



# **Late Bloomers: spotting funky fall flowers and what it tells us about climate change**

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Department of Biology and Wildlife),  
Pam Diggle (University of Connecticut)

# What is wrong with these pictures!?



*Viburnum edule* (highbush cranberry)  
August 12, 2016

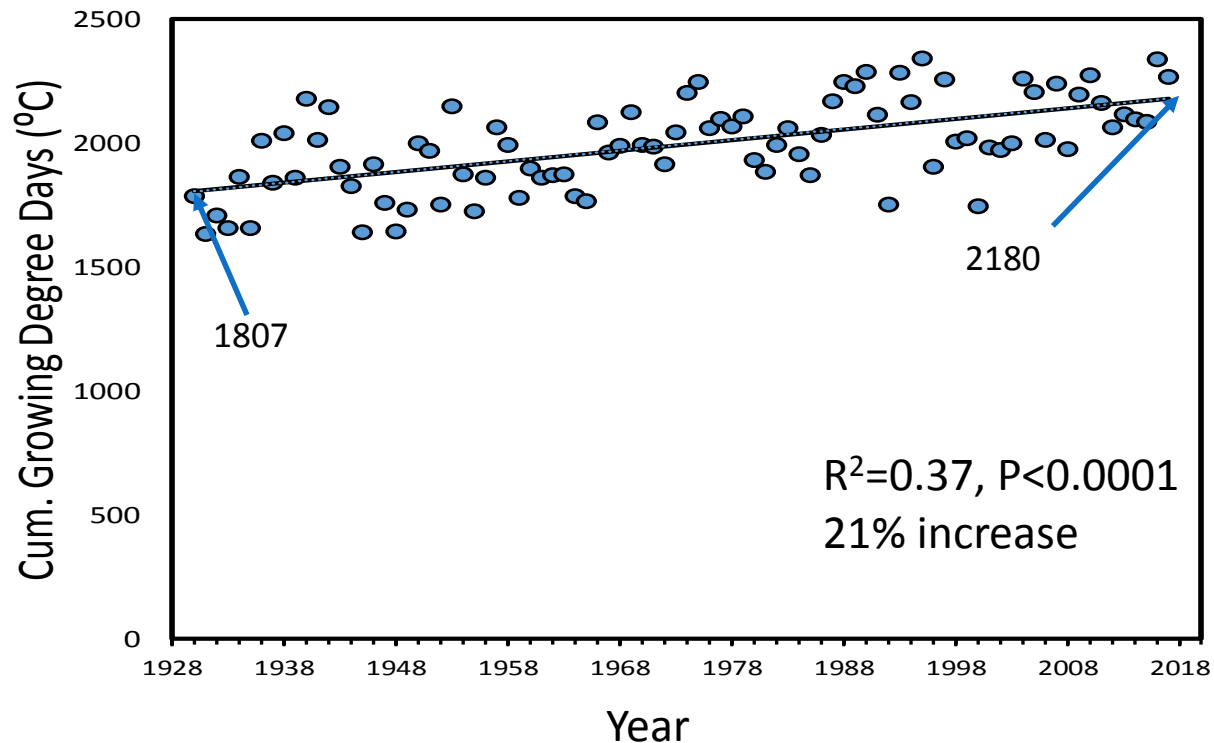


*Vaccinium vitis-idaea* (lowbush cranberry)  
August 12, 2016

# How are seasons changing in interior Alaska?

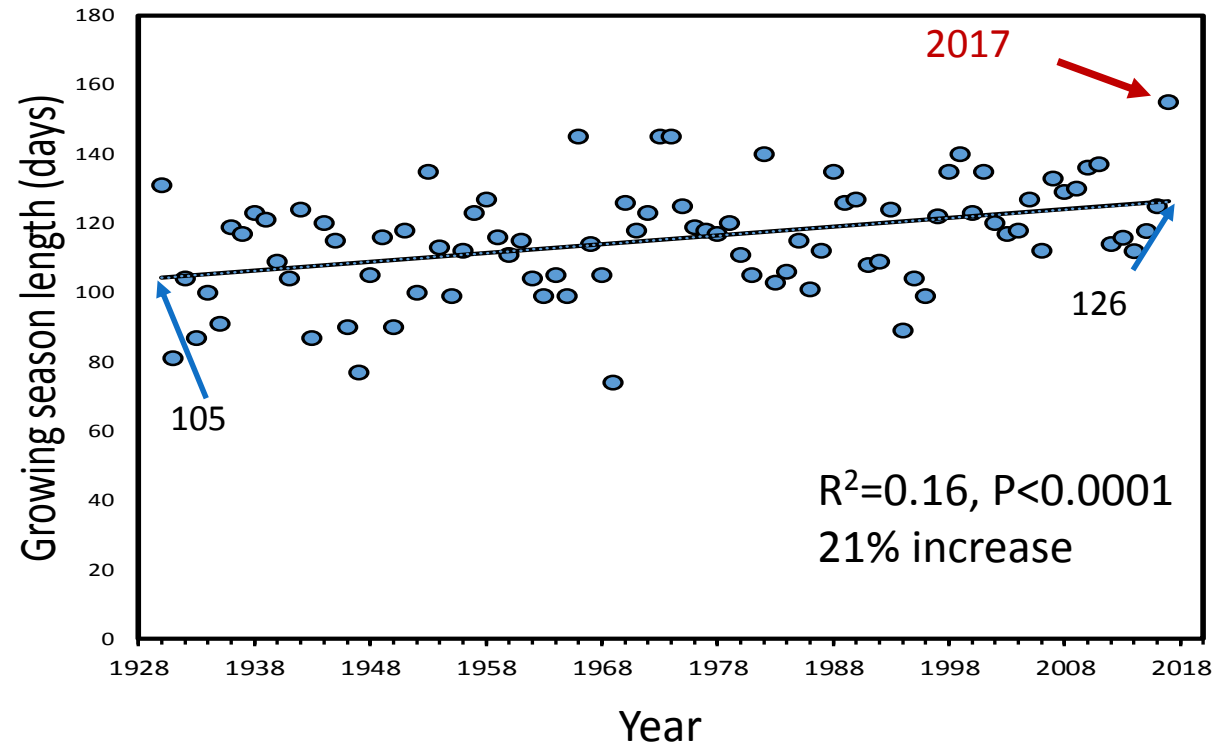
## Summers are getting warmer

(sum of mean temp for each day  $>0^{\circ}\text{C}$ )



## Growing season is lengthening

(# continuous days above freezing)





