Creating blue-green networks

In a nutshell

SUMMARY
It is best practice to develop blue-green networks, recreating a nature-oriented water cycle and contributing to the amenity of the city, by bringing water management and green infrastructure together. Blue-green networks can combine and protect the hydrological and ecological values of the urban landscape while providing resilient and adaptive measures to deal with flooding events.
Target group
Public administrations responsible for the management of green urban areas.
Applicability
This best practice is applicable to all local authorities.
Environmental performance indicators
• Percentage of green and blue urban areas in the urban area out of the total urban area (%)
Benchmarks of excellence
N/A

Description

Green infrastructure has been defined as a "*network of natural and semi-natural areas with other environmental features designed and managed to deliver a wide range of ecosystem services*" (Baró et al., 2015). "*It incorporates green spaces and/or blue if and when aquatic ecosystems are concerned and other physical features in terrestrial (including coastal) and marine areas"* (EC, 2013). For instance, in urban areas, green infrastructure elements may consist of parks, urban forests, allotments, street trees, green roofs, etc. (Landscape Institute, 2009; Baró et al., 2015).

The development of blue-green networks is an important and efficient way to improve the quality of the cities as well as mitigating the effects of the climate change impact and the food and energy shortages (Vandermeulen et al., 2011; Urban green-blue grids, 2015).

Local public authorities can create blue-green networks in their territory with the aim of re-creating a naturally-oriented water cycle while contributing to the amenity of the city by bringing water management and green infrastructure together. This is achieved by combining and protecting the hydrological and ecological values of the urban landscape while providing resilient and adaptive measures to deal with flood events.

In particular, the blue-green networks recognise the vital role played by water and green spaces in the urban environment in terms of quality of life, health, biodiversity conservation and economic development. The blue-green networks generally refer to an urban space development concept defining a network of existing and/or restored rivers and their valleys (blue areas), and green areas (agricultural areas, parks, old orchards, wastelands, degraded areas and others) as a basis for spatial planning of cities, which will provide sustainable development and adaptation to global climate change.

There is a series of measures that result in the construction of efficient blue-green networks within cities. For instance, the creation of buffer zones around the green areas and rivers, allowing for more intensive urban functions, can contribute to the protection and maintenance of the ecological processes within the network (University of ?ód? & City of ?ód? Office, 2011). In fact, buffer zones are effective means of minimising the conflicts between potentially incompatible land uses and do ensure a minimal separation. They may vary considerably leading to significant differences in the physical, cultural socio-economic aspects and in plant cover and soil use. In order to choose the most suitable buffer zone, the local conditions have to be taken into account. Some examples of buffer zones with at times fundamentally different characteristics include industrial/residential buffers, sensitive habitat buffers, riparian buffer and public facility buffers (Placer County California General Plan, 1994).

But also blue-green networks can take a variety of shapes and sizes, and can either be set up by regenerating and connecting remaining natural spaces in a city or by implementing protections to ensure natural spaces are preserved. The idea of a network is vital, as it recognises the importance of corridors for the enhancement of biodiversity, and can also be linked to other urban networks such as the transport network, by linking these natural spaces with cycling and walking paths.

Furthermore another measure that can be applied under the blue-green network is the creation of areas where storm-water management is undertaken (blue measures are mentioned here). In particular, eco-hydrological measures and/or ecosystem biotechnologies can be applied such as application of bio-filtering systems, constructed wetlands, river rehabilitation, building reservoirs with increased capacity due to phyto-technology applications (the use of plants to address technological challenges), and other relevant measures. In particular, increased retention of purified storm-water in the city landscape will result in lower runoffs during storm-water events, lowering the costs of investments in storm-water infrastructure, reducing economic losses after flooding, and thus improving functioning of the waste water treatment plant and the rivers quality around cities (University of ?ód? & City of ?ód? Office, 2011). Other green measures can be the establishment of alternatives for individual and public transportation by providing space for bike routes, pedestrians and trams, the improvement of the air quality in the city to contribute to a healthier environment and eventually to reduce the number of cases of illnesses (University of ?ód? & City of ?ód? Office, 2011).

The combination of green and blue measures (i.e. measures like filtration and buffering) is illustrated in Figure 1 where the presence of biotopes that are connected to each other is essential for exchange and dynamism (Ministerium für Klimaschutz NRW, 2011).

http://www.urbangreenbluegrids.com/uploads/Schema_lobbenstad-naar-Tjallingii-1996-484x630.jpg

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Figure 1: Combination of green and blue measures within a city (Ministerium für Klimaschutz NRW, 2011)

Environmental benefits

The creation of Blue-Green networks brings a number of environmental benefits which are closely linked to ecosystem services. For example, the green spaces absorb rainfall and therefore decrease the risk of flooding, absorb CO_2 and therefore mitigate climate change, filter particulates and therefore improve air quality, and provide habitat for flora and fauna, among other advantages.

Side effects

There are no reported cross media effects from the implementation of this BEMP.

Applicability

Since Blue-Green networks can range from small-scale endeavours to all-encompassing city plans, they are replicable in most settings. The example of Lodz shows the case of a city starting from a challenging baseline situation; cities with fewer modifications to natural habitats may find it easier to implement.

