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Nature-based Solutions (NBS) towards the European Green Deal: bridging the gap between science and practice of planning.

Dr. Blal Adem Esmail, Environment Analysis & Planning in Metropolitan Areas

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Content

- European Green Deal in a nutshell
- Planning with Nature-based solutions (NBS)
  - ❑ Sustainable river landscape, Lahn River, Germany
  - ❑ Water security & poverty alleviation, Toker watershed, Eritrea

Albert et al. , Plansmart Project

Adem Esmail & Geneletti, PHD-UNITN

European Green Deal

BENEFITS & ACTIONS

fresh air, clean water, healthy soil and biodiversity

renovated, energy efficient buildings

healthy and affordable food

more public transport

cleaner energy and cutting-edge clean technological innovation

longer lasting products that can be repaired, recycled and re-used

future-proof jobs and skills training for the transition

globally competitive and resilient industry

REPowerEU

Climate

Agriculture

Finance and regional development

Environment and oceans

Energy

Transport

Industry

Research and innovation

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European Green Deal

6 April 2022,
WWF, Extreme drought of the Po river


15 September 2022,
Flash Floods in Cantiano, Marche

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European Green Deal

Promising future and historical responsibility!

European Green Deal

- We have to do it as soon as possible
- Inaction is not an option
- It is transversal
- It is global

WHAT IS TO BE DONE IN PRACTICAL TERMS

?

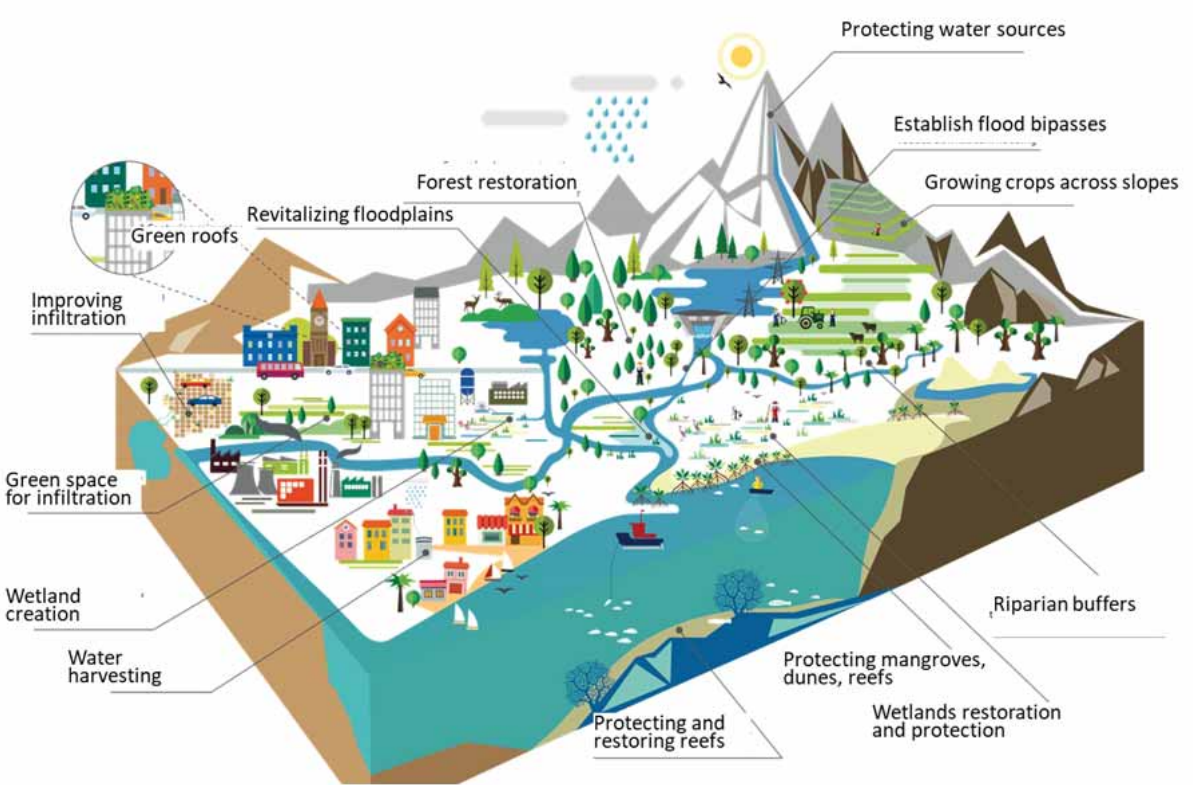
Cities and Metropolitan regions

Challenges

Cities and Metropolitan regions

Opportunities

"**Solutions that are inspired and supported by nature**, which are cost-effective, simultaneously provide environmental, social and economic benefits and help build resilience. Such solutions bring more, and more diverse, nature and natural features and processes into cities, landscapes and seascapes, through locally adapted, resource-efficient and systemic interventions." **EU Commission**



IUCN (2016), adapted

Nature-based solutions in Urban Context


Lahn River, Germany
Metropolitan Region of Frankfurt, Main

Key societal challenges

Substantial transfor-mations

Ecological deficits

Flood risks

Lahn River, Germany
Metropolitan Region of Frankfurt, Main

Context and aim

Blue Ribbon Programm

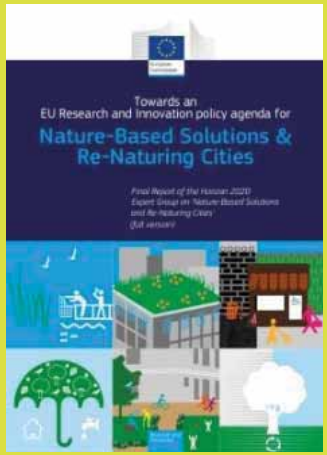
„Developing integrated strategies for subordinate federal waterways“

BMVI and BMUB 2017

Nature-based solutions

„Harnessing ecological processes to address societal challenges “

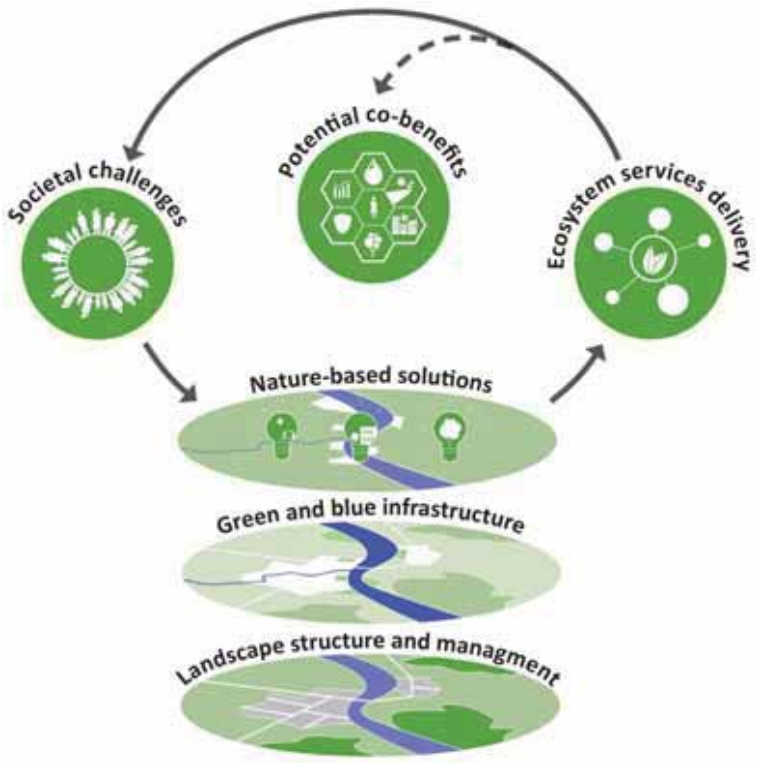
EU Commission 2015,
Albert et al. 2017, *Nature*



Aim

– To introduce an approach for planning nature-based solutions, and to illustrate its application in practice

NBS criteria



Criteria

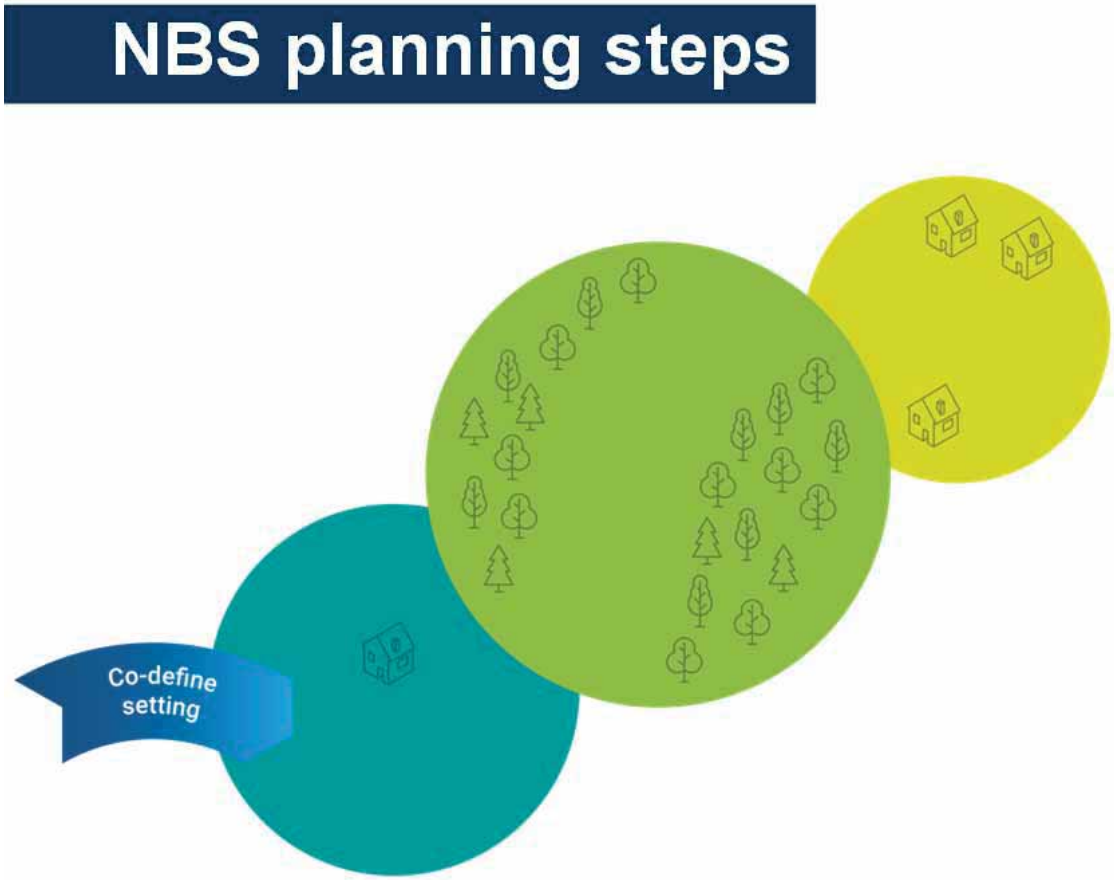
NBS are actions that

- alleviate a well- defined societal challenge,
- use ecosystem processes of spatial, blue and green infrastructure networks, and
- are embedded within viable business or governance models for implementation.

Complementary characteristics

- often co-benefits, but also co-costs
- often time lags until full operation
- sometimes cost-effective

Albert et al. 2019, *Landsc Urban Plan*

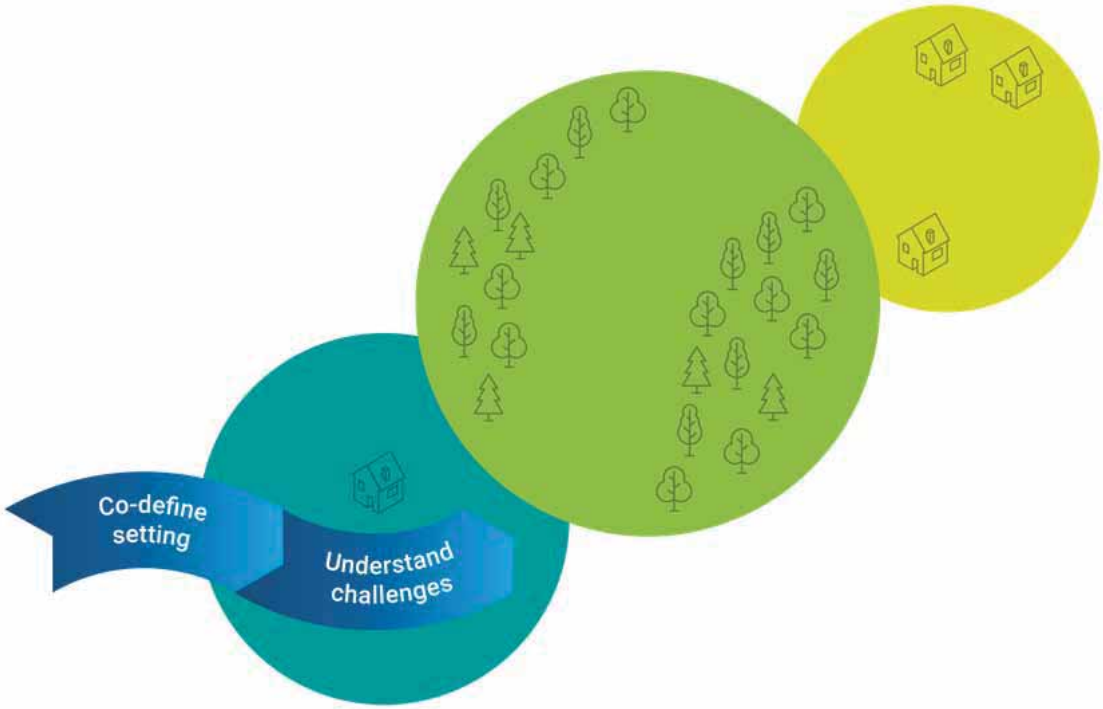


Co-define setting

- Clarify context, overarching aims and processes
- Identify and systematically involve decision-makers, relevant and affected stakeholders, and citizens
- Implement expectation management

