NPS's Arctic Network Programs

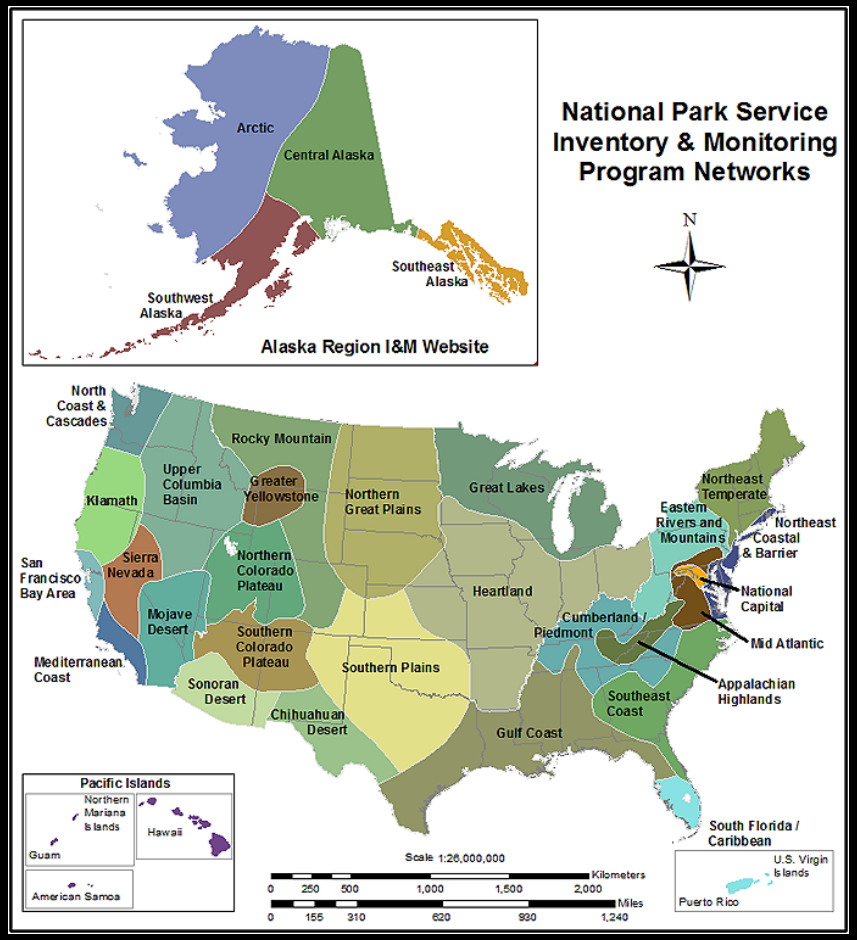
Inventory, Monitoring and Research for Management Applications

Peter Neitlich and Jim Lawler

NPS Inventory and Monitoring Programs

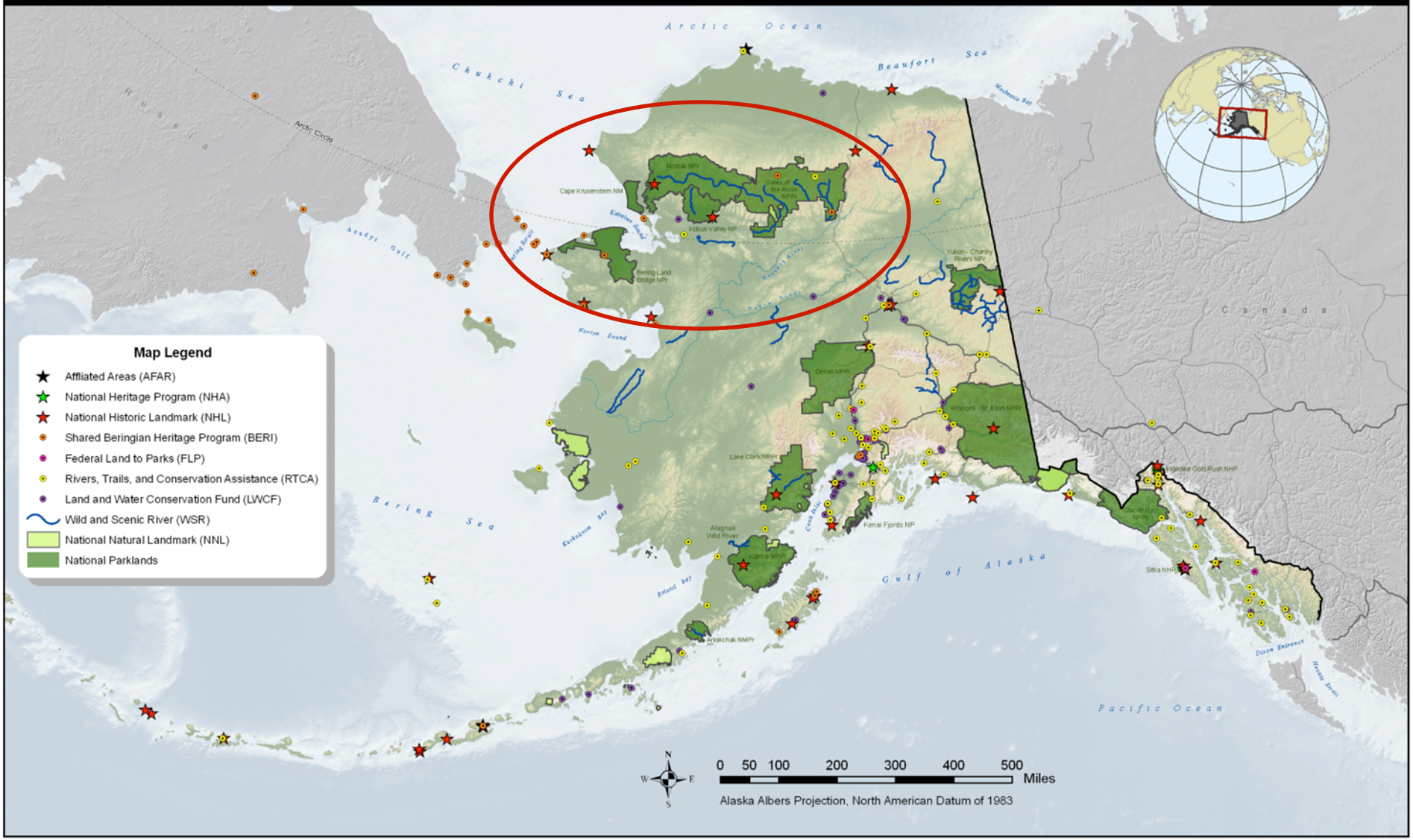
National Program Goals

- *Determine the status and trends, in selected indicators, of the condition of park ecosystems to allow managers to make better-informed decisions…*
- *Provide early warning of abnormal conditions of selected resources to help develop effective mitigation measures...*
- *Provide data to better understand the dynamic nature and condition of park ecosystems and to provide reference points for comparisons with other, altered environments.*
- *Provide data to meet certain legal and Congressional mandates related to natural resource protection and visitor enjoyment.*
- *Provide a means of measuring progress towards performance goals.*



