

# Paleoecological Data from Archaeological Sites: A Rich Resource under Imminent Threat

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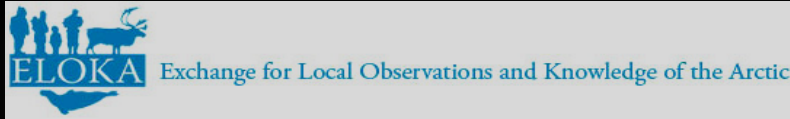
# IHOPE

Integrated History and Future of People on Earth

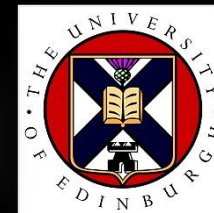


## NABO

North Atlantic Biocultural Organisation



REYKJAVÍKUR AKADEMÍAN



Deeply stratified sites with organic preservation:  
Not just for archaeologists anymore?

Or:

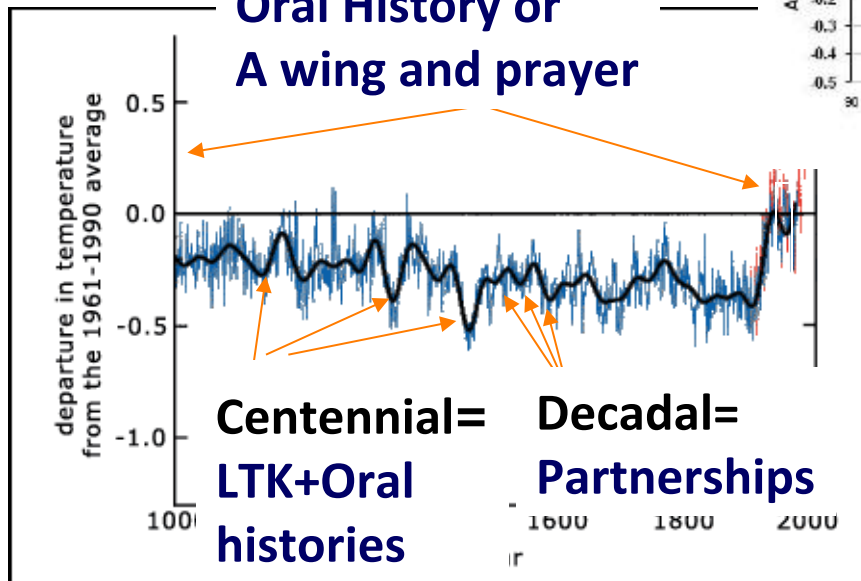
**“distributed observing networks of the past”**



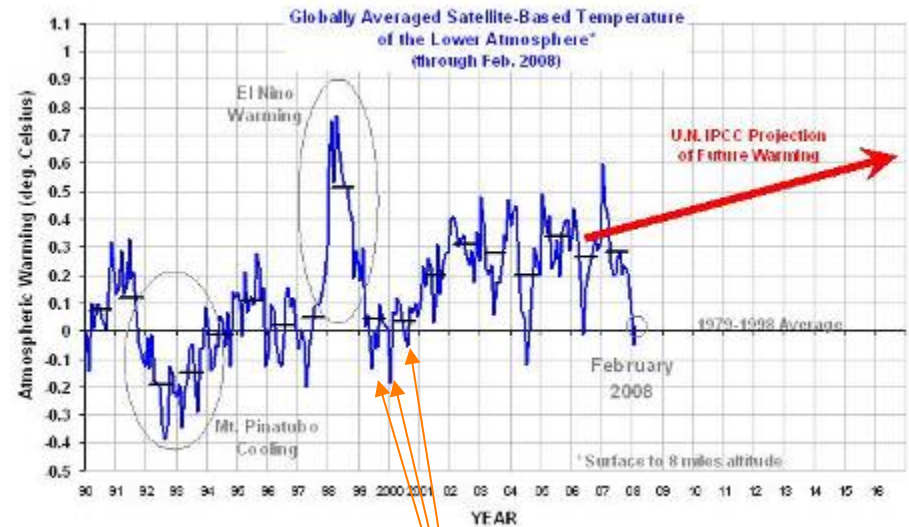
# Cultural Knowledge: From Black Box to Tool Kit

- Local and traditional knowledge (LTK) as resource.
- How to collect, mobilize, and assess?
- Long term records (archaeology/ paleoecology)
- Sustainability of what, for how long, at what cost, and for whom?
- Creating practical tool kits for future sustainability.