Albert et al., *2021, AMBIO*

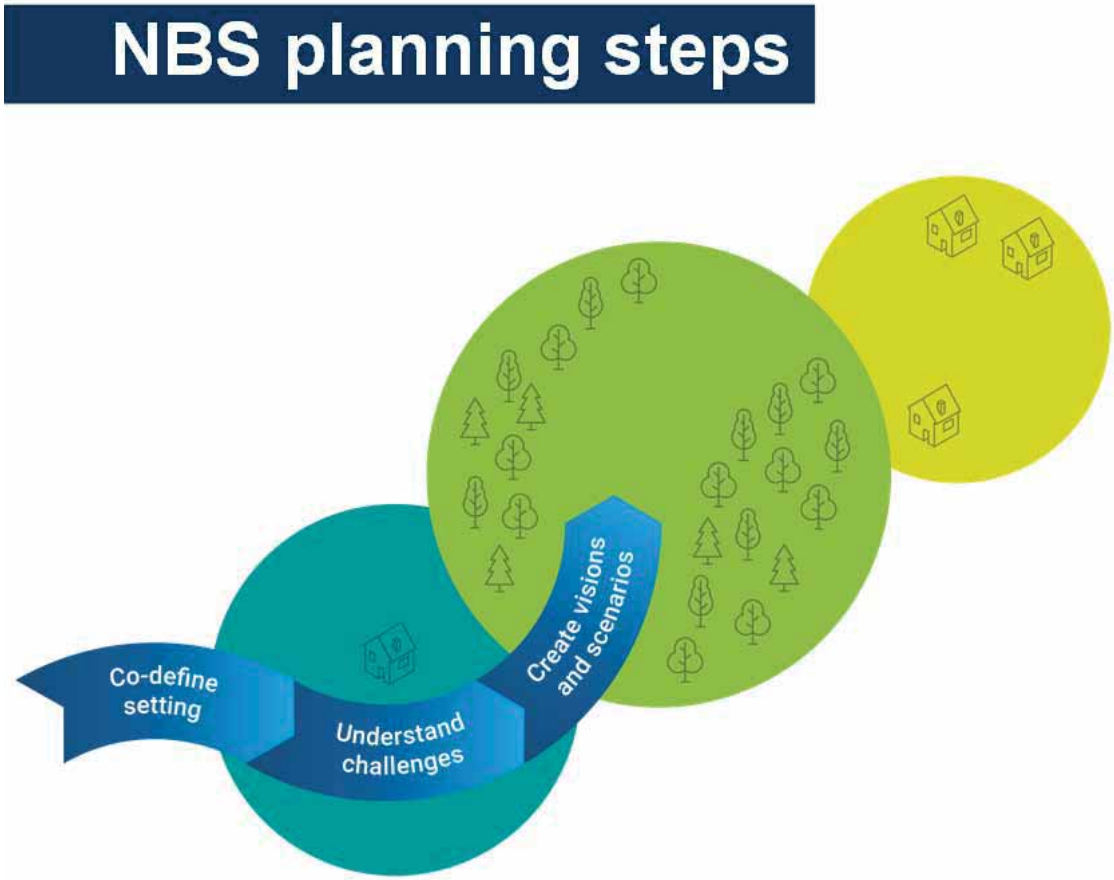
NBS planning steps



Understand challenges

- Assess existing problems and opportunities across scale
- Consider path-dependencies, existing concepts and plans
- Develop systemic understanding, for example through causal loop diagramming

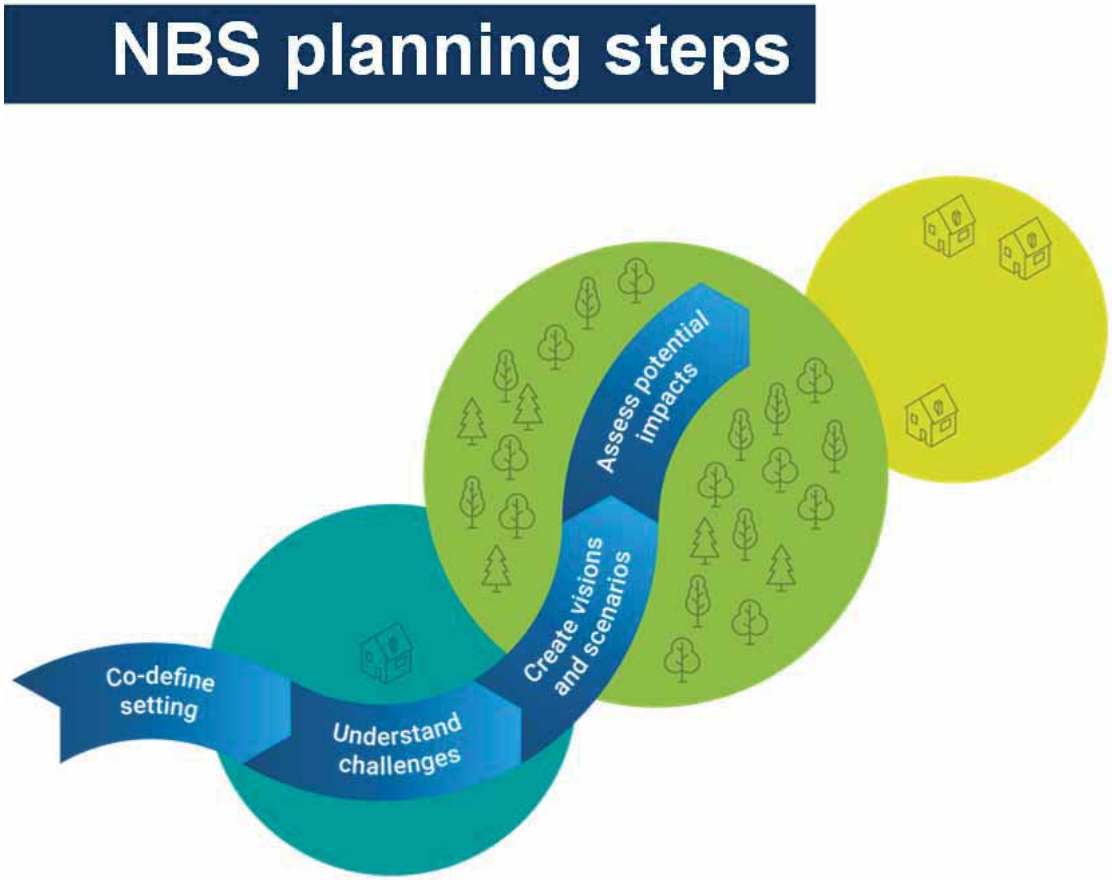
Albert et al., *2021, AMBIO*



Create scenarios

- Stimulate re-thinking river development through creative scenario methods, with and without NBS
- Identify and spatially localize options for siting NBS in landscape context
- Systematically combine sceario narratives and simulations

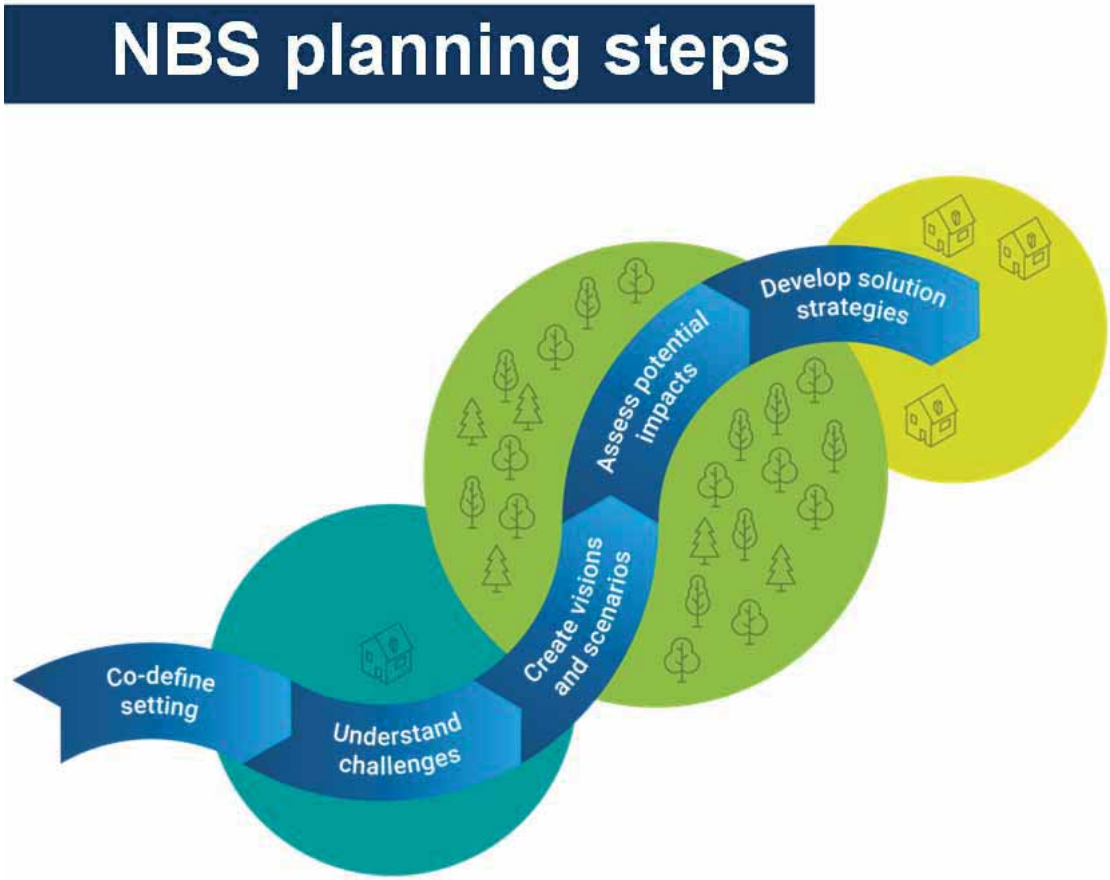
Albert et al., *2021, AMBIO*



Assess impacts

- Multideminsional evaluation of (potential) costs and benefits of NBS and alternative options
- Apply and integrate results of qualitative and/or quantitative impact assessments, e.g. through multi-criteria analysis

Albert et al., *2021, AMBIO*

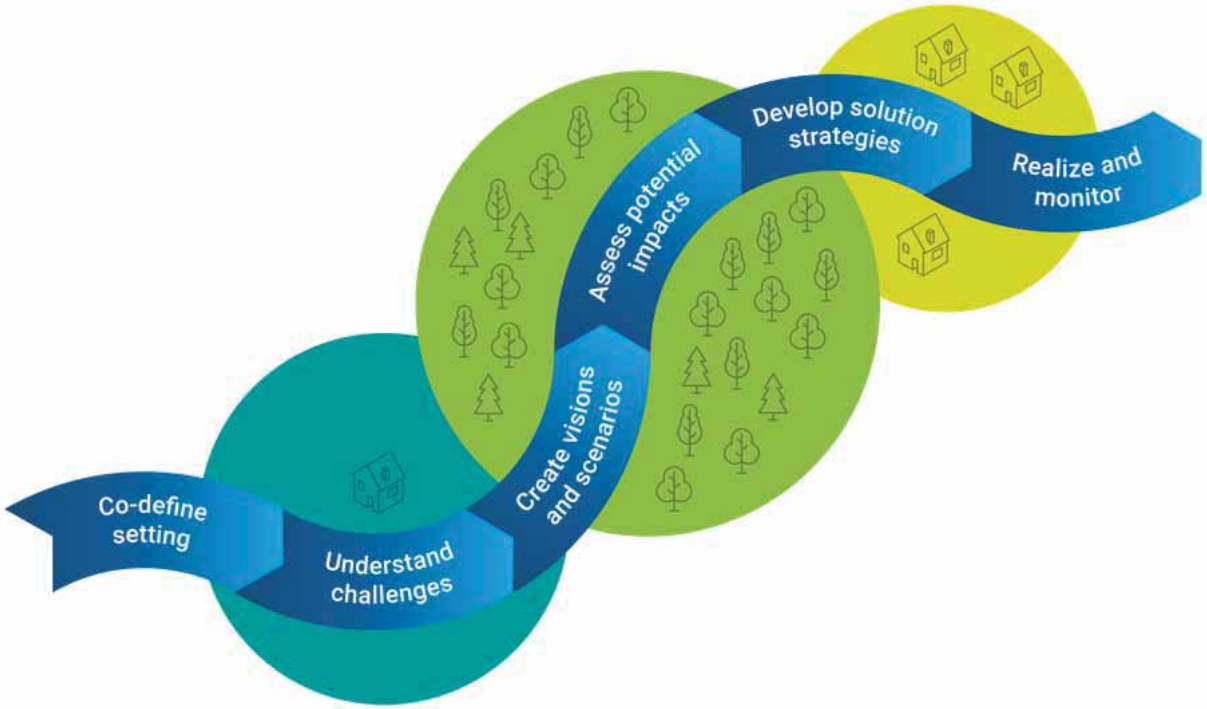


Develop solutions

- Design feasible governance and business models
- Address multiple barriers for implementation
- Create suitable policy mixes with formal instruments as backbones
- Secure sufficient resources

Albert et al., *2021, AMBIO*

NBS planning steps



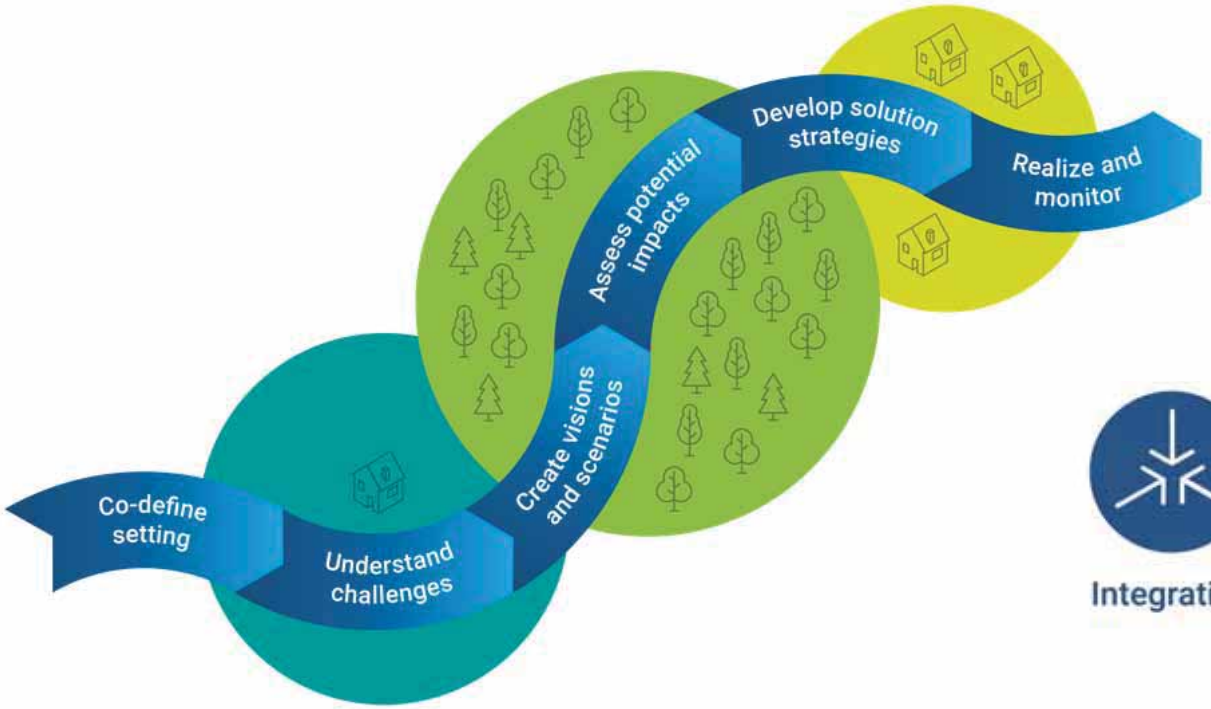
Realize and monitor

- Implementation of NBS pilots
- Monitoring impacts and trade-offs
- Implement systemic learning and adaptive governance

Design as a common ground, connecting scientific inquiry and landscape change

Albert et al., *2021, AMBIO*

NBS planning principles



Integration


Equity


Trans-disciplinarity


Place-specificity


Evidence base

Albert et al., *2021, AMBIO*

Case: Lahn river, two projects

PlanSmart research team

PLAN SMART

Leibniz Universität Hannover

zalf

RUB

LIFE project 'Living Lahn'

bfg

HESSEN Hessisches Ministerium für Umwelt, Klimaschutz, Landwirtschaft und Verbraucherschutz

