The Littoral Zone of the Three Gorges Reservoir: Challenges and Opportunities

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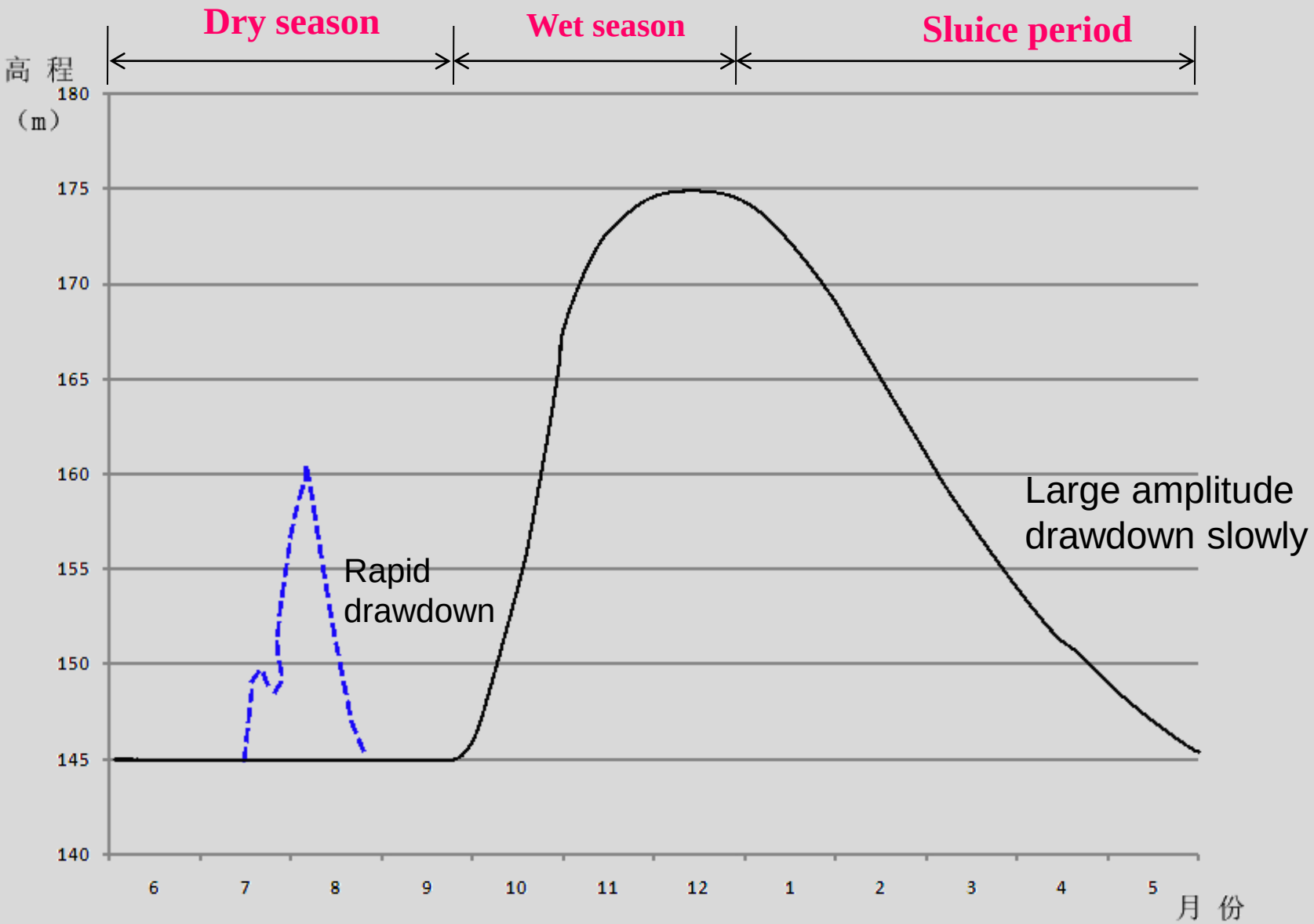
1. Background of the Three Gorges Reservoir Littoral Zone
2. TGR Littoral Zone Habitat Fluctuation
3. TGR littoral zone challenges
4. TGR littoral zone opportunities
5. Approaches to optimizing ecological service functions
6. Future research opportunities

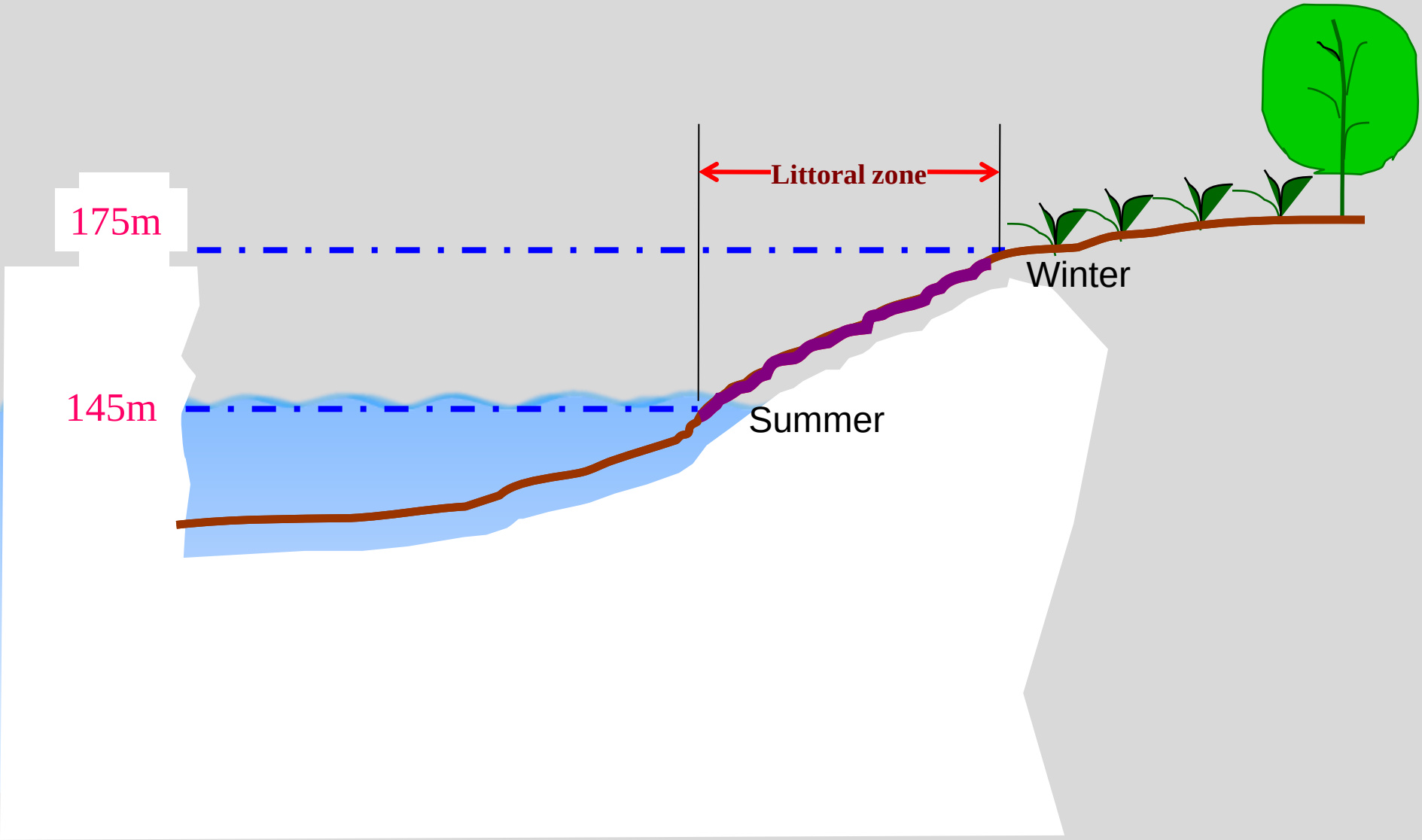
1. Background of the Three Gorges Reservoir Littoral Zone

