*International Symposium on Water Sustainability 2022*

# Understanding the value of urban rivers from the public's perspective


**HUA Junyi**

School of International Affairs and Public Administration
Ocean University of China


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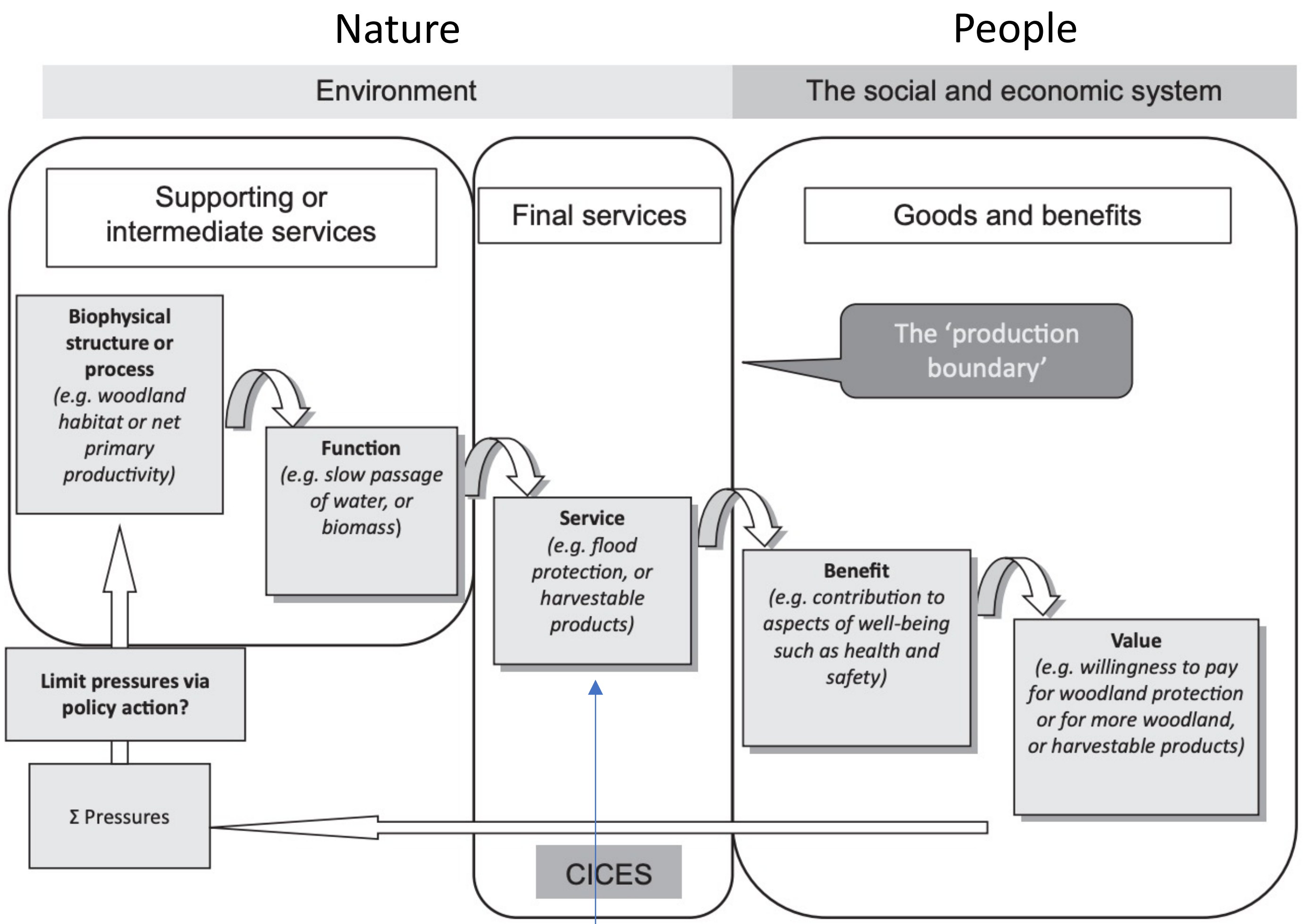
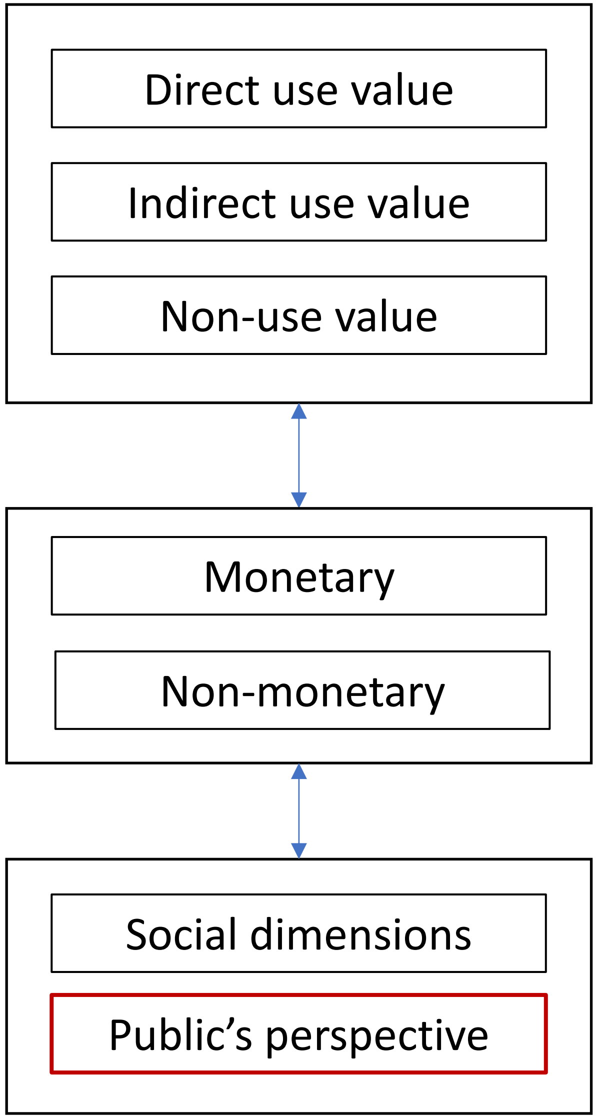



