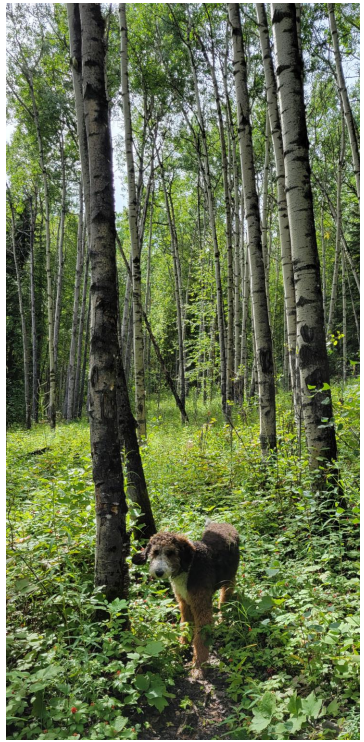
GLOBE PROGRAM®

Why Phenology Matters

Christi Buffington
Joyanne Hamilton
Cheryl Williams



GLOBE European Phenology Campaign 23 April 2025

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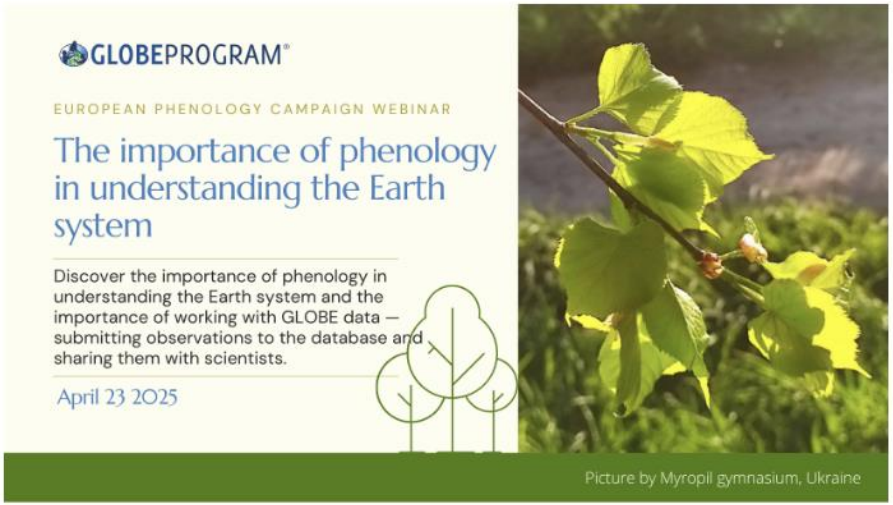
UAF University of Alaska Fairbanks

Why Phenology Matters?

📅 **Wednesday, April 23, at 6 PM CEST (Prague time)**

Discover the importance of phenology in understanding the Earth system and the importance of working with GLOBE data — submitting observations to the database and sharing them with scientists.



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Phenology

Timing of cyclical events in nature → Patterns and life cycles

Field of ecological research → How living organisms respond to cues (day length, temperature, rainfall)

Way of life → Knowledge passed on through generations

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Why Phenology Matters through Three Stories

Christi Buffington → Data and Science

Joyanne Hamilton → Culture and Community

Cheryl Williams → Curriculum and Opportunities

GLOBE European Phenology Campaign 23 April 2025

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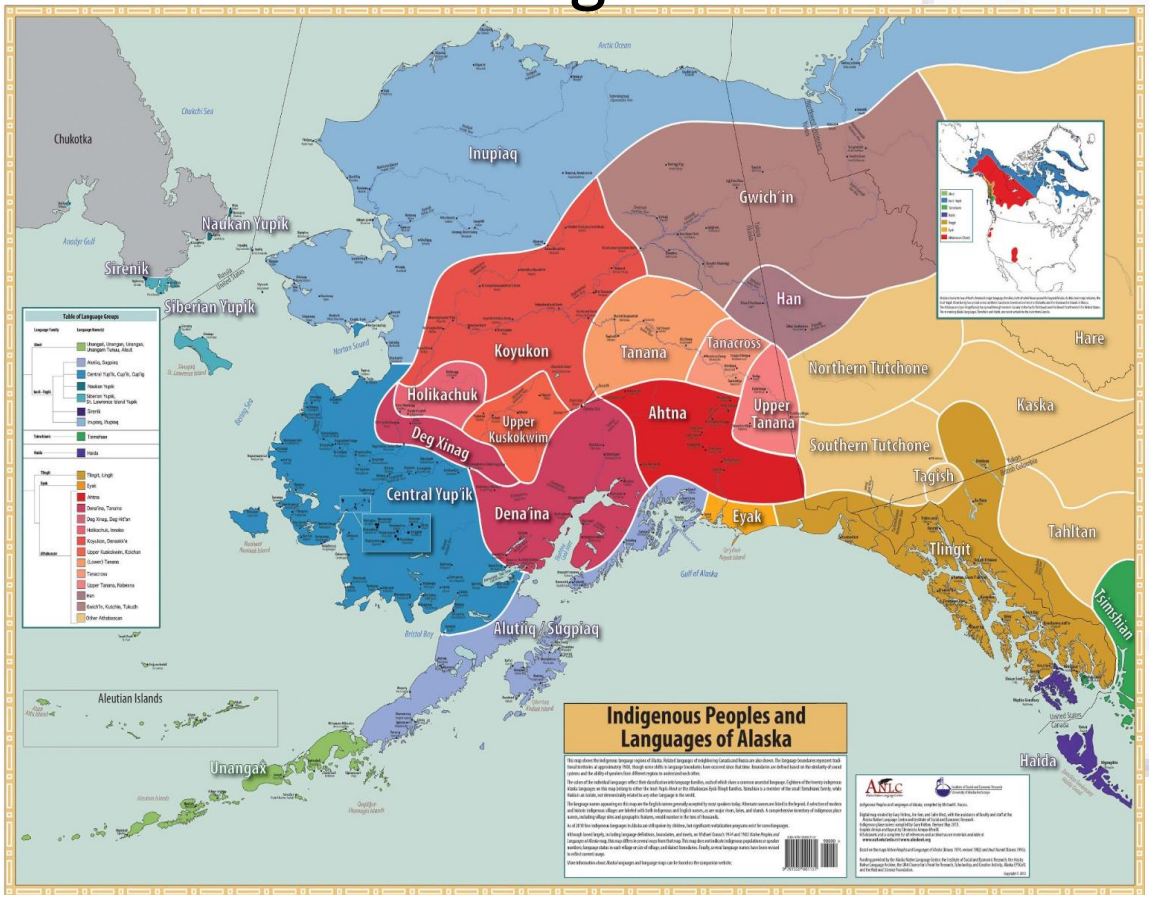
Land Acknowledgement



Credit: compiled by Michael E. Krauss (2013). Alaska Native Language Center

Shageluk

Deg Hit'an Dene Land

Troth Yeddha' campus University of Alaska Fairbanks

Lower Tanana Dene Land

Matanuska-Susitna Valley

Dena'ina and Ahtna Dene Land

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Learning Framework

Discover what youth and adults know

Identify key changes and issues for community

Brainstorm investigation and stewardship ideas

EXPLORE

Do culturally responsive activities to establish knowledge base

Talk with a scientist

Select inquiry question

Identify aligning larger scale cit sci efforts (GLOBE, etc)