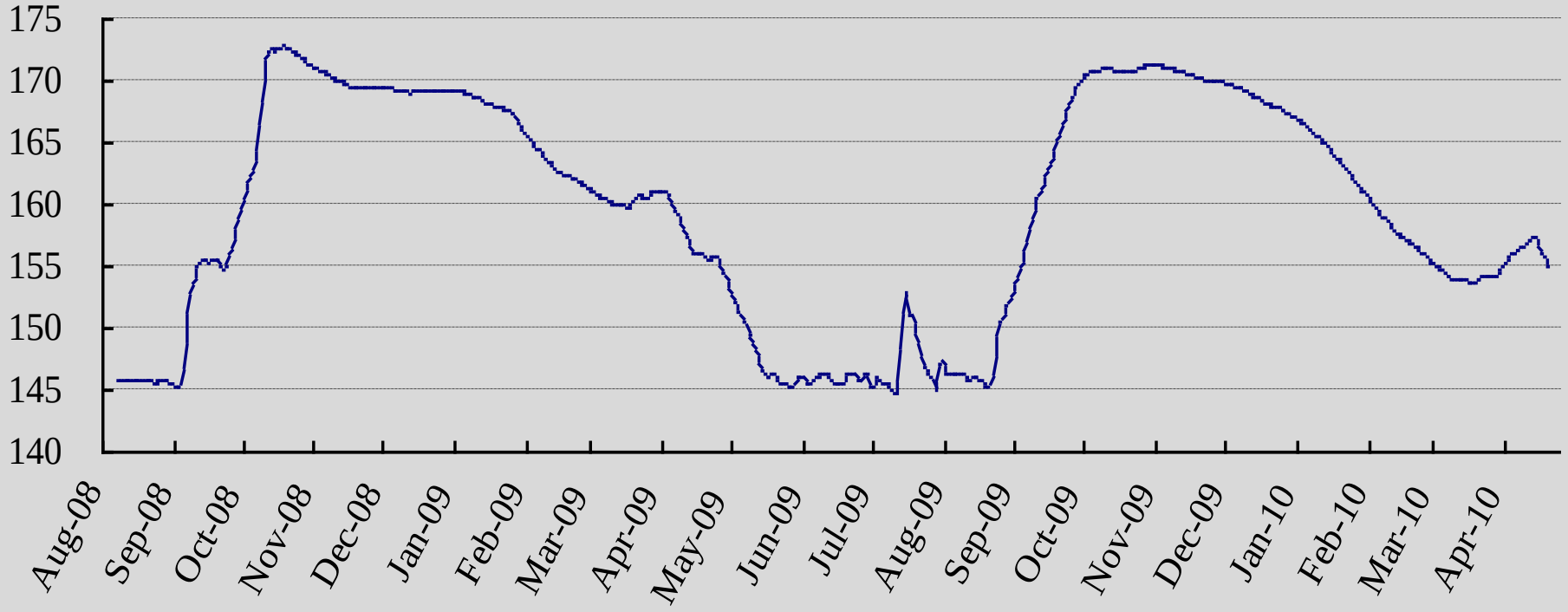


Operational hydrograph “storing clear water and releasing the muddy”,

Summer-low water level (145m), winter-high water level (175m)

★ Formation of the water-level fluctuating zone



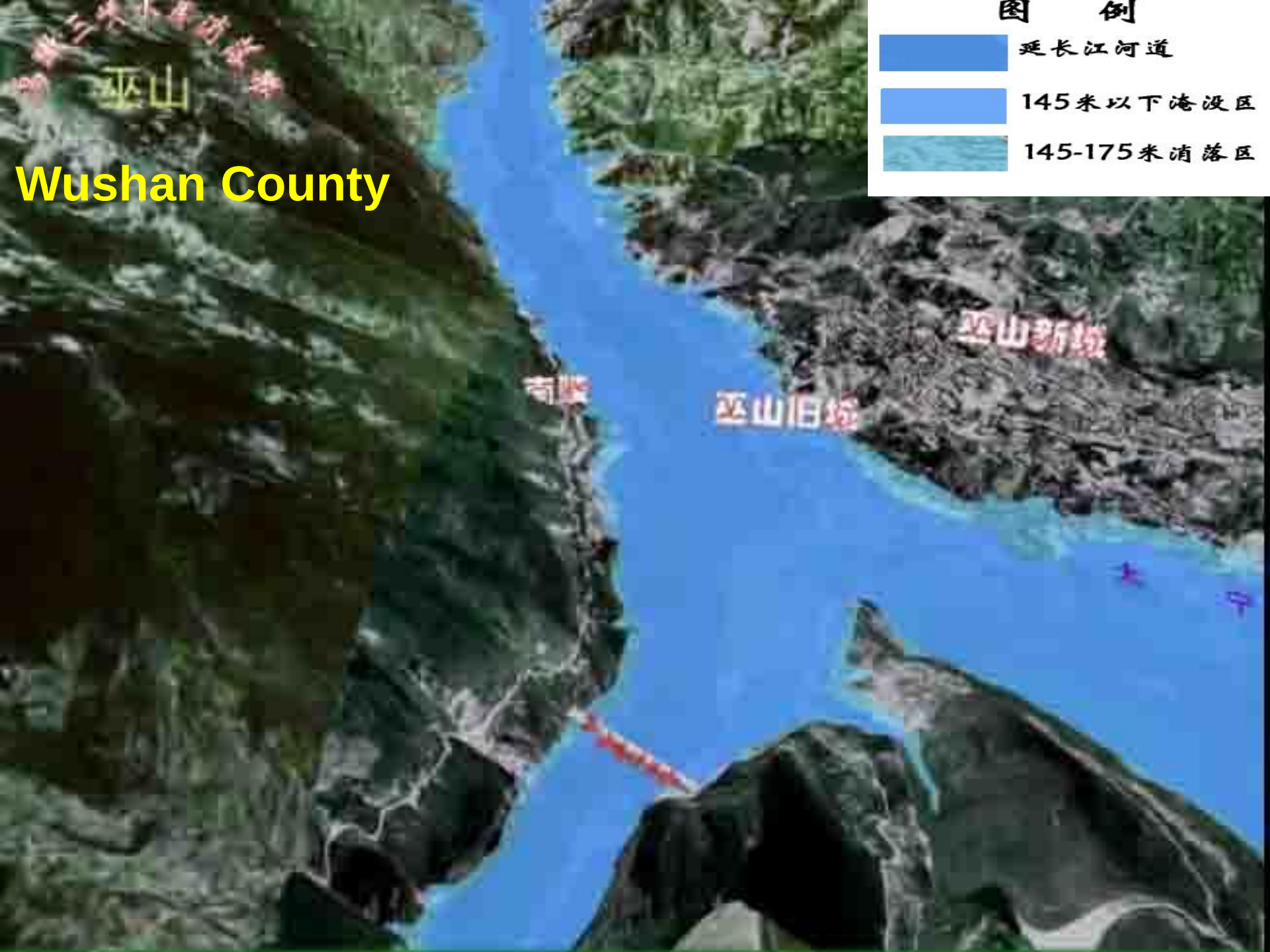


Water level variation curve of the Three Gorges Reservoir, Aug. 2008 to Apr. 2010

