China’s National River Health Monitoring & Restoration Program

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Contents

China’s River and Water Resources

National River Health Monitoring & Restoration Program

Yellow River – Lessons learnt
China’s Rivers
Population density

Social and Economic Development
Challenges for River

- Floods
- Water Scarcity
- Water pollution
- Soil Erosion/Sediment
Many rivers and lakes suffer quality deterioration, changes in morphology and hydrology, as well as habitat degradation.

Since 1990s, water reallocations have been carried out in the Yellow River, Hei River and Tarim River, which reduced deterioration of river health in those basins.

Starting in 2004, pilot projects have been undertaken in 12 cities to carry out ecological protection and rehabilitation of the rivers and lakes in these regions.
Restore the River Health

- Water Quality
- Hydrology
- Habitat
- Ecology
- Water Functions

- Impact assessment

- Strategy and Actions
National River Health Assessment Programme

Purpose:
To carry out regular river basin health assessment by 2015.
To commissions perform their role in water and ecological protection.
To achieve the river health objectives by 2020.

Outputs:
(i) River health assessment methods and principles.
(ii) Publication of River Health Assessment Report every 2 years.
Definition of Healthy River

- Water Framework Directive – EU
- Healthy Waterway and Report Cards - Australia
- Clean Water Act –USA
- Yellow River Environment Flow Restoration - YRCC

**Health River** refers to a water body with good natural status and good social functions, a sustainable and harmonious relations between Human and Nature. The natural status will be evaluated in respect of Biology, Hydrology, Habitats and Chemical etc. The Social Function is to evaluate the water status for human needs.
Time Schedule

Phase I
- Develop river health assessment indicators, standards and methodologies
- River health survey for a complete year
- Preparation of River Health Assessment Report (Pilots)
- Capacity building

Phase II
- Revision of relevant technical documents/guidelines
- Study on key technologies
- Capacity building
- River health assessment of major rivers/lakes
Monitoring Investigation Evaluation

National Health Assessment Report of Rivers & Lakes

Workplan of Phase I

- Identification
- Researches Pilot study
- Monitoring Investigation Evaluation

2010 2011 2012 2013

The Value of Rivers

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Current Work (2010 to 2011)

Pilot selection

- One river, lake and reservoir selected for each of seven major basins to carry out health assessment

Research Studies

- Ecological survey of typical rivers/lakes and characterisation study
- Study on river health assessment in China and abroad
- Data base analysis and investigation on monitoring capacity
- River health assessment indicators
- River health assessment standards
- River health assessment methodologies
Water quality
Climate
Land use
Geology

Hydrology
Geomorphology
Hydraulic habitat
Physical

Economy
Education
Trade, etc

River management policy
Catchment management policy

Ecological river health
Social river health

Water quality
Ecological processes

Chemical
Biological

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Results of River Quality

<table>
<thead>
<tr>
<th>Level</th>
<th>River Quality</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>High</td>
</tr>
<tr>
<td>2</td>
<td>Good</td>
</tr>
<tr>
<td>3</td>
<td>Moderate</td>
</tr>
<tr>
<td>4</td>
<td>Poor</td>
</tr>
<tr>
<td>5</td>
<td>Bad</td>
</tr>
</tbody>
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[Diagram showing various dimensions of river quality with levels 1 to 5]
Challenges for River Health Assessment

- Insufficient knowledge about:
  - ecological zoning for river health assessment
  - threat-impact relations
  - indicators, standards and methodologies

- Data base: Inadequate data and capacity on biological and habitats monitoring

- Interagency collaboration: pollution (environmental protection), wetland (forestry), fishery (agriculture)

- Lack of empirical studies: limited cases available in terms of number and types
Yellow River Health Assessment and Environment Flow Research

- River health assessment and environmental flow methodologies developed is of great help to China’s practice

- Identification of suitable river health indicators and preparation of river health report cards

- Field works, training and workshops have improved the capacity building

- Provide advice and policy recommendations on e-flows, water allocation and basin planning methods based on international reviews.
Healthy River framework

“Healthy Indicators of the Yellow River”

• Flow continuity
• Channel configuration for water and sediment transportation
• Water quality standard
• River ecosystem
• Water supply capacity

Indicator groups

- Hydrology
- Geomorphology
- Water quality
- Ecology
- Social-economic

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River Health Index

Social/Economic

Indicators...

Ecology

Physical form

Hydrology

Water quality

Fish

Invertebrates

Vegetation

Wetland vegetation (remote sensing)

Primary productivity

Hydraulic habitat

Survey and modelling
Mengjin wetlands
Zhengzhou wetlands
Kaifeng wetlands

Reaches and Assets

River channel
Delta wetlands
Dongping Lake

Mengjin wetlands
Zhengzhou wetlands
Kaifeng wetlands

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Technical work

- Acquire data
- Establish metrics
- Experiment with weightings
- Work on presentation
  - Report card
  - Technical reports
  - Manuals
• YRCC established an environmental flow regime since 2000
  – Minimum flows
  – Flows to maintain water quality
  – Sediment flushing flows
  – Flows for estuary and delta health
• Many environmental flow studies have since been undertaken:
  – Basin-scale
  – Single asset focus
  – Hydrology-only
  – Holistic
Trend in water use

**Irrigated area**

- Lower reaches
- Middle reaches
- Upper reaches

**Water utilised**

- Lower reaches
- Middle reaches
- Upper reaches

Decade:
- 1950s
- 1960s
- 1970s
- 1980s
- 1990s

Land under irrigation (10^4 ha)

Mean water utilised (10^8 m³/year)
Natural trend – climate change

Lijin annual natural discharge (10^9 m^3)

- 61.7 x 10^9 m^3
- 43.9 x 10^9 m^3

Is this suitable for reference hydrology?
No drying-up

Lijin

Xiaolangdi Dam
River health hydrology index

• The reference
  – The environmental flow components
    • Baseflows
    • Flow pulses
    • Sediment flushing

• The test
  – In any year, to what extent were the components met?
    • Score, 0 = not met at all; 1 = fully met; 0 – 1 = partially met
    • Test: frequency, duration, magnitude, rate of rise and fall
Environmental Flow Restoration Actions 1998-2011

- Legal measures, Public Consultation,
- Technical measures
  - Water Allocation Scheme  58 bcm=37+21 bcm (EF)
  - Remote control and Real time control
- Artificial Floods
- Flushing river sediments
- Flood plain and wetlands restoration
- Improve river morphology and Reduce flood risk
- Ecological restoration
Water Quantity and Water Quality

- **Continuous river flow restored**
  - in 1997, river dried for 226 days
  - since 1998, the river has flow continuously for 12 years

- **Water quality improved**
  - Legislation of water pollution control
  - Pollution reduction and cleaner production Tech.
  - Monitoring and supervision enhanced
  - Water quality trends of mainstream of the Yellow River in 2002-2006
Wetlands eco-system

- habitat of the fishes and migration birds
- recovered from the dry up periods
International Yellow River Forum

Oct. 16, 2012, Zhengzhou , China

Keeping Healthy Life of the Rivers