**Phenology**

One man, 73 years, and 25 species. Evaluating phenological responses using a lifelong study of first flowering dates By:[Bolmgren, K](https://cuvpn.colorado.edu/,DanaInfo=0-apps.webofknowledge.com.libraries.colorado.edu+OneClickSearch.do?product=WOS&search_mode=OneClickSearch&excludeEventConfig=ExcludeIfFromFullRecPage&colName=WOS&SID=2FrGSNcCm1zDsimm6jX&field=AU&value=Bolmgren,%20K" \o "Find more records by this author) (Bolmgren, K.)**[** [**1**](https://cuvpn.colorado.edu/,DanaInfo=0-apps.webofknowledge.com.libraries.colorado.edu+full_record.do?product=WOS&search_mode=GeneralSearch&qid=1&SID=2FrGSNcCm1zDsimm6jX&page=1&doc=4#addressWOS:000317474400004-1)**,**[**2**](https://cuvpn.colorado.edu/,DanaInfo=0-apps.webofknowledge.com.libraries.colorado.edu+full_record.do?product=WOS&search_mode=GeneralSearch&qid=1&SID=2FrGSNcCm1zDsimm6jX&page=1&doc=4#addressWOS:000317474400004-2) **]** ; [Vanhoenacker, D](https://cuvpn.colorado.edu/,DanaInfo=0-apps.webofknowledge.com.libraries.colorado.edu+OneClickSearch.do?product=WOS&search_mode=OneClickSearch&excludeEventConfig=ExcludeIfFromFullRecPage&colName=WOS&SID=2FrGSNcCm1zDsimm6jX&field=AU&value=Vanhoenacker,%20D) (Vanhoenacker, D.)**[** [**3**](https://cuvpn.colorado.edu/,DanaInfo=0-apps.webofknowledge.com.libraries.colorado.edu+full_record.do?product=WOS&search_mode=GeneralSearch&qid=1&SID=2FrGSNcCm1zDsimm6jX&page=1&doc=4#addressWOS:000317474400004-3)**,**[**4**](https://cuvpn.colorado.edu/,DanaInfo=0-apps.webofknowledge.com.libraries.colorado.edu+full_record.do?product=WOS&search_mode=GeneralSearch&qid=1&SID=2FrGSNcCm1zDsimm6jX&page=1&doc=4#addressWOS:000317474400004-4) **]** ; [Miller-Rushing, AJ](https://cuvpn.colorado.edu/,DanaInfo=0-apps.webofknowledge.com.libraries.colorado.edu+OneClickSearch.do?product=WOS&search_mode=OneClickSearch&excludeEventConfig=ExcludeIfFromFullRecPage&colName=WOS&SID=2FrGSNcCm1zDsimm6jX&field=AU&value=Miller-Rushing,%20AJ) (Miller-Rushing, A. J.)**[ [5](https://cuvpn.colorado.edu/,DanaInfo=0-apps.webofknowledge.com.libraries.colorado.edu+full_record.do?product=WOS&search_mode=GeneralSearch&qid=1&SID=2FrGSNcCm1zDsimm6jX&page=1&doc=4" \l "addressWOS:000317474400004-5),**[**6**](https://cuvpn.colorado.edu/,DanaInfo=0-apps.webofknowledge.com.libraries.colorado.edu+full_record.do?product=WOS&search_mode=GeneralSearch&qid=1&SID=2FrGSNcCm1zDsimm6jX&page=1&doc=4#addressWOS:000317474400004-6) **]** INTERNATIONAL JOURNAL OF BIOMETEOROLOGY Volume: 57 Issue: 3 Pages: 367-375 DOI: 10.1007/s00484-012-0560-8 Published: MAY 2013

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Author(s): Iler, Amy M.; Hoye, Toke T.; Inouye, David W.; et al.

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Author(s): Gauthier, Gilles; Bety, Joel; Cadieux, Marie-Christine; et al.

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Times Cited: [1](https://cuvpn.colorado.edu/,DanaInfo=apps.webofknowledge.com+CitingArticles.do?product=WOS&SID=1CmKcESlHrmd2KpZu5G&search_mode=CitingArticles&parentProduct=WOS&parentQid=8&parentDoc=39&REFID=454260122) (from Web of Science)

**Papers citing Gallagher et al. 2009**

Chambers et al. 2013. PLOS ONE. Phenological Changes in the Southern Hemisphere. Meta-analysis of phenological drivers; advance in timing of spring events; temperature most frequently identified as primary driver (though in many cases that was only one considered); when precipitation considered, often played key role but direction of variation difficult to predict.

Li et al. 2013. Biodiversity and Conservation. Species-level phonological responses to ‘global warming’ as evidenced by herbarium collections in the Tibetan Autonomous Region. Growing realization that herbarium-based collections offer baseline data; looked at average flowering time; used mixed model with randomized blocks for 41 species (909 specimens), with altitude as the block and year and temp fixed effects and flowering time was the response variable; found earlier flowering time (0.5 days per year).

Keatley and Hudson. 2012. Austral Ecology. Detecting change in an Australian flowering record: Comparisons of linear regression and cumulative sum analysis change point analysis. CUSUM can detect multiple change points but linear regression cannot; but two methods agreed 84.6% of the time.

Diskin et al. 2012. International Journal of Biometeorology. The phenology of Rubus fructicosus in Ireland: herbarium specimens provide evidence for the response of phenophases to temperature, with implications for climate warming. Looked at temp vs date of first flower, full flower, first fruit, and full fruit with linear regression; supports use of multiphase approach to using herbarium specimens since prior work validated single phenophase work. Only one of five species examined had enough data to yield statistically significant results with temperature.

Panchen et al. 2012. American Journal of Botany. Herbarium specimens, photographs, and field observations show Philadelphia area plants are responding to climate change. Used regression analysis of date of flowering with year or with temp; 16 days earlier over 170 year period and 2.7 days earlier per 1C rise in temp; woody plants with short flowering duration best indicator of warming climate.

Proenca et al. 2012. Ecography. Phenological Predictability Index in BRAHMS: a tool for herbarium-based phenological studies. The main focus of such studies have been phenological changes which accompany warmer spring and autumn temperatures in northern temperate (Robbirt et al. 2011) or southern hemisphere alpine plants (Gallagher et al. 2009, Gaira et al. 2011, Zalamea et al. 2011).

Gaira et al. 2011. Biodiversity and Conservation. Potential of herbarium records to sequence phonological pattern: a case study of Aconitum heterophyllum in the Himalaya. Used herbarium records to look at flowering times along elevational gradient and through time; also compared to maximum winter temp and mean winter temp; used general additive model (GAM)

Robbirt, et al. 2011. Journal of Ecology. Validation of biological collections as a source of phenological data for use in climate change studies: a case study with the orchid Ophrys sphegodes. Rigorous test of validity of using herbarium specimens for phonological studies by comparing peak flowering time to climate from both herbarium and field observations, used mean spring temp. herbarium data corresponded closely with field observations.