



## **Investigation of the main causes of forest decay in a Hungarian Pinus forest**

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Hungary has several places where the changing conditions (climate, water or soil) have an influence on the natural ecosystems. Lack of the adaptation capacity can lead to the mortality of the affected forests. In our study we try to find the reasons of the decay of a Hungarian old-growth forest (150-200 years old) in Fenyőfő – which is growing on protected area – whether it is caused by the soil properties and other abiotic variables or it is the result of the drying climate. On the studied area 119 samples from 20 soil profiles have been collected to find the causes of the tree mortality. The characteristic soil types are Luvisols, Cambisols, Arenosols mainly sand (56%) or loam (42%) by the physical assessment, but we found buried humus layer in a few cases that improves the water and nutrient supply of soils. Due to this favourable property the  $\text{CaCO}_3$  content appeared near to the surface, which hinders the vegetation in water utilization or water uptake. The average  $\text{pH}(\text{H}_2\text{O})$  of topsoil was between 4.2 and 5.5, where the leaching was characteristic and we found  $\text{CaCO}_3$  in deeper layers. The effects of climate change on the Pinus forest were also analysed. We used gridded station data from the Hungarian Meteorological Service for the time period 1961-2013. It contains daily, monthly and yearly time series for precipitation and temperature means and extremes. The meteorological data clearly show, that the mean annual temperature of the research plot increased drastically ( $\sim 1^\circ\text{C}$ ). We also analysed the frequency of extreme high temperatures such as the total number of summer days (daily maximum temperature  $T_{\text{max}} > 25^\circ\text{C}$ ), hot days ( $T_{\text{max}} > 30^\circ\text{C}$ ) and extremely hot days ( $T_{\text{max}} > 35^\circ\text{C}$ ). This frequency of these days showed an increase in Fenyőfő, which caused higher water utilization and water deficiency. The annual precipitation sum decreased in the last few decades but this signal is not significant. The intensity and the variability of the precipitation in the vegetation period showed an increase. We collected 23 wooden discs from 11 points to investigate the change of the tree ring growth, which was decreased in the last 50 years. Soil conditions and climate change together have led to the decrease of the groundwater level that became unavailable for the vegetation, and result the forest decay in the study area.

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