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Session 4* - Urban ES concept, definitions and links to urban planning

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EUP - Session 4: Urban ES concept, definitions and links to urban planning and decision-making

Guiding questions

- How does the ecosystem services concept apply to urban contexts? (e.g. urban ecosystem services in sensu lato vs sensu stricto in Tan et al 2020)
- How can urban ecosystem services be defined?
- What are similarities and differences between urban and natural ecosystems?
- What are the spatial relationships in the provision of ES and the scale of ES benefiting areas?
- Early examples of application into urban planning

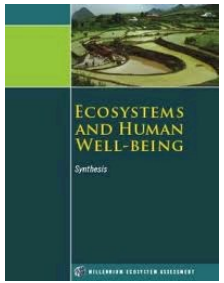
- **Co-design of the Skarpnäck** (environmental planning) case study

Ecosystem services definitions

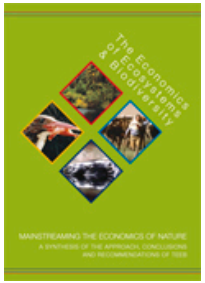
"… the benefits that people obtain from ecosystems" **MA, 2005**

"..the direct & indirect contributions of ecosystems to human well-being" **TEEB, 2010**

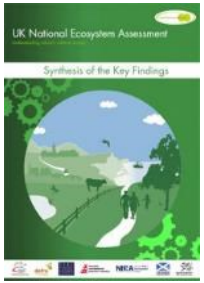
"Nature Contribution to People", **IPBES, 2019**



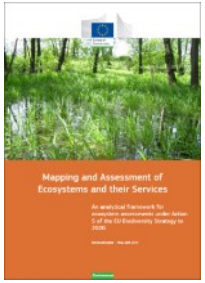
MEA



TEEB

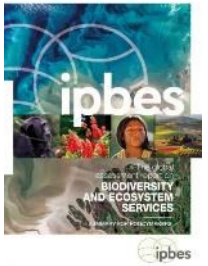


UK NEA



MAES

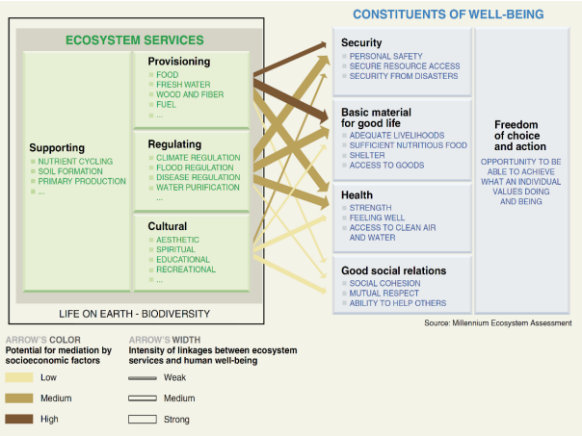
TEEB-DE

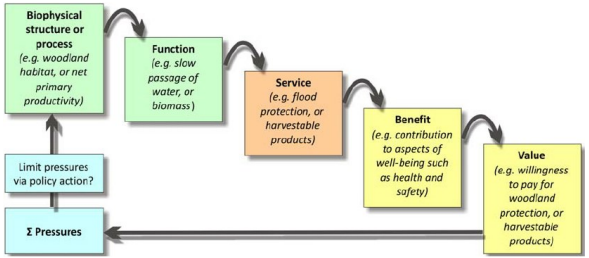


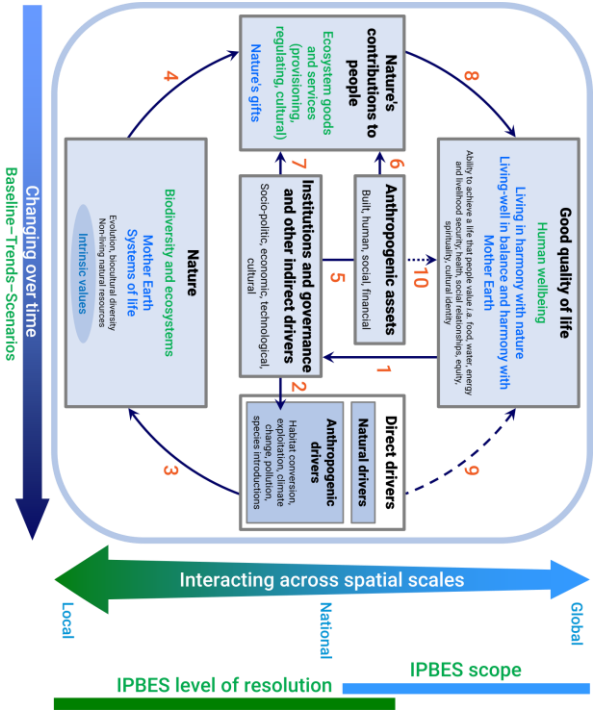
IPBES

2005 2006 2007 2008 2009 2010 2011 2012 2013 2014 2015 2016 2017 2018 2019 2020

Evolving conceptualizations







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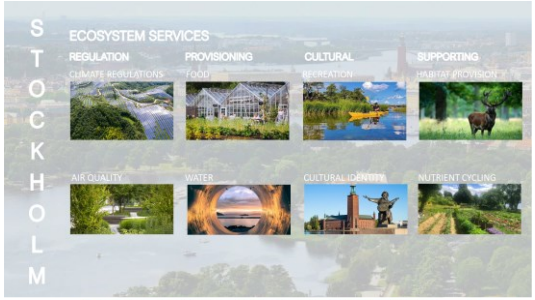

