URB401: Systems Approaches for Urban Transitions

Courtesy of UN-Habitat and Global Utmaning

Multifunctional Approaches through Ecosystem Services

Beate Jessel

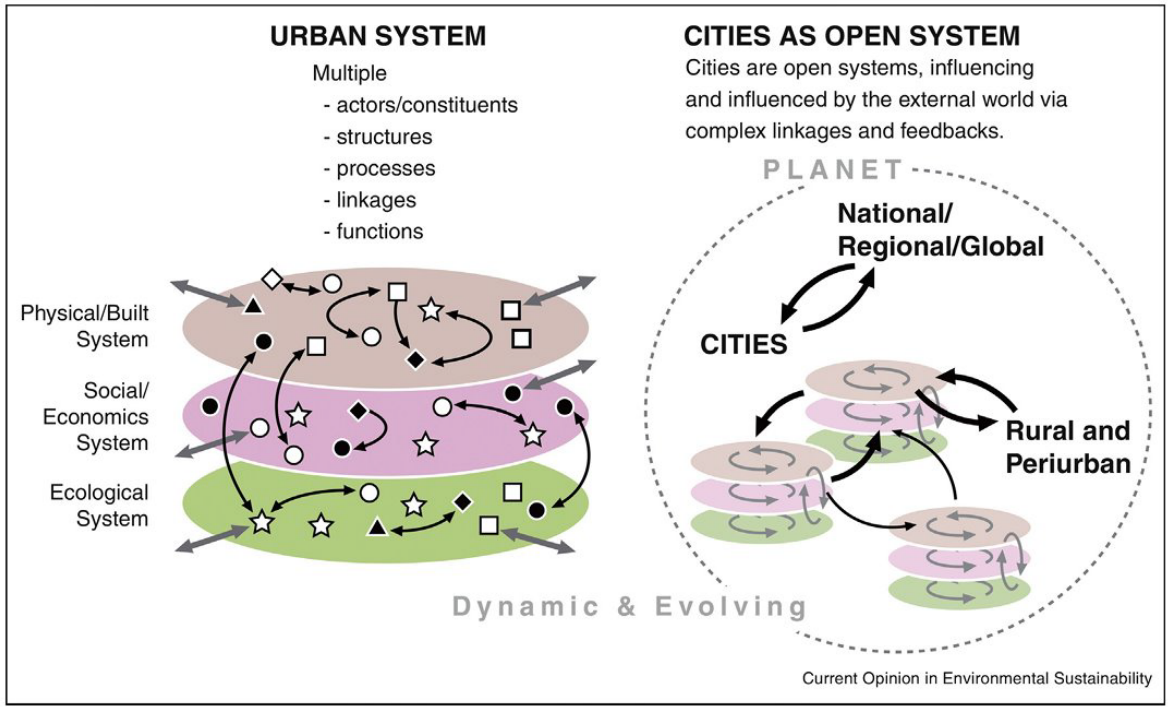
November 5, 2025

Course syllabus

Lectures 9:00-11:00
GC D0 386

Part	Week	Date	Teacher	Lecture
Part I: Urban transitions from a systems perspective	**1**	Sep 10	Hecher	Introduction to the course **Special guest:** Poetic transitions in the case of a historical architectural and urban design (Darius Karácsony)
	2	Sep 17	Hecher	Systems thinking for sustainable urban transitions
	3	Sep 24	Hecher	**Special guest:** Leverage points in the housing system (Anna Pagani)
	4	Oct 1	Binder	Transition research in urban systems
	5	Oct 8	Binder	Urban metaphors and urban metabolism
Part II: Social perspectives of urban transitions	**6**	Oct 15	Hecher	Social innovation and urban niches
	7	Oct 29	Hecher	Social acceptance in cities
Part III: Urban infrastructure and ecology in cities	**8**	Nov 5	Jessel	Multifunctional approaches through ecosystem services
	9	Nov 12	Jessel	Combining green-blue-grey infrastructures: Large-scale approaches (city level)
	10	Nov 19	Jessel	Combining green-blue-grey infrastructures: Small-scale approaches (building and neighborhood level)
Part IV: Policy and governance for urban transitions	**11**	Nov 26	Montfort	Multi-level embedding of cities: From global governance to scope for action in cities
	12	Dec 3	Montfort	Climate solutions in different types of cities
	13	Dec 10	All	**Special guest:** Urban transition processes in practice (Anton Sentic)
	14	Dec 17	All	Presentation City Lab projects

Recap: Cities are interconnected social–ecological–technological systems



Bai et al. (2016). Defining and advancing a systems approach for sustainable cities. Current Opinion in Environmental Sustainability, 23, 69–78. https://doi.org/10.1016/j.cosust.2016.11.010

Key Questions

- How can the ecological perspective be integrated into systems approaches for urban transitions?
- In what ways are ecological systems interconnected with social, and technological systems, and how can the ecosystem services approach be used to explore these connections?
- Why are multifunctional approaches necessary for urban transformation?
- What can the ecosystem services approach contribute to systems approaches for urban transitions?
- What lessons have been learned from a case study?

Two initial premises:

- Cities as interconnected social-ecological-technological systems
- Space/land as a scarce resource in cities – need for multifunctional approaches

Urban Systems as interconnected networks

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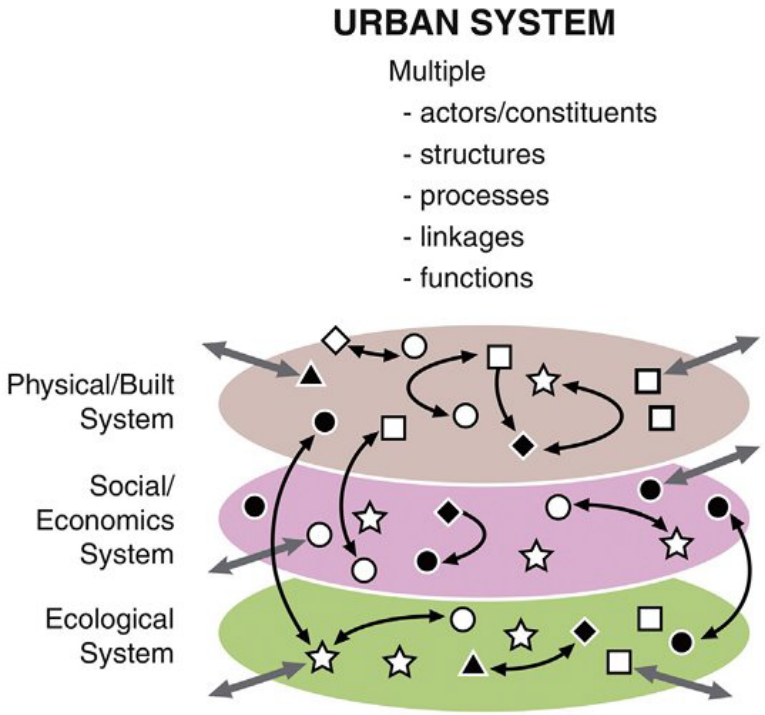

Bai et al. 2016

a. Economic – Ecological

e.g.

