

Integrated Flood Management in the Yellow River: Nature-based solution and Engineering

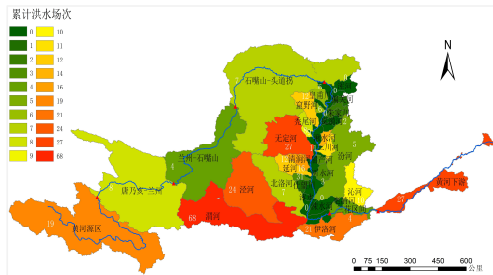
Zhihui Wang

Yellow River Conservancy Commission, MWR, China 

Jun. 18th 2026

1. Flood Risk Remains the Greatest Threat to the Yellow River

- ❑ The Yellow River Basin is a key region for human settlement and economic development in China
- ❑ Since 1949, floods with a discharge exceeding 10,000 m³/s have occurred more than 10 times, posing a severe threat to people's lives and property, as well as regional economic and social stability



Flood occurrence frequency



Population 324M



Coal 67%



Crop Yield 34.8%



GDP 21.6%



1958 Flood



1982 Flood

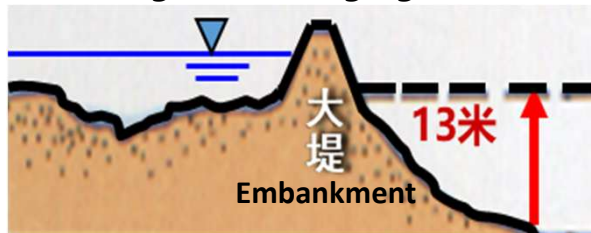


2021 Flood

Year	Inundated Farmland (10 ⁴ mu)	Collapsed Houses (10 ⁴ units)
1958	304.79	29.53
1976	225.00	30.80
1982	217.44	40.08
1996	247.60	26.54
2003	30.23	3.88



