Cold Weather Data Collection and Citizen Science for Children: A Success Story in Alaska

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Northern Environmental System Change

Environmental change is pervasive in northern regions. Changes are being observed throughout the Arctic system:

- Atmosphere;
- Oceans and sea ice;
- Marine ecosystems;
- Terrestrial and aquatic ecosystems;
- Terrestrial hydrosphere and cryosphere;
- People and communities.

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Freshwater Ice Change

Since 1845 on lakes and rivers in the Northern Hemisphere:

- **Freeze-up** now occurs 8.7 days **later**.
- **Break-up** now occurs 9.8 days **earlier**.
- Thus, **duration** of the ice cover has **decreased** by almost 19 days.

Break-up on the Tanana River, Alaska

Now 5.5 days earlier than in 1917 &
10 days earlier than in the early 1960s
"Nenana Ice Classic"

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Lake Ice Growth and Heat Flow

Break-up also depends on ice thickness at the end of winter. The freezing of water and thickening of the ice cover (phase change) *occur when the air temperature is lower than the freezing point of the water*.

The resultant negative temperature gradients also lead to conductive heat flow (loss) through the ice and snow to the atmosphere.

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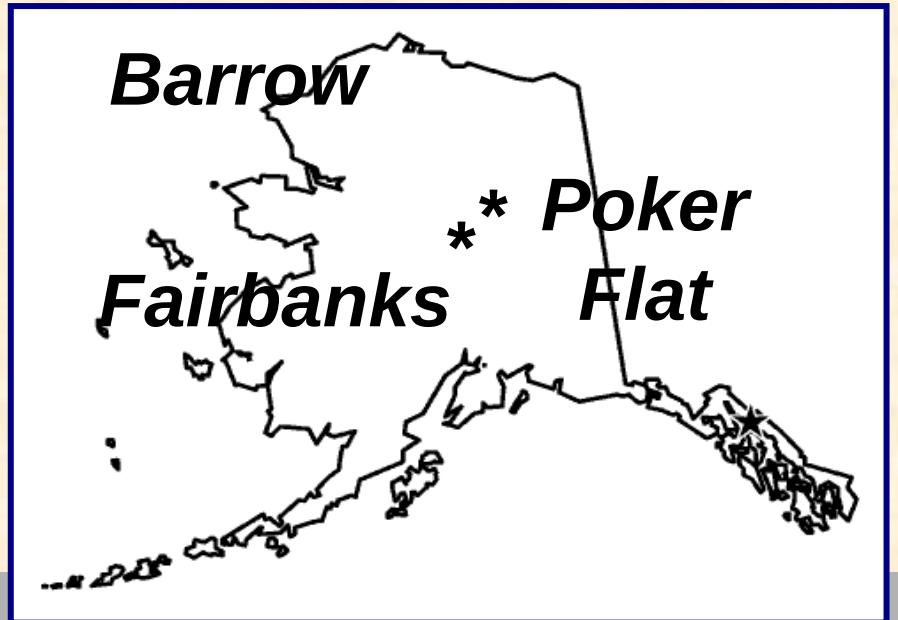
Lake Ice Growth and Heat Flow in Alaska

- How much heat is lost from frozen lakes?
- “Snapshot” study at Barrow in April 1997.
- First winter-long studies began in winter 1999-2000 at Poker Flat. *



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K-12 Educators & Lake Ice Research

Marge Porter, CT

Ron Reihl, AK

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ALISON: Alaska Lake Ice & Snow Observatory Network

A K-12 and university science education and scientific research partnership of teachers and students learning science and the nature of scientific inquiry by making locally relevant measurements of familiar and abundant materials - *snow and ice* - that advance scientific knowledge and understanding of lake ice growth and conductive heat loss. Reword this—make simpler

www.gi.alaska.edu/alison

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K-12 Science Learning & Understanding

- Observation, measurement & SI units
- Data analysis & computer modelling
- Weight, mass, volume & density
- Temperature, heat, energy & phase change

Science & mathematics are for everyone

Arctic science - it's not just for summer!

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Mrs Gallego & Mrs Deblauw Join ALISON

Teachers' Goals

Integrate the investigation of lake ice, snow cover and conductive heat flow at Horseshoe Lake, Denali National Park & Preserve, into local ecosystem studies by mixed 3rd, 4th and 5th grade classes at Tri-Valley School, Healy, Alaska.

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Horseshoe Lake

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Student Scientists at Horseshoe Lake - 1

Snow bottom temperature and depth

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Student Scientists at Horseshoe Lake - 2

Snow sampling

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Student Scientists at Horseshoe Lake - 3

Ice thickness

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ALISON: Moving Pictures

A short documentary produced in 2007 by KUAC TV and the Geophysical Institute (GI), University of Alaska Fairbanks. This is one of a number of shorts that are broadcast in the intervals between longer programs to showcase research and education activities at the GI.

