

Based on the discussion during the side event at the Green Infrastructure conference:  
Nature Based Solutions for sustainable and resilient cities. Orvieto (Italy) April 6<sup>th</sup> 2017.  
Organized by IUCN & Deltares, moderated by: Chantal van Ham; Authors: Victor Beumer & Chantal van Ham.  
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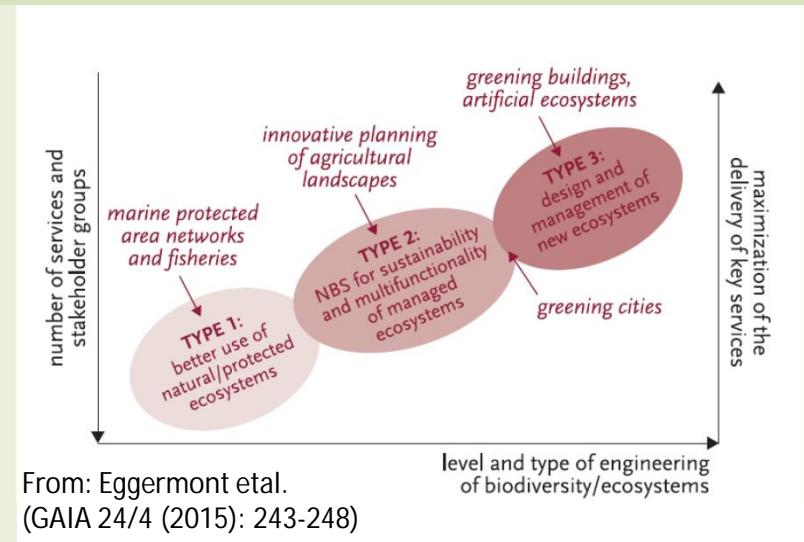
Key question of discussion: How to secure future implementation of NBS or Green Infrastructure in cities? What are the success criteria for urban NBS implementation?

Implementation of urban NBS is about making sure NBS is designed and built in a city in a way that it supplies multiple services. The process itself requires system knowledge, designing & technical expertise, stakeholder participation, sound business cases, communication, awareness on NBS benefits, management skills and decision making.

Criteria for the implementation of urban NBS is covered by four themes (see also next sheets):

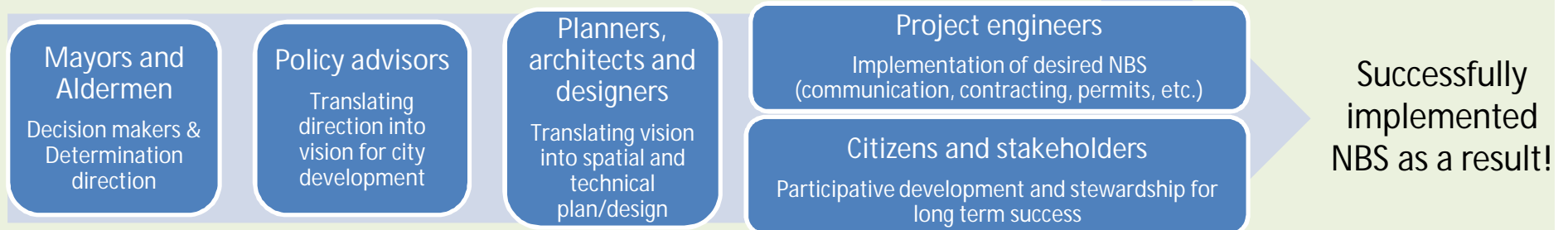
- Policy/organization criteria
- Financial/business criteria
- Knowledge criteria
- Social criteria

Evaluating success criteria for NBS implementation we must regard an important difference between individual NBS. Ecosystem-based NBS (Types 1 and 2 in Figure; designed and restored) are highly connected with local and regional site conditions (soil, groundwater and disturbance), have multiple benefits and often need more space than hybrid solutions. Think of parks, green water-sides, forest, meadows, etc. The City Tree ([www.greencityolutions.de](http://www.greencityolutions.de)) and green roofs are examples of hybrid NBS (soft combined with hard structures; Type 3 in the Figure). It is also defined as being less to not dependent on the site conditions within the city and often needs little space. These hybrid NBS usually focus on 1 or 2 benefits and have clear business cases.



