

Helmholtz Water Safety and Security Challenge // Solution Labs

Systemic blue-green-red urban development – A Helmholtz Solution Lab

KA4-WSSC-06 URBAN LE

UFZ | HZDR | KIT | HIOH

14.05.2025

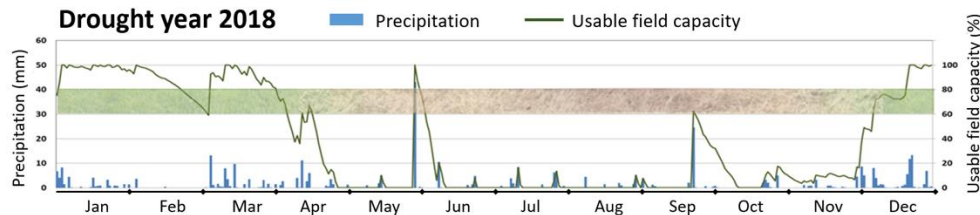
Roland A. Müller

Where we come from:

Our Starting Point – Preparatory Work

2019: Climate emergency in the City of Leipzig

Mayor / city administration asked UFZ for help



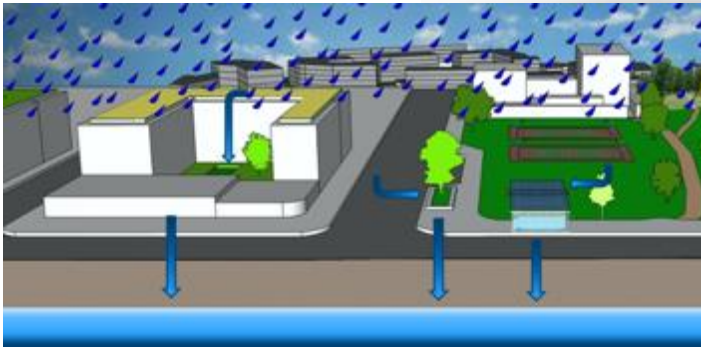
Burkhard Jung, Mayor of Leipzig, Vice president of the Association of German Cities

Solution Approach: Blue-Green urban water management

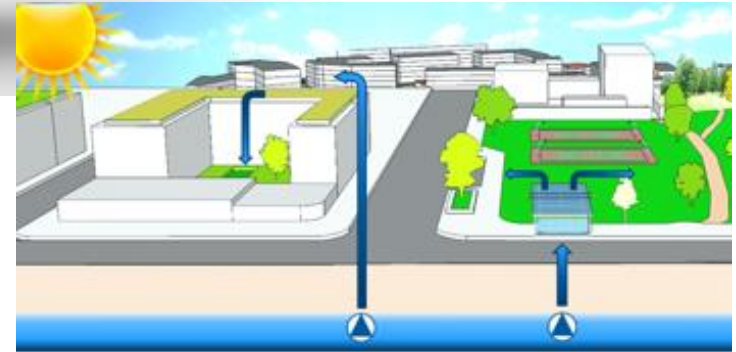
How much water does a city need, for what purposes, when – and how will this demand change in the future?



What design principles enable urban water infrastructure to handle both, water scarcity and local flooding?