- Economic growth may foster resource extraction, energy use and waste generation
- Green economies (renewable energy, circular economy models) can reduce ecological footprints
- Real estate and industrial development can either destroy natural ecosystems or fund restoration and sustainable design

b. Technological – Ecological

e.g.

- The production and disposal of high-tech-equipment contribute to electronic waste and resouce depletition
- Howecer, smart technolgies (e.g. sensors for water and waste management) can improve efficiency and reduce pollution
- Transport innovations (electric vehicles, public transit system) reduce air pollution and carbon emissions

Urban Systems as interconnected networks

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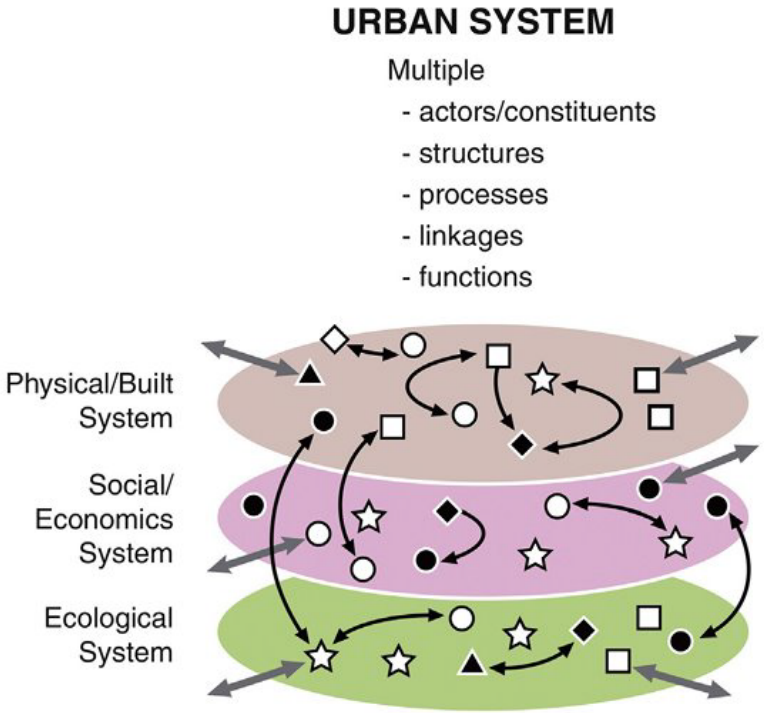


Bai et al. 2016

c. Socio – Ecological

e.g.

- Urban expansion to meet housing demands leads to habitat loss and fragmentation
- Public green spaces improve mental health and social cohesion, while also providing heat cooling, water retention and biodiversity support
- Environmental justice: Lower-income communities often live in more polluted or ecologically degraded areas

d. Socio – Economic - Technical

e.g.

- Urbanization -> demand for housing and jobs (social & economic) -> higher use of resources and energy (technological) -> increased emissions, water stress and heat islands (ecological)
- Conversely, urban sustainability planning (like green buildings, transport innovations, renewable energy) improves urban ecosystems and quality of life

Different Perspectives on Sustainability Transitions

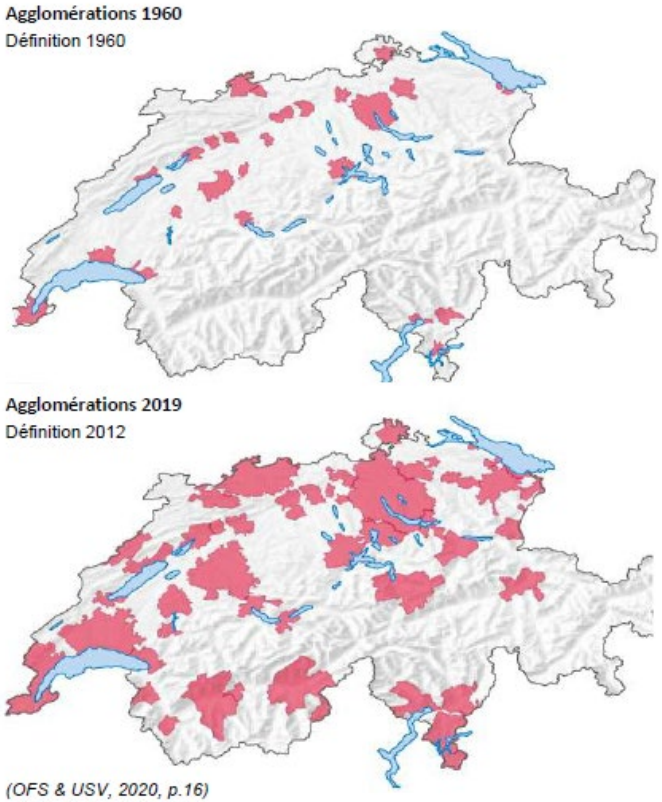
	Socio-technical	Socio-institutional	Socio-ecological
Disciplines	Innovation studies, history, technology, science and technology studies, practice theory	Sociology, governance, policy, economics, geography, political science	Ecology, biology, governance
Focus	Technology in social context Analysis of (historical) innovation journeys	Institutions, agency, power Analysis of networks, social innovation and governance	Ecology and socio-ecological relations Analysis of system vulnerability and transformative capacity
Main analytical lenses	Seamless web, multilevel perspective, path dependency, strategic niche management	Culture, structure, and practices; power in transition; transition management, multi-actor perspective	Panarchy, resilience, adaptive and transformative capacity, navigating, planetary boundaries
Approach to the energy transition	Emphasis on technological innovation, e.g., transition from combustion engine to electric car or from coal-fired power plants to solar panels in a societal context through dedicated innovation policy	Emphasis on political and institutional change, e.g., from central to decentral energy production as a shift in power from centralized monopolies to decentralized networks through countermovement and disruption	Emphasis on ecological thresholds and extraction of fossil resources to renewable resources within closed cycles through adaptive management

Loorbach, Frantzeskai & Avelino 2018

We cannot grasp complex systems (e.g. urban systems, landscapes) as a whole, but we must try to interpret them as a whole.

