

COOL TOWNS

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GREENWICH

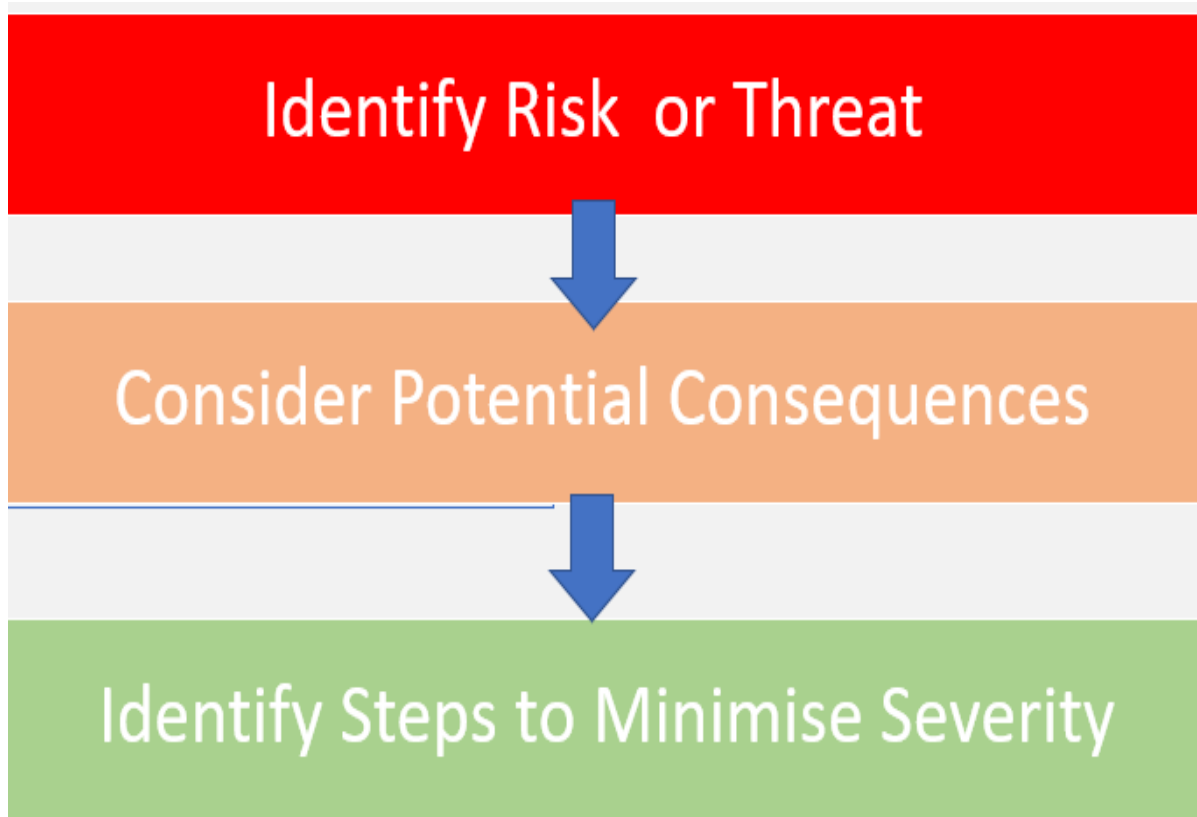
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European Regional Development Fund



COOL TOWNS

Towards heat resilient cities

Cool Towns Project

To provide cities and municipalities with knowledge and tools to
become heat-resistant Sept 2018 - Dec 2022



Late afternoon temperature °C



Rural

Suburban Residential

Urban Residential

Rural Farmland

Impacts of increasing heat

- **Economic impacts**
- **Damage to infrastructure**
- **Social impact**
 - **Health – death and morbidity**
 - **Outdoor workers**
 - **Learning ability**
 - **Violent crime**
- **Environmental – food production and wildlife**

Liveability of cities is under threat worldwide

UK is no longer a cold country and must adapt to heat, say climate scientists

Experts call on UK officials to prepare for periods of extreme heat or risk thousands of excess deaths

Extreme UK weather - live updates



People shelter from the sun on the South Bank in London on Monday. Photograph: Alberto Perrotti/Corbis

