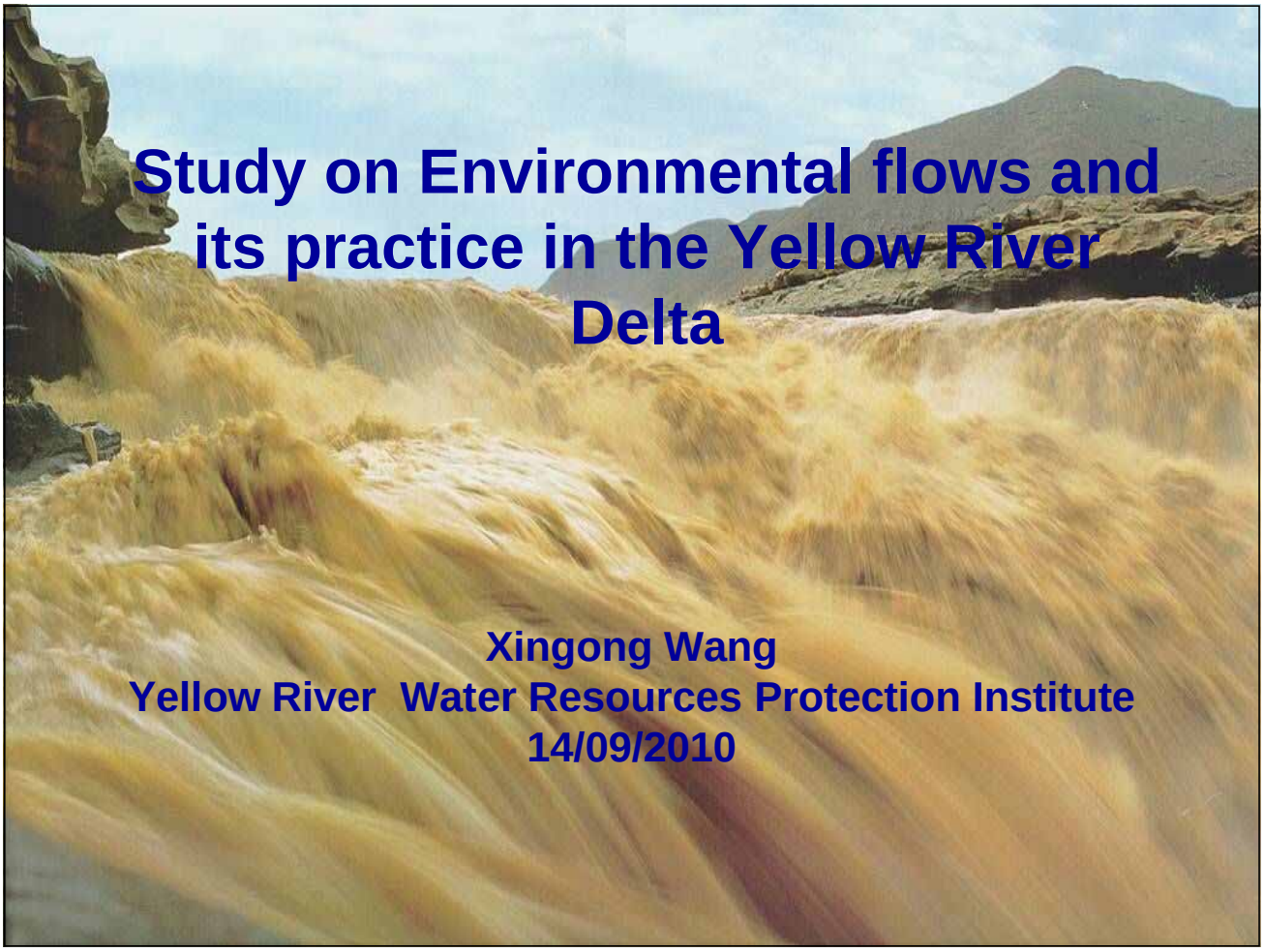
