

GLOBE & Long Term Ecological
Research Station (LTER)
Weather Station at Watershed
School in Fairbanks, Feb. 2020



GLOBE and the GLOBE Observer App in Alaska: Decades of Environmental Learning



Christina Buffington, GLOBE Trainer & Teacher

Science & Education Specialist, Program Manager

Geographic Information Network of Alaska

Geophysical Institute



GINA
www.gina.alaska.edu

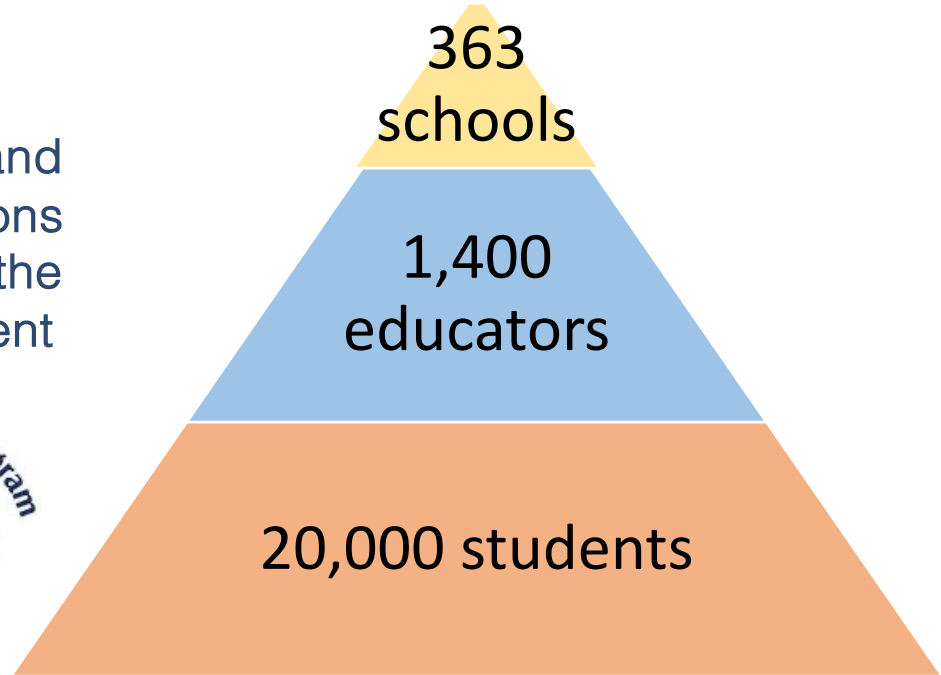
Virtual Alaska
Weather Symposium

September 17, 2024



Dr. Elena Bautista Sparrow brought GLOBE to Alaska in 1996

Global Learning and Observations to Benefit the Environment



Source: GLOBE 2024 www.globe.gov and International Arctic Research Center <https://uaf-iarc.org/project/global-learning-and-observations-to-benefit-the-environment-globe/>



International Arctic Research Center

GLOBE Alaska Partnership is operated by International Arctic Research Center at UAF



Major funding: Arctic and Earth STEM Integrating GLOBE and NASA Assets (SIGNs)

Supported by **NASA** under Award No. NNX16AC52A.



Partner

In partnership with **Association of Interior Native Educators**



GLOBE: Decades of Science & Education

Global Learning and Observations to Benefit the Environment

1

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2

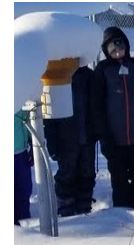
**Alaska
GLOBE
Examples**



**A story of
a box
and the
weather**

3

**Collect, visualize
GLOBE weather
data**



1990s



1994: Earth Day, U.S. Government announces The GLOBE Program as a multi-agency effort. Six US federal agencies are involved with the program's development:

- The National Oceanic and Atmospheric Administration (NOAA) is the lead agency
- The National Aeronautics and Space Administration (NASA)
- National Science Foundation (NSF)
- Department of State (DoS)

Credit: The GLOBE Program,
<https://www.globe.gov/about/learn/history>

**GLOBE
announced
on Earth Day
in 1994**

Began 1995

Alaska 1996

GLOBE by the Numbers



GLOBE Educators
receive in-person or
online training

127 Countries

41,965 Schools / Informal Education
Organizations

51,550 Educators

284,150 GLOBE Observers

258,325,456 Measurements

720,158 Measurements this month

GLOBE Observers
participate by using
the GLOBE Observer
app



From www.globe.gov as of September 17, 2024

GLOBE Protocols are Data Collection Methods

Atmosphere



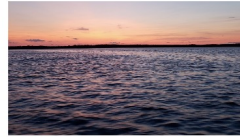
- Aerosols
- Air Temperature
- Barometric Pressure
- Clouds
- Precipitation
- Relative Humidity
- Surface Temperature
- Water Vapor
- Wind

Biosphere



- Biometry
- Carbon Cycle
- Green Up/Down
- Land Cover Classification
- Phenological Gardens

Hydrosphere



- Alkalinity
- Conductivity
- Dissolved Oxygen
- Freshwater Macroinvertebrates
- Nitrates
- Water Temperature
- Water Transparency
- Water pH

Pedosphere



- Bulk Density
- Frost Tube
- Soil Characterization
- Soil Fertility
- Soil Infiltration
- Soil Moisture - Gravimetric
- Soil Moisture - SMAP Block Pattern
- Soil Particle Density
- Soil Particle Size Distribution
- Soil Temperature
- Soil pH

Earth as a System



- Agriculture
- Air Quality
- ENSO
- Mosquito
- Ocean
- Rivers and Lakes
- Soils
- Urban
- Water Cycle
- Water Quality
- Weather

Can be done on the GLOBE Observer application

How Students do GLOBE Investigations



Credit: The GLOBE Implementation Office, 2024
<https://www.youtube.com/watch?v=cT2ek43b37o&t=3s>

