Nature-Based Solutions for Water Management in the Peri-Urban

NATWIP is the acronym for a project titled “Nature-Based Solutions for Water Management in the Peri-Urban: Linking Ecological, Social and Economic Dimensions”. This is a large transnational research project funded under the 2018 Joint Call of the Joint Programming Initiative - Water Challenges for a Changing World (or the Water JPI), which aims to tackle the ambitious challenge of achieving sustainable water systems for a sustainable economy in Europe and abroad. This joint call focused on “Closing the Water Cycle Gap – Sustainable Management of Water Resources”.

Project NATWIP intends to develop and share knowledge on nature-based solutions (NBS) for addressing challenges confronting the water cycle in peri-urban areas, with significant direct implications for the urban core areas as well. NBS for water have been envisaged as central to achieving the 2030 Agenda for Sustainable Development because these are rooted in integrated approaches and generate social, economic and environmental co-benefits.

The co-benefits generated by NBS cross-cut the fields of human health and livelihoods, food and energy security, sustainable economic growth, decent jobs, ecosystem rehabilitation and maintenance, and biodiversity. It is argued that the substantial value of these co-benefits can tip investment decisions in favour of NBS. Further, effective implementation of NBS involves the participation of many different stakeholders including those at local level. It should thus encourage consensus-building and help raise social awareness about why and how to adopt NBS to improve water security.

**Aim and Objectives of NATWIP**

NATWIP aims to contribute to closing the water cycle gap by exploring the potential that nature-based solutions (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, commonly referred to as ‘peri-urban’ areas. The overall purpose 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 different hydrological challenges such as water scarcity, pollution, and risks related to extreme events like flood and drought.

NATWIP’s specific objectives are as follows:

1. Review international experiences to identify barriers, lessons learned and challenges in the implementation of different NBS to deal with water management in the peri-urban.
2. Establish a methodological framework as a tool to analyze the potentials, content and benefits of NBS in the peri-urban context, considered from ecological, socio-economic, technological, policy, planning, governance, institutional perspectives, and including different types of stakeholders (authorities, administrators, associations, scientists and the public).
3. Apply the methodological framework to conduct an analysis at a number of case study sites to:
   - complete a scenario study to identify the main challenges for implementing different forms of NBS in the peri-urban (from ecological, socio-economic, political, planning, governance, institutional perspectives);
   - compare situations in the different case study sites to draw generalizations at the pan-European level, including some comparisons of NBSs with more conventional solutions;
reflect on the overall socio-economic-policy and governance context that would favour the implementation of NBS in the peri-urban context.

4. Create a common narrative to deal with water challenges specific to peri-urban areas and the implementation of NBS. This would be attempted by developing best practices guidelines and policy recommendations for promoting NBS in the peri-urban for closing the water cycle gaps.

The project includes case study sites in Brazil, India Norway, South Africa, Spain, and Sweden where the project partners have established contacts and ongoing work.

**Originality and Innovativeness of NATWIP**

NATWIP aims at comprehensive research on NBS regarding water and wastewater-related needs in peri-urban areas. Though increasing interest in NBS in research and action is being expressed globally, this project’s originality lies in: first, developing an innovative multi-disciplinary approach to designing & implementing NBS for water in the peri-urban, especially taking socio-economic perspective; second, evaluating the strengths & weaknesses of NBSs for water vis-a-vis conventional engineering solutions from economic, ecological & social perspectives; and third, adopting an evidence-based integrated approach rooted in European and international contexts to develop tools to promote NBS for water in the peri-urban.

The innovation of the project basically lies in development of an interdisciplinary methodological framework to assess NBS for water and applying it to understand case situations spread across multiple European & international sites. The innovation further lies in creating a common narrative & hence best practices to deal with water challenges in the peri-urban through implementation of NBS. The innovativeness & comprehensiveness of the project can be further seen as represented by the 3 dimensions within which it operates: i) academic; ii) spatial; & iii) socio-political.

