



## **Growing season changes under climate warming – adaptive (genetic) traits of understory, natural beech regeneration and canopy**

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Phenology, the science of annually re-occurring events in physical and biological systems, is strongly affected by changing environmental conditions. Vegetation reacts by specific timing of phenological phases on these environmental / climate influences. Thus phenology may act as an integrated measuring instrument for environmental impacts.

The length of the vegetation period and therefore the canopy duration determines, among others, the period of carbon assimilation of deciduous trees.

Trends in the onset of spring phenological phases observed over the last 50 years have been related to temperature increase, up to 80% of the phenological onset date can be linked to temperature of the preceding months.

In autumn the climate influence is much less clear. In particular, autumn phenology of deciduous trees in mid latitudes cannot be adequately explained by temperature of previous months nor by temperature sums. In contrast, Delpierre et al. (2009) proposed that there is a thermal influence on annual timing of temperate forest leaf colouring.

To clarify this problem we have observed spring leaf emergence and autumn colouring of beech (*Fagus sylvatica* L.) intensively. Beech is a typical forest tree in Germany, therefore we observed beeches within natural forest stands including their natural regeneration as well as perennial and annual herbs. Phenological onset dates were analysed in context with genetic information to study its impacts on plant behaviour. Here genetics of 20 adult *Fagus sylvatica* L. and 3 regeneration groups have been analysed in a forest stand near Freising.

We assume that the integration of various climate parameters over the vegetation period as well as a larger part of genetics play an important role in triggering the onset of the end of the growing season of deciduous trees.

Phenological observations in spring and autumn based on a detailed observational key according to the BBCH code were carried out on the selected trees. At the same time hemispheric fisheye photos were taken. This information was linked to the canopy coverage, leaf area index (LAI), and the phenological development phase.