Source: guardian.com

UK is no longer a cold country and must adapt to heat, say climate scientists

Delhi suffers at 49C as heatwave sweeps India

By The Associated Press & the Guardian

10:00 AM

Climate change



Twitter: @guardian via @the_earth_magazine via @the_earth_magazine

Source: bbc.com

Delhi suffers at 49°C as heatwave sweeps India

Japan swelters in its worst heatwave ever recorded

10:00 AM

Climate change



Twitter: @guardian via @the_earth_magazine via @the_earth_magazine

Source: bbc.com

Japan swelters in its worst heatwave ever recorded

Perth swelters through record six consecutive days over 40C temperatures

West Australian capital also setting records for most days above 40C in a summer with the tally now at 11 days

Follow our Australia news live blog for the latest updates

Download the free Guardian app: get our morning email briefing

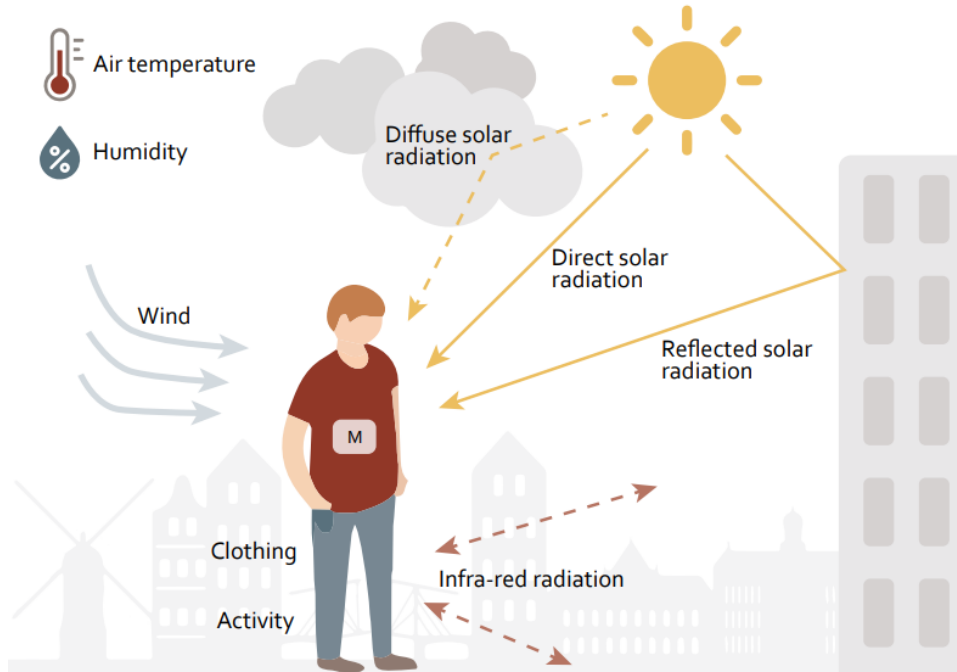


Twitter: @guardian via @the_earth_magazine via @the_earth_magazine

Source: guardian.com

Perth swelters through record six consecutive days over 40°C temperatures

Physiological Equivalent Temperature



Adapted from Havenith (1999)

PET	Stress Category
<4	Very high cold stress
4 – 8	High cold stress
8 – 13	Moderate cold stress
13 – 18	Slight cold stress
18 – 23	No thermal stress
23 – 29	Moderate heat stress
29 – 35	High heat stress
35 – 41	Very high heat stress
>41	Extreme heat stress

Vulnerable spatial typologies

City centres / Shopping areas



Veemarktstraat, Breda, NL

Schools / Playgrounds



de Reigers School, Zelzate, BE

Residential neighbourhoods



Waverley Road, Margate, UK

Mobility hubs



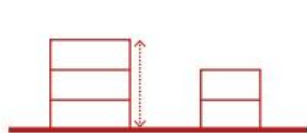
Bus station, Middelburg, NL

Pedestrian / Cycling routes

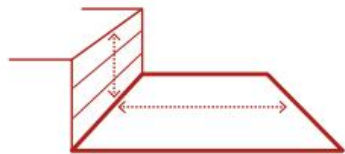


Coehoornstraat, Breda, NL

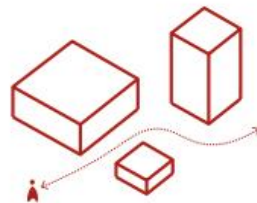
- Identifying vulnerabilities in and between outdoor spaces
- Resolving through tactical small-scale interventions as a start