*Figure 3.1* The cascade model.

*Source*: original, Haines-Young and Potschin, 2010; adapted from Potschin and Haines-Young, 2011

Source: Potschin & Haines-Young, 2016




Ecosystem services: provisioning, regulating, cultural, and supporting

**Ecosystem services** are the benefits people obtain from ecosystems (Millennium Ecosystem Assessment, 2005).
**Ecosystem services** are the direct and indirect contributions of ecosystems to human well-being (TEEB, 2010).

# Previous research – Increasing recognition of ecosystem services and urban rivers

- Public preferences and assigned importance for various ecosystem services (Asah et al., 2014; Bertram et al., 2015; Guo et al., 2018; Larson et al., 2013; Rey-Valette et al., 2017)
- Preference and willingness to pay for urban river conservation (Bergstrom & Loomis, 2017; Brouwer et al., 2016; Che et al., 2014; Dai et al., 2021; Vollmer et al., 2017)

ELSEVIER

Journal of Environmental Management
Volume 223, 1 October 2018, Pages 478-488

Research article

Public perception towards river and water conservation practices: Opportunities for implementing urban stormwater management practices

Yuling Gao [a], Sarah P. Church [a], Sara Peel [b], Linda S. Prokopy [a]

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https://doi.org/10.1016/j.jenvman.2018.06.059 Get rights and content

Highlights

- Public environmental awareness increased over the last decade studied.
- People value natural features of rain gardens and support public implementation.
- Reducing stormwater charges for adopters of practices can be an incentive.
- Emphasizing functionality of green practice helps motivate its adoption.

ELSEVIER

Ecological Economics
Volume 190, December 2021, 107186

ANALYSIS

Measuring the economic value of urban river restoration

Dan Dai [a, b], Roy Brouwer [c], Kun Lei [a]

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Highlights

- The benefits of urban river restoration in Beijing are estimated
- Residents living up and downstream of the Yongding River are interviewed
- Public WTP for water quality improvements is several times higher than the current water bill
- Spatial preferences and place attachment play a key role in public preferences
- The study provides important info to guide investment decisions in river restoration