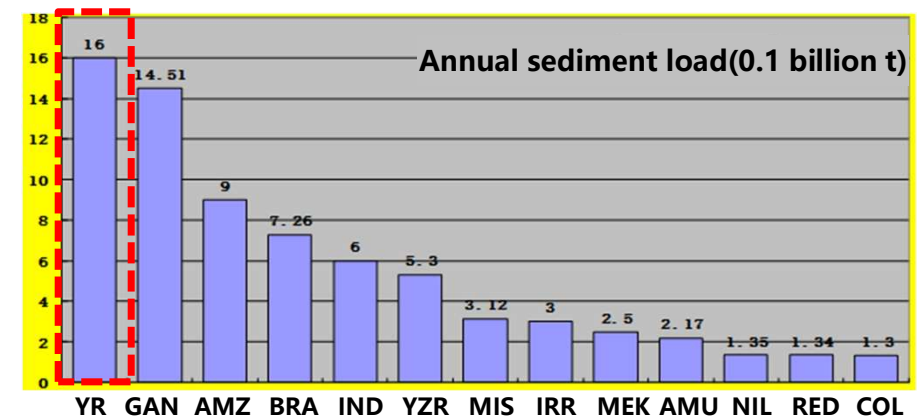
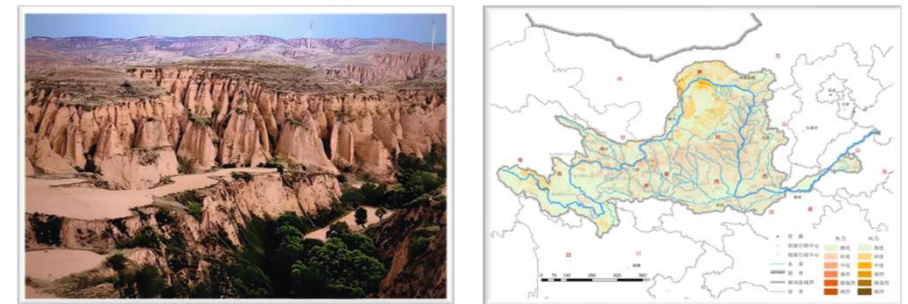
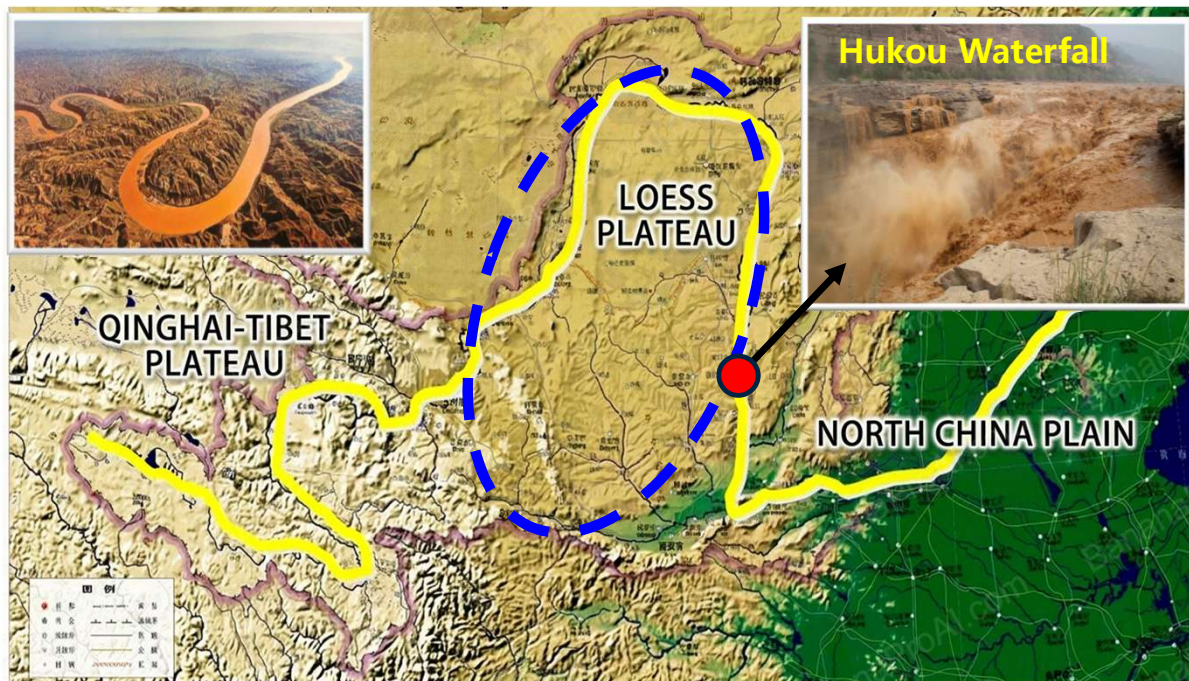
Overground hanging river



- The riverbed in its lower reaches is higher than the surrounding land, making it more vulnerable to flooding

2. Severe Soil Erosion on the Loess Plateau

- ❑ The formation of the elevated riverbed is the sediment from the Loess Plateau. It has a highly fragmented landscape and suffers from some of the most severe soil erosion over the world

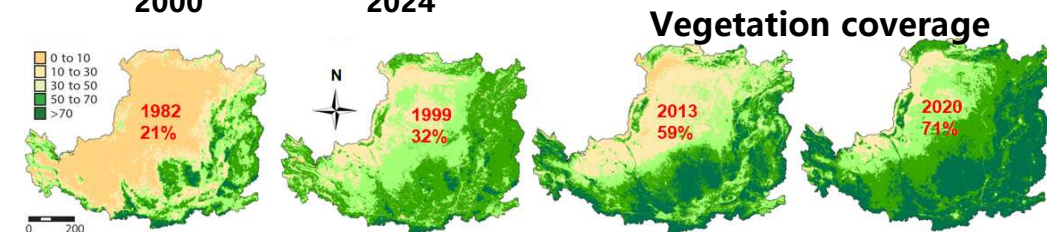
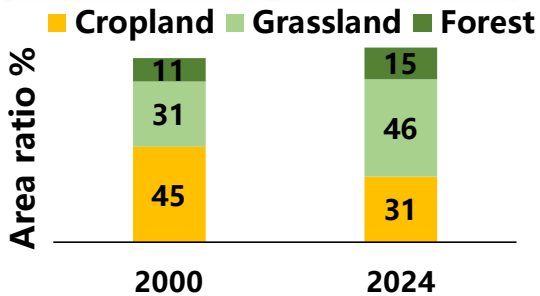
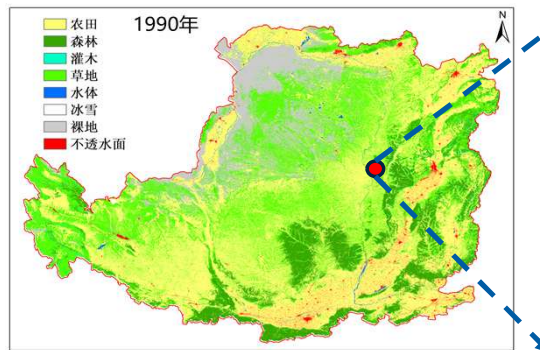


