GREEN SURGE

Assessing and mapping ecosystem services generated by urban GI

Nadja Kabisch, Humboldt-Universität zu Berlin

April 04, 2017, Orvieto, SESSION 11

SEVENTH FRAMEWORK PROGRAMME

the URBES project

biodiversa

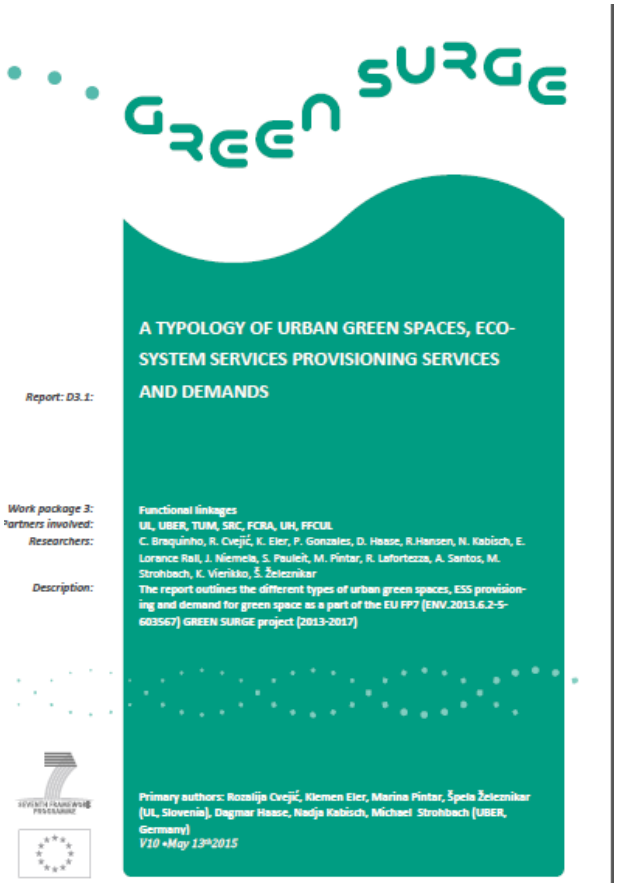
Green Infrastructure – What is it?

Green Infrastructure (GI) is an interconnected network of green space "that supports native species, maintains natural ecological processes, sustains air and water resources and contributes to the health and quality of life" (Benedict and McMahon, 2006:281).

GI comprises a number of environmental features.

Green Infrastructure – features: Typology and Inventory in GREEN SURGE

No.	UGS element	Description	Example
12	green playground, school ground	Green areas intended for playing or outdoor learning.	
13	riverbank green	Green space sideways the rivers, streams and canals, usually with foot or bike paths.	
14	large urban park	Larger green area within a city intended for recreational use by urban population, can include different features such as trees, grassy areas, playgrounds, water bodies, ornamental beds, etc.	
15	historical park/garden	Similar to large urban parks, but with distinct management due to heritage status.	



Green Infrastructure – Mapping and Assessing

GI as a concept is already included in practice of spatial planning in urban areas

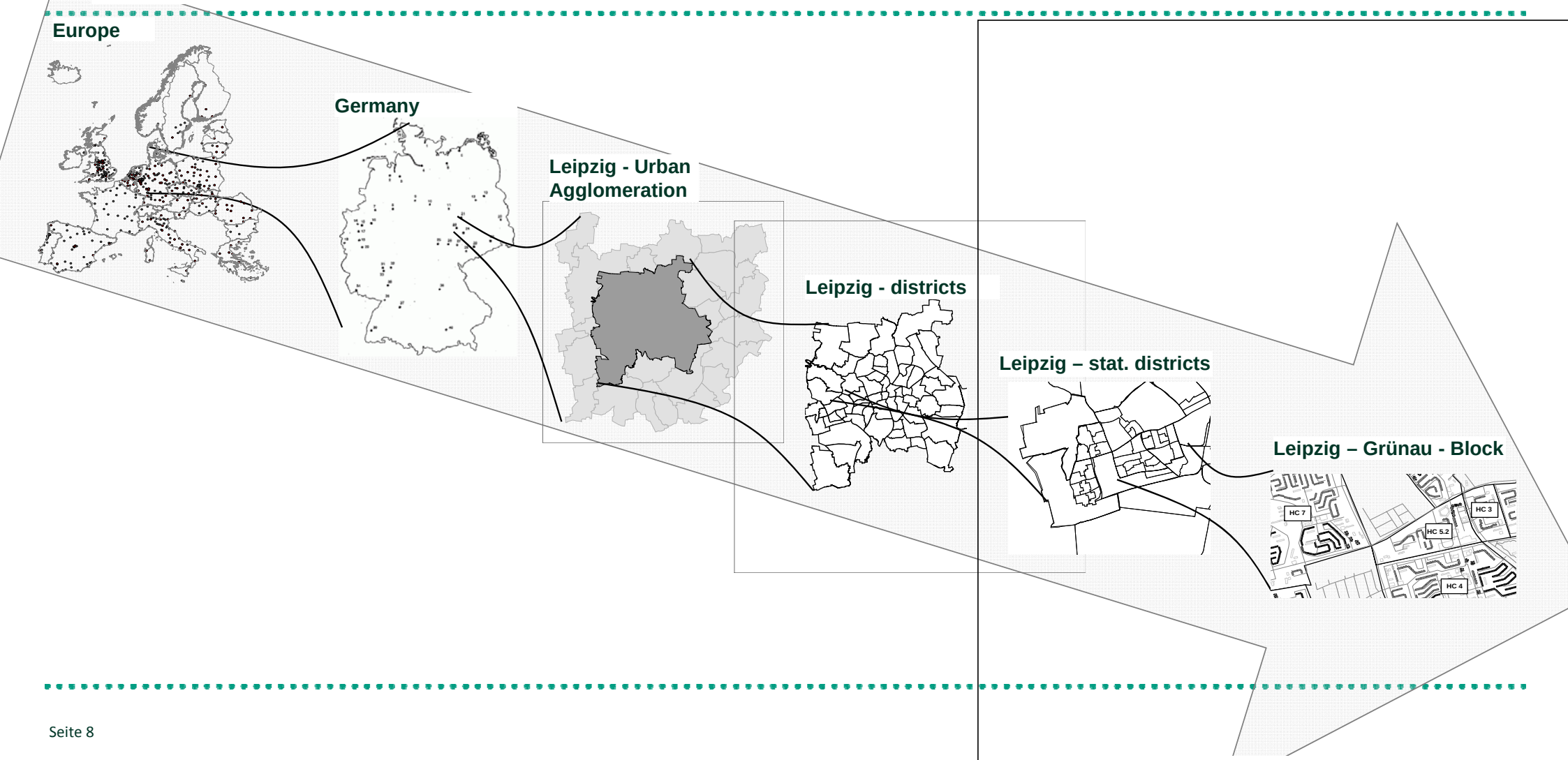
Principles for UGI planning: Multifunctionality, connectivity, multi-level, social inclusiveness and adoption of a communicative approach (Pauleit et al., 2011; Hansen & Pauleit, 2014).

→ GI concept refers to different spatial scales (European, national, local)

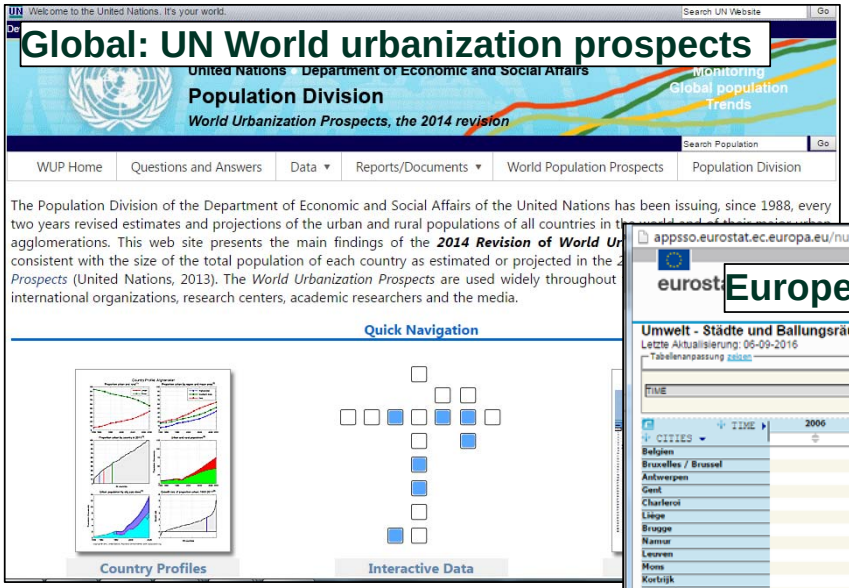
→ Assessed with a multi-method approach using multiple data: different data sources, different methods (GIS, statistics)

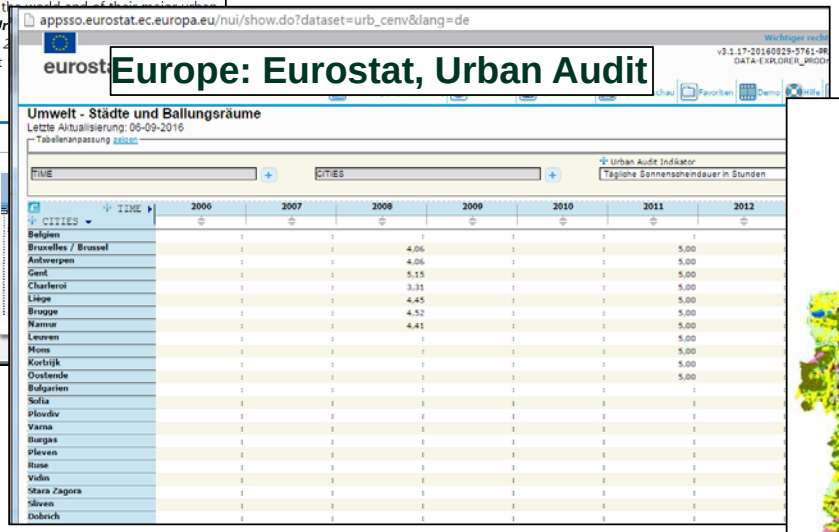
Green Infrastructure – Mapping and Assessing: spatial scales, data and methods

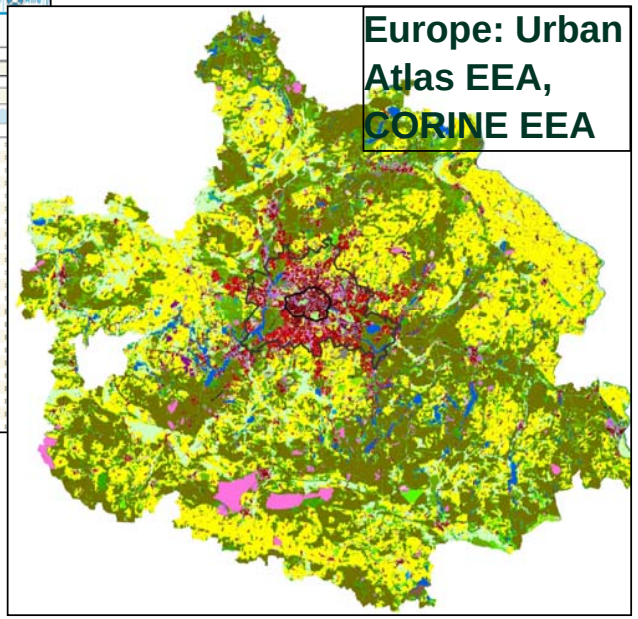
Green Infrastructure – Mapping and Assessing: spatial scales