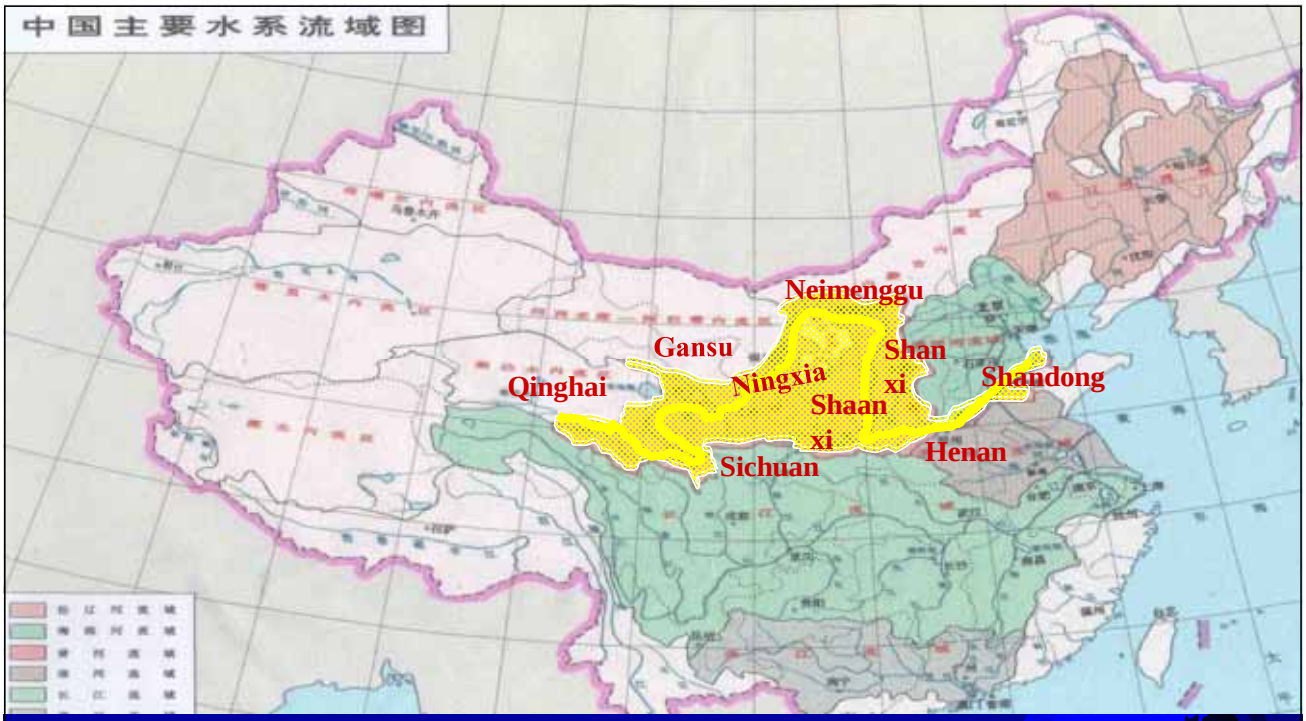


