FRESHWATER HEALTH INDEX APPLICATIONS & IMPLEMENTATION

Dr. Derek Vollmer, Sr. Director, Freshwater Science

Workshop on Lancang-Mekong Freshwater Ecosystem Management, 16 November 2017

CONSERVATION INTERNATIONAL

FRESHWATER HEALTH INDEX

1

Focus on “freshwater health” as the ability to deliver water-related **ecosystem services** sustainably and equitably

2

Maintenance of **ecosystems** central to freshwater health

3

Requires responsive **governance** and collective action of stakeholders

FRESHWATER
HEALTH INDEX

19 SCIENTISTS FROM 9 COUNTRIES

Sandy Andelman (Organization for Tropical Studies)
Chusit Apirumanekul (Stockholm Environment Institute)
Timothy Capon (CSIRO)
Naresh Devineni (Columbia University)
David Dudgeon (Hong Kong Univ)
Tracy Farrell (CI)
Isabelle Fauconnier (IUCN)
Glen MacDonald (UCLA)
Matthew McCartney (IWMI)

Amy McNally (NASA)
Cho Nam Ng (Hong Kong Univ)
Alison Power (Cornell)
Helen Regan (UC Riverside)
Kashif Shaad (CI)
Rebecca Shaw (WWF)
Nick Souter (CI)
Caroline Sullivan (S Cross Univ)
Derek Vollmer (CI)
Raymond Wang (Sun Yat Sen University)

FRESHWATER HEALTH INDEX GOALS

Assess status and trends of freshwater health

Apply indicators within a basin to guide management and policies

Evaluate trade-offs and synergies for future scenarios

FRESHWATER HEALTH INDEX

INDICATORS OF FRESHWATER HEALTH

- Combination of remotely sensed, monitored, modeled and survey data
- Each indicator scaled from 0-100 for ease of interpretation
- Ecosystem Vitality and Ecosystem Services indicators can be modeled to assess scenarios

FRESHWATER HEALTH INDEX

ECOSYSTEM VITALITY

Water Quality
- Deviation from natural flow
- Groundwater storage depletion

Water Quality
- Suspended solids
- Total nitrogen
- Total phosphorus
- Other quality parameters of concern

Basin Condition
- Bank modification
- Flow connectivity
- Change in land cover

Biodiversity
- Species of concern
- Invasive & nuisance species

ECOSYSTEM SERVICES

Provisioning
- Water supply reliability
- Biomass for consumption

Regulation & Support
- Sediment regulation
- Water quality regulation
- Flood regulation
- Disease regulation

Cultural
- Conservation areas
- Recreation

GOVERNANCE & STAKEHOLDERS

Enabling Environment
- Water resources management
- Right to resource use
- Incentives & regulations
- Financial capacity
- Technical capacity

Stakeholder Engagement
- Information access
- Engagement in decision-making processes

Vision & Adaptive Governance
- Strategic planning & adaptive management
- Monitoring & learning mechanisms

Effectiveness
- Enforcement & compliance
- Distribution of benefits
- Water-related conflict