(Jessel 1998)

Urban Development and Metropolisation



(OFS & USV, 2020, p.16)

Findings for Switzerland (OFS & USV 2020)

- The Swiss population has **more than doubled between 1920 and 2020** and is expected to increase further to more than 10 million by 2050. The growth has been **primarily concentrated in the urban areas**.
- In 1950, **45%** of the Swiss population (2,1 million) lived in urban centres (24 agglomerations)
- In 2018, **77%** of the Swiss population (8,9 million) lived in urban centres (49 agglomerations)
- Between 1950 and 2019, Switzerland's urban space increased from **5%** to **28%** of the land

Need for multifunctional approaches for the transformation of cities

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Complex challenges require integrated solutions:

- Cities simultaneously face ecological, social, economic, and technological problems – A multifunctional approach allows for the pursuit of multiple goals at the same time.
- Maximizing limited urban space: Space is limited in densely populated cities – Multifunctional planning uses areas more efficiently (e.g., parks that also serve as retention areas for heavy rainfall).
- Promoting social integration and resilience – Multifunctional spaces bring different groups together and create places for interaction.
- Interlinking policy areas and governance – Multifunctional approaches compel administrations to think across sectors and act cooperatively.

> Multifunctional approaches are necessary because they do not reduce complexity, but actively shape it.

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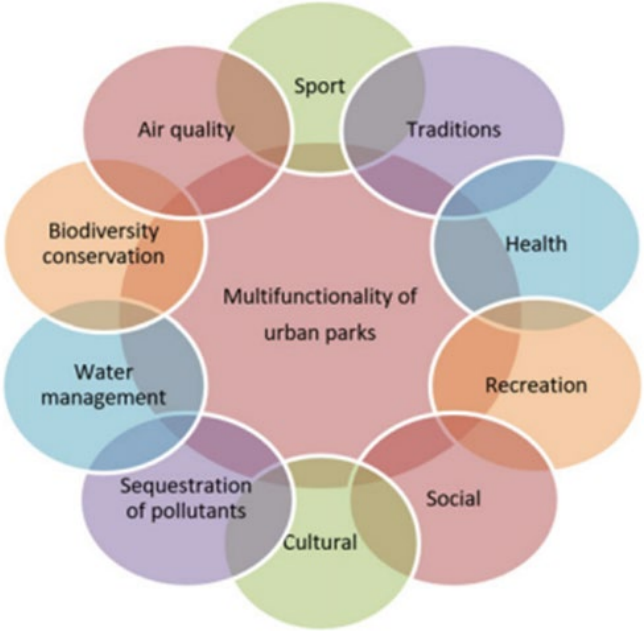
Multifunctionality of urban space



Breuste et al. 2023

Important to consider urban (green) spaces from an integrated perspective that includes ecological, social and economic dimensions.

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Urban Ecosystem Services

Ecosystem Services – "The benefits that people obtain from nature" (MEA 2005)

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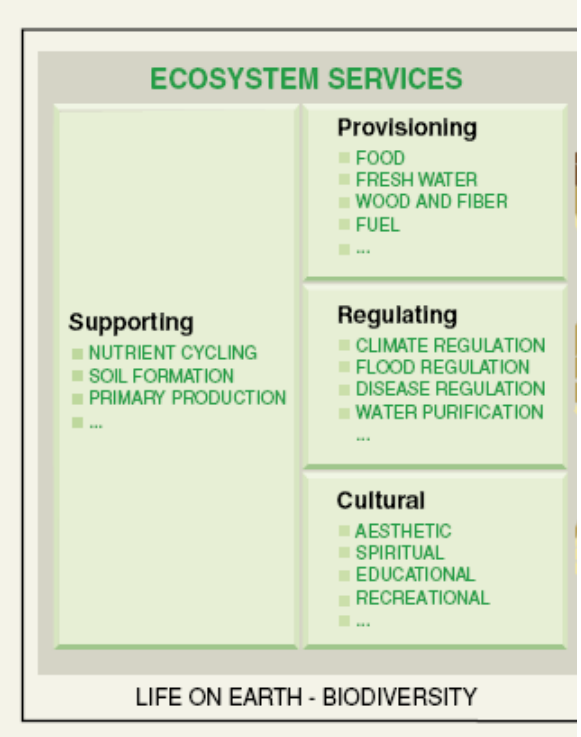
Provisioning Services
Products obtained from ecosystems

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



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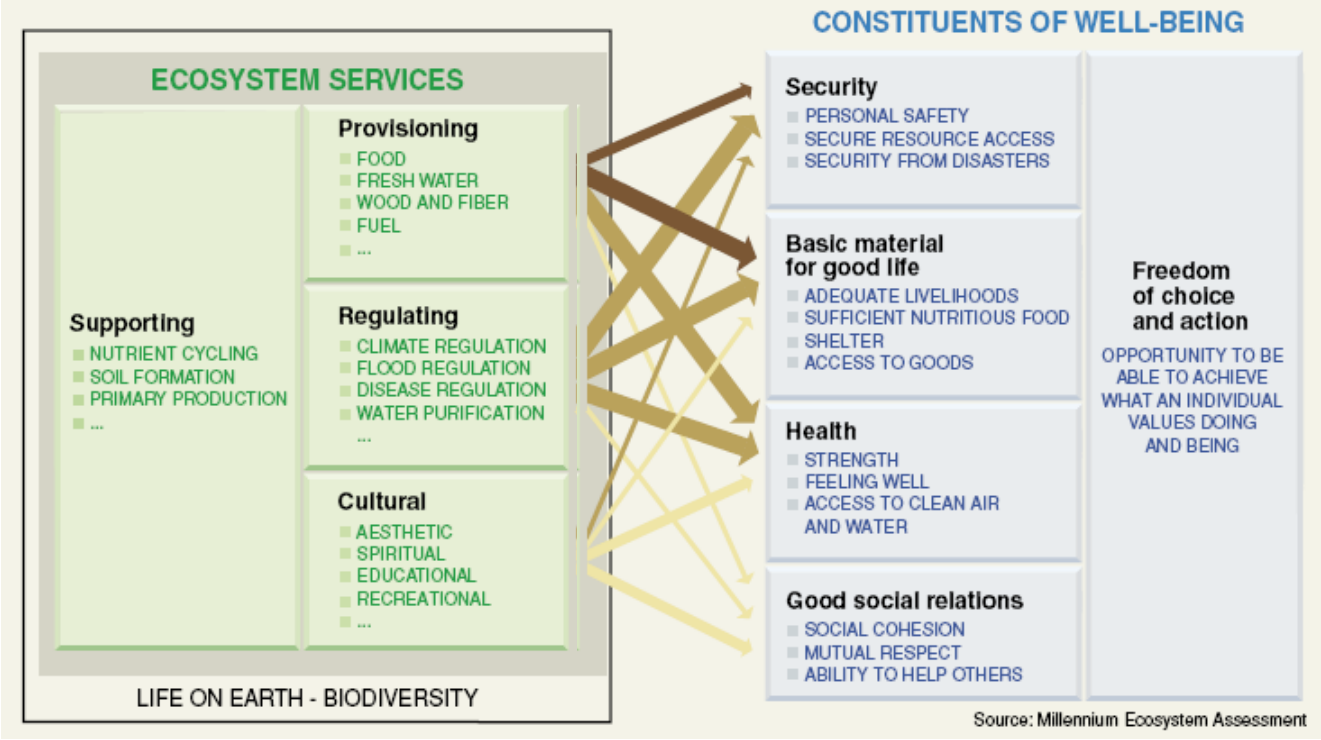
Ecosystem Services – "The benefits that people obtain from nature" (MEA 2005)



