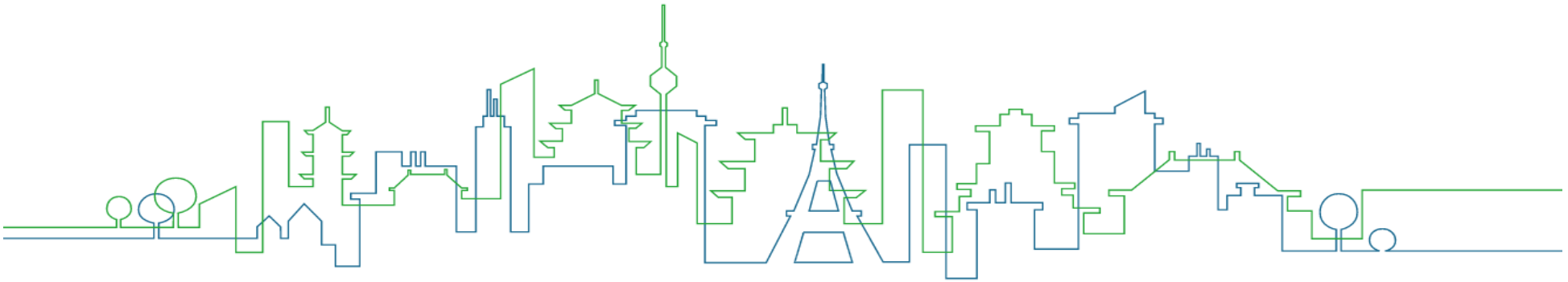
Nature Based Solutions to address societal challenges – evidence from two EC funded projects

2nd webinar of the PEER working group on Climate Action

Marianne Zandersen, REGREEN Coordinator & I4N WP-lead
Senior researcher, Aarhus University, Department of Environmental Science
mz@envs.au.dk



These projects have received funding from the European Union's Horizon 2020 and Horizon Europe research and innovation programmes under grant agreement no.821016 & no.101061083. This document reflects only the author's view and the Commission is not responsible for any use that may be made of the information it contains.

REGREEN - Fostering nature-based solutions for equitable, green and healthy urban transitions in Europe and China

Aims to integrate **knowledge and evidence on benefits** from NBS to address urban challenges; **develop and test tools to guide, design and plan** NBS**; consolidate business and investment models** for NBS and promote NBS **awareness and institutionalisation** in education, governance, and planning

- *Children & youth's experience & awareness of natural environment & NBS*
- *Quantifying and modelling ecosystem services from NBS*
- *Quantifying benefits & values from NBS and their services*
- *Improve systems of governance and planning*
- *Business incubation, new financial models, cost-effectiveness & risks*
- *Exchange of knowledge & experience, training between urban living labs*

twitter.com/REGREEN-nbs
linkedin.com/company/regreen-horizon-2020
Email: regreen.nbs@gmail.com
Website: www.regreen-project.eu

Invest4Nature - Promoting investments in NBS and accelerating market uptake by gaining a better understanding of the economic performance of NBS, considering climate mitigation and risk reduction

*Aims to gain a better understanding of the **economic** and **financial** performance of NBS, considering their role for **mitigation** as well as **climate risk reduction**, to promote **upscaling** and **investments** in NBS, and to accelerate **market uptake.***

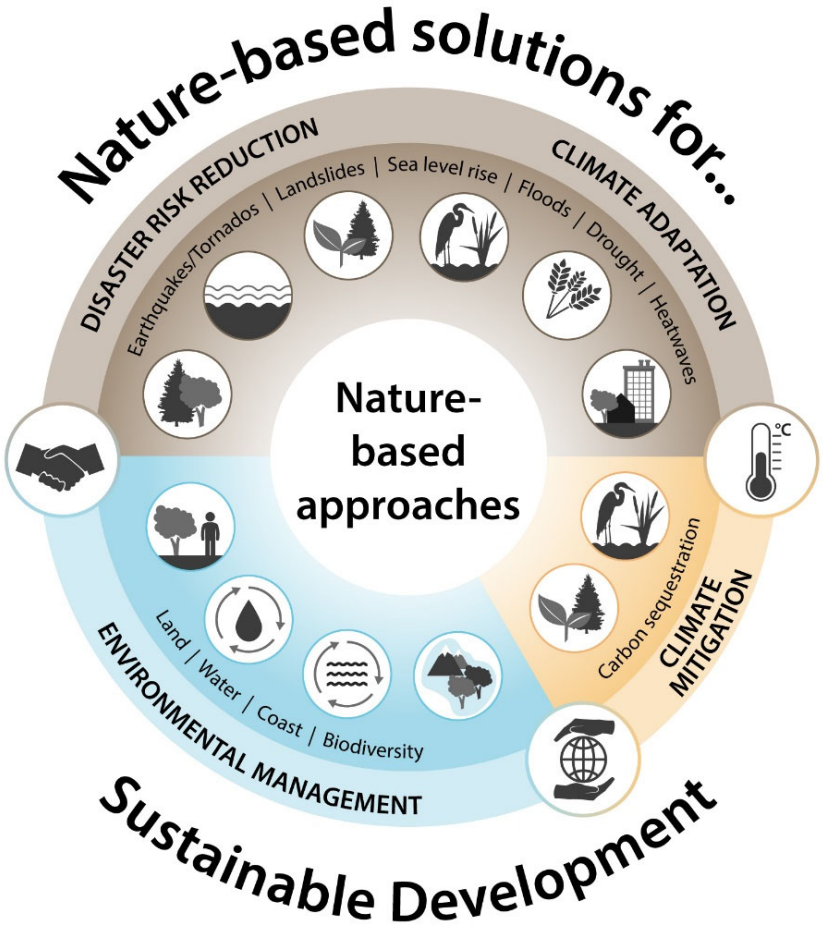
- *Scope of NBS across urban, coastal, mountains, forests, agriculture, water management*
- *Conceptual and methodological advancements*
- *Stocktaking of evidence and knowledge of economic and financial performance of NBS*
- *Mapping of motivations, needs, hurdles in Living Labs & wider NBS community*
- *Testing and validating usefulness of tools, market & financing frameworks*
- *Co-creation workspace with stakeholders from Living Labs*

Invest4Nature in a nutshell:

- Duration: July 2022 – June 2026
- 15 partners from 11 countries
- Funded by the Horizon Europe programme of the European Union

What is NBS?

"..actions to protect, conserve, restore, sustainably use and manage natural or modified terrestrial, freshwater, coastal and marine ecosystems which address social, economic and environmental challenges effectively and adaptively, while simultaneously providing human well-being, ecosystem services, resilience and biodiversity benefits." [UNEA, 2022]



NBS typologies across landscapes

- **NBS objects :** parks, green roofs, cropland, production forest, street trees river, wetland, salt marsh, kelp forest etc.. [i.e. the ecosystem providing services]
- **Generic context**: i) high quality ecosystem, ii) degraded ecosystem, iii) ecosystem not there yet
- **Generic NBS actions:** i) protection of high-quality ecosystem; ii) restoration/rehabilitation of degraded ecosystems; iii) introduction of new ecosystem
- **Specific NBS actions** – individual for each landscape/NBS objects

invest4 nature

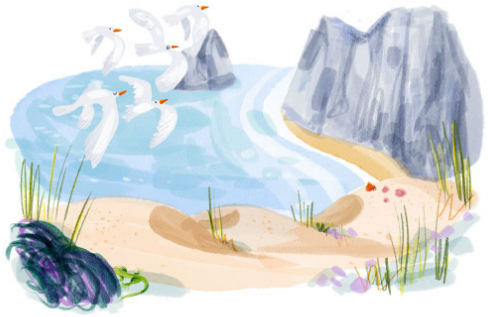
Forest

Forest ecosystems

Landscape	NBS Generic actions	Eggermont type	Specific NBS actions (non-exhaustive)
Forests/ Forestry	Protection of primary and old-growth forest	1	Maintenance of forest cover in headwater areas
	Strong modification of an existing forest ecosystem such as restoration of degraded forests	2	Restoration of degraded forests Implementing forests in riparian buffers Reforestation
	Creation of a new forest ecosystem	3	Afforestation - Land use conversion from agriculture to forest Introduction of trees and forests into landscape and other sectors e.g., agriculture (agro-forestry), urban planning

invest4 nature

Coastal & Marine ecosystems



Landscape	Generic actions	Eggermont type	Specific NBS actions (non-exhaustive)
Coastal areas	Protection of intact coastal ecosystems	1	Protection of barrier islands Protection of salt marshes Protection of sea grasses
	Strong modification of coastal ecosystems	2	Cliff stabilisation Restoration of reefs (oyster, coral) Increasing vegetative supplies e.g., the restoration of seagrasses Restoration of barrier islands Restoration of salt marshes
	Creation of a new coastal ecosystem/natural features	3	Dune reconstruction Construction and strengthening of vegetated dunes Engineered/hybrid NBS

