Task 6.6 Buddy System Activities - WEBINAR #2 Summary

Nature Based Solutions For Water

Organized by RINA-C in collaboration with UNALAB cities

25/09/2018

This project has received funding from the European Union's Horizon 2020 research and innovation programme under Grant Agreement No. 730052
*Topic: **SCC-2-2016-2017: Smart Cities and Communities Nature based solutions***

UNALAB CITIES WEBINAR #2

Nature Based Solutions For Water

1) Introductive part on water related risks in cities with an overview of the related NBS and their application

The main water related risks in cities nowadays are:

- Water pollution and so water quality;
- Disasters related to floods and droughts;
- Change in water availability (water scarcity or lack of water).

All these risks are mainly caused by the damage of ecosystem connected to both agricultural and industrial activities. The use of agrochemicals, the intense exploitation of soil with the deforestation, and the industrial untreated wastewater are factors deeply connected with the ecosystem damage.

Nature plays an important role in the management, regulation and purification of water, so the use of the nature or the semi-natural systems could be very effective to prevent or to mitigate the water risks and to provide a better management of the water storm. The Nature Based Solutions (NBS) could substitute the grey infrastructures in the water storm management and regulation, but the best results are obtained in the projects where the green and the grey infrastructures work together.

Concerning the water quality issue, some of the most effective NBS are:

- Constructed wetlands;
- Intensive roofs;
- Biofilters.

All these NBS have the function to purify water, partially retaining the storm water that is naturally filtered and cleaned after the slow infiltration into the substrate. The installation of intensive roofs and biofilters is not affected by any particular difficulty in the implementation phase, their depreciation doesn't exceed the 10 years and both these NBS could represent a valid substitute to urban grey infrastructures for managing storm water. On the contrary, constructed wetlands need large areas to be implemented and depreciation time could reach 20 years. As for the aforementioned NBS, wetlands could substitute dams and levees as grey infrastructures.

Regarding the managing of water disasters, some of the most effective NBS are:

- Bioswales;
- Detention ponds wet or dry;
- Infiltration basins.

All these NBS have the function of convey, retain and storage storm water. In particular, they all need medium/large areas to be implemented (possible limitation), and they could substitute grey infrastructures for management of urban storm water. Depreciation doesn't exceed 10 years, except for the detention ponds that could reach 15 years.

Examples of the previously mentioned NBS could found in the following projects:

- Fornebu, in Oslo, an airport area that has been requalified using detention/retention ponds, bioswales etc.;
- Hammarby Sjostad in Stockholm, a requalified urban area where bioswales, roof gardens and a green ground infiltration system have been implemented as nature based solutions;
- Park Jacob Kaplan in Lyon, an interesting project where an elevated basin was constructed with an underground drainage system;
- Burghplan in Eindhoven, an urban area where it has been used, among the other green solutions, a filtering construction system to clean the runoff water from roads.

All the aforementioned topics could be deepened using these website links:

Risks connected to water in cities and overview of related NBS:

- Report on NBS for Water – World Water Forum International Event (8th edition) http://www.unwater.org/publications/world-water-development-report-2018/

- WWF Flood Green Guide Publication https://www.worldwildlife.org/publications/natural-and-nature-based-flood-management-a-green-guide

- New Strategy for Re-Naturing Cities through Nature Based Solutions www.urbangreenup.eu/

- Urban NBS Projects from across 100 European Cities www.naturvation.eu/atlas -

Water NBS application study cases:

- http://nwrm.eu/case-study/sustainable-stormwater-management-and-green-infrastructure-fornebu-norway

- http://www.urbangreenbluegrids.com/projects/hammarby-sjostad-stockholm-sweden/

- http://www.aqua-add.eu/?page=handbooks

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2) Frontrunner cities contributions on water related natural solutions

a) EINDHOVEN: Daylight Watercourse
b) GENOA: Retention Basins/Draining Areas
c) TAMPERE: Waterstorm Management

a) EINDHOVEN:

- *Introduction: description of the studied area and of the water related challenges that had to be faced:*

  In the past the river 'Gender' was covered and finally changed into a sewage. Eindhoven started almost 20 years ago with the reconstruction of water courses in order to make the water system visible and to create a more robust and as natural as possible water system.

- *Description of the different water related NBS adopted:*

  The NBS of interest is daylighting water course making the water system visible. The main challenge in implementing such a solution is related to the fact that the city has grown and now it is very difficult to find places to create a water course and an ideal solution to implement. The actors involved are citizens, the Waterboard (a regional independent government body charged with managing water barriers, waterways, water levels, water quality and sewage treatment in its respective regions), politicians, civil engineers. The idea is to create water storage areas and a system that connect water bodies and that is disconnected from sewage plant. The Municipality (water department) and the Waterboard will finance this action.

- *Successful stories that inspired the water related NBS implemented:*

  BURGHPLAN – Park renovation, Eindhoven, Netherlands
  The project focuses on the renovation of the park and a reconstruction of the water system. The main actions concerned Water Quality Improvement (a filtering system and a fountain were constructed) and Storm water Control (a water connecting system that contains water only when it rains was implemented).

