River Classification: Gui River


Different types of river will:

Require different indicators

Have different targets

图例

采样点

桂江水系

河流分类

1

2

3

4

30,000 15,000   0   30,000 Meters
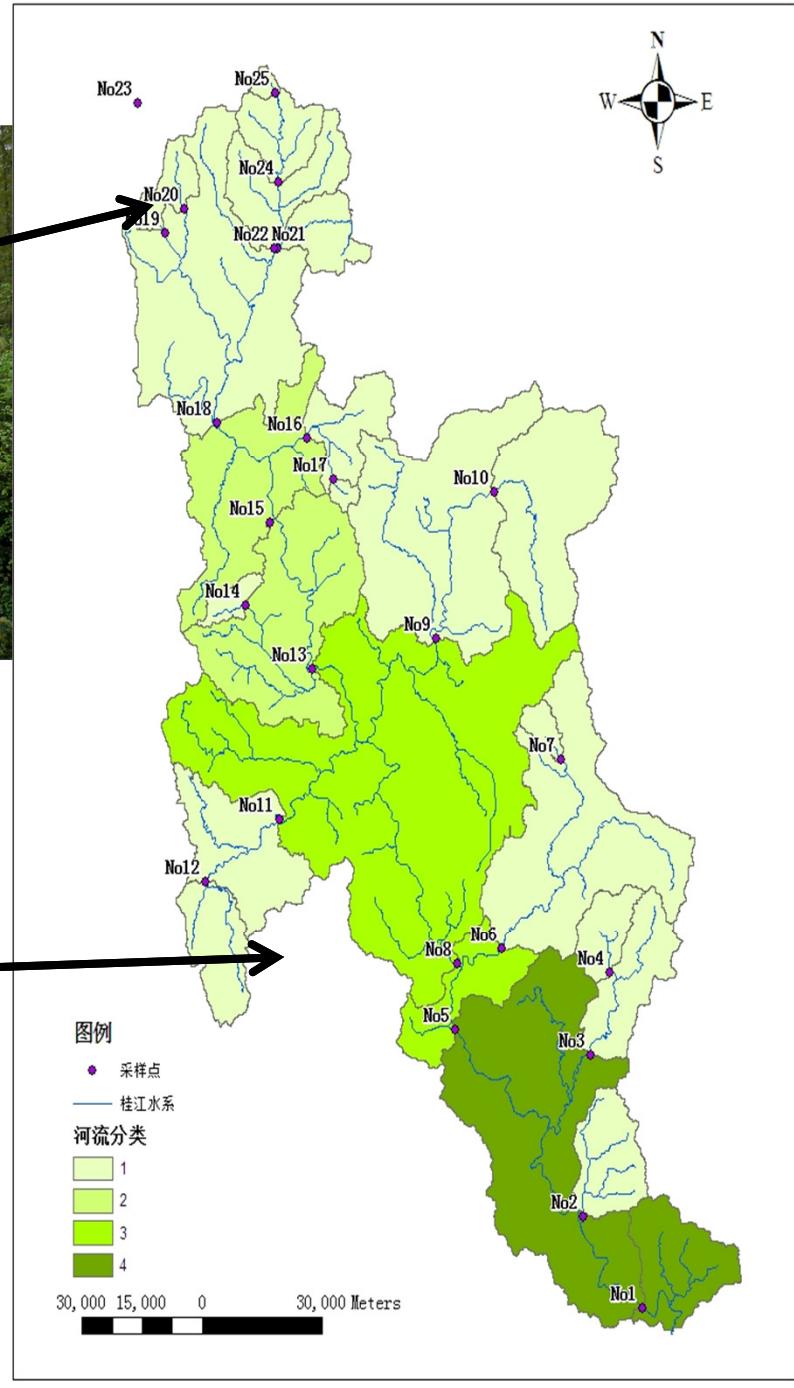
River classification: Liao River

Highlands
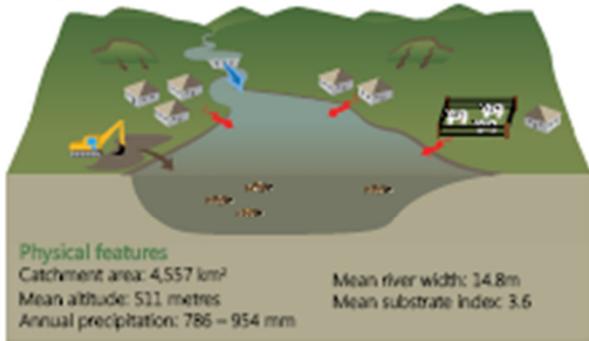
Human disturbances
- Loss of native vegetation
- Grazing livestock
- Urban development
- In-stream sand mining

Dominant species
- Fish: *Phoxinus lagowskii Dybowski, Phoxinus czekanowskii*
- Macroinvertebrates: *Baetis thermicus, Epeorus latifolium, Serratella rufa*

Priorities for management*
- Maintain natural habitat
- Protect diversity and biotic integrity of aquatic organisms
- Reduce suspended solids

Physical features
Catchment area: 4,557 km²
Mean altitude: 511 metres
Annual precipitation: 786 – 954 mm
Mean river width: 14.8m
Mean substrate index: 3.6

Midlands

Human disturbances
- Flow alteration due to dams
- Mining (predominately iron-ore)
- Urbanization
- Point source pollution from factories

Dominant species
- Fish: *Phoxinus lagowskii Dybowski, Abbottina rivularis*
- Macroinvertebrates: *Baetis thermicus, Serratella rufa, Gammarus sp.*

Priorities for management*
- Reduce nitrogen and phosphorus loads
- Protect ecologically important aquatic organisms

Physical features
Catchment area: 3,896 km²
Mean altitude: 282 metres
Annual precipitation: 717 – 868 mm
Mean river width: 44.4m
Mean substrate index: 3.4

Lowlands

Human disturbances
- Point source pollution from factories
- Diffuse pollution from farmland
- Urbanization

Dominant species
- Fish: almost non-existent
- Macroinvertebrates: *Baetis thermicus, Branchiura sowerbyi*

Priorities for management*
- Reduce organic pollutant load
- Protect the most common aquatic organisms
- Improve water quality within national standards

Physical features
Catchment area: 4,749 km²
Mean altitude: 65 metres
Annual precipitation: 653 – 775 mm
Mean river width: 84 m
Mean substrate index: 2.1

* Note: Priorities for management were developed by the project team based on existing government programs and expert opinion

Flow variability
Point source input
Diffuse source input

Nutrients   Sediments   Chemicals

Fieldwork to collect samples

Macroinvertebrates 大型底栖无脊椎动物

Channel condition 河道状况

Fish 鱼

^{13}C ^{15}N

Macrophytes 大型植物

Diatom 硅藻

Collation of data

编号		Arthropoda					Mollusca	Mollusca
Phylum	Arthropoda						Mollusca	Mollusca
Class	Crustacea	Bivalvia	Gastropoda	Gastropoda	Bivalvia	Gastropoda	Gastropoda	Gastropoda
Order	Decapoda	Mytiloida						
Family	Atyidae	Mytilidae	Viviparidae	Lymnaeidae	Corbiculidae	Lymnaeidae	Valvatidae	Melaniidae
Genera	*Caridina*	*Limnoperna*	*Bellamya*	*Radix*	*corbicula*	*physa*	*Valvata*	*Semisulcospira*
Species		*lacustris*	*aeruginosa*	*Radixswinboei*	*fluminea*			
Species name_Chinese	米虾属	淡水壳菜	铜锈	椭圆	河蚬	膀胱螺	盘螺	短沟卷
No.1 平度村	0	0	0	1	0	0	0	0
No.2 龙江	0	0	0	0	3	0	0	0
No.3 富罗	71	1	1	27	7	1	4	38
No.4 黄姚	110	0	4	0	12	0	0	0
No.5 下福水电站	0	0	0	4	1	0	6	11
No.6 siqinjiang2	7	23	0	0	43	0	6	57
No.7 红花镇siqinjiang1	0	0	0	3	5	32	0	0
No.8 昭平水电站	2	216	1	1	0	0	0	2
No.9 恭城水文站	0	0	5	25	0	0	0	31
No.10 龙岭	10	0	3	6	4	0	52	28
No.11 荔浦水文站	138	0	0	0	0	11	0	0
No.12 念村	0	0	0	0	0	0	0	0
No.13 阳朔水文站	27	0	0	0	0	0	0	1
No.14 遇龙河	32	0	1	0	0	0	0	17
No.15 冠岩	10	0	1	1	11	1	4	7
No.16 潮田河	1	0	0	3	0	0	0	0
No.17 新寨	0	0	0	0	0	0	0	0
No.18 桂林水文站	47	0	3	8	1	3	0	0
No.19 兰田	0	0	0	0	0	0	0	0
No.20 东江	0	0	0	0	0	0	9	0
No.21 灵渠	37	0	9	8	6	2	7	1
No.22 大榕江	10	0	6	9	1	0	0	0
No.23 杉木河(猫儿山)	0	0	0	0	0	0	0	0
No.24 六洞河	0	1	0	0	0	0	0	8
No.25 花江	0	0	0	0	0	0	0	0

Testing indicators against disturbance gradient

Ecological health indicator

Reference values

Low

High

Disturbance gradient
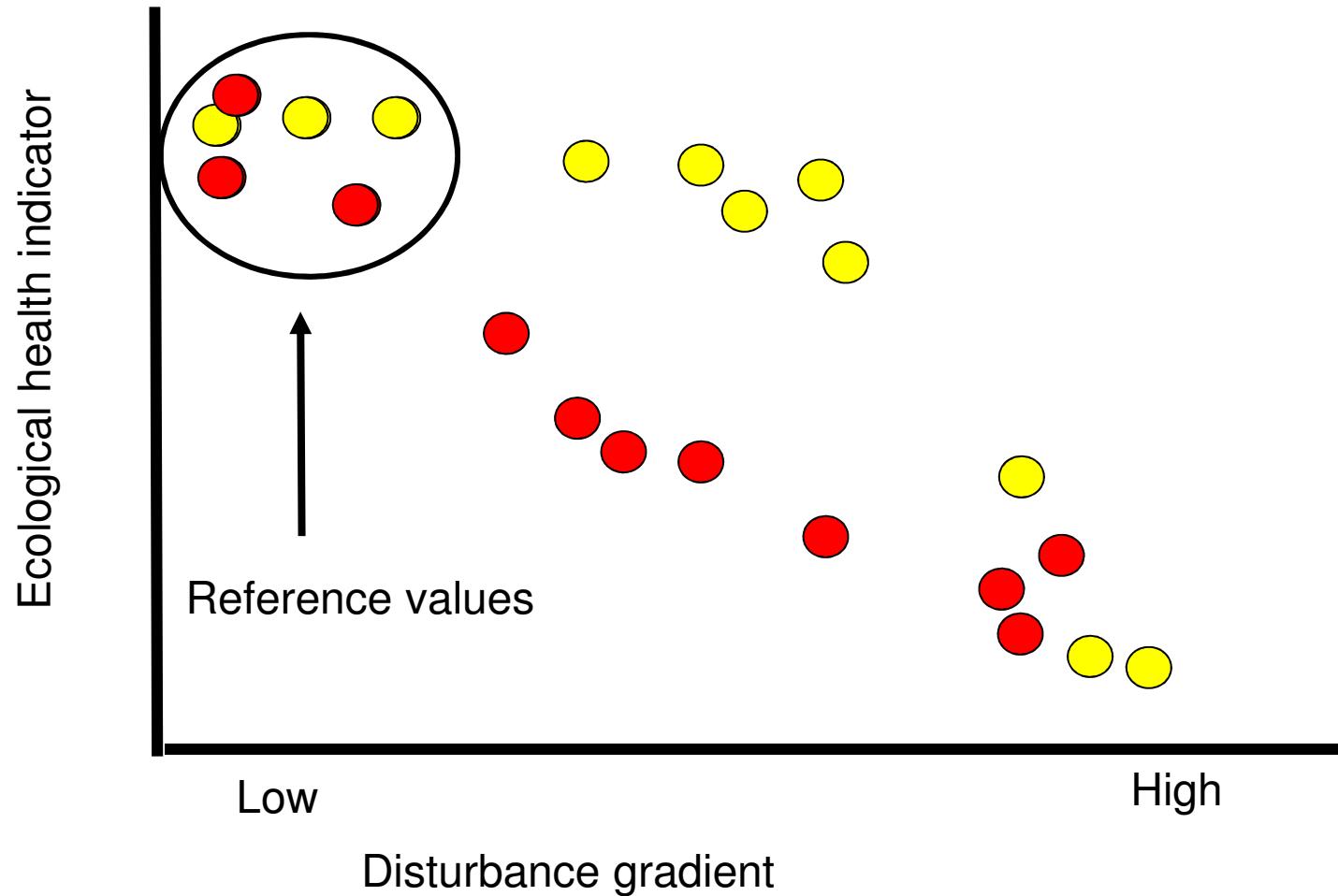
Weighting of indicator scores

Freq. (# obs.)

