METHOD FACTSHEET

Blue-green factor scoring

Introduction

Green space factors and points systems have been used in several European cities as a policy instrument to attain desired levels of green and blue surfaces in new property developments (Farrugia et al., 2013; Fongar, 2015; Kruuse, 2011; Szulczewskaa et al., 2014). Different green and blue 'elements' are scored based on their importance for a particular ES, or a bundle of services, and an area-weighted score is calculated for a proposed property development.

Keywords

Urban ES; green infrastructure; blue infrastructure; smartphone application

Why would I chose this approach?

The aim of blue-green factor (BGF) scoring is safeguarding blue-green structures and elevating the status of such structures within urban environments through awareness-raising. Green space factors are a non-economic valuation method because they score the relative importance of different green structures. They are also a policy instrument. The BGF may be used for certifying new building development in relation to achieving a minimum total score that can be differentiated for different parts of a city depending on demand for the ES in question. At the same time, property developers are given flexibility in designing how to incorporate blue-green structures into building plans. The BGF developed for Oslo municipality (OpenNESS case study 3) focuses on the urban flood control function of green and blue structures. Other green space factor scoring systems may weight structures differently based on other ES.

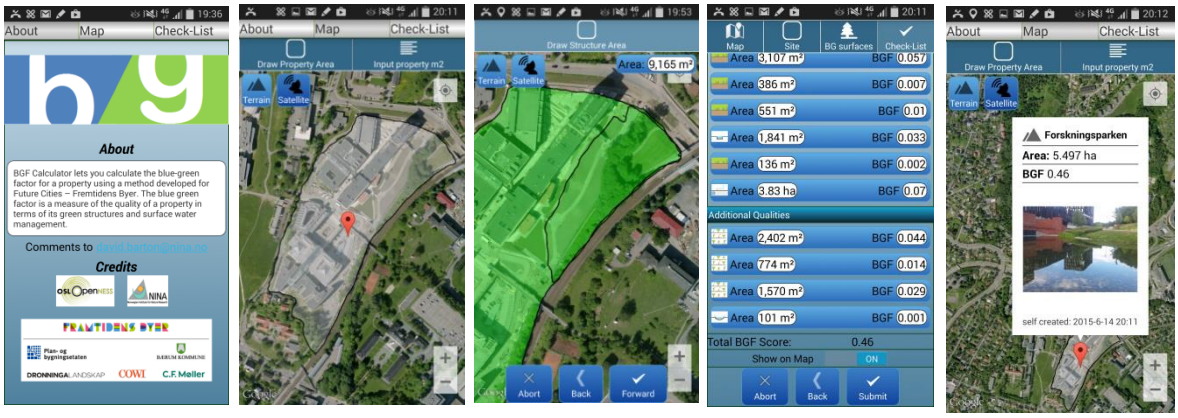

Figure 1: Selected screens from the BGF App for Android Smartphones.

A practical reason for using the approach is that there are few methods that evaluate ES supply at the spatial resolution of a property (rather than a pixel). The scoring system can be easily implemented using an Excel spreadsheet. An App for Android Smartphones has also been developed that allows a property owner to carry out a rapid assessment of the BGF at property level (Figure 1). Pixel-based extrapolation of BGF scoring to whole catchments is being tested in Oslo.

What are the main advantages of the approach?

- Ease of use (Excel spreadsheet, Smartphone App);
- Speed of use;
- Draws on existing data;
- Participatory approach – can be applied by stakeholders themselves;
- Spatially-explicit;
- Expert knowledge not required for its use.

What are the constraints/limitations of the approach?

- Property-specific weighting;
- Weighting not adjusted for spatial context, such as catchment location, hydrological characteristics of neighbouring properties;
- BGF structures and weights have been selected and developed by an expert panel to specifically address urban flood control, with some additional weight being given to importance of biodiversity habitat. Weights should not be applied to other ES.

What types of value can the approach help me understand?

The tool can help identify socio-cultural values held by citizens as well as provide information on regulating ES provision as biophysical value.

How does the approach address uncertainty?

