



# **Methods and Practices of Ecological Flow Requirement Assessment in China**

**Dr. ZHAO Zhongnan**

**Deputy Division Director & Senior Engineer**

**General Institute of Water Resources and Hydropower Planning and Design,**

**Ministry of Water Resources of China**

**Webinar of Environmental Flows: Harmony between Humans and Nature**

**2020.7**

The background features a stylized globe on the left side, with a person's profile overlaid on it. The person's profile is rendered in a semi-transparent, reddish-orange color, showing the head and neck. The globe is light blue and white, with a soft glow. The overall background is a light blue gradient with some abstract, wavy patterns.

# Outline

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- **Issues and Challenges** (*background*)
- **Concept and Principle** (*philosophy*)
- **Methods and Procedure** (*goal setting*)

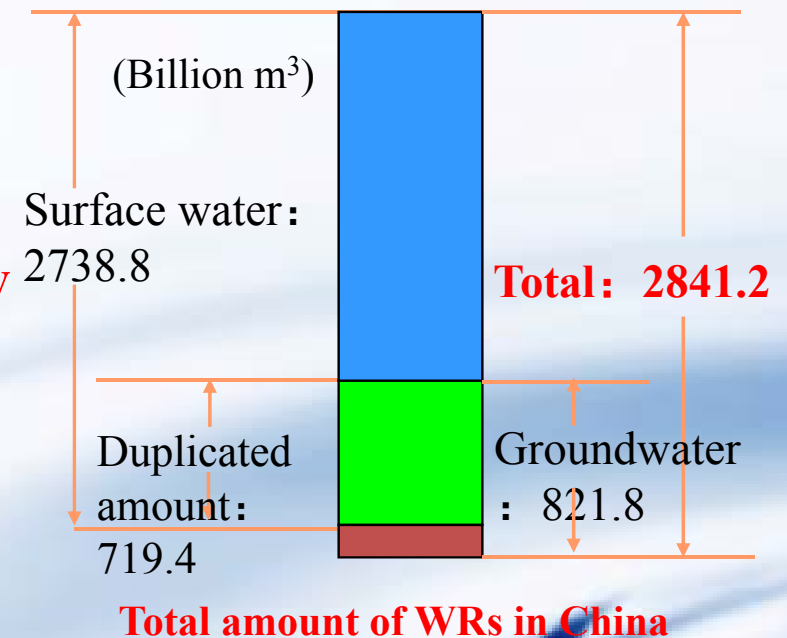
# Issues & Challenges

## ◆ Current Situation of Water Resources (WRs) in China

□ Water quantity in China is 2841 BCM in total, accounting for 7% of the global amount, shared by 20% of the world's population.

## □ The characteristics of WRs in China

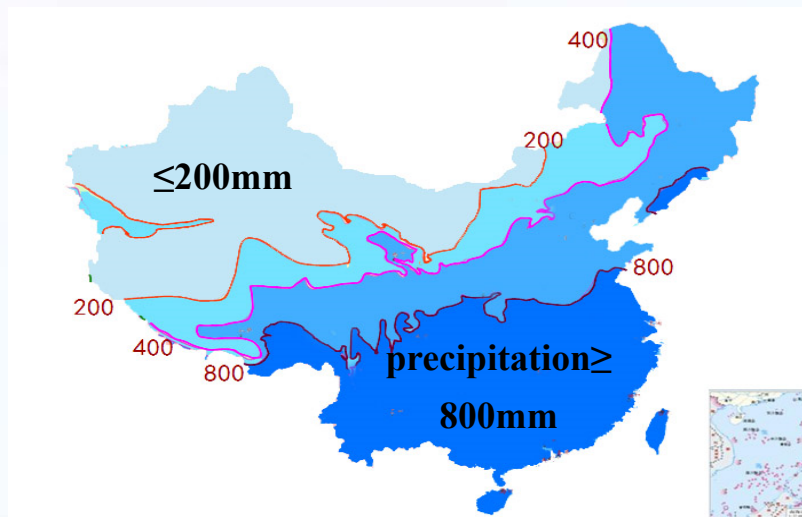
- ◆ Uneven distribution
- ◆ Mismatch between water and productivity
- ◆ Fragile water-related ecosystem



