Developing Heat Resilient Cities the ‘Cool Towns’ project

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Interreg
2 Seas Mers Zeeën
European Regional Development Fund

London vs New Dehli

We are 6,727 km or 4,180 miles apart.

Average temperature in London is 14.7 °C (26.4°F) cooler than in New Delhi .

London has 1396 fewer hours of sunlight per year than New Dehli

That is 3h 50' less per day or about 1/2 as many.

At midday the sun is overall 22.8° lower in London than in New Delhi.

Source: http://www.london.climatemps.com/vs/new-delhi.php

Weather


London
+ Add to your locations
Today
16°
11°
Sunny intervals and a moderate breeze
Thu 3rd 13° 7°
Fri 4th 13° 5°
Sat 5th 13° 12°
Sun 6th 14° 11°
Mon 7th 15° 12°
Tue 8th 15° 11°
Wed 9th 15° 11°
Thu 10th
New Delhi
+ Add to your locations
Today
30°
17°
Sunny and light winds
Thu 3rd 31° 17°
Fri 4th 30° 17°
Sat 5th 30° 17°
Sun 6th 30° 17°
Mon 7th 30° 16°
Tue 8th 29° 16°
Wed 9th 29° 16°
Thu 10th

Same problem – different baseline

We are ALL facing the same climate emergency and a biodiversity crisis

Climate crisis

Europe's climate warming at twice rate of global average, says report

Trend of faster warming over last 30 years likely to cause exceptional heat, wildfires and floods, warn scientists

Helena Horton
Environment reporter

Wed 2 Nov 2022 14.00 GMT

https://www.theguardian.com/environment/2022/nov/02/europes-climate-warming-at-twice-rate-of-global-average-says-report?CMP=share_btn_link

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

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

Source: bbc.com

Delhi suffers at 49°C as heatwave sweeps India


Japan swelters in its worst heatwave ever recorded

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

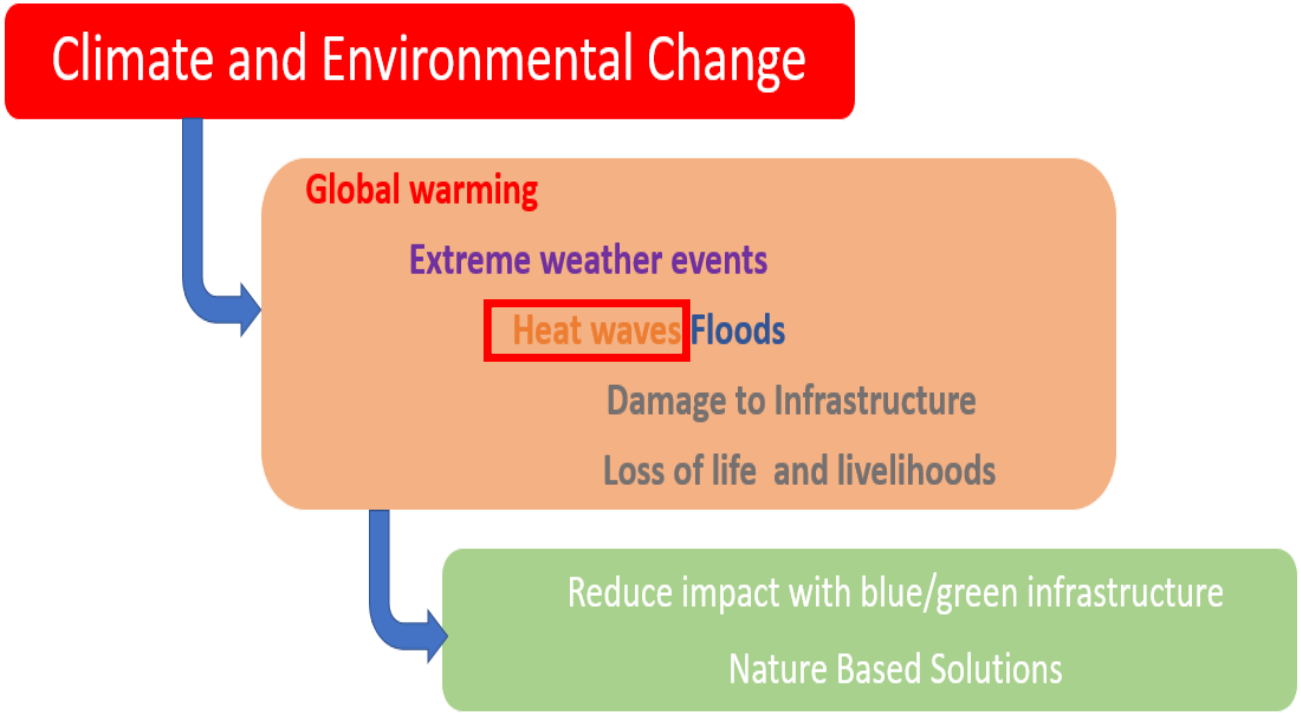
Follow our Australia news live blog for the latest updates

Download the free Guardian app: get our morning email briefing

Source: guardian.com

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

So what can we do?