invest 4 nature

Urban ecosystems

Landscape	Generic actions	Eggermont type	Specific NBS actions (non-exhaustive)
Urban areas	Protection of high-quality urban ecosystems	1	Protection of primary and old urban park/forest
	Strong modification of urban ecosystems	2	Restoration of urban green space and corridors - parks, trees, etc. Afforestation and reforestation of urban & peri-urban forests
	Creation of a new ecosystem	3	Establishment of new parks Establishment of new green corridors Creation of green roofs, green facades Swales & retention ponds Rain gardens Constructed wetlands

invest 4 nature

Challenges

Generic Challenges	Specific Challenges
Climate change mitigation	1. Climate mitigation
Climate change adaptation	2. Flooding (riverine, pluvial, sea-level)
	3. Heat (Urban Heat Island)
	4. Storms
	5. Drought & water scarcity
Natural hazards	6. Avalanches, landslides, earthquakes
Environmental management	7. Erosion
	8. Poor air quality
	9. Poor water quality
	10. Biodiversity loss
	11. Noise pollution
Socio-economic challenges	12. Lack of economic opportunities and jobs
	13. Inequality, lack of inclusion, environmental justice, social segregation
	14. Public health and wellbeing
	15. Economic Challenges
	16. Awareness & Education
	17. Energy related challenges
	18. Insecurity, crime
	19. Unsustainable transport

invest4 nature

NBS Benefits – CCA/DRR

Reduced flood risk -> reduced damage values (direct and indirect) => e.g. reduced expected annual damage, health risks, agricultural crop loss, costs of evacuation and transportation time

Reduced impact of UHI => reduced cases of heat-related deaths, levels of air pollution, energy consumption, improved employee health

Reduced impacts of storms => reduced economic losses (buildings, infrastructure, crops), reduced health risks

Reduced drought and water scarcity risks => reduced economic losses in agriculture, reduced risks of wildfire (buildings, lives, biodiversity), reduced cost of water supply

Reduced risk of avalanches, landslides, earthquakes => reduced damage values (direct & indirect) - buildings, inventory, infrastructure, clean up, evacuation & permanent relocation, reduced health risks

Typology for urban GI & impact matrix

- Multi-functional performance matrix of urban GI, which supports both mapping and modelling purposes
- Synthesis of evidence behind the performance of each GI to provide key ecosystem services
- Analysis shows i.a. that multifunctional GI typically support higher levels of biodiversity
- Can help plan & design urban NBS

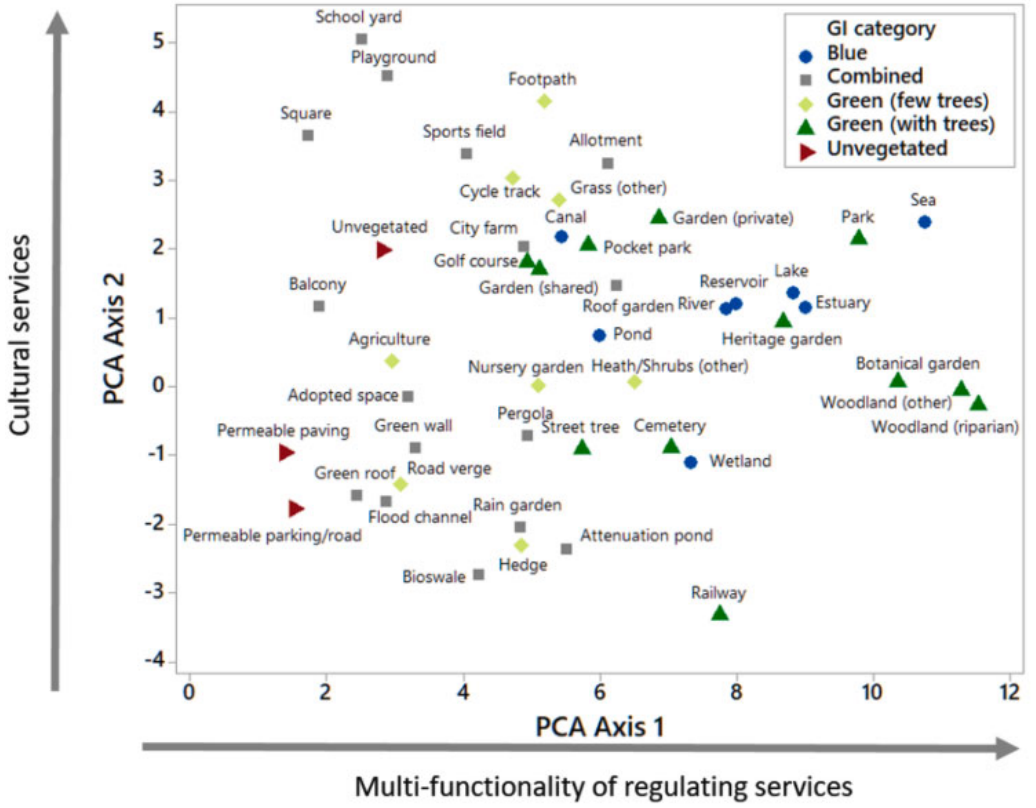
Brief description	Object type	Object category	Food provision	Air pollution removal	Noise mitigation	Heat mitigation	Water quality mitigation	Water flow management	Maintaining carbon stocks	Supporting physical activity	Supporting social interactions	Restoring capacities - stress reduction and cognitive restoration	Supporting biodiversity
Mainly private space linked to dwellings	Gardens	Balcony	Low	Negligible	Negligible	Negligible	Negligible	Negligible	Negligible	Negligible	Low	High	Low
		Private garden	Medium	Low	Low	Medium	Medium	Medium	Low	Very high	Medium	Very high	High
		Shared common garden area	Medium	Low	Low	Medium	Medium	Medium	Low	Medium	High	Medium	Low
Mainly public space, but some access restrictions may apply	Parks	Pocket park	Low	Low	Low	Low	High	Medium	Low	Medium	Very high	High	Medium
		Park	Low	High	High	High	High	Medium	High	Very high	Very high	Very high	High
		Botanical garden	Low	High	Very high	Very high	High	Medium	High	Medium	High	Very high	Very high
		Heritage garden	Medium	Medium	High	High	High	Medium	Medium	Medium	High	Very high	High
		Nursery garden	Medium	Medium	Low	Low	High	Medium	Medium	Low	Medium	Medium	Low
Areas designed primarily for specific amenity uses	Amenity areas	Sports field	Negligible	Low	Low	Low	Low	Low	Low	Very high	High	Medium	Negligible
		School yard	Negligible	Negligible	Negligible	Negligible	Negligible	Negligible	Negligible	Very high	Very high	Medium	Negligible
		Playground	Negligible	Negligible	Negligible	Negligible	Low	Low	Negligible	Very high	Very high	Medium	Negligible
		Golf course	Negligible	Medium	Low	Low	Negligible	Medium	Low	Medium	High	High	Medium
		Shared open space (e.g. square)	Negligible	Negligible	Negligible	Negligible	Negligible	Negligible	Negligible	Medium	Very high	Low	Negligible
Areas designed primarily for specific uses (not leisure); some access restrictions may	Other public space	Cemetery	Negligible	Medium	Medium	Medium	Medium	Medium	High	Low	Low	Very high	High
		Allotment/other growing space	Very high	Medium	Low	Low	Negligible	Medium	Negligible	High	High	Very high	High
		City farm	Very high	Medium	Low	Low	Negligible	Medium	Negligible	Medium	Medium	High	Medium
		Adopted public space	Low	Medium	Low	Low	Low	Low	Negligible	Negligible	Low	Medium	Low
Linked to routeways, geographical features and boundaries	Linear features/routes	Street tree	Low	High	Low	High	Low	Low	Medium	Negligible	Low	High	Medium
		Cycle track (as green/blue corridor)	Low	Low	Low	Low	Low	Low	Low	Very high	Medium	High	Low
		Footpath (as green/blue corridor)	Low	Low	Low	Low	Low	Low	Low	Very high	Very high	High	Low
		Road verge	Low	Low	Low	Low	Medium	Medium	Low	Negligible	Negligible	Low	Low
		Railway corridor	Negligible	Very high	Very high	Very high	Low	Medium	High	Negligible	Negligible	Low	Very high
		Riparian woodland	Low	Very high	Very high	Very high	Very high	High	Very high	High	High	Very high	Very high
		Hedge	Low	Medium	Low	Low	High	High	Medium	Negligible	Negligible	Medium	Medium
Constructed green and blue space, added to infrastructure	Constructed GI on infrastructure	Green roof	Negligible	Low	Negligible	Low	Low	High	Low	Negligible	Negligible	Low	Low
		Green wall	Negligible	Medium	Medium	Low	Negligible	Low	Low	Negligible	Negligible	Medium	Low
		Roof garden	Medium	Medium	Low	Medium	Low	Low	Medium	Low	High	Very high	Medium
		Pergola (with vegetation)	Negligible	Medium	Low	High	Low	Low	Medium	Negligible	Low	High	Low
Infrastructure designed to incorporate some GBS components	Hybrid GI (for water)	Permeable paving	Negligible	Negligible	Negligible	Negligible	High	High	Negligible	Low	Negligible	Negligible	Negligible
		Permeable parking/roadway	Negligible	Negligible	Negligible	Negligible	High	High	Low	Negligible	Negligible	Negligible	Negligible
		Attenuation pond	Negligible	Low	Low	Low	Very high	Very high	Medium	Negligible	Low	Medium	High
		Flood control channel	Negligible	Low	Negligible	Low	Low	Very high	Low	Negligible	Low	Negligible	Medium
		Rain garden	Low	Medium	Negligible	Low	High	High	Medium	Negligible	Negligible	High	Medium
		Bioswale	Negligible	Medium	Low	Low	Medium	Very high	Medium	Negligible	Negligible	Low	Medium
Bluespace features	Waterbodies	Wetland	Negligible	Medium	Low	Medium	Very high	Very high	Medium	Low	Medium	Very high	High
		River/stream	Low	Low	High	High	Medium	High	Low	Medium	High	Very high	High
		Canal	Low	Low	Low	Medium	Low	Medium	Low	Medium	High	Very high	Low
		Pond	Negligible	Low	Low	Low	Low	High	Medium	Low	High	Very high	High
		Lake	Medium	Low	Medium	High	High	High	Medium	High	High	Very high	Very high
		Reservoir	Low	Low	Medium	High	High	Very high	Medium	High	High	Very high	Medium
		Estuary/tidal river	High	Low	High	High	High	N/A	Medium	Medium	High	Very high	Very high
		Sea (incl. coast)	High	Low	High	Very high	High	N/A	Very high	Very high	Very high	Very high	Very high
Other un-sealed features without specified use, often on private land	Other non-sealed urban areas	Woodland (other)	Low	Very high	Very high	Very high	High	High	Very high	High	High	Very high	Very high
		Grass (other)	Low	Low	Low	Low	Medium	Medium	Low	Very high	High	Medium	Medium
		Shrubland (other)	Low	Medium	Low	Low	High	High	Medium	Medium	Medium	High	High
		Arable agriculture	Very high	Medium	Low	Low	Negligible	Low	Negligible	Low	Negligible	Low	Low
		Sparsely vegetated land	Negligible	Negligible	Low	Negligible	Low	Low	Negligible	Medium	Medium	Medium	Low

