Geophysical Research Abstracts
Vol. 14, EGU2012-637, 2012
EGU General Assembly 2012

Incorporation of Complex Hydrological and Socio-economic Factors for Non-point Source Pollution Control: A Case Study at the Yincungang Canal, the Lake Tai Basin of China

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It is increasingly realized that non-point pollution sources contribute significantly to water environment deterioration in China. Compared to developed countries, non-point source pollution in China has the unique characteristics of strong intensity and composition complexity due to its special socioeconomic conditions. First, more than 50% of its 1.3 billion people are rural. Sewage from the majority of the rural households is discharged either without or only with minimal treatment. The large amount of erratic rural sewage discharge is a significant source of water pollution. Second, China is plagued with serious agricultural pollution due to widespread improper application of fertilizers and pesticides. Finally, there lack sufficient disposal and recycling of rural wastes such as livestock manure and crop straws.

Pollutant loads from various sources have far exceeded environmental assimilation capacity in many parts of China. The Lake Tai basin is one typical example. Lake Tai is the third largest freshwater lake in China. The basin is located in the highly developed and densely populated Yangtze River Delta. While accounting for 0.4% of its land area and 2.9% of its population, the Lake Tai basin generates more than 14% of China's Gross Domestic Production (GDP), and the basin's GDP per capita is 3.5 times as much as the state average. Lake Tai is vital to the basin's socio-economic development, providing multiple services including water supply for municipal, industrial, and agricultural needs, navigation, flood control, fishery, and tourism. Unfortunately, accompanied with the fast economic development is serious water environment deterioration in the Lake Tai basin. The lake is becoming increasingly eutrophied and has frequently suffered from cyanobacterial blooms in recent decades.

Chinese government has made tremendous investment in order to mitigate water pollution conditions in the basin. Nevertheless, the trend of deteriorating water quality has yet to be reversed. At least two factors contribute to the dichotomy between huge investment and limited results. First, the majority of the efforts have been limited to engineering approaches to water pollution control, ignoring the important roles of non-engineering approaches and stakeholder participation. Second, the complex hydrological regime of the basin may aggravate the impacts of various pollutant sources. Using the Yincungang canal, one major tributary to the Lake Tai, as an example, we discuss our work on both hydrological and socio-economic factors affecting the water quality of the canal, as well as the grand challenges of coupling hydrological systems and socio-economic systems in the region.

Keywords
non-point source pollution, rural sewage, agricultural pollution, spatio-temporal pattern, stakeholder participation