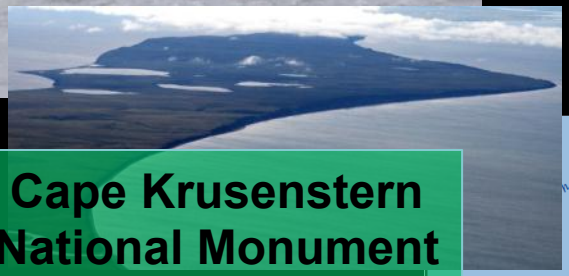
The National Park Service Alaska Region

National Park Service
U.S. Department of the Interior



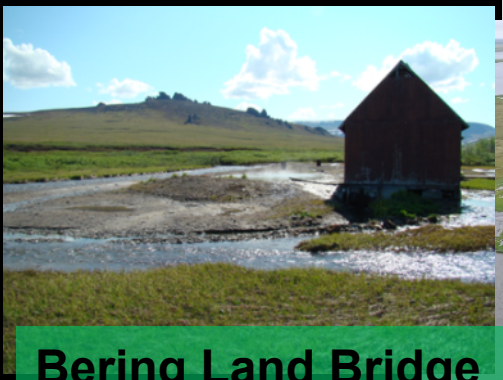
Arctic Parks

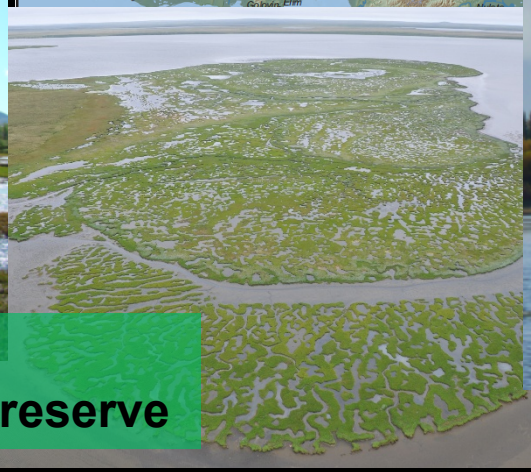
Gates of the Arctic National Park & Preserve



