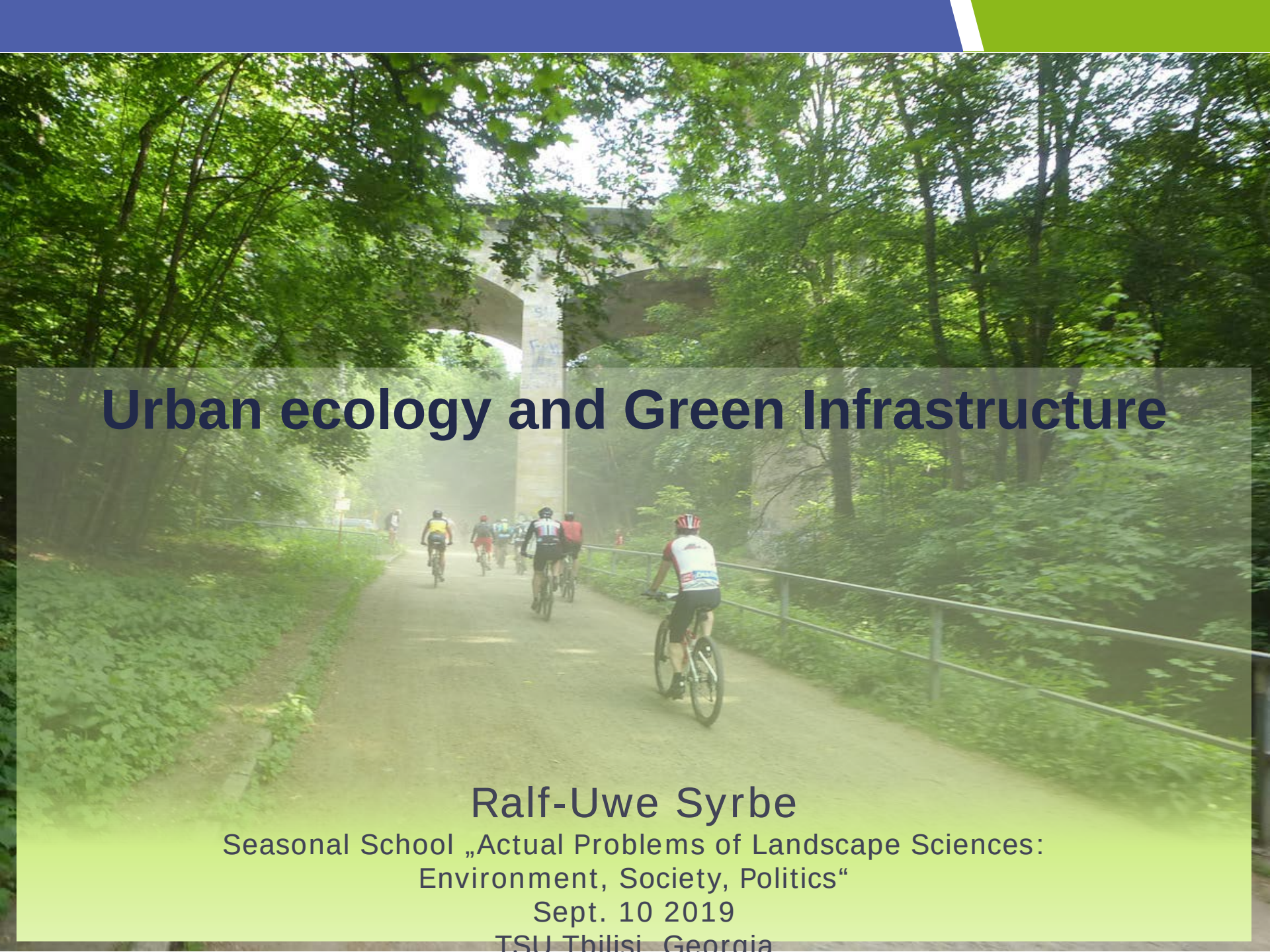




Urban ecology and Green Infrastructure

Ralf-Uwe Syrbe

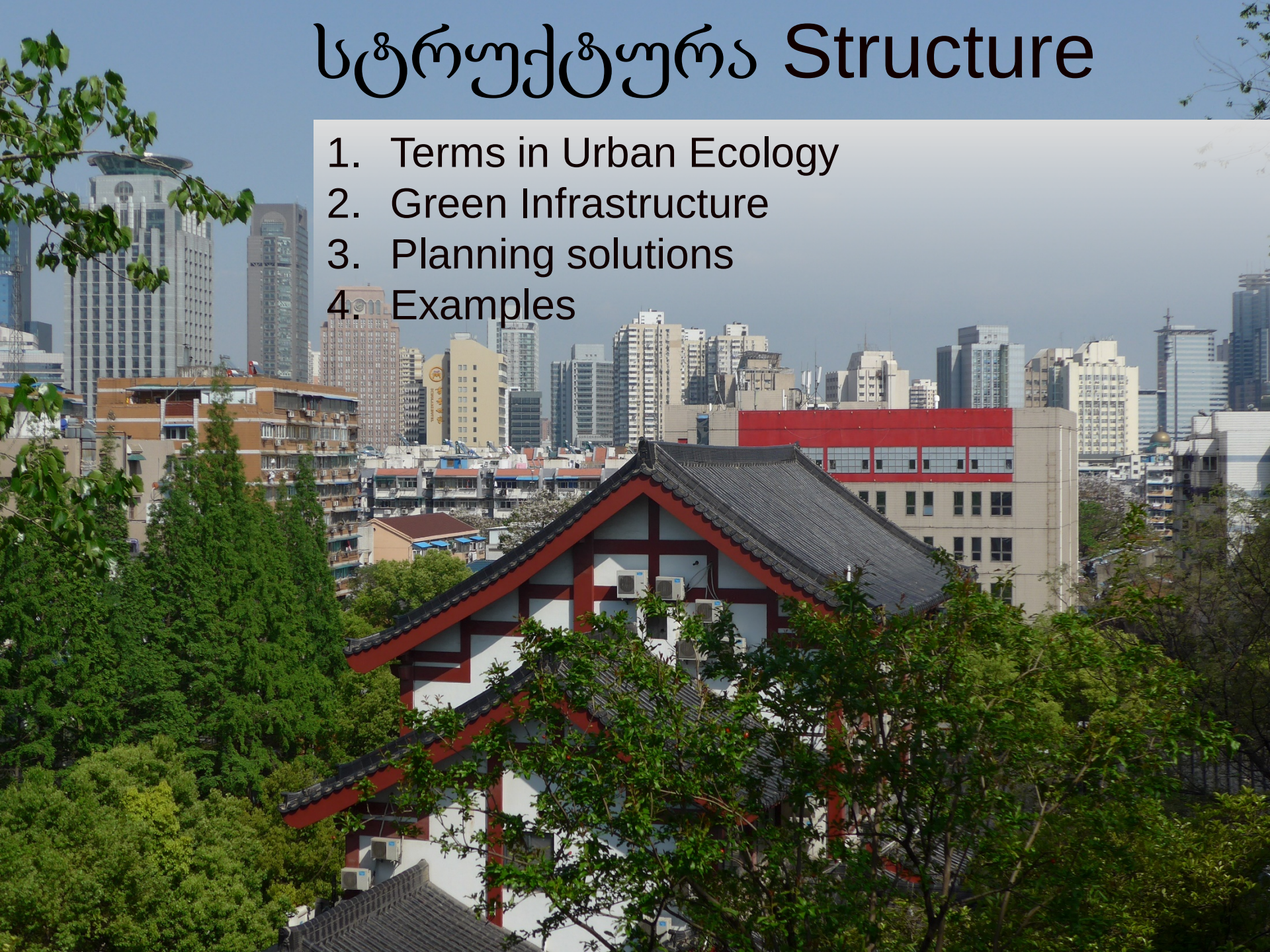
Seasonal School „Actual Problems of Landscape Sciences:
Environment, Society, Politics“

Sept. 10 2019

TSU Tbilisi Georgia

სტრუქტურა Structure

1. Terms in Urban Ecology
2. Green Infrastructure
3. Planning solutions
4. Examples



1. Terms in Urban Ecology

Definition

Urban ecology is an interdisciplinary field dealing with the design and the development of cities and their special habitats; it is focused on environmental issues and the living quality of the inhabitants.

Perspectives to urban ecology

