Urban Green & Blue Infrastructure : definition, concept and strategies

- Definition, types and benefits of UGBI
- Strategic assessment, planning and design of UGBI

Yves Kazemi, Monday, February 28, 2025

Concept, Definition and Type of UGBI

Definition of “Green & Blue” Infrastructure

« Green & Blue »

natural features and/or media that provide ecosystem and/or environmental services

« Infrastructure »

An interdependent set of works, equipment and/or services organized or structured in a network

An **interconnected network** of natural environments and semi-natural developments **strategically distributed** throughout the urban space to produce the **widest range of ecosystem services** to strengthen the resilience of cities

(adapted from EC 2013 p.3 and Metro Vancouver n.d. p.6)

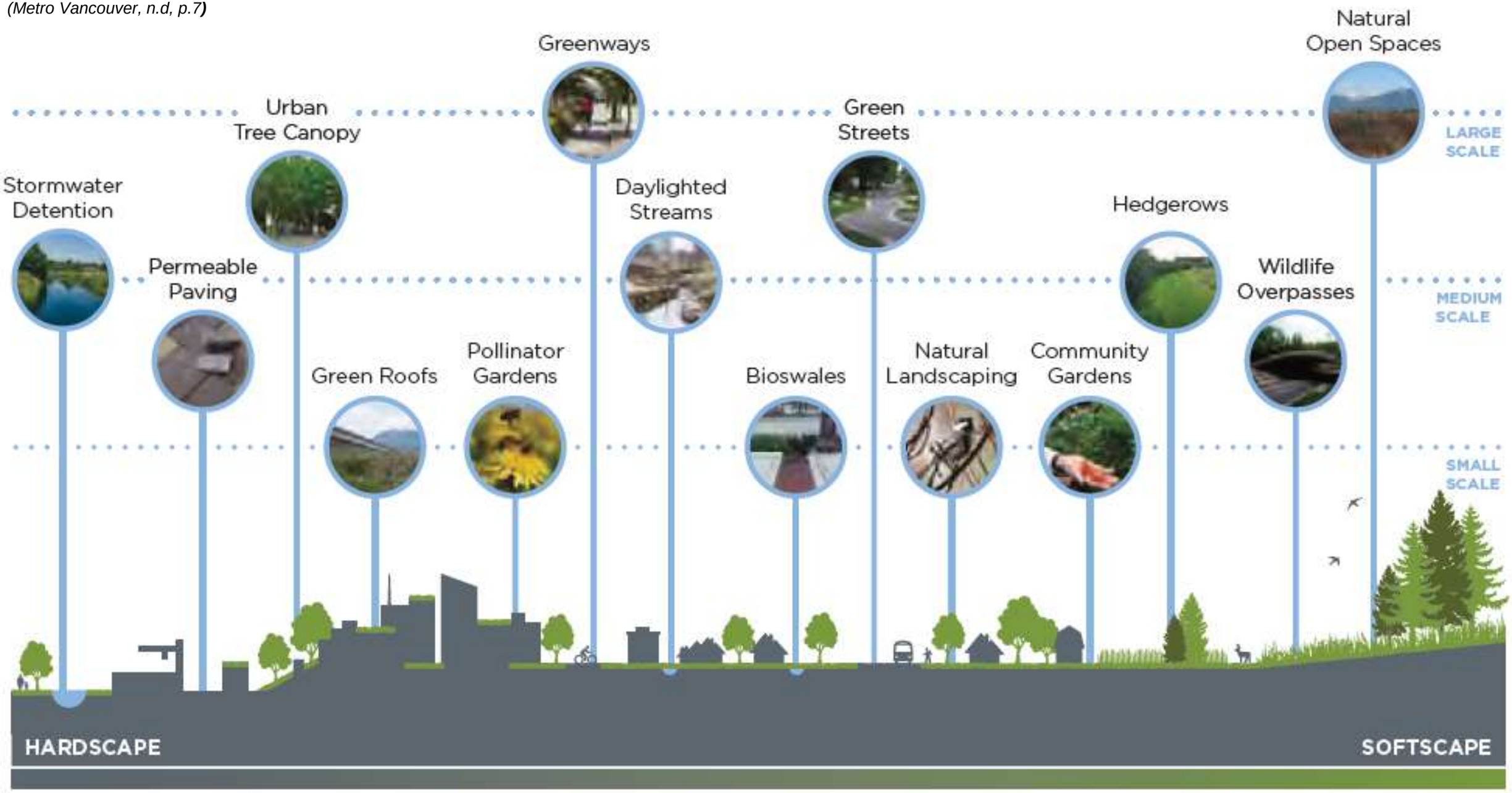
Green Infrastructure Typology

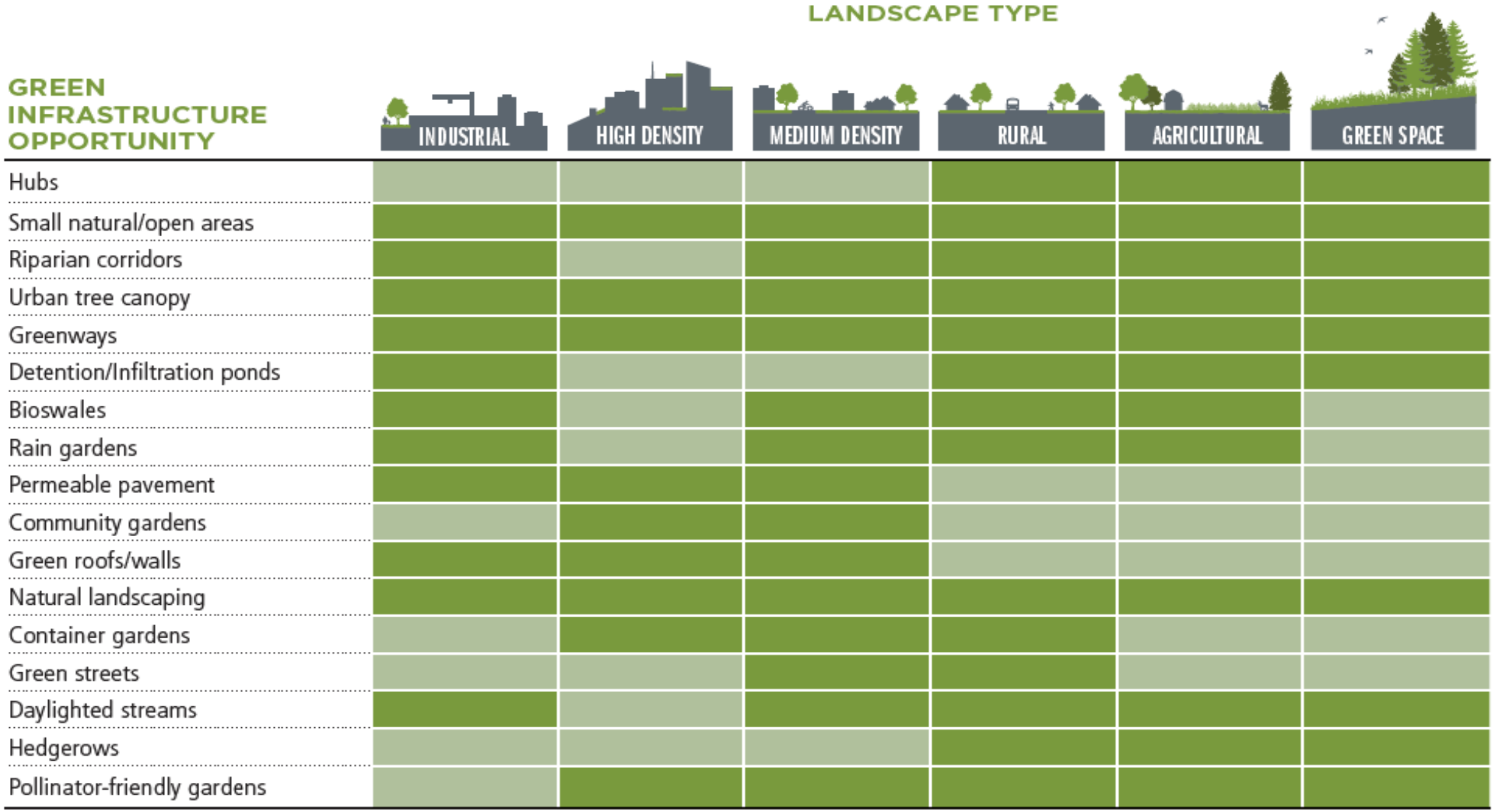
Hansen et al. 2017 (p.6)

Green space typology, made up of 44 green space types clustered in eight groups. Image credits: Rieke Hansen

Green Infrastructure Opportunities across the Urban Landscape

(Metro Vancouver, n.d, p.7)





(Metro Vancouver, n.d, p.21)

Green and Blue Infrastructure Components

Hubs: Core areas of high biodiversity value and non-protected core areas with large healthy functioning ecosystems

Corridors and stepping stones: natural features like small watercourses, ponds, hedgerows, woodland strips

Restored habitats : reconnect or enhance existing natural areas (e.g., restored reedbed)

Artificial features : such as eco-bridges, bio swales or green roofs to enhance ecosystem services

Buffer zones: improve the general ecological quality and permeability of the landscape (e.g. organic farming)

Multi-functional zones: land uses that support multiple land uses in the same spatial area (e.g. food & recreation)