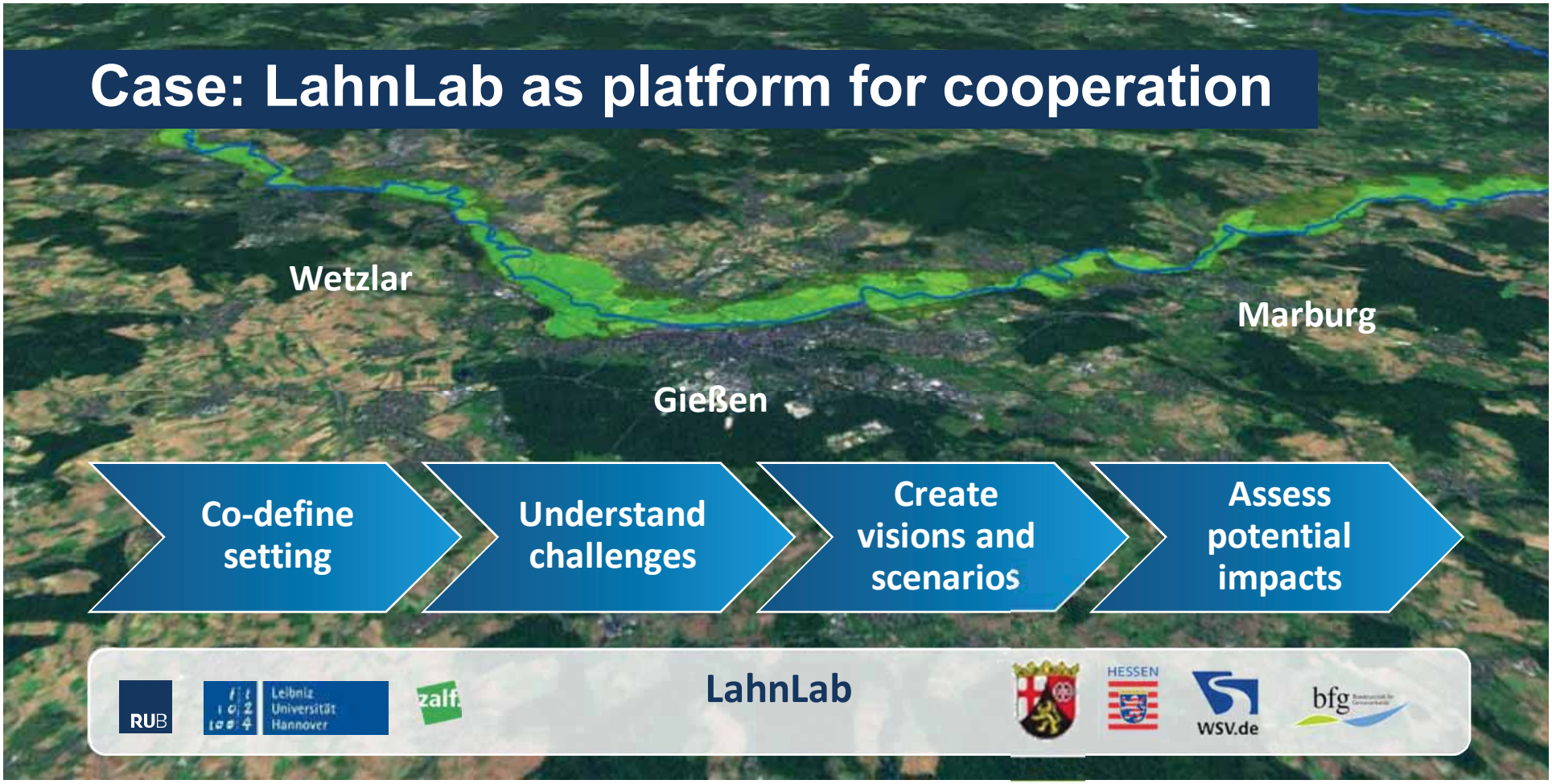
RheinlandPfalz

STRUKTUR- UND GENEHMIGUNGSDIREKTION NORD

WSV.de

Living Lahn

Case: LahnLab as platform for cooperation



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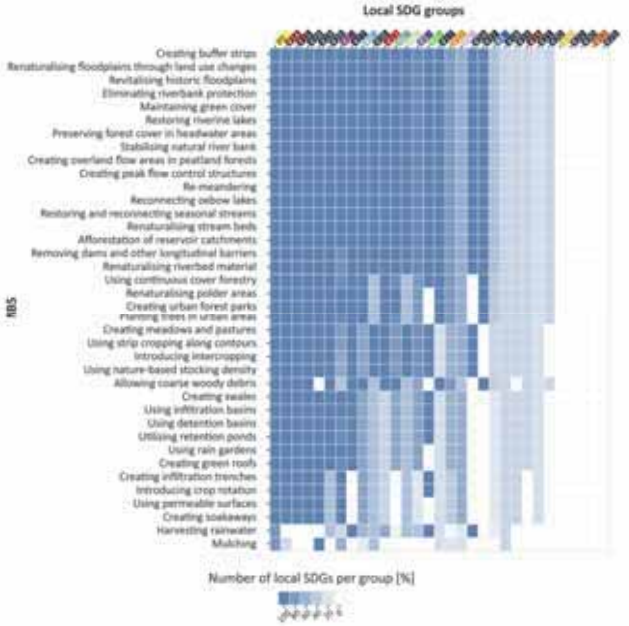
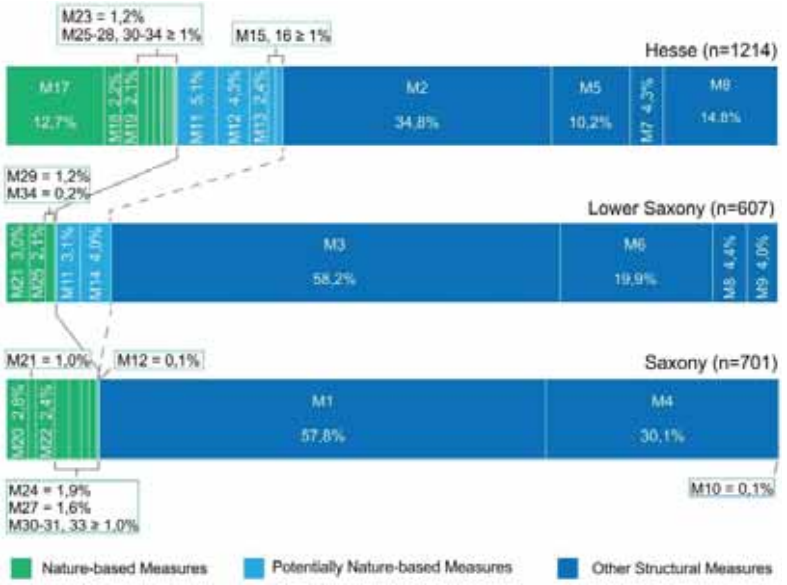
Step 1: Co-define setting

Linking local SDGs with NBS



Schmidt et al., 2022, *J. Of Env. Management*

Exploring NBS uptake so far



Brillinger et al. 2019, *Env. Science and Policy*

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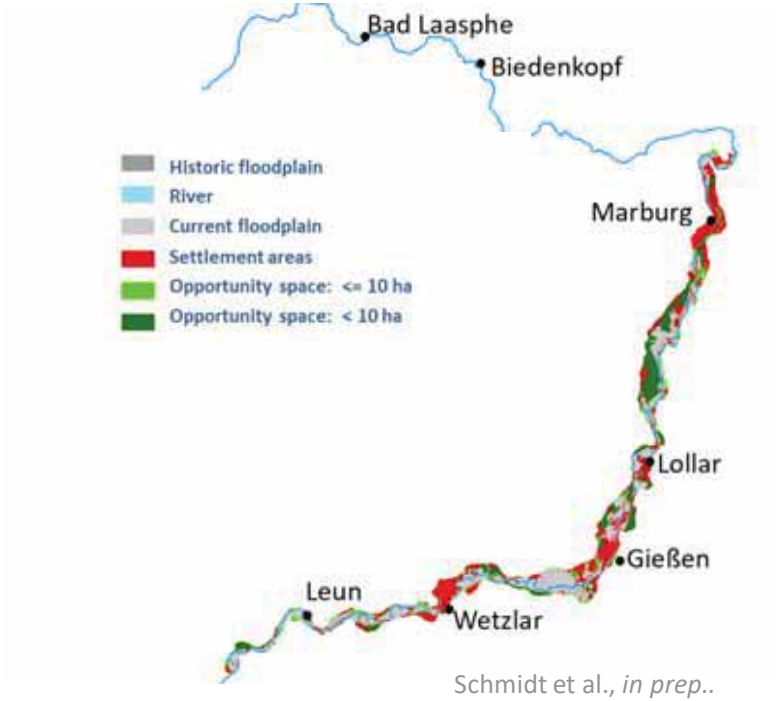
Step 2: Understand challenges

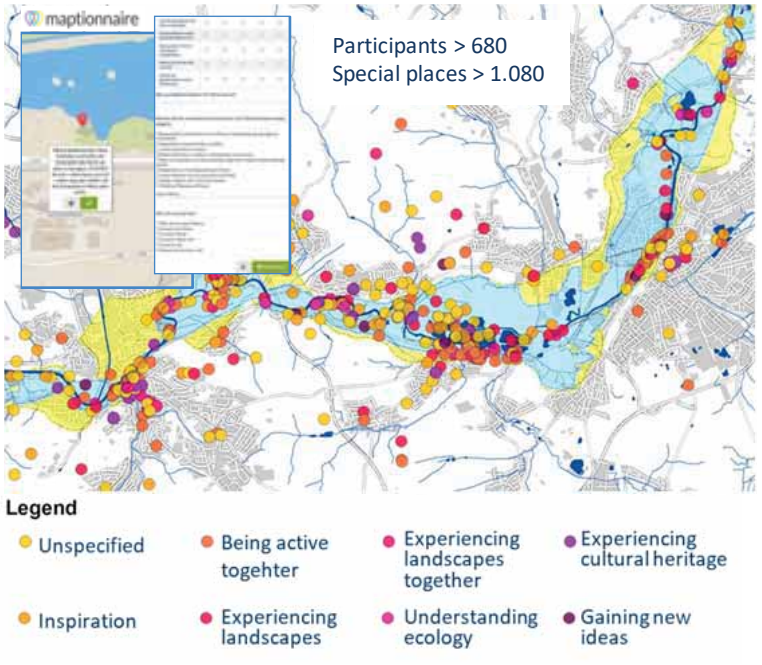
In prep., please do not to share

Mapping NBS opportunity spaces



Schmidt et al., *in prep.*.

Exploring meaningful places



Gottwald et al., 2022, *in Land. Ecology*

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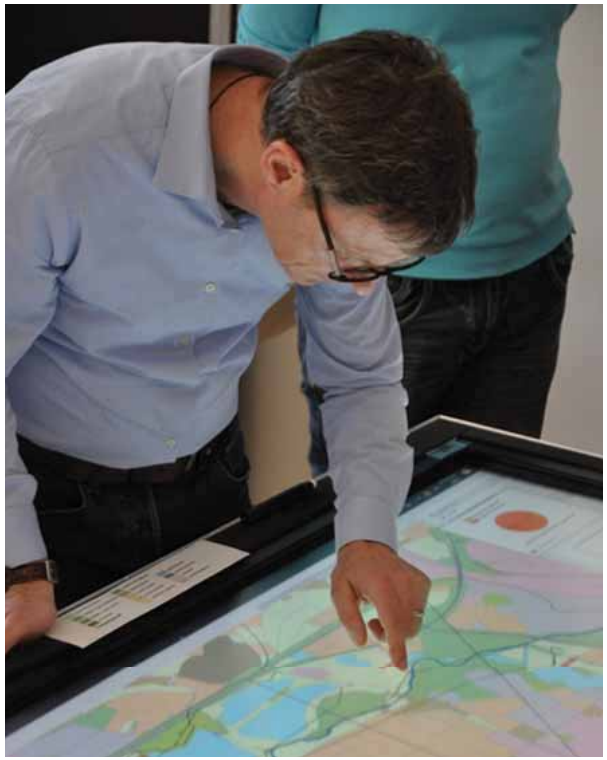
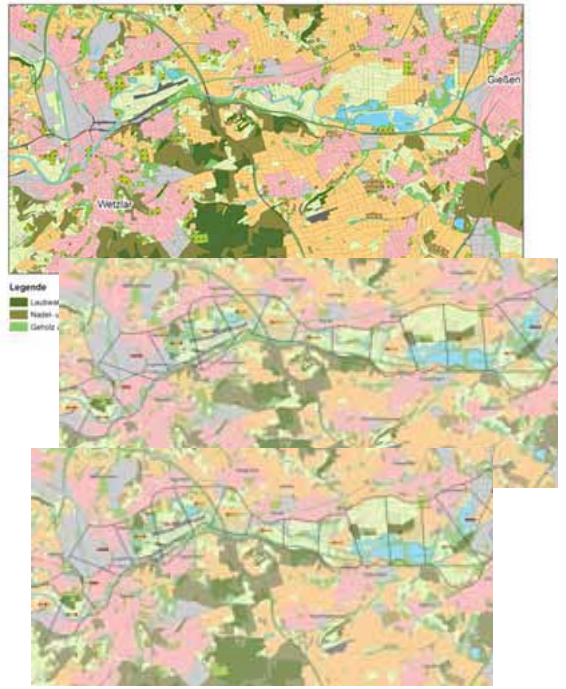
Step 3: Create visions and scenarios