Noatak National Preserve

Cape Krusenstern National Monument





Kobuk Valley National Park

Bering Land Bridge National Park and Preserve

Areas of research and monitoring

Biological Elements

Water

Ecosystem Processes

Geology and Soils

Air and Climate

Brown Bears

Caribou

Dall's Sheep

Landbirds

Muskox

Yellow-billed Loons

Terrestrial Vegetation

Coastal Lagoons

Streams and Large Lakes

Shallow Lakes

Fire Extent and Severity

Terrestrial Landscape Dynamics

Coastal Erosion

Permafrost

Air Quality

Climate and Weather

Snowpack

Wet and Dry Deposition

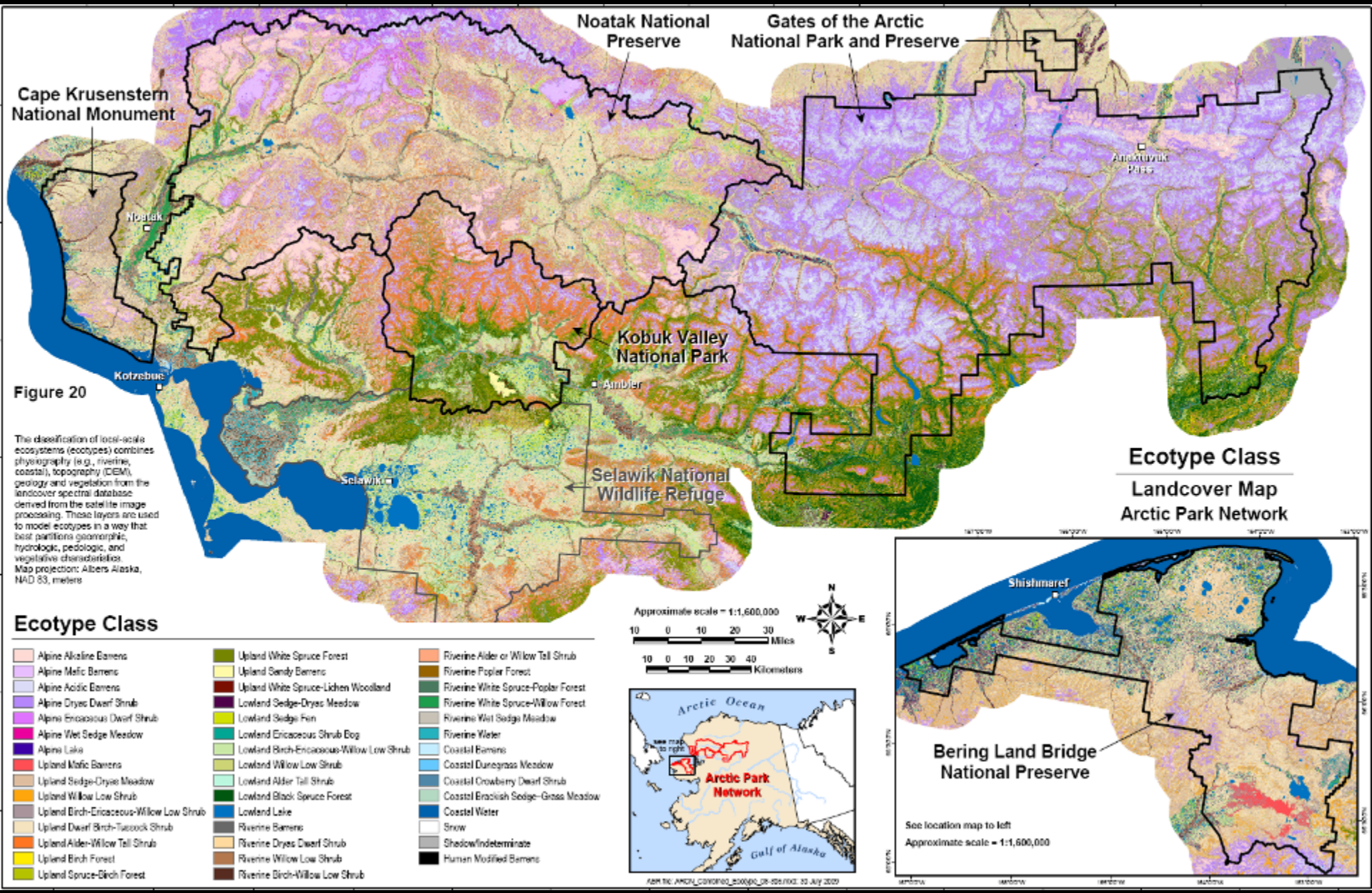
Vegetation and Habitat Change

Nimiuktuk River in NOAT

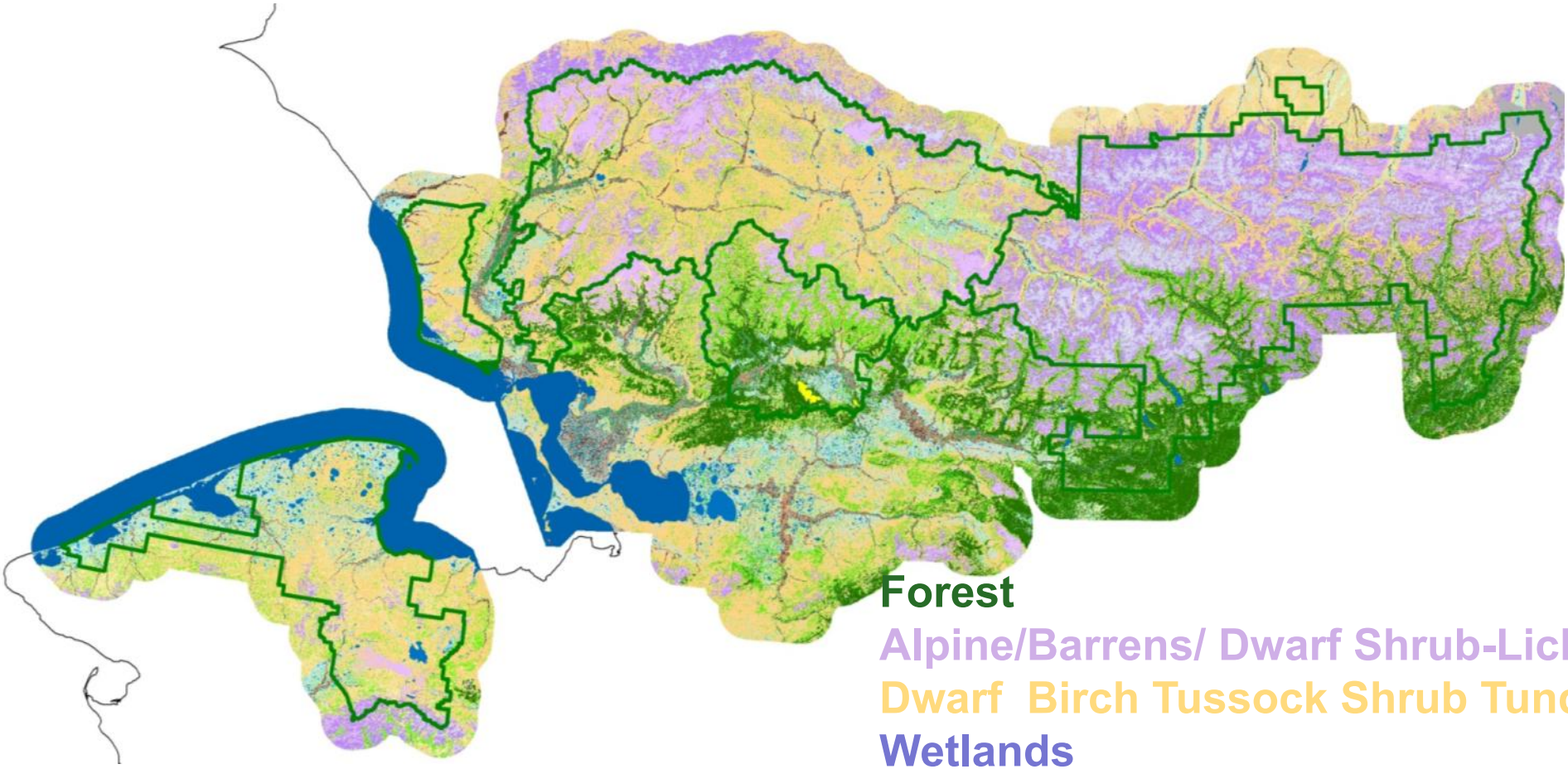
Shrubs on North Slope for first time in recorded history or pollen record.

Courtesy Ken Tape

Ecotype Map of the Arctic Network



Landcover


Forest
Alpine/Barrens/ Dwarf Shrub-Lich
Dwarf Birch Tussock Shrub Tund
Wetlands
Dunes
Shrub Thickets

Applied Research Using Arctic Network Data

Alaska Park Science, Volume 12, Issue 2

Predicting the Effects of Climate Change on Ecosystems and Wildlife Habitat in Northwest Alaska: Results from the WildCast Project

By Anthony R. DeGange, Bruce G. Marcot, James Lawler, Torre Jorgenson, and Robert Winfree

ForeCASTing Framework, or WildCast, was begun as a collaboration between the National Park Service and the U.S. Geological Survey to develop a predictive framework

WildCast Vision and Objectives

WildCast is intended to help anticipate how climate change could affect species, communities, wildlife

Climatic Change (2015) 130:131–144
DOI 10.1007/s10584-014-1302-1

Projected changes in diverse ecosystems from climate warming and biophysical drivers in northwest Alaska

