

Implementation of the Ecosystem Services concept into the Green Infrastructure Planning for resilient urban development in the Ruhr and in Chinese Megacities (IMECOGIP)

SPONSORED BY THE



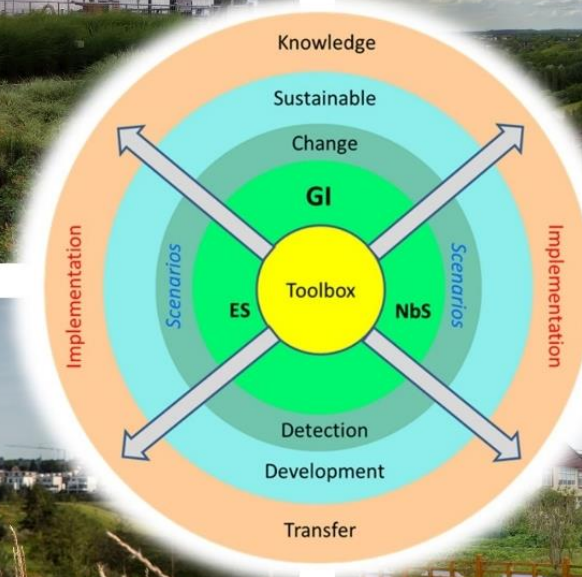
FKZ: 01LE1805A/B1

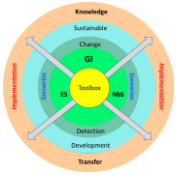
R&D: 10/2020 – 9/2024



Presenter:
Prof. Dr. Harald Zepp
(RUB)

Contact:
imecogip@rub.de





IMECOGIP

Contribution to Ecosystem services and Nature Based Solutions



Focus areas: Shanghai and Ruhr Metropolis

Outline

1. Main Threats to Ecosystems
2. Nature based solutions (NbS) counteracting negative effects: Evidences from Shanghai
3. Action-oriented resilience strategies supported by the IMECOIP Toolbox
4. Conclusion

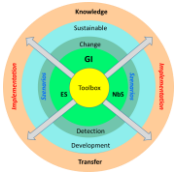
1. Main threats to ecosystems

Shanghai

- Air pollution
- **Urban Heat Island**
- **Urban flash floods**
- **Loss of biodiversity**
- **Urban green space per capita**

Ruhr Metropolis

- Urban Heat Island
- Urban flash floods
- Loss of biodiversity
- Air pollution

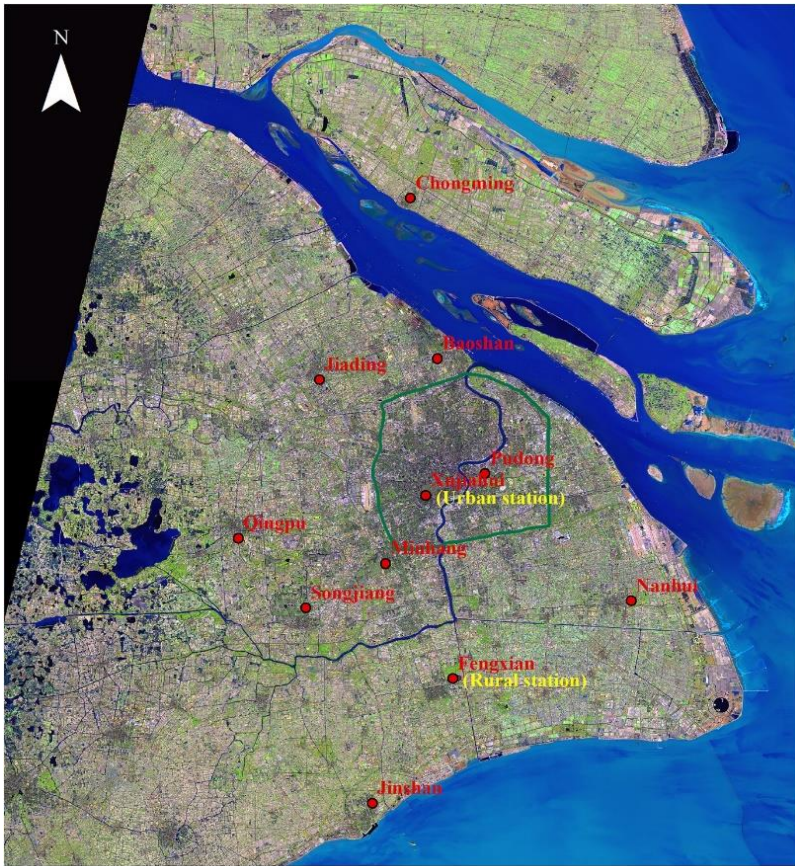


IMECOGIP

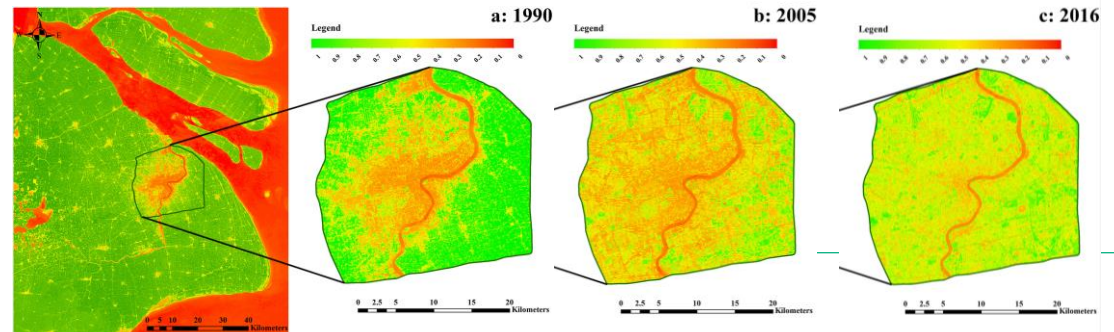
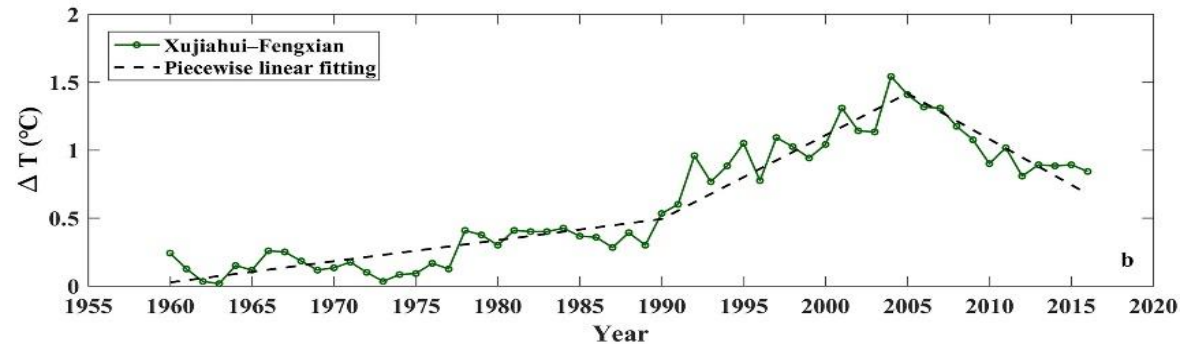
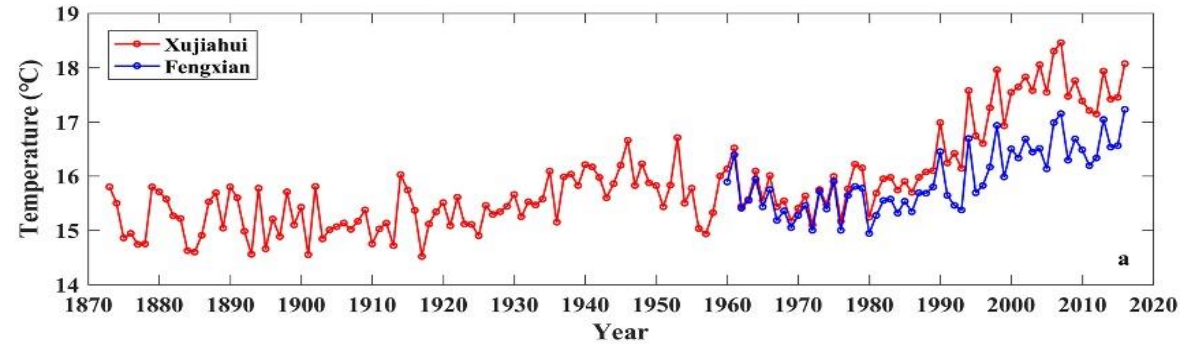
Contribution to Ecosystem services and Nature Based Solutions



