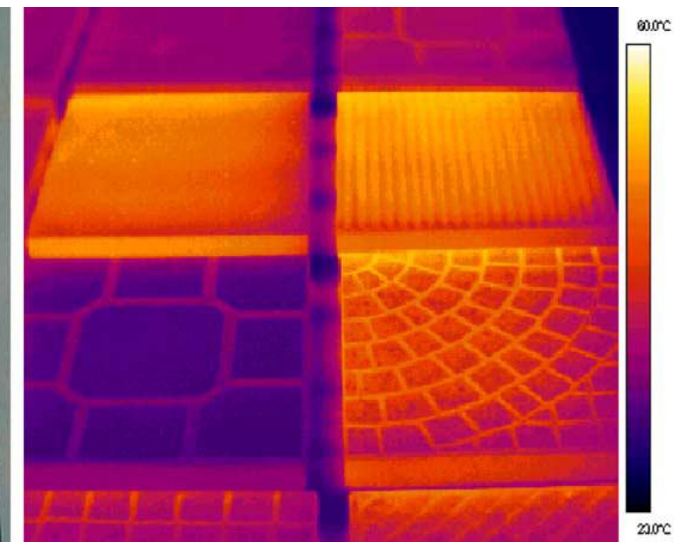
- Urban Heat Island
- Up to +10°C
- Exacerbate heatwaves





Strategies for resilience to heat

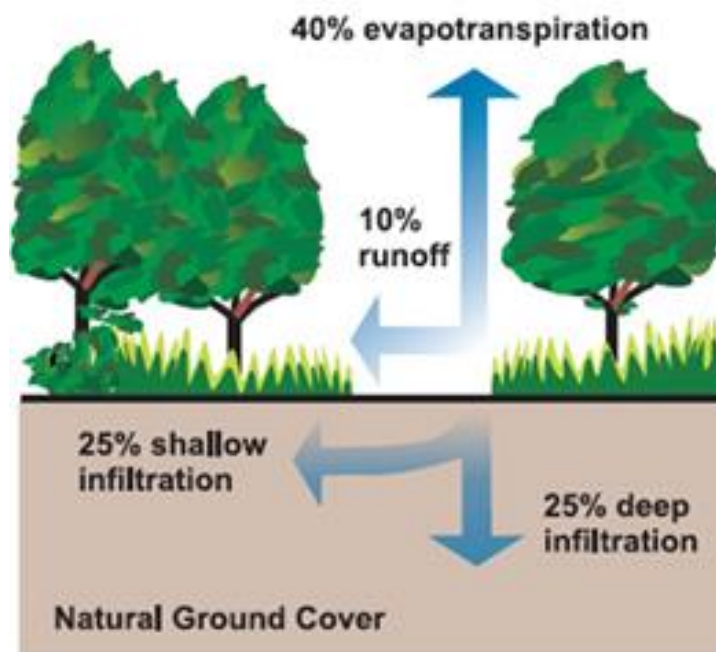
- Cool materials
- Reflect back the incoming solar radiation
- Cool surface and air temperature





Strategies for resilience to heat

- SUDs: greenery, trees





NEW PROJECTS FOR INDUSTRIAL SITES

Common strategies

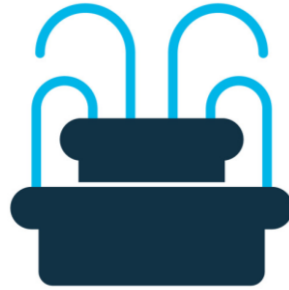
- Cool permeable paving
- SUDs: greenery, trees
- Water