Buffington 2024 • GINA – GLOBE VAWS Webinar

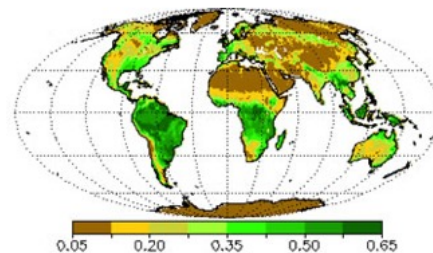
Green-up and Green-down protocols started in AK



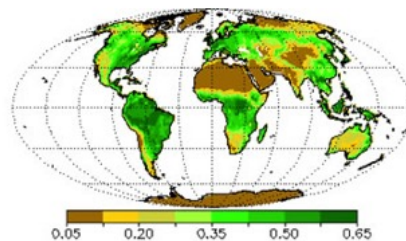
Elena Sparrow doing Green Down in 2024.
Photo Credit Chynna Lockett



Color chart used for Green Down.
Photo Credit: Katie Spellman



March
1987



May
1987

Image: NDVI, NASA



NASA Sensor,
Moderate
Resolution
Imaging
Spectrometer
(MODIS)

used for
Normalized
Difference
Vegetation
Index (NDVI)

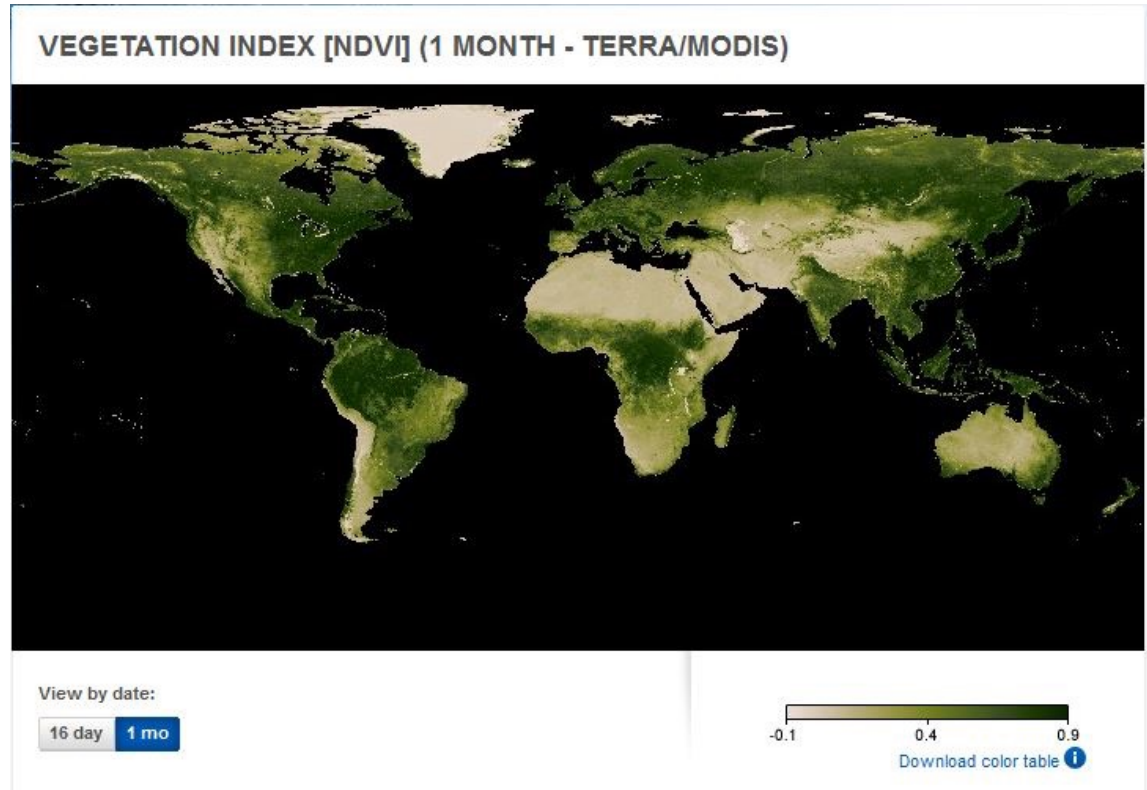
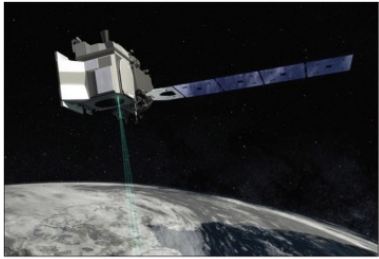


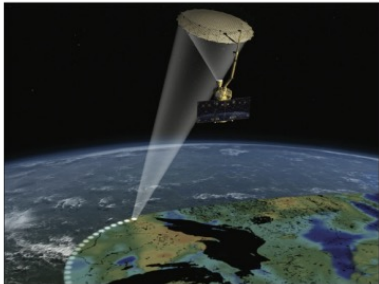
Image: NASA
Earth Observatory



Global
Precipitation
Measurement
Mission



Ice, Cloud and
Elevation Satellite-
2 (ICESat-2)
Mission



Soil Moisture
Active Passive
(SMAP) Mission

GLOBE helps us learn about NASA Satellite Missions and Data

Participate in NASA Science:

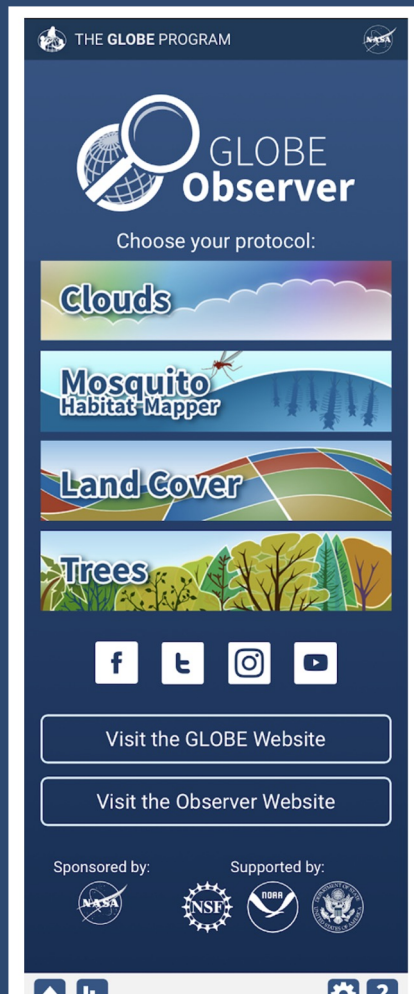
Download the
GLOBE Observer
app and contribute
your observations.

observer.globe.gov



Download the GLOBE Observer App and register with an email address

Get the App



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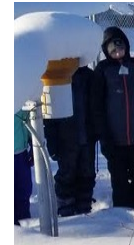
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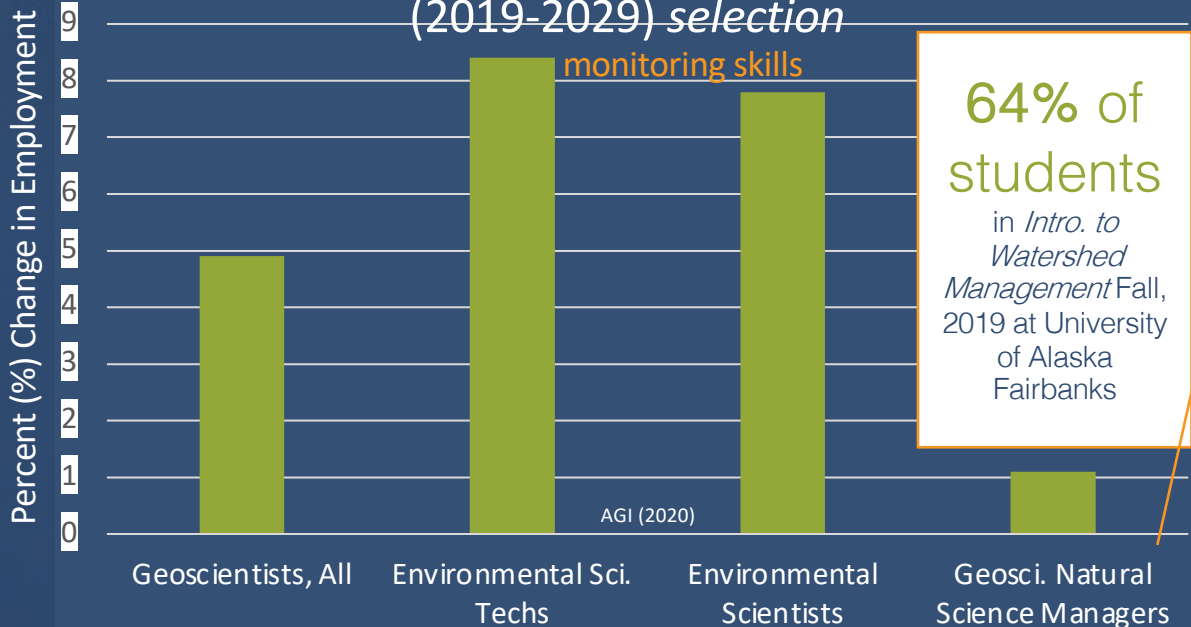
**Collect, visualize
GLOBE weather
data**





Monitoring skills will help students seeking geoscience jobs

Projected Geoscience Workforce Changes (2019-2029) *selection*



[Buffington 2019]



Use GLOBE Observer app - Landcover

Write in the chat what changes you've noticed to a local stream or lake



Tanana Chiefs Conference Technician, Wounded Warrior Volunteer and First Generation graduate student observe changes to Cripple Creek in Fairbanks, Alaska [C. Buffington 2022]

(Former) UAF Students monitor changes to Cripple Creek in Fairbanks, Alaska before and after restoration



[S. Glade 2022]



[C. Buffington, 2023]

2007
presentation at
GLOBE Annual
Meeting

GLOBE Freshwater Ice Phenology Protocols

Kim Morris, Martin Jeffries and Elena Sparrow

University of Alaska Fairbanks

Potential
GLOBE ice
phenology
protocol is now
part of GLOBE
Observer



***Global Learning
and Observations
to Benefit the
Environment
(GLOBE)***



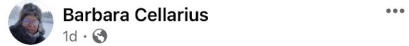
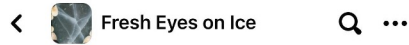
Prepared by Kim Morris and Martin Jeffries, UAF



Share information with river users

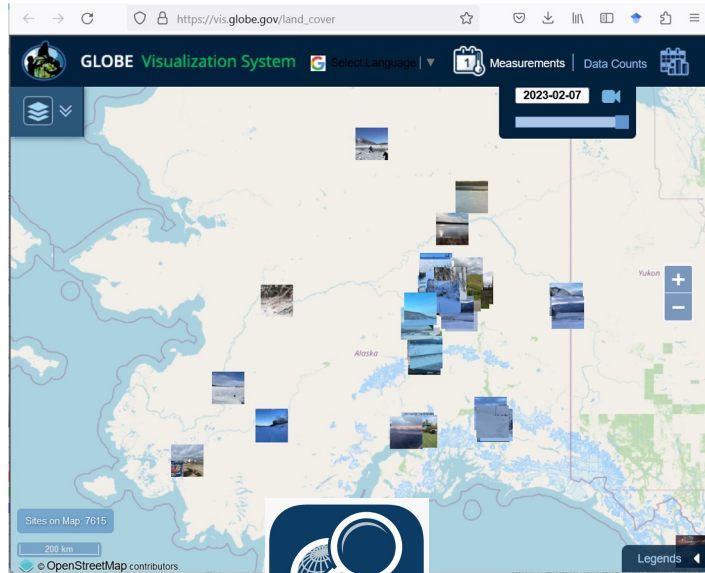
Citizen science platforms GLOBE Observer Landcover

