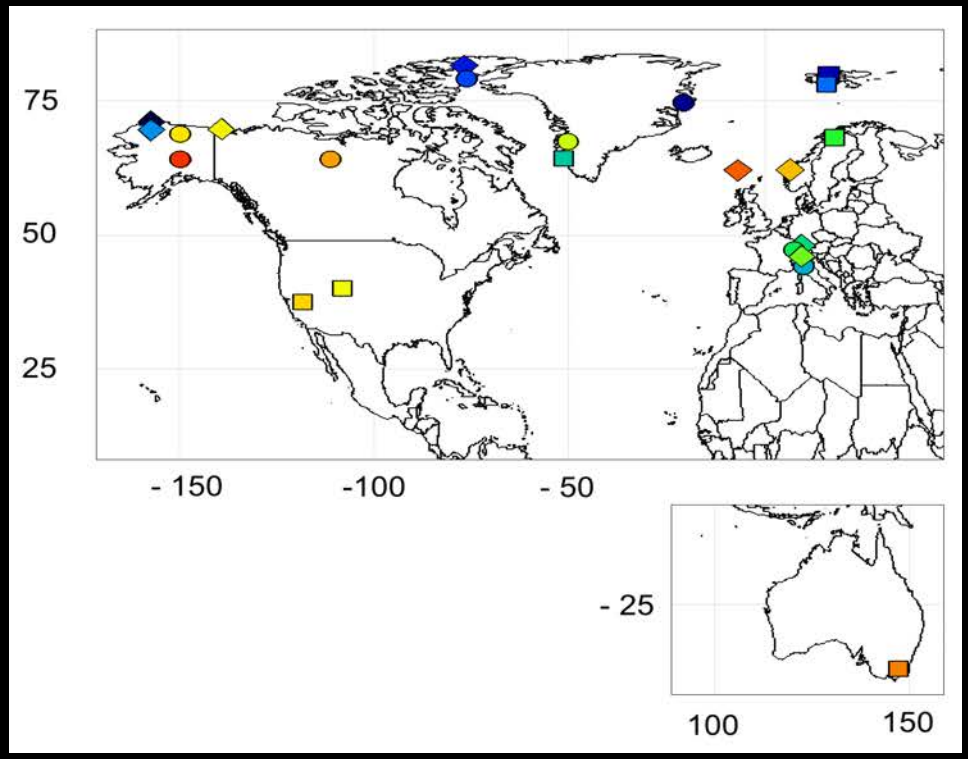
The ITEX phenology database: Recent syntheses and future directions

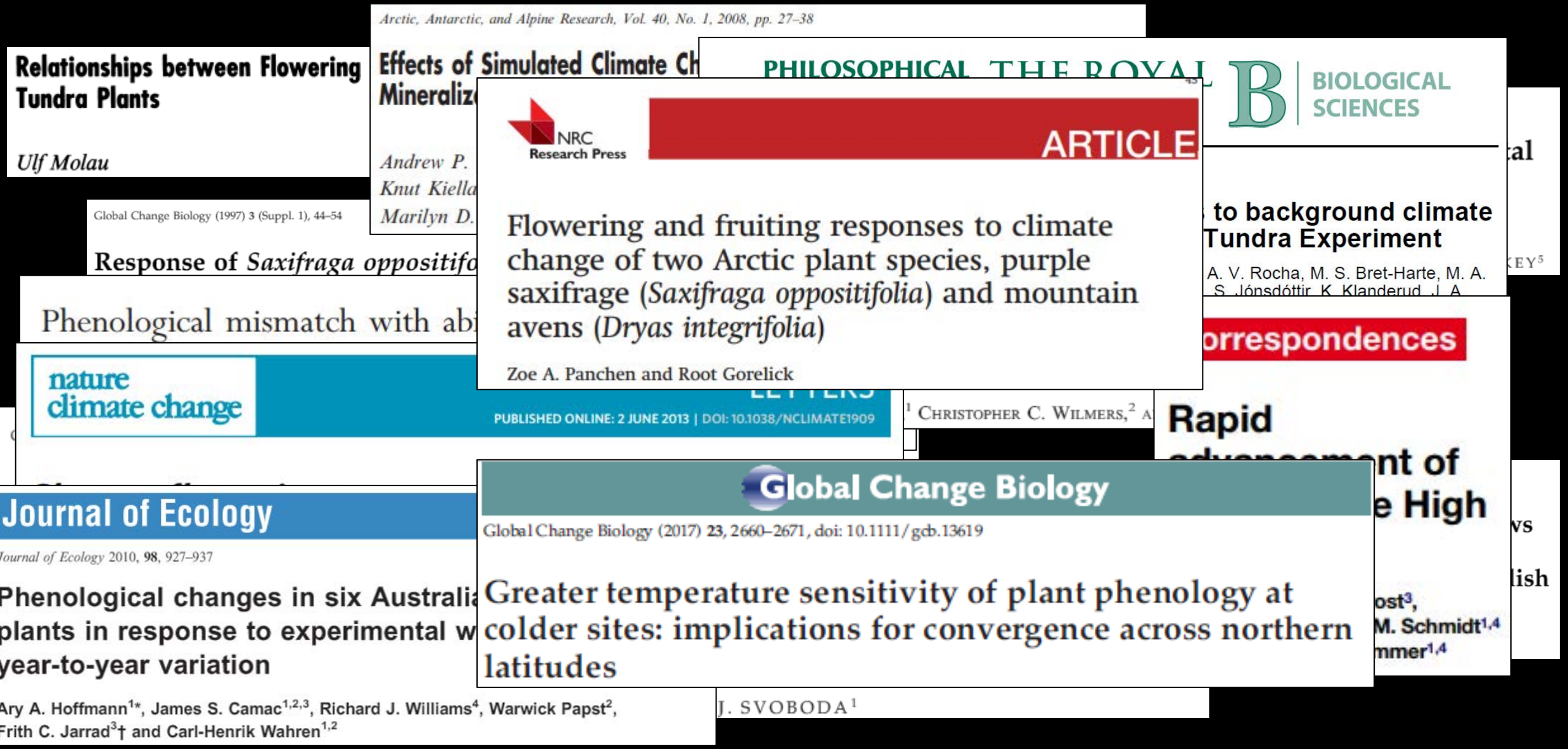
Janet Prevéy, Christian Rixen, and the ITEX Consortium

Background

- First phenology observations taken at ITEX sites in the early 1990s
- First large scale phenology synthesis in 2013 led by Steve Oberbauer
- The latest version of the ITEX phenology database contains: **253 species**, **23 sites**, and over **20 years** of data from Arctic and alpine ecosystems



Over the last 20+ years, **many** publications have incorporated ITEX phenology data……