All sites – all years

Standard to achieve values

Reference sites – all years，

Single site， – report year，

50th %'ile

80th %'ile

95th %'ile

1 (reference)，

Concentration，

0 (worst case)，
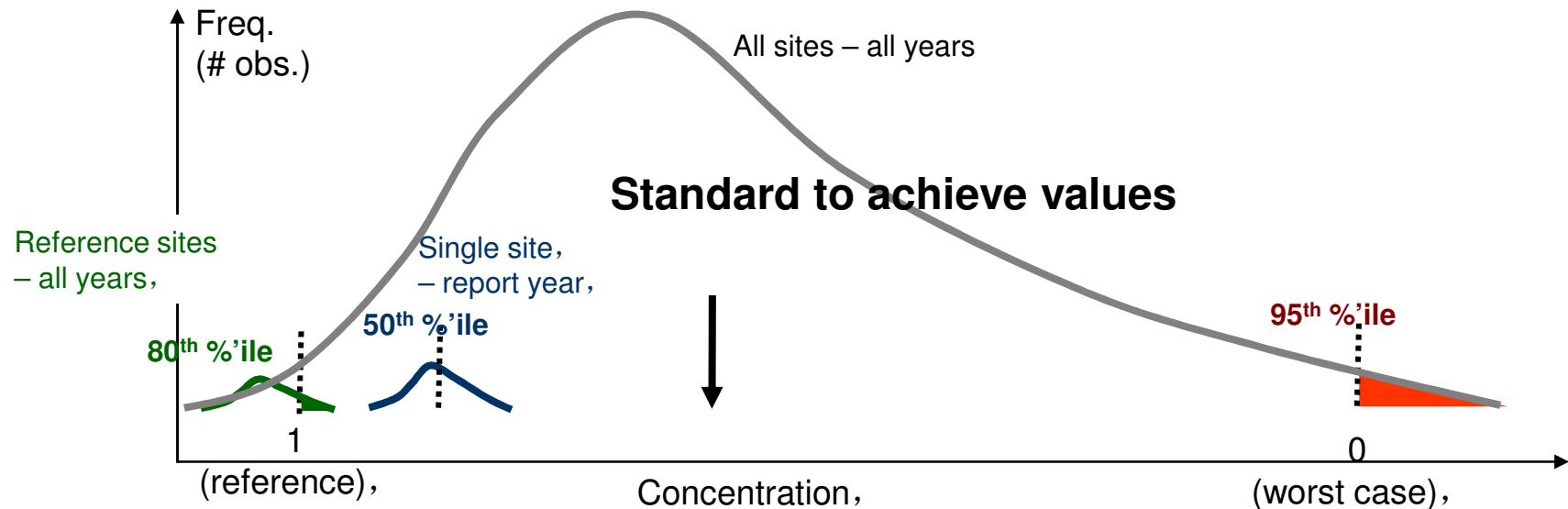
Convert all values to common scale to allow comparison
Compare values against: other sites in study; other studies
- national standards; international standards

Indicators of river health: Liao River

General information

Hekouzhen

上游Upper reaches

中游Middle reaches

下游Lower reaches

青铜峡
Qingtongxia

Daliushu
大柳树

刘家峡
兰州
Lanzhou

Longyangxia
龙羊峡

Liujiaxia

碛口
Qikou

龙门
Longmen

小浪底水库
Xiaolangdi

三门峡
Sanmenxia

洛阳
Luoyang

Zhengzhou

Taohuayu

黄河
Yellow River
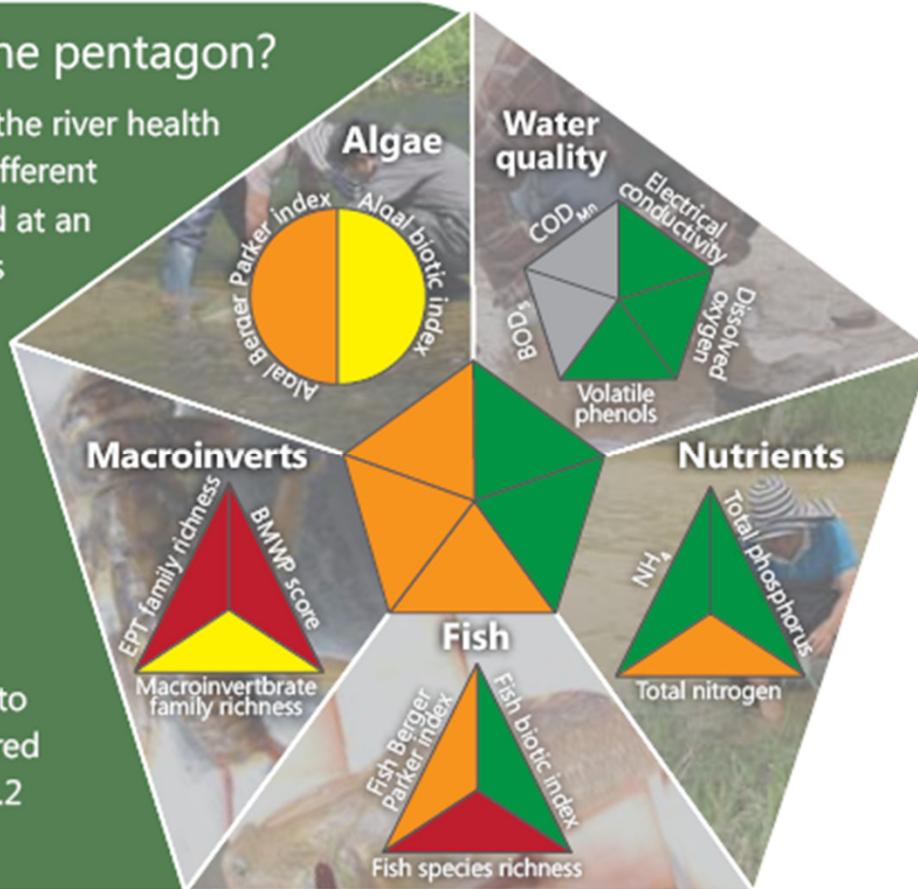
Total length:5,464km   Drainage area:795,000Km^2
Population in the basin :107 million   Cultivated land : 12 million hm^2

Start with objectives (from YRCC)

- Ultimate target
  - "Keeping the Yellow River Healthy"

- 4 × Criteria ("the 4-nos")
  - No embankment breaching
  - No river running dry
  - No water pollution beyond standard
  - No riverbed rising further

Project Framework

Environmental flow assessment

How much water does the river need to protect assets?

E-flow options

Management decisions

Compliance test

Hydrological health index

River health assessment

What is a healthy river?

Social

Biological

Chemical

Physical

Geomorphological index

Training
Exchange
Method development

INTERNATIONAL
WATERCENTRE
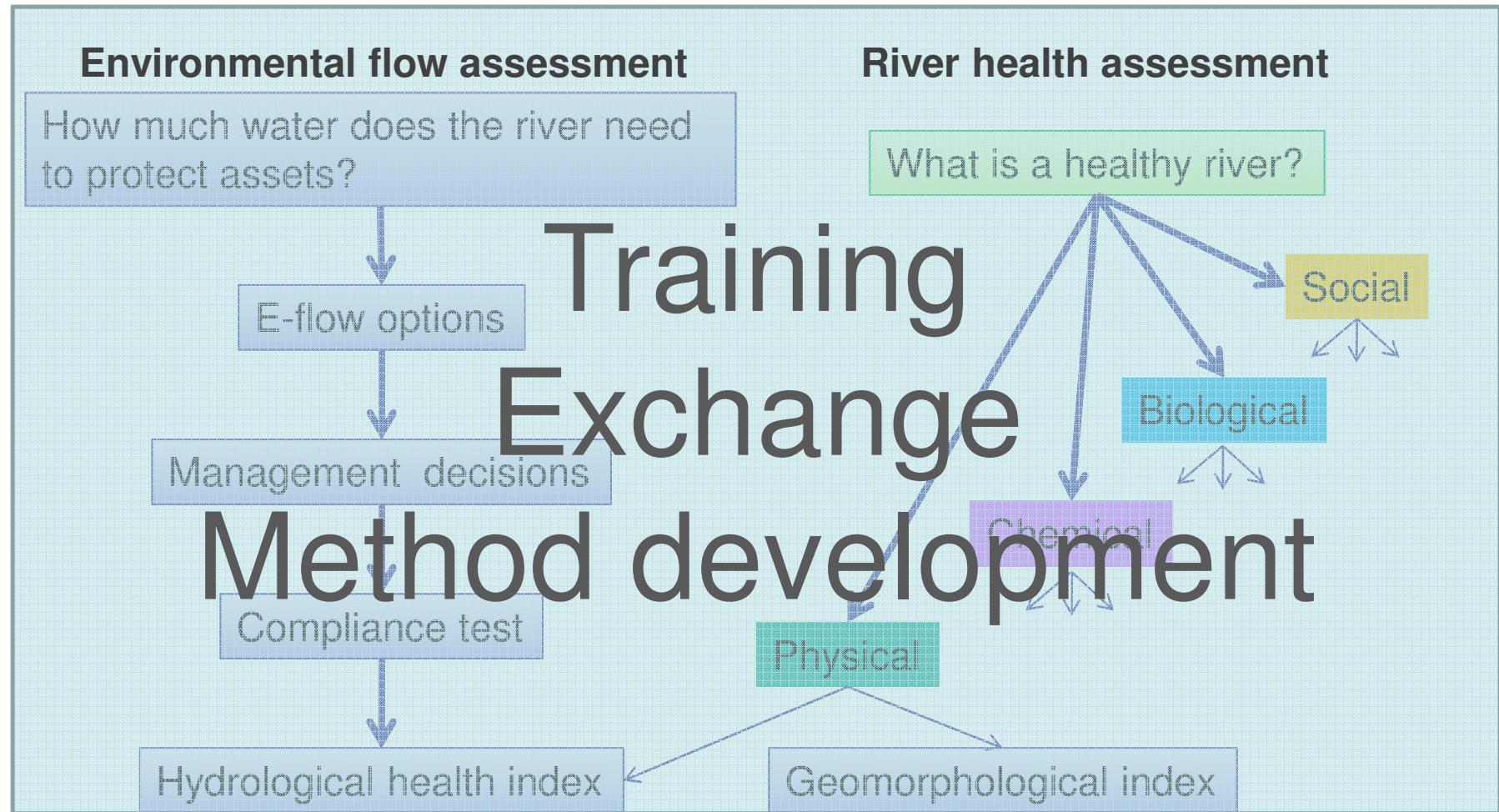
Establish a framework (from YRCC)