Study on Environmental flows and its practice in the Yellow River Delta

Xingong Wang
Yellow River Water Resources Protection Institute
14/09/2010

Outline

1. Background
2. Methodology
3. Research results
4. Practice of EFs
5. Conclusion

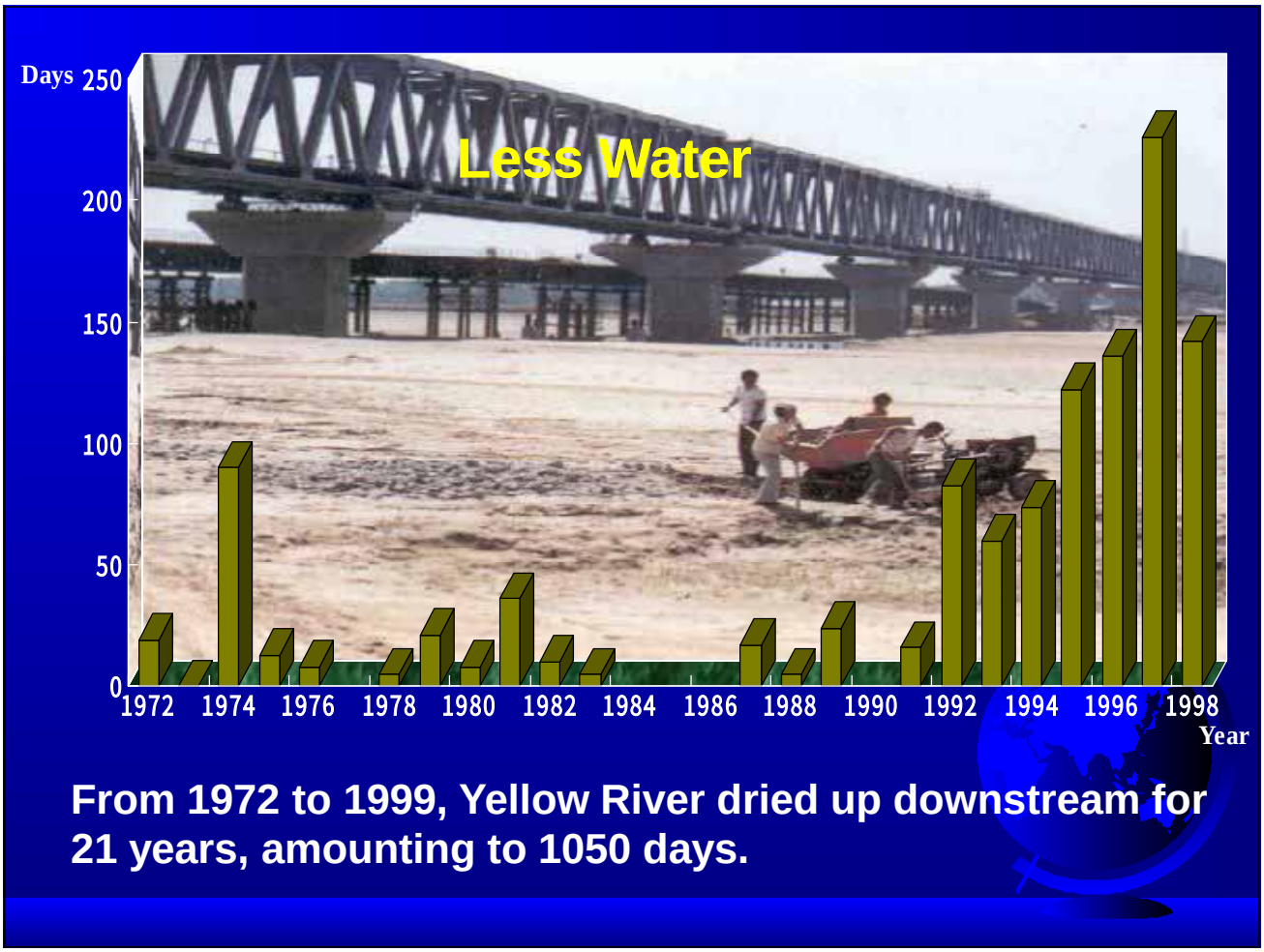


Yellow River in China is flowing through nine provinces, with a total length of 5,464km, basin area 795,000km^2, finally empties itself into the Bohai Ocean.

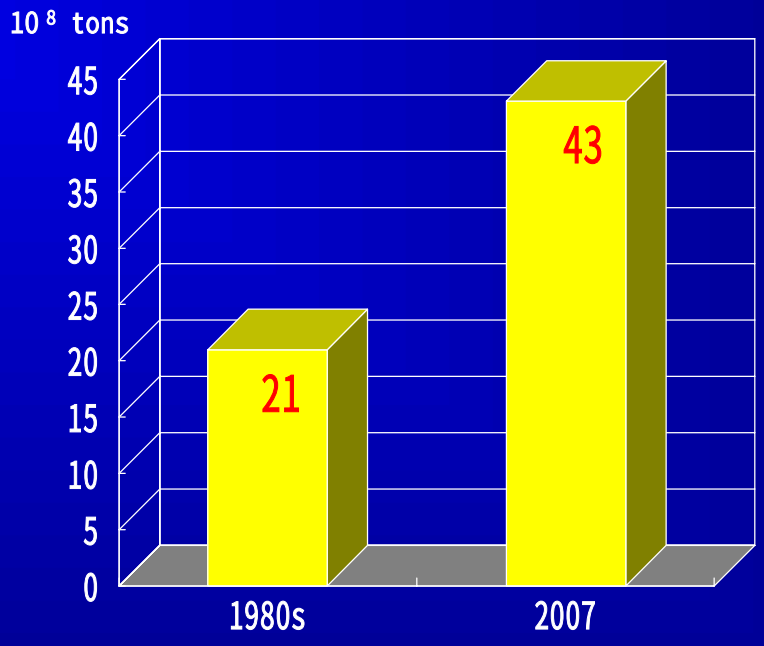
The main environmental problems

1. More water—Flooding (In the past)
2. Less water—Dry up
3. Dirty Water—Pollution
4. Turbid Water—High sediment
5. Changed Water (Regime)—Unsuitable to Aquatic Organism


More Water


Less Water
Days
250
200
150
100
50
0
1972
1974
1976
1978
1980
1982
1984
1986
1988
1990
1992
1994
1996
1998
Year
From 1972 to 1999, Yellow River dried up downstream for 21 years, amounting to 1050 days.