Social media



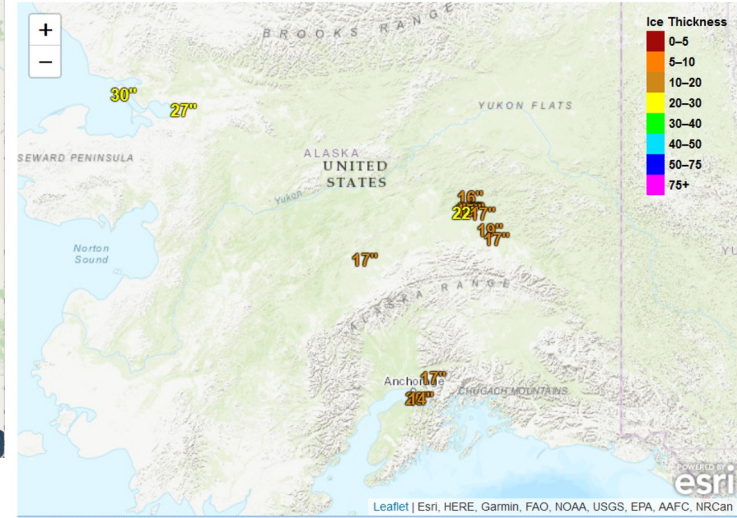
Copper River, Copper Center/Silver Springs

2/5/2023: Overcast and about 12 degrees when I went down to the river today.



National Weather Service maps

Alaska Rivers and Lakes Ice Thickness Map

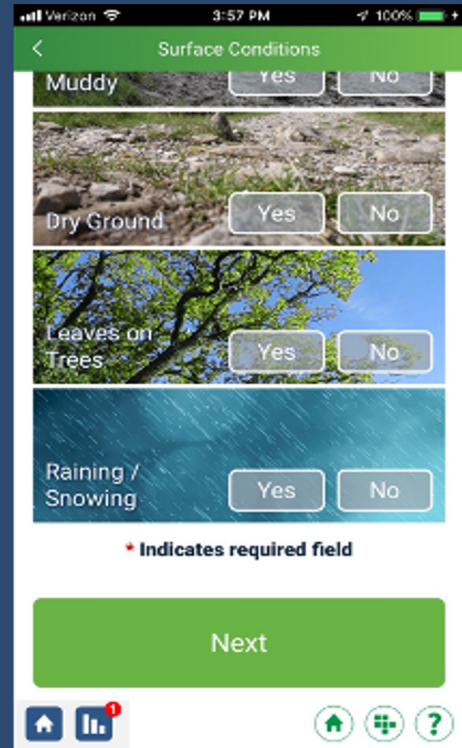
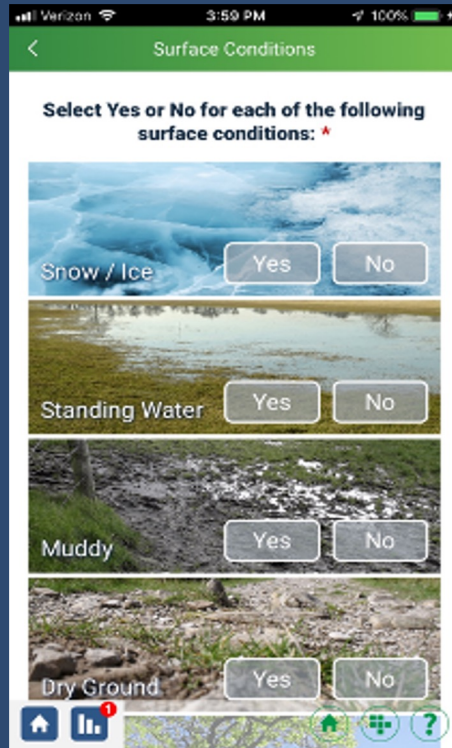
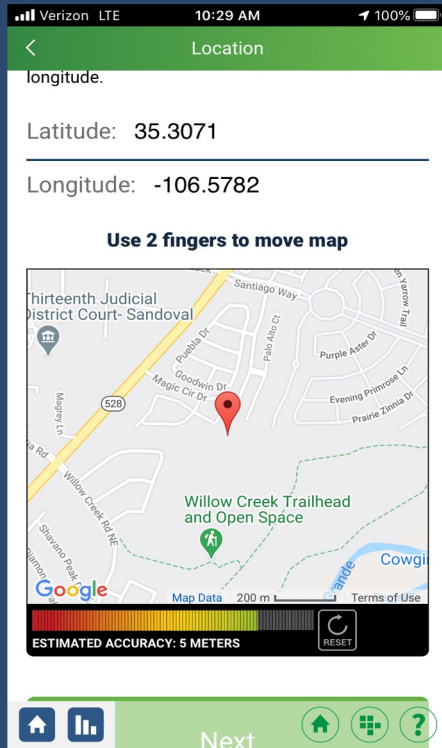


