

Fostering Nature-based Solutions for equitable, green and healthy urban transitions

Policy Recommendations

- Involve cities and regions directly as full partners in Research & Innovation Action projects to reap full benefits.
- Involve children in NbS and give them opportunities to be included in collective processes of developing and governing local NbS.
- Create the right enabling conditions - adequate funding, break down silos, foster policy champions, effective enforcement and take advantage of emerging opportunities.
- Involve diverse stakeholders in planning processes to facilitate the update of NbS and motivate collaboration.
- Make use of rapid assessment of NbS efficiency and scenarios to gain insights on potential of NbS at city-scale.⁴
- Apply localised and spatially explicit ecosystem service models combined with scenarios to upscale NbS implementation.
- Recognize the value of NbS impacts as more than an economic metric - include different forms of evidence of how people interpret, experience, perceive, and learn from NbS.
- Private entrepreneurs and investors need transparency, accountability, and clarity for what is defined as a sustainable investment.

This brief provides information about the outcome of the REGREEN project.

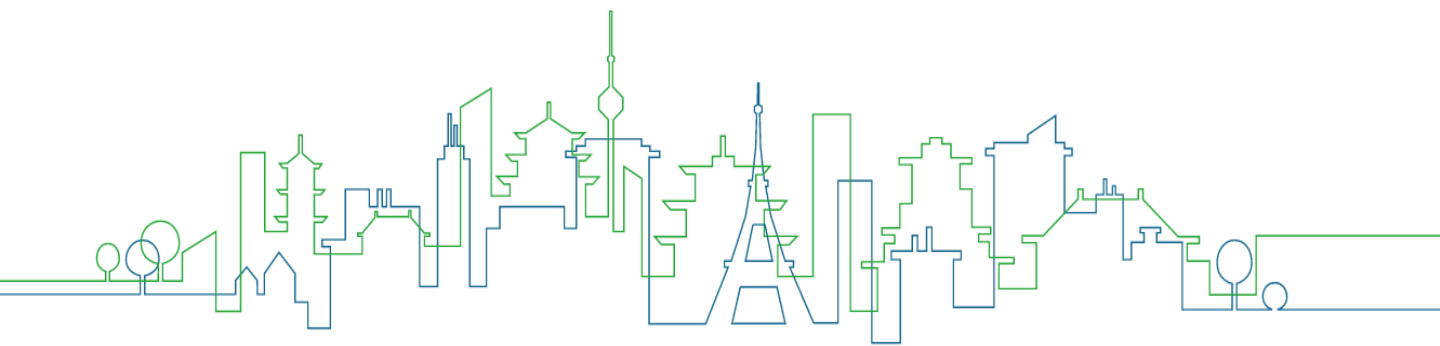
Urban Nature-based Solutions (NbS) such as street trees, parks, green roofs, lakes and rivers offer multifunctional solutions to major societal challenges, including reducing the risk of flooding, alleviating the impacts of heat waves, improving water quality, reducing noise pollution and enhancing health and well-being. But nature is under significant pressure in cities. Increasing land-take at the periphery of cities and densification within city boundaries coupled with climate extremes make cities increasingly vulnerable and unpleasant to live in. The European Nature Restoration Law seeks to reverse this trend to restore and protect i.a. urban ecosystems.

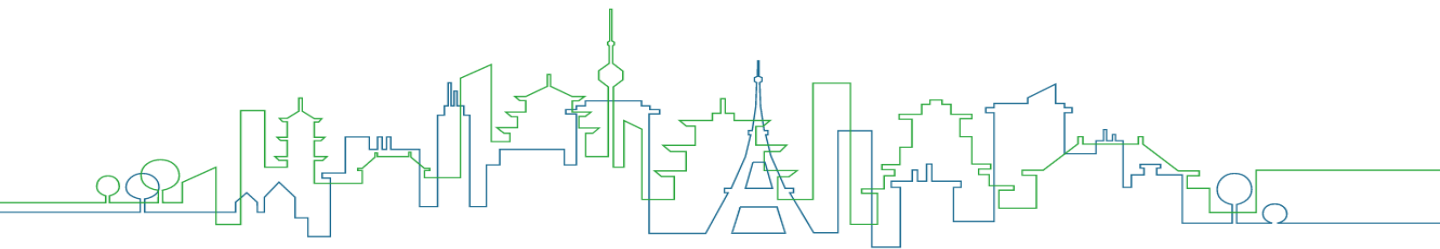
The H2020 REGREEN project aimed to promote urban liveability by systematically modelling the benefits of ecosystem services and biodiversity as the basis for NbS that can be widely deployed by public and private actors. Such NbS, underpinned by evidence-based tools, improved urban governance, and nature-based education and learning can enable urban planners and policy makers to meet contemporary and future challenges, such as climate change resilience, public health and well-being and social inclusion. Thereby REGREEN findings and insights can help accelerate the crucial transition toward equitable, green and healthy cities.