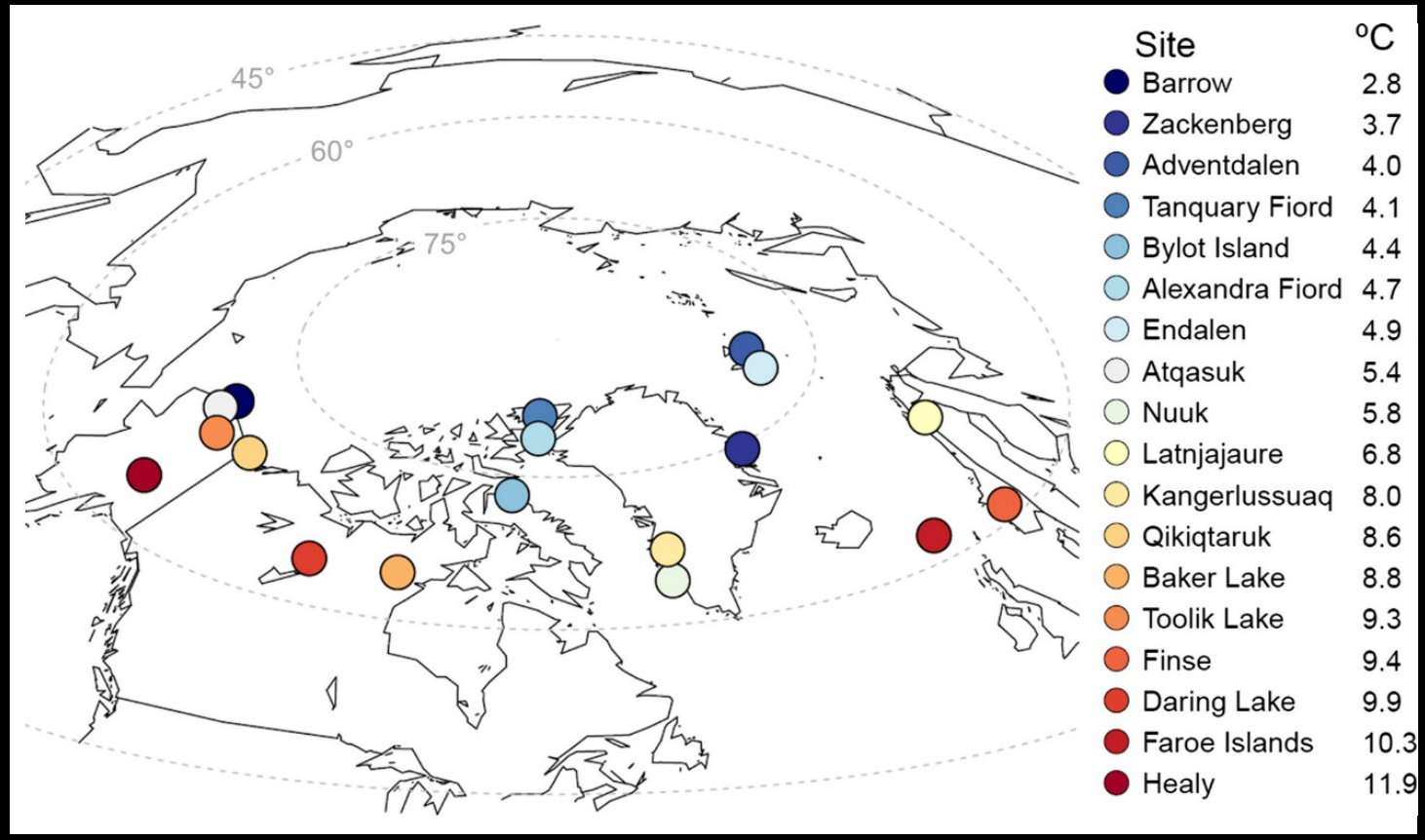


Greater temperature sensitivity of plant phenology at colder sites: implications for convergence across northern latitudes

(Prevéy et al., *Global Change Biology*, 2017)

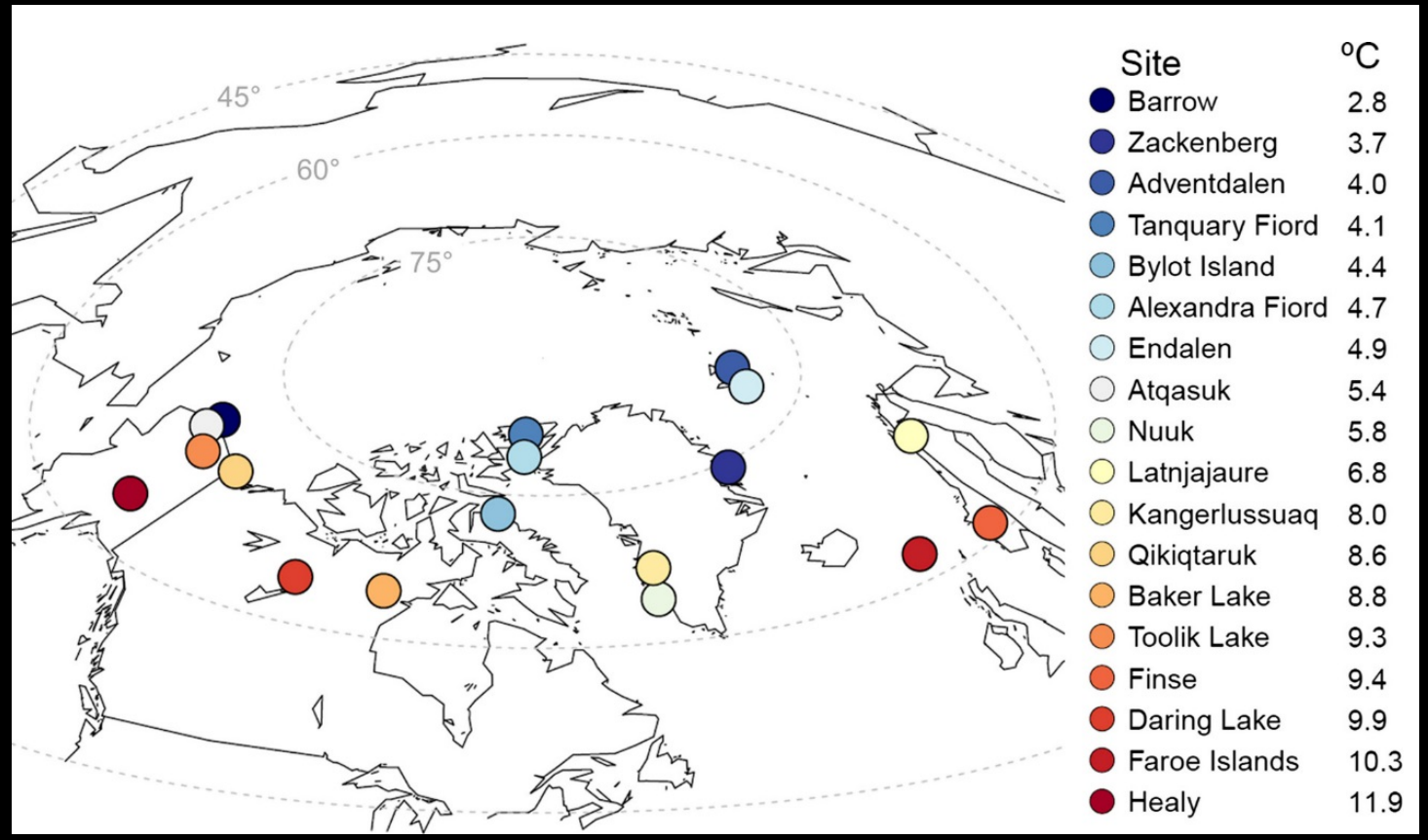
- Added phenology data from 10 new Arctic sites

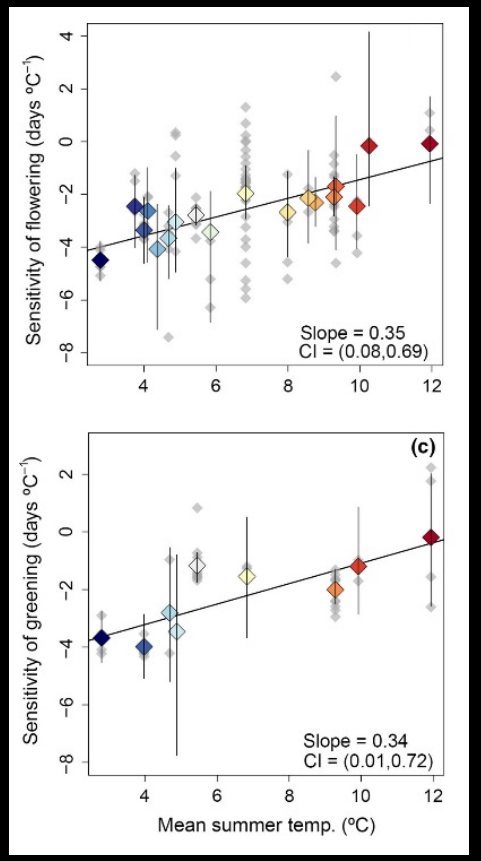
- **Hypothesis**: Plants from colder Arctic sites would have greater temperature sensitivity of phenology