In prep., please do not to share

Albert et al., *in prep,* Illustration by L. Böhm

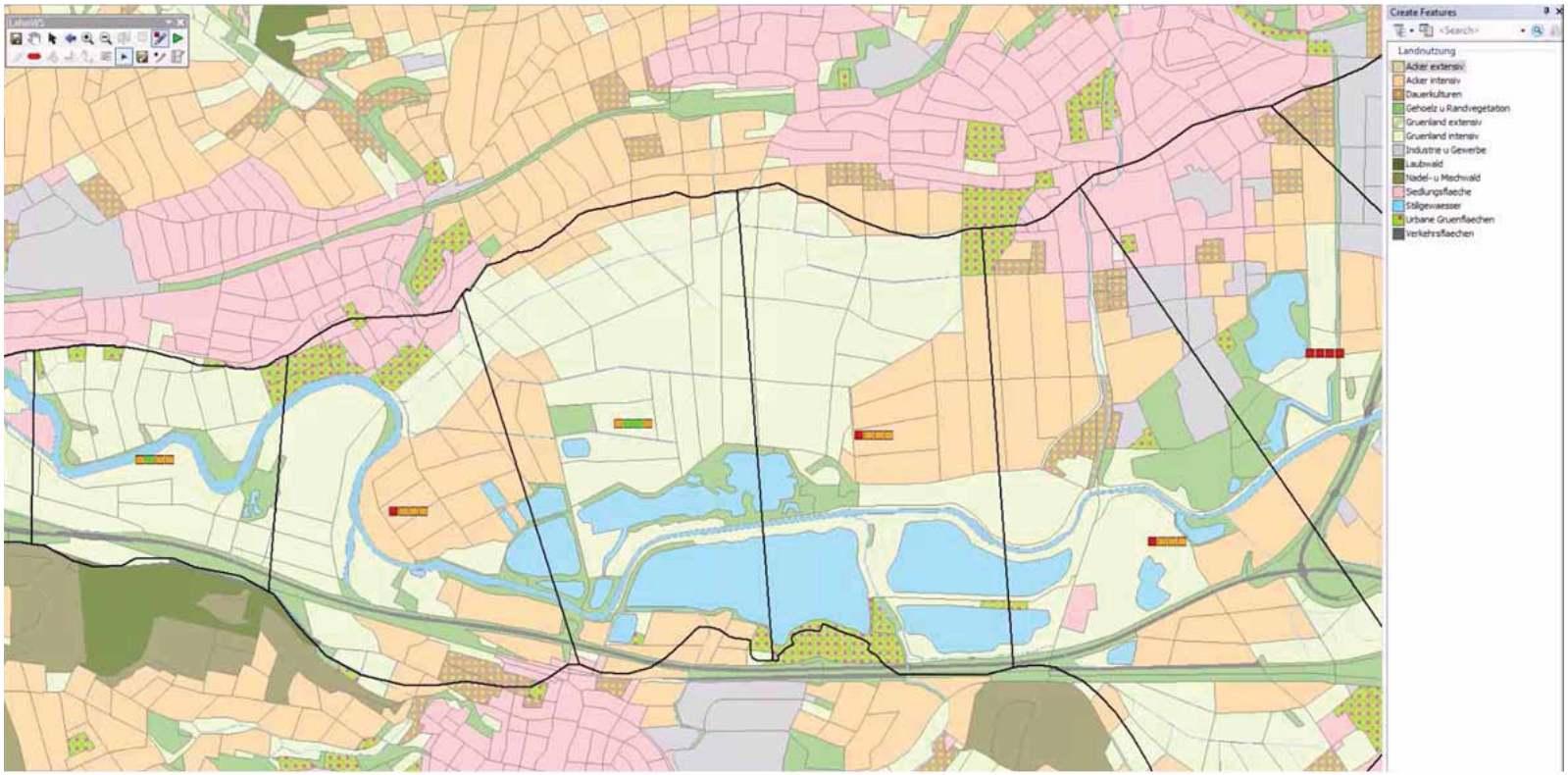
Step 4: Assess potential impacts





Gottwald et al., 2021, *AMBIO*

Step 4: Assess potential impacts



Gottwald et al., 2021, AMBIO

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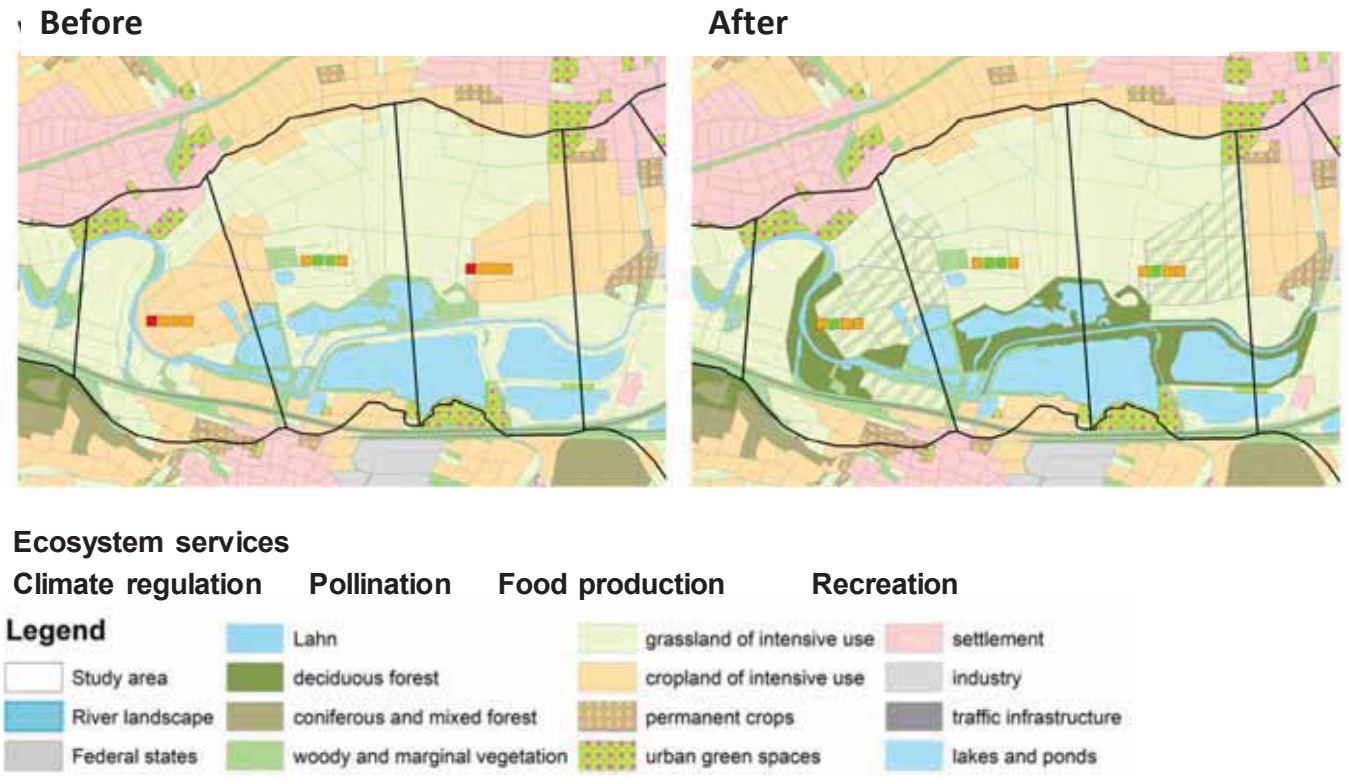
Step 4: Assess potential impacts



Gottwald et al., 2021, AMBIO

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Planning Nature-based Solutions in Metropolitan Regions

Prof. Dr. Christian Albert, PLACES Lab – Planning Metropolitan Landscapes

@DrChrAlbert | @PlacesLab | bit.ly/placeslab


Intermarché
WANTY
GOBERT
MATERIAUX
ZABÙ
ARKÉA
UAE


Eritrea 4k Drone
Sabra

Key societal challenges

Rapid urbanization

Water scarcity & soil erosion

Rural poverty

Toker Watershed, Eritrea
Greater Asmara Area, Zoba Maekel

Context and aim

Ecosystem services concept

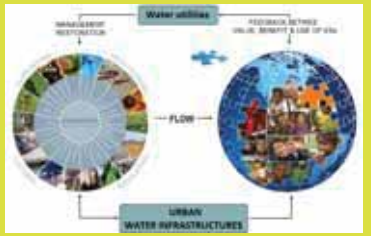
„..benefits from ecosystems“
„..in/direc contribution to human wellbeing“

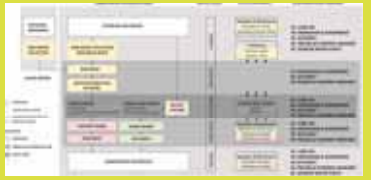
MA 2005 and TEEB 2010

ES for watershed management

„..operationalizing ES for adaptive watershed management and planning“

Adem Esmail, PhD Thesis, 2016





Aim

– To develop an operational approach for designing Watershed Investments (to promote NBS activities) and assessing their impact

Watershed Investments (to promote NBS)

Protection

Agricultural management

Rrevegetation

Terracing

(NBS-related) Activities

Financial and governance mechanisms to **secure water for cities,** involving **upstream communities** (in NBS-related activities);

LARGE-SCALE TRANSFORMATIVE CHANGES

Multiple-objectives (co-benefits)

Erosion control

Flood mitigation

Biodiversity

Poverty alleviation

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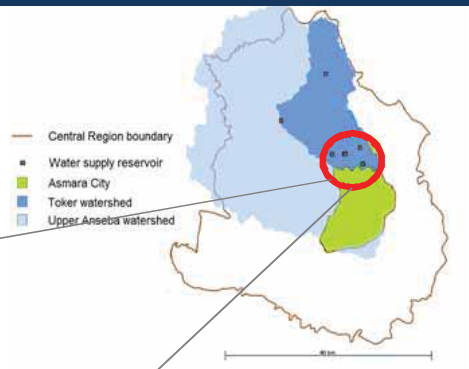
Toker Watershed, Eritrea



Toker reservoir

- **13 million** m^3 capacity
- **US$44 million** est. value

Asmara - Inclusive City?

- **650.000** inhabitants
- **50%** of urban population of the country

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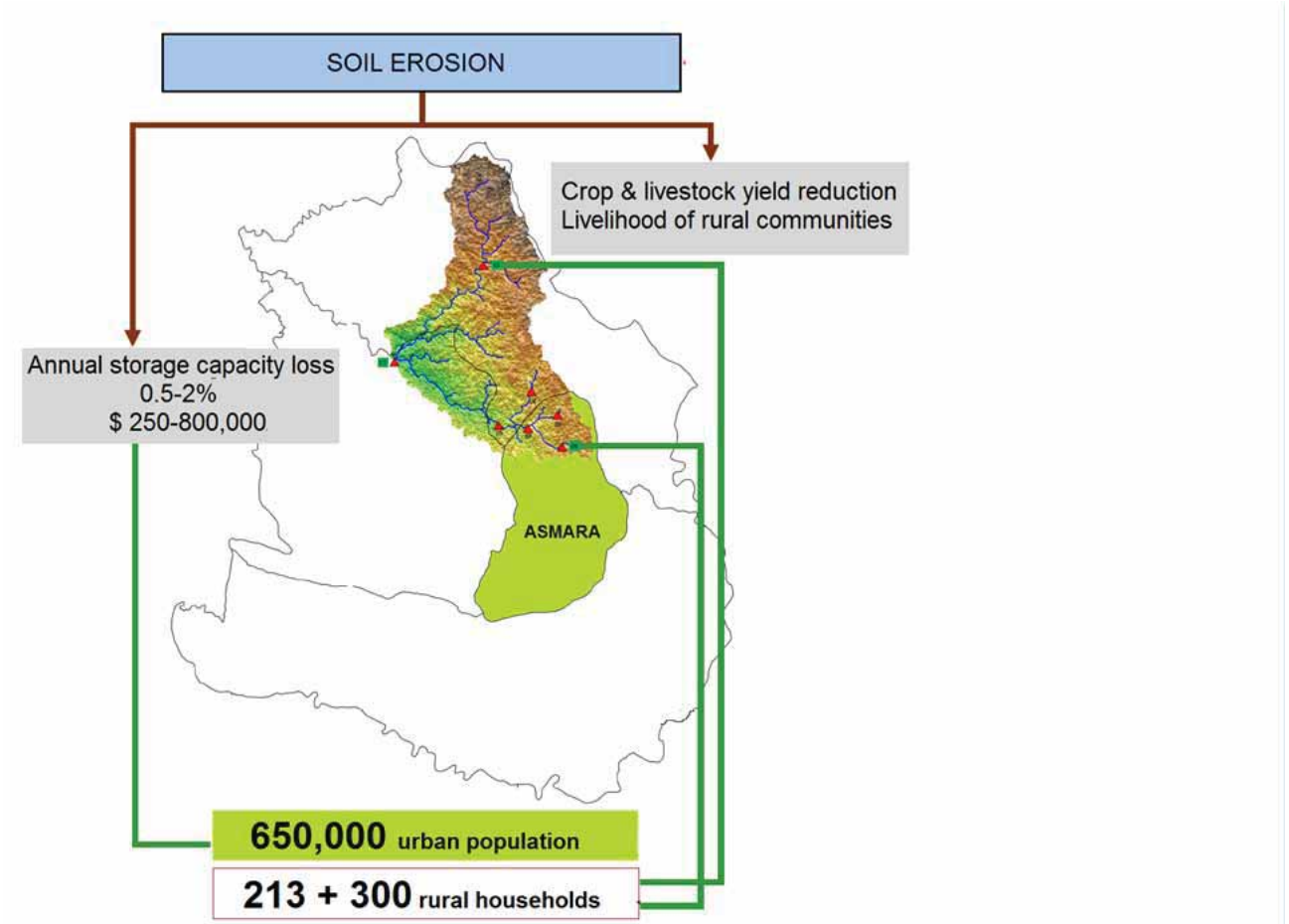
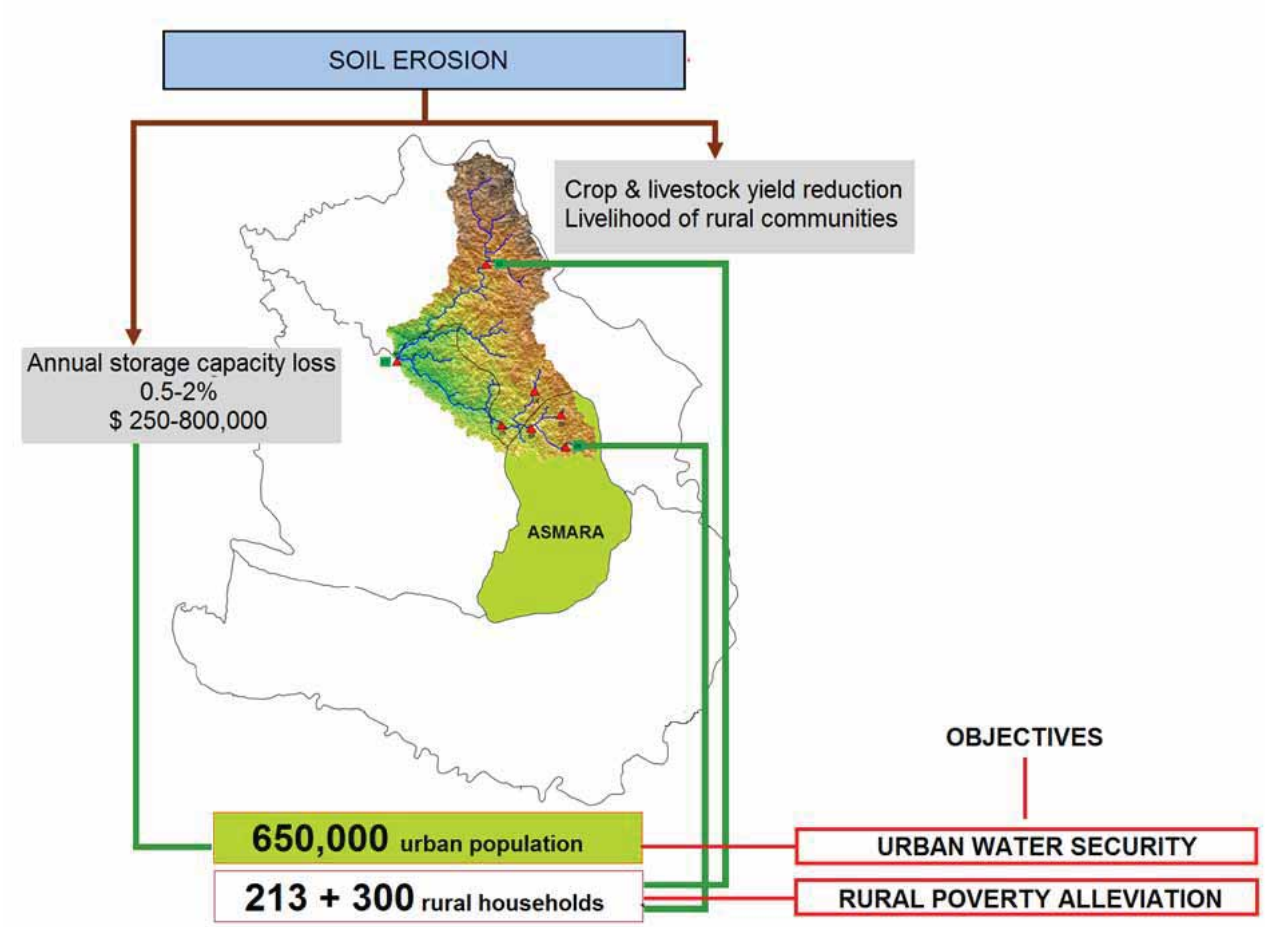