Collaborate with a scientist & community to develop and implement investigation

EXPERIMENT

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 issue

SHARE

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

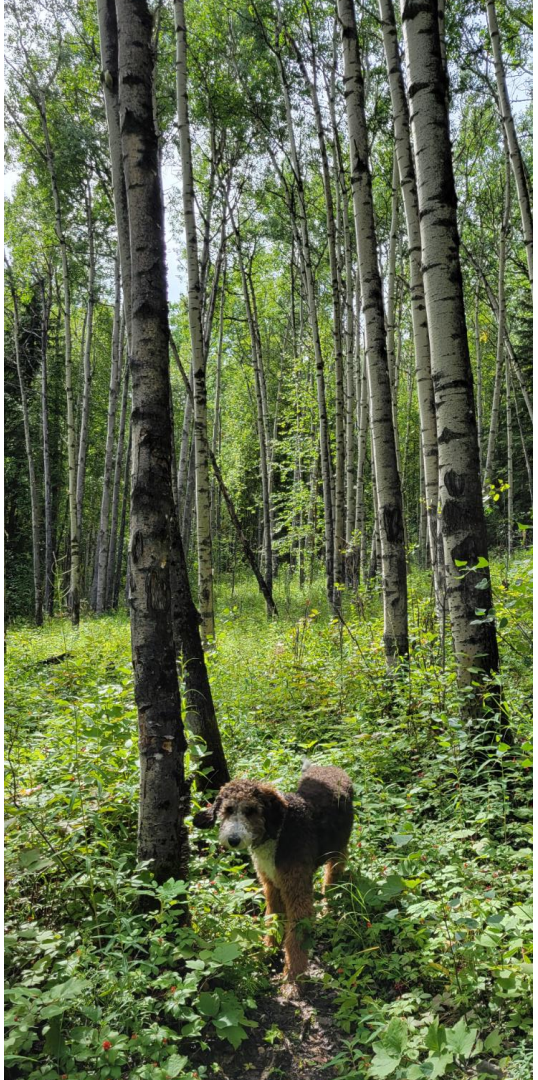
SHARE

Spellman et al. 2018.*Connected STEM Learning* (figure modified from Stephens 2003 and OLCG 2002)

Alaska paper birch (*Betula neoalaskana*)

Belongs to circumpolar complex related to Asian species

Also called resin birch



Credit: Flora of North America
http://beta.floranorthamerica.org/Betula_neoalaskana
J. Arnold Arbor. 3: 206. 1922

Green up in Fairbanks, Alaska 2019

Alaska Timelapse by the Geophysical Institute

Credit: UAF Geophysical Institute

https://youtu.be/fFkOqojalEE?feature=shared

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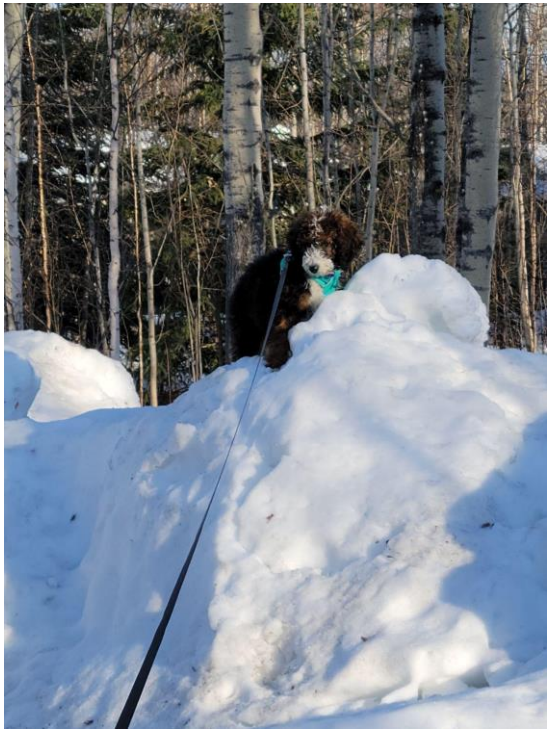
Tools to Study Phenology and Earth's System at Different Scales and Times

My NASA Data → Leaf Area Index

https://mynasadata.larc.nasa.gov/globe-connections/globe-connections-plant-growth-patterns

Leaf Area Index → Amount of leaves relative to the land area

Sponsored by: NASA Supported by: NSF NOAA



April 27, 2022

May 10, 2022

May 22, 2022

Sponsored by: NASA Supported by: NSF NOAA DEPARTMENT OF STATE UNITED STATES OF AMERICA UAF UNIVERSITY OF ALASKA FAIRBANKS

Spring Mystery: When did birch green up happen on a South Facing Slope in Fairbanks, Alaska in 2022?

Some clues:

Leaf out

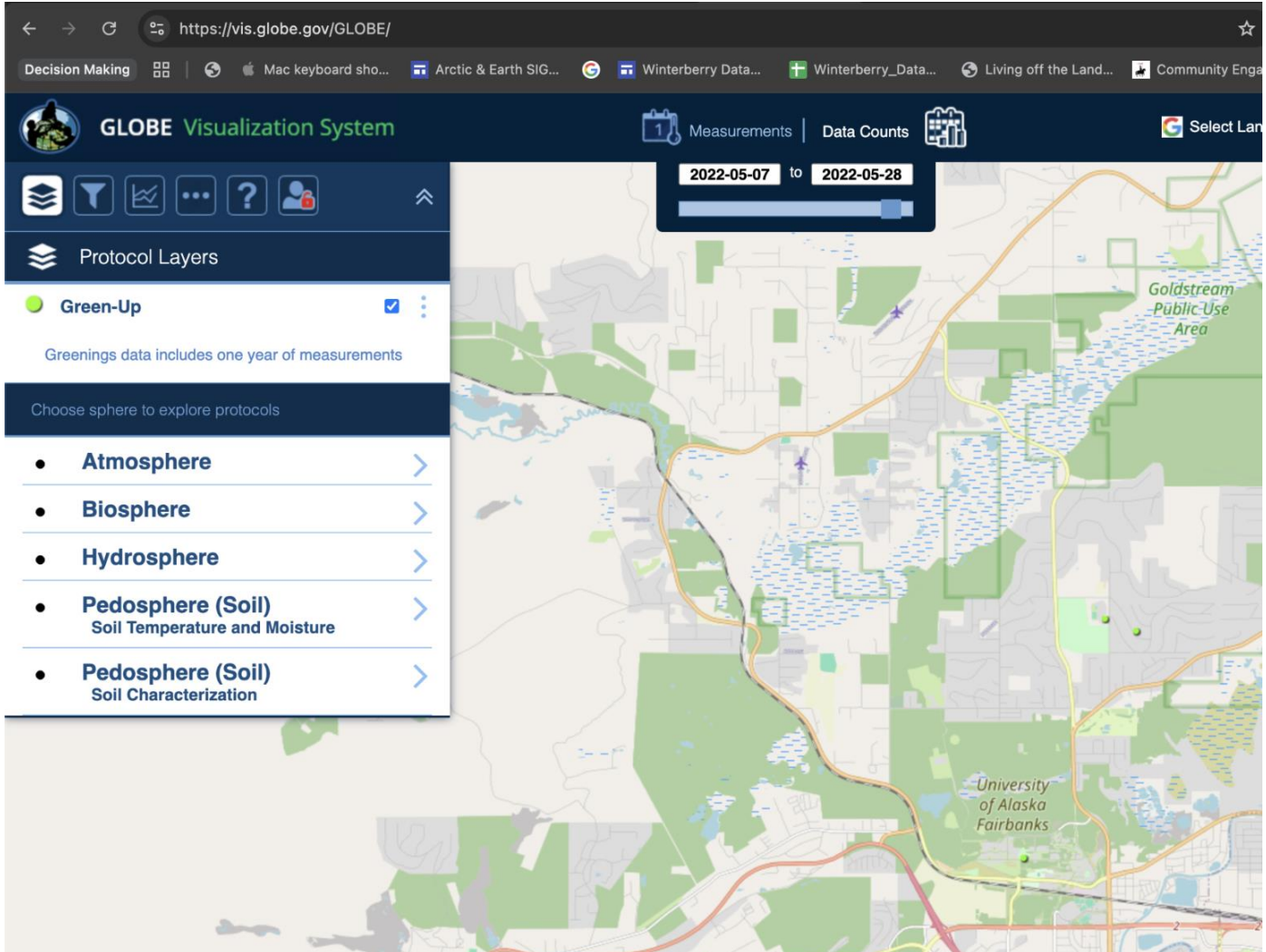
May 14

Ground

thawed

May 21

Students can use GLOBE to answer this question


https://vis.globe.gov/GLOBE/
Decision Making
Mac keyboard sho...
Arctic & Earth SIG...
Winterberry Data...
Winterberry_Data...
Living off the Land...
Community Enga
GLOBE Visualization System
Measurements
Data Counts
Select Lan
2022-05-07
to
2022-05-28
Protocol Layers
Green-Up
Greenings data includes one year of measurements
Choose sphere to explore protocols
Atmosphere
Biosphere
Hydrosphere
Pedosphere (Soil)
Soil Temperature and Moisture
Pedosphere (Soil)
Soil Characterization
Goldstream
Public Use
Area
University
of Alaska
Fairbanks

May 14 Leaf Out

School: University Of Alaska Fairbanks - IARC

Site: Troth Yeddha' lawn

International Arctic Research Center

Measurements | Data Counts | School Info | Site Info

Biosphere

Green-Up

Green-Up

May 13, 2022 Budburst One-Time Observation

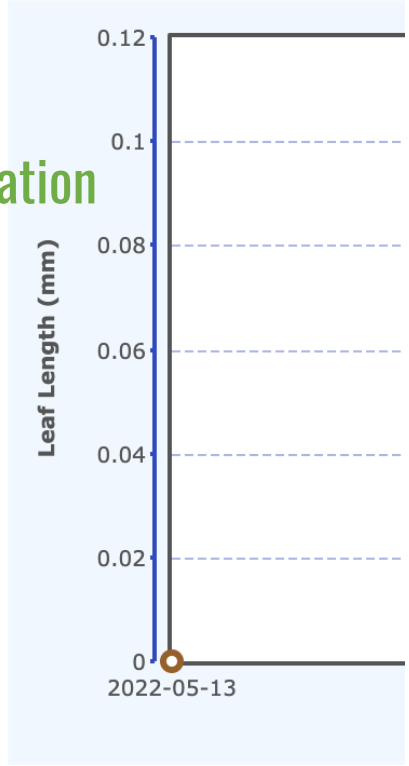
Data Date Range: 2022-05-13 to 2022-05-13

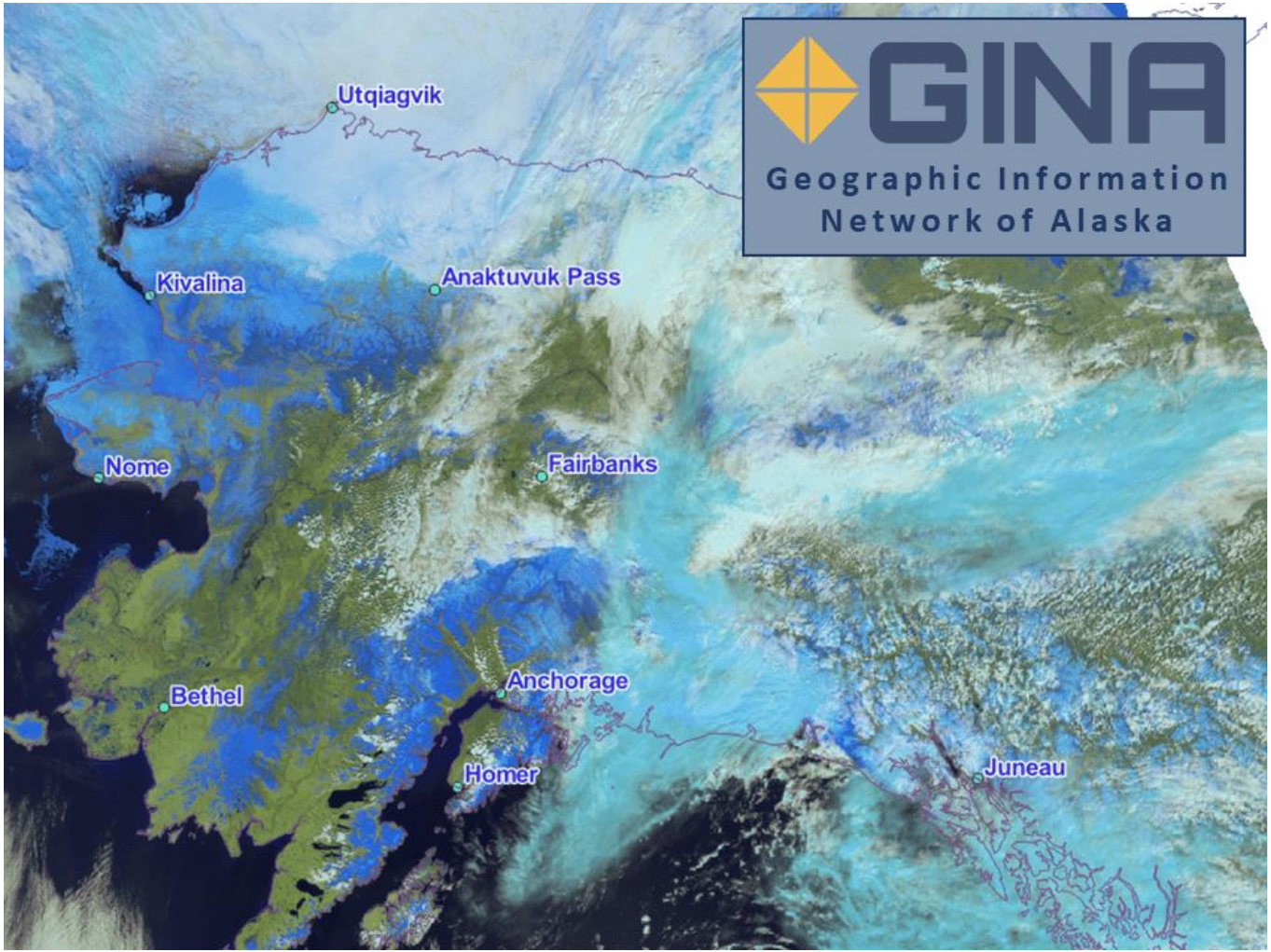
Plant: Betula / neoalaska | Average

Year: 2022
Genus: Betula
Species: neoalaskana

Leaf States (first occurences)
Budburst: 2022-05-13
Dormant: 2022-05-13
Length Measurable: 2022-05-13

Greening Cycle: 1
Vegetation Type: tree
Number Of Leaves: 1
Number Of Same Plants: 4
Elevation: 121





Caption: "**It was declared green-up in Fairbanks on May 17, 2022 but there's still snow across Alaska.** This RGB image taken on May 17 using VIIRS with the NOAA-20 satellite shows different types of snow.