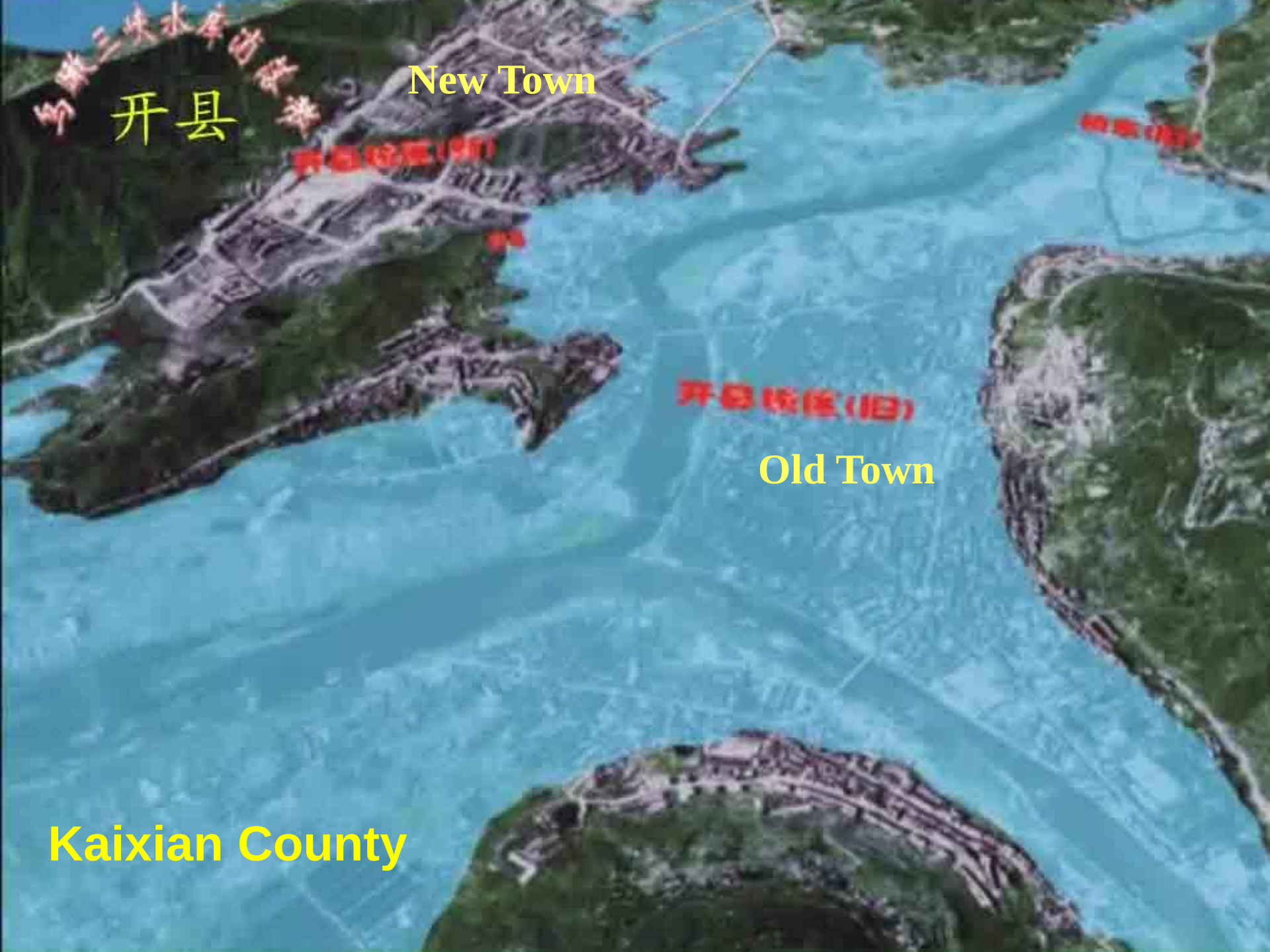
Littoral zone distribution by watershed

River	River length (km)	Perimeter of littoral zone at 175m （km）	Area of littoral zone （km^2）	Width of littoral zone (km)
Yangtze River	665.14	2603.19	140.58	0.21
Jialingjiang River	71.9	212.14	5.05	0.06
Wujiang River	87.03	212.45	10.27	0.12
Pengxi River	52.55	385.46	55.47	1.06
Meixi River	32.13	269.01	7.55	0.23
Tangxi River	43.84	211.43	6.65	0.15
Daning River	61.93	277.90	16.27	0.26
Modaoxi River	35.26	173.64	6.82	0.19
Baolong River	13.87	112.28	1.34	0.10
Chantan River	19.52	216.68	5.81	0.30
Other tributary		207.21	50.52	
Total		4881.43	306.28	