Indicator groups

"**Healthy Indicators of the Yellow River**"

- Flow continuity ⟶ **Hydrology**
- Channel configuration for water and sediment transportation ⟶ **Geomorphology**
- Water quality standard ⟶ **Water quality**
- River ecosystem ⟶ **Ecology**
- Water supply capacity ⟶ **Social-economic**

River Health

Reaches and Assets
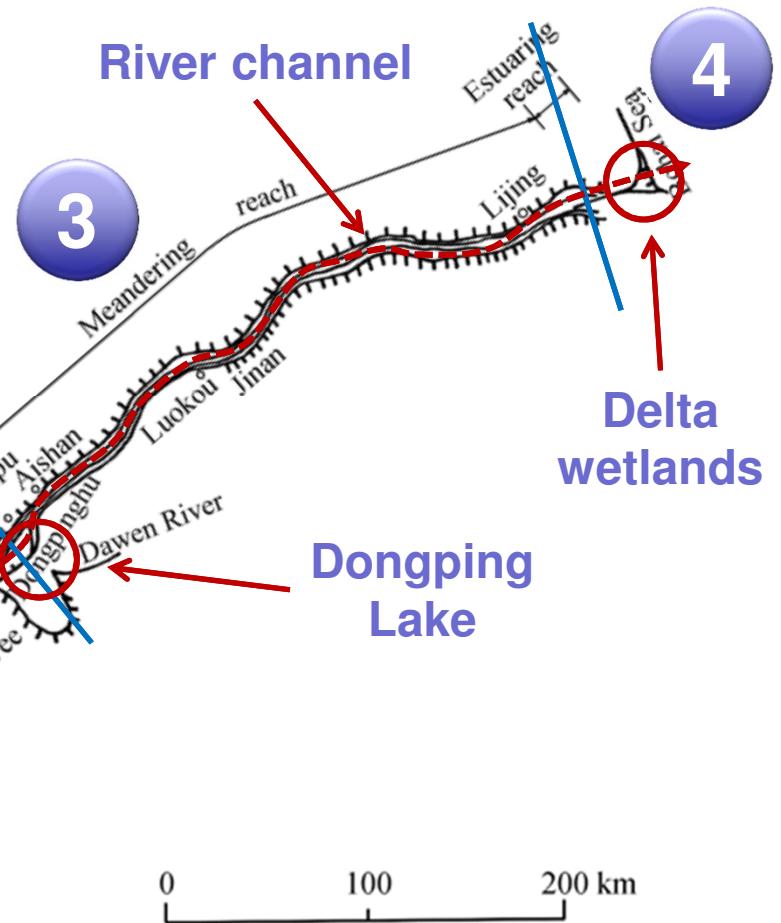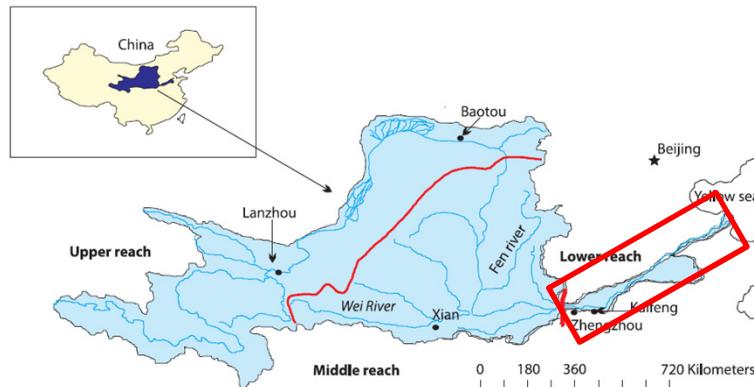
River Health
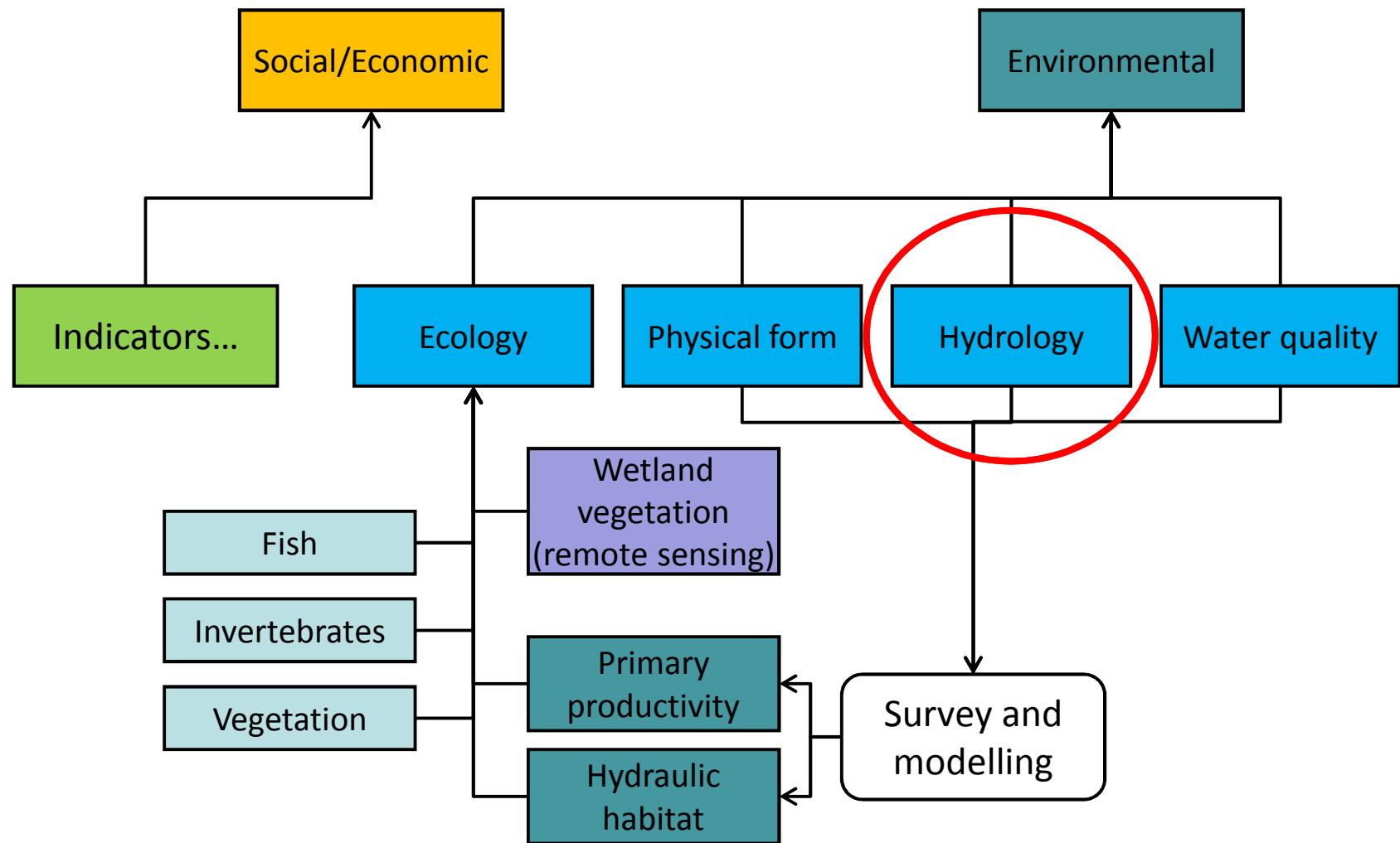
Regulation phases
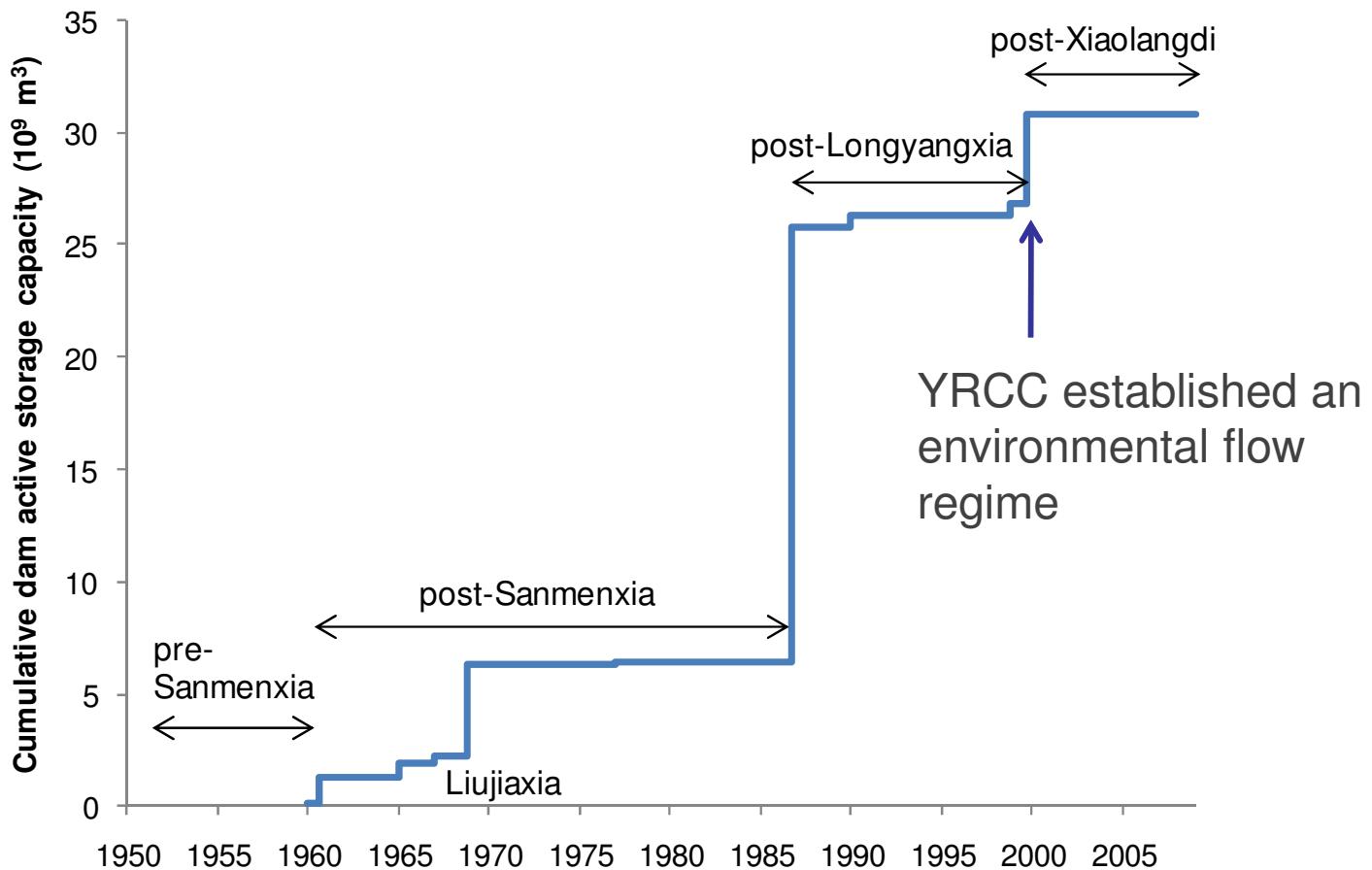
Baseflows (flow exceeded 75% of the time)
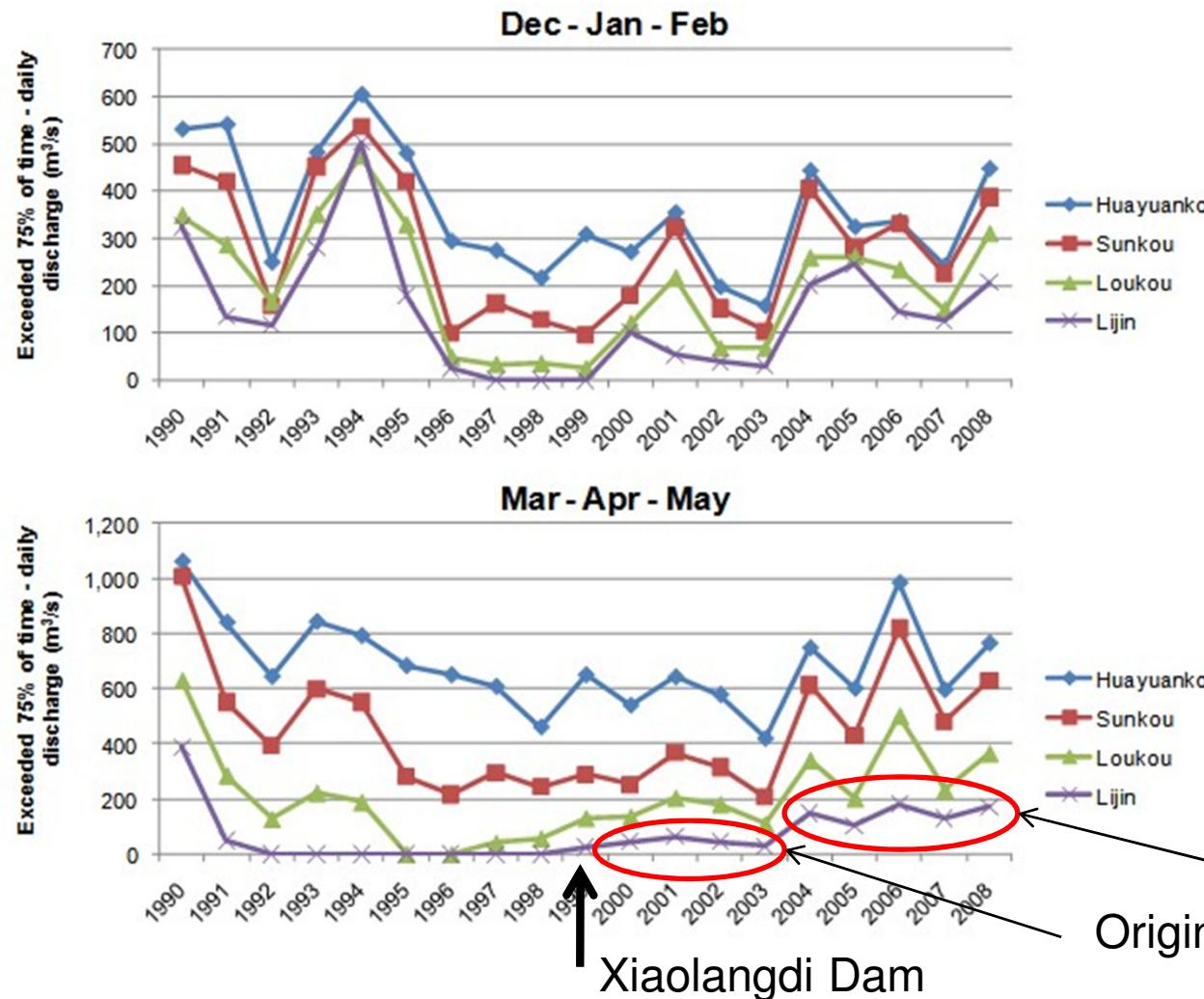

