



Monitoring Alaska Berries in a Changing Climate

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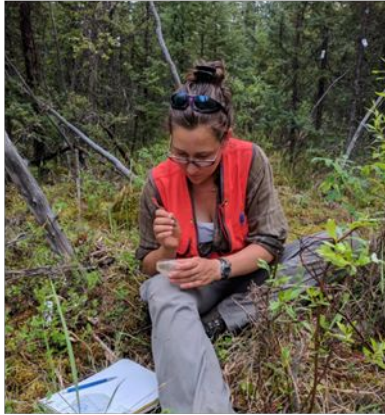
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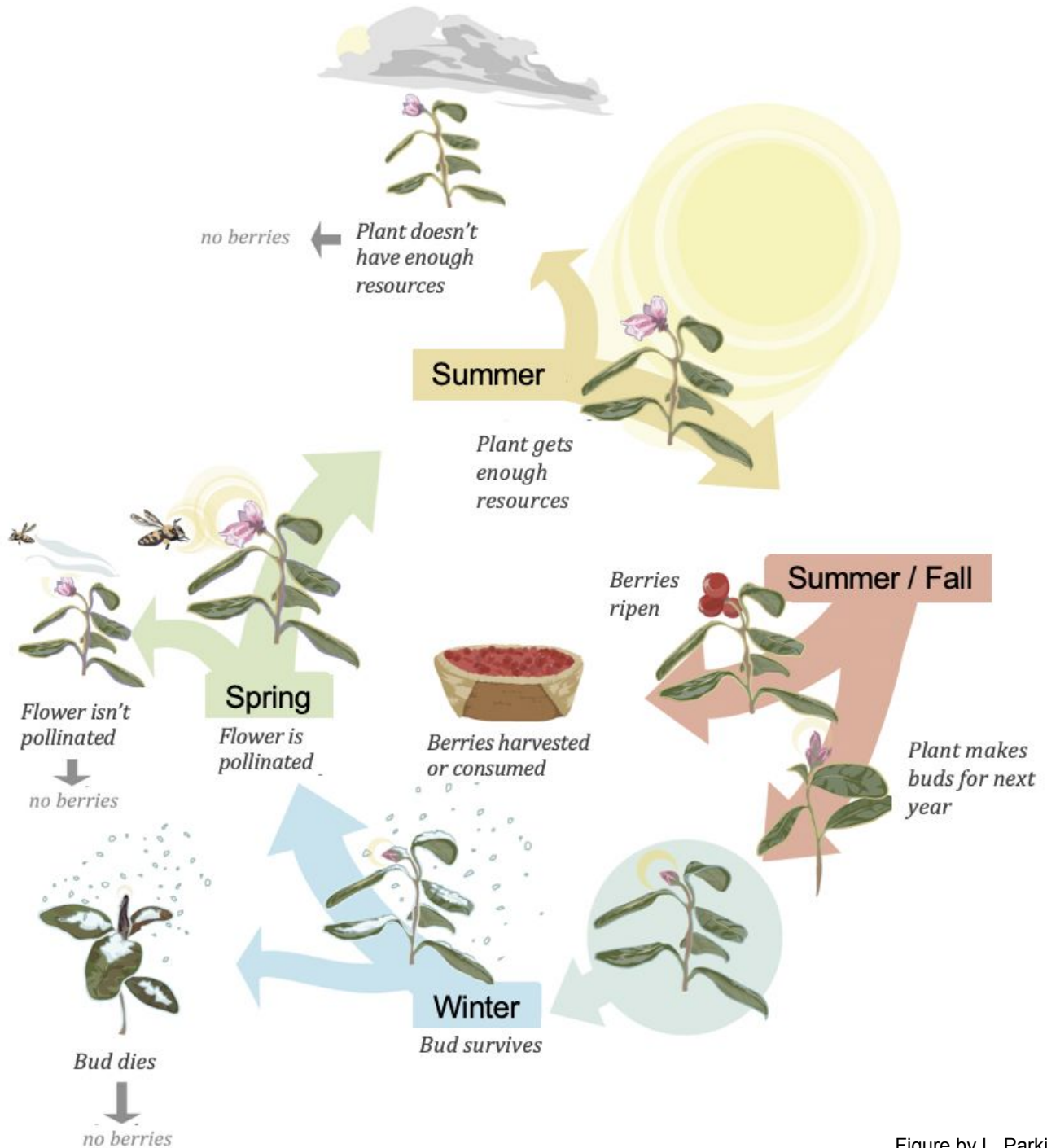


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researcher

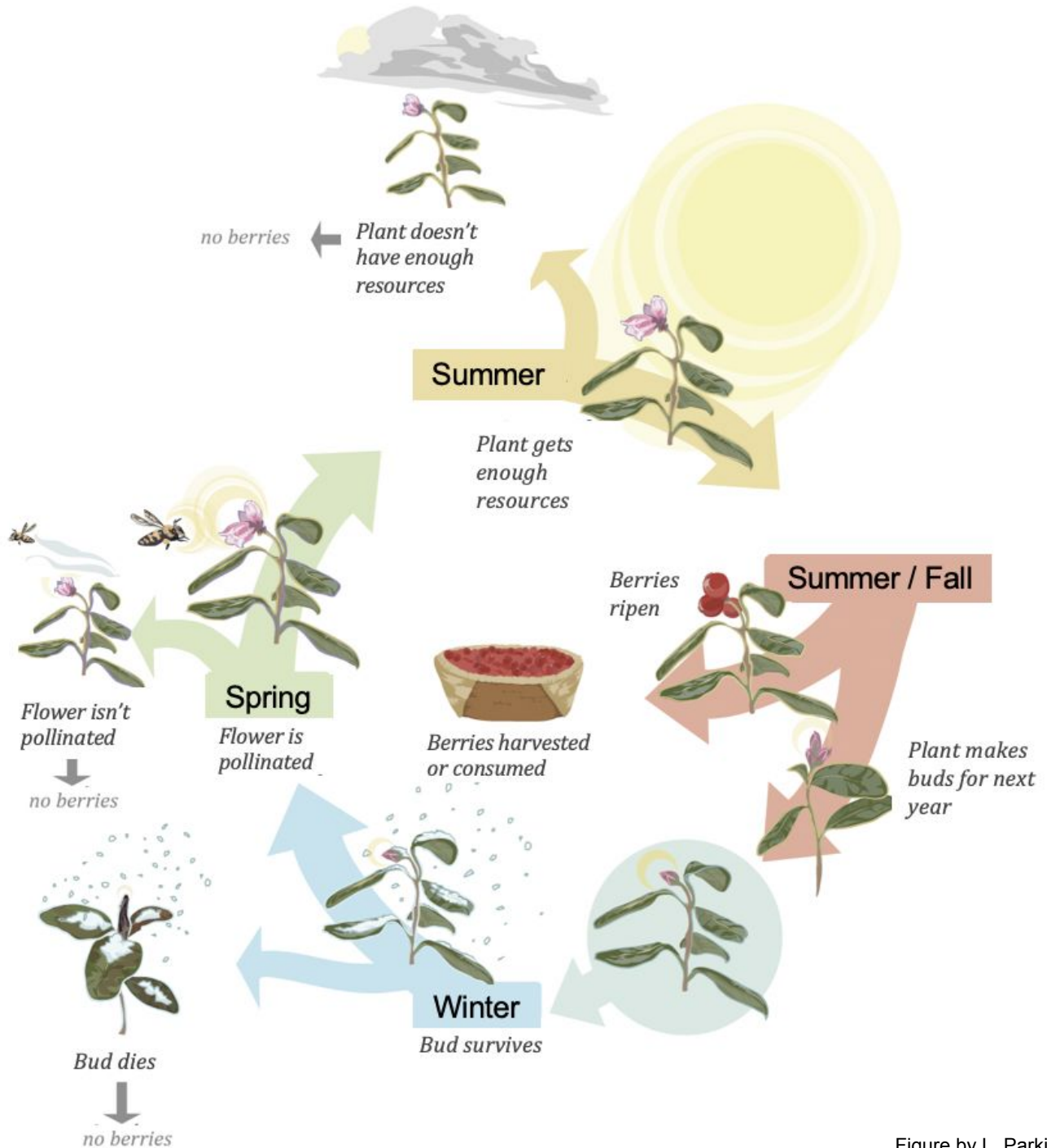


Anne Ruggles
Photographer

The birth of a berry is a miracle.