# Public perception of and preference for urban rivers

## Research questions:

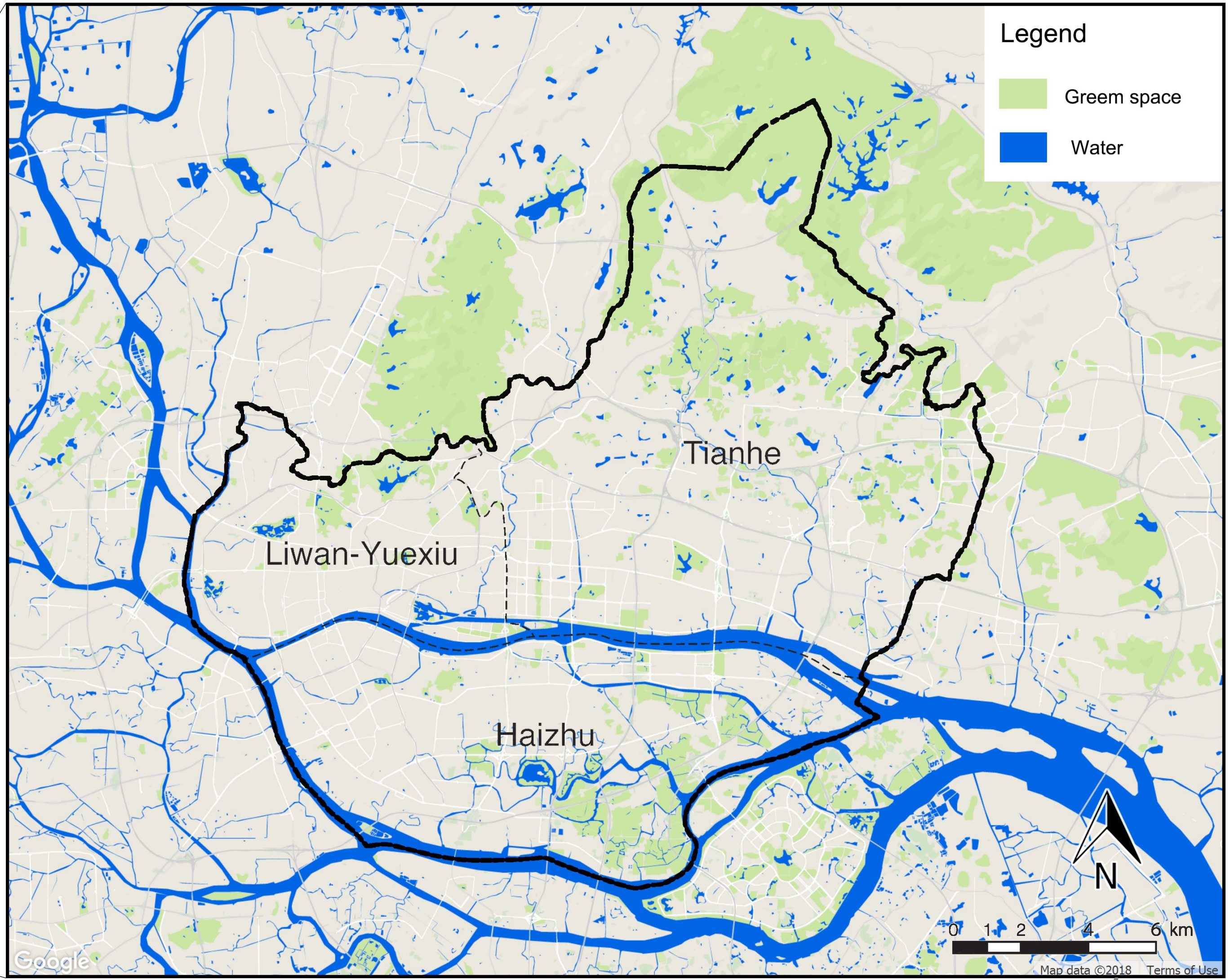
- Perception of importance and performance of ecosystem services
- Willingness-to-pay for hypothetical restoration
- Preference heteorogeneity

## Research significance:

- To understand societal dependence on urban natural environments
- To incoperate social perspectives into natural perspectives
- To provide scientific evidence for decision-making

# Guangzhou, China


(Google Maps)