Effects of heatwaves: Summer 2022

Parsons L.A. *et al.* "Increased labor losses and decreased adaptation potential in a warmer world." *Nature Communications* 2021.

Climate crisis

Climate crisis study finds heatwaves have cost global economy $16tn

Researchers examining data going back to 1990s find global south has borne brunt despite causing least emissions

Sofia Quaglia

Fri 28 Oct 2022 19.00 BST

Opinion
Education

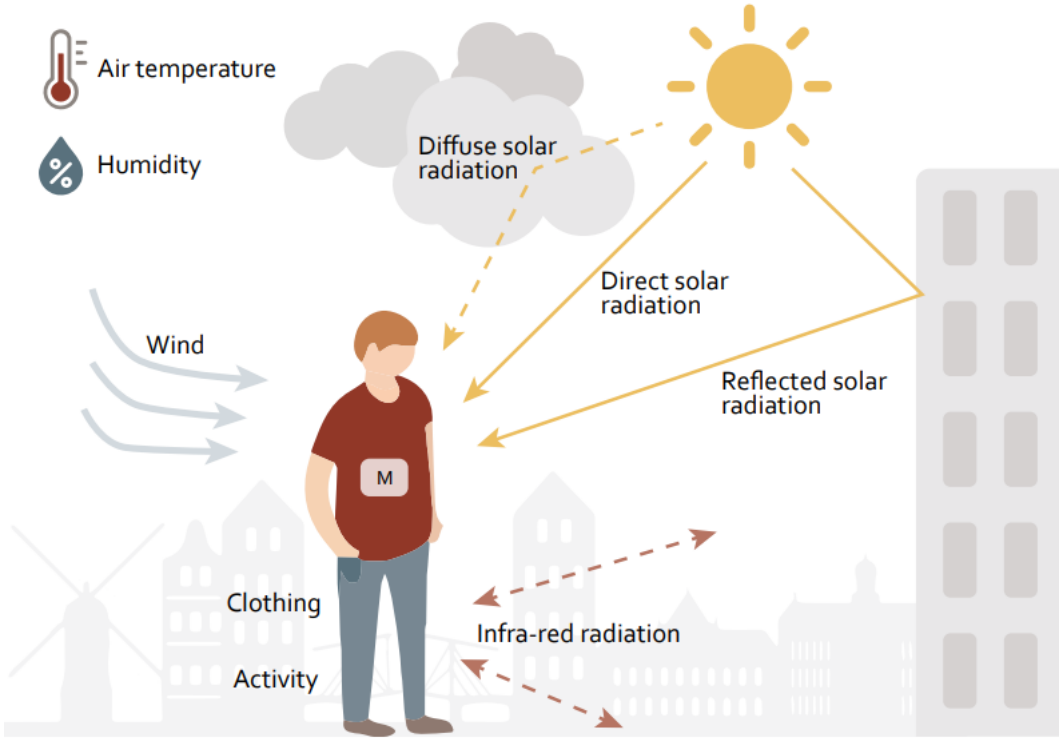
Making school cool helps children do better in exams

Torsten Bell

Sun 3 May 2020
06.30 BST

Hot weather makes it harder for students to focus, and that shows in their results

