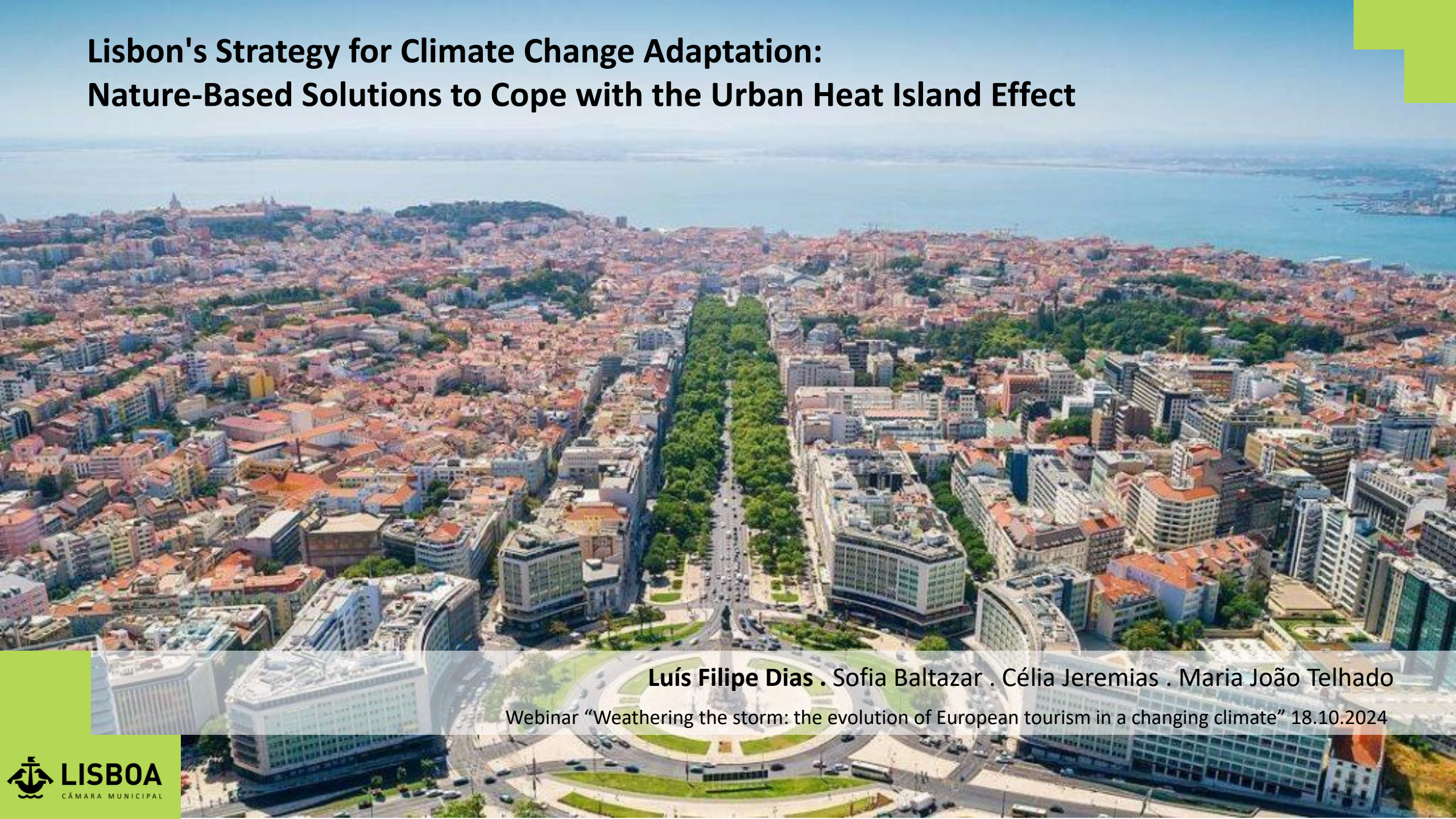
Lisbon's Strategy for Climate Change Adaptation: Nature-Based Solutions to Cope with the Urban Heat Island Effect



Luís Filipe Dias . Sofia Baltazar . Célia Jeremias . Maria João Telhado

Webinar “Weathering the storm: the evolution of European tourism in a changing climate” 18.10.2024