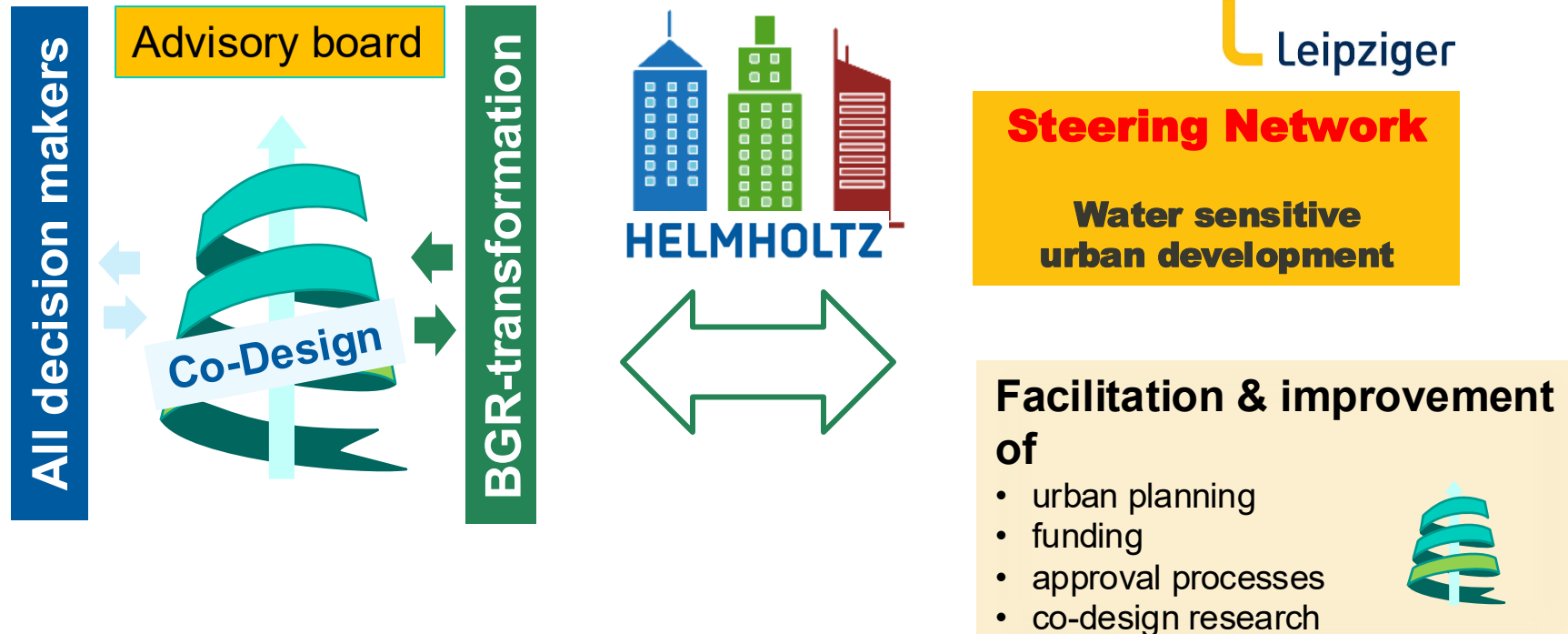
Retention, storage, infiltration



Irrigation and evaporation

Impact: New communication structures established

From co-design towards a steering network

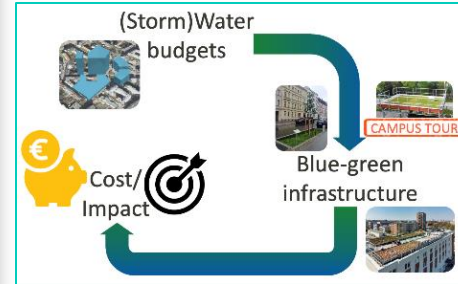


Blue-Green *Solutions*:

New development area approved by the city council



New development area, city center

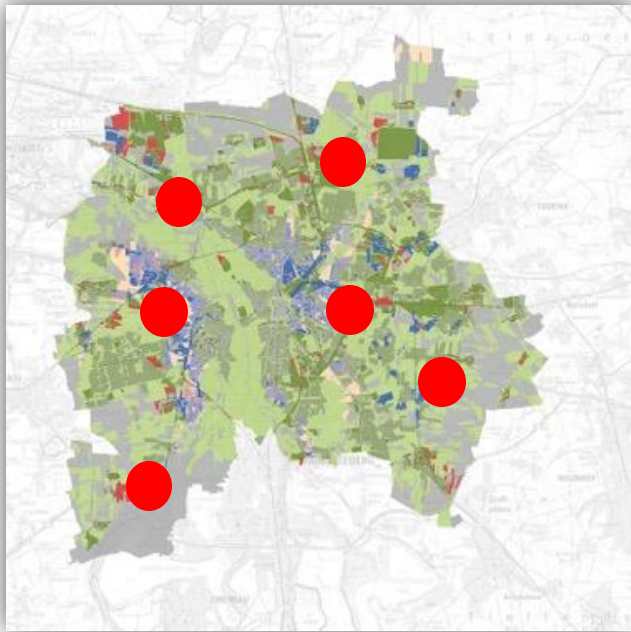


Leipzig city council
approves blue-green
development plan

**100-year
stormwater proof**

Solution Lab Leipzig – paradigm shift

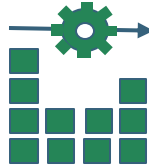
Decoupling decision and 6 initial city districts



