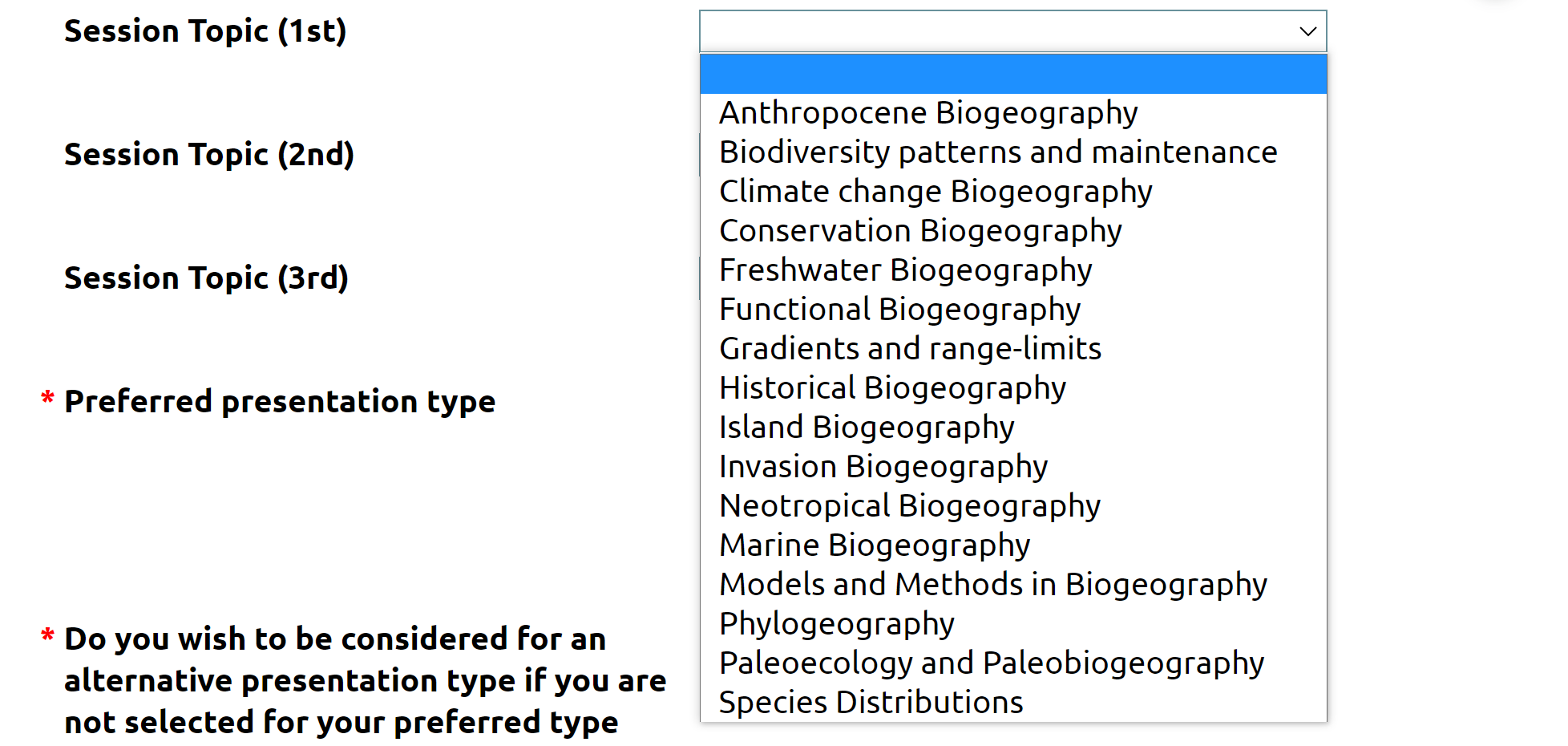
# Abstract for International Biogeography Society Conference Presentation

**Submission Title: Meta-analysis of local adaptation in spring phenology across Europe and North America**

**Abstract summary (**should be a maximum of 250 words, in one paragraph, and not contain images or links)

Please select the session topic that best fits your abstract (in order of suitability) below