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Lisbon Location

100 km² Total area

44 km² Green area

20 km River front

24 Parishes

547.796 Inhabitants

925.959 Inhabitants commuters

49.223 Buildings

325.000 Housing

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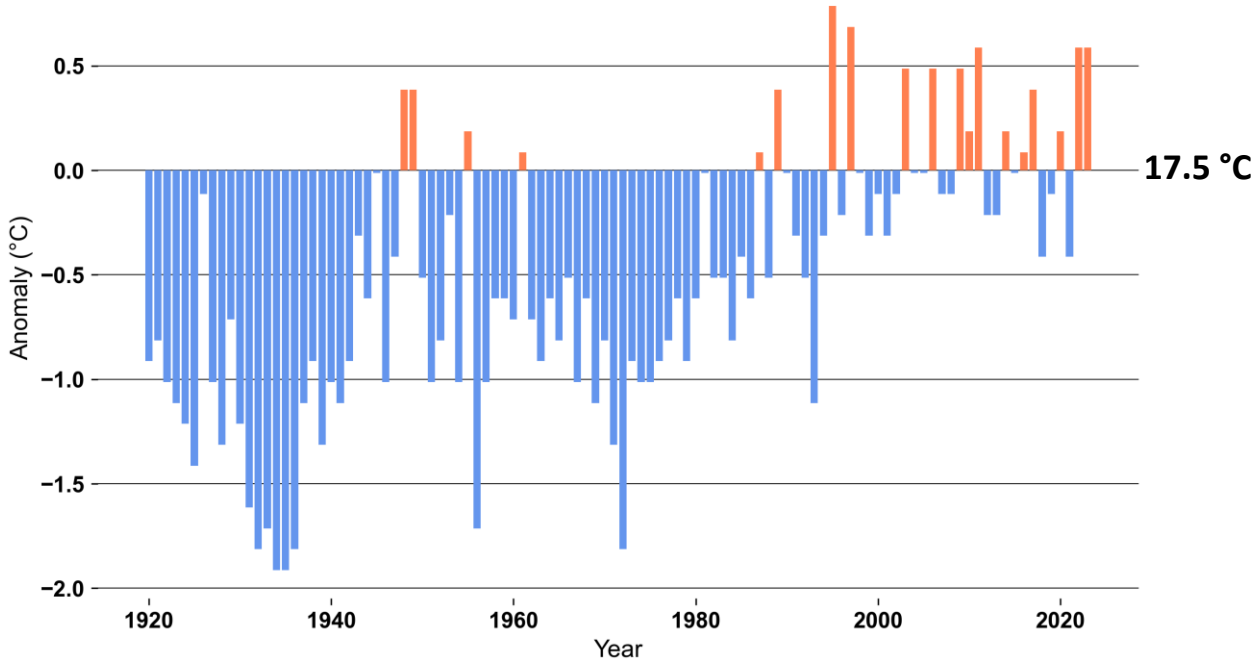
Observed climate and Climate change projection

Air Temperature Anomalies Relative to the 1991–2020 Reference Period



Source: E-OBS / Geofísico weather stations

Climate change projection on monthly average temperature

Time frame	2000-2023	2041-2070			2071-2100		
	observed	RCP2.6	RCP4.5	RCP8.5	RCP2.6	RCP4.5	RCP8.5
jan.	11.4	+1.19	+1.6	+2.09	+1.38	+1.96	+3.3
feb	11.7	+0.74	+1.32	+2.02	+0.89	+1.75	+3.19
mar	13.7	+1.13	+1.28	+1.6	+0.81	+1.79	+2.98
apr	15.4	+1.26	+1.49	+1.81	+0.95	+2,04	+3.67
may	18.1	+1.29	+1.52	+2.24	+1.25	+1.98	+3.88
jun	20.7	+1.12	+2	+2.17	+1.4	+2.13	+3.7
jul	22.1	+1	+1.71	+2.19	+1.28	+2.03	+4.09
aug.	22.8	+1.42	+1.65	+2.61	+1.05	+2.3	+4.15
sep.	21.4	+1.78	+2.53	+3.16	+1.61	+2.75	+4.91
oct.	18.6	+1.7	+2.33	+3.13	+1.67	+2.98	+5.25
nov.	14.1	+1.44	+1.63	+2.46	+1.24	+2.34	+4.05
dez	11,7	+1.44	+1.39	+2	+1.25	+2.22	+3.59