Dark blue is old or wet snow & light blue is new or dry snow.

High cirrus clouds that are composed of ice are shown as cyan and water-based clouds are white. The lighter cyan shows some areas of new snow in parts of the Seward Peninsula and western north slope."

https://gina.alaska.edu/may-spring-snowmelt-across-alaska/

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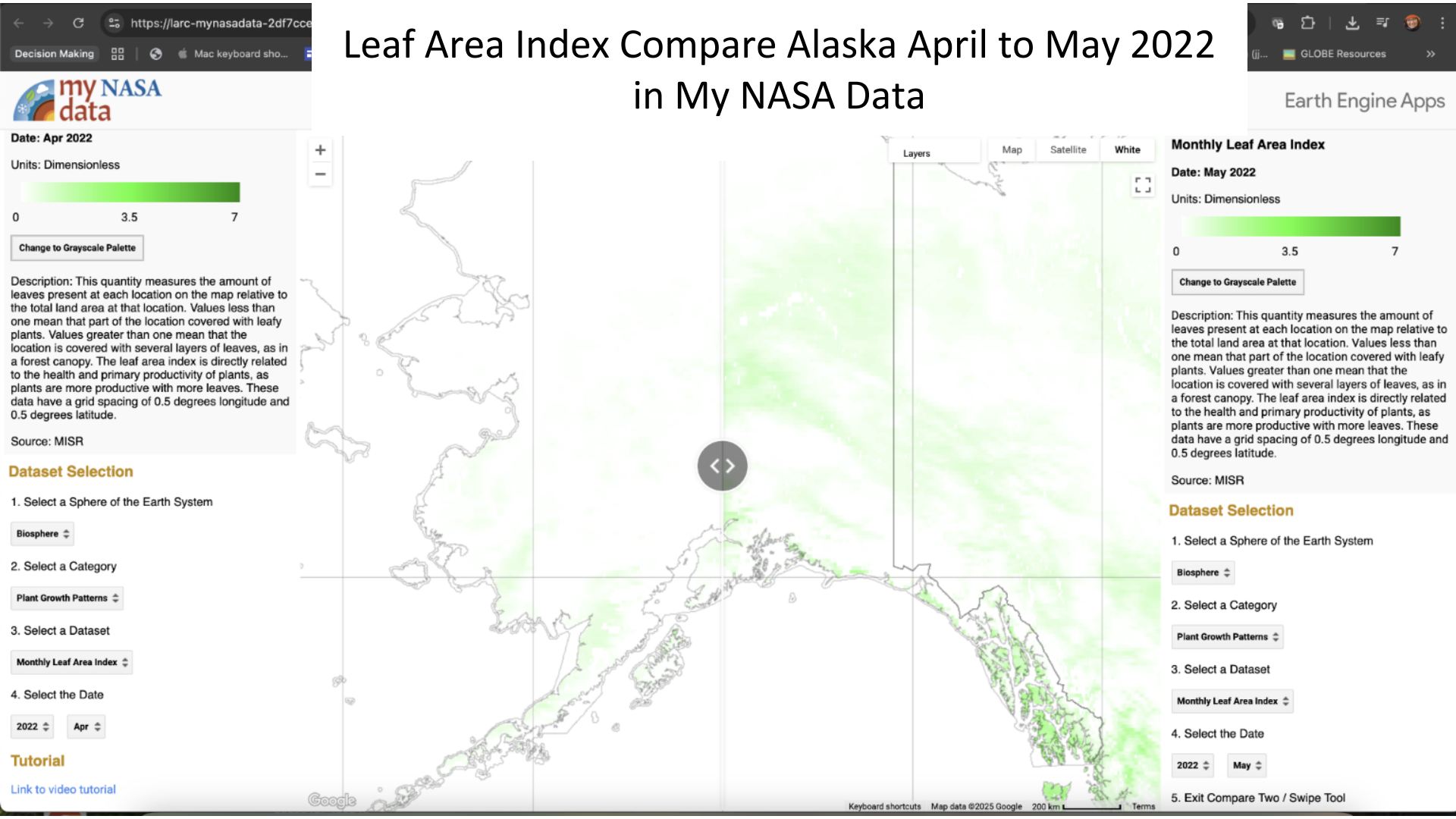
Leaf Area Index Compare Alaska April to May 2022 in My NASA Data



An Alaskan Spring Mystery: A GLOBE Data Exploration

Budburst is the time in the spring when the buds on trees first open to expose the small leaves within. The timing of seasonal changes in living things are affected by four main factors.

- **Genetics:** Different species can have different timing of events – budburst can happen at different times for different species of trees, for example.
- **Latitude:** In lower latitude locations, where warm temperatures arrive earlier in the spring, budburst generally happens earlier than at higher latitude, cooler locations.
- **Temperature:** Seaasonal changes can be triggered by warming temperatures in the spring.
- **Moisture:** The amount of moisture available in the environment can impact the timing of seasonal changes.

Sponsored by: NASA Supported by: NSF NOAA

Investigating an Alaskan Spring Mystery
Reading: Seasons and Trees

How did the amount of leaves in May 2022 compare to May 2002?