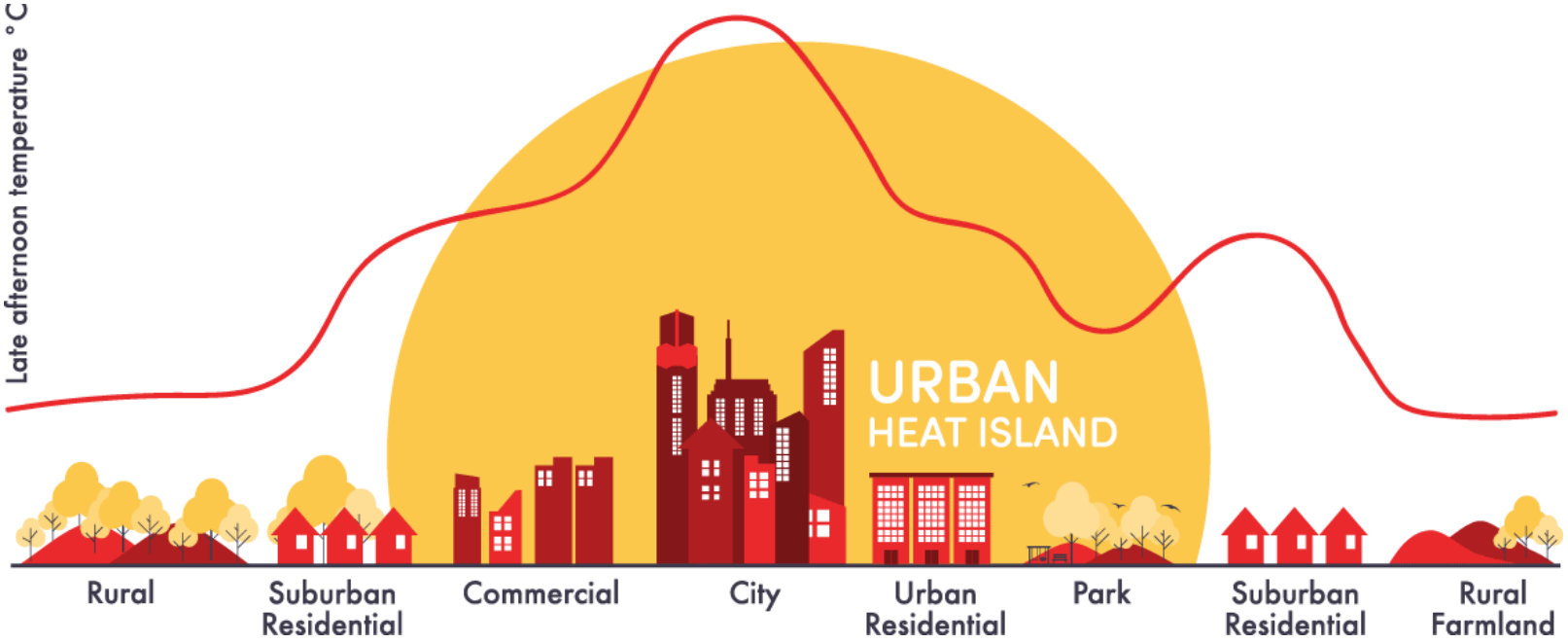
Physiological Equivalent Temperature



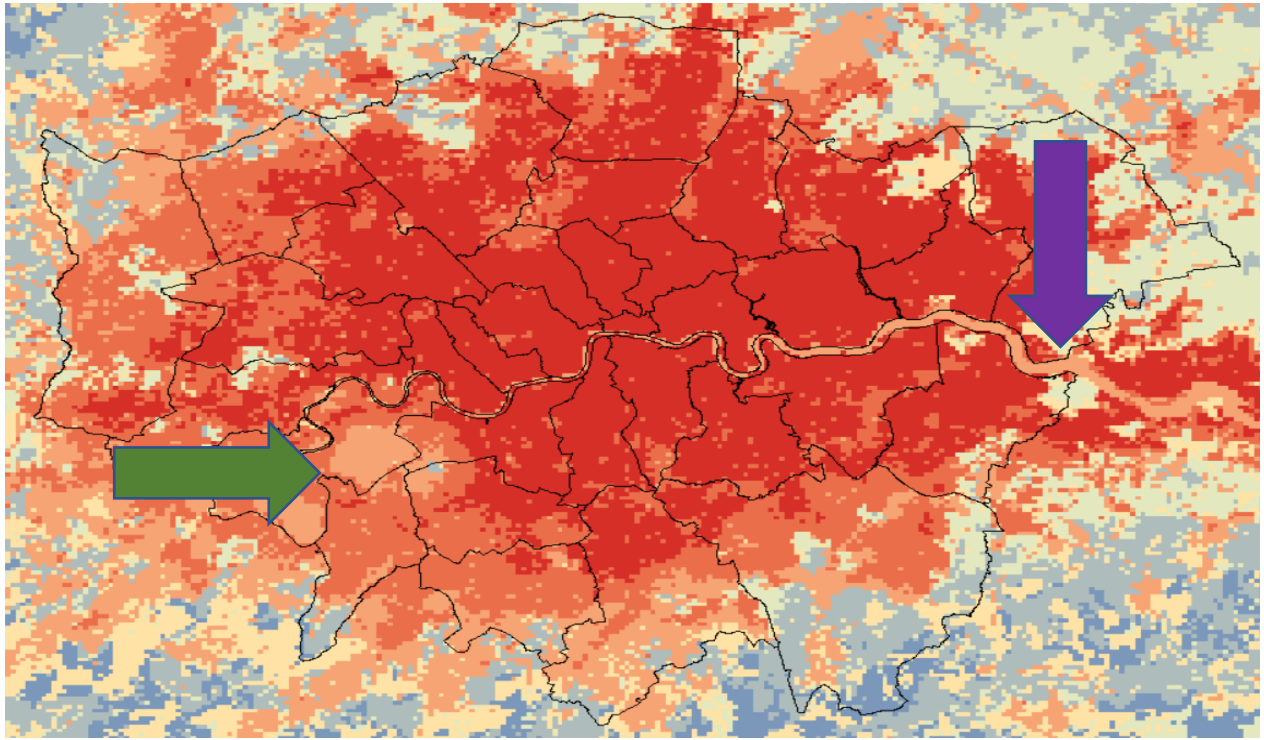
Adapted from Havenith (1999)

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

The Urban Heat Island Effect



UHI in London



UrbClim' simulation for the mean temperature at midnight

https://aiph.org/green-city/green-city-awards/wgca-2022-shortlist/

The AIPH World Green City Awards 2022 are designed to champion ambitious nature-orientated approaches to city design and operation.