Jones et al., 2022, https://doi.org/10.1016/j.nbsj.2022.100041

Synergies and trade-offs

- Principal component analysis
- Right side: higher level of multifunctionality of regulating services => more natural & score highest for supporting biodiversity
- Axis 2: variation of level of cultural services

For maximum multiple services -> focus on top right quadrant



Impacts & Benefits of NBS

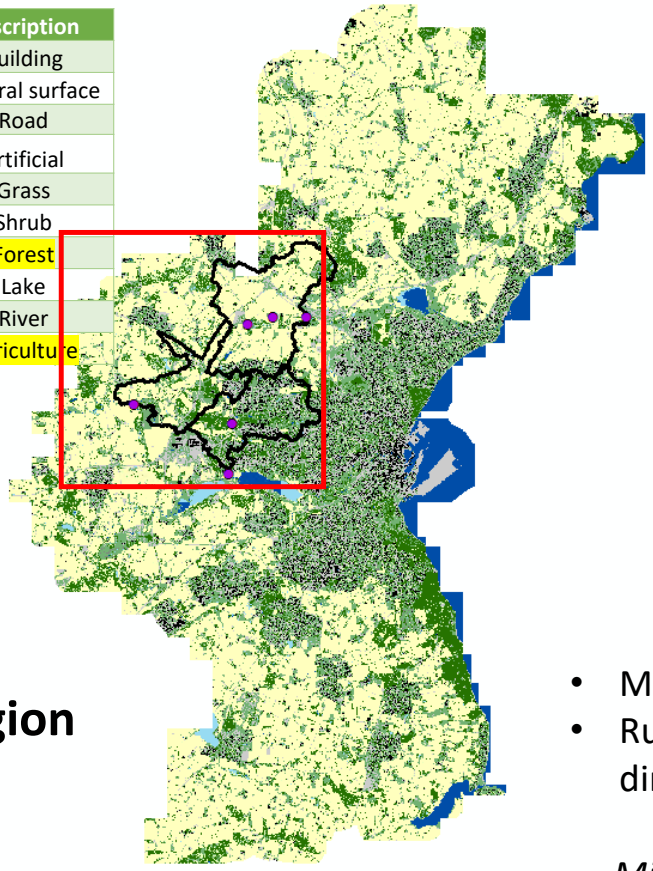
- Using NBS to mitigate water flow (led by James Miller, UKCEH)
- Using NBS to improve water quality (led by Michael Hutchins, UKCEH)
- NBS benefits of trees to mitigate air pollution (led by Laurence Jones, UKCEH)
- Using NBS to mitigate urban heat island (led by Jo Garret & Tim Taylor, UNEXE)
- People's willingness to pay for NBS (led by Marianne Zandersen, AU)

Also in REGREEN (not included today):

- Using NBS to mitigate noise pollution (led by David Fletcher, UKCEH)
- Street trees and mental health – using causal loop diagramming to develop systems thinking hypotheses (led by Miriam Alvarado & Ben Wheeler, UKCEH)
- Using Photo-elicitation & Ecological Momentary Assessment and to assess wellbeing effects of urban green infrastructures (led by Conny Guell & James Fullam, UNEXE, and Clive Sabel & Prince Amegbor, AU)

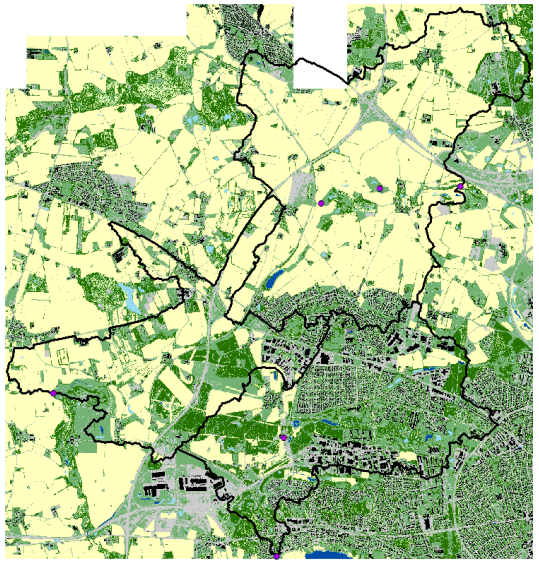
AnArM model – using NBS to mitigate water flow (prel. results)

wrdclass	Runoff (%)	description
1	95	Building
2	92	Mineral surface
4	91	Road
5	70	Artificial
6	35	Grass
7	35	Shrub
8	25	Forest
9	100	Lake
10	100	River
	55	Agriculture

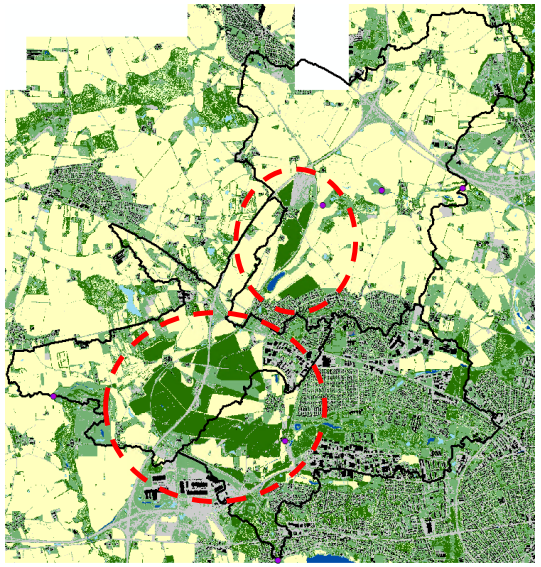


Aarhus region

Before



After



- Modelled the conversion of agricultural land into forest.
- Runoff from the converted regions flows in three distinct directions.