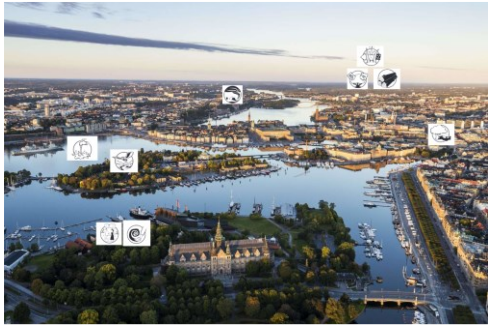

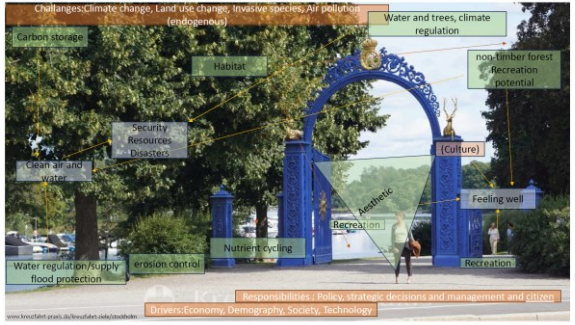

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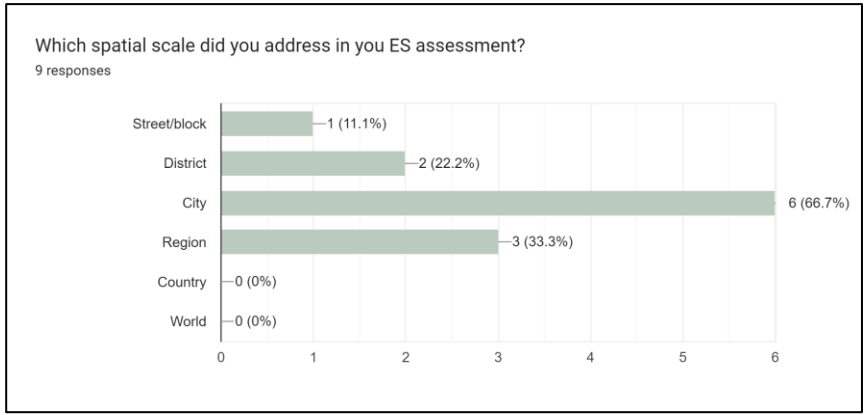
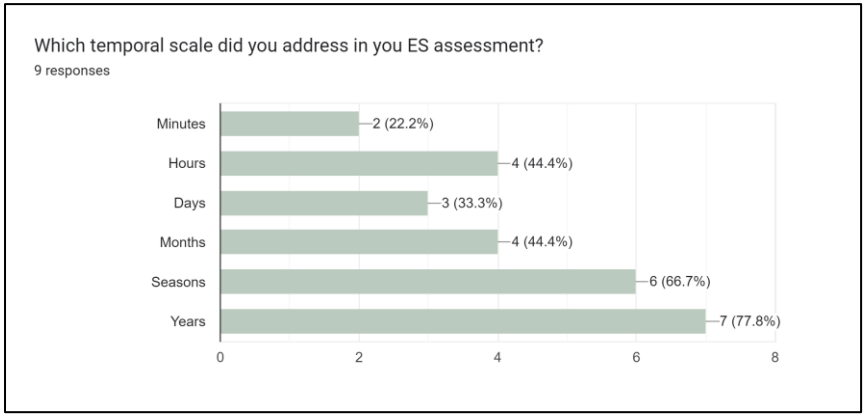
Your assignment: Collages

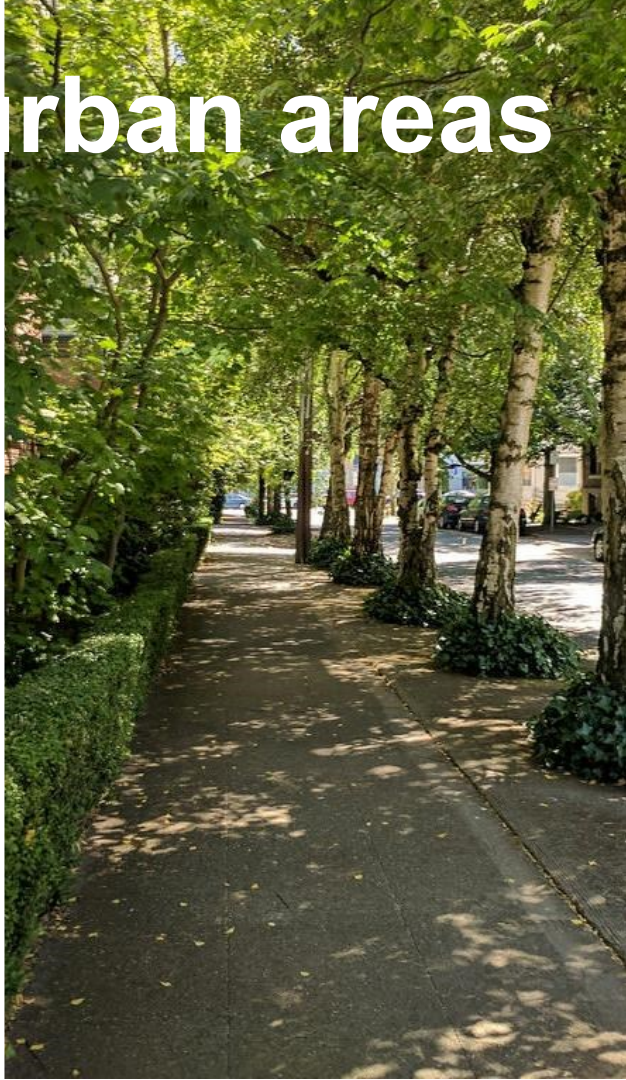
	Provisioning	Regulating	Cultural	Supporting	Spatial scale	Temporal scale
Demir Zerin	4	2	2	2	City	Y
Sefkow Stephan	0	3	0	3	City	Mo, S
May Julius	1	4	3	1	District, City	Mi, Hrs, D, Mo, S, Y
Althaus Leon	3	3	more that 7	3	Region	Mi, Hrs, D, Mo, S, Y
Cullen Richard	6	4	4	4	Street/block, City	Hrs, S
Olegário Gabriel + Alozie Ikechukwu	4	4	4	4	City	Hrs, D, Mo, S, Y
Dahlems Maximilian	2	6	6	5	District	Y
Magin Nils	3	3	2	0	City, Region	S, Y
Lensker Jonas	4	3	3	1	Region	Y
Lee Kwang Joo						
Total	**24**	**32**	**31**	**23**		