Pauleit et al. (p.36) in Kabisch et al 2017

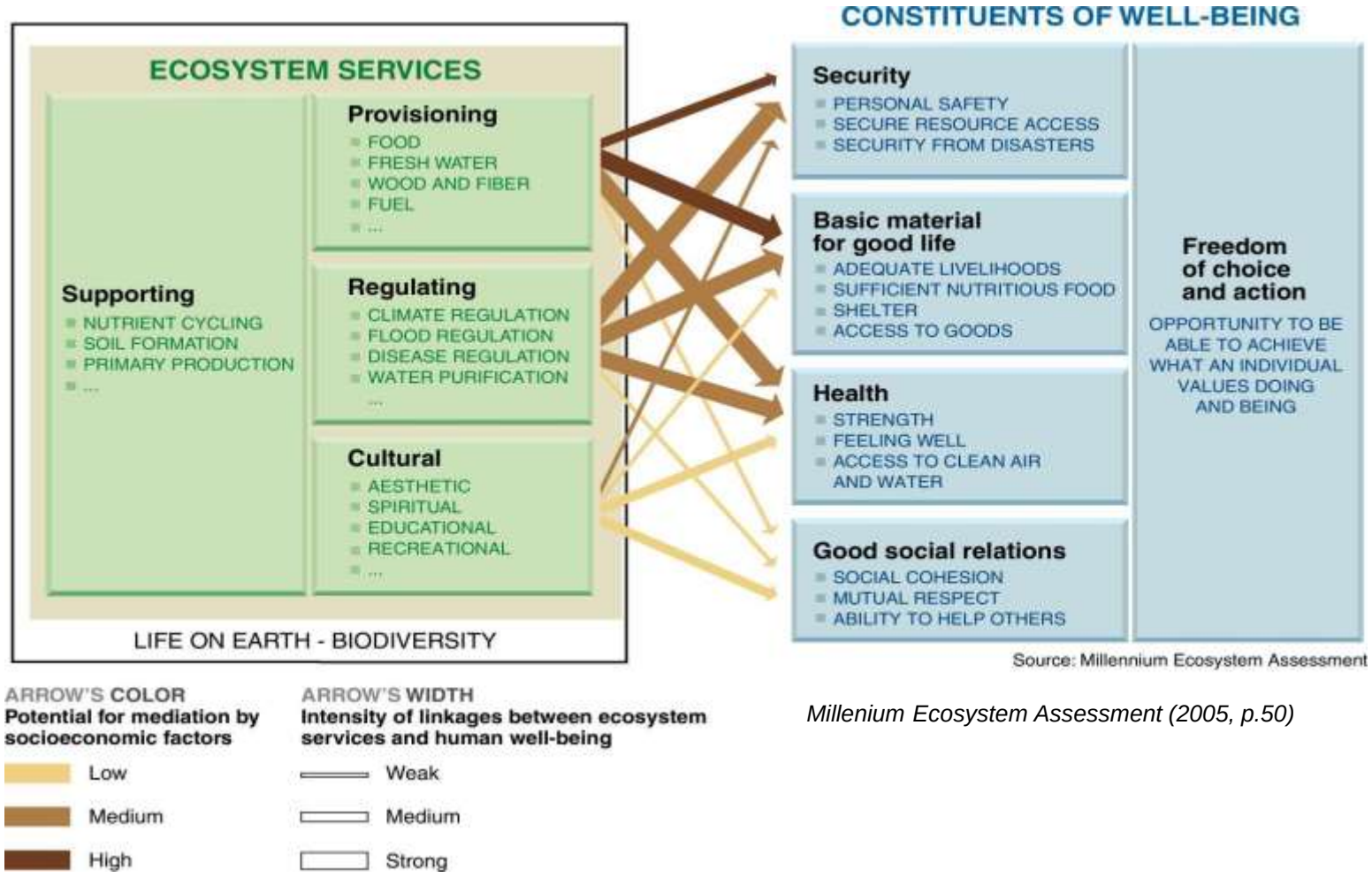
European Commission 2016

Ecosystem Services & UGBI

“Ecosystem services are the benefits people obtain from ecosystems” (MEA 2005)

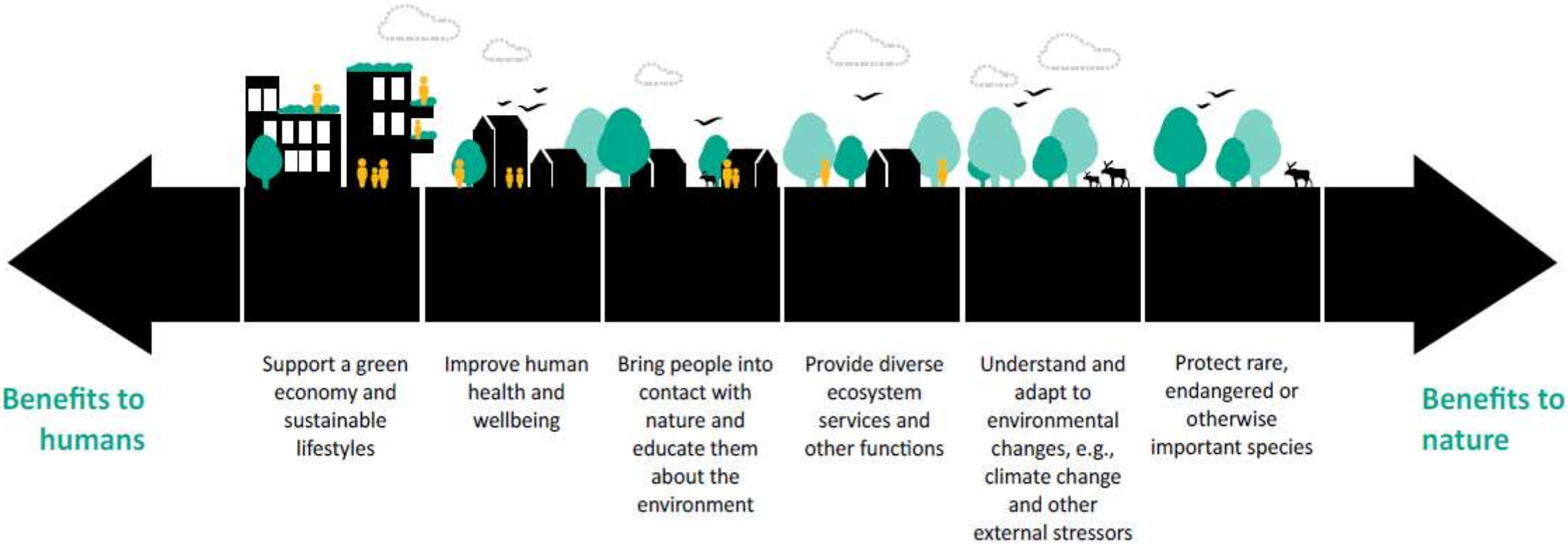
- **Provisioning Services**
  Products obtained from ecosystems
- **Regulating Services**
  Benefits obtained from the regulation of ecosystem processes
- **Cultural Services**
  Nonmaterial benefits people obtain from ecosystems through spiritual enrichment, cognitive development, reflection, recreation, and aesthetic experiences
- **Supporting Services**
  Are necessary for the production of all other ecosystem services

(MEA, 2005, p.40)



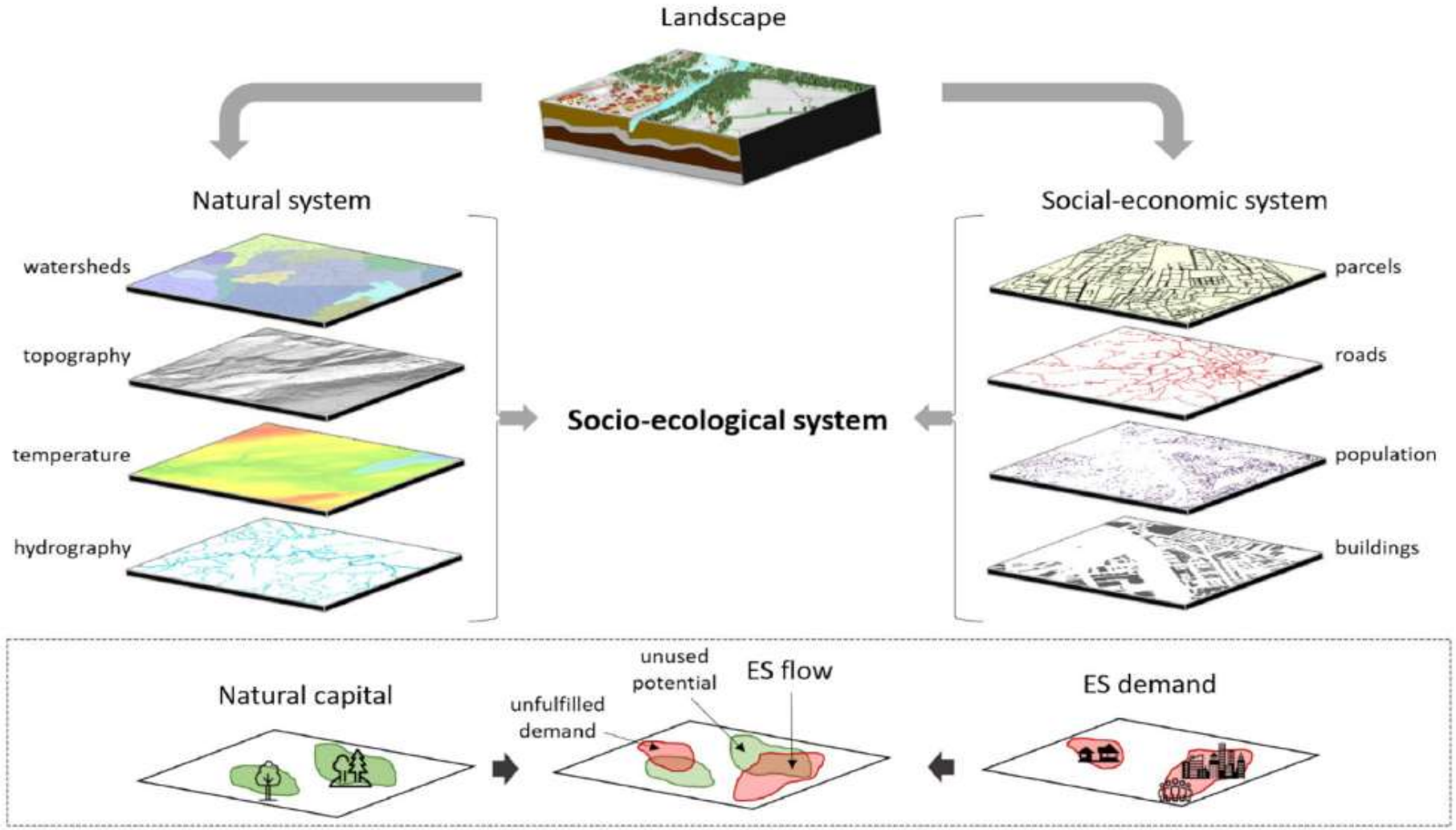
Millenium Ecosystem Assessment (2005, p.50)

Benefits of Urban Green & Blue Infrastructure to People and Nature



Hansen et al. 2017 (p.12)