# Urban rivers in Guangzhou, China


# Urban rivers in Guangzhou, China

# Case 1: Prioritizing urban rivers' ecosystem services: An importance-performance analysis

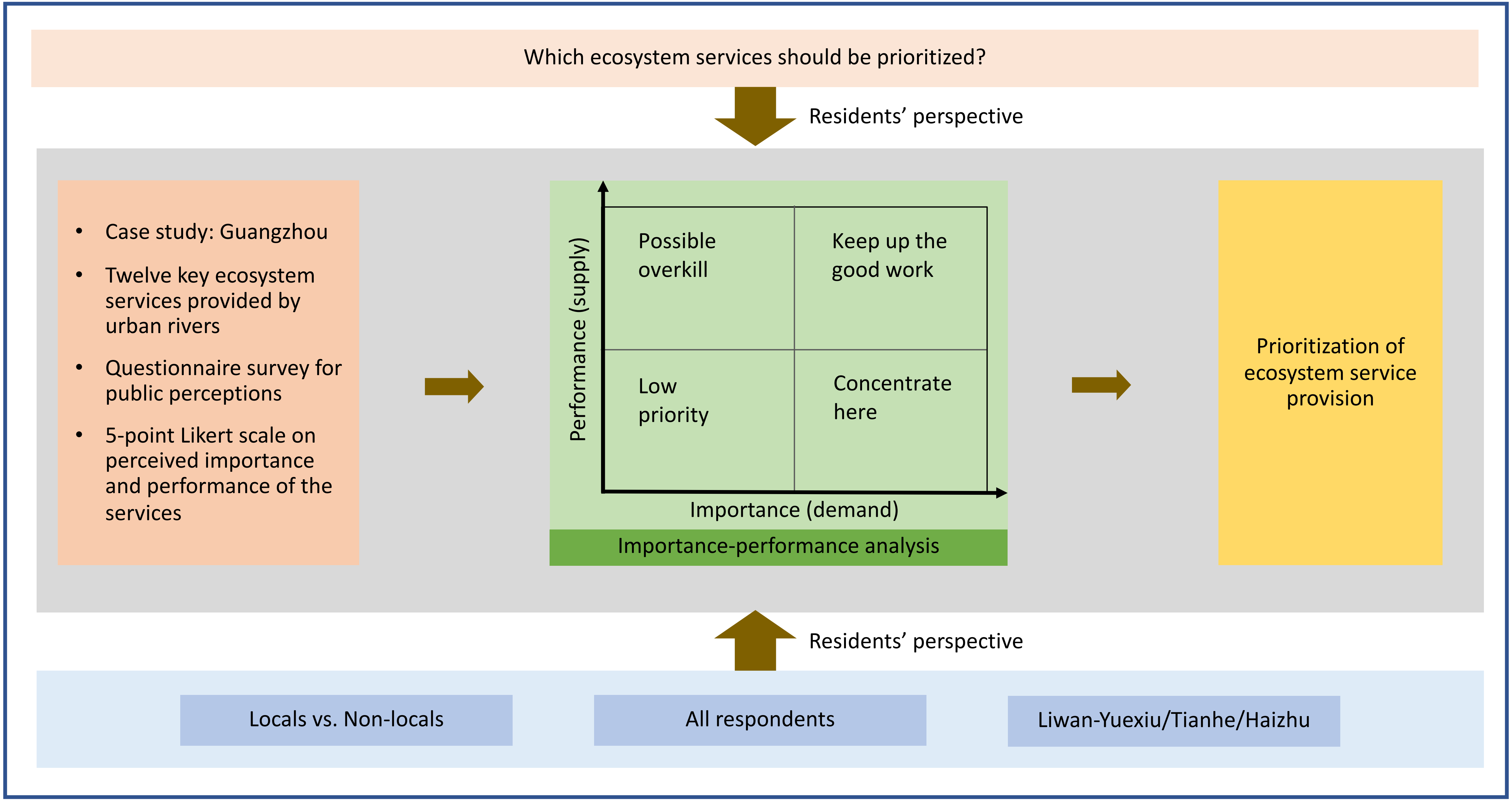
| CATEGORY | ABBR. | DESCRIPTION |
|---|---|---|
| Provisioning | WATERSUPPLY | Supplying fresh water for multi-purposes |
| | TRANSPORTATION | Transporting goods and people |
| Regulating | PURIFICATION | Purifying water pollutants |
| | FLOODCONTROL | Mitigating floods |
| | COOLING | Alleviating high temperature in summer |
| Supporting | BIODIVERSITY | Providing habitats for diverse floral and faunal species |
| Cultural | SYMBOL | Representing symbols of the city and local communities |
| | EDUCATION | Serving as subject matter of education |
| | TOURISM | Promoting river-related tourism |
| | RECREATION | Providing recreational opportunities |
| | HERITAGE | Representing cultural and historical heritage |
| | AESTHETICS | Representing natural beauty and aesthetics |

Ecosystem services provided by urban rivers in Guangzhou

Which should be prioritized?

