BIOTOPE AREA FACTOR

The Biotope Area Factor (BAF) is a tool used to measure the absorbent properties of a surface. To calculate this indicator, one need only determine the relationship between the ecologically effective surface area and the total surface area of a lot. Over the last three decades, this factor has been incorporated into the urban planning practices of several cities so that under-used spaces such as walls and roofs can be better integrated into greening policies. The BAF is particularly valued because it offers a flexible approach to reconciling densification and greening policies. Given the problem of heat islands, which affect the health of the most vulnerable, this innovative measure provides a way to improve air quality and increase access to cooler spaces in the city. With regard to the built environment, it helps solve the problem of urban flooding by lowering the degree of soil sealing.

Calculation

The calculation is performed in different cities using essentially the same formula, according to research conducted by the Conseil régional de l’environnement de Montréal (CRE-Montréal):

$$\frac{\textbf{Ecologically effective surfaces} \times \textbf{Ecological value factor per m}^2 \textbf{ of surface}}{\textbf{Total surface area of lot}}$$

The example below[1] demonstrates the flexibility of the model. The developer’s initial project (left) has a 6% factor. By including a partially greened roof, absorbent paving materials and green walls, the developer is able to reach the required 30% of surface area.

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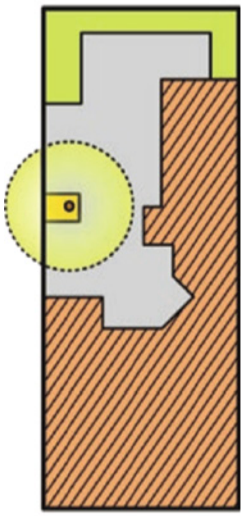


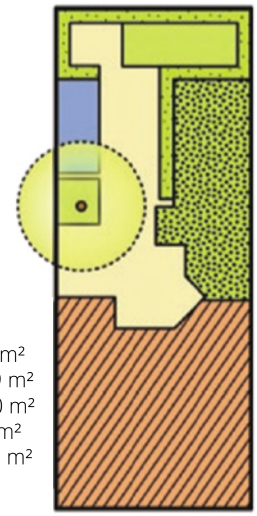
Surface area of lot = 479 m²
Floor area = 279 m²
Uncovered surface area = 200 m²
Land-to-building ratio = 0.59
Required BAF = 0.3

Asphalt	140 m² x 0.0 = 0 m²
Gravel with grass	59 m² x 0.5 = 30 m²
Open ground	1m² x 1.0 = 1 m²

BAF = $\frac{31}{479}$ = 0.06

Concrete slab (bikes)	21 m² x 0.0 = 0 m²
In-ground green space	79 m² x 1.0 = 79 m²
Paved surface	100 m² x 0.3 = 30 m²
Green walls	10 m² x 0.5 = 5 m²
Green roof	41 m² x 0.7= 29 m²