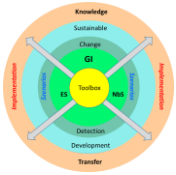
2.1 Evidence from Shanghai NbS: Mitigation of Urban Heat Island by Increasing Green Infrastructure



Legend
 ● Meteorological stations
 — Outer ring
 0 5 10 20 30 40 Kilometers



Wang, W. & Shu, J. (2020): Urban renewal can mitigate Urban Heat Islands. *Geophysical Research Letters* 47



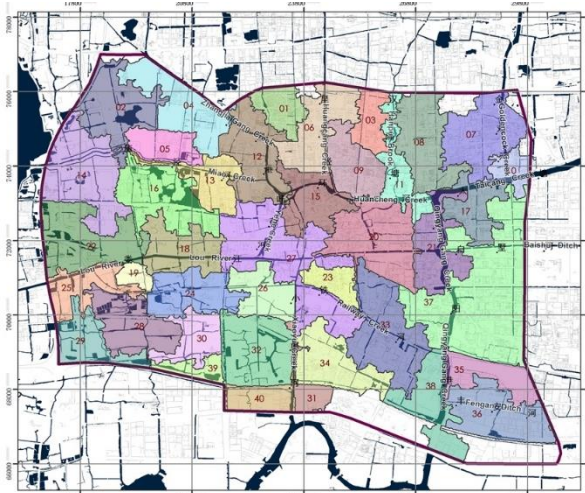
IMECOGIP

Contribution to Ecosystem services and Nature Based Solutions

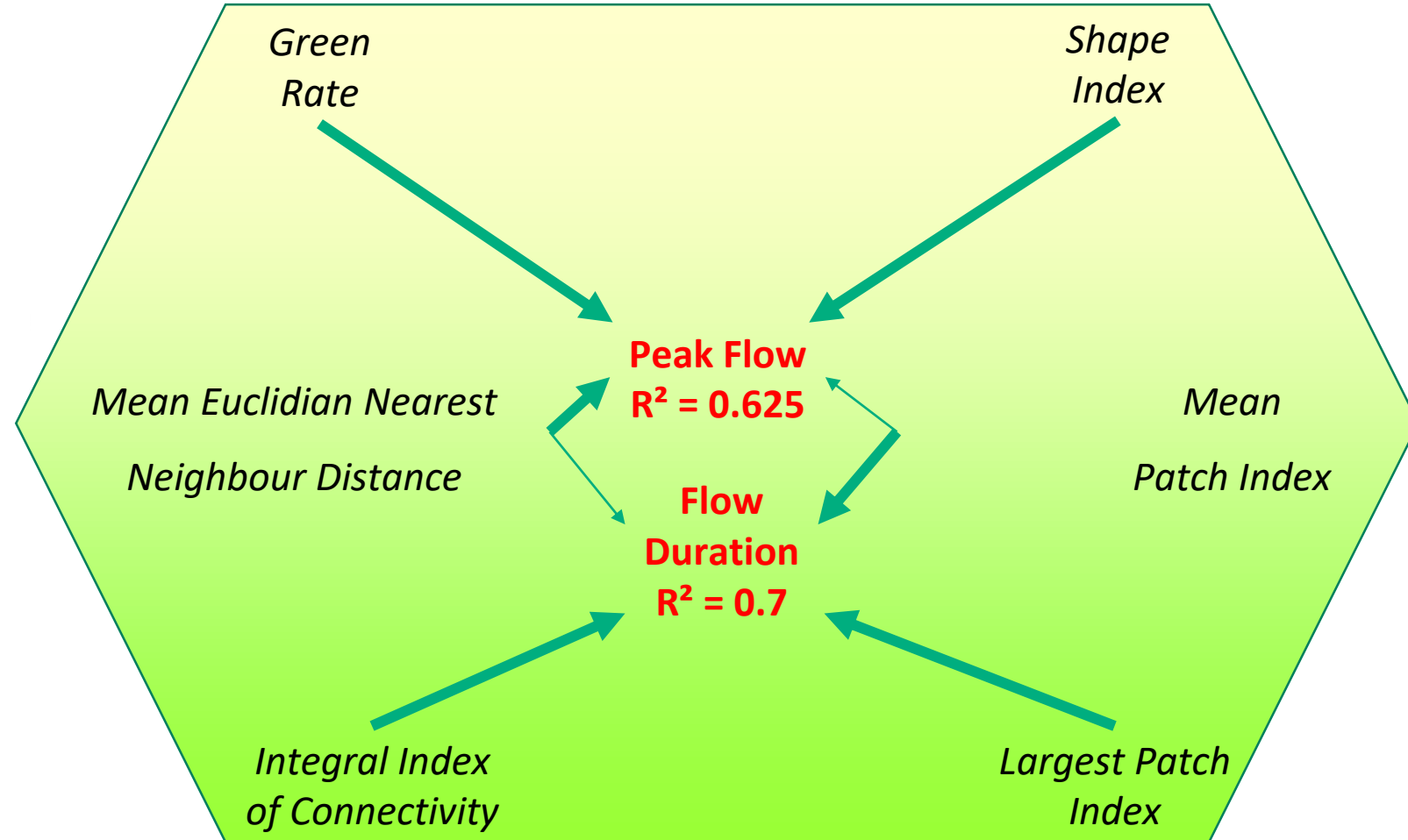
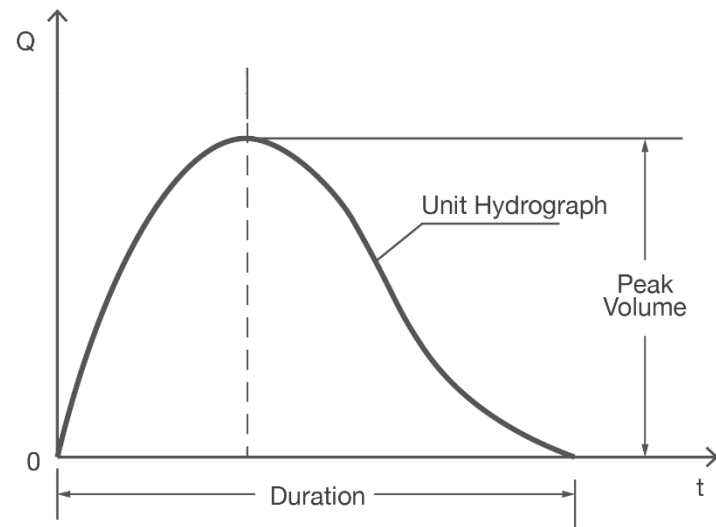