Low flow period

Irrigation period

Revised rule

Original rule

Xiaolangdi Dam

# Sediment flushing flow

(flow exceeded 5% of the time)
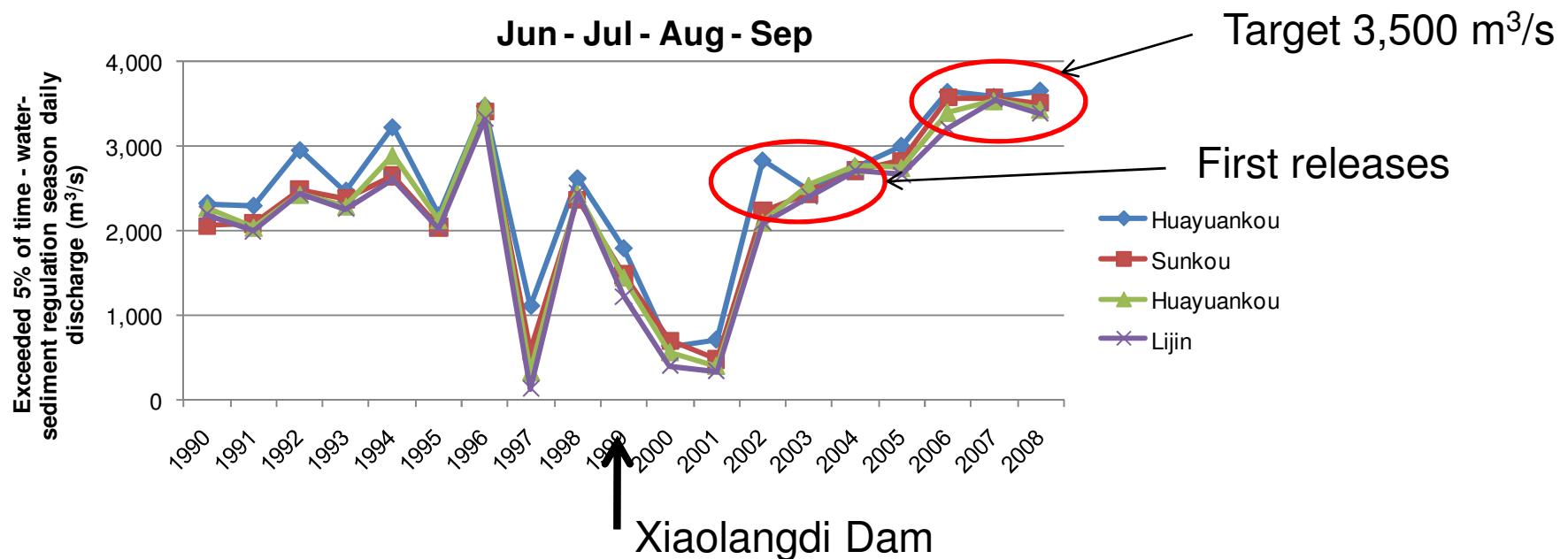
Jun - Jul - Aug - Sep

Target 3,500 m³/s

First releases

Huayuankou
Sunkou
Huayuankou
Lijin

Xiaolangdi Dam

INTERNATIONAL
WATERCENTRE

No drying-up

Lijin

Legend:
- Cumulative annual days of cease to flow
- Annual peak cease to flow spell duration
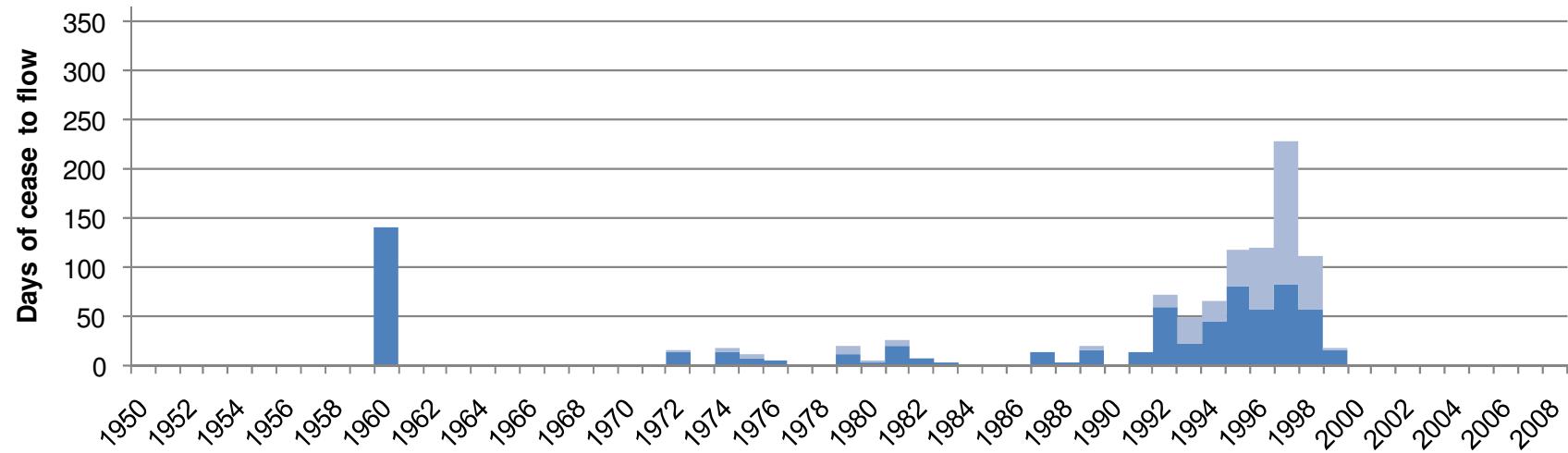
Xiaolangdi Dam

# River Health

- Social/Economic
  - Indicators...
- Environmental
  - Ecology
    - Fish
    - Invertebrates
    - Vegetation
    - Wetland vegetation (remote sensing)
    - Primary productivity
    - Hydraulic habitat
  - Physical form
  - Hydrology
  - Water quality
  - Survey and modelling

Water quality

Chinese Grade	Drinking water			Recreation			Industry agriculture and parks					Ecological river health							Arbitrary aquatic health rating
	Source areas	1st Class	2nd Class (requires treatment)	Primary contact	Secondary ccontact	Passive non-contact	Aquaculture	General industrial uses	Industrial cooling	Agricultural irrigation	irrigation of parks and created landscapes	National conservation areas	Sensitive and rare aquatic species	Common aquatic species	Fish spawning	Fish rearing	Fish migration	Fish winter survival	
I	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	High-V. high
II	U	S	S	S	S	S	S	S	S	S	S	U	S	S	S	S	S	S	Mod. -High
III	U	U	S	S	S	S	S	S	S	S	S	U	U	S	U	U	S	S	Low-Mod.
IV	U	U	U	U	S	S	U	S	S	S	S	U	U	U	U	U	U	U	Very low
V	U	U	U	U	U	S	U	U	S	S	S	U	U	U	U	U	U	U	Very low
VI	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	No value

Trend in water quality (Grade III target)