Source: http://rna2100.portaldoclima.pt

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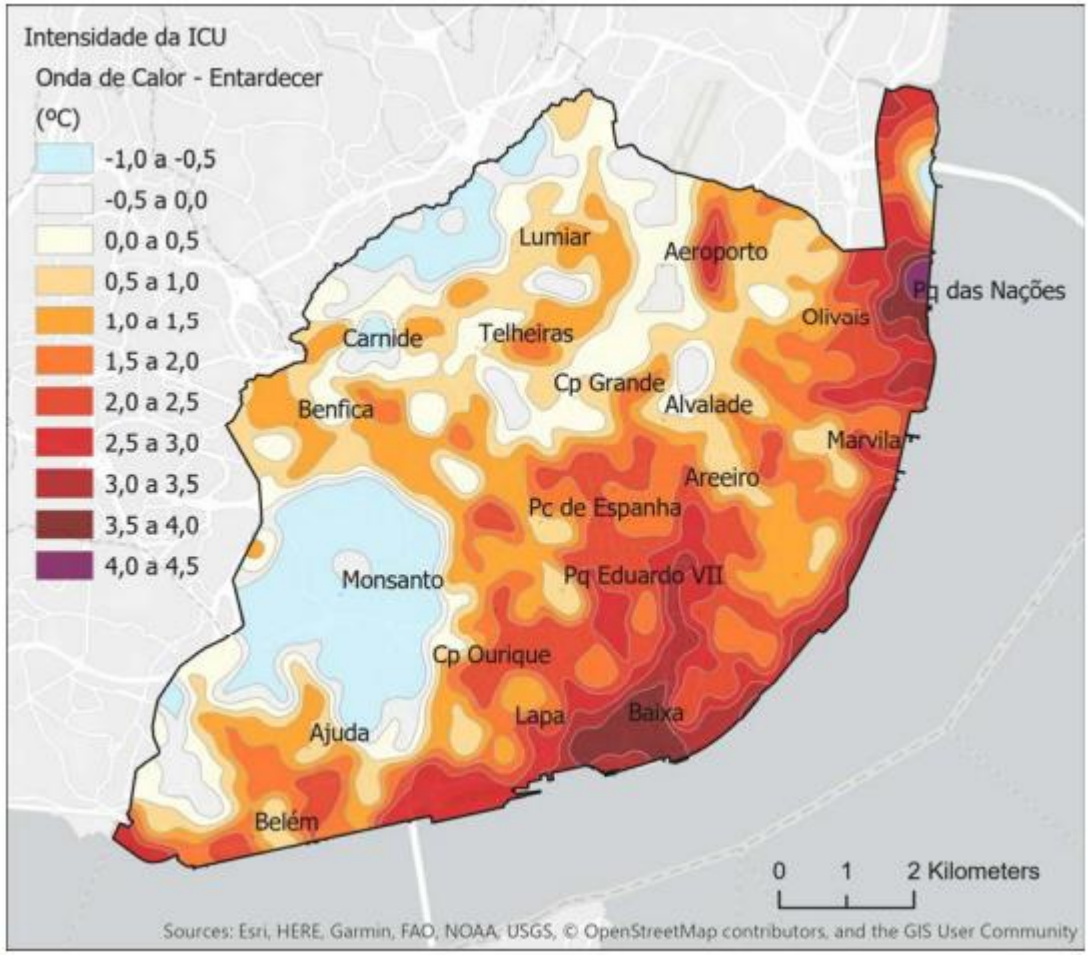
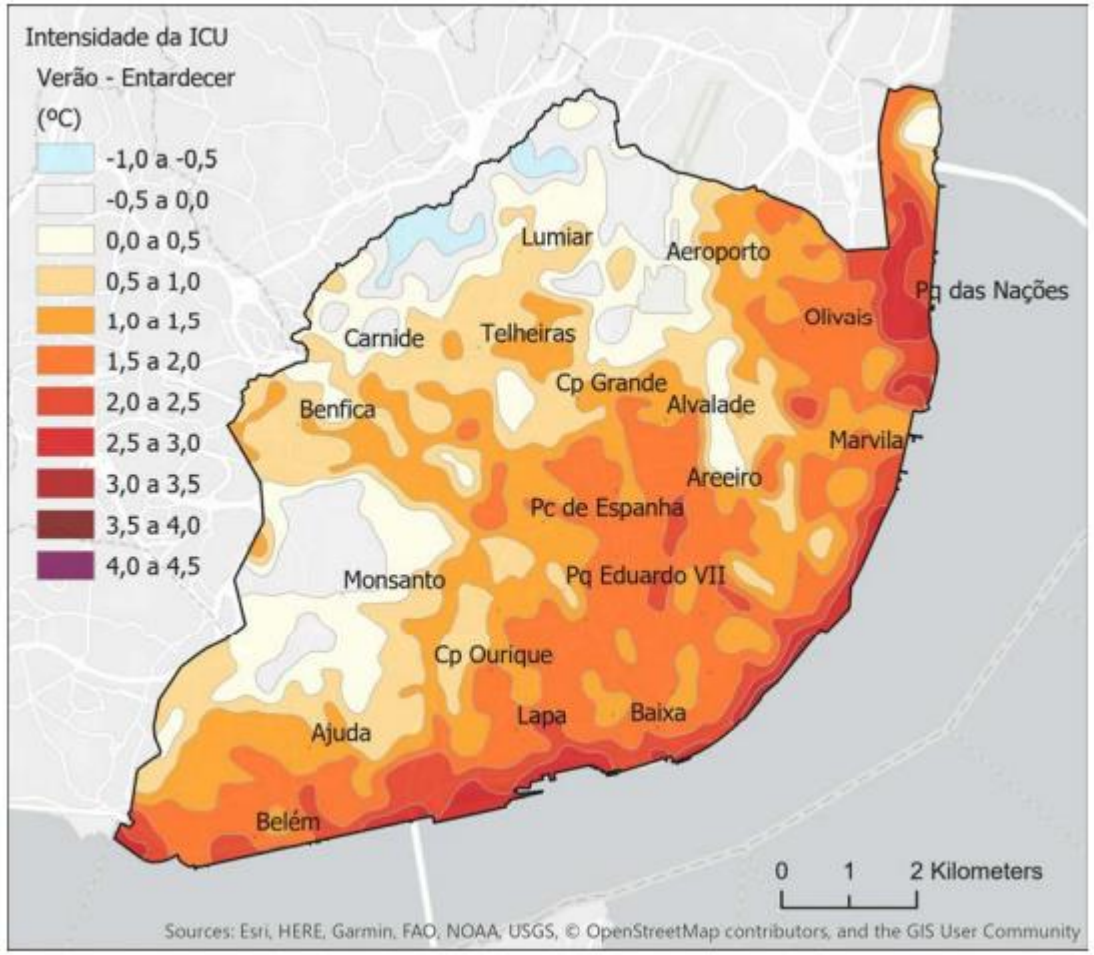
Urban heat island effect in Lisbon

