ARCTIC & EARTH

STEM INTEGRATING GLOBE & NASA

Project Partners:
University of Alaska Fairbanks; Association of Interior Native Educators; GLOBE Implementation Office; NASA Langley Research Center Office of Education; NASA Goddard Space Flight Center Cryosphere Branch; North Slope Borough School District and other school districts; Kenaitze Indian Tribe; 4-H Alaska; Santa Ana Community College MESA; Goldstream Group; NASA Science Mission Directorate Education Collective

Exploring impacts & feedbacks of a warming Arctic, Engaging learners in STEM using GLOBE & NASA Assets

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Project Collaborators

Citizen Science Spectrum

Theoretical or generalizable needs ⟷ **Local community needs**

Question	Researcher	Citizens
Methods Design	Researcher	Citizens with researcher assist.
Data collection	Citizens	Citizens
Data Analysis	Researcher	Researcher with citizen assist.
Use of findings	Researcher & Citizens	Citizens & Researcher

Assets

NASA and GLOBE data provide opportunity for climate change learning from local to global scales.

Shageluk village 8th grader organizes data in a brush pile near the school's GLOBE post-fire succession monitoring site.

MODIS image taken by the Aqua Satellite captures smoke filled skies throughout Alaska in July 2015.

Background- Jeff Schmaltz, MODIS Rapid Response Team; Inset- Katie Spellman, UAF

Arctic and Earth SIGNs Objectives

1: Develop a high quality climate change education program that includes NASA assets (resources and experts), citizen science, and mobile technology for formal and informal science education settings

2: Engage educators and community members in learning experiences to model best practice for inquiry-based, culturally responsive climate change science teaching

3: Engage youth, community members and educators in locally and globally important science where they produce and apply new information on the impacts of a changing global climate.

Project Overview

Target Audiences

- Primary audience- Educators in rural and indigenous communities and the youth they serve, including:
  - Pre- and in-service teachers and K-12 youth
  - Informal STEM educators (4-H leaders/others and youth
  - Community leaders (elders, tribal or town council members, etc.)

- Secondary audience- educators and students in other communities underserved in STEM

Needs assessment of target audiences

QUESTIONS

1. What issues related to climate change and citizen science are of greatest interest to our target audiences?
2. What benefits do our target audiences seek from participation in a climate change education program rooted in GLOBE citizen science, interaction with NASA scientists and assets, and civic engagement?
3. What training or support needs are there for successful participation of our target audiences?

METHOD

- Data taken from participant questionnaires or program applications from pilot activities with each target audience
- Large scale needs assessments for target audiences from other sources

Table 1. Data sources, collection methods, and sample sizes (*n*) for Arctic and Earth SIGNs target audience needs assessment. For each audience, data were collected from both the pilot participants of the first Arctic and Earth SIGNs program activities and a larger scale, more intensive needs assessment of the same audience for a climate change education or citizen science participation.

Target Audience	Arctic and Earth SIGNs Pilot Activity			Large-scale Needs Assessment		
	Venue (length)	Needs assessment method	*n*	Scope (source)	Needs assessment method	*n*
Pre- & in-service teachers in rural & indigenous communities	GLOBE teacher training course (6-day course)	Coded application essay responses	10	Alaska (Anderson & Plude 2010)	Survey	151
4-H informal STEM educators	4-H Western Regional Leaders Conference (1/2-day workshop)	Retrospective pre- and post-survey	13	USA (Shirk et al. 2013)	Survey	129
Rural & indigenous community members and leaders	Signs of the Land Camp (4-day camp)	Coded application essay responses	14	Alaska (Knapp et al. 2014, Jones & Skogrand 2015)	Coded semi-structured interviews	49
Disadvantaged undergraduate/ community college students	Santa Ana College field research course (10-day course)	Coded pre-course essay responses	22			

Summary of interests and benefits sought by **Target Audiences**

Teachers

- Engaging students in citizen science that braids western science and indigenous knowledge
- Students develop personal connection to climate change
- Students gain experience with practical application of STEM
- Students generate real science and use real data

4-H leaders

- Citizen science projects on natural resources, agriculture, and environmental quality
- Youth engaged in 4-H priority areas (civic engagement, STEM)

Community leaders and members

- Opportunity for dialogue across generations and communities
- Opportunity to learn about climate change from elders and scientists
- Youth more connected with community, traditions, and empowered
- Learn about climate change mitigation strategies & impacts of climate change on daily life

Undergrads

- Research experience
- Networking for career development
- Mentoring from professional scientists
- See new places and explore

Arctic and Earth SIGNs Big Idea:

We can make a difference on climate change issues by listening, inquiring, observing, and then acting.