- ❑ The annual average sediment load is 1.6 billion ton (**1st**), and the unique imbalance between low water volume and high sediment load makes the Yellow River one of the most complex and challenging rivers to manage in the world

3. Soil and Water Conservation Measures on the LP (NbS)

□ Since 1999, China advocates the integrated management of mountains, rivers, forests, farmlands, lakes, grasslands and deserts as a fundamental approach to ecological governance

● Abandoning Slope Farmland



● Afforestation in the grassland and barren land



● Enclosure protection for forest and grassland



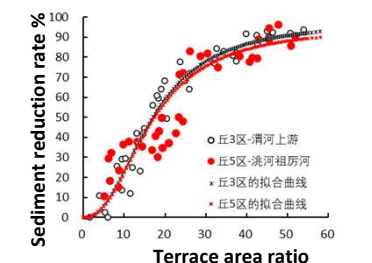
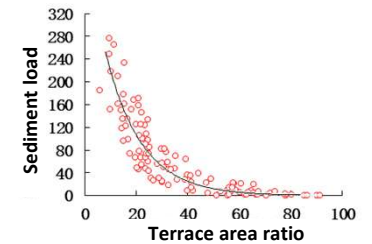
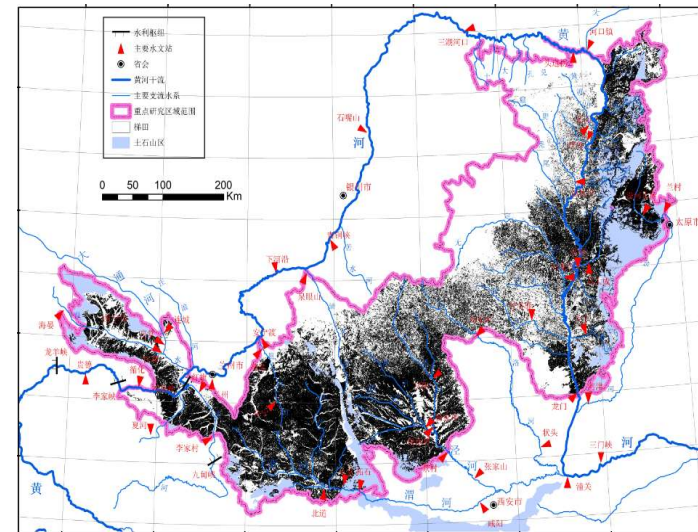
➤ Vegetation plays a crucial role in intercepting rainfall, enhancing infiltration, and both reducing the magnitude and delaying the timing of flood peaks.

3. Soil and Water Conservation Measures on the LP (NbS)

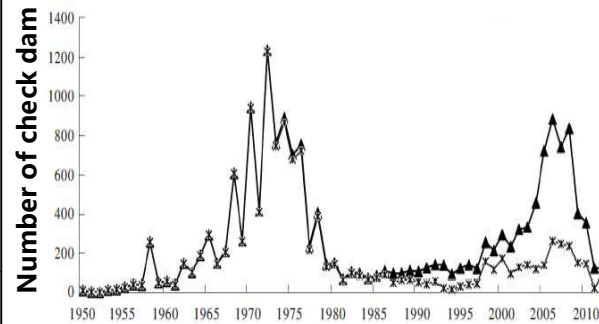
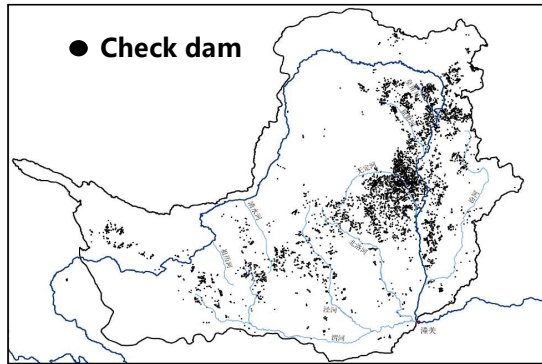
▣ Terraces are a critical NbS in the Loess Plateau, and China's terraces have been inscribed on the UNESCO World Heritage List . 70,000 Km² of terraces have been built in the LP by 2025



