

Yihan Wu and Robert I. Colautti

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13.7K Tweets



Brigid Christison \* @Brigidomorpha · 1h

Replying to @CylitaGuy @csee2018

I look at the teeth of different dead animals to figure out how they shared food while living at the same time and place.

(Reeeally wish #mammals, #carnivores, or even meat-eating were on that list!) #CSEETweetShop









Cylita Guy @CylitaGuy · 1h

Replying to @KirstenGrant3

Nice summary!

Loving these common word research summaries from the #CSEETweetShop!



# I find photographs of plants from the past,

measure how long their sex parts are,

and when their sex parts open

and close over the years.

# Global Biodiversity Information Facility



~ 75 million preserved specimens records

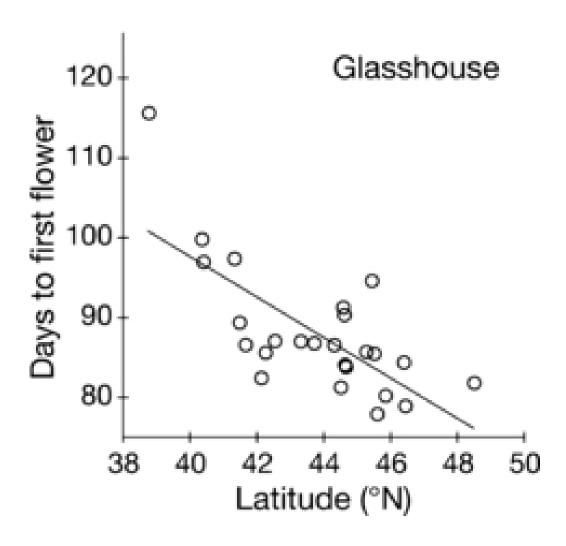


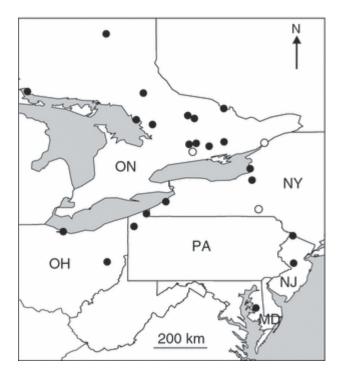






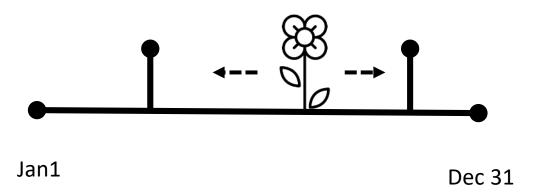


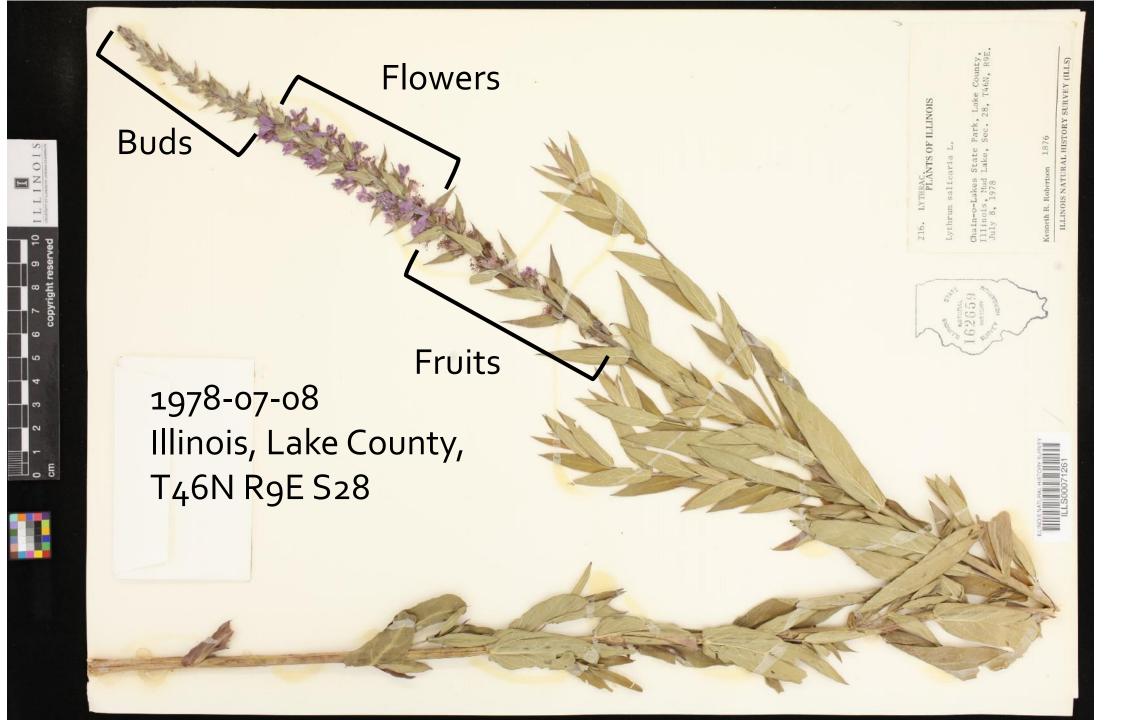


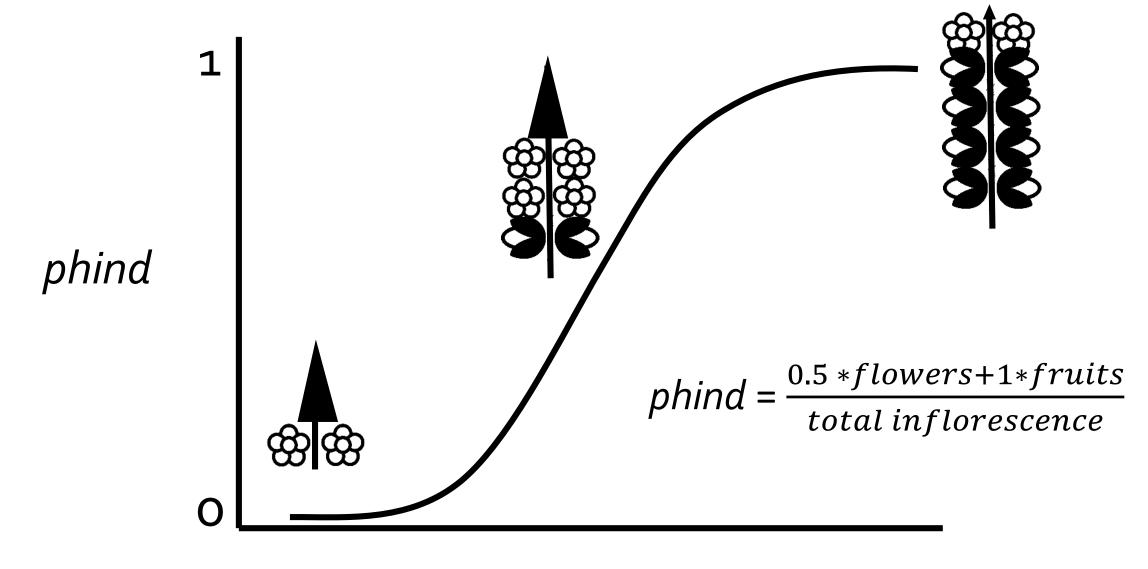


- 1) Parallel clines across North America
- 2) Phenological shifts over time









Time



# Sept 6, 2008





Donna J. Sheridan 88-023

July 18,1988