Urban Forests to

reduce UHI

store carbon

improve air quality

and

increase liveability

https://www.local.gov.uk/case-studies/cambridge-city-council-cambridge-canopy-project-building-climate-resilience-future#the-impact

We know what helps
but it is still difficult to achieve

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Reducing incident radiation
- Shade
- Reflecting radiation

Reducing conductivity
- Light colour
- Texture

Perception of coolness
- Fluttering material
- Movement of water
- Rustling of leaves

Increasing evaporation
- Water feature
- Misting/spraying on surfaces
- Vegetation

Increasing air movement

Ways to Cool the Microclimate

INTERVENTIONS

- ✓ Geometric
- ✓ Surface
- ✓ Constructed Shade
- ✓ Green infrastructure
- ✓ Blue infrastructure

Increasing

Shade

Evaporation

Reflection

Ventilation

Can all make people cooler

Cool Towns Project

To provide cities and municipalities with knowledge and tools to become heat-resistant

- Determine objectives regarding heat stress and investment decisions
- Effective spatial interventions with additional benefits - testing and measuring pilot projects - decision tool
- Integrating heat resistance into policy: climate and spatial strategies - road map
- Increase skills and sense of urgency regarding heat resilient urban design among spatial specifiers

Interreg 2 Seas Mers Zeeën
European Regional Development Fund

Figure 2: The European CoolTowns partners in the Interreg Two Seas Region.

Design Professionals

EVIDENCE

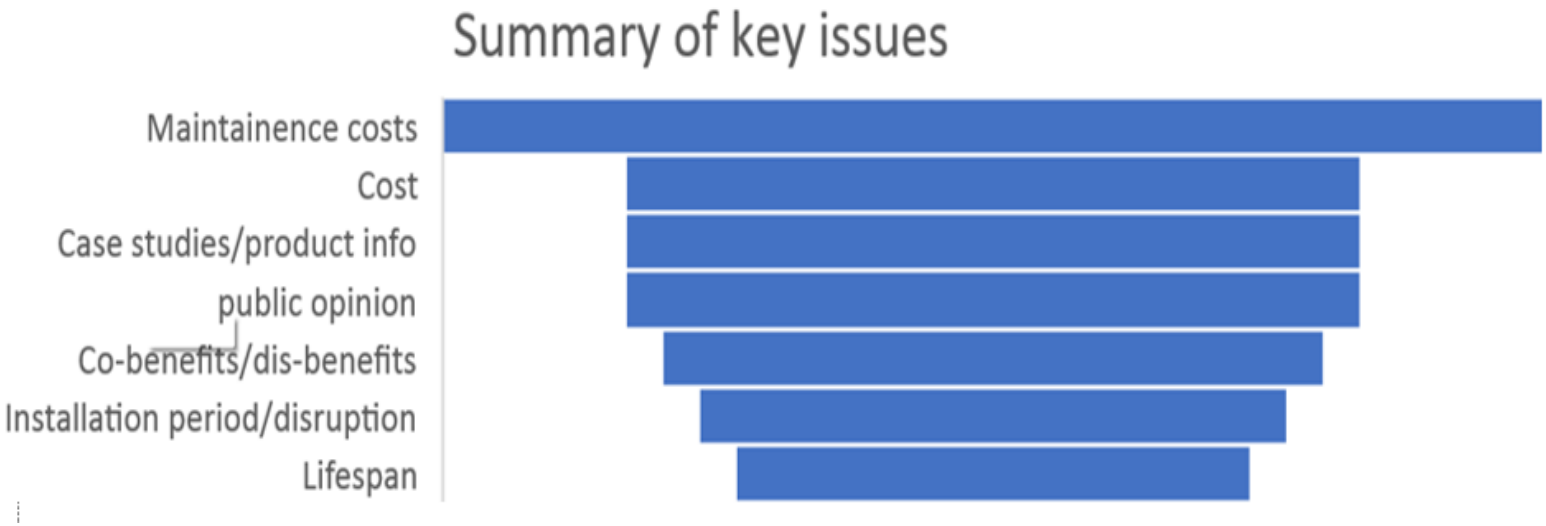
Elected Representatives

"well done – thank you for all the hard work"
"a lot tidier – used to be a grim parking place"
"glad to see house sparrows in the city"
"now its an attractive place and will attract new business"

Positive comments from local people

Stakeholder workshops Belgium, France, the Netherlands & UK

Elected members, landscape architects, technical staff, facillities management etc



