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# Reconstruction and Prediction of Climate and Vegetation Change in the Holocene over the Altai-Sayan Mountains, Southern Siberia

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Mountains are a good study area for monitoring and modeling vegetation changes in both the past and future climates because various landscapes from hot and dry lands in lowlands to cold and wet highlands are located across a rather small area. Our goal was to model vegetation redistribution during the Holocene - from 10000 years before present (B.P.) to the year 2100 AD over the Altai-Sayan Mountains using different climate change scenarios and identify how similar/dissimilar was the past vegetation versus future vegetation. We used our mountain bioclimatic vegetation model (MontBioCliM) to predict the paleo and future vegetation distribution coupling MontBioCliM with different climate change scenarios. Our model is an envelope-type model that predicts a vegetation type from three climatic indices: growing degree days, base 5 deg. C; negative degree days below 0 deg. C; and annual moisture index (a ratio between growing degree days and annual precipitation). The past climate change scenarios were constructed by comparing current and past vegetation. The past vegetation was reconstructed from fossil data in 10 sites for 3200 B.P.(the Subboreal), 5300 B.P.(the mid-Holocene), 8 000 B.P. (the Boreal), and 10 000 B.P. (the Pre-Boreal). We inversely used MontBioCliM to predict climatic indices for a vegetation type in a paleo time. Paleo vegetation was mapped by coupling MontBioCliM with each of four paleo climate change scenario. To predict future vegetation we coupled MontBioCliM with Hadley HadCM3 A1FI and B1 climate change scenarios for 2020, 2050 and 2080. An agreement between pairs of vegetation maps for different time slices was found based on kappa statistics. The kappa statistics matrix showed that the vegetation structure in the Altai-Sayan Mountains was similar during the mid-Holocene and the Boreal with warmer and moister climates than nowadays, and the Last Glacial and Subboreal with colder and dryer climates than nowadays. No analogs between future and paleo vegetation distribution were found although in literature the mid-Holocene is suggested to consider as an analog of the current mid-century climate. Climates 5300-8000 B.P. were warmer but also moist compared to dry climates across the 21st century suggested by climate change scenarios from general circulation model projections.