# Broadleaf trees show reduced sensitivity to global warming

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The international researchers investigated the change in the sensitivity of leaf unfolding to climate warming using observations for dominant European tree species like this beech. Credit: Stefanie Ederer

The sensitivity of leaf unfolding phenology to climate warming has significantly declined since 1980s, according to a study recently published in the journal *Nature* by an international collaboration of scientists. Earlier spring leaf unfolding is a frequently observed response of plants to climate warming. Many deciduous tree species require cold temperatures, in other words 'chilling', for dormancy release, and the warming-related reductions in chilling may counteract the advance of leaf unfolding in response to warming. Empirical evidence for this, however, was very limited.

To check whether warm winters have already attenuated the advance in spring phenology, an international team of researchers from China, Belgium, France, Spain, Switzerland and Germany investigated the change in the sensitivity of leaf unfolding to climate warming using long-term observations for seven dominant European tree species at 1245 sites in Central Europe.

Their analyses show that leaf unfolding occurred, on average, four days earlier per degree Celcius increase in spring temperature between 1980 and 1994, whereas this advance dropped to 2.3 days per degree between 1999 and 2013, a decrease of over 40 percent. "This lower sensitivity of trees to climate change likely reflects the reduced cold during winter that delays dormancy release. However, we could not fully exclude photoperiod and/or insolation as co-controlling mechanisms. These two factors may also become limiting when leaf unfolding dates occur too early in spring" said Yongshuo H. Fu, the first author of this study.

The study provides the first large-scale empirical evidence for a declining sensitivity of spring phenology to warming in mature trees for Central Europe. Professor Annette Menzel from the department of Ecoclimatology at Technical University of Munich who was also involved in the interational research said "The European PEP725 phenological database was a perfect basis to reveal that strong winter

warming in the future may result in a slowdown in the advance of spring phenology".

Since plant phenology is a very important determinant of the carbon uptake and water balance of ecosystems, the declining temperature sensitivity of leaf unfolding might reduce the potential of forests to sequester even more carbon than they currently do. However, in the end it may be beneficial for the trees by reducing the risk of late spring frost damage, since extreme climatic events are projected to increase in future.

**More information:** Yongshuo H. Fu, Hongfang Zhao, Shilong Piao, Marc Peaucelle, Shushi Peng, Guiyun Zhou, Philippe Ciais, Mengtian Huang, Annette Menzel, Josep Peñuelas, Yang Song, Yann Vitasse, Zhenzhong Zeng and Ivan A. Janssens: 'Declining global warming effects on the phenology of spring leaf unfolding', *Nature* 23.9.2015. DOI: 10.1038/nature1540

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