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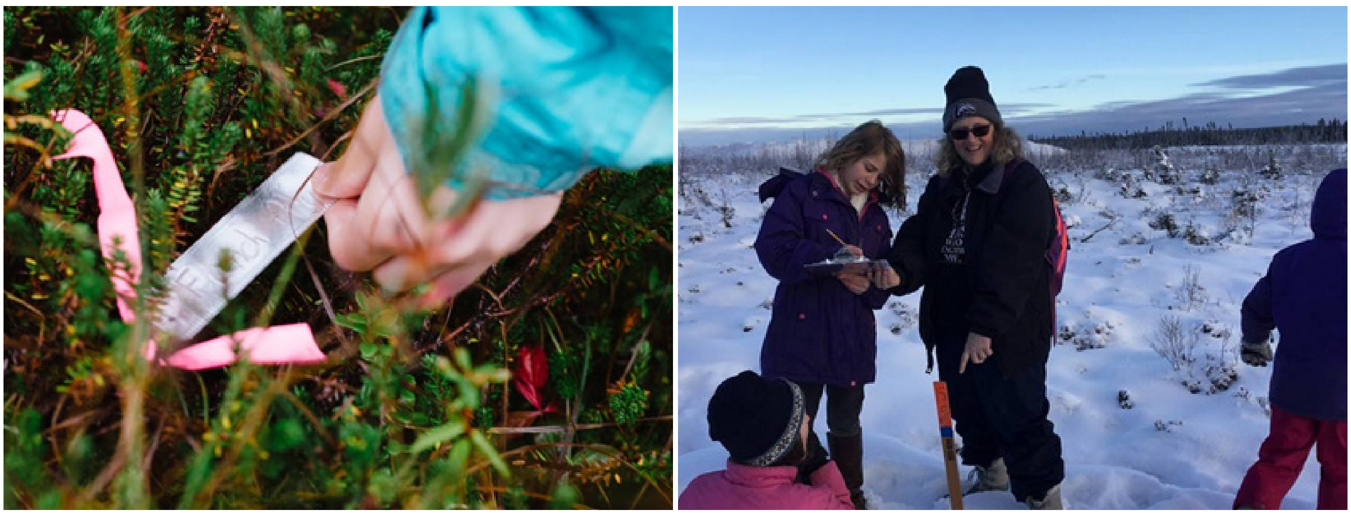
CITIZEN SCIENCE ACROSS AGES, CULTURES, AND LEARNING ENVIRONMENTS

Alaska Arctic Harvest - Public Participation in Scientific Research

By Katie V. Spellman and Jasmine D. Shaw, University of Alaska Fairbanks; Christine P. Villano, CV Education Consulting; Christa P. H. Mulder, Elena B. Sparrow, and Douglas Cost, University of Alaska Fairbanks



PICTURED: For the Winterberry Citizen Science protocol, volunteers tag and name a minimum of 20 individuals of one of four berry species with broad distribution across Alaska that hold a high proportion of their fruit into winter. They make weekly observations of berry number and condition in the fall and spring, and measure snow depth in the winter. J. Shaw, S. Smith.

INTRODUCTION

Alaskans are concerned about berry resources becoming less reliable in a changing climate (Hupp et al., 2015), and this is a resource that Alaskans of all types can access. Berry picking is an important subsistence practice in rural Alaska, and a major recreational activity in urban communities. For many rural Alaskan communities, berries are one of the few sources of local fruits and vegetables, and families routinely pick > 20 L of berries each year (Hupp et al., 2015). Nearly every school, home, or community center in Alaska has an edible berry species growing within short walking distance. Because of their cultural and nutritional importance, we focused our project on a topic that is directly relevant to a wide range of people: will climate change make berries less available in fall and winter for the people and animals that depend on them?

ALIGNING LAND GRANT UNIVERSITY ASSETS AND BERRY CITIZEN SCIENCE FOR A BROAD AUDIENCE

With expertise in locally-relevant science, Extension, and education, Land-Grant Universities are well-positioned to design citizen science programs with the needs and priorities of diverse communities in mind. At the University of Alaska Fairbanks we capitalized on the strong overlap of: 1) our prior scientific research on berries and environmental change; 2) the desire of Alaskans who rely on or love berry picking to better understand why their berries are changing; 3) the easy proximity to the focal species for groups underrepresented in citizen science in Alaska and beyond; and 4) seasonal timing that could easily facilitate multi-generational engagement (the fall and winter seasons when school was back in session and subsistence activities begin to slow).