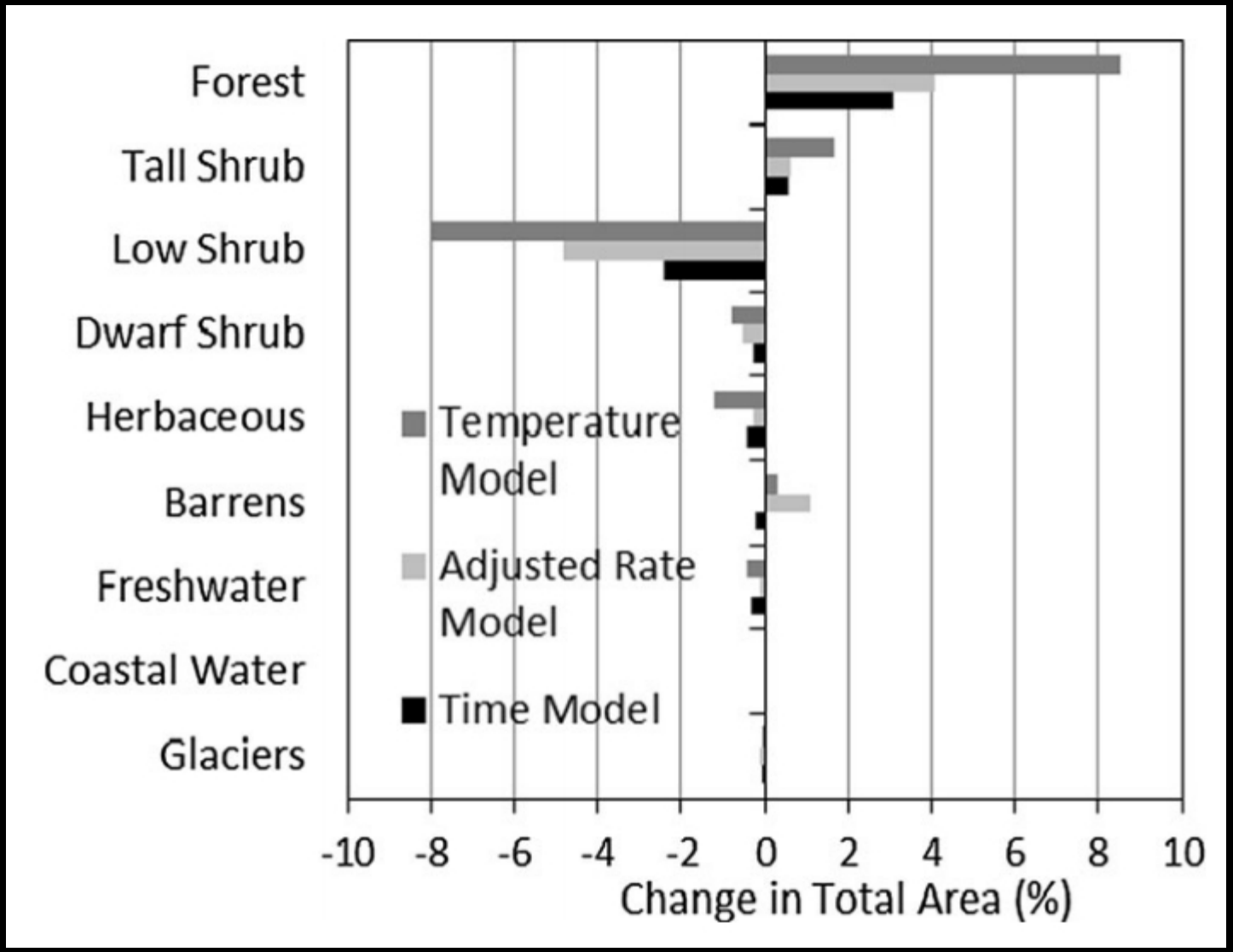
Mark Torre Jorgenson · Bruce G. Marcot · David K. Swanson · Janet C. Jorgenson · Anthony R. DeGange

Climatic Change (2015) 130:145–154
DOI 10.1007/s10584-015-1354-x

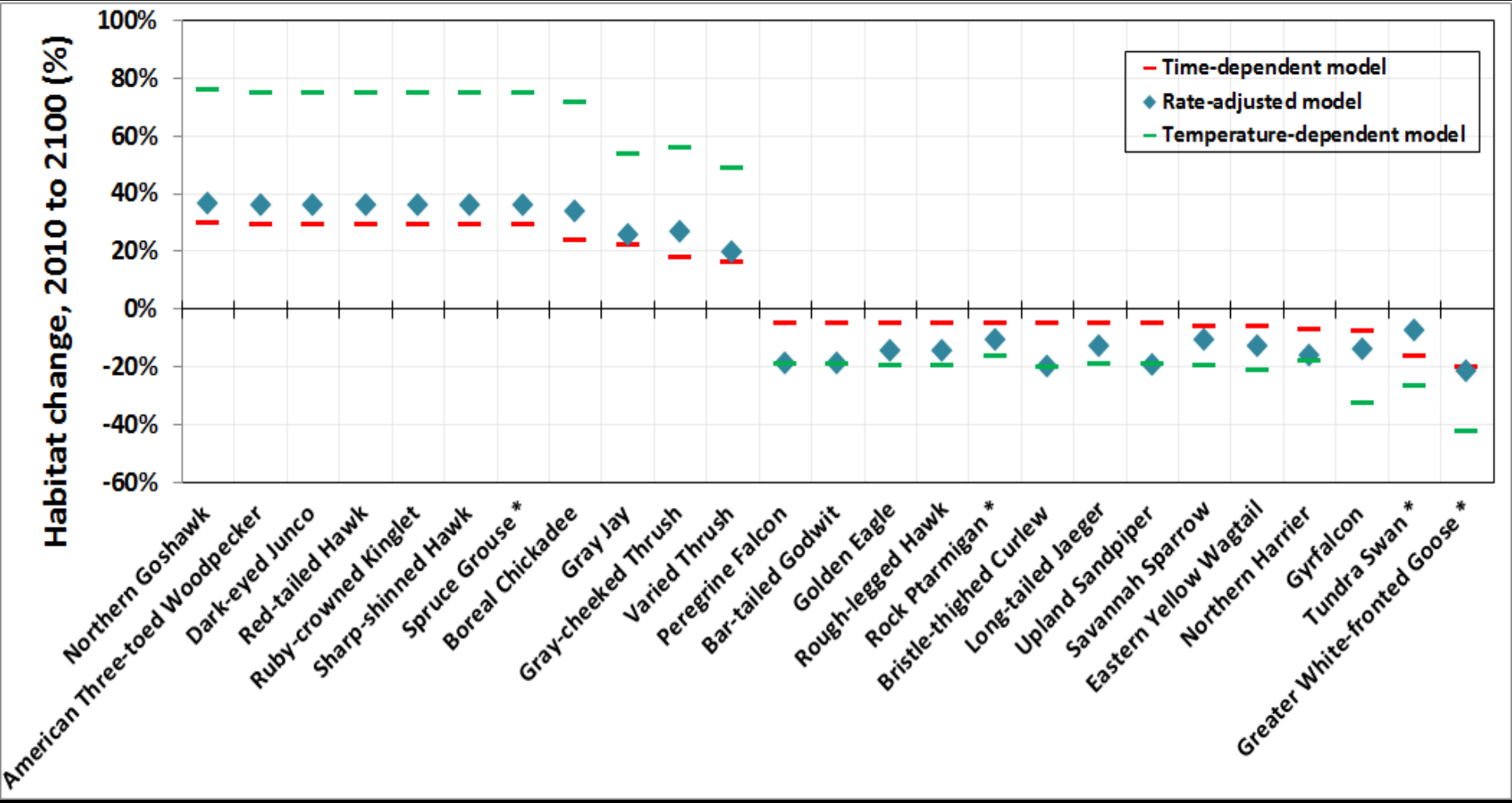
Projected changes in wildlife habitats in Arctic natural areas of northwest Alaska

