Research on Ecological Safety and Utilization Pattern on the Lower Reaches Wetland of the Yellow River in Kaifeng City

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Abstract

Wetland, located in the terrestrial-aquatic transverse zone, is an important landscape and ecosystem. This paper describe the features and functions of wetlands, and take the case of lower reaches of the Yellow River wetlands, analysis on existing problems of ecological safety on wetland in lower reaches of the Yellow River. Using of GIS and two-dimensional water-sediment mathematical model of the Lower Yellow River, in accordance with the requirement of wetland areas, submerged areas for floods of below the 8000m3 /s magnitude designated as different functional areas. The ideal patterns of ecological security on the wetlands are divided into the core zone, buffer zone and experiment zone.

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Introduction

Wetlands are areas of marsh, fen, peat-land or water, whether natural or artificial, permanent or temporary, with water that is static or flowing, fresh, brackish or salt, including areas of marine water the depth of which at low tide does not exceed six meters[1]. Wetland shave huge environmental functions in maintaining ecological balance and regional stability due to their particular characteristics in hydrology, soil, and plant, as well as landscape ecological structures[2]. In the ecosystem wetland functions significantly in regulating climate, preserving and controlling water sources purifying water body, conserving soil and water, producing biomass, protecting biodiversity and wildlife habitats, and serving educational and recreational tourism, etc[3]. The ecological Benefits generated by wetlands mainly in the adjust flood, disaster prevention; degradation of pollutants and other benefits, and provide humanity with a rich animal and plant products[4]. It is not only the life and production of human offers a variety of resources, but also has significant environmental features and benefits, known as "kidney of the
earth”[5]. As long has not been aware of the importance of wetlands, combined with protection and management capacity is weak, still a lot of wetland has cultivated and random occupied in many places. Especially in recent years, the total area, the patch number and other index of wetland reduced obviously and the area of the marsh wetland decreased most obviously[6]. As soon as possible to reverse situation that the wetland area reduced and degradation of ecological functions, give full play to the role of wetland resources, so the resolute protection, rational development and utilization of wetland resources is an urgent need to study and solve problems in current and future periods.

Case study area and Data sources

Case study area. The Kaifeng Yellow River Wetland case study area is located in the middle of the Yellow River embankment. It is bounded on the south and north by the Yellow River embankment, on the north by the Yellow River water’s edge, on the west by the junction of HuihuiZhai of Shuidao Township and Zhongmou County, and on the east by the junction of Yuezhai of Guying Township of Lankao County and Shandong province. The straight-line length of the first section of the Kaifeng Wetland, comprising the Ming and Qing’ old river course, is about 52 km; the river channel is that of a typical, wide and shallow, wandering river with a distance between banks of 5.5-12.7 km and a river channel of 1.5-7.5 km in width. Below the first section, from the Lankao east groin head, the following length is about 7 km, and is the river section formed by the Tongwaxiang changing its channel and occupying the Daqing river channel in 1855; the distance between the two banks is 1.4-20 km, and the river channel is 1.0-6.5 km wide [7].

Data sources. Geographic Information System (GIS) mapping technologies were applied to remote sensing (RS) images obtained by the Thematic Mapper (TM) satellite to extract the river flood transit fringe line for October 16, 1992, September 29, 1994, August 17 and October 4, 1996, September 7, 2002, October 24, 2003, September 22, 2004, April 7, 2006 and June 29, 2007. Using the June 26, 2006 (3700m³/s) TM image as background data, the map of these flood regimes in four typical years during this nearly 20 year period is mapped. Then, floods of different orders of magnitudes were simulated using a two-dimensional water-sediment mathematical model of the Lower Yellow River. These data were then superimposed on the maps of the flood transit region over the past 20 years, and 1:50,000 scale maps were produced showing the pattern of submerged areas for floods of different orders of magnitude (Figure 1).

Fig.1 Superpimpose map of wetland in lower reaches of Yellow River for different orders of magnitude of flow

Statistic on current status of wetland use. Using the superimposed map produced above, the water level
line for the 4000m³/s flow was drawn on a 2007 SPOT2.5 remote sensing image, which was then overlain on a 1:10,000 land use map for 2005 to produce a current (2007) 1:10,000 land-use map. Six types of land use were identified (cultivated land, forest land, garden plots, wild land, residential quarters and industrial-mining land, and unused wetland) and their areas classified and calculated by pixels’ feature from field survey and remote sensing mapping. Based on these statistics, the total land area of the Kaifeng Yellow River Wetland is 11139.60 hectares.