Climate change can influence every phase in a berry plant's life.



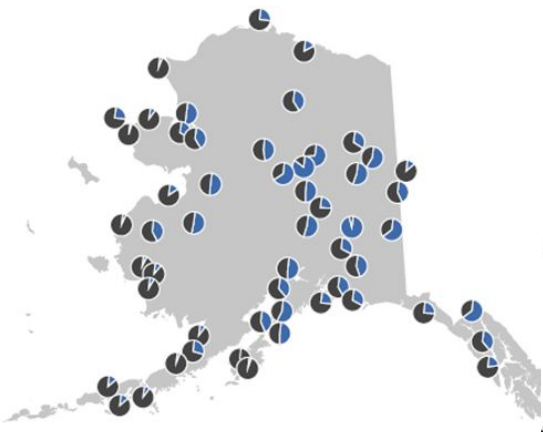
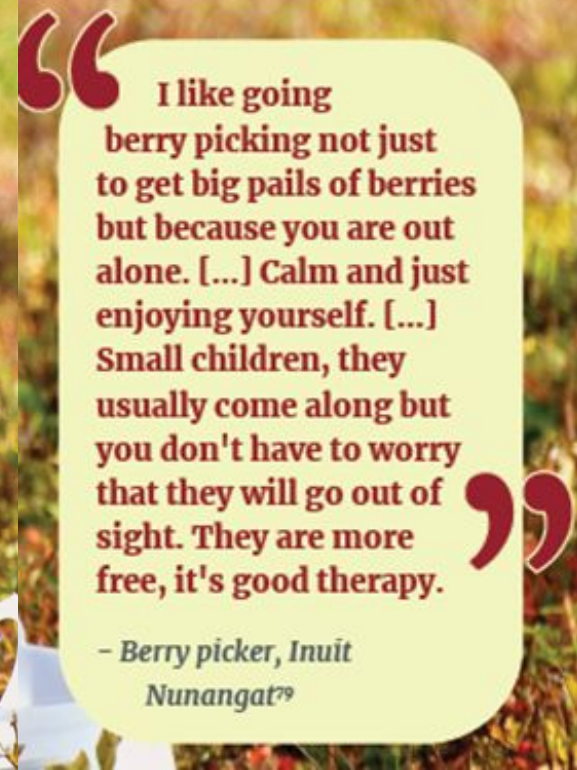
- Most families pick at least 19 L (5 gallons) of berries
- Some families pick > 75 L (20 gallons)

Hupp et al. 2015

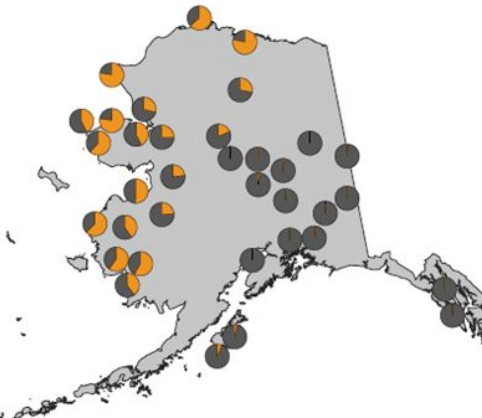
Photo: Kourak Nakak, Nome



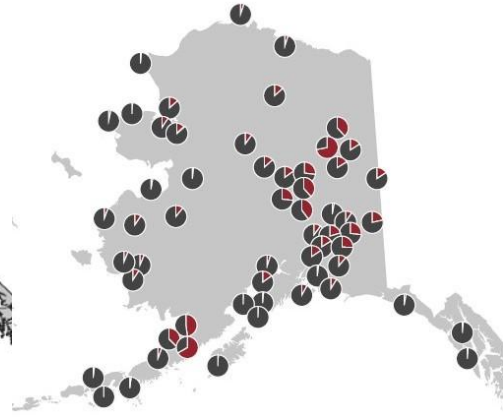
Berry picker near Chitina, Alaska.
Photo credit: A. Ruggles