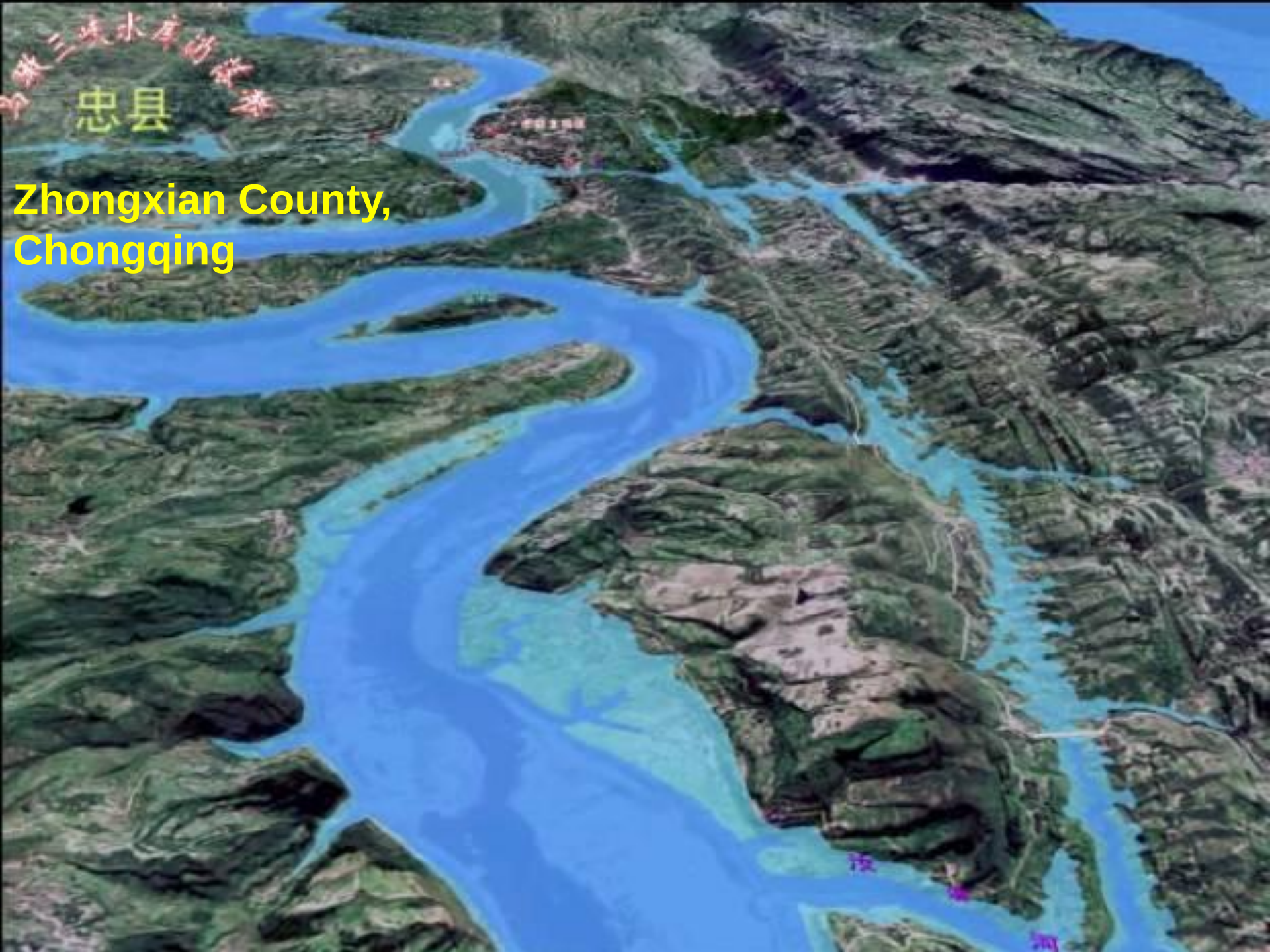

Water-level fluctuating zone
图 例
延长江河道
145米以下淹没区
145-175米消落区
三峡水利枢纽
Zigui County,
Hubei Province