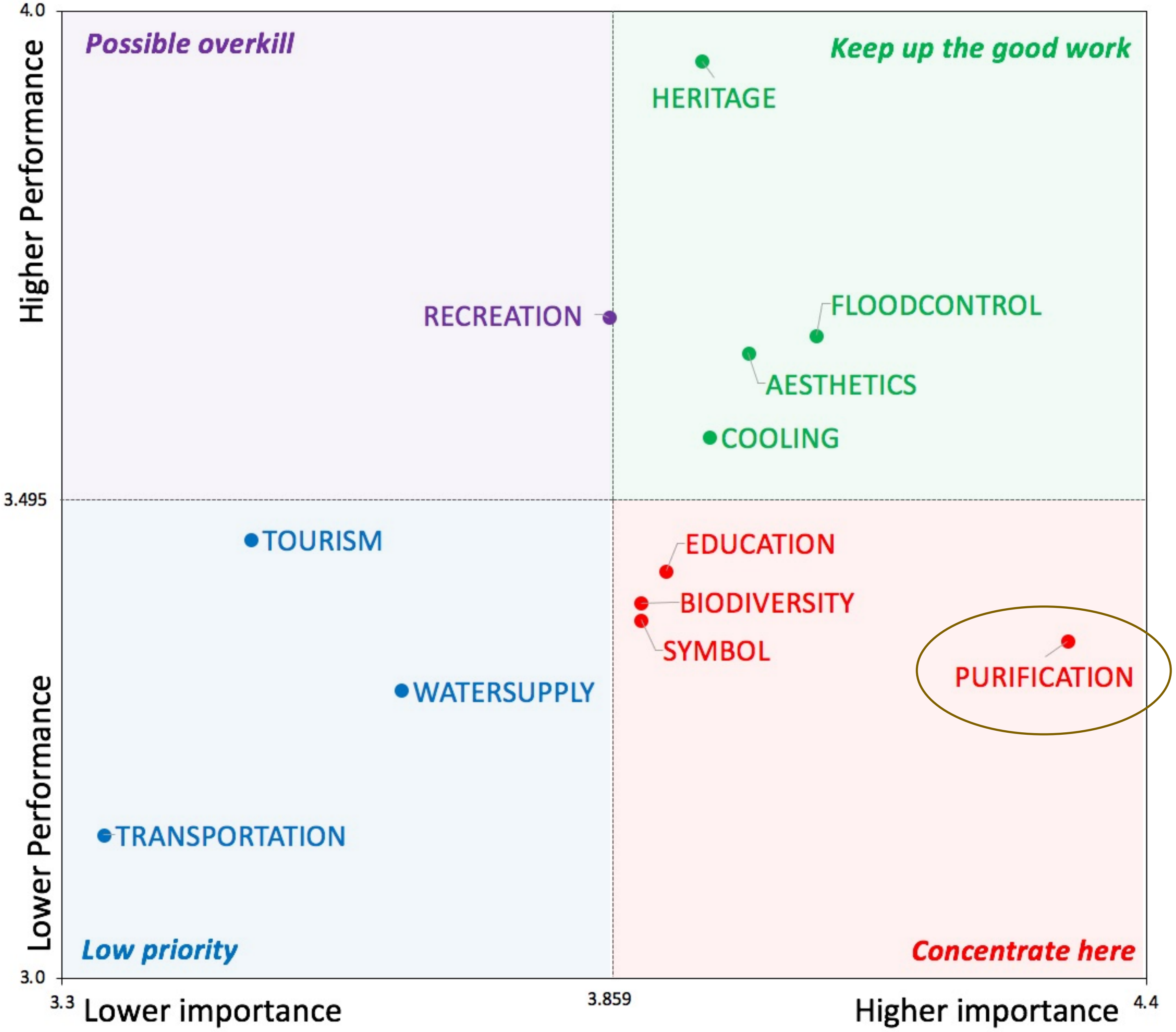
How important? (Demand)
How well provided? (Supply)

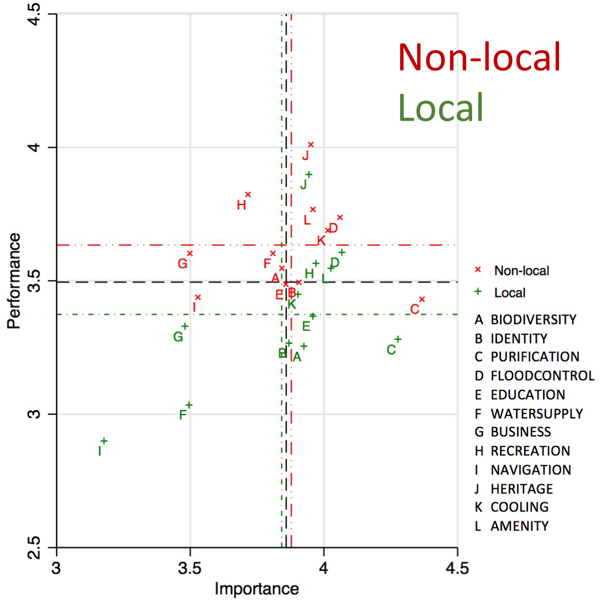
Hua, J., & Chen, W. Y. (2019). Prioritizing urban rivers' ecosystem services: An importance-performance analysis. *Cities, 94*, 11-23. doi:10.1016/j.cities.2019.05.014