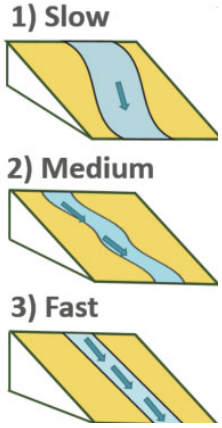
Miller et al. 2023. Landscape & Urban Planning 234, 104737
https://doi.org/10.1016/j.landurbplan.2023.104737

Using NBS to improve Water Quality - (Simplified QUESTOR model) (prel. results)

SLOW flowing
7m wide
Deep water (>1m)

MEDIUM flowing
3.5m wide
Deep water (1-3m)

FAST flowing
3.5m wide
Shallow water
(0.2-1m)

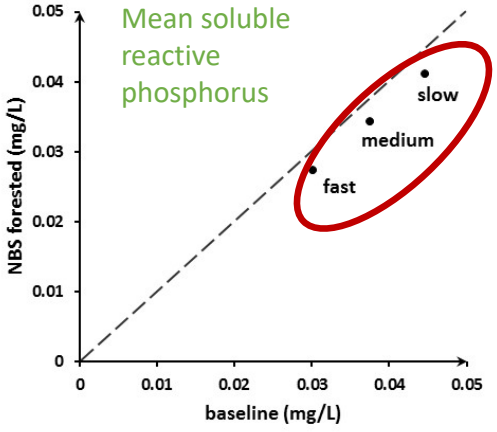


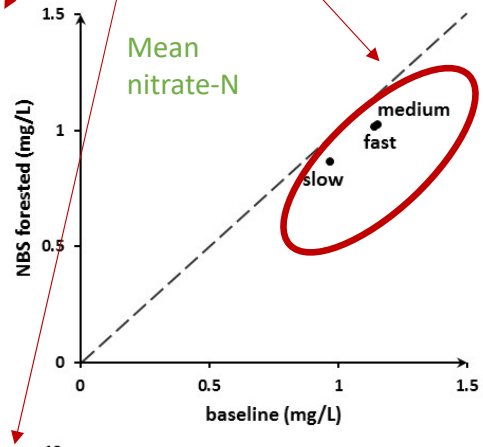
- Three “standard” typical hydrodynamic river types
- 30 km2 basin, 10 km river

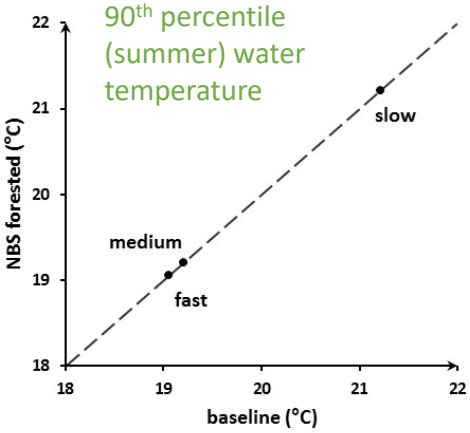
New forest scenario has:

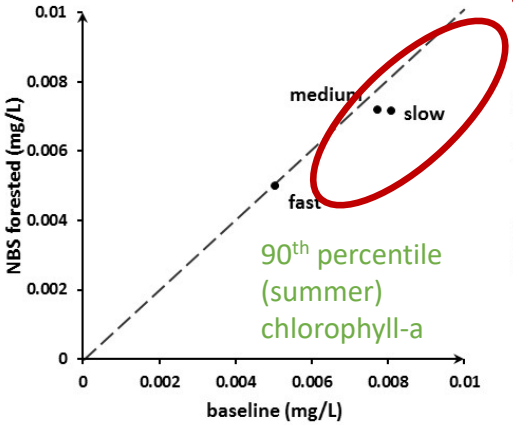
- Lower SRP, NO3, chlorophyll-*a*
- Unchanged DO, temp

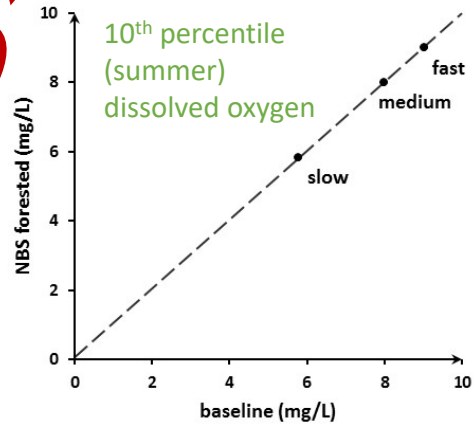
Impact of NBS shown as points below the line







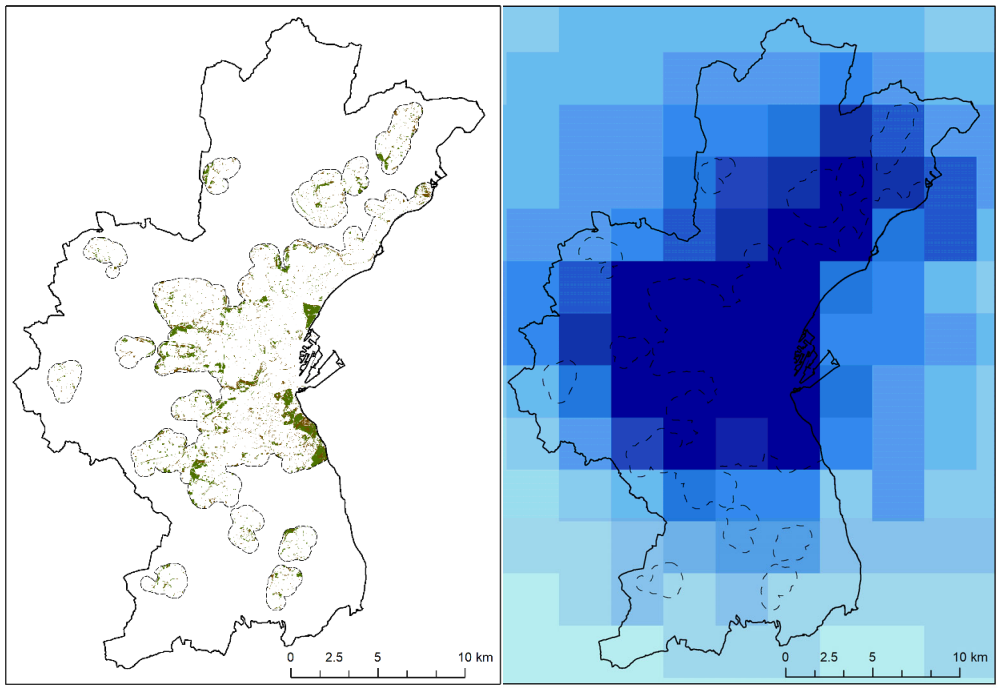




REGREEN
NATURE-BASED SOLUTIONS

Using NBS to mitigate air pollution (prel. results)

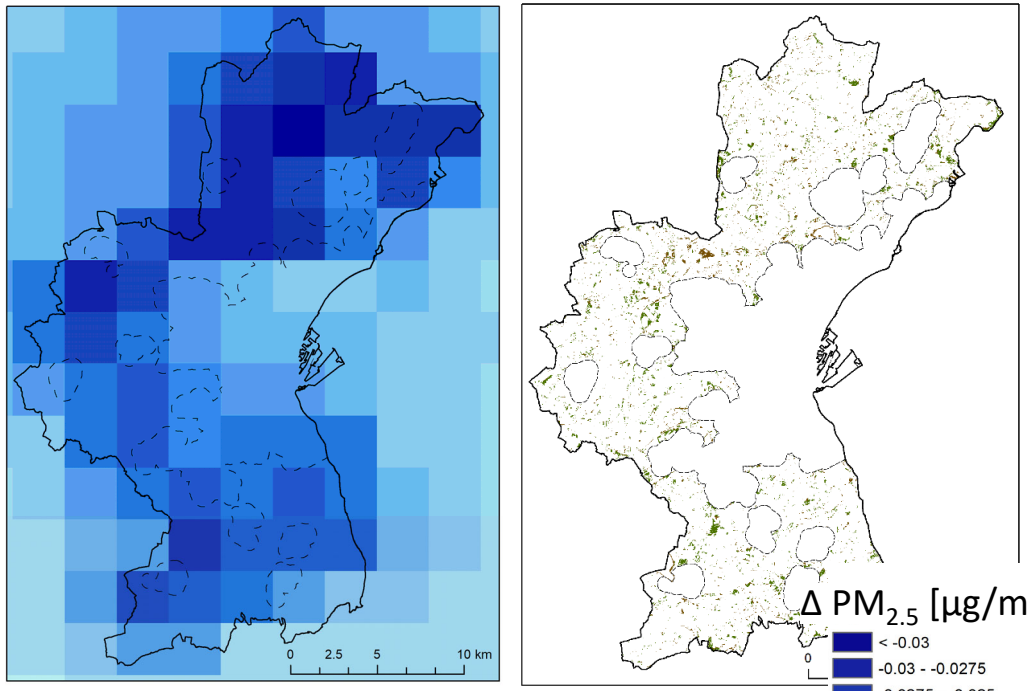
Scenario A:
remove trees within urban footprint