Your assignment: Collages

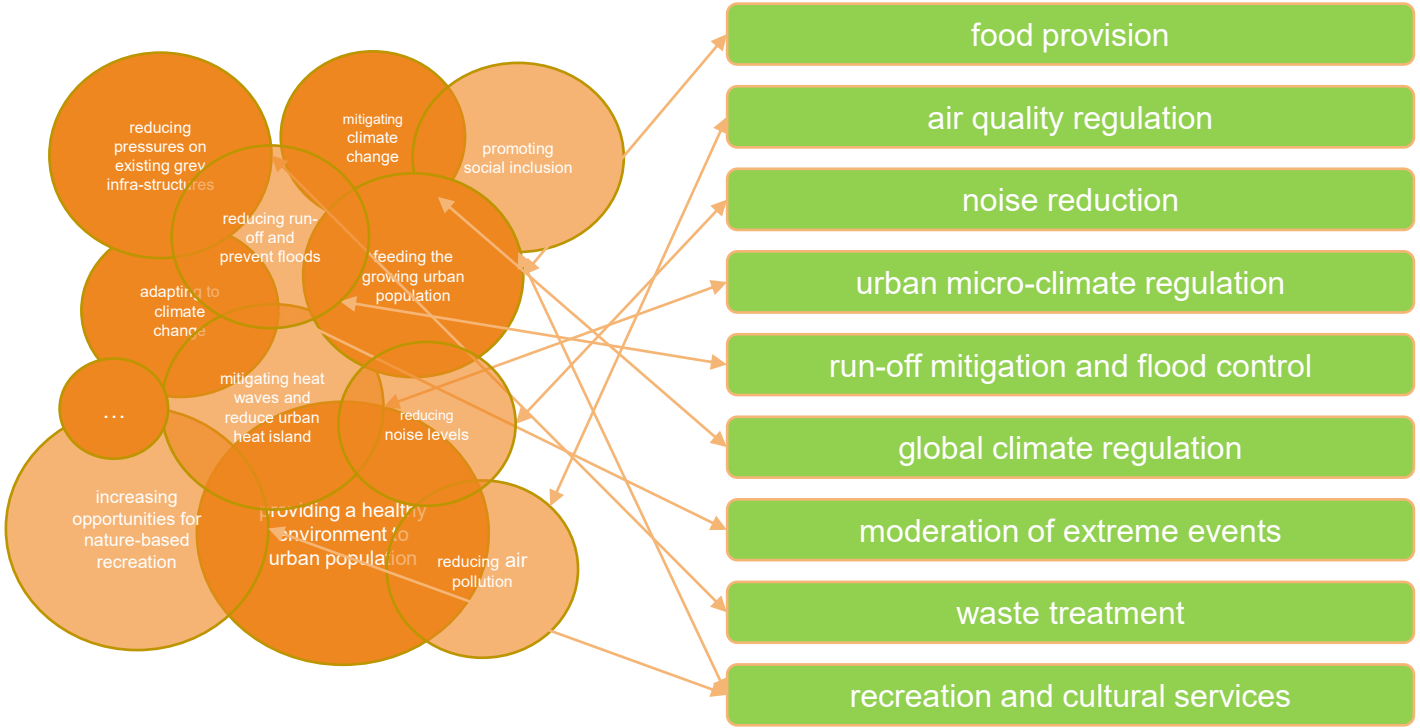




Ecosystem services in urban areas



Planning & Urban Ecosystem Services



Definition: Urban Ecosystem Services

ES

Urban ES

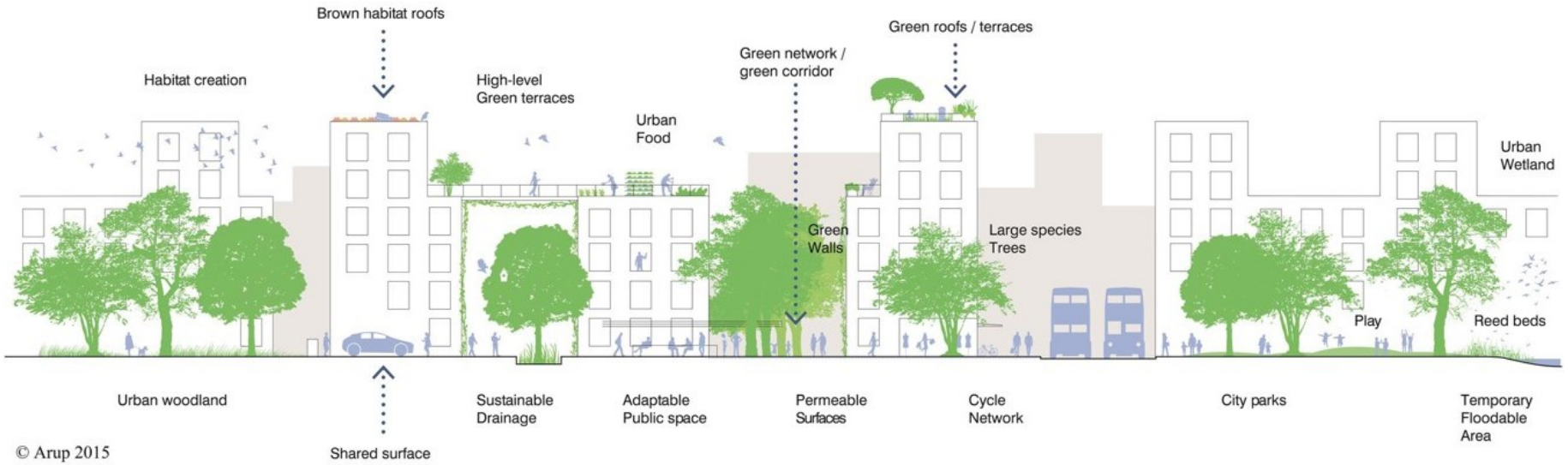
supplied locally by urban ecosystems

PROVISIONING
- food supply
- water supply

REGULATING
- urban microclimate regulation
- water regulation & runoff mitigation
- noise reduction
- air purification
- extreme events regulation
- waste treatment
- global climate regulation (carbon)

CULTURAL
- recreation
- aesthetic benefits
- identity & social cohesion
- cognitive development

Urban Ecosystems?



Typical Green Infrastructure assets & their scales

Local, neighbourhood and village scale	Town, city and district scale	City-region, regional and national scale
• Street trees, verges and hedges • Green roofs and walls • Pocket parks • Private gardens • Urban plazas • Town and village greens and commons • Local rights of way • Pedestrian and cycle routes • Cemeteries, burial grounds and churchyards • Institutional open spaces • Ponds and streams • Small woodlands • Play areas • Local nature reserves • School grounds • Sports pitches • Swales, ditches • Allotments • Vacant and derelict land	• Business settings • City/district parks • Urban canals • Urban commons • Forest parks • Country parks • Continuous waterfronts • Municipal plazas • Lakes • Major recreational spaces • Rivers and floodplains • Brownfield land • Community woodlands • (Former) mineral extraction sites • Agricultural land • Landfills	• Regional parks • Rivers and floodplains • Shorelines • Strategic and long distance trails • Forests, woodlands and community forests • Reservoirs • Road and railway networks • Designated greenbelt and strategic gaps • Agricultural land • National parks • National, regional or local landscape designations • Canals • Common lands • Open countryside

Source: EEA, 2011, Green infrastructures and territorial cohesion.