ES = Interactions between Natural Systems and Socio-economic Systems

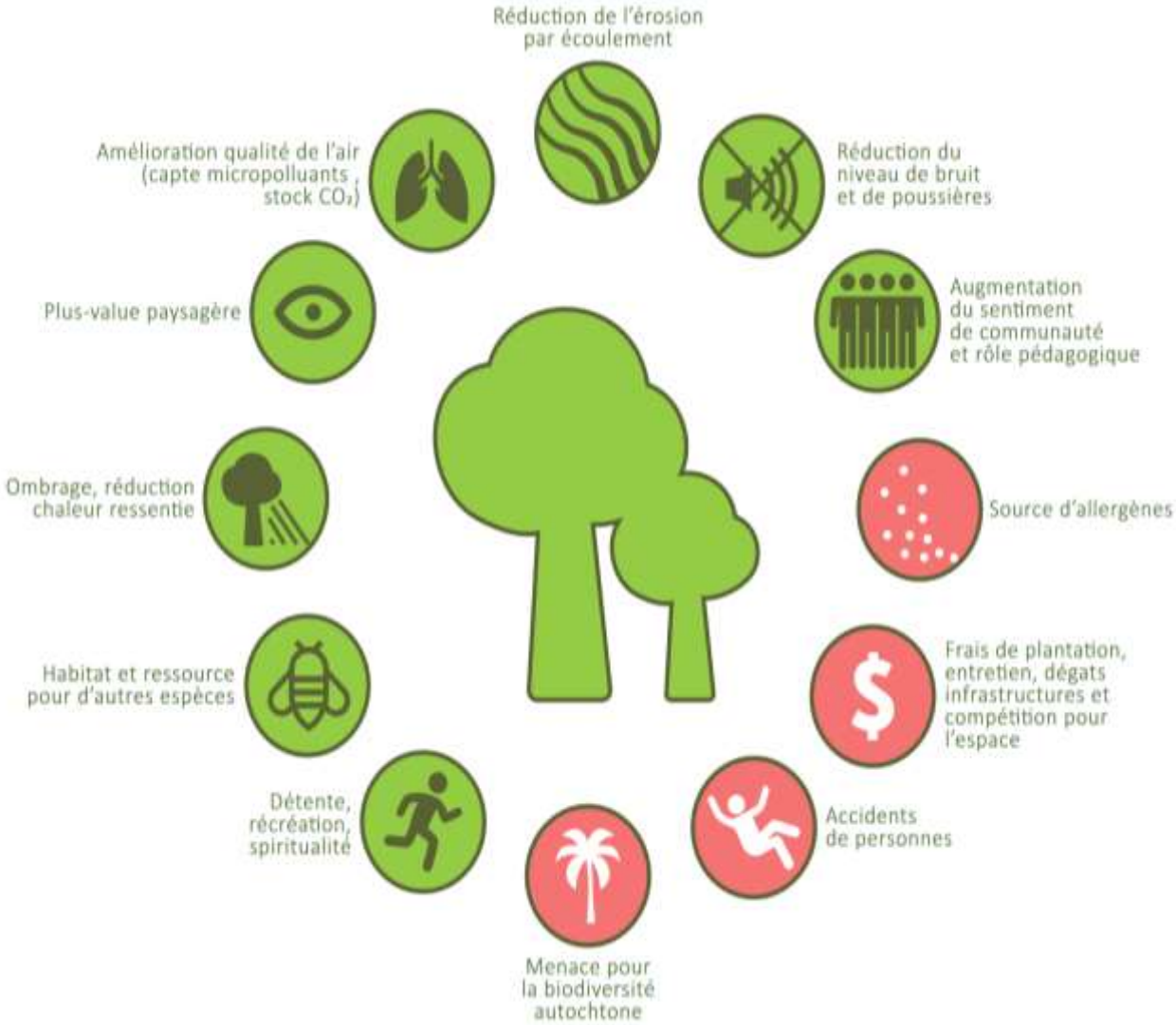


Honeck et al. 2020 (p.9)

Photo credits: Front: Jeff Marsh; Inside left (left to right): Stewardship Partners, Mark Godfrey, Doreen King; Inside right (left to right): Kelly Compton, Courtney Beeler/TNC.

Not only Services but also some Disservices (e.g. trees)

(Schlaepfer et al., 2018, p. 15)

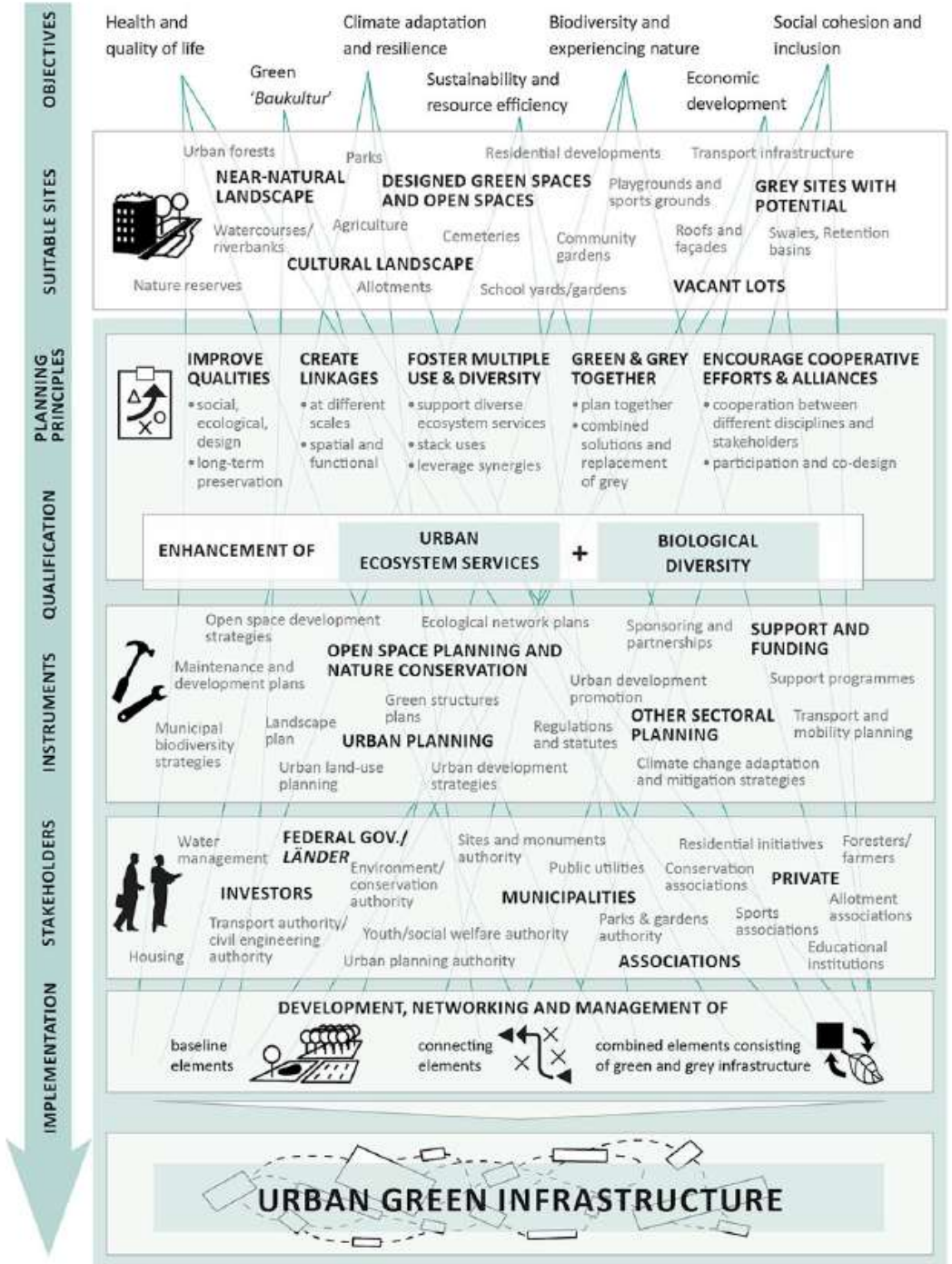


Strategic assessment and planning of UGBI

Steps Toward Urban Green infrastructure

(BfN 2017, p.6)

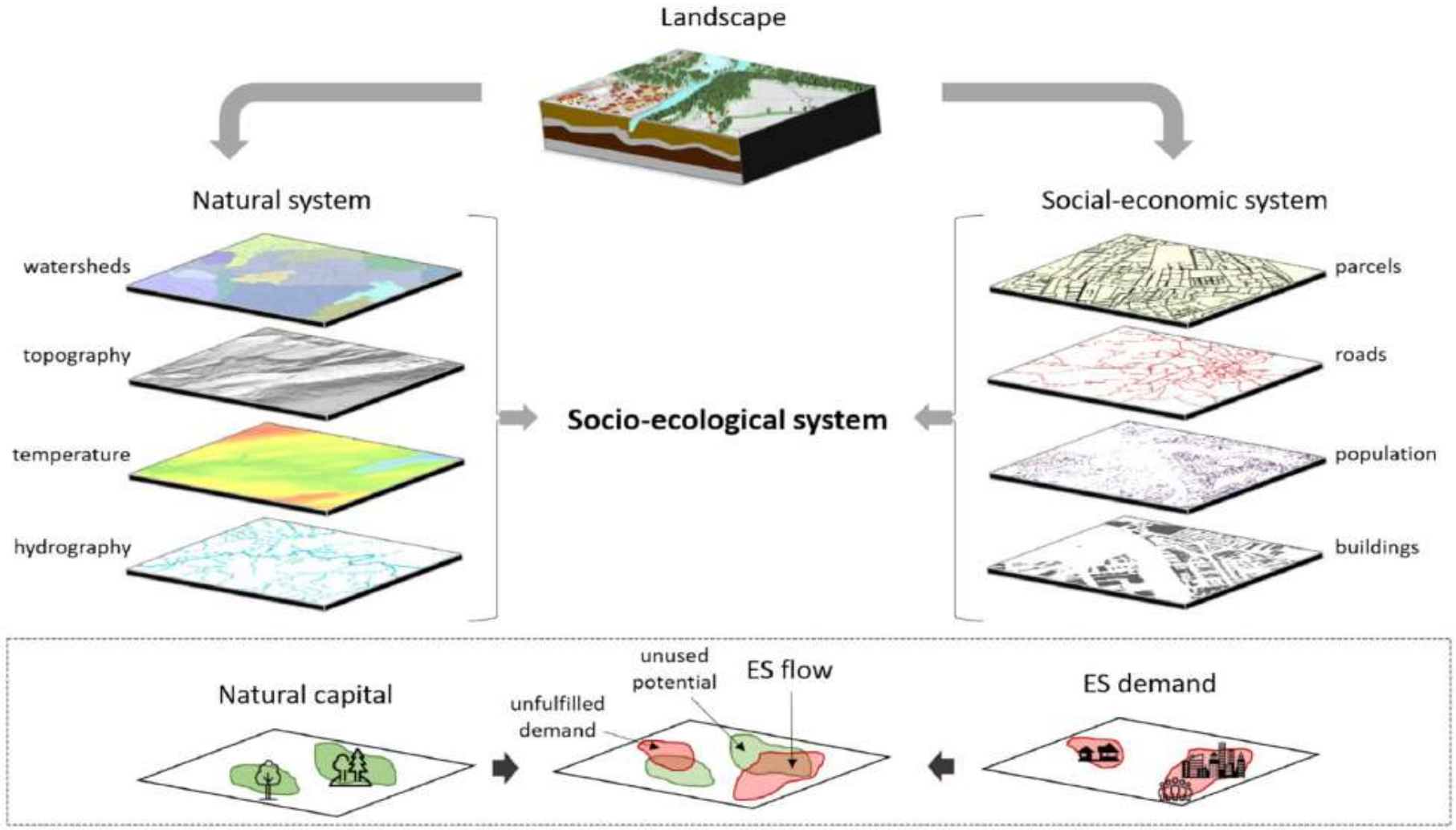
- Setting objectives
- Identifying suitable sites
- Establishing principles of planning
- Defining qualification requirements
- Making targeted use of instruments
- Working together for green infrastructure
- Securing and developing green infrastructure