### Wallace Lake, Wisconsin

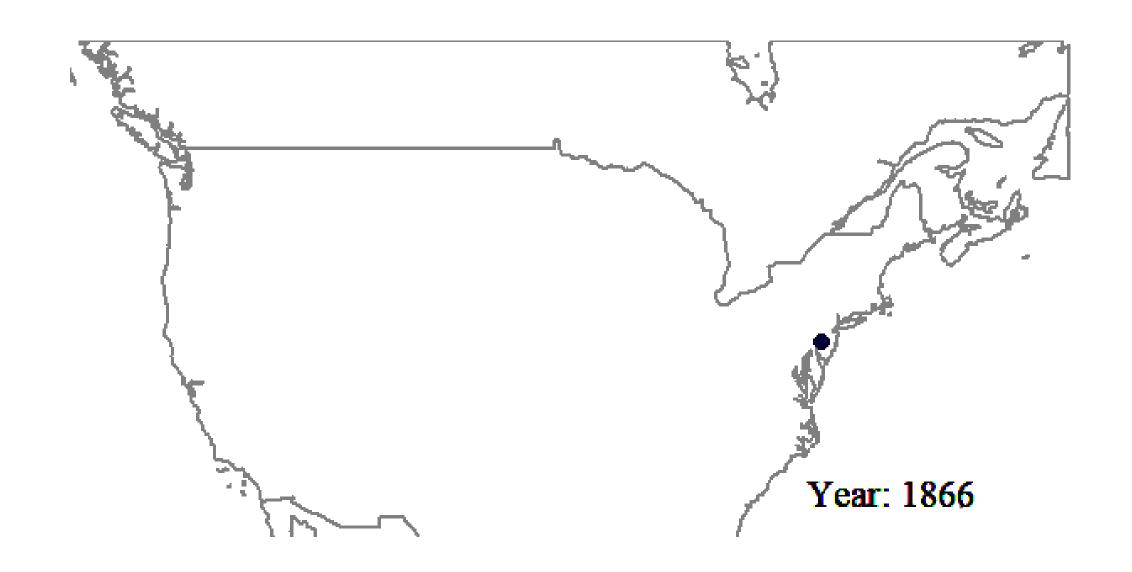


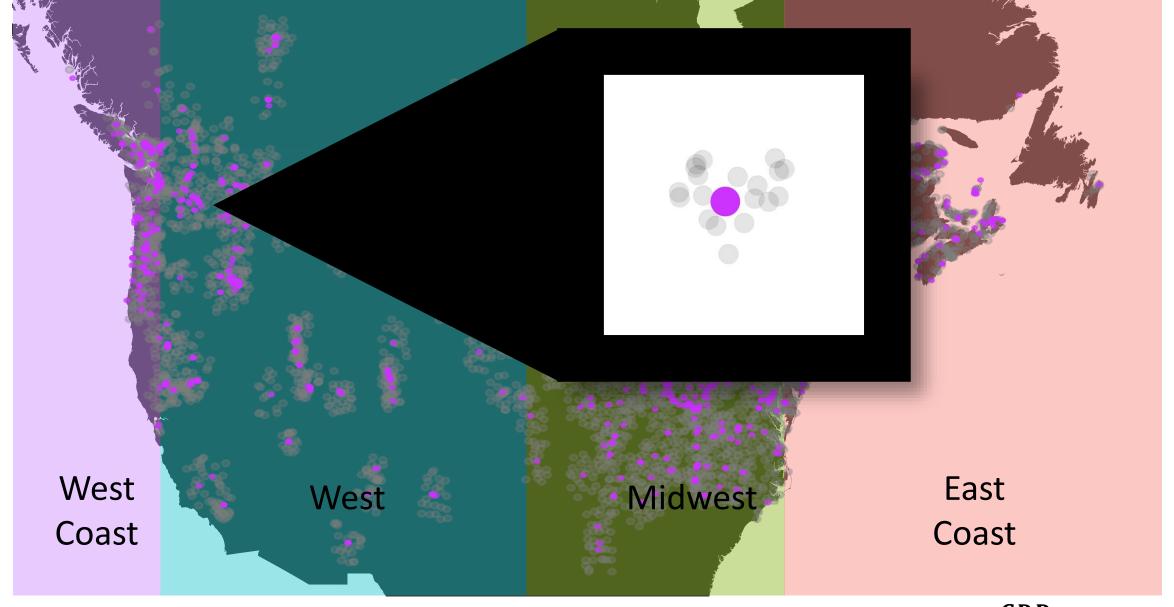
#### Oct 10, 1988



#### Growing-Degree-Days

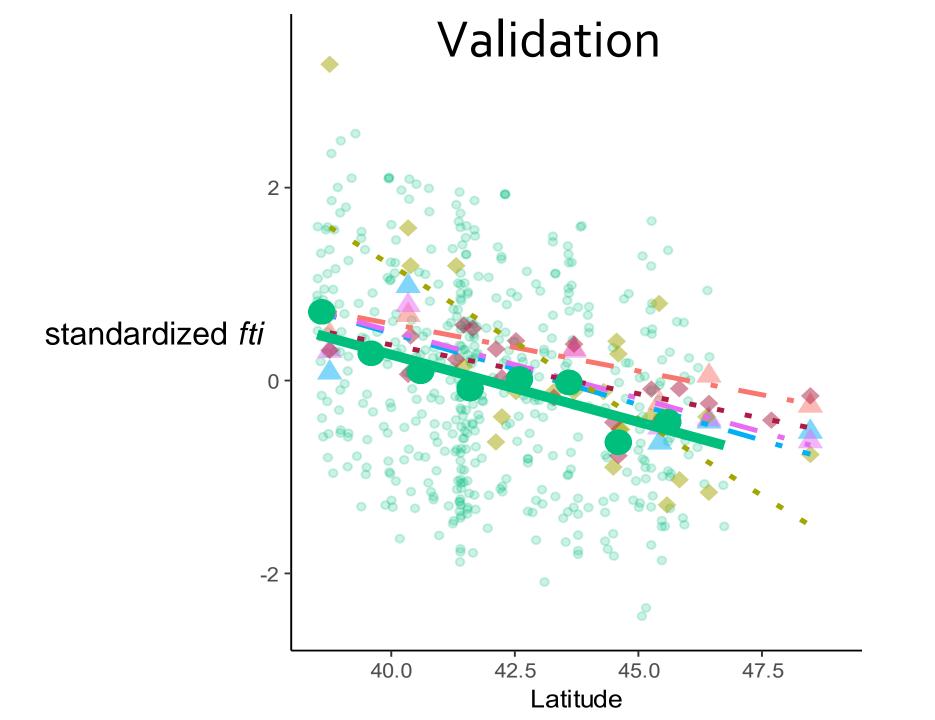
$$GDD = \frac{T_{max} + T_{min}}{2} - T_{base}$$



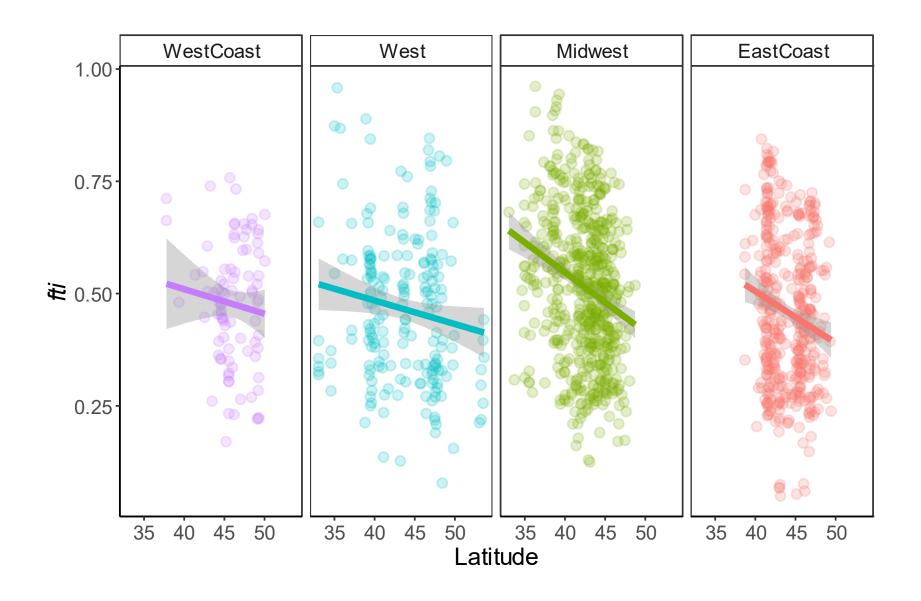


3,427 herbarium specimens 6,303 unique weather stations 62,208 annual weather records