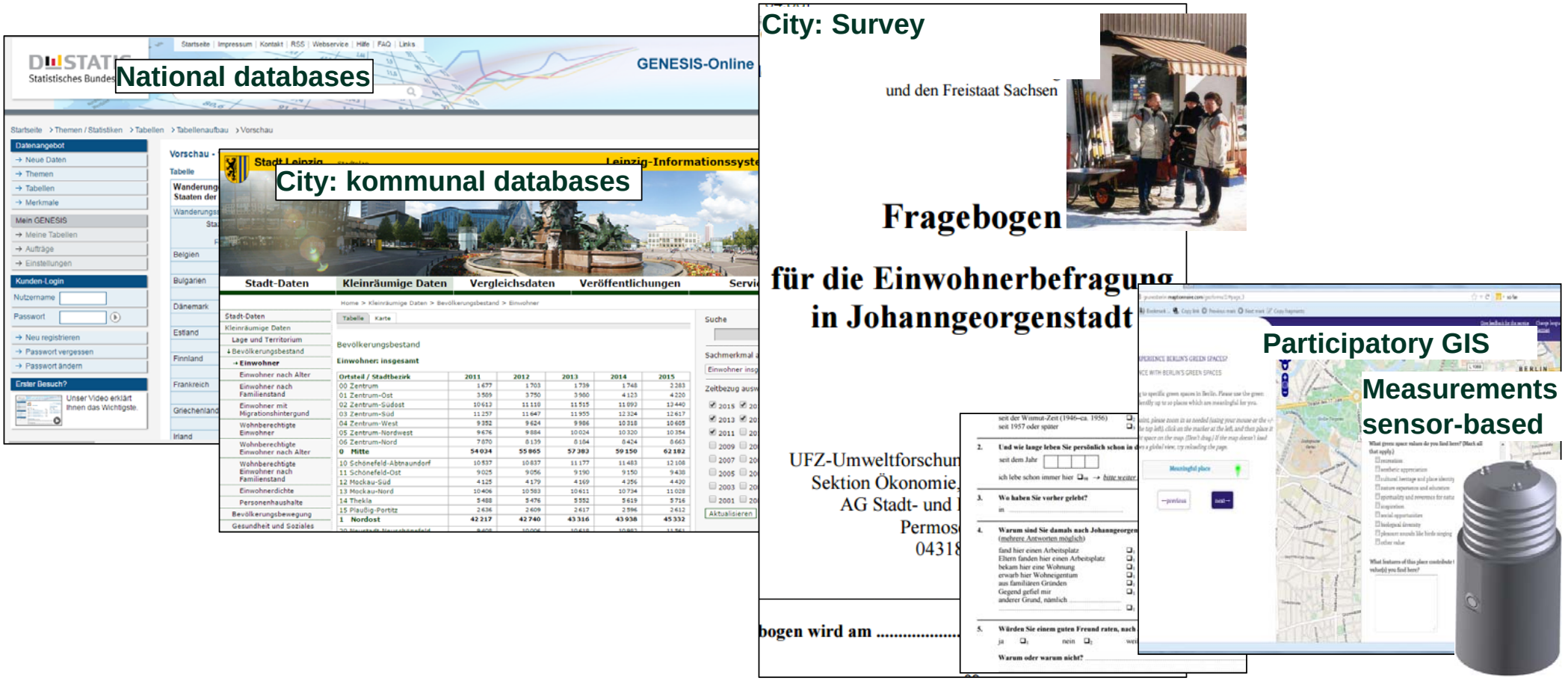
Green Infrastructure – Mapping and Assessing: data







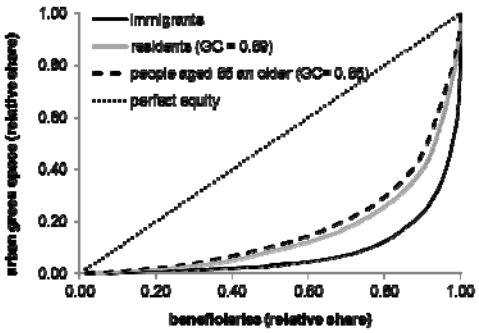
Green Infrastructure – Mapping and Assessing: data



Green Infrastructure – Mapping and Assessing: methods

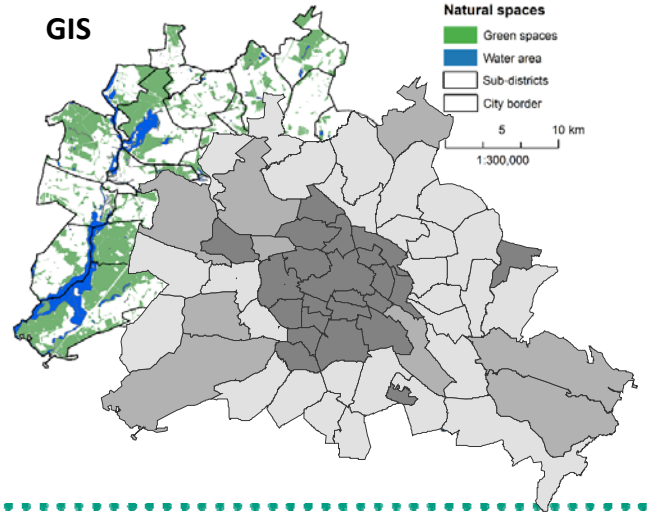
- Bi- und multivariate statistics: Descriptive, Regression, Correlation, Cluster (SPSS; Statistica; R)
- Geographical Information Systems (GIS): Land use, land cover (change), visualization
- Indicator development
- Qualitative: Focus groups, Scenario development workshops, Expert interviews

Statistics

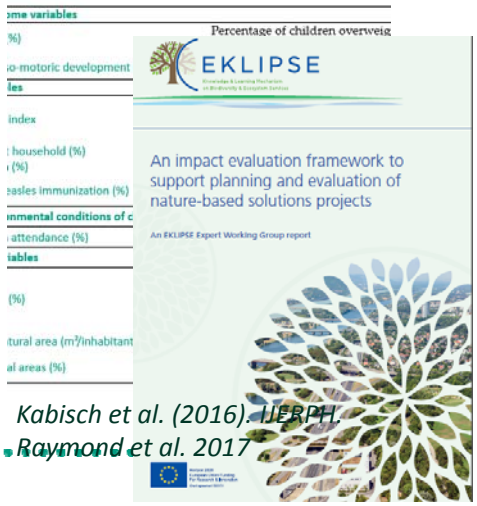


Kabisch und Haase (2014). Land.

GIS



Indicators



Kabisch et al. (2016). IJERPH.
Raymond et al. 2017

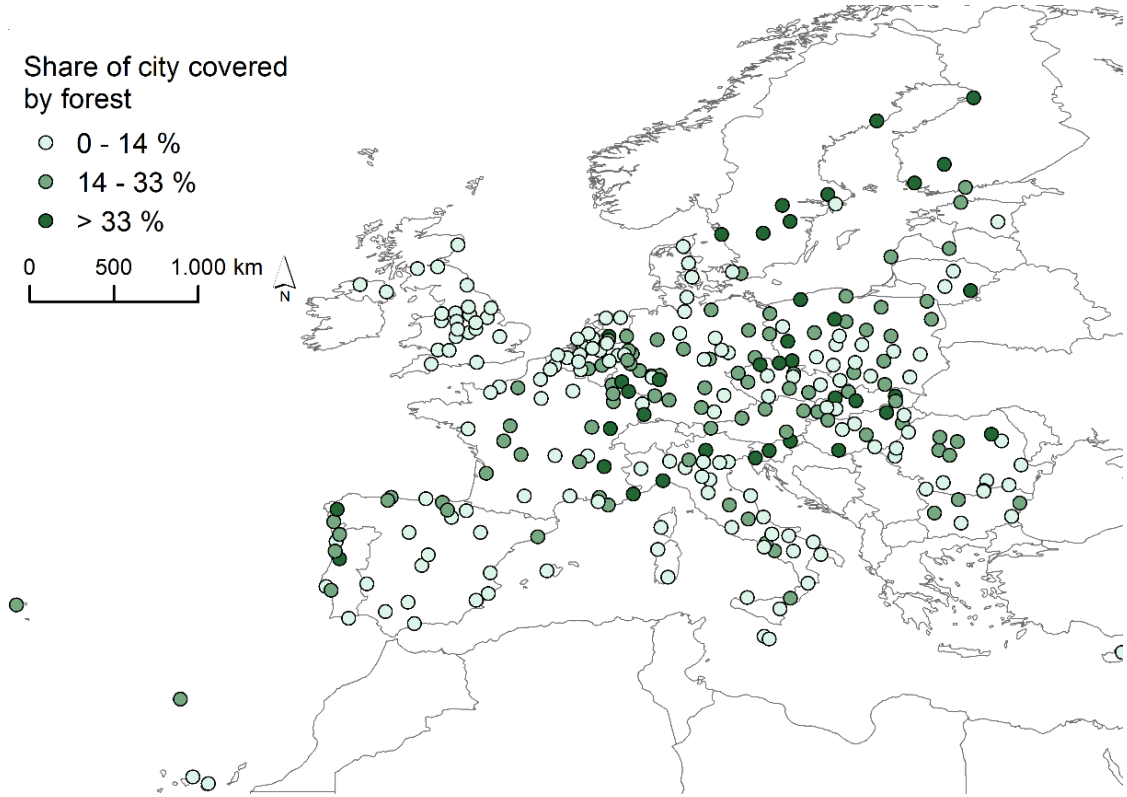
Scenario workshops

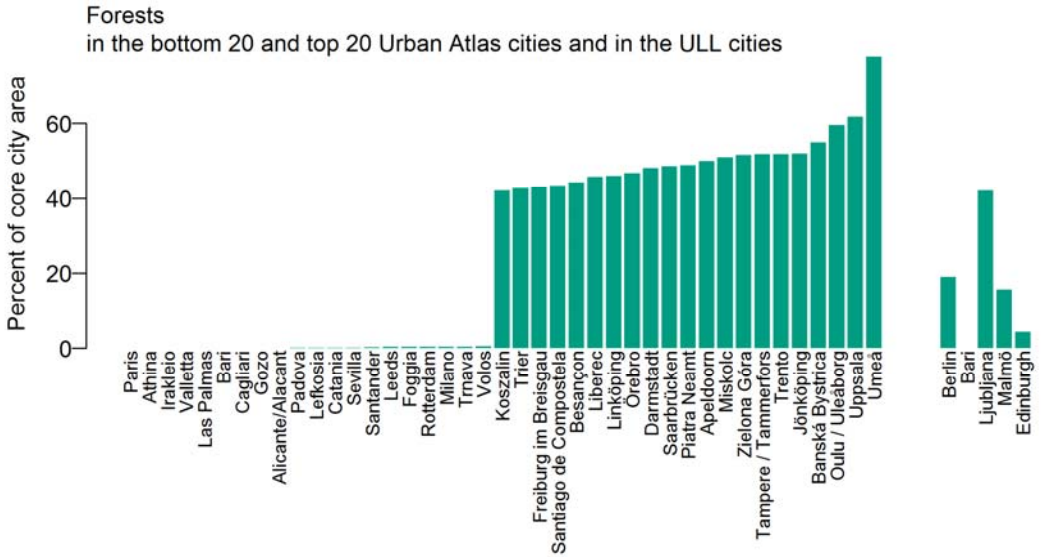
Kabisch (2015). Land Use Policy.

