Ecosystem Services of Wuliangsuhai Lake

Case study from Inner Mongolia, China

Köbbing, Jan Felix; Thevs, Niels (Institute of Botany and Landscape Ecology, University of Greifswald, Germany

6th Sino-German Workshop on Biodiversity Conservation
TEEB for Cities and Urban-Rural Interactions
15-18 July 2013- Bonn, Germany

Kurt-Eberhard-Bode Stiftung
Stifterverband
für die Deutsche Wissenschaft

Ernst Moritz Arndt Universität Greifswald
Institut für Botanik und Landschaftsökologie

中国环境科学研究院

1. Introduction SuWaRest (I)

- **Su**stainable **Wa**ter management and wetland **Rest**oration in continental-arid Central Asia (SuWaRest)
- Special regard to water management, ecosystem services (reed, water purification) and wetland restoration

I: Ecosystem quality of wetlands and wetland restoration in the settlements (University Bozen)

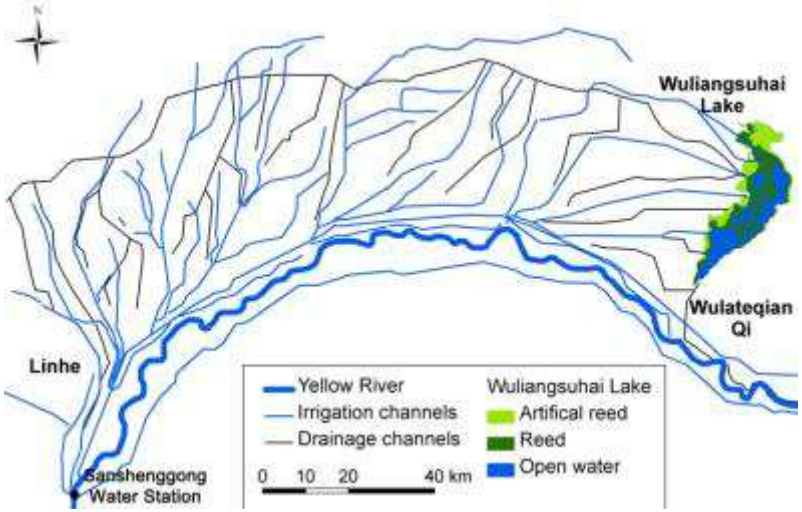
II: Use of biomass in settlements (University Bozen)

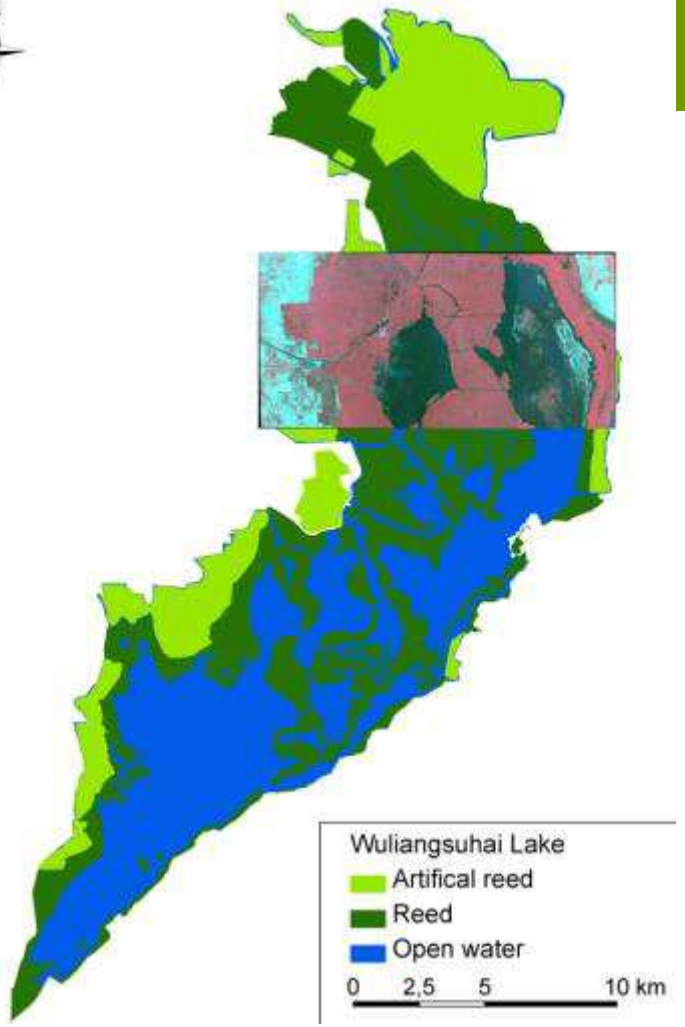
III: Water pollution and purification (University Bozen)

IV: Water and wetland management, common reed (Phragmites australis) utilization and remote sensing (University Greifswald, Thevs & Köbbing)

V: Water cultures and water management schemes (University Kiel)