# Scales of Unpredictability through Time



**Millennial =**  
**Oral History or**  
**A wing and prayer**

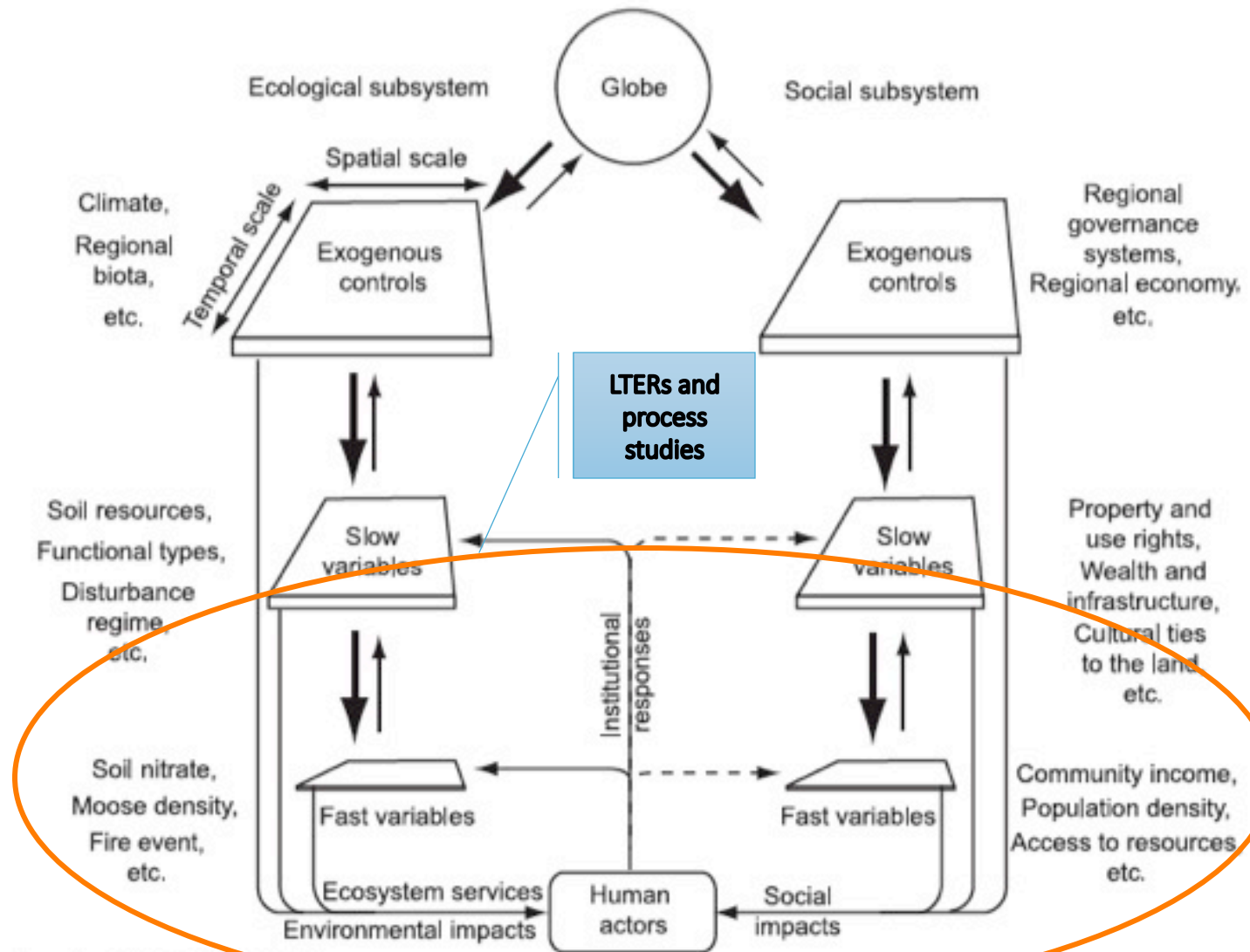


**Sub-Annual =**  
**local adaptive**  
**mechanism**

# Why archaeology?

- Longue durée—deep time
- Multiple (relatively) independent cases
- We know how the story ends
- Implies a long period of success

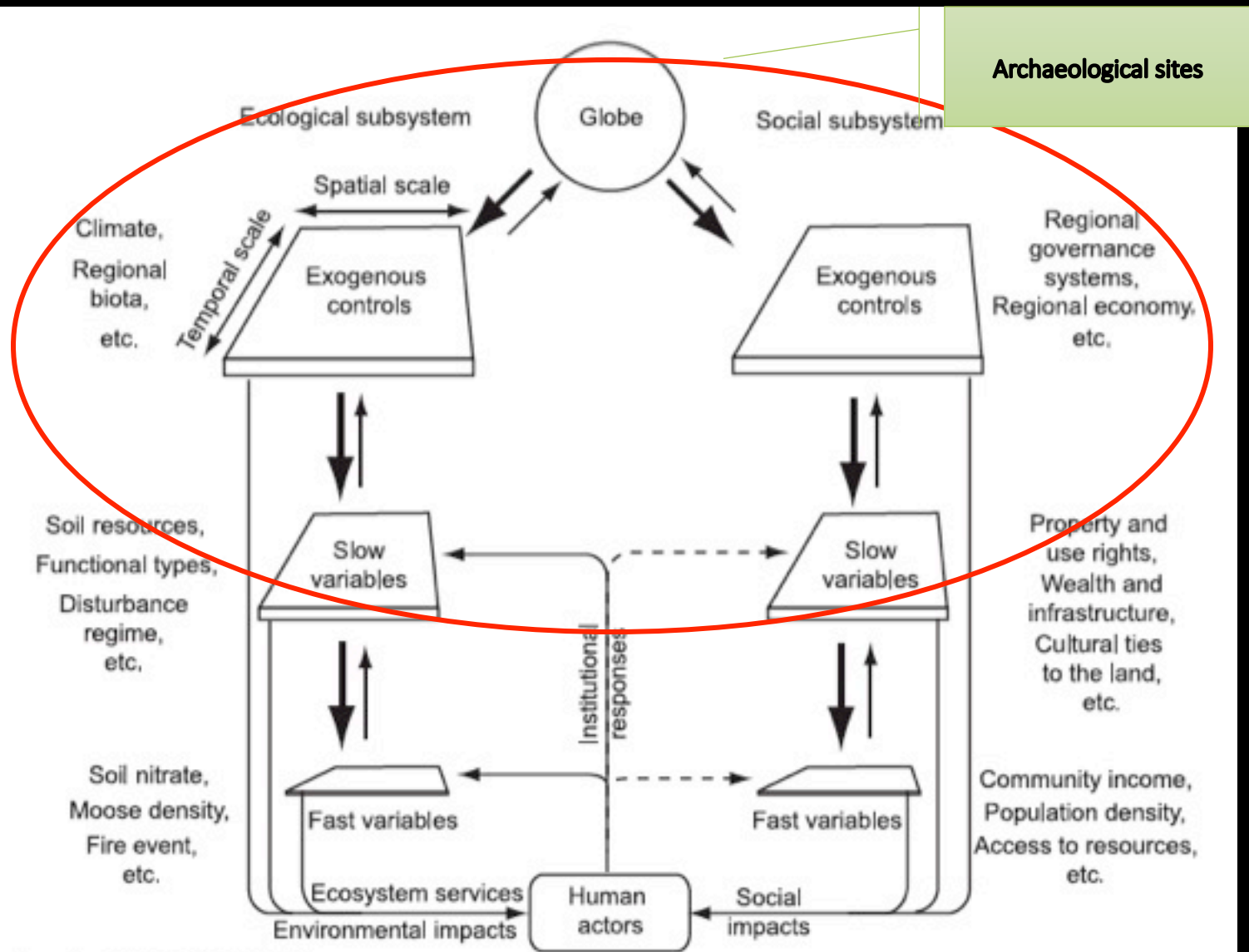
# Socio-ecological systems



(Chapin et al 2006 PNAS)