Green Urban Infrastructure component & ES

URBAN REGULATING ES	GREEN URBAN INFRASTRUCTURE COMPONENT							
	Trees	Shrubs	Herbaceous covers	Permeable surfaces	Wetlands	Water courses	Water ponds	Soil
Air purification	X	X						
Urban microclimate regulation	X	X	X		X	X	X	
Global climate regulation	X	X						X
Runoff mitigation & flood control	X	X		X	X			
Noise reduction	X	X	X					
Extreme event moderation	X				X			
Waste treatment				X	X		X	

Complexity of the services (different components & different functions involved)

Multi-functionality of the components (synergies between services)

Urban vs Natural ecosystems

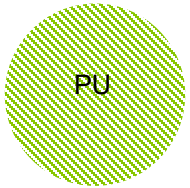
- fragmentation
- inhomogeneities

- Scattered elements
- Spatial variability in the composition
- Spatial variability in performance
- Interactions with the built environment
- Different pressures

Group discussion – 12 min

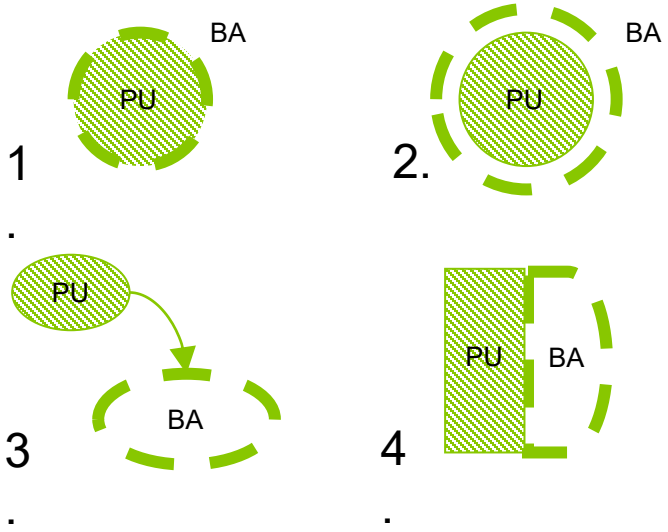
- What different typologies of spatial relationships between the areas that produce the ES (PU) and areas that benefit (BA) can you identify? Please suggest some **schematic graphical representations**.

- If possible, reflect on the different spatial scales involved as well.



PU = service providing unity
BA = service benefiting area

Spatial relationships in the provision of ES

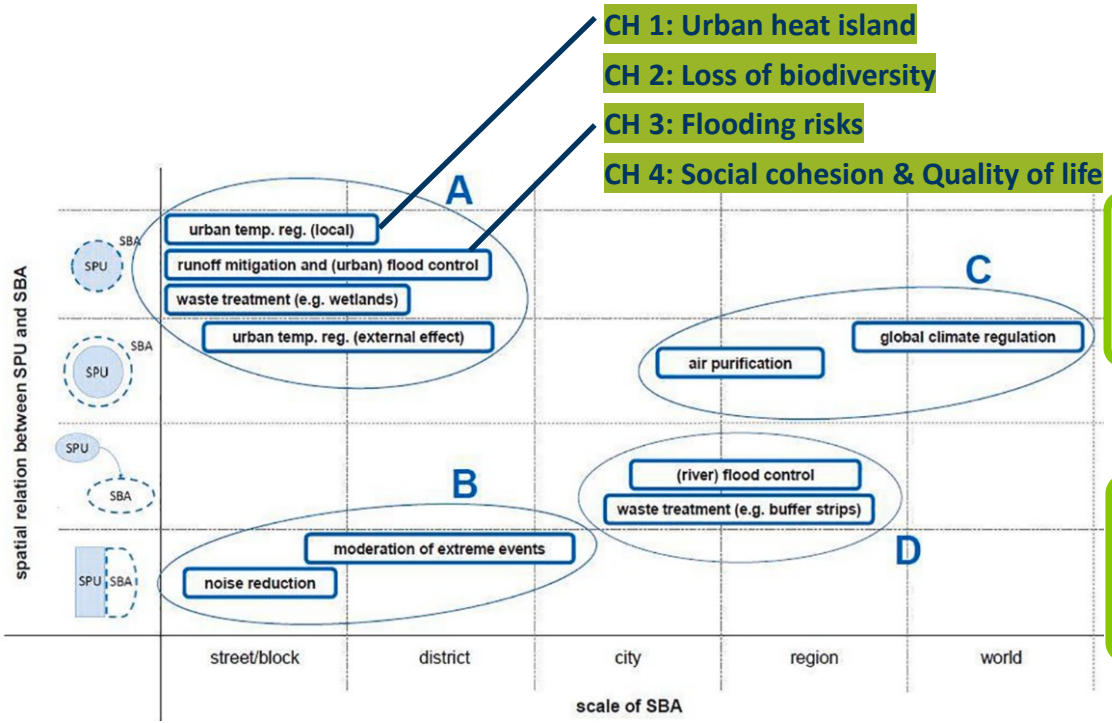


PU = production unit; BA = benefitting area

different spatial relationships between the areas that produce the ES and areas that benefit from it:

1. **overlapping** (e.g. recreation within a green area)
2. **homogeneous distribution around** (e.g. cooling due to the presence of a park)
3. **service provided to downstream areas** (e.g. flood control)
4. **contiguous areas** (protection buffer – e.g. noise reduction)

Scale of benefitting areas



LOCAL

A. with homogeneous effects

B. with directional effects

SUPRA-LOCAL

C. with homogeneous effects

D. with directional effects

Source: Cortinovis and Geneletti (2019) 'A framework to explore the effects of urban planning decisions on regulating ecosystem services in cities', Ecosystem Services, 38, doi: 10.1016/j.ecoser.2019.100946.