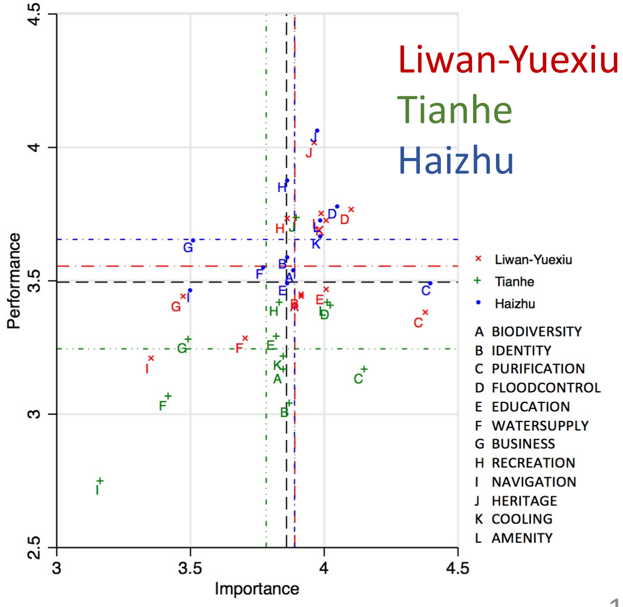

Which ecosystem services should be prioritized?
Residents' perspective
Case study: Guangzhou
Twelve key ecosystem services provided by urban rivers
Questionnaire survey for public perceptions
5-point Likert scale on perceived importance and performance of the services
Performance (supply)
Possible overkill
Keep up the good work
Low priority
Concentrate here
Importance (demand)
Importance-performance analysis
Prioritization of ecosystem service provision
Residents' perspective
Locals vs. Non-locals
All respondents
Liwan-Yuexiu/Tianhe/Haizhu

# Importance-performance gap

| | Importance | | Performance | | | *t-test* | |
|---|---|---|---|---|---|---|---|
| Service | **Mean** | S. D. | **Mean** | S. D. | ***I-P*** | *t* | *p* |
| WATERSUPPLY | **3.644** | 0.987 | **3.298** | 1.161 | ***0.346*** | 4.6261 | 0.0000 |
| TRANSPORTATION | **3.342** | 1.011 | **3.149** | 1.207 | ***0.193*** | 2.5548 | 0.0112 |
| PURIFICATION | **4.320** | 0.709 | **3.349** | 1.105 | ***0.971*** | 13.0082 | 0.0000 |
| FLOODCONTROL | **4.066** | 0.761 | **3.666** | 1.049 | ***0.400*** | 6.0443 | 0.0000 |
| COOLING | **3.956** | 0.768 | **3.560** | 1.067 | ***0.396*** | 5.6275 | 0.0000 |
| BIODIVERSITY | **3.887** | 0.787 | **3.389** | 1.167 | ***0.498*** | 5.9359 | 0.0000 |
| SYMBOL | **3.887** | 0.800 | **3.371** | 1.081 | ***0.516*** | 7.2081 | 0.0000 |
| EDUCATION | **3.913** | 0.769 | **3.422** | 1.024 | ***0.491*** | 6.8524 | 0.0000 |
| TOURISM | **3.491** | 0.922 | **3.455** | 1.084 | ***0.036*** | 0.4606 | 0.6454 |
| RECREATION | **3.855** | 0.851 | **3.684** | 1.073 | ***0.171*** | 2.1946 | 0.0290 |
| HERITAGE | **3.949** | 0.861 | **3.949** | 0.969 | ***0.000*** | 0.0000 | 1.0000 |
| AESTHETICS | **3.996** | 0.790 | **3.647** | 1.102 | ***0.349*** | 4.5350 | 0.0000 |
| Mean | **3.859** | 0.535 | **3.495** | 0.826 | ***0.364*** | 6.8471 | 0.0000 |




Lai, I. K. W., & Hitchcock, M. (2015). Importance–performance analysis in tourism: A framework for researchers. *Tourism Management*, *48*, 242-267.
Martilla, J. A., & James, J. C. (1977). Importance-performance analysis. *The Journal of Marketing*, *41*(1), 77-79.