Health benefit from reduced exposure to air pollution:

A) Euro 420,000

Scenario B:
remove peri-urban trees



B) Euro 150,000

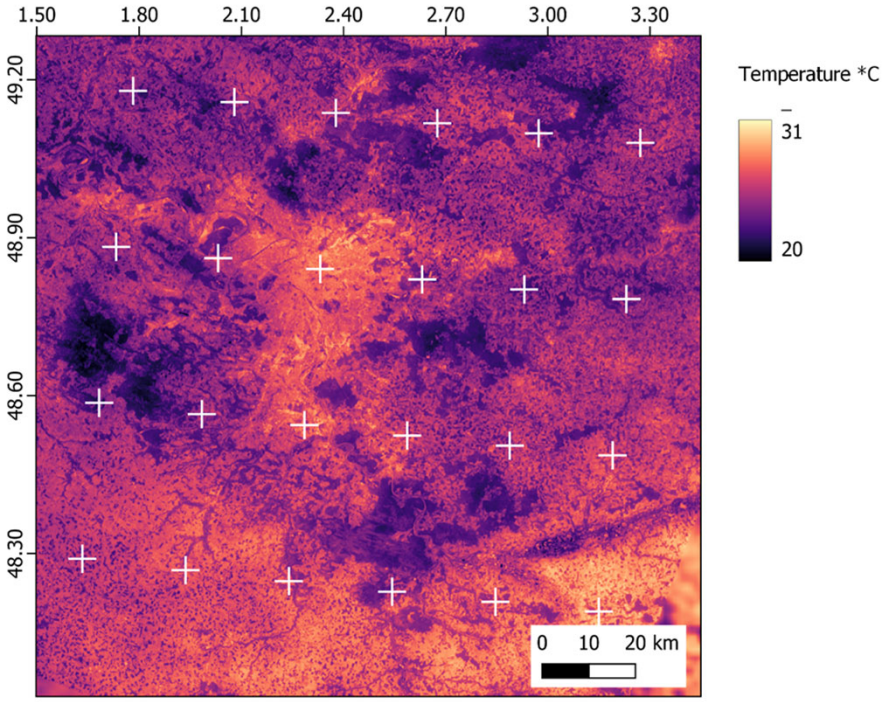
Scenario modelling for Aarhus Municipality, Denmark

REGREEN
NATURE-BASED SOLUTIONS

Valuing the reduced risk from mortality by heat from public green spaces in Paris (prel. results)

Data

- Modelled temperature
  - 10th, 22nd, 24th July 2019
  - 22°C - 32 °C



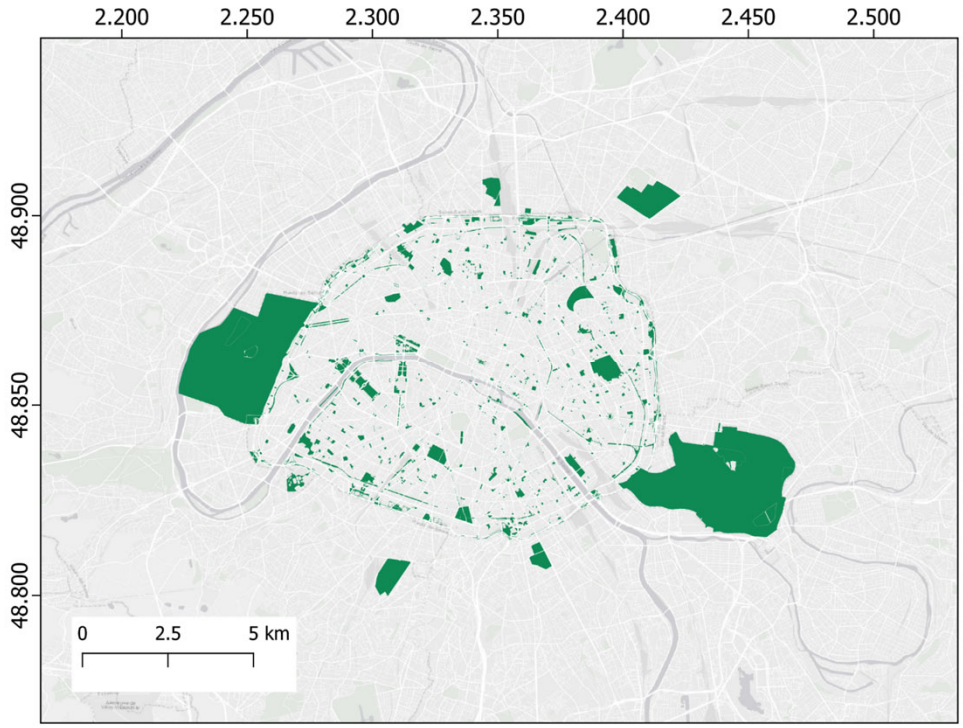
REGREEN
NATURE-BASED SOLUTIONS

Valuing the reduced risk from mortality by heat from public green spaces in Paris (prel. results)

Data

- Modelled temperature
  - 10th, 22nd, 24th July 2019
- Public green spaces
  - >1000 m^2
  - >100 m from another green space or water body

➢49 public green spaces.

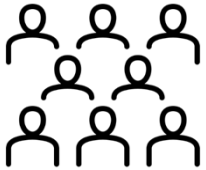


REGREEN
NATURE-BASED SOLUTIONS

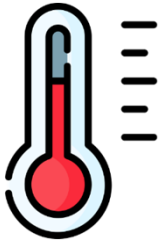
SEJ - Service d'exploitation des Jardins, 2021. Espaces verts et assimilés. Accessed on 18th June 2021. https://opendata.paris.fr/.

Valuing NBS – Urban heat island mitigation

How far away can we detect a cooling effect from the park?



How many people affected?

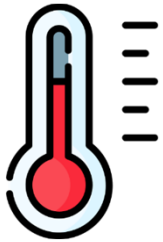


What's the difference in temperature?

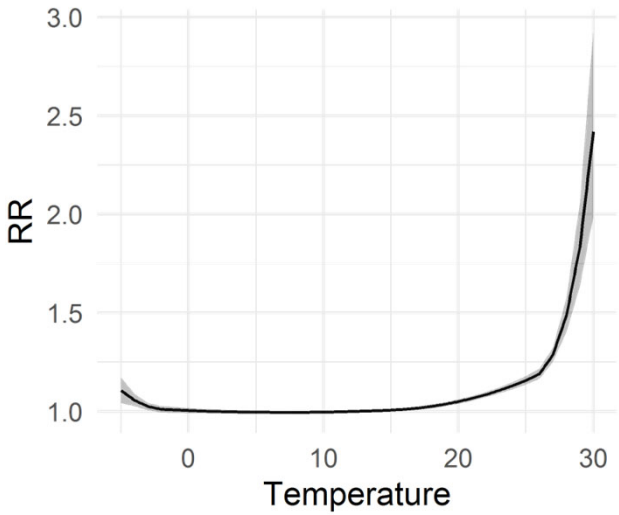
Icons from freepik at flaticon.com

Valuing NBS – Urban heat island mitigation

How many people within the cooling effect?



What's the difference in temperature?