Integrated research field of humanities, geo-sciences, and planning science

City
development
and structures



Ecosystems' state
habitats, species



Ecosystem
Services

Governance

Contributions from natural science

Ecology

„The science of the relationships between organisms and the surrounding environment“

(E. Haeckel 1866)

“Theory of the natur’s houshold“

(E. Haeckel 1869)

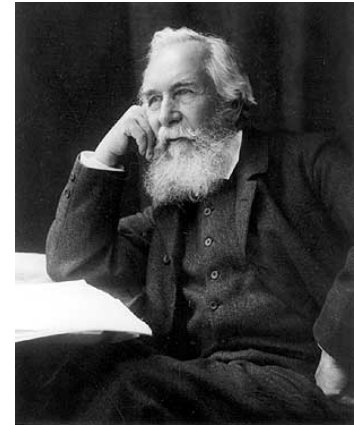
Sub fields:

Animal ecology, plant ecology, ecology of microorganisms
autecology, population ecology, synecology

metaphorische use:

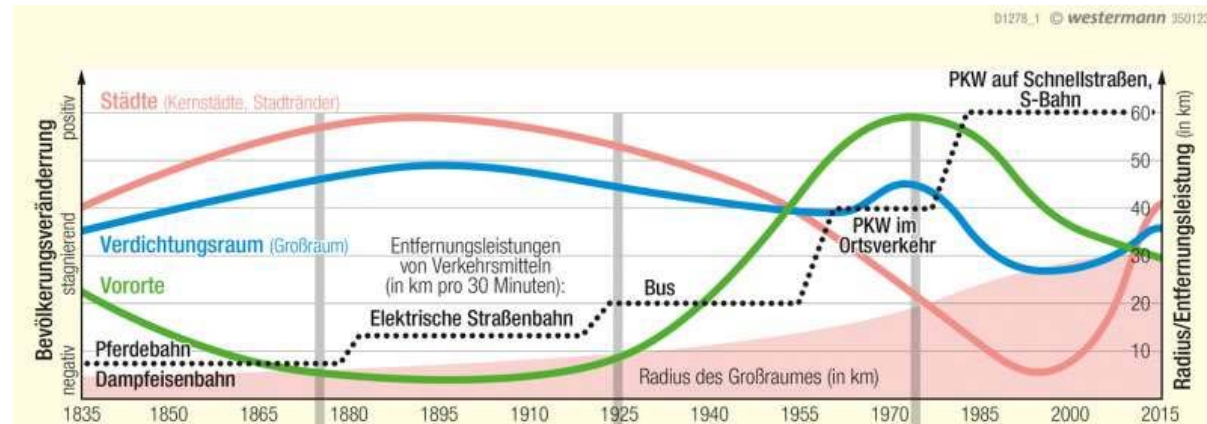
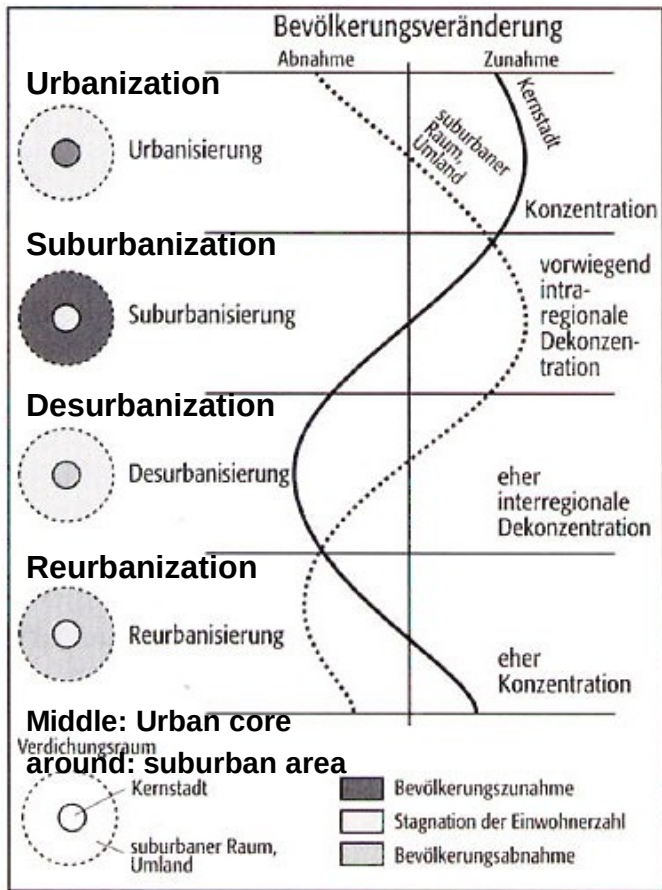
Political ecology, human ecology