Linking the ecological with the social system

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Services provided by urban ecosystems

Provisioning services

Nutrition, food
(e.g. urban agriculture)
Drinking water
Genetic resources

Regulating services

Reduction of air pollution
Climate regulation
Regulation of water balance
Protection from natural disasters

Cultural services

Aesthetic values
Recreation
Education
Identification
Cultural heritage

Supporting services
Habitat for species, maintenance of genetic diversity, formation of urban soils

➢ **In urban areas, regulating and cultural ecosystem services are particular important.**

Different types of urban green spaces provide different Ecosystem Services

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	Street tree	Lawns/ parks	Urban forest	Farm-land	Wet-land	River/ creek	Lake/ sea
Air purification	x	x	x	x	x		
Microclimate regulation	x	x	x	x	x	x	x
Noise reduction	x	x	x	x	x		
Rainwater drainage		x	x	x	x		
Wastewater treatment					x		

…using the example of Stockholm and considering regulating services (Breuste 2022, after Bolung and Hunhammer 1999)

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Ecosystems can also produce disservices = Negative effects on human wellbeing

Examples of Ecosystem Disservices in Urban Areas

(compiled and modified from Gómez-Baggethun, E. et al. (2013).

Category	Description	Examples
Health-related disservices	Natural elements can trigger allergies or spread diseases.	• Pollen from trees and grasses causing hay fever and asthma. • Stagnant water in parks and drains breeding mosquitoes → dengue, malaria. • Bird droppings spreading pathogens
Safety and infrastructure impacts	Natural growth or processes can damage urban structures or pose physical hazards.	• Tree roots cracking sidewalks, roads, and building foundations. • Falling branches during storms damaging cars or injuring people. • Leaf litter blocking drains → urban flooding.
Aesthetic and nuisance issues	Some natural features cause discomfort or inconvenience to city dwellers.	• Noise from birds (like crows or parakeets). • Odor from decaying vegetation or algae in ponds. • Wild animals (monkeys, rats, stray dogs) damaging property or creating fear
Economic disservices	Costs incurred in managing or mitigating natural effects.	• Maintenance costs for cleaning fallen leaves, pruning trees, or managing invasive species. • Crop damage in peri-urban gardens from wildlife.
Environmental trade-offs	Some “green” solutions can have unintended consequences.	• Urban trees increasing humidity or shading solar panels. • Green roofs attracting pests or increasing water use

- ➢ **Recognizing disservices helps urban planners balance benefits and risks**

“Princess Gardens”, Berlin

Kowarik et al. / TEEB DE (2017), Photographs: Marco Clausen

A litter-stream wasteland in Berlin-Kreuzberg….

….that was transformed into an urban gardening area through the initiative of the residents

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"Princess Gardens", Berlin

Not just a food garden, but a multifunctional urban ecysystem

What ecosystem services are provided by this area?

Cultural services, e.g.

- Social interaction & community building – the garden as a meeting place
- Education and learning - publicly accessible harvesting and educational opportunities
- Aesthetic and sense of place – enhancing the visual and experimental quality of the neighbourhood
- Cultural identity & participation – supporting citizen-driven initiatives

Provisioning services, e.g.

- Food production (urban agriculture, bees – honey production)
- Seeds and seeds diversity – sharing and maintainig seeds diversity is actively promoted

Regulating services, e.g.

- Urban heat island mitigation
- Rainwater infiltration
- Air quality improvement
- Humus-rich soils contribute to carbon storage

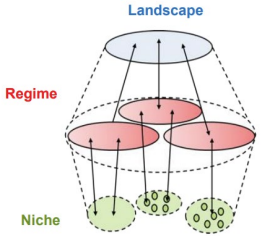
Supporting services, e.g.

- Resource and circular economy (composting, use of recycled materials)
- Promotion of biodiversity
- Improving soil fertility, sustaining nutrient cycles

Kowarik et al. / TEEB DE (2017), Photographs: Marco Clausen

"Princess Gardens", Berlin

Management and operation of the Princess Gardens



Geels 2002

Previously a 6000 square meter vacant lot for 60 years.

- *A typical niche project that came into being in 2009 thanks to the motivation and initiative of local citizens.*
- *Gained international recognition and triggered numerous other initiatives.*

In 2012, the land was to be sold by the city of Berlin to an investor - was stopped by a citizen campaign.

- *The positive external effects for the district and the city were estimated as more valuable than the real estate value (estimated at 4,5 million €, i.e. 750.- € per square meter)*

Decision by the Berlin Senate (at the state level) to return the property to the district so that the district can make further decisions.
The area is managed by an NGO, which receives a usage permit from the district for five years at a time.

- *Choosing the appropriate level of action and a collaboration between civil society and public administration are important.*