Dirty Water

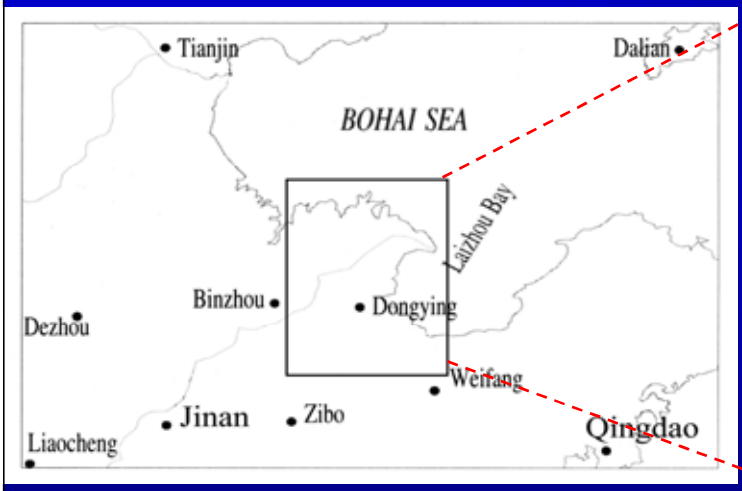


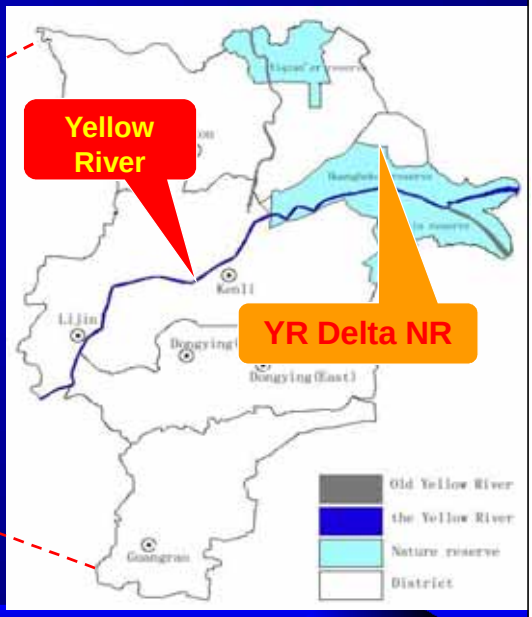
Wastewater into Yellow River

Changed Water

The present and planning hydraulic engineering of the YR

Yellow River Delta Nature Reserve

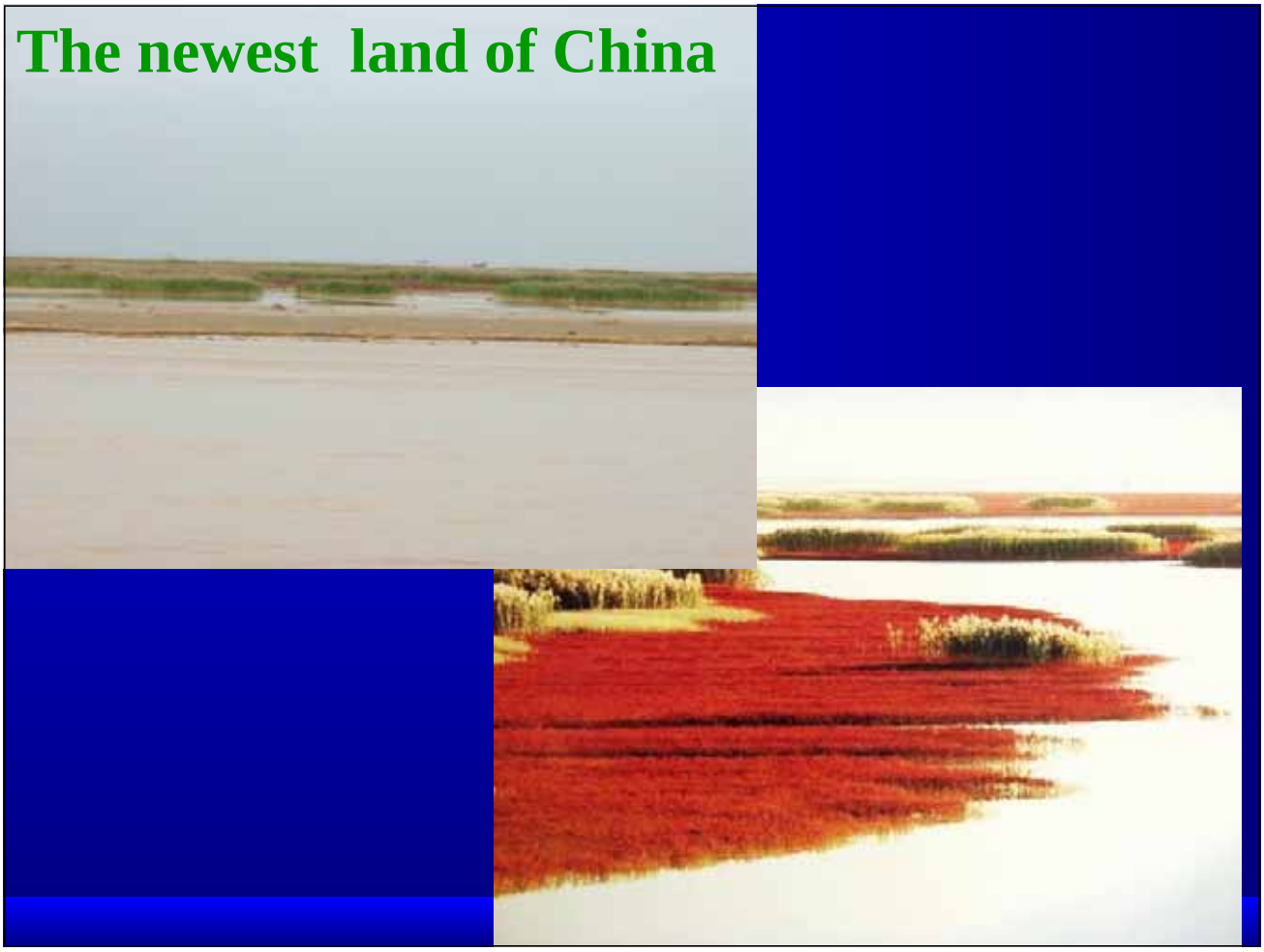




Migration routes in Eurasia

The nature reserve is an important staging, wintering and breeding site for birds in north-east Asia and around Pacific migration route.

