University of Colorado
at Boulder

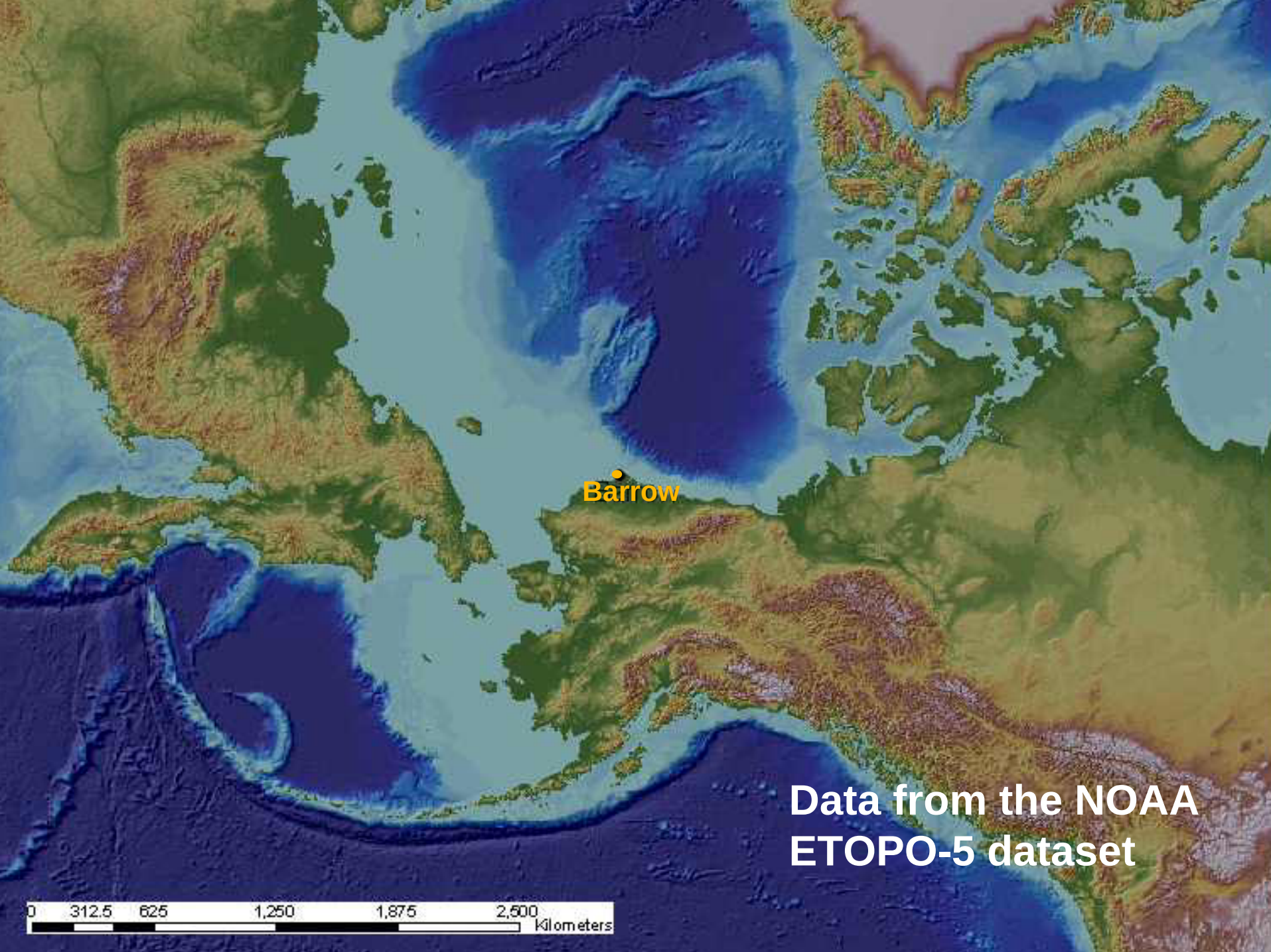
MONASH University
Arts

Context & Climate Change

Lessons from Barrow, Alaska

Ron Brunner, Amanda Lynch, & Jim Maslanik

Funded by Office of Polar Programs
National Science Foundation


Barrow
Data from the NOAA ETOPO-5 dataset
0 312.5 625 1,250 1,875 2,500
Kilometers