  MEERHOVEN – New created water system, Eindhoven, Netherlands
  The project focuses on the water storm management and on the water purification using a water system artificial flow with the implementation of a pump. It has been faced the problem of the blue algae in the water.

b) GENOA:

- *Introduction: description of the studied area and of the water related challenges that had to be faced:*

  The project area is the Lagaccio river basin, an area with high slopes gradient, short distance between the sources and the sea, bedrocks, high percentage of sealed soil in the urbanized area, channeled rivers and built up, flooding and damage. The project concerns an urban park in the Gavoglio military compound.

- *Description of the different water related NBS adopted:*

  Infiltration Areas: depressions of vegetated soil for the temporary retention of surface meteoric water, with the objective of the management of the runoff water from the slopes and the pathways related to the Rio Cinque Santi, and their infiltration into the soil.
  The only actor involved is the Municipality and the cost is 15-25 €/m^2 of annual maintenance (pruning, mowing of existing vegetation, inlet and outlet control structures of the detention basin water flow).
  The barrier is the lack of experience of the PA in this type of rainwater management.

  Draining Pavements: porous pavements that enable storm water to flow through it and so it allows to reduce runoff and to improve water quality during the infiltration. The cost is 15-20 €/m^2 and the action is financed by the Public Administration. The only barrier is the need of skilled workers for the realization of this intervention.

  Rain Garden: bioretention shallow basin designed to collect, store, filter and treat water runoff, with the help of porous soil mixture, native vegetation and hyper accumulator plants, capable of phytoremediation.
  The only actor involved is the Municipality, the cost is 40 €/m^2 and there are no particular barriers.

  Underground Detention Systems: reduction of the surface runoff through the collection and the detention of the rainwater, creating water supplies for irrigation. The system is made by underground rooms in modular elements of self-supporting semi-recycled polypropylene with rainwater detention/retention capacity.
  The only actor involved is the Municipality and the cost of this intervention is 78.000 € financed by public investment or experimental sponsorship.
  The important conditions to implement this action are:
  - An accurate insulation on borders to contain water;
  - The control of water quality standards to reuse it for irrigation;
  - A proper infrastructure where water could be conveyed when full capacity is reached.

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Afforestation on slopes: arboreal areas with young plants (local species) that have the function to alleviate the impacts of flooding in urban areas. This natural solution is usually combined with containing walls along the slopes.
The only actor involved is the Municipality and the cost of investment is 36.000 € financed by public funds.
The important condition to implement this action is that the soil is permeable with acceptable pedestrian conditions.

- *Successful stories that inspired the water related NBS implemented:*

GAZZO'S AREA – Hill's slope consolidation and meteoric water management, Genoa, Italy
The objective of this project was to reduce the surface runoff rainwater with infiltration direct in the ground, with the use of the wooden support poles and the reuse of local stones to reinforce the soil. This intervention was public financed and it is has been in operation since 2016.
Among the positive and the negative aspects there are:

- The use of materials present on site;
- The lower disposal costs of landslide material;
- The need to a constant maintenance over time.

VEGETATED STONE GABIONS – Genoa, Italy
The aim of the intervention, in operation since 2015, was the hill's slope consolidation and the vegetated coverage of the area. For this purpose it was used a gabionade system in wire mesh filled with crushed debris coming from demolition, arranged to form:

- Containment walls steps with integrated seats;
- Renovated terracing with roofing in shrubbery.

Among the positive and the negative aspects there are:

- The use of materials present on site;
- The lower disposal costs of landslide material;
- The need to a constant maintenance over time.

LURA RIVER AREA – Como, Italy
The project consists of the implementation of two rolling basins connected by an open air ditch and a pond filled with ground water, to obtain a better water management and so to avoid severe flooding during heavy rain events.
Since 2017 the basins are temporarily flooded by Lura river during intense rainy periods through natural inlet from the river bed, whilst the pond recharges constantly the ditch to maintain wetland vegetation all over the year to guarantee its phytodepuration functions.
The actors involved were *Consorzio Parco del Lura, Regione Lombardia* and private professionals the project was public financed.

VARESINE GARDEN – Milan, Italy
The intervention aimed to create a high quality green open space with sustainable feature, with the use of draining pavements and green roofs.
The garden is indeed a green roof on underground parking and a wide event hall, which at the same time provides rest spaces, mitigates heat-island effect during summer days, control inner temperature variations of the hall and collect

rainwater through draining surfaces of the paths for the cooling system of the surrounding office buildings.
The actors involved were Hines, City of Milan, private professionals, and the experience was positive because of the successful everyday usage of a green accessible rest area in the compact city center.

KRUPP PARK – Essen, Denmark
The aim of the project was to shape the area of the ThyssenKrupp industrial plant in Essen into hills, moving around 400,000 m³ of soil. The project was in operation since 2012 and the nature based solutions used were: bioswales, retention ponds, draining paths and afforested slopes. The project created an attractive green space with playgrounds, where the rainwater is collected and directed through bioswales to a retention pond, a beautiful lake, at the northern end of the park.