NEW PROJECTS FOR INDUSTRIAL SITES

Research

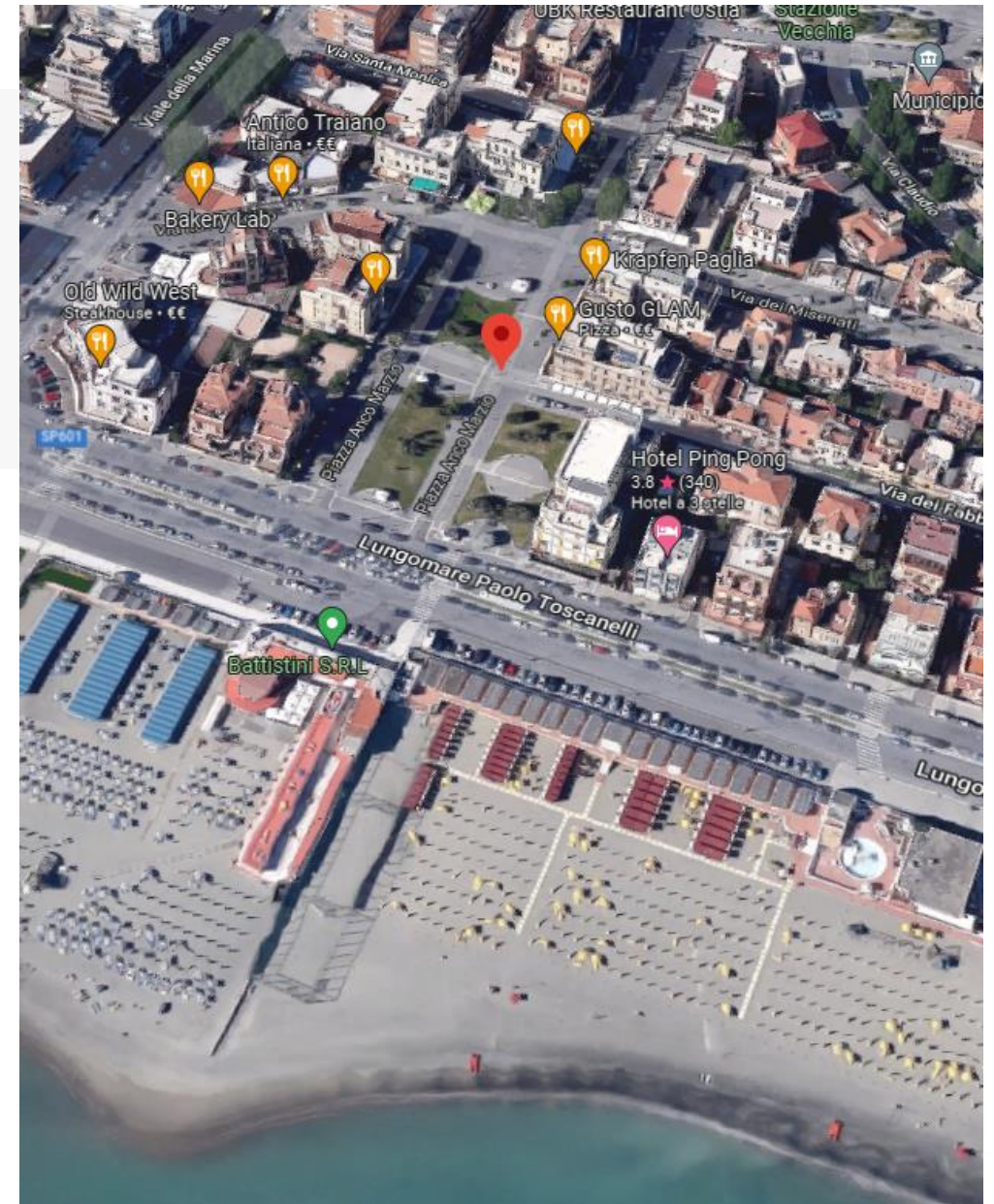
- Ostia
- Public square
- Mitigate flooding (runoff) and heat