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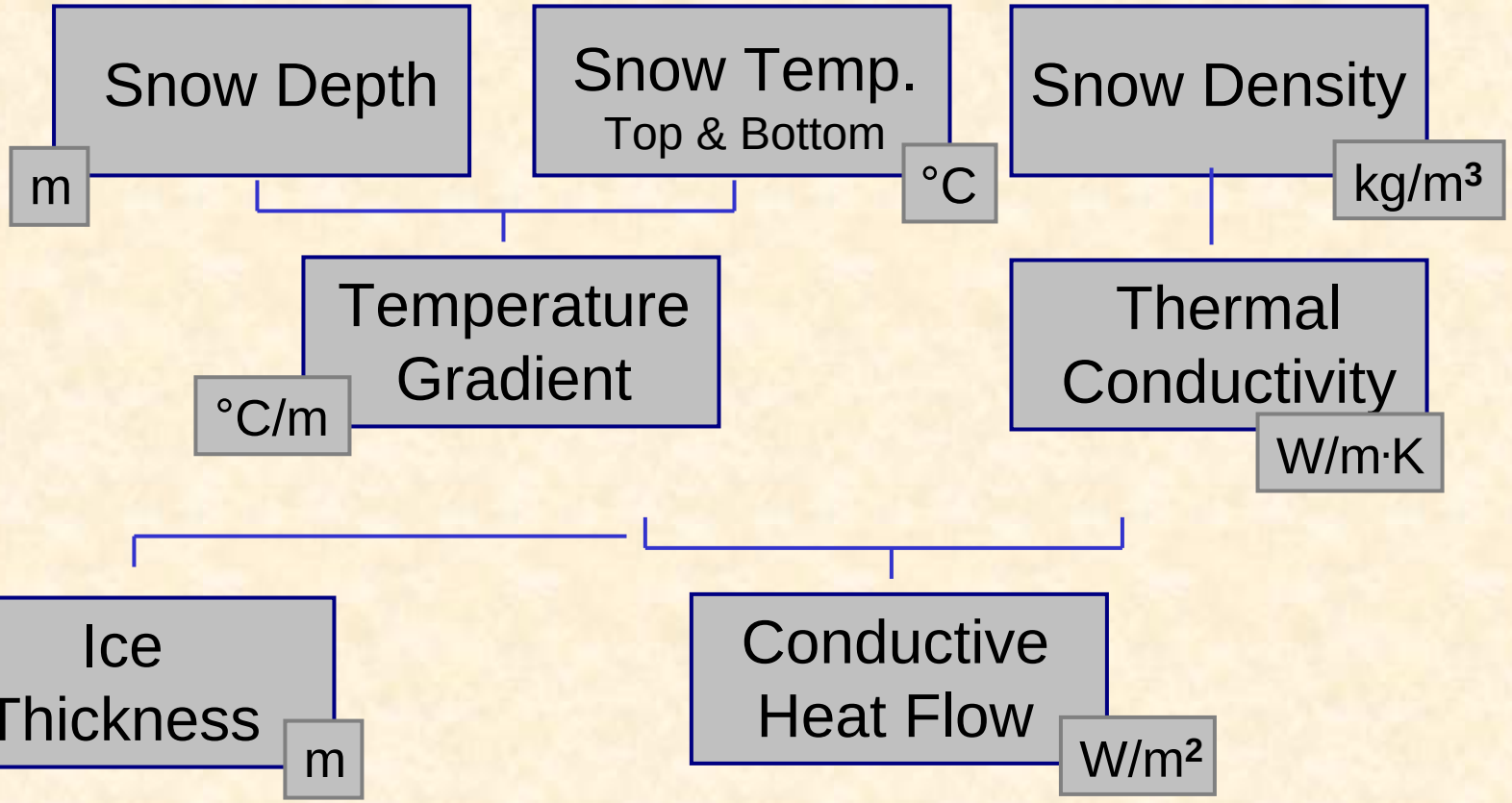
Snow and Ice Measurements and Derived Variables



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Horseshoe Lake: Achievements

- Youngest student participants in ALISON - grades 3 through 5.
- Among the youngest student participants in the International Polar Year (IPY).
- Dorothy Deblauw and Kris Capps awarded a 2007 ‘Toyota Tapestry Grant’ to continue measurements during IPY.
- Five consecutive winters of measurements have been completed.

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Horseshoe Lake: Education & Outreach - 1

- Snow and ice measurements are an integral part of the ‘local ecosystem’ unit for grades 3-5.
- “A Year of Science at Horseshoe Lake” - a teacher’s guide and alignment to Alaska Science Content Standards.
- All data are on the ALISON Web site:
  www.gi.alaska.edu/alison/HLY_location
- Classroom activities: making graphs, dioramas and videos.
- Parents’ evenings at Tri-Valley School.

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Horseshoe Lake: Education & Outreach - 2

Denali 'Winterfest'

a. Students have presented their videos
www.gi.alaska.edu/alison/HLY_people

b. Students' dioramas and graphs displayed
www.gi.alaska.edu/alison/HLY_winterfest08

c. Results have been presented by Jeffries.

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Horseshoe Lake: Education & Outreach - 3

‘Alaska Park Science Symposium’

Results were presented at the symposium in September 2006, and published in the NPS journal ‘Alaska Park Science’, Vol. 5, No. 2, December 2006: *Lake Ice and Snow Study in Denali National Park and Preserve Promotes Elementary School Science Education*, Jeffries, Gallego, Deblauw, Morris and Norris-Tull.