Kowarik et al. / TEEB DE (2017), Photographs: Marco Clausen

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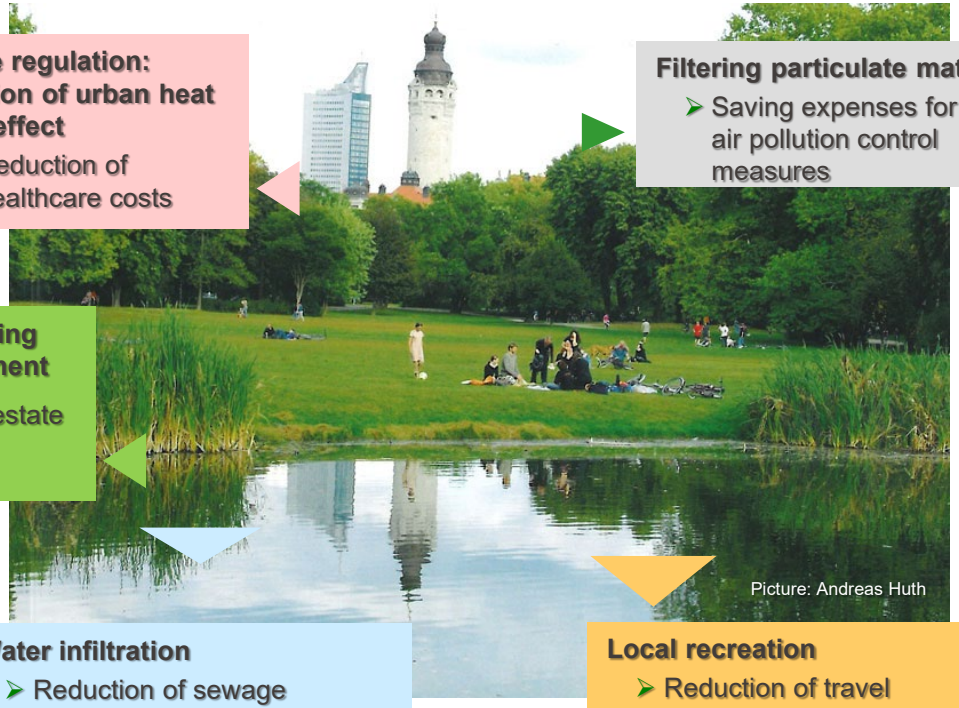
Valuation of Ecosystem Services

In cities, many of these services are often invisible or underestimated.

Incorporating ecosystem services valuation into cost-benefit and decision analysis

- links ecological functions to urban policy and governance
- helps to make non-market values and common goods visible and to integrate them into decisions.



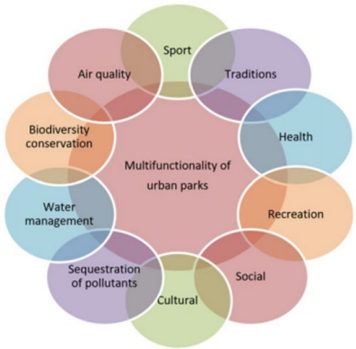
Implementing multifunctional approaches by considering different services

Some Examples

- **Growing food in the city** – in gardens, on balconies and in public spaces – not only helps people to become partially self-sufficient, but also promotes an awareness of regional products and a healthy diet.
- **Urban nature is a location factor.** A green city is an attractive location for companies and a popular place to live. Environmental quality, leisure value and an attractive living and working environment are significant »soft factors« in location decisions.

Extensively designed green spaces also **save maintenance costs and benefit employees' health, motivation and performance**, as well as the company's image.

City residents are often more exposed to excess temperatures, fine dust (particulate matter) and noise than rural inhabitants. These environmental pressures can impair human health and cause elevated sickness and mortality rates. They limit quality of life and incur major costs to society, especially for healthcare. Urban nature, and particularly its regulating ecosystem services, can help to minimise these environmental pressures.



(according to Kowarik et al. 2017)

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Role of Ecosystem Services in Systems Analysis for Cities

Examples of indicators and proxies for measuring urban Ecosystem Services

Provisioning services, e.g.

Food Provision
- Food supply, production of food (t/year)

Freshwater Provision
- Volume of harvested rainwater (m3 per year)
- Water flow from surfaces (in m3/year)
- Area covered by green roofs with water reuse systems (ha)

Raw materials
- Biomass harvested from urban green spaces (tons/year)
- Proportion of recycled green waste (%)

Regulating services, e.g.

Air Quality Regulation
- Concentration of PM2,5 and NO_2, absorbed by urban vegetation (tons/year)
- Area of green infrastructure within 300m of roads (ha)
- Modeled reduction in air pollutants due to vegetation (%)

Climate Regulation
- Urban vegetation carbon storage (tons C/ha)
- Leaf area index
- Urban heat island intensity (% difference between green and built-up areas)
- Percentage of sealed surfaces in the city (%)

Water Regulation and Flood Control
- Green surface ratio or blue-green infrastruture index (%)
- Stormwater retention capacity (m3 per ha)
- Soil infiltration capacity (% sealed relative to permeable surface/ha)

Noise regulation
- Vegetation buffer length along transport corridors (km)
- Average sound level reduction due to green barriers (dB)

(compiled and modified from Gómez-Baggethun, E. et al., 2013).

Examples of indicators and proxies for measuring urban Ecosystem Services

Cultural Services, e.g.

Recreation and Aesthetic value
- Green space area per capita (m^3/inhabitant)
- Percentage of residents within 300m of a public green space (%)
- Number of park visitors per year
- Perceived satisfaction with urban green spaces (survey-based)

Cultural Heritage and Sense of Place
- Number of scenic or heritage trees/sites
- Residents cultural ecosystem service perception (survey-based)

Education and knowledge
- Number of environmental education programs linked to urban nature
- Area of urban nature reserves used for education (ha)

Supporting services, e.g.

Habitats and Biodiversity
- Species richness (e.g. plants, bird, pollinators) per ha
- Percentage of ecological corridors connected to green spaces (%)
- Shannon diversity index of urban vegetation
- Area of natural/semi-natural habitats in urban boundaries (ha)

Soil Formation and Quality
- Percentage of sealed surfaces (%)
- Soil permeability index

Water Cycle Support
- Groundwater recharge rate (mm/year)

➢ **Use bundles of ecosystem services (and related indicators) to make synergies and trade-offs visible**

(compiled and modified from Gómez-Baggethun, E. et al. (2013).