Heat wave at dusk



Summer at dusk



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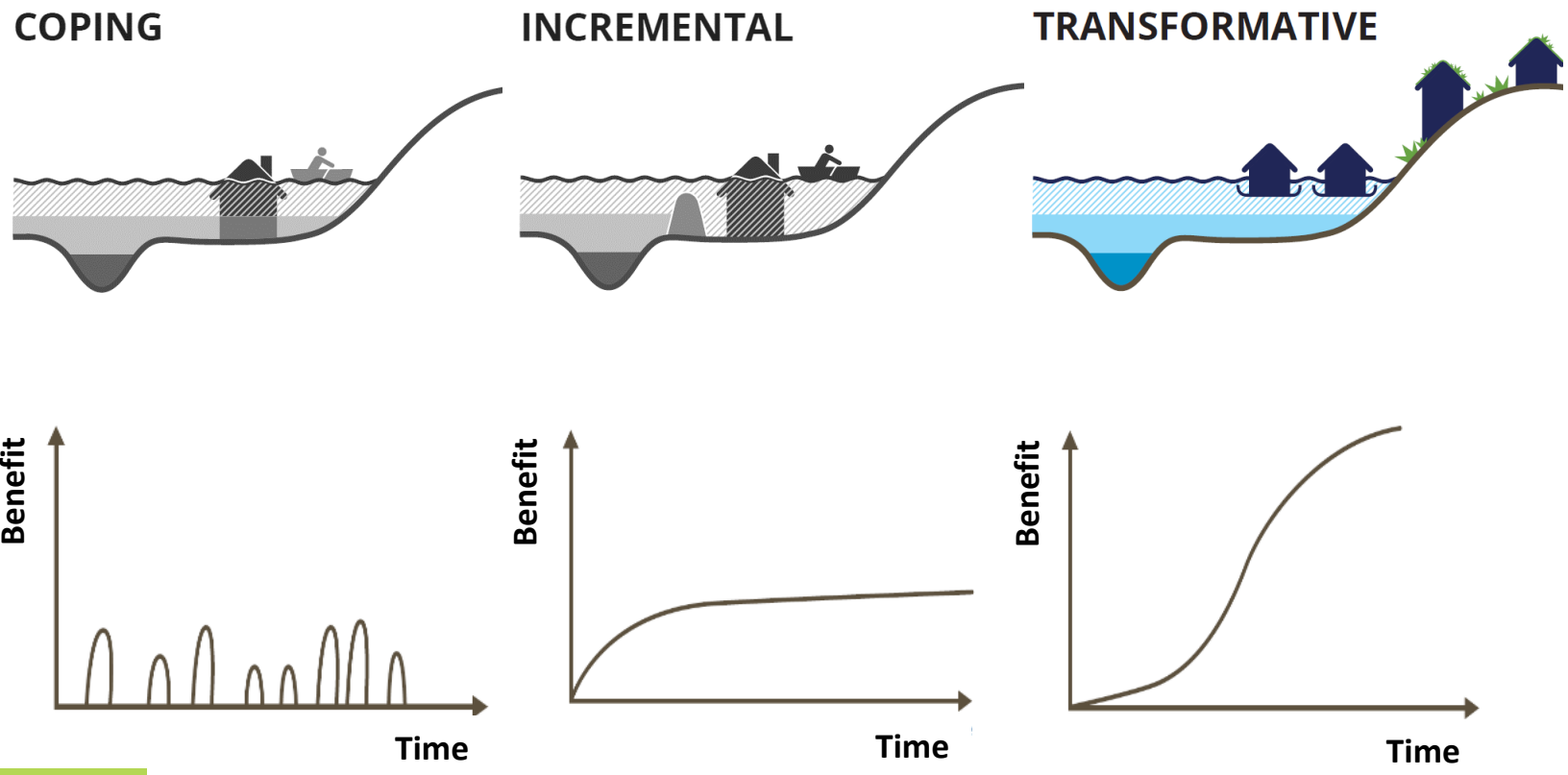
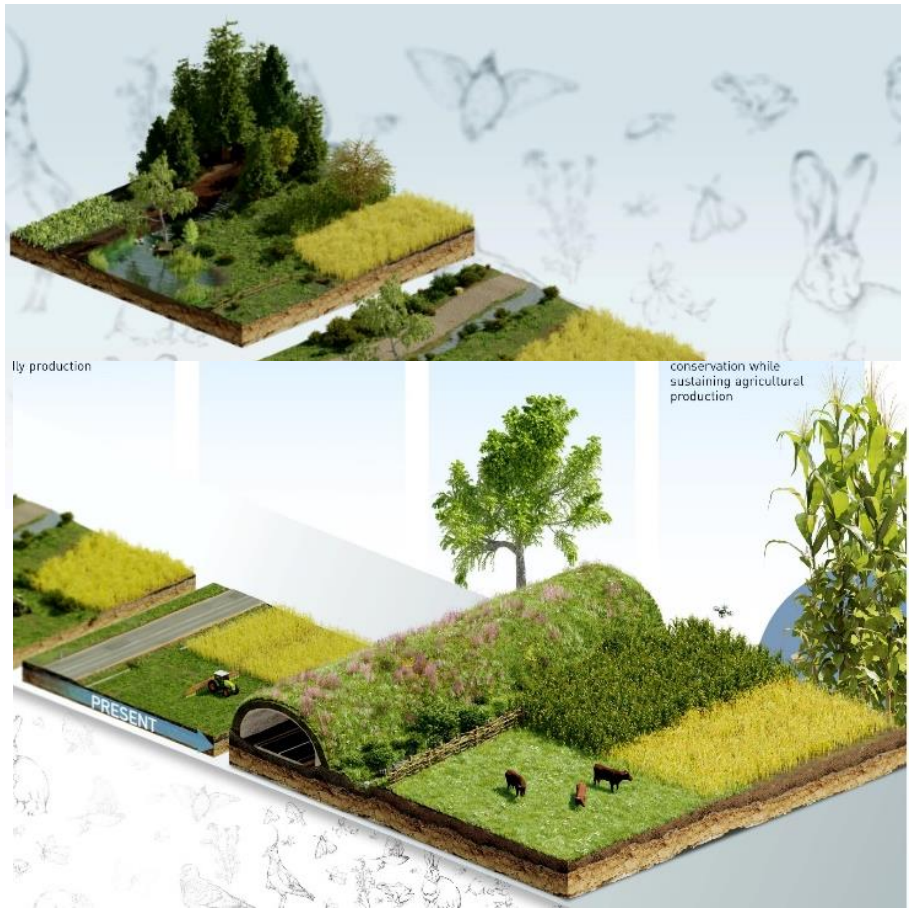
Adaptation Strategy Adopted in Lisbon