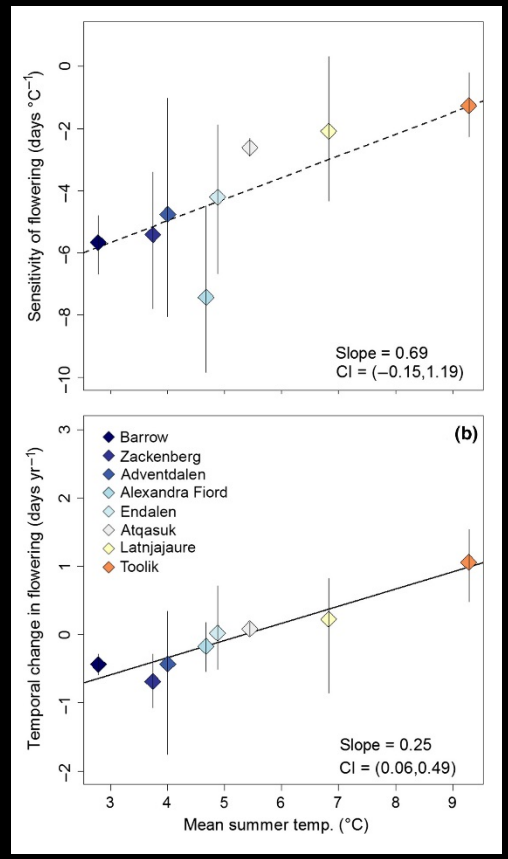


Greater temperature sensitivity of plant phenology at colder sites: implications for convergence across northern latitudes

(Prevéy et al., *Global Change Biology*, 2017)







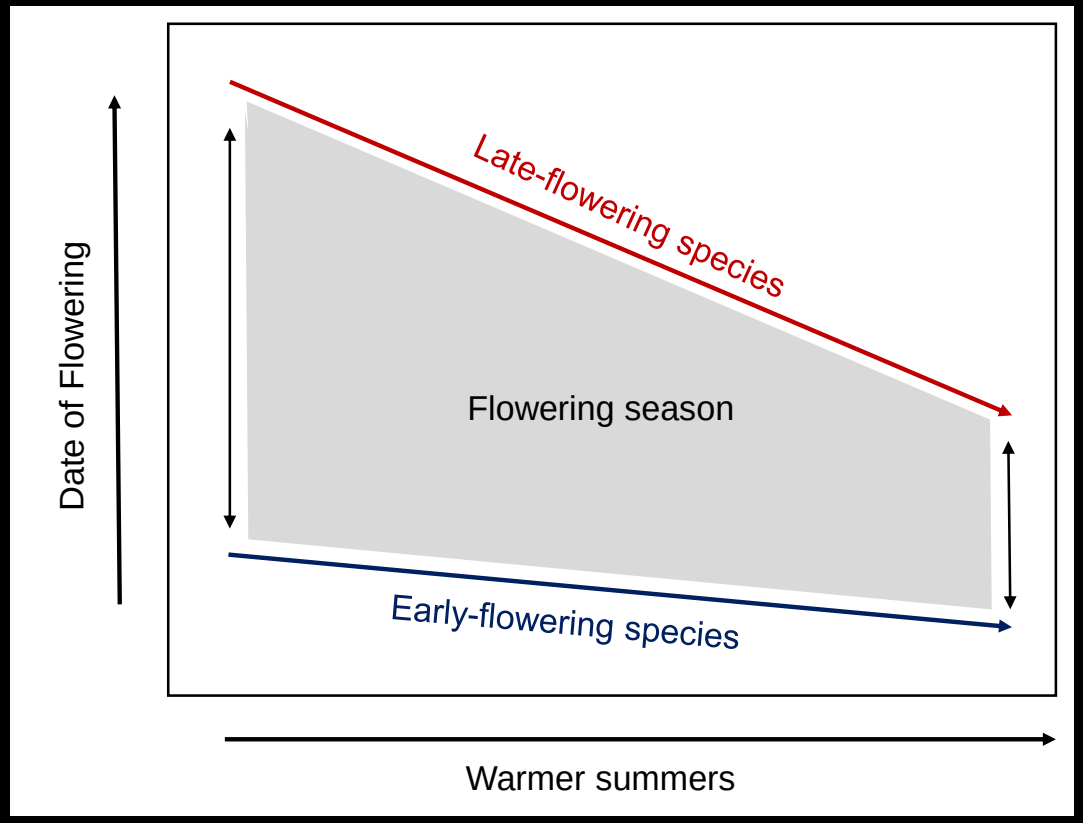
- This sort of analyses would not be possible without **multiple sites** across a climatic gradient with **multiple years** of data!

Upcoming publication: Warming shortens flowering seasons of tundra plant communities (Prevéy et al., *in review*)

Relationships between Flowering Phenology and Life History Strategies in Tundra Plants