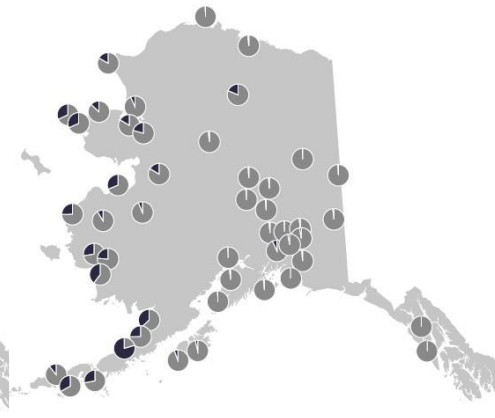
blueberry



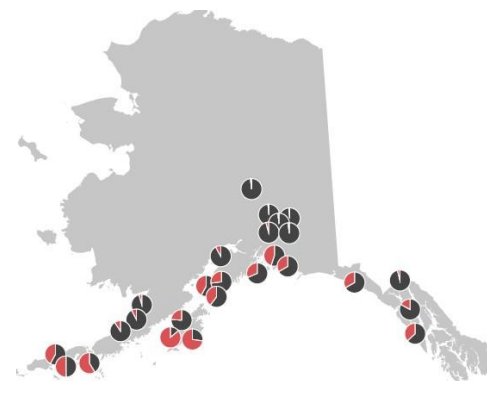
cloudberry



cranberry

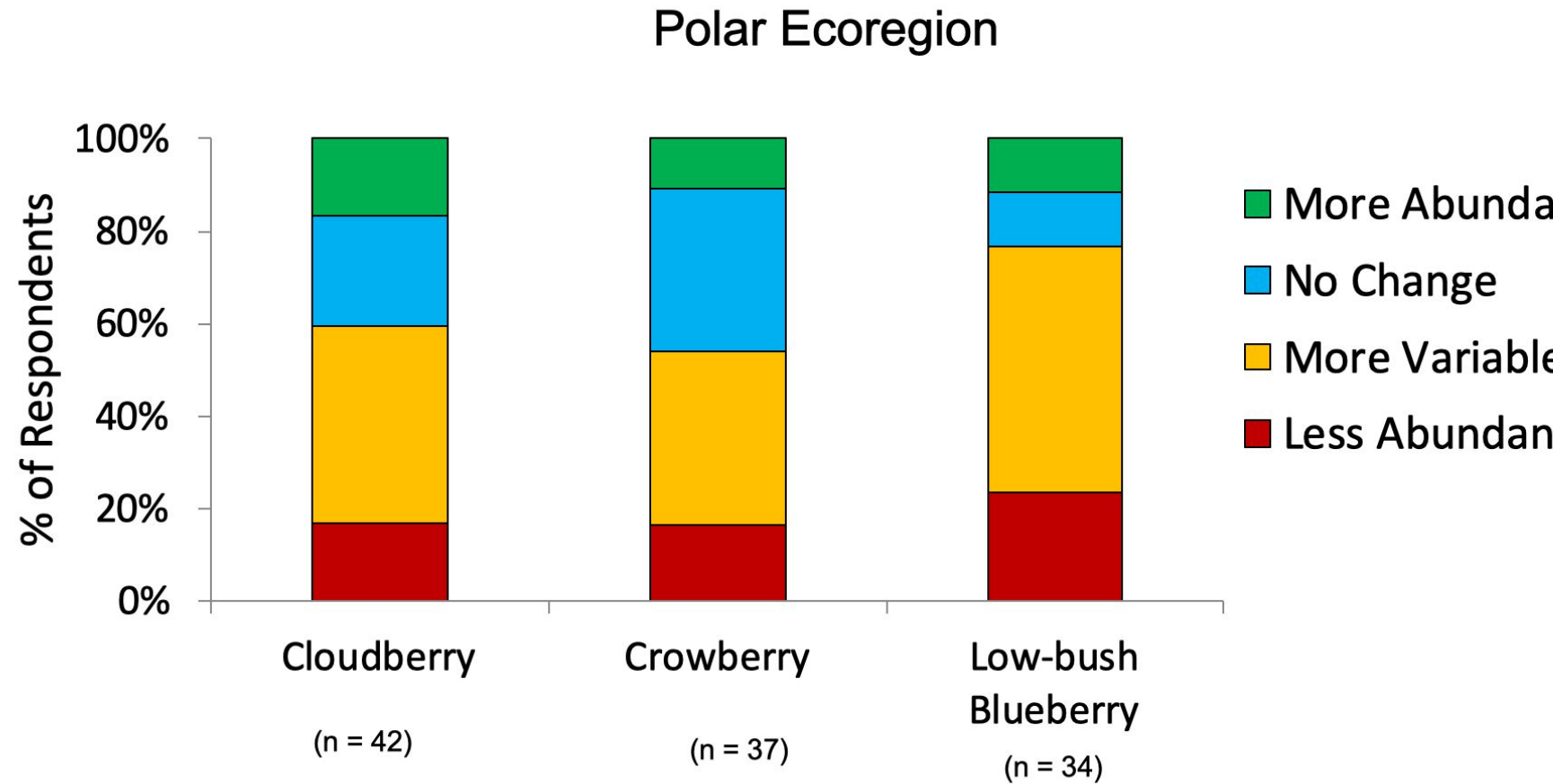


crowberry



salmonberry

**Alaskans
have noticed
increased
variability in
berry
abundances.**



A. Ruggles



A. Ruggles

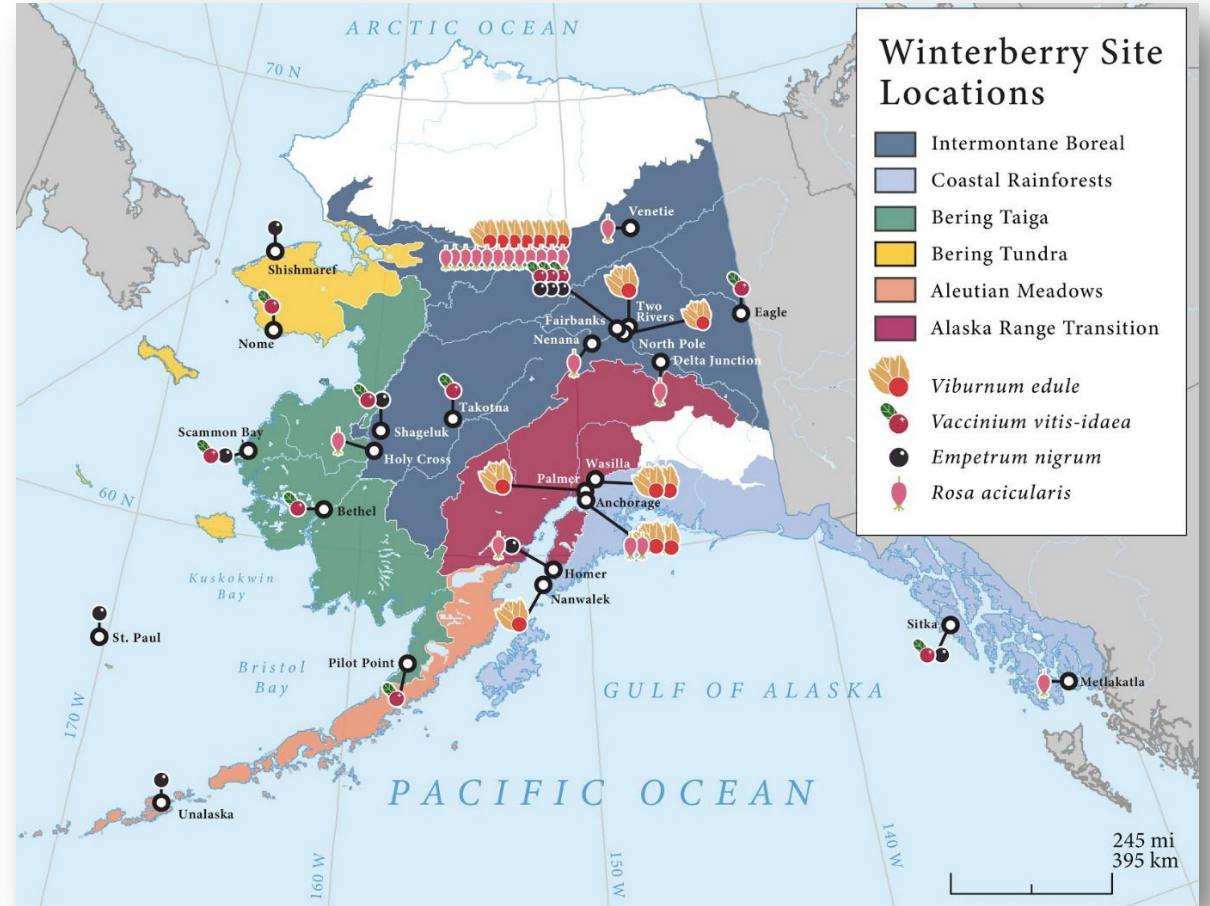


A. Smythe

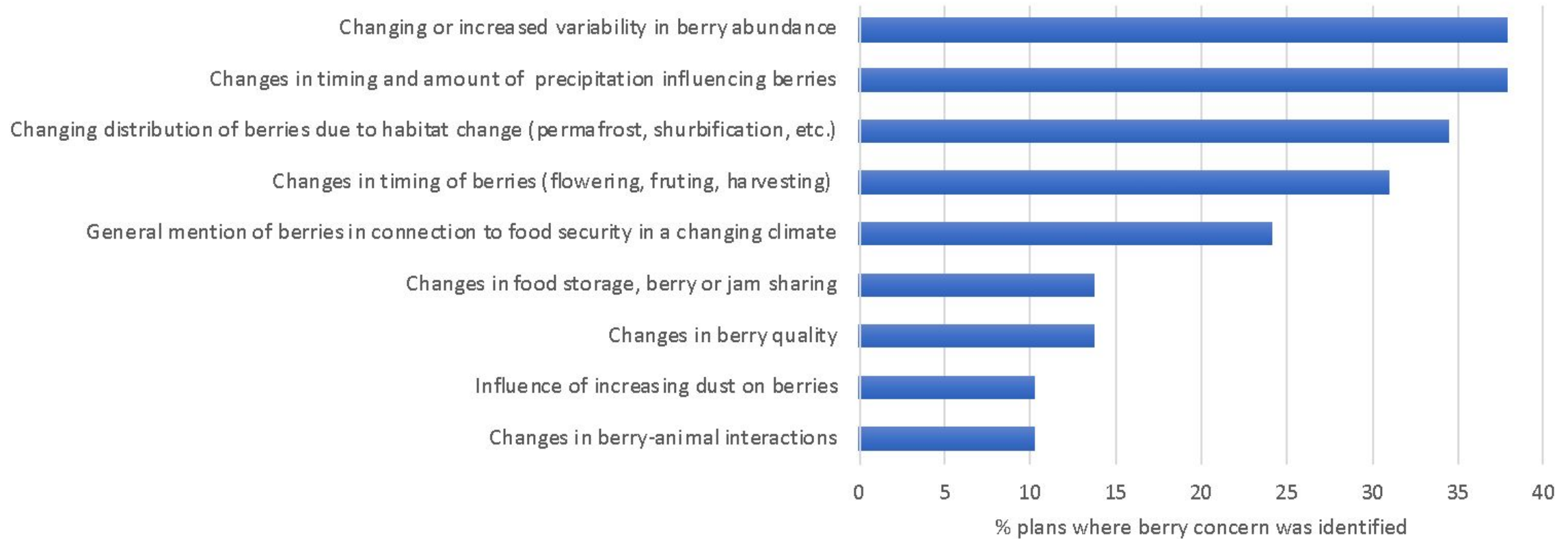
Winterberry



> 1500 volunteers in 30 communities tracking berry abundance & condition



Communities and Tribes are naming berry concerns in adaptation plans



Community Concerns in Listening Sessions

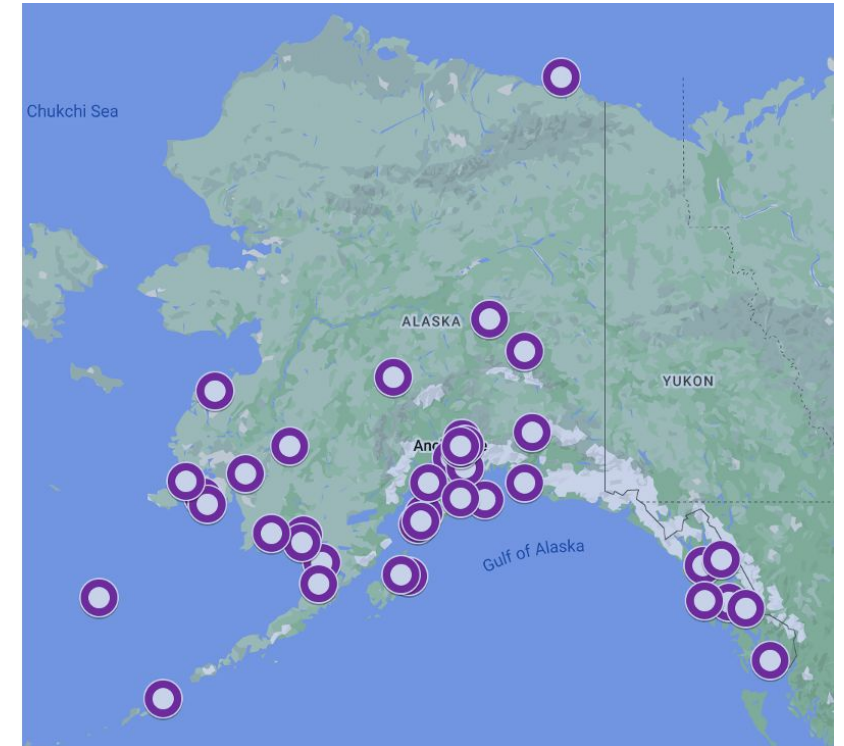
“ Growing up, you weren't supposed to pick blueberries until first frost. But now they are ripe before first frost; they are ripening earlier over time ”