The newest land of China



- MoU China – Netherlands on Water Management: focus on Yellow River
- YRD Environmental Flow Study implemented by YRCC, leading a consortium of Chinese and Netherlands experts

- Contract signed between Royal Netherlands Embassy and YRCC, in the presence of Prince Willem Alexander of the Netherlands on 17 October 2005 ZhengZhou

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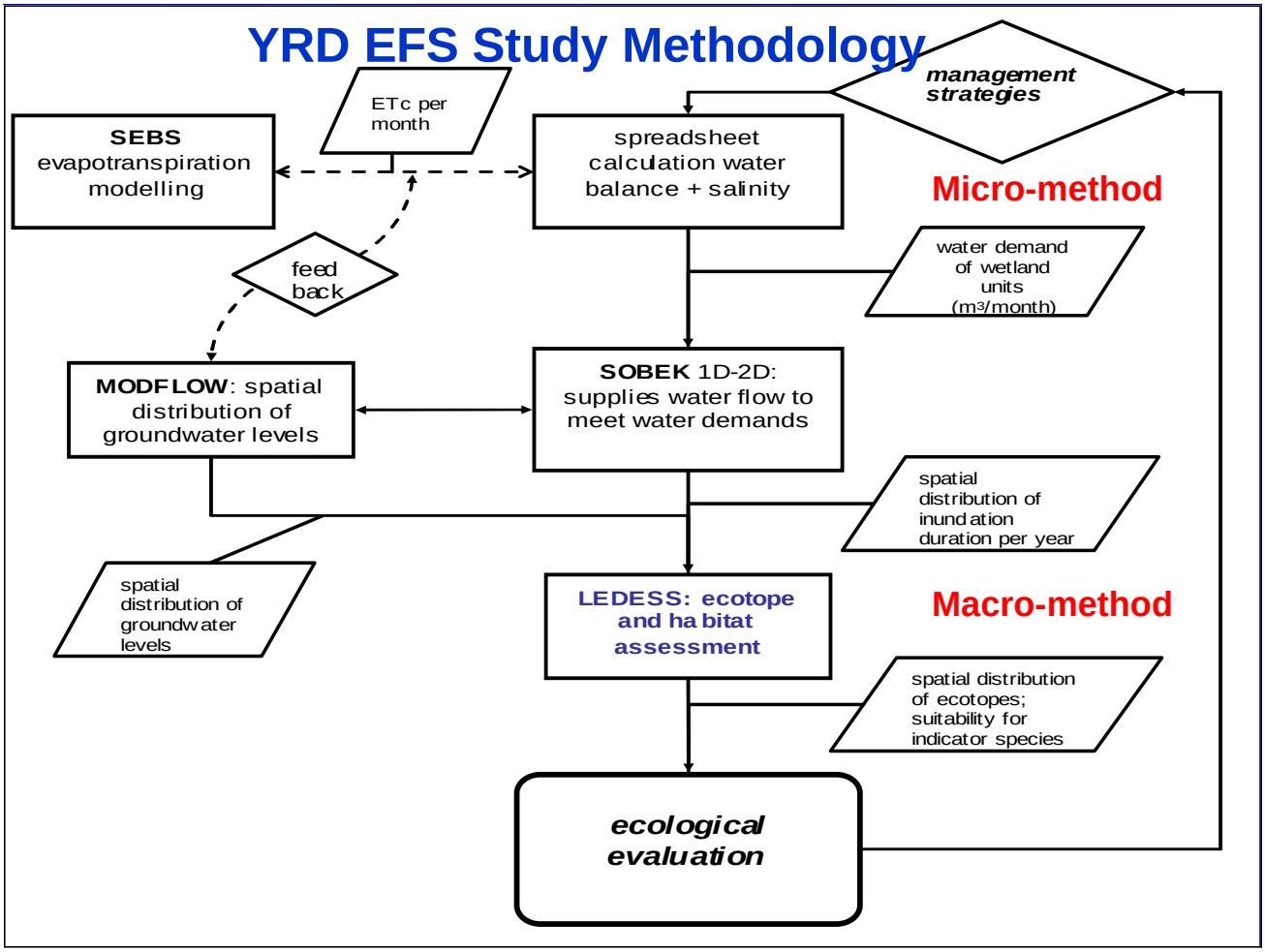
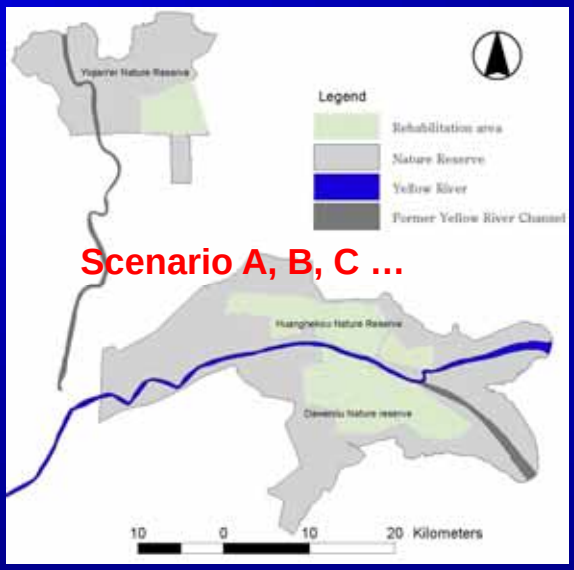