Different NBS types result in different success criteria for their implementation.

## Policy/organization success criteria for the implementation of urban NBS:



Highly generalized and simplified process steps for the implementation of NBS within a municipal organization.

Raise awareness at all levels within a municipal organization to ensure people don't make 'obvious' mistakes that are widely known in other disciplines (ecological, hydrological, geological): vegetation needs water, animals need variety of habitats, nature has tendency to change without management, etc.

Make sure that city planners, architects and designers understand the importance of using a variety (tree) species and their traits to create robust ecosystems.

A city needs a long-term Urban Vision on green infrastructure or nature-based solutions and spatial development ('green/blue' vision). To secure it, it needs to be integrated in the general urban planning vision.

For a successful implementation green infrastructure should be regarded at all scales simultaneously: multi-scale approach. Benefits and responsibilities of a single NBS (especially restored or designed ecosystem-based NBS) are valid at street, neighborhood and city scale.

Think of a management/maintenance strategy upfront and in line with expected benefits. Common management of green urban areas might not fit the desired benefits/services. Most of our present management or maintenance of urban NBS is focused on recreational or esthetical services.

It is easier to build a business case around hybrid NBS (first sheet; Type 3) than on restored ecosystem-based NBS (first sheet; Type 1) and designed ecosystem-based NBS (first sheet; Type 2). Why? And how to use that for making business cases of ecosystem-based NBS more successful.

- Due to the complexity of the ecosystem → make clear how the ecosystem works & how benefits/services of the NBS are dependent of the on the local geological, hydrological and ecological system (awareness).
- Ecosystem-based NBS represent many benefits while not all are distinctly quantified → quantify 2 or 3 benefits clearly to link with stakeholders (visualization).
- Area owner is often not the problem owner (receiver of potential benefits) so who is paying for what is a difficult discussion. → identify a clear relation between the area owner and the problem owners (involvement).
- The restored and designed ecosystem-based NBS often need space that is expensive in the built environment (esp. inner-city areas) → the value of services increases in these densely build areas, or use temporarily available space.

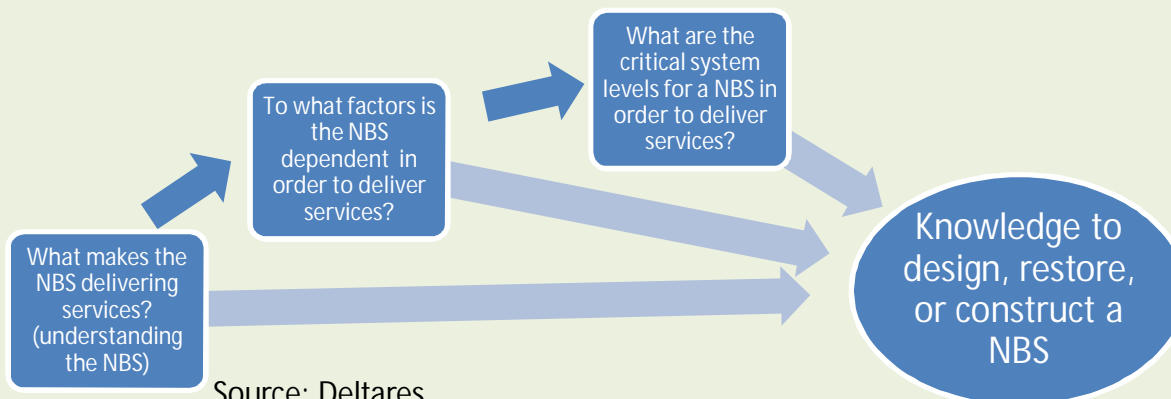
### The City Tree ([www.greencitysolutions.de](http://www.greencitysolutions.de))



We need successful startups who help create visibility for the benefits of NBS by quantifying and demonstrating them, and to understand how to build successful business cases on NBS. For instance the Green City Solutions with the City Tree: What makes their business case a success?