# Socio-ecological systems

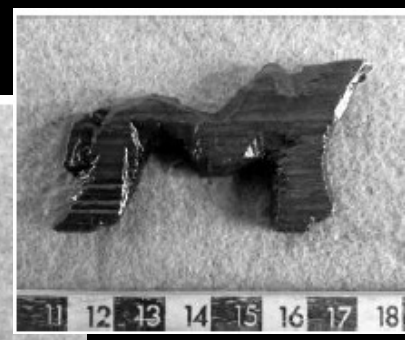
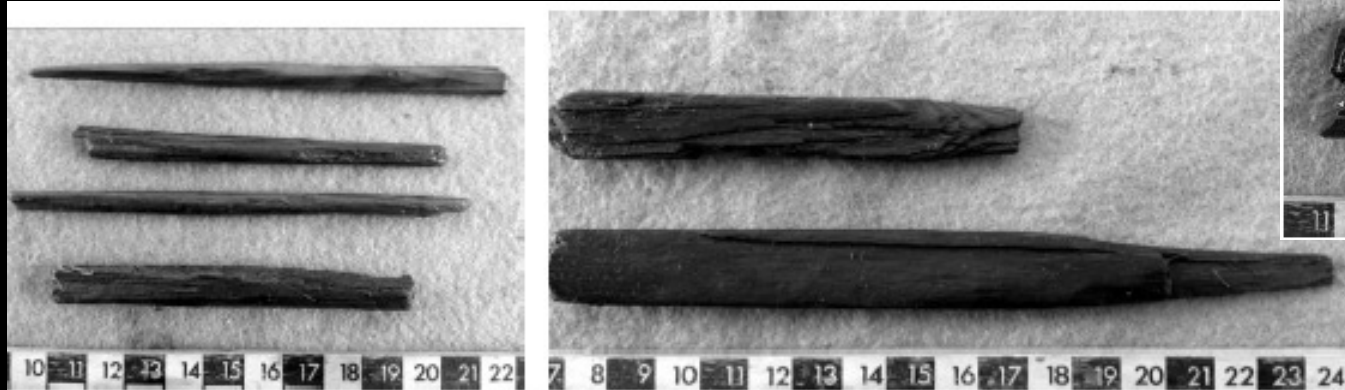


(Chapin et al 2006 PNAS)

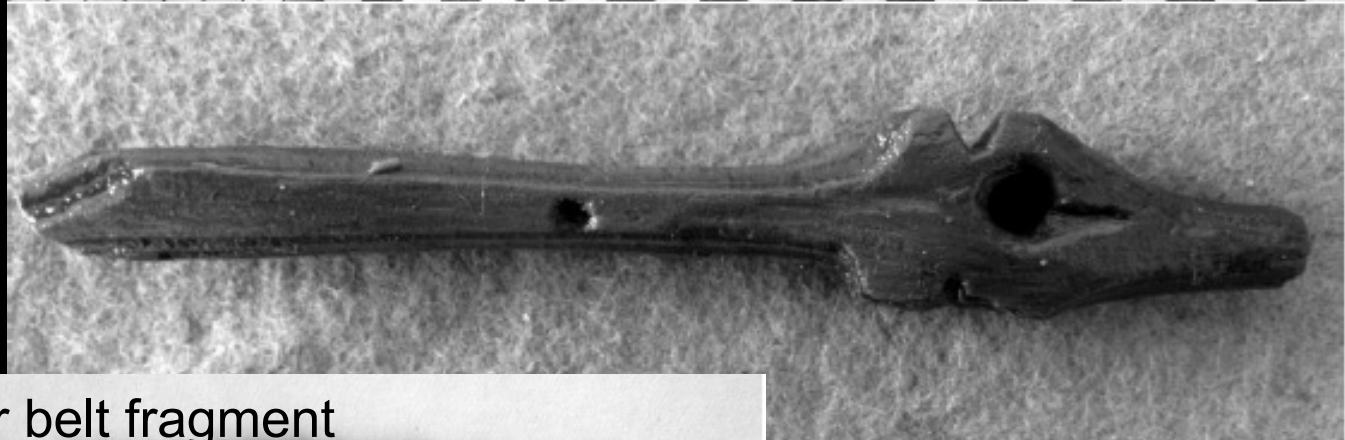


# Some finds

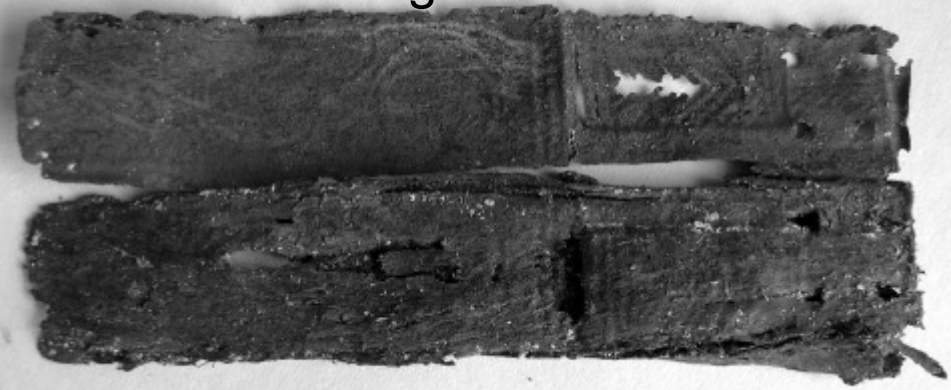
Wooden artifacts



Toy horse



Leather belt fragment



X-070. Cross arm with the inscription '... father and ...'



X-070. Other side of arm '... holy John.'