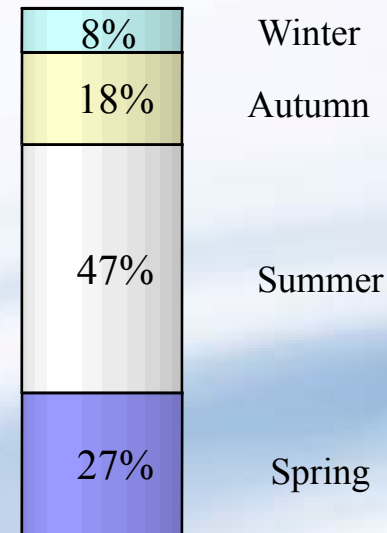
# Issues & Challenges

## □ Uneven Distribution

- 74% in spring and summer, 26% in autumn and winter
- Variation of river runoffs between dry and wet years could reach 2-6 times inter-annually.



Precipitation in different areas

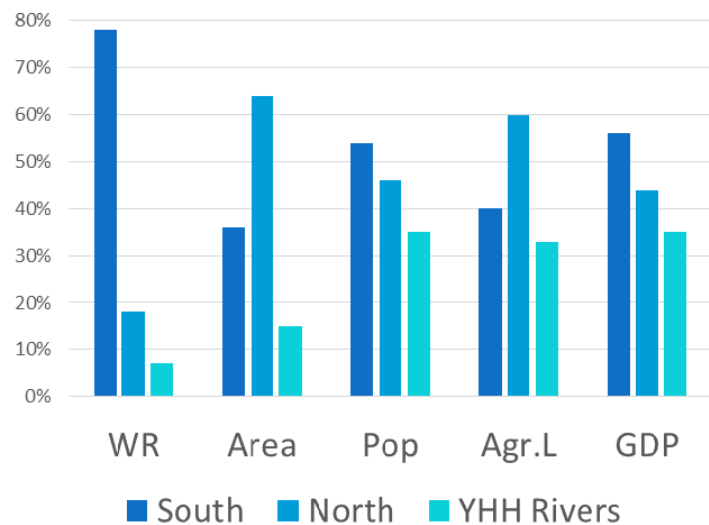


Seasonal distribution of rainfall

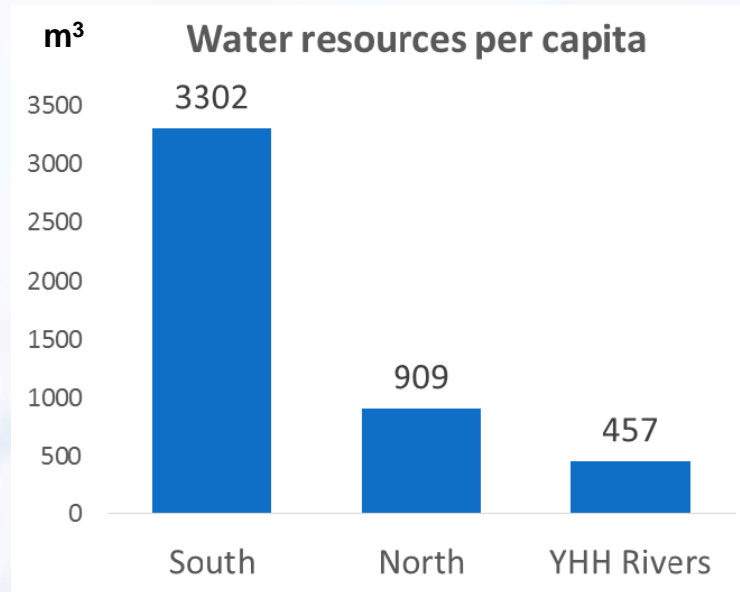
# Issues & Challenges

## ❑ Mismatch between Water and Productivity

**22% of water resources is in the north, associated with 38% of population, 46% of arable land area, and 63% of food production nationwide.**