Slide adapted from Dana Brown and Katie Spellman, used with permission



Globe Observer Landcover

Step 1 - Location and Surface Conditions





Globe Observer Landcover

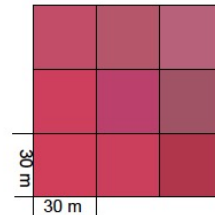
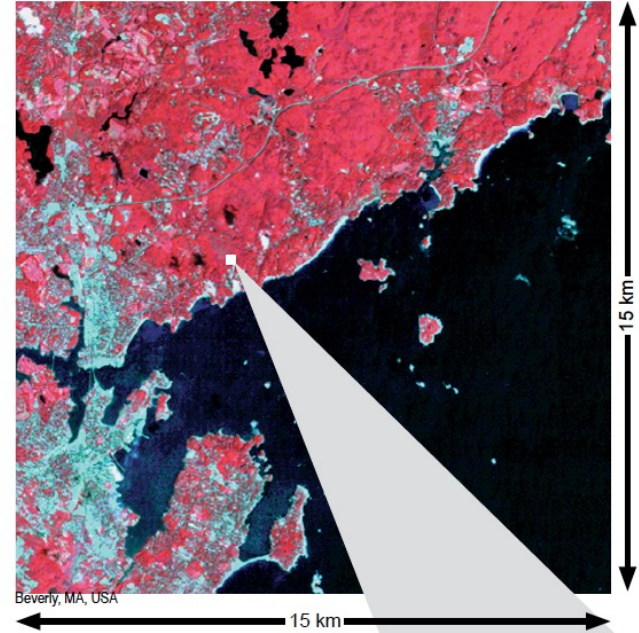
Step 2 – Photograph (50 meters in front)



Slide adapted from Holli Kohl for Fresh Eyes on Ice GLOBE presentation in 2023 training, used with permission

GLOBE Observer Landcover Observations can align with Landsat images

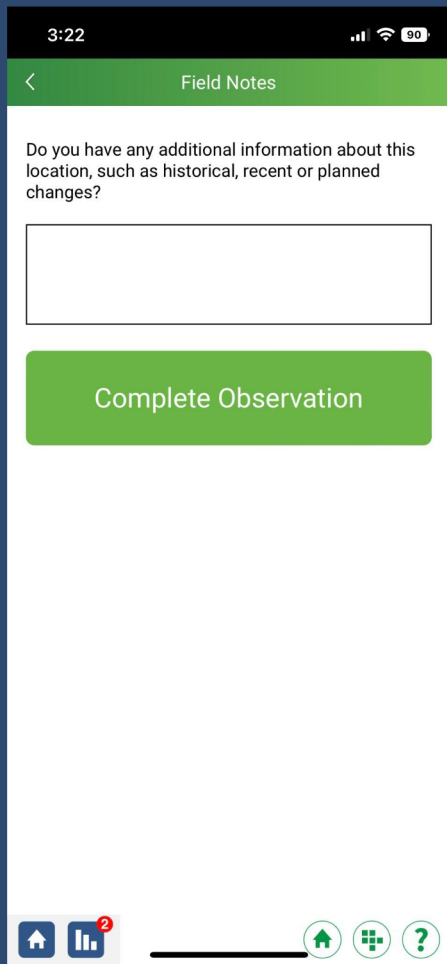
Satellite Image of Beverly, MA in False-Color



Area of 3 pixels x 3 pixels
(equal to 90 m x 90 m)



Subset of Main Image



Optional on GLOBE
Observer
Landcover

Add Field Notes

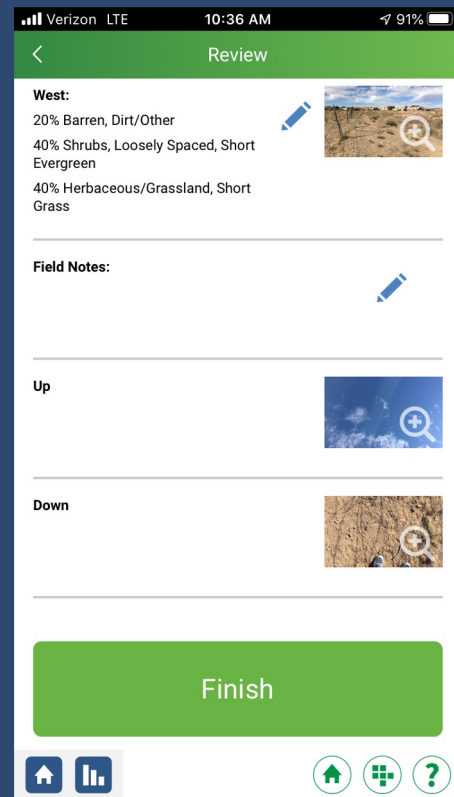
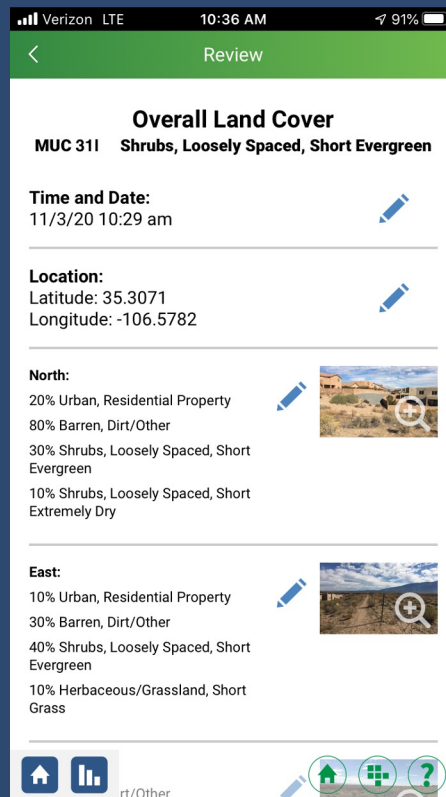
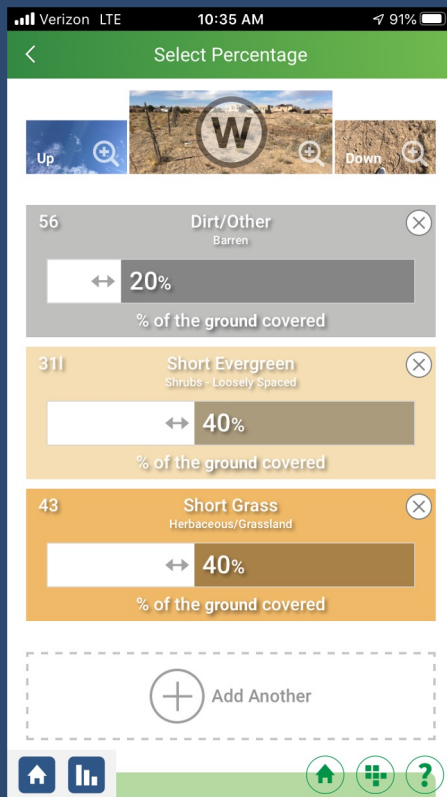
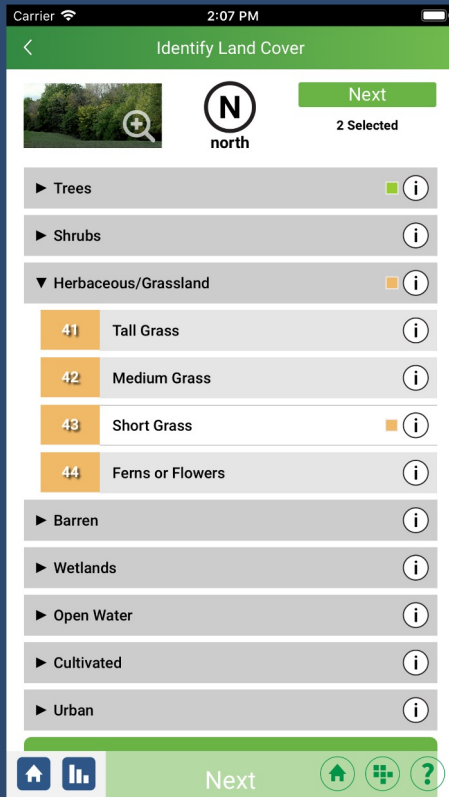
Add Feature Photos

