2013

POLLINATOR ATTRACTION CITIZEN SCIENCE

IN THIS REPORT

Citizen Science Report

The Melibee Project investigates how the recent invasion of sweetclover (*Melilotus albus*) might affect the pollination of our wild Alaskan bog blueberries and lowbush cranberries (*Vaccinium uliginosum and V. vitis-idaea*) where they co-occur. In 2010, the Melibee research team conducted a survey of pollinators, pollination, and fruit production in sites with and without sweetclover on the Dalton Highway. In 2011 and 2012, they conducted controlled experiments with careful sweetclover additions to blueberry and cranberry patches in the Bonanza Creek Long Term Ecological program experimental forest. They found that the presence of invasive sweetclover can have both positive and negative effects on the pollination and fruit production in the berry plants. The effect depended on the distance the berry plant was away from the invasive plant patch, the amount of sweetclover in the patch, and the number of rain-free hours available for pollinators to fly in while the plants were in flower.

With so many different regions and climates in Alaska, the team knew that the effects of sweetclover on berry pollination would change in different parts of the state depending on the amount of time their flowers were both open. They created the Melibee Project's Citizen Science Program to help piece together the mosaic of competitive or facilitative interactions between the invasive species and the berries across the state. Over the course of the past two summers, 246 volunteers made 868 phenology (or the timing of life events) observations on one of our focal species at 106 different monitoring sites. Volunteers included families, interested individuals, school groups and teachers, youth camps, tourists, nature centers, conservation non-profits, and professional biologists.

Using the citizen science data in combination with historical herbarium records, the researchers are building mathematical models to predict the phenological phase of sweetclover, cranberry, and blueberry across Alaska. Using this information, we can identify which parts of Alaska will have the greatest overlap in sweetclover and native berry flowering times. We hope to communicate the most recent Melibee Project results in this report, and show you what your combined hundreds of volunteer hours have produced.

"I loved the opportunity to learn about invasives and climate change's impacts on AK's berries, being able to contribute data to a neat study, and having an excuse to pay really close attention to phenology!" -Margi Dashevsky, Melibee volunteer at Denali

Citizen Science All-Stars

Find out who some of the super citizen scientists were during 2013, and some of their amazing (and creative!) contributions...Page 2

Melibee models: predicting patterns across the landscape

Learn how the Melibee team is using the data gathered by volunteers to understand the overlap in flowering times of invasive sweetclover and native berries plants... Page 4

SPECIAL THANKS TO OUR VOLUNTEERS AND SUPPORTERS

Volunteers: Trysten Aguchak, Sam Aguilar, Adriana Amayr, Cera Andrew, Jessica Ayagalaria, Louis Bastille, Mika Beans, Seth Beaudreault, Mercedes Becker, Johnathan Bemlin, Bruce Bennett, Rebecca Bentzen, Evan Brasheor, Liane Budden and Al Yatlin, Will Caldwell, Matt Carlson, Alaina Childrason, Alex Clark, Gideon Cole, Samantha Craig, Margi Dashevsky, Steve Decina, Kevin Dee, Laurel Devaney, Patty Dolese, Griffin Downey, Taeyoung and Michael Dunton, Margaret Durst, Thom Eley, Sally and Ari Endestad, Darcy Etcheverry, Jeff Evon, Ruth Faj, Craig Feinstein, Erik Finley, Rebecca Gilbert, Isaac Gilbert, Gino and Fiora Graziano, Maryjane Hadaway, James Hancock, Jenny Heckathorn, Tom Heutte, Dash Hicks, Curtis Hightower, Todd Hindman, Jeanette Hoffman, Bill Holden, Hillary Houghton, Kari Hunter, Patricia Hurtt, Nathan Johnson, Alice Julius, Morgan Kain, Jen Kain, Amber Kairainak, Tricia Kent, Cyrus Kinegak, Marcy Kuntz, Nola Kurber, Elvis Lamont, Nicole Landry, Ryan Lane, Ruby Leff, Nick Lisuzzo, Brennan Mackinnon, Malea Marks, Blair Martin, Mason Martinez, Valarie Martucci, Jeff Mason, Sarah, Katy and Everett Masterman, Laura Medinger, Jenni Medley, Maddie and Mitch Michaud, Emily Monicken, Meg, Amelia & Tucker Mueller, Christa Mulder, Jayne Naze, Agatha Nicholas, Cherie Northon, Aart Nugteren, Thomas Oktoyak, Tessa Olson, Keith Oster, Kelsy Pannuk, Kiana Peters, Jessica Phillips, Elizabeth Ramirez, Victoria Ramirez, Pam Randles, Zoe Ratzlaff, Parker Rickett, Jennifer, Charles & babyRobinette, Alexa-Ann Roehl, Barbara Ross, Patrick Ryan, Laura Schneller, Lindsey Shelly, River Simon, Michael Sowrs, Blaine, Katie & Izzy Spellman, Kaelyn Stalker, Shannon Stevens, Kathy Taylor Yokel, Linnaea and Euan Uliassi, Lindsay VanSomeren, Ali Vos, Alex Voznitza, Jackie Wassillie, Travis Wassillie, Vincent Wassillie, Jimmy Wise, Katya, Dunya and Zhenya Wise, Jane and Anya Wolken, Arthur Woodard