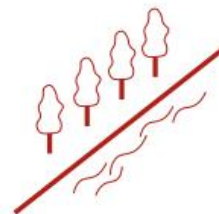
Urban Geometry



Height-Width Ratio



Social Movement



Green-blue infrastructure



User-groups

Vulnerable health groups

- Elderly
- Children
- Ill people
- Living alone (social isolation)
- Low socio-economic status

Vulnerable activity groups

- Commuters (on foot & bike)
- Leisure (escape the heat)
- Sport players
- Shoppers (daily)

Vulnerable places

Schools

Playgrounds

Care homes

Train + Bus
stations

Shopping
areas

Festival
grounds

Vulnerable Routes

- Towards amenities (e.g. pharmacy)
- Towards large cool places (e.g. parks)
- Towards train station
- Towards centrum area
- Towards bus station

Which places call for urgent action?



- **Market area** under Level 2 Extreme Heat stress
- Double row of plane trees, when 10-15 meter tall have a 15-17 °C PET heat reduction capacity
- Aim to make the area car free



- **Bus station route** suffers from Level 2 Extreme Heat Stress
- Re-connecting existing green infrastructure: planting row of trees at the end of 2020 (maple, ornamental pear, rowan)



- **School yard's** forested area offers escape from the heat, heat stress reduced to Moderate level
- Area's exposed to heat serve as Cool Towns pilot sites



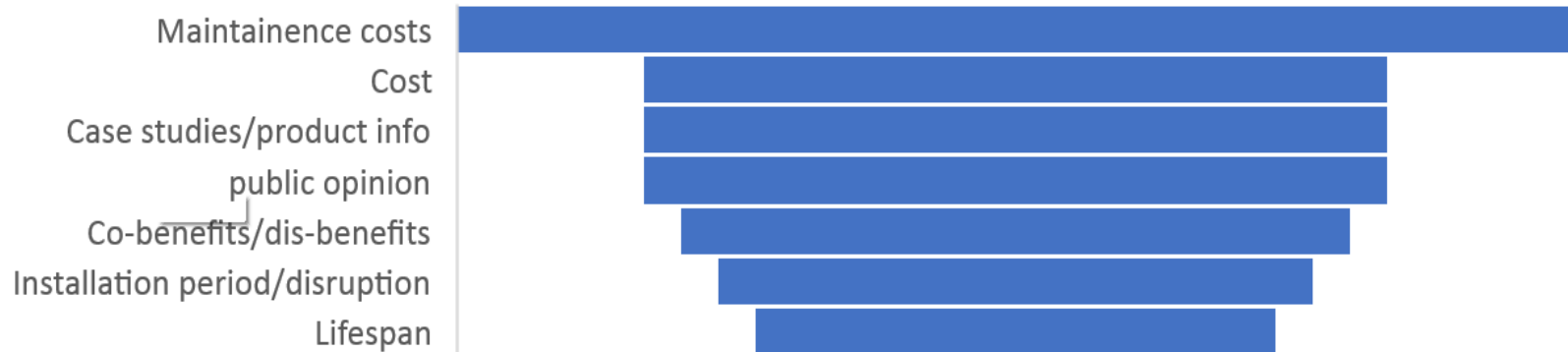
The Urban Heat Atlas

Gideon Spanjar, Debbie Bartlett,
Sába Schramkó and Jeroen Kluck

A standardised assessment
for mapping heat vulnerabilities
in Europe

Which intervention is most suitable?

Summary of key issues

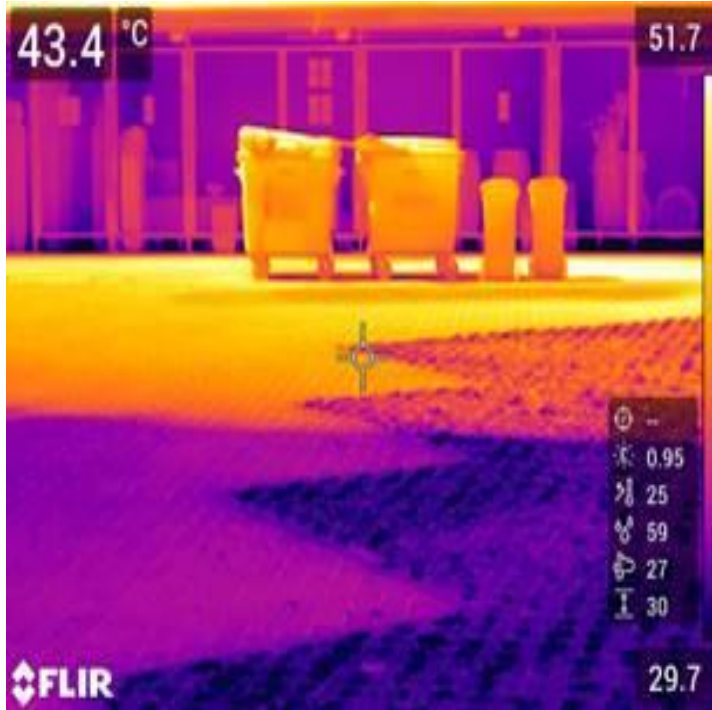


Which is most effective at increasing thermal comfort?