Ulf Molau

Abstract



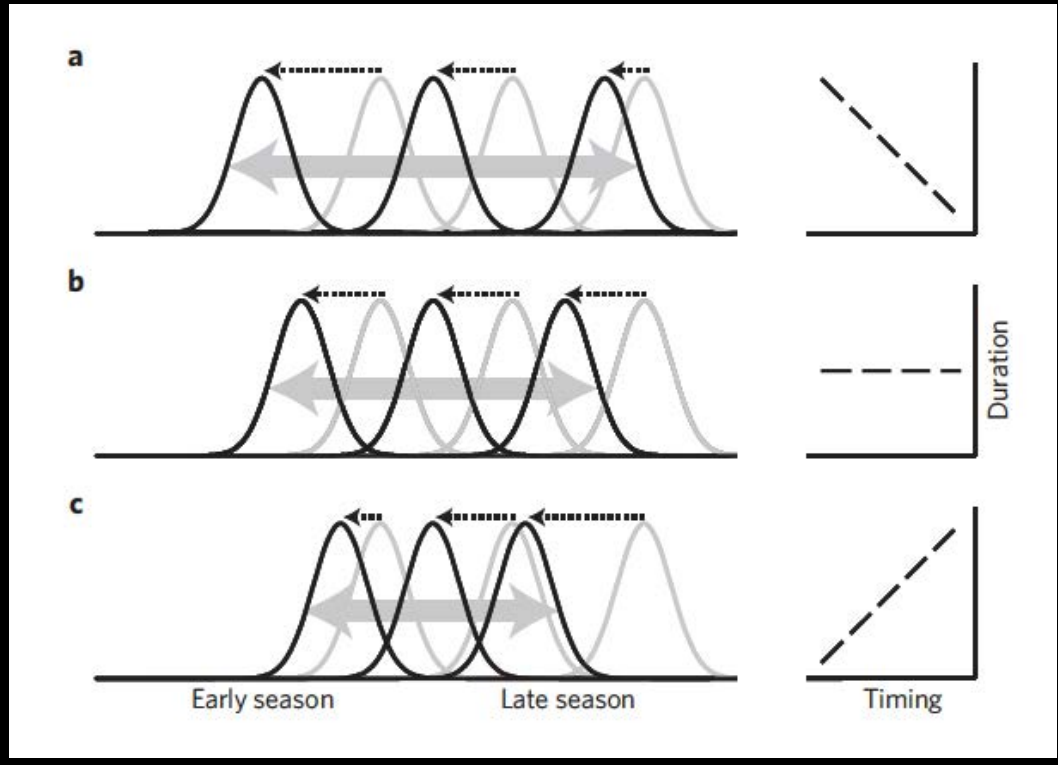
nature climate change

LETTERS

PUBLISHED ONLINE: 2 JUNE 2013 | DOI: 10.1038/NCLIMATE1909

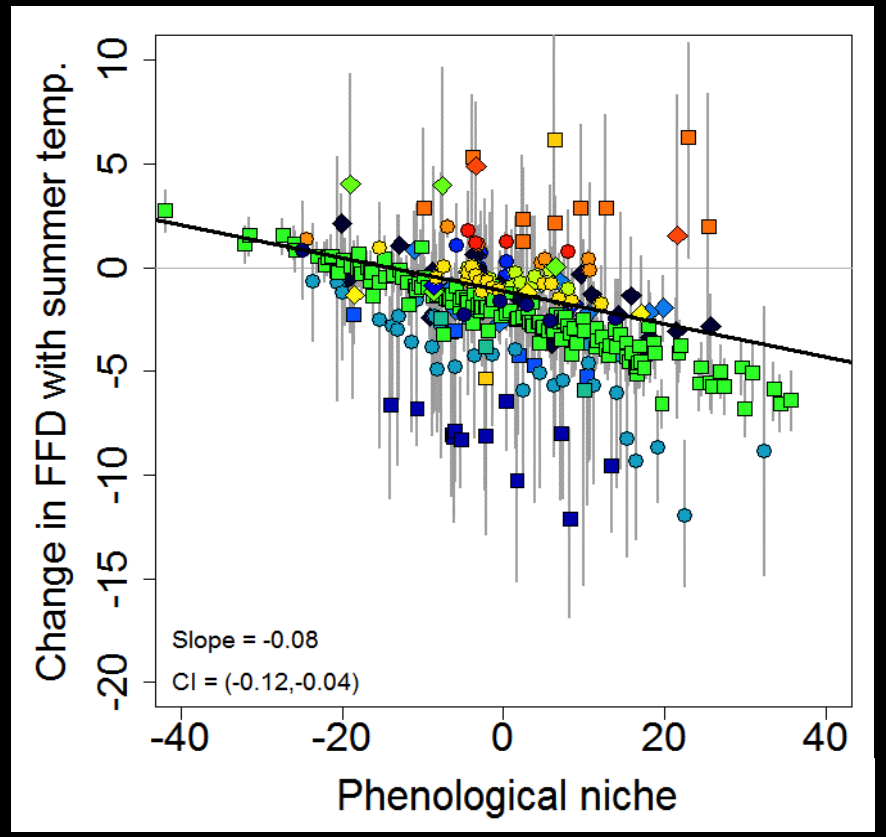
Shorter flowering seasons and declining abundance of flower visitors in a warmer Arctic

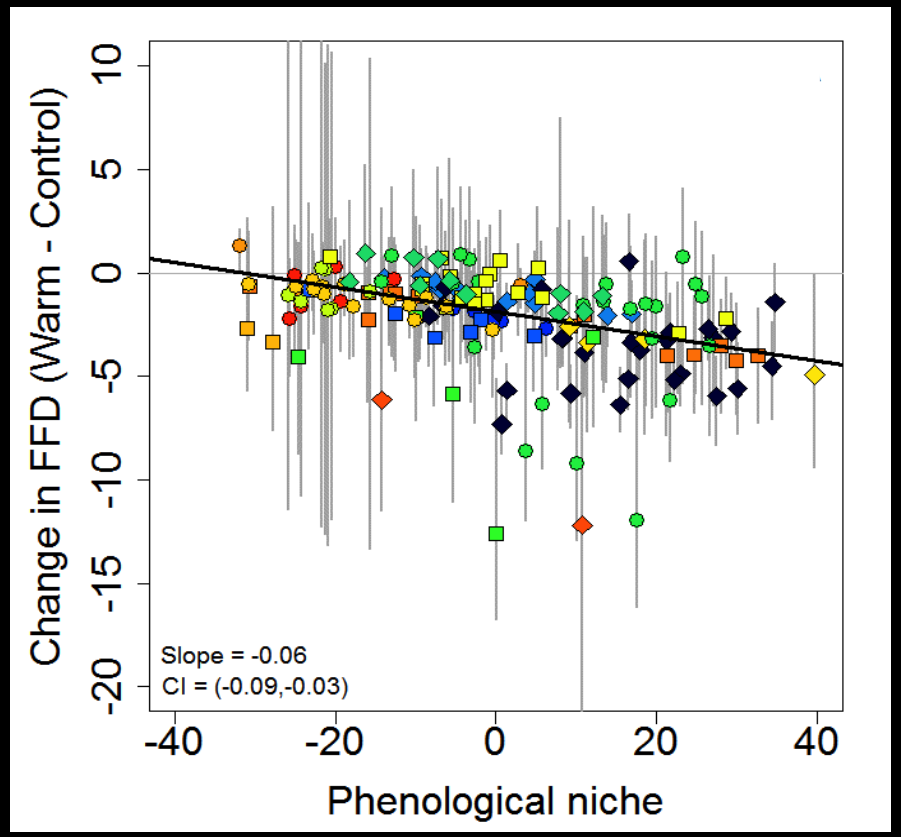
Toke T. Høye[1,2]*, Eric Post[3], Niels M. Schmidt[2,4], Kristian Trøjelsgaard[5] and Mads C. Forchhammer[2,4,6]



Upcoming publication: Warming shortens flowering seasons of tundra plant communities (Prevéy et al., *in review*)

- Late-flowering species were more sensitive to summer temperature than early-flowering species, and advanced flowering **more** in warmer years