The approach does not explicitly address uncertainty.

How do I apply the approach?

Through the Cities of the Future program, Oslo Municipality Planning and Building Agency, Bærum Municipality, Dronninga Landskap AS, Cowi AS, and C. F. Møller collaborated in developing a 'blue-green factor' (BGF) scoring system to guide new urban development towards the overall goals of the Green Plan for Oslo (FramtidensByer, 2014). BGF was inspired by the Biotopflächenfaktor (Berlin), Grönytefaktor (Malmö) and Green area factor (Stockholm). The BGF proposal has been developed and tested on a number of case studies. However, the final proposal has so far not been incorporated into municipal building codes or regulation.

The BGF scores the 'importance' of each structure based on performance criteria mainly in relation to water infiltration and storage capacity. Scores are given for different kinds of blue-green surfaces in relation to their hydrological regulating effect. Additional points are then given for water and vegetation

features that enhance run-off control in conjunction with aesthetic qualities and biodiversity habitat (Figure 2).

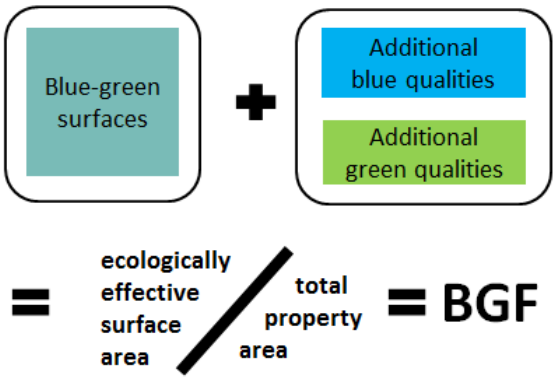

Figure 2: Blue-green factor calculation. Source: translated from Framtidens Byer (2014).

Each structure score is divided by the total plot area resulting in normalised BGF scores for each structure. The total score is calculated through either adding all individual BGF scores or dividing the total value scores by the total plot area. The sum of scores is divided by the total property area, so that each property has a normalised BGF score/m2 which can be compared across properties (Figure 3). Scoring of each structure is based on the judgement of technical experts in architecture, urban planning, hydraulics and hydrology. Judgements were tested and adjusted through a number of case studies in Oslo (Framtidens Byer, 2014):

- **Blue-green surfaces**
  - Open permanent water surfaces are relatively more important than potentially permeable or impermeable surfaces with regard to their run-off storage capacity.
  - Vegetation surfaces with direct drainage to soil or bedrock are more important than surfaces with no drainage with regard to their infiltration potential. The deeper the soil for non-connected surfaces the higher the water storage capacity. Non-connective surfaces refer to soils and vegetation placed above built structures, such as sub-terrain parking or green roofs.

- **Blue additional qualities**
  - Natural edges and rain beds slow water flow rates, and increase water basin holding capacity, in addition to providing aesthetic and habitat qualities to water surfaces.
- **Green additional qualities**
  - **Trees** are scored individually relative to size and growth potential, determining their importance for rainfall interception and evapotranspiration, and for their functions as habitat and for aesthetics. Trees may constitute a large share of the total BGF score for a property.
  - **Native vegetation, perennials and other ground cover** provide additional scores for their importance for biodiversity habitat and aesthetics.
  - **Hedges, bushes and green walls,** give additional scores for both their hydrological properties and their aesthetic value.
  - **Contiguous green areas and connection** give additional score for their importance as recreation areas and connectivity with other urban green infrastructure structure.

