# Abstract for ESACSEE

**Submission Title:**

**Changes and trends in budburst and leaf flush across Europe and North America: A meta-analysis of local adaptation in spring phenology studies**

**Instructions:**

* **The body of the abstract is split between two sections:**

1. **(200 words) Background/Question/Methods, in which the objective of the study is clearly identified**
2. **(200 words) Results/Conclusions, in which specific results of the study are explicitly reported and their implications for ecology are briefly discussed.**

* **The abstract must report specific results. The results may be preliminary but they may not be vague. Abstracts without explicitly stated results will be rejected.**
* **It is understandable that abstracts describing non-traditional work may lack quantitative data; however, it is still expected that the abstract will address some question and have a "take-home message" describing specific findings.**

**Part 1: Background/Question/Method (197/200 Words)**

More than 250 years of common garden studies have shown that most studied tree species have the highest fitness at their geographical origin. Across the globe, similar trends of adaptive differentiation in fall events, such as bud set and cold hardiness, have been observed along latitudinal and altitudinal gradients. Spring events, including budburst and leaf flush, however, seem to show stronger phenotypic plasticity and higher variability, at least in North American contexts. Interest in predicting local adaptation across different locations has grown alongside its implications for climate change forecasting. While there are abundant common garden experiments in North America and Europe, no study has examined the relationship between the spring phenology variations observed on the two continents**. Combining meta-analytic techniques with hierarchical Bayesian models, we provide the first cross-continental assessment of local adaptation in spring phenology. We assembled a dataset of peer-reviewed publications that reported spring event dates, encompassing data from 384 North American provenances and 101 European provenances with observations from 1962 to 2019**. We extracted daily temperature over the past 10 years for each provenance and its associated common garden to further test how much climate similarity, between provenance and common garden, predicts local adaptation.

**Part 2: Results/Conclusions (180/200 Words)**

To our knowledge, this marks the first study to synthesize spring phenology data retrieved from studies across North America and Europe. Across seven angiosperm and eight gymnosperm species, we found a weak latitudinal cline of spring leaf-out in Europe, but not North America, with strong hierarchical effects of garden and species explaining much of the variation. We observed little to no clines regarding mean annual temperature across gardens. This lack of effect may be explained by the similar spring climate of most provenances and gardens, but also suggests diverging latitudinal patterns in each continent. Our analysis confirmed that the closer a garden is to a provenance, the more overlap in temperature. The higher the percentage overlap, the less difference in spring event timing, with a stronger relationship observed in Europe. In contrast to spring events, we found strong latitudinal clines in fall events across both continents, with local adaptation appearing much stronger in North America than in Europe. Our results show that spring events are highly plastic, and thus may shift with warming, but data on more species and greater information on important factors, such as their geographic location in relation to their origins and elevation, are needed for forecasting.

Themes

Climate Change, Ranges and Phenology