- *Conclusions: suggestions related to the previous reported experiences that could be helpful to the other cities:*

  - The interventions carried out in extra-urban territory have given good results in terms of functionality and environmental performance;
  - Good maintenance planning must be done to ensure durability over time.

c) TAMPERE:

- *Introduction: description of the studied area and of the water related challenges that had to be faced:*

  The project areas are Hiedanranta and Vuores.

  1) Hiedanranta is a dense brownfield area, with little space for NBS and contaminated soils. The aim of the project is to make this zone a residential area with 25000 inhabitants.

  2) Vuores is a 'greenfield' development in a woodland area in the south of the city of Tampere. The project objective is to create a residential area with 13000 residents and 3000 – 5000 jobs. The NBS will be located in parks and surrounded by blocks. Part of the project has been already realized.

- *Description of the different water related NBS adopted:*

  A) Hiedanranta:

  Biofilter for leakage from contaminated soil: Filtration system to prevent pollutant, odors and nutrient load to the Lake Nasijarvi. This solution allows also to increase biodiversity and to measure the water quantity, quality and other relevant parameters.
  The system consists of a filter medium (biofilm) where bacteria and microorganisms degrades nutrients and pollutants in the leakage that is piped through the filter material.

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The cost of the intervention is 39000 € for a 100 mq area, financed by UNALAB project and the actors involved are storm water planners, landscape architects, Ramboll, the construction department, the environmental authorities, NGOs, citizen society and SMEs.

Green roof: vegetated areas to manage water flows, with particular focus on their performance during cold seasons. This solution increases rainfall interception, enhance C storage (climate regulation), reduce albedo and heat stress, increase biodiversity, contributes to create recreational and social spaces.
The estimated cost of the intervention is 100000 €, it is financed by UNALAB Projects and planned by Ramboll (UNALAB partner). The actors involved are storm water planners, landscape architects, research institutions, construction companies, green infra builders, NGOs, citizen society and SMEs.
In order to implement this kind of solution it has to be considered:

- The choice of a suitable vegetation to resist in the sub – arctic climate;
- The strict legislative orders regarding building and fireproofing;
- The nutrient leakage, to be avoided;
- The possible effects on roof structures and health.

B) Vuores:

Biofilter, retention basin and alluvial meadows: a biofilter area of 650 mq and a retention basin and alluvial meadows area of 700 mq, to prevent solids and nutrient load to waterways and urban floods, to handle the first flush, to regulate flow rates to the pre – construction level and to increase biodiversity creating a recreational values of blue – green network.
The estimated cost of the intervention is 100000 €, it is financed by UNALAB Projects and planned by Ramboll (UNALAB partner). The actors involved are storm water planners, landscape architects, Ramboll, the construction department, NGOs and citizen society.
In order to implement this kind of solution it has to be considered:

- The nature protection laws (endangered species of plants and animals);
- The Nordic climate changing;
- The lack of knowledge regarding the NBS among the residents;
- The difficulty in the maintenance of multifunctional NBS.

Plot scale NBS: Rain gardens, green roofs and similar plot – scale solutions to increase the rainfall infiltration, to prevent solids and nutrient load to waterways and urban floods, to combine recreation, food production and/or biodiversity preservation and social connectivity targets.
The intervention is financed via innovation vouchers of 30000 € from UNALAB, and of 10000 € from housing company. The actors involved are landscape planners, housing companies, residents, green infrastructures builders and Vuores service company. This intervention complements and replaces grey infrastructures.
The performances of the nature based solutions (water quality and flow) already implemented are online monitored by six online monitoring stations.

- *Successful stories that inspired the water related NBS implemented:*

  STORM WATER MANAGEMENT – Vuores, Finland
  Some interventions have already been implemented in Vuores area, like the central park storm water system, designed by a famed design office and further developed in UNALAB via co – creation process.
  Vuores storm water system is a hybrid system: the runoff from the blocks is gathered to storm water sewers which end up to NBS. The system consists of 4 bioswales, 10 retention ponds, 3 wetlands, willow treatment, 2 alluvial meadows and a biofiltration system.
  The building started in 2007, it is mostly finished now and it was financed mainly by the city's construction department.
  One of the lessons learnt in this project is that it is very important to carefully measure the quality of soil and bedrock in land use planning phase. In Vuores, in fact, there has been sulphur consisting soil that has caused problems for the water quality in the area. If the measurements had been done in advance the sulphur could have been taken into consideration in land use planning.

- *Conclusions: suggestions related to the previous reported experiences that could be helpful to the other cities:*

  - Create co-operation with city's different units and other stakeholders from planning to building and maintenance;
  - Measure the quality of soil and bedrock in land use planning phase;
  - Consider the treatment of the waters from the construction work areas (e.g. retention and filtration);
  - Educate people about urbanization, climate change related challenges and nature based solutions;
  - Establish detailed guidelines for maintenance;
  - Take advantage of UNALAB co – creation process engaging different stakeholders to further develop the existing NBS.

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