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ALISON: Other Outcomes

- Cheryl Williams and Marc Swanson were awarded a 2004 ‘Toyota Tapestry Grant’ for ALISON measurements and materials.
- In 2005, Cheryl and Marc published two guides to ALISON. PDF files are at: *www.gi.alaska.edu/alison/ALISON_data_guides*
- The ‘Nenana River Project’ involving the University of Alaska Fairbanks and Denali Borough School District began in autumn 2007 *www.gi.alaska.edu/river_ice/index*

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Conclusion

1. Tri-Valley School students are the first to make systematic snow and ice measurements at Horseshoe Lake. They have created new knowledge.

2. Students are *citizen scientists* contributing to the knowledge of the ecosystem of Denali National Park and Preserve, and being IPY scientists during 2007-08 (& 2008-09)

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Conclusion

3. Students are learning science by being scientists in their own backyard, and gaining a better appreciation of their local environment.

4. Young children can be good scientists, making scientifically useful measurements.

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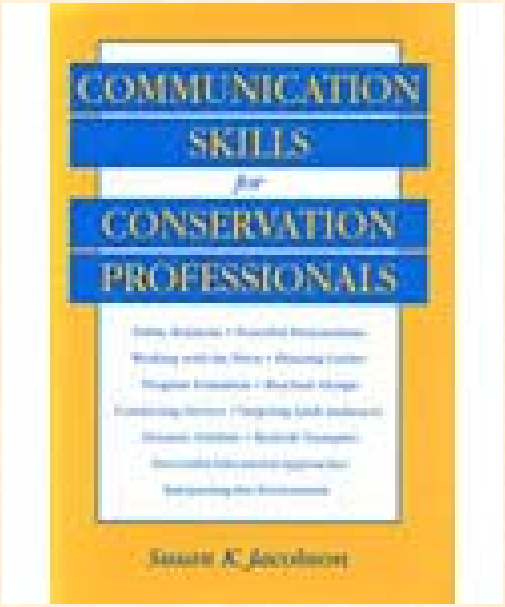
http://science.nature.nps.gov/research/ac/ResearchIndex



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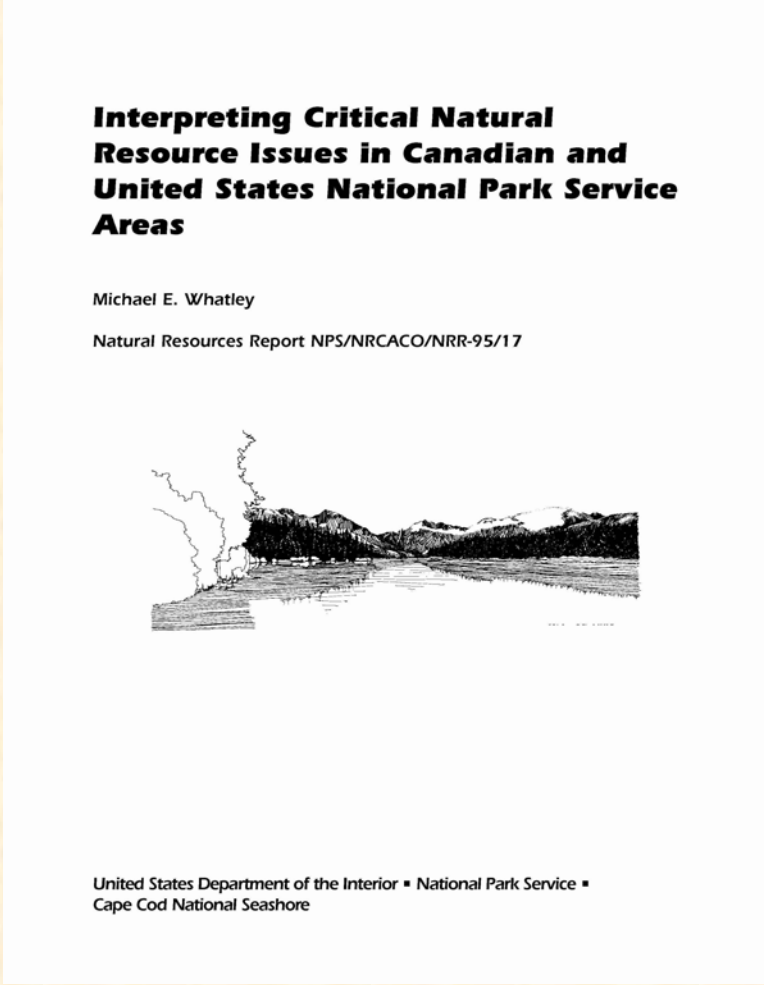

Interpreting Critical Natural Resource Issues in Canadian and United States National Park Service Areas

Michael E. Whatley

Natural Resources Report NPS/NRCACO/NRR-95/17

United States Department of the Interior ▪ National Park Service ▪
Cape Cod National Seashore

Course Credit

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