Steps towards urban green infrastructure

Green and Blue Infrastructure Assessment

Assessment of the natural and the socio-economic systems



Honeck et al. 2020 (p-9)

Green and Blue Infrastructure Assessments

(NRM Board, DPAS subgroup, 2023, p.6)

GBI Assessments need to:

- **Identify** existing green and blue infrastructure and areas for improvement (e.g., enhancement of existing and/or provision of new GBI).
- **Consider** what improvements can be made to biodiversity, to ecosystem resilience, to the needs of local communities and society, and how green and blue infrastructure can meet these needs.
- Be **applicable at various levels**, from GBI strategic planning at the regional level to GBI infrastructure development at the site level.
- Be **regularly reviewed** to ensure up-to-date and evidence-based information, to assist reporting requirements, and to inform management decisions.

Flowchart of the GBI Assessments

(NRM Board, DPAS subgroup, 2023, p.6-7)

Step 1: Setting the baseline

What green and blue infrastructure already exists in the area? Where are the key ecological assets and ecological networks? What conditions are these in, and what are the main threats these are under?

Step 2: Identifying priorities

What are the main socio-economic and environmental challenges that need to be addressed in the area, and to what extent can this be done through green and blue infrastructure?

Step 3: Identifying opportunities

At a strategic level, where are the best places to address the issues identified under step? What would that look like in practice? (i.e. enhancement of existing and/or provision of new green and blue infrastructure)

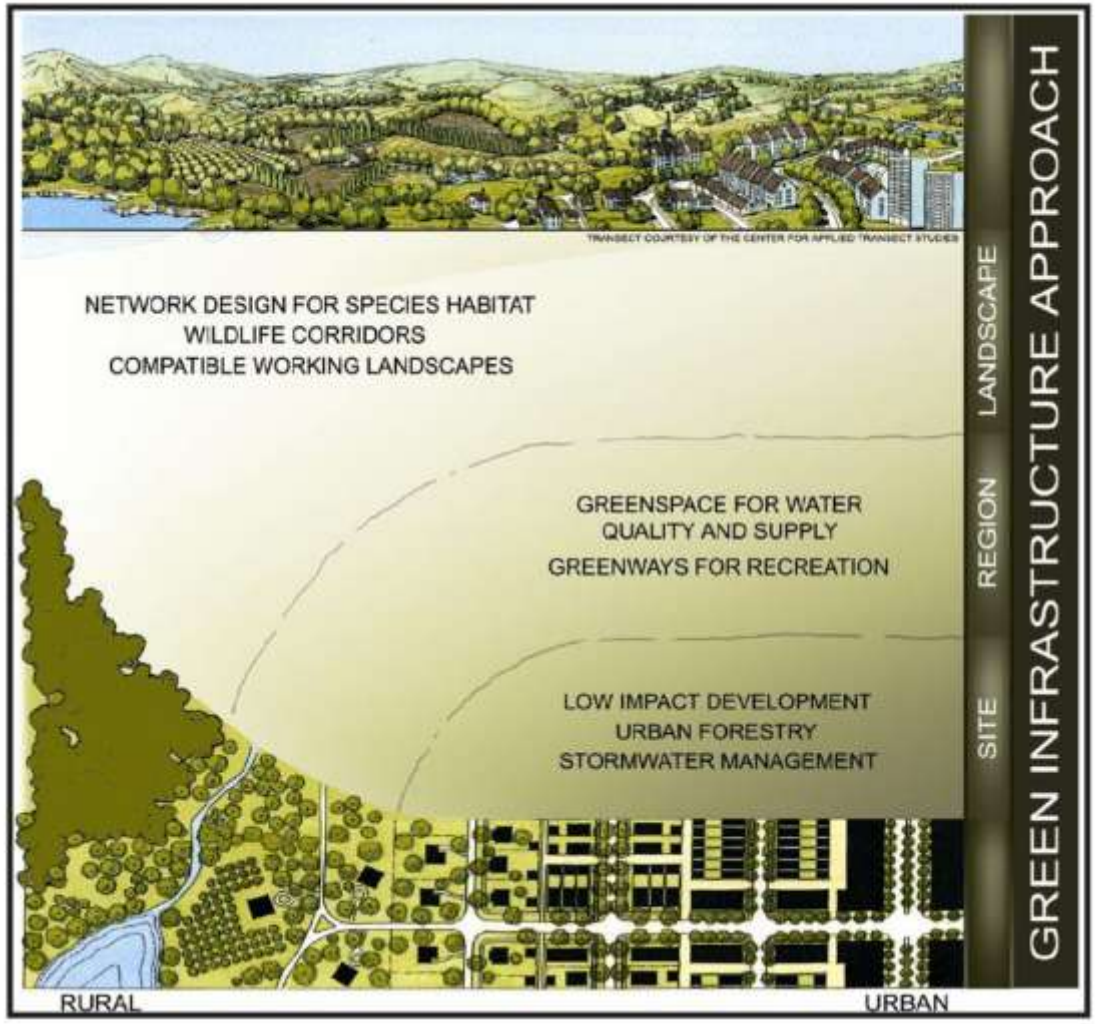
Step 4: Site assessment

What important green infrastructure assets can be found on sites? What are the main threats and challenges this green infrastructure is exposed to? What opportunities are there to maintain and improve this GI?

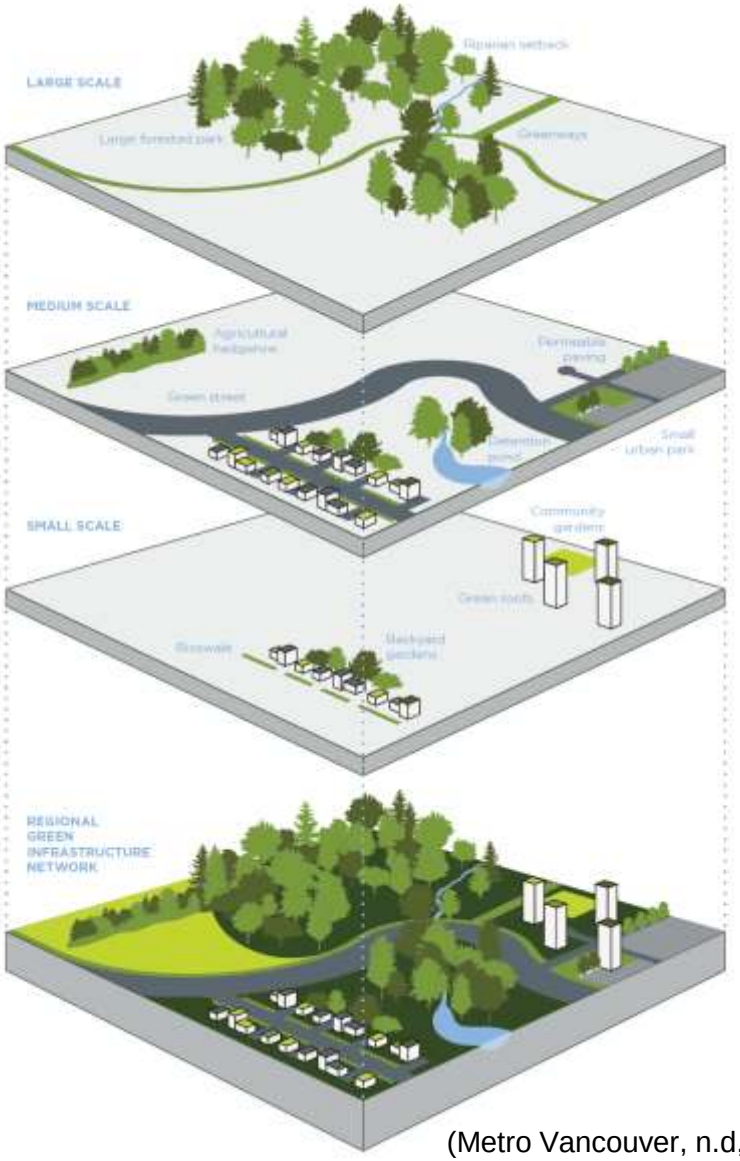
Step 5: Monitoring and review

Is the green and blue infrastructure assessment helping to deliver the desired results? If not, should the green and blue infrastructure assessment be reviewed?

Functional Scales of GBI Network Planning



(Alen 2014 in Baró et al., 2015, p.2)



(Metro Vancouver, n.d, p.8)

Green Infrastructure Planning Principles

Approaches addressing the green structure

- **Integration**
  Seeks to integrate and coordinate urban green with other urban infrastructures in terms of physical and functional relations.
- **Multi-functionality**
  Considers and seeks to combine ecological, social and economic/abiotic, biotic and cultural functions of green spaces.
- **Connectivity**
  Includes physical and functional connections between green spaces at different scales and from different perspectives.
- **Multi-scale approach**
  Can be used for initiatives at different scales, from individual parcels to community, regional and state.