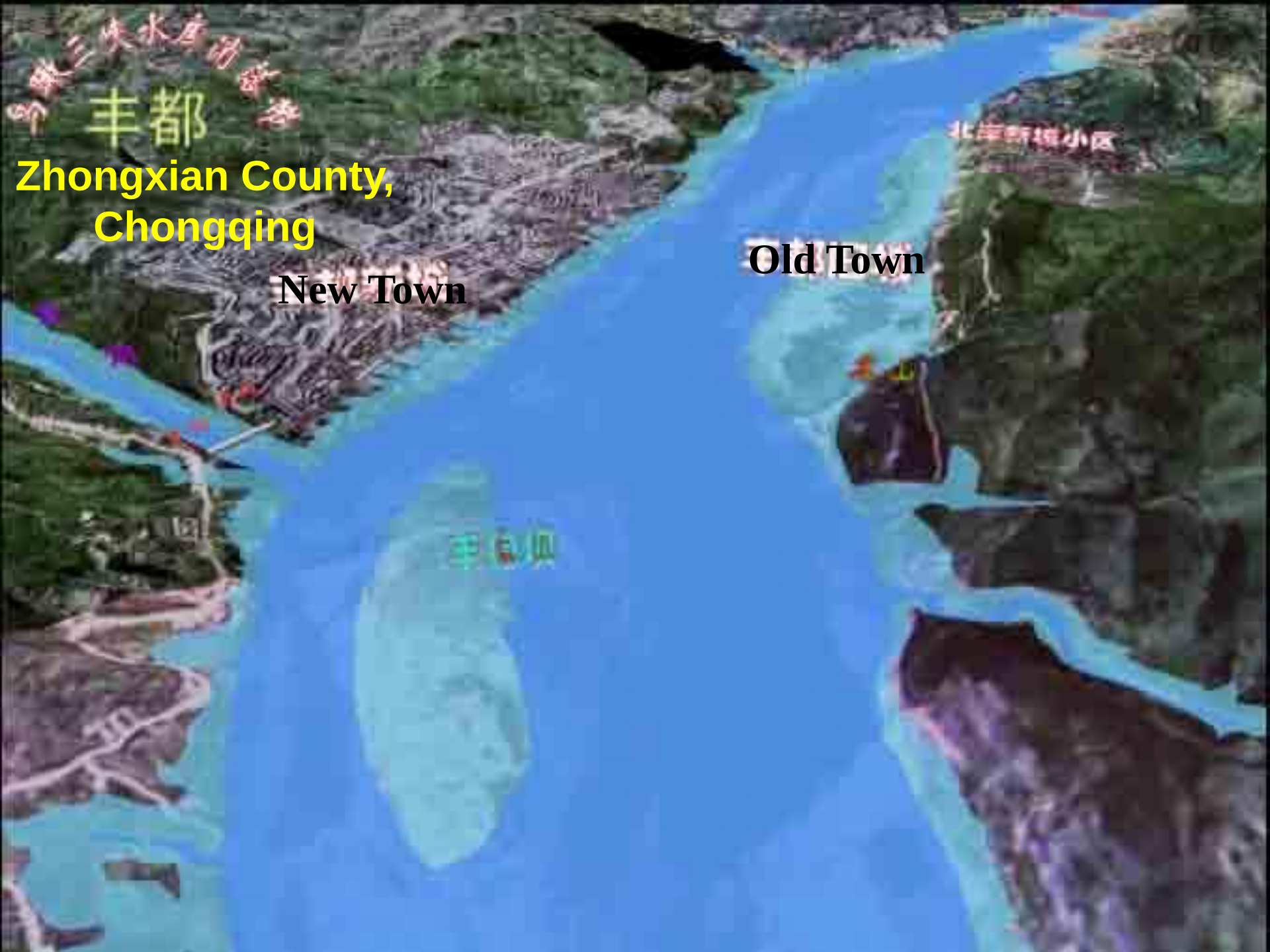
Wushan County



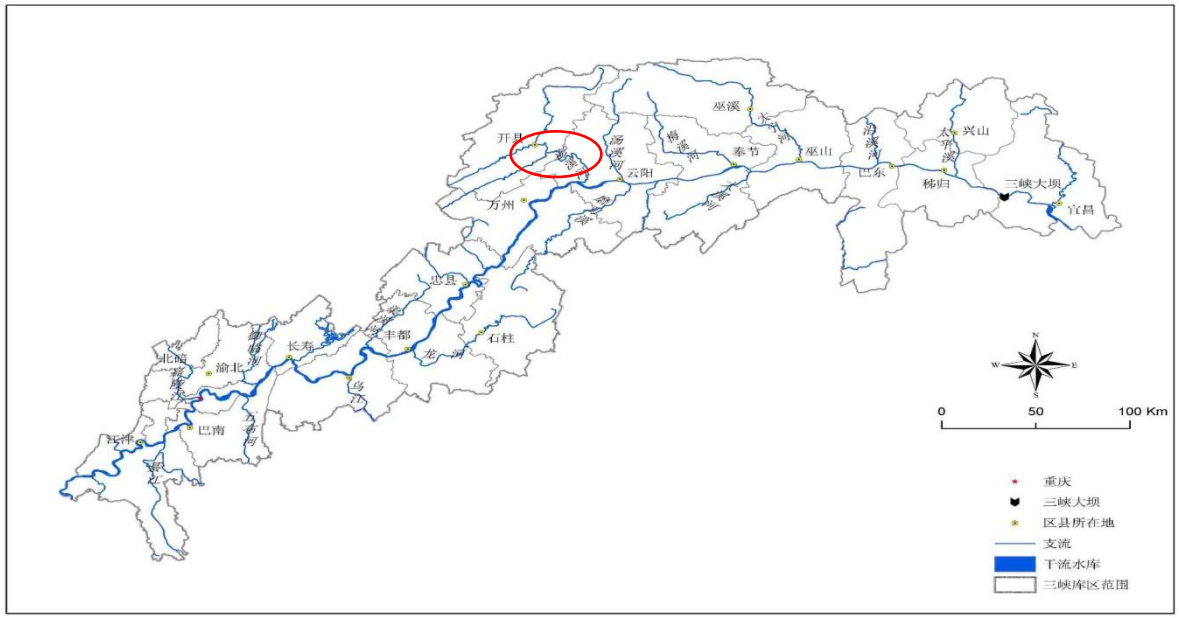
Kaixian County



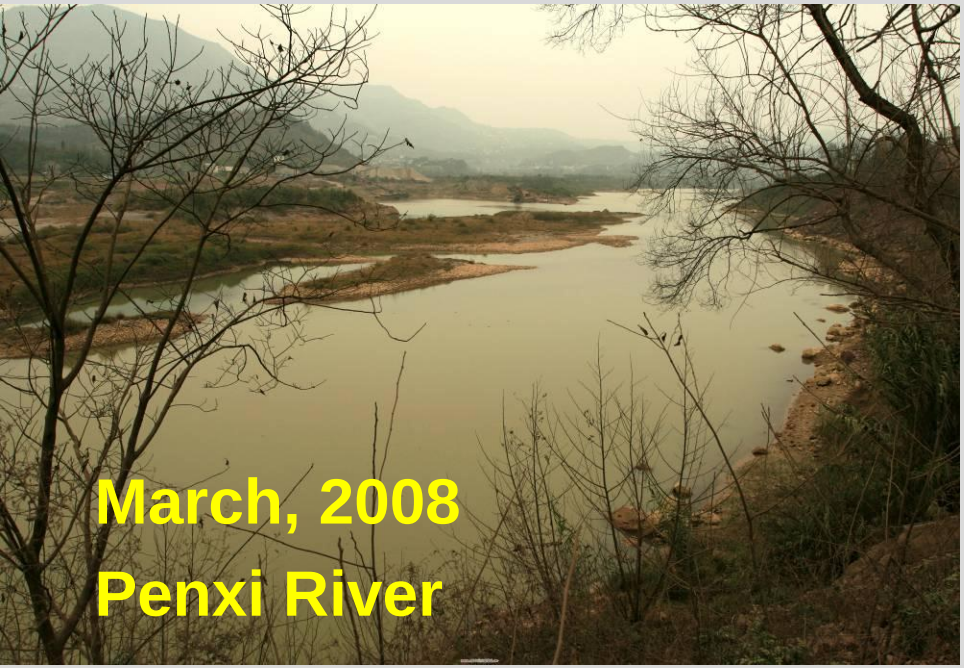
Zhongxian County, Chongqing


丰都
Zhongxian County,
Chongqing
New Town
Old Town

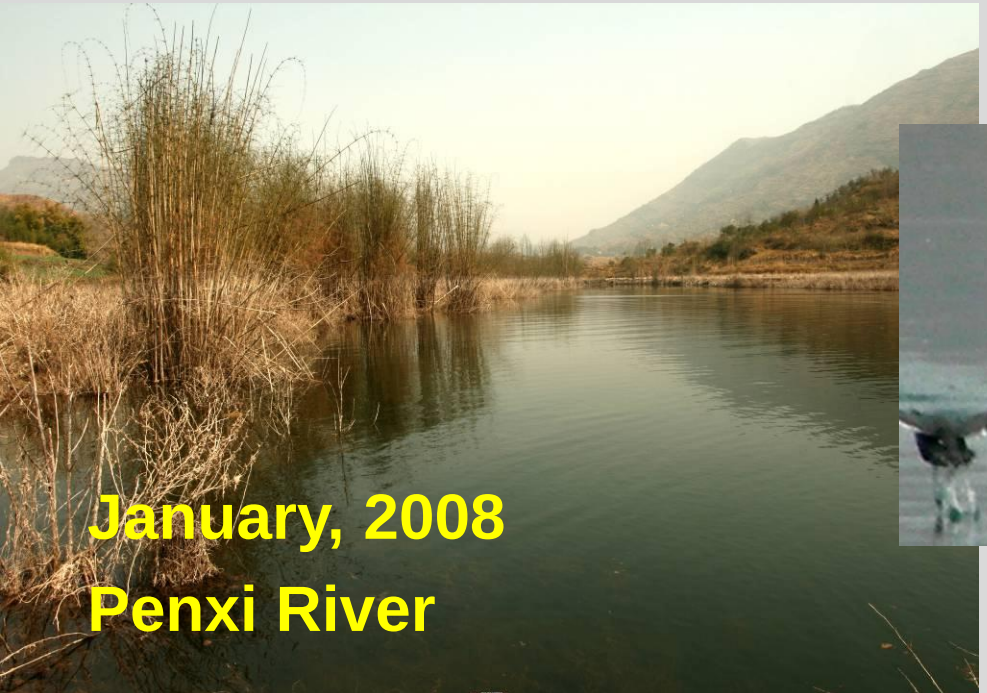
2. Littoral Zone Habitat Fluctuation



Pengxi River littoral zone



Waterfowl in Pengxi River, January, 2008



★ Same site

★ Same site


July 2008
Same site
October 2008
Wetland station

December 2008

June 2010

3. TGR littoral zone challenges

- **Endangered and extinction of special species in original riparian zone；**
- **Reduced stability of reservoir bank and inducement of secondary geological disasters ;**
- **Littoral zone landscape not coordinated with designated Scenic Spots;**
- **Potential water quality problems**

