

EGU24-5709, updated on 20 May 2024

<https://doi.org/10.5194/egusphere-egu24-5709>

EGU General Assembly 2024

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Dynamics of alpine treeline in the High Tatra Mts., Slovakia

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Global warming affects the climatic conditions in the mountain environments. The climate of the alpine treeline ecotone (ATE) in the High Tatra Mts. is represented by unique conventional long-term climatological series from Skalnaté Pleso Observatory (49°11'21.9" N; 20°14'02.7" E). When considering the two last normal periods (1961-1990 and 1991-2020), the average air temperature in ATE increased by 1.1 °C. In this work, we analysed the altitudinal shift of the boundary 6°C isotherm, which represents the minimum temperature requirements for the growth and reproduction of tree vegetation. To determine the altitude of the cold treeline limit, i.e. upper limit of ATE, we used climate data from Skalnaté Pleso Observatory (1,778 m a.s.l.) and the near top meteorological station Lomnický štít (2,634 m a.s.l.). We found that over the analysed period 1951-2020, the limiting isotherm moved upwards from the level of 1,950 m a.s.l. to 2,200 m a.s.l.. Preliminary field monitoring and mapping indicated the colonisation of the dominant subalpine vascular species *Pinus mugo* Tura (mountain pine) into alpine summits. We identified young individuals or small groups of mountain pine at altitudes between 2,000-2,200 m a.s.l., which is consistent with the assumption of vertical extension of low tree vegetation due to positive changes in ambient thermal conditions. The warming of the alpine tree line ecotone may lead to a gradual reduction and eventual disappearance of montane species due to their strict ecological specialisation. The replacement of the populations of cold-adapted alpine species by those profiting from the warmer climate may cause a decline in the ecosystem's biodiversity. Therefore, further research will be focused on verification of the climate-related shift of the boundary line for the growth of mountain pine at the ATE zone in the highest mountain range of the central-eastern region of Europe.