Source: EEA (2016)

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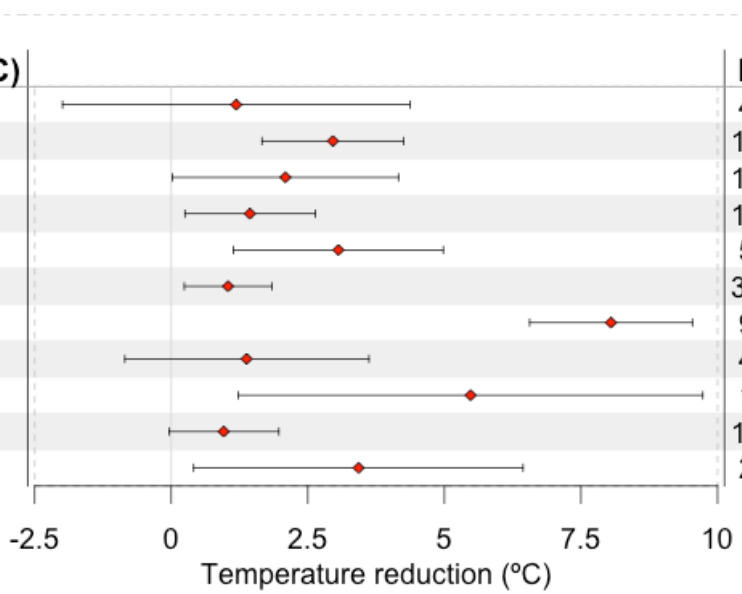
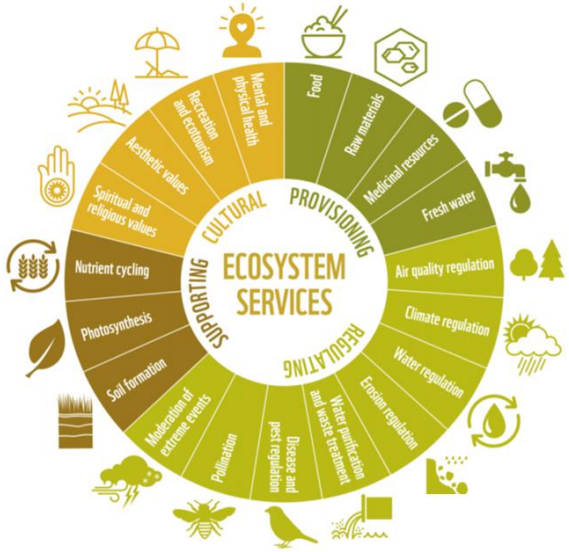
Natural based-Solutions : Benefits for decreasing in Temperature

Measurement type	NbS	Average temperature (ºC)	k	5% CI	95% CI	p-value
Air	Green roof	1.19	4	-1.99	4.37	0.459
Surface	Green roof	2.96	14	1.66	4.25	<.0001
Surface	Green wall	2.09	10	0.02	4.16	0.048
Air	Park	1.44	13	0.25	2.64	0.018
Surface	Park	3.06	5	1.14	4.98	0.002
Air	Tree(s)	1.04	30	0.24	1.84	0.011
Surface	Tree(s)	8.05	9	6.56	9.54	<.0001
Air	Urban forest	1.38	4	-0.85	3.62	0.222
Surface	Urban forest	5.48	1	1.23	9.73	0.012
Air	Urban green space	0.96	19	-0.04	1.97	0.059
Surface	Urban green space	3.43	2	0.41	6.44	0.026