New Runic Inscriptions

Jet & Ivory composite labret  
and fish bones



An Ipiutak egg



# Not just culture~~

- Basic zooarch data
- Stable isotopes
- aDNA
- Steroids
- Trace elements
- Big data
- Ecosystem reconstruction and change
- Climate/habitat reconstruction
- Extinctions & bottlenecks
- Species response to specific types of change

**OVER MILLENIA**



# Sites as nodes in Distributed Observing Networks of the Past (DONOP)

- Today:

- Researchers collect samples from land & sea
- Samples are returned to a home base (museum or lab)
- Samples are curated and remain available for study



- In the past:

- People hunted and gathered animals and plants from land and sea
- Items were returned to a home base (archaeological site)
- Parts of those were discarded and remain available for study



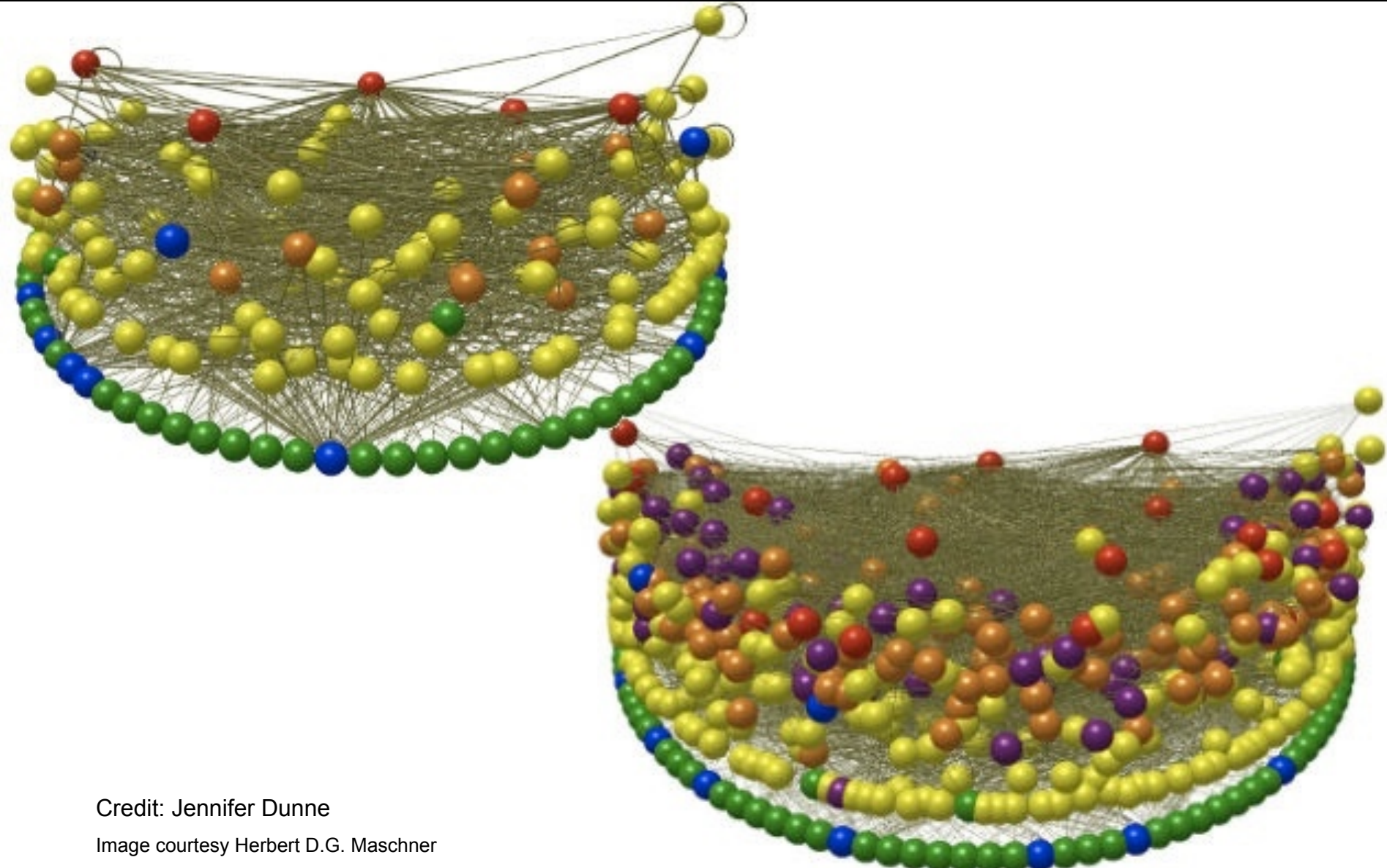
Different goals, similar outcomes

## Sites as nodes in a Long-Term Ecological Observing Network

- Differing trajectories of Atlantic cod vs. Pacific Cod under different fishing regimes (CODSTORY & Sanak Biocomplexity Project)
- Eider conservation on a millennial scale and LTK in Iceland (Hicks et al. 2014)
- WALRUS--Walrus Adaptability and Long-term Responses: Using multi-proxy data to project Sustainability (aDNA, C14, stable isotopes, steroids, morphology)
- Pre-contact fish use in the Barrow area



