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Relating Snow Cover Patterns to Phenology of European Blueberry (*Vaccinium myrtillus*) in a Mountain Spruce Forest of the Western Tatras: A Continuous Digital Imagery Approach

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Abstract
In this research, we investigate snow cover monitoring in relation to the evaluation of the phenological phases of European blueberry (*Vaccinium myrtillus* L.), using phenological cameras and camera traps. The observations were carried out at the research site Črevenec in the Western Tatras at an altitude of 1420 m.a.s.l. The site represents original - climax spruce forests of mountain and subalpine vegetation stage Natura 2000: No. 9410 Acidophilous spruce subalpine forests (*Vaccinio-Piceetea*). In the paper we further evaluate meteorological parameters: air temperature, sums of active temperatures above 5 °C, precipitation, and other parameters which are closely related to the phenological cycles of plants. Hydrometeorological observations were carried out using local micrometeorological stations located directly in the monitored stands. Simultaneously, we monitored the height and duration of snow cover and the onset and course of blueberry phenological phases using phenological cameras and camera traps. Measurements were carried out between 2019 and 2021. We compared these years with each other in terms of hydrometeorological conditions and phenological phases. Growing degree-days and snow cover depth and duration also proved to be the most important. Phenologically, we evaluated 5 phenological phases: leaf unfolding, leaf colouring, leaf fall, flowering and ripe fruits. The early melting of the snow cover and the following bare frost increase the shoot mortality which is later reflected in a low blueberry berry yield. Bare frost refers to frost close to the ground that directly affects the top layer of soil and plants due to the lack of insulating snow cover. European blueberry is shown to be a sensitive bioindicator of the impact of hydrometeorological extremes.

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Keywords: Snow cover, Phenological phases, Phenological camera, Meteorological elements, Growing degree days