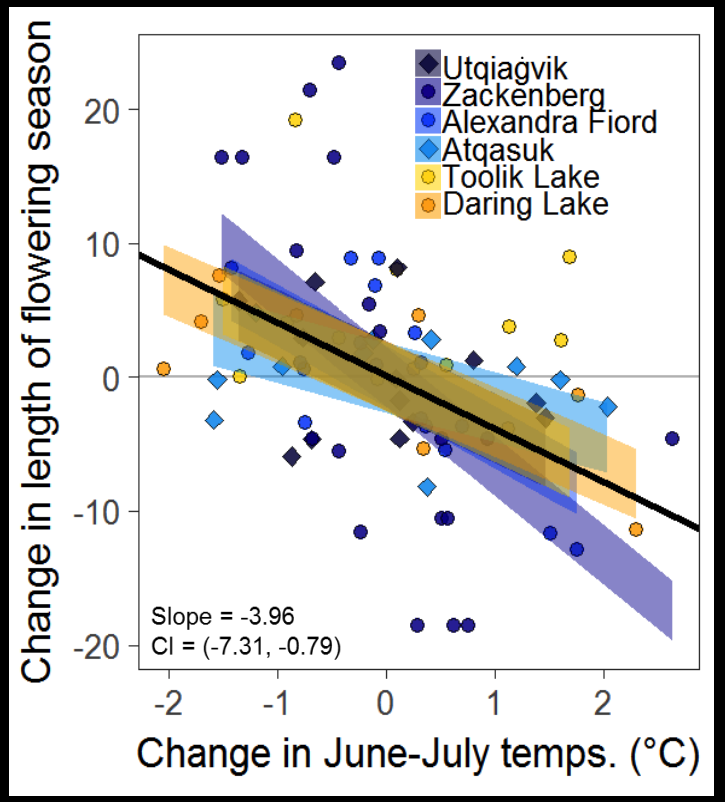


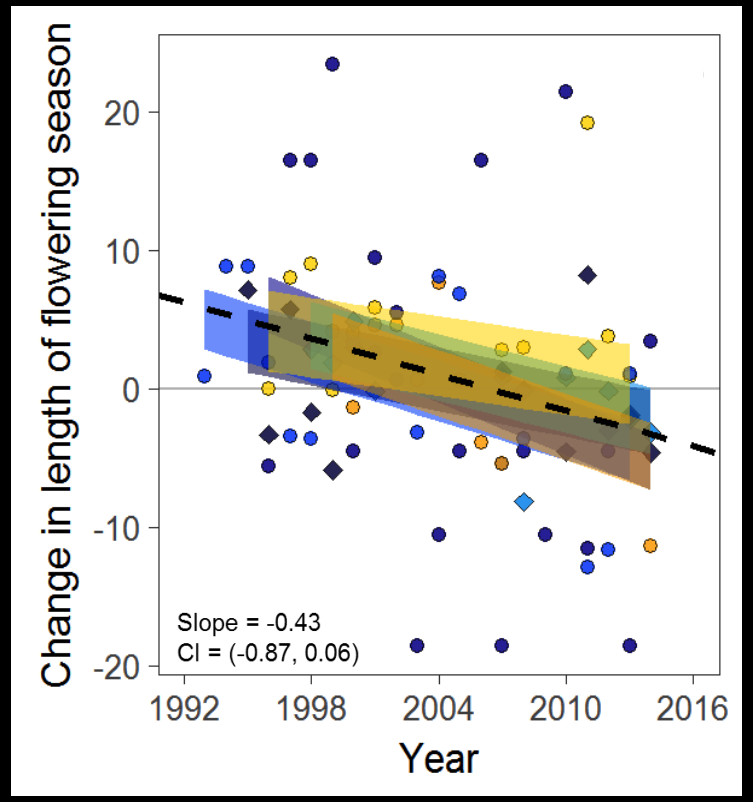


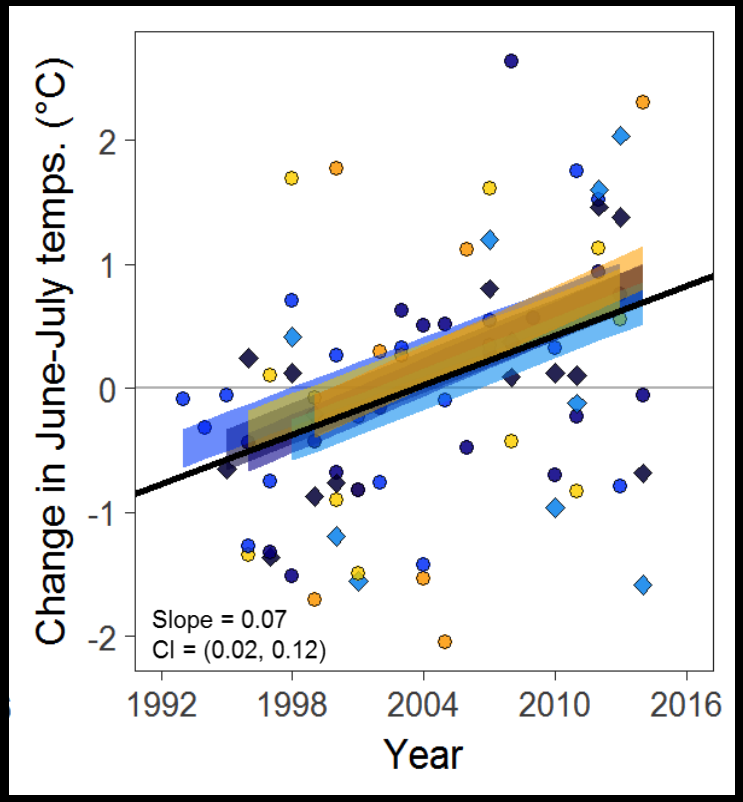
- Similar results for long-term monitoring plots and warming experiments

Upcoming publication: Warming shortens flowering seasons of tundra plant communities (Prevéy et al., *in review*)

- The greater advancement in flowering times of late-flowering species led to a contraction of community-level flowering seasons in **warmer years** and **over time** at 6 sites with long-term data

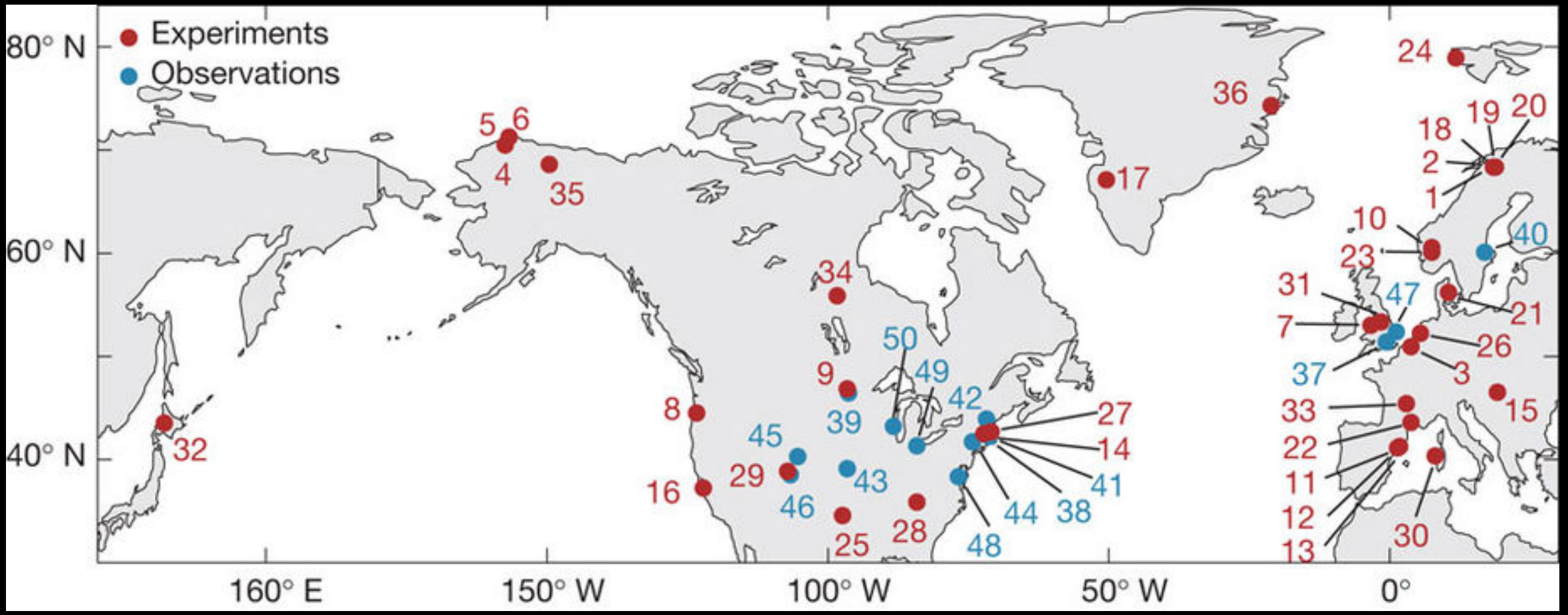






These results **differ** from those of plant phenological studies at lower latitudes and altitudes...