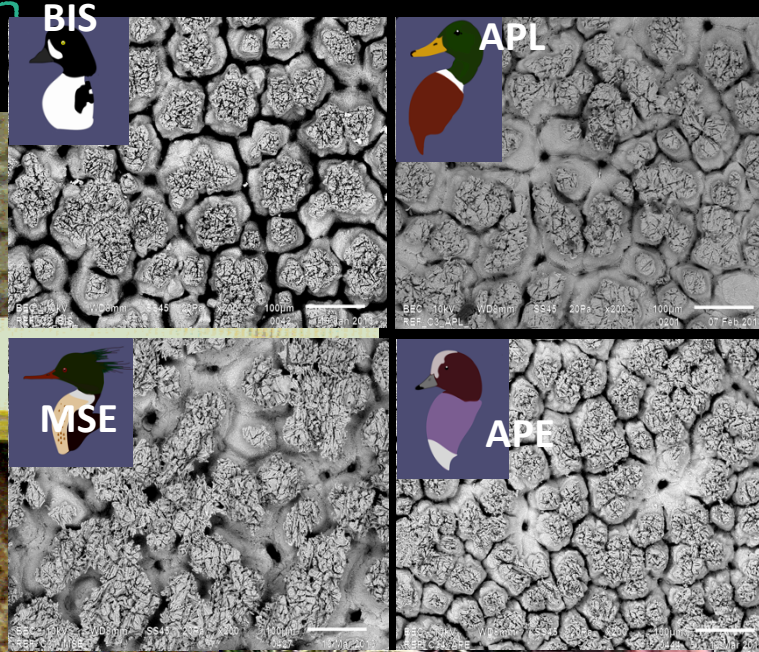
# Sanak Island Food Webs



Credit: Jennifer Dunne

Image courtesy Herbert D.G. Maschner

# Archaeology and Egg shell Identification

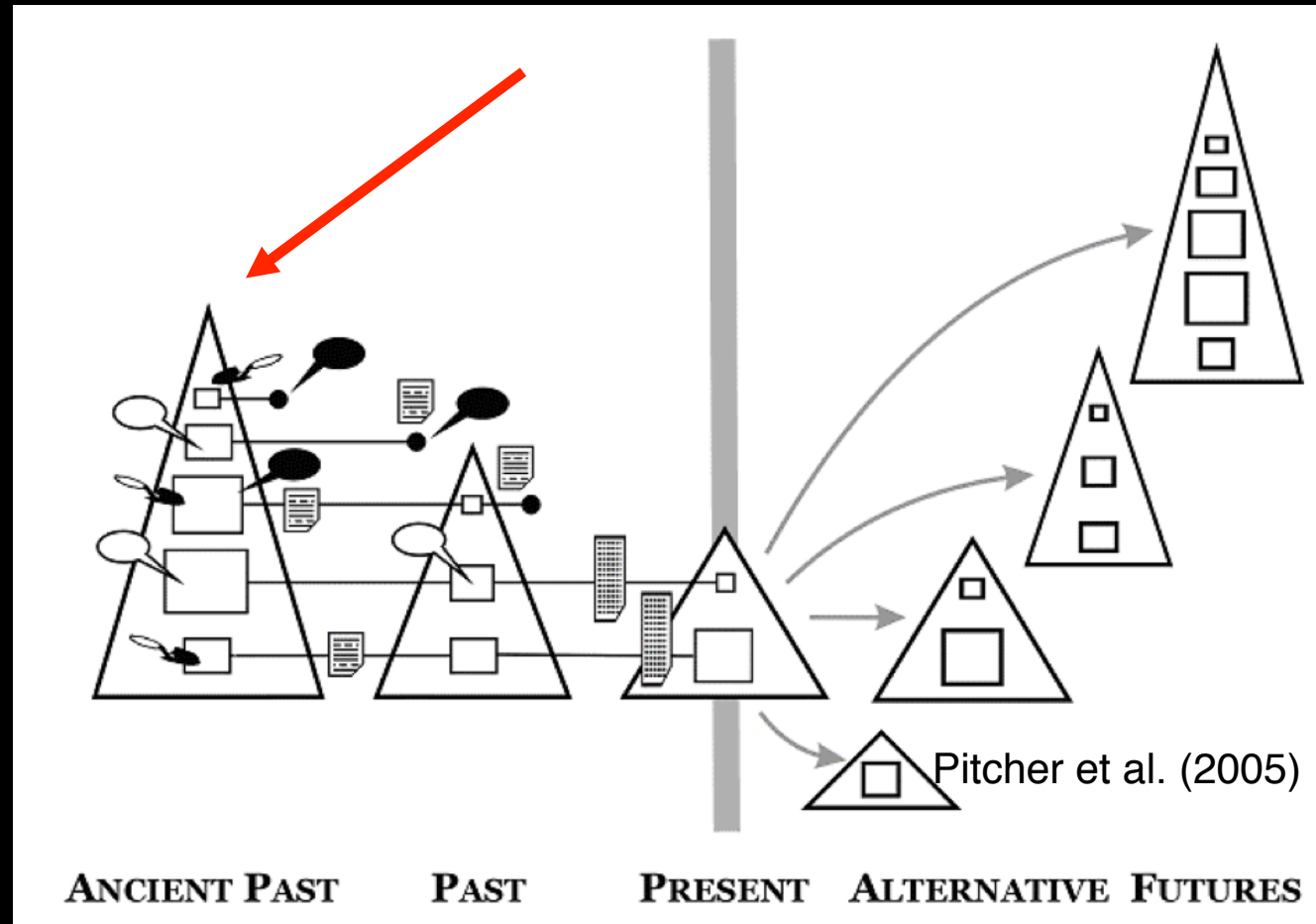


- Massive concentrations of egg shells are found in Mývatn archaeological sites dating to first settlement (c.875 AD)
- Electron Microscope analysis of excavated bird egg shell proves that most eggs came from ducks
- Kesara Anamthawat Jónsson, Arni Einarsson & Megan Hicks expand the story: large collections and deep stratigraphy, sp. Level ID.

Modern and recent historic sustainable management of waterfowl in Mývatn extends back to first settlement- over 1100 years! Local TEK on the millennial scale, bioscience, archaeology, ethnography, and local ecological knowledge combine synergistically.

# Looking Back to Look Forward

- Uses information about past ecosystems for the strategic management of future ecosystems
- Reverse the **'shifting baseline'** syndrome by broadening the understanding of ecosystem dynamics across time



YOU KNOW YOU'RE A HISTORY FAN WHEN

**YOU STILL GET UPSET THINKING  
ABOUT THE LIBRARY OF  
ALEXANDRIA.**

Our Library is  
on Fire NOW





# Rising Sea Level & Coastal Heritage Worldwide Problem

Coastal defenses at Skara Brae Orkney  
UNESCO World Heritage Site endure for  
80 years