# Prioritization

**Higher priority**

*Top*

- **Water purification**

*Second*

- Biodiversity
- Education
- Symbol

**Lower priority**

*Economic*

- Tourism
- Transportation
- Water supply

**Important & good**

*Regulating*

- Cooling
- Flood control

*Cultural*

- Natural beauty
- Heritage

**A little too much**

- Recreation

## *Case 2: Residents' heterogenous preferences and willingness to pay for restoring urban river attributes in Guangzhou and Brussels*

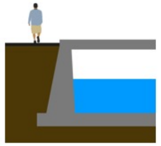
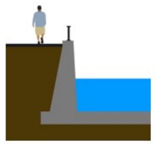
- Stated preference methods - Discrete choice experiments
- Polynomial attribute attendances: always, often, seldom, never
- Mixed logit models with separate parameters for attendance levels

| Attributes | Levels |
|---|---|
| Biodiversity | Limited<br>(BIO1) 50% increase in plant and animal life<br>(BIO2) 75% increase in plant and animal life |
| Morphological feature | Covered, highly-engineered channel<br>(MORPH1) Open, highly-engineered channel<br>(MORPH2) Open, more naturalized channel |
| Water quality | Bad, highly polluted<br>(WATER1) Average, slightly polluted<br>(WATER2) Good, swimmable |
| Recreational facilities | Unavailable<br>(REC) Available |
| Household cost | No cost<br>Guangzhou: ¥5, ¥10, ¥20, ¥30, ¥40, ¥50 monthly<br>Brussels: €10, €25, €50, €75, €100, €125 annually |

285 respondents in Guangzhou, 299 respondents in Brussels

Each respondent:

- answered **6 choice cards**
- stated attendance levels to each attribute

| | Status quo | Alternative A | Alternative B |
|---|---|---|---|
| Biodiversity | Limited | 75% increase | 50% increase |
| Morphological feature | Partly covered, highly-engineered channel  | Open, highly-engineered channel  | Open, more naturalized channel  |
| Water quality | Highly polluted | Slightly polluted | Good |
| Recreational facility | Unavailable | Available | Unavailable |
| Annual household cost | 0 | EUR25 | EUR75 |
| Please select your answer here | □ | □ | □ |

Choice card example

Hua, J., Chen, W. Y., Liekens, I., & Cho, F. H. T. (2021). Partial attribute attendance in environmental choice experiments: A comparative case study between Guangzhou (China) and Brussels (Belgium). *Journal of Environmental Management, 285*, 112107. doi:10.1016/j.jenvman.2021.112107

# Results

**Table 6**
Results of MIXL_SANA: extended MIXL models with separate parameters for different SANA.

| | | Guangzhou | | | | | Brussels | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | Always | Often | Seldom | Never | | Always | Often | Seldom | Never |
| *Mean* | | | | | | | | | | |
| ASC | 3.078** | | | | | 1.113** | | | | |
| | (0.539) | | | | | (0.321) | | | | |
| COST | | −0.049** | −0.020** | 0.002 | 0.004 | | −0.048** | −0.014** | 0.003 | 0.008 |
| | | (0.008) | (0.005) | (0.005) | (0.012) | | (0.003) | (0.003) | (0.003) | (0.004) |
| BIO1 | | 0.668** | 0.472** | −0.191 | −0.998 | | 1.182** | 0.737** | −0.001 | 0.747 |
| | | (0.247) | (0.155) | (0.176) | (0.794) | | (0.232) | (0.184) | (0.436) | (0.624) |
| BIO2 | | 1.716** | 0.558** | −0.072 | −0.693 | | 1.894** | 1.141** | −0.020 | 0.412 |
| | | (0.287) | (0.16) | (0.175) | (0.724) | | (0.247) | (0.20) | (0.479) | (0.583) |
| MORPH1 | | 0.654** | 0.018 | 0.019 | −0.273 | | 0.974** | 0.551** | 0.779* | 0.465 |
| | | (0.232) | (0.131) | (0.181) | (0.663) | | (0.272) | (0.210) | (0.288) | (0.552) |
| MORPH2 | | 1.102** | 0.077 | −0.153 | −1.707* | | 1.685** | 0.974** | 0.647* | −0.313 |
| | | (0.288) | (0.146) | (0.245) | (0.735) | | (0.293) | (0.222) | (0.262) | (0.562) |
| WATER1 | | 1.388** | 0.600** | 0.105 | 0.046 | | 2.446** | 1.120** | 1.077* | 0.032 |
| | | (0.147) | (0.148) | (0.338) | (0.866) | | (0.230) | (0.188) | (0.531) | (0.995) |
| WATER2 | | 2.485** | 0.759** | 0.595 | −14.924 | | 3.720** | 1.791** | 1.126* | 1.132 |
| | | (0.240) | (0.183) | (0.460) | (440.135) | | (0.294) | (0.245) | (0.509) | (0.769) |
| REC | | 1.095** | 0.366** | −0.032 | −0.366 | | 1.009** | 0.867** | 0.343* | −0.023 |
| | | (0.197) | (0.126) | (0.120) | (0.335) | | (0.335) | (0.156) | (0.174) | (0.231) |