Enduring Understandings:

1. Climate change influences our lives.
2. Climate change influences earth systems at multiple scales, and we need information at different scales to understand it.
3. Everyone can DO science.
4. We can use local and traditional knowledges and STEM to help our community adapt to climate change.

The Arctic and Earth SIGNs inquiry model

Using GLOBE, NASA, and local knowledge to make STEM learning locally relevant and have an impact

Learn from elders, long-term residents, and scientists about signs and impacts of climate change.

SHARE

Discover what youth and adults know

Identify key climate change issue for community

Brainstorm investigation and stewardship ideas

SHARE

EXPLORE

Do culturally responsive activities to establish knowledge base on the topic

Talk with a NASA scientist

Select inquiry question

EXPERIMENT

Collaborate with a scientist & community to develop and implement GLOBE investigation

EXPLAIN

Make sense of research by analyzing data and reviewing information from local experts, NASA data, and existing research

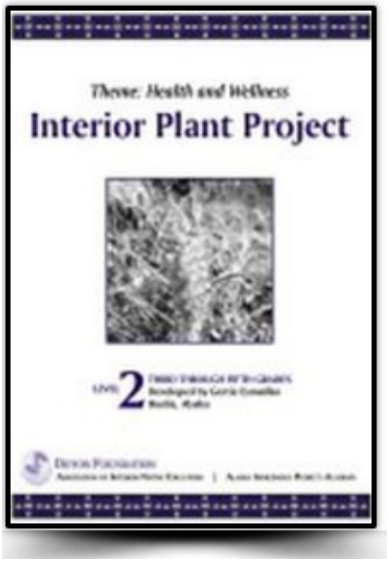
APPLY

Design and implement stewardship project to help community address the climate change issue

Culturally Responsive Learning Units

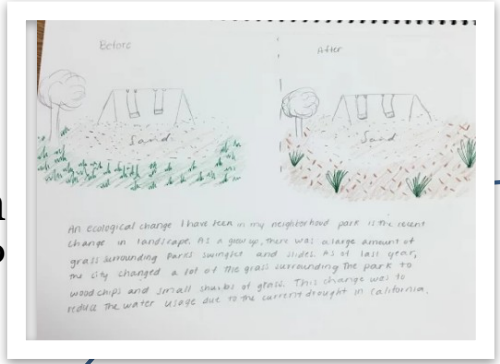
Association of Interior Native Educators curriculum update and development