Approaches addressing the green structure

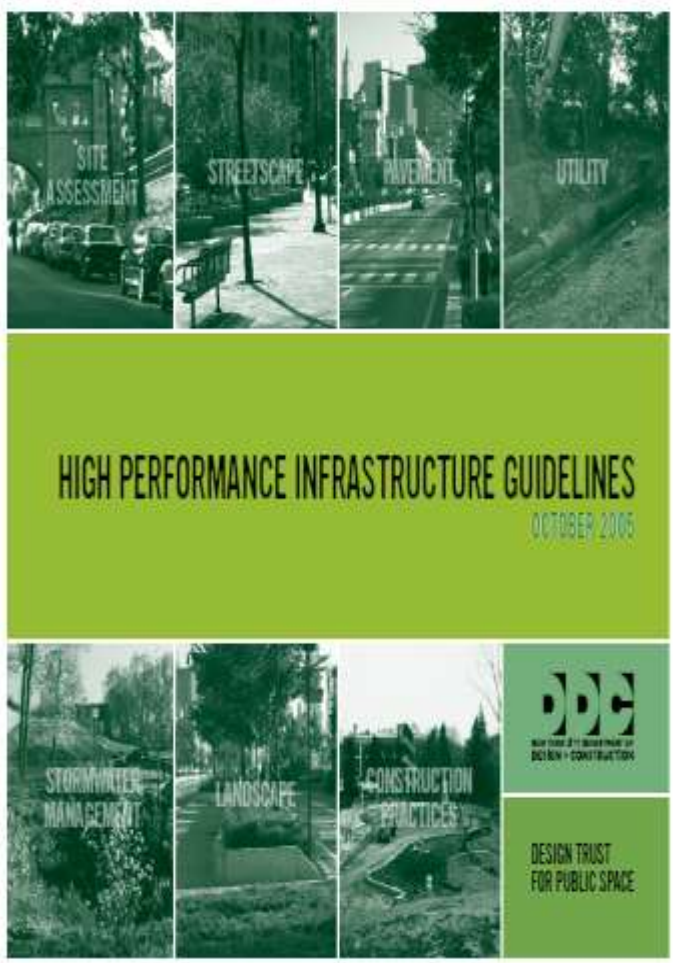
- **Multi-object approach**
  Includes all kinds of (urban) green and blue space; e.g., natural and semi-natural areas, water bodies, public and private green space like parks and gardens.

Approaches addressing governance processes

- **Strategic approach**
  Aims for long-term benefits but remains flexible for changes over time.
- **Social inclusion**
  Stands for communicative and socially-inclusive planning and management.
- **Trans-disciplinarity**
  Based on different disciplines such as urban ecology, regional planning, and landscape architecture and developed in partnership with local authorities and stakeholders.

Hansen et al. 2014 (p.517)

Best management practice for «High Performance» Infrastructure (HPI)

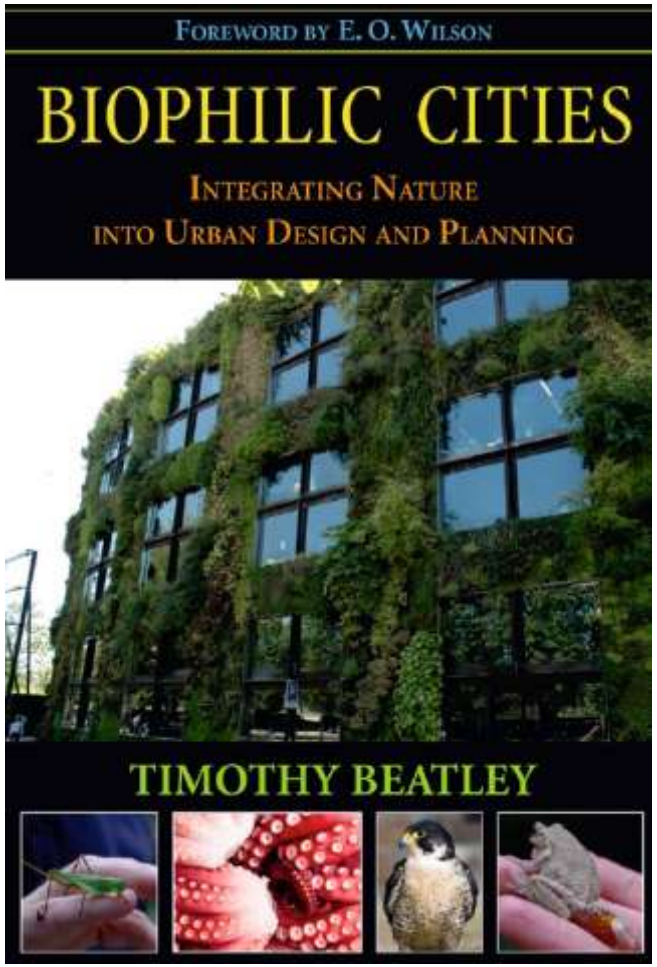


(New York City 2005)

- Maximize urban **ecosystem services**
- Disseminate and interconnect HPI **strategically**
- Develop **tridimensional** spatial planning and design
- Integrate HPI through **cross-disciplinary** teamwork
- Optimize HPI **performance**, efficiency and lifecycle
- Promote infrastructural **synergies** to adjacent systems
- **Restore ecology** and **functionality** of urban natural system
- **Reduce detrimental** impacts to air, water, soil, vegetation

(Adapted from New York City 2005 and Singelton et al. 2018)

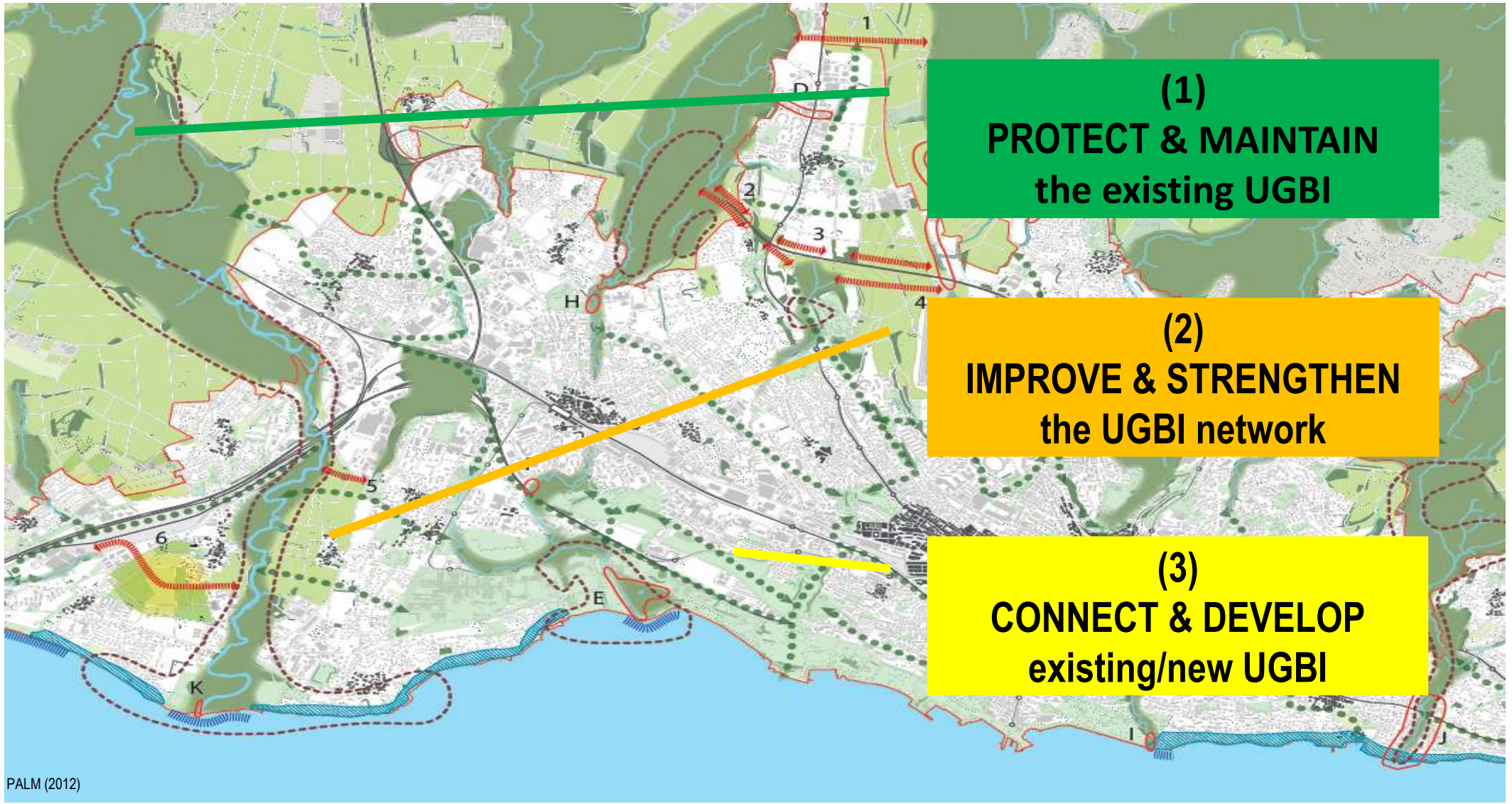
Biophilic Cities: Integrating Nature into Urban Design and Planning (Beatley 2011)



- Restore large **interconnected** green system
- Trees, parks and forests within **100m** of where people live
- Insert nature and **biodiversity** in urban interstices
- Protect and **restore** natural urban hydrology
- **Design biophilic** urban street and infrastructure
- Grow food and develop **agriculture** in the city
- Green **retrofit** existing urban neighbourhoods
- Creates safe spaces for **walking** and **biking**
- Promote **healthy** building and working environment
- Green the **vertical** dimension (Walls/Rooftops)

Tactical design and and distribution of UGBI

The 3 Steps for Tactical Design of UGBI



Decision support matrix: connectivity of the GI network (weak, moderate, strong) vs quality of its elements (low, adequate, high)

(altered from Hansen 2014 in BfN, 2017, p.27)

Connectivity → **Urban green infrastructure**

Assessment of condition:

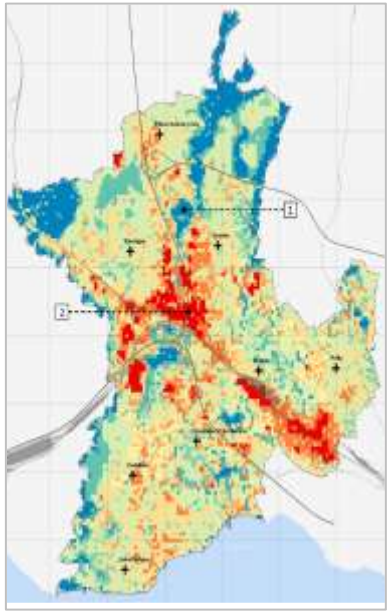
Weak	Moderate	Strong
Add new connecting elements	Strengthen connectivity between elements	Maintain green infrastructure system
Enhance element quality and add new connecting elements	Enhance element quality and strengthen connectivity between elements	Enhance element quality
Develop new/restore existing elements and add new connecting elements	Develop new/restore existing elements and strengthen connectivity	Develop new/restore existing elements