Types of pavement



solid
compared
with
vegetated
(permeable)
paving





Tree(s)



- single tree
- row of trees
- group of trees



Shelter Canopy



- shade sail
- awning
- pergola



Green Wall



- direct green façade
- indirect green façade
- living wall system
- free-standing green screen



Water Feature



- fountain
- smaller waterway
- misting



Cool Surface



- grass
- vegetated paving
- damped pavement

Cool Towns Heat Stress Measurement Protocol



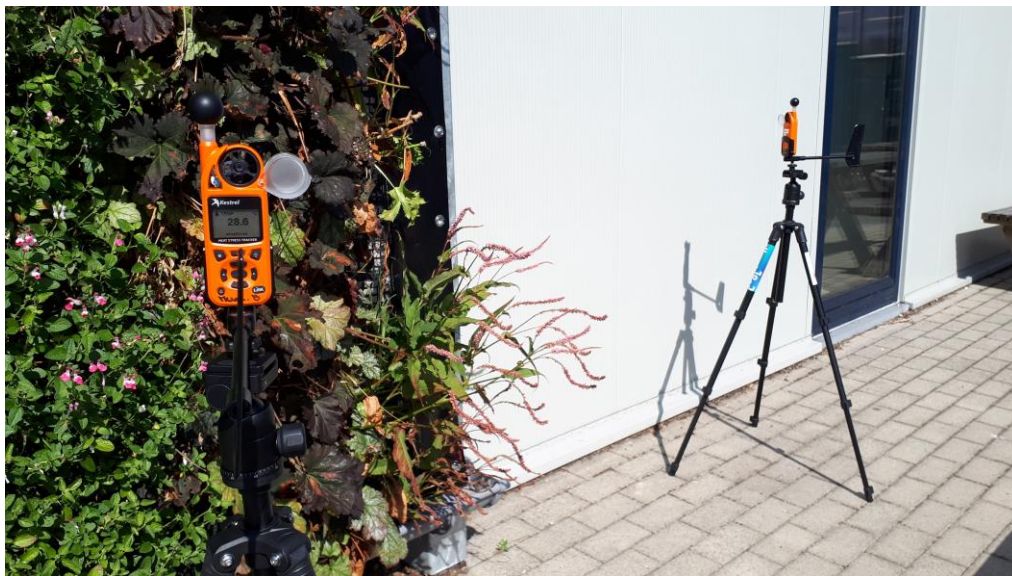
Cool Towns Heat Stress Measurement Protocol

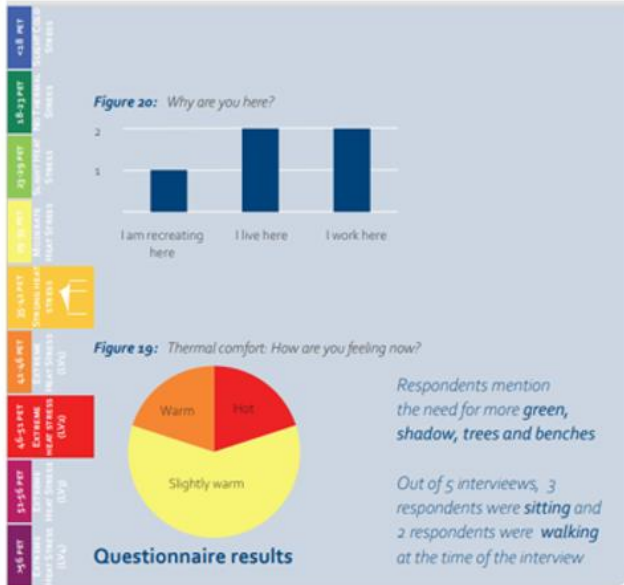
Gideon Spanjar, Luc van Zandbrink,
Debbie Bartlett and Jeroen Kluck