Köppen-Geiger zone	Average temperature (ºC)	k	5% CI	95% CI	p-value
Csa	2.33	42	1.41	3.25	<.0001
Csb	1.17	3	-2.57	4.92	0.535

Source:

Science of the Total Environment 950 (2024) 175179

Contents lists available at ScienceDirect

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journal homepage: www.elsevier.com/locate/scitotenv

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[b] cE3c – Center for Ecology, Evolution and Environmental Changes & CHANGE – Global Change and Sustainability Institute, Faculdade de Ciências da Universidade de Lisboa, Edifício C2, 5º Piso, Sala 2.5.46 Campo Grande, 1749-016 Lisboa, Portugal

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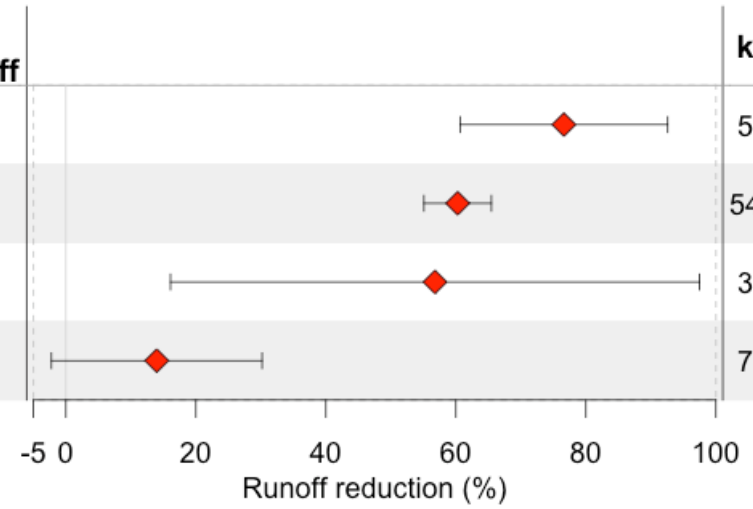
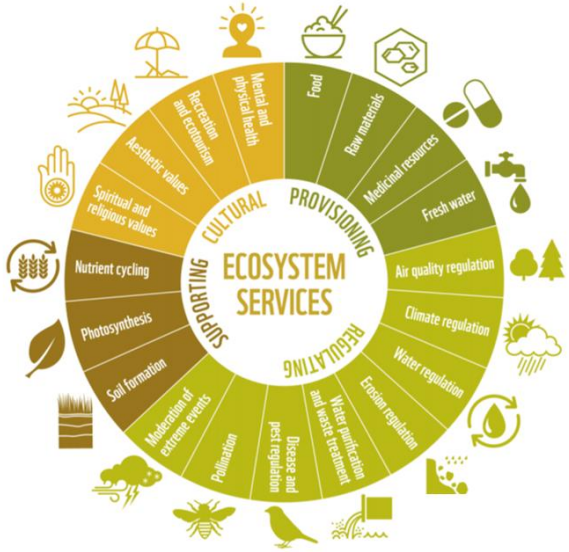
Nature-Based Solutions: Added Benefits for Flooding

NbS	Average reduction in runoff	k	5% CI	95% CI	p-value
Bioretention cell	76.61	5	60.63	92.58	<.0001
Green roof	60.27	54	55.08	65.46	<.0001
Park	56.78	3	16.09	97.47	0.007
Trees	13.97	7	-2.23	30.18	0.09





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Natural based-Solutions

Trees (-1°C Air | -8°C Surface)	Parks (-1.4°C Air | -3°C Surface)	Forests/Green spaces (≈-1°C Air | ≈-3.5°C Surface)	Green Roofs (-3.5°C Surface)
			
Reinforcement of tree planting in densely built-up areas (street trees)	Increase of green spaces (trees and shrub densification, urban gardens and vineyards)	Strengthening the connectivity network and ecosystem services	Investment in green solutions applied to roofs, façades, courtyards, and underground constructions.

Public spaces

Buildings

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Natural based-Solutions . Trees

República Avenue

- Heavy vehicle traffic
- Limited pedestrian spaces
- Lack of green areas
- Narrow sidewalks
- High noise and air pollution
- Degraded urban space

Images Source: CML, Google Maps, Vitor Antunes

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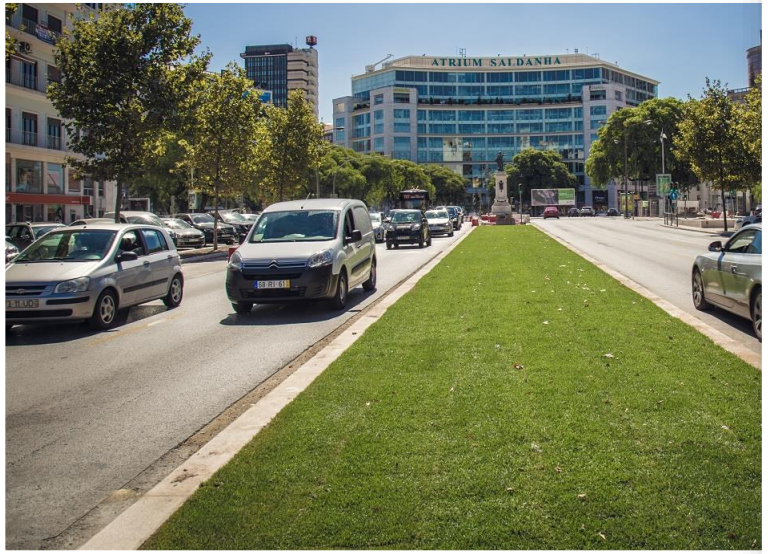
Natural based-Solutions . Trees