Land Cover



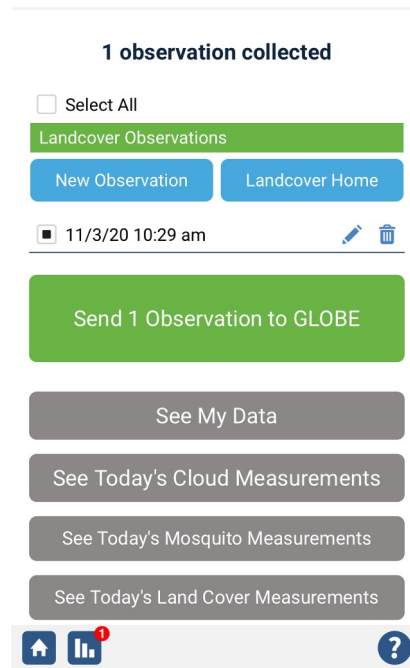
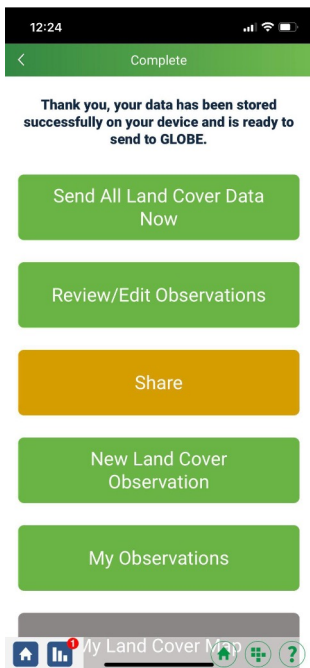
Measured Date:	2024-07-27
Organization Name:	Department of Natural Resources and Environment
Site ID:	360466
Site Name:	06WVS586923
Latitude:	64.852485
Longitude:	-147.873134
Elevation:	142.3m
Measured At:	2024-07-27T18:57:00
Measurement Latitude:	64.8533
Measurement Longitude:	-147.873
Measurement Elevation:	141.5
Location Method:	automatic
Location Accuracy M:	8
Leaves On Trees:	true
Data Source:	GLOBE Observer App
Field Notes:	Happy Creek below diversion structure with groundwater upwelling

Step 3 (optional): Classify Land Cover, Check Landsat



Last Step: Submit your Observations

Now or Later (with better reception or wifi)



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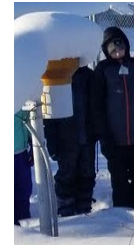
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Alaska Students from 4 Schools at 2024 Northwest and Pacific Student Research Symposium in Pasedena CA



How Does Temperature Affect the Snowpack Depth

Data and Report
published to the GLOBE
Website

By the Middle School Science Students
James Smith, Mylee Johnson, Peyton Hilty, Josh Olson, Carlyann
Anvil, Lyra Abruska
Mrs. Faith Lussow and Mrs. Gwen Diltz

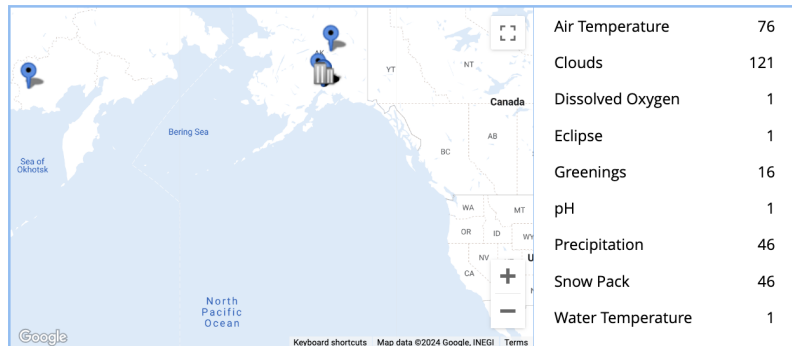
Knik Charter Northern Lights

Alaska, United States of America

Year Created: 2023

Data Site Locations

Data Period: Jan 01, 2019 📅 - Sep 17, 2024 📅



Knik Charter School



Wasilla, Alaska USA

11/15/23 - 2/29/24

2024 GLOBE Annual Meeting in New York Alaska Students from Salcha and Aniak



Dissolved Oxygen and Fish & Wildlife Habitat in Gravel Pit Ponds

Jack Boelens, Ralph Steeves, & Gavin Smith



Aniak Jr./Sr.High School

Research Questions

- Is there a difference in dissolved oxygen concentrations between the 6 gravel pit ponds?
- Can the ponds support fish and wildlife during winter?