Bruce G. Marcot · M. Torre Jorgenson · James P. Lawler · Colleen M. Handel · Anthony R. DeGange

Change in Ecotype Classes
2070 – 2100

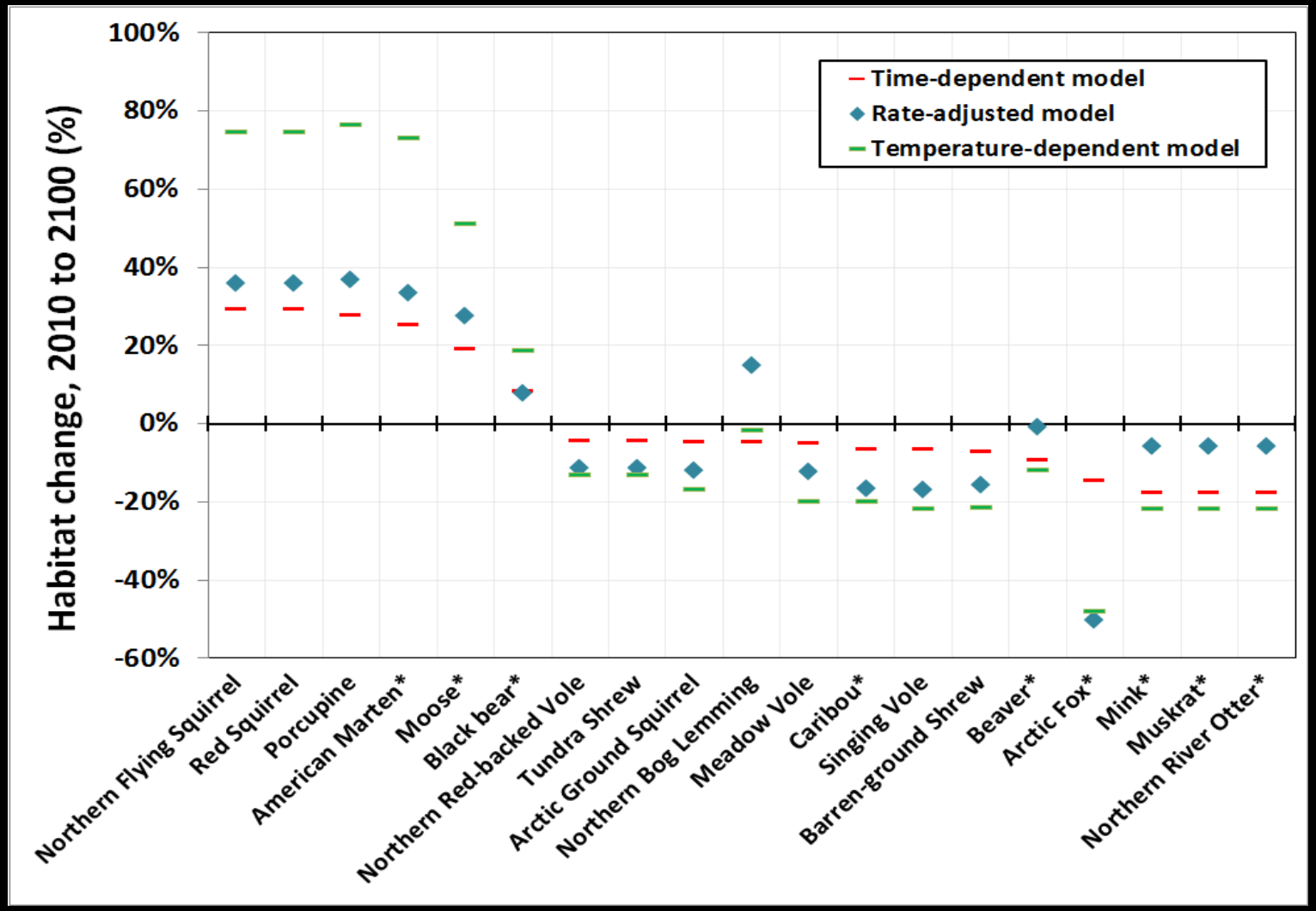


Birds: Major habitat gainers and losers 2010 – 2100

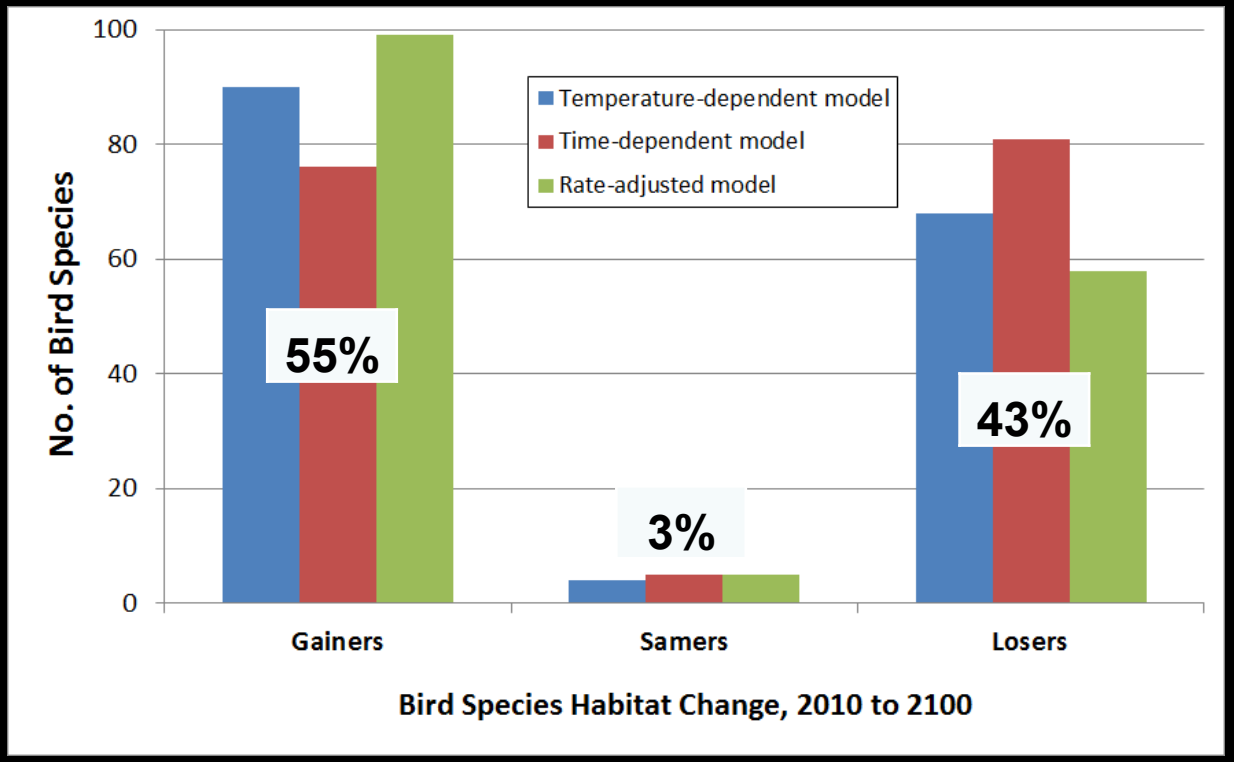


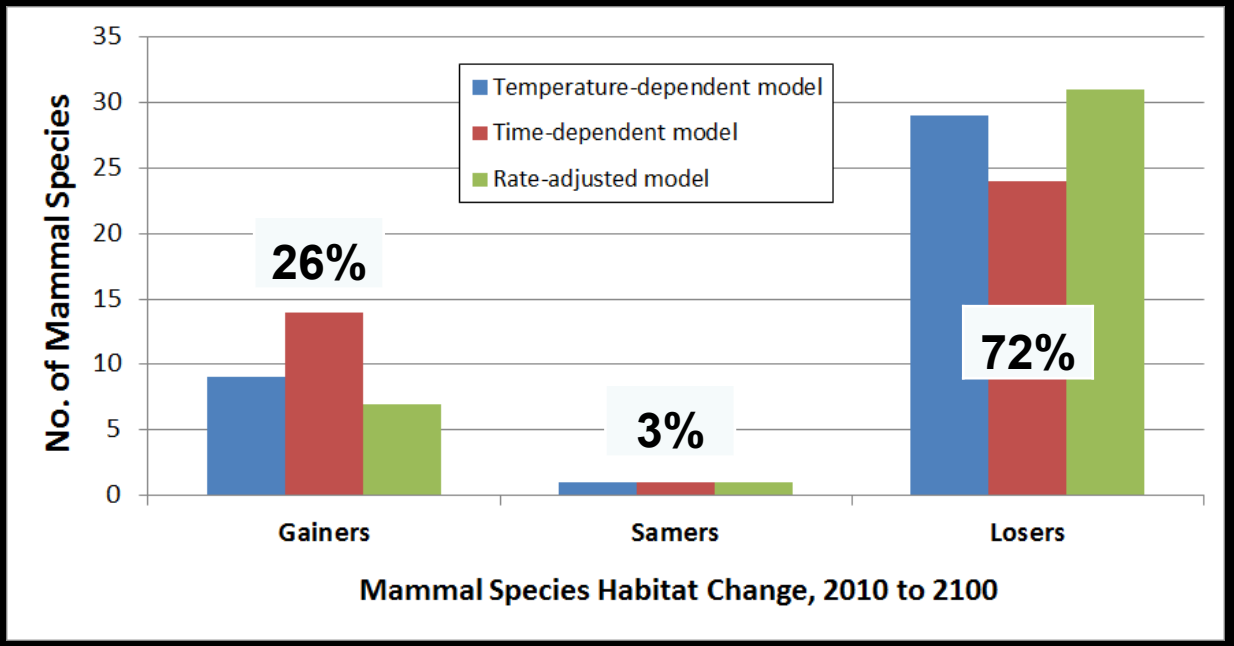
Species with ≥ +5% (increase) or ≤ -5% (decrease) in habitat based on time-dependent model

Mammals: Major habitat gainers and losers 2010 – 2100



Species with ≥ +5% (increase) or ≤ -5% (decrease) in habitat based on time-dependent model


100
80
60
40
20
0
No. of Bird Species
Temperature-dependent model
Time-dependent model
Rate-adjusted model
55%
3%
43%
Gainers
Samers
Losers
Bird Species Habitat Change, 2010 to 2100


35
30
25
20
15
10
5
0
No. of Mammal Species
Temperature-dependent model
Time-dependent model
Rate-adjusted model
26%
3%
72%
Gainers
Samers