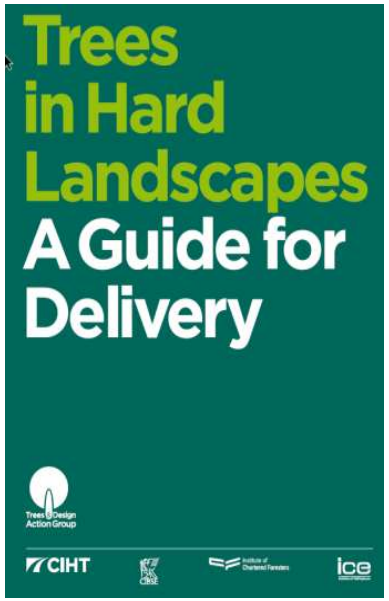
Assessment of quality: Low – Adequate – High

Element quality

The 4 "**Rights**" for UGBI Projects Design

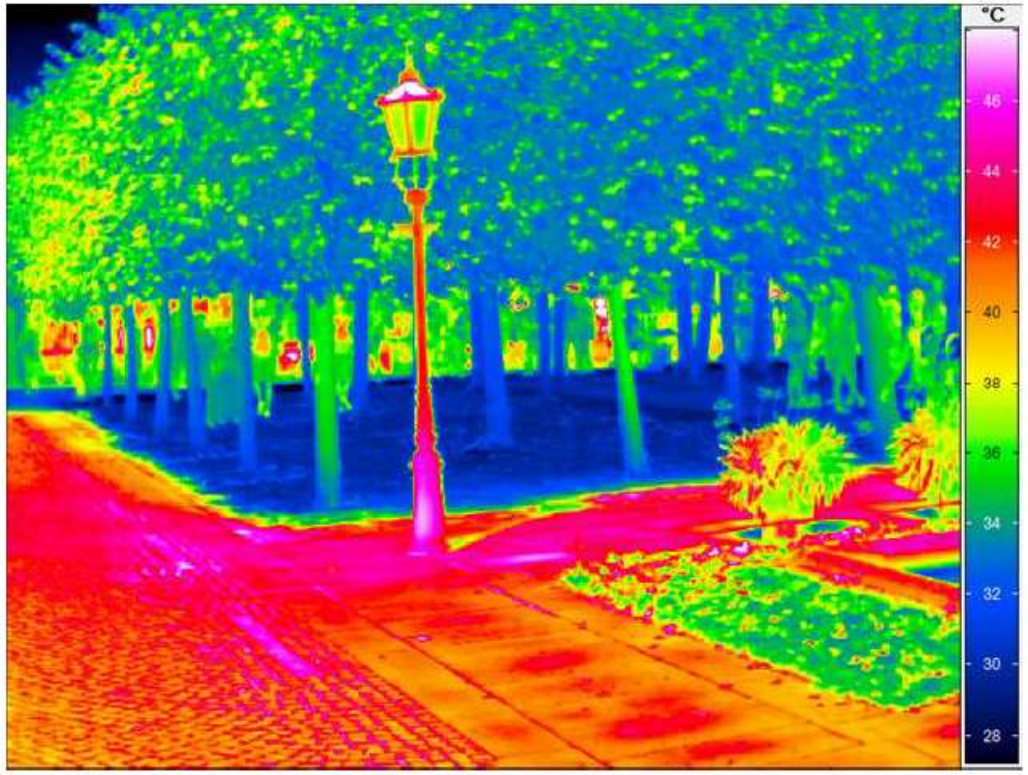
The right GREEN → **For the right SERVICES** → **In the right PLACE** → **In the right WAY**



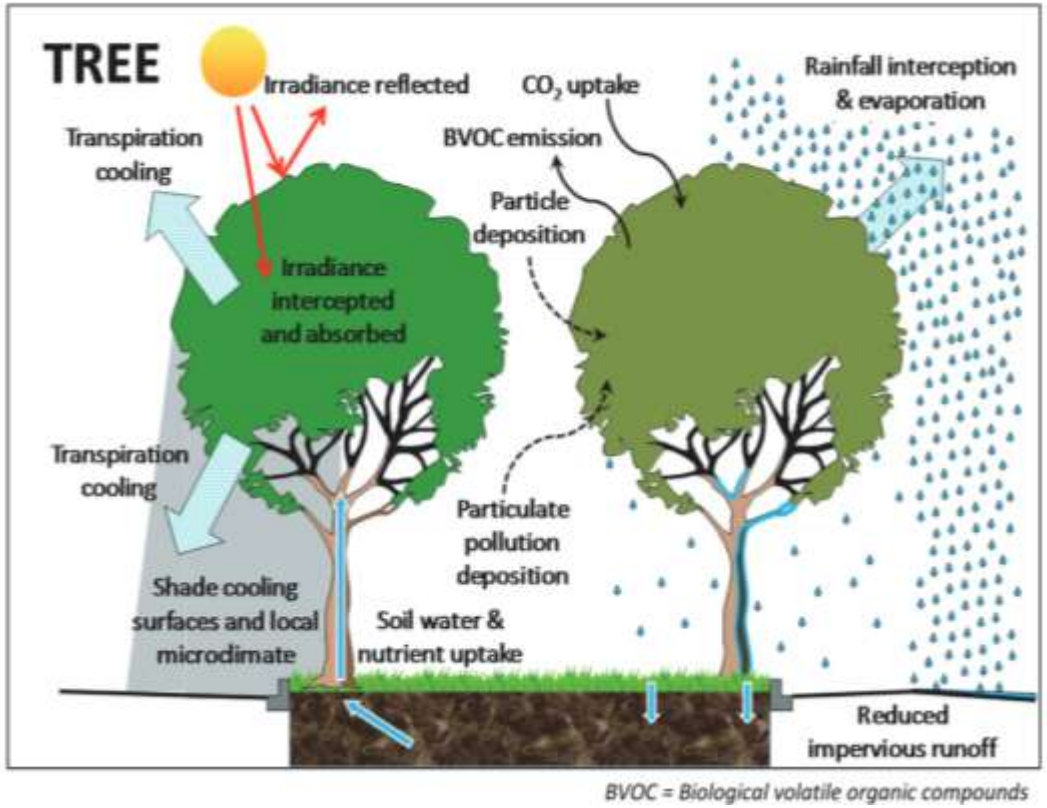


The right **GREENE** for the right **SERVICE**

Role of trees in mitigating urban heat island



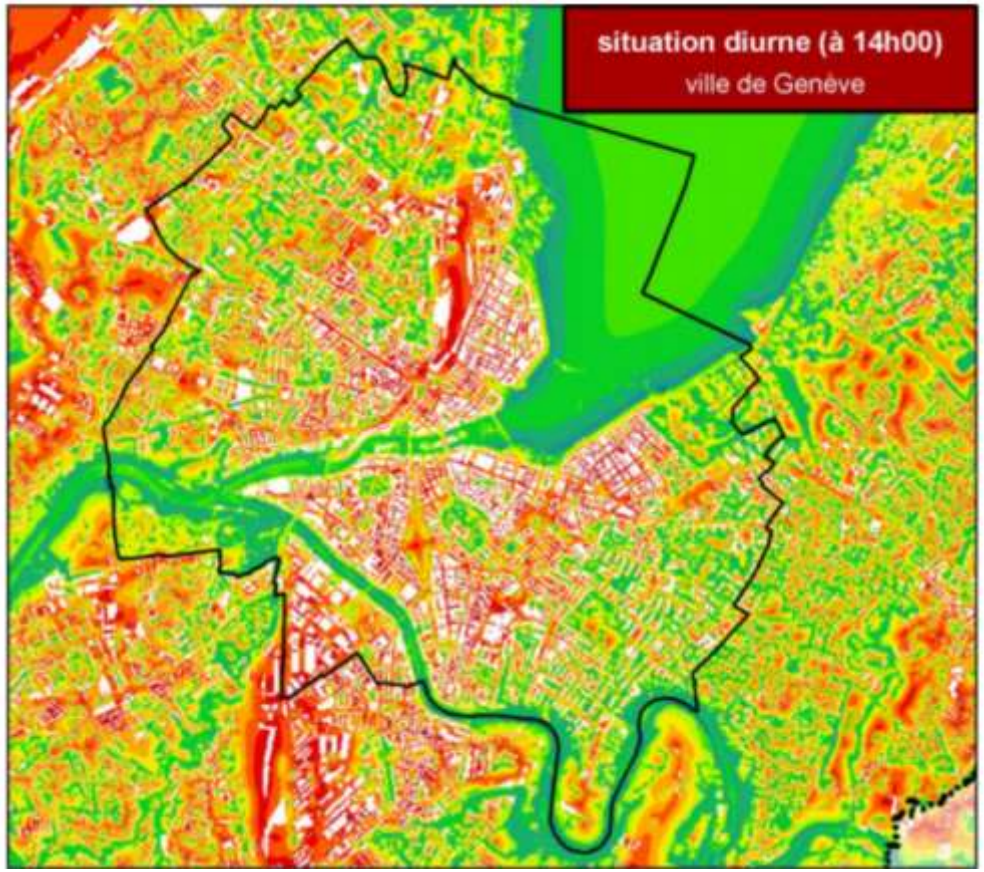
(Courtesy of Gillner et al. in EFUF 2014 n.p.)