Constraints

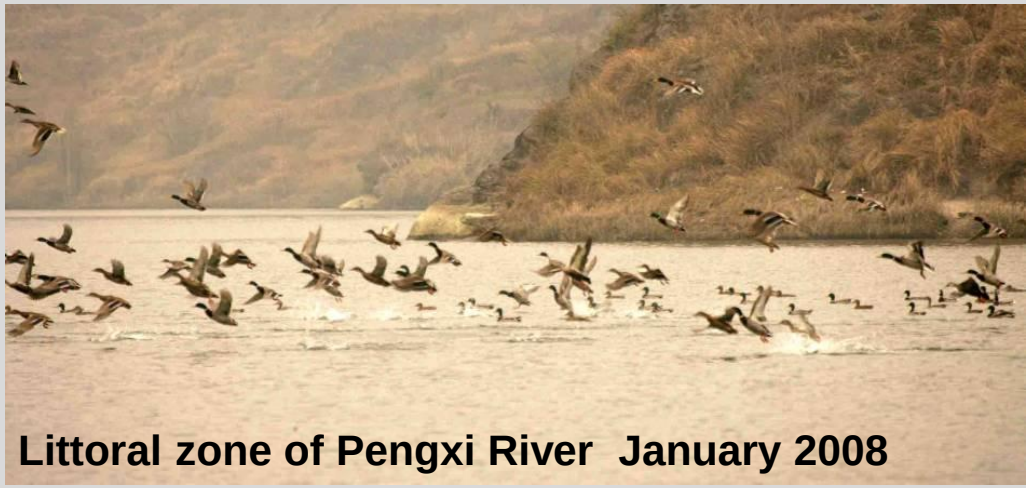
- large area，different types，complex restoration
- densely populated area，conflicts between littoral zone and adjacent agriculture
- pollutant discharges through into littoral zone from adjacent uplands

4. TGR littoral zone opportunities

We believe it is important to understand the many complex ecological issues within the TGRLZ and coordinate with the numerous stakeholders within the TGR. In order to maintain ecosystem health of the TGRLZ we must reduce pollution decrease and carbon emissions while incorporating ecologically friendly utilization. We believe there are opportunities for optimizing ecosystem services in these new riparian systems through application of ecological engineering concepts.

The littoral zone has a potentially important water quality treatment function since pollutants flow from the uplands into the reservoir through the drawdown zone.

biodiversity function


Littoral zone of Pengxi River January 2008

Bird watching station in Hanfeng lake of Kaixian County September 2011

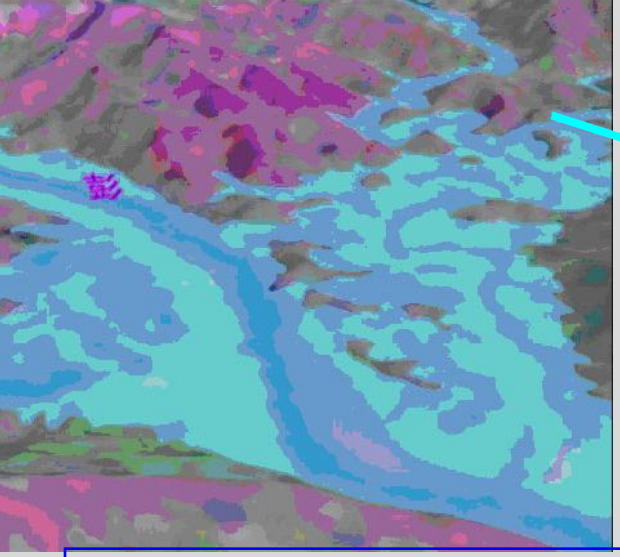
5. Approaches to optimizing ecological service functions

Ecological engineering applied within the littoral zone could potentially minimize impacts and enhance ecological services. This ecological restoration would improve ecosystem heath in the TGR by providing; soil stabilization, water quality treatment, biodiversity conservation and carbon sequestration.

Promoting techniques such as dike-pond and forested littoral zone engineering may encourage society to coordinate the protection and sustainable utilization of these wetlands.

Dike pond system engineering Laotudi Bay, Pengxi River

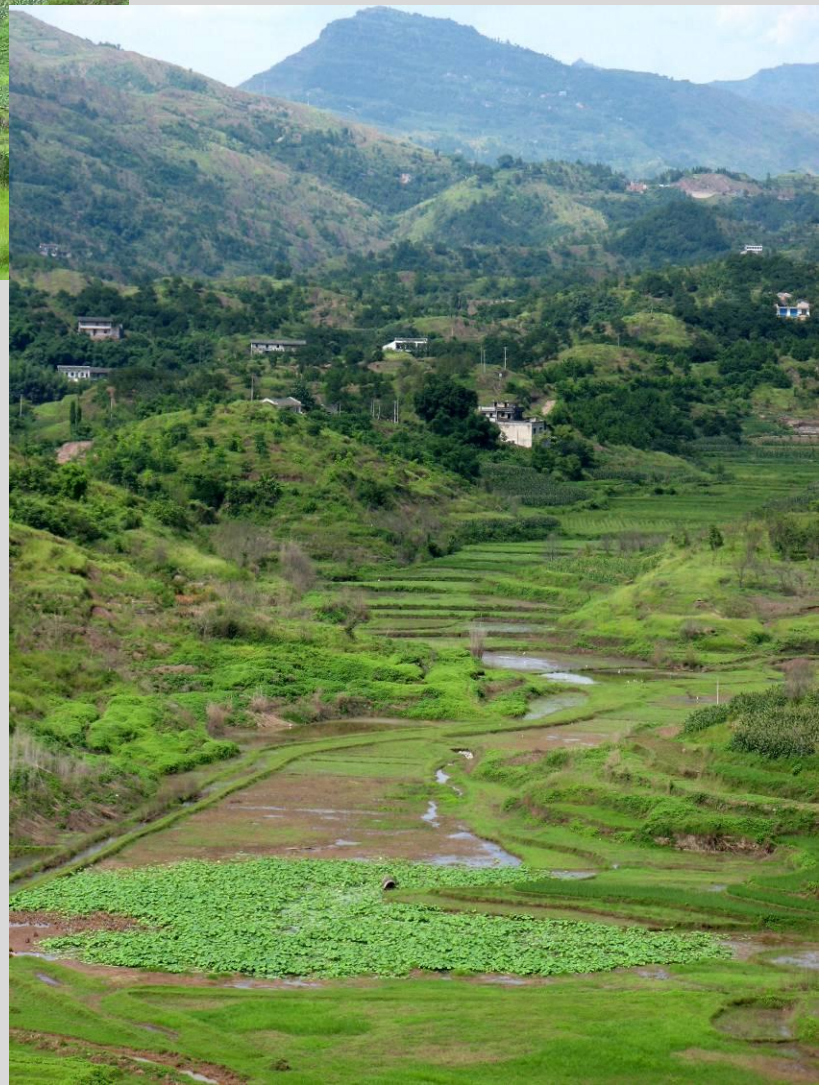
The dike-pond system is an important agricultural culture heritage in China. In a dike-pond system, economically valuable hydrophytes were planted in ponds where the selected plants should adapt to the widely fluctuating water levels and also sequester carbon.