1. Gradient and range limits
2. Climate change biogeography

**Draft abstract (250 words Max.)**

Over 250 years of common garden experiments have shown that most studied trees exhibit local adaptation–having the highest fitness at their site of origin. Around the globe, researchers have observed similar patterns of adaptive differentiation in fall biological events (e.g., bud set, cold hardiness) along altitudinal and latitudinal gradients Spring phenological events, such as budburst and leaf flush, appear to show greater phenotypic plasticity and more variable patterns of variation, at least in North American studies. As research in this area has grown, alongside its importance to climate change forecasting, so has an interest in predicting local adaptation across different traits and locations. While common garden studies are abundant in North America and Europe, no study has looked at the relationship between the two continents’ spring phenology variations. Combining meta-analytic techniques with hierarchical Bayesian models, and daily climate data in Europe and North America, we provide the first cross-continental assessment of local adaptation in spring phenology. Across 59 common garden studies in Europe and North America, 21 published studies have examined spring phenology across latitudinal clines. We found a latitudinal cline of spring leafout in North America, but not Europe, with strong hierarchical effects of garden and species explaining much of the variation. Clines across gardens with mean annual temperature were weak. This lack of effect may be explained by the similar spring climate of most provenances and gardens but suggests diverging latitudinal patterns in each continent.

Over 250 years of common garden experiments have shown that most studied trees exhibit local adaptation–having the highest fitness at their site of origin (Alberto et al., 2013). Around the globe, researchers have observed similar patterns of adaptive differentiation in fall biological events (e.g., bud set, cold hardiness) along altitudinal and latitudinal gradients (Alberto et al., 2013; Howe et al., 2004; Savolainen et al., 2007). Spring phenological events, such as budburst and leaf flush, appear to show greater phenotypic plasticity and more variable patterns of variation, at least in North American studies (Duputie et al., 2015; Harrington & Gould 2015). As research in this area has grown, alongside its importance to climate change forecasting, so has interest in predicting local adaptation across different traits and locations. While cCommon garden studiesexperiments are abundant in North America and Europe respectively. However, no study has looked at the relationship between the two continents’ spring phenology variations. Combining meta-analytic techniques with hierarchical Bayesian models, and daily climate data in Europe and North America (2011 to 2020), we provide the first cross-continental assessment of local adaptation in spring phenology. AcrossTo date, across hundreds of papers and 59 common garden studies in Europe and North American we found only 21 published studies have examined spring phenology across latitudinal clines. We found a latitudinal cline of spring leafout in North America, but not Europe, with strong hierarchical effects of garden and species explaining much of the variation. Clines across gardens with mean annual temperature were weak. This lack of effect may be explained by the similar spring climate of most provenances and gardens, but suggests diverging latitudinal patterns in each continent. We conclude that We found that a. the two continents showed similar interannual climate variability relative to spatial climate variability and b. local adaptation between the two continents could be due to deciduous and evergreen species divergence. We conclude that the spring phenology of trees from European provenances might have stronger clines and less plasticity, but this finding might be skewed given the lack of studies on European provenances (n=4).

# 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 (200 Words Max)**

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 the North American context. 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 made from 1962 to 2019. We extracted daily temperature over the past 10 years for each provenance and its associated common garden and calculated the temperature percentage overlap. We ran blah blah blah model to

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

Our study features seven angiosperms and eight gymnosperms. We found a slight 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. As provenance latitude gets higher, we witness a stronger delay in spring phenology in Europe. 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 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 slightly stronger relationship observed in Europe. We also found strong latitudinal clines of fall events in both continents, but fall event local adaptation appears to be way stronger in North America than in Europe. We conclude that

Fall event/local adaptation way stronger in NA than in Europe

Spring event/local adaptation slightly stronger in Europe than in NA

We found that the farther apart the garden is from a provenance, the less climate overlap.

The higher the percentage overlap, the less difference in spring doy -> slightly stronger relationship observed in Europe

We found that local adaptation in fall events (leaf senescence, leaf abscission) is way stronger in North America than in Europe.