Green Infrastructure – Mapping and Assessing: Results from GREEN SURGE and URBES

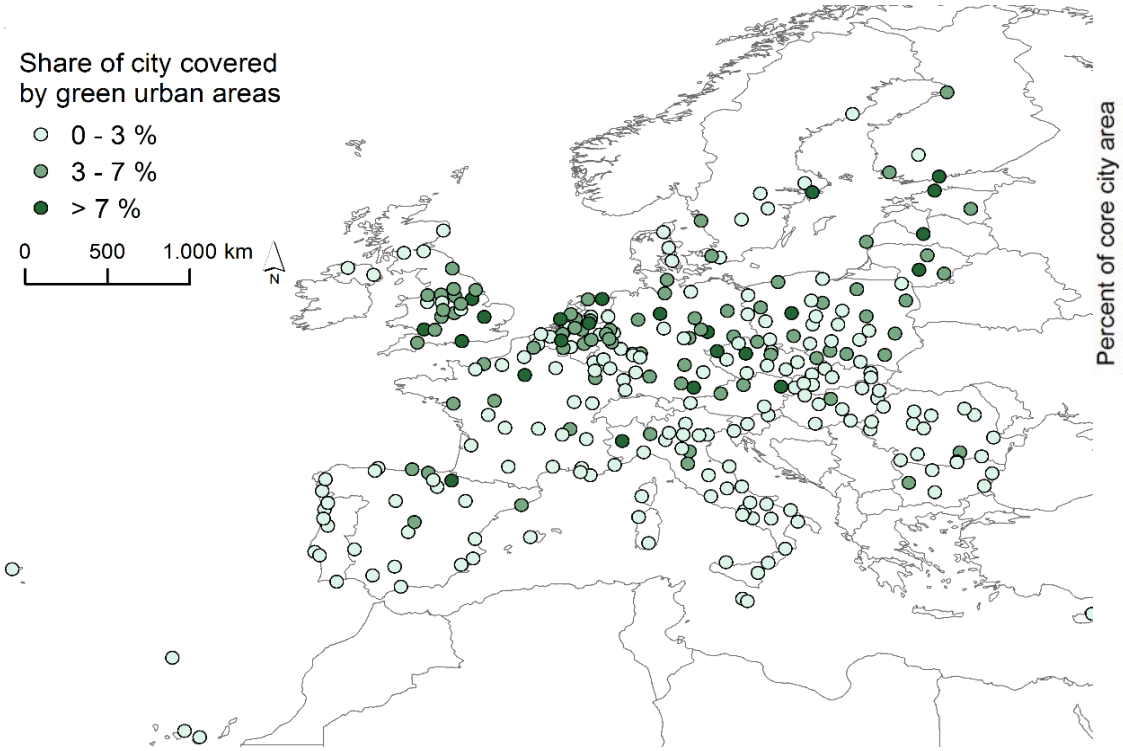
European city level

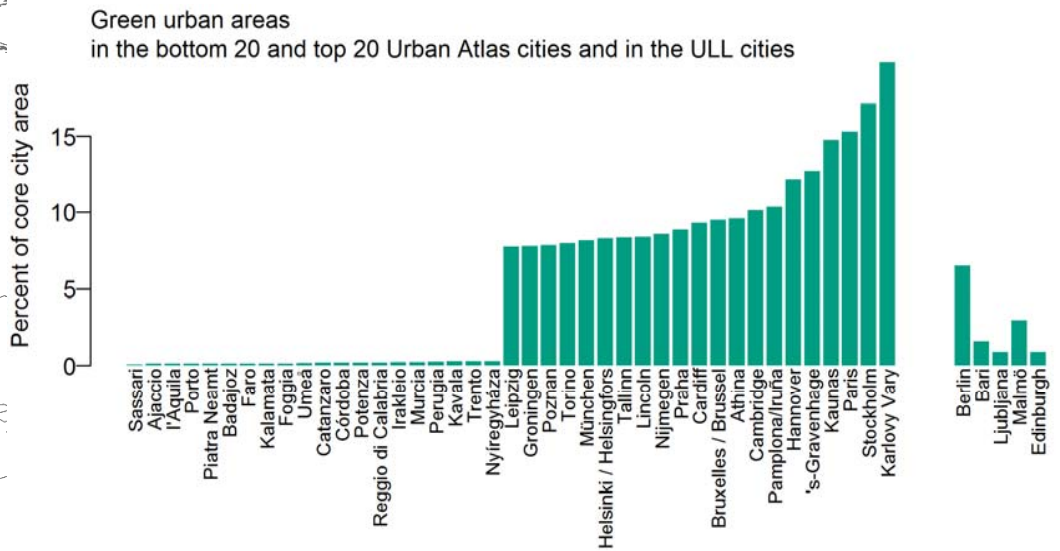
Green Infrastructure – spatial scales – European scale



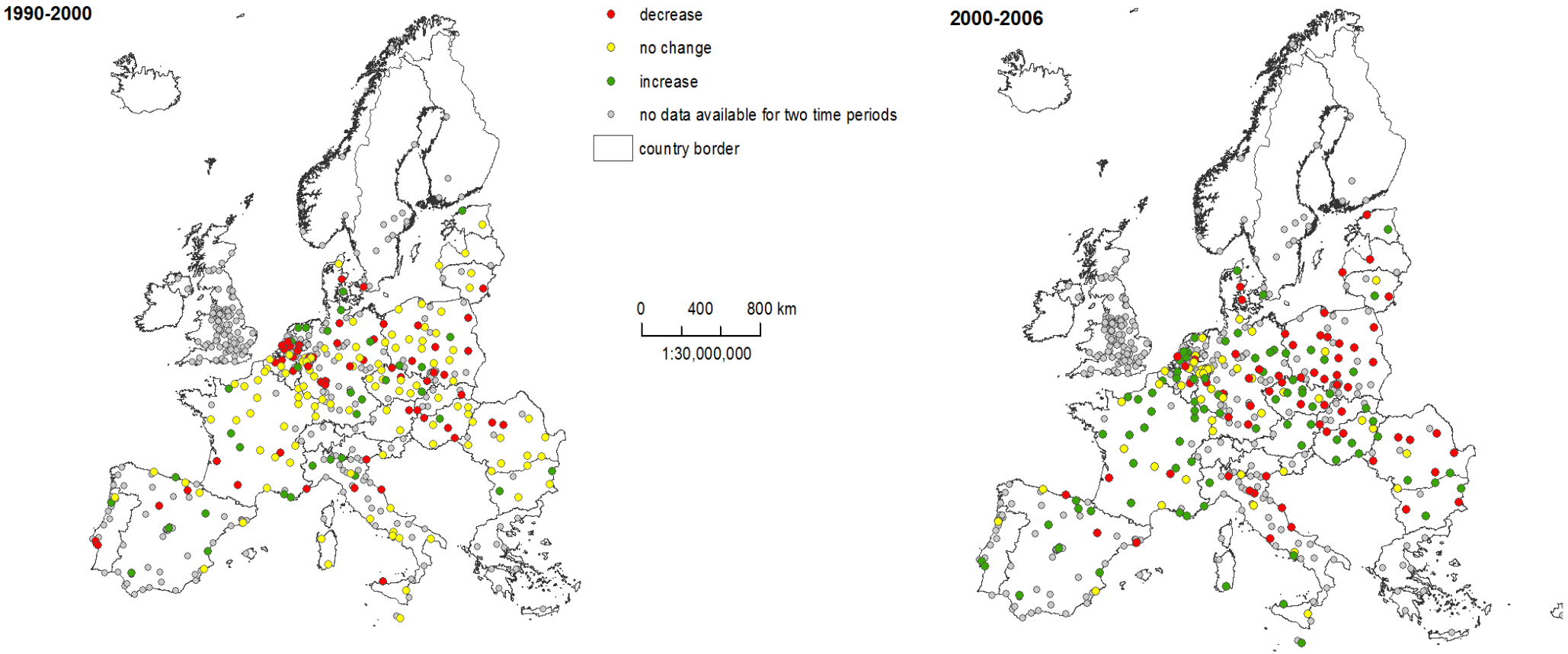


Green Infrastructure – spatial scales – European scale





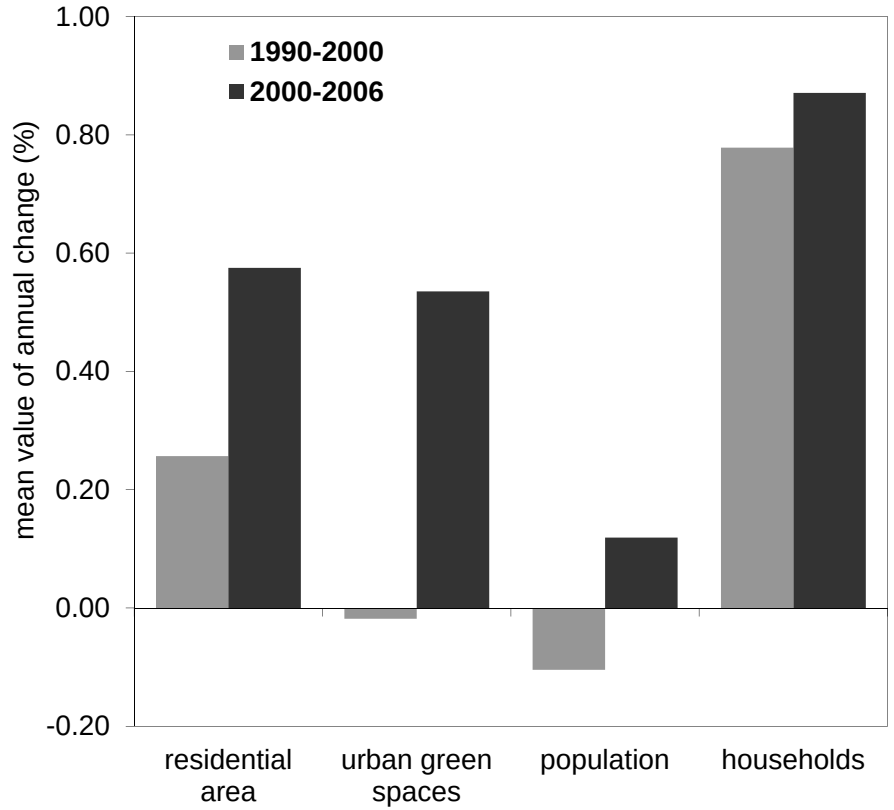
Green Infrastructure – spatial scales – European scale



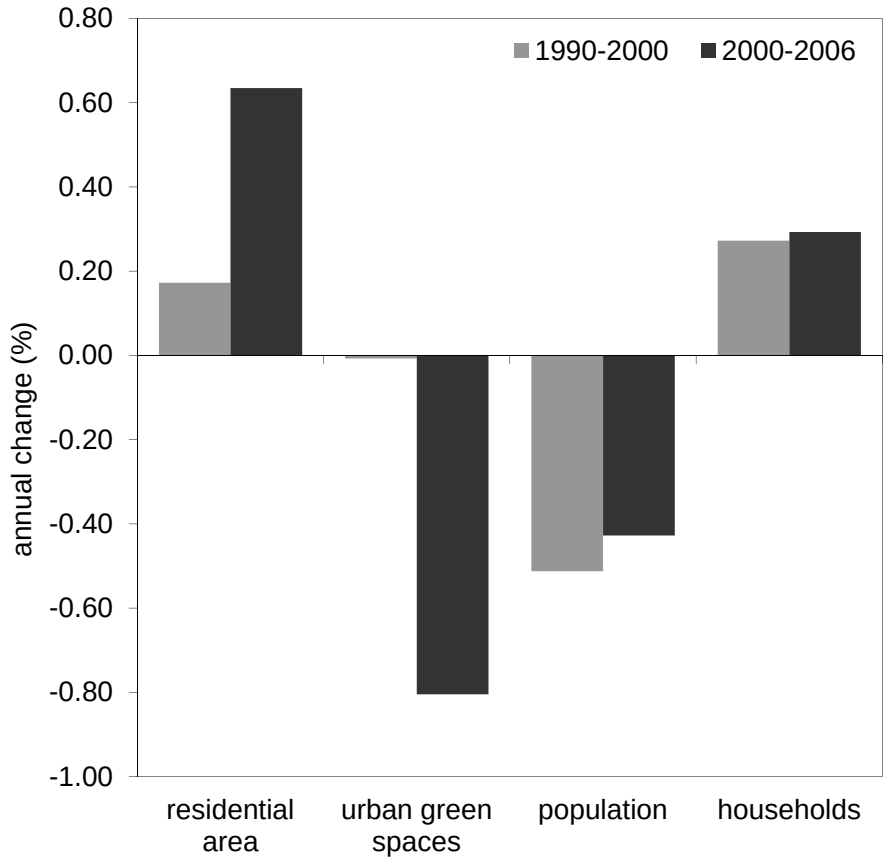
Kabisch, N., Haase, D. (2013) Green spaces of European cities revisited for 1990-2006. *Landscape and Urban Planning*, 110, 113-122.