Annual - Proportion of months target achieved | High flow - Proportion of months target achieved | Low flow - Proportion of months target achieved
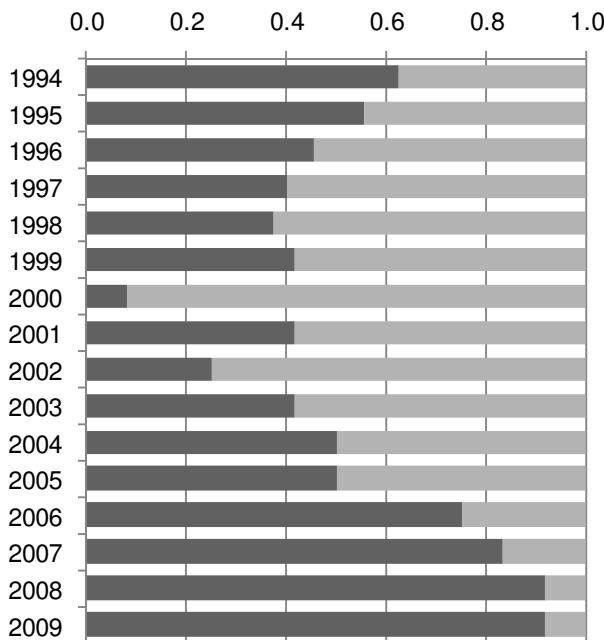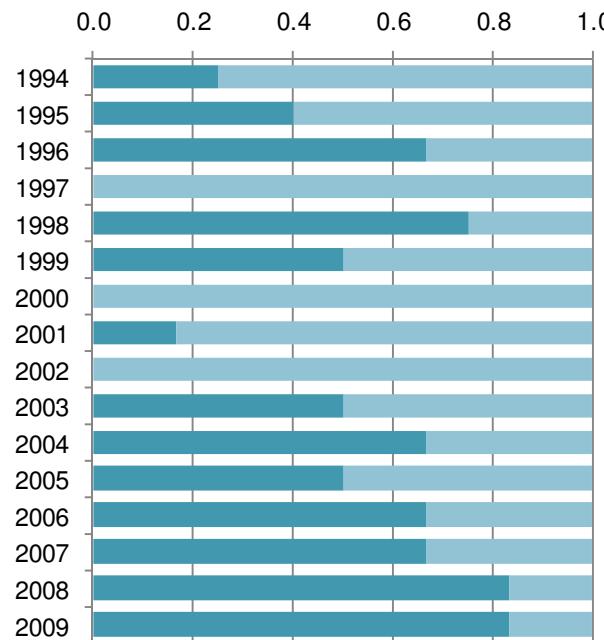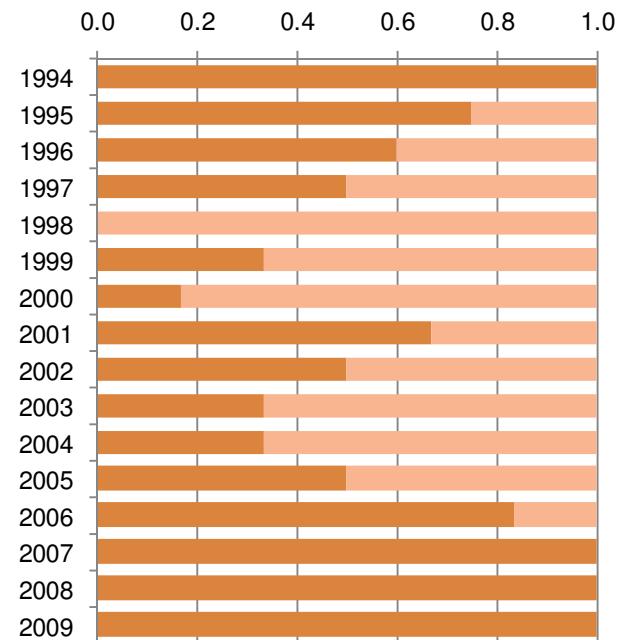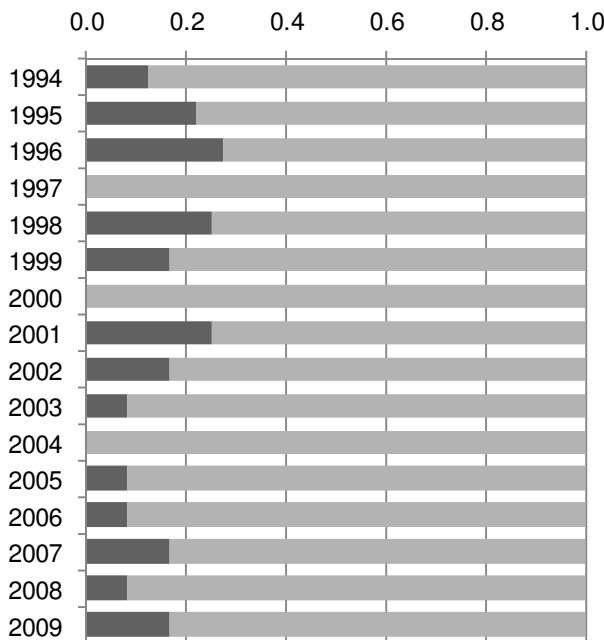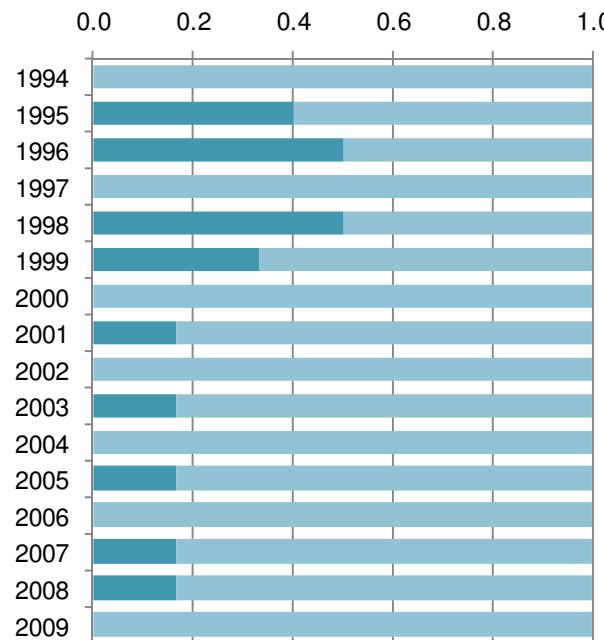
Huayuankou

Water quality

Chinese Grade	Drinking water			Recreation			Industry agriculture and parks					Ecological river health							Arbitrary aquatic health rating
	Source areas	1st Class	2nd Class (requires treatment)	Primary contact	Secondary contact	Passive non-contact	Aquaculture	General industrial uses	Industrial cooling	Agricultural irrigation	irrigation of parks and created landscapes	National conservation areas	Sensitive and rare aquatic species	Common aquatic species	Fish spawning	Fish rearing	Fish migration	Fish winter survival	
I	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	High-V. high
II	U	S	S	S	S	S	S	S	S	S	S	U	S	S	S	S	S	S	Mod. -High
III	U	U	S	S	S	S	S	S	S	S	S	U	U	S	U	U	S	S	Low-Mod.
IV	U	U	U	U	S	S	U	S	S	S	S	U	U	U	U	U	U	U	Very low
V	U	U	U	U	U	S	U	U	S	S	S	U	U	U	U	U	U	U	Very low
VI	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	No value

# Trend in water quality (Grade II target)

Huayuankou

River Health
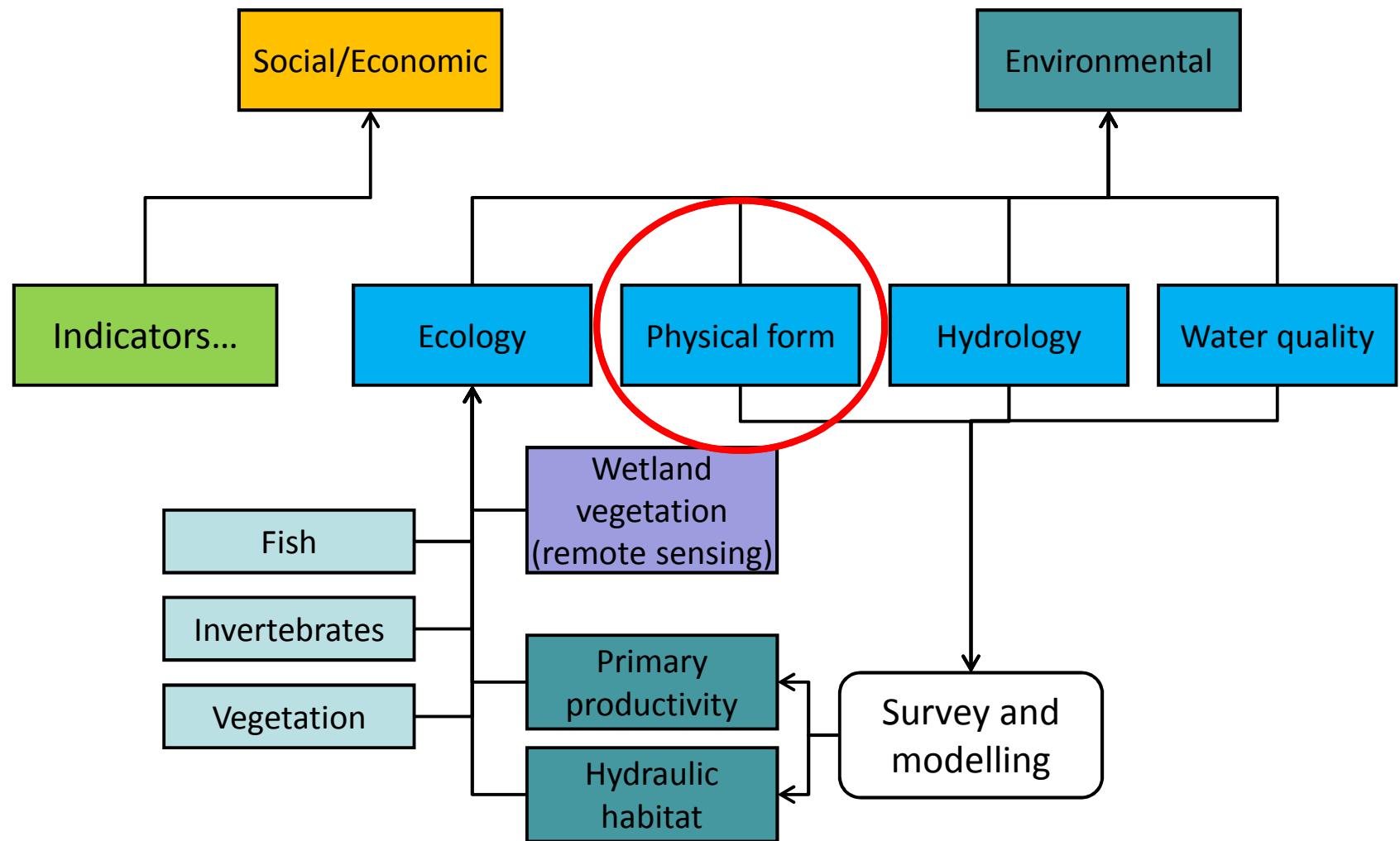
Potential indicators

- Load delivered to the estuary
- Channel capacity
- Channel width/depth ratio
- Channel mobility (lateral shift per year)