Methodology—4 key questions

- How many areas to be restored (Integrated method)
- How much water (EFs) do they needed (ET+ physiologic demands)
- How to evaluate the restoration results (SOBEK+MODFLOW+LEDESS)
- How to implement environmental flows

(Integrated water resources management and regulation)

Restoration area: 236km^2 –***Integrated method***
Objective: Fresh water reed wetlands (1992 level)



Scenarios Design

Scenario	Current0	Scenario A	Scenario B	Scenario C
Restoration area	3333ha	23600ha	23600ha	23600ha
Discharge month	3-10	3-10	3-10	3-10
Water quantity (10^8m^3)	**0**	**2.78**	**3.49**	**4.17**

Assessment standard—Landscape Ecological Decision & Evaluation Support System (*LEDESS*)

- Freshwater wetland area
- Indicator species numbers


Red Crown crane


Swan


Sauder's gull

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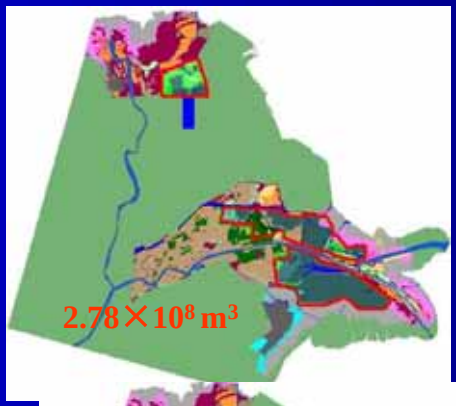
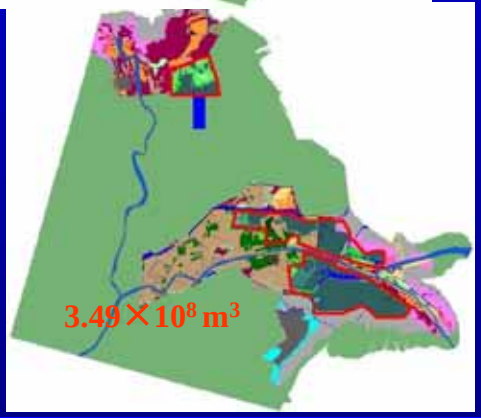
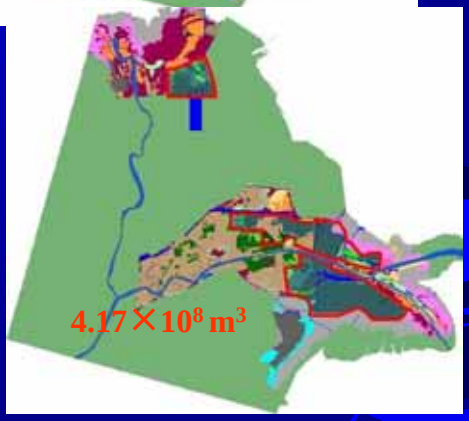
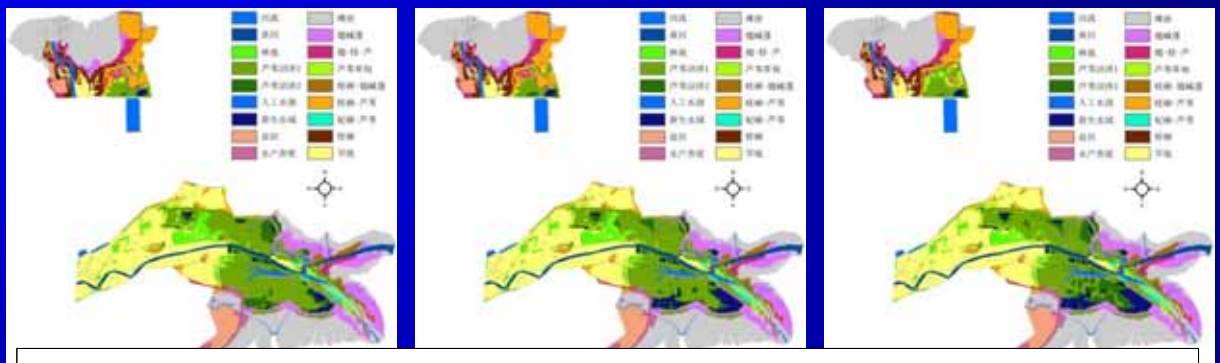
Hydrological results of water supplying