- **Modifies slope microtopography, reduces runoff velocity, increases infiltration**
- ✓ Intercept flood runoff flowing down slopes
- ✓ Trap sediment from slope within gullies
- ✓ Mitigate rainstorm-induced disasters
- **Maintains ecological functions, ensures food security, achieves ecology-livelihood win-win**
- ✓ UNEP promotes terraces as exemplary Nature-based Agricultural Solution



3. Soil and Water Conservation Measures on the LP (NbS)



- ❑ Check dams are a Loess Plateau-specific NbS
- ❑ By 2025, 60,000 check dams including 20,000 large and medium-sized check dams and 40,000 small check dams

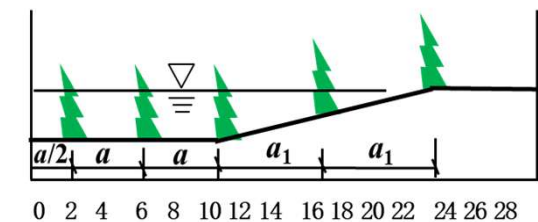
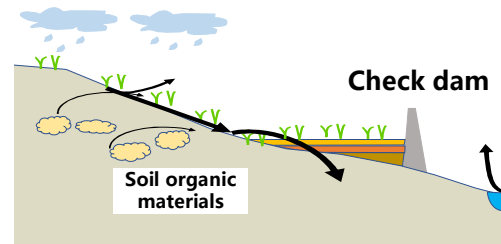
➤ **Design principles in harmony with nature:**

- ✓ Utilize natural topographic gradient of gullies to retain floodwater and sediment via dam construction
- ✓ Allow natural sediment deposition to gradually form fertile dam farmland, and prevents soil organic carbon loss
- ✓ Vegetative check dams is a cost-effective NbS for gully erosion control, and trap sediment while allowing runoff to pass through
- ✓ Achieving "No flood or sediment leaves the gully"