2.2 Evidence from Shanghai - Urban Flash Floods: Green-space Pattern Optimization for Mitigation of flash floods

QIU Ming (2021): Double Degree Master Thesis, Tongji Univ. Shanghai & Ruhr University Bochum



40 urban catchment in Kunshan, Jiangsu



Multiple linear regressions (→ significance level < 0.05)



IMECOIGIP

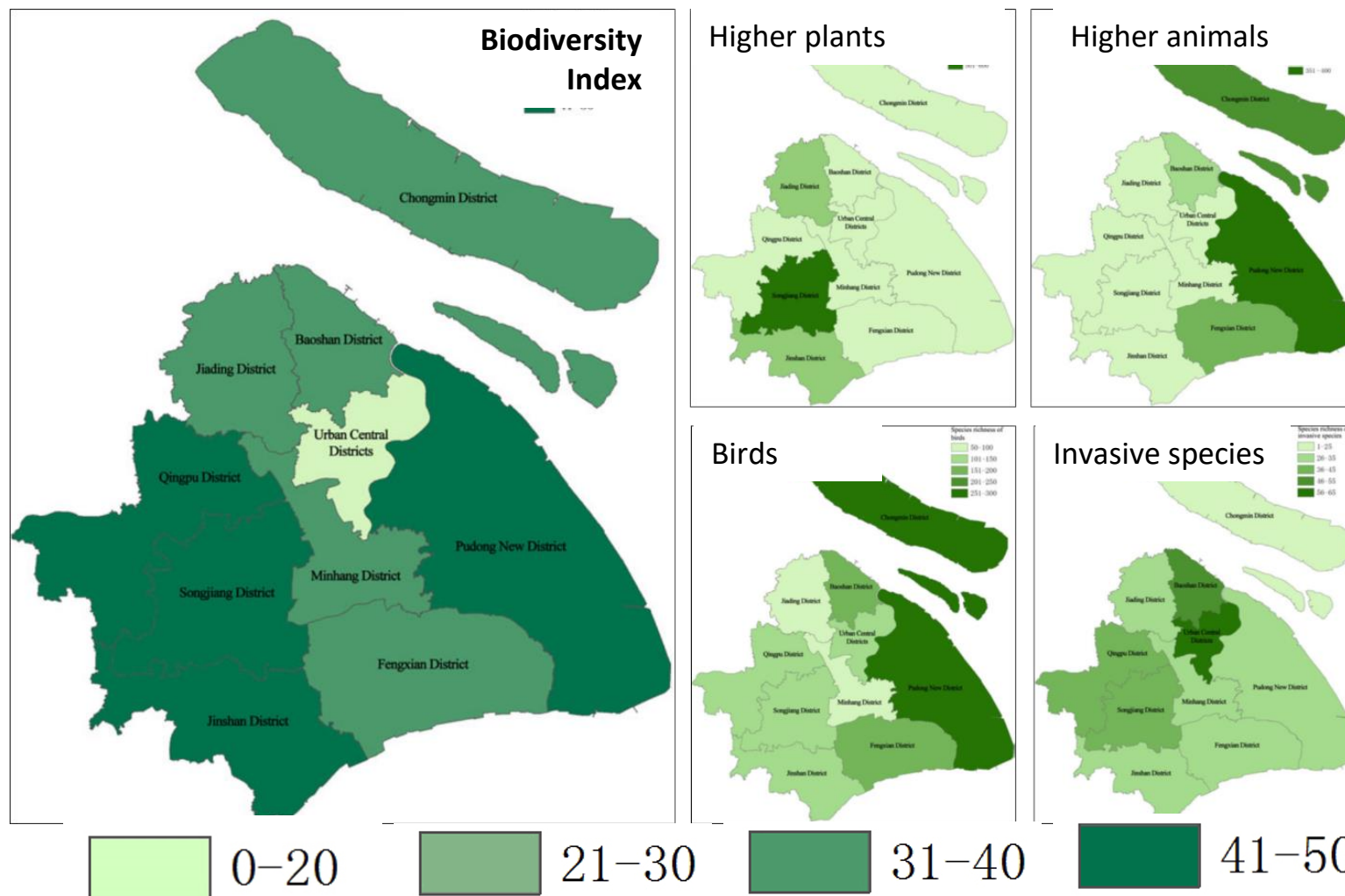
Contribution to Ecosystem services and Nature Based Solutions



2.3 Evidence from Shanghai Urban Biodiversity & GI: Traditional Parks are no panacea

Results from IMECOIGIP Cooperation Partner GAN Jing

	Biodiversitäts-Index
Ecological land area proportion (%)	0,659*
Public green space area proportion (%)	-0,671*
Cultivated land area proportion (%)	0,637*
Forest land area (ha)	0,519
Population density (persons/km ²)	-0.827**
Building density (10 ⁴ m ² /km ²)	-0,765**
Road network density (km/km ²)	-0.801**



GAN, Jing (2021): Urban Biodiversity and Built Environment. Case Study of Shanghai. Shanghai



IMECOGIP

Contribution to Ecosystem services and Nature Based Solutions

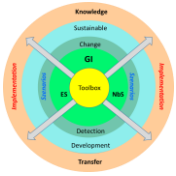


2.4 Evidences from Shanghai and the Ruhr NbS: Sociocultural ES promoting health, enjoyment, education and aesthetic experiences

