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Review

Status of wetlands in China: A review of extent, degradation, issues and recommendations for improvement

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ABSTRACT

The total area of wetlands in China is 53.42 × 10^6 ha, accounting for 10% of global wetlands and 5.58% of China's territorial area. Wetlands in China are constantly under serious threat from multiple influencing factors. A large number of wetlands have been destroyed and degraded since the 1950s. During past decades, China has already recognized the importance of wetland ecosystems and made many efforts in wetland conservation. More than 550 National Wetland Nature Reserves and 100 National Wetland Parks have been established. However, in the context of so much effort being done, the annual wetland disappearance rate is still close to 1%. In this paper, the current status of wetland resources was reviewed, and the impact factors of wetland degradation were discussed. We further discussed the weaknesses of the current management system. Furthermore, some key recommendations for improvement of wetland protection and management for China were given. These recommendations include: improve special laws and regulations regarding wetlands, establish specialized management agencies; strengthen wetlands research and monitoring; and enhance public wetland conservation awareness.

Contents

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1. Introduction

Wetlands play an important role in maintaining ecosystem functions globally. Known as the most valuable natural ecosystem type that significantly supports wildlife habitat, wetlands not only provide food, water and shelter for fish, birds and other wildlife (Costanza, 2006), but also provide important ecosystem services such as water quality improvement, flood abatement and carbon sequestration (Tiner, 2010). The wetland's purification function is very significant. More than 1000 kg of nitrogen and 130 kg of phosphorus can be removed in every hectare of wetland per year. Peat storage in wetlands plays an important role in the response to climate change. The wetlands, which accounts for 6% of the earth's land area, has a total of about 770 billion tons of carbon, accounting for 35% of the terrestrial ecosystem carbon storage, of which 500 billion tons of carbon are stored in the peat wetlands. For example, in Ruoergai wetland, about 8 million ha, store up to 1.9 billion tons of peat, an average of 4130 tons per hectare. This means that the destruction of 1 ha of wetlands will be result in an increase of carbon dioxide emissions of 15 thousand tons. Scientific definition is the basis of wetland management and protection. However, there is much disagreement concerning the definition of wetland. Ramsar Convention on Wetlands, which is an international treaty signed in 1971 for national action and international cooperation for the conservation and wise use of wetlands and their resources, defines wetlands (Article 1.1) as “areas of marsh, fen, peatland 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 6 m”. What are the basic characteristics of wetland? In spite of some different opinion, most scientists agree that wetlands including three important characteristics: (1) the soils are hydric, (2) they support wetland vegetation, and (3) they have wetland hydrology (Skaggs et al., 1994).

Wetlands exhibit enormous diversity according to their genesis, geographical location, dominant species, and soil and sediment characteristics (Space Applications Centre, 2011). Different wetland classification systems have been given by some agencies and researchers (Shaw and Fredine, 1956; Bellamy and Bellamy, 1966; Glooschenko, 1993). One of the first widely used wetland classifications systems (devised by Cowardin et al., 1979) categorized wetland into coastal wetlands, estuarine (including tidal marshes and mangrove swamps), lakes, riverine and palustrine (including marshes, swamps and bogs) based on their genesis, geographical location and ecological characteristics. According to this wetland classifications method, wetlands were divided into five grades including system, subsystem, class, subclass and dominance type. The classification method of Cowardin has the advantages of comprehensive classification and easy operation, which has become the basis of wetland resource management of USA.

The Ramsar Convention uses a broad definition of wetlands. Its wetland types includes all lakes and rivers, underground aquifers, swamps and marshes, wet grasslands, peatlands, oases, estuaries, deltas and tidal flats, mangroves and other coastal areas, coral reefs, and all human-made sites such as fish ponds, rice paddies, reservoirs and salt pans. Some Chinese researchers put forward own wetland classification based on different study area. The wetlands in China include 5 types in 34 variations, covering riverine wetland, lake wetland, inland marshes/swamp, coastal wetlands and artificial wetlands. In China, a national wetland resources survey has been conducted twice, during 1995–2003 and 2009–2013. According to the China's second national wetland resources report, completed in 2014, the total area of wetlands is 53.42×10^6 ha, and accounts for 5.58% of China's territorial area, with a loss rate of 9.33% compared to the first survey (Wetland China, 2014). Due to the lack of awareness of wetland protection and the rapid economic development and urbanization, a large number of China's wetlands have been destroyed or degraded since the 1950's. Since Reform and Opening in 1978, China has made significant achievements in economic development. At the same time, the Chinese government has strengthened the protection of wetland resources and formulated the “National Wetland Protection Plan (2002–2030)”. According to the plan, 8.99 billion CNY will be invested in wetlands protection and restoration. More than 550 National Wetland Nature Reserves and 100 National Wetland Parks have been established. The draft of National Wetland Protection Regulations has been completed based on the absorption of the views of all aspects. At the local level, some provinces such as Heilongjiang, Gansu, Hunan and so on have implemented local wetland protection regulations. Some scholars have done research related to coastal wetland (Sun et al., 2015; Jiang et al., 2015; Luo et al., 2016), lakes wetland (Mei et al., 2016) and riverine wetland (Zhang et al., 2016) that including wetland ecosystem assessments (Sun et al., 2016), restoration, carbon cycle, wetland change and management system (Lin et al., 2016). However, in the context of so much effort done, the annual wetland disappearance rate is still close to 1%. Therefore, it is very necessary to understand the general situation of wetlands in China. There are still some issues that should be discussed, as well as efforts that need to be undertaken in the conservation of China's wetlands.

In this paper, the current status of China's wetlands resources were reviewed, and the degradation of wetlands was discussed based on the national wetland resources survey incorporated with related research. The objectives of this paper are as follows: 1) review the status of China's wetland resources, 2) analyze the issues on conservation and degradation of wetlands in China, and finally 3) summarize problems of wetland management and discuss recommendations for improvement.

2. Current status and distribution of wetlands in China

With its varying climatic regimes and topography, China has the all wetland types illustrated by the Ramsar Convention. The available estimates about the wetlands area in China vary widely from a lowest of 5.58% ($53.42 \times 10^4 km^2$) to a highest of 20.37% ($195.72 \times 10^4 km^2$) of geographical area (Table 1). Because of different data sources, the results of Niu et al. and Wetland China were incomparable. A change trend was only illustrated in the Table (Niu et al., 2014; Wetland China, 2014).

During 1995–2003, China conducted the first national wetland resources survey. Wetlands with an area of more than 100 ha were counted. And, the distribution, protection and degradation of wetlands were also investigated. The survey results showed that the total wetlands area of China is 38.48 M ha, of which the natural