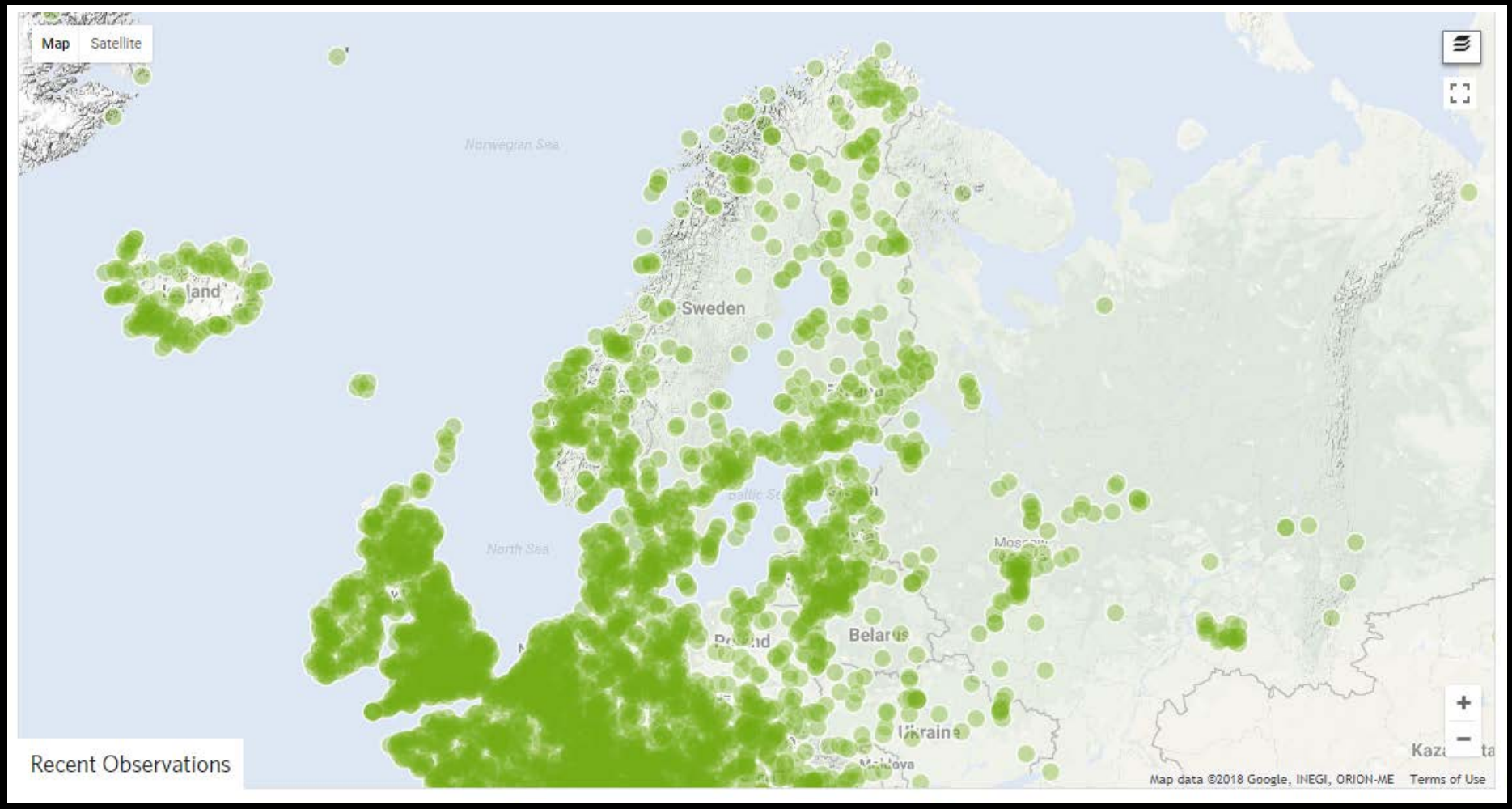
Previous studies find **earlier** growing plants are more sensitive to increasing temperatures than later growing plants (e.g. Fitter and Fitter 2002, Menzel et al. 2006, Parmesan 2007, and **Wolkovich 2012**)



Wolkovich et al. 2012

Do current “world-wide” ecology databases lack coverage of Arctic and alpine sites?

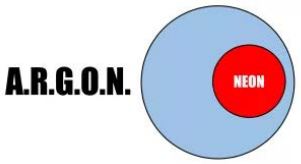
iNaturalist

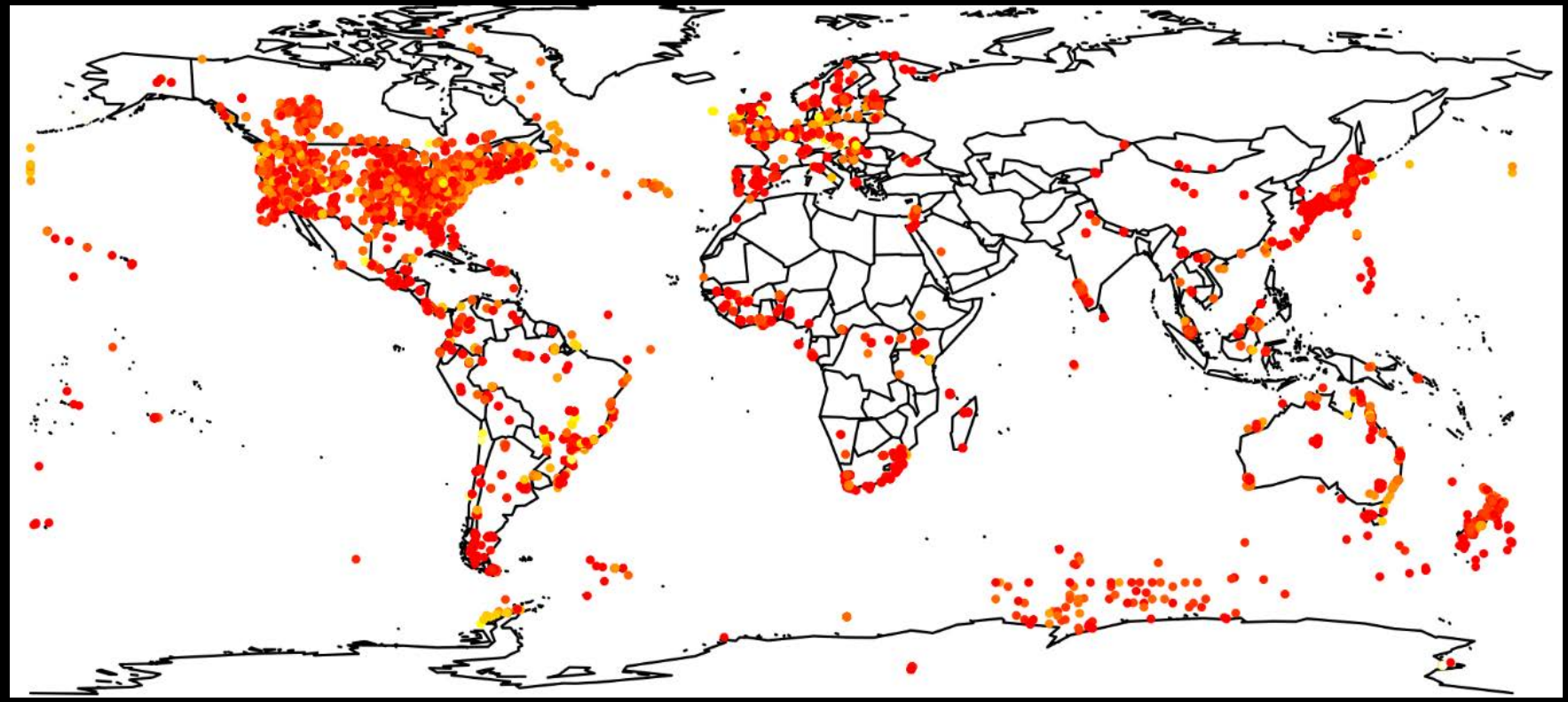


Do current “world-wide” ecology databases lack coverage of Arctic and alpine sites?