Academically, NATWIP is foreseen to promote knowledge exchange through interdisciplinarity approach to foster interaction between disciplines to develop a common language & a change in understanding. Spatially, the case studies are foreseen to illustrate NBS for water in six countries spread throughout four different continents having distinct environmental, economic and social characteristics. This will help generate broad-based information regarding NBS’ best practices and challenges for water and wastewater needs, serving as examples of solutions in different contexts. Socio-politically, the scientific data generated will be both dependent on inputs from local stakeholders and a useful tool in the creation of policy and action instruments, establishing a connection among science, society and decision-makers. The inclusion of stakeholders in the process would improve acceptance regarding the project, as well as amplify their awareness on water challenges and on the importance and scope of their participation in NBS activities for sustainable water resources management.

**NATWIP Case Studies**

**Brazil: Restoration in Guandu Watershed**

Restoration in Brazil has been spurred by international and national commitments. In the Atlantic Rainforest, a highly fragmented biome and a global biodiversity hotspot, restoration in private areas is being promoted by NGOs, government, and research organizations. The case study from Brazil will gather lessons learned from the ‘Guandu Water Producer Project’, the most advanced Payment for Environmental Service initiative in Latin America. Through this project, fees collected
from water users will pay farmers to conserve and restore riparian forests on their lands. The Guandu Watershed is a vital source of drinking water for 8 million people in the city of Rio de Janeiro, and this project aims to encourage conservation and forest restoration practices to improve water quality and quantity, as an alternative to conventional solutions. This case study will provide an example of environmental and socio-economic opportunities and challenges associated with restoration in Brazil.

**India: Rainwater Harvesting as a Tradition**

Fast expanding urban centres in India engulf rural hinterlands, replacing wetlands and green spaces with built-up areas, in turn leading to increasing water scarcity & compromised water quality in the new peri-urban areas. This contradicts the historical scenario when NBS rooted in rainwater harvesting used to constitute the most reliable local solution for water supply, often linking the urban and rural spaces in a continuum. Unfortunately, the value of NBS in general & rainwater harvesting in urban development has been lost. Even under current policies/programs, such as AMRUT, water supply & development of green areas appear to be separately considered without requisite concern for water sustainability. This case study aims to undertake: 1) policy evaluation of current approaches to urban development in India from the perspective of NBS in the peri-urban; 2) participatory research on rainwater harvesting in & around the cities of Udaipur (in Rajasthan) and Nalanda (in Bihar). Both these cities together with their rural hinterlands had a rich history of rainwater harvesting (centralized state-based as well as decentralized community-based) but today increasingly face water quality and quantity challenges. The study will primarily help generate evidence-based knowledge on the challenging facing and the potential offered by rainwater harvesting as an option for peri-urban water sustainability (vis-à-vis conventional grey infrastructure-based approaches). It will also explore the role of different stakeholders in taking forward such integrated approaches.

**Norway: Watershed Management in Skien Municipality**

Skien municipality represents a peri-urban area close to Oslo where a large-scale transformation project is planned - opening a buried river using blue-green infrastructure as a catalyst for city development, to mitigate potential flooding as a result of climate change and to improve water quality. However, the landscape transformation faces challenges; the Kjørbekk river is currently diverted in an aging concrete pipeline buried up to 15 meters deep thus rendering excavations technically challenging and expensive. Furthermore, some areas along the Kjørbekk have been buried using municipal waste which has now become a source of pollution downstream. The aim of this case study site is therefore to explore the available alternatives that prevent the transport of pollutants from the buried landfills in order to permit the excavation of the buried river and subsequent implementation of NBS. Potential solutions include stabilization, establishing a barrier, capping as well as local redistribution and reuse. These solutions will be assessed according to the local policy context including relevant regulations and local perceptions, the ecological benefits of
increased biodiversity and pollutant load reduction, as well as the economic implications of each solution.

**South Africa: Invasive Tree Management & Riparian Restoration**

As a semi-arid developing country (MAR 450mm), South Africa faces significant water scarcity challenges with increasingly variable rainfall, frequent drought & floods, and growing water demand. In the Western Cape of South Africa, Berg-Breede river catchments supply strategic water sources to surrounding towns and agriculture, but supplies are dwindling and water quality is deteriorating. Several projects focusing on NBS/ecological infrastructure [as opposed to built infrastructure, which has reached limitations] are underway, and include a focus on alien tree clearing, riparian restoration and wetland reconstruction.