As shown in the case of Lodz, cities do not exist independently from their surroundings, for instance both green spaces and water bodies are connected with areas that are often beyond the political boundaries of a city. Blue-Green networks will often need to take this into consideration and coordinate with the political entities managing their contiguous territories or the landscapes which they have an interest in preserving. Many cities for example make an effort to protect the catchments that supply their drinking water so in order to improve water quality and reduce the costs associated with treatment.

Figure 3: Lodz's Blue-Green network (University of Lodz & City of Lodz Office, 2011)

Economics

Costs will vary according to the level of complexity and the chosen elements, type of facilities, intensity of usage etc. Some of the returns associated with the implementation of this best practice will be perceived by the local authority, for example in terms of reduced storm-water management costs or reduced costs associated with flooding damage to public infrastructure. However, other returns will either accrue to others, for example when citizens benefit from recreational opportunities, or will not be immediately quantifiable, for example in the case of health care expenditure reductions. However, there have been tremendous efforts to place monetary value on green infrastructure, in order to allow for a clear visualisation of costs and benefits. This in turn may help stimulate investment, since it allows decision makers to evaluate economic returns at the regional and community scale. Figure 4 offers a highly simplified method of calculating the economic benefit of investments in green or blue infrastructure. The economic benefits to individuals and society, government and business that can be derived from a huge variety of benefits having an economic value are added up. Then in a second step the costs related to the intervention such as development and capital costs as well as management and maintenance costs are subtracted from the economic benefits. By doing so, the net economic benefit or cost can be obtained. Since this calculation remains rather theoretical, a case study from the St. Helens in the UK will visualize how this calculation can be done in practice.

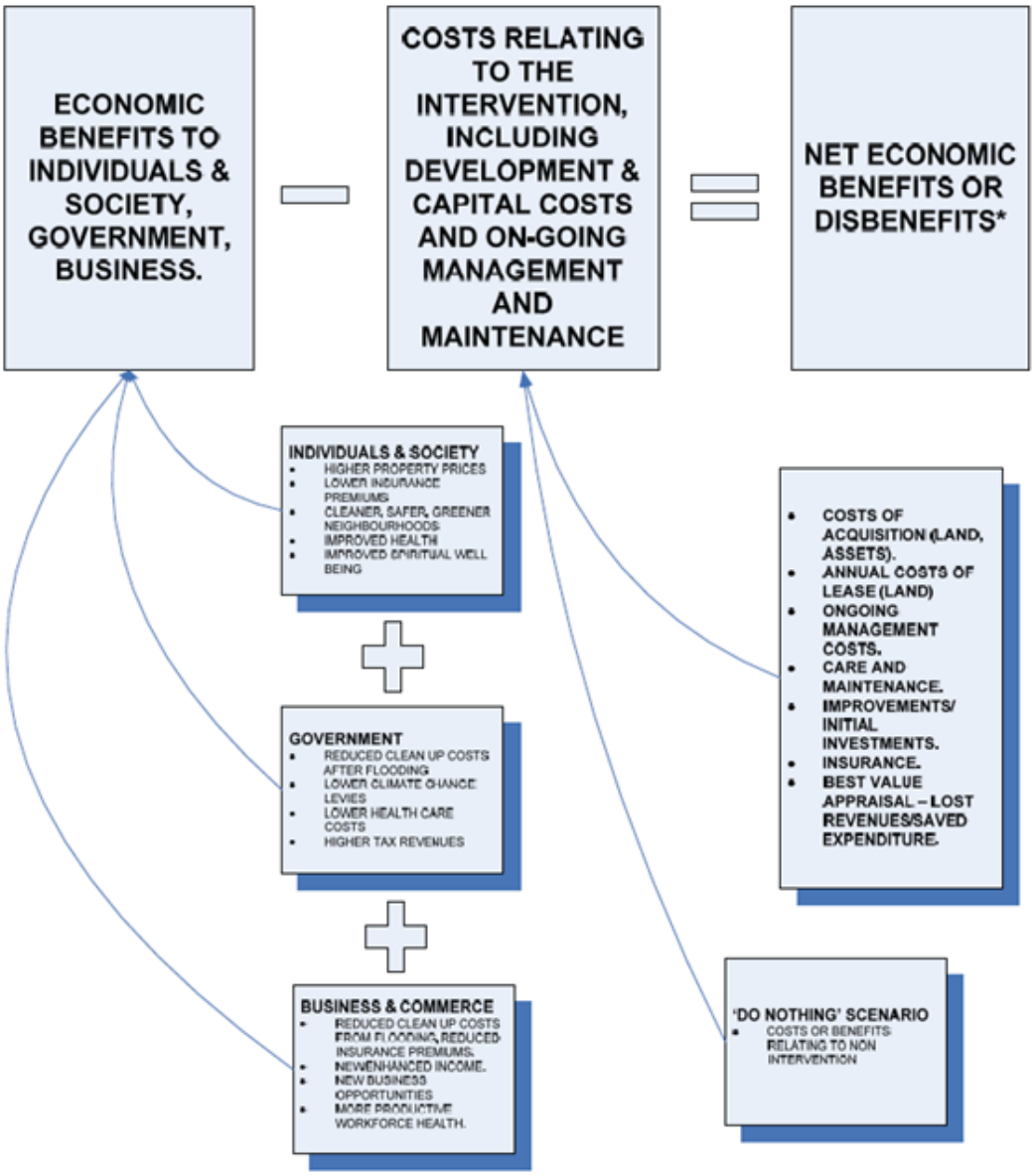

Figure 4: Estimating economic value from green infrastructure investment (Urban Open Space Foundation 2003/ECOTEC, 2008)