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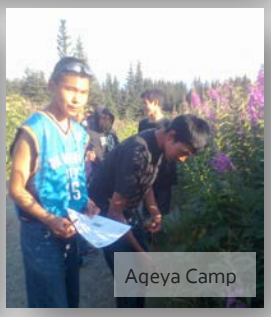
Citizen Science All-Stars

Whether you were only able to submit one observation, or you monitored your plants almost every day, the data you gathered is VERY important to us. We wanted to highlight some of our citizen scientists with a few special honors.

- **Most data observations:** Seth Beaudreault, and Aart Nugteren, Toolik, 172 observations!
- **"Budding" naturalist award:** Liane Budden, Fairbanks, and Blair Martin, Kenai, added great naturalist notes to their data
- **Most diligent data submitter:** Marcy Kuntz, Fairbanks, hand delivered data sheets every week!
- **Best online data submitters:** Gino and Fiora Graziano, Anchorage; Alex Voznitza and Nicole Landry, King Salmon
- **Best photographic data:** Vincent Wassillie, Nunapitchuk; Rebecca Bentzen, Mentasta
- **Most volunteers involved at a site:** Margi Dashevsky and 50 others, Denali Education Center
- **Best Site Name:** Linnaea & Euan Uliassi, Fairbanks, named their site "He-hoo Trail" after their family dog
- **Best youth dataset:** US Fish and Wildlife Service Youth Corps, Fairbanks
- **Best smartphone submission:** Wise Family, Denali
- **Most observations off the road system:** Blaine Spellman, north eastern Alaska
- **Largest youth group:** Ageya Wilderness Education (32 students!), Homer
- **Most creative plant names:** Lindsay VanSomeren, Keith Oster & Sam Aguilar, North Slope, they monitored blueberries at seven sites and named every plant thematically at each site! Blueberry Manilow… need I say more?