Our project, Arctic Harvest- Public Participation in Scientific Research, had two primary goals:

1) investigate how shifts in environmental conditions affect the fate of berries and timing of berry loss from plants in fall and winter across Alaska;

2) improve the participation in and effectiveness of citizen science across diverse audiences, particularly at high-latitudes where a high proportion of communities have populations underrepresented in STEM.

We blended expertise from faculty and staff across two science research institutes (the International Arctic Research Center and the Institute of Arctic Biology), the Cooperative Extension Service, the School of Education, and English Department, as well as local education and evaluation experts, and combined this with the prior knowledge and experience each citizen science volunteer brought to the project.

We designed the Winterberry Citizen Science protocol, piloted it at four sites with rural and urban youth and adults, revised the protocol based on their feedback, and fully launched the project in fall 2017. All participants tagged berry plants of one of four species (at least 20 per site) in late summer and early fall, and then counted and classified berries remaining on the plant on a weekly basis throughout the fall, snowless-periods of winter, and spring. Data were entered into an online database where they were accessible to all participants.

In this article, we discuss the design elements we added or modifications we made to accommodate the diverse group of over 1,080 participants -- across ages, cultures, and learning environments.

We recruited volunteers through newspaper, radio, social media, our prior citizen science program networks, and environmental and education agencies across Alaska, with an emphasis on youth-serving organizations. Our participants in the first two years of the program came from Boys and Girls Club, afterschool clubs, Girl Scouts, 4-H, Future Farmers of America, K-12 classrooms, tribal environmental management agencies, other land management agencies, nature centers, families, and interested individuals (Figure 1).

PROGRAM DESIGN AND ACCOMMODATIONS FOR DIVERSE PARTICIPANTS

DESIGNING FOR DIFFERENT AGES

To accommodate participation at different age levels, we modified our approach to the training, data collection, and engagement in data analysis. For adults, we provided online or in-person trainings and always started the training with personal observations of how berries are changing. Individuals or small team could record all 20+ of the individual plants they tagged on a single datasheet. We provided adult groups access to the data through our online visualizations and through a newsletter and results summaries sent to each site. For youth groups, we created a highly interactive training that also began with the youth's prior experiences with berries, but continued with a live dramatization of

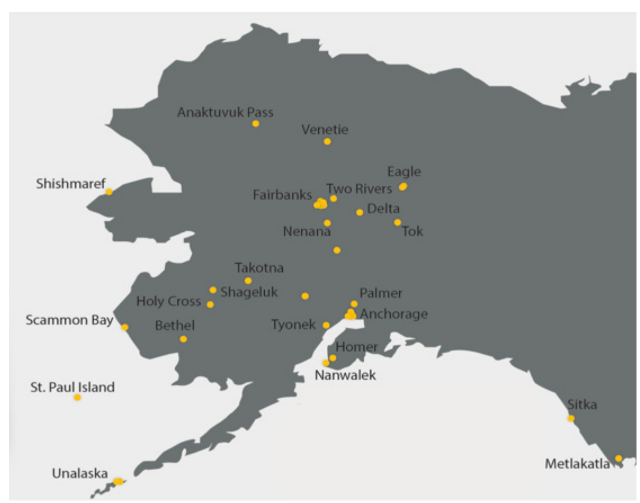


Figure 1. Locations of volunteers or groups monitoring berry condition and abundance through the University of Alaska Fairbanks Winterberry Citizen Science project during the program's first two years, August 2017- May 2019.

the research question and a sorting game to give the youth practice identifying the berry condition categories. Small groups of kids each "adopted" a few plants to monitor, and this was reflected in datasheets with space for only a few plants. Program scientists provided each youth group with a live "Data Jam," either in-person or through videoconference, to make sense of their data and compare it to other sites.

We focused on age-appropriate data representations for different grade levels, with early primary grades using berry pie charts, while older youth groups used line graphs. We developed complete lesson plans and resource collections to make it easier for youth group leaders to incorporate the citizen science project into their classrooms or clubs. An Extension agent even developed a dual-credit course for returning college students in rural Alaska Native villages and high school students; this course incorporated food preservation (berry jams and fruit leathers), berry science, and local knowledge about berries.

CULTURALLY RESPONSIVE CITIZEN SCIENCE

We incorporated culturally-responsive teaching practices into the citizen science learning. These practices engage cultural knowledge, language, prior experiences, and diverse modes or "performance styles" for facilitating learning (Gay, 2000). Stories are often used as a way to connect the concepts to the daily lives of the learners and to the knowledge gained from their parents, relatives, and elders. This type of integration can improve Indigenous students' educational experiences (e.g., Cajete, 1999; Barnhardt & Kawagley, 2005).

