

Nature-based solutions for water resource management in the urban fringe

Amy Oen (NGI, Norway), Sarah Hale (NGI, Norway), Nandita Singh (Södertörn University, Sweden), Lina Suleiman (KTH, Sweden), Karen Esler (Stellenbosch University, South Africa), Elisabet Roca Bosch (UPC, Spain), Nupur Bose (ANC, India), Agnieszka Latawiec (IIS, Brazil)

NATWP: Nature-based solutions for water management in the peri-urban

- Contributing to closing the water cycle gap by exploring the **potential that NBS offer to address water management challenges** in landscape areas that have been neglected because they lie in the transition zones between the urban and the rural.
- The main objective is to **exchange learning experiences** among the partnership and promote the debate between science and society in order to **increase awareness among practitioners and users** on the application of NBS to manage water scarcity, pollution, and risks related to extreme hydrological events.
- 3-year R&D project (2019-2021)

Peri-urban context relevance for NBS

➤ SPATIALLY:

- Urban buffer zones (surrounding the urban boundary and limited by the rural one)
- Transition spaces (change in land use due to encroachment of urban areas)
- Hybrid landscapes

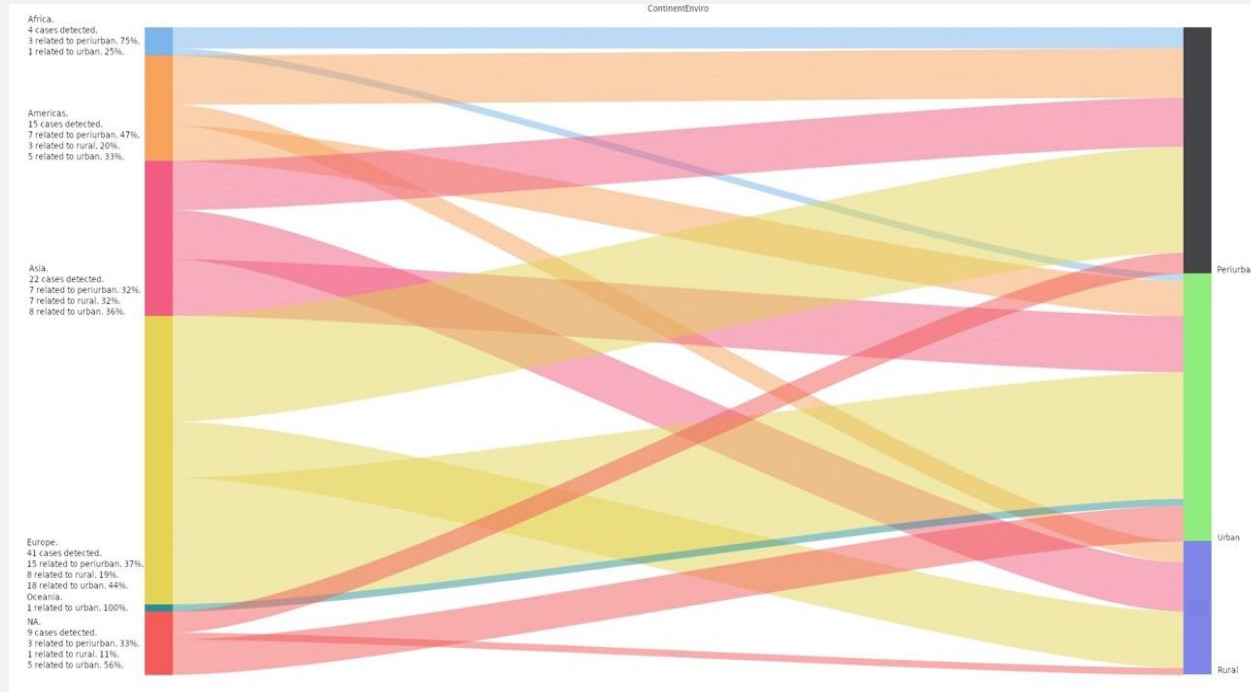
➤ RELEVANCE FOR NBS:

- Peri-urban as strategic for Environmental Services (multi-functional landscape)
- Historically relevant in development and sustenance of urban centers, provision of water-related services (water supply, wastewater management and flood control)
- Usually located in close proximity to land with high biodiversity habitats