Rigid check dam

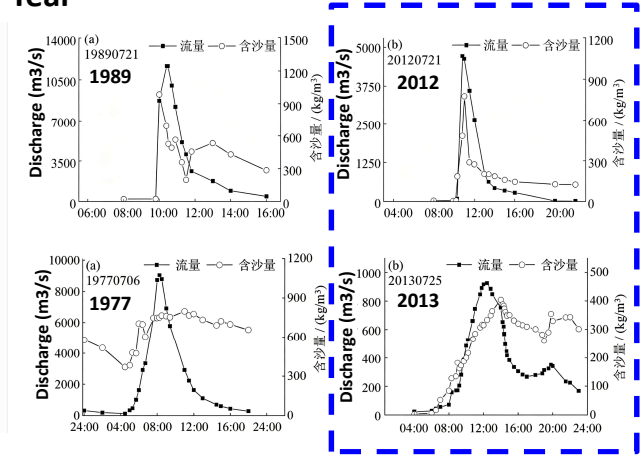
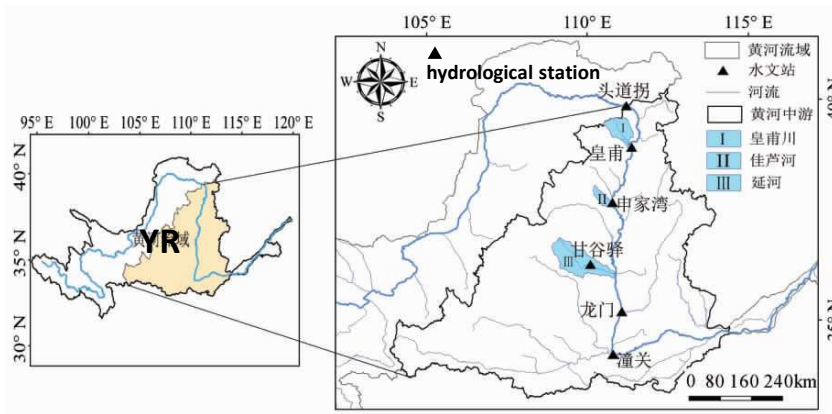
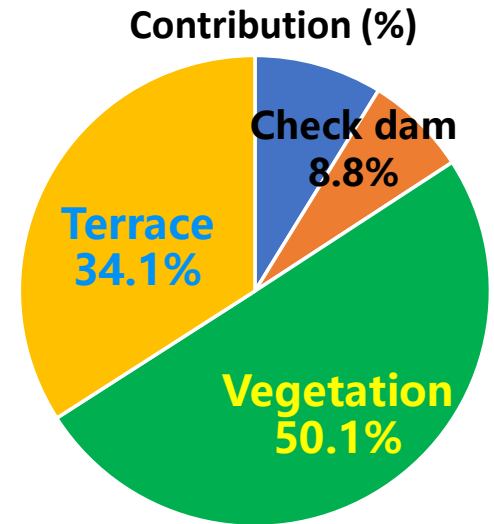
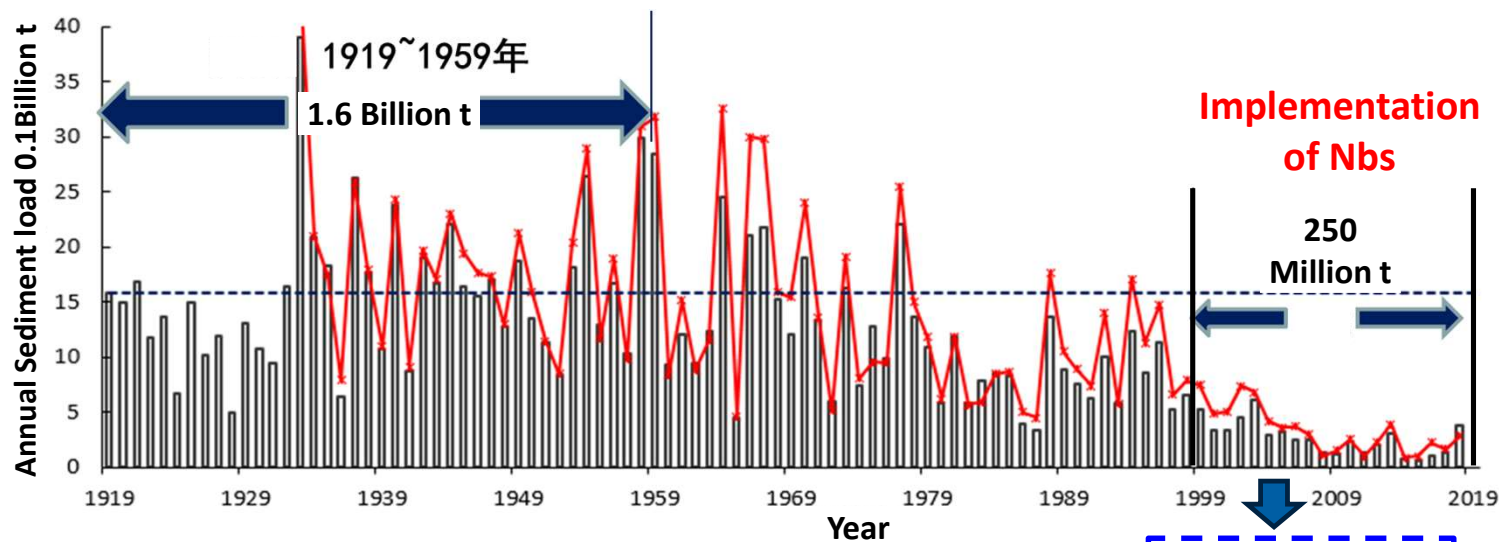