(Livesley et al. 2016, p.120)

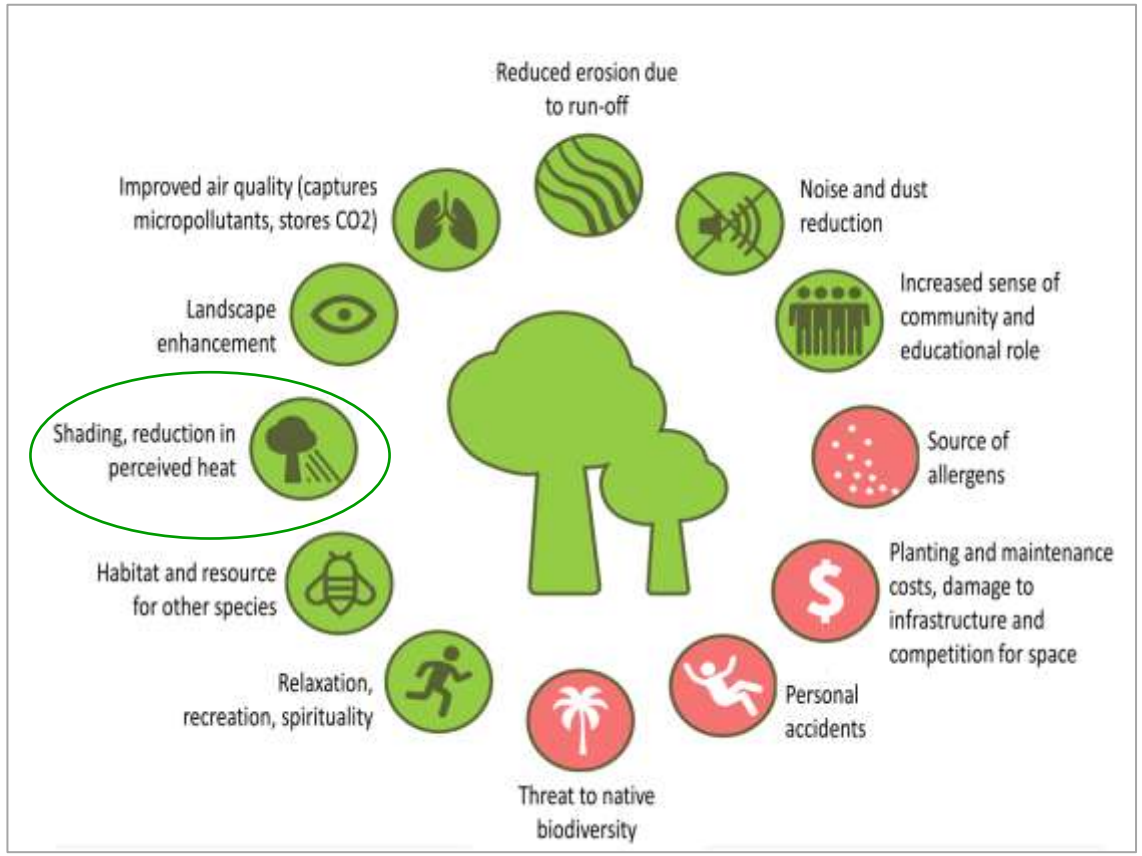
The right **SERVICE** in the right **PLACE**

Temperature in Geneva, 22,12,20



(SITG, 22.12.2020)

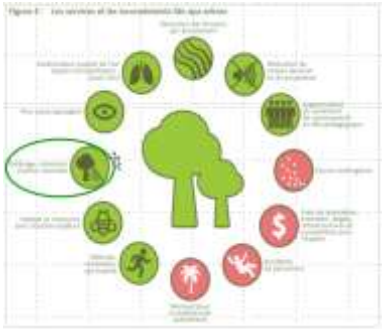
Role of trees in mitigating urban heat



(Schlaepfer et al., 2018, p. 15)

(1)
Diagnosis
GE canopy

(2)
Selected services



(3)
Deficits / Priorities
GE canopy

Figure 3 : Densité d'arbres par hectare sur le canton de Genève (2009).

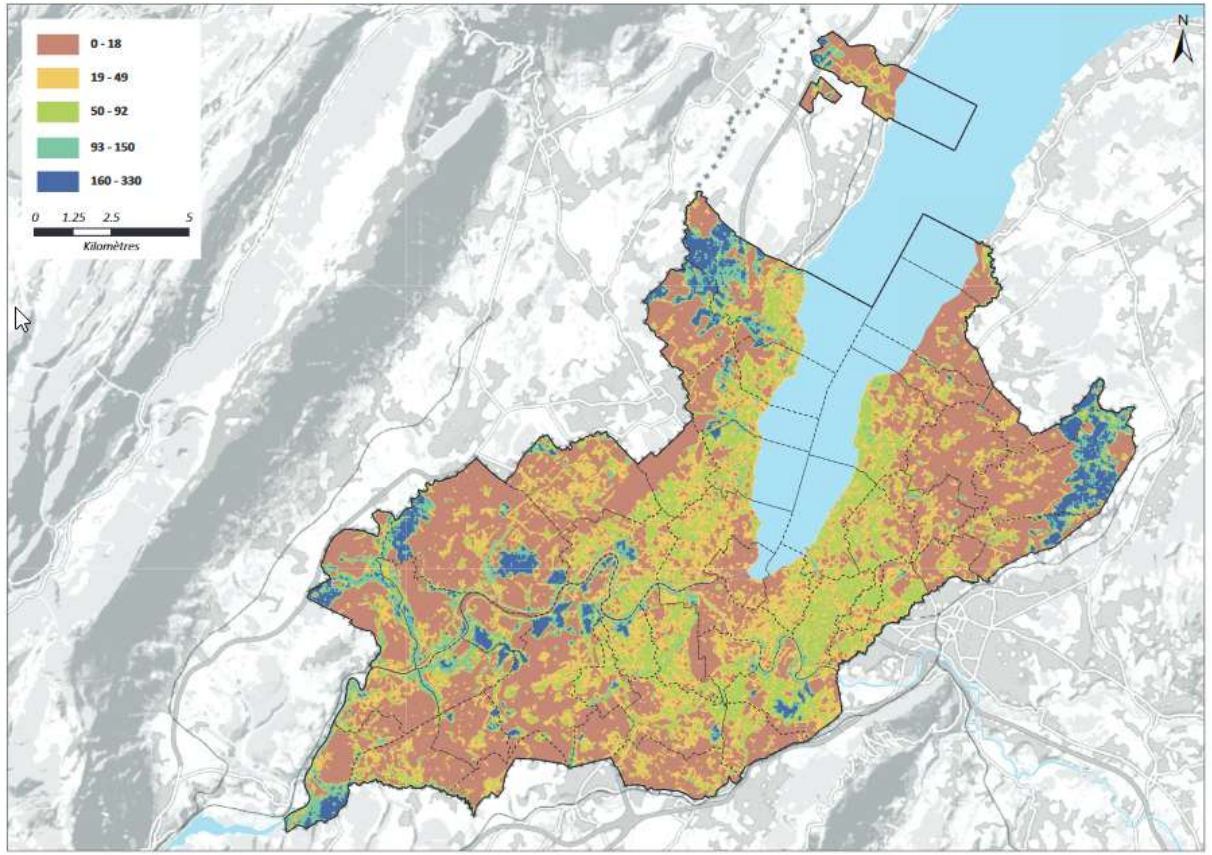
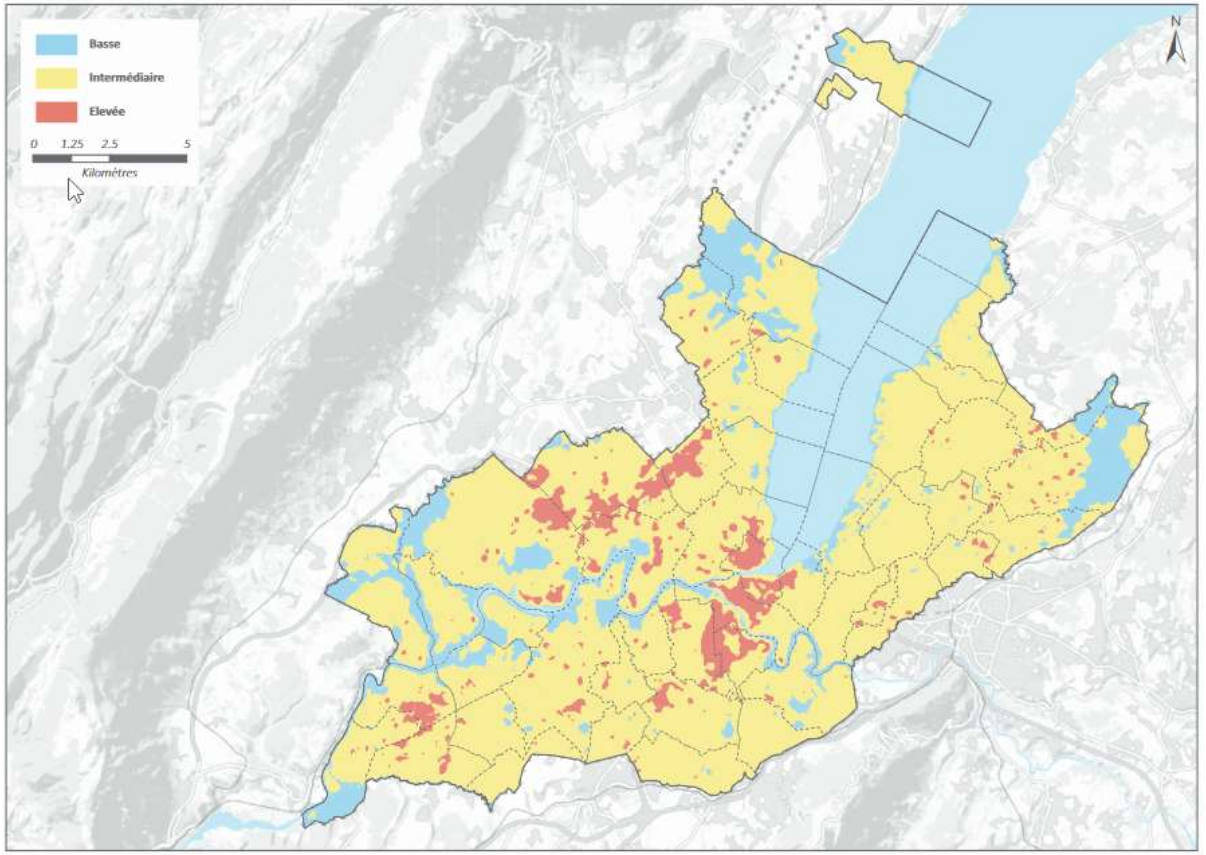
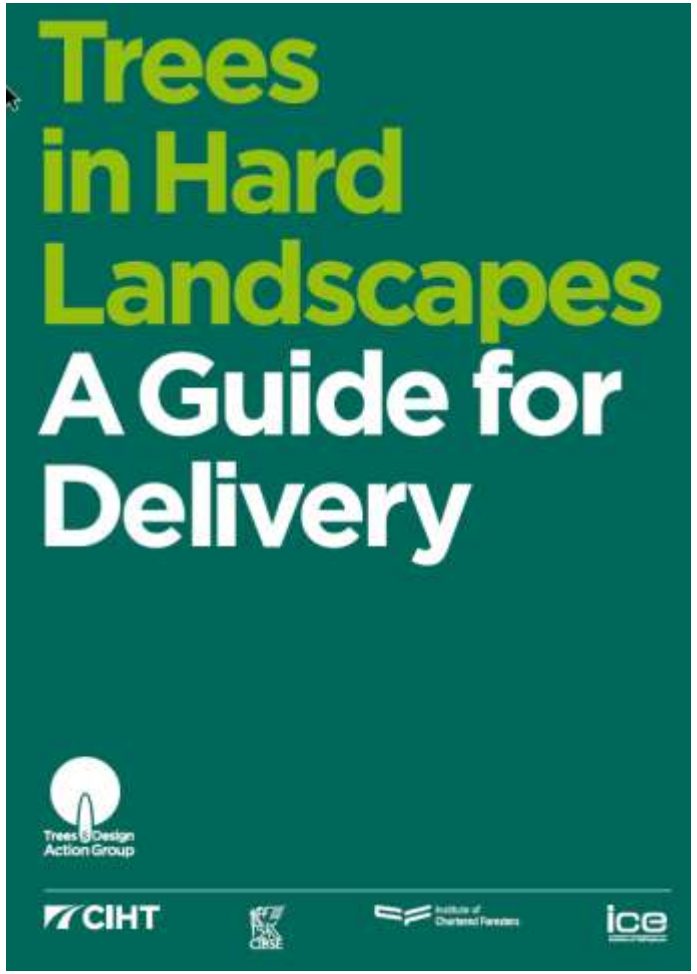