The Roadmap

https://www.cooltowns.eu/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

Raising awareness of heat stress

https://www.cooltowns.eu/local-stakeholder-workshop/

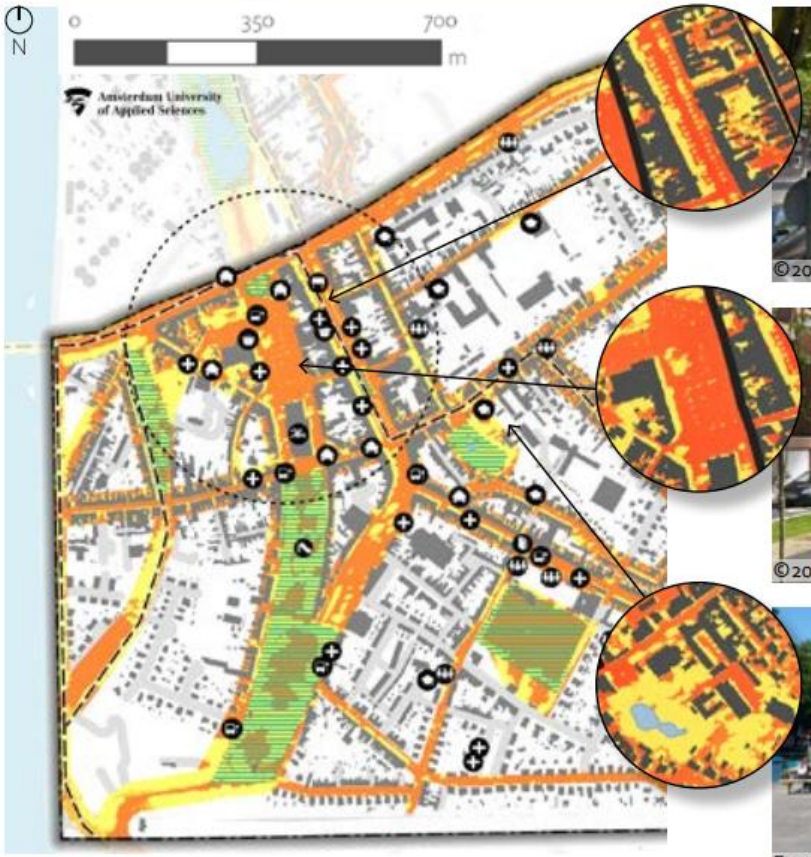
Local Stakeholder Workshop

A stakeholder workshop is a good way to engage those who are affected by, have a direct interest in, or are somehow involved with heat stress.

Downloads

- Practical tips for organizing a workshop
- Stakeholder workshop green infrastructure
- Presentation Stakeholder workshop

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

Vulnerable spatial typologies

City centres / Shopping areas

Veemarktstraat, Breda, NL

Schools / Playgrounds

de Reigers School, Zelzate, BE

Residential neighbourhoods

Waverley Road, Margate, UK

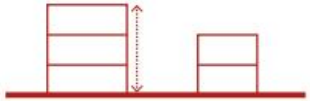
Mobility hubs

Bus station, Middelburg, NL

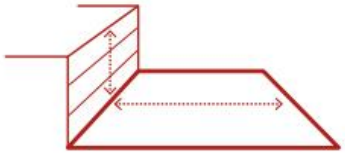
Pedestrian / Cycling routes

Coehoornstraat, Breda, NL

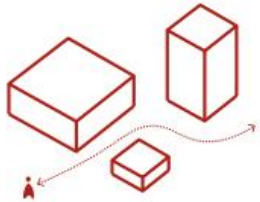
- Identifing vulnerabilities in and between outdoor spaces
- Resolving through tactical small-scale interventions as a start



