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Responses to environmental changes detectable in Holocene tree-line variations in the Rila Mountains, Bulgaria

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Mountain vegetation is facing more rapid changes in temperature than the global average with the risk of losing essential ecosystem services in higher elevation environments. Therefore, it is important to thoroughly understand the sensitivity of mountain vegetation to climatic and anthropogenic induced changes. Although a general framework of Holocene tree-line evolution in Southwestern Bulgaria has already been established in previous research, data on higher elevations spanning the entire Holocene was still lacking.
To provide this data, a multi-proxy analysis (comprising plant macro-remains, pollen and charcoals), covering the entire Holocene, was performed on a core from a peat bog near the tree-line of the Rila Mountains (Southwestern Bulgaria). The results of this study were subsequently interpreted in the framework of other palaeoecological records from the region providing information on tree-line shifts. The resulting reconstruction, supported by radiocarbon chronology, revealed the climatic and anthropogenic impact on the development of the postglacial vegetation.
From this reconstruction can be concluded that our data is well in agreement with the general vegetational and environmental changes in the region. After the end of the last glaciation (around 11,500 cal. BP) open vegetation developed, which was gradually replaced by pioneer tree species. This phase was followed by the establishment of a coniferous belt (around 6700 cal. BP) as a response to an increase in humidity in the Atlantic. During the next period, the Subboreal (after 4800 cal. BP), the tree-line underwent major changes in composition as a response to a decrease in average temperatures and a rise in average precipitation. This signal is however biased during the Subatlantic (after 2400 cal. BP) because of the intensification of anthropogenic disturbance in the form of deforestation, burning and animal husbandry.
Human impact in the area is still playing a significant role, threatening the peat bogs that provide valuable ecosystem services and serve as unique palaeoenvironmental archives. This study provides a more complete insight in the sensitivity of mountain vegetation to climatic and anthropogenic driven changes, in order to anticipate the likely future responses in tree-line position and diversity. In this way, it will contribute to the choice of more effective conservation strategies for the protection of the biodiversity and other ecosystem services in these ecological hotspots.