Figure 7 : Lieux prioritaires pour atténuer l'îlot de chaleur

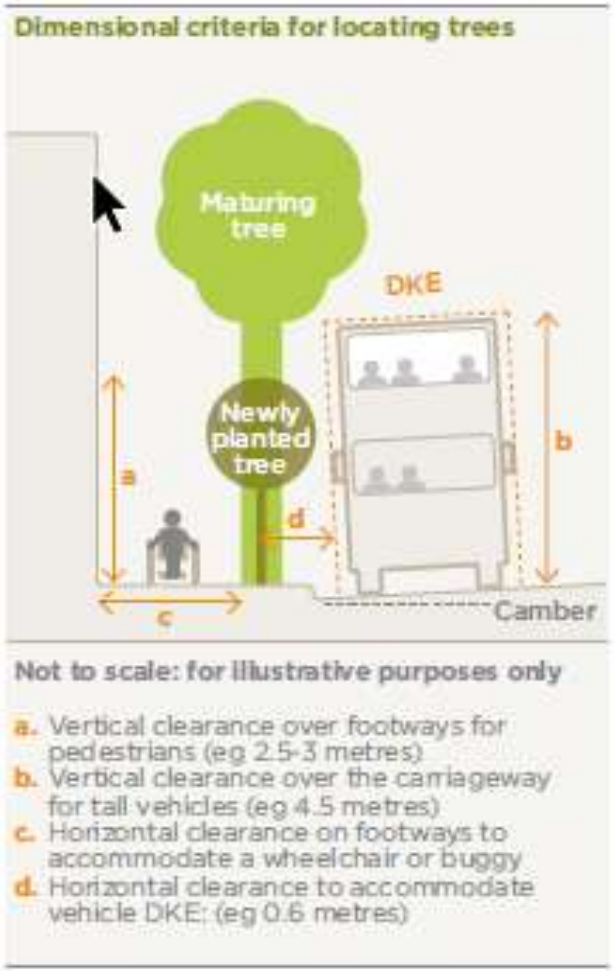


(Schaelpfer et al., 2018, p.14 & 21)

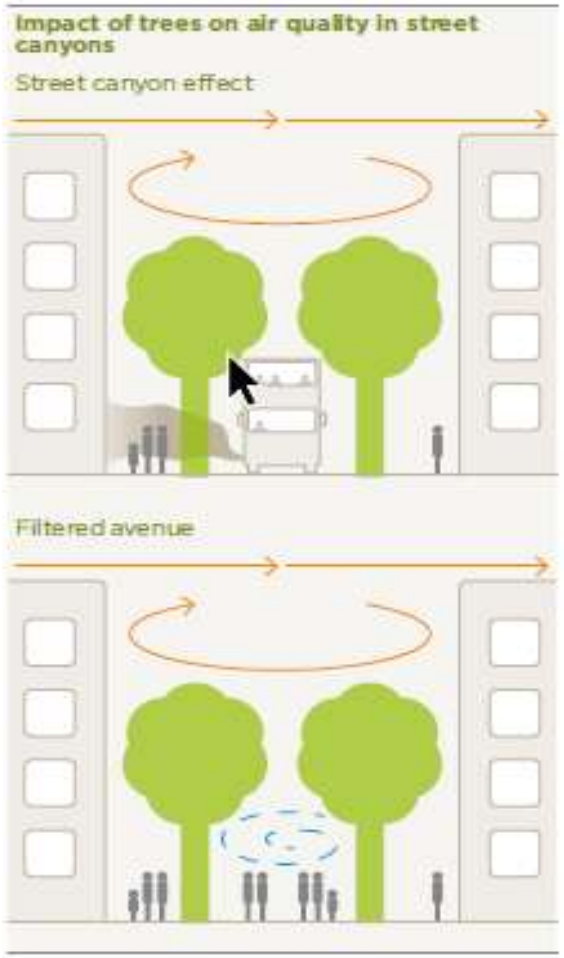
The right **GREEN** in the right **WAY**



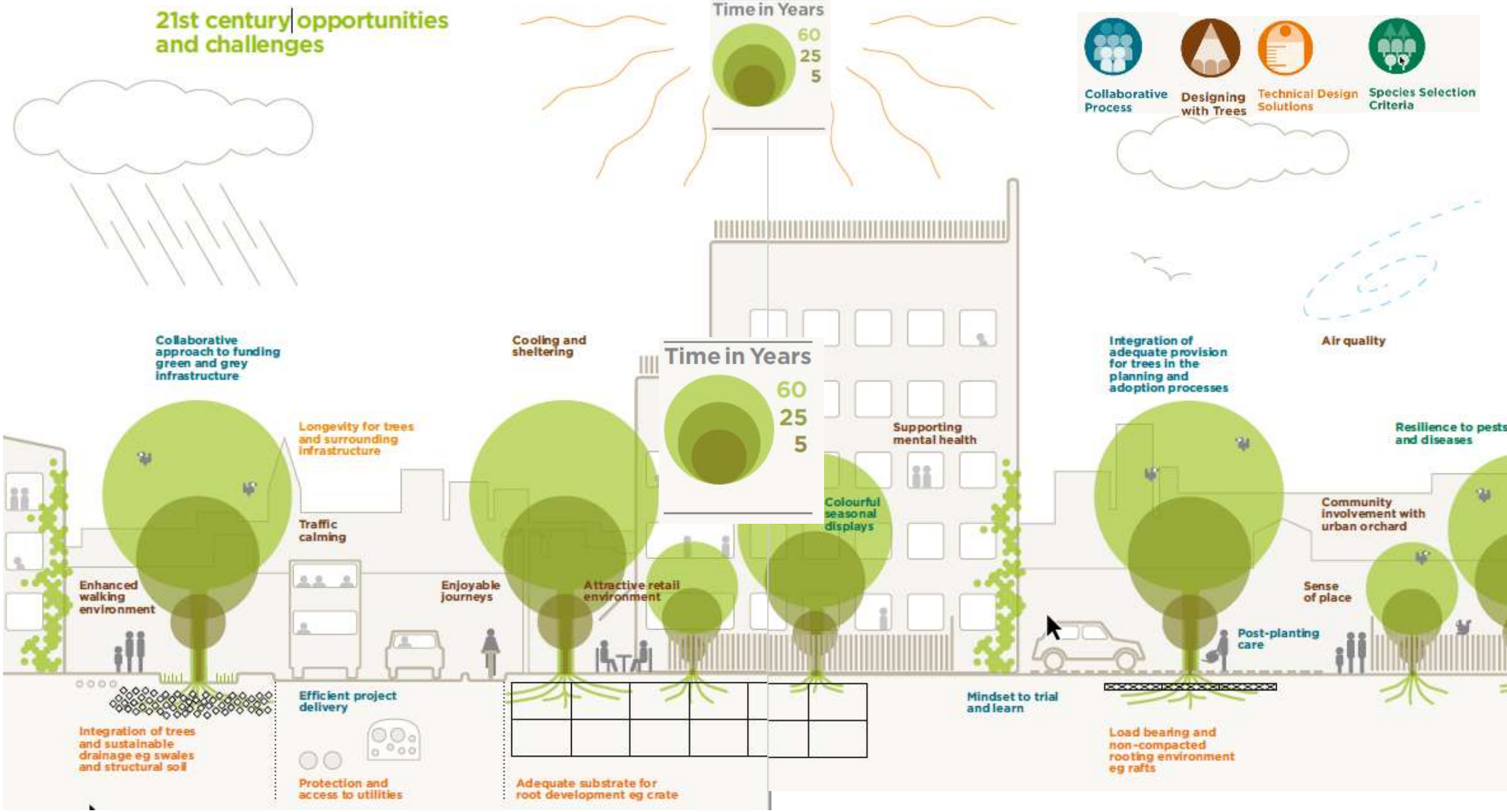
(TDAG, 2016)



(TDAG, 2016, p.54)



(TDAG, 2016, p.63)

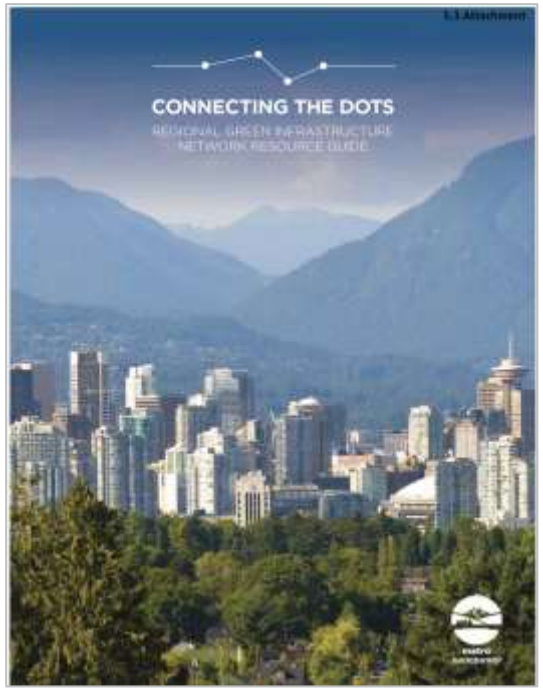


(TDAG, 2016, p.4 & p.5)

Further Reading on the Subject

UGBI Definition & Concept

Metro Vancouver (n.d.)



UGBI Ecosystem Services

House et al. 2016.

Planning Process

BfN, 2017

Planning Guide

Hansen et al. 2017