ARGON – Augmenting Research Grounded on NEON

We are soliciting collaborators/members of ARGON – please register your interest by filling in this survey.



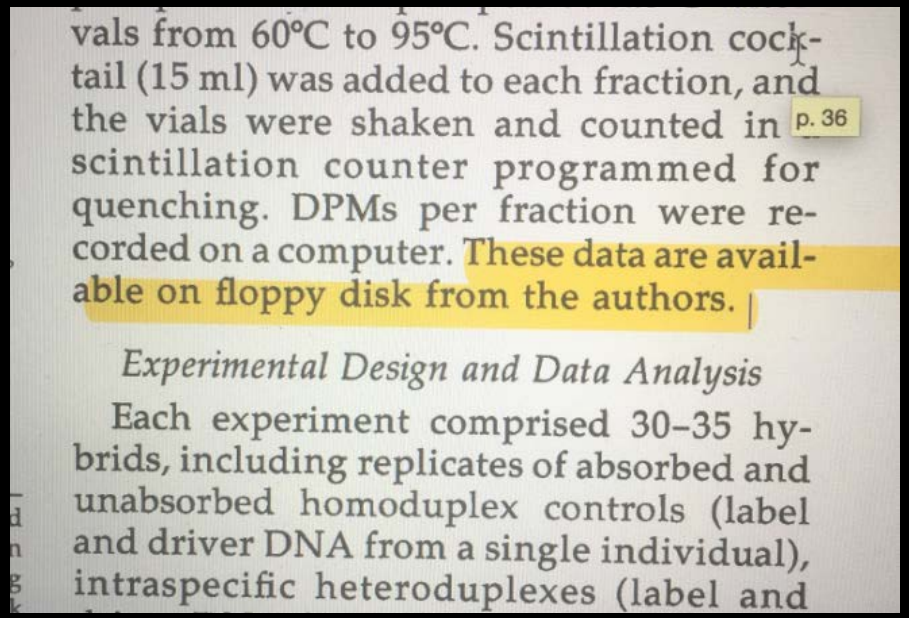


Where is the ITEX phenology data now?

- Current ITEX site phenology data repositories:
  - Barrow and Atqasuk plant data: https://arcticdata.io/catalog/#view/doi:10.18739/A21S1S
  - Zackenburg and Nuuk plant data: http://data.g-e-m.dk/

- ITEX phenology synthesis data repositories:
  - Oberbauer et al. 2013: https://arcticdata.io/catalog/#view/doi:10.18739/A2DP8T
  - Prevéy et al. 2017: https://www.polardata.ca/pdcsearch/?doi_id=12722
  - Prevéy et al (*in review*): ???

Thinking about data availability…..



vals from 60°C to 95°C. Scintillation cocktail (15 ml) was added to each fraction, and the vials were shaken and counted in a scintillation counter programmed for quenching. DPMs per fraction were recorded on a computer. These data are available on floppy disk from the authors.

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Experimental Design and Data Analysis

Each experiment comprised 30–35 hybrids, including replicates of absorbed and unabsorbed homoduplex controls (label and driver DNA from a single individual), intraspecific heteroduplexes (label and

Sheldon, F.H., and M. Kinnarney. 1993. The effect of sequence removal on DNA hybridization estimates of distance, phylogeny, and rates of evolution. *Systematic Biology* 42: 32-48.

- Technology changes over time… how will our current data sharing practices work in 25 years?

So now what?

- If a cross-site ITEX phenology database is desirable: How do we keep this resource up to date?
  - **Zoe Panchen** is offering to update the current Arctic database with new measurements!
- Should these phenology data be integrated with growth, reproduction, plant trait and cover data?
- What other types of site data (if any) should be included in the database?

Data availability options

- Publish a data paper on the data *a la* Bjorkman (*in review*), Dierenbach et al. (2013) and Templ et al. 2018)
  - Pros: article may increase visibility, all data owners get another citation to help justify funding, etc.
- Set up a Github repository with the data
  - **Pros**: Easy to access and download data, easy to add to and correct datasets – instantly update your data from anywhere in the world
  - **Cons**: a bit of a steep learning curve Continue to update data in polar data catalogue
  - **Pros**: Prompt responses from site admins, they are very helpful in providing additional QA/QC and correcting metadata / notes
  - **Cons**: Time lag between data entry and acceptance in database, all data passes through one database administrator

New tools to collect ecological data from the web:

Pan European PEP725 Phenology DB

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A.R.G.O.N. NEON

TECHNOLOGY REPORT ARTICLE Provisionally accepted The full-text will be published soon. Notify me

Front. Plant Sci. | doi: 10.3389/fpls.2018.00517

The Plant Phenology Ontology: A new informatics resource for large-scale integration of plant phenology data

Brian J. Stucky[1]*, Robert Guralnick[1], John Deck[2], Ellen G. Denny[3], Kjell Bolmgren[4] and Ramona Walls[5]

[1]Florida Museum of Natural History, United States
[2]Berkeley Natural History Museums, University of California, Berkeley, United States
[3]USA National Phenology Network, United States
[4]Swedish University of Agricultural Sciences, Sweden
[5]CyVerse, United States

Plant phenology — the timing of plant life-cycle events, such as flowering or leafing out — plays a fundamental role in the functioning of terrestrial ecosystems, including human agricultural systems. Because plant phenology is often linked with climatic variables, there is widespread interest in developing a deeper understanding of global plant phenology patterns and trends. Although phenology data from around the world are currently available, truly global analyses of plant phenology have so far been difficult because the organizations producing large-scale phenology data are using non-standardized terminologies and metrics during data collection and data processing. To address this problem, we have developed the Plant Phenology Ontology (PPO). The PPO provides the standardized vocabulary and semantic framework that is needed for large-scale integration of heterogeneous plant phenology data. Here, we describe the PPO, and we also report preliminary results of using the PPO and a new data processing pipeline to build a large dataset of phenology information from North America and Europe.

Keywords: Plant phenology, USA National Phenology Network, Pan-European Phenology Network, Knowledge representation, ontology, data integration, semantic data

The plant phenological online database (PPODB): an online database for long-term phenological data

Jonas Dierenbach, Franz-W. Badeck, and Jörg Schaber✉

- So – it's possible that *where* the database is stored won't matter so much in the end – as long at it is located somewhere that can be easily accessed for years in the future…

Important Considerations:

How do we ensure that credit is given to data owners when data is made public?

- Has anyone used your data inappropriately, or without your permission?

- What are ways to encourage data ***sharing,*** without encouraging data ***stealing***…….or is this even an issue??