2. Hetao area & Wuliangsuhai Lake





2. Hetao area & Wuliangsuhai Lake

- Hetao irrigation area (600.000 ha) and Wuliangsuhai lake (29.300 ha)
- Hetao is an important agriculture production basis
- Annual precipitation is 215 mm, annual evaporation is 2200 mm
- The lake is highly polluted through drainage water
- More that 50% covered by reed, the „open water“ is covered by submerged vegetation
- Risk of algae bloom and converting to a marshland

3. ESS of Wuliangsuhai Lake

- Provisioning (food, fibre & fuel, medicine)
  - **Reed**: 11,5 million (1,4 Million €) CNY net operation income from paper making (2012)
  - Typha harvest: 600,000 CNY net income for mat making (2003)
  - Submerged vegetation (*Potamogeton)*
  - Fish catching: /
  - Aquaculture in ponds: /

Source: Barton 2005; Shen 2005

3. ESS of Wuliangsuhai Lake

- Regulating (water purification & waste treatment, prevention of desertification, habitat)
  - Water storage for downstream in March (300 million m^3): worth 90-150 million CNY (opportunity costs)
  - Water purification
- Cultural (recreational, aesthetic)
  - Recreational value: 7 million CNY (2003) (contingent valuation method)
  - Biodiversity (bird migration/ habitat)
- Supporting (nutrient cycling)

= > They are threatened by water overutilization, pollution and reclamation for agriculture

Source: Barton 2005; Shen 2005

3.1. Provisioning services of Wuliangushai Lake (Quantitative & Monetary)

- Focus: common reed (*Phragmites australis*) utilization
  - Reed harvesting is important for local livelihood. 110.000 tons of reed harvested annually for paper production
  - Around 2500 employees and 300 hired workers in the winter season
  - Market demand is necessary to ensure the harvesting and maintain the ecosystem. At the moment the demand from pulp market is decreasing
  - 11,5 million (1,4 Million €) CNY net operation income

3.1. Provisioning services of Wuliangsuhai Lake

- Utilization possibilities of reed
  - Industrial
    - Thatching
    - Construction
    - Pulp & Paper
    - Polymerisation
  - Energy
    - Combustion
    - Biogas
    - Bio-fuel
  - Agriculture
    - Fodder
    - Fertilizer

Source: www.his-reet.com

3.2. Regulating services of Wuliangsuhai Lake

- Purification
  - Harvesting of aquatic plants can be one way to extract nutrients from water
  - By transferring air and uptake of nutrients in the biomass
  - It can prevent „second pollution“ through decomposing biomass
  - Moreover, it can have beneficial effects for the vegetation
  - The utilization of wetlands plants can contribute to local livelihood (see above)

3.2. Regulating services of Wuliangsuahi Lake (Quantitative)

Year	Water-In	Water-Out	P-In	P-Out	P cut in the reed	N-In	N-Out	N cut in the reed
	Mio $m^{3/}$ year		Ton/year					
1998	618	126	189	2	**26**	689	13	**318**
2001	464	40	143	29	**24**	2,217	442	**294**
2007	482	4	265	44	**24**	3,143	331	**299**
1998-2009	534	114	183	27	**26**	2,291	253	**301**

- Water evaporation is app. 400 million m^3 per year
- Reed harvesting is around 100.000 and removes 36 tons (0.2 kg/t) of phosphate and 300 tons (3 kg/t) nitrogen annually
- Harvest in summer can removal more than four to five times the nutrient

4. Discussion & Conclusion

- Aim of SuWaRest:
  - Valuing ecosystem services
  - Water management scheme incl. Hetao irrigation area
  - Providing recommendations
- Wuliangsuhai provides many significant services. Its especially crucial in this arid area
- Reed use is significant for local livelihood and
- Reed harvesting is important for water purification and lake maintenance.
- Reed can play a possible role in the supply of raw material

References

- Barton, David N. (2005). Economic analysis of the value of water in alternative uses in the Lake Wuliangsuhai catchment, Inner Mongolia, China
- Barbier, Edward; Acreman, Mike; Knowler, Duncan (1997). Economic Valuation of Wetlands- a guide for policy makers and planners
- Burian, K. (1971). Primary production, carbon dioxide exchange and transpiration in phragmites communis trin. On the lake Neusiedler See Austria
- Shen (2005). Economic Valuation of Alternative Water uses in Hetao Basin
- Zhao, W; Hu, G; Zhang, Z; He, Z (2008). Shielding effect of oasis-protection systems composed of various forms of wind break on sand fixation in an arid region: A case study in the Hexi Corridor, northwest China
- Xin-Rong Li; Hong-Lang Xiao; Jing-Guang Zhang Xin-Ping Wang (2004). Long-Term Ecosystem Effects of Sand-Binding Vegetation in the Tengger Desert, Northern China

Kurt-Eberhard-Bode Stiftung
für medizinische und naturwissenschaftliche Forschung
Stifterverband
für die Deutsche Wissenschaft

Ernst Moritz Arndt Universität Greifswald
Institut für Botanik und Landschaftsökologie

中国环境科学研究院