Sediment load
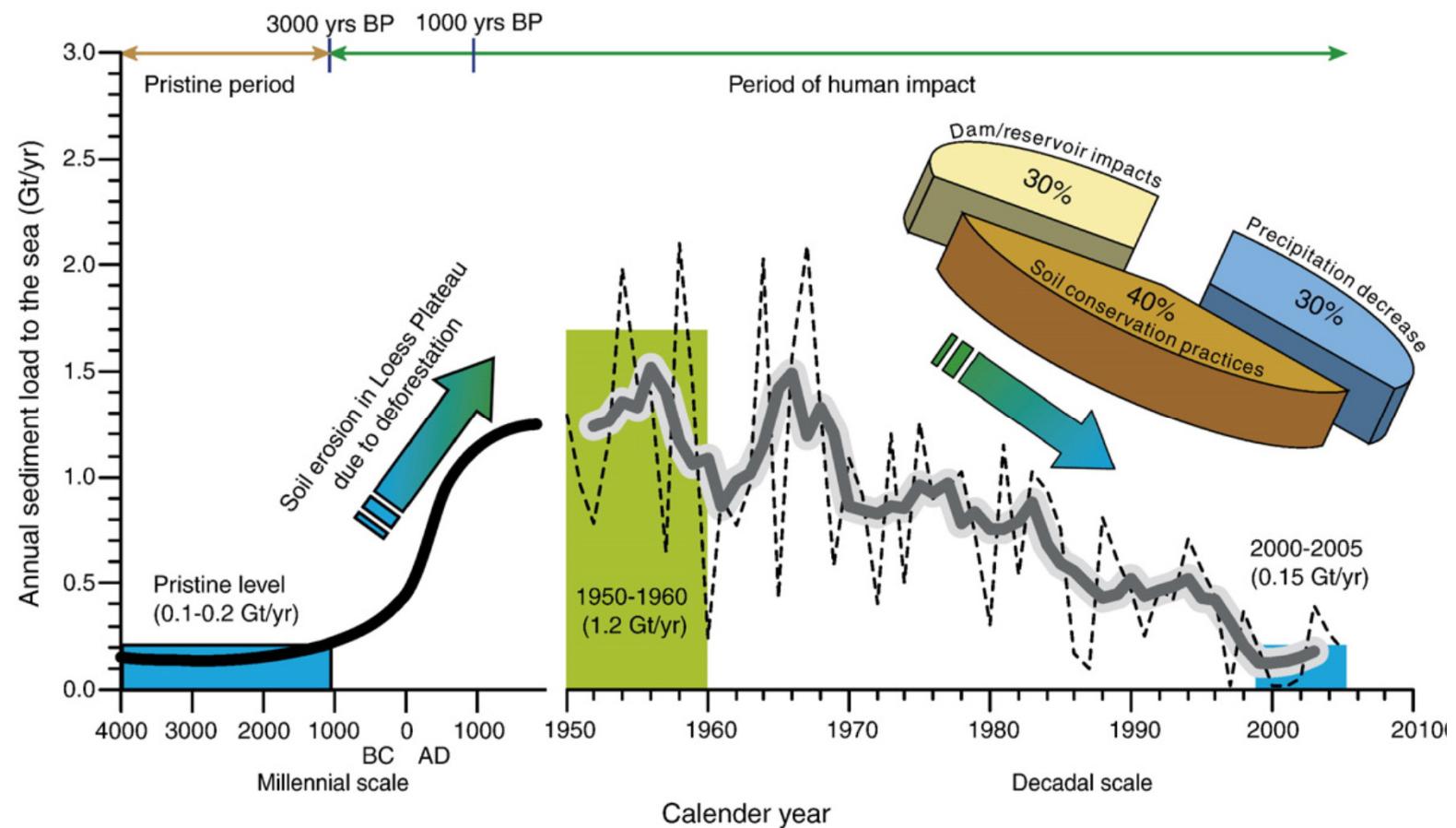
Reach 2 – effect of training works
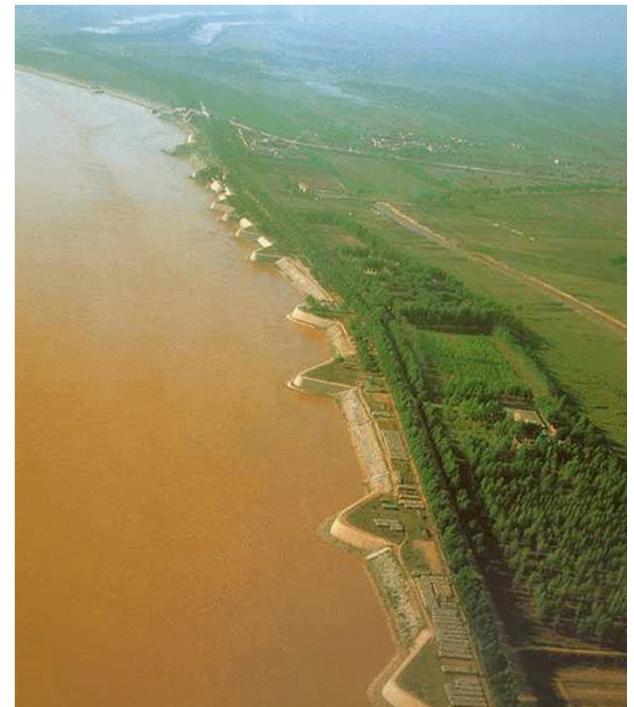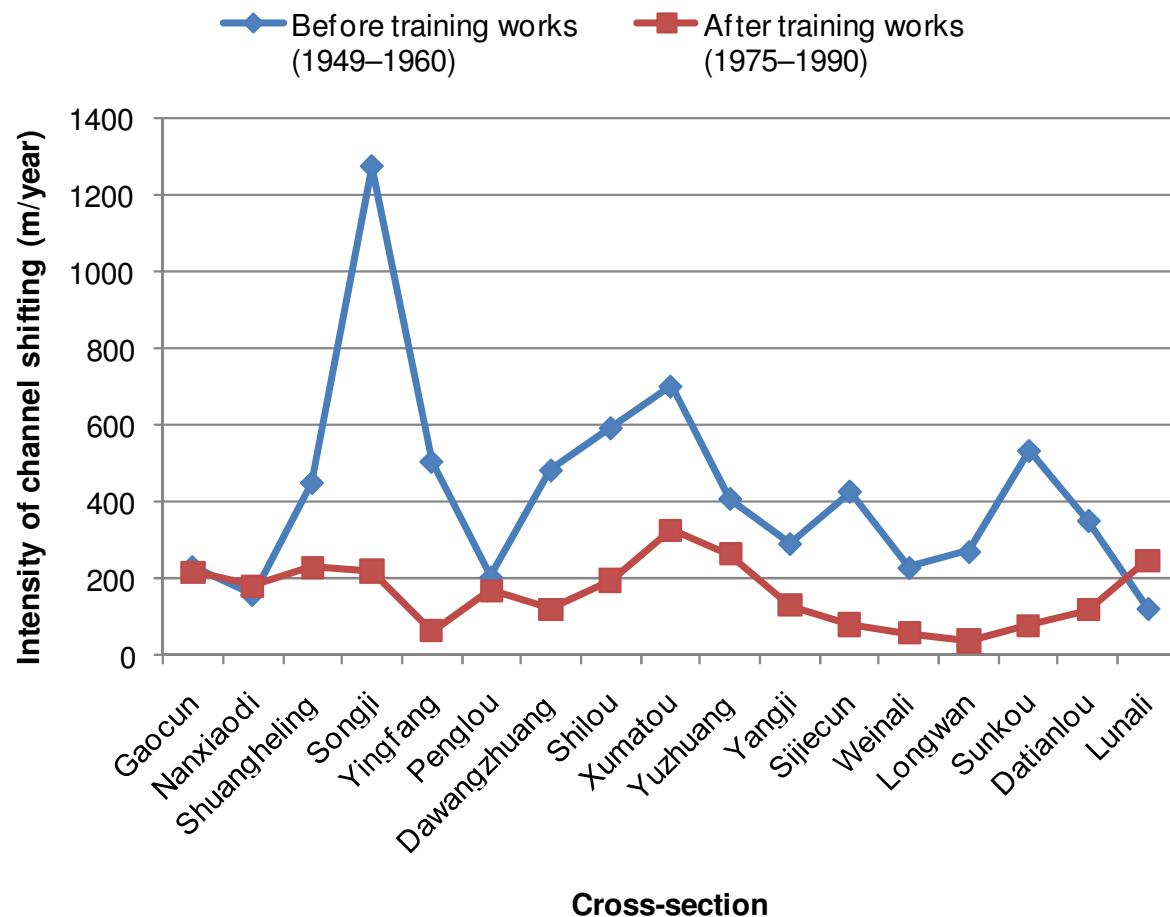
Channel capacity
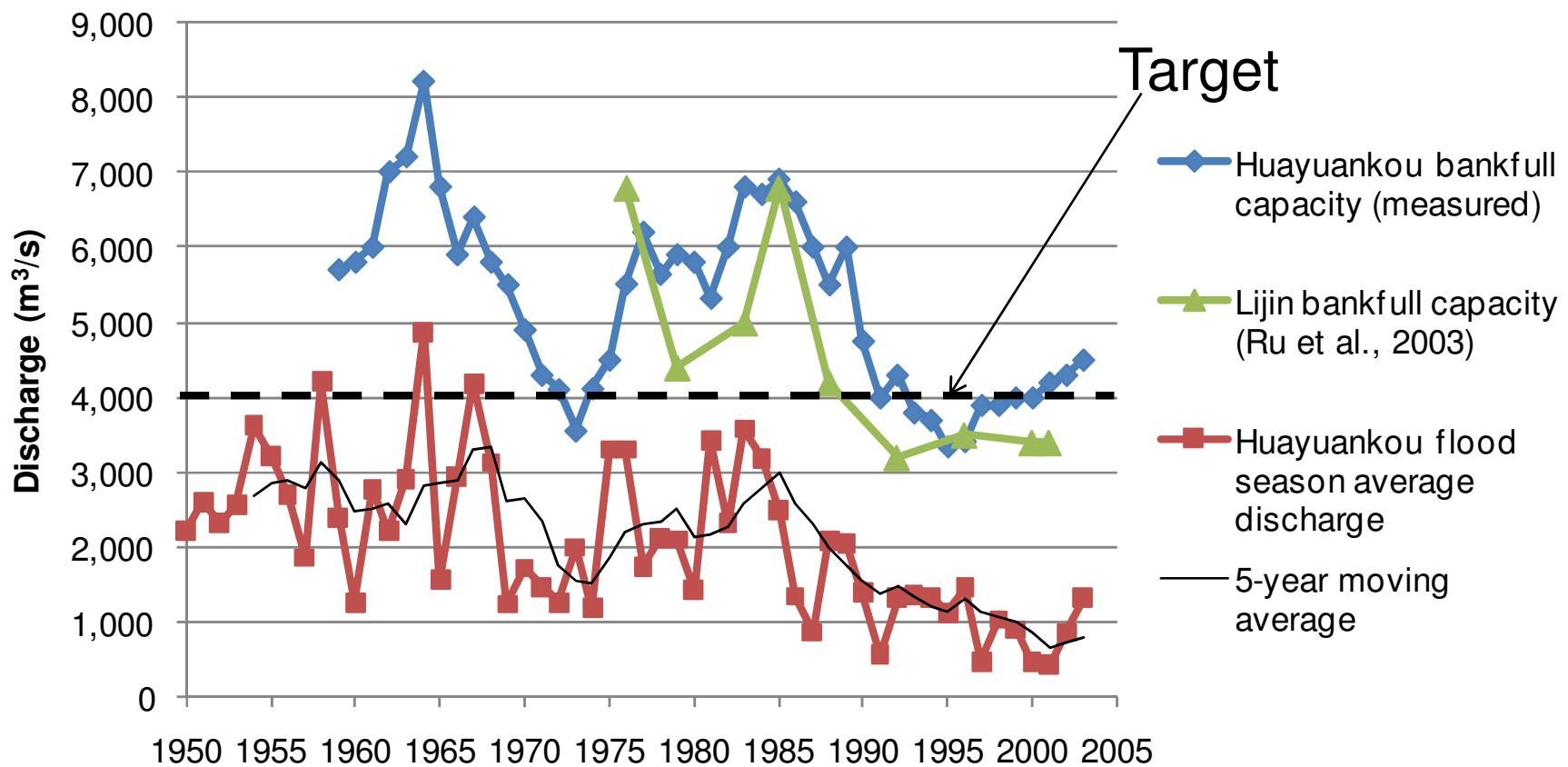
River Health
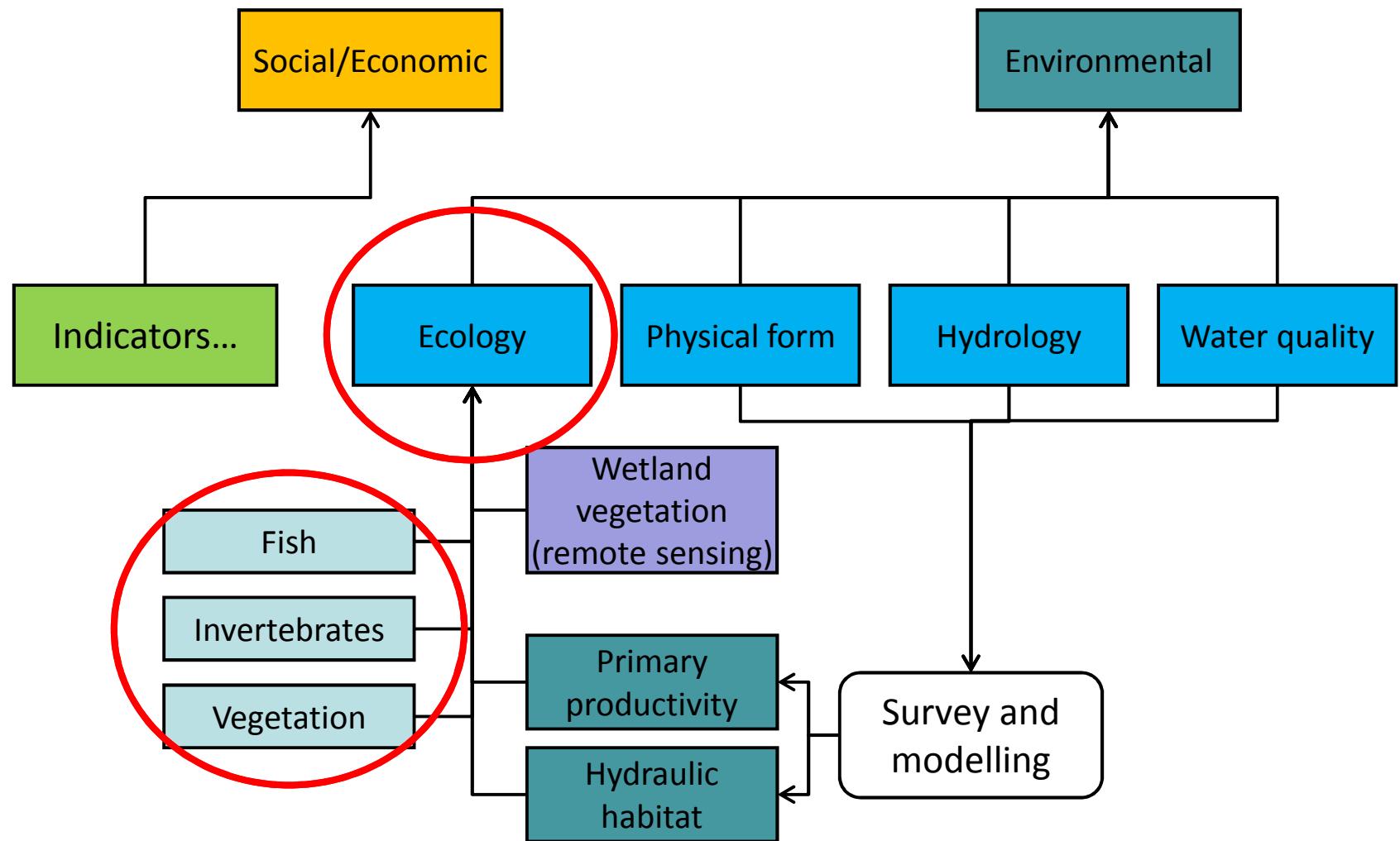
2008 Catchment wide survey
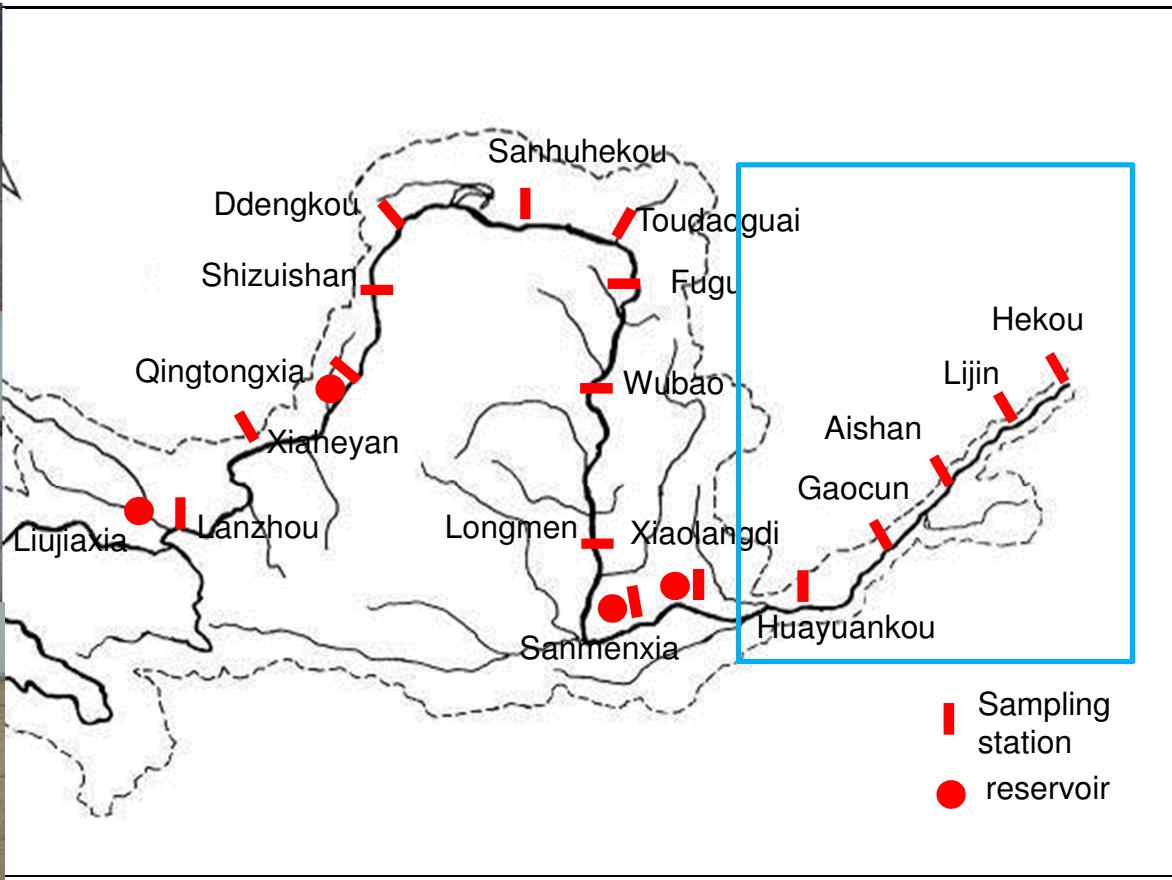
Metrics structure

