

Modeling tree dormancy with the PhenoFlex framework

Eike Luedeling^A, Katja Schiffers^A, Lars Caspersen^A, Eduardo Fernandez^B and Carsten Urbach^C

^A Horticultural Science, Institute of Crop Science and Resource Conservation (INRES), University of Bonn, 53121, Bonn, Germany

^B Escuela de Agronomía, Pontificia Universidad Católica de Valparaíso, Casilla 4-D, Quillota, Chile

^C Helmholtz Institut für Strahlen- und Kernphysik (HISKP), University of Bonn, Germany

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Abstract (max 200 words)

Regular release of bud dormancy is vital for the productivity of temperate fruit orchards. Considerable attention has therefore been paid to modeling the timing and extent of budbreak and other early-season development stages of temperate fruit tree species. Available modeling frameworks have often used outdated concepts of chill and heat accumulation, and they have failed to account for possible species- and cultivar-specific temperature response patterns. The PhenoFlex framework, which forms part of the chillR package for R, addresses these challenges by combining state-of-the-art chill and heat submodels, which can be parameterized with observed phenology data. PhenoFlex is flexible regarding the transition between endo- and ecodormancy, allowing for parallel, sequential or overlapping accumulation of chill and heat. PhenoFlex has been successfully used for several species and cultivars, generally providing accurate predictions of spring phase timing. Current challenges include the need for relatively large datasets to reliably fit the twelve parameters of the framework, the implementation of fast, computationally efficient and reproducible fitting procedures, and the difficulty of interpreting and comparing parameter sets across species and cultivars. Despite these challenges, PhenoFlex shows promise for providing reliable predictions of the timing of phenological stages in temperate fruit trees under current and future climates.