Eroding Archaic 5,000  
BP shell midden Barbuda



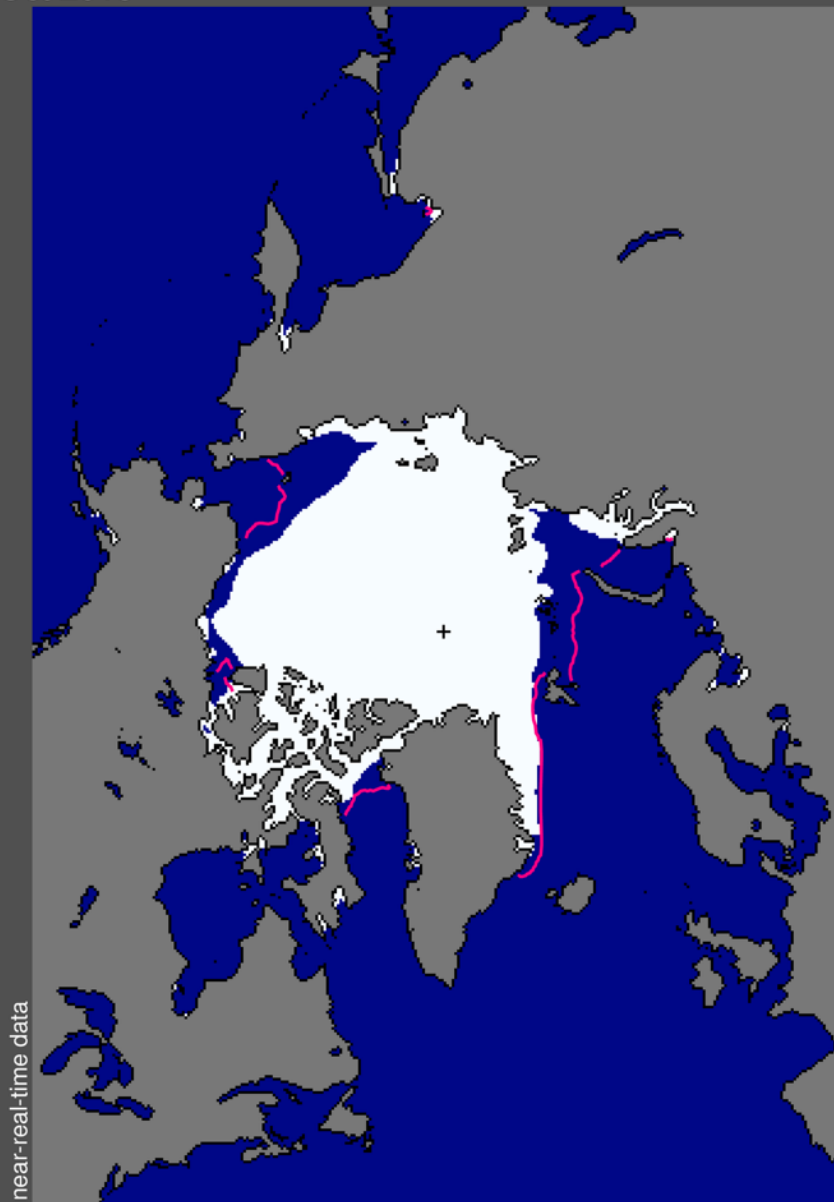
Rising sea level and increasing storminess threaten sites  
from arctic to tropics. Not all sites can be rescued or  
conserved, but expertise exists in site protection and  
rapid rescue. Need for international collaboration in  
priorities and joint action.

Permafrost and sea  
level rise at Birnirk



Sea Ice Extent  
Oct 2015

Sea Ice  
extent  
reduced



near-real-time data

National Snow and Ice Data Center, Boulder, CO

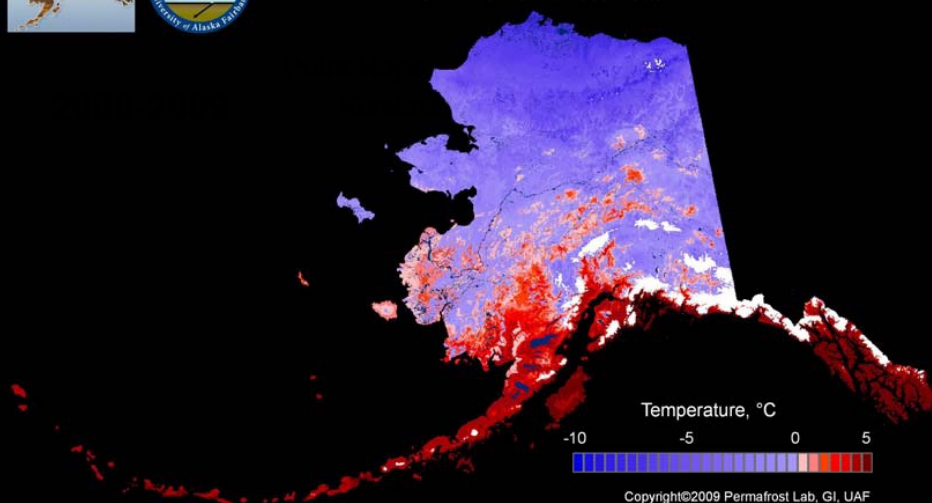
median  
ice edge

Total extent = 7.7 million sq km



Mean Annual Soil Temperatures at 1 m Depth  
ALASKA 2000-2009

GIPL1.3 Permafrost Model



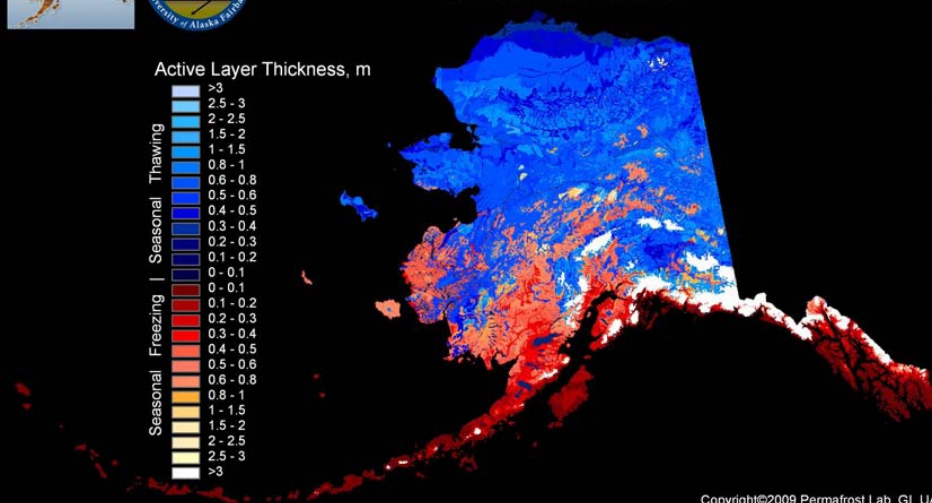
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Five-Model Composite Air Temperature and Precipitation A1B Scenario