In South Africa, two sites facing significant peri-urban growth within these catchments will be assessed to determine strategies in place to address water availability and quality risks, through protection and restoration of ecological infrastructure, management of invasive alien trees, and how these might integrate with /or even replace hard engineering solutions. Two study sites in South Africa are: Dwarsriver and Langrug.

**Dwarsriver:** The “Wildlands Dwars River” project is an NBS that aims to increase water quantity & reduce pollution impacts to service in the adjacent communities and farm landowners by clearing invasive alien trees and re-planting riparian zones.

**Langrug:** The “Genius of Space” Langrug Community Project is a NBS that aims to reduce pollution impacts to surface water in the informal peri-urban area of Langrug.

The objectives are to: (1) perform a scenario analysis on these 2-3 sites within the catchments to identify the main challenges for implementation of NBS in the peri-urban, & (2) study and describe the overall socio-economic-policy and governance context that would favour implementation of NBS.

**Spain: NBS for Barcelona Metropolitan Area**

The Spanish case study is located in Barcelona Metropolitan Area, where the overlapping of blue and green infrastructure as an ecological skeleton is a current challenge for the configuration of its peripheral limits. It concerns Besòs River Park where the water was polluted from the industrial surroundings and NBS as an opportunity for its socio-ecological restoration.

The study will apply the NATWIP assessment framework to analyse planning and governance processes and ecosystem services provided by current NBS and with a particular focus on cultural ecosystem services (landscape aesthetics and recreation). Its final goal is to improve its environmental quality & water cycle management under Mediterranean climate conditions of scarcity and torrential storms, reducing flood risks and taking advantage of underused freshwater resources to promote innovation for urban resilience. Specifically, the aim of this case study will be to: i) identify the ecosystem services provided by the past NBS interventions (flood management, river restoration, biodiversity increase, recreational areas); ii) understand how the previous NBS experiences built capacity for present and future urban green/blue infrastructure interventions; iii) analyze how advancing on environmental quality becomes a key driver for
promoting NBS river and sea connectivity, through technical innovation developments to move towards a more sustainable water management (rainwater harvesting, groundwater use and water quality improvement).

**Sweden: NBS in Årstafältet, Stockholm and Norrtälje, Stockholm Archipelago**

In Sweden, two different case studies will be undertaken. The first case study will reveal the tensions and complements of NBS alongside conventional systems for water management in a newly urbanized area - Årstafältet, a suburb in southern Stockholm. Årstafältet is a large open field located in a valley, which is wet and muddy with soil conditions that make development of this area costly and risky. Nature-based facilities were constructed between 2005 and 2008 for transforming Årstafältet into a landscape park. These consist mainly of a stormwater pond, a small stream “Valla”, a distribution ditch, surface screens, vegetated soil beds and water steps. The objectives have been to reduce the water load and the risk of overflows, clean the water, and restore the dry stream “Valla”, in addition to biodiversity, cultural and pedagogic values. Because of growing housing demand, however, the original plan was altered with a plan to build urban settlements in 2006. The new plans integrate highly ambitious NBS in terms of scale and environmental, ecological, social & urban quality requirements and values. The plans comprise enlargement of the water pond and redesign of the stream into 3 water ponds merged into one watercourse. Trees planting along streets, rain-gardens and locally water-treated facilities alongside housing blocks are also planned as NBS to improve water quality and manage overflow and floods.

The other case study concerns NBS for greywater treatment in the holiday home areas of Stockholm Archipelago. Here Norrtälje municipality has among the highest figures, with 129 holiday home areas and 13 900 holiday homes. Apart from leisure, many of these homes are converted into permanent housing. A large number of these lie on the outskirts of Norrtälje town or the urban core area and are excluded from the municipal wastewater network. The greywater treatment system used in these holiday homes/areas is not always efficient and operational, thus discharging contaminated wastewater. In turn, this leads to an increased risk of contagion, eutrophication and oxygen deficiency in the waterways, groundwater, lakes and coastal waters. This study aims to make a sustainability assessment of NBS as an option for greywater treatment in the holiday home areas of Norrtälje municipality within the Stockholm Archipelago, exploring the social, economic and environmental dimensions.