Based on Abraham et al. 2009



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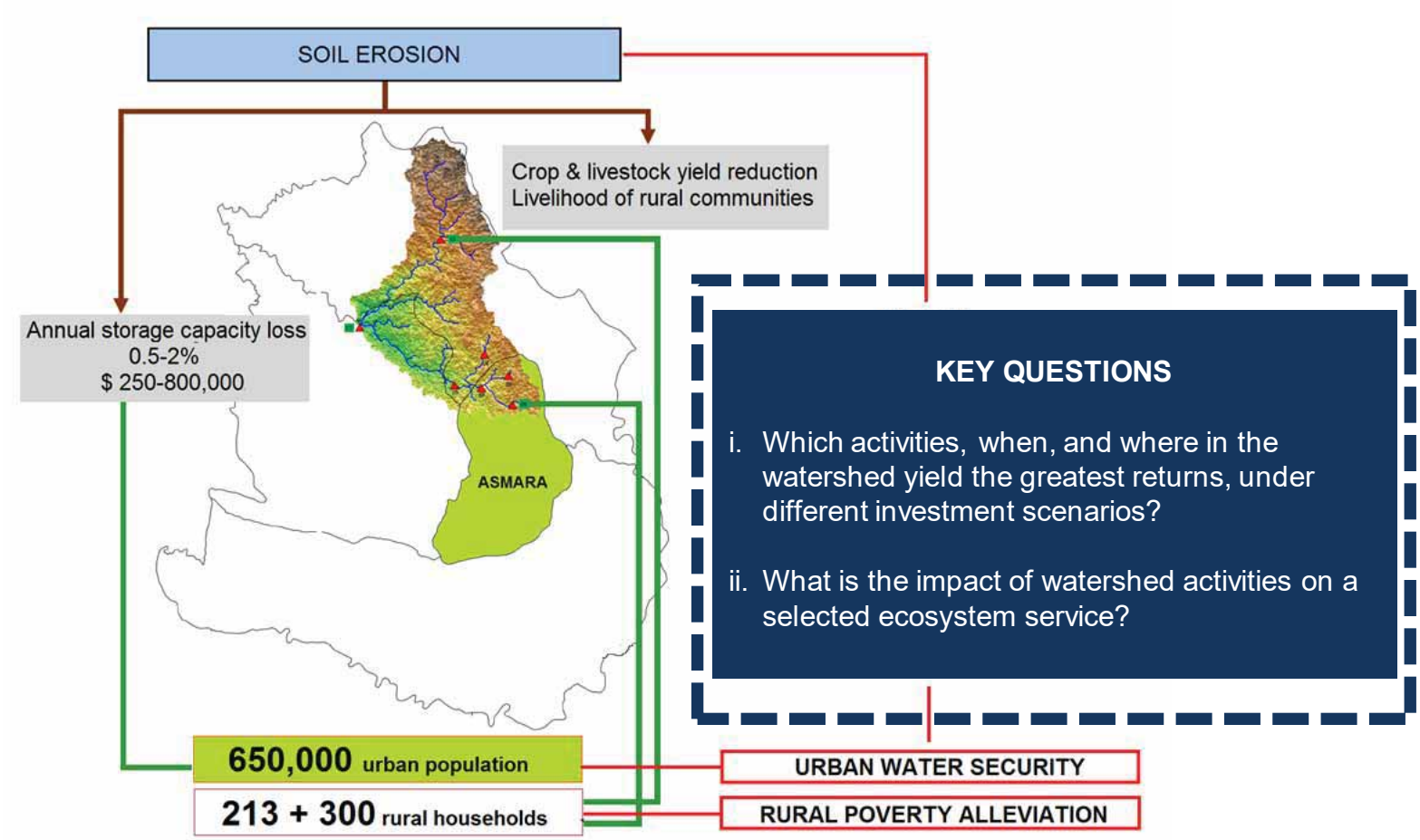


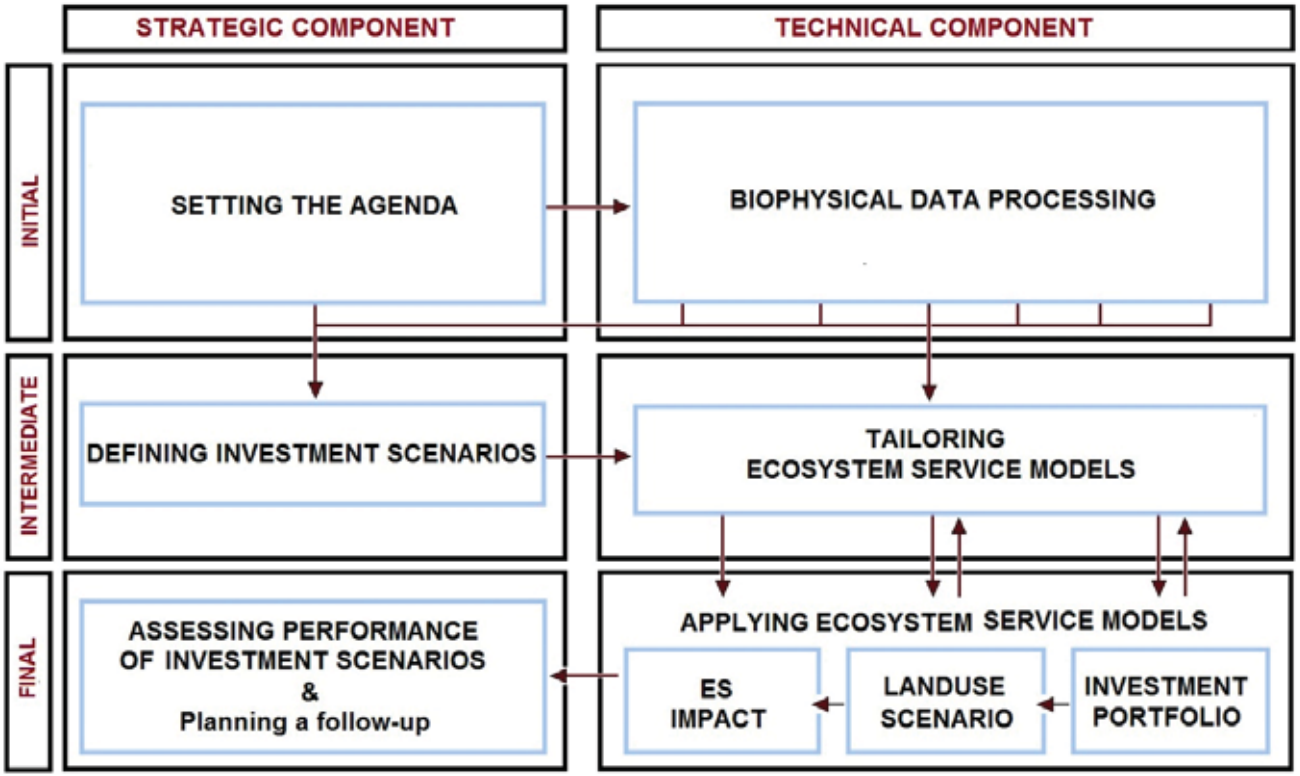
Based on Abraham et al. 2009

Key challenge to real-life implementation

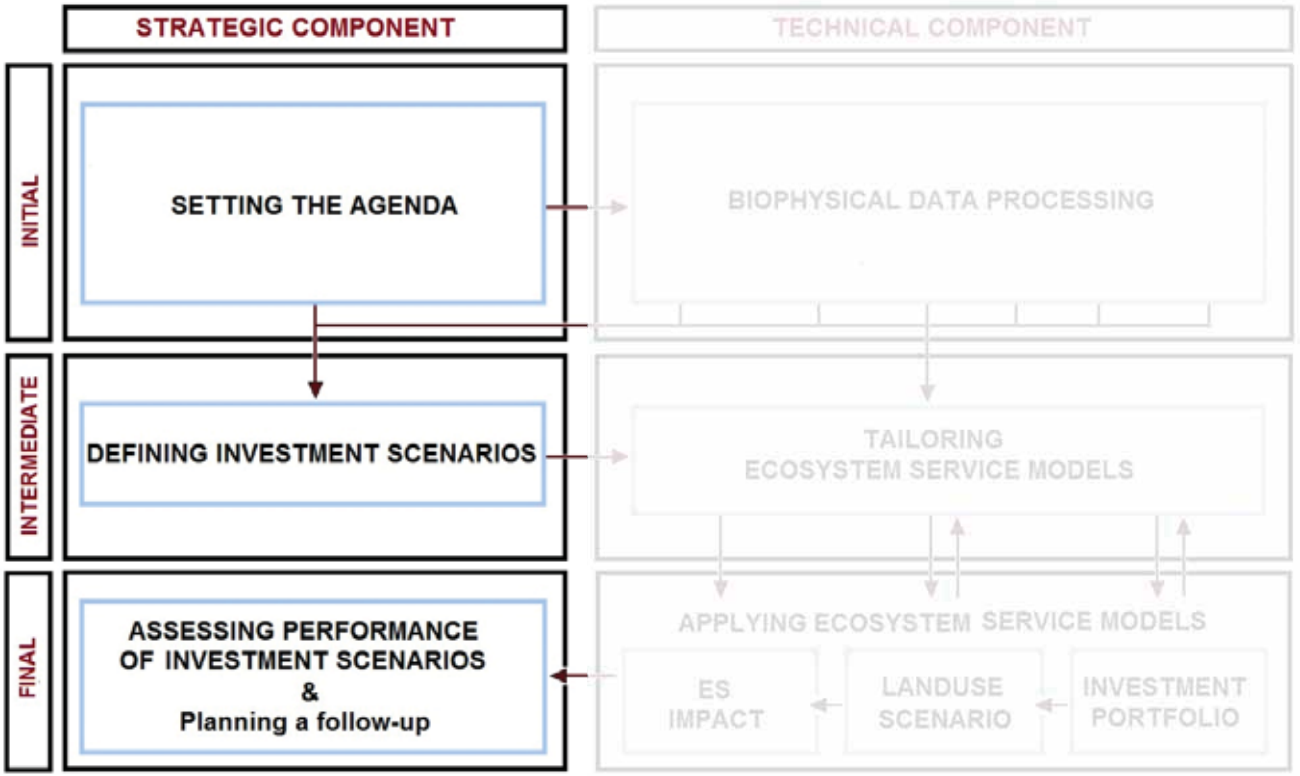
- Linking diverse actors and knowledge systems, across management levels, sectors, and institutional boundaries.

(Folke et al. 2005, Parker and Corona 2012, Kowalski & Jenkins 2015)

A participatory process-based approach



Strategic component



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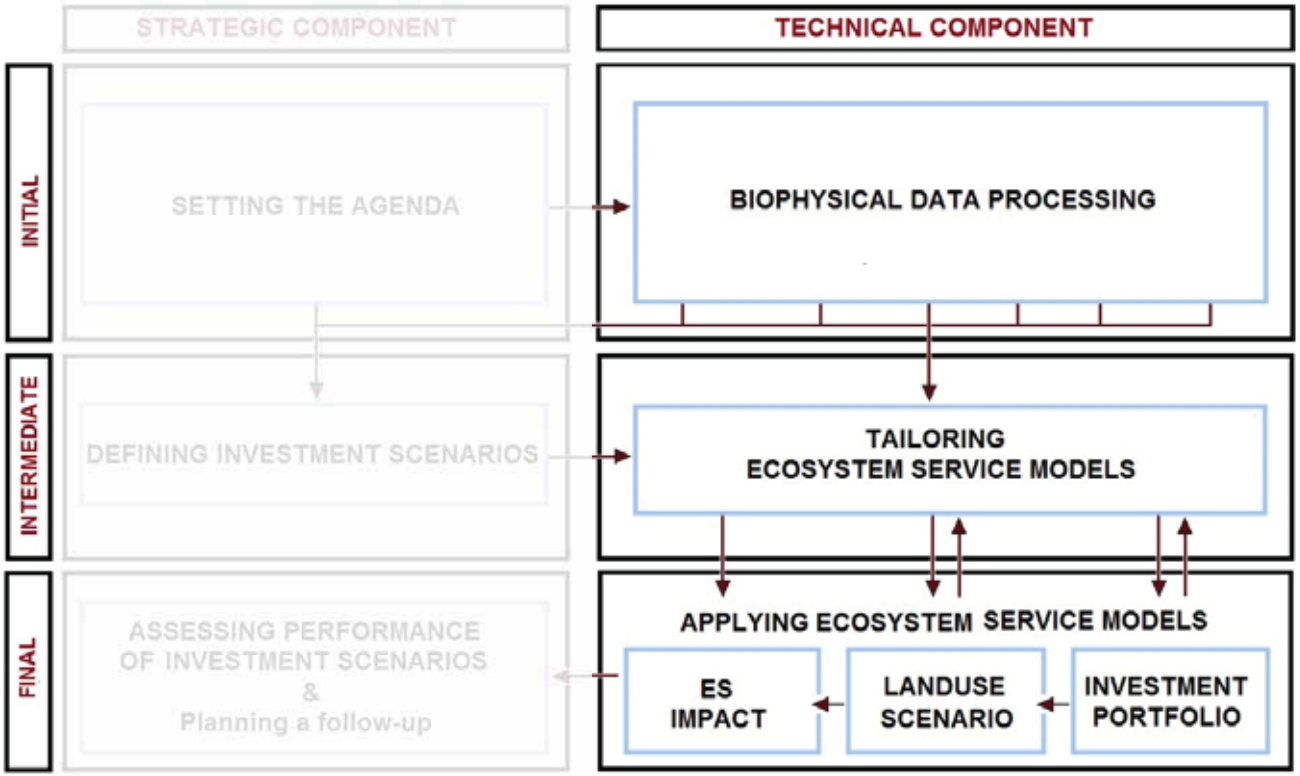
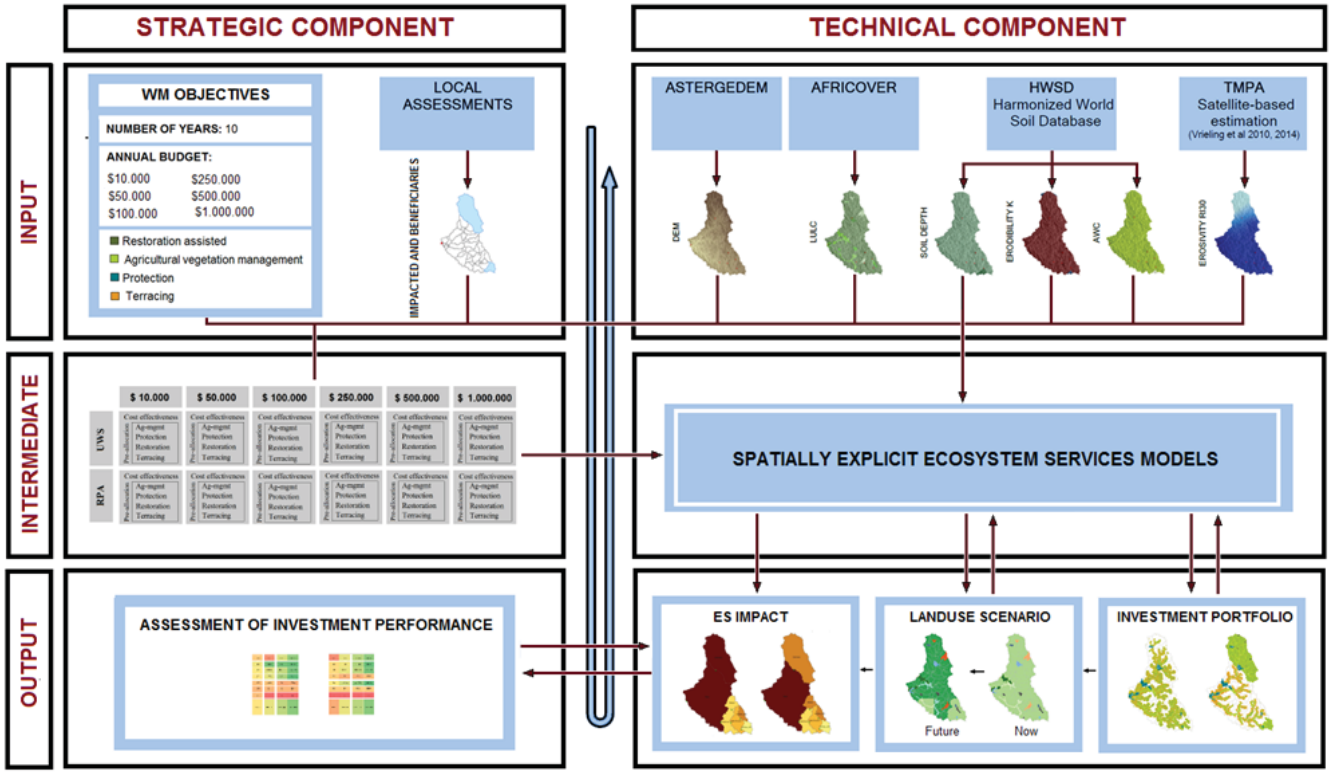
Technical component