Results of a qualitative social media analysis of around 20,000 reviews in Google Maps and Baidu Map

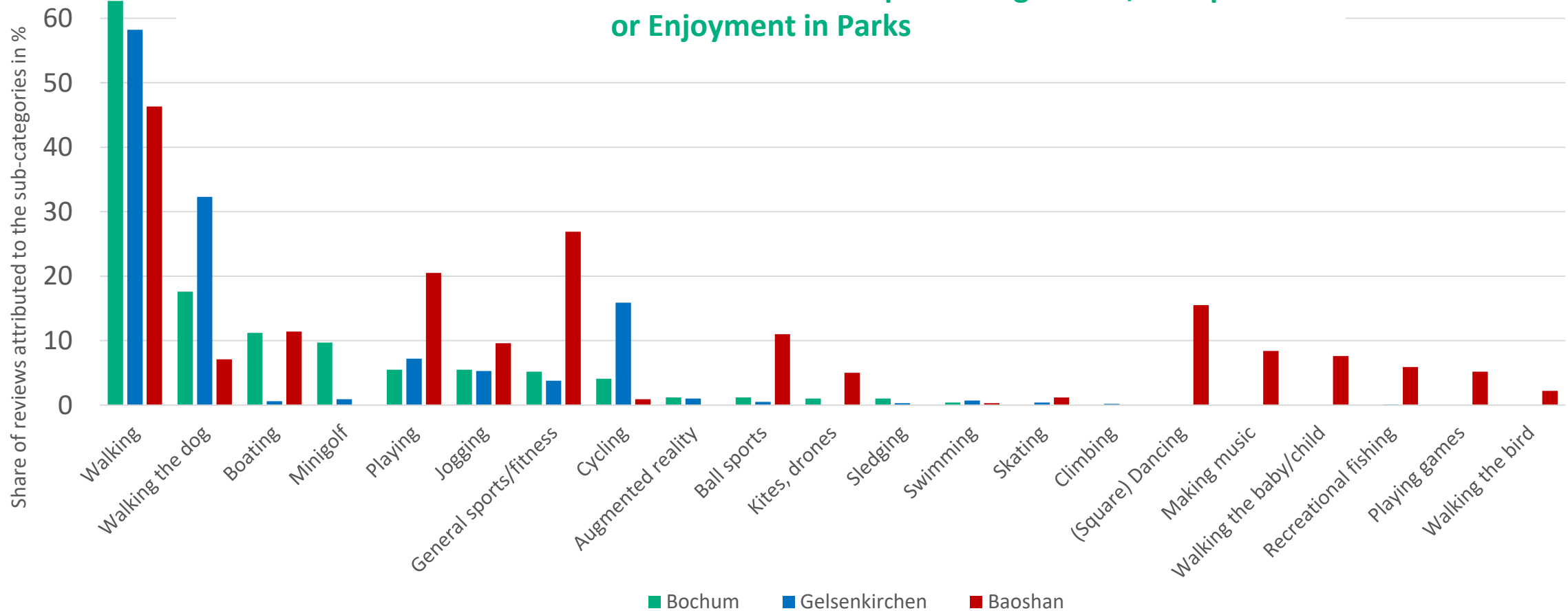
Bochum %										
	Parks	Zoos	Water bodies	Golf clubs	Ceme-teries	Allotment gardens	Heaps	Protected areas	Play-grounds	
3.1.1.1 Active or Immersive Interactions	32,82	9,65	49,6	53,33	26,92	15,84	21,47	64,73	19,93	
3.1.1.2 Passive or Observational Interactions	38,11	34,74	34,94	23,33	30,77	47,96	14,97	32,37	22,03	
3.1.2.4 Aesthetic Experiences	61,78	73,6	60,46	46,67	53,85	55,2	83,05	61,35	69,58	

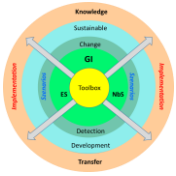
Shanghai %								
	Parks	Scenic Area	Residential Area	Temple	Leisure square	Attractions	Sports-ground	Other
3.1.1.1 Active or Immersive Interactions	74,43	49,37	39,29	7,25	50	51,92	95,74	45,45
3.1.1.2 Passive or Observational Interactions	39,29	47,47	28,57	47,1	44,44	64,42	5,32	43,64
3.1.2.4 Aesthetic Experiences	30,6	52,22	55,95	26,09	42,59	36,54	11,7	76,36



2.4 Evidences from Shanghai and the Ruhr NbS: Sociocultural ES promoting health, enjoyment, education and aesthetic experiences

Share of Reviews attributed to Active Interactions promoting Health, Recuperation or Enjoyment in Parks



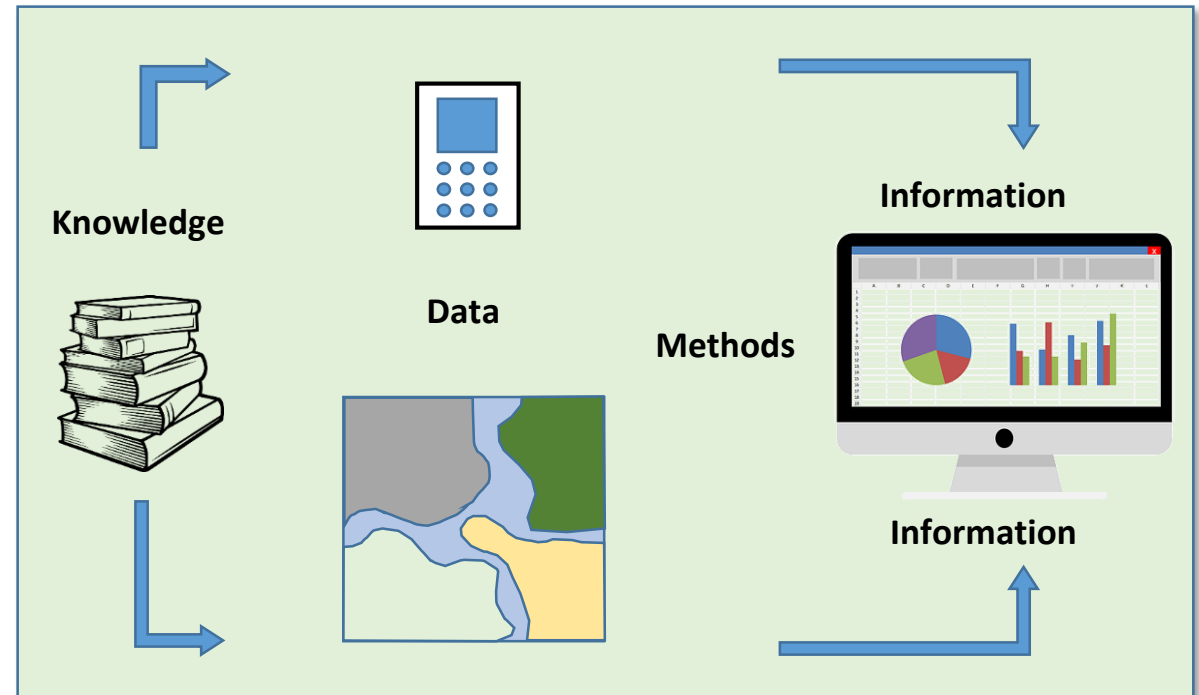


IMECOGIP

Contribution to Ecosystem services and Nature Based Solutions

3 Action-oriented resilience strategies supported by the IMECONGIP Toolbox

- Evaluation of planning options in view of anticipated ecosystem services (decision support, benchmarks etc.)
- Planning of NbS (nature based solutions)