E.g. Air purification

function:
capture of gaseous pollutants, deposition of particulate matter

GI components:
arboreal and shrub vegetation

dimension:
capacity increases with increasing surface area

location:
production depends on the quantity of pollutants (proximity to emission sources)

beneficiaries:
benefits redistributed across the entire city / region

variability:
variable environmental conditions, deciduous trees lose their capacity during the winter season

E.g. Noise reduction

function:
reflection, refraction and absorption of sound waves

GI components:
high density vegetation groups with different heights (arboreal & shrubby + permeable bottom)

dimension:
minimum thickness of the vegetation strip (≈15 m) -efficacy increases with > thickness

location:
proximity to the source of noise

beneficiaries:
areas directly screened (buffer)

variability:
constant environmental condition, deciduous trees lose capacity during the winter season

E.g. Runoff mitigation and Flood control

function:
interception and infiltration of rainwater

GI components:
permeable areas (infiltration) & tree cover (interception)

dimension:
minimum size for perceptible reduction, depending on the size of draining areas

location:
downstream (or hydraulically connected) to the drainage areas

beneficiaries:
local benefits and for downstream areas (floods)

variability:
environmental condition depending on precipitation events, infiltration depending on soil moisture conditions (previous events), deciduous trees do not intercept in the winter season, (risk of contaminants)

E.g. Microclimate regulation

function:
shading and evapotranspiration, evaporation

GI components:
green areas in general, blue infrastructures

dimension:
Δt increases in a manner not proportional to the surface, importance of the form (better low index of form)

location:
indifferent to the production of the service

beneficiaries:
cooling produced within the area and in its immediate surroundings (up to a few hundred m for large areas)

variability:
environmental condition depending on the summer heat waves, deciduous trees still produce the service when necessary (summer)

E.g. Recreation services

function:
supply of open spaces for physical and social activities

GI components:
public green areas with specific functions (parks)

dimension:
depending on the specific functions, a minimum size or presence of a certain infrastructure may be necessary

location:
the service is tied to use, so the area must be accessible to citizens

beneficiaries:
depending on the functions & accessibility, the potential beneficiaries may be at different distances from the green area, but the benefit is obtained only within

variability:
more significant for demand than for supply

Real-world example: The Birmingham plan

The seven green living spaces principles

Principle	Outcomes
An Adapted City	Retain City's top ranking for adaption • Ensure all future growth is 'adapted'. • Trees for cooling and thermal insulation. • Green roofs, walls and street canyon research.
The City's Blue Network	Adopt water sensitive urban design • Integrated SuDS, flood and water management solutions. • 'Blueprint' for enhanced walking and cycling network. • Blue Corridor/network policy with Canal River Trust.
A Healthy City	Adopt Natural Health Improvement Zones (NHIZ) • Integrate the delivery of health and green living spaces. • Continue to extend the Be-active offer. • Public health as key partners in planning.

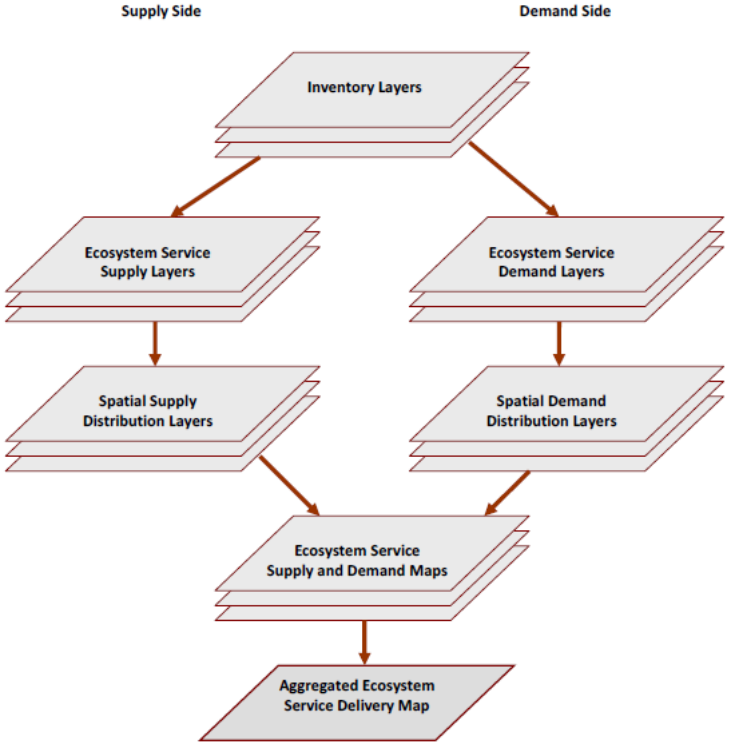
Development Directorate Birmingham City Council.
Making Birmingham Green
Green Living Spaces Plan (sept. 2013)
www.birmingham.gov.uk/greenlivingspacesplan

Real-world example: The Birmingham plan

The City's Productive Landscapes	**Embrace urban forestry and urban food growing** • Continue to promote allotments. • Facilitate community food growing and orchards. • Promote the multiple benefits of urban forestry.
The City's Greenways	**Change gear - to a walking and cycling City** • Create walkable/cyclable neighbourhoods. • Citywide signed routes linked to public transport.. • Link healthcare activities and prevention programmes.
The City's Ecosystems	**Birmingham as a biophillic City** • City to adopt an ecosystem services approach. • Partners to lead on District NIA continuation plans. • Birmingham to join global Biophillic Cities network.
The City's Green Living Spaces	**Birmingham an international City of Green Living Spaces** • Adopt the 7 principles across Planning Framework. • Green Infrastructure and Adaption Delivery Group. • Work with business partners on green economy.