Green Infrastructure – spatial scales – European scale

All cities

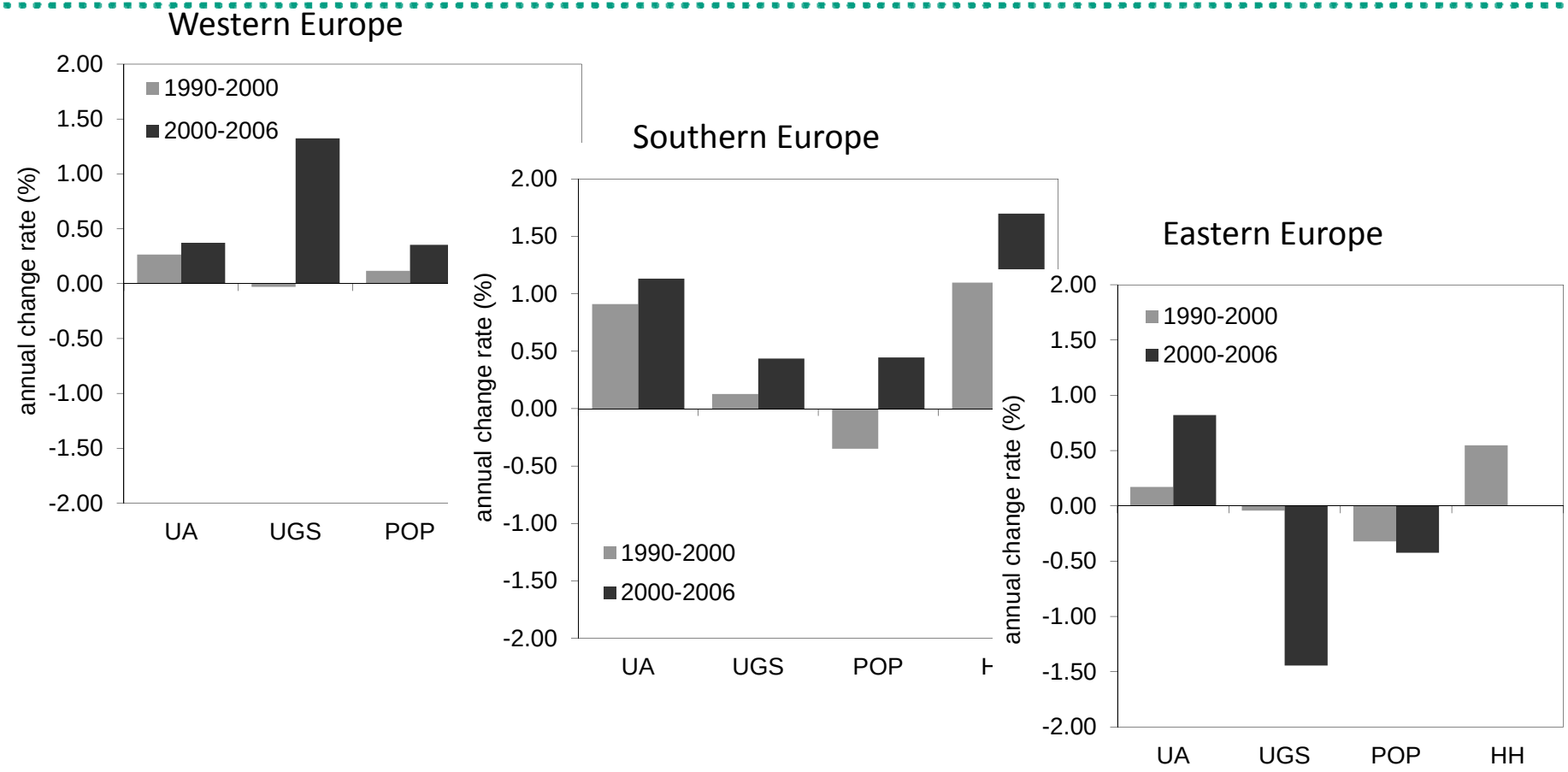


Shrinking cities



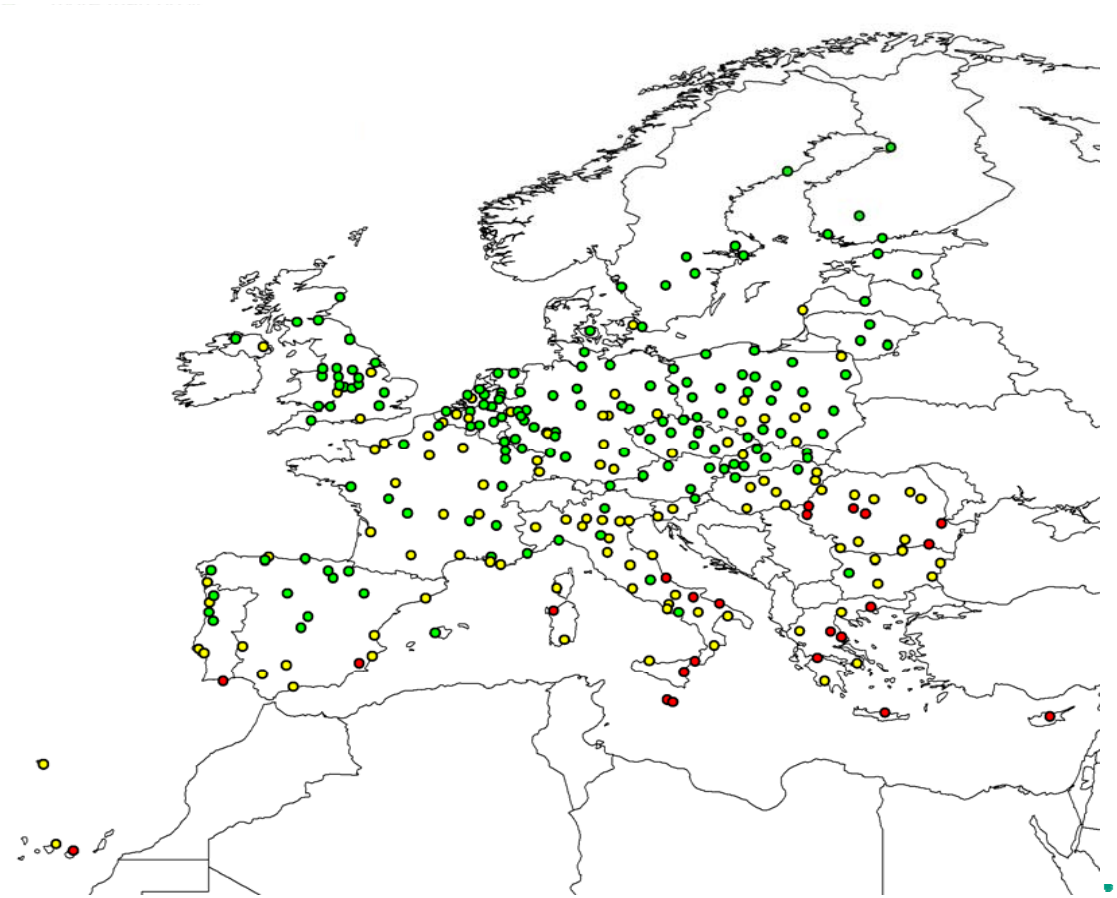
Kabisch, N., Haase, D. (2013) Green spaces of European cities revisited for 1990-2006. *Landscape and Urban Planning*, 110, 113-122.

Green Infrastructure – spatial scales – European-regional scale



Kabisch, N., Haase, D. (2013) Green spaces of European cities revisited for 1990-2006. *Landscape and Urban Planning*, 110, 113-122.

Green Infrastructure ESS mapping – spatial scales – European scale



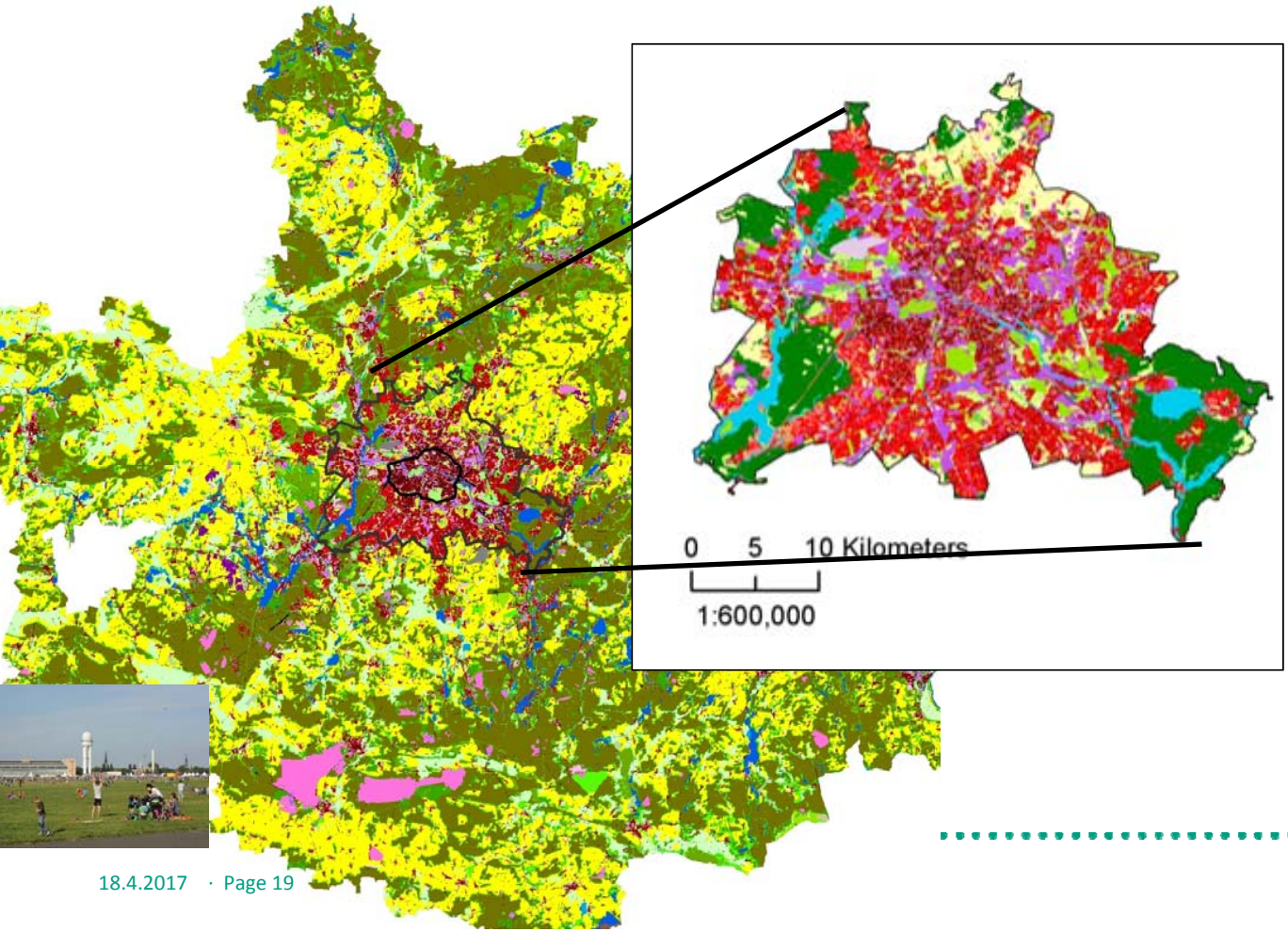
Data: Urban Atlas (EEA2010)
GISCO: Pop 2011