Margi Dashevsky, Denali Education Center


Wise Family


Ageya Camp


Blaine Spellman

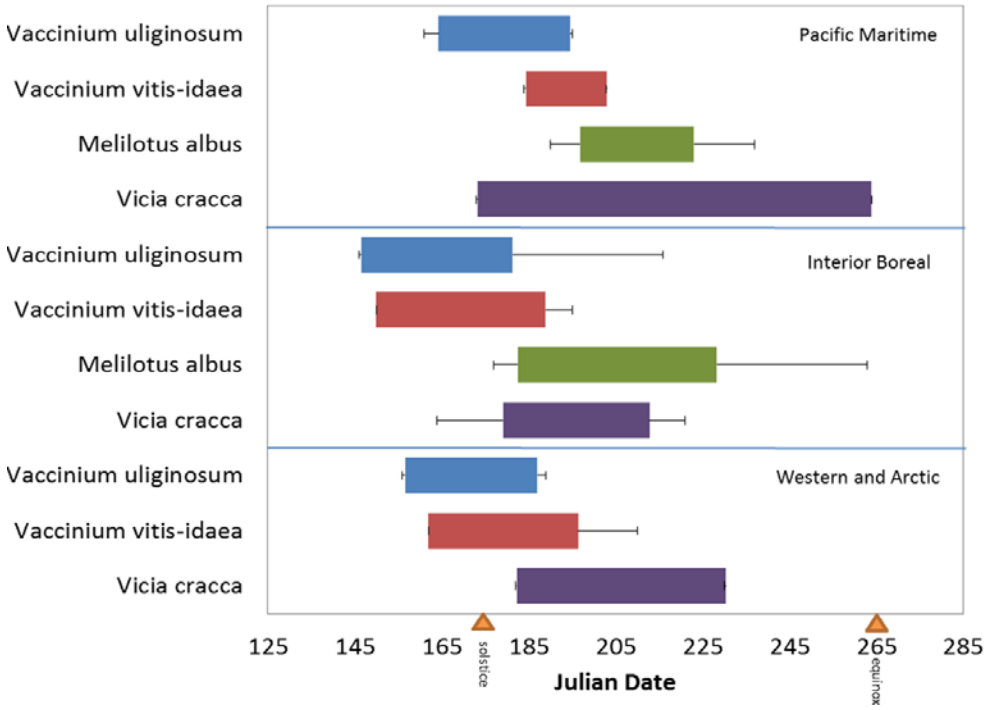

FWS Youth Corps


S. Beaudreault


V. Wassillie


Photo data by R. Bentzen

PHENOLOGICAL OVERLAP



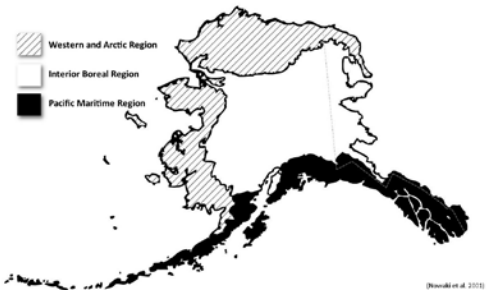


Figure 1. Peak flowering dates for invasive plant and native berry species in the three ecoregions of Alaska (map above; Nowacki et al. 2001) based on two years of citizen science monitoring data (2012-2013). Boxes are average start and end dates from regressions and the whiskers are the earliest and latest observed flowering dates. Orange triangles on the horizontal axis indicate the Julian dates of summer solstice and fall equinox for reference.

Melibee Monitoring Results

"The temperatures have cooled nearly 20 degrees, but the sweetclover plants are growing tall and all of them now have flower buds on them, no flowers yet," noted Fairbanks Melibee volunteer Liane Budden on her 3 July 2013 data sheet. We all watched with anticipation to discover how the unusually cold spring and hot June would affect the phenology of our adopted plants.

After two years of citizen science effort, we have an interesting picture of some general trends in the overlap in flowering between sweetclover and the berry species (figure 1). Using the two year average, sweetclover overlaps with the flowering of cranberry for about a week in the Pacific maritime ecoregion of Alaska. It only overlaps with blueberry in a few early cases. Similarly, sweetclover and cranberry also overlap in flowering times for about a week in the interior boreal ecoregion. Blueberry and sweetclover only overlap in the interior in the case of early flowering sweetclover, or later flowering blueberry.

We also increased our effort monitoring bird vetch (*Vicia cracca*) this year after Cherie Northon and Thom Eley reported some interesting results in Anchorage in 2012. It appears that bird vetch has an even greater length of overlap in flowering times with both blueberry and cranberry than sweetclover in all three ecoregions of Alaska. These data suggest that some experiments looking at the effects of vetch on pollination of native blueberries and cranberries should be pursued in the future.

Thanks to volunteers who monitored the same sites two years in a row, we were able to get a good sense of how flowering times vary from year to year. Figure 2 explains how factors such as snow and temperature can influence the timing of flowering in different years.

We are excited to get a better picture of the phenology of these species by continuing to monitor through the Pollinator Attraction Citizen Science Program in summer 2014. We hope you will join us again next year!

VARITATION BETWEEN YEARS

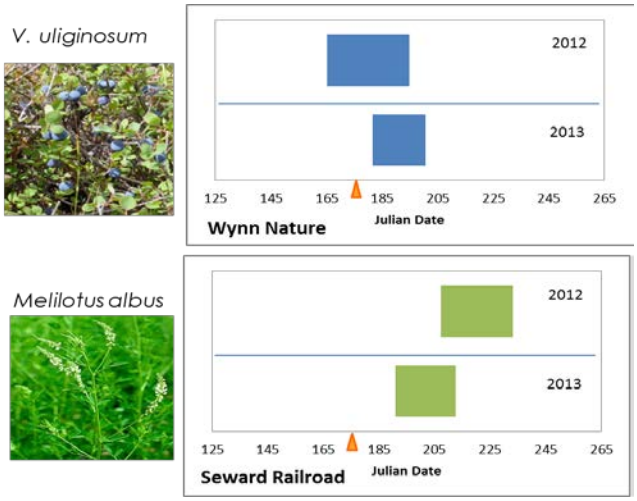


Figure 2. Peak flowering dates in 2012 and 2013 for bog blueberry (*Vaccinium uliginosum*) at Wynn Nature Center in Homer, Alaska (top) and sweetclover (*Melilotus albus*) at the Seward railroad yard in Seward, Alaska (bottom). Orange triangles on the horizontal axis indicate the Julian date of summer solstice for reference. Greater snow depth in spring 2013 delayed blueberry flowering in Homer by 2 weeks compared to 2012. The unusually warm July 2013 temperatures also shortened the length of blueberry flowering in Homer. Ten more inches of spring snow in 2012 delayed the sweetclover flowering in Seward by 2 weeks compared to 2013.