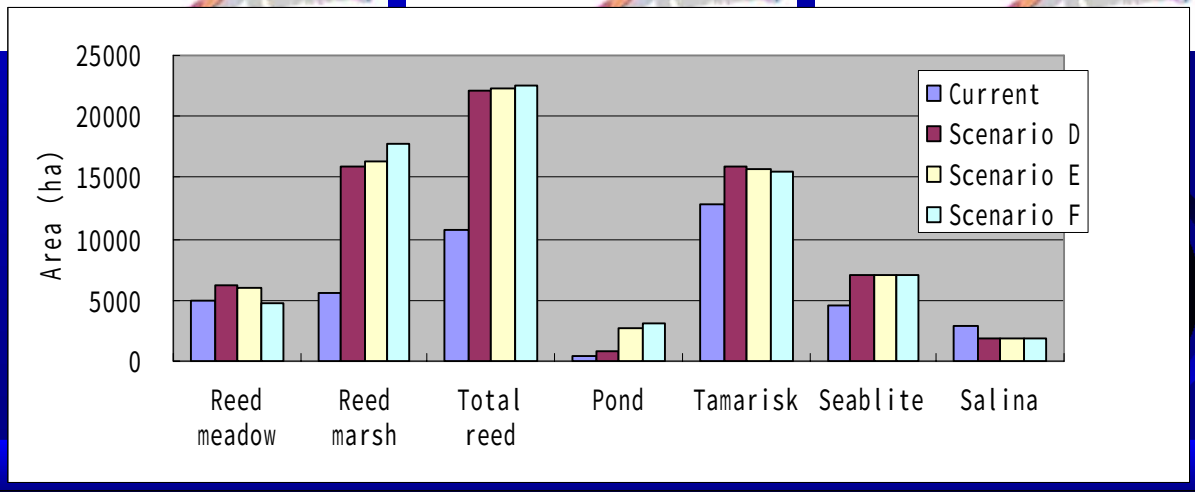






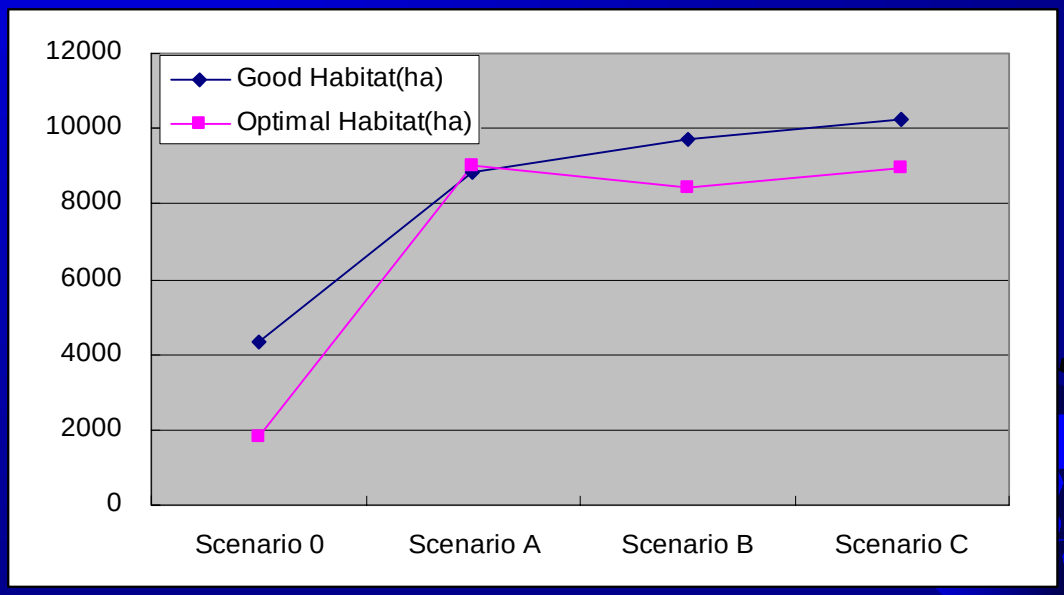
Wetland Restoration landscape modeling results





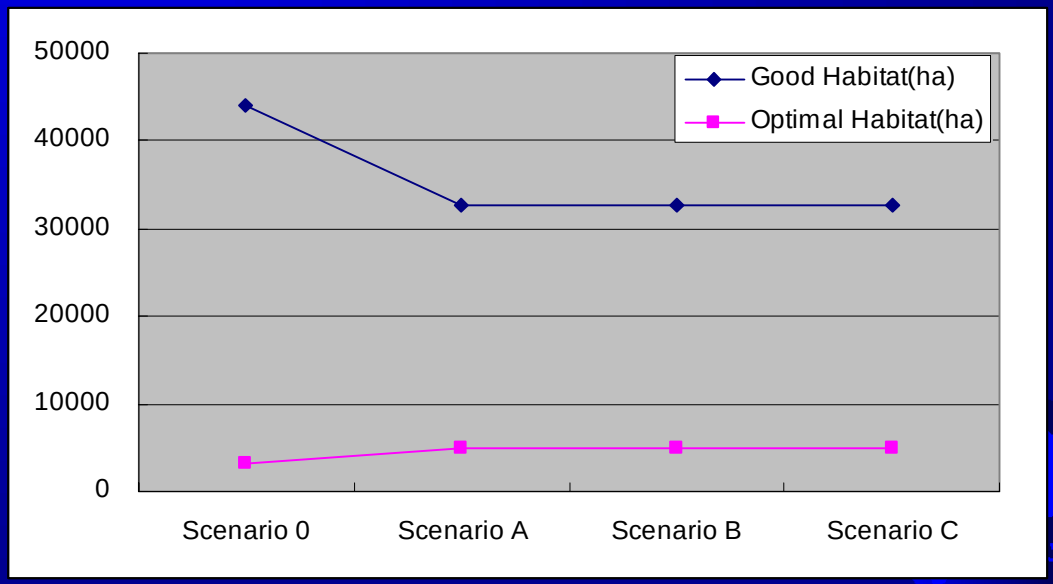
The number changing of indicator species