base hardly on „ecology“



*Ernst Haeckel
1834-1919*

Urbanization: The growth of cities

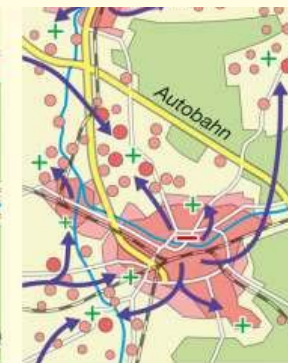


Urbanization

Suburbanization

Suburbanization (at the city edge)

Reurbanization



Urban structural units

Block development



Single-family house



Commercial area



Parks



Agriculture



Allotment

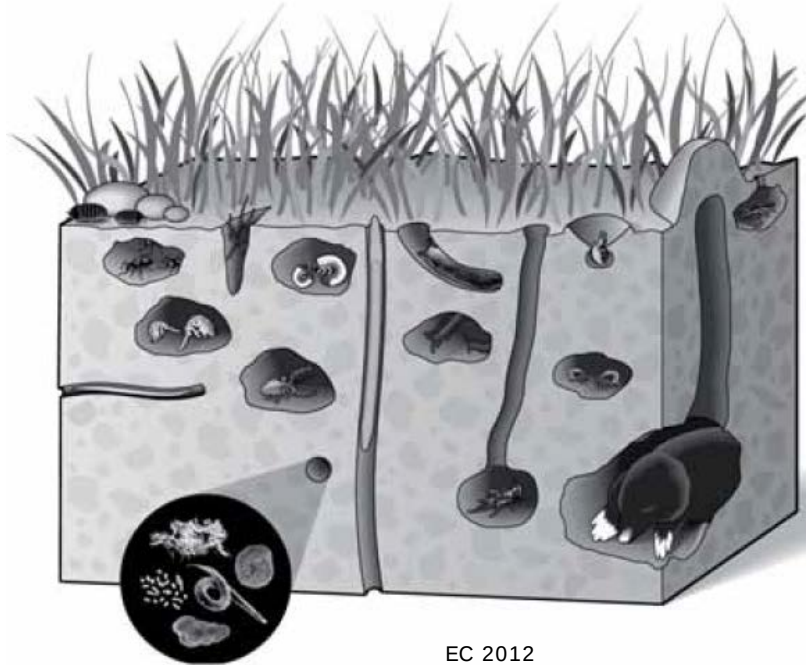


Soil sealing & biodiversity

Soil sealing =
the covering of the
ground by an
impermeable
material (such as
buildings, streets)
(EEA)



Biodiversity =
the variability
among living
organisms from all
sources, this
includes diversity
within species,
between species,
and of ecosystems.