**Unbalance**

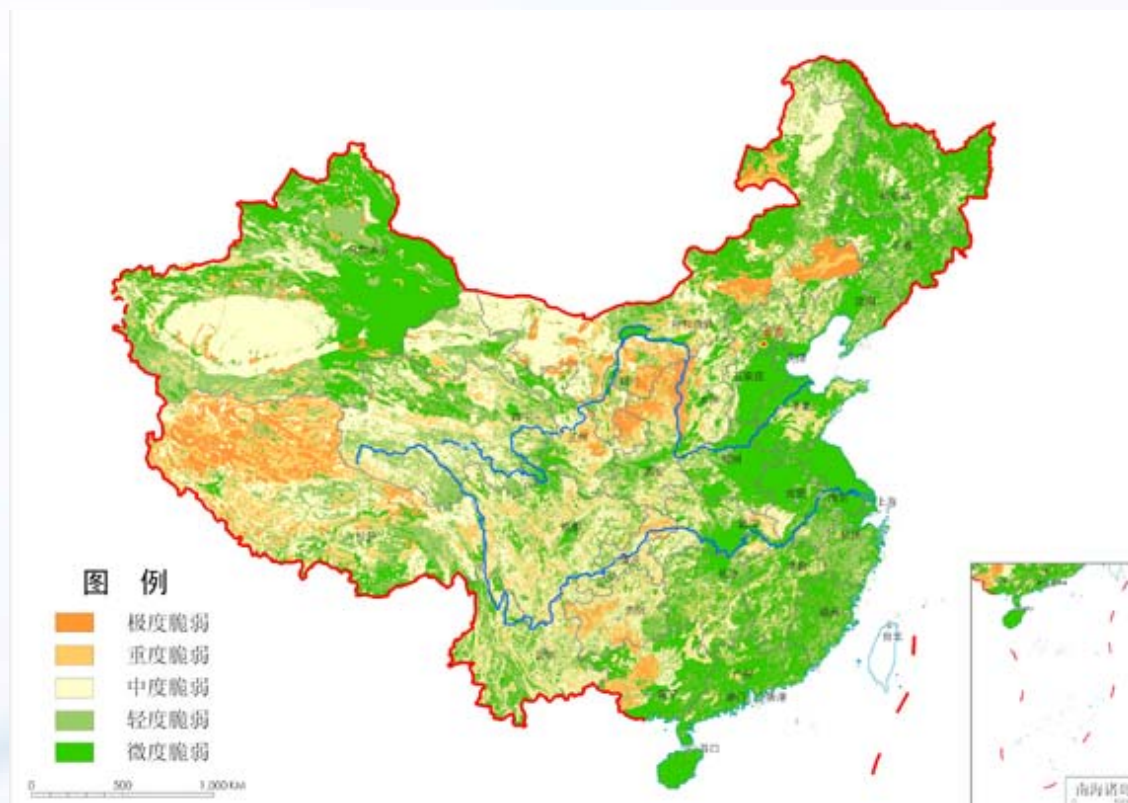


**Serious in Yellow, Huai and Hai Rivers (YHH Rivers)**

## Issues & Challenges

### ❑ **Fragile Water-related Ecosystem**

**More than 60% of national area is very fragile, with naturally vulnerable water-related ecosystem, including arid and semi-arid regions.**