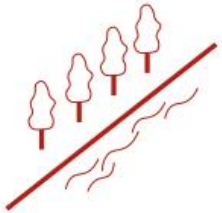
Urban Geometry



Height-Width Ratio



Social Movement

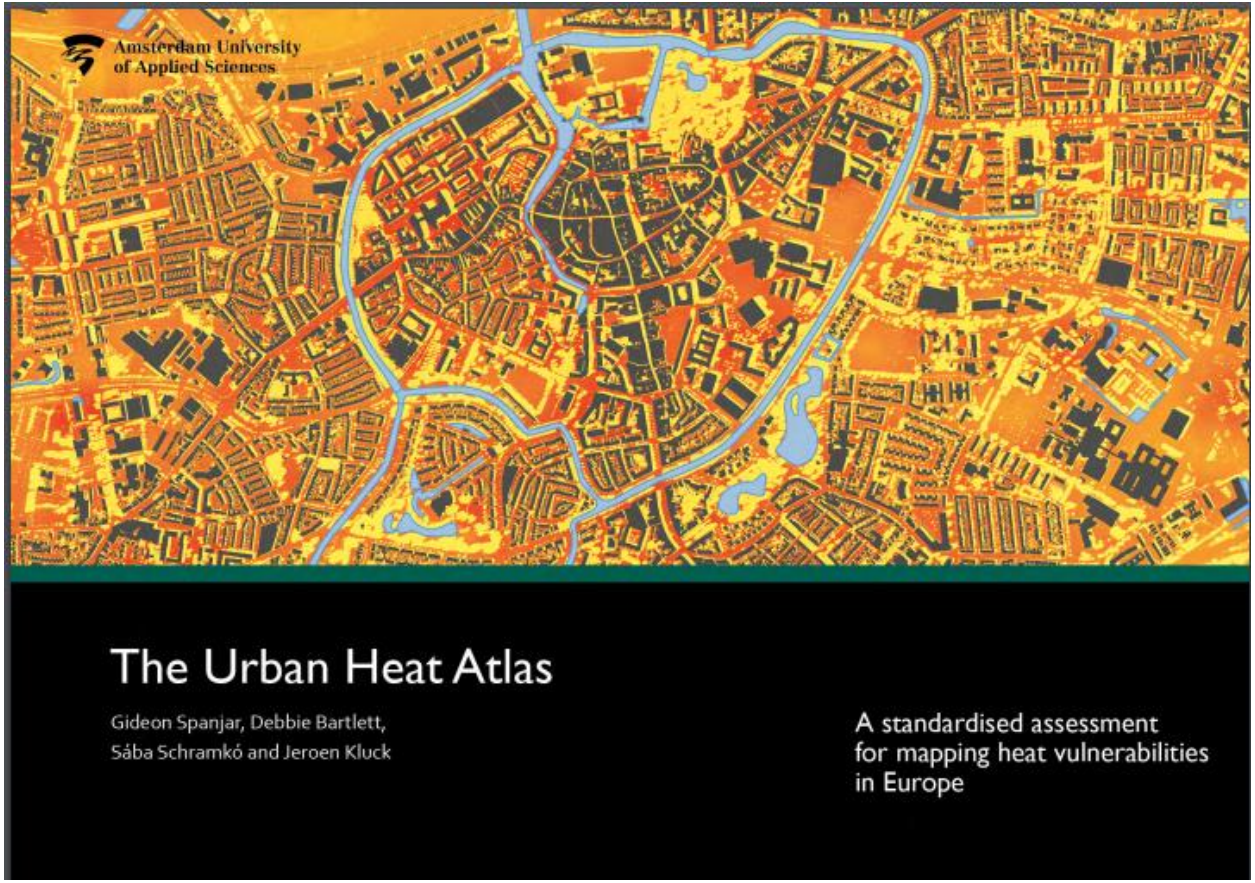


Greeb-blue infrastructure

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

https://pure.hva.nl/ws/portalfiles/portal/25019655/Spanjar_et_al_2022_The_Urban_Heat_Atlas.pdf



The partner's pilot projects

Cool Towns Pilot sites

City centres / Shopping areas


Grote Markt, Breda NL

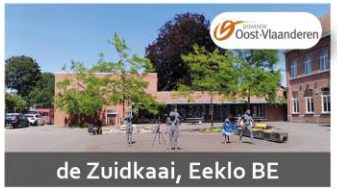

London Road, Southend-on-Sea UK


Centrum, Merelbeke BE


York Road, Southend-on-Sea UK


Lijnbaanstraat, Ostend BE

Schools / Playgrounds


de Zuidkaai, Eeklo BE


de Reigers, Zelzate BE


Ecole de Montaigne, Saint Omer FR

Residential areas


Menno van Coehoornstraat, Breda NL


Maynard Av., Margate UK


Nijverheidssingel, Breda NL


Zusterplein, Middelburg NL


Tuinwijk Jan Verhaegen, Merelbeke BE


Garrard Av., Margate UK

Transport hubs


Kanaalweg station, Middelburg NL

Street level solutions: Intervention Catalogue

Tree(s)

Single tree, Ghent (BE)

- single tree
- row of trees
- group of trees

Shelter Canopy

Shade sails, Amsterdam (NL)

- shade sail
- awning
- pergola

Green Wall

Indirect green facade, Ardooie (BE)

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

Water Feature

Fountain, Merelbeke (BE)

- fountain
- smaller waterway
- misting

Cool Surface

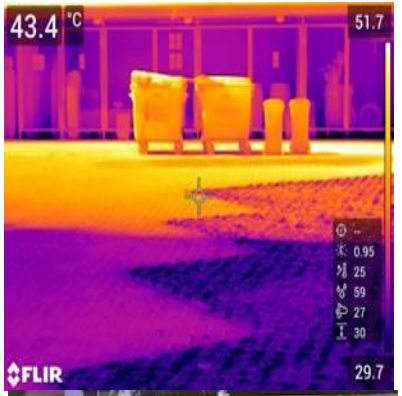
Vegetated paving, Merelbeke (BE)

- grass
- vegetated paving
- damped pavement

...but how effective are these heat stress mitigation interventions

https://www.cooltowns.eu/app/uploads/2020/11/Cool-Towns-Heat-Stress-Measurement-Protocol.pdf

Measuring effect on PET



Case studies

Project description

Reflection

Technical specifications

Capital Costs: Phase 1	€	£ = 1.6 €
Single Tree in grass		
Grass 78m²	507	428
Tree x 1	680	575

Annual Maintainence Costs:	€	£ = 1.6 €
Single tree in grass	38	32
Pruning tree (1x/3 years)	35	30
Watering (9 times/year)	86	72
Mowing (22x/year)		

Figure 20: Why are you here?