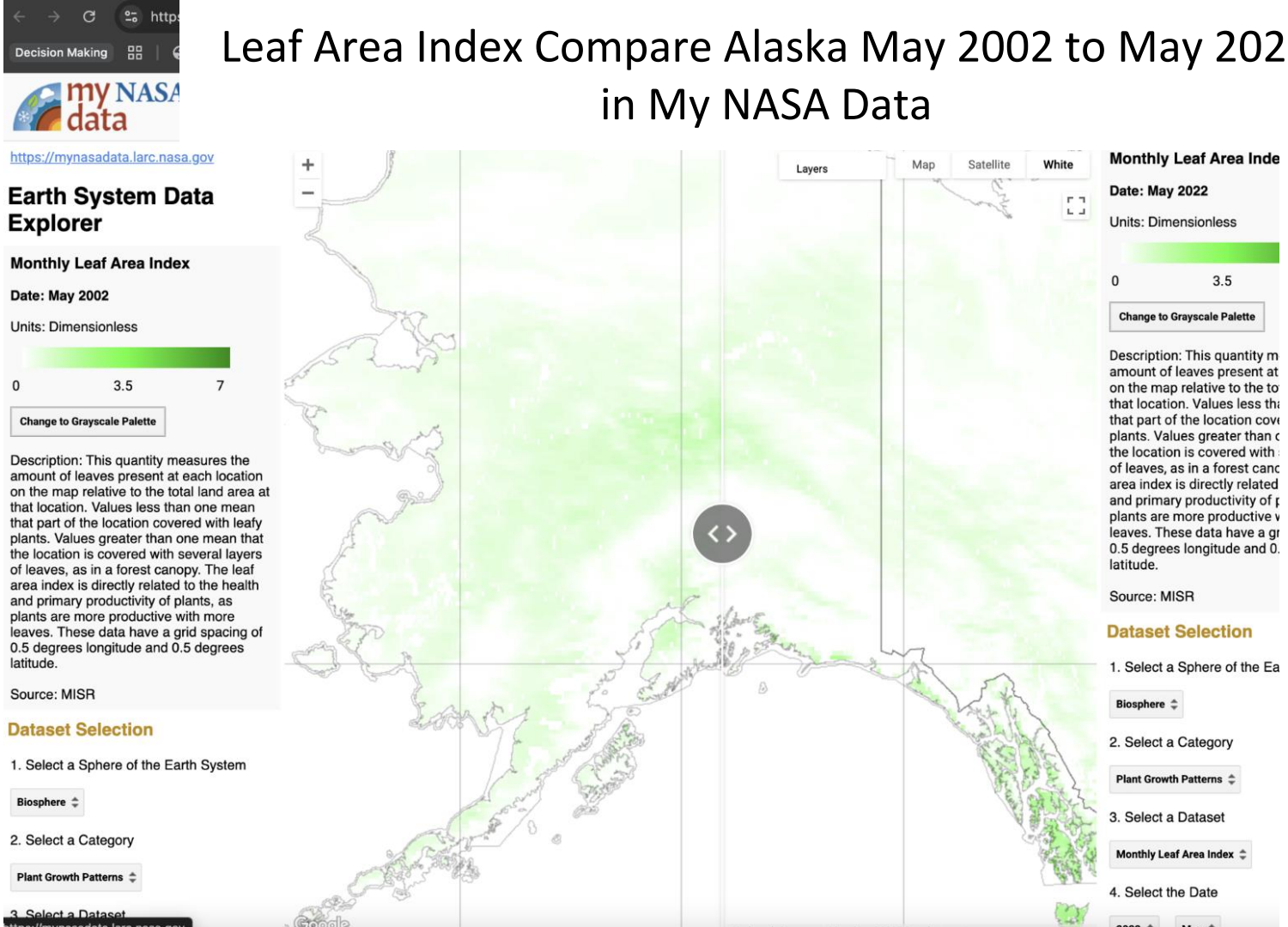
Why Phenology Matters: Long-term thinking

Timing of cyclical events in nature → Patterns and life cycles

Field of ecological research → How living organisms respond to cues (day length, temperature, rainfall)

Way of life → Knowledge passed on through generations

Leaf Area Index Compare Alaska May 2002 to May 2022 in My NASA Data



Compare Leaf Area Index Czech Republic May 2002 to May 2022

https://mynasadata.larc.nasa.gov

Earth System Data Explorer

Monthly Leaf Area Index

Date: May 2002

Units: Dimensionless

0 3.5 7

Change to Grayscale Palette

Description: This quantity measures the amount of leaves present at each location on the map relative to the total land area at that location. Values less than one mean that part of the location covered with leafy plants. Values greater than one mean that the location is covered with several layers of leaves, as in a forest canopy. The leaf area index is directly related to the health and primary productivity of plants, as plants are more productive with more leaves. These data have a grid spacing of 0.5 degrees longitude and 0.5 degrees latitude.

Source: MISR

Dataset Selection

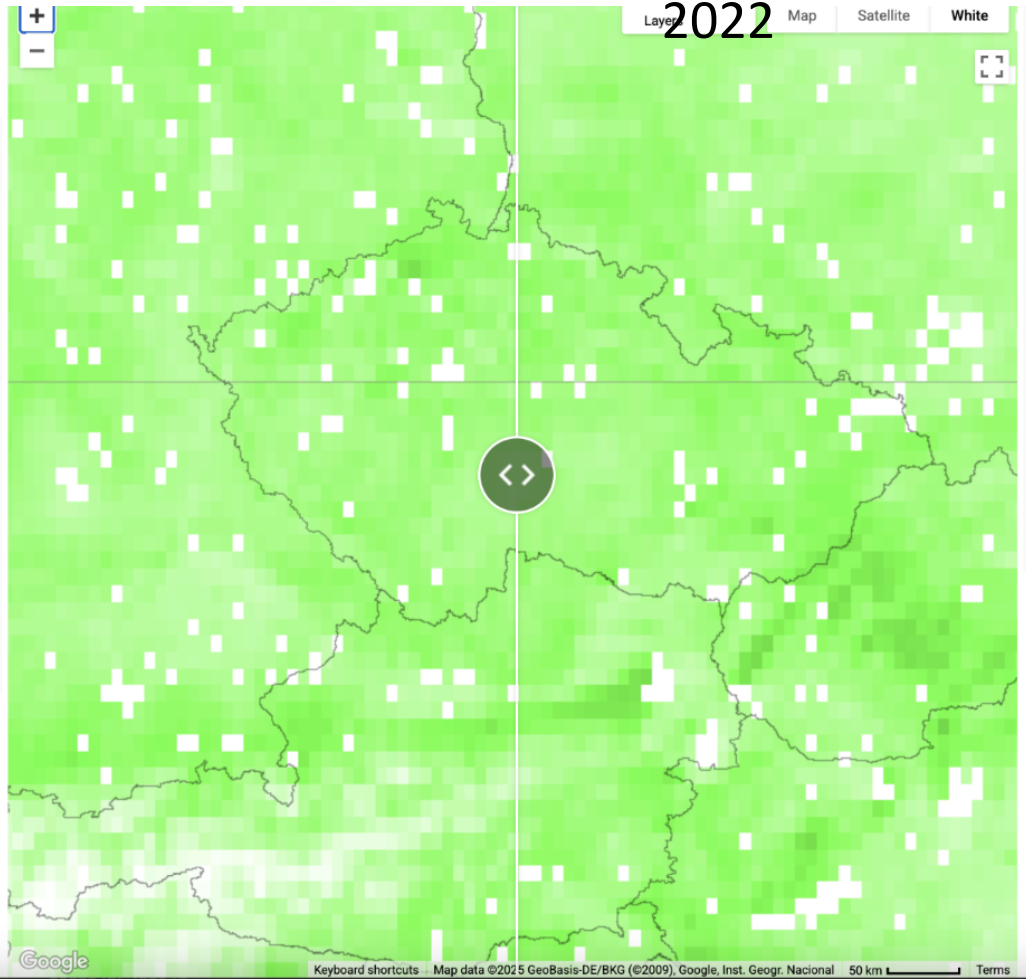
1. Select a Sphere of the Earth System

Biosphere

2. Select a Category

Plant Growth Patterns

3. Select a Dataset



Monthly Leaf Area Index

Date: May 2022

Units: Dimensionless

0 3.5 7

Change to Grayscale Palette

Description: This quantity measures the amount of leaves present at each location on the map relative to the total land area at that location. Values less than one mean that part of the location covered with leafy plants. Values greater than one mean that the location is covered with several layers of leaves, as in a forest canopy. The leaf area index is directly related to the health and primary productivity of plants, as plants are more productive with more leaves. These data have a grid spacing of 0.5 degrees longitude and 0.5 degrees latitude.