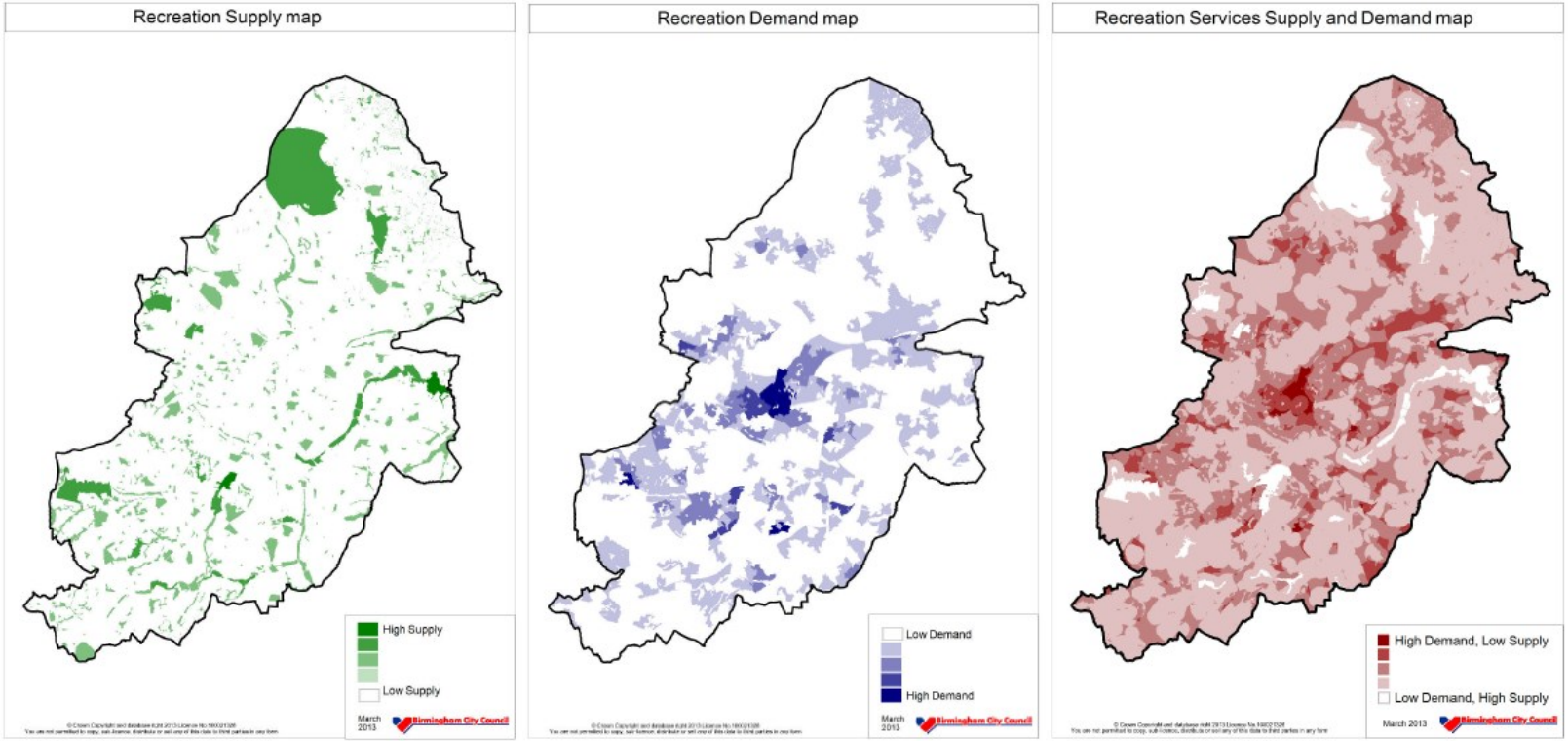
Development Directorate Birmingham City Council.
Making Birmingham Green
Green Living Spaces Plan (sept. 2013)
www.birmingham.gov.uk/greenlivingspacesplan

Mapping supply & demand of ES

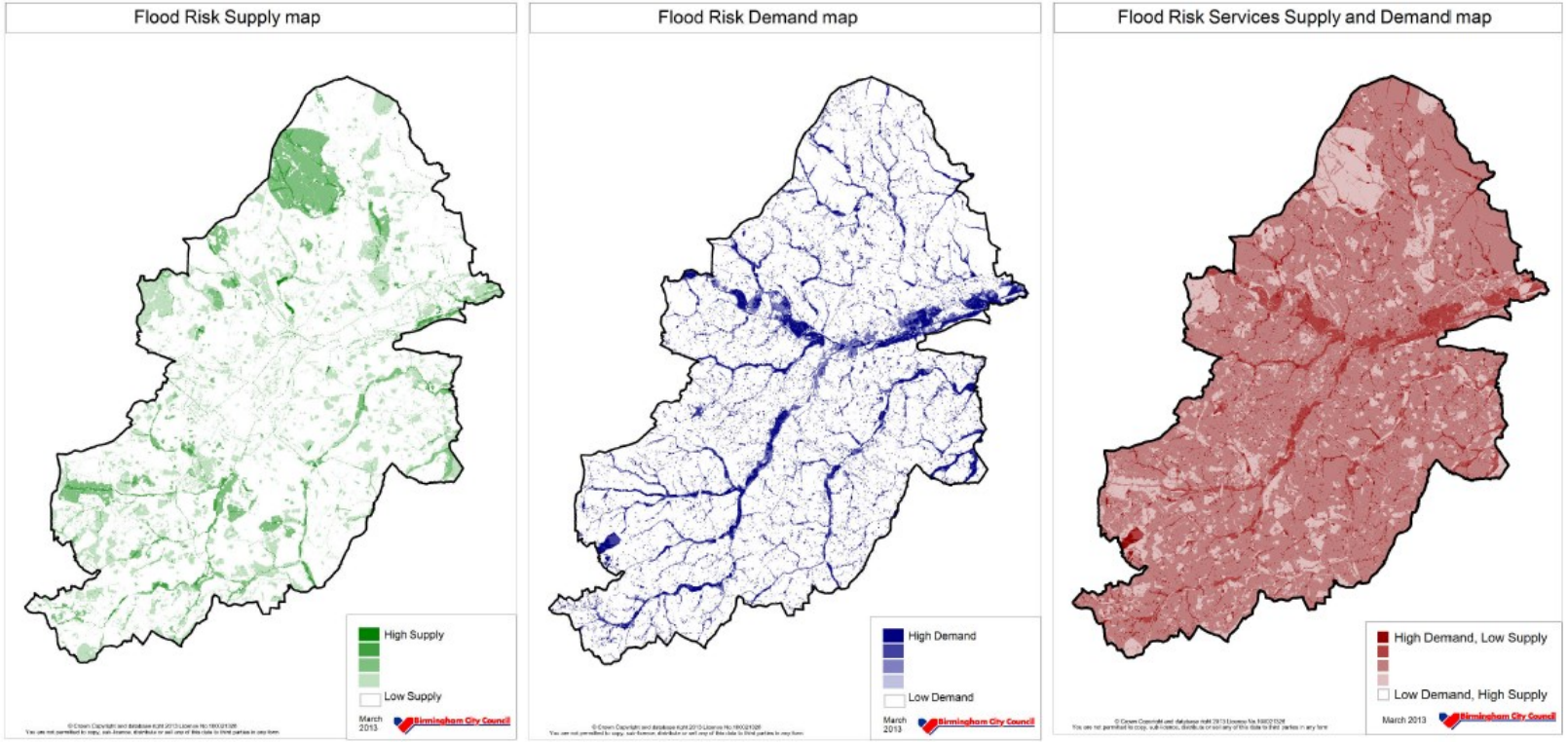


Source: Hölzinger, O., Tringham, N., Grayson, N., and Coles, R. (2013). Multiple Challenge Map for Birmingham: Ecosystem Services Supply and Demand Maps. Appendix 2 to Birmingham's Green Living Spaces Plan 2013, Birmingham City Council, Birmingham.