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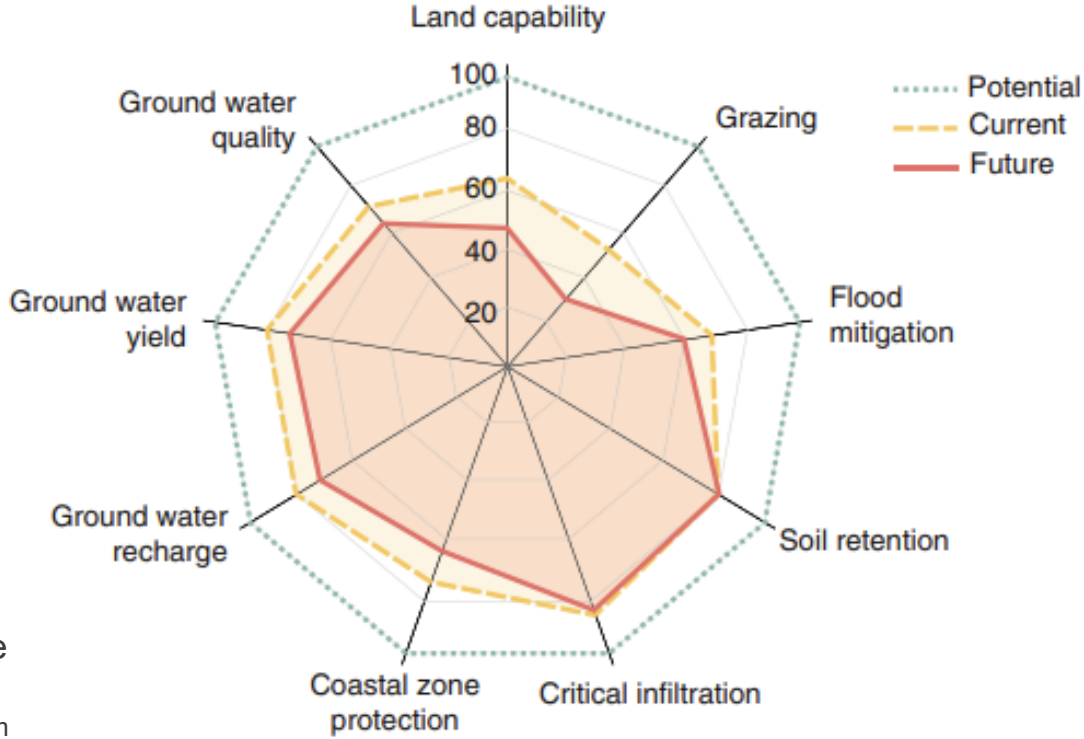
Changes in Ecosystem Services Supply for Cape Town

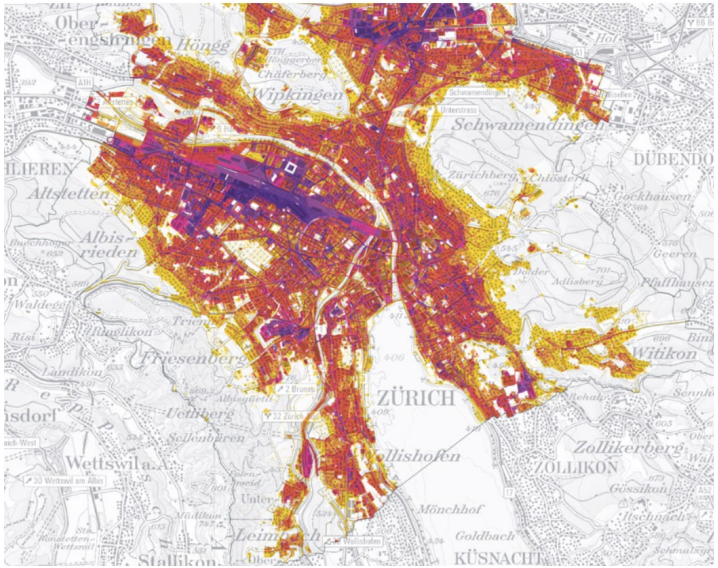


Present and potential changes in ecosystem service supply for Cape Town, shown as a percentage of the potental service produced
(Gómez-Baggethun, E. et al. 2013, modified from O'Farrell et al. 2012)

Integrating Ecosystem Services into a System Analysis
Example: Urban Climate Analysis

Initial Situation

In the summer months, cities are increasingly suffering from urban heat islands, i.e., areas where temperatures are significantly higher than in the surrounding areas. As part of a system analysis for urban planning, the aim is to investigate how different components – buildings, traffic, vegetation, and bodies of water – interact with each other and how they influence the urban climate.



Heat stress in urban areas, using Zurich as an example, at 2:00 PM
(AWEL Kanton Zürich, Züricher Kantonalbank, 2022)

System Analysis

View the city as a complex system consisting of various subsystems that interact with each other:
Social system: e.g., population, usage patterns, quality of life
Technical system: e.g., buildings, streets, energy and water supply
Natural system: e.g., green spaces, soils, bodies of water, air

Integrating Ecosystem Services into a System Analysis Example: Urban Climate Analysis

Integrating Ecosystem Services into the Analysis

Category	Exemplary ES	Contribution to Systems Analysis
Regulating Service	Temperature regulation through urban trees and parks	Modeling how vegetation mitigates heat islands
Provisioning Service	Local food production in urban gardens	Analysis of regional material flows (e.g., water requirements)
Cultural Service	Recreational spaces, aesthetic and health value of green spaces	Assessment of quality of life and social use, accessibility as a component of environmental justice
Supporting service	Soil formation	Analysis of the contribution of urban soils to runoff reduction and water retention

Exemplary analysis results

By including ecosystem services, urban planning can recognize that:

- Green spaces create microclimates that are several degrees Celsius cooler
- Urban trees sequester several tons of CO_2 annually
- Natural retention areas reduce flood risks
- Access to nature experiences improves mental health and thus overall resilience

Without considering these services, the analysis would be incomplete, as key aspects that influence the urban climate would be missing.

What role can ecosystem services play in systems analyses?

1. System definition and structuring

Ecosystem services help identify relevant system components and relationships. They reveal how ecological processes (e.g., soil formation, photosynthesis) are linked to social processes (e.g., agriculture, energy production).

2. Flow analysis and material cycles

In material and energy flow analyses, ecosystem services are modeled as inputs, outputs, or feedbacks (e.g., carbon sequestration, nutrient cycles). This allows dependencies and bottlenecks in the system to be identified.

3. Evaluation and decision support

Ecosystem services enable the quantitative or qualitative evaluation of environmental impacts and measures. They are integrated into cost-benefit analyses, life cycle assessments (LCAs), or multi-criteria analyses to identify sustainable options for action.

4. System Dynamics and Feedbacks

Ecosystem services operate in feedback loops: For example, if land use reduces biodiversity, pollination services also decline in the long term → which in turn affects agriculture. In systems analysis, such feedback effects are modeled to understand nonlinear developments (e.g., tipping points).

5. Scenario and Transformation Analyses

When developing future scenarios or sustainability pathways, ecosystem services are used as indicators to show how changes in the system (e.g., climate change, policy measures) affect well-being.