IMECOGIP

Contribution to Ecosystem services and Nature Based Solutions



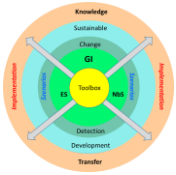
3.1 Action-oriented resilience strategies supported by the IMECOGIP Toolbox

Toolbox-Road Map: Achievements and Prospect

Ecosystem services

Mediation of waste (PM ₁₀)	Feb. 2022
Carbon sequestration	
Carbon fixation	
Cooling intensity	
(Flash) flood regulation	
Visual screening	Oct. 2022
Health, recreation, enjoyment (physical activity)	
Health, recreation, enjoyment (passive)	
Education and training	
Aesthetic experiences	

Cultivated plants for nutritional purposes	until Oct. 2024
Surface water for drinking	
Regulation of chemical condition of freshwaters	
Elements of living systems for entertainment/representation	
Surface water used as material	
Maintaining nursery populations and habitats	
Characteristics enabling scientific investigation/ecol. knowledge	
Characteristics that are resonant in terms of culture or heritage	
Mediation by other chemical or physical means	
Noise attenuation	
Abiotic characteristics enabling spiritual, symbolic interactions	
Polination	
Elements of living systems that have symbolic meaning	



IMECOGIP

Contribution to Ecosystem services and Nature Based Solutions

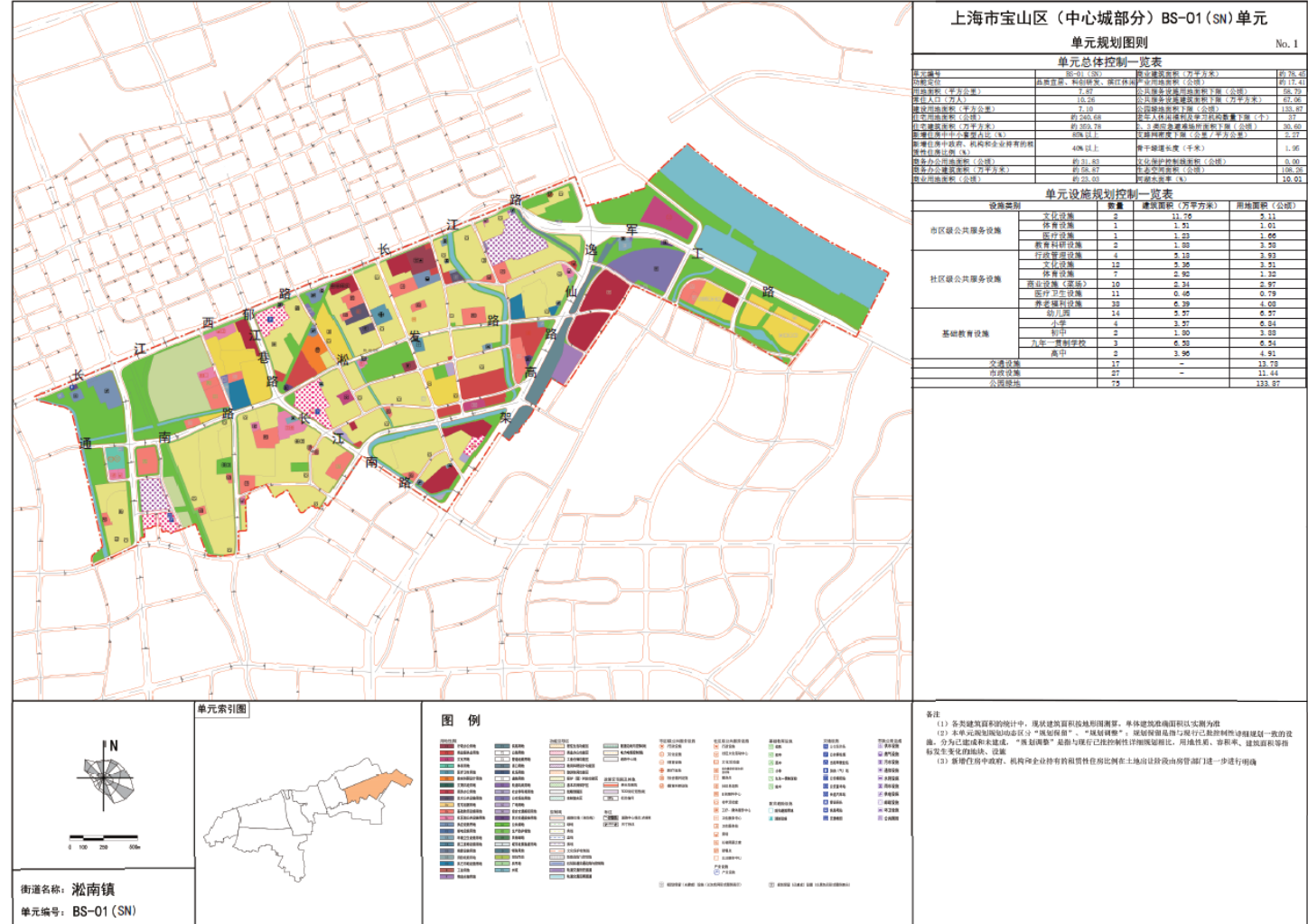


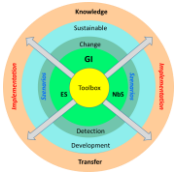
3.2 Action-oriented resilience strategies: Implementation of the IMECOIP Toolbox

上海市宝山区（中心城部分）单元规划
 （含重点公共基础设施专项规划） 草案公示稿

Detailed Regulatory Plan of Songnan Community, Baoshan District (Central City part)