Fish	Macroinvertebrates	Riparian plants
Species richness	Species richness	Species richness
Native/exotic	Functional feeding groups	Grass/Woody species
Proportion of feeding guilds	Densities and biomasses	Densities and biomasses
Proportion of habitat guilds		
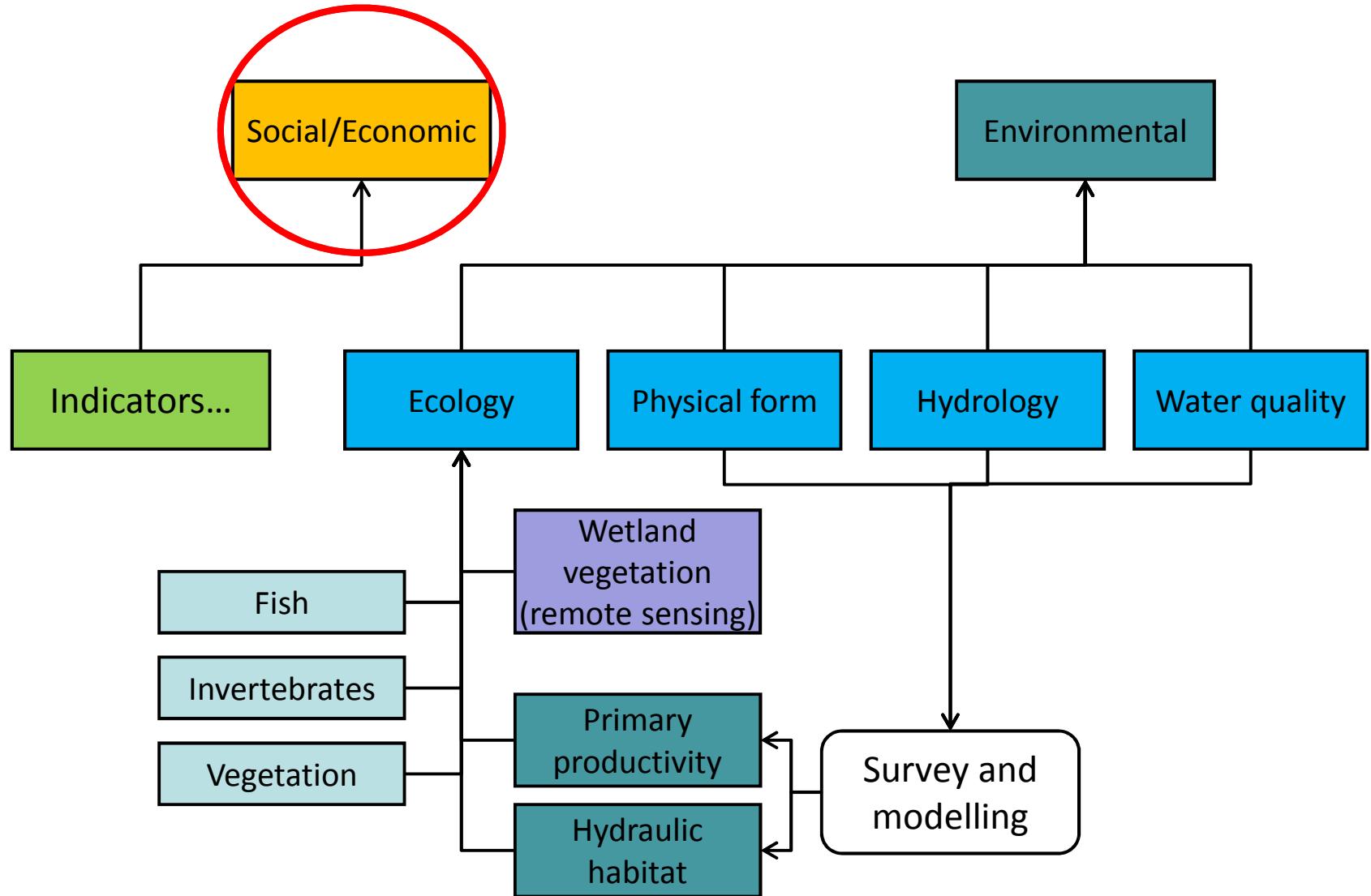
Social Health Indicators

- A river provides social benefits
    - Flood control function
    - Drought control function
    - Water supply function
    - Hydro-power function
    - Navigation function
    - Water quality self-purification function
    - Recreation function