DONGJIANG TESTBED

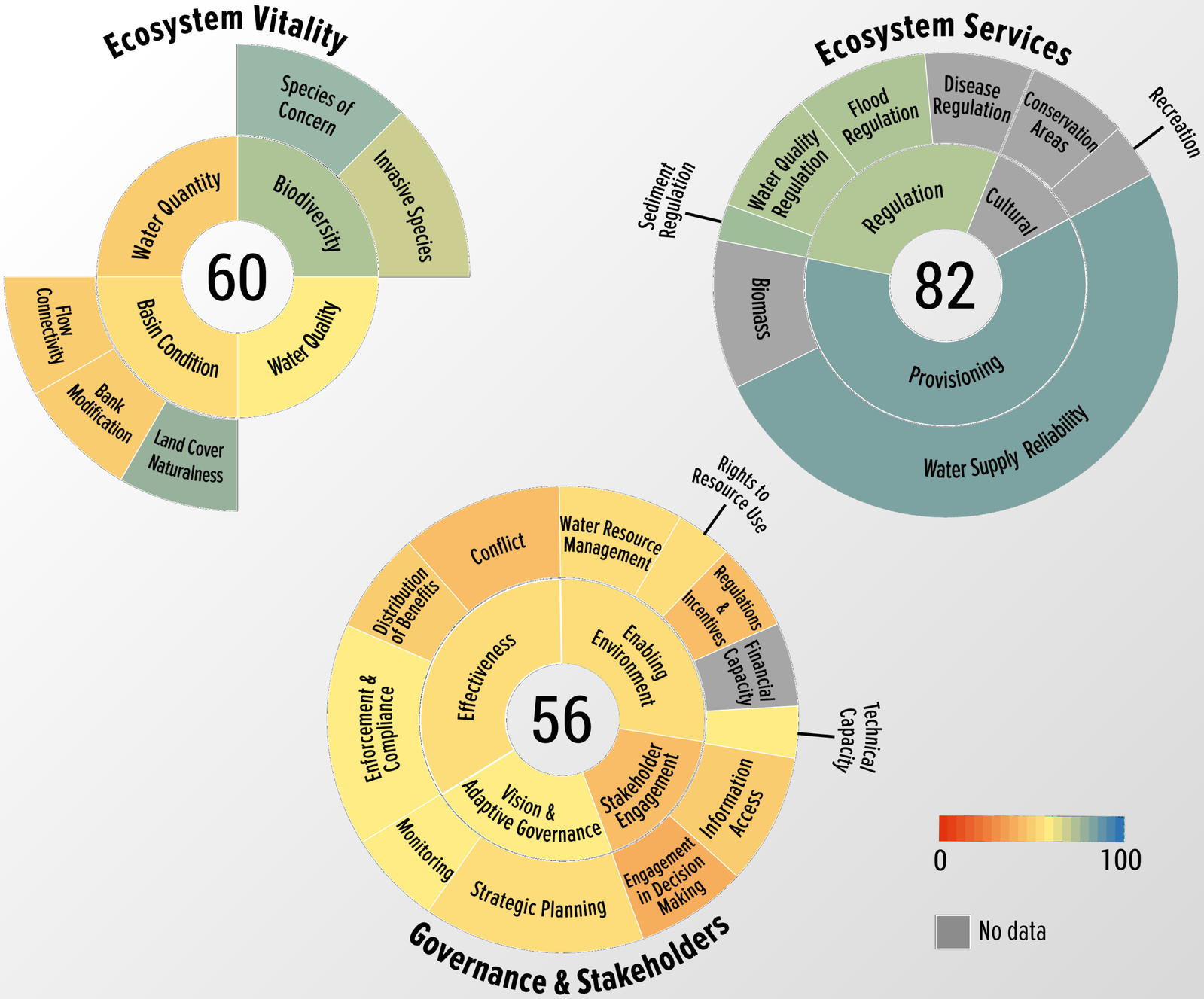
40 million people in 6 cities depend on Dongjiang, including Hong Kong
80% of Hong Kong's water supply

Stressors: Urbanization, industrialization, pollution, mining

Stakeholders: Guangdong provincial government, cities of Hong Kong, Shenzhen, Guangzhou, Dongguang, Huizhou, Heyuan; Xunwu county and villages in the headwaters (Jiangxi Province); water-intensive industries

FRESHWATER HEALTH INDEX

THREE TIERS OF INFORMATION AT BASIN SCALE



FRESHWATER HEALTH INDEX

MEASURING INDICATORS

ECOSYSTEM VITALITY

- Monthly flow (gauging stations, VIC model)
- Monthly quality (monitored TSS, TN, TP, DO)
- Land use (GLC30)
- Connectivity (satellite imagery)
- Species data (IUCN Red List)