# What is phenology?

Timing of life events in organisms



Early spring: bud expansion



Late spring: flowering



Summer: fruit development

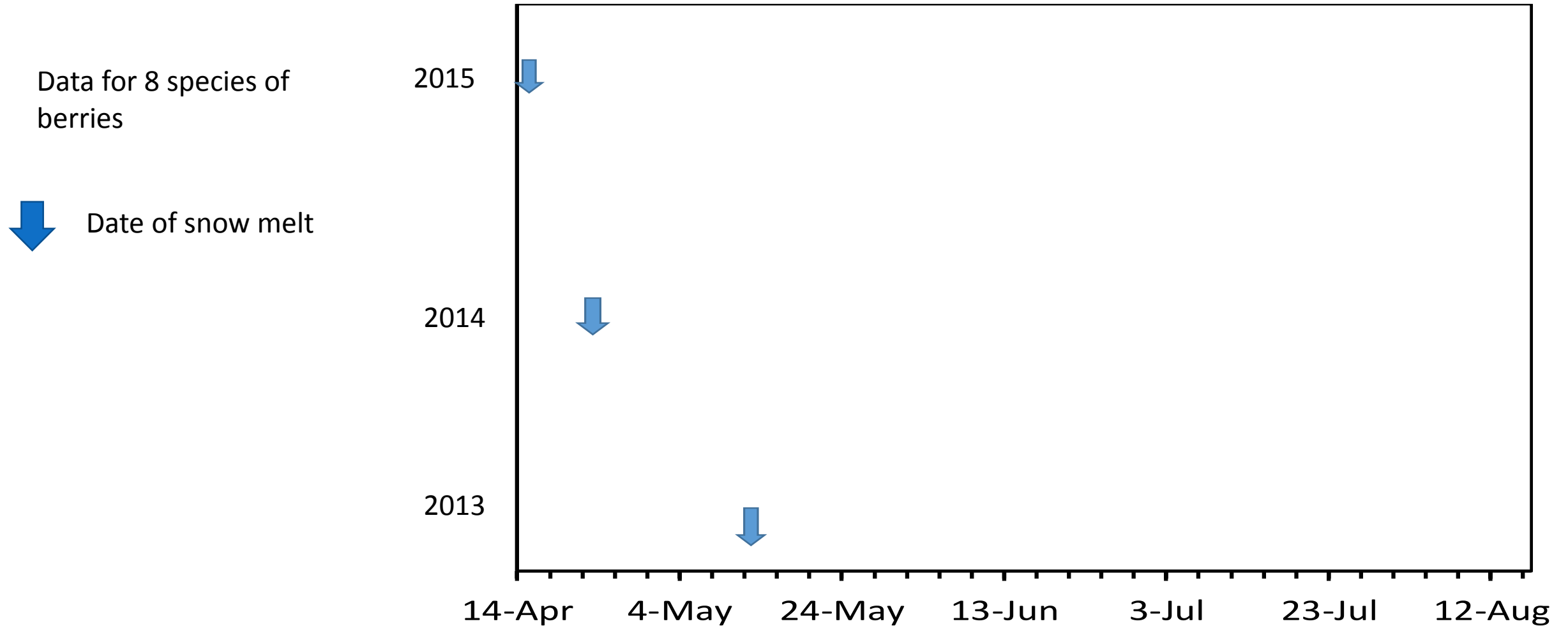


Fall: fruit ripens



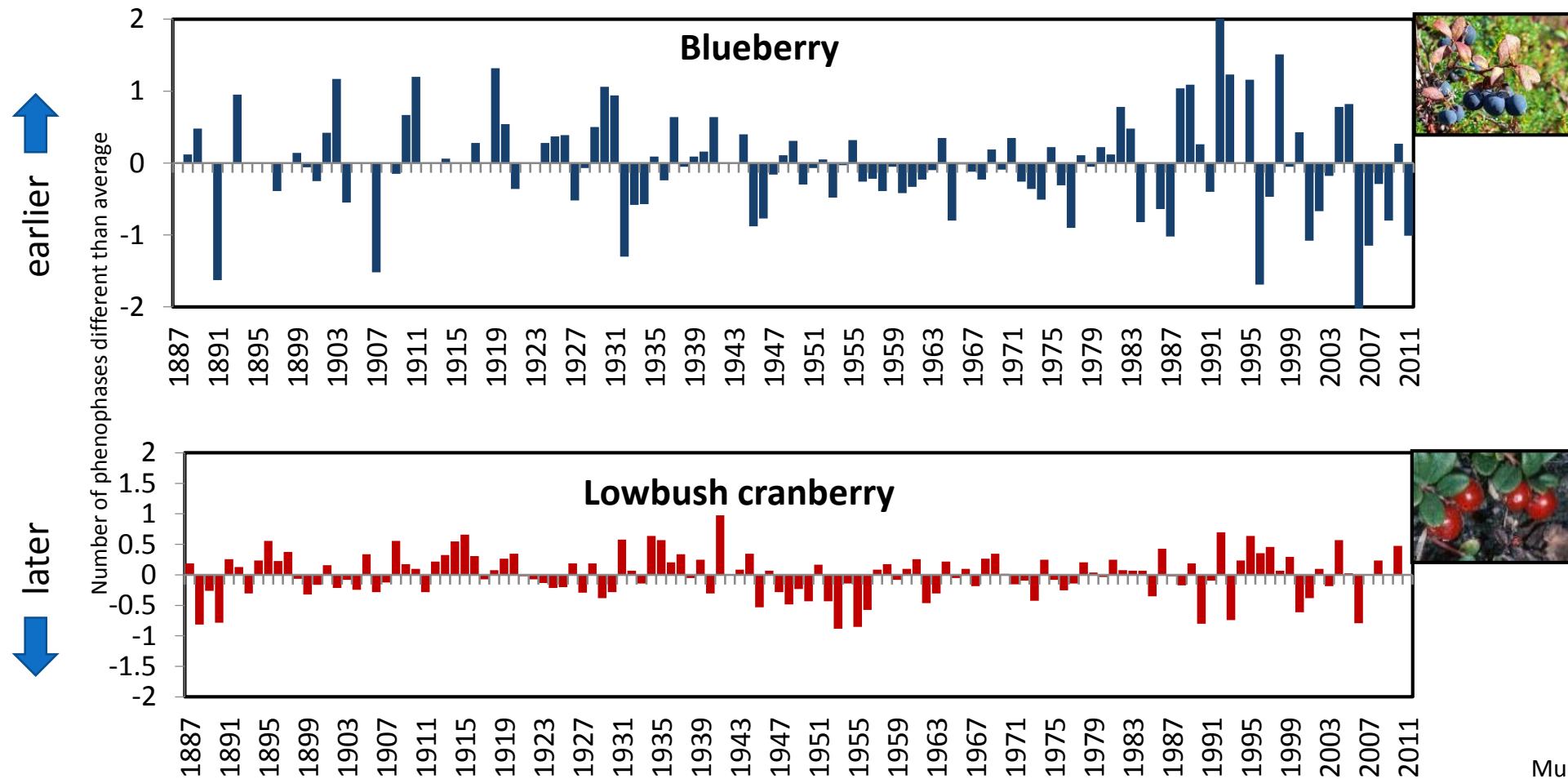
New buds become visible

# What do we know about berry phenology?



# Greater variability in timing of flowering

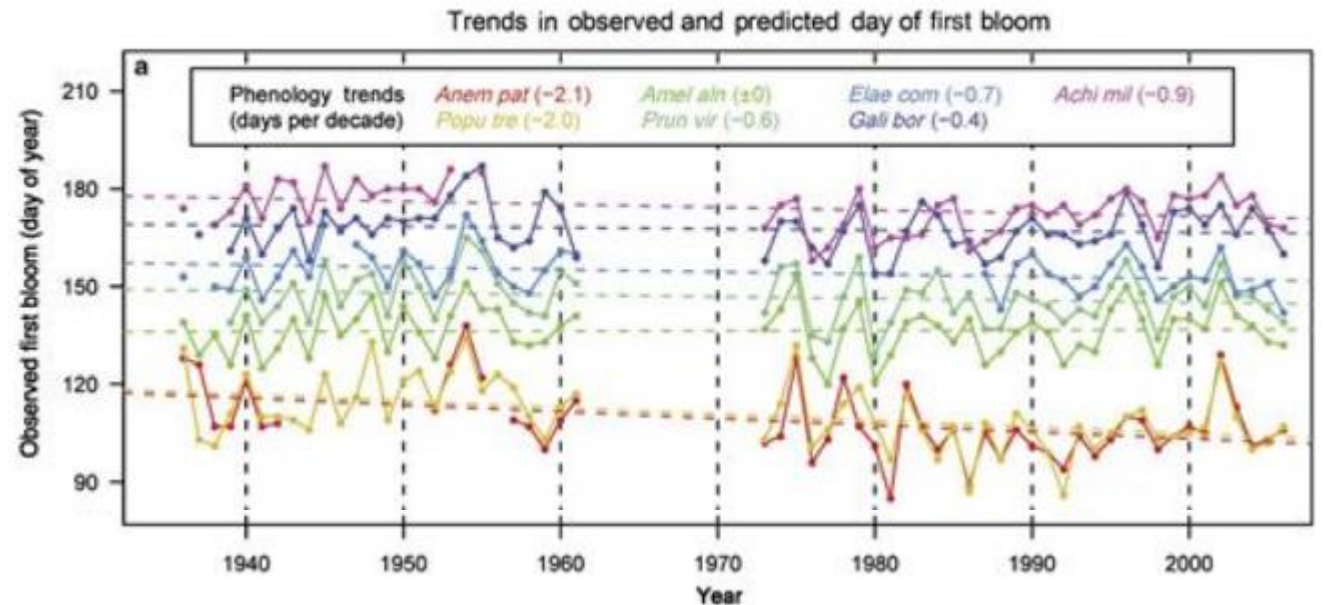
- On a continental scale there has been little or no change over time in average timing of flowering
- Timing is becoming more VARIABLE for some species