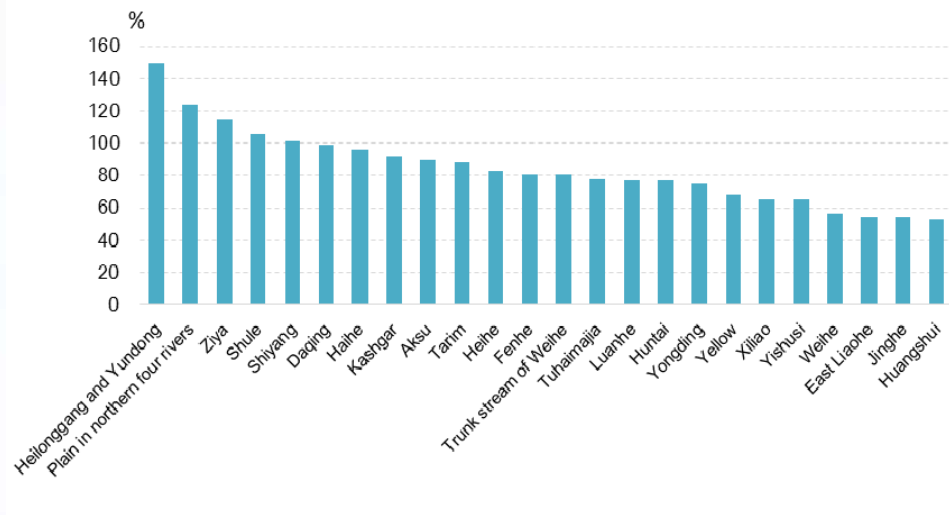


**Ecological Vulnerability in China**

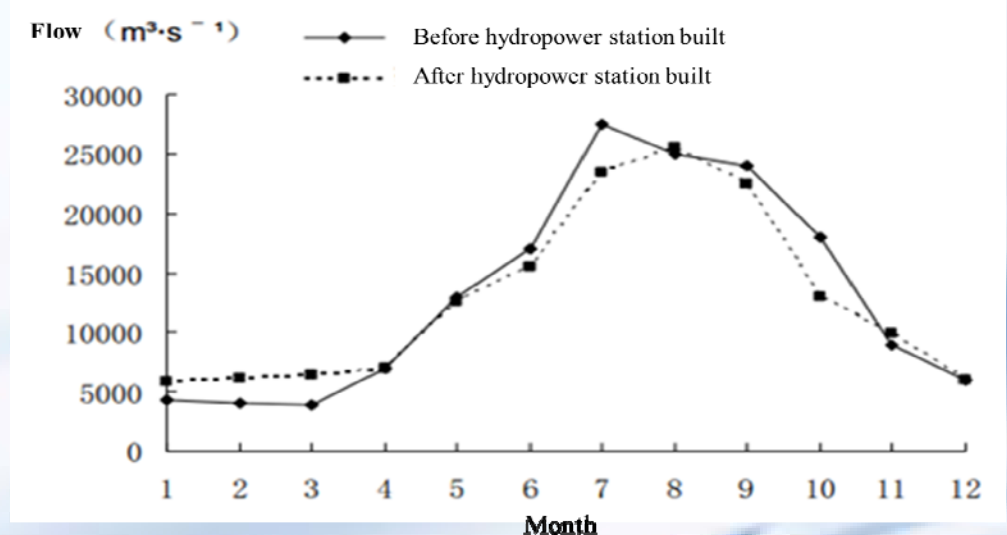
# Issues & Challenges

## ◆ Issues of Water Resources

- ❑ Significant reductions in the instream E-flows
- ❑ Significant impacts on the natural runoff pattern
- ❑ Significant changes in the downstream habitats



Water resources development ratios in basins (regions) of northern China



Changes in monthly flows in the downstream of the Three Gorges

# Issues & Challenges

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## ◆ The Challenges of Ecological Flow Requirement Assessment in China

- ❑ Water requirements by rapid socioeconomic growth
- ❑ Water requirements by fragile ecosystem and restoration
- ❑ Unevenly spatial and temporal distributions of water resource
- ❑ Significant changes in water resources environment

How to balance water requirements by human and nature?

How to set proper EFR criteria for different river basins and regions?

How to allow the EFR criteria suitable for the future situation?



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# Concept & Principle

## ◆ Concept of EFR (Ecological Flow Requirement) in China

The runoff and its process that is needed to maintain the structure and function of water ecosystems, such as rivers, lakes and marshes, which can be referred by indicators such as flow ( $\text{m}^3/\text{s}$ ), water amount ( $\text{m}^3$ ), water level and water depth (m).



# Concept & Principle

## ◆ Concept of EFR in China

Classification	Definition
<b>Basic EFR</b>	the <b>minimum</b> ecological flow and procedure in rivers, lakes and marshlands to maintain the ecological environment function of the specific eco-environmental protection objectives, such as the basic forms of rivers and lakes, the basic ecological corridors, the basic habitats of organisms, and the basic self-purification ability.
<b>Optimal EFR</b>	the ecological flow and procedure in rivers, lakes and marshlands to maintain the <b>good ecological status</b> . It is to determine the development and utilization degree of river and lake surface water resources.

Reference: “Specification for Calculation of Environmental Flow in Rivers and Lakes” (National Standard)

# Concept & Principle

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## ◆ Principle of EFR assessment

The purpose of EFR assessment is to clarify the objectives and requirements of river and lake ecological protection, especially the water use control in dry season, to control the development and utilization intensity of water resources, and to implement the dispatching and management of river and lake water resources.