Vegetative check dam



3. Soil and Water Conservation Measures on the LP (NbS)

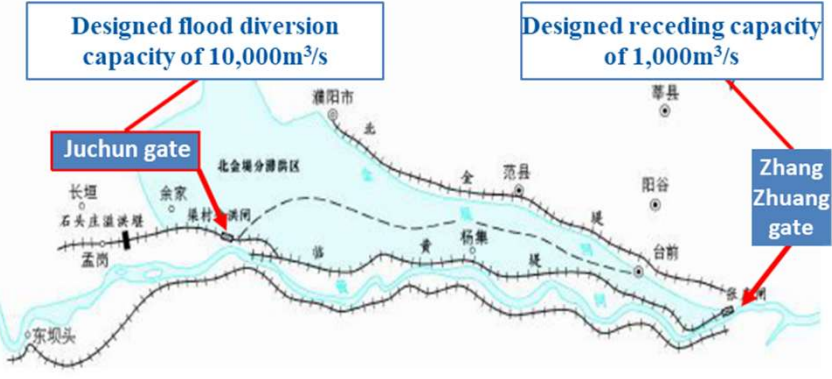
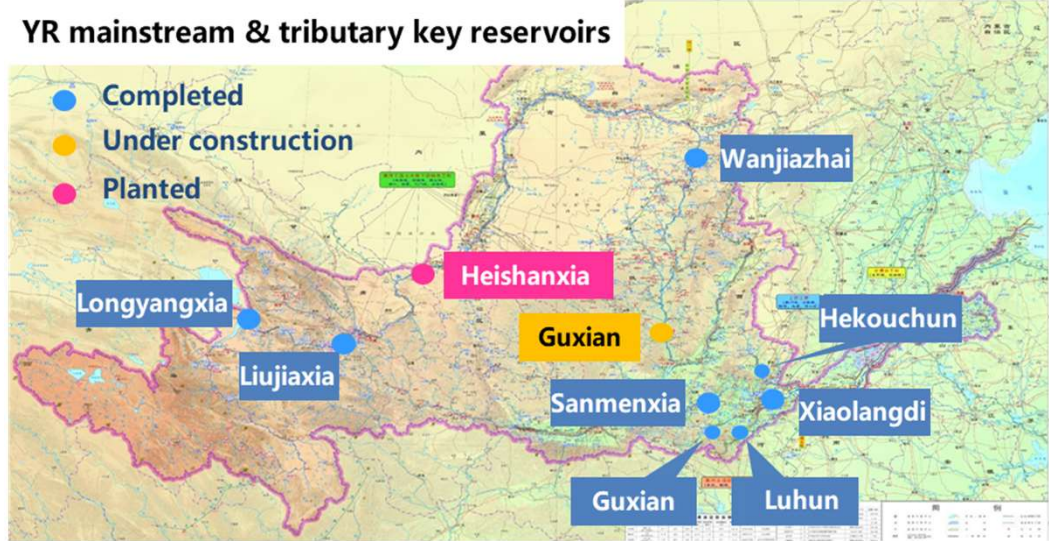
Annual average sediment load has experienced a sharp reduction in the past 30 years



- Under the same rainfall intensity, the implementation of soil and water conservation measures has resulted in a marked **reduction in both peak flood discharge and sediment concentration**
- Effectiveness of measures in flood control and sediment reduction

4. Yellow River flood control engineering system

With frequent extreme weather events, pure NbS measures can hardly cope with catastrophic flood defense, and flood control engineering measures play an irreplaceable role in addressing major floods



- ✓ Key reservoirs
- ✓ Embankment
- ✓ Detention area

5. Key technologies for reservoir dispatch



- ❑ Established the "one high and one low" dispatching theory
- ✓ **One High:** Longyangxia Reservoir (upper Yellow River) operates at high water level to store floodwater
- ✓ **One Low:** Xiaolangdi Reservoir (middle Yellow River) operates at low water level to release flood and sediment
- ❑ Developed a reservoir group regulation model

- ❑ Constructed the Yellow River Intelligent Flood Control Platform based on the Digital Twin technology
- ✓ Hydrological and hydrodynamic models realize flood and sediment forecasting,
- ✓ System automatically generates flood control plans, extending the forecast lead time and effectively improving flood control efficiency



Yellow River Intelligent Flood Control Platform

Thanks for your attention!



Yellow River Conservancy Commission, MWR

Address: No.45 Shunhe Road, Jinshui District, Zhengzhou, China

Email: wzh8588@aliyun.com

Website: www.yrihr.com.cn