Ref case: as is

Dev case: further impermeabilization

Strat case: strategies applied



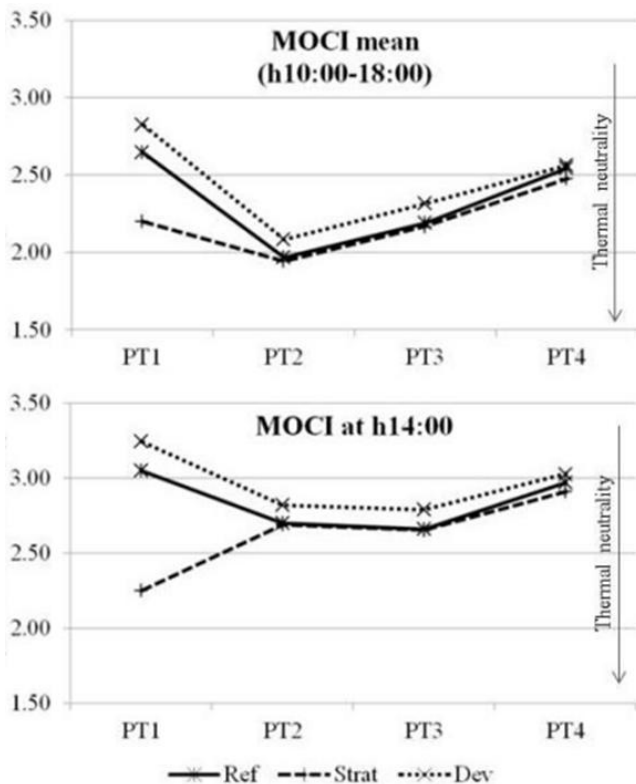