上海市规划和自然资源局 | 宝山区人民政府
 2021年11月



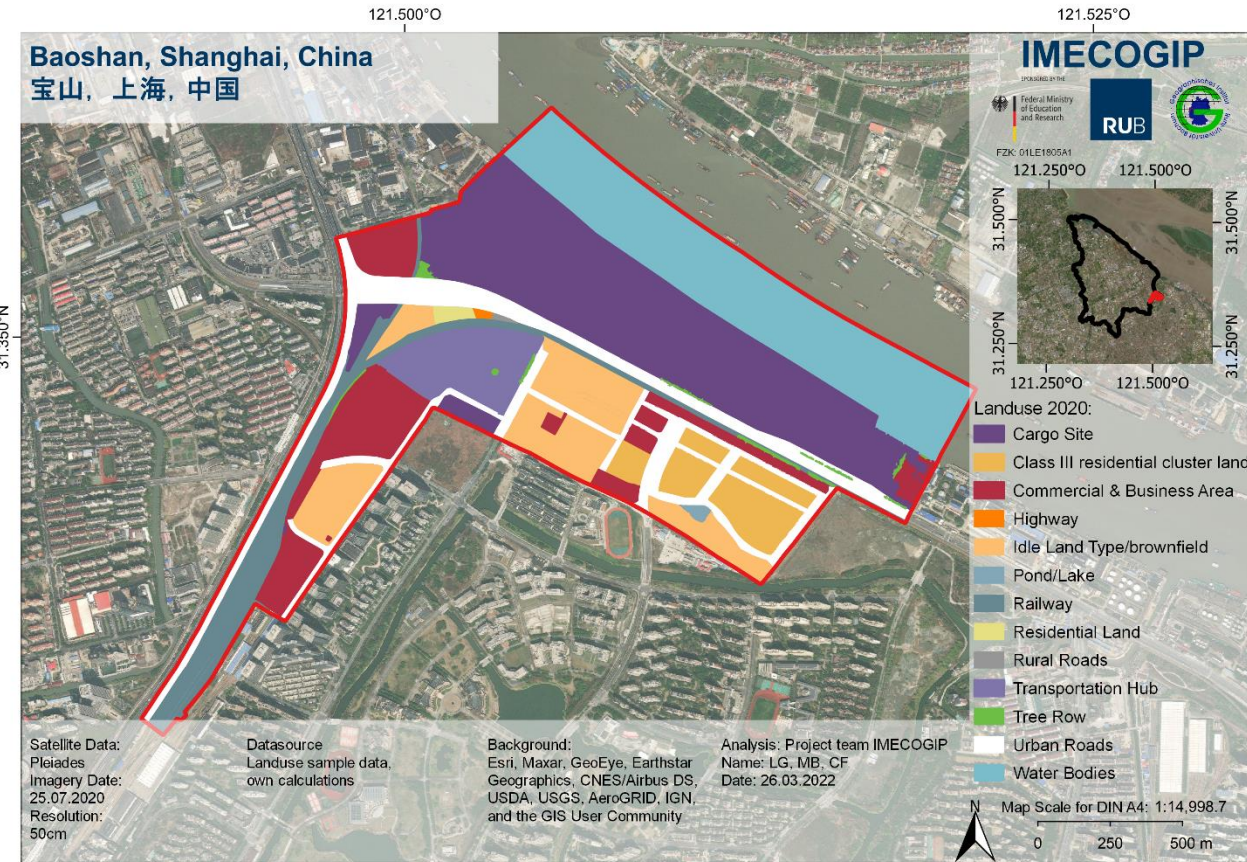
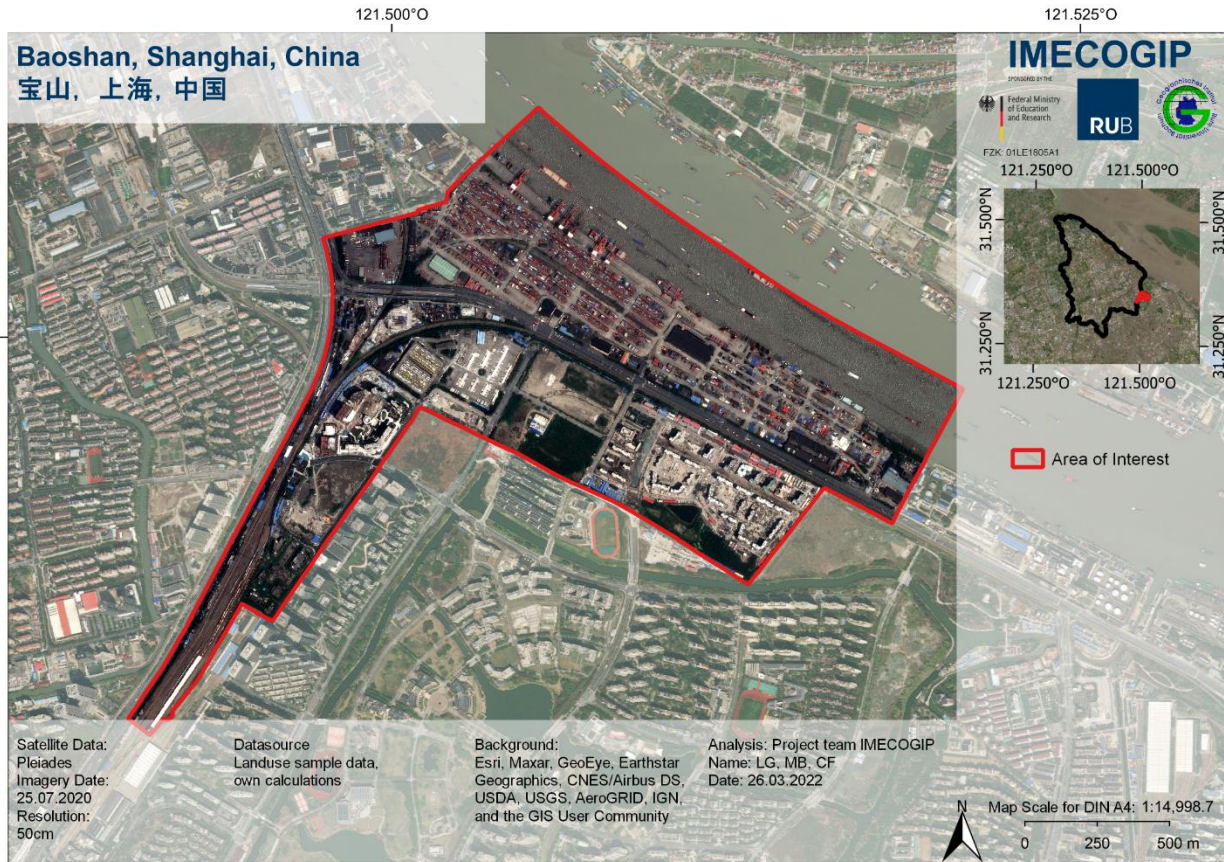


IMECOGIP

Contribution to Ecosystem services and Nature Based Solutions



3.2 Action-oriented resilience strategies: Land Use 7/20

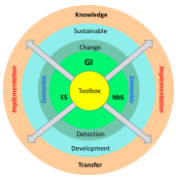


Project manager of IMECCOGIP: Prof. Dr. Harald Zepp, Geographisches Institut, Ruhr-Universität Bochum, D-44780 Bochum, Deutschland, imeccogip@rub.de, <https://www.geographie.ruhr-uni-bochum.de/forschung/angewandte-physische-geographie/forschung/imeccogip/>