Climate Change in Barrow

Barrow Is Significant

- **Microcosm of things to come**
  - As signs of climate change become more obvious
  - Series of extreme events will force action to adapt
  - Perhaps Hurricane Katrina is part of the beginning
- **Source of experience to harvest**
  - Many extreme events in the last half century
  - Storm of October 1963 is still the most damaging
  - Subsequent storms prompted policy responses

Overview

- **Harvesting Barrow's experience**
  - Coastal managers in other local communities
  - State and national policy makers
- **Context matters**
  - Barrow is unique, like every local community
  - Lessons of experience must be adapted
  - There is no one-size-fits-all solution
- **Science, policy & decision-making**
  - In Barrow and in conclusion

Our Integrated Assessment

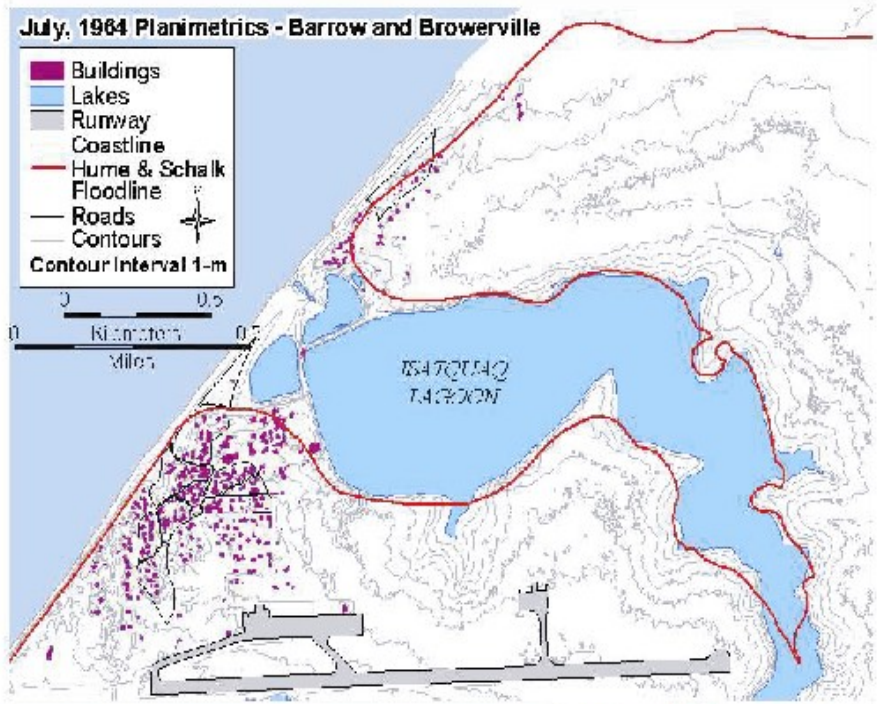
- **Designed to expand informed choices**
- **Focused on erosion & flooding problems**
- **Reports annually & seeks local guidance**
- **Approach is intensive**
  - Centered on Barrow
  - Comprehensive in range of factors studied
  - Integrative in focus on extreme events
- **Approach has been field-tested**