Relative risk of mortality by temperature for Paris Pascal *et al* 2018

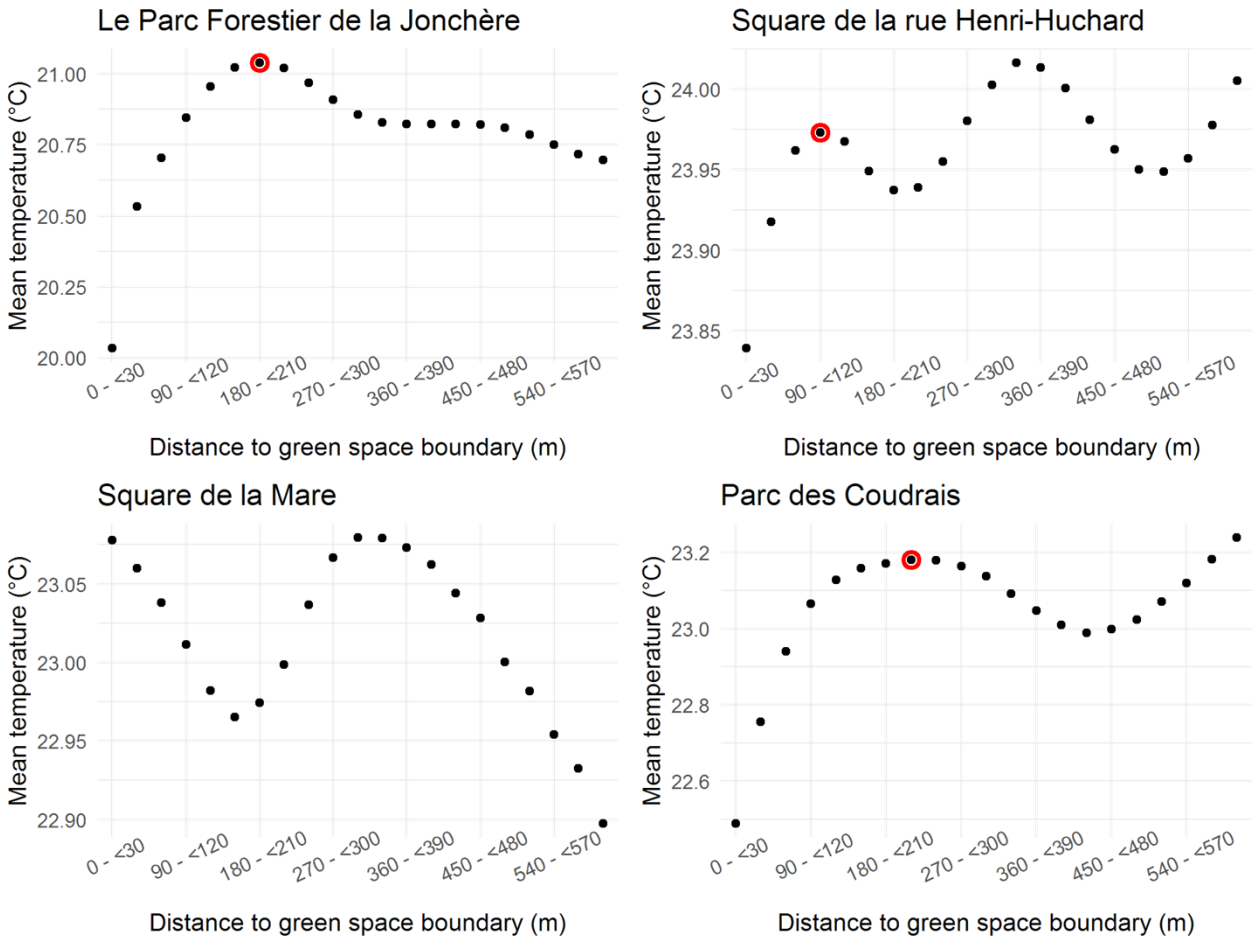
Lives saved

Value of a statistical life
€3.371 million
for EU-27 + Croatia

Icons from freepik at flaticon.com

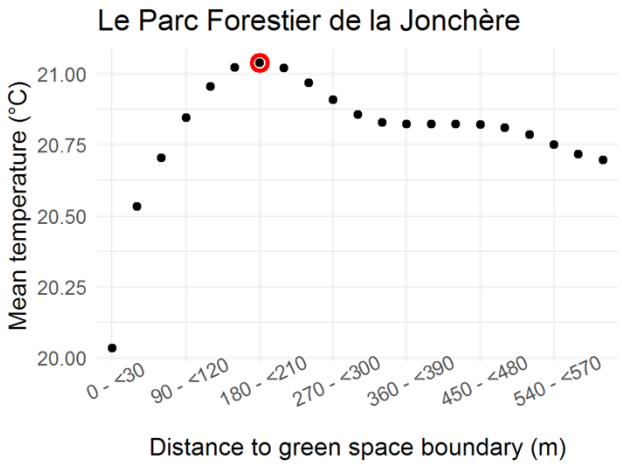
Example green spaces and their cooling (prel. results)

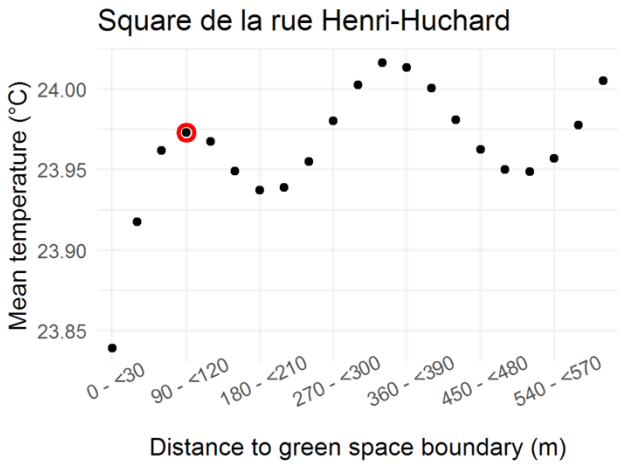
The red circles indicate the distance up to which we can detect cooling

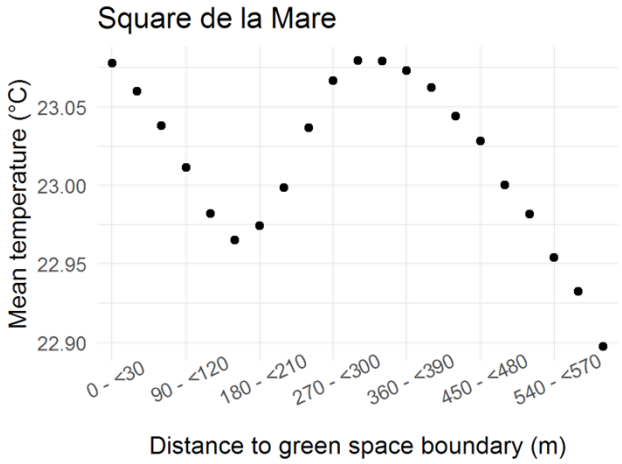


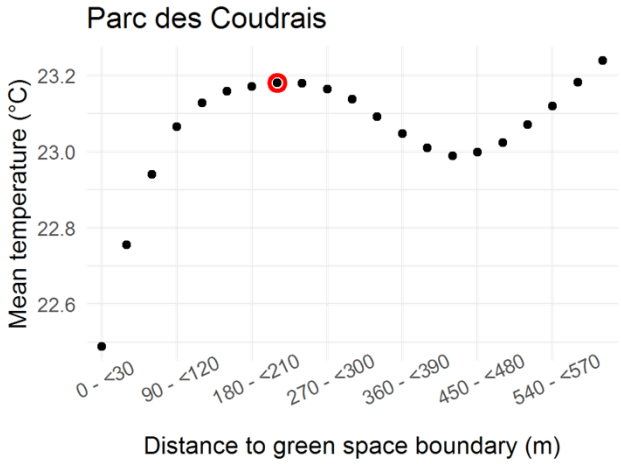
Example green spaces and their cooling (prel. results)

Square de la Mare seems to cause no cooling, possibly due to another space nearby









Deliberative Valuation of NBS

- Deliberative workshops in Paris, Aarhus, Velika Gorica
- Ca. 45 people per city
- Perceptions and deliberations of urban nature
- Valuation of different levels and combinations of NBS objects => elicit trade-offs & WTP

Choice experiment attribute table

New Parks	100% access to parks >1.5ha
	75% access to parks >1.5ha
	100% access to pocket parks <0.5ha
Water courses and ponds	Daylighting of watercourses 100% where possible
	Lakes in 100% of parks
	Ponds in 10% of inner yards
Canopy cover	4% increased canopy cover
	8% increased canopy cover
	12% increased canopy cover
Green roofs	10% increase of green roofs
	20% increase of green roofs
	40% increase of green roofs
Monthly ear-marked local tax (DKR)	15
	30
	45
	60

Example Choice card

kort 5/12

Tiltag	Option A	Option B	Status Quo
Nye parkområder	 100% adgang til parker >1,5ha	 75% adgang til parker >1,5ha	Ingen forandring
Vandløb og gadekær	 100% genåbning hvor muligt	 Søer i 100% af parker	
Trædække	 8%	 4%	
Grønne Tage	 10%	 40%	
Øremærket kommunalskat per måned i 10 år	45 Kr	30 Kr	0 kr
Hvilket valg foretrækker du? (sæt 1 kryds)	☐	☐	☐

Status Quo: Ikke flere end 48% bor indenfor 300m af en park på minimum 1,5ha. Der kommer ikke flere end de nuværende i gennemsnit 37 lommeparker (i alt 8ha). Trædækket forbliver det nuværende 14%. Der findes meget få grønne tage. Der kommer ikke yderligere små søer eller gadekær i parker og i indre gårde