Red Crown Crane



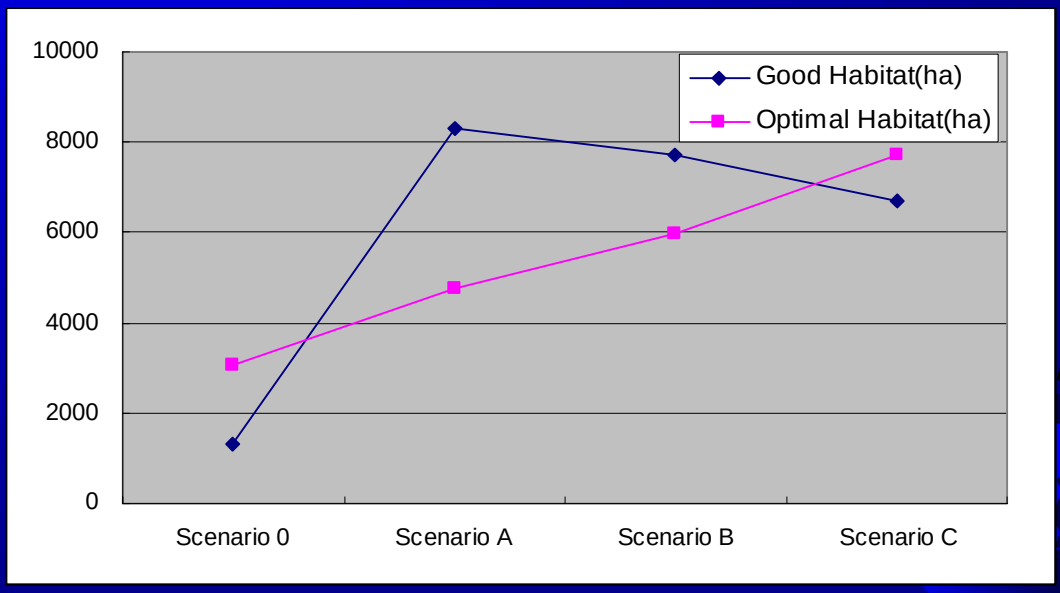
The number changing of indicator species

Sauder's gull



The number changing of indicator species

Swan



All scenarios can notably increase reed area through replenishment fresh water to the wetland., the landscape pattern changed a lot. Former reed meadow wetland evolved to reed marshes after 5 years, which are extensively distributed in the demonstration area. As for YRD, large area ponds formed by scenario B and C have important ecological values in sustaining wetland water balance. Besides, ponds are optimal habitats for most swimming fowl like Red Crown Crane, Sauders' gull and swans. But it is not the more water quantities we discharged, the better outcomes we can get for reed wetlands restoration.

Stakeholders' meeting





2008, Dong ying, Shangdong, China

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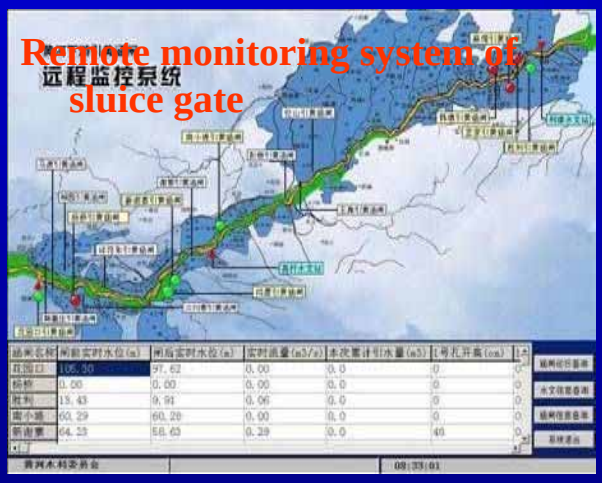
➢**Integrated management and regulation of water resources-** Guarantee enough water to flow into Delta



➢**Recharging water to important wetlands**

Keep landscape integrity and avoid fragmentation

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◆ Big rivers' restoration should be consider at a basin's and macroscopic perception.
◆ Landscape ecology approaches are good ways to solve complex problems in ecosystem management.
◆ Environmental flows, as one of essential elements of sustainable water resources management, is playing an important role on keeping rivers' healthy life.
◆Optimizing big Reservoirs' operating mode and implement ecological regulation is a basic method to restore the Yellow River ecosystem.


Thank you for
your attention