Kabisch, N., Strohbach, M., Haase, D., Kronenberg, J. (2016) Urban Green Space Availability in European cities. Ecological Indicators. http://dx.doi.org/10.1016/j.ecolind.2016.02.029

City level

Green Infrastructure ESS mapping – spatial scales – city scale

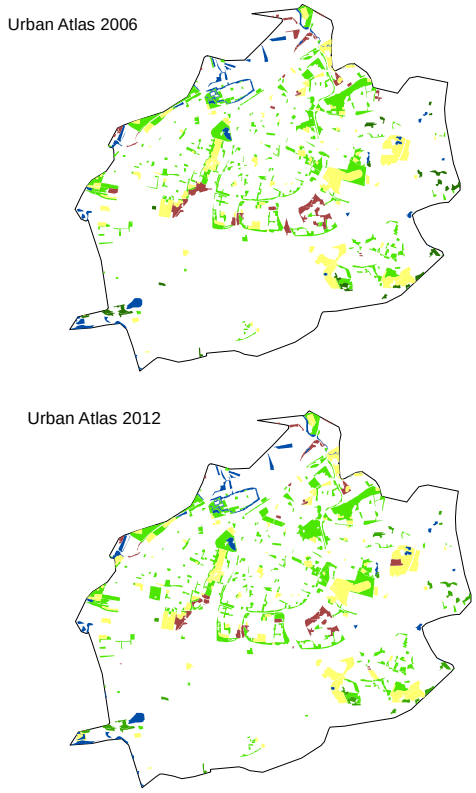
Urban Atlas data 2006 (EEA 2010): Urban Agglomeration/City Berlin

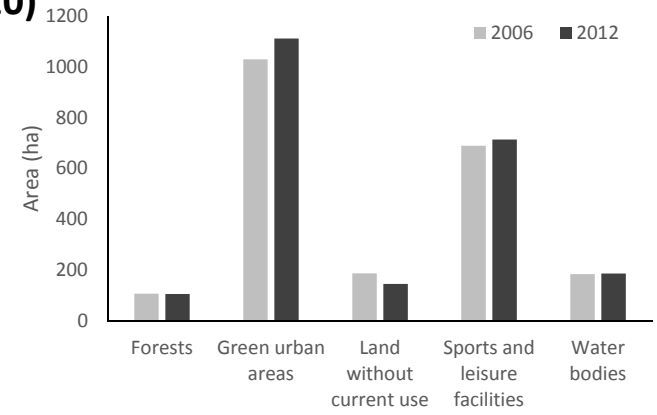


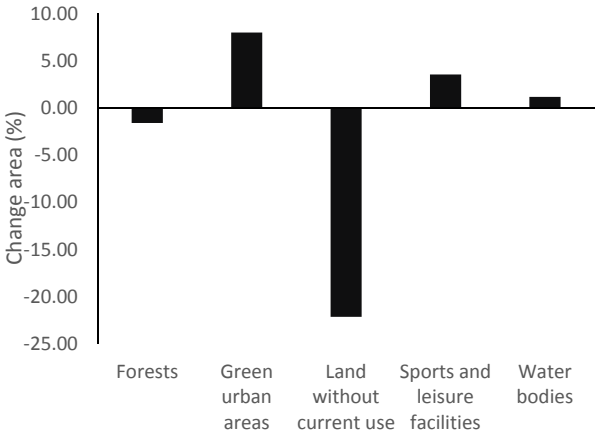
- Continuous urban fabric (S.L > 80%)
- Discontinuous dense urban fabric (S.L 50%- 80%)
- Discontinuous medium dense urban fabric (S.L 30%- 50%)
- Discontinuous low dense urban fabric (S.L 10%- 30%)
- Discontinuous very low dense urban fabric (S.L <10%)
- Isolated structures
- Industrial, commercial, public, military and private units
- Fast transit roads and associated land
- Other roads and associated land
- Railways and associated land
- Port areas
- Airports
- Mineral extraction and dump sites
- Construction sites
- Land without current use
- Green urban areas
- Sports and leisure facilities
- Agricultural Areas
- Forests and semi-natural areas
- Wetlands
- Water

Green Infrastructure ESS mapping – spatial scales – city scale

Land cover change based on Urban Atlas land cover data Malmö (EEA 2010)



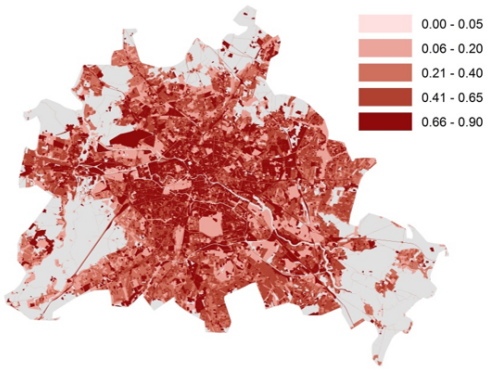




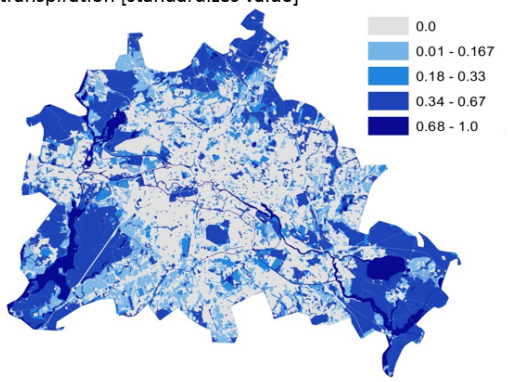
Green Infrastructure ESS mapping – spatial scales – city scale

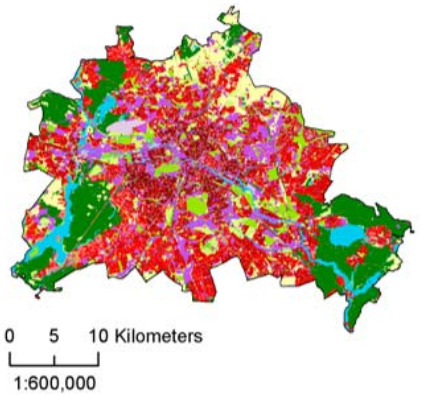
Regulating ESS performance based on Urban Atlas land cover data Berlin (EEA 2010)

Sealing [in %]

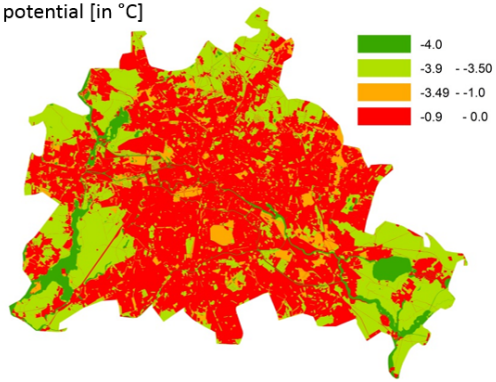


Evapotranspiration [standardizes value]

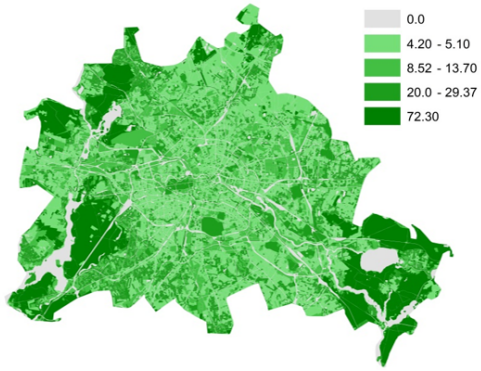




Cooling potential [in °C]



Above ground carbon storange [in tC/ha]



Kabisch, N., Larondelle, N., Reeve, A., Artmann, M. (2014) Human-Environmental Interactions in Cities: Challenges and Opportunities of Urban Land Use Planning and Green Infrastructure. Cambridge Scholars Publishing, Newcastle Upon Tyne.

Green Infrastructure ESS mapping – spatial scales – city scale

Urban green space accessibility GREEN SURGE Berlin

Data	Reference year	Source
Administrative city boundaries European sample	2004	GISCO Urban Audit http://ec.europa.eu/eurostat/web/gisco/geodata/re
Demography GEO STAT Grid EU	2011	GISCO 2014 http://ec.europa.eu/eurostat/web/gisco/geodata/reference
UGS (class 141 and class 30)	2006	Urban Atlas 2006 (EEA, http://www.eea.europa.eu/data-and-maps/dat
Berlin green spaces	2011	Senate Department for Urban Development and the Environment
Łódź green spaces	2014	Łódź City Geodesy Center

1. Select UGS categories ≥ 2 ha

2. Buffer all selected areas within 300-m and 500-m distance.

3. Intersect buffer with 1 km² grid file within city border and calculate area of UGS within buffer for each grid cell.

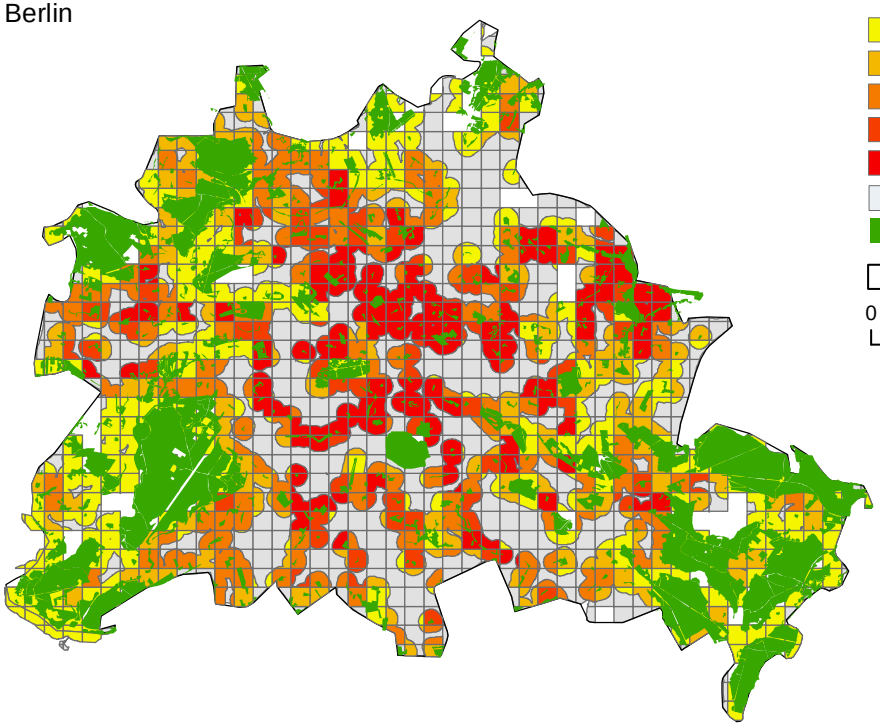
4. Final map: cells with UGS of 2-ha minimum (m²/inh.) available within a 300-m and a 500-m distance.