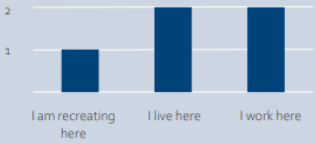
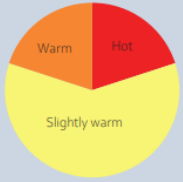


Figure 19: Thermal comfort: How are you feeling now?



Questionnaire results

*Respondents mention the need for more **green, shadow, trees and benches***

*Out of 5 interviews, 3 respondents were **sitting** and 2 respondents were **walking** at the time of the interview*

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.

Cool Towns

INTERVENTION

CARALOGUE

Available in

December

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					

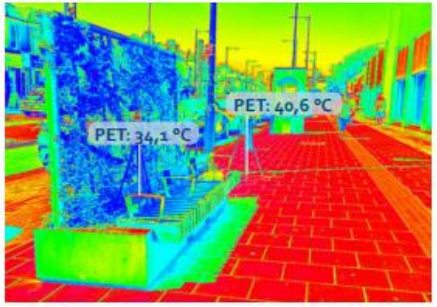
UNIVERSITY of GREENWICH

Date	21 July 2021
Time	12:29
dPET	6,5 °C PET reduction

Intervention characteristics

Species	English Ivy (Hedera helix)
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					



Green bench Southend England

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All interventions have co-benefits and dis-benefits

Additional benefits:

- Aesthetics
- Air quality
- Noise reduction
- Nature
- Health and wellbeing

Disbenefits:

- Establishment costs
- Maintenance
- Pests & disease
- Leaf fall
- Health & Safety

Trees

Provide many benefits

BUT ONLY

if they establish and grow

They need a long time

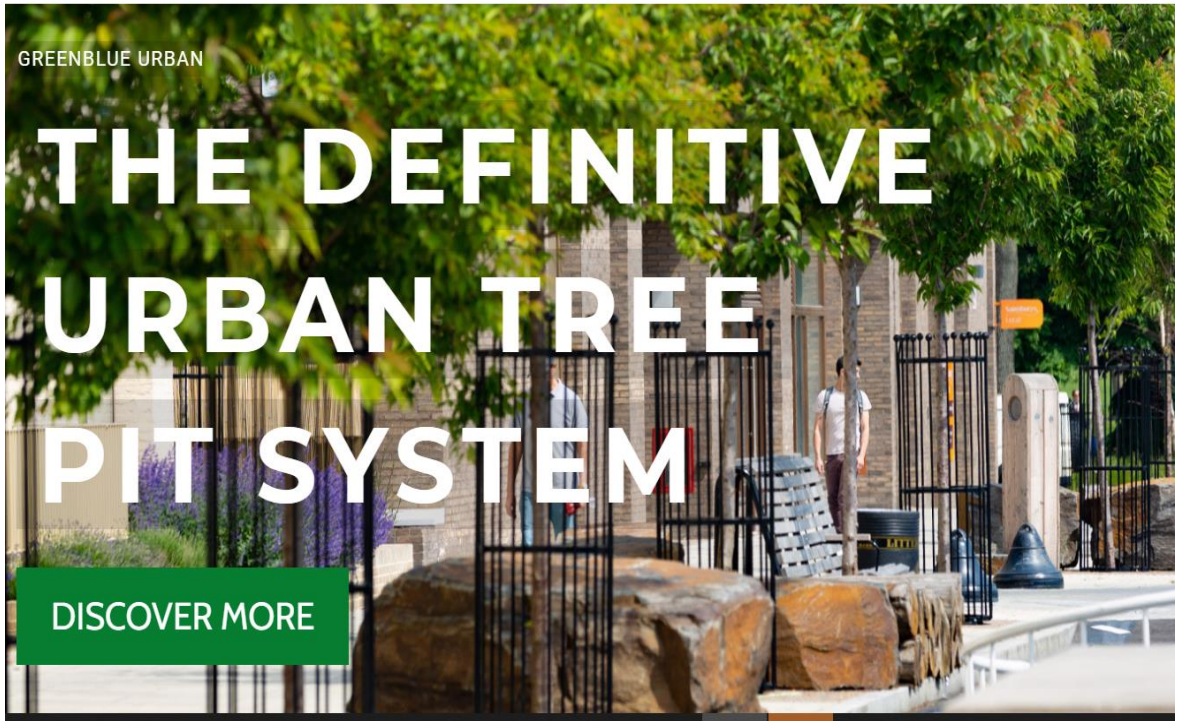
to mature

Source: Pace, Rocco - 2020 - Modeling ecosystem services of urban trees to improve air quality and microclimate.pdf
https://www.researchgate.net/publication/348973171_Modeling_ecosystem_services_of_urban_trees_to_improve_air_quality_and_microclimate

SuDs Sustainable Drainage Systems

Interreg 2 Seas Mers Zeeën


ZS-161-G



GreenBlue Urban offers landscape architects and designers load-bearing paving support systems that provide optimum soil conditions for root growth.