A quarter of species on
the planet live in soils

EC 2012

Habitat fragmentation
reduces the size and
persistence of wildlife
populations

Different types of soil sealing

Asphalt



Buildings



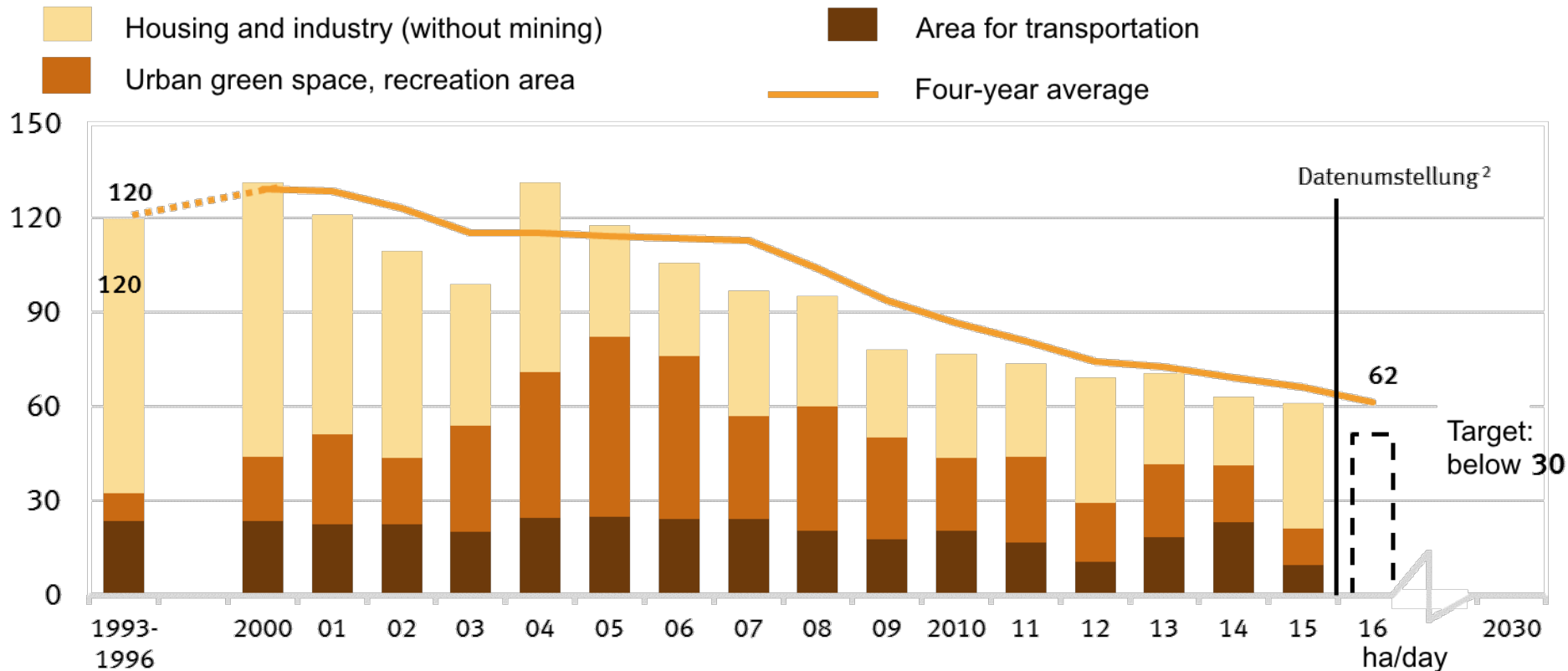
Paving stones



Grass pavers



Land consumption: Germany (ha/day)



(German Federal Statistics Office 2018)

2. Green Infrastructure

GI = strategically planned network of high quality natural and semi-natural areas with other environmental features, which is designed and managed to deliver a wide range of ecosystem services and protect biodiversity in [...] urban settings.

It is a modern planning approach for the linking-up of urban green elements; complement to the so-called „Grey Infrastructure“ which comprises the transportation, water and energy networks.

In the urban context, all kinds of vegetation and water covered areas can be part of the Green Infrastructure. Also paved or built-up areas can be qualified to be a part of it by unsealing, greening, planting by trees.“ (White Paper Green Spaces in the City 2017)

Example: „Green C“ of the city of Bonn and its surrounding villages



What belongs to the Urban Green Infrastructure?



European Commission (2013): Building a Green Infrastructure for Europe. doi: 10.2779/54125

Four kinds of nature in cities (Kowarik 1993)

- **Remnants of former natural landscape**
Forest, Swamps, Rock areas etc.
- **Remnants of agricultural landscape**
Fields, orchard meadows, meadows, pastures, heaths, dry grassland etc.
- **Designed and symbolic nature**
Parks, gardens, street trees, flower pots etc.
- **Specific urban-industrial nature**
wall vegetation, vegetation of sidewalks, spontaneous vegetation in gap sites, brownfields and fallow land



Part of 4th kind's Urban Nature = Informal green space

open vegetated areas, spontaneous vegetation but not included in the formal green spaces system.

(Christoph, Rupprecht 2017).

Many of those areas are ecologically valuable and also play an important role for ES delivery (recreation in particular)



Street verges



Gap spaces



Vacant lots



Railway verges

**Informal
green space**



River/canal banks



Overgrown structures



Brownfields



Powerlines



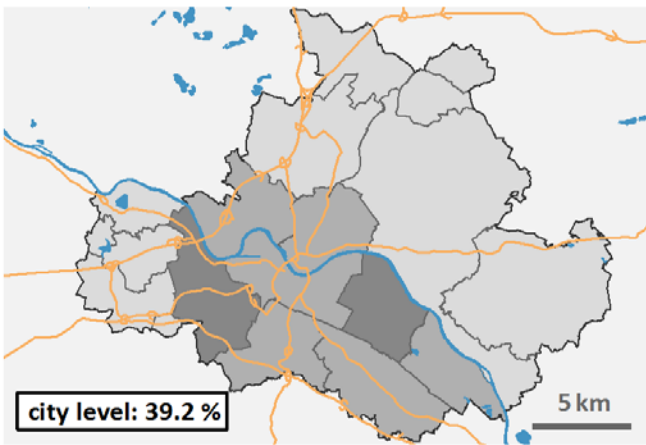
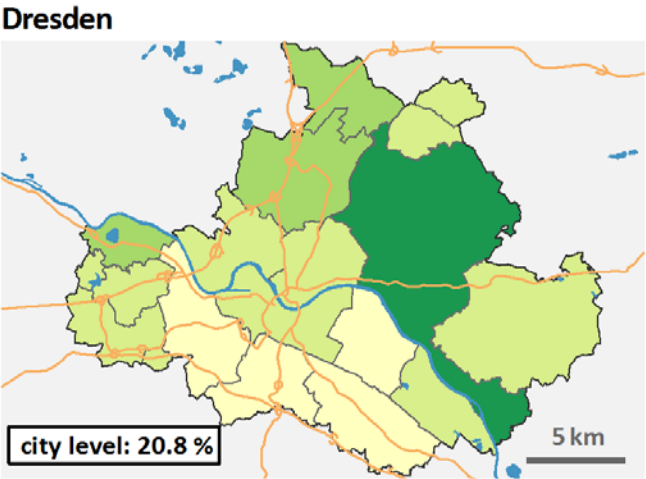
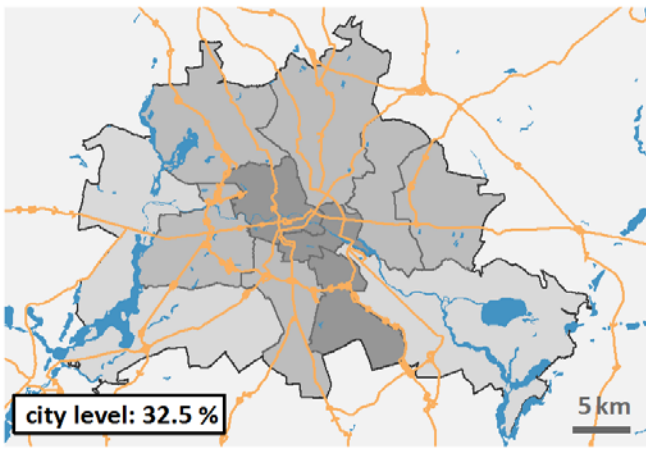
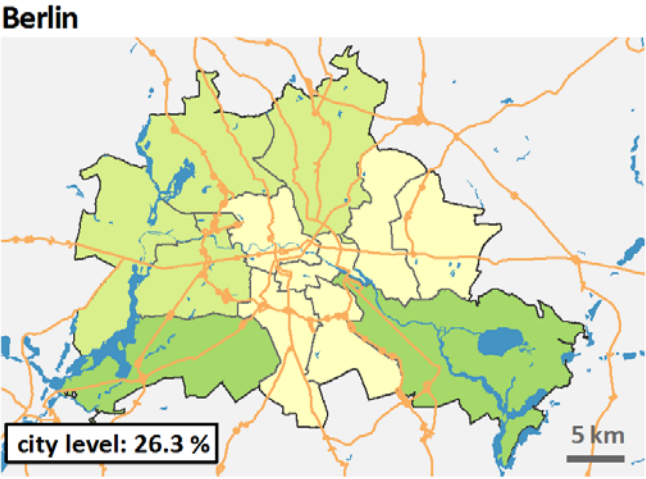
Urban green: Indicators for monitoring

