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# Mid-late Holocene environmental history of Kulunda, southern West Siberia: vegetation, climate and humans

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### ABSTRACT

An environmental reconstruction of mid-late Holocene vegetation, climate and lake dynamics was inferred from pollen and diatom records of Lake Big Yarovoe in Kulunda, southern West Siberia. The reconstruction suggests a general prevalence of steppe during the last 4.4 ka. Under a relatively warm and dry climate, open semi-desert and dry steppes with patchy birch forest spread between 4.4 and 3.75 ka BP. The largest development of conifer forest started in Kulunda after 3.75 ka BP. The onset of the Late Holocene is characterised by the dominance of steppe with birch and pine forests in the lowlands and river valleys. After AD 1860, open steppe and semi-desert vegetation with fragmentary birch forest have been dominant in Kulunda, along with a sharp reduction of conifers. These results are in agreement with the general pattern of the Holocene environmental history of the surrounding areas, including the Baraba forest-steppe, Kazakh Upland and Altai Mountains. The penetration of coniferous forest into the Kulunda steppe after 3.75 ka BP was related to its geographical location northwest of the Altai Mountains. The economic activities of the ancient population of Kulunda depended on the environmental changes during the Holocene.

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## 1. Introduction

The Kulunda depression is located in the southern part of West Siberia and used to provide a paramount connection between the Central Asian steppe and the North Asian forest-steppe. This is reflected in a variety of archaeological sites that belong to diverse human cultures of the Bronze, Iron and Middle Ages. Despite the importance of palaeoenvironmental studies in the Kulunda depression and neighbouring Baraba forest-steppe, there are only few radiocarbon-dated sedimentary records from the several lakes and peat sites, and all of them are published in Russian (Klimanov et al., 1987; Levina et al., 1987; Nenashva et al., 2006; Khazin and Khazina, 2009). Middle and Late Holocene environmental changes might have had a significant influence on the development of the

human societies in the region. However, until now, this question has not been studied. The present study focuses on the reconstruction of environmental changes in the Kulunda region during the last 4.4 ka, and we discuss the probable interaction between climatic changes and human activities in the Middle and Late Holocene.

In this study, we present (1) the results of pollen and diatom analyses of sediment core from Lake Big Yarovoe; (2) a reconstruction of the vegetation, climate and lake environmental changes during the second half of the Middle and Late Holocene; (3) a discussion of our results and the environmental records from the neighbouring regions of Kazakhstan and Altai Mountains; and (4) a discussion of the environment–human interactions in Kulunda during the last 4.4 ka.

## 2. Site setting and environment

The Kulunda depression is an extensive accumulative lowland in the southeastern part of the West Siberian plane and is located at an altitude of 100–140 m asl. In the Middle and Late Pleistocene,

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