– Elizabeth Mears,
Unalaska

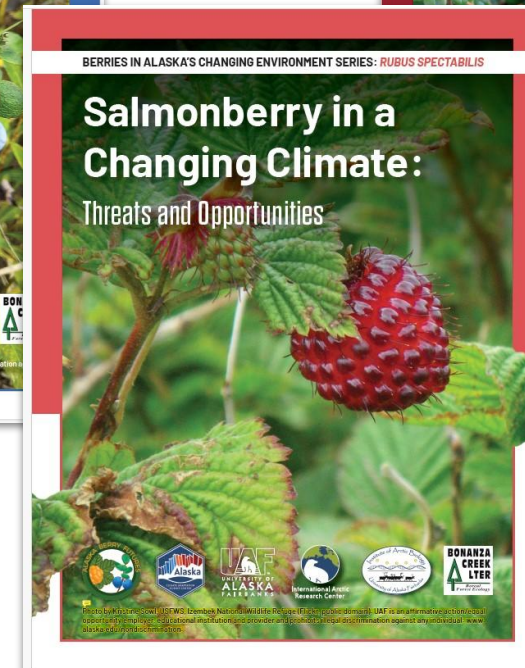
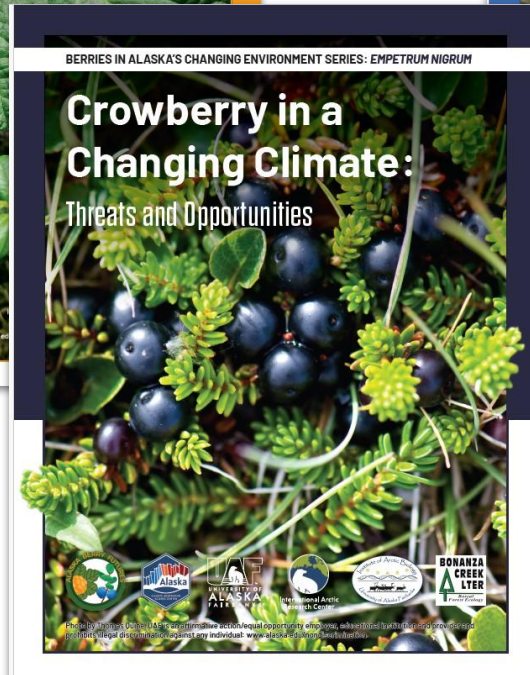
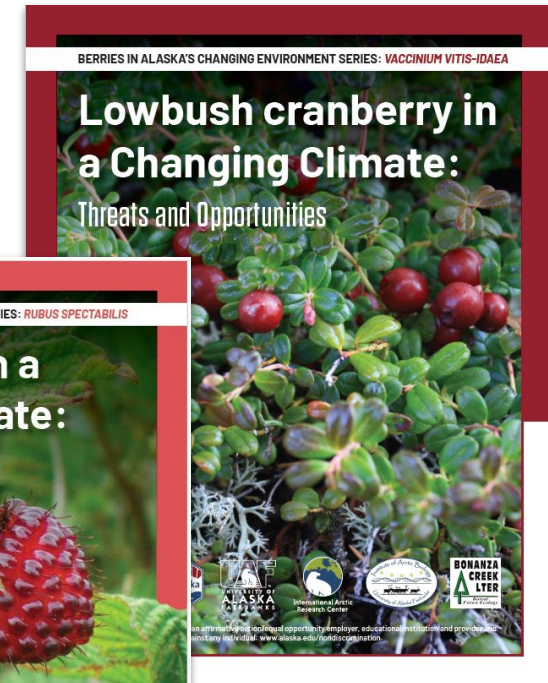
Photo credit: K. Schroder.



Variability in abundance, quality and timing
Changes in ecosystems (insects, permafrost, invasives, pollinators)
Shrubification
Accessibility and food security



Distribution of the 132 attendees participating in the Alaska's Berries in a Changing Climate listening sessions December 9, 2021, January 24, 2022, and February 9, 2022.



Download at:
casc.alaska.edu/changingberries



**What questions or
concerns do you have for
berries in your
community???**



**Berry plants
make flower
buds a year
before they
flower.**



Lowbush cranberry buds in fall.



Highbush cranberry buds in fall.