dike-pond engineering

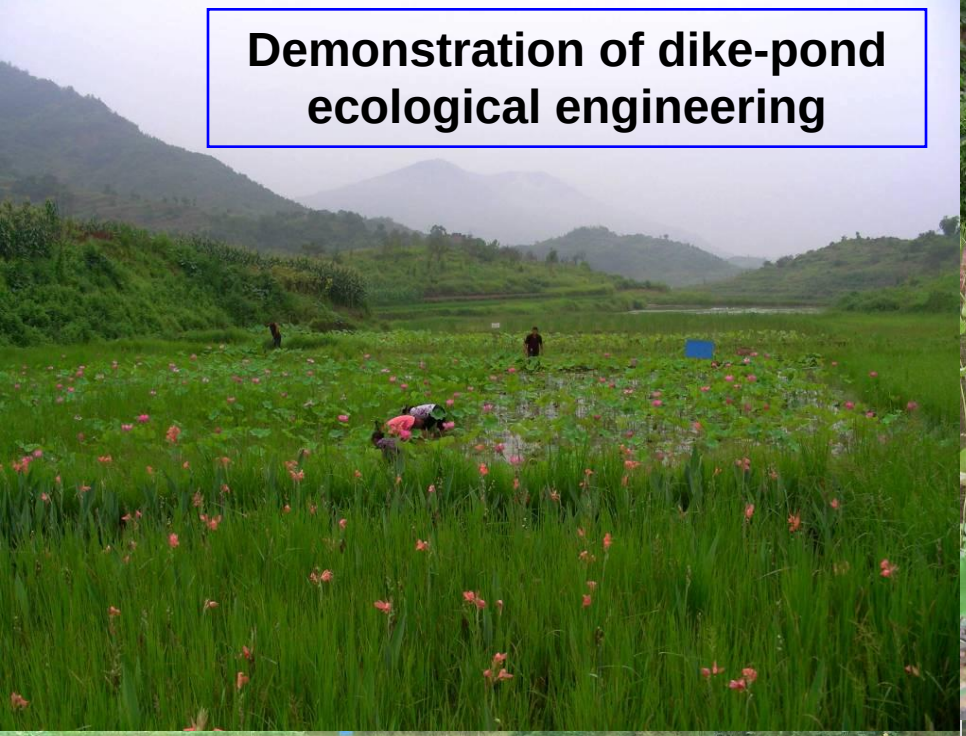
Using lessons learned from mulberry fish ponds in the Pearl River delta in Guangdong Province, ponds of different sizes, shapes and depth were excavated in the TGRLZ， then planted with hydrophytes and vegetable and crops.

dike-pond engineering

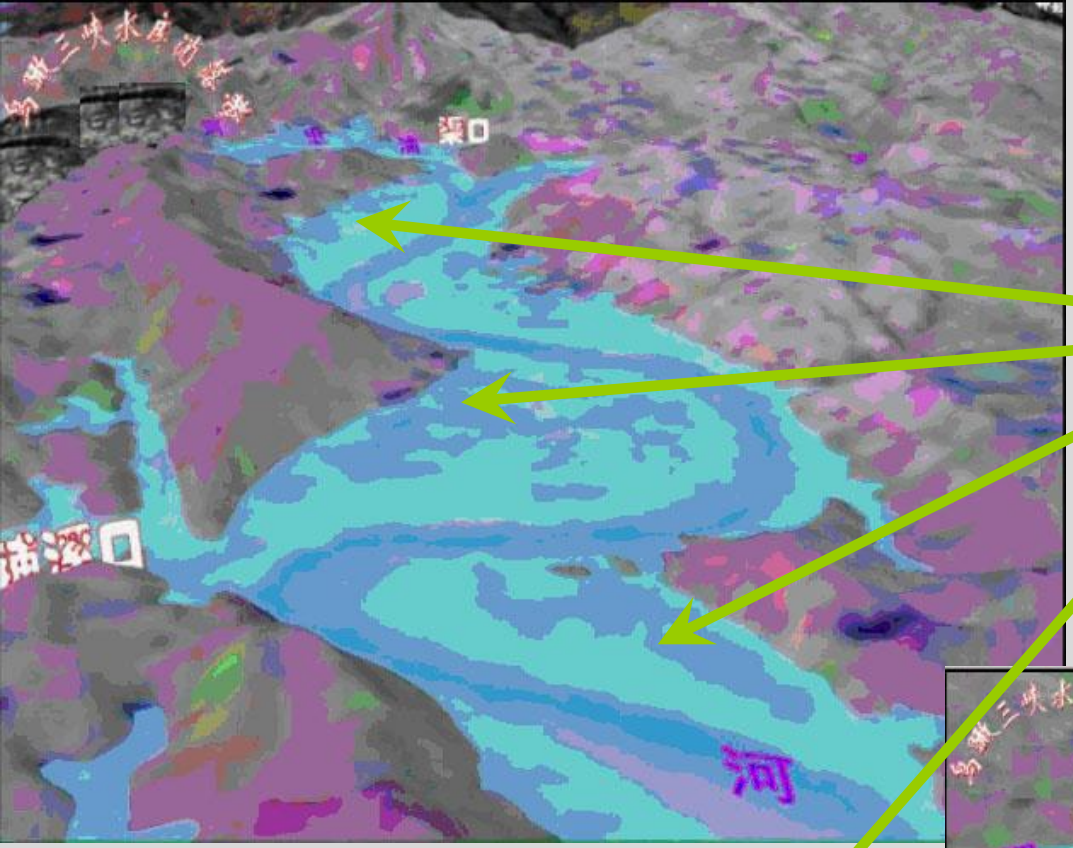


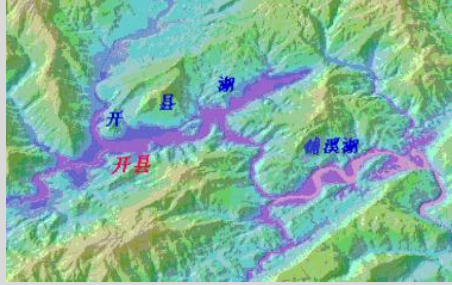
We believe this system of dike-pond wetlands is an important ecological buffer between the uplands and the reservoir and it has the capacity to reduce nutrient loading in the river system from adjacent uplands.