Peri-urban

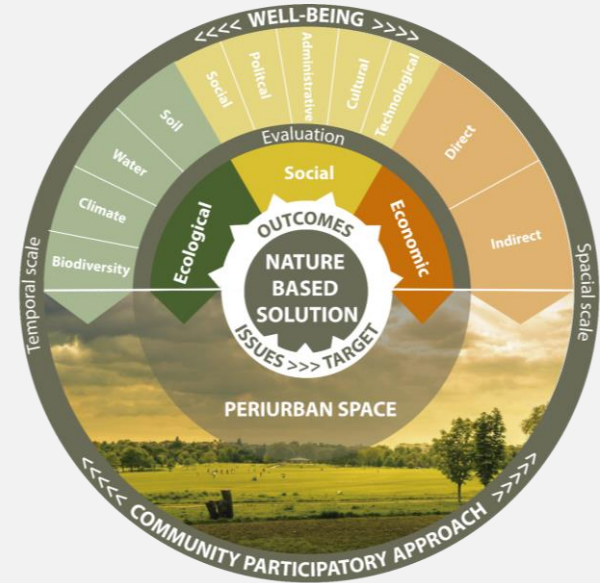
NBS in the literature – relationship between continent and context (peri-urban, urban and rural)



Ramirez et al. 2020 "Review of International Experiences of NBS for Water in the Peri-Urban. The Natwip Project."
(Forthcoming)

Development of a methodological framework

Sustainability dimension	Nature of Indicator	Suggestive Criteria
Social	Political	Policy instruments, long term political support
	Administrative	Responsiveness for dealing with water issues, availability & quality of human resources, role of governmental organizations at all levels
	Collaborative & integrated approach	Cross-disciplinary & inclusive approach, involvement of civil society, research bodies, other actors
	Societal	Citizen engagement, societal awareness
	Cultural	Cultural values, local knowledge, gender perspective
Economic	Financial resources	Long-term financial support – public & private
	Cost-effectiveness	Long vs. short term cost-effectiveness of NBS vis-à-vis conventional engineering solutions
Ecological	Ecosystem services	Impact on ecosystem services
	Water quality/quantity	Long-term impact on water quality & availability
	Environment & Climate	Implications for environmental sustainability & climate resilience



Latawiec et al. 2020: WP2 Sustainability Assessment of NBS for Water in the Peri-Urban - A 'Methodology Guidebook': outlining the assessment framework (forthcoming)

Application of framework to case study sites

- Sweden: Greywater treatment and urban transformation
- Spain: Barcelona Metropolitan green corridor restoration
- Brazil: Reforestation
- India: Rainwater harvesting
- South Africa: Invasive Tree Management and Riparian Restoration
- Norway: Watershed management



CASE STUDIES

Sweden: Greywater treatment in Norrtälje, the Stockholm Archipelago

In the holiday home area of Norrtälje municipality, home owners are responsible for treatment of their greywater. Different NBS will be explored (infiltration, soil bed, bio-module and a hybrid solution) and their social, economic and ecological benefits will be assessed.



Sweden: Årstafältet, a suburb in southern Stockholm

In this large open field located within a valley, changing forms of NBS for water under urban transformation will be studied with the aim of exploring tensions & complements of NBS alongside conventional water solutions



CASE STUDIES

Spain: NBS for Barcelona Metropolitan Area

Aims to analyze social significance of eco-system services provided by past river NBS interventions (e.g., flood management, river restoration) and understand how present & future urban projects can draw benefits



Brazil: Reforestation in Guandu Watershed

Aims to provide learning on environmental & socio-economic opportunities & challenges associated with forest restoration for improving water quality & quantity in 'Guandu Water Producer Project'



CASE STUDIES

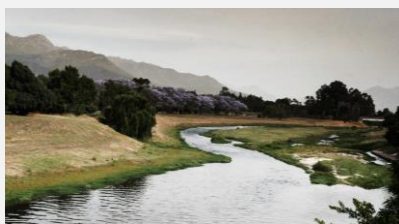
India: Rainwater Harvesting as a Tradition in Cities

Urbanization is replacing wetlands & green spaces, in turn bringing water challenges. This study will explore potential of RWH as source of peri-urban water sustainability (vs. conventional grey options) in semi-arid Udaipur & humid subtropical Bihar Sharif, known for rich traditions of RWH for water supply & other uses



South Africa: Invasive Tree Management & Riparian Restoration

Degradation in water quantity & quality in Berg-Breede watersheds is bringing forth NBS projects - alien tree clearing, riparian restoration & wetland construction. Through scenario analysis, this case study will identify challenges & suggest policy & governance contexts



CASE STUDIES

Norway: Watershed management in Skien municipality - hindering leaching of pollutants when reopening waterways for flood mitigation

Assess feasibility & benefits of different NBS to support the reopening of the buried river Kjørbekk. The NBS aim to be a catalyst for city development, to mitigate potential flooding as a result of climate change and to improve water quality. Current challenges are that excavations are technically challenging and expensive, the work will go through landfills and provide a potential source of pollution downstream. The case study will look at solutions such as stabilization, establishing a barrier, capping as well as local redistribution and reuse.