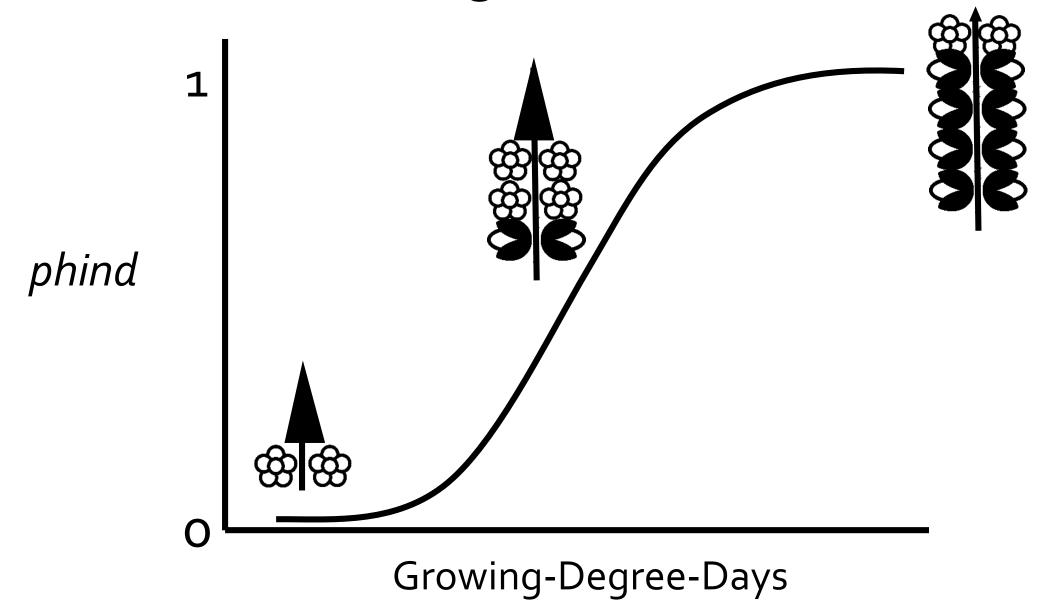
$$GDD = \frac{\sum_{1}^{n} \frac{GDD_{i}}{d_{i}}}{\sum_{i}^{n} \frac{1}{d_{i}}^{2}}$$