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1. Select a Sphere of the Earth System

Biosphere

2. Select a Category

Plant Growth Patterns

3. Select a Dataset

Monthly Leaf Area Index

4. Select the Date

2022 May

Numbers

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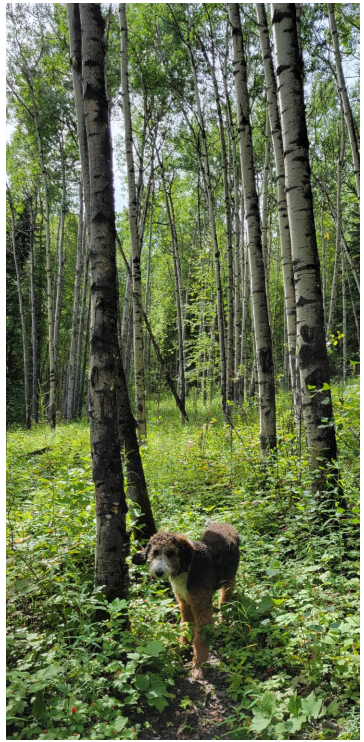
Why Phenology Matters



Questions for

Christi Buffington

GLOBE European Phenology Campaign 23 April 2025

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Green Up & Phenology GLOBE

Joyanne Hamilton
Innoko River School
Shageluk, Alaska

Joy Hamilton - Innoko River, Shageluk, Alaska

THE INNOKO RIVER

All interior Alaskan villages thrive on the seasonal conditions of the land, rivers, and lakes. The tiniest details of growth during the spring sun and longer days are a time for spring subsistence preparations.

Timing is Everything

No One Has Idle Hands. We are always Learning

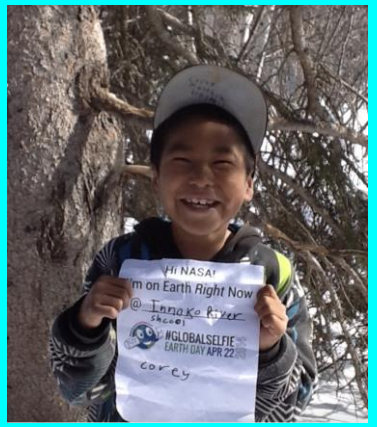
Because it all matters

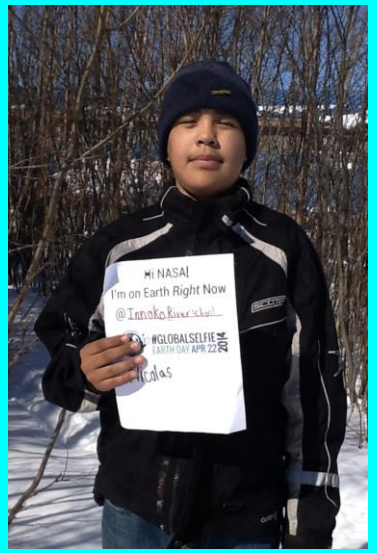
And it Matters….

Adapting, Adopting, Creating, Conceiving

And then we add to what we know about our lives

Happy 30 Year Anniversary GLOBE!





Happy 4.5 Billion Year Old Birthday GLOBE!

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Why Phenology Matters

Questions for

Joyanne Hamilton

GLOBE European Phenology Campaign 23 April 2025

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UAF University of Alaska Fairbanks

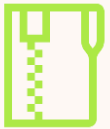
Green Up & Phenology GLOBE

Cheryl Williams
Palmer High School
Palmer, Alaska

Why Phenology & GLOBE?

Outside

Curricular Connections



Data Collection & Entry

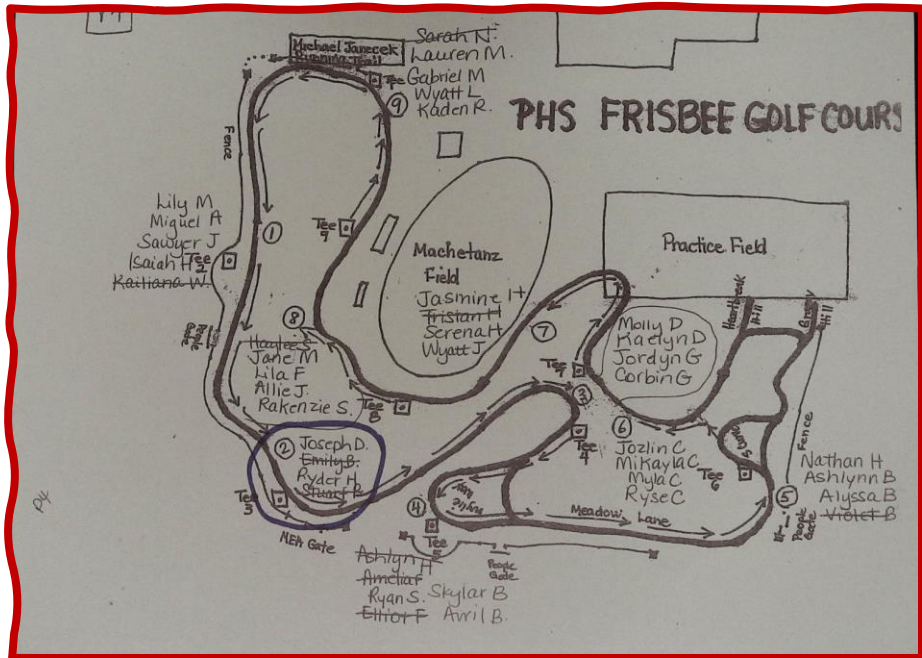
Opportunities

Introduction

- What is GLOBE and Green Up/Down?
  - GLOBE Video 1 – general
  - GLOBE Video 2 - international partnership
  - GLOBE Video 3 - learning expedition
- Biology Curriculum: Ecology, Biomes, Photosynthesis, Energy in Ecosystems
- Satellites
- “You work for NASA.”

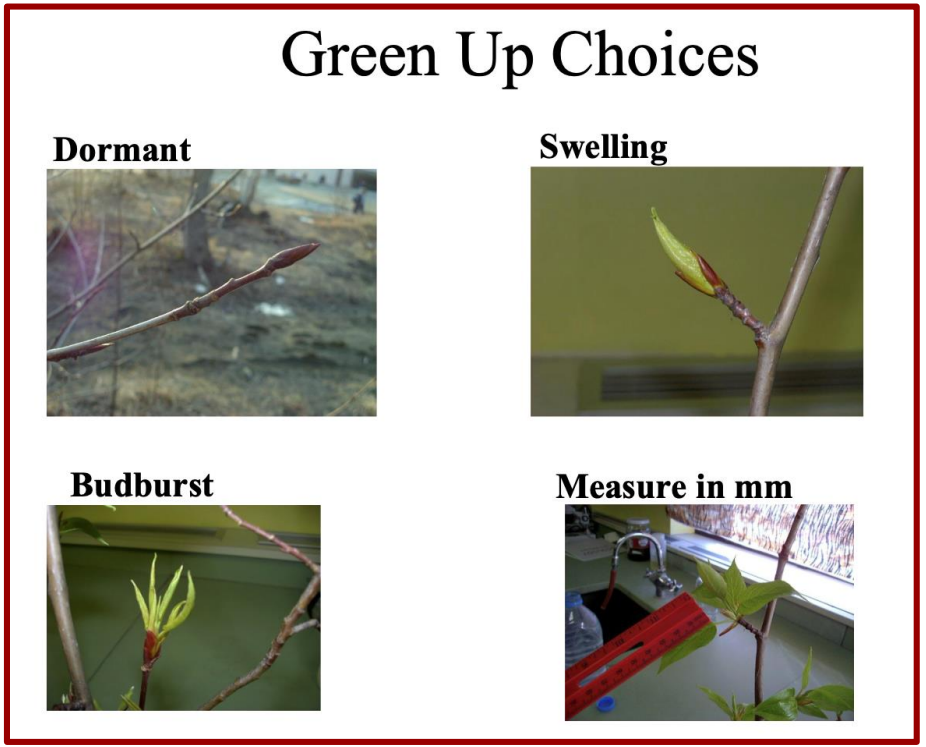
Data Collection Logistics

- Determine dominant tree species
- Reusable Study Sites – site definitions in GLOBE
  - Name sites “Birch 1” “Birch 2” etc.
- Each group chooses own branch
- First time out – check everything
- Rite in Rain Paper
- Fancy Clipboards
- Photo Scavenger Hunt
- School Grounds Map with Group Names