# Does changing climate explain whether the flowering of these berries is delayed or advanced?

Many flowering plants bloom earlier in response to warmer temperatures, and earlier flowering times of plants is often considered a fingerprint of global warming.

Some species do not respond or delay flowering when there are warmer temperatures.



Beaubien and Hamann (2011) *BioScience* 61(7):514-524

# Does temperature in the previous years explain phenology in this year?

Data from 39 tundra and saltmarsh plants in northern Manitoba

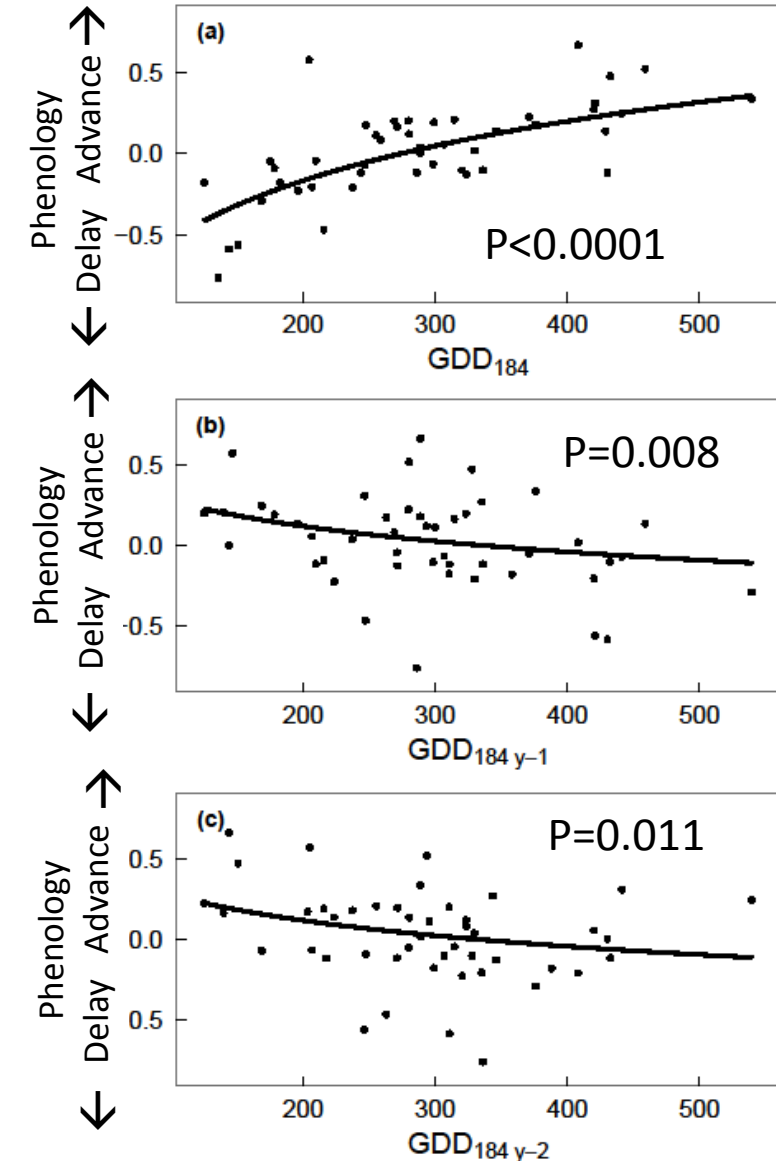


Mulder et al. 2017, *Global Change Biology* 23: 801-814

Same year: more heat,  
more advanced

Year  
before flowering: more  
heat, less advanced

Two years before  
flowering:  
negative correlation





# What explains exceptions to the pattern?

- 1) responses to other cues like photoperiod or soil moisture that may oppose the effects of warming,
- 2) increased snow fall that may result in delayed snow melt, or
- 3) warmer winter temperatures that may result in unmet chilling requirements that delay when a plant emerges from dormancy.
- 4) Or...