Demonstration of dike-pond ecological engineering

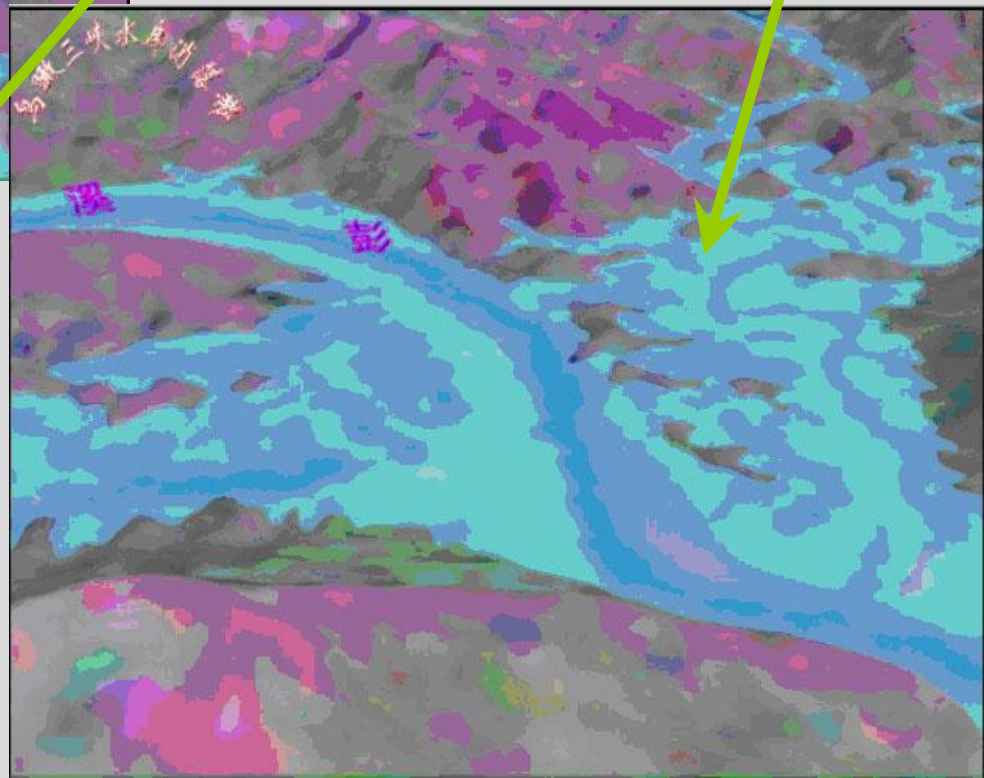


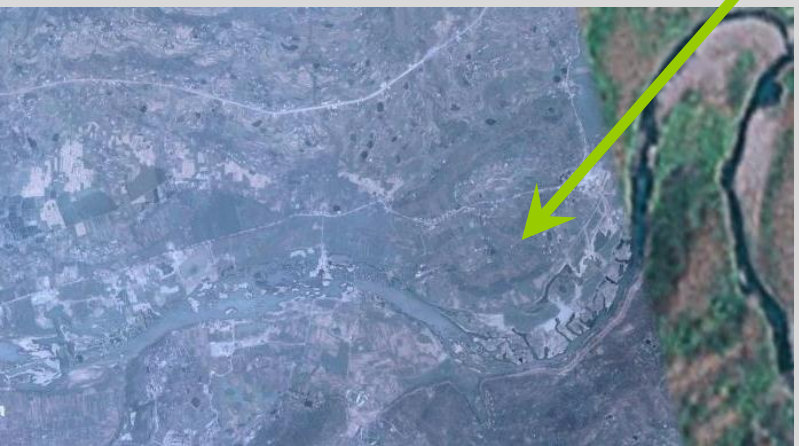
These hydrophytes were planted after water receded in early April and maintained using ecologically friendly management practices that forbid the use of fertilizer and pesticides. Crops are harvested before they are drowned.





Engineering forested littoral zones





Constructing forested littoral zones

Species evaluated for survival of winter inundation.

Glyptostrobus pensilis, Taxodium distichum, Taxodium ascendens, Ascendens mucronatum，Metasequoia glyptostroboides，Sapium sebiferum，Morus alba，Debregeasia orientalis，Lycium chinense Miller，Tamarix chinensis

Taxodium distichum

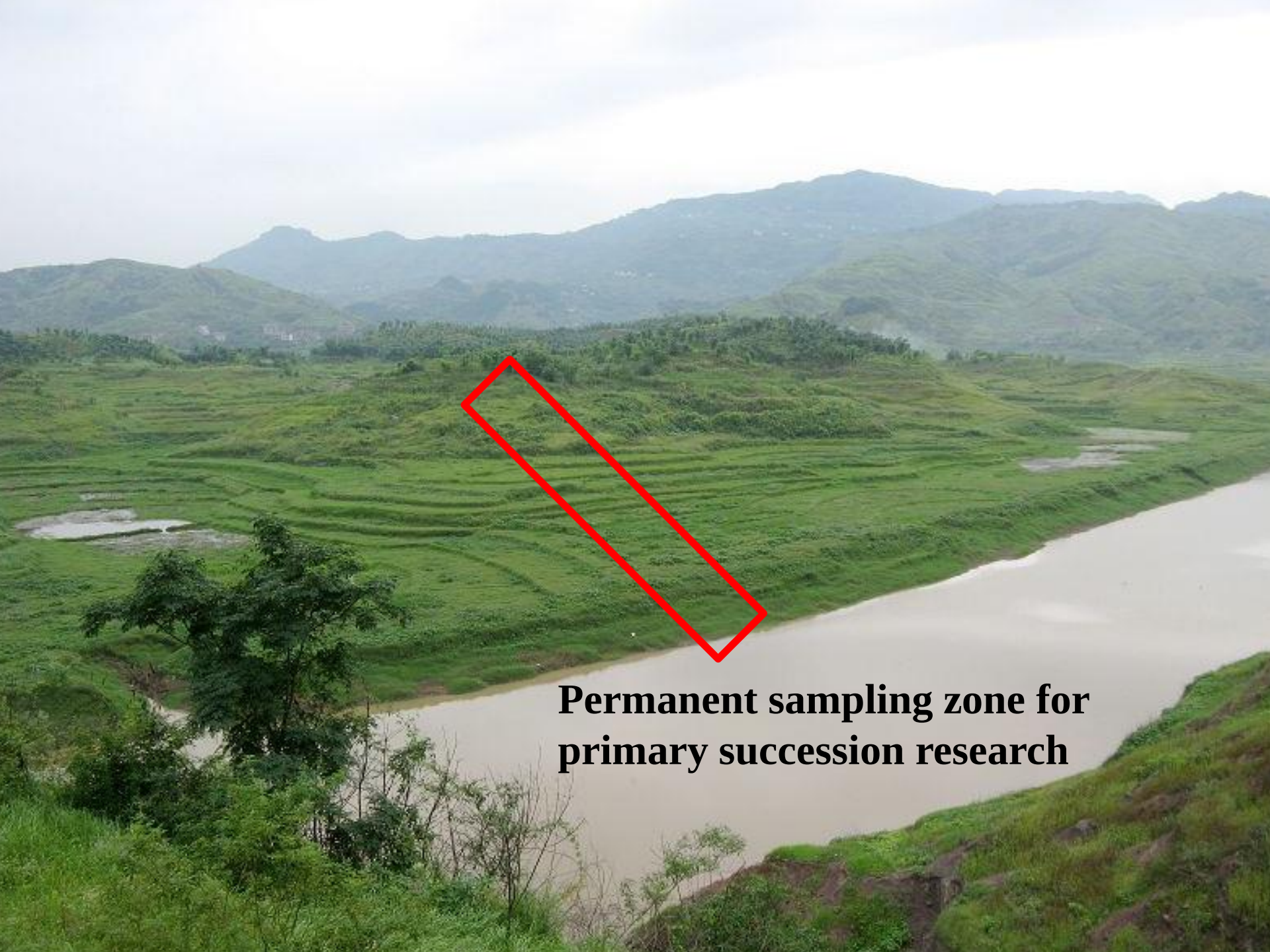
Complex ecological engineering of *Morus alba* and *Taxodium distichum*

★same site

Engineering of forested littoral zones

6. Future research opportunities

- **Studying the structure of littoral zone ecosystems and the interaction of ecological processes;**
- **Revealing the coupling mechanism of physical, chemical and biological processes of the littoral zone;**
- **Establishing the process of formation and succession of the littoral zone;**
- **Carbon sequestration and weak carbon source**
- **Evaluating natural selection and plant adaptation.**


Permanent sampling zone for
primary succession research

- **Understanding the drivers of wetland ecosystem evolution;**
- **Determine the control processes and drivers among various changing, eco-hydrological factors caused by water level fluctuation;**
- **Investigate wetland ecosystem responses to changing eco-hydrological cycles.**

Chinese and foreign experts at Penxi River Wetland Research Station

This is a good start for research cooperation. **October 23, 2011**

“如果你不改变，你将止步于原地”

“If you do not change direction, you may end up where you are heading

老子 （604-531BC）

中国古代思想家、哲学家

Lao Tzu, Ancient Chinese philosopher

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