Toker watershed case study application



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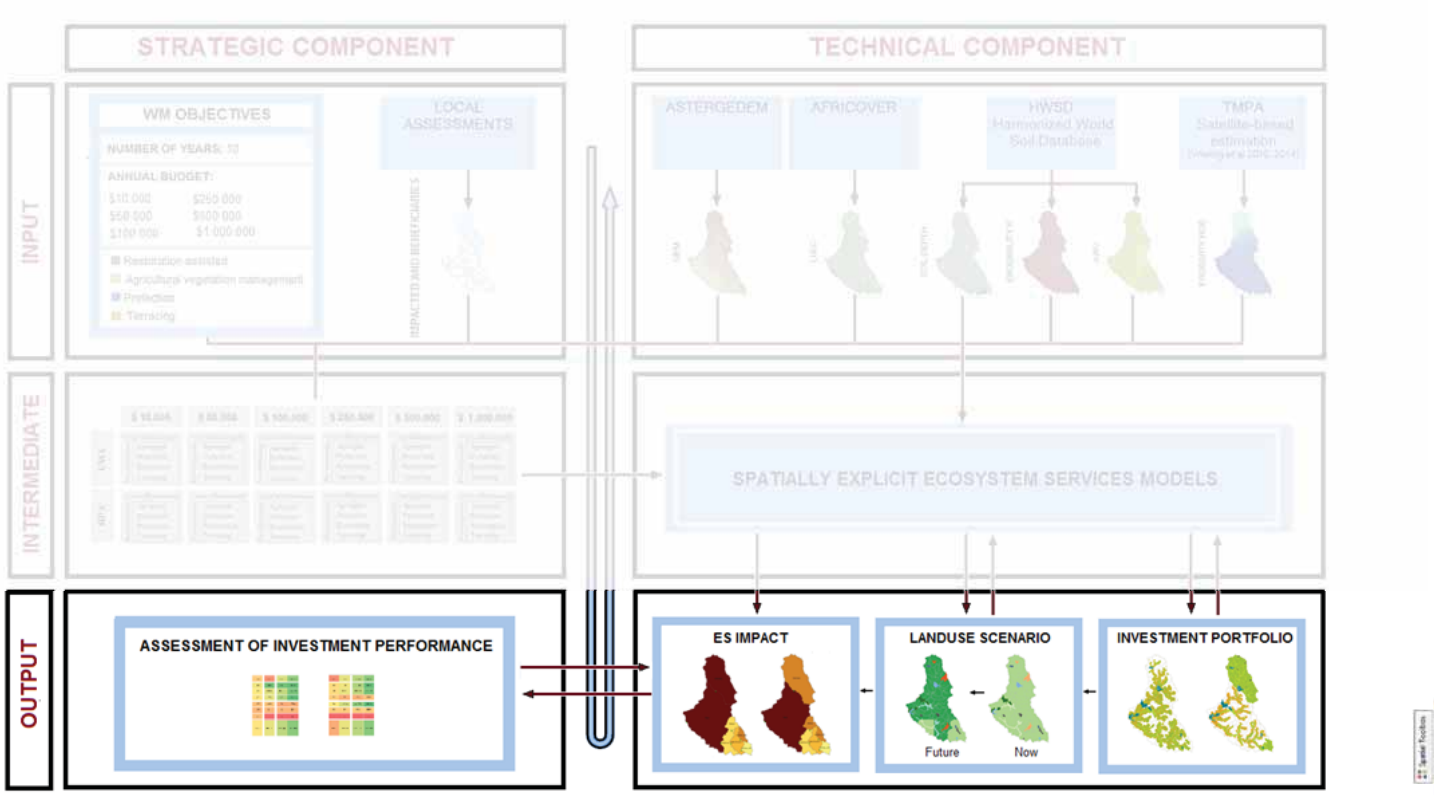
Illustrative results



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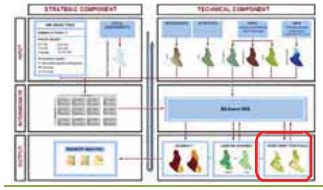
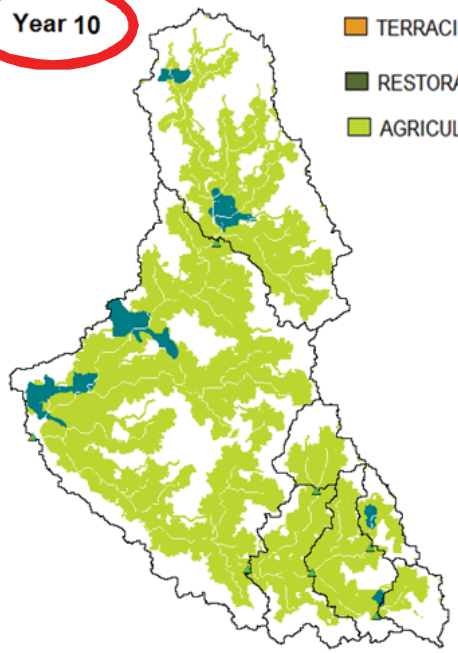
Investment Portfolio

Annual budget
$100,000 allocated
cost-effectively



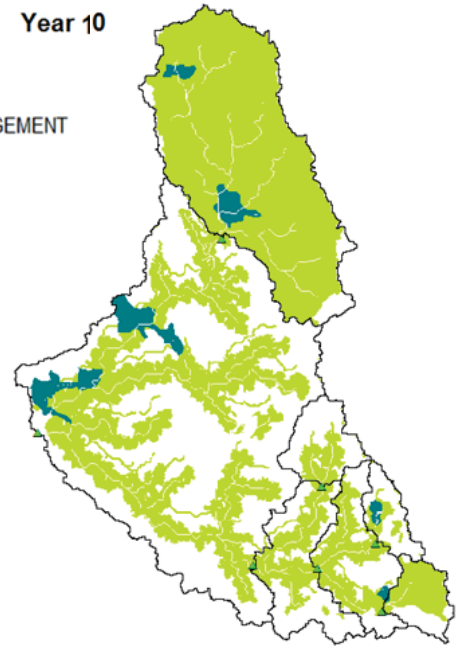
Year 10

PROTECTION
TERRACING
RESTORATION ASSISTED
AGRICULTURAL VEGETATION MANAGEMENT



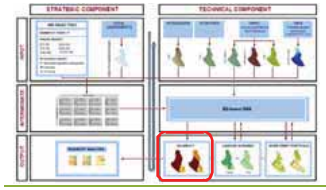
URBAN WATER SECURITY

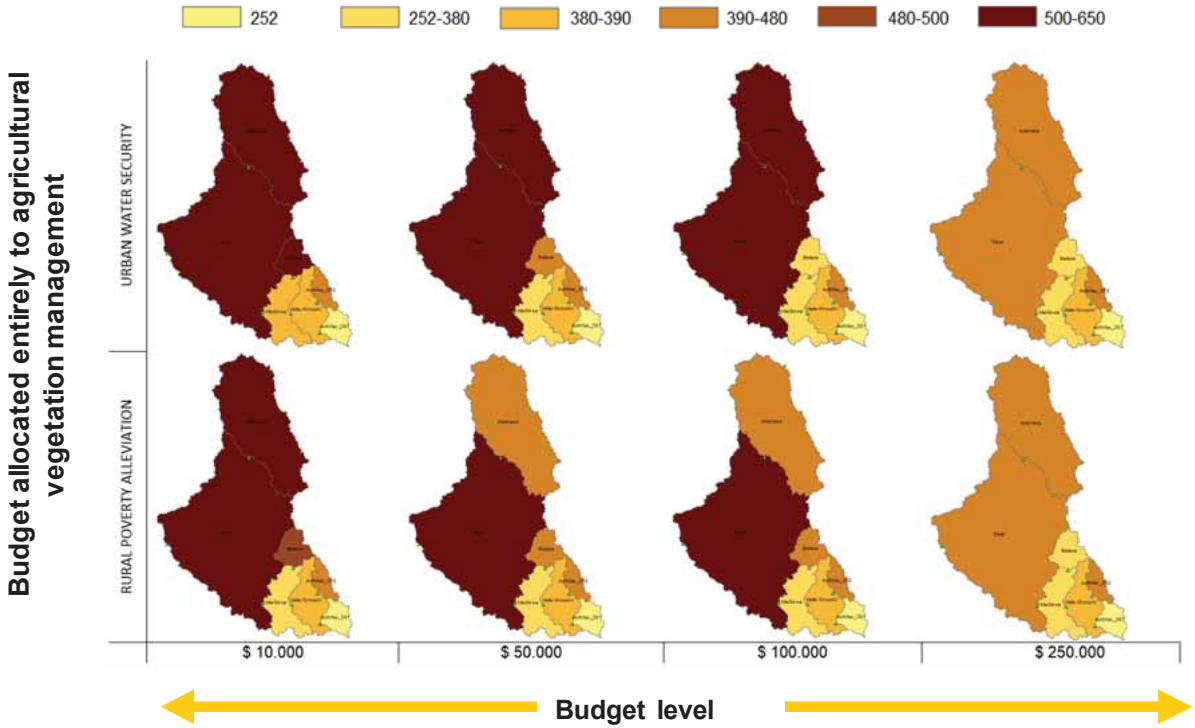
Year 10



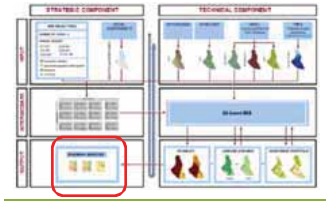
RURAL POVERTY ALLEVIATION

Impact on soil erosion





Synthesis of 38 scenarios



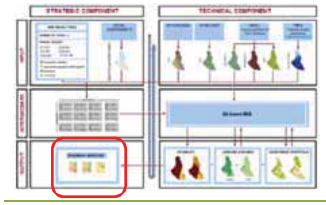
Assessing investment performance

% REDUCTION OF SOIL EROSION AT SUB-WATERSHED LEVEL

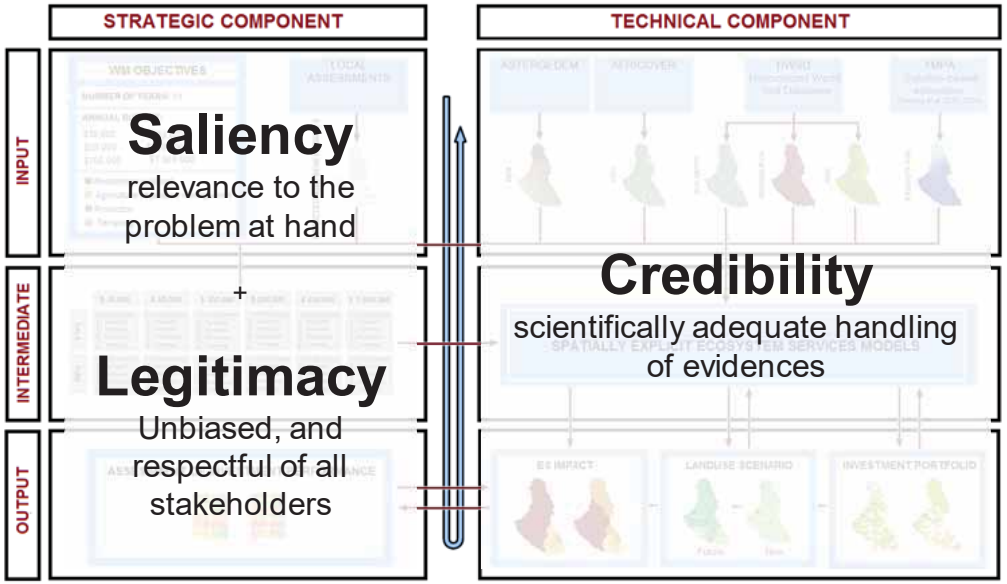
Budget allocated cost-effectively

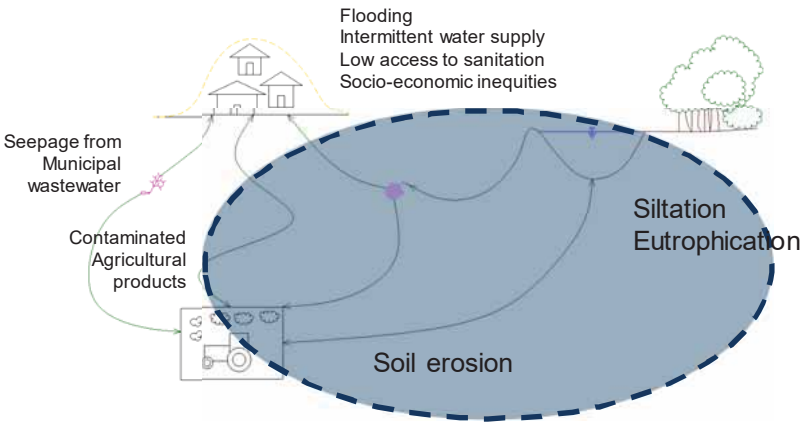
Sub-watershed

SUB-WATERSHED	$10,000	$50,000	$100,000	$250,000	$500,000	$1,000,000
TOKER	-0.7%	2.6%	-10.1%	-24.5%		
ADISHEKA	-5.5%	-29.0%	-29.6%	-32.2%		
MAISIRWA	-2.8%	-8.7%	-14.1%	-28.6%		
BELEZA	-2.3%	-7.6%	-18.9%	-33.8%		
VALLE-GNOCCHI	0.0%	-0.4%	1.2%	0.9%		
ADINIFAS_D01	0.4%	0.4%	0.4%	0.4%		
ADINIFAS_D02	0.0%	4.9%	5.0%	5.0%		
TOTAL	**-2.2%**	**-7.3%**	**-15.3%**	**-25.4%**		