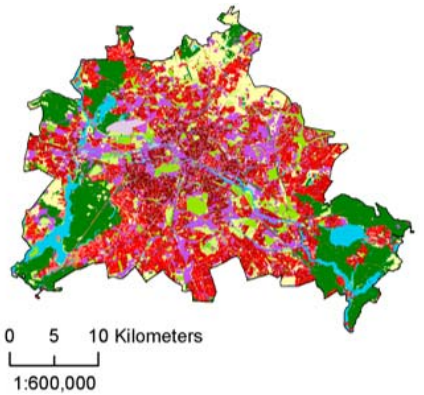
Kabisch, N., Strohbach, M., Haase, D., Kronenberg, J. (2016) Urban Green Space Availability in European cities. Ecological Indicators. http://dx.doi.org/10.1016/j.ecolind.2016.02.029

Green Infrastructure ESS mapping – spatial scales – city scale

Urban green space accessibility GREEN SURGE Berlin

Berlin

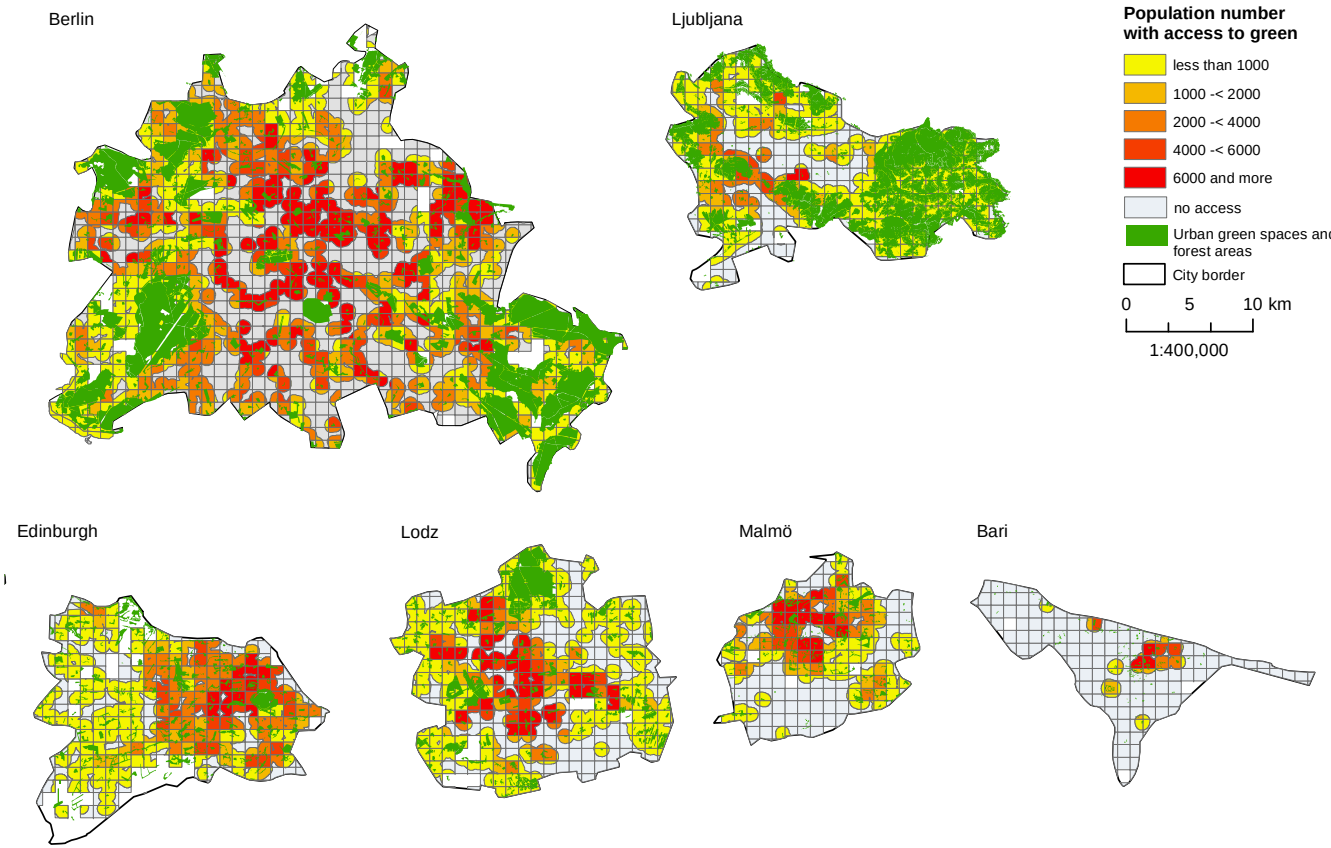




Kabisch, N., Strohbach, M., Haase, D., Kronenberg, J. (2016) Urban Green Space Availability in European cities. Ecological Indicators. http://dx.doi.org/10.1016/j.ecolind.2016.02.029

Green Infrastructure ESS mapping – spatial scales – city scale

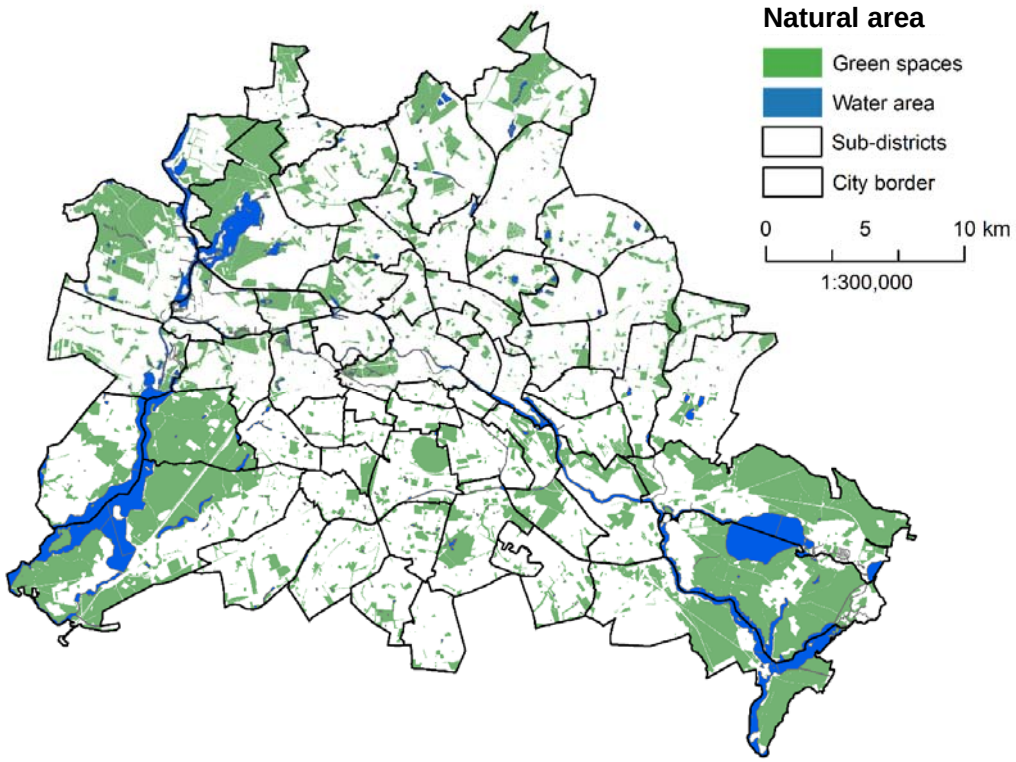
Urban green space accessibility GREEN SURGE Urban Learning Labs



Kabisch, N., Strohbach, M., Haase, D., Kronenberg, J. (2016) Urban Green Space Availability in European cities. Ecological Indicators. http://dx.doi.org/10.1016/j.ecolind.2016.02.029

City district level

Green Infrastructure ESS mapping – spatial scales – city scale/district



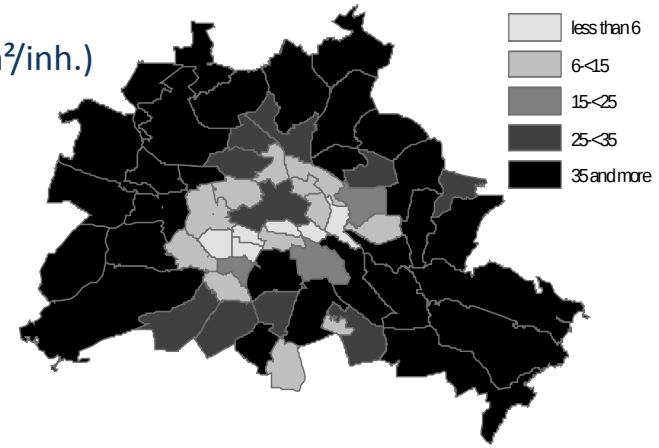
- publicly available spatial data on an aggregated level of the 60 sub-districts
- landuse variables as natural area indicator (green and blue spaces)
- socio-deomographic data
- health outcome and social variables of children and their families

Kabisch, N., Haase, D., Annerstedt van den Bosch, M. (2016) Adding Natural areas to Social Indicators of Intra-Urban Health Inequalities among Children: A Case Study from Berlin, Germany. International Journal of Environmental Research and Public Health 2016, 13, 783; doi:10.3390/ijerph13080783

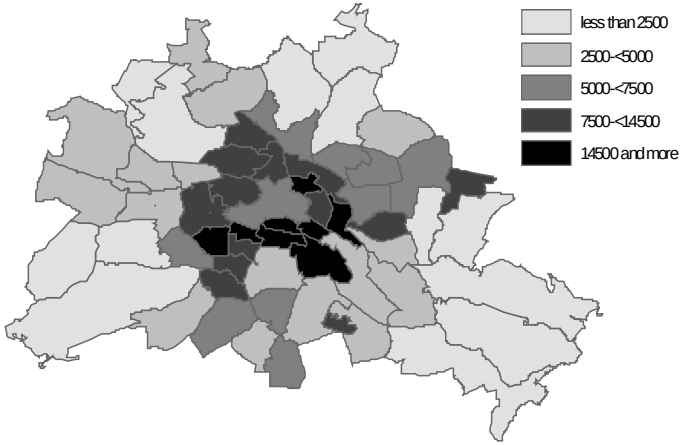
Green Infrastructure ESS mapping – spatial scales – city scale/district

Urban green space availability – a socio-environmental justice perspective

per capita UGS (m²/inh.)

