Geophysical Research Abstracts
Vol. 13, EGU2011-13728, 2011
EGU General Assembly 2011

Bud burst response to changing climatic conditions in birch (Betula pubescens) and aspen (Populus tremula) for use in a phenological model

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The impact of climate change on phenological events, such as bud burst and leaf unfolding in trees, is now widely accepted. In temperate regions, the timing of these key phenological phases is of vital importance for survival in perennial species, because if dormancy release is too early leaves become vulnerable to frost damage. In order to model the impact of changing environmental conditions on budburst rate we carried out controlled environment experiments on juvenile birch (Betula pubenscens) and aspen (Populus tremula) trees, two native species with a broad distribution range across Europe. The two main triggers for the release of dormancy investigated were (1) temperature (chilling temperature on one hand and forcing temperature on the other) and (2) photoperiod. This allowed us to determine the effects of these individual cues and of the interaction between both variables on the timing and rate of bud burst. Results to date suggest that there is a strong interaction effect between the duration of chilling and photoperiod. In both species, trees that received insufficient chilling duration showed great inconsistencies in the release of dormancy and irregular growth in shorter photoperiods, whereas in fully chilled plants the rate of budburst was more similar, irrespective of photoperiod. Consequently, if temperatures continue to rise as predicted, some temperate tree species may experience insufficient chilling duration during winter which in turn may force them to change their distribution range. Although both species are opportunistic pioneers, B. pubescens had lower chilling requirements than P. tremula, which makes the latter species more robust in a climate change scenario with extreme temperature fluctuations during spring. These experimental results will be integrated into a mechanistic phenological model.