Questions/thoughts/ideas?
Contact: janetprevey@gmail.com
POLAR DATA CATALOGUE
ITEX

Acknowledgements

- **Funding**: Swiss Federal Institute for Forest, Snow and Landscape Research WSL
- http://www.wsl.ch/

- **Data:** ITEX Consortium - all researchers, observers, recorders, and field technicians for the **ITEX** Project
- http://ibis.geog.ubc.ca/itex/

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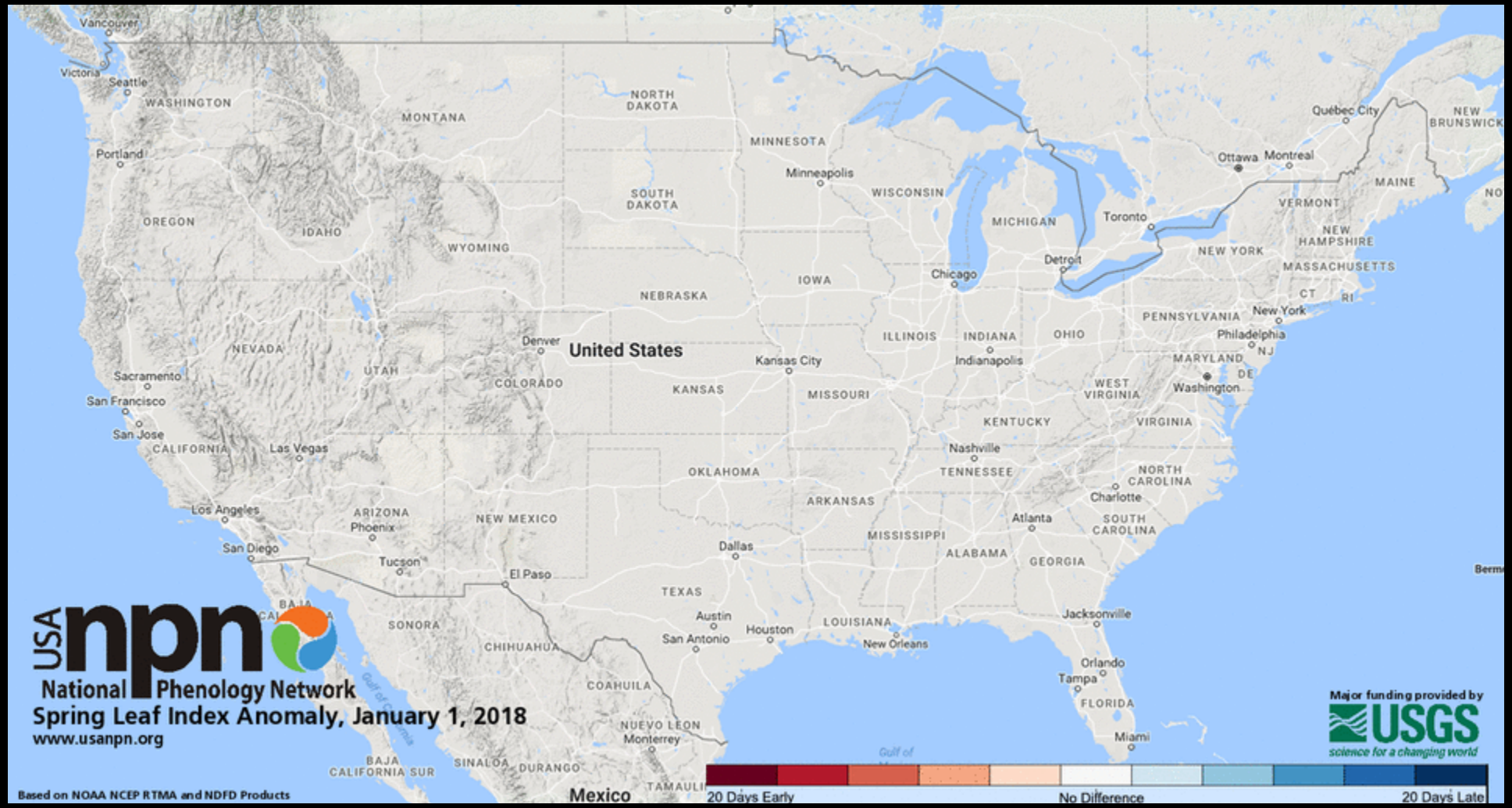

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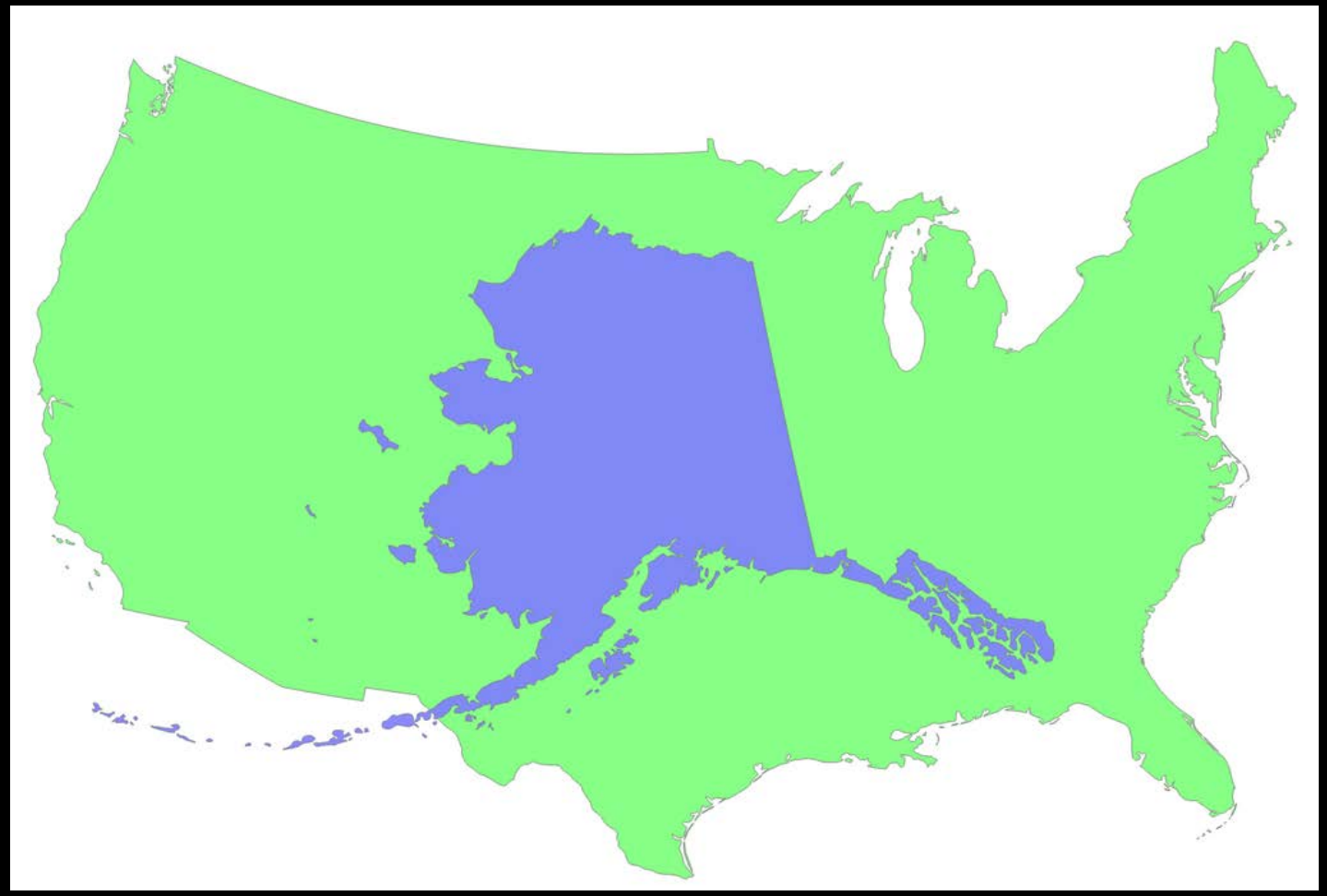

Other data to add?

- Daily climate data
- Precipitation – specifically snowmelt dates
- Small hobos or ibuttons even when weather stations are not available

Other syntheses

- Other possibly syntheses using the data – Jakob's

- Zoe Panchen and Jakob Assman (*coastal phenological responses*)
  - What other types of data would be useful for us here?