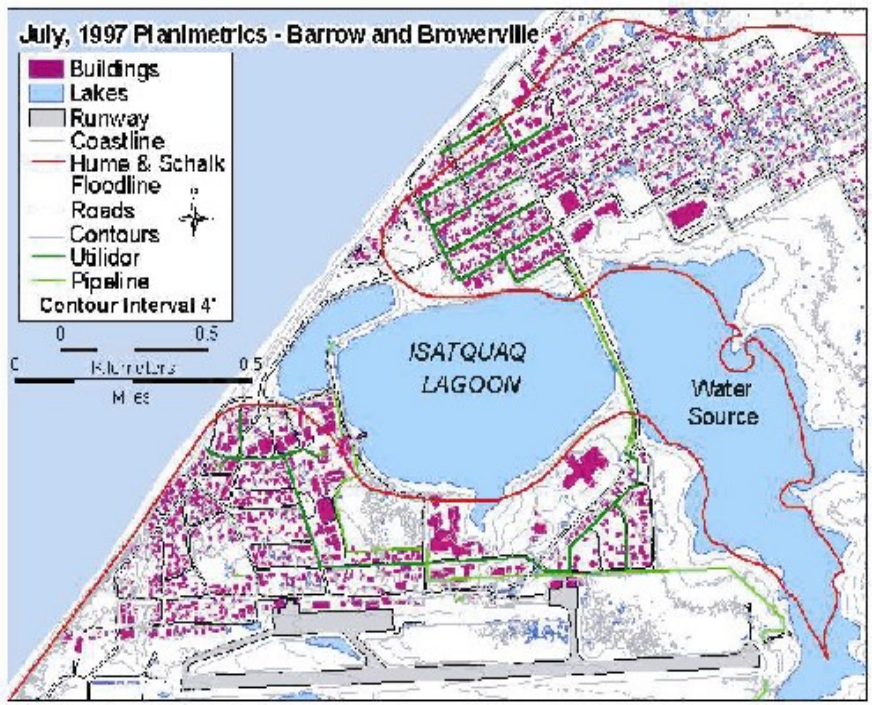
Risk and Vulnerability Factors

- **More community development**
- **More frequent & intense storms?**
  - Trend is unclear
- **More fetch from sea-ice retreat**
- **Rising temperatures & permafrost thaw**
  - Until recently
- **Policy responses & other human factors**

More Development 1964 - 1997

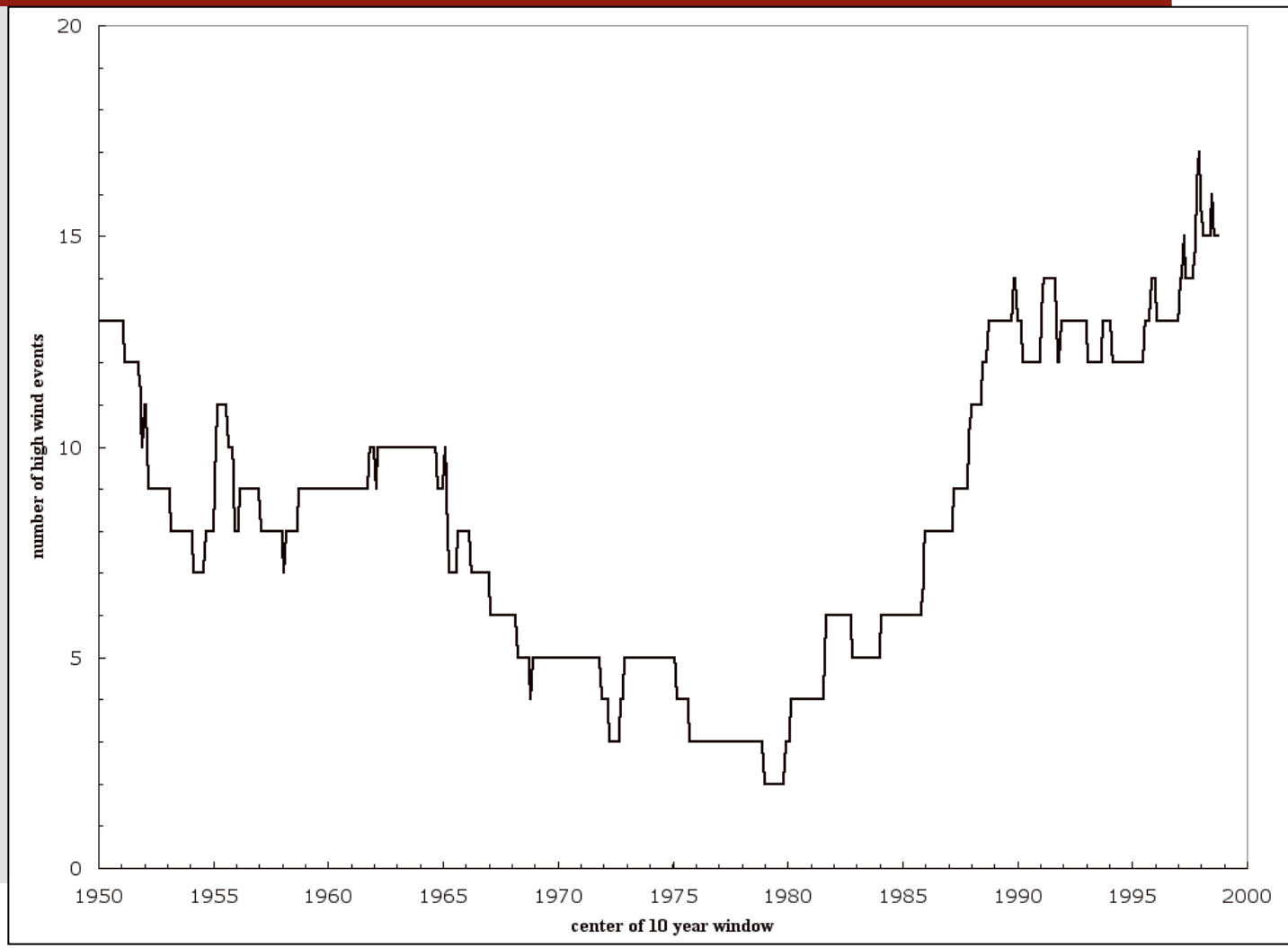
- Population tripled to about 4700
- Much more property (shown in purple)
- Utility corridor (green) a major concern