Indicator	Recording method
1. Green space proportion	Green space / total area in % 1. topographical data 2. remote sensing (total green)
2. Green space per capita	Green space in m ² /inhabitant 1. topographical data 2. remote sensing combined with population statistics
3. Green space volume	1. Average vegetation height (m) 2. Tree canopy proportion (%) 3. Green volume number (m ³ /m ²) 4. Leaf area index (m ² /m ²)
4. Green space accessibility	Share of inhabitants living within an walking distance to accessible urban green
5. Soil sealing degree	Area of developed or paved surface divided by total area

Indicators on city district level:

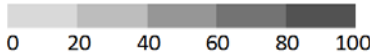
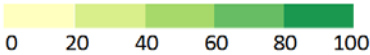
Public green space proportion (left)

Sealing degree (right)



Proportion of green space
Percentage of urban green space in reference area

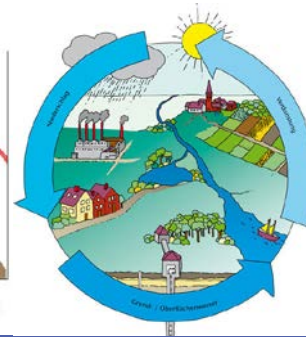
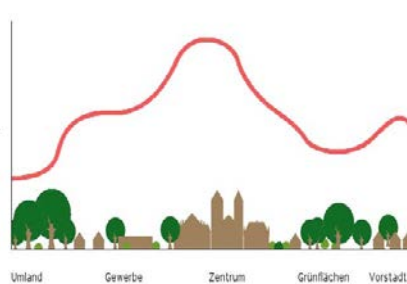
Degree of soil sealing
Percentage of sealed soil in reference area



— motorway/main road — water

The challenges of urbanization

- Soil sealing and isolation of habitats
- Destruction and pollution of soils
- Change of climate
(UHI: Urban Heat Island, wind / rain anomaly)
- Increase + speedup of discharge
- Release of alien species



Main challenge: urban growth



~~Urban growth → shrinking urban green
or urban sprawl~~

3. Planning Solutions

Double Internal Development

Tension between urban growth and the protection of urban green spaces

Double Internal Development means, available space within the city should not only developed but also used for the improvement of urban green. The aim is to protect the rural landscape against urban sprawl and to maintain their ecological functions.

The quality of life within the city will be improved using this way, too.



The Sponge City Concept

We have poured more than enough concrete. It's time to invest in a new type of green infrastructure. Source:

<https://www.youtube.com/watch?v=uWjGGvY65jk>

- Passively absorb, store, release and purify rainwater in an ecological friendly way
- Public open green spaces: absorbing and keeping rainwater where it lands
- Green roofs facades
- Urban wetlands & roadside renches
- Permeable pavements & roads
- Rain gardens

Pilot Cities:

GERMANY

Berlin, Stuttgart, Essen

CHINA

Qianan, Baicheng, Zhenjiang, Jiaxing, Chizhou, Xiamen, Pingxiang, Jinan, Hebi, Wuhan, Changde, Nanning, Chongqing, Suining, Guian New District, Xixian New District

Source: ICLEI Briefing Sheet & China's Sponge City Program

Sponge City:

Possible elements

- ROOF GARDENS
- GREEN ROOFS
- RAIN GARDENS
- GREEN WALLS & FACADES



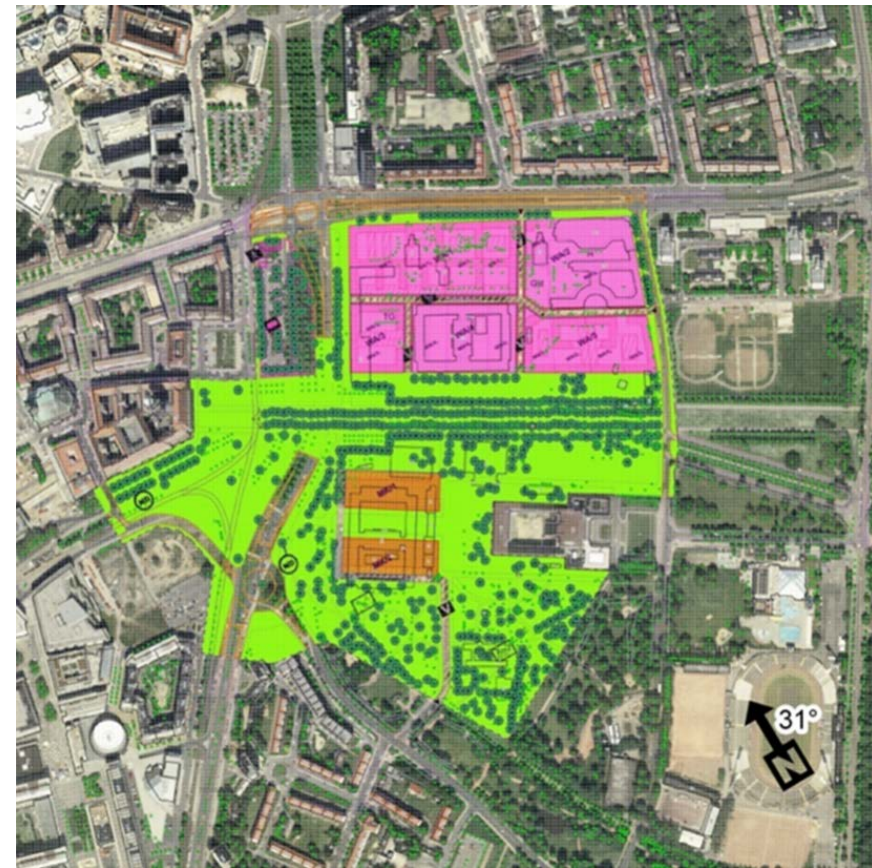
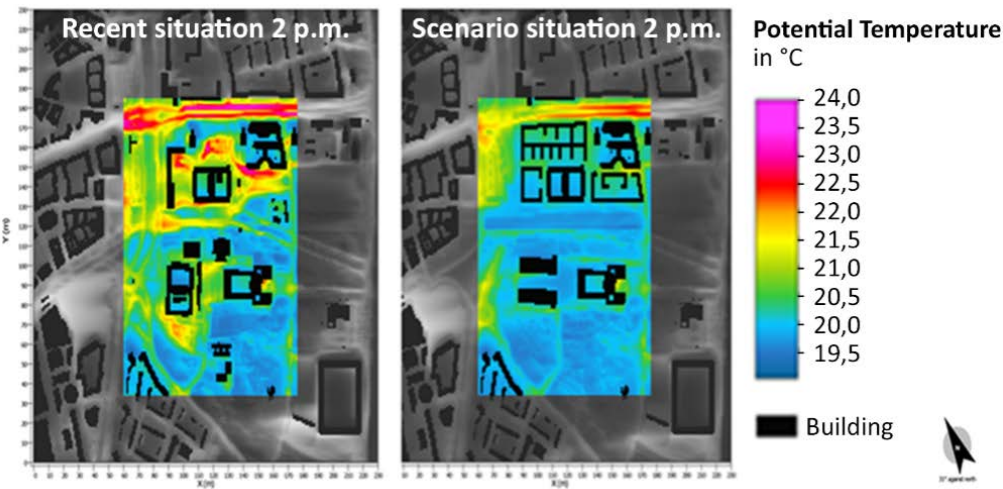
Photos:
<http://madlonsbigbear.com>
<http://www.prweb.com>
<http://www.naturalhabitats.co.nz/rain-gardens/>

Living roofs

Ralf-Uwe Syrbe r.syrbe@ioer.de

Nature-based solutions

Optimization of benefits by ecosystem services (non-technical approach)



New trend in Europe:

Edible Cities



Implementation?

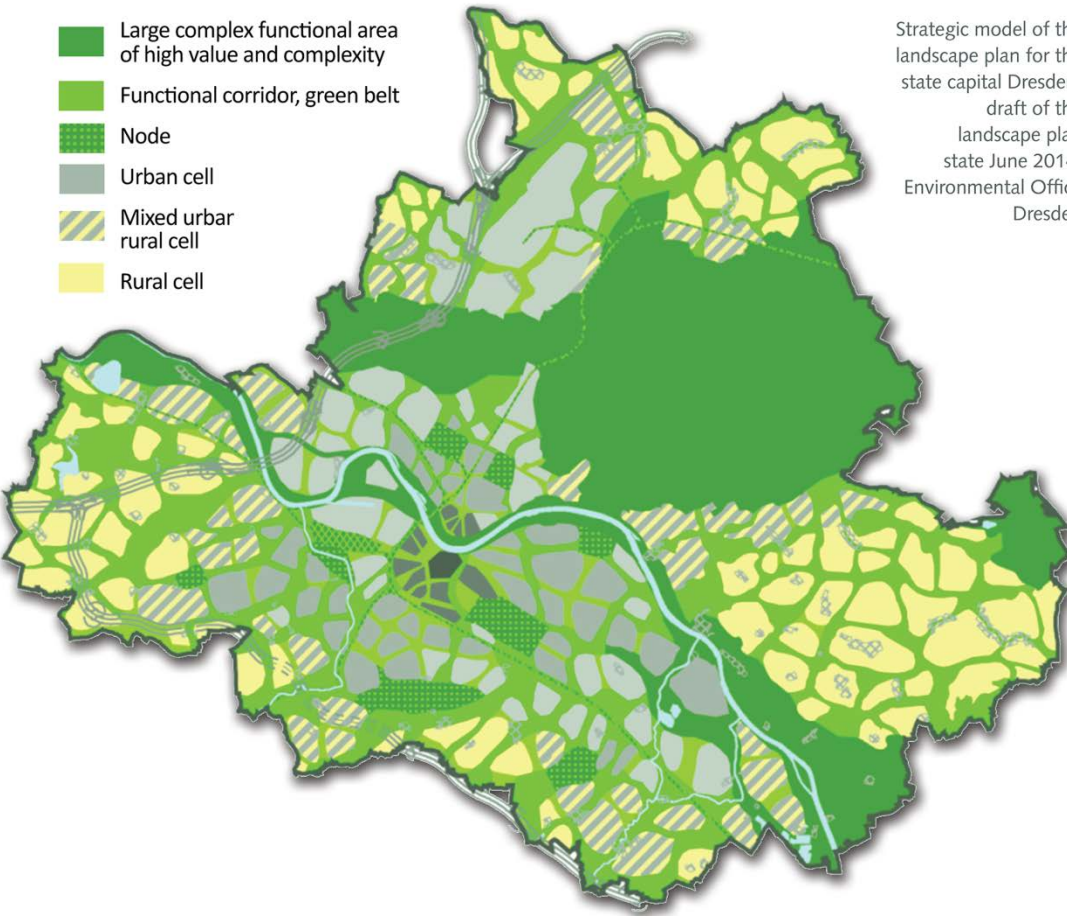
Impact?