# Do lag effects have anything to do with preformed buds?



*Vaccinium vitis-idaea* in fall

Next year's  
flower buds



*Viburnum edule* in fall



Pam Diggle

# Flower bud initiation in early summer before flowering



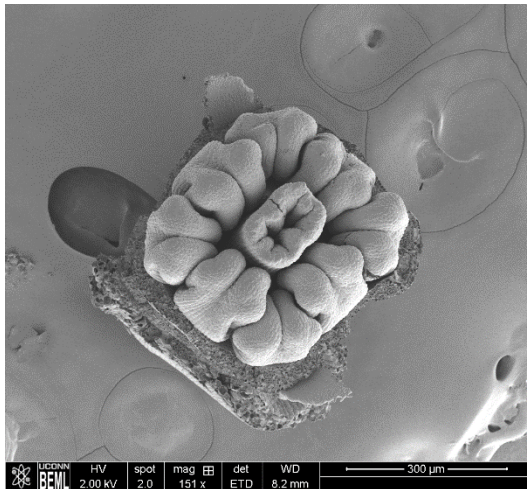
*Arctos alpinus* June  
19, 2015



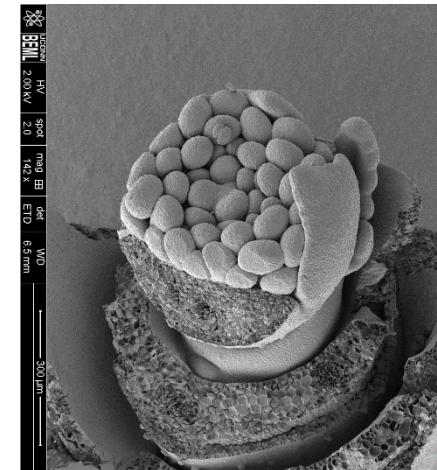
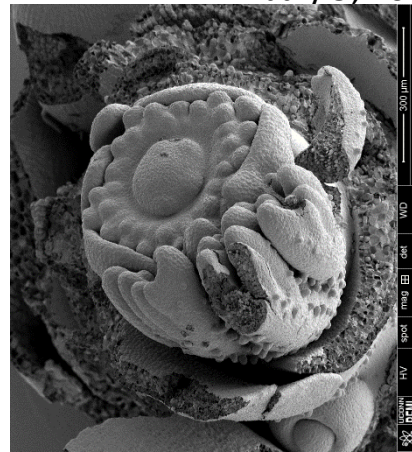
*Rhododendron decumbens*  
July 9, 2015

*“Plants in utero. Due  
date: two weeks after  
snow melt”*

*-K. Spellman*



*Vaccinium vitis-idea*  
July 9, 2015



*Rubus chamaemorus* female (left) and male (right)  
July 9, 2015



# Experiment Set-Up



228 plots at 19 sites  
4 treatments  
8 species



# Late Bloomers

A Far North Phenology Network Citizen Science Project

<https://sites.google.com/alaska.edu/latebloomers>

## We need YOU as a citizen scientist!

Join scientists from University of Alaska Fairbanks and University of Connecticut in Late Bloomers research by collecting winter buds or making observations of late blooming flowers. Follow the links for the directions on how to collect samples or report observations.



[How to collect winter buds](#)



[How to report late blooming flower observations](#)

Are results of the open top chamber experiment representative of a larger geographic area?

# Observe Fall Blooms

- LEO Network project to capture dates, locations, and densities of late blooming flowers