- 12 choice cards
- Description of status quo
- One choice only per choice card

Preliminary regression results

VARIABLES	Description	Parameters		Std. errors
ASC_SQ	Status Quo	-1,341	***	0,257
park_100%	100% access park >1.5ha	0,409	***	0,158
park_75%	75% access park >1.5ha	0,075		0,164
water_daylighting	100% daylighting streams where possible	0,588	***	0,161
water_pondsparks	Ponds/lakes in 100% parks	0,651	***	0,174
canopy_8%	8% increased canopy cover	0,284	*	0,166
canopy_12%	12% increased canopy cover	0,679	***	0,153
greenroof_20%	20% increased green roofs	0,31	**	0,137
greenroof_40%	40% increased green roofs	0,563	***	0,168
tax_dkr	Monthly local tax o. 10 years	-0,022	***	0,003
Log Likelihood		-413,12662		
Number of cases		516		
Observations		1,548		

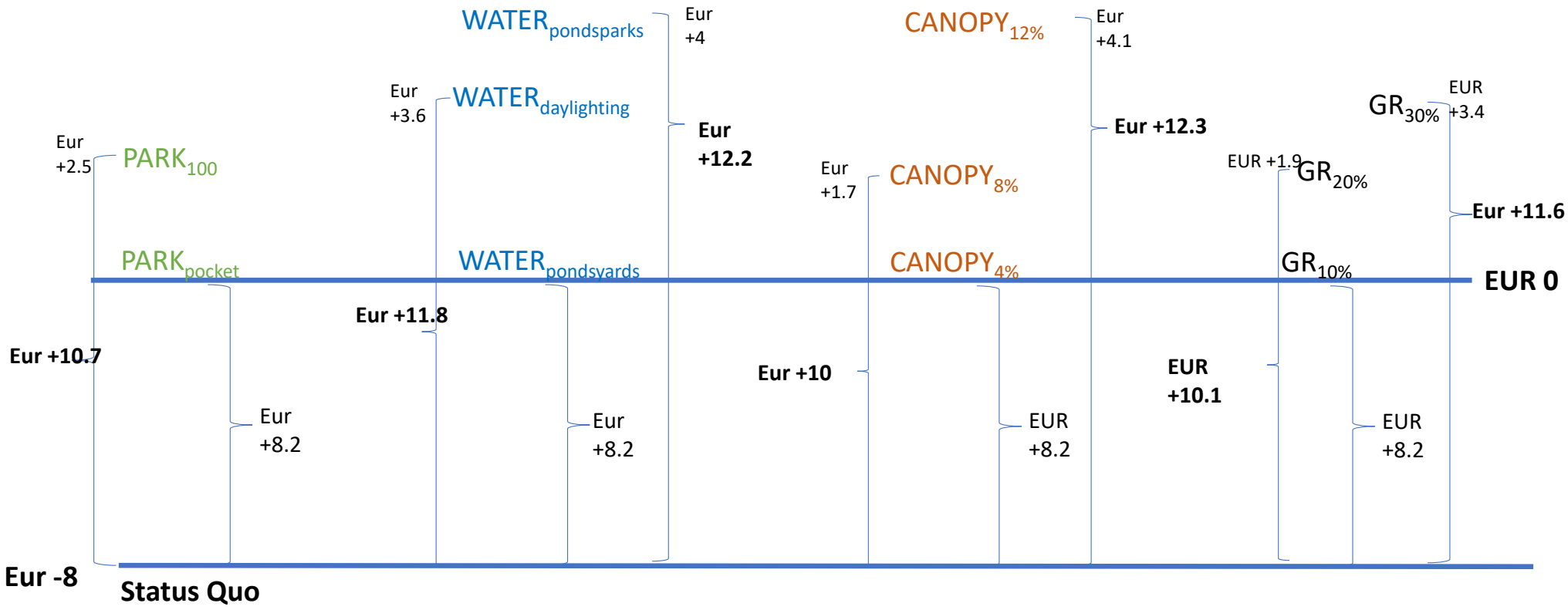
*** p<0.01, ** p<0.05, * p<0.1

reference levels:

- 100% access pocket parks
- ponds in 10% inner yards
- 4% increase canopy cover
- 10% increase green roofs

Based on 40 respondents from Aarhus ULL

Part-Worth Ranking (prel. results)



Policy scenarios (Prel. based on Aarhus sample)

WTP high preferences: 22Eur/household/month o. 10 years

100% access to parks >1.5h

Lakes/ponds in 100% of parks

12%

40%

WTP low preferences: 8Eur/household/month o. 10 years

100% access to pocket parks <0.5ha

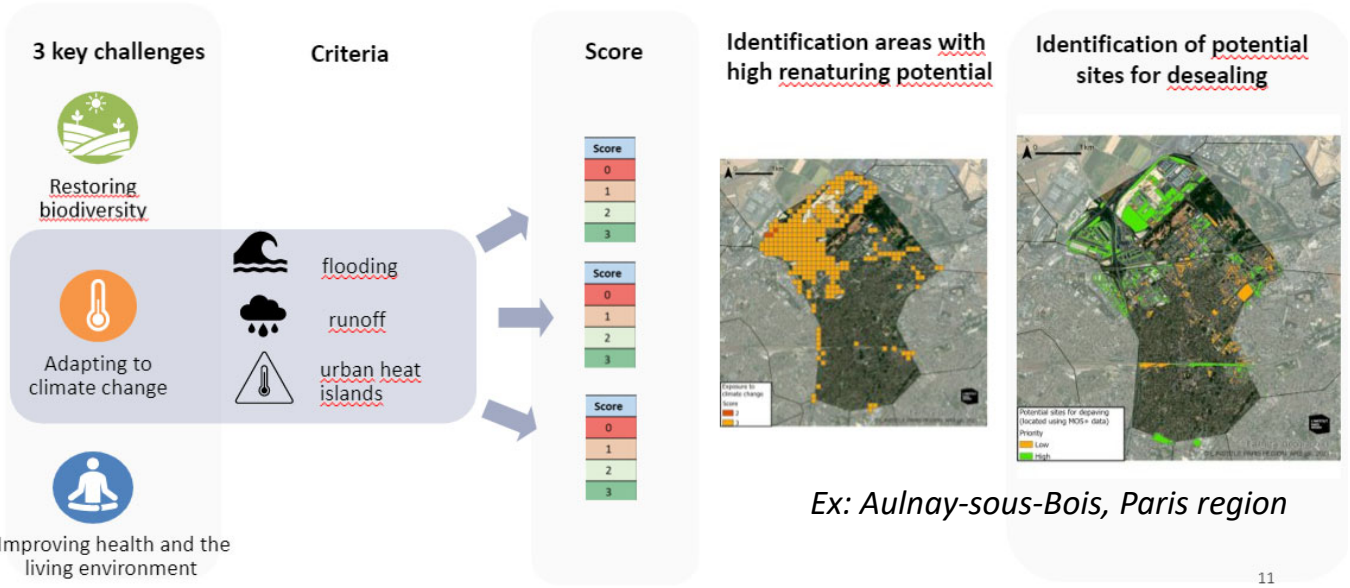
Ponds in 10% of backyards

4%

10%

Tools & Resources

Depavement and renaturalisation – a methodology & tool



Ex: Aulnay-sous-Bois, Paris region

11

- Potential in Paris to depave and renaturalise a total of 1406ha
- Different challenges: biodiversity recovery, adaptation, improving health and living environment
- Methodology used to develop a tool in support of regional master plan and to assist in local strategies of depavement & renaturalisation