Introduction

- Gravel pits were constructed in Aniak, Alaska, during the early 1990s with additional pits added in 2018 for airport runway construction. Since excavation, these pits have been filled with water and are connected to the Kuskokwim River through a channel.
- The gravel pit acts as a bottleneck after river break up, trapping fish that can't contribute to the overall population when water levels are low.
- During our bird watching field activity last September 15, 2023, we observed ravens, grouse, ducks and geese around the ponds. It seems that the gravel pit ponds support both resident and migratory birds during spring and fall.
- Aniak residents have reported catching pike, spotting beavers, and observing nesting waterfowl in the gravel pit ponds, but no effort has been made to evaluate the efficacy of the gravel pit as a habitat for fish and wildlife.
- Our objective is to collect GLOBE water quality data (temperature, pH, dissolved oxygen, and conductivity) in 6 gravel pit ponds and develop baseline data for a potential restoration initiative. For this study, we analyzed dissolved oxygen differences across the ponds under the ice in winter.



Figure 1. Aniak location map.
Generated by: Emily Sousa

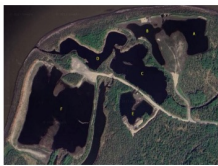


Figure 2. Satellite image of the study site. A, B, C, D, E, F represents the gravel pit ponds.
Retrieved by: Dan Gillman

Research Methods

- GLOBE Hydrology Protocols were utilized.
- Land cover data was obtained through GLOBE Observer App.
- Snow cover measurements were conducted at a location where snow drift does not occur.
- Utilized an ice auger to drill a hole in the pond and measured ice thickness, water depth, and total depth.
- YSI ProQuatro probe was deployed to collect water quality samples, measuring temperature, pH, conductivity, and dissolved oxygen. We conducted 3 trials midway and 3 trials at the bottom at each of the ponds. (See the pond depth and surface area measurements in **Table 1**).

Pond	Midway Depth	Bottom Depth	Surface Area
A	100 cm	200 cm	23340 m ²
B	90 cm	180 cm	13064 m ²
C	150 cm	290 cm	40272 m ²
D	145 cm	185 cm	23392 m ²
E	45 cm	90 cm	14563 m ²
F	175 cm	340 cm	96640 m ²

- For our data analysis, we used Google Earth to determine the surface area of each ponds.
- Generated a scatter plot correlating midwater dissolved oxygen levels with surface area to test our hypothesis.
- Generated a graph to visualize the standard error of the average midwater dissolved oxygen levels within each pond.



Fig.3 YSI ProQuatro probe



Fig.4 Drilling a hole in the ice



Fig.5 Jack and Ralph deploying the probe



Fig.6 The whole group collecting water quality data

Results

- Dissolved oxygen levels near the bottom of the ponds were low during winter, but Pond A and Pond F shows potential levels for sustaining fish near the midway.

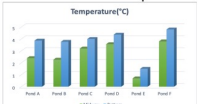


Figure 7. Average temperature for each site
Dissolved Oxygen (mg/L)

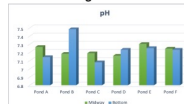


Figure 8. Average pH for each site
Conductivity(µs/cm)

Discussion

- Dissolved oxygen with a minimum of 5mg/L can generally support fish and other aquatic organisms (Herrick, 1982).
- The midway dissolved oxygen levels observed in Pond A and Pond F may be due to the fact that they are more recent ponds compared to Ponds D, C, E. The older ponds have accumulated more organic matter and nutrients over time, which can lead to oxygen consumption as they break down, affecting dissolved oxygen levels.
- The ponds were completely frozen over and had been since early December and presumably at their lowest levels during our data collection. Low levels of dissolved oxygen were detected in all ponds near the bottom during winter. This findings yielded the same outcomes with Bryant (1988) who investigated gravel pit ponds as habitat for coho salmon.
- The correlation graph indicates weak relationship between midway dissolved oxygen levels and surface area (See **Figure 11**). This weak correlation results from high dissolved oxygen readings from Pond A, which are considered outliers in our dataset. This can be explained by the greater inflow Pond A receives due to the river bend. This suggests for further investigation, specifically comparing the water quality between the river and Pond A for the next data collection.
- The graph displaying the standard error of average midway dissolved oxygen levels indicates that the data collected from Pond B and Pond C were more spread out compared to the other ponds. This is evidenced by the longer standard error bars as shown in **Figure 12**. This could be due to the different students involved in deploying the probe, indicating an implementation issue. This serves as a valuable factor for our future data collection.
- Our investigation can further be improved if we collected data before freeze-up and after break-up to assess overwinter use of ponds and examine effects on water quality parameters during river flooding.