- Salmon
- Fish
- Berries
- Birds
- Medicinal Plants

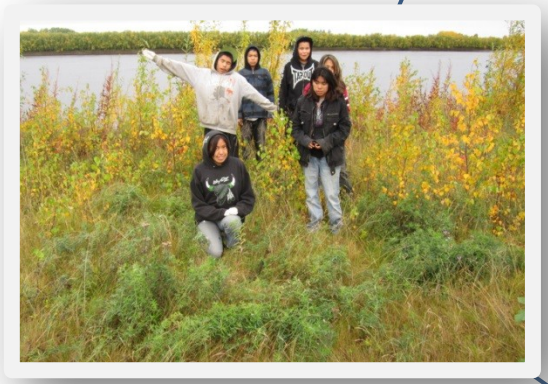


Climate Change and My Community Course

1. What is my personal connection with climate change?



2. How does climate change influence the Earth system?



3. How does climate change affect my community?

4. What can I do about a climate change issue in my community?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Rose Hips
Rose Hips
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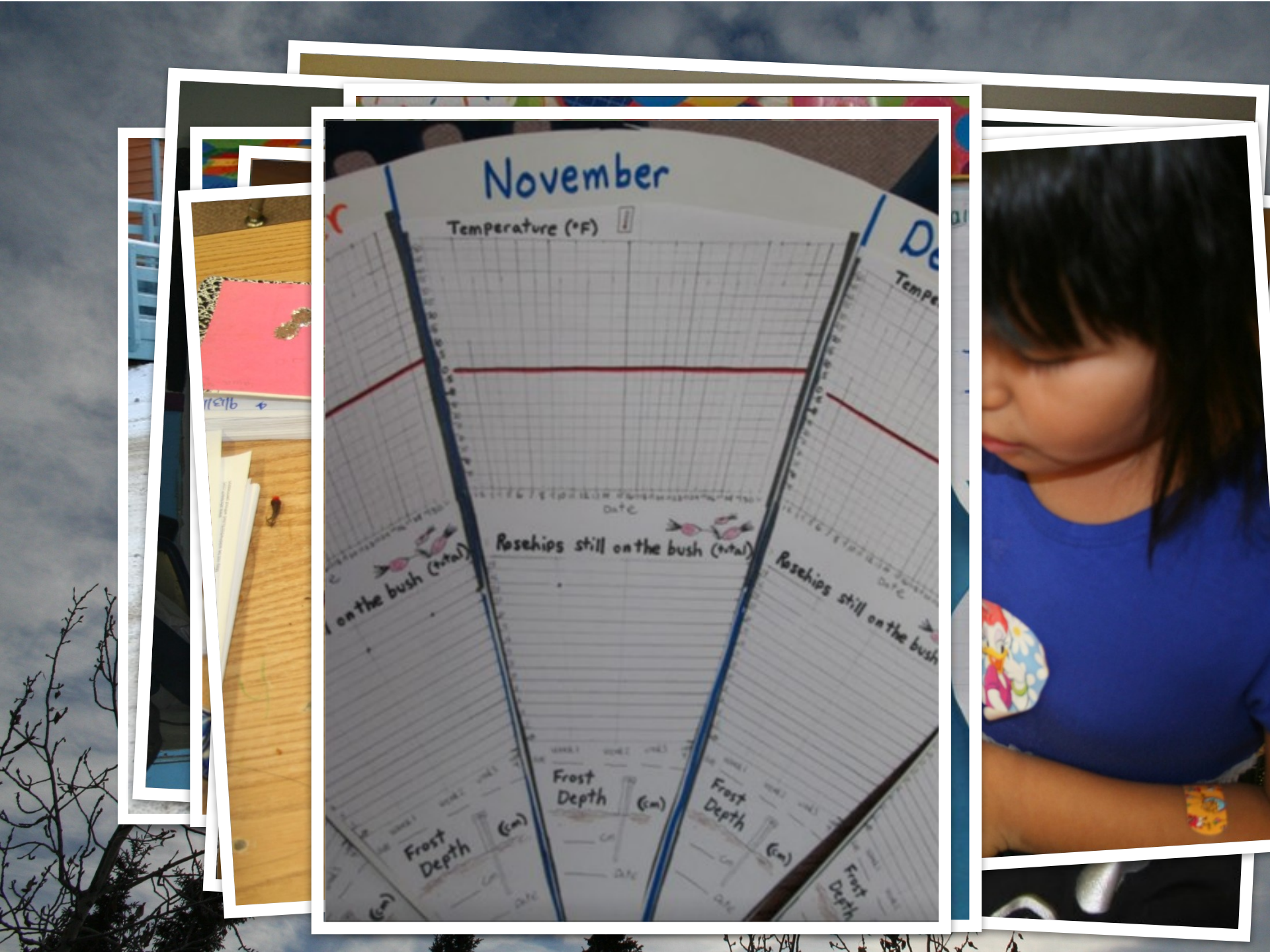
Rose Hips
Rose Hips
Nice Pictures! I love the color of your rose