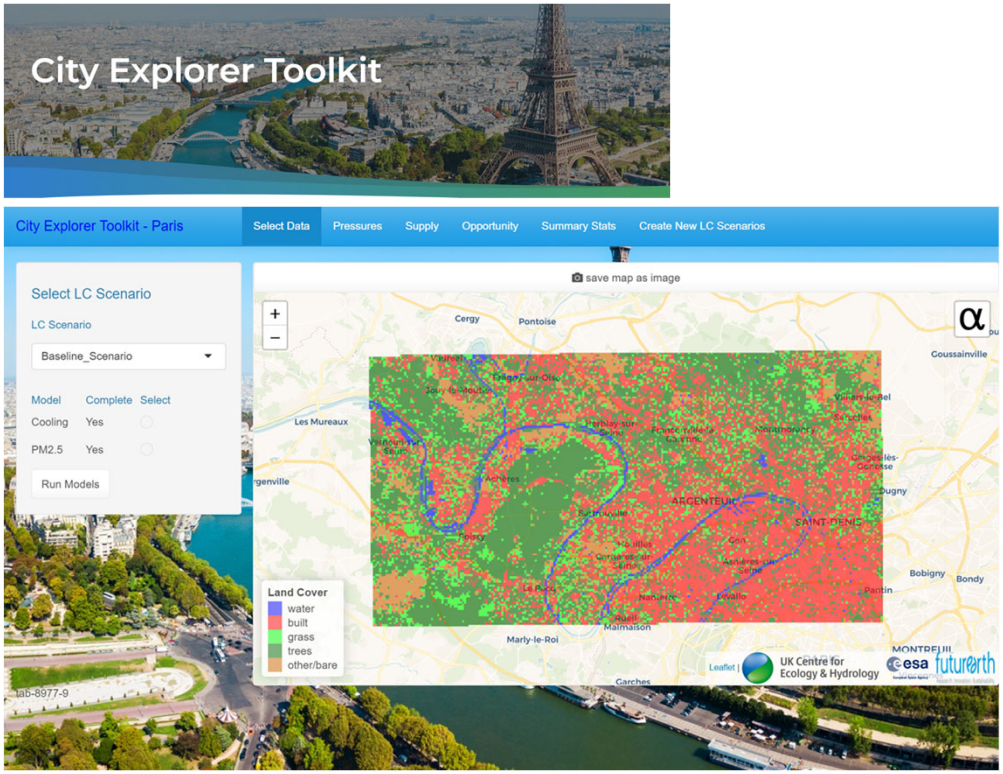
REGREEN NATURE-BASED SOLUTIONS

L'INSTITUT PARIS REGION

City Explorer Toolkit

A tool to help plan Urban Green & Blue space
https://www.ceh.ac.uk/city-explorer

- interactive web-based tool
- helps planners to understand where best to create urban green spaces
- to ensure that benefits such as cooling on a hot day, improved air quality, and noise reduction are received by the people who need them most.



Online tool kit under development

8 PodCasts

- About NBS & REGREEN
- Water challenges and afforestation projects (Aarhus ULL)
- Restoration of biodiversity in urban areas (Paris region ULL)
- Forest as a problem and a solution (Velika Gorica ULL)
- The green side of a huge city (Beijing ULL)
- Citizen science - how to increase critical thinking about nature, biodiversity and NBS
- Kids and nature learning
- NBS & UN SDGs

https://www.regreen-project.eu/resources/

Nature Solutions Platform

- Shares knowledge, insights, knowledge, and experience on NBS to SMEs, NGOs, cities, schools, and other interested communities
- Online crowd-funding opportunity

https://nature-solutions.eu/

Upcoming from I4N

1. Document and showcase the evidence of financial performance and societal benefits of NBS => open and searchable database on Oppla

2. Evidence the innovation, entrepreneurship opportunities and job creation in current NBS

3. Stock-take market characteristics, financing approaches and incentive mechanisms for NBS

Resources from REGREEN

The economics of nature-based solutions and restoration	
REGREEN NATURE-BASED SOLUTIONS / CLEARINGHOUSE 中欧城市森林后时方案	Mayor, B., Toxopeus, H., McQuaid, S., et al., 2021. **State of the art and latest advances in exploring business models for nature-based solutions. Sustainability.** 13, 1–21. DOI: 10.3390/su13137413
REGREEN NATURE-BASED SOLUTIONS	McQuaid, S., Kooijman, E., Rizzi, D., et al., 2022. **The vital role of Nature-Based Solutions in a nature positive economy. Bruxelles.** DOI: 10.2777/307761
REGREEN NATURE-BASED SOLUTIONS	Panduro, T.E., Nainggolan, D., Taylor, T., Zandersen, M., 2021. **Cost-effectiveness of NBS in the Urban environment**. Deliverable 2.3. REGREEN. DOI: 10.5281/zenodo.7308360

Policy, governance and institutional issues	
REGREEN NATURE-BASED SOLUTIONS	Kirsop-Taylor, N., Russel, D., Jensen, A., 2021. **Urban governance and policy mixes for nature-based solutions and integrated water policy.** Journal of Environmental Policy & Planning. 0, 1–15. DOI: 10.1080/1523908X.2021.1956309
REGREEN NATURE-BASED SOLUTIONS	Kirsop-Taylor N., Russel D., 2022, **Agencies navigating the political at the science-to-policy interface for nature-based solutions**, Elsevier, Environmental Science and Policy 127 (2022) 303–310, DOI: 10.1016/j.envsci.2021.10.029
REGREEN NATURE-BASED SOLUTIONS	Morère, L., Grandin, G., Huart, G., et al., 2021. **Les solutions fondées sur la nature. Défis et opportunités pour la méga région parisienne in: Atlas Collaboratif de La Mégarégion Parisienne** [En Ligne]. UMR CNRS 6266 IDEES, Université de Rouen Normandie. Rouen, p. 6. DOI: 10.48390/ds8t-j329
REGREEN NATURE-BASED SOLUTIONS	Banzhaf, E., Anderson, S., Grandin, G., et al., 2022. **Urban-Rural Dependencies and Opportunities to Design Nature-Based Solutions for Resilience in Europe and China.** Land 11. DOI: 10.3390/land11040480

Environmental aspects of nature-based solutions and restoration	
REGREEN NATURE-BASED SOLUTIONS	Baker, H.J., Hutchins, M.G., Miller, J.D., 2021. **How robust is the evidence for beneficial hydrological effects of urban tree planting?** Hydrological Sciences Journal. DOI: 10.1080/02626667.2021.1922692
REGREEN NATURE-BASED SOLUTIONS	Jones, L., Reis, S., Hutchins, M., et al., 2022. **Airsheds, watersheds and more – The flows that drive intra-extra-urban connections, and their implications for nature-based solutions (NBS).** Nature-Based Solutions. 2, 100040. Doi: 10.1016/J.NBSJ.2022.100040
REGREEN NATURE-BASED SOLUTIONS	Elze, S., Banzhaf, E., 2022. **High-precision monitoring of urban structures to understand changes in multiple ecosystem services.** Urban Forestry & Urban Greening. 73, 127616. DOI: 10.1016/J.UFUG.2022.127616
REGREEN NATURE-BASED SOLUTIONS	Bird, D.N., Banzhaf, E., Knopp, J., et al., 2022. **Combining Spatial and Temporal Data to Create a Fine - Resolution Daily Urban Air Temperature Product from Remote Sensing Land Surface Temperature (LST) Data.** Atmosphere. 13, 19. DOI: 10.3390/atmos13071152
REGREEN NATURE-BASED SOLUTIONS	Wu, W. Ben, Ma, J., et al., 2021. **Spatio-temporal changes in urban green space in 107 Chinese cities (1990–2019): The role of economic drivers and policy.** International Journal of Applied Earth Observation and Geoinformation. 103, 102525. DOI: 10.1016/j.jag.2021.102525
REGREEN NATURE-BASED SOLUTIONS	Wu, W.-B., Yu, Z.-W., et al., 2022. **Quantifying the influence of 2D and 3D urban morphology on the thermal environment across climatic zones.** DOI: 10.1016/j.landurbplan.2022.104499
REGREEN NATURE-BASED SOLUTIONS	Banzhaf, E., Wu, W., Luo, X., Knopp, J., 2021. **Integrated Mapping of Spatial Urban Dynamics—A European-Chinese Exploration. Part 1—Methodology for Automatic Land Cover Classification Tailored towards Spatial Allocation of Ecosystem Services Features.** Remote Sensing. 13, 1744. DOI: 10.3390/RS13091744
REGREEN NATURE-BASED SOLUTIONS	Wu, W., Luo, X., Knopp, J., Jones, L., 2022. **A European-Chinese Exploration : Part 2 — Urban Ecosystem Service Patterns, Processes, and Contributions to Environmental Equity under Different Scenarios.** Remote Sensing. 14, 26. DOI: 10.3390/rs14143488
REGREEN NATURE-BASED SOLUTIONS	Fletcher, D., Zhao, B., Grandin, G., et al., 2020. **Report on assessment of drivers and pressures leading to urban challenges, across the ULLs, including spatial and temporal components.** DOI: 10.5281/zenodo.7308435

https://zenodo.org/communities/clearinghouse-conexus-interlace-regreen

https://zenodo.org/communities/regreen

REGREEN
NATURE-BASED SOLUTIONS

invest4nature

itter.com/REGREEN-nbs

kedin.com/company/regreen-horizon-2020

ail: regreen.nbs@gmail.com

ebsite: www.regreen-project.eu

nodo: https://zenodo.org/communities/regreen/

twitter.com/invest4N

linkedin.com/company/invest4nature

Email: info@invest4nature.eu

Website: www.invest4nature.eu