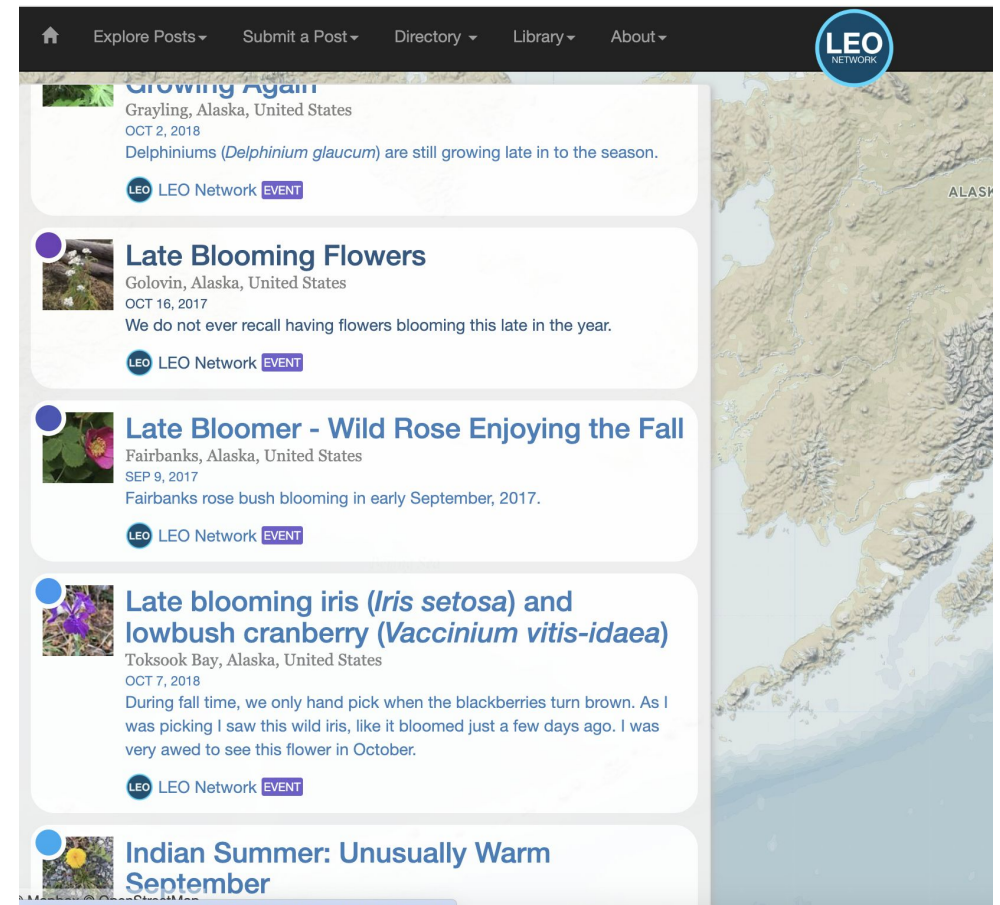
Credit: C. Mulder

Track late blooming or early blooming berry flowers

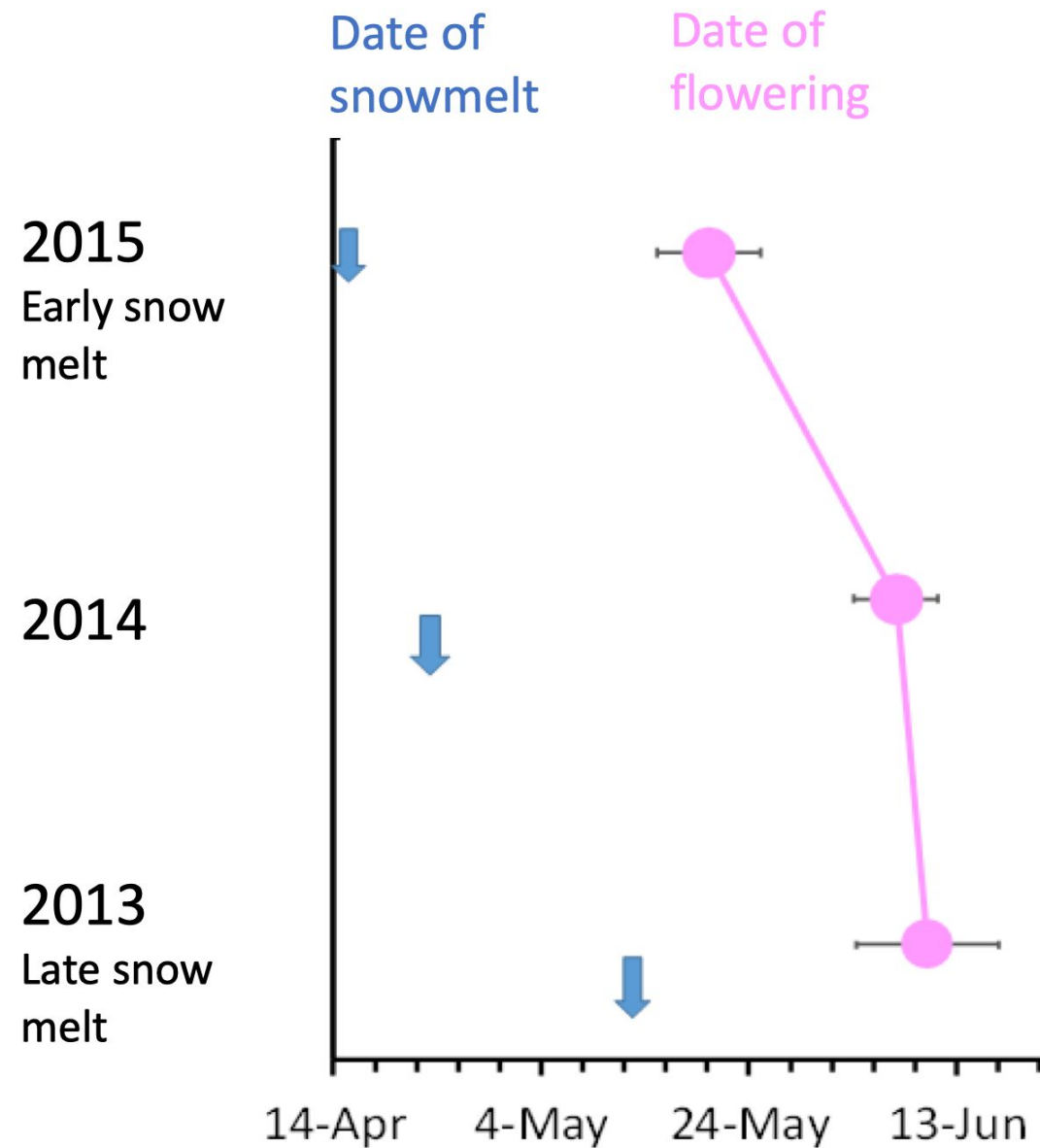
Track late
blooming or
early
blooming
flowers.



Credit: leonetwork.org



Timing of
snow melt
influences
when flower
buds open
and when
growth
starts.