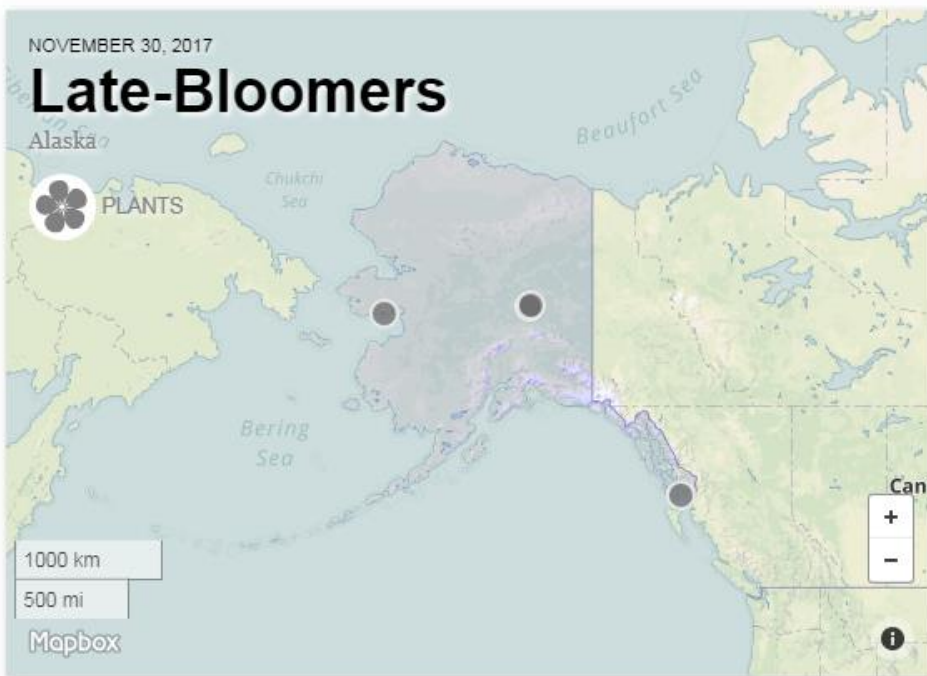
- Bearberry (*Arctostaphylos rubra*)
- Labrador tea (*Rhododendron groenlandicum*, *Ledum groenlandicum*)
- Prickly rose (*Rosa acicularis*)
- Cloudberry (*Rubus chamaemorus*)
- Buffalo berry (*Shepherdia canadensis*)
- Lowbush cranberry (*Vaccinium vitis-idaea*)
- Lowbush blueberry (*Vaccinium uliginosum*)
- Highbush cranberry (*Viburnum edule*)



*Vaccinium vitis-idaea* (lowbush cranberry)  
August 12, 2016

- Are there any geographic or climatic patterns in late blooming plant observations?





**Location:** All of Alaska

**Description:** The Late Bloomers project is looking for observations of flowers blooming at unusual times in late summer or fall throughout Alaska. We have been finding a weird signal in arctic and boreal plant responses to warmer temperatures and longer growing seasons, and think it might be because some species are busting their buds in the fall, making them delayed in the spring. Have you seen wild rose or cranberry species flowering late in the fall, and you think, "man, little flower, why are you doing that? Don't you know the snow is coming??" All these woody plants pre-form their buds for the next year, but we think there might be something to longer summers leading to these buds being able to now develop a little too far along. University of Alaska Fairbanks and University of Connecticut researchers need your observations of Alaskan plants that seem to be flowering way too late in the fall.

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## Project Contributors [All Contributing Members >](#)



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### Late Bloomer-Wild Rose

Fairbanks, Alaska, United States

OCT 16, 2017

[+ My Maps](#)

### Late Blooming Flowers

Golovin, Alaska, United States

OCT 16, 2017

[+ My Maps](#)

### Late Bloomer - Wild Rose Enjoying The Fall

Fairbanks, Alaska, United States

SEP 9, 2017

[+ My Maps](#)

### Late Bloomer - Salal / Laughing Berry (*Gaultheria shallon*)

Metlakatla, Alaska, United States

# Observing guidance

- Please take at least two photos of the late blooming flower for the post,
  1. up close so that the species can be identified
  2. approximately 3 ft away from the flower, so we can get a sense of the proportion of flowers that are blooming on the plant and nearby plants.



*Linnaea borealis* (twinflower)  
September 1, 2016



# Observing guidance

In the notes, please record

- the latitude and longitude,
- an estimate of the percent of the buds on the plant that have popped open in the area. To do this, imagine a square area with the late blooming flower at the center that is the length and width of your arms fully spread out. What percent of the buds in the square have popped: less than 1%, 1-5%, 6-10%, greater than 10%?
- Make other notes you think are relevant in your post, like unseasonable weather, pollinators or insects being observed, or proximity to trails or buildings.



Late Bloomer - Salal / Laughing Berry (*Gaultheria shallon*).

“Late blooming Salal flowers observed by Katie, Sesilynn Jasmine, and Sarah out on a hike. All the other salal were in ripe fruit phase, except this one plant.”



“Arctic Light Elementary school students in the afterschool club have been monitoring rosehips and found this late-blooming flower. There are lots of other buds in the area ready for overwintering but this one popped! (Less than 1% of the buds in the area.) The weather this fall has been unusually warm.”

