

# Evaluation of a wide range of plant species phenology in botanical gardens across the world

Mini-project, Living Data Project Productivity and Reproducibility course

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## Introduction

Botanic gardens have played an important role in the popularization of plant biology in occidental societies for already several decades (Krishnan & Novy, 2017). They help bridge the gap between scientists and the general public.

However, these island of green can also be useful to scientists and are an important source of phenological data (Primack et al., 2021). With climate change affecting plant communities and causing populational and phenological shifts (Vellend et al., 2021), these places regrouping plant individuals from everywhere in the world subjected to variable environmental conditions in different biomes are a window on plant species' capability to withstand changes. That special setting gives meaning to the existence of the **PhenObs initiative** (Phenological Observation Network) (Nordt et al., 2021). It is a collaborative research project designed to track and monitor plant phenology in these particular and rich sites that are botanic gardens. PhenObs focuses on gathering detailed observations on plant phenology across multiple biomes to understand how climate change and other environmental factors impact vegetation and biodiversity.

This initiative relies on data collected by researchers and citizen scientists in various cities from around the globe (though mostly in Europe).

## Methods

Different phenological traits were measured for common species found in a wide selection of botanical gardens from across the world. Indeed, the flowering onset, flowering peak and senescence of the plant were systematically noted for every population sampled.

## Results

There was great variability between the day of peak flowering regardless of the species involved, particularly for most northern and continental places, such as the Petrozavodsk Botanical Garden, in Russia (Figure 1).

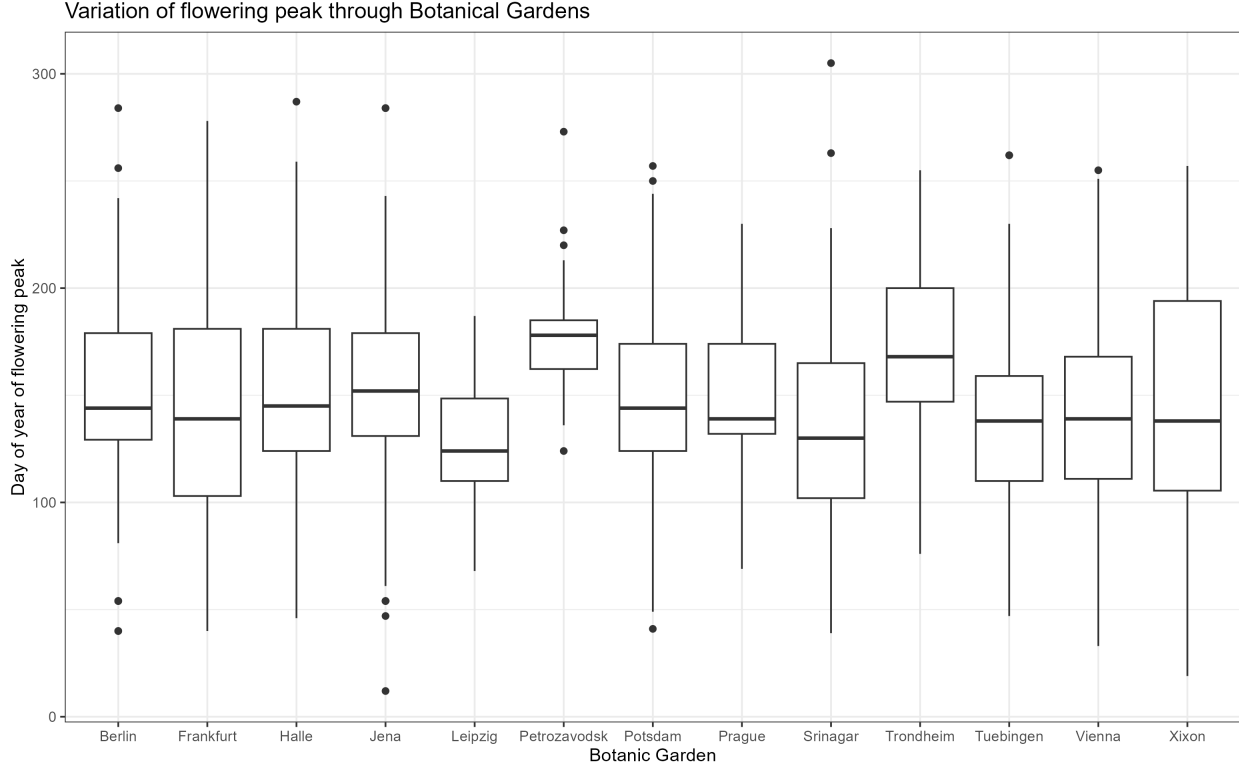


Figure 1 : Comparison of flowering peak at all sampled Botanic Gardens

Even greater differences could be observed at the species level. For example, flowering peaks could be different by as much as 57 days for *Achillea Millefolium* (Table 1).

Table 1: Peak of flowering and senescence for *Achillea Millefolium* in different gardens

Botanic_Garden	FlPeak	SenPeak
Xixon	152	208
Tuebingen	209	5
Jena	179	354
Potsdam	195	13
Srinagar	158	340
Halle	181	294
Vienna	187	361
Prague	188	314

## Discussion

In the PhenObs experiment, latitude serves as a reliable proxy for climate variation because it is closely linked to temperature and seasonal changes, which influence plant phenology. As expected, longitude, however, is less effective as a proxy for climate change, as it does not capture the same consistent environmental gradients due to differing continental influences, ocean currents, and topography. Therefore, while latitude strongly affects plant responses to climate, longitude contributes more indirectly through localized climate conditions.

## Bibliography

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