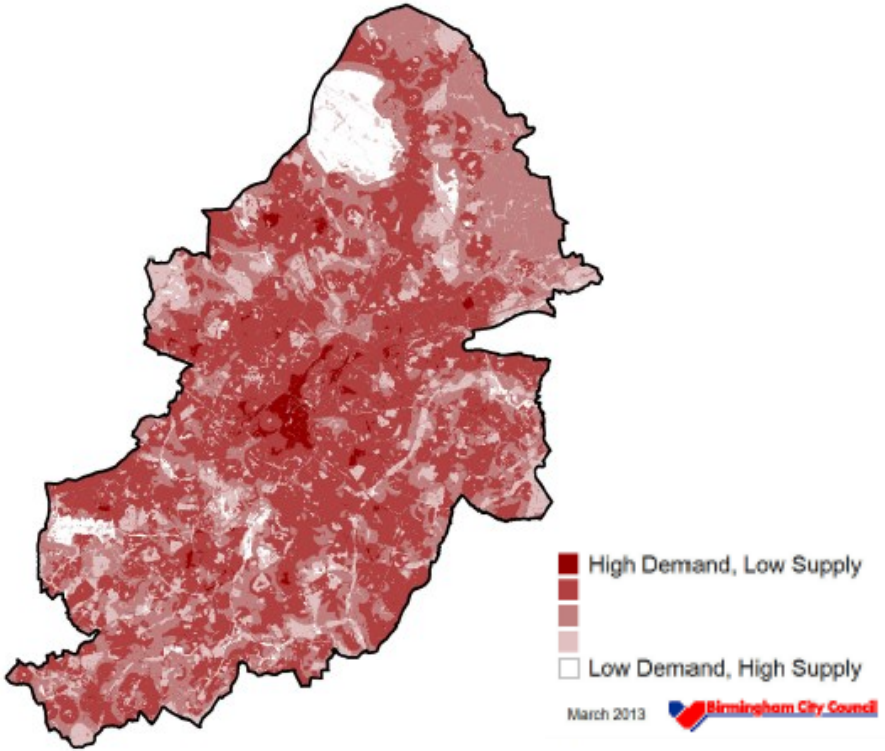
E.g. Maps of Recreation services



E.g. Maps of Flood control



Aggregated ES delivery maps



Source: Hölzinger, O., Tringham, N., Grayson, N., and Coles, R. (2013). Multiple Challenge Map for Birmingham: Ecosystem Services Supply and Demand Maps. Appendix 2 to Birmingham's Green Living Spaces Plan 2013, Birmingham City Council, Birmingham.

The Birmingham plan: monetary valuation

Table 2
Annual value of ecosystem services provided by Birmingham's green infrastructure.

Best guess estimates; annual values; 2011 prices		Woodland	Heathland	Wetland	BAP Priority Grassland	Total
Provisioning Services	Water supply			£0.001 m		£0.001 m
	Wild species diversity	£0.25 m	£0.19 m	£0.10 m	£0.03 m	£0.64 m
Cultural Services	Recreation	£1.42 m	£0.65 m	£0.10 m	£0.10 m	£10.13 m
	Aesthetic values & sense of place	£7.78 m				
	Cultural heritage & spiritual values					
Regulating Services	Flood regulation	£0.76 m	£0.10 m	£0.10 m	£0.01 m	£0.98 m
	Storm buffering					
	Water quality regulation			£0.08 m		£0.08 m
Total		**£10.20 m**	**£0.94 m**	**£0.38 m**	**£0.14 m**	**£11.66 m**
Area of habitat		1.528 ha	310 ha	199 ha	70 ha	2.107 ha
Average value per Ha		£6.678	£3.034	£1.904	£2.005	£5.536

Notes: All values are 'best guess' estimates. Cells left blank can't be interpreted as 'no value'.

Source: Hölzinger, O., ., van der Horst D., Sadler J. (2014). City-wide Ecosystem Assessments - Lessons from Birmingham, Ecosystem Services, 9: 98-105.

TEEB Case Study Cape Town

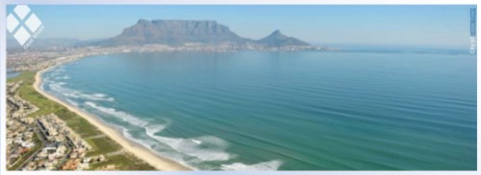
SECTION 2:
HOW TO INCLUDE ECOSYSTEM SERVICES IN DECISION MAKING AND POLICY – THE TEEB STEPWISE APPROACH

This section guides the reader through a set of steps that can be considered and adapted in the process of applying a focus on ecosystem services in urban management. Examples illustrate the ways in which each step has been applied in real-life situations. Note that some examples are used to illustrate several steps. By considering each step, and noting how they have been approached in the past, the reader can formulate an idea of how to approach the relevant step in each specific context.

Briefly, the steps are as follows:

Step 1: Specify and agree on the problem or policy issue with stakeholders
Step 2: Identify which ecosystem services are most relevant
Step 3: Determine what information is needed and select assessment methods
Step 4: Assess (future changes in) ecosystem services
Step 5: Identify and assess management/policy options
Step 6: Assess the impact of the policy options on the range of stakeholders

The explanation of the TEEB stepwise approach below draws on case studies to illustrate the practical implementation of a focus on ecosystem services. The following describes the Cape Town context and its key characteristics that have shaped the implementation and successes of applying a focus on ecosystem services.



Cape Town's clear skies are often attributed to the "Cape Doctor", the prevailing summer wind that helps remove air pollution. Doubtless, this is just one of countless examples of nature contributing to human health and quality of life.

Case Study: Assessing the natural assets of Cape Town, South Africa

Cape Town boasts enviable natural assets including world-class mountains, beaches, green open spaces, wetlands and marine life all within the limits of a bustling metro of roughly 3.6 million people. The city has a relatively well-diversified economy and is a world-renowned tourism destination. In addition, it enjoys the status of a 'global biodiversity hotspot' due to its location in the Cape Floral Region. This broader region hosts almost 9,000 indigenous flowering plant species of which 70% are endemic.

Cape Town's latest State of the Environment report indicates that 60% of its original natural areas have been lost and 30% of the remaining vegetation is considered to be either endangered or critically endangered. Its natural assets are under extreme pressure primarily from land transformation, pollution and aggressive alien invasive plant species and are in need of increased investment and management effort.