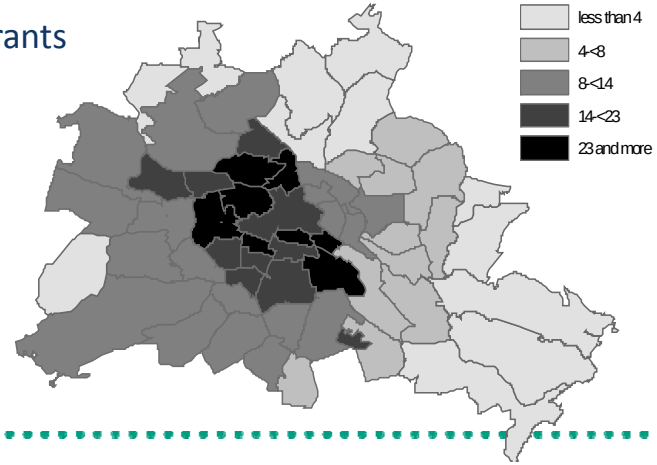


population density (inh./sqkm)

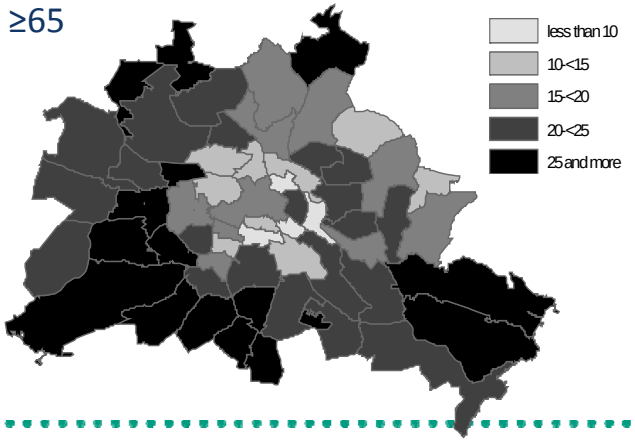


0 4.5 9 km
1:500,000

percentage of immigrants (%)



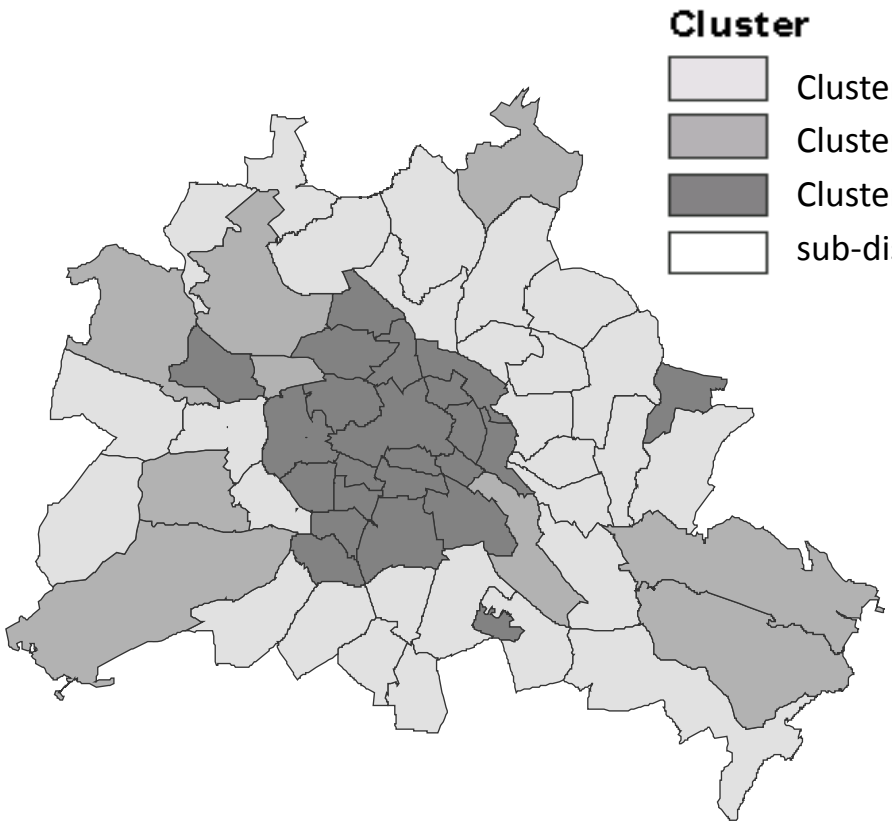
percentage of people ≥65 years of age (%)



Kabisch, N., Haase, D. (2014) Green Justice or just Green? Urban Green Space Provision in the City of Berlin. *Landscape and Urban Planning* 122, 129-139.

Green Infrastructure ESS mapping – spatial scales – city scale

Urban green space availability – a socio-environmental justice perspective

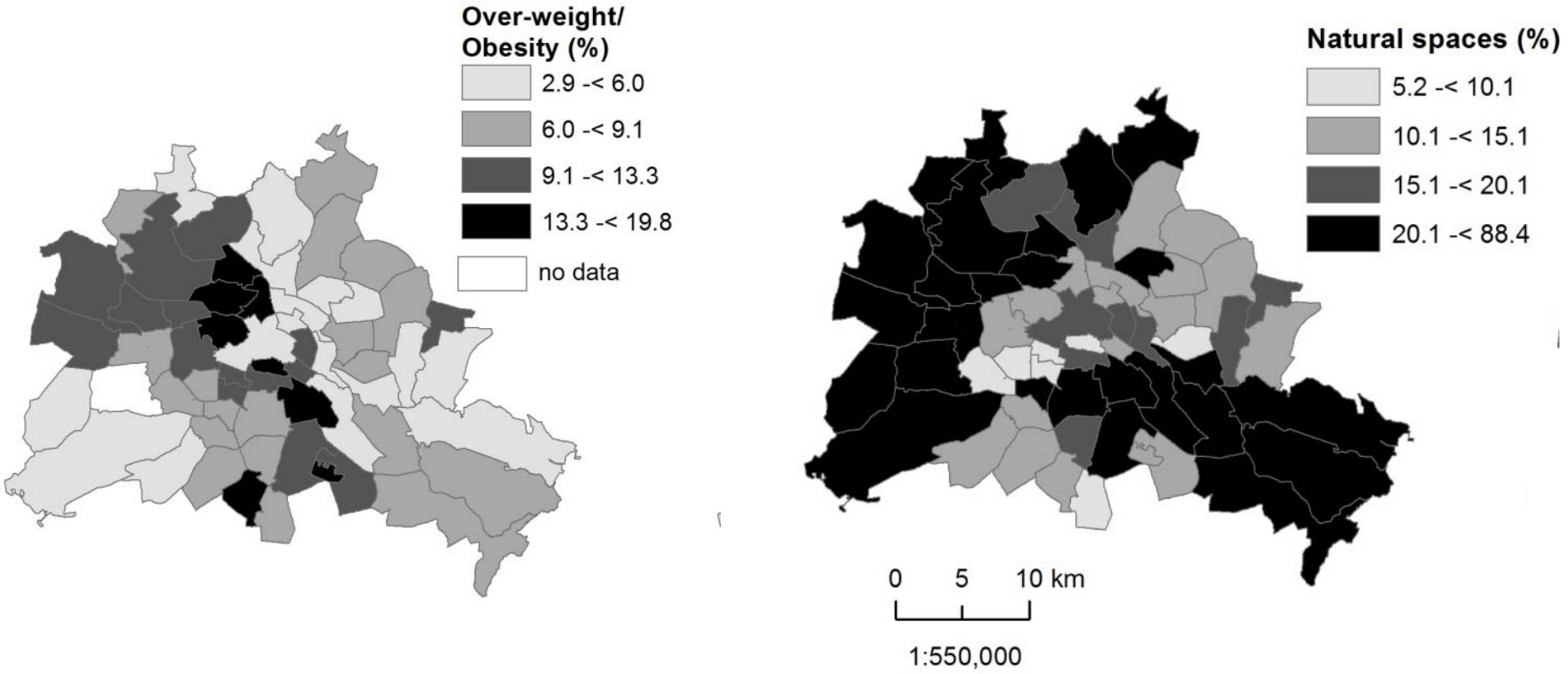


	C 1	C 2	C 3	Total city
Share of UGS (%)	21.77	55.27	16.06	24.61
Population density (inh./km²)	3770.66	1554.53	10889.23	6167.06
Percentage of immigrants (%)	6.64	7.89	20.21	12.03
People ≥ 65 years of age (%)	22.43	26.23	15.07	20.18
Nr. of cases	28	9	23	60

Kabisch, N., Haase, D. (2014) Green Justice or just Green? Urban Green Space Provision in the City of Berlin. *Landscape and Urban Planning* 122, 129-139.

Green Infrastructure ESS mapping – spatial scales – city scale/district

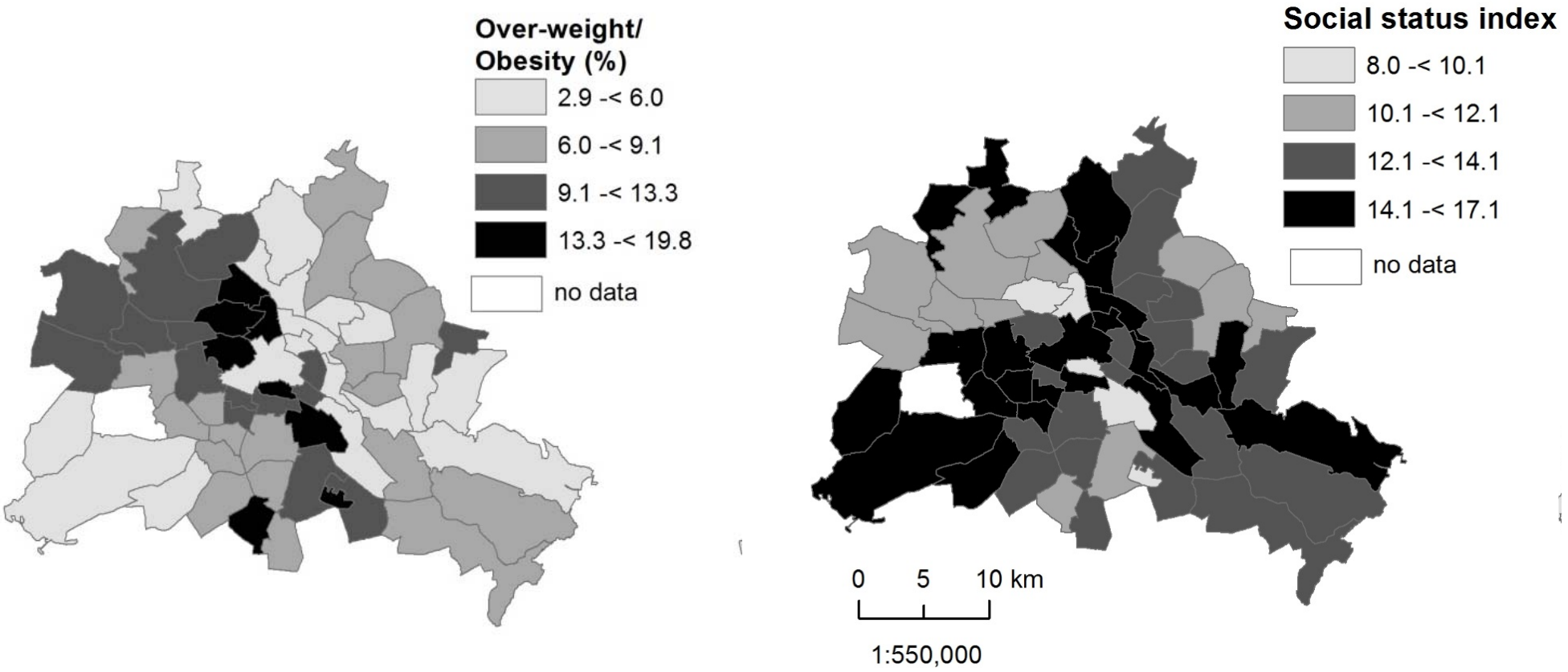
Urban green space availability and health and well-being