Preliminary comparison of case stites – similarities and differences in water pressures

City/country	Case study	NBS	Quality (Pollution)	Climate change	Quantity	Societal
Stockholm, Sweden	Årstafältet	Urban transformation	✓	✓	✓	
Stockholm, Sweden	Norrtälje	Greywater treatment	✓			
Skien, Norway	Kjørbekk	Watershed management	✓	✓	✓	
Rio Claro, Brazil	Water and forest producers	Reforestation	✓		✓	
Stellenbosch, South Africa	Genius of space	Riparian restoration			✓	
Stellenbosch, South Africa	Wildland Draws	Rainwater harvesting	✓		✓	
Bihar, India	Biharsharif	Rainwater harvesting	✓			✓
Udaipur, India	Udaipur	Rainwater harvesting	✓		✓	✓
Barcelona, Spain	Besòs River Park	Restoration	✓	✓		

Preliminary comparison of case stites – similarities and differences in water ecosystem services

City/country	Case study	NBS	Water Provision (Provisioning ES)	Food Provision (Provisioning ES)	Sand Provision (Provisioning ES)	Water Regulation / Mngmt (Regulating ES)	Water Purification (Regulating ES)	Flood Attenuation (Regulating ES)	Religious/ Heritage Value (Cultural ES)	Asthetic Value (Cultural ES)	Recreation (Cultural ES)
Stockholm, Sweden	Årstafältet	Urban transform	✓				✓	✓		✓	✓
Stockholm, Sweden	Norrtälje	Greywater treatment	✓	✓			✓				✓
Skien, Norway	Kjørbekk	Watershed management				✓	✓			✓	✓
Rio Claro, Brazil	Water and forest producers	Reforestation	✓			✓	✓			✓	
Stellenbosch, South Africa	Genius of space	Riparian restoration		✓			✓			?	
Stellenbosch, South Africa	Wildland Draws	Rainwater harvesting	✓		✓	✓	✓			✓	
Bihar, India	Biharsharif	Rainwater harvesting	✓	✓		✓		✓	✓		✓
Udaipur, India	Udaipur	Rainwater harvesting	✓	✓		✓		✓	✓	✓	✓
Barcelona, Spain	Besòs River Park	Restoration	✓			✓	✓	✓	✓	✓	✓

Preliminary comparison of case sites – challenges

City/country	Case study	NBS	Institutional/ governance	Legal	Financial	Technical	Political	Societal	Flooding and drought
Stockholm, Sweden	Årstafältet	Urban transformation	✓			✓			✓
Stockholm, Sweden	Norrtälje	Greywater treatment			✓			✓	
Skien, Norway	Kjørbekk	Watershed management			✓	✓		✓	✓
Rio Claro, Brazil	Water and forest producers	Reforestation		✓	✓	✓	✓	✓	
Stellenbosch, South Africa	Genius of space	Riparian restoration		✓				✓	✓
Stellenbosch, South Africa	Wildland Draws	Rainwater harvesting			✓		✓	✓	
Bihar, India	Biharsharif	Rainwater harvesting	✓		✓	✓		✓	
Udaipur, India	Udaipur	Rainwater harvesting	✓		✓	✓		✓	
Barcelona, Spain	Besòs River Park	Restoration	✓		✓		✓	✓	✓

Next steps – application of the framework

- Further assessment of opportunities and barriers in implementation and management of NBS.
- Exploring the use of sustainability indicators defined as NBS that are inexpensive and feasible in their specific context as well as ensure long-term effectiveness.
- Case studies located in the global south represent interesting examples where the framework is used to explore potential management practices that Nordic countries could learn from.

Project partners

- Project leader: Södertörn University, Sweden
- Supporting partners:
 - Royal Institute of Technology (KTH)
 - Stellenbosch University, South Africa
 - International Institute for Sustainability Brazil
 - Universitat Politècnica de Catalunya (UPC), Spain
 - Norwegian Geotechnical Institute, Norway
 - A.N. College, India

Acknowledgements

The authors would like to thank the European Commission and FORMAS, WRC, MINECO – AEI & RCN for funding in the frame of the collaborative international consortium NATWIP financed under the 2018 Joint call of the WaterWorks2017 ERA-NET Cofund.

This ERA-NET is an integral part of the activities developed by the Water JPI.

2018 JOINT CALL







#onsafeground

NORWEGIAN GEOTECHNICAL INSTITUTE
NGI.NO