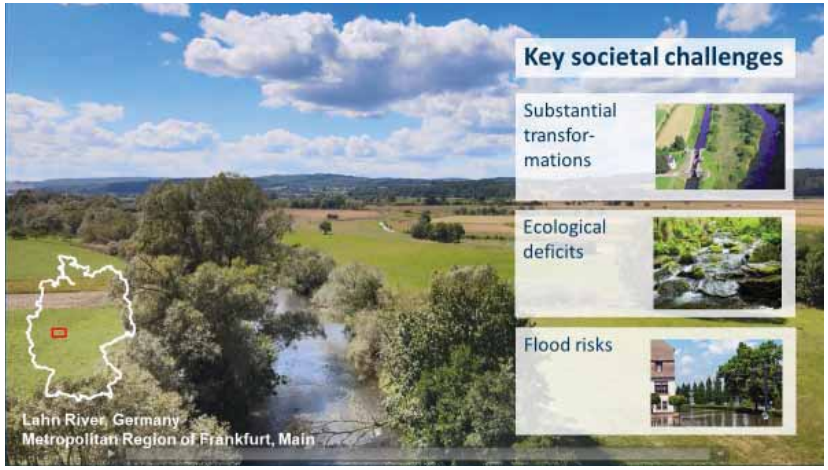


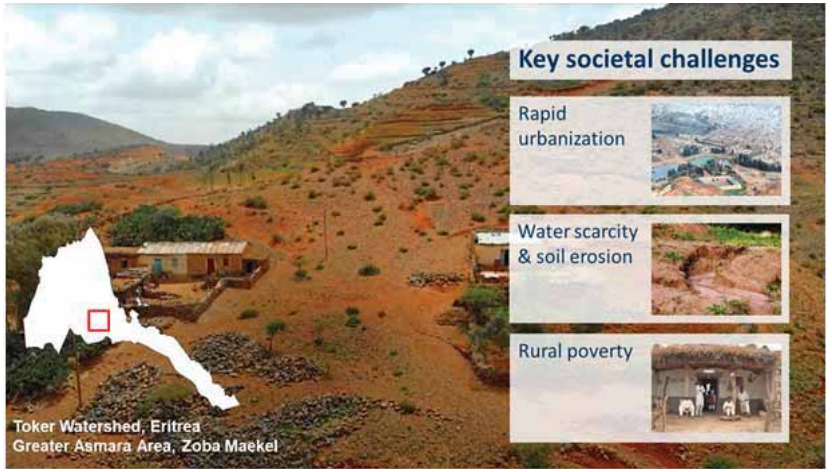
Supporting decision-making processes



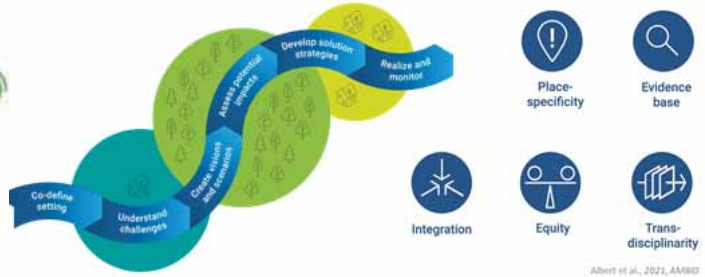


Summary

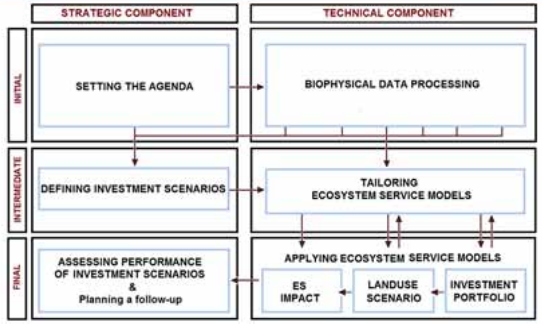




NBS planning principles



A participatory process-based approach



RUB

Examples of nature-based solutions

IUCN (2016), adapted

Priority areas for innovation and application

	Relevance in Trentino?
 Urban regeneration through nature-based solutions	✓
 Nature-based solutions for improving well-being in urban areas	✓
 Establishing nature-based solutions for coastal resilience	✓
 Multi-functional nature-based watershed management and ecosystem restoration	✓
 Nature-based solutions for increasing the sustainability of the use of matter and energy	✓
 Nature-based solutions for enhancing the insurance value of ecosystems	✓
 Increasing carbon sequestration through nature-based solutions	

European Commission (2015)

Grazie per l’attenzione!

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+ C. Anderson, L. Yang, E. Hartkopf, C. Suttmeyer, M. Hashemi, M. Makeschka

OUR MISSION

Environmental Analysis & Planning in Metropolitan Areas working group aims to advance excellent teaching and research to support **just** and **sustainable transformations** for **people** and **nature** in **metropolitan regions.**

Dr. Eng. Blal Adem Esmail

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ORCID
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Work experience

- **Postdoc -** *Planning NBS in Metropolitan Areas* **(RUB, Germany)**
- **Researcher -** *Sustainable urban water systems* **(KTH, Sweden)**
- **Postdoc -** *Mapping and assessment of ES for policy-making* **(UNITN, Italy)**
- **Technical Manager -** *Environment*, *Health & Safety* **(Amir Costruzioni, Italy)**

Education

- **PhD -** *"ES for watershed management and planning",* **(UNITN, Italy)**
- **Ba, MSc -** *Civil Engineering* **(UNITN, Italy).**

Current research

- **REPLAN** – (re)Planning Nature-Based Solutions and Green Infrastructure for Sustainable Urban Transformations (KTH, 2021-2025)
- **MAES Eritrea** – Mapping and assessing ES for sustainable policy and decision making in Eritrea
- **NBS4Water** – Nature-based solutions for water security in Asmara, Eritrea.

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Thank you!
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A boy bathes on the side of the road in the southern Indian city of Chennai (Reuters)

Some references

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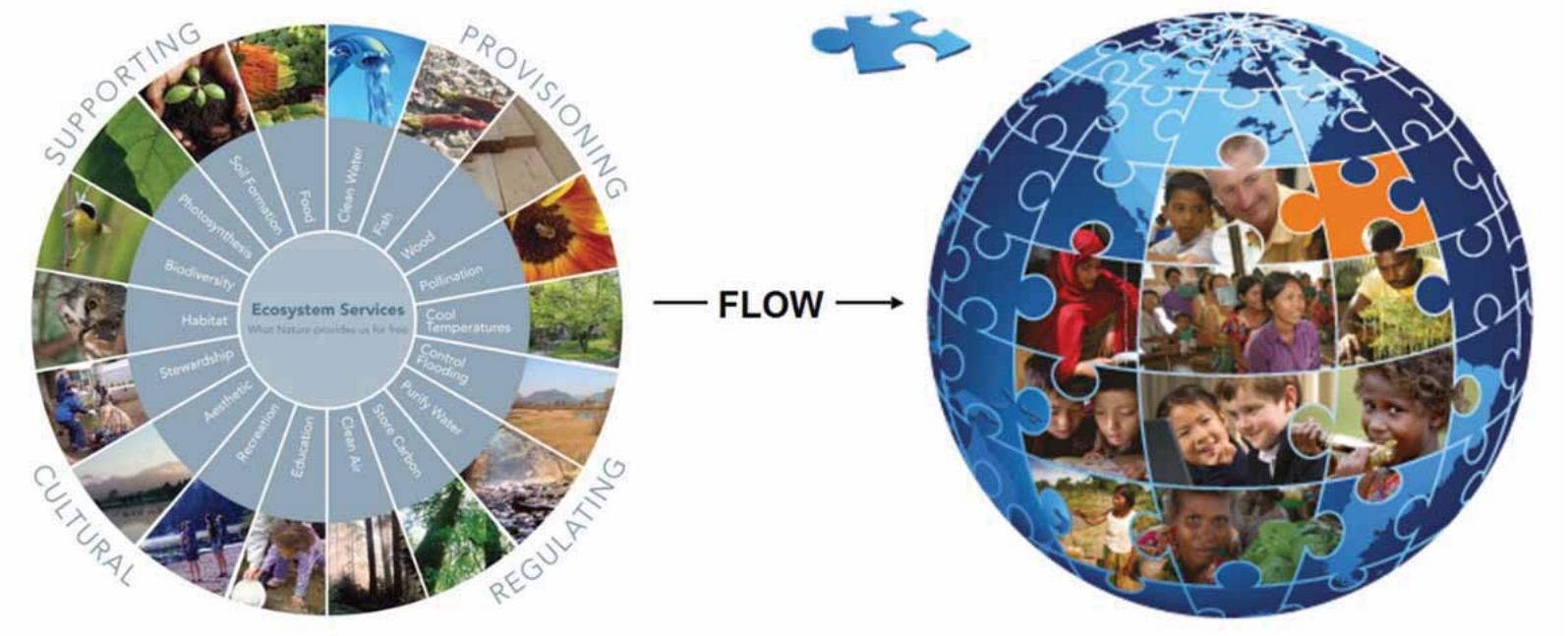
ECOSYSTEM SERVICES

HUMAN WELL-BEING



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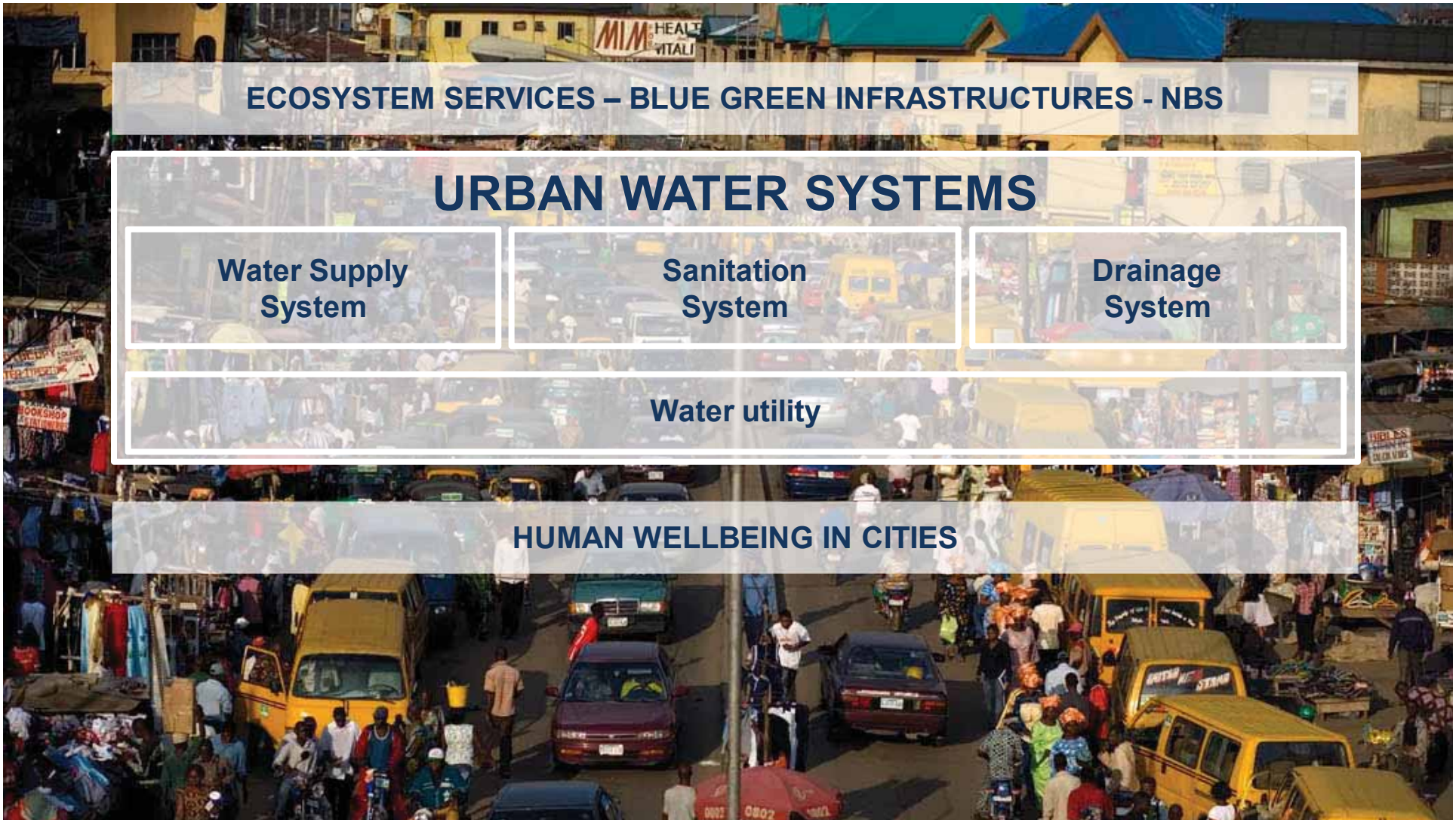
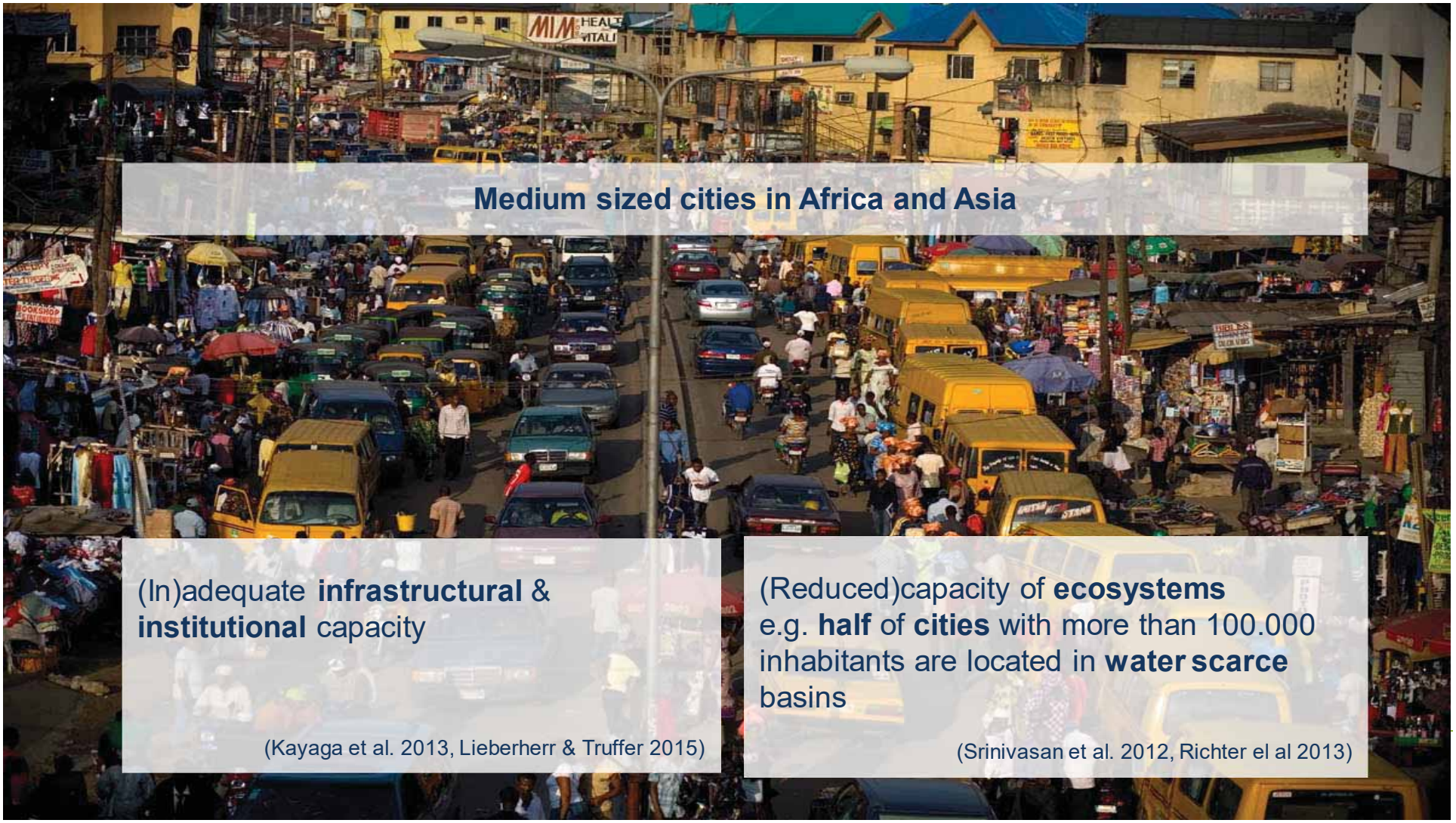