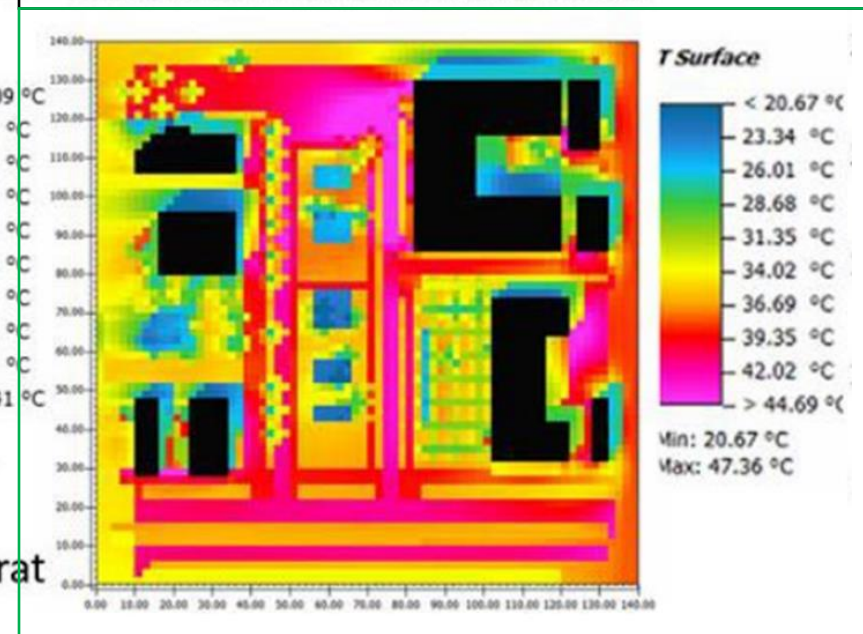
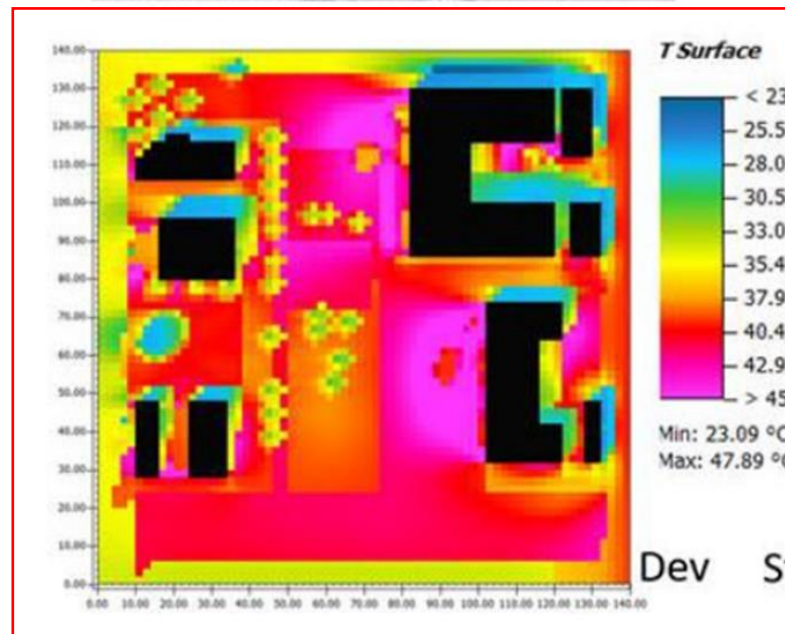
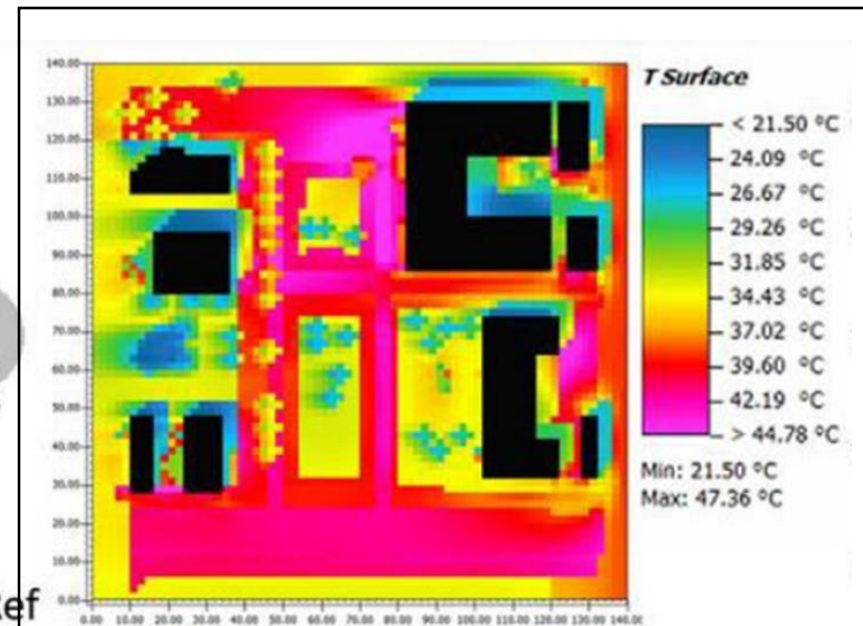