Compact city in the ecological network

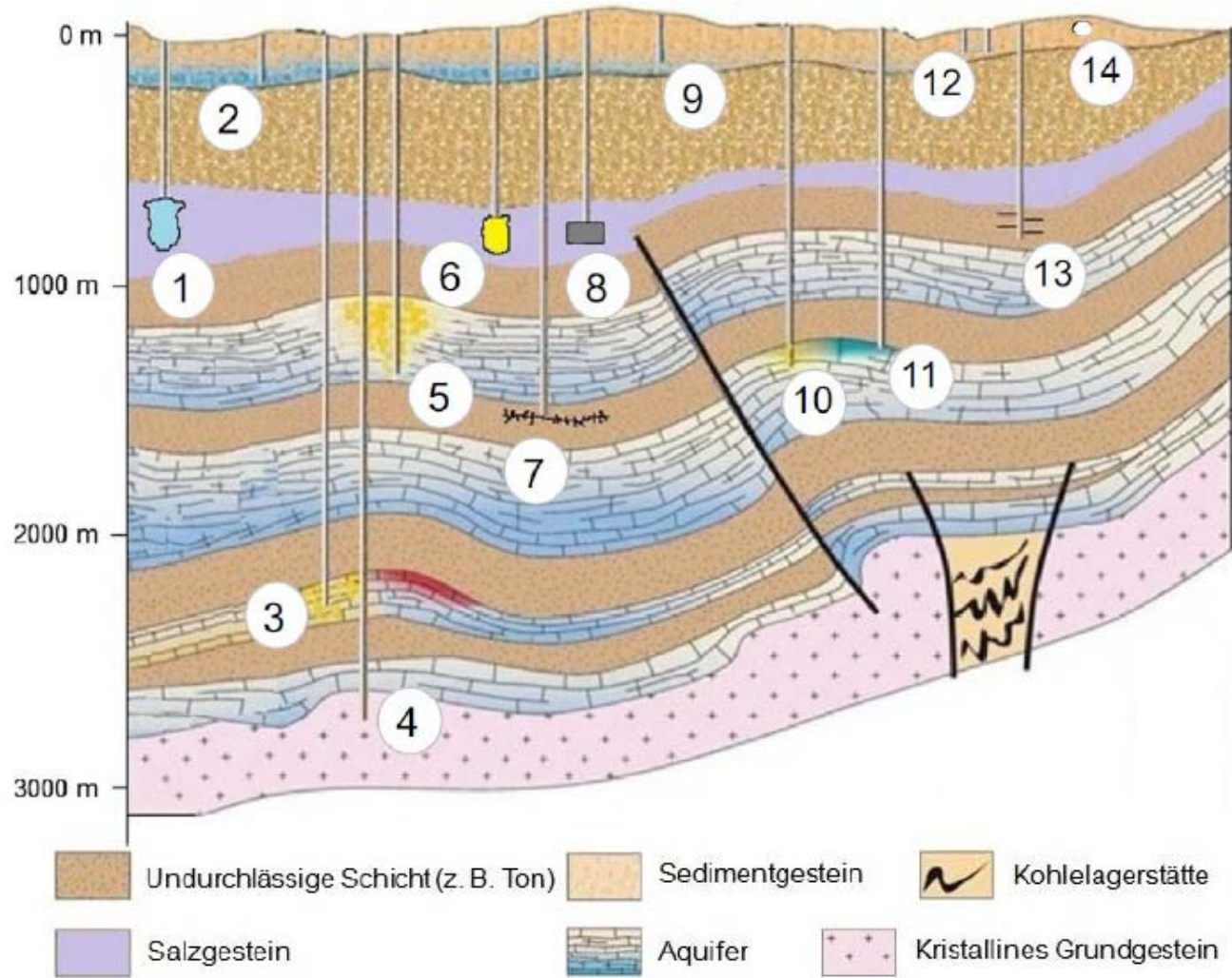
- Large complex functional area of high value and complexity
- Functional corridor, green belt
- Node
- Urban cell
- Mixed urban rural cell
- Rural cell

Strategic model of the landscape plan for the state capital Dresden, draft of the landscape plan state June 2014, Environmental Office Dresden



Underground use + planning

1. Energy storage (air pressure)
2. Ground water use
3. Hydrothermal energy
4. Petrothermal energy
5. CCS Carbon storage
6. Oil/gas storage
7. Oil/gas fracking
8. Underground deposit
9. Near-surface geothermal energy ...
14. Underground infrastructure



Urban planning instruments in Germany

Urban development = several processes of change of urban structures, e. g. land use as physical expression of socio-economic changes

Urban planning = foresighted steering of the spatial development of an urban area, including green spaces

Instruments available for urban planning:

Formal instruments of regional planning

Regional plan

Formal instruments of land use planning (federal building code)

Zoning plan (preparatory land use plan)

Local construction plan (binding land use plan)

Formal instruments of urban redevelopment (federal building code)

Informal instruments (e. g. ***Integrated urban development concepts***)

Sectoral planning, particularly environmental planning

Instruments available for urban areas:

Formal instruments of landscape planning (Nature conservation act):