República Avenue

- New tree planting
- Creation of green spaces
- Fewer traffic lanes
- Improved public spaces
- Better integration of public transport, cyclists, and pedestrians



Images Source: CML, JLL Portugal

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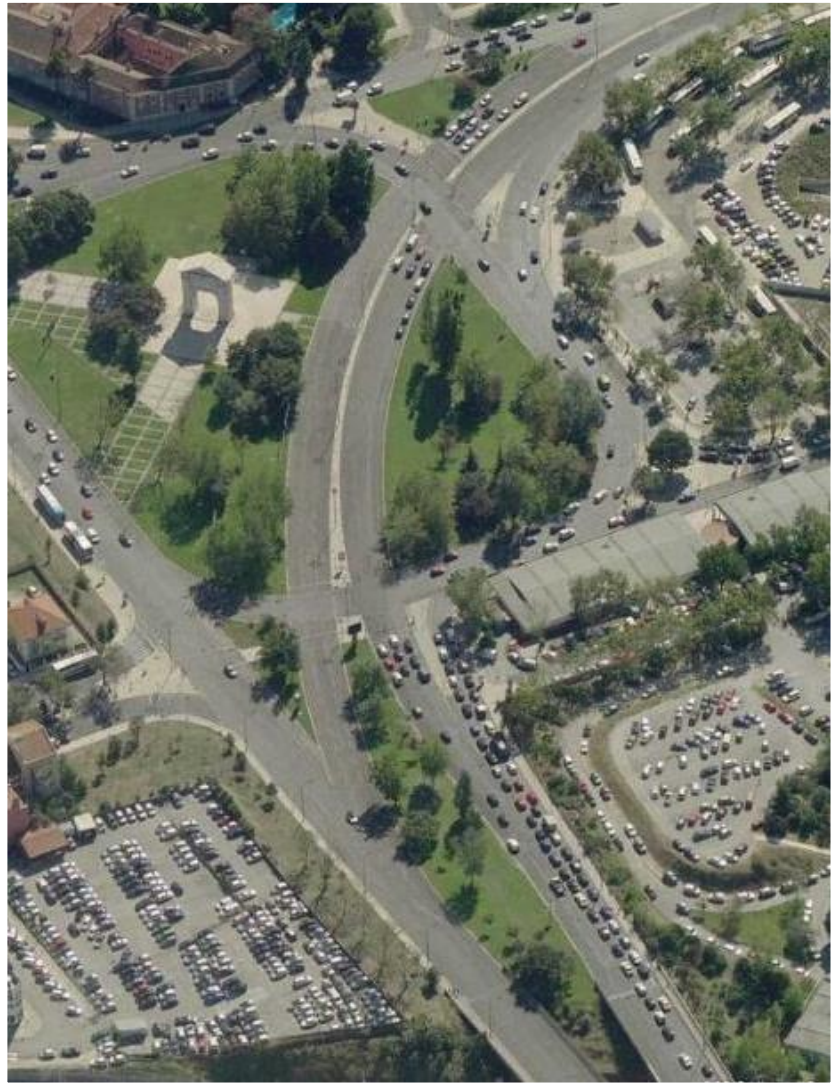
Natural based-Solutions . Parks

Espanha Square

- Unused space
- A disused market
- Public transport hub
- No walking or cycling paths



Images Source: CML

Natural based-Solutions . Parks

Gonçalo Ribeiro Telles Garden

- Watercourse renatured
- Use of riparian vegetation
- Plantation of + 1000 trees
- Creation of fruition areas
- New pedestrian paths
- New cycle lanes
- Reclaimed water network

Images Source: CML, LPP

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Natural based-Solutions . Urban forests/Green spaces

Monsanto Green Corridor

- Degraded areas
- Lack of connection between Monsanto's park and the city
- No pedestrian or cycling paths
- Sparse vegetation
- Low public use

Images Source: CML

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Natural based-Solutions . Urban forests/Green spaces

Monsanto Green Corridor

- New pedestrian and cycling paths
- Improved city connection (boosts biodiversity)
- Tree planting and rewilding
- Leisure areas (skate park)
- Urban gardens creation

Images Source: CML

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Natural based-Solutions . Green roofs

Alcântara Wastewater Treatment Plant

- Minimal aesthetic or ecological value
- Industrial area with no vegetation
- Large area of impermeable surface
- Odor release

Images Source: ADP, Confrasilvas

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Natural based-Solutions . Green roofs

Alcântara Wastewater Treatment Plant

- Improved energy efficiency
- Reduced odor release
- Enhanced biodiversity
- Improved aesthetics, creating a greener and more visually appealing environment

Images Source: CML, Argex S.A.