Research

Ref case: as is

Dev case: further impermeabilization

Strat case: strategies applied



Research

Ref case: as is

Dev case: further impermeabilization

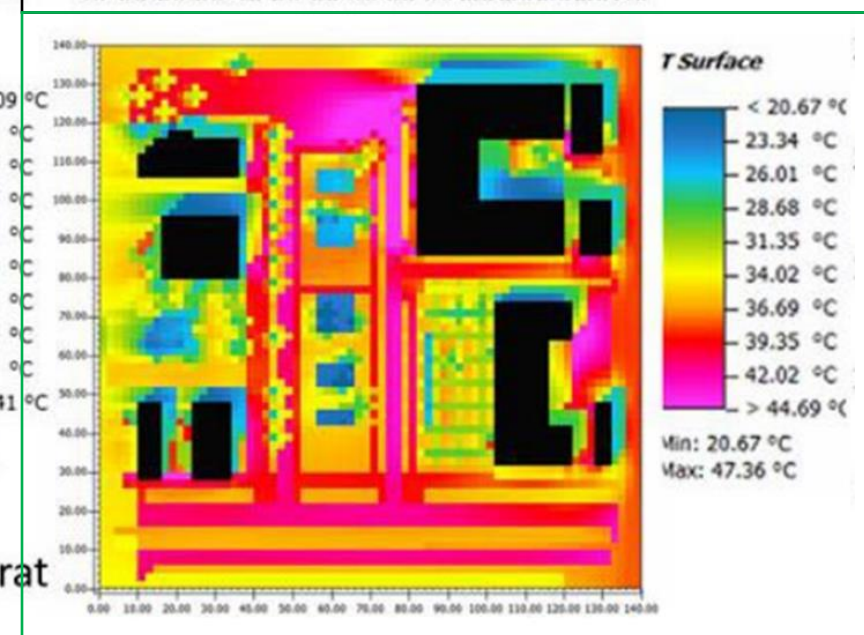
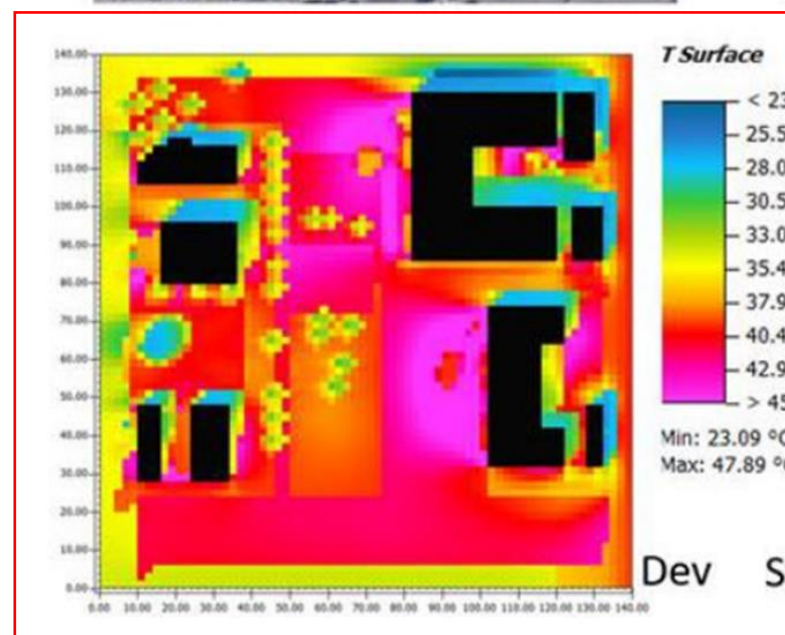
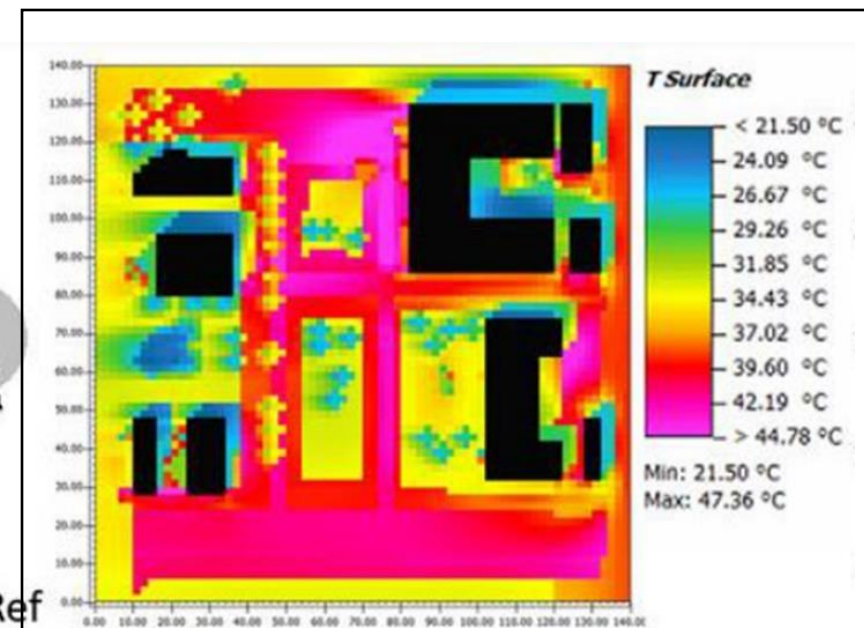
Strat case: strategies applied

From excess runoff

REF runoff: 67.1 mm

Dev runoff: 90.84 mm

Strat runoff: 42.2 mm





Common strategies

- It is possible to mitigate more than one challenge at a time, by means of a joint consideration of them
- The result is a more resilient built environment in marine or fluvial contexts





Thank you for your attention!

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**Design for complexity: multi-scale
and multi-objective adaptive
strategies and methods for
uncertain climatic conditions
IS (10)**