Currently, we are testing a model that incorporates storytelling at the start of the project through community berry story nights, during the middle of the project by storyboarding of the participant's science experience, and at the end of the project through using the data from across sites in different climate zones to imagine stories of possible futures for berries in their community.

Other culturally responsive practices we embedded in the project:

Starting with personal connections: All trainings started with establishing personal connections and relevance of the research question to each participant's life. Each person shared an experience with berries, a berry-picking story, or an observation of the changes they had seen in berries in Alaska.

Connecting the effort to community knowledge: We offered the opportunity for youth groups to hold berry family nights or berry storytelling events to connect the youth science effort to the larger community and allow knowledge sharing across generations.

Inclusion of local languages: In one community, we worked with a Gwich'in language expert who was involved in indigenous language revitalization efforts to develop a bingo game to train youth in the berry condition categories and practice their language skills simultaneously. The idea was shared with other Alaska Native language teachers in other communities where different languages were spoken and the game was adapted.

Flexible species selection: In Alaska, ecoregions and culture are tightly linked, and different berries are available to and prized by different groups. While all groups selected one of the four focal berry species, some communities expressed interest in additional species. For example, in communities along the southern coast of Alaska, salmonberries (Rubus spectabilis) are of much higher value and changes in their availability have been much more of a concern than the four focal berry species. Groups monitored this important species in their community to establish a local dataset, but also one of the four species that contributed to the larger scale research questions.

MEETING THE GOALS FOR INFORMAL AND FORMAL LEARNING SETTINGS

The challenges, goals, and rewards of participating in citizen science with youth groups are very different in formal classrooms than in informal learning environments such as clubs or family groups. In classrooms, larger group sizes, limited preparation time, and curricular alignment all needed to be addressed in our program design elements. We developed lesson plans aligned to the state and national education curriculum standards to facilitate easy implementation into classroom teaching. We also provided web-based supplemental resources on berries developed by other sources, including lesson plans, crafts, children's books, recipes, games, and videos.

In informal learning environments, lessons developed for classrooms had to be shortened for the typically shorter contact time, and sequenced to fit the monitoring into a weekly club meeting alongside a craft project, game, or snack. In many cases, we sought to align the activities to existing program initiatives. For example, with Girl Scout troops we fit the project into the "Think like a Citizen Scientist" Badge requirements. Across the many types of informal learning groups that participated in the project - Boys and Girls Club, 4-H, scouts, afterschool clubs, etc. - and formal classroom groups, STEM learning is a major program emphasis and citizen science can satisfy that need.

RESULTS AND CONCLUSIONS

The interdisciplinary team that included researchers, Extension agents, educators, evaluators, and support staff was critical to the intentional effort to include diverse volunteers in the research and learning process. It allowed us to design a project that could be responsive to the needs of each group or individual volunteer while maintaining the consistency and rigor in data collection across sites needed to meet scientific goals. Our approach was highly successful. We had 568 participants in preK-6th grade (age 3-12), 424 in 7th-12th grade (age 12-18) and 107 adults (ages 18+). Approximately 44% of our participants (479 of 1099 participants) were from groups historically underrepresented in STEM fields, which greatly exceeds the percent in the Alaska state population (28%, US Census 2010).

Of our 55 groups, 15 participated in out-of-school settings (youth, family, and adult groups) and 40 in a K-16 classroom setting. During our first full year of program monitoring (August 2017 – July 2018), 100% of the groups that set up their sites completed weekly berry monitoring until snow fell.
In our program evaluation interviews and surveys, participant satisfaction was high (Goldstream Group, 2018). Both the participants' sense of preparedness to engage in the science and the relationship between the program and the volunteers were strengthened when our program scientists or educators were able to visit the site in person (Goldstream Group, 2018). This emphasizes the importance of in-person relationship building when working with underserved and rural communities in citizen science.

For those of you who are hoping to use citizen science as a research and engagement tool, we encourage you to find the overlap between your university's ongoing research programs and a topic of personal and cultural relevance to a diversity of participants. Invest in travel to make in-person contact with volunteers a priority. Work across disciplines to design program elements that can accommodate different ages, cultures and learning environments. Small design modifications and accommodations can help move the field of citizen science toward greater equity, better learning, and better science. ❊

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