This policy brief provides key insights and recommendations from across the many fields of REGREEN, while a number of subsequent policy briefs offer a deeper look into specific topics. The REGREEN transition Handbook gives a comprehensive overview of key findings and outcomes⁽¹⁾.



Gonesse constructed wetland, Paris region, France © SIAH





Kindergarten children 'investigating' nature © Lars Brundin



The importance of engaging cities and regions

The involvement of two municipalities (Aarhus, Denmark; Velika Gorica, Croatia) and one regional agency (Paris Regional Institute, France) in REGREEN has served as a catalyst for strategic shifts, capacity building of staff, wider stakeholder outreach and has also secured the mandate for further exploring and implementing NbS. The three cities differ widely in scale and complexity but share the same type of challenges and potentials. For REGREEN, the engagement with these cities has played a crucial role in contextualising and providing crucial insights across the different themes of REGREEN⁽²⁾.

Nature-based learning and NbS

NbS have extensive educational potential that is not yet well developed. REGREEN has explored NbS as co-creative educational processes from kindergarten to youth, investigating collaborative learning opportunities in developing NbS locally and involving children, teachers and schools as active partners. Children risk being alienated from nature with the current reduced opportunity to experience biodiverse natural settings, the dominance of indoor activities and the general use of artificial materials and bright colours in playgrounds. Interactive walkable floorplans^(3,4), citizen science on biodiversity for school children⁽⁵⁾, play biotopes where children and biodiversity thrive⁽⁶⁾ and digital educational tools of GREENOPOLIS⁽⁷⁾ and field e-books for Eco-Explorers⁽⁸⁾ have been developed and validated with schools through REGREEN.

Creating integrated governance contexts for NbS implementation

Conditions for successful NbS implementation can vary significantly across European cities due to contextual differences. Because NbS is complex and multi-functional, getting NbS from an idea-stage to actual implementation often requires integrated approaches that involves bringing together different sectors in local administrations each with their agenda and tradition. REGREEN found that enablers for local NbS implementation involve openness to collaborate with stakeholders, the presence of a policy champion within local government to influence and drive the processes, the ability to utilise emerging windows of opportunity and public awareness to speed up decision-making. Enablers also involve aligning NbS initiatives with government strategies to facilitate negotiations, effective enforcement of targets and regulations for green space and the availability of strategic and long-term funding^(9,10).

Further reading

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Nature-based urban land use planning approaches

Slowing and ultimately stopping urban land take and developing NbS in urban environments need to become key strategies. Because of the complexity and multi-functionality of NbS, it is preferable, in addition to strategic planning, to facilitate a participatory process with stakeholders including government at different levels, semi-public organisations, businesses, non-governmental organisations, local community organisations and citizens more broadly and integrate NbS into urban planning documents. REGREEN investigated new approaches to reducing urban land take and new methods of integrating NbS in planning systems⁽¹¹⁾. REGREEN also developed a highly topical approach and tool to identify potential for de-paving and guidance on re-greening strategies in cities that is now being put to use at regional level in Paris. The concept and approach are available in English⁽¹²⁾, French, Danish and Croatian and the underlying concept is in principle replicable to all cities. REGREEN also explored the role of NbS on how to enhance urban-rural resilience. We focused on peoplesheds that concern patterns of human dwellings and mobility in the larger context of watersheds, airsheds, and naturessheds⁽¹³⁾.

Urban drivers, pressures, and solutions

There is a lack of clear, collated information about the relative effectiveness of many types of urban NbS, which can hinder the uptake of NbS in cities. REGREEN has developed an internally consistent typology of NbS backed up by a summary of the evidence base for the ecosystem services that each NbS provides, considered as a quantity per unit area of NbS to allow for a direct comparison across NbS and ecosystem services⁽¹⁴⁾. The resulting matrix comprises nine main categories of NbS ranging from gardens and parks to linear features, NbS on infrastructure and water bodies. These NbS typologies are assessed for 11 different ecosystem services. NbS with more natural features have a high multi-functionality for regulating services and score highest for supporting biodiversity. This matrix helps planners make rapid decisions on which type of NbS are more multi-functional. It can also play a useful role in communication. Building on this typology, REGREEN developed different types of scenarios to represent NbS across the city for use with ecosystem service models to inform planning.