Active Layer Thickness, 2000-2009

GIPL1.3 Permafrost Model

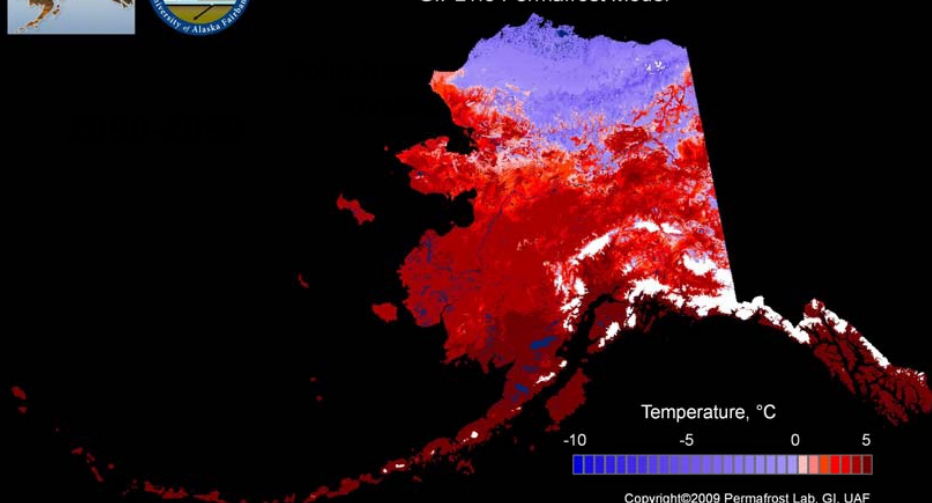


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Mean Annual Soil Temperatures at 1 m Depth  
ALASKA 2090-2099

GIPL1.3 Permafrost Model



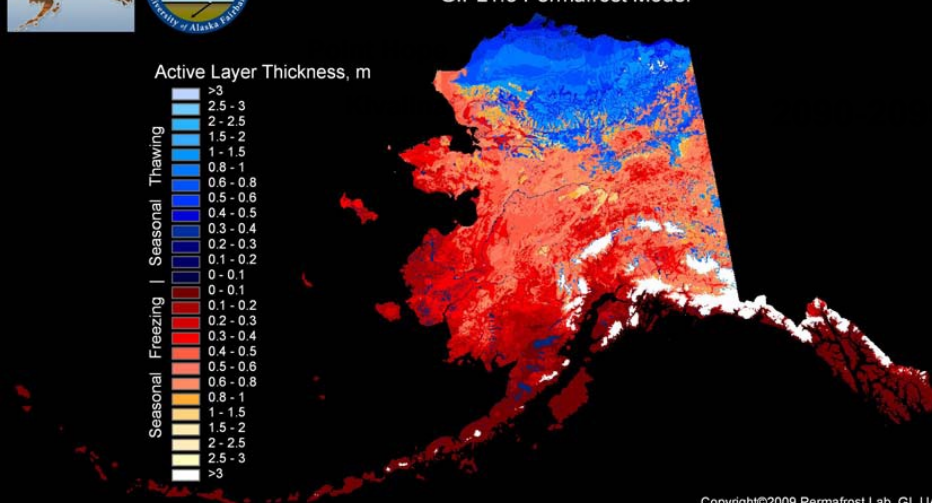
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Five-Model Composite Air Temperature and Precipitation A1B Scenario

Active Layer Thickness, 2090-2099

GIPL1.3 Permafrost Model



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Simulated ground temperatures at 1 meter depth for Alaska for the periods 2000-09 (above) and 2090-99 (below)

Simulated active layer depth for Alaska for the periods 2000-09 (above) and 2090-99 (below)