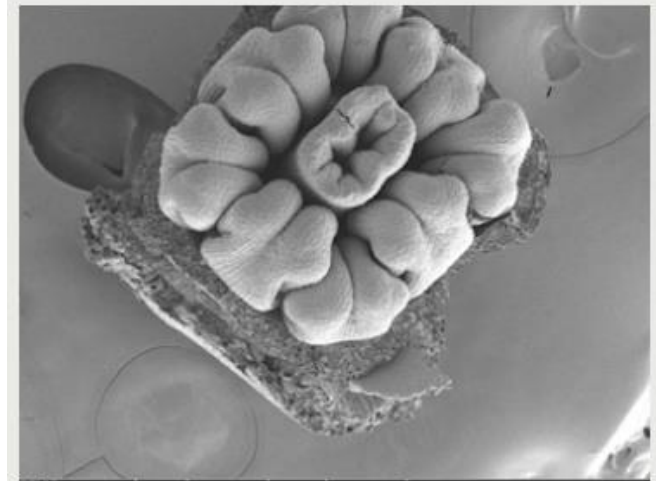


# Collect Winter Buds

- *Vaccinium vitis-idaea* sampling during winter
- Can climate variables explain geographic variation in lowbush cranberry pre-formed bud developmental stage?



Overwintering buds on lowbush cranberry (*Vaccinium vitis-idaea*) look like this. This is what you will collect. Photo by C. Mulder



Your buds will be sent to UConn to be carefully dissected under a scanning electron microscope (SEM). This photo is a lowbush cranberry bud under the SEM. Photo by P. Diggle.

# Sampling Procedure

## Materials needed:

- scissors to cut 10 lowbush cranberry stems with flower buds on them
- ziplock bag
- shovel (if there is snow)
- datasheet (below)
- manilla envelope and postage for sending samples





# Sampling Procedure

## Directions:

1. Once the temperature is consistently below freezing, go to a site that you have seen flowering or fruiting lowbush cranberry plants.
2. Collect **10 stems** of lowbush cranberry (*Vaccinium vitis-idaea*) that **have winter flower buds visible**. One step apart for each other. Put the stems in a ziplock bag.



# Late Bloomers Citizen Science Project Lowbush Cranberry Winter Buds Collection Form



Please fill out this form and send it in with your samples.

Name: \_\_\_\_\_

Mailing Address: \_\_\_\_\_  
(this is how your results will be sent back to you!)

Email Address: \_\_\_\_\_

List names of all the people who helped you collect the samples:

## Location of collection site:

Is this a site you have monitored before in one of our projects?

- ☐ No
- ☐ Yes, in the ~~Melba~~ Project
- ☐ Yes, in Project ~~BrownDown~~
- ☐ Yes, in the Winterberry Project

If yes, what was the site name? \_\_\_\_\_

If no, please provide the following information about your site:

Nearest town: \_\_\_\_\_

Site location description (describe where your site is located using landmarks):

Location GPS coordinates or location coordinates from google maps:

Latitude \_\_\_\_\_ N

Longitude \_\_\_\_\_ W

Site elevation, in meters \_\_\_\_\_ m

Dominant vegetation (Select one):

- ☐ moss / lichen
- ☐ herbaceous (grasses and forbs)
- ☐ shrub tundra
- ☐ tall shrubs

- ☐ deciduous trees
- ☐ coniferous trees
- ☐ Other \_\_\_\_\_

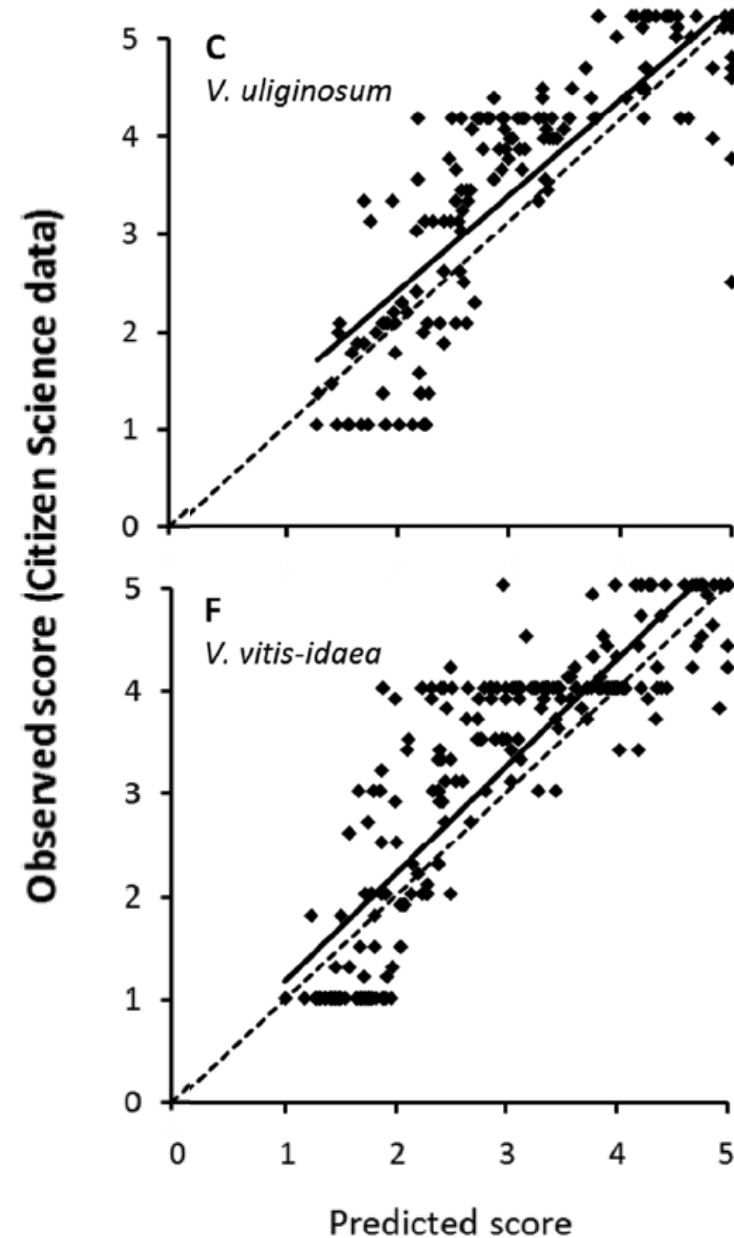
Continued on back...