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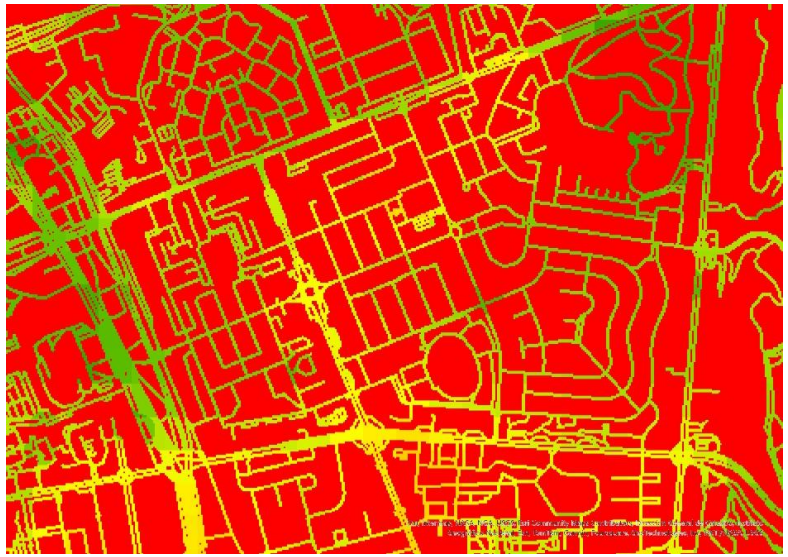
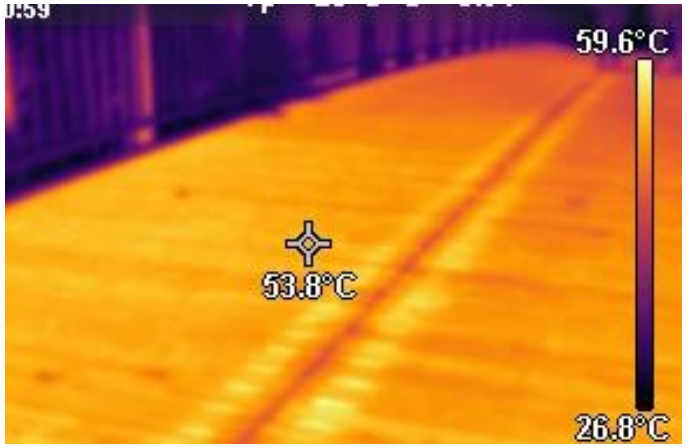
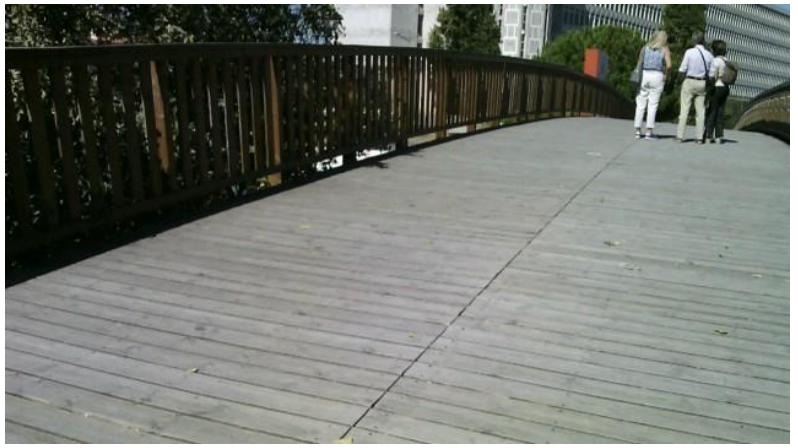
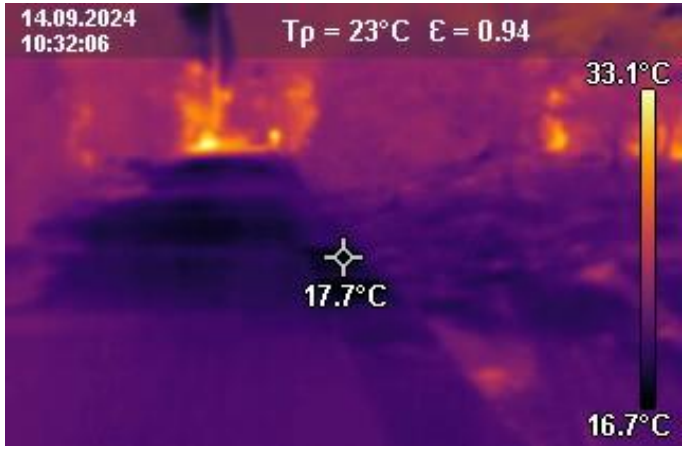
Interreg Euro-MED COOL NOONS

OBJECTIVE: Promoting **climate change adaptation** in **urban tourism**, through the **involvement of citizens** and the **testing of solutions**, including NBS, in Mediterranean cities.









Interreg Euro-MED COOL NOONS

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