 BGR city districts approved
(Climate Board of Leipzig, 2025)



Stormwater proof local sewer system
(100-year model rainfall/a) **1 billion €**



Solution:

Decision: decouple **25 % of rain water** from the sewer system – **300 million €**



 Leipziger
BlauGrün

 Leipziger
Wasserwerke

 Leipziger
BlauGrün  Leipziger

**Steering
Network**

**Water sensitive
urban development**

Achievement:

German model city: (BMBF-Federal Ministry of Education and Research)



German Parliament; Parliamentary Evening

HELMHOLTZ
CLIMATE INITIATIVE

Deutscher Städtetag  Die Stimme der Städte
(German Association of Cities)

Blue-Green coaching of 10 German cities



Central German Competence Center
for Water Management

4 Blue-Green dialogues with
> 300 city representatives



Political consulting

The URBAN LE Lab-Structure

Solutions for Water Safety and Security



Climate resilient city
German City Council
and other stakeholders

SOLVE-Solution
Lab Terrestrial
Water Cycles



Leipziger L-Group
Leipzig Waterworks
Municipal Utilities

City of Leipzig
Office for Environmental Protection
Urban Greenery and Water
City planning office
Mobility and Civil Engineering Office
Department "Digital City"

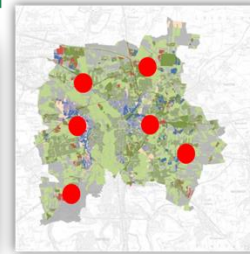


Water quantity:
Blue-green-red infrastructure research
(SPs 2 and 5)
Hydrosystem modelling (SP1)

Water quality (SP3):
Persistent chemicals and AMR bacteria
Technology supplements

Outreach:
Citizen science (SP6)
Legislation (SP4)

Solution Lab
Rur-ERFT



The URBAN LE Lab

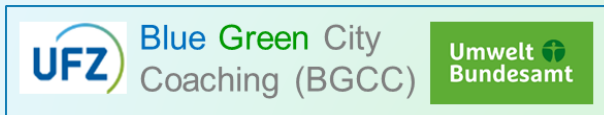
Visibility builds connections for outreach activities

Existing projects, collaborations and infrastructures (examples):

Regional:



National:



Infrastructures/Sites (e.g.)