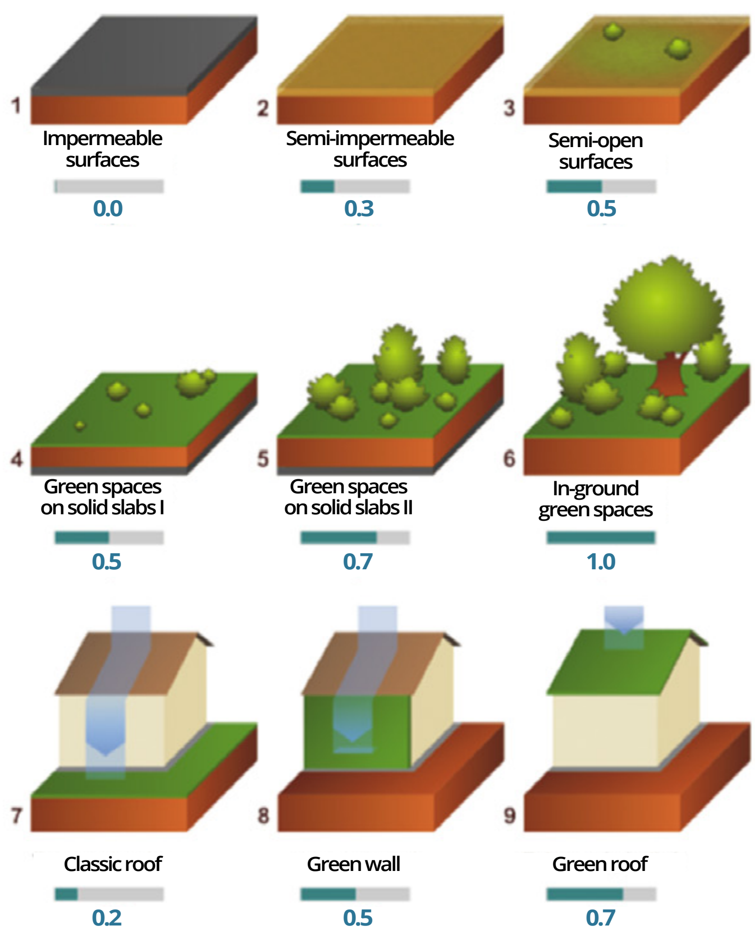
BAF = $\frac{143}{479}$ = 0.3



Implementation

Naturally, the inclusion of an absorbent surface is not given the same rating as an in-ground garden. Cities, boroughs and developers can draw on existing typologies to weight their calculation. In the example[2] below, in-ground green spaces receive the highest score (1.0), while an impermeable surface such as asphalt receives a score of zero.

Example of a scoring system



1. Surfaces impermeable to air and water, without vegetation (concrete, asphalt, cement mortar slab).
2. Surfaces permeable to air and water, without vegetation (clinker brick, mosaic paving, slabs with a sand or gravel subbase).
3. Surfaces permeable to air and water, infiltration of rainwater, with vegetation (wood-block paving, honeycomb brick with grass).
4. Green spaces on solid ground cover or underground garages with less than 80 cm of soil covering.
5. Green spaces with no connection to soil below but with more than 80 cm of soil covering.
6. Connected to soil below, available for development of flora and fauna.
7. Rainwater infiltration for replenishment of groundwater, infiltration over surfaces with existing vegetation.
8. Greenery covering walls with no windows, up to 10 m.
9. Extensive or intensive coverage of rooftop with greenery.

Origin and dissemination

Despite international dissemination, this tool is not yet widely used in Canada. The Factor emerged as such in Germany following the adoption of the nature conservation act in 1976. An initial model establishing a minimum biotope area factor for urban planning was first developed in Berlin (1994). The measure was subsequently adopted by cities such as Seattle[3], Singapore and Seoul. In Montreal, some districts, such as Rosemont – La Petite-Patrie, have integrated criteria related to greening into their urban planning regulations, without classifying the absorbency of surfaces, as with the BAF. However, the Conseil Régional de l'Environnement (CRE)[4] and the Montreal Climate Coalition (MCC)[5] are working toward the adoption of this measure[6]. **And for each context, collaborative adaptations are necessary!** From one city to another, the characteristics of the built environment and the type of development desired lead to varied criteria. For example, Berlin adopted the rate of 60% for residential areas only after extensive consultations.

Types of policies

The table below, which lists different types of policies that incorporate the biotope area factor, indicates some of the terminology used, describes types of use of the factor and provides an overview of the extent of its dissemination.

Uses	Actors	Examples
Inclusion of a minimum coefficient in an urban plan.	City	• Berlin: Biotope Area Factor—BAF (1994)[7] • Malmö: Green Area Factor —GAF (2001) • Singapore: Green plot ratio (2003) • Paris: Coefficient de biotope (2004)[8]
Creation of design guides for green roofs and green walls	• City • Company • Civic organization	• Malmö: Green roof guide (2002) • Seoul: Green spaces guide (2004) • CMHC: Green Roofs (2006)[9] • Zinco [company]: Life On Roof, Unterensingen, Germany (2018)
Measurement of the degree of green space in a zone	• State • City • Scientists • Civic organization	• Seoul (Seoul Development Institute): Biotope mapping for planning (2000)[10] • Montréal (CRE): Cartographie des biotopes urbains et périurbains (2008)

Criticism

As regards criticism, researchers point out that regulation could be enhanced by the creation of context-adapted guides allowing for higher quality and more diverse ecologically effective spaces. In this regard, cities such as Malmö in Sweden and Seoul in Korea are leading the way with guides identifying types of green roofs and assigning ratings to integrate them into the system. To guide the installation of green walls and roofs, the Montréal Urban Ecology Center has already carried out a review of best practices in the use of climbing plants[11]. This type of guide could help address other issues, such as the consideration of fauna, as well as local cultural values and economic issues[12]. By adopting their own rating system, Canadian cities could easily increase the quality of life and resilience of their community.

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