Mainstreaming Building with Nature for Flood Resilience

A summary report on research barriers

The Interreg Building with Nature project

Tim Busker, IHE Delft

21-02-2020

Preface

The North Sea Region (NSR) is naturally exposed to river and coastal flood risk, and to erosion of the coastline[1]. Together with climate change and increasing populations living in exposed areas, the hazards and exposure to flooding will only increase over coming decades. Climate change will impact many disciplines, far beyond flood risk management alone. Therefore, multi-disciplinary solutions like Building with Nature (BwN) are increasingly recognized as one of the effective solutions to adapt to climate change. This resulted in a pro-active policy of the European Commission towards accelerating the uptake of BwN, through for example the EU policy agenda for nature-based solutions & re-naturing cities[2].

This Interreg VB North Sea Region Building with Nature (BwN) project has been launched in 2015 to increase our understanding of the benefits and challenges of nature-based solutions to increase flood resilience in Europe. Extensive monitoring and evaluation along 7 coastal and 6 catchment laboratories have increased our understanding about the functioning of BwN solutions under different environmental and socio-economic conditions.

Although this project hence helped to increase the BwN evidence base, the uptake and mainstreaming in Europe remains relatively slow. This was found to be due to four main barriers, which have been collectively identified in the project by all partners from countries bordering the North Sea Region. The purpose of this document is to give specific recommendations for future research directions, which can help to overcome these barriers. A larger scientific knowledge base on BwN design, its wide range of benefits, implementation and maintenance will accelerate its implementation and mainstreaming along the North Sea Region.

The Eddleston Water Project in Scotland investigates the effect of a range of BwN techniques, including re-meandering of the Eddleston river on flood risk and specific co-benefits, like increasing biodiversity and habitat.

The 4 main barriers for mainstreaming BwN

Although the challenges for mainstreaming BwN are different in every country, four overarching barriers that hamper mainstreaming of BwN have been identified: (1) lack of knowledge on system performance and monitoring, (2) underappreciation of the local context and stakeholders, (3) a non-bankable business case, and (4) a suboptimal governmental and institutional setting (Figure 1).

Figure 1 The four main barriers identified in the project.

1. **Scientific evidence**: knowledge on system performance is often lacking, as a result of a lack of understanding on the functioning of BwN solutions under different conditions. Moreover, it is often unclear what to monitor and how to select key performance indicators for monitoring.
2. **Local context**: local stakeholder involvement and alignment is generally more crucial for BwN solutions than for grey solutions, but their expertise, knowledge and perspectives remain underutilized.
3. **Bankable business case**: benefits of BwN solutions are spread out over multiple disciplines (e.g. flood risk reduction, health, environment), but the funding often still comes from one discipline. Moving out of this 'financial silo' is crucial to make BwN bankable.
4. **Governance gap**: cross-sectoral collaboration and supportive legislations are necessary to facilitate the initiation and implementation of BwN.

1. Monitoring and evaluating Building with Nature

Even after years of performance monitoring and evaluation of the BwN pilot sites in the project, the benefit streams to the environment and society are still often unclear. Multiple countries highlighted the need to improve monitoring techniques and systems, and to create a clear evaluation framework to determine what and when needs to be monitored and how the results are evaluated.

Many general guidance reports and frameworks exists for the implementation and monitoring of BwN solutions[3,4], which have been used by our project to develop a preferred evaluation framework[5]. This framework has evaluated three case studies from the project in the Netherlands (Room for the River), Belgium (River Kleine Nete) and Scotland (Eddleston Water) based on four different criteria: (1) efficiency (related to output), (2) effectiveness (related to outcome), (3) social support and (4) flexibility. Although this evaluation framework provided a basis for evaluating the case studies, it is crucial to develop more detailed monitoring and evaluation frameworks in future. These frameworks should be based on specific quantitative performance indicators and contain baseline information together with targets to achieve (i.e. the desired outcomes for each indicator). The Asian Development Bank[6] provides clear guidance on developing performance indicators for monitoring, based on project output, outcome and overall impact. Guidances like these should be used to develop the assessment framework. Specific indicators for BwN in urban areas have been developed[7], but these are examples rather than indicators embedded in a comprehensive framework.

For mainstreaming BwN in Europe and beyond, it is crucial that these general guidances are converted to specific and detailed monitoring and evaluation frameworks. Preferably, evaluation frameworks should be developed for dedicated types of solutions (e.g. coastal, fluvial and urban) with specific performance indicators for each type (including flexibility and adaptability). These frameworks will be beneficial to 'sell' BwN solutions, as they allow to systematically report the multiple benefits, and will therefore make the cost-benefit analysis more realistic (see section 3). Moreover, monitoring and evaluation facilitates the process of adaptive management: the solution can be adapted once certain factors change (e.g. availability of knowledge, climate impacts, or stakeholder needs) and another configuration is expected to be more effective [8]. The process of adaptive management should include the full range of solutions, ranging from gray, to hybrid and green.