Landscape structure plan

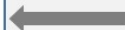
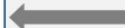
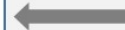
Landscape plan

Green structure plan

Environmental impact assessment

Further environmental planning (e. g. ***Air pollution control plan***)

Informal instruments (e. g. ***Green space development concepts***)

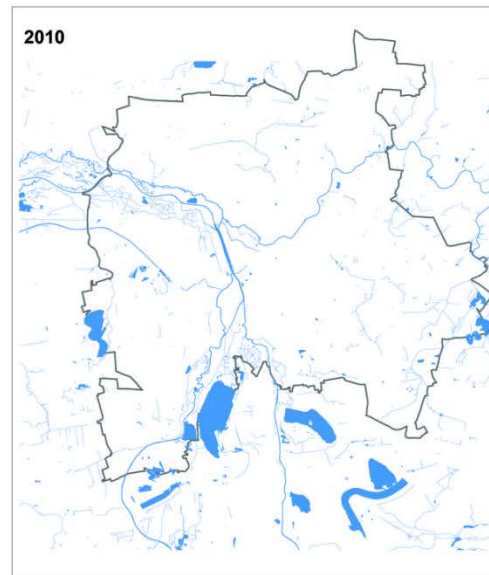
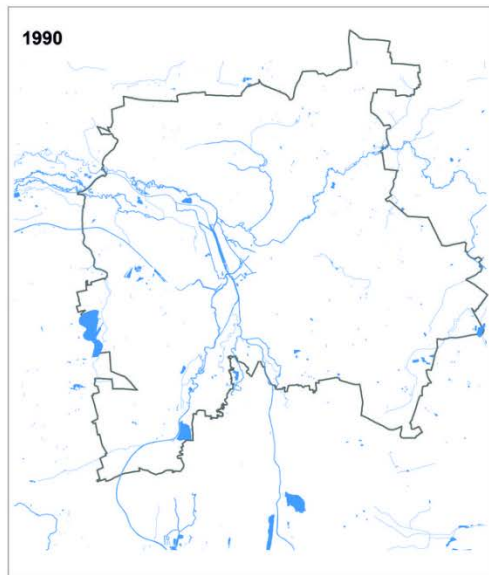
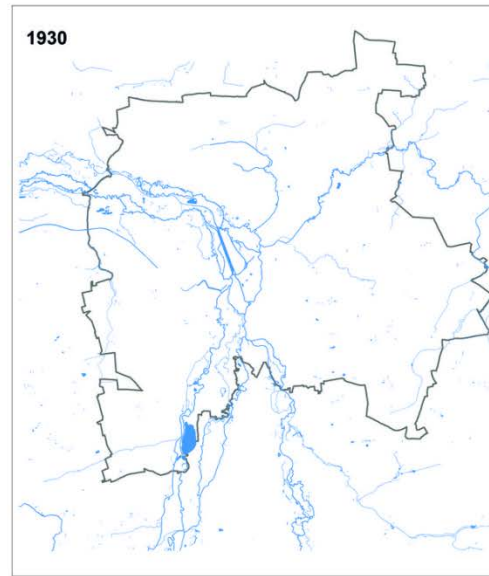
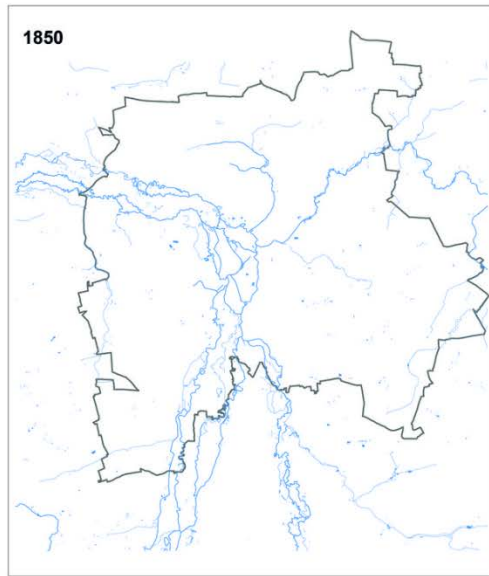


4. Examples

Combine and enhance the functions of greenspace

- Green recreation and sport areas
- Green areas for aged people
- Outdoor arts exhibitions
- Greenspace as social meeting points
- Green traffic: short + beautiful cycleways, walkways





Water Town Leipzig



Case study Berlin: Urban gardening

- Initiative of D.G.M. Schreber (1808-1861) „Screbergardens“
200-400 m² healthy food + recreation + green experiences



- >3000 ha allotment gardens cov. 3.5 % of city's territory
- Demanded by young families as save playground for kids: 14,000 applicants vs. 3106 gardens available in 2015
- New types of cooperativ gardening: community / solidarity / neighbourhood / gardens became popular

Case Munich: compact urban green

- Informal strategy “Long-term open space development 2030”
- Opportunities for participative urban green development proposed
- Selection and honor of projects with certificates and small prizes
- Initiative „green courtyards – green walls”



Before: bicycle parking without green infrastructure



After: courtyard with urban green and amenity value

Case Dresden: Structure Small Scale Biotopes



No. 1: Edible garden close to Plitzschhof



No. 3: Near-natural yard



No. 2: Small habitat at Dohnaer Straße



No. 4: Wild bee house and wildflower plots

Conclusions

- Contradicting aims require innovative solutions
- Targets need to be socially negotiated
- Consistent planning framework needed
- Combined solutions are necessary



Relevant initiatives and strategies for urban greening

- 2007 Leipzig Charter on sustainable European cities
- 2011 The EU Biodiversity Strategy to 2020
- 2015 UN sustainable development goals
- 2016 HABITAT III Conference Quito: New Urban Agenda – Toolbox for modern cities
- 2017 White paper „Green Spaces in the City“ (s. cover)
- 2017 Textbook „Toward Green Cities“



Thank you for your attention!

გმადლობთ ყურადღებისთვის!