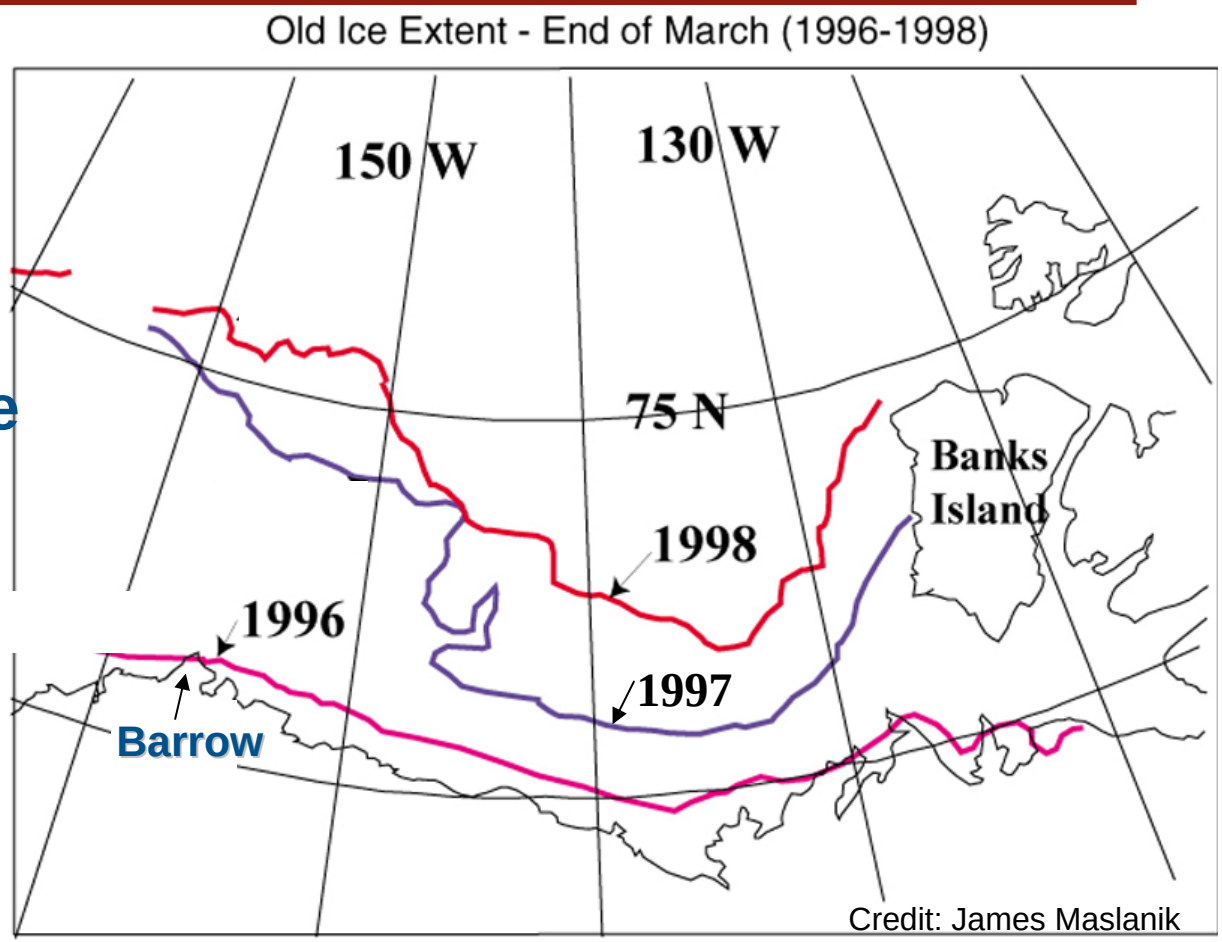
More Storms

- Drive erosion & flooding
- Is trend linear or cyclical?
- Variability has Increased



