



Palaeovegetation of Honghe wetland in Sanjiang Plain as a basis for conservation management and restoration



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ABSTRACT

This paper documents the history of vegetation assemblage in Honghe Wetland (NE China) during the last 6200 years. Vegetation changes were reconstructed based on high-resolution plant macrofossil analysis of sedimentary sequence obtained from Honghe National Nature Reserve located in Sanjiang Plain, in conjunction with Accelerator Mass Spectrometry (AMS) ¹⁴C radiocarbon data. Results indicate that plant macrofossil composition of Honghe wetland ecosystem are dynamic and have undergone several significant changes. Around 2500 cal yr BP, plant composition transited from *Equisetum fluviatile* community to *Carex lasiocarpa*-*Drepanocladus aduncus* community, and then following by *Drepanocladus aduncus* community at 460 cal yr BP. Another major vegetation changes occurred at 220 cal yr BP, transitioning to *Carex* sp. community. By comparison between the plant macrofossil assemblages and the climate changes during the last 6200 cal yr BP, we suggest that ASM (Asian summer monsoon) is the main driving force for the vegetation succession before the impacts of human activities. Since some restoration programs have been undertaken at Honghe wetland, thus our results can provide valuable baseline data for assessment of the practicability and suitability of the former restoration plan and the further designing of conservation management and restoration targets. Since the vegetation composition of Honghe wetland is pronouncedly sensitive to water level, it can be inferred that wetland ecosystem can be restored to near-natural condition through the effective management and restoration by controlling the water source of the wetland.

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1. Introduction

Sanjiang Plain, one of the largest freshwater wetlands in China, is sensitive to the changes in climate and hydrology (Sun et al., 2006a). Honghe National Nature Reserve is the epitome of the original wetlands in Sanjiang Plain, containing almost all of the vegetation types of Sanjiang Plain and abundant animal resources (Zhou et al., 1984). However, Honghe National Nature Reserve is facing an increasing significant ecological threat due to the impact of human activities (Ma et al., 2004; Sun et al., 2006b). Therefore, conservation management and restoration for Honghe National Nature Reserve is imminent (Ma et al., 2004). However, what extent should the wetland ecosystem be restored to? Hence, there is a great need to understand baseline of ecological conditions and further to develop

management goals and restoration strategies (Coffey et al., 2011, 2012; Valsecchi et al., 2010).

Palaeoecological reconstructions can provide valuable information about naturalness ecosystems, which containing considerable vegetation changes, environment factors, and the impact of human activities on wetland ecology. (Barber, 1993; Barber et al., 2003; Chambers and Charman, 2004; Jong et al., 2010). Plant macrofossil analysis plays a very important role in the reconstruction of local vegetation history (Birks, 2002). One advantage of plant macrofossil analysis is that it reflects the regional vegetation *in situ*. An additional advantage of the application of plant macrofossil analysis is the possibility of the identification at the species level, which is rarely possible through pollen analysis (Mauquoy and VanGeel, 2007; Birks and Birks, 2000; Tobolski and Ammann, 2000).

The peatlands formed in the Honghe National Nature Reserve record the vegetation history and environment changes (Xia, 1988). Unfortunately, there are few AMS radiocarbon data and little is known about the palaeoecological history of the peatlands in San-