Losers
Mammal Species Habitat Change, 2010 to 2100

Biggest Habitat Gainers

Birds

Red-Tailed Hawk
Sharp-Shinned Hawk
Northern Goshawk
Spruce and **Ruffled Grouse** ❖
Bufflehead ❖
Common Goldeneye ❖
Black, **Surf**, and
White-Winged Scoter ❖
American Wigeon ❖
Harlequin Duck ❖
Sandhill Crane ❖
Gray Jay
Gray-Cheeked Thrush
Varied Thrush
American Three-Toed Woodpecker
Dark-Eyed Junco
Ruby-Crowned Kinglet
Boreal Chickadee

Mammals

Moose ❖
Black Bear ❖
American Marten ❖
American Porcupine
Northern Flying Squirrel
Red Squirrel

Habitats:
- Forests, woodlands
- Tall shrub

❖

Biggest Habitat Losers

Birds

Golden Eagle
Gyrfalcon
Peregrine Falcon
Snowy Owl ❖
Northern Harrier
Rough-Legged Hawk
Greater White-Fronted Goose ❖
Tundra Swan ❖
Rock and
Willow Ptarmigan ❖
Long-Tailed Jaeger
Eastern Yellow Wagtail
Savannah Sparrow
Upland Sandpiper
Bristle-Thighed Curlew
Bar-Tailed Godwit