Attribute attendance

| | Guangzhou | | | Brussels | | |
|---|---|---|---|---|---|---|
| Attributes | Attendance | Non-attendance | Partial attendance | Attendance | Non-attendance | Partial attendance |
| Biodiveristy | 64.2% | **35.8%** | 42.5% | 88.6% | **11.4%** | 50.5% |
| Morphological Feature | 21.4% | **78.6%** | 0.0% | 95.3% | **4.7%** | 67.2% |
| Water Quality | **90.5%** | **9.5%** | 36.1% | 98.0% | **2.0%** | 41.5% |
| Recreational Facilities | 53.0% | **47.0%** | 34.7% | 84.0% | **16.1%** | 68.9% |
| Cost | 54.0% | **46.0%** | 37.5% | 69.6% | **30.4%** | 29.4% |

# Results

Marginal WTP estimates (Euro/household/year)

| | Guangzhou | | | | Brussels | | | |
|---|---|---|---|---|---|---|---|---|
| | MIXL | | MIXL_SANA | | MIXL | | MIXL_SANA | |
| | Mean | 95% conf. int. | Mean | 95% conf. int. | Mean | 95% conf. int. | Mean | 95% conf. int. |
| Alternative specific constant | 1497.07 | (452.56, 2541.64) | 302.71 | (145.58, 459.85) | 56.25 | (21.25, 91.26) | 33.12 | (13.29, 52.96) |
| 50% increase of plants and animals | 86.66 | (4.5, 168.77) | 35.93 | (16.38, 55.48) | 43.34 | (32.31, 54.36) | 23.53 | (15.32, 31.73) |
| 75% increase of plants and animals | 190.14 | (82.55, 297.73) | 61.25 | (36.03, 86.48) | 68.14 | (55.69, 80.58) | 36.73 | (27.01, 46.45) |
| Open, highly-engineered channels | 0 | | 13.29 | (3.24, 23.34) | 34.28 | (22.62, 45.94) | 20.36 | (11.58, 29.15) |
| Open, more naturalized channels | 0 | | 22.41 | (9.45, 35.36) | 56.96 | (43.76, 70.17) | 30.41 | (20.8, 40.03) |
| Slightly polluted water | 367.6 | (148.19, 587.02) | 94.49 | (56.35, 132.62) | 81.83 | (67.87, 95.79) | 52.07 | (38.31, 65.83) |
| Good, swimmable water | 603.23 | (257.26, 949.16) | 154.1 | (95.84, 212.36) | 125.23 | (107.2, 143.26) | 79.48 | (60.6, 98.36) |
| Provision of recreational facilities | 100.47 | (20.54, 180.39) | 37.45 | (19.33, 55.58) | 27.26 | (18.15, 36.37) | 16.66 | (9.93, 23.40) |

WTP (preference):

- Guangzhou: **Water quality** > Biodiversity > Recreational facilities > **Morphological feature**
- Brussels: **Water quality** > Biodiversity ≈ Morphological feature > Recreational facilities

Findings:

- Guangzhou: greater non-attendance, very low attendance to morphological features, only high attendance to water quality
- Brussels: high attendance to all attributes
- Both: Highest attendence & WTP – Water quality
- Attribute attendance is positively associated with perceived importance of ecosystem services (Ordered Logit).
- Accounting for attribute attendance improves the goodness-of-fit of models and affects WTP estimates.

Implications:

- Need to consider public knowledge on environment goods to protect in applications of environmental choice experiments in China
- Need to enhance public understanding of details and importance of environmental goods and services for increasing public engagement in China

# Final remarks

- How city residents value urban rivers
- Two-dimensional perceptions of river ecosystem services
- Heterogeneity of preference and willingness-to-pay for river restoration
- Dominant “water quality”

# Thanks