Institutional: HELMHOLTZ CLIMATE INITIATIVE



CARF-Group

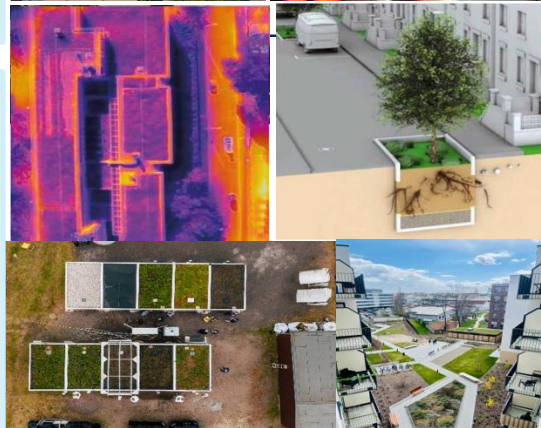


KONATES



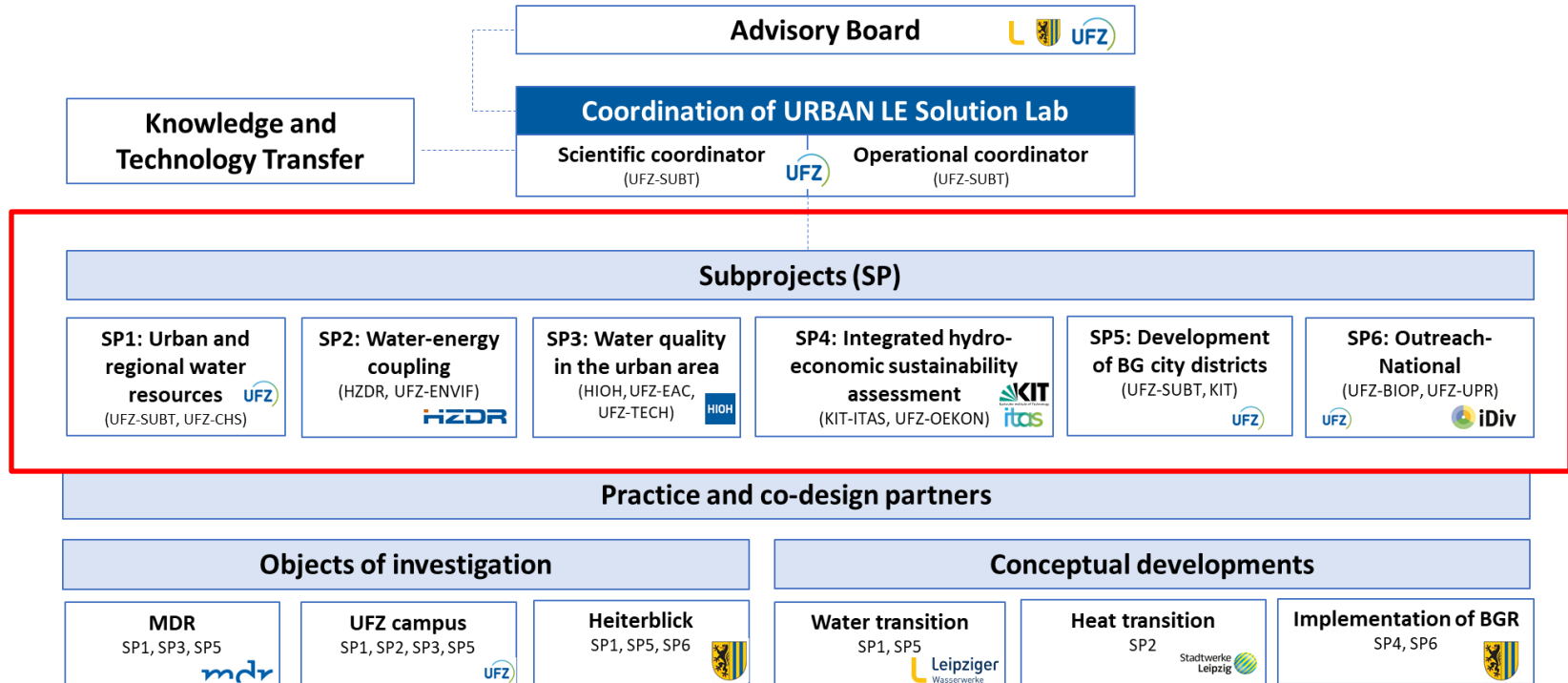
International

giz



Urban Solution Lab – Solutions for what?

Priorities and project structure



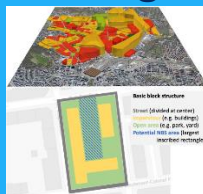
What is the impact of urban blue-green interventions towards rural, peri-urban water resources?

By highlighting water interactions we ensure safe & secure use at both urban and landscape scale.

We provide functional digital twin solutions that highlight how urban water planning interacts with rural water resources.