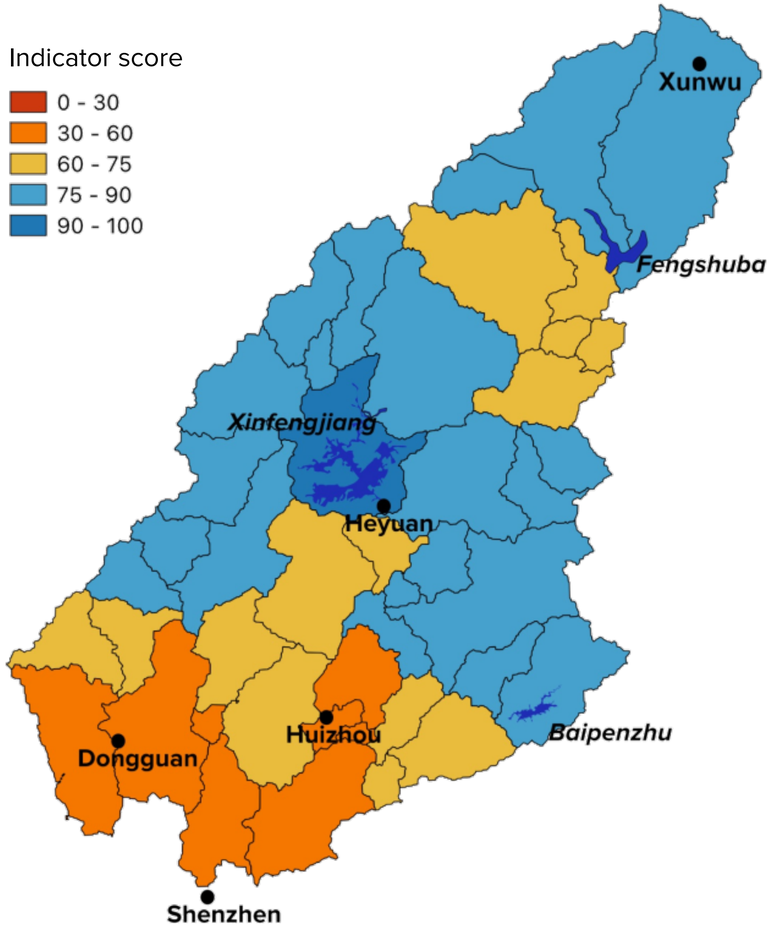
ECOSYSTEM SERVICES

- Annual water use by municipality & sector
- Annual soil loss rate (RUSLE model)
- Monthly quality (9 monitored parameters)
- Flood occurrence

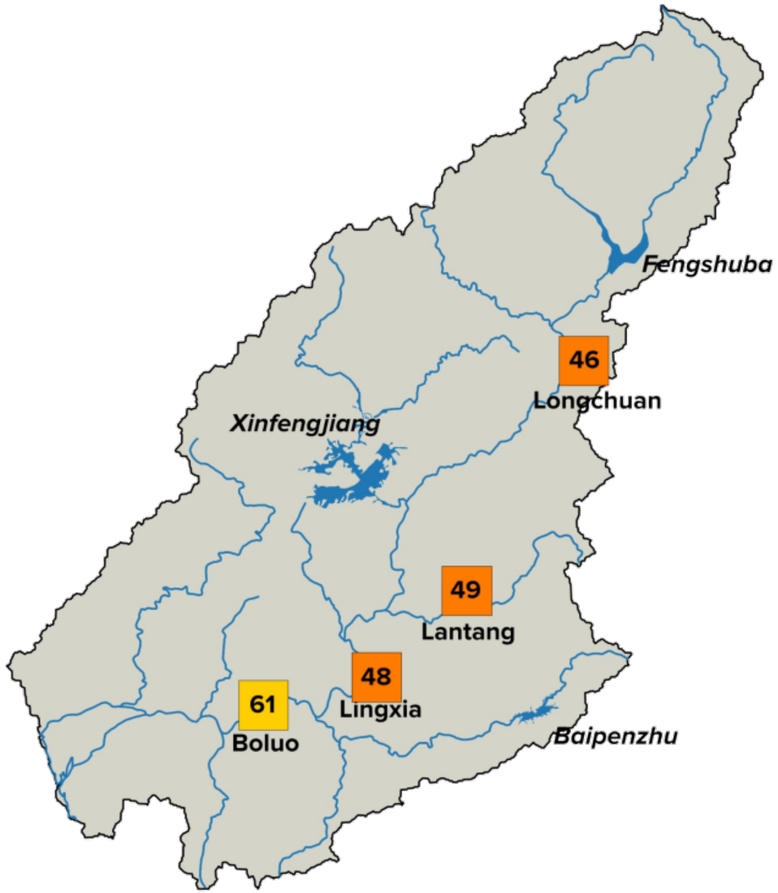
GOVERNANCE & STAKEHOLDERS

- Stakeholder survey
- 30+ participants knowledgeable about water governance in the basin
- Representatives from upstream and downstream, public and private sectors

REPRESENTING SPATIAL DATA



LAND COVER NATURALNESS (sub-basin)



DEVIATION FROM NATURAL FLOW (monitoring station)