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Case Study: Ecosystem Services in the Social-Ecological Transitions of the City of Lodz

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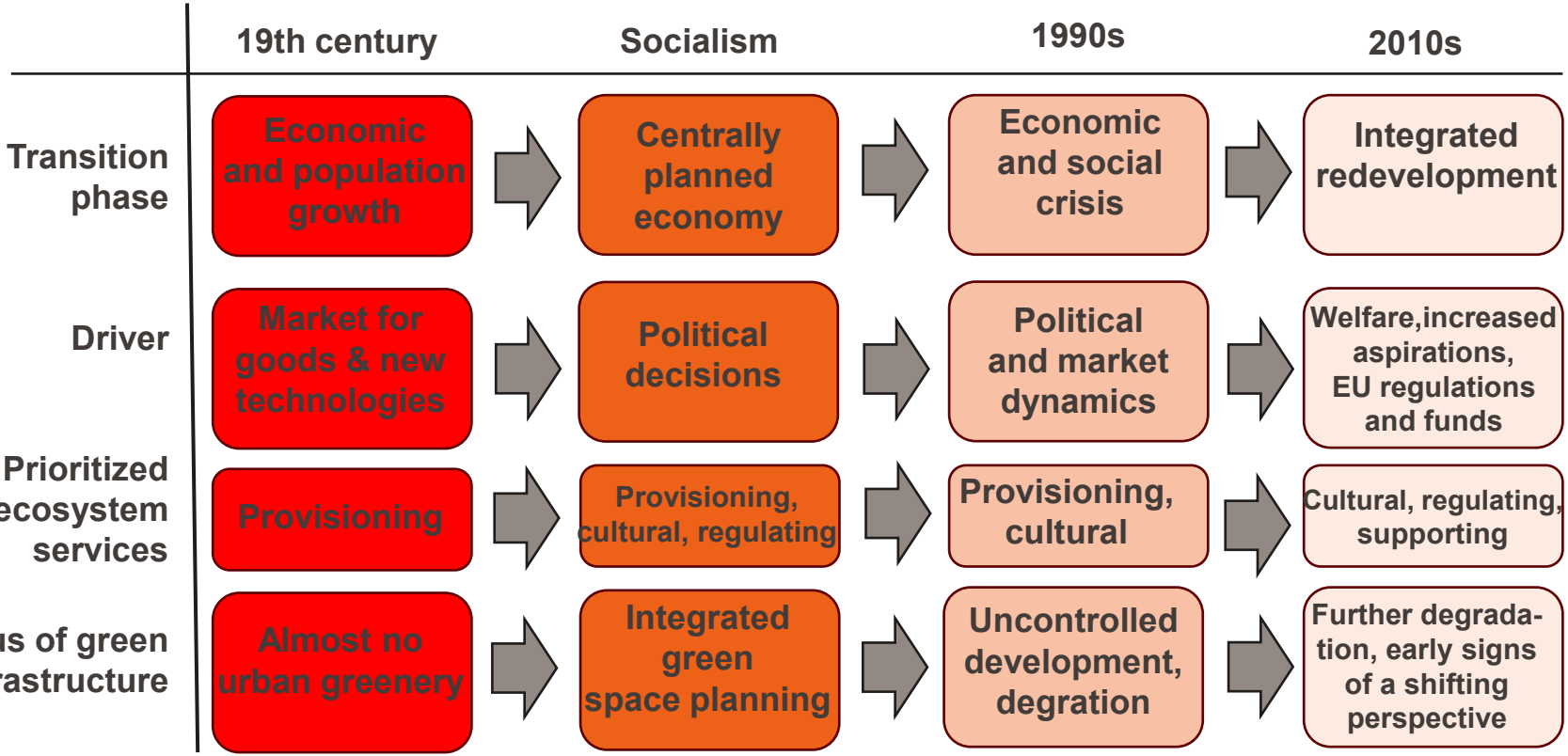
Lodz in Transition (Kronenberg et al. 2017)



Major transition phases experienced by Lodz (Kronenberg et al. 2017)

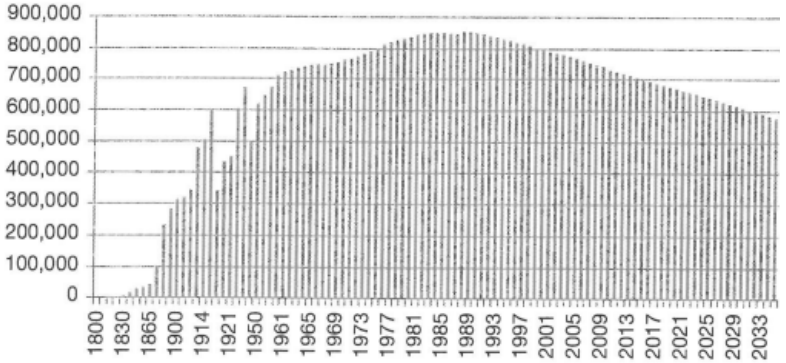
Lodz – Facing a shrinking population

Migration of the upper and middle classes from the central district to the suburbs in search for a better quality of life.

- Despite its decreasing population, the city continues to sprawl over the city borders

Central city population (with lowest quality of life) – has halved between 1960 and 2011,
in districts with better living environments – population increased by up to 61%

- Growing discrepancies



Population of Lodz (Kronenberg et al. 2027)

Lodz – Current Challenges (from ecological perspective)

Natural resources (forests and waterways) formed the basis for rapid growth and industrialization in the past.

Nowadays:

- Legacy industrial fabric and large-scale regeneration needs:
  > Large areas of former textile industry and brownfields which have to be converted and require complex regeneration
- Water management, flood risk and degraded urban waterways
  > Historical canalization of rivers and low water retention raise flood risk during heavy precipitations and reduce resilience to drought
- Urban heat island & lack of connected green space
  > Dense built-up areas, loss of soil moisture and limited green corridors contribute to heat stress
- Poor air quality, urgent need for improvement
  > Air quality is among the worst in Poland, due to residential coal-fire heating and old buildings

https://iclei-europe.org/member-in-the-spotlight/lodz#:~:text=The%20city%20of%20%C5%81%C3%B3d%C5%BA%20has%20also%20taken,*%20**Installing%20photovoltaic%20systems%20on%20public%20buildings**

https://worldofdecay.blogspot.com/2016/11/mills-of-odz.html

How have ecosystem services been included in Lodz's urban development discourse? (Kronenberg et al. 2017)

1. Balancing Greater and Inner City Development

- Creation of a network of 19 protected areas within the city borders ("Green Treasures of Lodz"). Established to maintain or restore habitats + green corridors (> supporting services) and to protect landscape beauty (> cultural services).

  But: All of the areas are located at the outskirts of the city, lacking a comprehensive system of green infrastructure that would them link with the centre.

- A proposal for a Blue-Green-Infrastructure Network that was developed within an EU project and which had a broader focus, also including regulating services (stormwater management, regulating humidity, air quality and microclimate) was only partially included into subsequent Spatial Development Master Plans.

- Due to the declining population, many vacant lots + brownfields within the built-up areas could be reused, but no suitable incentives to prevent further urban sprawl.