Value	Symbol	Factor
		Plot Area (including the built area) Fill out the area
		1.BLUE-GREEN SURFACES
1		Open permanent water surface that can receive rainwater
0.3		Partially permeable surface like gravel, crushed stone, and reinforced grass surface
0.2		Impermeable surfaces with drainage to vegetated areas or an open drainage magazine
0.1		Impermeable surfaces with drainage to a local closed storm water drainage
1		Surfaces with vegetation associated with soil or bedrock
0.8		Surfaces with vegetation, not associated with soil > 80 cm
0.6		Surfaces with vegetation, not associated with soil 40 – 80 cm
0.4		Surfaces with vegetation, not associated with soil 20 – 40 cm
0.2		Surfaces with vegetation, not associated with soil 5 –20 cm

		2. Additional qualities = Blue and Green additional qualities that give extra points. The same area can therefore be counted a number of times below
		Blue additional qualities
0.3		Natural edges to water srufaces
0.3		Rain bed or equivalent
		Green additional qualities, Points below (trees) should be filled in as a number
1		Existing large trees > 10 m
0.8		Existing trees that can be expected to grow to over > 10 m
0.6		Existing trees that can be expected to grow to be small to medium, 5 – 10 m
0.7		Newly planted trees that are expected to be > 10 m
0.5		Newly planted trees that are expected to be 5 – 10 m
		Points below should be filled in as m2
0.6		Native vegetaion
0.4		Hedges, bushes and multi-stemmed trees
0.4		Green walls
0.3		Perinnials and other ground cover
0.1		Contiguous green areas over 75 m2
		Points below are filled in with the number 0,05
0.05		Connection to existing blue-green structures.
		TOTAL BLUEGREEN FACTOR (BGF)

Figure 3: Blue-green factor scores. Source: translated from Framtidens Byer (2014).

The assessment approach recognises that ES of green infrastructure are 'bundled', and difficult to disentangle. The BGF therefore has a deliberate focus on regulating hydrological services in order to be simple to implement. For this reason structures providing biodiversity habitat, aesthetics and recreation are seen as 'additional' ES. Their relative importance in the overall BGF score is also smaller than for the hydrological regulating services.

The BGF focus on simplicity means that each structure is scored the same no matter where the assessment takes place. The assumption is that the marginal value of each structure in terms of surface area or number of individual trees is the same whether upstream or downstream in an urban catchment. BGF scoring also does not presently differentiate between developed (landscaped) and natural properties with high density of trees.

Requirements

Data	☐ Data is available ☑ Need to collect some new data ☐ Need to collect lots of new data	Area calculations for blue and green structures can be calculated using the BGF App.
Type of data	☑ Qualitative ☑ Quantitative	Weighting (predetermined scores) Surface areas and counts
Expertise and production of knowledge	☑ Work with researchers within your own field ☐ Work with researchers from other fields ☐ Work with non-academic stakeholders	
Software	☑ Freely available ☐ Software licence required ☐ Advanced software knowledge required	Excel spreadsheet (upon request) Android Smartphone App (upon request)
Time resources	☑ Short-term (< 1 year) ☐ Medium-term (1-2 years) ☐ Long-term (more than 2 years)	Smartphone-based assessment of a single property can be carried out in about 1 hour.
Economic resources	☑ < 6 person-months ☐ 6-12 person-months ☐ > 12 person-months	
Other requirements		

Where do I go for more information?

Guidance document in Norwegian can be downloaded here: http://www.miljodirektoratet.no/Global/klimatilpasning/Bl%C3%A5gr%C3%B8nn%20faktor/BGF%20Veileder%20byggesak%20Hoveddelen%202014.01.28.pdf

An extensive explanation can be found in Fongar (2015) (to be made available at the OSLOpenNESS case website http://www.openness-project.eu/node/78)

Fongar, C., 2015. Identification of bluegreen structures and percieved values in public urban green spaces: a comparative case study of a natural and a constructed green space in Oslo, Master of Science in Natural Resources Management. Specialization Geography. Norwegian University of Science and Technology, Faculty of Natural Science and Technology, Department of Geography, p. 127.

Kruuse, A., 2011. The green space factor and the green points system. GRaBS Expert Paper 6 (Green and Blue Space Adaptation for Urban Areas and Eco Towns).

Szulczewskaa, B., Giedycha, R., Borowskib, J., Kuchcikc, M., Sikorskib, S., Mazurkiewiczd, A., Sta´nczykea, T., 2014. How much green is needed for a vital neighbourhood? In search forempirical evidence. Land Use Policy 38, 330– 345.

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