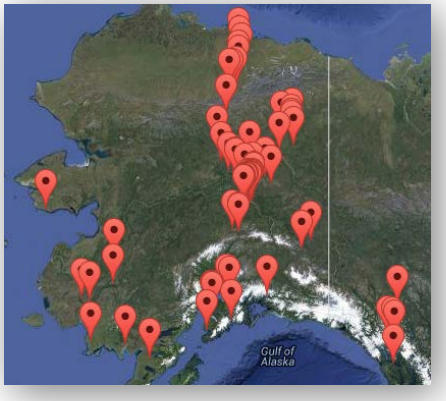
Melibee Models:

Predicting patterns across the landscape

Imagine you are a land manager responsible for ensuring a sustainable harvest of wild berries on your land in the face of sweetclover invasion. How do you know if sweetclover control efforts are necessary in your area to protect the subsistence berry resources? Models can help. While mathematical models are not crystal balls forecasting events, they can help people make decisions and plan for the future. In combination with historical data from herbarium collections, Melibee Project experiments and citizen science program have provided some powerful information to help create models that can aid invasive plant management decisions in Alaska.

In order to build predictive models, we needed to know when blueberry and cranberry flowered in different parts of Alaska and how the flowering was related to climate. Dr. Christa Mulder used herbarium collections as a way to get information from the past. People tend to collect herbarium specimens when they are flowering because that is when it is easiest to identify the plant. With a date and geographic location on each herbarium specimen, she was able to piece together the flowering times of sweetclover, blueberry, and cranberry over the past century across northern North America.

Mulder found that a model including the different days of the year the herbarium samples were collected, geographic information on the collection locations, and climatic information from the locations could explain a great deal of variation in the phenological stage of the plants (56% of the variation for blueberry, 33% for sweetclover). For example, the most important variables explaining the phenophase of blueberry were March mean temperature, the mid-summer temperature, March, July and August precipitation, latitude, elevation and the distance the site is from the ocean.



Melibee Project citizen science monitoring sites 2012-2013.

To evaluate how well the model worked, we needed to test and validate the model using a completely independent dataset from the one used to create the model. Katie Spellman, Mulder's PhD student, used the citizen science data to validate the models created with the herbarium data. Spellman ran the model for all the dates and locations in which the citizen science volunteers had collected observations. She then looked at how closely the phenophase values that the model predicted correlated with the phenophase that the volunteer actually observed (right). The blueberry model did a good job predicting what people actually observed ($r = 0.76$, $p < 0.0001$).

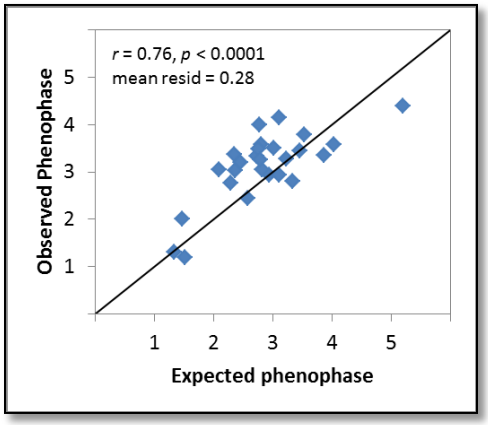
This is just a first attempt to model the flowering times of sweetclover and native berry species. We expect to get even better performing models as we get more detailed climate data for each of herbarium specimen locations and citizen science monitoring sites.

Using the models we generate, we can predict which parts of Alaska have the greatest overlap in flowering and which berry-picking habitats will be most vulnerable to the effects of sweetclover in the future. This sort of information can be a powerful tool to encourage strategic thinking about invasive plant management, particularly in communities where the harvest of berries for subsistence is a way of life. In the words of one of our volunteers, Jessica Phillips, Vice President of the Aniak Traditional Council, "The Melibee Project helped me build a strong voice about invasive plants for my council members, for our culture and way of life in rural Alaska."

MELIBEE MODELS

Historical Flowers

Dr. Christa Mulder (UAF) collected data from herbaria in museums across northern North America. She counted buds, flowers, petal drops and fruits on *Melilotus albus*, *Vaccinium vitis-idaea*, and *V. uliginosum* specimens dating back over 100 years. The above specimen is from 29 August 1924.



Validating the models

PhD student Katie Spellman (UAF) used the citizen science data to test how well Mulder's herbarium record-based models could predict the phenology of the focal species. In the above figure, the expected blueberry phenophase predicted by the model is plotted against the observed phenophase recorded by volunteers around Alaska. A phenophase of 1=bud, 2=flower, 3=petal drop, 4=unripe fruit, 5=ripe fruit. The predictions and observations were highly correlated, telling us that the models are pretty darn good.

Check out what's new!

Through a partnership with Hands on the Land, a clearing house for environmental education programs on public lands, we have an awesome new online citizen science data portal. Try this:

- Enter your data in the field from your smart phone or tablet
- Graph your data and compare it to data from other sites
- Play with the interactive map of Melibee monitoring sites

http://www.handsontheland.org/environmental-monitoring/melibee-project.html