Temperature influences growth

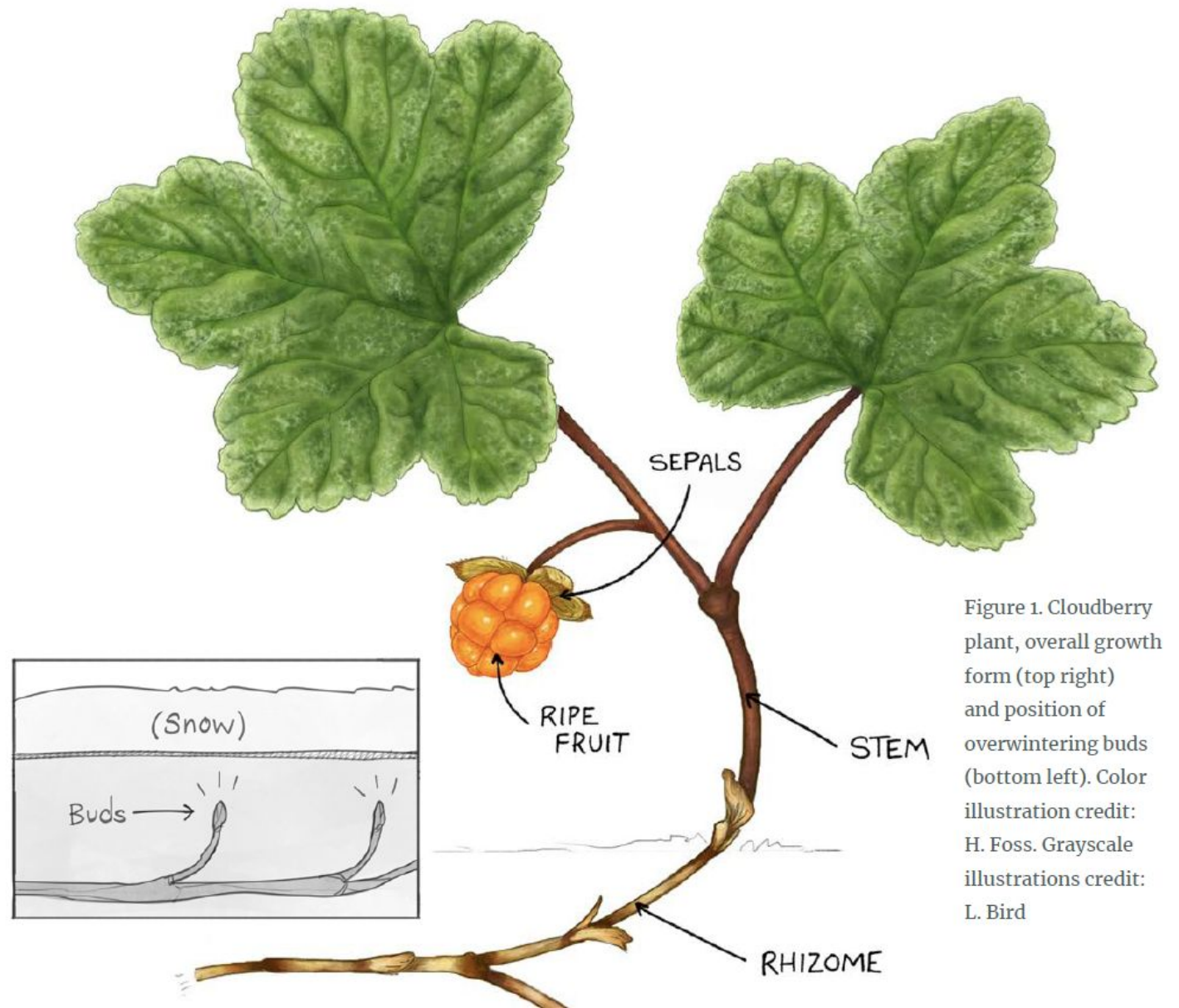


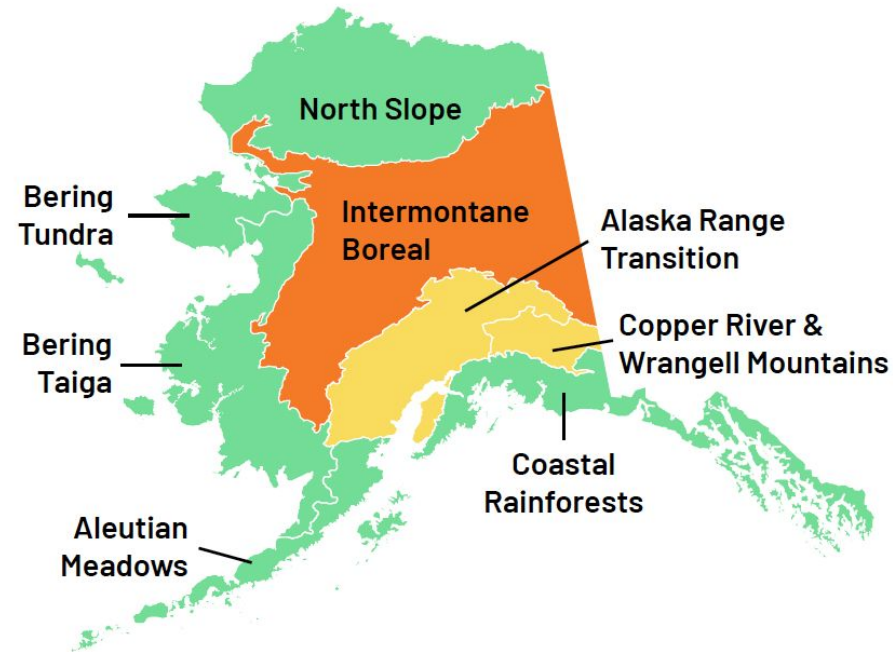
Figure 1. Cloudberry plant, overall growth form (top right) and position of overwintering buds (bottom left). Color illustration credit: H. Foss. Grayscale illustrations credit: L. Bird

Above 18°C /
64°F
cloudberry is
under stress

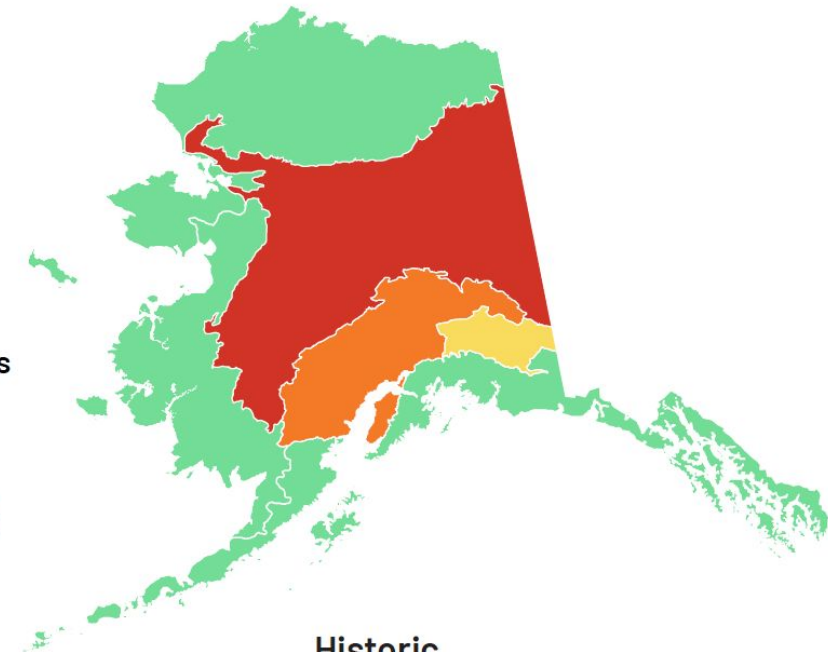


Historic and Projected Percent of Summer Days Stressful for Cloudberry Photosynthesis by Ecoregion

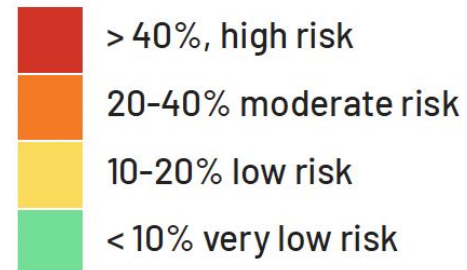
Projected for 2060-2069 under the Slow Progress
toward Reduced Emissions Scenario (RCP 6.0)*



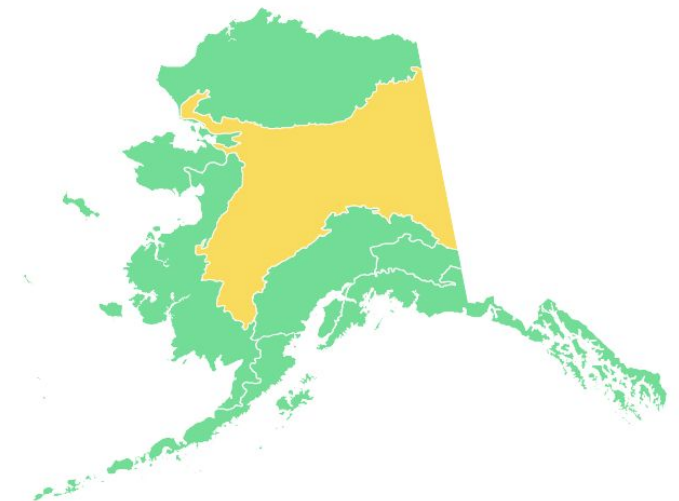
Projected for 2060-2069 under Business
as Usual Scenario (RCP 8.5)*



Degree of Risk

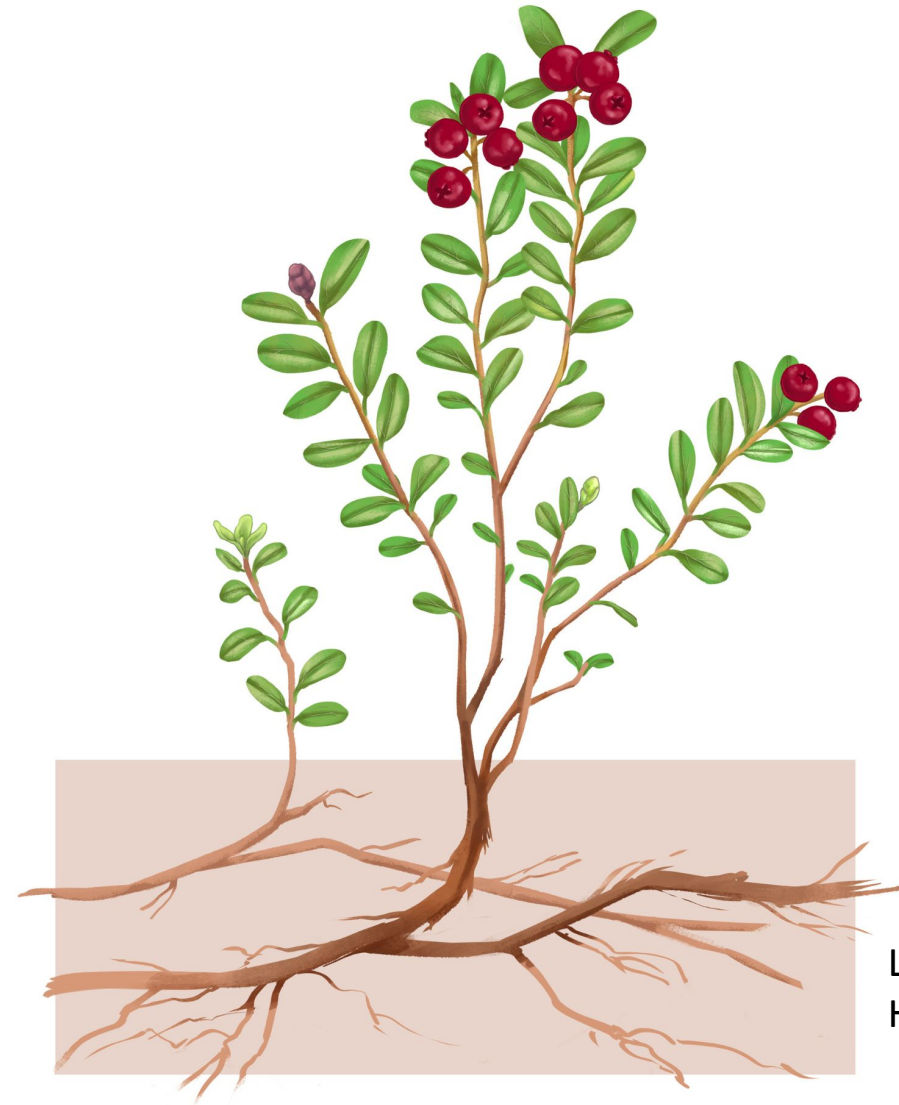
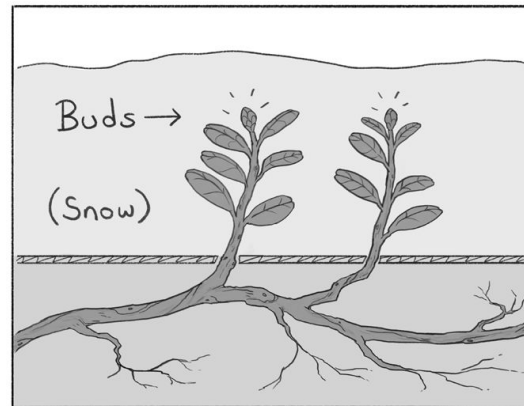