Hybrid solutions are very promising, as they have the potential to increase the reliability of NBS while still providing 'green' co-benefits. It is therefore no surprise that hybrid solutions are the most used type of BwN to manage flooding[9]. But also for hybrid solutions, the monitoring and evaluation still remains a large knowledge gap[10].

The scope of future research

Our recommendation for future projects is that there should be more emphasis on the development and use of detailed monitoring and evaluation frameworks. These guidances should be developed for different types of BwN solutions (coastal, fluvial and urban), with performance indicators that:

a. *cover a wide range of co-benefits;*
b. *include trade-offs and risks associated with certain indicators;*
c. *are based on a baseline and target performance;*
d. *support flexibility and adaptation in case the performance is not anymore reaching the desired level;*
e. *are focused on the long-term and the whole-life costs and benefits.*

2. *Local understanding: the local context and its stakeholders are often not fully understood*

The local context and stakeholders are often more important for BwN solutions than for grey solutions, as BwN solutions generally require more physical space, more local knowledge and therefore a higher number of stakeholders to engage with. Moreover, BwN solutions often touch upon multiple disciplines other than flood risk management (.e.g. nature conservation, health, agriculture) with a diverse group of stakeholders and therefore highly varying interests. The interdisciplinary nature of BwN is therefore not only a strength, but also a challenge during the planning and implementation process. Therefore, the successful implementation of BwN is hard when the local stakeholders are not aligned from the initial phase onwards. From literature it becomes clear that an important knowledge gap is a clear guidance for the involvement and alignment of stakeholders in all phases of the project, from initiation to the maintenance phase[10].

The scope of future research

Future projects should use the high amount and high variety of different stakeholders as an asset. Therefore, future research should:

- *Develop new guidelines for stakeholder engagement and alignment in all phases of BwN projects;*
- *Collect and analyze all local knowledge already available from stakeholders, including local citizens, and use it in the project;*
- *Develop a community-centered approach, where citizens are involved actively until the maintenance stage (in so-called community-based maintenance).*

3. The bankable business case: benefit streams need to be understood and funding arrangements optimized

In contrast to grey solutions, BwN solutions generally provide a large amount of benefits that are spread to a variety of disciplines. Therefore, a clear framework and improved tools to value wide-ranging tangible and intangible benefits should become available. This project recommendation is also given by scientific literature[10]. Many tools and frameworks are currently available to assess the economic value of natural capital (e.g. BeST (Benefits of SuDS Tool), TEEB (2010) and the System of Environmental Economic Accounting (SEEA)). These tools and frameworks should be used in every BwN project to make sure that the benefit streams are valued, and monetized whenever possible. This will strengthen the position of BwN solutions compared to grey solutions in the cost-benefit analysis. Also in literature, limited research is available that compares grey and green solutions using a holistic cost-benefit evaluation[9].

These holistic cost-benefit evaluations are crucial to strengthen the business case for BwN solutions compared to grey solutions, as funding can be sought at a wide range of beneficiaries. However, funding arrangements still often come only from one single discipline. It is still unclear how to take these co-benefits optimally into account in the business case, especially if they seem far-fetched and only play a role in the long-term (e.g. well-being of future generations[12]). This 'financial silo' hampers the development of a bankable business case, because the projects are paid by one discipline, governmental department or even one company, while the benefits are widely spread and only part of it will be available for the funder. An important reason for this problem is the following: '*those with technical knowledge of nature-based solutions (NBS) often do not themselves have the knowledge about available financing and the requirements to access it, and vice versa, finance specialists often do not recognize or appreciate NBS*' [13]. It is clear that improved connections between these two groups will foster the implementation of BwN in Europe.

The scope of future research

Future projects should develop new tools, or use existing tools, to compare green, grey and hybrid options to reduce flood risk. These tools should assess the costs and benefits in a holistic manner, including an assessment of the full range of co-benefits of BwN solutions, and the environmental and social damage of grey solutions. A future project can develop these tools and use them to compare the costs and benefits of already existing grey infrastructures with predicted costs and benefits of a green or hybrid substitution. This should result in a clear set of rules that will ensure that BwN are always considered as a substitution of, or addition to, grey solutions.

4. Governance and institutional gap: Governance and institutions need to be optimized for increasing on-the-ground actions

From the project meetings it became clear that every country has a different legal framework, and different routines during the project preparations. These legislations sometimes tend to stimulate the development of grey measures over green ones, even in nature conservation areas (like Natura 2000[14]).