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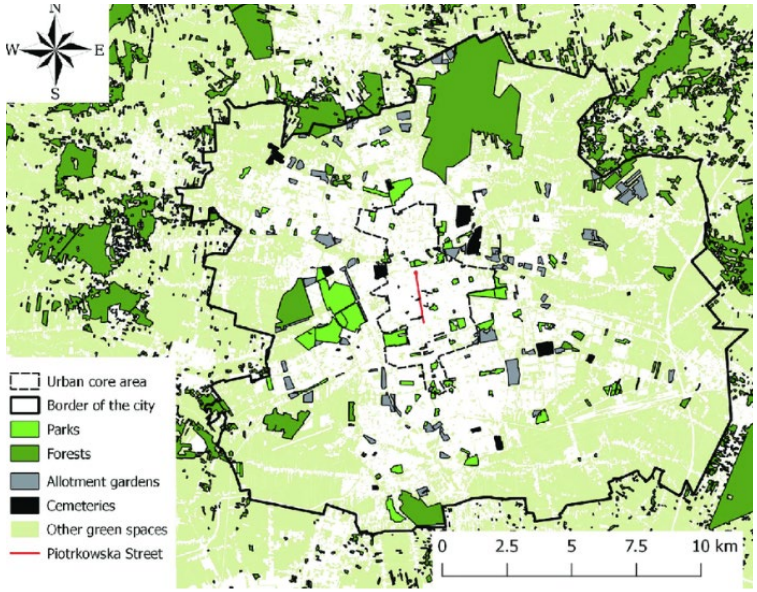
How have ecosystem services been included in Lodz's urban development discourse? (Kronenberg et al. 2017)



Distribution of urban green spaces in Lodz (Koprowska et al. 2020)

2. Balanced perspectives on different urban ecosystems

Urban planning focuses on a few large green spaces and parks, such as the Lagiewniki Forest (approx. 1200 ha). Other important urban ecosystems such as agricultural areas, allotment gardens, and cemeteries are only given little attention, other components of the green infrastructure, such as green wedges, are not considered at all.

Information on street greenery is restricted to the affirmation that it "is very important in an urban context", followed by the succinct observation that the number of trees in Lodz is constantly decreasing.

➢ *Only high diversity of green infrastructure components may provide a variety of ecosystem services which are best suited to different parts of the city.*

How have ecosystem services been included in Lodz's urban development discourse? (Kronenberg et al. 2017)

3. Focus on the Future

Documents guiding the decisions of the Lodz authorities regarding environmental issues pay a lot of attention to the past, but focus comparatively little on the future ("recycling of existing information").

No future-oriented sensitivity and vulnerability assessments.

Lack of comprehensive cause-effect and risk analysis based on a deep understanding of the consequences of socio-economic transformations for environmental quality and vice versa.

- *Analysis combining insights from long-term observations with predictions of the consequences of current political measures and failures are required (e.g., impacts of the increasing fragmentation of urban green spaces on social and ecological factors).*

How have ecosystem services been included in Lodz's urban development discourse? (Kronenberg et al. 2017)

4. Integrated Approaches to Policymaking

2012 Adoption of the „Integrated Development Strategy for Lodz 2020"

- Environmental issues almost completely absent in the initial version
- Fostered by a bottom-up movement and following public consultations environemtnal aspects were included, environment was placed as one of the three pillars of development

➢ *Although it is still a long way from any strategy to implementation, the inclusion of concepts such as ecosystem services and green infrastructure is a significant impetus to put them on the agenda of local authorities and stakeholders.*

2021 „Development Strategy of the Lodz Region 2030"

Focus on socio-economic situation,
3 dimensions of vision:

https://strategia.lodzkie.pl/wp-content/uploads/2022/01/Strategia-Rozwoju-Wojewodztwa-Lodzkiego-2030-wersja-w-jezyku-angielskim.pdf

How have ecosystem services been included in Lodz's urban development discourse? (Kronenberg et al. 2017)

5. Coordinated Management

Plenty of activities took place, e.g.:
2012 Different units from different departments responsible for urban greenery were consolidated within one authority.
(But: Main motivation was not better coordination, but cutting costs)

2014 Establishing a Greenery Task Force, composed of senior managers from different departments to better coordinate activities related to urban greenery.

Development of an integrated water vision for the city and recommendations for the implementation of best practices in rainwater management and the blue-green network into the master plan.

Lodz has the biggest participatory budget in Poland, enabling inhabitants to create and select projects they consider important.

But:
In total no breakthrough in thinking about environmental issues in the city,
due to various institutional barriers, inconsistency of regulations and of decisions made at different levels, lack of long-term planning.
Poor collaboration between the various stakeholders involved appears, as the analysis of social networks shows, to be the main reason for the failure.

And how have ecosystem services been included in the urban development discourse of your case study?

Lessons learnt from the Lodz case (Kronenberg et al. 2017)

1. Balance greater and inner city ecosystems considerations.
2. Enhance the protection of urban green infrastructure (new protected areas are not yet sufficient to control urban sprawl)
3. Prioritize urban sprawl restriction and restoration of the water cycle, along with ecological connectedness aimed at maintaining urban green infrastructure and securing the delivery of ecosystem services
4. Focus on systems to link various aspects of urban planning
5. Pay attention to ecosystems other than forests and parks
6. Consider other, complementary green infrastructure components that would improve urban resilience and adaptive capacity, especially in the inner city
7. Perform modern ecosystem assessments, including from the perspective of ecosystem services
8. Consider environmental policies in all sectoral policies and develop human and institutional capacity for their understanding and implementation
9. Facilitate collaboration between the authorities and various stakeholders
10. Ensure a more open and determined approach to the implementation of local regulations

Some Take-Aways

- The concept of ecosystem services (ES) helps to make evident the multiple benefits that people obtain from nature
- Urban nature delivers numerous ES, contributing above all to regulating (e.g. temperature regulation) and cultural (e.g. recreation) services.
- In systems analysis, ecosystem services serve as a major link between nature and society and help to understand interactions and feedback loops.
- Using ecosystem services to assess the benefits and trade-offs that nature provides can help integrate nature and ecosystem services into various sectors and relevant policy areas.
- In planning, taking ecosystem services into account helps to implement multifunctional approaches in practice.

Some possible guiding questions for your case studies

- Which key subsystems (ecological, social, economic and technical) can you identify in your case study, what interdependencies exist between them, and how can these be represented?
- Do ecosystem services play a role in current and future urban development (explicitly or implicitly)? Are certain services prioritized, or are others rather neglected?
- Are the considerations for the further development of the city balanced between the city center and the outer districts?
- Are environmental concerns addressed only sectorally, or are they also taken into account in other sectors and different policy areas?
- Are the various sectoral policies interconnected? What potential benefits would arise from a stronger interconnectedness?

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