Kabisch, N., Haase, D., Annerstedt van den Bosch, M. (2016) Adding Natural areas to Social Indicators of Intra-Urban Health Inequalities among Children: A Case Study from Berlin, Germany. International Journal of Environmental Research and Public Health 2016, 13, 783; doi:10.3390/ijerph13080783

Green Infrastructure ESS mapping – spatial scales – city scale/district

Urban green space availability and health and well-being



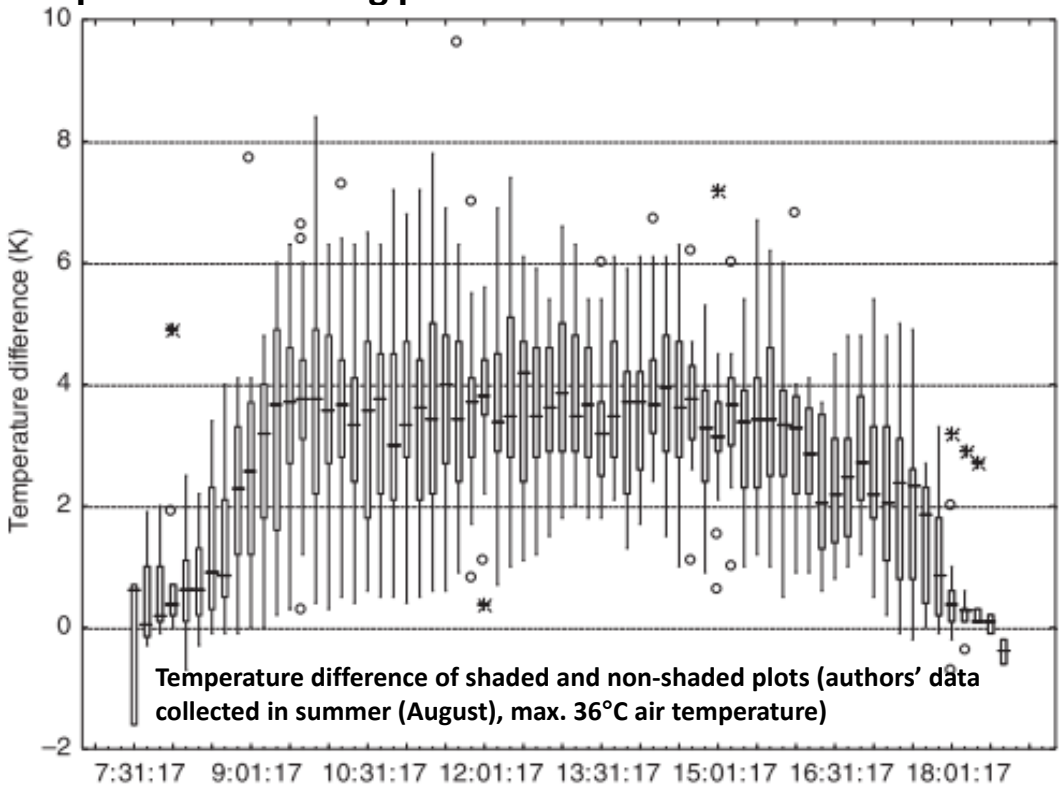
Kabisch, N., Haase, D., Annerstedt van den Bosch, M. (2016) Adding Natural areas to Social Indicators of Intra-Urban Health Inequalities among Children: A Case Study from Berlin, Germany. International Journal of Environmental Research and Public Health 2016, 13, 783; doi:10.3390/ijerph13080783

Site and block level

Green Infrastructure ESS mapping – spatial scales – site level

Green Infrastructure Functionality – Mean temperature lowering potential of the tree shade

Example of Leipzig

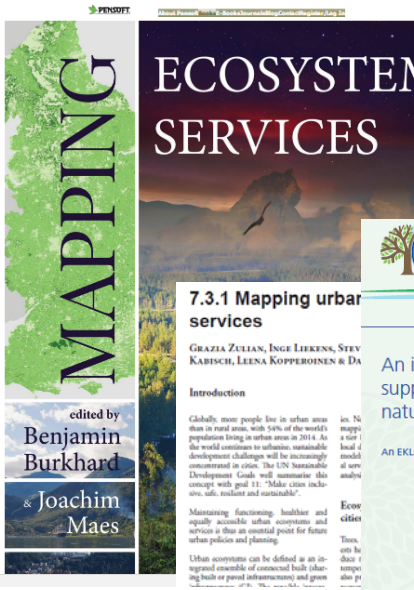


Temperature difference of shaded and non-shaded plots (authors' data collected in summer (August), max. 36°C air temperature)

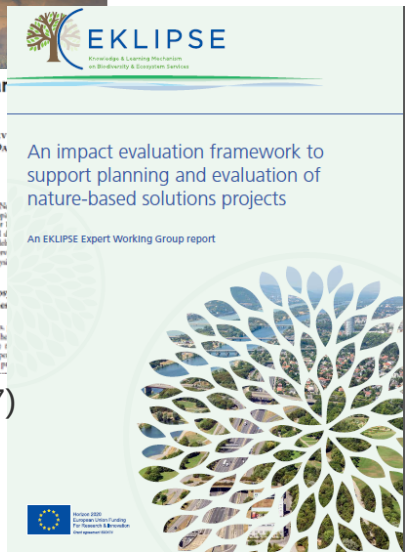
Breuste, J., Haase, D., & Elmqvist, T. (2013). Urban Landscapes and Ecosystem Services. In S. Wratten, H. Sandhu, R. Cullen, & R. Costanza (Eds.), Ecosystem Services in Agricultural and Urban Landscapes (pp. 83–104). Wiley.

Conclusion

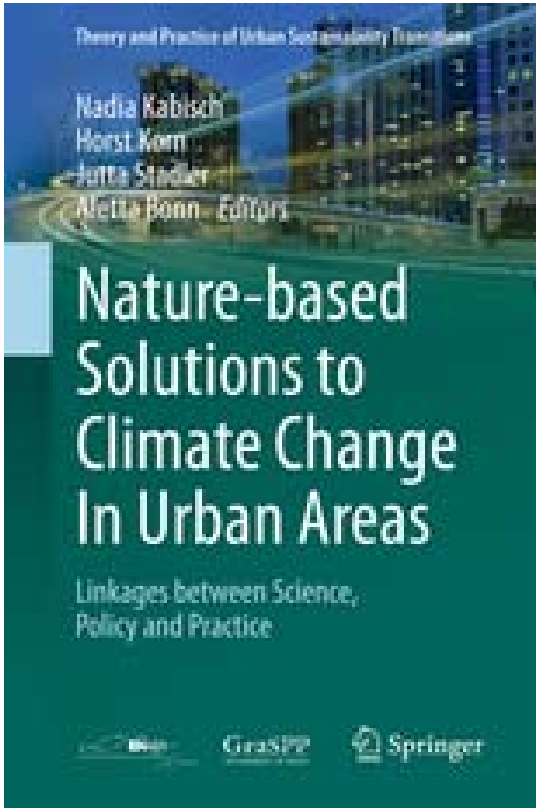
Ecosystem Services and Nature-based Solutions mapping – and assessing



Burkhard and Maes (2017)
ISBN 9789546428295



Raymond et al. (2017)
ISBN 978-1-906698-62-1



Kabisch et al. (2017, in production)
ISBN 978-3-319-56091-5

Authors
Marco Fritz
Nadja Kabisch, Jutta Stadler, Horst Korn, Aletta Bonn
Tobias Emilsson, Åsa Ode Sang
Stephan Pauleit, Teresa Zölch, Rieke Hansen, Thomas B. Randrup, Cecil Konijnendijk van den Bosch
Erik Andersson , Sara Borgström, Timon McPhearson
Niki Frantzeskaki, Sara Borgstrom, Leen Gorissen, Markus Egermann, Franziska Ehnert
Yaella Depietri, Timon McPhearson
Dagmar Haase
McKenna Davis, Sandra Naumann
Francesc Baró, Erik Gómez-Baggethun
Vera Enzi, Blanche Cameron, Péter Dezsényi, Dusty Gedge, Gunter Mann, Ulrike Pitha
Matthias Braubach , Andrey Egorov, Pierpaolo Mudu , Tanja Wolf, Catherine Ward Thompson, Dorota Jarosinska, Marco Martuzzi
Nadja Kabisch, Matilda Annerstedt van den Bosch
Annegret Haase
Ines Cabral, Sandra Costa, Ulrike Weiland, Aletta Bonn
Christine Wamsler, Stephan Pauleit, Teresa Zölch, Sophie Schetke, André Mascarenhas
Chantal van Ham, Helen Klimmek
Jakub Kronenberg, Tomasz Bergier, Karolina Maliszewska
Nils Droste, Christoph Schröter-Schlaack, Bernd Hansjürgens, Horst Zimmermann
Nadja Kabisch, Horst Korn, Jutta Stadler, Aletta Bonn

Thank you for the attention!

nadja.kabisch@geo.hu-berlin.de

Frantzeskaki, N., Kabisch, N., McPhearson, T. (2016) Advancing urban environmental governance: Understanding theories, practices and processes shaping urban sustainability and resilience. Environmental Science and Policy. http://dx.doi.org/10.1016/j.envsci.2016.05.008

Kabisch, N., Frantzeskaki, N., Pauleit, S., Naumann, S., Davis, M., Artmann, M., Haase, D., Knapp, S., Korn, H., Stadler, J., Zaunberger, K., Bonn, A. (2016) Nature-based solutions to climate change mitigation and adaptation in urban areas - perspectives on indicators, knowledge gaps, barriers and opportunities for action. Ecology and Society 21(2):39. http://dx.doi.org/10.5751/ES-08373-210239

Kabisch, N., Haase, D., Annerstedt, M. (2016) Adding Natural Spaces to Social Indicators of Intra-Urban Health Inequalities among Children: A Case Study from Berlin, Germany. International Journal of Environmental Research and Public Health.

Kabisch, N., Strohbach, M., Haase, D., Kronenberg, J. (2016) Urban Green Space Availability in European cities. Ecological Indicators. http://dx.doi.org/10.1016/j.ecolind.2016.02.029

Kabisch, N., Haase, D. (2014) Green Justice or just Green? Urban Green Space Provision in the City of Berlin. Landscape and Urban Planning 122, 129-139.

Kabisch, N., Qureshi, S., Haase, D. (2015) A quantitative review of human-environment interactions in urban green spaces – contemporary issues and future prospects. Environmental Impact Assessment Review 50, 25-34, 10.1016/j.eiar.2014.08.007.

Kabisch, N., Haase, D. (2013) Green spaces of European cities revisited for 1990-2006. Landscape and Urban Planning, 110, 113-122.