- EFR assessment is not a purely scientific issues
- EFR is a result of multiple trade-offs
- EFR is a specifically spatial and temporal result
- EFR should be directly along with WR management measures

# Concept & Principle

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## ◆ Principle of EFR assessment

### □ The hierarchy of EFR assessment in China

**EFR of Cross sections → basic data of the system of EFs**

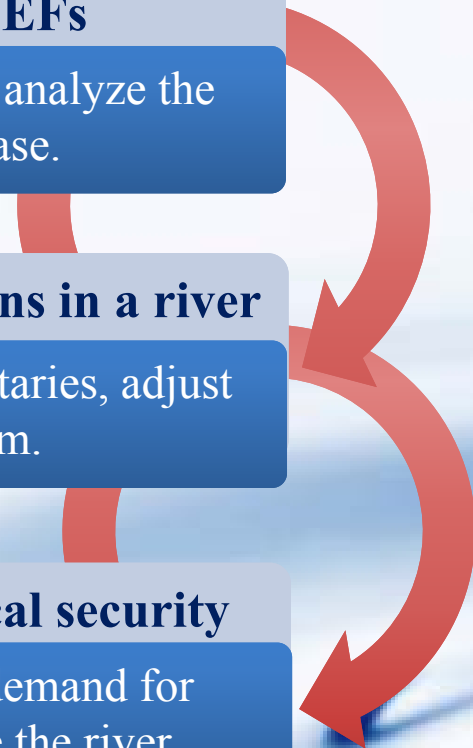
Calculate the EFs of each cross sections with long-term data, analyze the implementation of the results, then get the primary EF data base.

**EFR of Rivers → show the connections of each sections in a river**

Coordinate upstream and downstream, main streams and tributaries, adjust the EFs of sections, and then determine the flow of river system.

**EFR of Basin → indicate the degree of basin ecological security**

Take a river basin as a whole, analyze and balance the water demand for ecological use inside the river and socioeconomic use outside the river.



# Concept & Principle

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## ◆ Principle of EFR assessment



### **Respect the natural law of water ecosystems**

According to the natural hydrological conditions and ecological laws of rivers, do not **change** the actual situation of rivers and lakes.



### **Highlight the demand for ecological protection**

According to the ecological function of river and lake, give priority to the important and sensitive ecological protection objectives requirements for EFR.



### **Overall plan for water allocation**

Coordinate demands for ecological protection and social and economic development, take water source conditions and allocation plans into account.



### **Be realistic, reasonable and feasible**

Consider the current situation of river and lake development and utilization, determine recent and long-term goals, and approach the protection and governance requirements in stages.

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# Outline

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# Methods & Procedure

- ◆ **The methods of EFR assessment in China**
  - **The calculating methods**
    - ◆ At present, there are many methods to calculate, which can be roughly divided into hydrological method, hydraulic method and habitat method.
    - ◆ According to the regional type, the ecological characteristics and protection objectives, select appropriate methods.

	Elements	application	Methods
<b>hydrological method</b>	hydrology law, corresponding ecological status	general situations	Q <sub>90</sub> , Tennant,
<b>hydraulic method</b>	river corridors and lake shapes	special section of river	R2-Cross, Wetted Perimeter Method
<b>habitat method</b>	habitat, indicator species	sensitive ecological flow	IFIM, BBM



# Methods & Procedure

## ◆ The methods

physical geography

water resources development & utilization

Climatic zonation

Water resources distribution

Ecological Vulnerability

## □ The zonation of rivers and lakes



# Methods & Procedure

## ◆ The methods

### □ The classification of rivers

Index		Grade	characteristics
Size	Hydrodynamic condition	large	The main stream and the primary tributary
		small	Other tributaries and mountain rivers
Degree of Development and Utilization	Ecohydrological process impact	high	The structure and function of ecosystem are damaged
		low	The structure and function of the ecosystem are maintained at a good level
Engineering Control Capability	Management tool	strong	River with strong regulating capacity and multi-year regulating reservoirs
		weak	River with low regulation ability and monthly regulation reservoirs or no engineering regulation ability at all

# Methods & Procedure

## ◆ The methods

### □ The Recommend EFR threshold range in China

EFR/Total surface water (%)		Current development and utilization degrees of river					
		High		Medium		Low	
		Basic	Optimal	Basic	Optimal	Basic	Optimal
Large rives	North	10~20	30~40	15~25	35~45	≥25	≥50
	South	20~30	60~75	25~30	65~75	≥30	≥75
Major rivers	North	10~15	30~40	10~20	30~45	≥20	≥45
	South	15~30	55~65	20~30	60~70	≥30	≥70
Medium and small rivers	North	5~10	30~35	10~20	30~40	≥20	≥40
	South	15~25	45~55	20~30	50~60	≥25	≥60
Inland rivers	NW	—	30~40	—	35~45	—	≥45
	Tibet	—	—	25~30	65~75	≥30	≥75

Source: *Specification for Calculation of Environmental Flow in Rivers and Lakes (SL/Z 712-2014)*



Thank You !