For example, in the first stage of the improvement of a levee which is bordering with a Natura 2000 area in the Netherlands, several options were explored: (1) a traditional approach (i.e. increase in dike height and width), (2) the use of sheet-piles and (3) a decline of the outward slope by using "soft" revetments materials that match the natural deposits at surface levels, and create a diversity of habitats with space for flora and fauna. The latter option required research on ecological effects (as an evidence base is still lacking), which will have uncertainties in its results and valuation. Permit and legal procedures are moreover more difficult for this type of measure, and take a lot of time. The project phasing, however, is strict and doesn't allow the uncertainty in the planning. Hence, this nature-based option is not considered as viable, although it could be really cost effective and is in line with the biodiversity and habitat goals of Natura 2000.

To identify these barriers, there is a need for a comparative study highlighting the different legal frameworks and working routines in the NSR countries. This study should assess what the barriers are for BwN, and if these barriers also exist for grey solutions. This will help to create evidence about the reasons why a relative prioritizing attitude exists towards the selection of grey measures, although BwN measures generally respond more adequate to societal preferences. It should result in tailor-made approaches to overcome the governance and legislative barriers for mainstreaming BwN, which especially counts for the barriers in or adjacent to, nature conservation areas like N2000.

The scope of future research

A comprehensive study should be developed to compare different legal frameworks in different countries, and how they influence mainstreaming of BwN. This should result in recommendations that create a better legal and governance framework for BwN, which should especially prioritize nature-based solutions above grey solutions in (or bordering) nature conservation areas (like Natura 2000).

Conclusion

The aim of this document is to steer future research projects on flood resilience and nature-based solutions, and to eventually accelerate the implementation and mainstreaming of Building with Nature (BwN) in Europe. As direct investments in BwN compromise currently only around 0.1 % of the total investment in water resources infrastructure and management[13], Europe can take a leading position to overcome the overwhelming dominance of grey infrastructure. While BwN projects are nowadays mostly framed as pilot studies, we hope that further mainstreaming will take BwN to the new standard for climate adaptation in Europe.

The Interreg Cluster for Cloud-to-Coast Climate Change Adaptation project (C5a) is a continuation of this project, which further explores the potential of BwN to increase flood resilience, and the interface between adaptive asset management and BwN solutions.

References

1. Dottori, F. *et al.* Increased human and economic losses from river flooding with anthropogenic warming. *Nature Climate Change* (2018). doi:10.1038/s41558-018-0257-z

2. EC- European Commission. *Towards an EU Research and Innovation policy agenda for nature-based solutions & re-naturing cities. Final report of the Horizon, 2020*. (2015).

3. World Bank. *Implementing nature-based flood protection: Principles and implementation guidance*. (2017).

4. WWF. *Natural and nature-based flood management: a green guide*. (2016).

5. Huthoff, F. ten Brinke, W., Schielen, R., Daggenvoorde, R., Wegman, C. *Evaluating Nature Based Solutions: best practices, frameworks and guidelines*. (2018).

6. ADB. *Guidelines for Preparing a Design and Monitoring Framework*. *Adb* (2019).

7. Raymond, C. M. *et al.* A framework for assessing and implementing the co-benefits of nature-based solutions in urban areas. *Environ. Sci. Policy* (2017). doi:10.1016/j.envsci.2017.07.008

8. Nesshöver, C. *et al.* The science, policy and practice of nature-based solutions: An interdisciplinary perspective. *Science of the Total Environment* (2017). doi:10.1016/j.scitotenv.2016.11.106

9. Debele, S. E. *et al.* Nature-based solutions for hydro-meteorological hazards: Revised concepts, classification schemes and databases. *Environmental Research* (2019). doi:10.1016/j.envres.2019.108799

10. Ruangpan, L. *et al.* Nature-Based Solutions for hydro-meteorological risk reduction: A state-of-the-art review of the research area. *Nat. Hazards Earth Syst. Sci. Discuss.* (2019). doi:10.5194/nhess-2019-128

11. TEEB. Teeb - The Economics of Ecosystem and Biodiversity for local and regional policy makers. *Report* (2010).

12. Future Generations Commissioner for Wales. Well-being of Future Generations (Wales) Act 2015. Available at: https://futuregenerations.wales/about-us/future-generations-act/.

13. United Nations. *The United Nations World Water Development Report 2018: Nature-Based Solutions for Water*. *UN Water Report 2018* (2018). doi:https://unesdoc.unesco.org/ark:/48223/pf0000261424

14. European Commission. Natura 2000. (2019). Available at: https://ec.europa.eu/environment/nature/natura2000/index_en.htm.