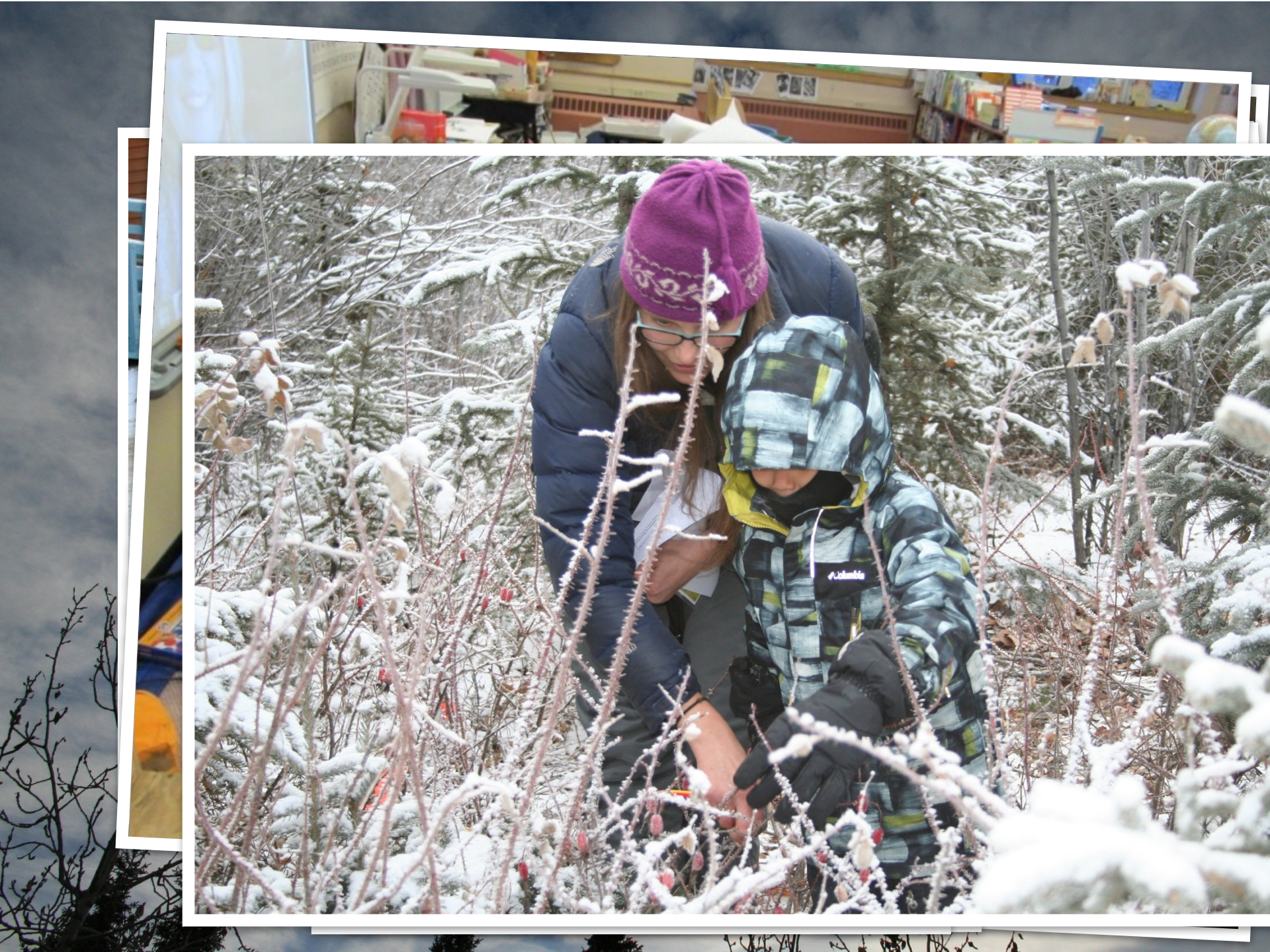

Happy


home
walk
chair
river
moose
Crayola


School glue


April
May
We are learning
about the four seasons
Summer
RAYnee
Kiana
Bliss
Loretta
Alin


November
Temperature (°F)
Date
Rosehips still on the bush (total)
Frost Depth (cm)




"R/D
Rosehip
Research
Dino
Facts