A representative example of construction and maintenance costs of greens is the city of Berlin. The average construction of greens ranges from 5 €/m^2 for greens located close to the city periphery (estimated an average quality without particular infrastructure) to 201 €/m^2 for greens located near the city centre (with high quality and cost-intensive infrastructure). Regarding maintenance costs of greens, an average ranges from 2 €/m^2 annually for greens with no particular infrastructure to 7 €/m^2 annually for greens with cost-intensive infrastructure. It should be noted that an average life span of green is considered as 15 years (Krekel et al., 2015).

Driving forces for implementation

In addition to environmental benefits, Blue-Green networks provide a number of non-environmental advantages which include: improving human health by bettering air and water quality as well as providing opportunities to exercise; providing opportunities for low-carbon transportation if they incorporate cycling and walking paths; and creating more aesthetically pleasing cities which attract tourists, new residents and businesses.

Reference organisations

The French Green and Blue Infrastructure: http://www.developpement-durable.gouv.fr/-La-Trame-verte-et-bleue,1034-.html

The urban green blue grids is a network, which provides all the required information for establishing or creating blue-green networks within cities: http://www.urbangreenbluegrids.com/measures/connection-of-biotopes-to-the-outlying-areas-and-green-blue-networks/

Literature

Baró F., Haase D., Gómez-Baggethun E., Frantzeskaki N. (2015), Mismatches between ecosystem services supply and demand in urban areas: A quantitative assessment in five European cities, Ecological Indicators, 55, 146–158.

City of Oslo (2011), Sustainable city: Oslo, Norway, available at: http://www.ewu.edu/Documents/CBPA/NWTTAP/2011_Symposium/Presentations/MWU_Oslo_Sustainable_DickWinchell.pdf , last accessed June 2015.

EC - European Commission (2013), Green Infrastructure (GI) - Enhancing Europe's Natural Capital, COM (2013) 249, Brussels.

ECOTEC (2008), The economic benefits of Green Infrastructure: The public and business case for investing in Green Infrastructure and a review of the underpinning evidence, Commissioned from ECOTEC by The Mersey Forest on behalf of Natural Economy Northwest The Mersey Forest on behalf of Natural Economy Northwest, available at: http://www.forestry.gov.uk/pdf/nweeconomicbenefitsofgideveloping.pdf/$FILE/nweeconomicbenefitsofgideveloping.pdf, last accessed June 2015.

European Green Capital Award Nantes (2010), Green urban areas, chap 03, available at: http://ec.europa.eu/environment/europeangreencapital/wp-content/uploads/2011/05/EGCNantesUKChap3-F.pdf, last accessed June 2015.

Krekel C., Kolbe J., Wustermann H. (2015), The greener, the happier? The effects of urban green and abandoned areas on residential well-being, German Socio-Economic Panel Study (SOEP), ISSN: 1864-6689

Landscape Institute (2009), Green Infrastructure: Connected and Multi-functional Landscapes — Position Document, available at: http://www.landscapeinstitute.org/PDF/Contribute/GreenInfrastructurepositionstatement13May09.pdf, last accessed May 2015.

Loftus A.C. (2011), Lodz, Poland – River restoration as a catalyst for sustainable urban development. In ICLEI European Secretariat (2011), *SWITCH Training Kit – Integrated Urban Water Management in the City of the Future,* Freiburg, Germany: ICLEI European Secretariat, available at:

www.switchtraining.eu/fileadmin/template/projects/switch_training/files/Case_studies/Case_study_Lodz_preview.pdf, last accessed May 2015.

Ministerium für Klimaschutz NRW (2011), Klimawandel in Nordrhein-Westfalen; Handbuch Stadtklima - Maßnahmen und Handlungskonzepte für Städte und Ballungsräume zur Anpassung an den Klimawandel, Erftstadt.

University of ?ód? & City of ?ód? Office (2011), *Implementation of the blue-green network concept,* SWITCH project, available at: http://www.switchurbanwater.eu/outputs/pdfs/W5-3_CLOD_DEM_D5.3.13_Final_Demo_Report_ANNEX_4_Blue-green_network.pdf, last accessed May 2015.

Urban green-blue grids (2015), Introduction to green-blue urban grids, available at: http://www.urbangreenbluegrids.com/about/introduction-to-green-blue-urban-grids/, last accessed May 2015.

Vandermeulen V., Verspecht A., Vermeire B., Van Huylenbroeck G., Gellynck X. (2011), The use of economic valuation to create public support for green infrastructure investments in urban areas, landscape and urban planning, 103(2), 198-206.