Green Up Hints

- Use same tree from green down
- Use same tree species
- Take photos of the dominant species
  - dormant
  - swelling
  - bud burst
- Baby Leaf Challenges:
  - Measurements … cm vs mm
  - Which leaf?
- Does your data make sense?
- Trail challenges: snow, mud, puddles
- Overall impression/average green up date

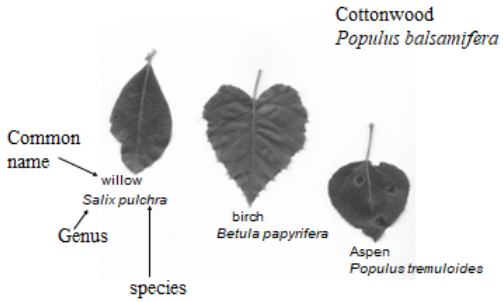


Green Down Tasks:

1. Put names on data sheet.
2. Find branch (south facing, birch tree)
3. Find four leaves counting back from the end of the branch.
4. Put flagging tape after the 4th leaf.
5. Record color of each leaf on the data table .... Full color code!
6. WAIT at your spot until the teacher releases you.
7. Do the Ecosystem Vocabulary Walk Assignment.
8. Return to the school on time. Wait at the entrance/lunch room area.

6

Tree Identification



7

Fill out before copying

P5

Earth System Science

Tree, Shrub, and Grass Green-Down Data Sheet

6

School Name: _____ Study Site: PHN-_____

Observer Names: Raiyan N. Nicole S.

Plant Scientific Name: Genus_____ Species: birch

Plant Common Name: _____

Green-Down Cycle:_____ Year: 2023

Photo Number and Orientation

Tree, Shrub, and Grass Green-Down

Date (day and month)	Leaf 1 (Color, fallen, snow covered)	Leaf 2 (Color, fallen, snow covered)	Leaf 3 (Color, fallen, snow covered)	Leaf 4 (Color, fallen, snow covered)	Reported to GLOBE
9/13/23	SGY 5/10	SGY 5/10	SGY 5/10	SGY 5/10	☐
9/18/23	SGY 6/10 5/10	SGY 6/10	SGY 6/10	SGY 5/10	☐
9/31	SGY 5/10	SGY 5/10	SGY 5/10	SGY 5/10	☐
9/15/23	SGY 6/10	SGY 5/10	SGY	fallen	☐
9/25/23	SGY 6/10	fell off	fell off	fell off	☐
10/2/23	fallen	fallen	fallen	fallen	☐
					☐
					☐
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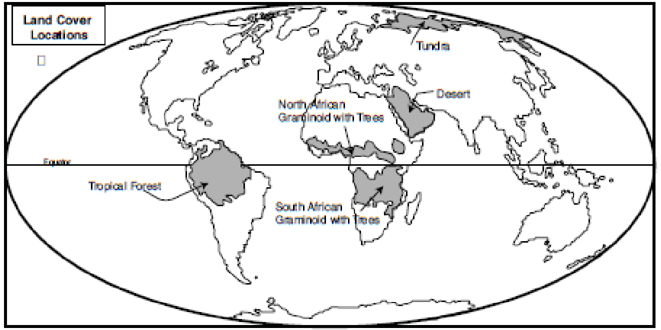
					☐

Comments *(date each comment):*

10/3/23 all leaves fallen off 9/23 all leaves same color

Global Green-Up and Green-Down Work Sheet



Flip Book Scale: Vegetation Vigor (NDVI) Value

Land Cover Descriptions

Tundra: High latitude treeless plains that occur in harsh climates of low rainfall and low average temperature.

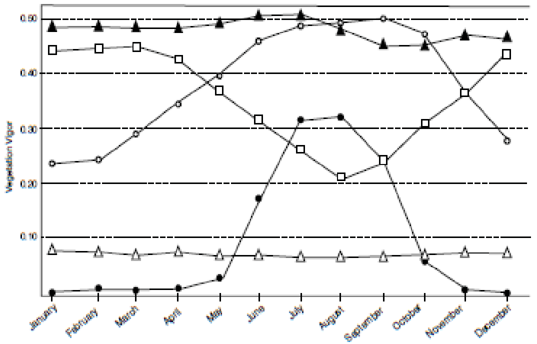
Tropical Forest: Tropical latitude ecosystem dominated by broadleaf evergreen trees.

Desert: Ecology limited by extremely low annual rainfall and sparse, low vegetation.

North African Graminoid with Trees: A moderately dry ecosystem dominated by grasslands and small trees.

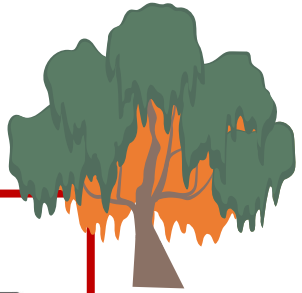
South African Graminoid with Trees: A moderately dry ecosystem dominated by grasslands and small trees.

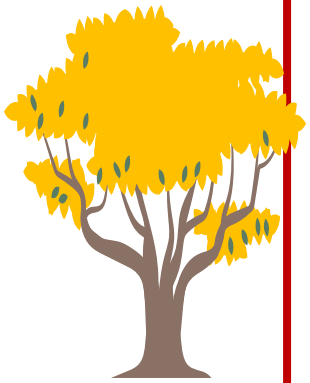
Vegetation Vigor



Symbol	Maximum Vegetation Vigor	Minimum Vegetation Vigor	Change	Growing Season
o———o	Month: Value:	Month: Value:		
Land Cover:	Explanation:			
Symbol	Maximum Vegetation Vigor	Minimum Vegetation Vigor	Change	Growing Season
□———□	Month: Value:	Month: Value:		
Land Cover:	Explanation:			
Symbol	Maximum Vegetation Vigor	Minimum Vegetation Vigor	Change	Growing Season
▲———▲	Month: Value:	Month: Value:		
Land Cover:	Explanation:			
Symbol	Maximum Vegetation Vigor	Minimum Vegetation Vigor	Change	Growing Season
△———△	Month: Value:	Month: Value:		
Land Cover:	Explanation:			
Symbol	Maximum Vegetation Vigor	Minimum Vegetation Vigor	Change	Growing Season
●———●	Month: Value:	Month: Value:		
Land Cover:	Explanation:			