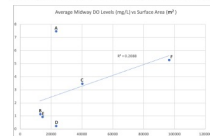


Figure 11

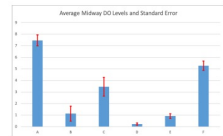


Figure 12

Conclusion

- Our results are inconclusive and requires further investigation regarding the reason for high dissolved oxygen levels in Pond A. The flow of groundwater into and out of the ponds could play an important factor determining water quality.
- Regular collection of water quality data can improve our understanding how these gravel pit ponds may transition into a more functioning ecosystem for fish and wildlife.
- Our next steps will align with Matter's (1988) claim, which states that disturbed land can be reclaimed to provide fish and wildlife habitat if water is present. By establishing baseline data through continued water quality monitoring, we can formulate management recommendations to enhance fish and wildlife habitat, create recreational and subsistence opportunities for the community and transform the area into a practical laboratory for students like us to better understand how ecosystems function.

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Protocol Training Slides for: Automated Weather Stations (AWS)

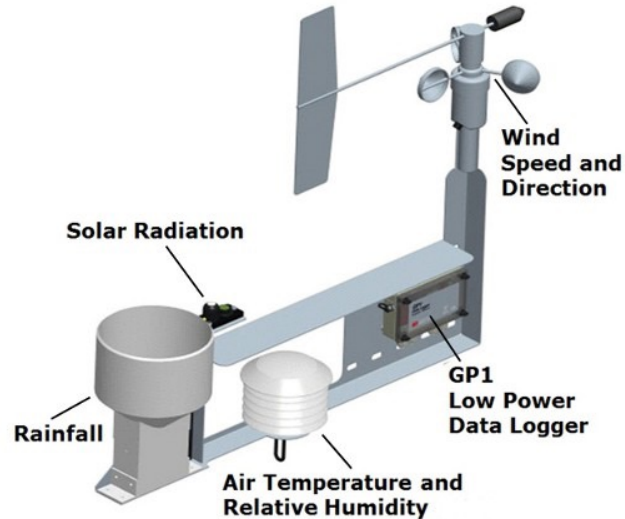
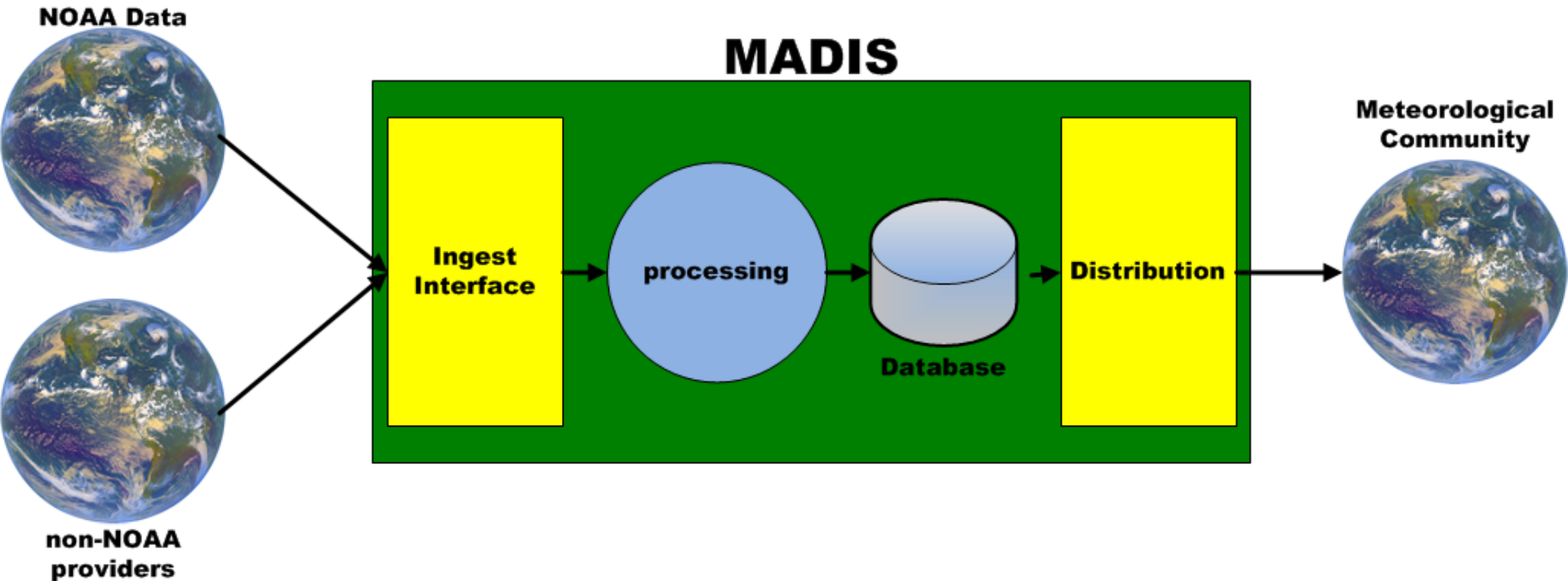


Photo credit: Daniel Miller

Automated Weather Stations (AWSs) can collect a variety of data for upload to GLOBE. They are also known as Personal Weather Stations (PWSs).

GLOBE data is in the process of being ingested into NOAA's Meteorological Assimilation Data Ingest System (MADIS)



Source: NOAA NCEP Central Operations <https://madis.ncep.noaa.gov/>



Arctic and Earth
SIGNs is supported
by NASA under
Award No.
NNX16AC52A.



THANKS

Arctic & Earth SIGNs team Dr. Elena Sparrow, Malinda Chase, Dr. Katie Spellman, Emily Sousa, Tori Brannan, Dr. Javier Fochesatto, Jasmine Shaw, Dr. Candi Dierenfield, Chris Villano, Jared Vaughn and many more!!

Association of Interior Native Educators
Malinda Chase, Sheila Vent, Fawn Jelinek

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WEBSITES

Arctic & Earth SIGNs

<https://arcticandearthsigns.alaska.edu>

GLOBE

[GLOBE.gov](https://www.globe.gov)

GLOBEObserver

<https://observer.globe.gov/>



International Arctic
Research Center



ACCAP
Alaska Center for Climate
Assessment and Policy
a NOAA CAP team