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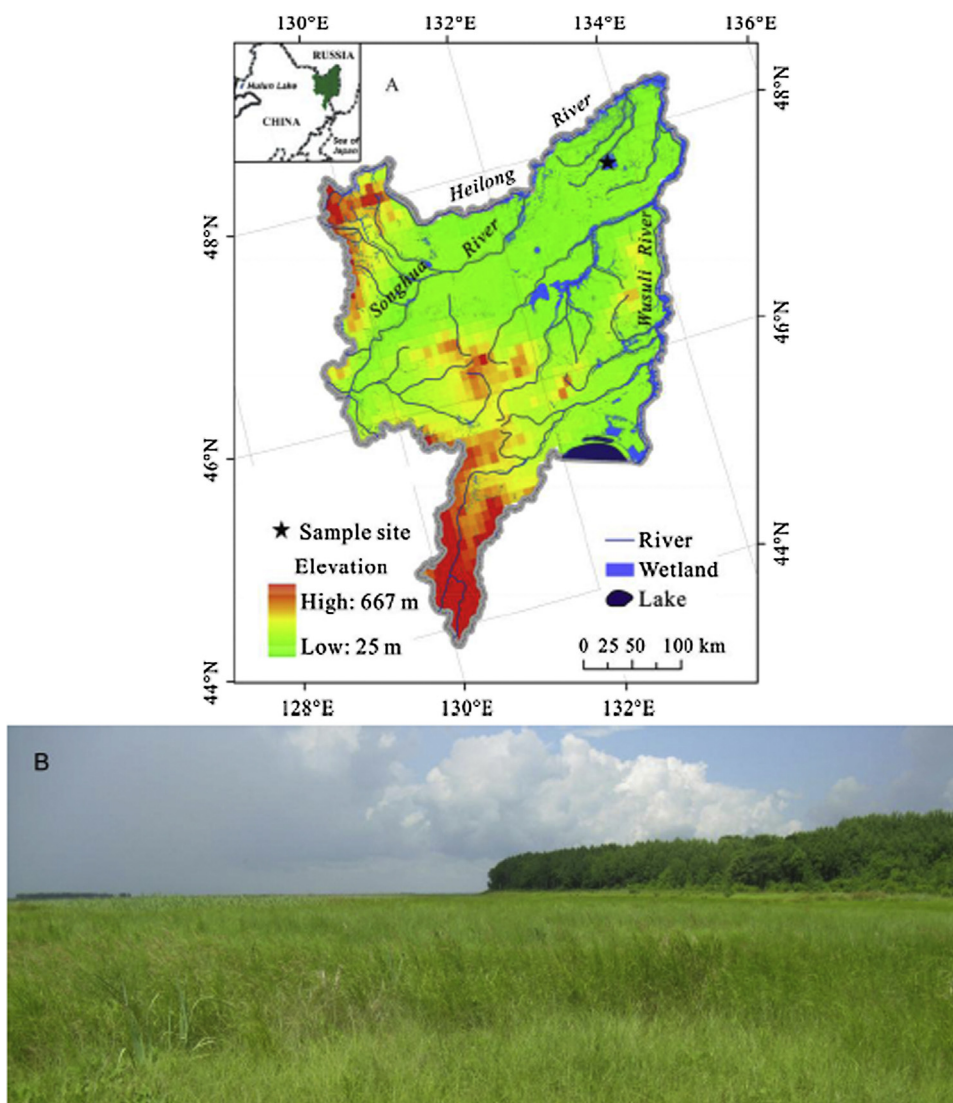


Fig. 1. Digital elevation map of the Sanjiang Plain. The black solid pentagram indicates the coring site. The coring site is near the east shore of Nongjiang river. (A). The landscape of Honghe wetland (B).

jiang Plain. Previous palaeobotanical studies in this area have been restricted to palynological analyses (Xia, 1988; Ye et al., 1983). Additionally, little research on plant macrofossil only focused on species identification, neither on semi-quantitative nor quantitative approaches (Zheng, 1989). Therefore, the primary concern of our study is to reconstruct the history of vegetation and establish the baseline for the formulation of management and restoration policies of Honghe National Nature Reserve ecology system.

The major objectives of the present study were to address the following questions: (1) what was the natural vegetation composition before the impact of human activities? (2) What was the main driving force of vegetation changes during the mid and late Holocene? (3) Is there any need to establish the further conservation management plan?

2. Study area and site

The Sanjiang Plain is an alluvial plain formed by three major rivers in Heilongjiang Province of Northeast China, namely the Amur River, Wusuli River and Songhua River (Fig. 1). Due to its characteristics, such as flat topography, low altitude and climate condition, Sanjiang Plain is one of the largest freshwater wetlands

in China (Wang et al., 2006). The whole region is essentially wetland, but has fragmented into different hydrological units by the ditches and agriculture land. The wetland of Sanjiang Plain covers an area of about 9069 km² (Wang et al., 2002). Honghe National Nature Reserve as a national nature reserve in Sanjiang Plain at 1996 and as an international important wetland by the Ramsar Convention organization at 2002. It is a microcosm of Sanjiang Plain wetlands, which can reflect the original picture of Sanjiang Plain wetlands. Honghe National Nature Reserve wetland contains almost all of the plant species and abundant animal resources in Sanjiang Plain. Unfortunately, ecological environments (water resource, plant diversity) have been seriously degraded due to human activities which mainly include dam which intercepts surface runoff of Nongjiang River, drainage channels surrounding the Honghe Nature Reserve, rapid development of rice areas surrounding the protected area, and the farmland reclamation inside the protected areas (Ma et al., 2004).

The research site is located in Honghe National Nature Reserve, Sanjiang Plain (47°35.096'N, 133°30.006'E) (Fig. 1), which is a river floodplain wetland (Zhu, 2010). The coring site is on the west shore of Nongjiang tributary in Honghe National Nature Reserve (Wang et al., 2009). The current climate is temperate continental climate.

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