**It is projected that communities of Point Hope and Kivalina will lose their permafrost by 2100**

Walakpa--July 2013

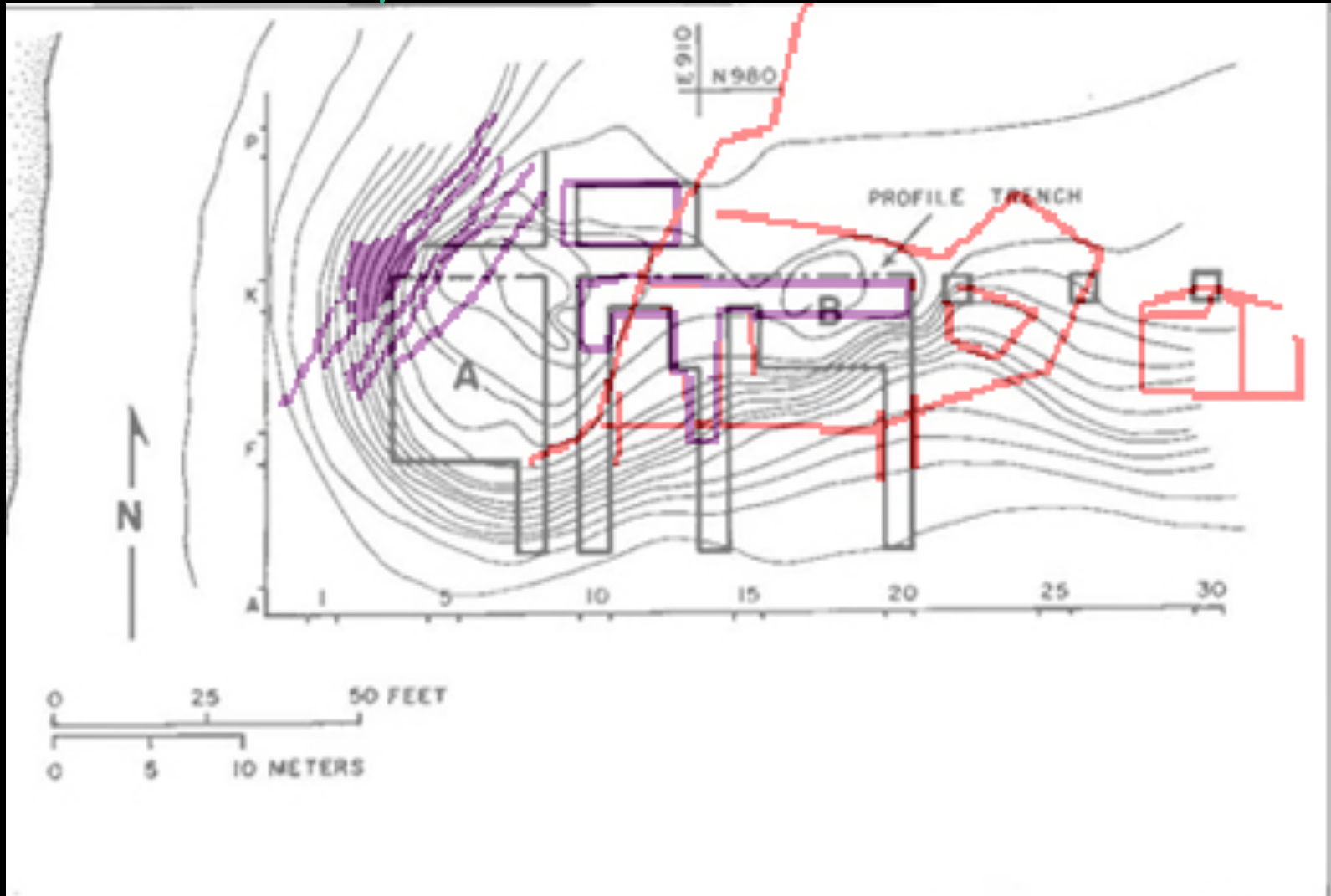




September 2014



# Stanford Map



Stanford in shown in black, 2013 points in purple; 2014 in red

August 2015



# Threats to Coastal Archaeology in Labrador

**Project: The Archaeology of Inuit subsistence and landscape in Northern Labrador**

PI : James Woollett Université Laval/Centre

[james.woollett@hst.ulaval.ca](mailto:james.woollett@hst.ulaval.ca)

<http://www.laboarcheologie.ulaval.ca/laboratoires/bioarcheologie/>



Approx. 200+ Dorset/Thule/Inuit winter sites in Labrador, each is a probable source of data regarding local subsistence and ecology in the past. Excellent site record spanning the MWP and LIA

- Relatively few large-scale excavations to date; some sites have yielded huge collections of well preserved animal bone, plant, insect and geoarchaeological data
- Excellent preservation and dating potential with the overlap of treeline and permafrost limits : frozen sites with dendrochronology, 14C
- Most sites are close to sea level and vulnerable to coastal erosion
- The most productive sites are threatened by permafrost melt (accelerated decay, destabilisation of soil column)

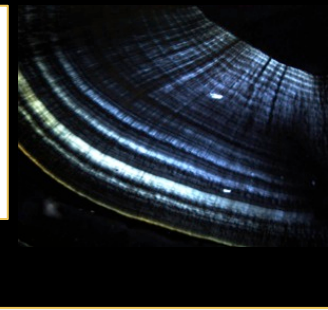


Dorset/Thule/Inuit winter village on 1 to 3m asl sand spit in Komaktorvik Fjord

Stratified midden at Uivak Point 1 HjCl-09: An archive of Inuit subsistence during the LIA



Growth ring record of age and season of death in dentine of a ringed seal (winter kill)



Collapse of soil column and shore edge slumping at Oakes Bay 1 HeCg-08 due to permafrost melting and shore erosion





- In Greenland sites are endangered by both marine erosion and increased summer temperatures
- “Melting middens” - Rapidly degrading organic preservation.
- Bishop’s Manor at Gardar. GHEA target for cooperative rescue by NKA, DK, CUNY, Arch. Inst. Iceland- drawing on IPY NABO experiences and resources.



Nunatta Katersugaasivia Allagaateqarfialu

Nunatta katersugaasivia Grønlands nationalmuseum Greenland National Museum





Melting middens  
and modern  
drainage ditches  
threaten organic  
preservation in the  
surviving stratified  
middens.

Fig. 6. The larger part of the 2012 crew on coffee break at the beginning of fieldwork. From left: Peter Steen Henriksen, Garðar Guðmundsson, Kristborg Þórsdóttir, Orri Vésteinsson, Norie Manigault, Cameron Turley, Michael Nielsen, Nuka Nathanielsen and Jade de la Paz.

# Gufuskalar Iceland 15<sup>th</sup> c Fishing Booths and Winter 2014/15 storm damage



2014 End of season



2015 Start of season



# What do we do about it? Scotland's Coastal Heritage at Risk

<https://twitter.com/CoastArch>

<https://www.facebook.com/ScotlandsCoastalHeritageAtRisk>



In Scotland, thousands of sites are threatened by erosion, and the SCAPE Trust has been working with Government Agency, Historic Scotland, to prioritise action at sites and promote collaborative working with communities around the entire coast. The public are encouraged to correct and update data using an interactive website and mobile apps, and they nominate locally-valued sites for projects.

## FACEBOOK

Scotland's Coastal Heritage at Risk

October 6 ·

We've had a fantastic weekend surveying the Newshot ship graveyard - thanks so much to everyone who came along. We'll be posting a blog soon to detail what we've discovered about the history of the boats.



# What do we do about it?

- We need an **Observing Network** to identify & prioritize archives that are being lost.
  - More “boots on the ground”
  - Clearing house for information
- We need **Support** to address most vulnerable sites in an interdisciplinary way
- We need to **Connect Nodes** in the archaeological network with nodes in modern observing networks

# Thanks to:

- ▶ Vladimir Romanovsky, UAF
- ▶ Owen Mason--Geoarch Alaska
- ▶ Claire Alix--Sorbonne
- ▶ Susan Lebo-- Hawai'i
- ▶ 2005-2014 NAP crews
- ▶ 2013 and 2015 WASP crews
- ▶ Barrow Arctic Science Consortium
- ▶ National Science Foundation (Office of Polar Programs)
- ▶ Education through Cultural and Historical Organizations (ECHO)
- ▶ North Slope Borough
- ▶ UIC Science LLC
- ▶ ARCUS—PolarTrec
- ▶ Ilisagvik College
- ▶ North Slope Borough School District