Historic



*Historic data from Scenarios Network for Alaska.

Temperature influences plant growth



L. Bird and
H. Foss

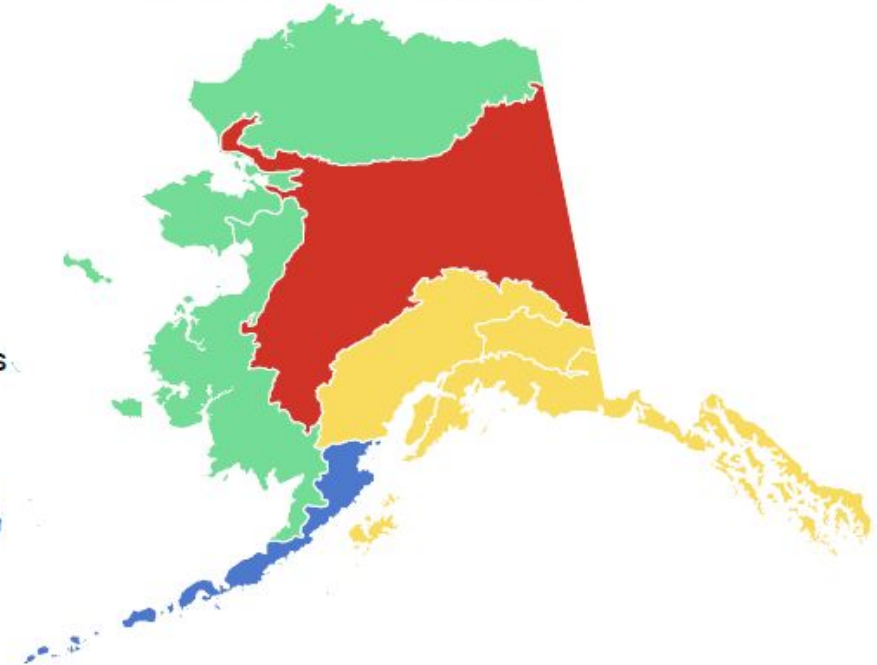
For lowbush
cranberry
15-20 °C
(59-68 °F) is
perfect for
fruit
production



Projected for 2060-2069 under the Slow Progress
toward Reduced Emissions Scenario (RCP 6.0)*



Projected for 2060-2069 under Business
as Usual Scenario (RCP 8.5)*



Conditions for best fruit production



Actions to support temperature and timing stress!



Snow
addition or
snow fences



Shading

**Actions to
support
temperature
and timing
stress!**



Berry Agrovoltaics



Blueberry agrivoltaic project in Maine.
Photo: University of Maine

Actions to support temperature and timing stress!



Photo: G. Winter, MIC



Fruit-bearing trees and shrubs planted around Metlakatla Indian Community

Community
food forests

Photo: K. Spellman, UAF



Honeyberry plot at Georgeson Botanical Garden in Fairbanks

Berry
cultivation

Most berry plants need pollinators.



V. Mononen, CC by NC-2.00 DEED



K. Spellman

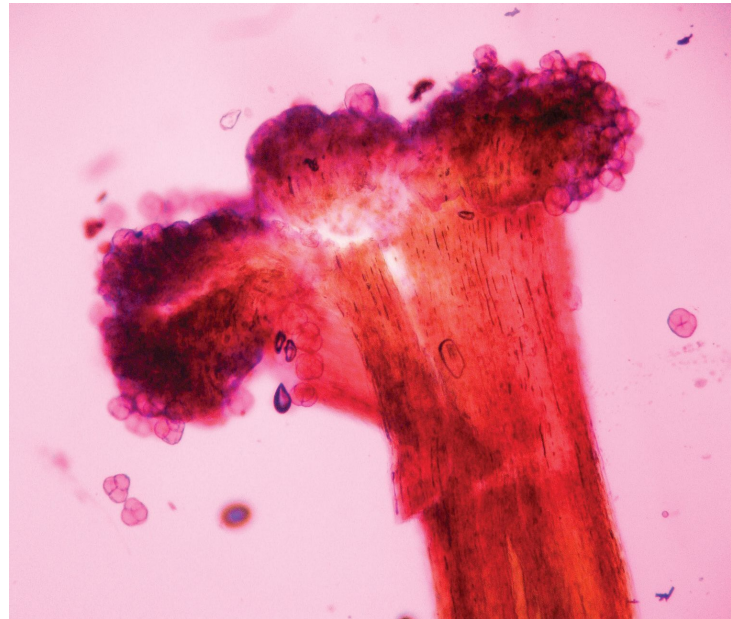


Figure 7b.
A lowbush cranberry flower with a stigma wet with fluid to trap the pollen from visiting pollinators. Photo credit: A. Ruggles.



Changes in flowering time may lead to a mismatch with pollinators



Credit: A. Ruggles



Credit: A. Ruggles



Credit: A. Ruggles

Monitor pollinators in your berry patch



J. Evans



Pollinator monitoring
- Alaska Bee Atlas
Project (Alaska Center for
Conservation Science and BLM
Casey Burns)

**Fruits and
seeds
develop
throughout
summer.**



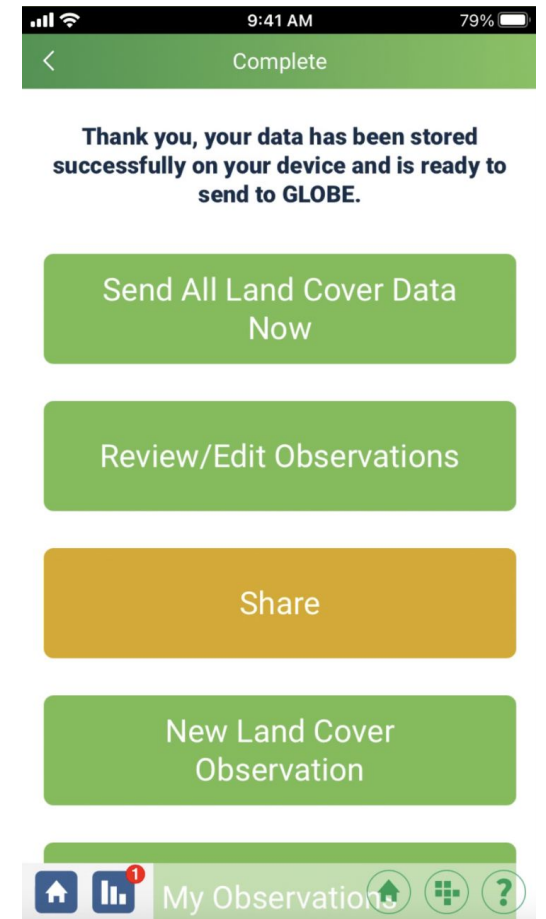
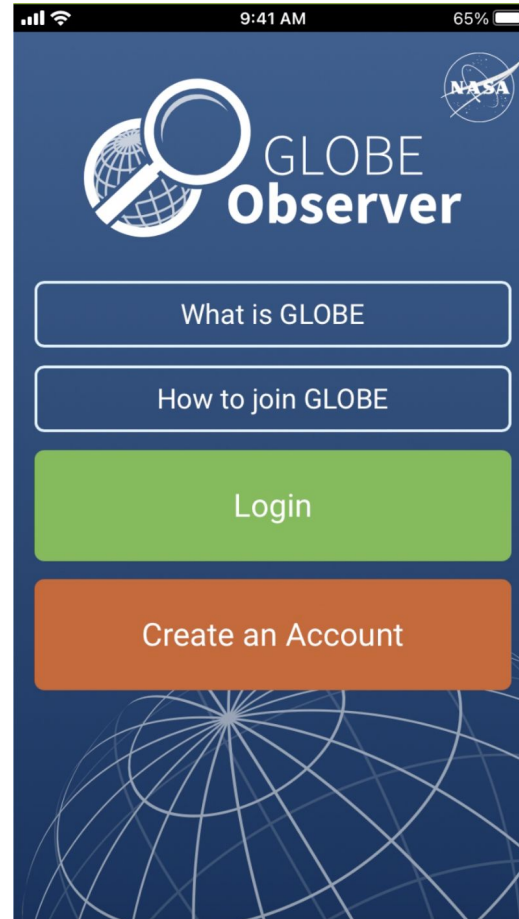
Credit: M. Chase

Changes in
habitat can
change
resources
available for
making
berries.