Utilizing Helmholtz-funded urban water infrastructure planning

HELMHOLTZ
Helmholtz Sustainability Challenge



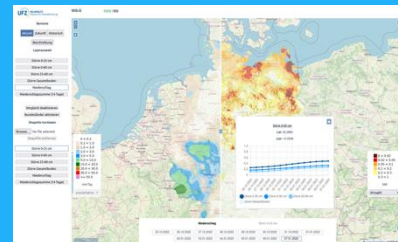
Jan Friesen (lead), Dept. SUBT, UFZ

Making use of the largest Climate-Hydrology-Ensemble developed in



Andreas Marx (co-lead), Dept. CHS, UFZ

Helmholtz-funded Water Resources Information System WIS-D



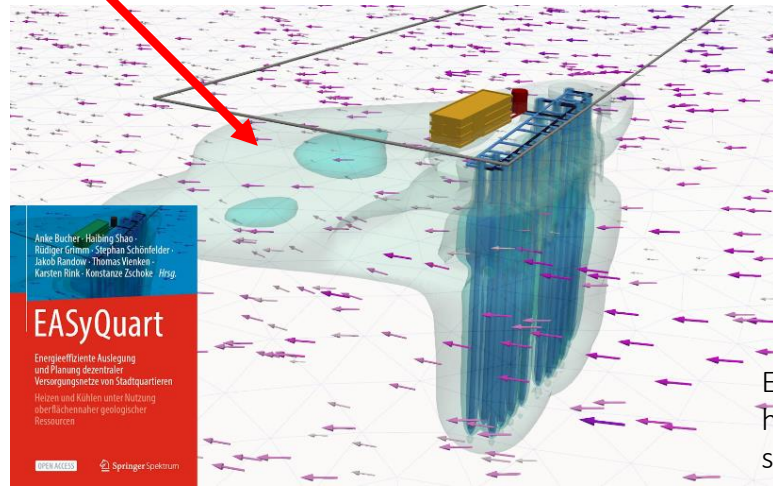
SP 2: Solution for water and energy efficiency

Implementation of BGR Infrastructures –integrated BGR City planning



How can the multifunctional capacities of BGR infrastructure systems be systematically integrated into urban planning and design processes to enhance performance and resilience?

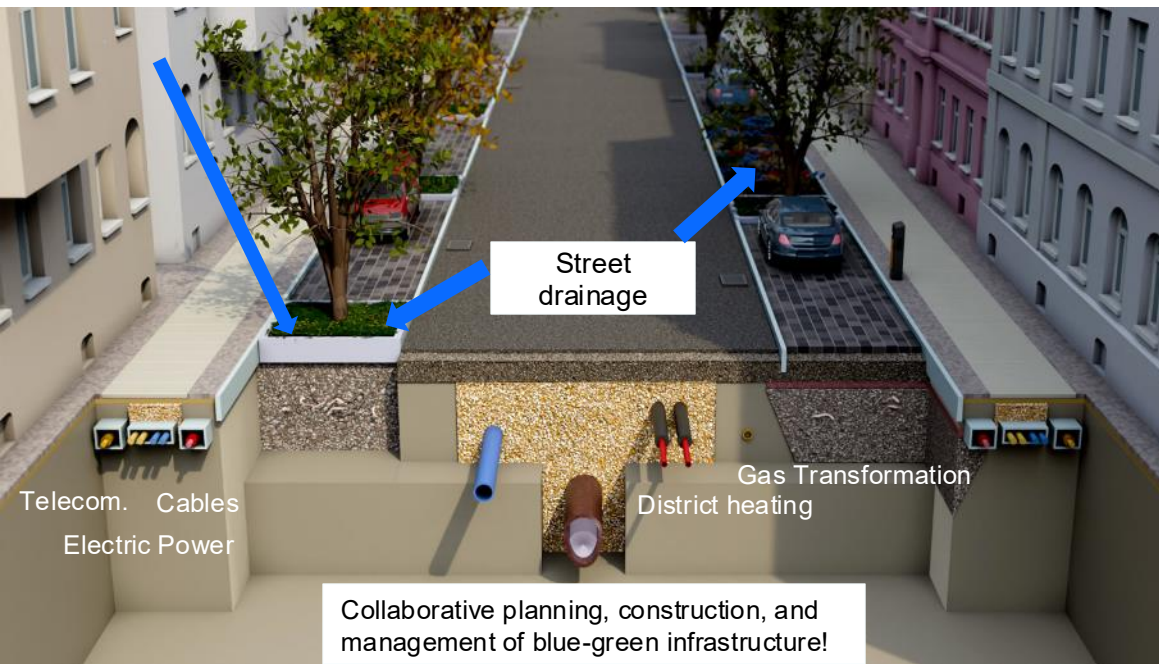
How can the performance of BGR infrastructures be quantified and evaluated with respect to their associated water demand?