Thermal comfort
assessment at
street-level scale



Measuring effect on PET





Spatial characteristics

26-36 Kanaalweg, Middelburg, NL



Spatial typology	Mobility hub (in its proximity, in 200m)
Urban geometry	Open site with one high building at each short end of the linear pergola structure
Social use	Place to stay and sit on the benches. Cycling route runs next to the site

3.3.2 Pergola structure near Middelburg station

This 50m long metal pergola is located on an important walking and cycling route to the central train station area in Middelburg. It runs parallel with the Canal of Walcheren on an open site. The sole buildings tower over either end of the structure with a height of 20-25 metres, potentially blocking the wind that often fortifies as it sweeps above open canals. The measured wind speed corresponds to a light breeze on the Beaufort scale. It is at the threshold when people passing by may experience a touch of air on their skin. The still wind conditions with the low relative humidity point to a dry summer day that aggravates heat stress on the site. The pergola's effectiveness in reducing heat stress was measured during the late afternoon, near the evening rush hour when the sun is not at its highest anymore, while facades and concrete tiles already warmed up and radiate heat.

The pergola is densely overgrown with Wisteria, spreading over the edges of the supporting structure and creating a continuous shade. In the spring, the purple flowers of the Wisteria make the pergola especially attractive. Residents living, recreating or working in the area appreciated the pergola for walking along and resting underneath. The measurement and interviews underline the effectiveness of the pergola in reducing heat stress. Interviewees sitting or walking under the shade felt only slightly warm, while those in the sun reported feeling warm or hot. Even though the pergola reduced air temperature by less than 1° under the pergola, it greatly improved thermal comfort with around 13° lower PET in the shade. The pergola improved thermal comfort by two Physiological Stress Grades largely because it shaded the users and the hard surfaces from direct solar radiation.

Date	31 July 2020
Time	15:46
dPET	13,1 °C PET reduction
Intervention characteristics	
Species	Wisteria
Height	3m
Shade size	100m²
Ground	concrete tiles
Material	metal pergola structure
Transparency	85%

	PET (°C)	T _{air} (°C)	T _g (°C)	MRT (°C)	Wind (m/s)	RH (%)
Intervention	36,6	33,5	35,5	42,1	2,2	26,4
Reference	49,7	34	44,7	10,7	2,2	26,3
Difference	-13,1	-0,6	-9,2	-31,4	0,02	0,06
Int. grade	🟡 Strong heat stress					
Ref. grade	🔴 Extreme heat stress: Level 2					



Date	21 July 2021
Time	12:29
dPET	6,5 °C PET reduction
Intervention characteristics	
Species	English Ivy (<i>Hedera helix</i>)
Height	2m
Width	3m
Orientation	North-South
Ground	Concrete tiles
Condition	Good
Coverage	50%

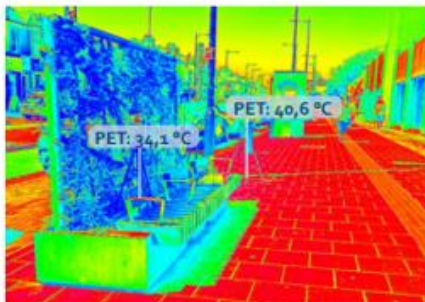
	PET (°C)	T _{air} (°C)	T _g (°C)	MRT (°C)	Wind (m/s)	RH (%)
Intervention	34,1	28,4	33	41,9	0,9	50,4
Reference	40,6	27,3	38	61	1,3	53,5
Difference	-6,5	1,1	-5	-19,1	-0,4	-3,1
Int. grade	Moderate heat stress					
Ref. grade	Strong heat stress					



Southend-on-Sea Municipality



Southend-on-Sea Municipality

Fisheye photo above
intervention point

Green bench Southend England



Amsterdam University of Applied Sciences

Cool Towns Intervention Catalogue

Gideon Spanjar, Debbie Bartlett, Sába Schramkó,
Jeroen Kluck, Luc van Zandbrink and Dante Föllmi

Proven solutions to
mitigate heat stress
at street-level



Trees provide many benefits
BUT ONLY
if they establish and grow
They need a long time
to mature