GLOBE snow and weather

Track
snowpack,
rain and
temperature
in your berry
patch.



GLOBE landcover, canopy cover

**Monitor
changes in
habitat.**



Actions to support berry availability in a changing landscape!



Photo: H. Rader, UAF CES



Photo: Hoonah Native Forest Partnership



Forest stand management

Pruning
(shrubs above berry
plant and berries
themselves)

Animals, fungi and bacteria consume fruits.



Credit: D. Baier

Bear scat full of berries in fall.



Credit: R. Rovira

Berry cache made by squirrel.



Credit: J. Hupp

Migratory geese eat berries
in fall and spring.



Credit: J. Hupp

Ptarmigan eat berries
whenever they can!

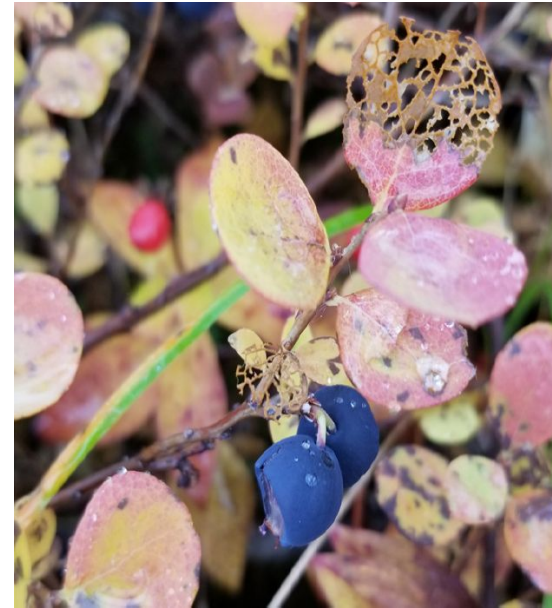
Changes in climate can increase vulnerability to herbivores and pathogens



Credit: A. Ruggles



Credit: L. Parkinson



Credit: A. Smyth

DATA NEEDED!

**Early
flowering
leads to
early fruits
and possibly
more rot.**



Credits: A. Ruggles, except for D (C. Mulder)

Taking Action

- Post your berry observations on LEO.
- Participate in berry monitoring or start a local program. (UAF can help!)
- Think about what adaptation strategies that might work for your community



Credit: leonetwork.org



Credit: K. Spellman





Monitoring Program Design

We have developed berry monitoring protocols that emphasize different aspects of berries that are changing in a changing climate.

Key questions your community might have:

- How is the timing of flowering and fruiting of berry species changing?
- How is the fruit quality and loss/removal of berries changing?
- How is the abundance of berries changing? (This question is more challenging to answer)

Resources for Monitoring Berries in your Community:

<https://sites.google.com/alaska.edu/alaska-berry-futures/your-berries/monitor-your-berries>

Berry Timing

How is the timing of flowering and fruiting of berry species changing?







Protocols were developed to investigate the flowering and fruiting phenology of important berry species in Alaska during the UAF Melibee Project (funded by USDA NIFA and Bonanza Creek Long Term Ecological Research Program).

The basics:

- Set up a site and tag berry plants as described in our [Berry Phenology Monitoring Protocol](#).
- Visit the plants weekly to count the number of buds, flowers, unripe and ripe fruits and track them through time. Use or modify the data sheets at the end of the above protocol document, which is aligned with the National Phenology Network protocols in Nature's Notebook.
- We have [phenophase photo guides](#) for a few of the berry species. Use them as a reference or create your own to share.

Phenophase Photo Guide

Bog Blueberry (*Vaccinium uliginosum*)

1. Leaf Unfurling/ Emergence  <p>New leaves emerge from green buds on the many branches of the plant. They begin as a bright green and darken through the summer.</p>	4. Petal Drop  <p>Petals and stamens fall off the flower, leaving only the green ovary and a prominent pistil pointing out (white arrow).</p>
2. Flower Buds  <p>Drooping, earring-like buds emerge from nodes on the branches. They start as tiny pink downward pointing shoots then expand into buds like the ones pictured here.</p>	5. Unripe Fruits  <p>The ovary swells and the sepals start to push together. The pistil turns brown (white arrow). The fruit is entirely green or beginning to turn blue. Count all fruits that still have green on them.</p>
3. Flowers  <p>Pink to white flowers open, with four lobes at the flower opening. The stamens and stigma are visible.</p>	6. Ripe fruits  <p>The fruit is entirely blue. This is the easiest phase to count! Remember, don't eat the berries on your focal plants until all your data collection is done in the fall. The plants nearby are fair game!</p>

Phenophase Guide created by Dr. Katie Spellman, UAF International Arctic Research Center. Photos by Dr. C. Mulder, K. Spellman, A. Ruggles or as cited. Phenophases are aligned with the National Phenology Network's Nature's Notebook. More information and berry monitoring resources at casc.alaska.edu/changingberries



Berry Quality



Credits: A. Ruggles, except for D (C. Mulder)

How is the fruit quality and loss/removal of berries changing?

A protocol for monitoring berry condition and fruit loss was developed by the [UAF Winterberry Project](#). The protocol is used to address a specific question regarding the timing and fate of berries in fall and winter for 4 widely distributed berry species that are important food resources for people and overwintering animals in Alaska. These species include *Empetrum nigrum* (crowberry or blackberry), *Vaccinium vitis-idaea* (lingonberry or lowbush cranberry), *Rosa acicularis* (rosehips), and *Viburnum edule* (highbush cranberry). The protocol may be used or adapted for any berry species that may be of interest to a community.

The basics:

- Set up site as described here <https://sites.google.com/alaska.edu/winterberry/monitor-berries/step-3-site-set-up>. I think you can just tag 12 plants if it is just you by yourself.
- You can start before you do your abundance survey at peak berry season. Early to mid August is good timing to start for most parts of Alaska.
- Here is how to collect the observations and the data sheet you need: <https://sites.google.com/alaska.edu/winterberry/monitor-berries/step-4-collect-data>



Berry Abundance



How berry abundance changing?

Berry abundance is more complicated to monitor because:

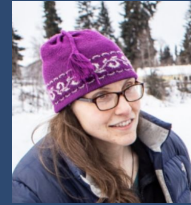
- Best berry spots move around on the landscape: places that are good in some years may not be good in other years, and vice versa. It is easy for abundance to look like a decline because the site you picked was good to start with.
- Many different factors add up to berry abundance, including the resources the plants had two years prior to flowering, what the conditions were like for pollinators when the plants flowered, and how many resources plants had available to turn flowers into fruits. That means the number of berries is going to vary a lot from year to year, and it takes many years to determine whether there is an overall trend or not.

If you want to monitor a single spot, you can use the ["getting an estimate of berry density"](#) section of the Winterberry Project protocol and [this datasheet](#). This protocol uses berries per unit area rather than berries per plant. Use this method every year for the same site or sites at peak berry season, when you first hear that it is time for picking, or notice all the berries are ripe.

You should also count on a large effort and many years to get a good estimate of whether berry abundance is really changing over time.



Contact details



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WEBSITE (download all completed booklets):

casc.alaska.edu/changingberries

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