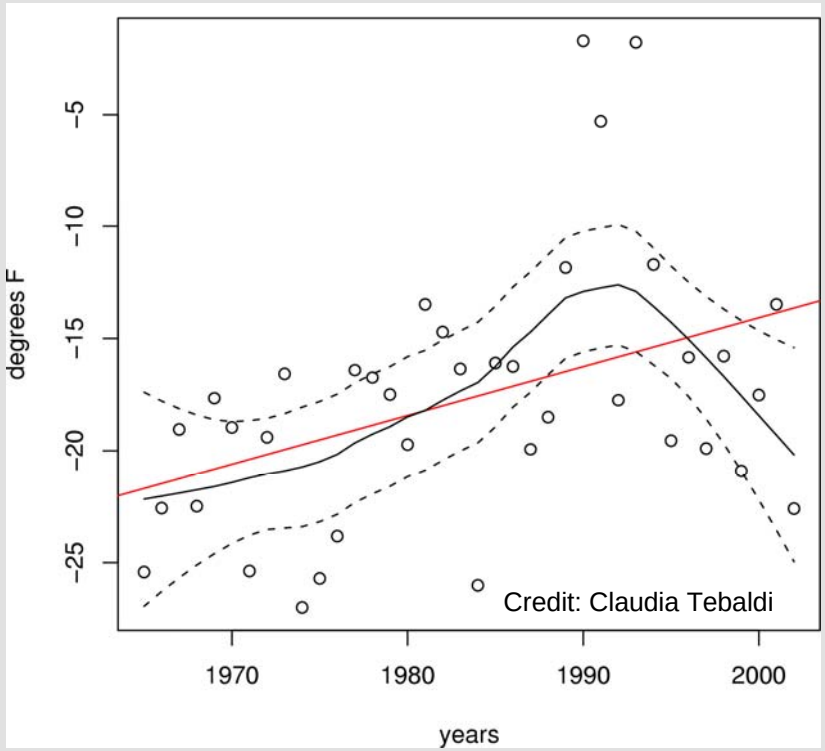
More Fetch

- Sea ice dampens effects of big storms
- Sea-ice retreat large and largest in west
- Barrow exposed to strong westerlies in autumn



Rising Temperatures

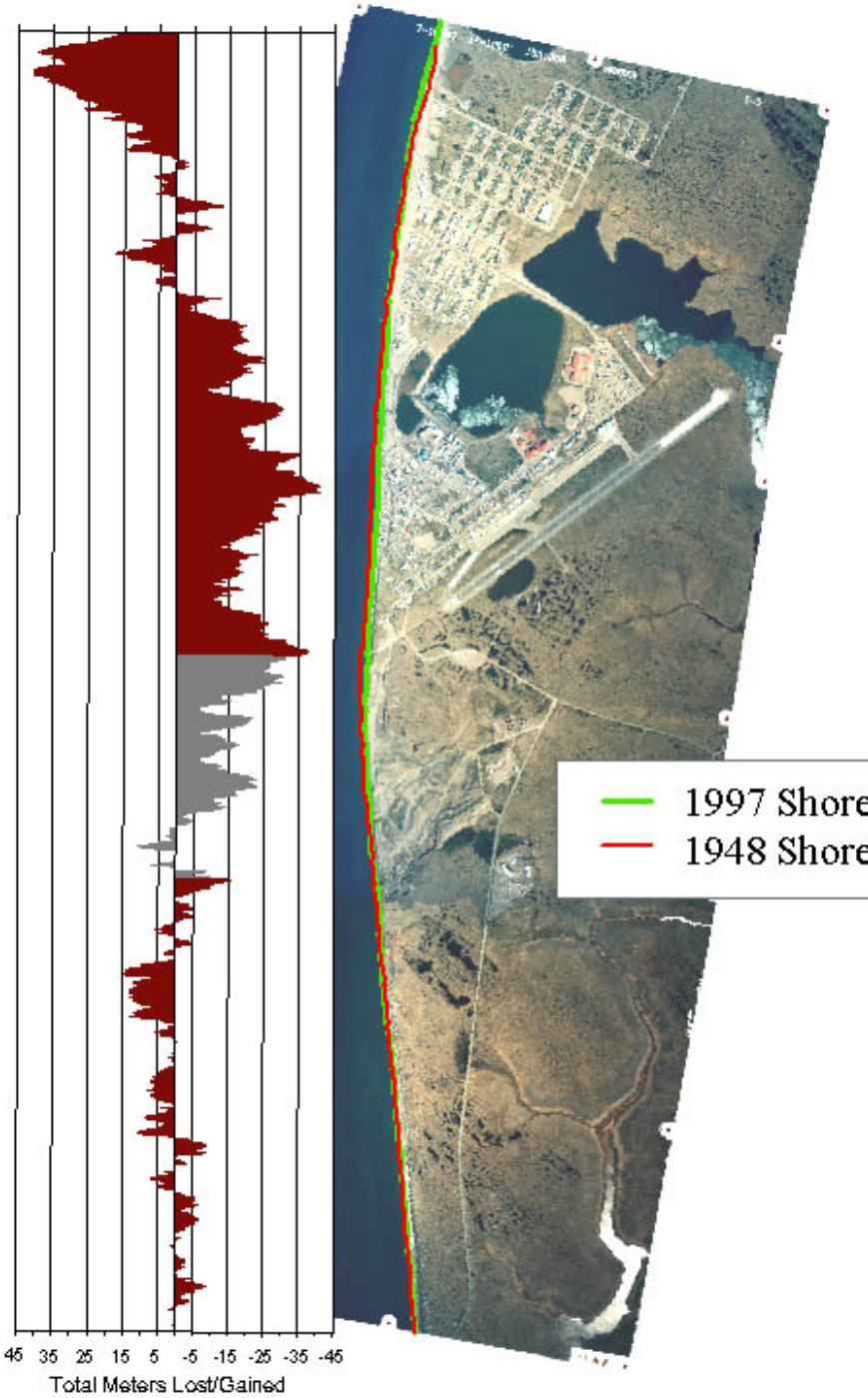
- Affect permafrost thaw
- But declining since 1990s
- Other indicators
  - Fewer very cold days
  - Shorter cold spells
  - Earlier spring thaw