GLOBE Land Cover Data Sheet





Land Cover Investigation

Tree Canopy and Ground Cover Data Sheet*

School Name: _____ Site: _____

Measurement Time: _____ (Year / Month / Day / Hour (UT))

Recorded By: _____

	Use this column to determine Tree Canopy	Use this column to determine Dominant and Co-Dominant Canopy Species	Use this column to derive MUC for closed forest or woodland	Use this column to determine Overall Ground Cover	Use this column to determine Dominant and Co-Dominant Ground Vegetation Type
	1. Canopy Observations + = Tree Canopy – = Sky or Shrub	2. Canopy Species or Common Name	3. Canopy Type E = Evergreen D = Deciduous – = Sky	4. Ground Observations G = Green Cover B = Brown Cover – = No Cover	5. Ground Vegetation Type GD = Graminoid FB = Forb OG = Other Green Veg. SB = Shrub DS = Dwarf Shrub
1					
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25					

Tree Canopy and Ground Cover Data Sheet – Page 2

	1. Canopy Observations + = Tree Canopy – = Sky or Shrub	2. Canopy Species or Common Name	3. Canopy Type E = Evergreen D = Deciduous – = Sky	4. Ground Observations G = Green Cover B = Brown Cover – = No Cover	5. Ground VegetationType GD = Graminoid FB = Forb OG = Other Green Veg. SB = Shrub DS = Dwarf Shrub
26					
27					
28					
29					
30					
31					
32					
33					
34					
35					
36					
37					
38					
39					
40					

Summary of Tree Canopy Observations	
Total "+"	
Total "–"	
Total Canopy Observations	
% Tree Canopy	

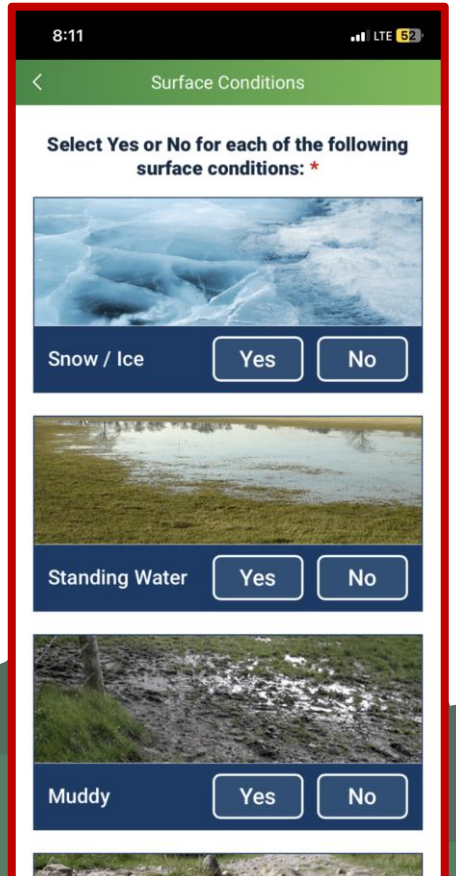
Summary of Canopy Type	
Total "E"	
Total "D"	
Total Canopy Type Observations	
% Evergreen (E)	
% Deciduous (D)	

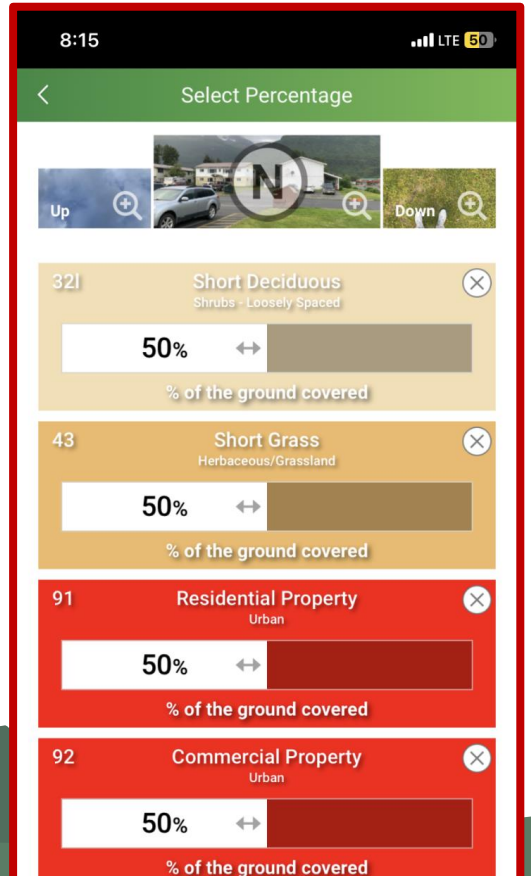
Summary of Ground Observations	
Total "G"	
Total "B"	
Total "–"	
Total Ground Observations	
% Ground	

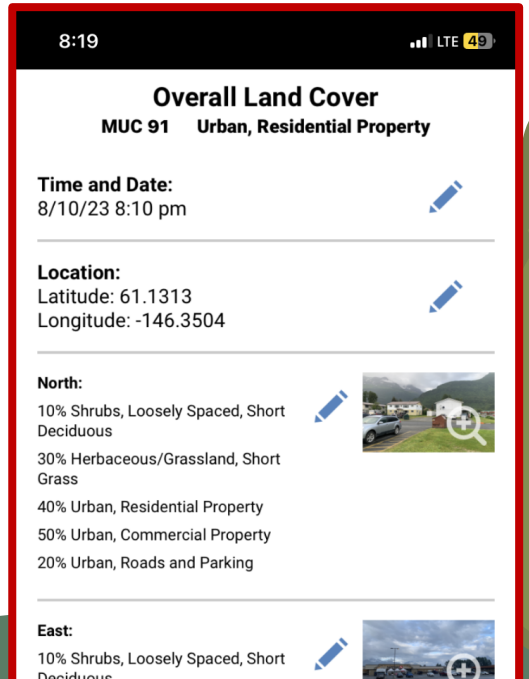
Summary of Ground Vegetation Type	
Total "GD"	
Total "FB"	
Total "OG"	
Total "SB"	
Total "DS"	
Total Ground Type Observations	
% Graminoid (GD)	
% Forb (FB)	
% Other Green (OG)	
% Shrub (SB)	
% Dwarf Shrub (DS)	

*Note: Always measure the highest level of canopy.
In a forest or woodland, canopy cover refers to the tree canopy.

GLOBE OBSERVER APP
GROUND COVER







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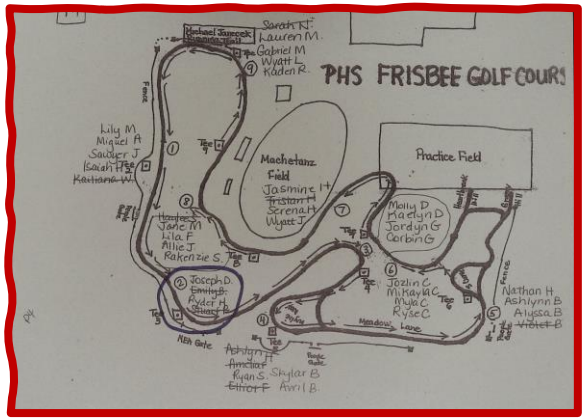
Questions for

Cheryl Williams



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