Project manager of IMECCOGIP: Prof. Dr. Harald Zepp, Geographisches Institut, Ruhr-Universität Bochum, D-44780 Bochum, Deutschland, imeccogip@rub.de, <https://www.geographie.ruhr-uni-bochum.de/forschung/angewandte-physische-geographie/forschung/imeccogip/>



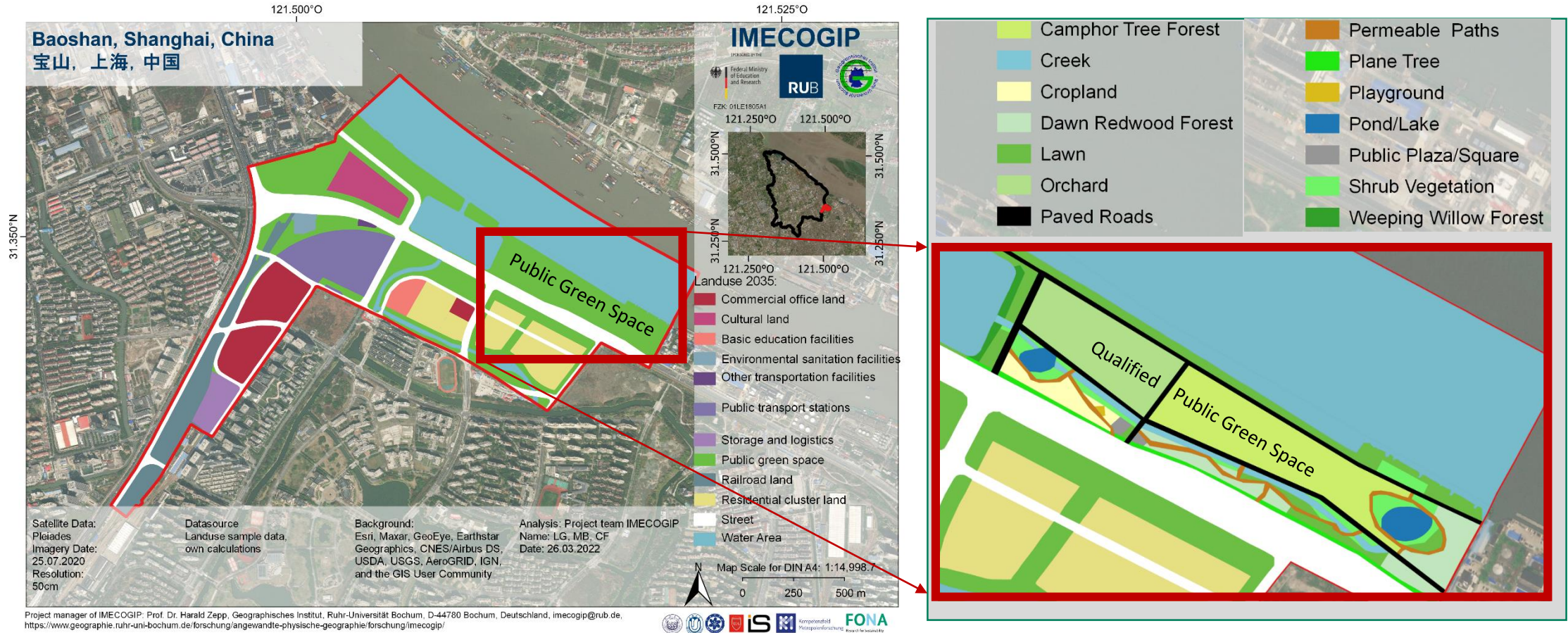


IMECOGIP

Contribution to Ecosystem services and Nature Based Solutions

3.2 Action-oriented resilience strategies: Land Use according to the Regulatory Plan

Qualified land use = Workshop result





IMECOGIP

Contribution to Ecosystem services and Nature Based Solutions

3.2 Action-oriented resilience strategies: Evaluation of planning variants

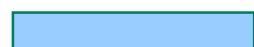
Land use



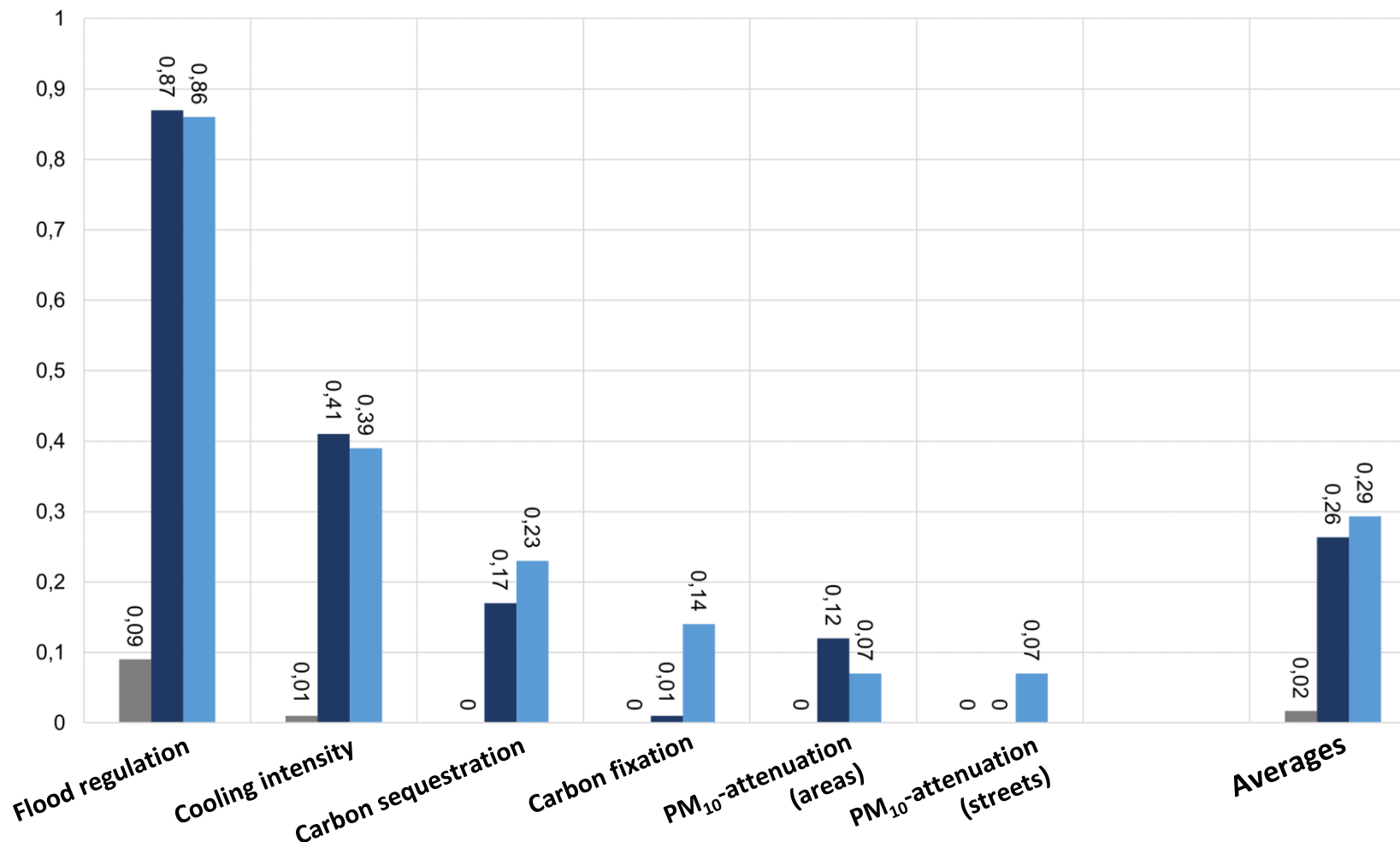
Present



Regulatory Plan



Workshop result





IMECOGIP

Contribution to Ecosystem services and Nature Based Solutions

3.3 Action-oriented resilience strategies: Implementation of the IMECOIP Toolbox



Present situation

- Street / Traffic area
- Deciduous forest
- Small woods
- Brownfield
- Meadow / Pasture
- Garden / Garden
- Permanent culture
- Fields
- Fringe, ruderal and
- Green space / Park
- Sports, leisure and recreation facility
- Public buildings or facilities
- Residential and mixed development