Barrow winter minimum temperatures

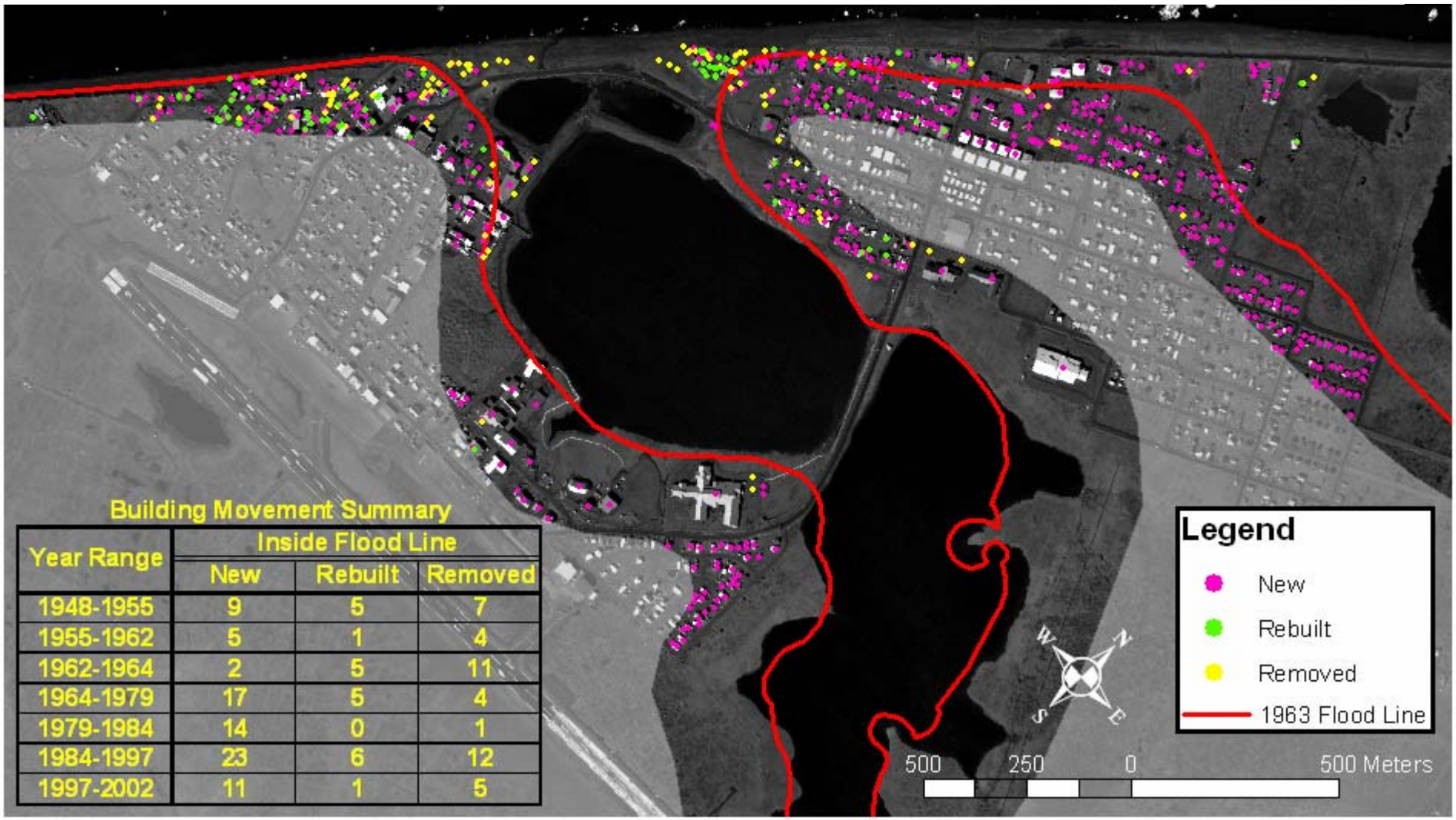
Shoreline Erosion 1948 - 1997

- Erosion exposes more things of value
- Highest erosion at the bluffs: about 34 m in 50 years
- Removal of beach material before 1968 may be a factor
- Erosion is mostly episodic



Credit: Leanne Lestak and William Manley

Construction & Destruction 1948-2002



Damage

- **Result of interactions among many factors**
  - Both natural and human factors
  - No single factor tells the story
  - Factors must considered together
- **Interactions manifest in extreme events**
  - Each is unique if describe comprehensively
- **Overall uncertainty is compounded by uncertainty in each factor**
  - Limits predictability in detail or with confidence

Major Extreme Events

- October 4 to 6, 1954
- October 3, 1963 – the most damaging
- September 12 & 20, 1986
- February 25, 1989
- August 10, 2000
- October 5 & 8, 2002
- July 29, 2003

