



Phenology through lenses and sensors – techniques and variation with aspect and vegetation density

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Besides traditional ocular phenological observations, camera phenology has turned out as an emerging tool to efficiently, continuously and objectively monitor seasonal plant development. However, fish-eye cameras, different types of digital cameras – from simple and cheap webcams to elaborated security cameras, as well as other sensors, such as spectrometers, or active measuring instruments are in use offering different options and settings. Their advantages and disadvantages for deriving phenological parameters are discussed by published examples from a literature review.

Measurements in two mixed forest stands (*Picea abies* – *Fagus sylvatica*, *Fagus sylvatica* - *Quercus* spp.) near Freising allow the comparison of the seasonal development of vegetation canopies screened from above and horizontally from meteorological tower and a crane, but also from below in five different altitudes within the stand. Impacts of these different aspects are studied with special emphasis on saturation or shading effects with varying vegetation density.