- Village settlement area / Farmyard location
- Commercial and industrial area
- Roadside greenery
- Unsealed path



A



B



C

225 m

Design competition variants

- Residential and mixed development
- Street / Traffic area
- Paths / Open spaces
- Largely forested areas
- Other green open spaces
- Water
- Roof greening

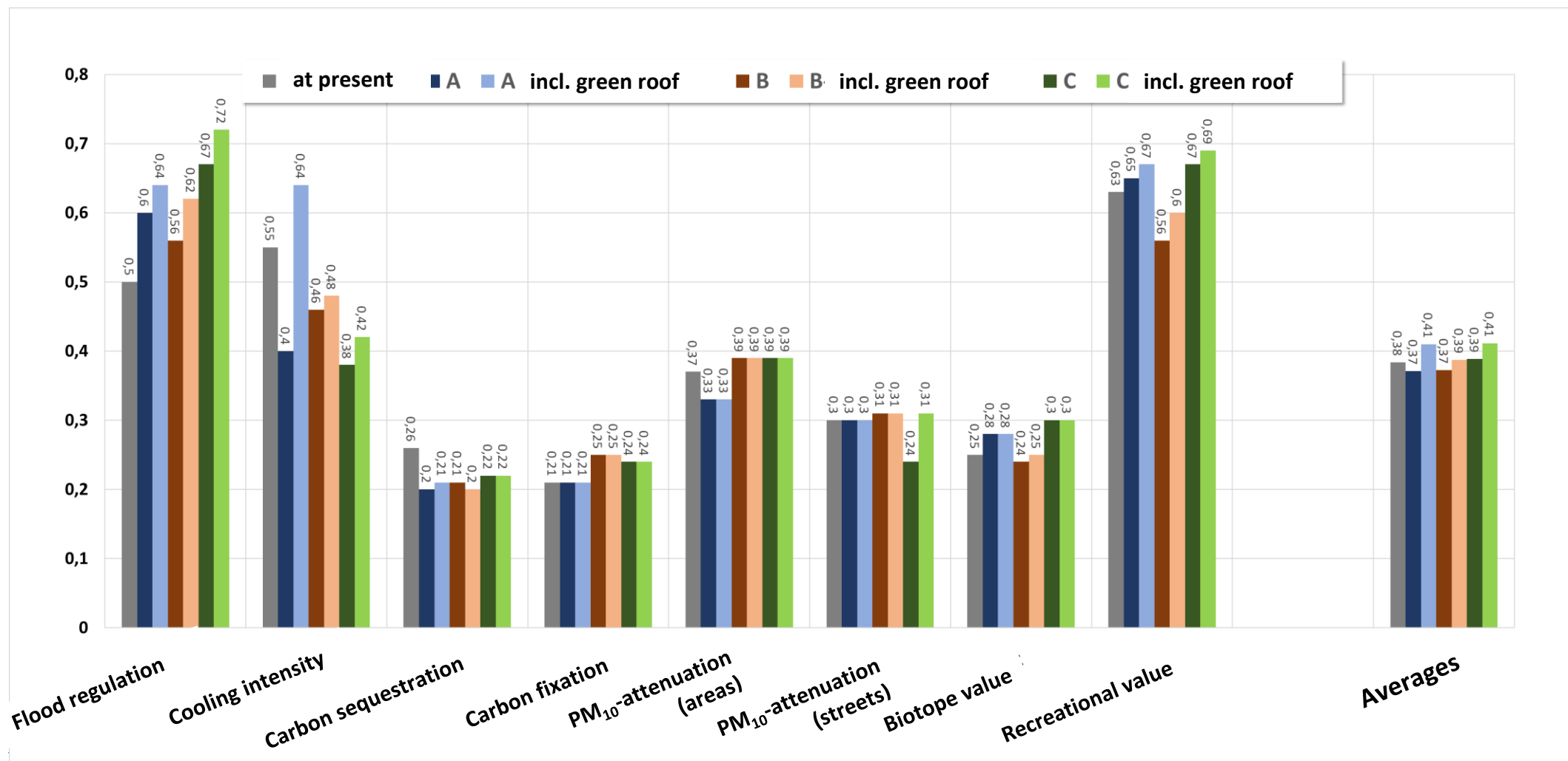


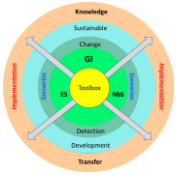
IMECOGIP

Contribution to Ecosystem services and Nature Based Solutions



3.3 Action-oriented resilience strategies: Evaluation of planning variants





IMECOGIP

Contribution to Ecosystem services and Nature Based Solutions

FONA
Research for sustainability

SPONSORED BY THE
 Federal Ministry
of Education
and Research

4 Conclusion

1 There is sound evidence from Shanghai that green infrastructure can effectively mitigate ecological and health threats in the research areas.

This was exemplified by proven effects of adapted green infrastructure Ecosystem services connected to

- the urban heat island,
- hydrograph characteristics during urban flash floods,
- health protection and
- biodiversity.

2 The IMECONGIP toolbox is - and will be even more - a powerful method to foster planning for urban resilience based on ecosystem services and in search for nature based solutions.