3 October 1963

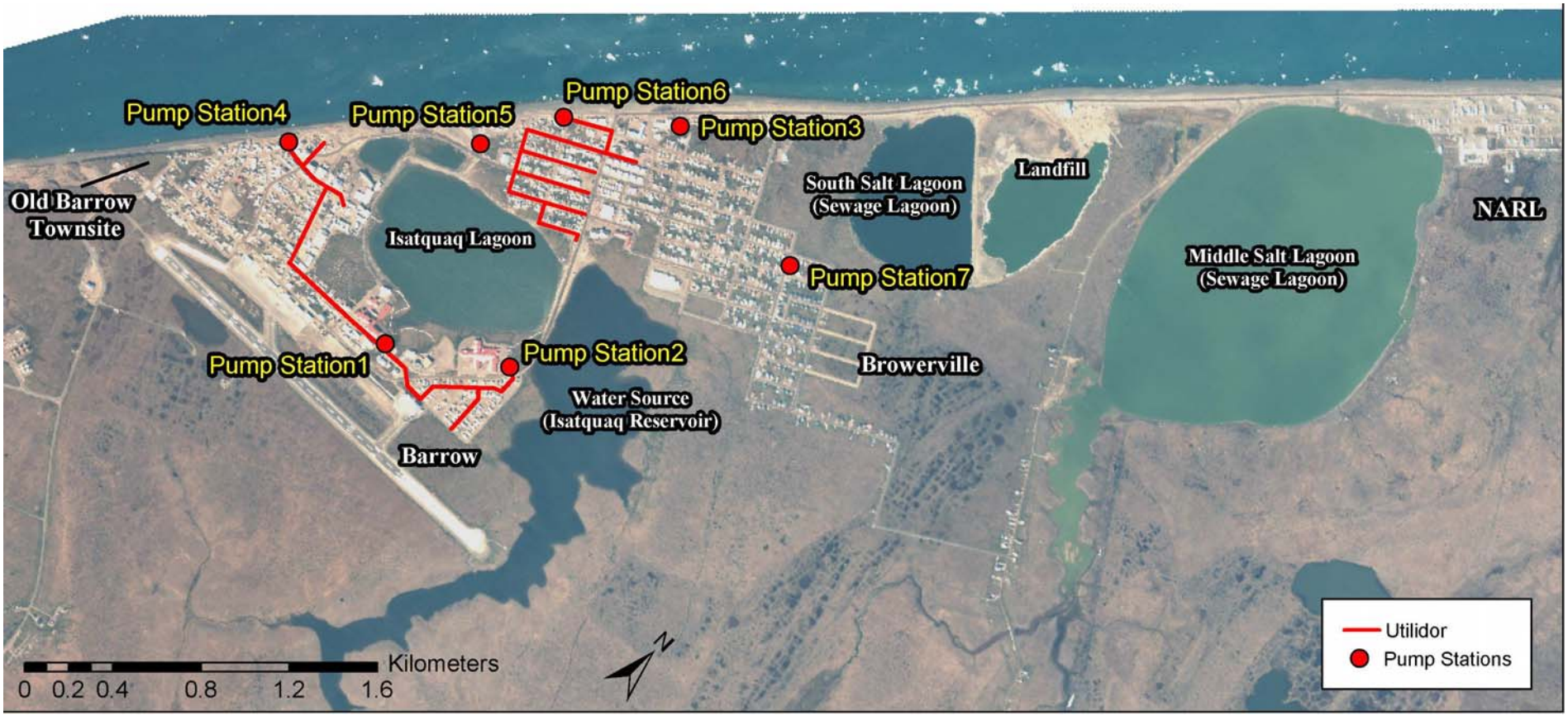
Photo by Grace Redding

Present Vulnerabilities

Old Barrow Townsite

Photo by Dora Nelson

Other Vulnerabilities



August 2002 QuickBird Satellite Image

Utilidor

Pump Station No. 4

Major Policy Responses

- **Beach Nourishment Program**
  - Initiated by September 1986 storms & loss of artifacts
  - July 1992: NSB Assembly appropriated $16 m
  - August 2000 storm damaged & sunk the dredge
  - Informal local appraisals are mixed at best
- **Joint Feasibility Study of NSB/USACE**
  - Prompted in part by August 2000 storm
  - Phase I scheduled for completion September 2005
  - O & M begin in 2012 if everything works out
- **Meanwhile, Barrow remains vulnerable…**

Other Policy Responses

- Old landfill site protected & capped
- Inland evacuation route from NARL
- New hospital location
- New research facility design
- Emergency management exercises
- Utilidor retrofit considered
- Planning/zoning & relocation on agenda

Networking Strategy

Alaska Native villages compare experiences on coastal erosion & flooding problems

- **Increase experience available for adaptation decisions in each village**
- **Help clarify their common interest in adapting state & federal programs**
- **Builds on hearings in Anchorage June 2004 and GAO-04-142 December 2003**

Lessons for Science

- **Context-specific information is used**
  - Addresses the community's priority problem
  - Connects with local knowledge of extreme events
  - Informs decisions they can control or influence
- **Intensive approach like ours can help…**
  - Reconstruct extreme events, e.g., 1963 storm
  - Document, integrate, and update historical trends