- They make the effectiveness/impact visible by giving real-time insight to the owner, in volume air purified (quantification of the benefit). It gives clarity on how much benefit you get.
- They focus on a single benefit for quantification and make that an incentive for the problem owner. Other benefits are positioned as extra and therefore need no exact quantification in this phase of the product development.
- They involve the private sector in company/product investment. This is also an indication for a successful future business case.
- The hybrid NBS is not dependent on the ecosystem present (potentially it could be installed anywhere).

## Knowledge success criteria for the implementation of urban NBS:



Source: Deltares

This is a simplified overview of the knowledge needed to design, restore or construct a NBS. Answering the 3 questions with any desired benefit (cooling, water or air purification, flood protection, biodiversity, recreation, etc.) or combination of desired benefits will give understanding of the NBS and service delivery.

Different species have specific features and possibilities regarding their requirements on site conditions but also on the intensity of delivering services or the potential to combine desired services.

Extrapolate knowledge and experience from successful and unsuccessful implementation projects and bring that to future projects.

Assess the water dependency of existing and desired green infrastructure to create a plan for effective solutions.

Interactive tools are needed to translate scientific and applied knowledge in order to supply insight and understanding of the effects of measures in a city

Monitor existing green infrastructure: check what the performance of your urban NBS is in time and determine what factors are preventing a maximum/optimum functionality (local drought may be major factor)

Present research is focusing on optimal conditions for NBS to deliver services. What will happen to the NBS and their services in other weather conditions. Insight is needed of the effectiveness of NBS in all circumstances (season, drought, flood, etc.).

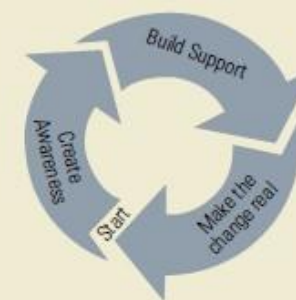
If you make design principles: regard the difference at street level and city level

## Social success criteria for the implementation of urban NBS:

To engage stakeholders we have to start by creating awareness on NBS and their services. What are the benefits and how relates that to the stakeholders and citizens. This will gently start up building stakeholder support. To effectively built up support the city needs to supply some kind of co-ownership to the stakeholders and citizens. Ultimate engagement will be secured when the installed or restored NBS will deliver services that connect to the desires and needs of the stakeholders and citizens. Failure or problematic functioning will jeopardize the engagement.

From Carr et al.  
Healthcare Quarterly (2009) 12:62-70

Figure 1. The three components of successful stakeholder engagement



1. **Creating awareness** – Educate and generate momentum (Communications led)
2. **Building support** – Target stakeholder outreach (Adoption led)
3. **Making the change real** – Sustain new business processes (Training led)

Implementation processes always seem to start with multi-stakeholder workshops. In reality an urban vision on spatial development in the city has been formulated prior to this and an area is defined/bordered where stakeholders can brainstorm on. Often a project area is defined prior to the implementation process and will not always link desires and needs with services of the NBS in an optimal way. A variety of engaging stakeholders will result in: 1. a good overview of desired benefits, 2. awareness of each others desires or needs, 3. understanding what is possible and what not due to combining multiple desired benefits, and 4. including the ideas and wisdom of the local community is an asset for effective implementation.

To successfully implement restored or designed ecosystem-based NBS local awareness and involvement of stakeholders/citizens is a highly important factor: the citizens/stakeholders are the people that will use or actively engage with the NBS. Widespread communication, engagement and education are the tools to reach this.

Make an urban development plan that includes green infrastructure and communicate that to citizens. This will increase local awareness of green areas supplying certain benefits.