- A river can be managed to optimise, or choose a balance of, the:
    - Social benefits
    - Ecological benefits

- The River Health Index is an important tool to help achieve the balance

Environmental Flows Framework

- ## Asset-based
  - ### Sites
    - Wetlands
    - Channel
    - Delta
  - ### Processes
    - Habitat hydraulics
    - Geomorphology
    - Vegetation
    - Fish
    - Invertebrates
  - ### Social
    - Flood control
    - Water supply

- ## Holistic
  - ### Entire flow regime

- ## Options
  - ### to balance
    - River health
    - Social needs

Environmental flow requirements

- Consolidation of existing studies, together with expert opinion
- Identify flow requirements for the key assets (wetlands, delta), focussed on:
  - Fish
  - Vegetation
  - Birds
- Hydrological model to assess capacity to achieve recommended flows

INTERNATIONAL WATERCENTRE

No drying-up

Lijin

Legend:
- Cumulative annual days of cease to flow
- Annual peak cease to flow spell duration

Xiaolangdi Dam
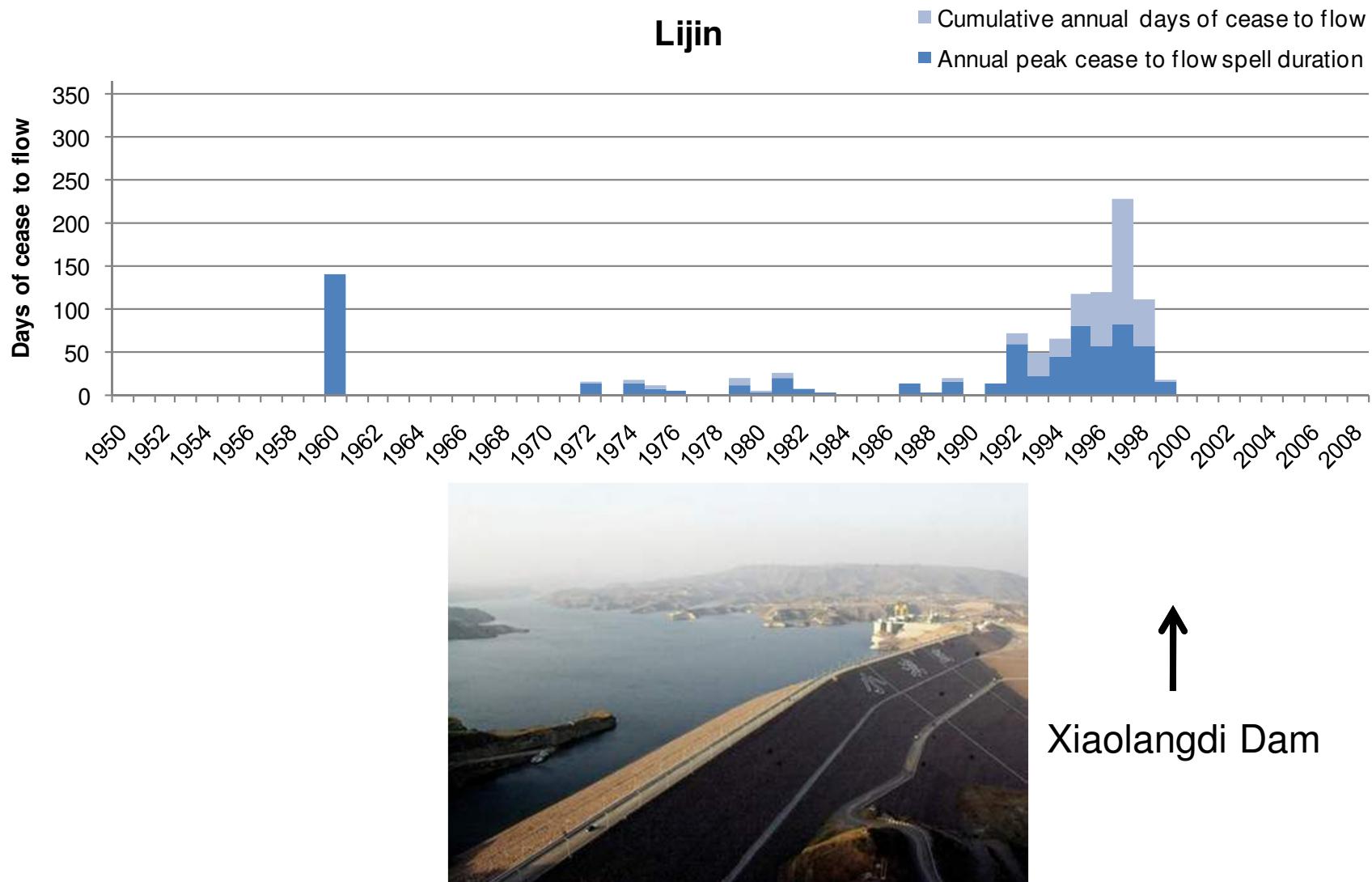
Delta growth

Lijin
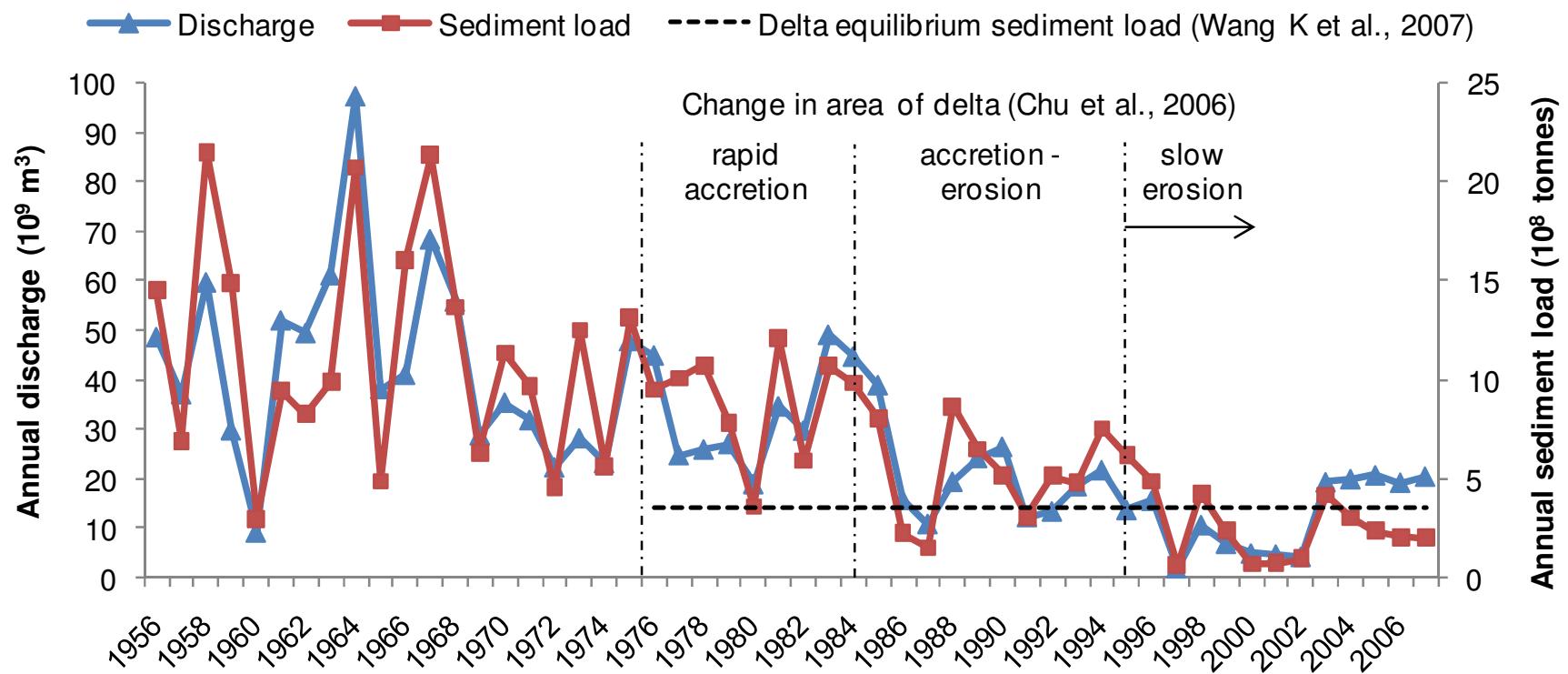
Hydrologic indicators of river health
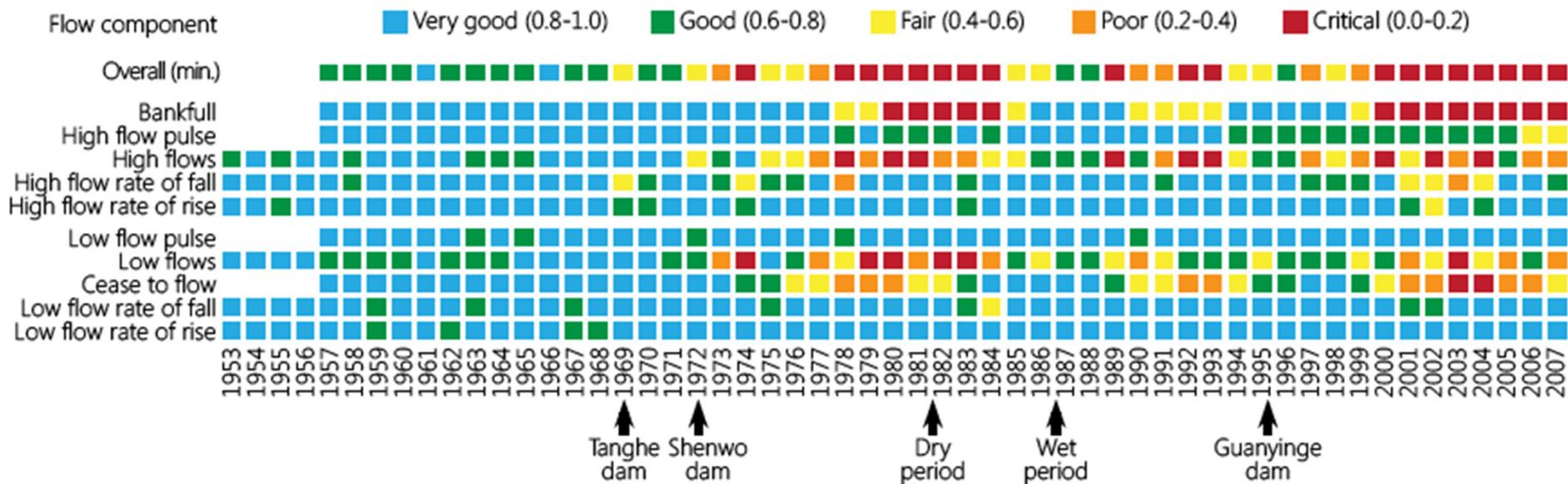
IFH score for Liaoyang from 1953 to 2007. The overall score for each year is the minimum score of any component.

Next steps

- Development of a River Health and E-Flow Assessment Publication
    - International case studies
    - Synthesis of lessons and approaches
    - Technical methodologies
    - Policy integration and basin planning
- First draft of publication at International River Symposium (Brisbane 26-29 September, 2011)
- 2nd draft and review – ADB Knowledge Hub Week – Nov 2011
- Sharing experience – Indian workshop (WWF India) Ganga Basin Plan
- APWF Water Summit – launch of publication and Technical Session (Thailand Feb 2012)
- Sharing Experiences – Chinese workshop (IWC – March, 2012)

Thank you

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