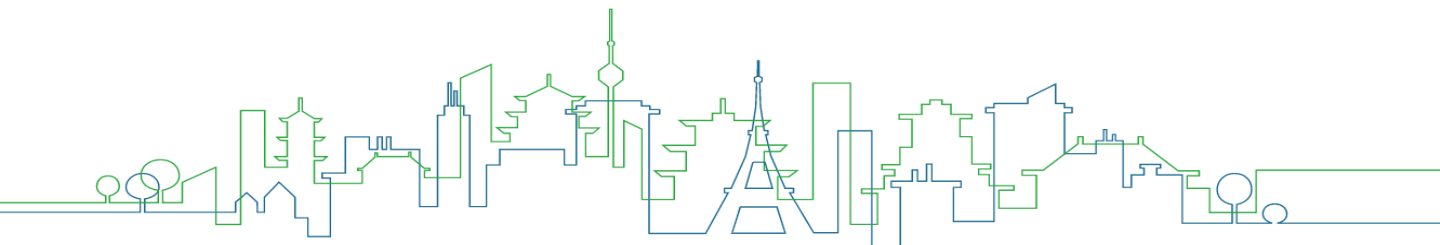
Object type	Object category	Food provision	Air pollution removal	Noise mitigation	Heat mitigation	Water quality mitigation	Water flow management	Maintaining carbon stocks	Supporting physical activity	Supporting social interactions	Restoring capacities	Supporting biodiversity
Gardens	Balcony	Low	Negligible	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	High	High	Medium	Low
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
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
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
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
	Pleasant 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 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	Low	Low
	Floof 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
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
	Plain 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
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
	Estuarine 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 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

Typology of NbS types and assessment of the challenges they help reduce⁽¹⁴⁾.



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Mapping urban ecosystem services and targets

With the requirements to map ecosystem services and set targets for increasing green infrastructures in European cities and towns under the European Nature Restoration Law, Member States and local authorities need to understand the spatial and temporal dynamics of urban ecosystems. REGREEN developed tools and guidelines for mapping and modelling procedures to allow for transferability and replicability⁽¹⁵⁾ and mapped land-cover/land-use across spatial scales and over time at high resolution⁽¹⁶⁻¹⁸⁾. These were enriched by land-cover scenarios until 2030⁽¹⁹⁾. The mapping has allowed cities to deepen the understanding of residential structures, socio-demographics and equity in relation to existing urban nature and provided the baseline for ecosystem models and economic valuation of NbS. REGREEN elaborated a typology of target values for various environmental pressures and developed a synthesis of cross-sectoral potential target values, including barriers and constraints in achieving them, which is of direct relevance for all cities in Europe⁽²⁰⁾.

Modelling ecosystem services and use of scenarios

Decision-makers also need accurate assessments of the benefits of NbS in absolute terms and tailored to the local context when planning for implementation of urban green and blue spaces. REGREEN has developed six improved ecosystem models that provide locally-relevant calculations of benefits, taking into account local pressures, people who may benefit and the type of NbS. The six models show how NbS can help address the challenges of reducing air and noise pollution⁽²¹⁾, alleviate Urban Heat Islands⁽²²⁾, reduce water flow under extreme precipitation⁽²³⁾, improve water quality⁽²⁴⁾, and maintain or increase biodiversity. REGREEN combined the models with scenarios of large-scale NbS implementation, aggregating the findings of multiple benefits of NbS. The models provide maps and summary metrics, showing where urban pressures are greatest and what impact different levels and types of NbS intervention may have. The models are integrated into the [City Explorer Toolkit](#), with the first online version created in REGREEN for the city of Aarhus, Denmark.

Wellbeing values of NbS

NbS are most often undervalued because assessments lack the full range of social, environmental and health benefits of NbS into account in decision-making. The multiple functions of NbS and the different environmental, social and economic impacts (depending on location and socio-demographics) make valuation of NbS particularly complex. REGREEN has demonstrated the importance of understanding NbS benefits from multiple perspectives⁽²⁵⁾ and has taken a complex systems thinking approach^(26,27), which can help strengthen arguments for the implementation of NbS and avoid sub-optimal or even harmful implementation.

Business model development & decision-support

Investments in NbS needs to accelerate and increase manifold. Governments at different levels, private companies and financial institutes can benefit from collaborating on developing sustainable business models for NbS. REGREEN has elaborated an overall approach for developing sustainable business models and three concrete business model approaches for inspiration including a public-private driven model, a commercially driven consultancy model and a citizen driven model⁽²⁸⁾. A Decision Support Tool gathers foundational knowledge from REGREEN and guides different types of stakeholders through the process of designing, implementing and delivering NbS⁽²⁹⁾.

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Authors

Marianne Zandersen

Contributors

Sally Anderson, Ellen Banzhaf, Gwendoline Grandin, Laurence Jones, Anders Branth Pedersen, Elena Petsani, Åsa Ode Sang, Andreas Türk, Benedict Wheeler

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