

Asymmetric temperature sensitivities of plant phenology in warmer and cooler springs are affected by climate factors in Europe

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Understanding temperature sensitivity of vegetation is important for predicting the effects of climate change on terrestrial ecosystem. Previous studies paid much attention on phenological response of plants to temperature elevation. Temperature elevation has induced and is expected to induce high temperature fluctuations combining with changes in other climate factors. However, little attention has been paid on phenological responses to temperature variations under different background temperature and these responses in relation to other climate factors.

Using the European phenology database PEP725, we examined the species-specific temperature sensitivities in warmer springs and cooler springs for start of spring (SOS) of woody species with more than 30 years phenological observations. Linear regression analyses were applied to determine the temporal correlations between SOS and spring temperature in warmer and cooler springs, and correlation analyses were further used to assess the relationship between temperature sensitivities and other factors.

We found that phenological responses to temperature in warmer springs (T_{sw}) were significantly greater than in cooler springs (T_{sc}). In warmer springs, the temperature sensitivity was higher in response to decreasing spring temperature. Moreover, we found that the temperature sensitivity varies with chilling days and precipitation. This study suggests that phenological sensitivity to temperature variation may differ in springs with different temperatures, i.e., temperature sensitivity is asymmetric between a warm and a cold spring, and the differential response can be further interacted with other climate factors.

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