

# THE HISTORY OF FIRES IN OLD-GROWTH KOREAN PINE – BROADLEAVED FORESTS IN THE MIDDLE REACHES OF THE BIKIN RIVER (WESTERN SLOPE OF THE SYKHOTE-ALIN MOUNTAINS) ACCORDING TO DENDROCHRONOLOGICAL AND PEDOANTHRACOLOGICAL DATA

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**Abstract.** The largest unfragmented tract of the rich-in-species old-growth Korean pine (*Pinus koraiensis*)-broadleaved forests in the world is situated in the basin of the Bikin River. The history of these forests, including the fire history, is very important for understanding factors of dynamics of these forests and prognosis of their development under different climate change scenarios and land-use regimes. However, this history has not been studied in detail so far. Here we aim at reconstructing the local history of fires in the middle reaches of the Bikin River using dendrochronology and pedoanthracology (analysis of charcoal in the soil). We used treefall mounds to search for charcoal in soils; charcoal was selected from 34 treefall mounds, 14 charcoal samples were radiocarbon dated. The age of fire scars on trunks was determined using the increment borer method on 45 *Pinus koraiensis* individuals. We defined that the main factors responsible for charcoal transport to the mineral soils were past treefalls with uprooting and soil erosion. The most ancient soil charcoals date back to the Upper Neolithic, about 3450 cal BP. The remaining charcoal samples are mainly grouped into four clusters: about 2250, 1610, 1450 and 600 cal BP. The increase of fire frequency is in good agreement with the previous results of lithologic-facies, botanical, spore-pollen and other analyses of bog sediments in the floodplain of the Bikin River. The earliest fires in the study area, which can be associated with human impacts, refer to the end of the first millennium (the time of the Bohai Kingdom). Fire scars were found on cores sampled from 39 out of 45 *Pinus koraiensis* individuals. The oldest *Pinus* we dated was 278 years old. Based on the cores, a fire chronology was built, covering the period from 1773 to 1993. Fires were marked for 36 years, while 10 years of them coincided in 3 and more cores. The periods with the highest frequency of fires are from 1937 to 1948 and from 1958 to 1980. We further followed possible connections between the frequency of fires and human activities. We also compared the fire chronology, data on precipitation and the number of fires in the Sikhote-Alin State Nature Reserve located closely to the study area. As expected, fires often occurred in the years with low precipitation or in the years following them. Preservation of a high species diversity of plants, especially the woody ones, with a significant frequency of fires in the study area can be explained by a complex relief determining the local fire spread and the presence of fire refugia. Soil charcoal analysis showed the existence of fire events from 3500 to 600 years BP and tree fire scars analysis showed the intensive fire history of the studied forests during the last 200 years. For the first time, fire regimes were reconstructed for Korean pine-broadleaved forest located on the slopes in the middle reaches of the Bikin River.

**Keywords:** charcoal, fire scars, tree uprooting, pit-and-mound topography, soil morphology, fire history, radio-carbon dating, Holocene, historical ecology, Russian Far East, Primorsky krai.