ECOSYSTEM SERVICES – BLUE GREEN INFRASTRUCTURES - NBS
URBAN WATER SYSTEMS
Water Supply System
Sanitation System
Drainage System
Water utility
HUMAN WELLBEING IN CITIES



Medium sized cities in Africa and Asia

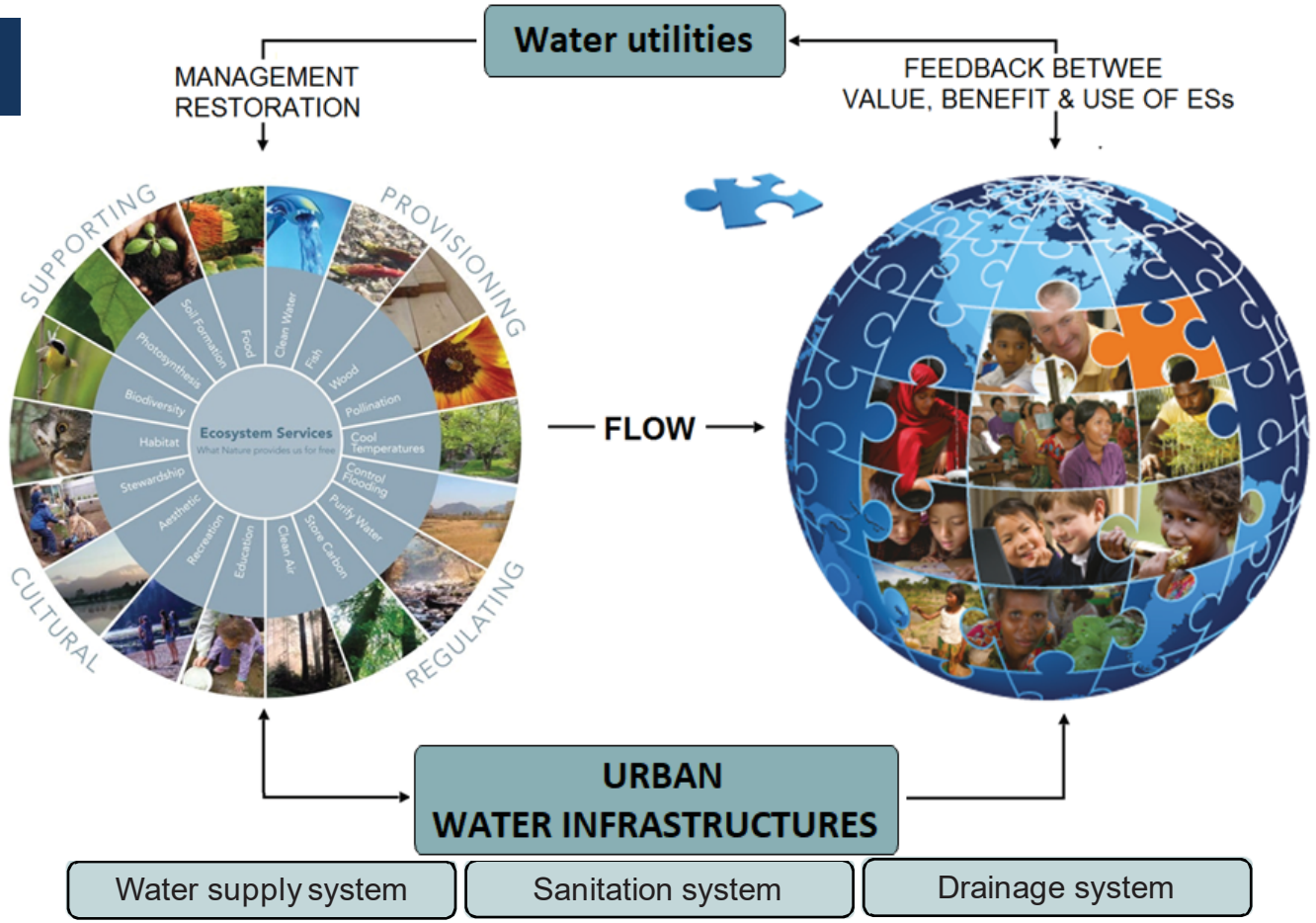
(In)adequate **infrastructural** & **institutional** capacity

(Kayaga et al. 2013, Lieberherr & Truffer 2015)

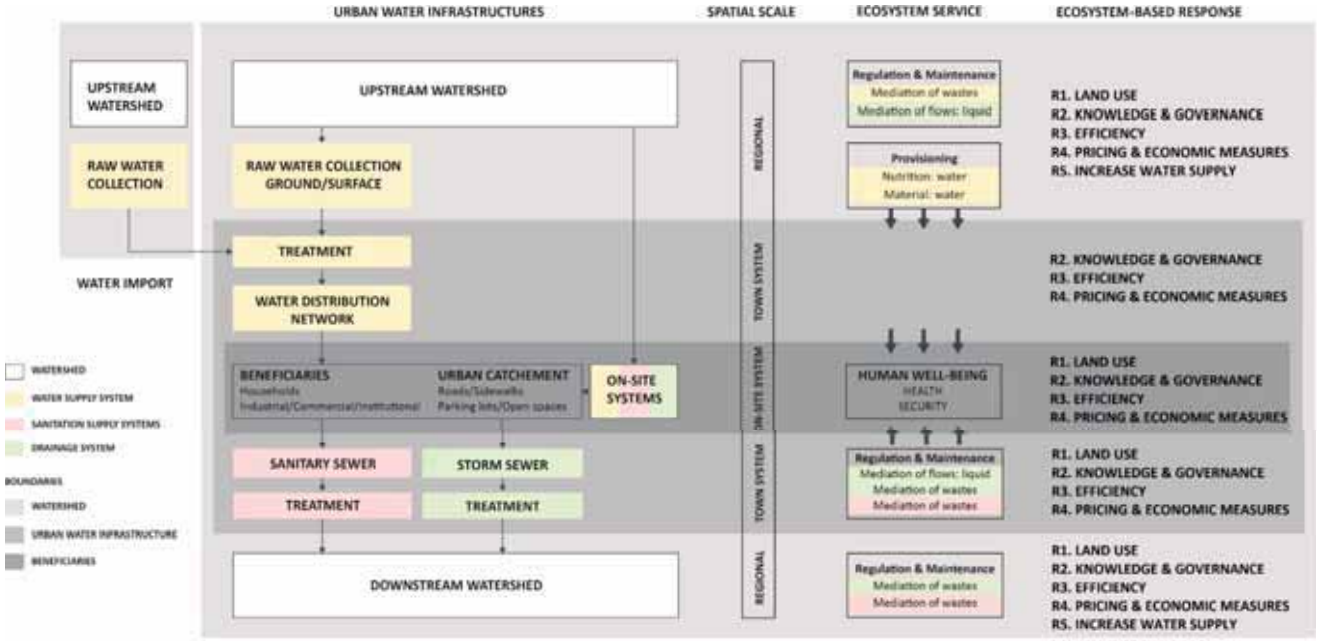
(Reduced)capacity of **ecosystems** e.g. **half** of **cities** with more than 100.000 inhabitants are located in **water scarce** basins

(Srinivasan et al. 2012, Richter el al 2013)

ES & UWS


Water utilities
MANAGEMENT
RESTORATION
FEEDBACK BETWEE
VALUE, BENEFIT & USE OF ESs
SUPPORTING
PROVISIONING
CULTURAL
REGULATING
Ecosystem Services
What Nature provides us for free
Soil Formation
Photosynthesis
Biodiversity
Habitat
Stewardship
Aesthetic
Recreation
Education
Clean Air
Store Carbon
Purify Water
Control Flooding
Cool Temperatures
Pollination
Wood
Fish
Clean Water
Food
FLOW
URBAN
WATER INFRASTRUCTURES
Water supply system
Sanitation system
Drainage system

Conceptual framework



ROLE

i. linking ecosystem service production and benefit areas;
ii. bridging spatial/temporal scales ranging (watershed to household);
iii. adopting Ecosystem-based responses to water vulnerability.

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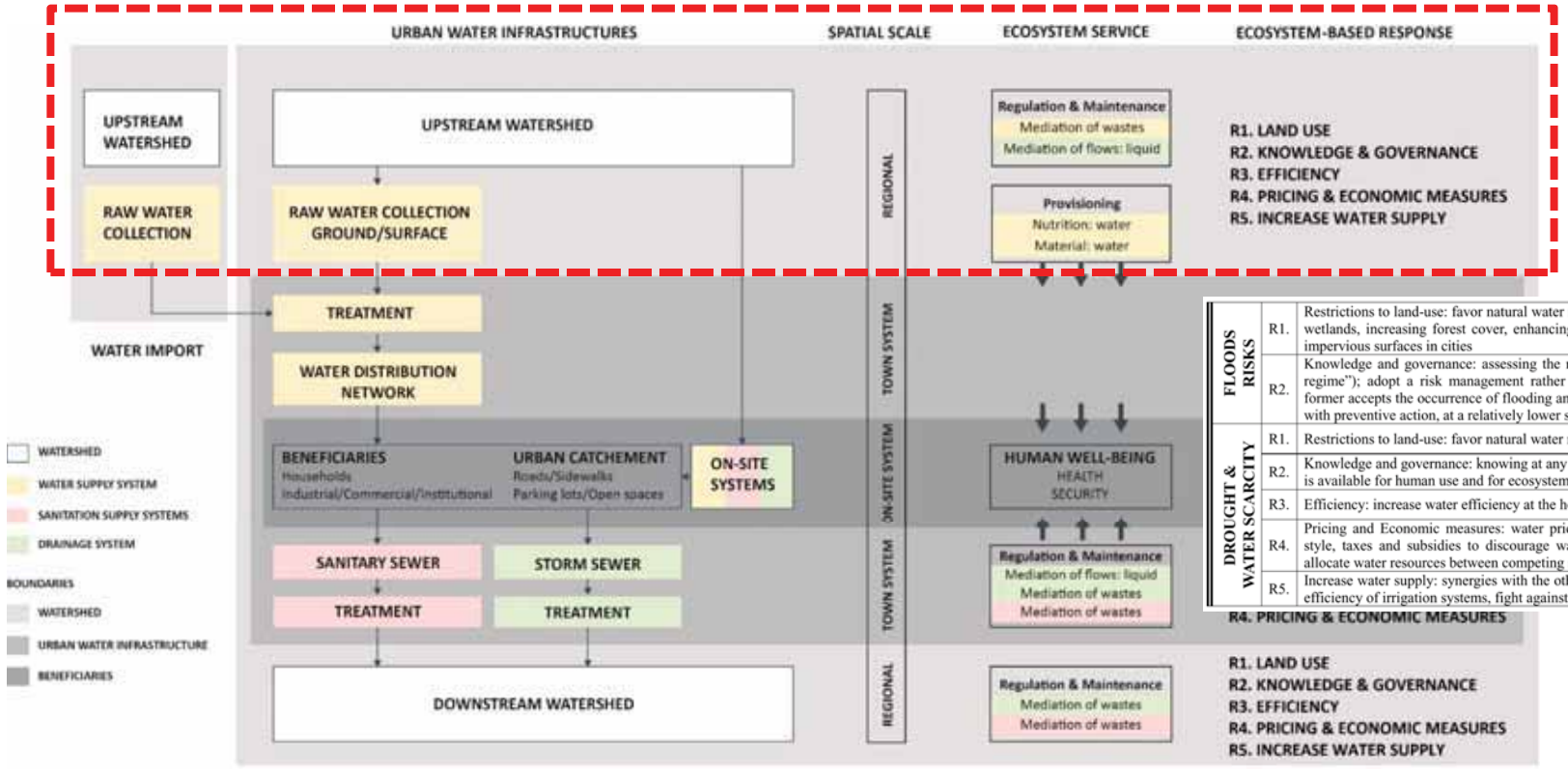
Operationalizing ecosystem services



FLOODS RISKS	R1.	Restrictions to land-use: favor natural water retention measures (NWRMs), by restoring wetlands, increasing forest cover, enhancing natural features of floodplains, reducing impervious surfaces in cities
	R2.	Knowledge and governance: assessing the natural water variability (concept of "flow regime"); adopt a risk management rather than a crisis management approach. The former accepts the occurrence of flooding and drought, but tries to mitigate their effects with preventive action, at a relatively lower societal cost.
DROUGHT & WATER SCARCITY	R1.	Restrictions to land-use: favor natural water retention measures (NWRMs)
	R2.	Knowledge and governance: knowing at any given time and location exactly what water is available for human use and for ecosystems.
	R3.	Efficiency: increase water efficiency at the household, industry and irrigation
	R4.	Pricing and Economic measures: water pricing and metering to change consumption style, taxes and subsidies to discourage water use in certain places and times, thus allocate water resources between competing sectors
	R5.	Increase water supply: synergies with the other sectors to reduce pressure (e.g. increase efficiency of irrigation systems, fight against invasive alien plants