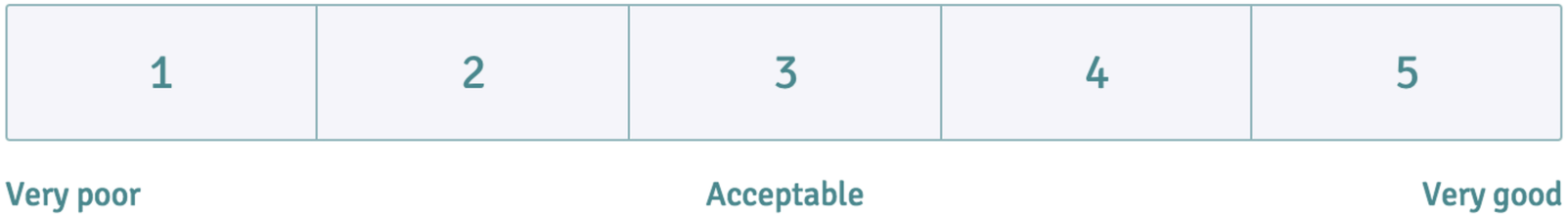
FRESHWATER HEALTH INDEX

ASSESSING PERCEPTION OF WATER GOVERNANCE

→ Groundwater abstraction guidelines are enforced

Examples include, but are not limited to: farmers or industries restricted from pumping more than a specified amount of groundwater.

Rating	Criteria
1	Enforcement is very poor or no guidelines (formal or informal) exist
2	Enforcement is poor
3	Enforcement is acceptable
4	Enforcement is good
5	Enforcement is very good



FRESHWATER HEALTH INDEX

INSIGHTS FROM GOVERNANCE ASSESSMENT

Enabling Environment: 55

Stakeholder Engagement: 47

Adaptive governance: 59

Effectiveness: 54

Rules for quantity scored better than for quality

Enforcement & compliance: **60**

Distribution of benefits: **50**

Water-related conflict: **48**

Conflict due to downstream quality impacts scored lowest

FRESHWATER HEALTH INDEX

EVALUATING STAKEHOLDERS' PREFERENCES

Pairwise Comparison Ecosystem Services

Please do the pairwise comparison of all criteria. When completed, click *Check Consistency* to get the priorities.

AHP Scale: 1- Equal Importance, 3- Moderate importance, 5- Strong importance, 7- Very strong importance, 9- Extreme importance (2,4,6,8 values in-between).

With respect to *Ecosystem Services*, which criterion is more important, and how much more on a scale 1 to 9?

Choose your preference

	A - wrt *Ecosystem Services* - or B?			Equal	How much more?
1	Provisioning	or	Regulating	1	2 **3** 4 **5** 6 **7** 8 **9**
2	Provisioning	or	Cultural	1	2 **3** 4 **5** 6 **7** 8 **9**
3	Regulating	or	Cultural	1	2 **3** 4 **5** 6 **7** 8 **9**

CR = 0% Please start pairwise comparison

Check Consistency

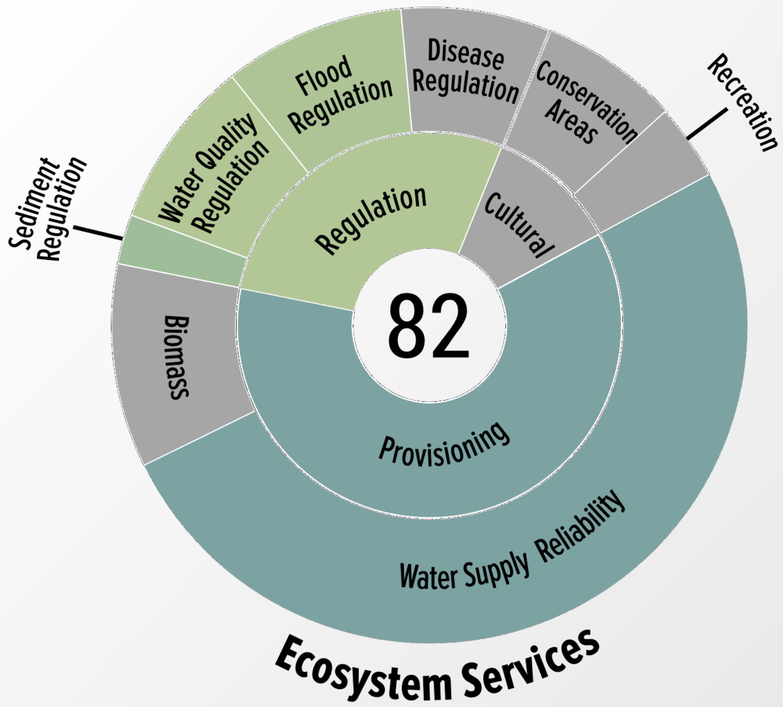
Rate the strength of your preference, following guidelines above