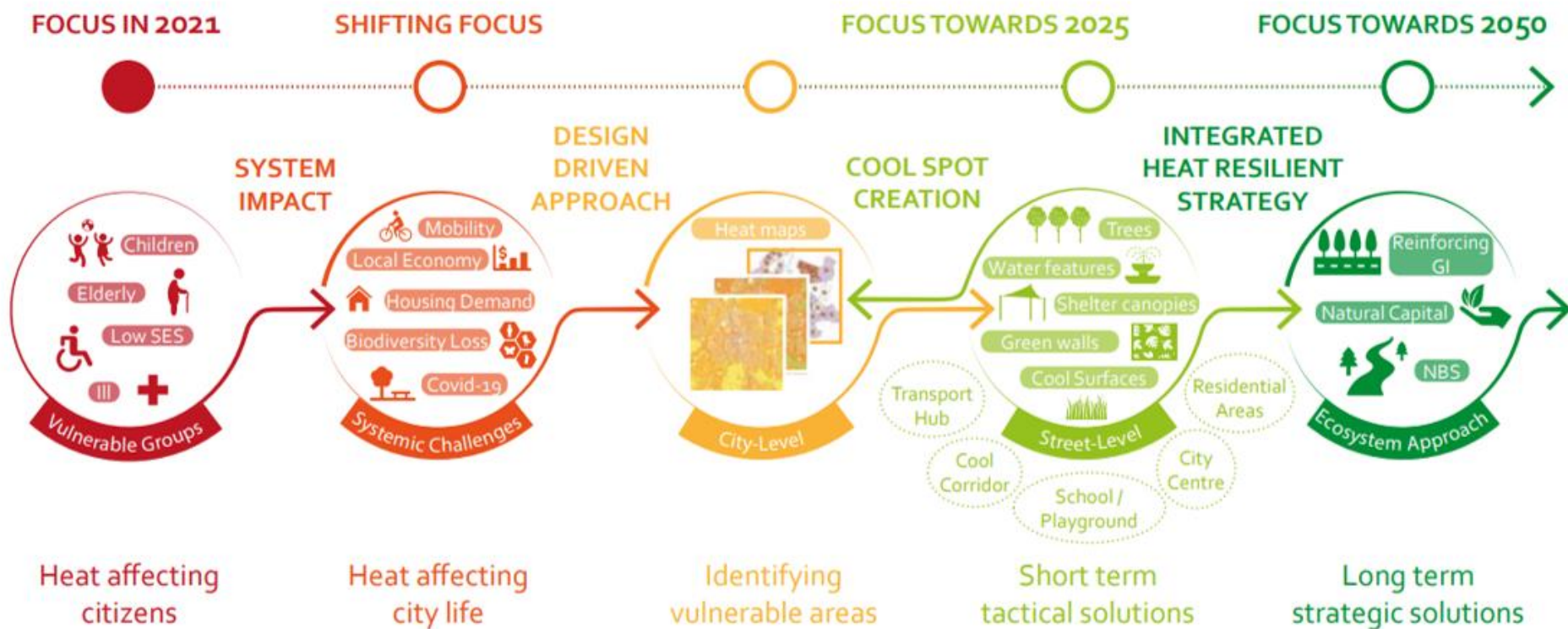
SuDs Sustainable Drainage Systems



[website](#)



Tackling heat vulnerabilities = shift in focus



The Roadmap

1. What is heat stress ?

2. What places have heat stress potential ?

3. How can heat stress be reduced ?

4. What is the best option to reduce heat stress in your area?

5. Case studies

6. Developing a city-wide strategy



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Proven solutions to mitigate heat stress at street-level

Free downloads

Heat Atlas

[https://pure.hva.nl/ws/portalfiles/portal/35821514/Spanjar et al 2022 The Urban Heat Atlas.pdf](https://pure.hva.nl/ws/portalfiles/portal/35821514/Spanjar_et_al_2022_The_Urban_Heat_Atlas.pdf)

Measurement protocol

[https://pure.hva.nl/ws/portalfiles/portal/16987054/Cool Towns Heat Stress Measurement Protocol.pdf](https://pure.hva.nl/ws/portalfiles/portal/16987054/Cool_Towns_Heat_Stress_Measurement_Protocol.pdf)

Intervention Catalogue:

[https://pure.hva.nl/ws/portalfiles/portal/41700065/Spanjar et al. 2023 Cool Towns Intervention Catalogue 175dpi.pdf](https://pure.hva.nl/ws/portalfiles/portal/41700065/Spanjar_et_al._2023_Cool_Towns_Intervention_Catalogue_175dpi.pdf)

Thank you for listening

If you require any further information

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Cool Towns

Cool Towns: European cooperation to combat heat stress in cities

<https://www.cooltowns.eu/>

For further information please email d.bartlett@gre.ac.uk