Example: Simulation of a combined building heat provision based on geothermal heat pump systems

SP2/4: Solution for an effective Water- and Heat transition

Water Infrastructure Resilience & Financing



How can upcoming large-scale infrastructure planning processes for the heat and water transitions be designed to create synergies?

Research on the ground:

BGR City district
&
BlueGreen Streets

SP3: Solution for save and healthy urban water

Water quality – Pollution and emerging contaminants



How can urban water systems be made resilient to microbial, chemical, and climate-related stressors to ensure long-term water quality?

Water quality in the Seine River

Solution for save and healthy urban water

Development of effective management strategies:

Sustainable technical and strategic solutions for rainwater reuse and storage (enhancing water security) and pollutant removal (ensuring water safety):

- **CITEPro**: Identification of critical entry pathways, accumulation processes, and temporal dynamics to develop targeted measures for safeguarding urban water quality.
- **PFAS Competence Cluster**-Use of existing *treatment toolbox*
- **Biosafety level 2** labs (HZI/HIOH) for AMR detection
- Fostering Pollutant Sinks-In-situ Treatment Technologies



Urban Health Strategy
(strategic advisory)

Focus Groups

Risk Mapping-Treatment
Priorities

Decentralized treatment options

Research questions:

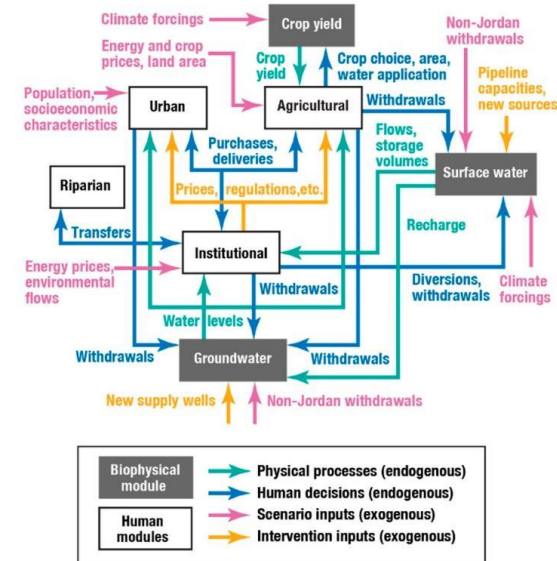
- To which degree can BGR solutions mitigate urban water scarcity and alleviate rural-urban water conflicts?
- Which socio-economic impacts do BGR solutions entail when a Leipzig and what is their potential for transfer to other cities?

Objectives

- Identify vulnerabilities of the city and surrounding areas under co-designed scenarios of climate-related water extremes and compound events

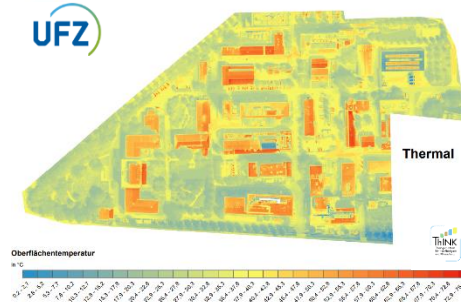
Products/Impact:

- Integrated sustainability assessment of BGR solutions
- Scalability and transferability appraisal for solutions
- Socio-economic analyses of extreme event impacts



Multi-agent system model DroughtMAS

Goals: harmonization of rainwater requirements with optimal multifunctional effects of blue-green infrastructures, solutions for spatial conflicts



Products:

- pilot of a water sensitive city district, supportive tools (e.g. predictive irrigation control systems based on weather forecast)
- urban BGR-integrated water pipeline planning in streetscapes



Thank You -



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