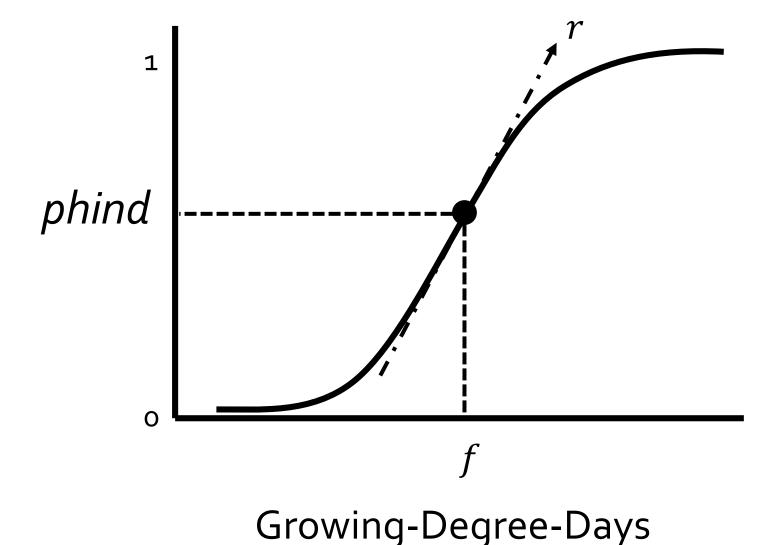


## 1) Parallel clines across North America



# 2) Phenological shifts over time

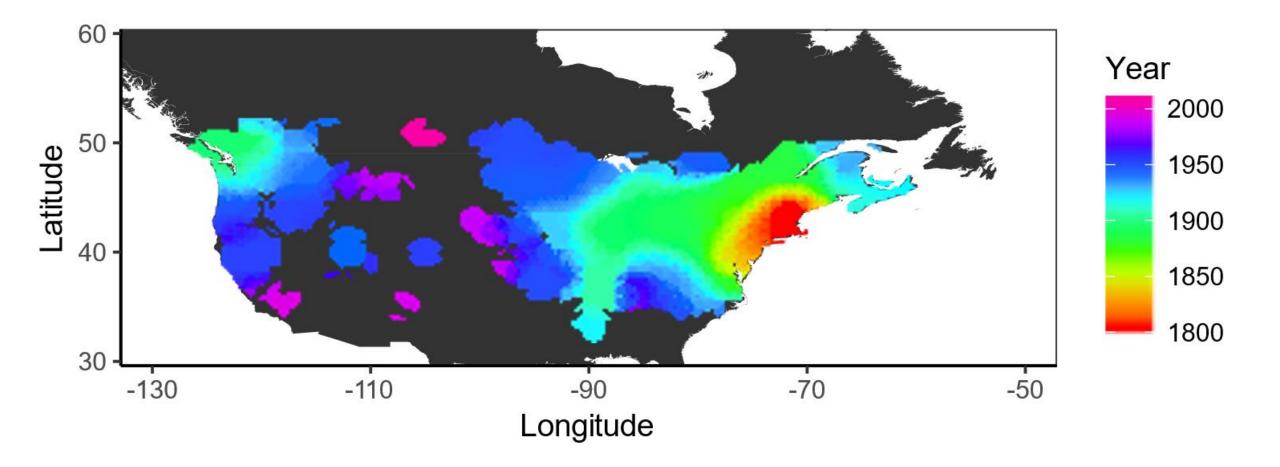


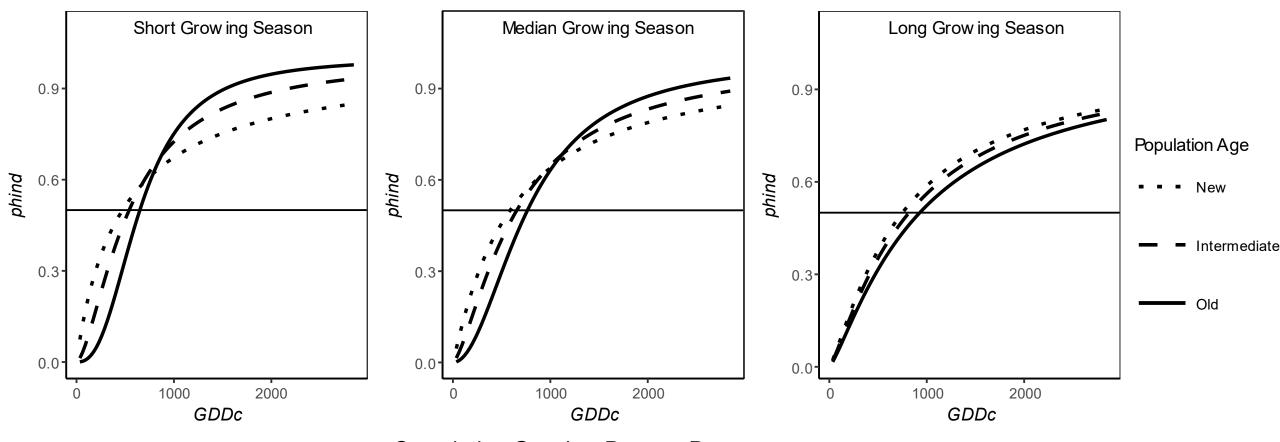


$$phind \sim \frac{1}{1 + (\frac{GDDc}{f})^{-r}}$$

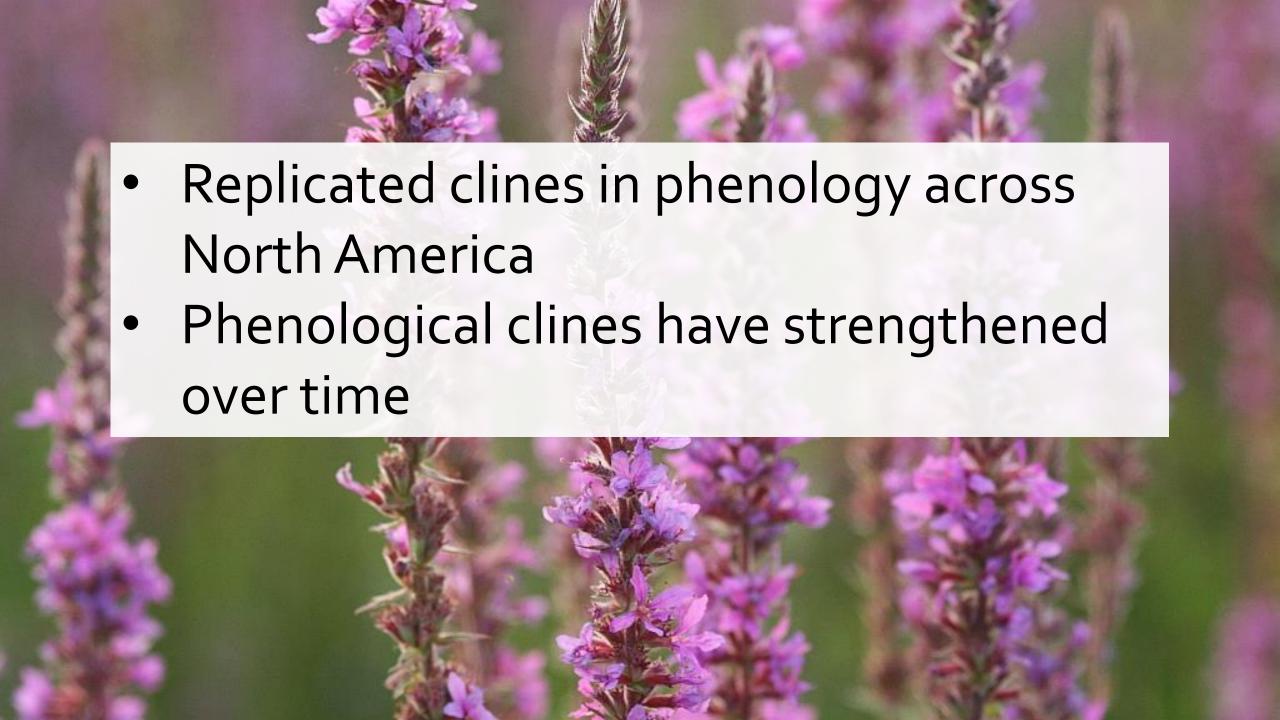
Variables in f and r:
Time since invasion
Season Length

Non-linear least squares model





Cumulative Growing-Degree-Days



# Acknowledgements

### Questions?

Collection and Measurement:

Leila Forsyth Julia Weder







Climate Data: NOAA

Herbarium Databases:

GBIF

VASCAN

**SEINET** 

Colautti and Eckert Lab members

Dr. Stephen Lougheed

Dr. Vicki Friesen

Image Sources:

Flickr

Noun Project

#### Herbariums:

Herbier Louis-Marie - Université Laval, University of Washington, University of Alberta, University and Jepson Herbaria, Kent State University, Lynchburg College, University of Massachusetts, Memphis State University, New Mexico State University, University of North Carolina, Queen's University, Rancho Santa Ana Botanic Garden, Western New Mexico University, UC Davis, UC Riverside, Utah State University, Royal Museum of British Columbia, Yale Peabody Herbarium, Oregon State University, Washington State University

# Flowering time index fti ~ phind + Ratiogod