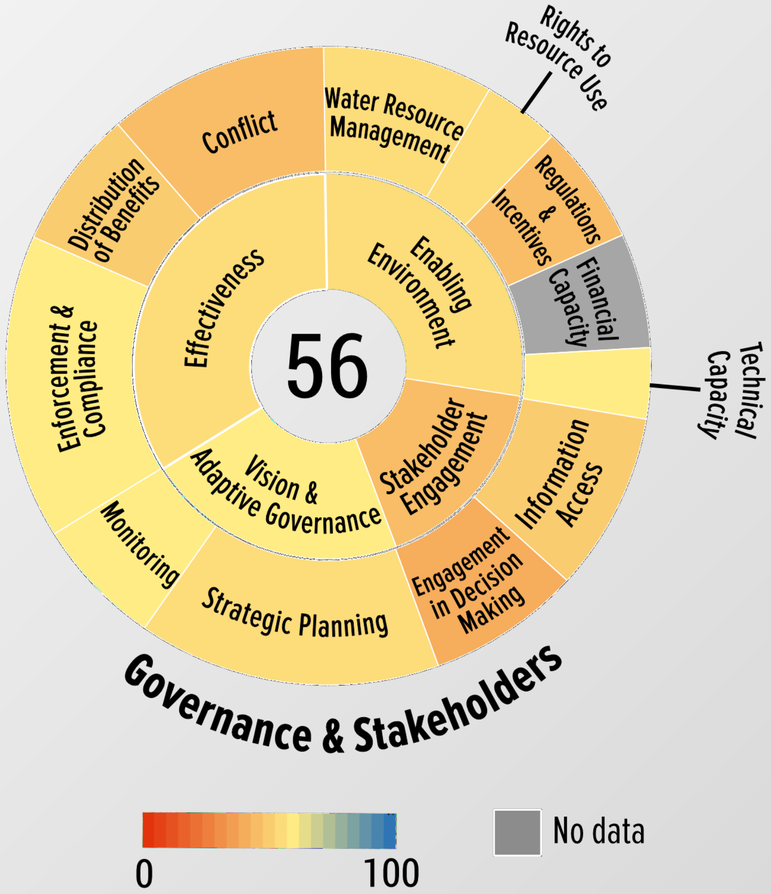
FRESHWATER HEALTH INDEX

Indicator	Weight	Consensus	Sub-indicator	Weight	Consensus
Provisioning	0.512	0.810	Water stress	0.451	0.714
			Supply reliability	0.378	
			Biomass for consumption	0.171	
Regulating	0.381		Sediment regulation	0.089	0.704
			Water filtration	0.308	
			Flood mitigation	0.334	
			Disease mitigation	0.270	
Cultural	0.107		Conservation & heritage	0.649	0.760
			Recreation	0.351	
Enabling environment	0.278	0.657	Water resource mgmt	0.308	0.711
			Rights to resource use	0.141	
			Incentives & regulations	0.216	
			Financial capacity	0.208	
			Technical capacity	0.127	
Stakeholder engagement	0.166		Information access	0.536	0.795
			Engagement in DM	0.464	
Vision & adaptive governance	0.220		Strategic planning	0.699	0.806
			Monitoring mechanisms	0.301	
Effectiveness	0.336		Enforcement & compliance	0.459	0.706
			Distribution of benefits	0.215	
			Conflict	0.326	

FRESHWATER HEALTH INDEX

QUICK INSIGHTS FROM THE DONGJIANG FHI





FRESHWATER HEALTH INDEX

HOW IS THE FHI BEING USED?

- First comprehensive assessment of the Dongjiang basin– reason to convene stakeholders 3x a year
- Identified data/monitoring gaps, and encouraged more information transparency
- Structured discussion about deficiencies in water governance in the basin
- Interest in developing scenarios around water allocation, rights trading, and eco-compensation

FRESHWATER
HEALTH INDEX

THANK YOU!

FOR ADDITIONAL INFORMATION PLEASE VISIT
FRESHWATERHEALTHINDEX.ORG