Problems of ecological security in Kaifeng Yellow River wetland

The Kaifeng Yellow River wetland ecological environment is very fragile, because of the huge wetland ecosystem services, wetlands to be the areas of human activities intensely and develop strength. However, due to irrational use of wetlands, the number of wetland resources reduce, both of the quality of ecosystem services and the biodiversity are become lower. These have seriously affected the sustainable development of wetlands and use. Reclamation and occupation of random phenomena such as severe lack of funds for construction, pollution and so on are seriously. Use of wetlands and protection of ecological security mainly in the following aspects:

Ecological functions decline and sharp drop in wetland area. Cultivated farmland and urban development is the main reason for reduction of wetland area currently. Blind reclamation of agricultural land and change the use of natural wetlands and natural wetlands occupied by urban development, Lead to the natural wetland area reduce and functional decline directly. Regional ecological environment is very fragile, habitat degradation and ecological dysfunction in wetland. As parts of the wetland were reclaimed for farmland; some places there the wet land for construction of the trend. In addition, sediment deposits also lead wetland area to shrink. Many small reservoirs due to sediment deposit and scrapped. The Yellow River carried 1.6 billion tons of sediment into the downstream every year, leading to severe channel situation and wetland area reduced further.

The transition of wetland resources exploitation, water quality deteriorate. Wetlands are a major source of industrial and agricultural water and domestic water, the transition and unreasonable use of water has affected water supply seriously. Because of the transition from water or groundwater exploitation of wetland, Hydrology of wetlands in some areas poses a serious threat. Therefore, many wetlands along the banks have been destroyed or disappeared, instead by farmland or residential land. The reduce issues on wetland water resources both the over-exploitation, and causing problems of the loss of waterfowl habitats and irresolute swim passage on fish. Result in different influence of biological diversity, ecological flows and water quality.

Unreasonable utilization decline and serious pollution in wetland. Unreasonable use patterns, including reclamation, water discharge, urbanization and so on. A large number of industrial and agricultural wastewater, sewage discharge and the development of oil and gas resources, serious pollution and damage to the wetland ecosystem, wetlands reduce the variety of values. Water Conservation was severe recession and agricultural production caused non-point source pollution is still increasing by excessive use of fertilizer and pesticide, the lack of integrated watershed management, wetland ecological environment deteriorate.

The lack of scientific protection. The Yellow River wetland within Kaifeng City has high population density, and frequent human activities, reduction or disappearance of the lake water and wetland plants. So, capacity-building of nature protection management needs to be improved. Particularly, aiming to increasing economics income, the existing most of land use planning failed to fully understand the special and vulnerability on wetland, let alone biodiversity and wildness wetland protection. Under these conditions, scientific wetland protection planning was certainly omitted.

Utilization division of ecological security
Obeying our national Nature Reserve Regulations and Water law, considering the characteristics and the current problems of Yellow River Wetland, the following wetland zoning and management system are proposed (Figure 2).

Fig. 2 Ecological safety and utilization pattern for different orders of magnitude of flow on wetland

The core zone. This band is closest to the main river channel, extending approximately 100-250m from the 4000 m$^3$/s flow water line which is the core area of the Yellow River wetlands. Prohibit any form of exploitation and utilization in this area. Just for resting place for animals without prejudice to the eco-conservation activities.

The buffer zone. This zone is located outside the core zone, roughly between the 4000 and 6000 m$^3$/s flow water levels. The use of these beaches is basically safe if it can be controlled and used according to the "farmland" standard. Large areas of land within the region are appropriate for farming and can play multiple roles in exploiting and using within measure, maintain actuality. The better environment of existing wetlands must be to strengthen the protection, comprehensive treatment on ecological environment deteriorated and ecological functions degraded in wetlands, using measures of restorative and rehabilitation to restore the original structure and function of wetlands gradually, to achieve wetland resources protect and sustainable use.

The experiment zone. This zone is located outside the buffer zone, approximately between the 6000 and 8000 m$^3$/s flow water levels. The area is stable all year, with thick soil, few villages, and sporadic distribution of agriculture production facilities. It provide for the animals resting place without affecting the ecological protection activities.

At the same time, the advantages of less land pollution of the Yellow River wetland area can be obtained if the forms of agricultural production established in this area are based on organic agriculture, green food production, ecological agriculture and high-quality raw material supply.

Summary

Although the paper analyzed on problems of the development and protection for the wetland resources and proposed the corresponding countermeasures, but the face of population growth and economic
development, development and protection of wetland resources will be a greater challenge. In the development and utilization of wetlands, innovative optimal use patterns for the development and protection must be followed.

Acknowledgements

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