How to decide which species of tree?

https://www.forestresearch.gov.uk/tools-and-resources/urban-tree-manual/

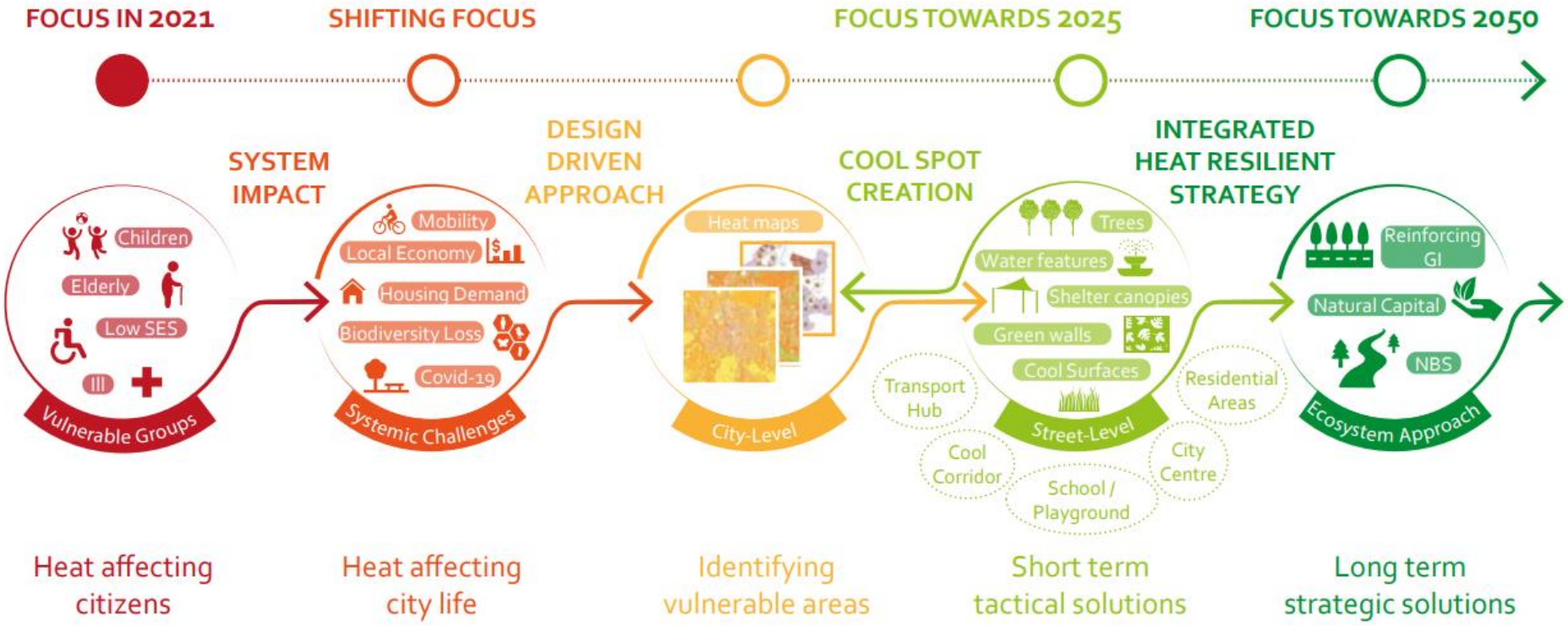
Native species?

Britain's climate zones shifting 5km a year

On 4th November 2020

Rewilding Britain has released a new report claiming that Britain's climate zones are shifting 5km a year, and that a nature recovery era is needed to avert a wildlife catastrophe.

Tackling heat vulnerabilities = shift in focus



Heat is an additional reason
include more
green **blue** elements
in public open space

To conclude

- I’ve given some background to our situation
- The cool towns project
- Small steps contribute to city wide heat resilience strate
- And mitigation of theUHI
- But we are beginners in dealing with heat ……

But you are the experts!

If anyone would be interested in a workshop to share experience

Contact Professor Debbie Bartlett
d.bartlett@gre.ac.uk

A

little

inspiration

Cool Towns

Cool Towns: European cooperation to combat heat stress in cities

https://www.cooltowns.eu/