Municipal budget allocations are heavily contested in Cape Town especially given the existence of often urgent and competing development needs. In this context, the City's Environmental Management Department thought it was important to be able to assess the 'business' case for increased investment in, and protection of, natural assets. This exercise showed the huge value of ecosystem services for the City of Cape Town and highlighted their crucial role in a number of areas, ranging from tourism, where the link is obvious, to waste-water treatment and protection from natural hazards, where the role of ecosystems can more easily go unnoticed. One of the key lessons of this case is that, apart from the impressive results, it was the process of jointly engaging in the analysis with various municipal departments which was most beneficial.

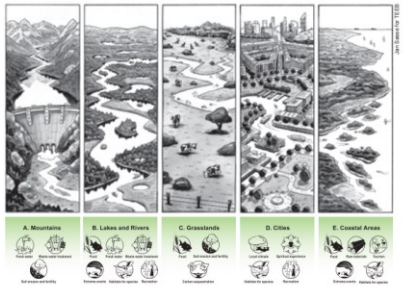
It was valuable to build a shared understanding of Cape Town's ecosystems as natural assets, and thereby prepare the ground for future efforts to better secure their maintenance and protection.

Source: De Wit and van Zyl 2011; De Wit et al. 2009.

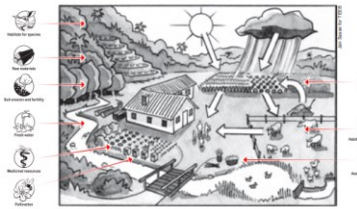
Table 4: Useful questions to identify relevant ecosystem services (Step 2)

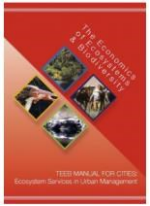
Ecosystem Service	Is this ecosystem service relevant to municipal management or the specific problem at hand?
Food	Is farming (crops, stock or fisheries) one of the economic activities in the city; or are there communities that depend directly on nature for their food?
Raw materials	Are raw materials such as wood, biofuel or fibre, produced in the city; or are there communities that depend directly on nature for such materials?
Fresh water	Are there water reservoirs, rivers or other water bodies in the city, that supply drinking or irrigation water? Are the catchment (watershed) areas feeding these water bodies located partly within the city?
Medicinal resources	Are there populations of wild or domesticated plants or animals in the city, which have medicinal value or are likely to have medicinal potential?
Local climate	Are trees and other vegetation in the city considered to be important for shade or more broadly for regulating the heat produced in built-up areas?
Carbon sequestration	Are trees and other vegetation being planted and maintained in the city, especially in built-up areas?
Extreme events	Does the city contain any wetlands, mangroves, coral reefs; or other ecosystems that can mediate the effect of extreme weather events such as drought, fire, floods and rough seas?
Waste-water treatment	Is the city reliant on water filtered through wetlands before entering reservoirs, thereby saving on costs of artificial purification?
Soil erosion and fertility	Does the city contain steep slopes that have good vegetation cover to slow the flow of rainwater and protect the soil?
Pollination	In the city, is crop farming practiced, which relies on animals (insects in particular) for pollination (for example most fruits and vegetables)?
Biological regulation	Are species present in the city, which control pests that endanger human health; or are there any crops for which pest control is delivered by predator species?
Habitats for species	Does the city contain ecosystems that are healthy enough to support a variety of wild species?
Habitats genetic diversity	Are there endemic species in your city which depend on ecosystems to maintain their genetic diversity, or are there typical rare cultivars or local varieties of species grown in your city?
Recreation	Do many citizens regularly use nature (forests, parks, etc.) within the city for recreation; or, is there potential to develop such nature-based recreation?
Tourism	Does the natural beauty of the city attract visitors to the area?
Aesthetic appreciation	Do the citizens appreciate the natural beauty of the area? This may be indicated by people enjoying natural areas respectfully; or taking photos or painting scenery.
Spiritual experience	Are religions, practiced within the city, dependent on natural areas; or do any of these natural areas have particular religious significance?

Examples of ecosystems and a few of the services they provide



Agriculture practices impact on, and are influenced by, the wider ecosystem and its services





Source: http://teebweb.org/publications/other/teeb-cities/

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Hands-on Environmental Urban Planning

Task: Analyze the Skarpnäck district and map existing **problems**, focusing in of the **4 key socio-environmental challenges:**

CH 1: Urban heat island

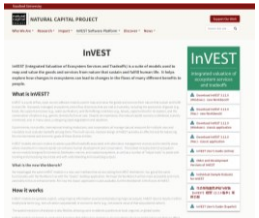
CH 2: Loss of biodiversity

CH 3: Flooding risks

CH 4: Social cohesion & Quality of life

Source:

- Stockholm City Plan, 2018 + Vision
- Geodatabase
- Relevant publication – Literature review
- **ESMERALDA MAES Explorer** Link
- **InVEST modelling** NatCap Link



Sustainability **2015**, *7*, 6872-6892; doi:10.3390/su7066872

OPEN ACCESS

sustainability

ISSN 2071-1050

www.mdpi.com/journal/sustainability

Article

Teaching Scenario-Based Planning for Sustainable Landscape Development: An Evaluation of Learning Effects in the Cagliari Studio Workshop

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Academic Editor: Marc A. Rosen

Received: 19 January 2015 / Accepted: 19 May 2015 / Published: 28 May 2015

Abstract: This paper investigates the contributions of an intensive educational workshop to advance students' understanding and skills for collaborative, scenario-based landscape planning. The research design involves a case study workshop with thirty international students and several regional experts as well as a multi-stage, in-process evaluation. The workshop resulted in six different alternative futures for the region of Cagliari, Italy, and a seventh combined version that was considered best by regional reviewers. The students' learning evaluation showed substantial advances in their relevant understanding and skills. Key aspects of the workshop pedagogy and the evaluation are discussed, and recommendations for future applications presented.

Hands-on Environmental Urban Planning

Each Team prepares a **10 min presentation**, based on its **Problem Analysis** in the Skarpnäck district using the lens of the selected **socio-environmental challenges**

Imagine that you are presenting to an audience that knows nothing about your study/project, so try to **provide all necessary elements** so that they are able to follow and provide feedback

You may consider making **a joint presentation**: given that most of the background information is the same (e.g. Swedish Planning System, Stockholm City Plan, and Vision, Skarpnäck etc.)

Thank You

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Suggested readings

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