  - Clarify underlying dynamics
- **We cannot predict in detail or with confidence**
  - Profound uncertainties exist at local level

Lessons for Policy

- **Sound adaptation policy integrates**
  - Profound uncertainties
  - Multiple community interests
  - Resource constraints
- **Sound policy process adjusts policies**
  - As events unfold in unexpected ways
  - Procedurally irrational to lock in entire policy
- **Policy responses are distributed**
  - Different people make different decisions

Lessons for Decision-Making

- **Local community best positioned to decide**
  - Knowledge of local values & circumstances
  - Responsibility from living with consequences
  - Outside advisers should be advisers
- **Difficult to know enough at higher levels**
  - Provide resources to help meet local needs
  - Subject to state & federal resource constraints
- **Cognitive constraints**
  - Could be most important human dimension

Opportunities

- **Factoring global problem of adaptation**
  - Each local problem is more tractable
  - Working in parallel maximizes experience
- **Adapting our intensive approach**
  - As other communities become ready to cope
- **Networking similar local communities**
  - Maximizes experience available to each
  - Clarifies their common interest
  - Scales up successful innovations

Context Matters!

Colleagues & Contributors

People of Barrow

Kenneth Toovak, Elder

Jim Maslanik, PI

Amanda Lynch

Matt Beedle

Elizabeth Cassano

Anne Jensen

Melinda Koslow

Leanne Lestak

Bill Manley

Linda Mearns

Scott Peckham

Matt Pocernich

Glenn Sheehan

Page Sturtevant

James Syvitski

Claudio Tebaldi

Jason Vogel