3. Record the date of collection, your contact information, and a basic site description (latitude, longitude, slope, aspect, and dominant veg) on the datasheet.
4. Place the ziplock with the 10 stems and datasheet in an envelope. Please send them within a day or two of collecting. Samples do not need to remain frozen. Send the samples to:

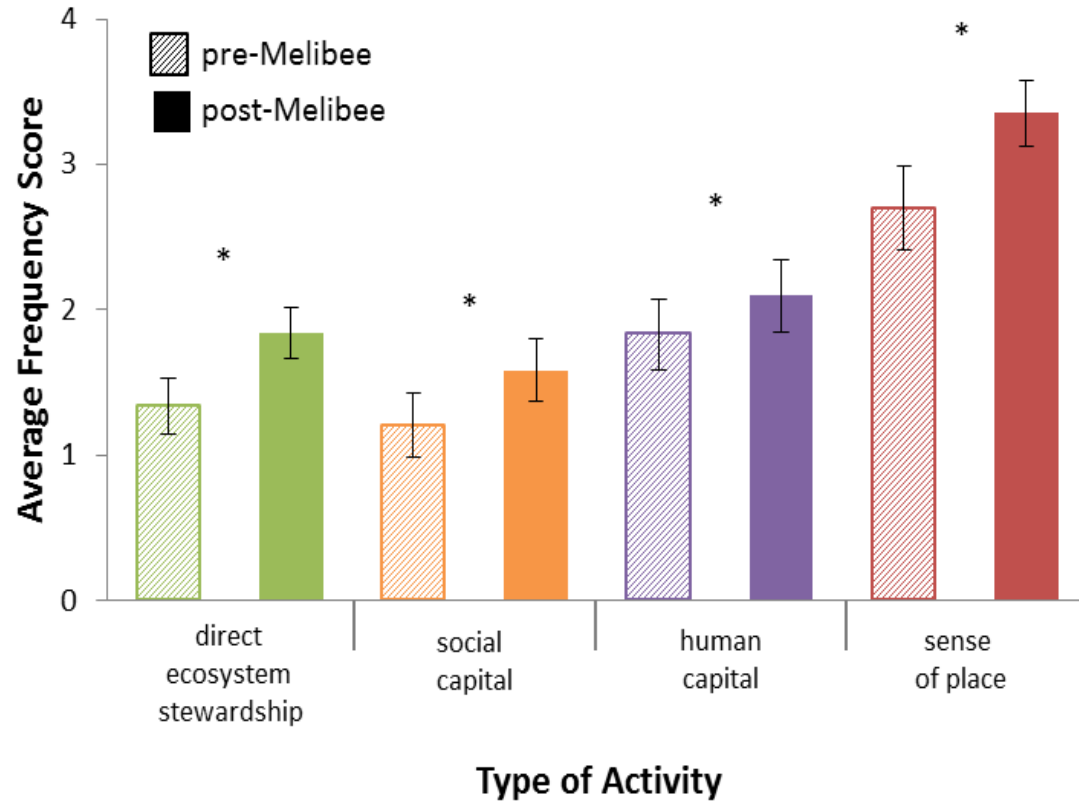
Dr. Christa Mulder  
UAF Institute of Arctic Biology  
PO Box 757000  
Fairbanks, AK 99775-7000

# What do we know about data from local observers?

- The data are very good!
- Helps extend and test inferences to a larger spatial scale
- Helps us all learn and notice new things!







**Figure 3.** Average self-reported activity frequency scores in different outcome categories for volunteers before (pre-) and after (post-) their participation in the Melibee Project Citizen Science Program. Statistical differences between pre- and post- Melibee activity frequency (tested using two-tailed t-tests) is indicated by \* ( $p < 0.05$ ).





# Thank you!

Website: <https://sites.google.com/alaska.edu/latebloomers/>

Email: [klspellman@alaska.edu](mailto:klspellman@alaska.edu) or [cpmulder@alaska.edu](mailto:cpmulder@alaska.edu)