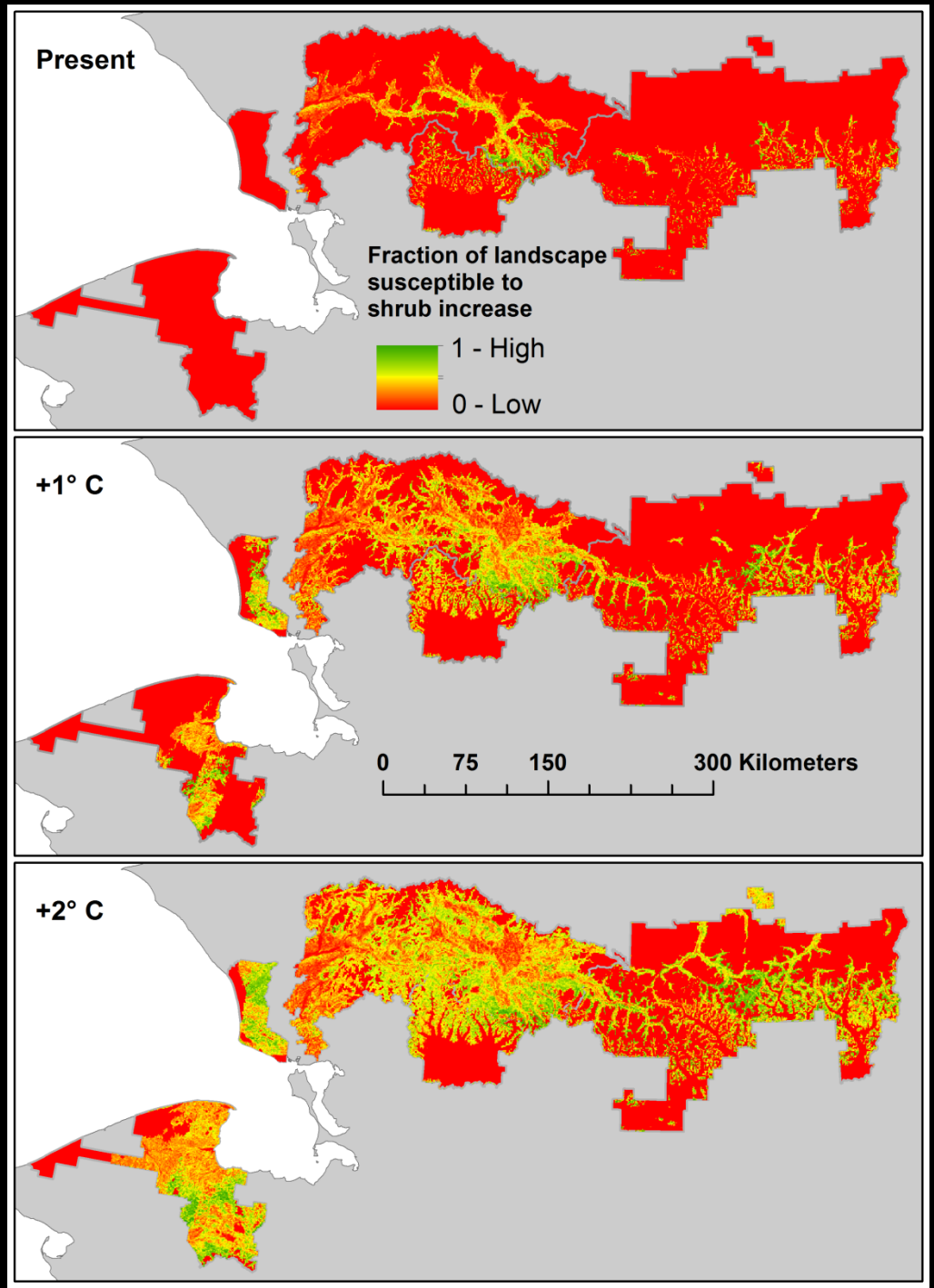
Mammals

Caribou ❖
Muskoxen ❖
Arctic Fox ❖
American Mink ❖
Muskrat ❖
American Beaver ❖
Northern River Otter ❖
Northern Bog Lemming
Collared Lemming
Arctic Ground Squirrel
Tundra Shrew
Cinereus Shrew
Dusky Shrew
Barren-Ground Shrew
Singing Vole
Meadow Vole
Northern Red-Backed Vole
Tundra Vole

Habitats:

- **Low shrub, dwarf shrub**
- **Herbaceous, grassland**
- **Freshwater**

❖

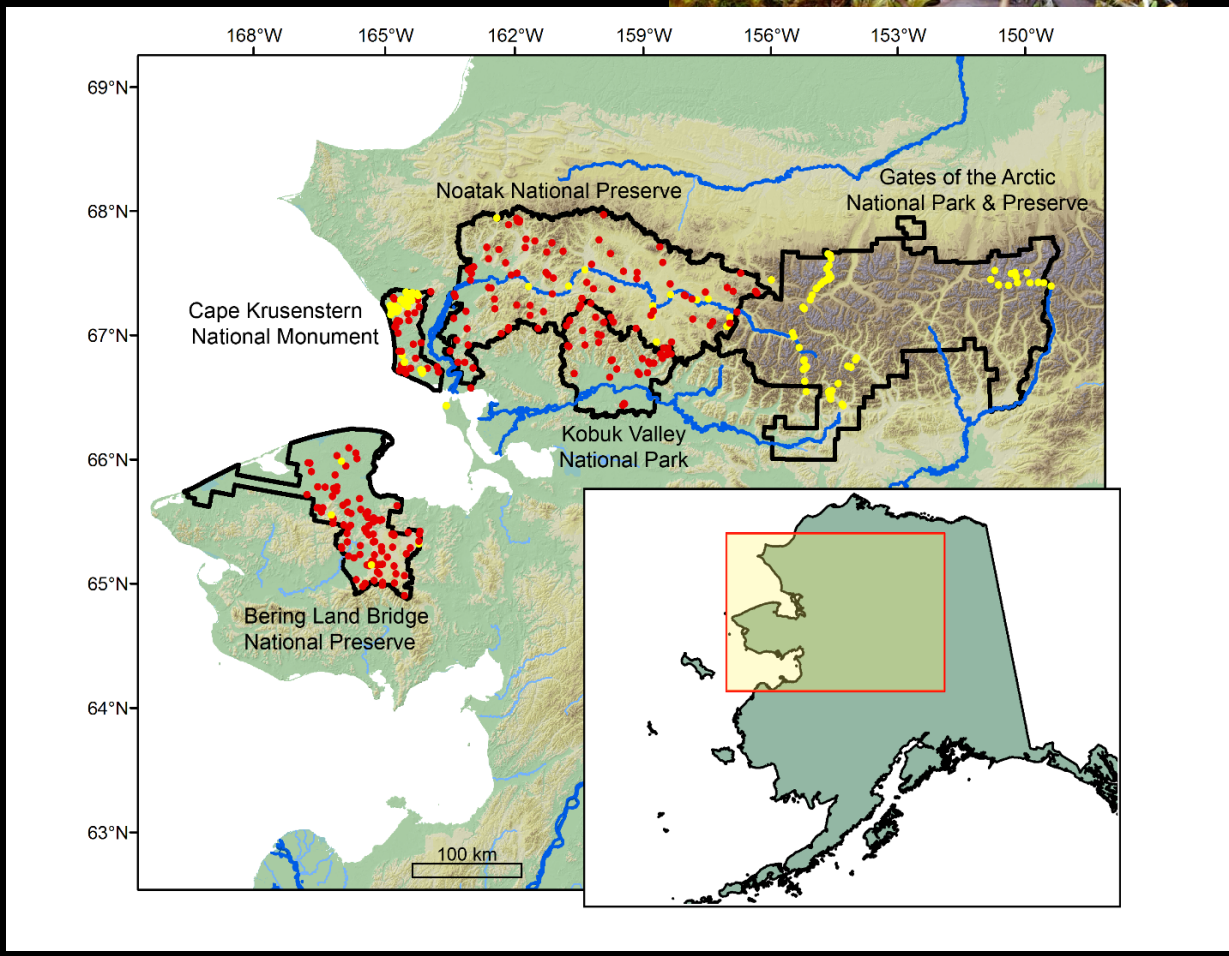


Shrub Increase Probabilities

Swanson DK (2015) Environmental Limits of Tall Shrubs in Alaska's Arctic National Parks. PLoS ONE 10(9): e0138387. doi: 10.1371/journal

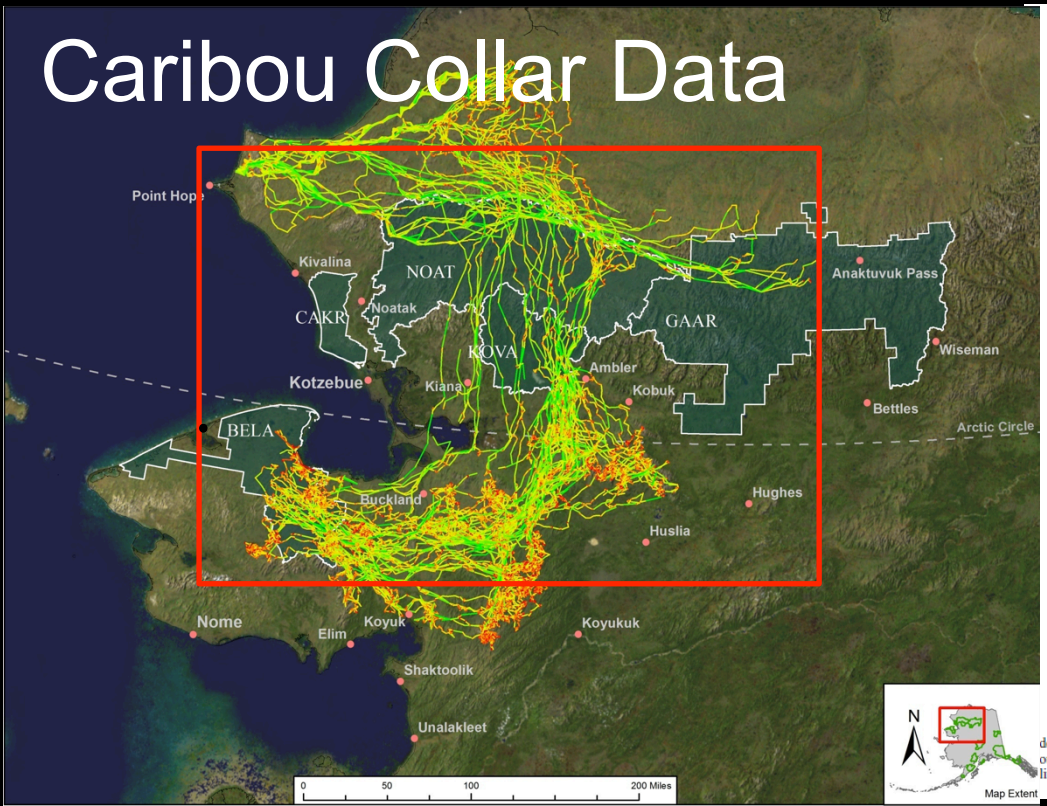
Lichen Plots in ARCN

- 330 large diversity plots
- 200 4x8m point count plots
- ~400 vegetation structure plots
- 18 grazing exclosures
- Stratified-random designs



Caribou

- Winter Range and CC/Shrub Increase
- Fire and Lichens
- Population Decline



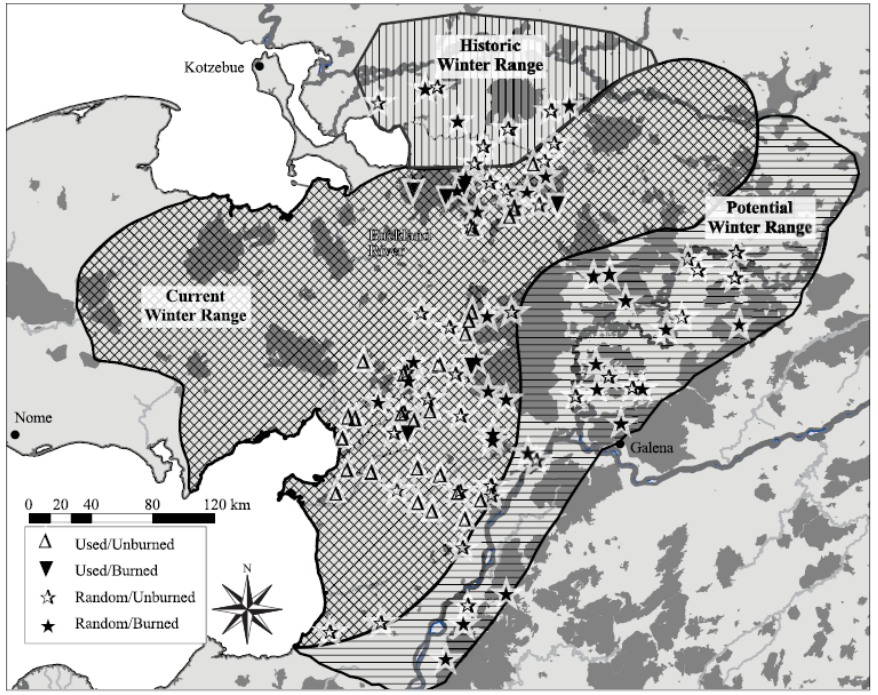


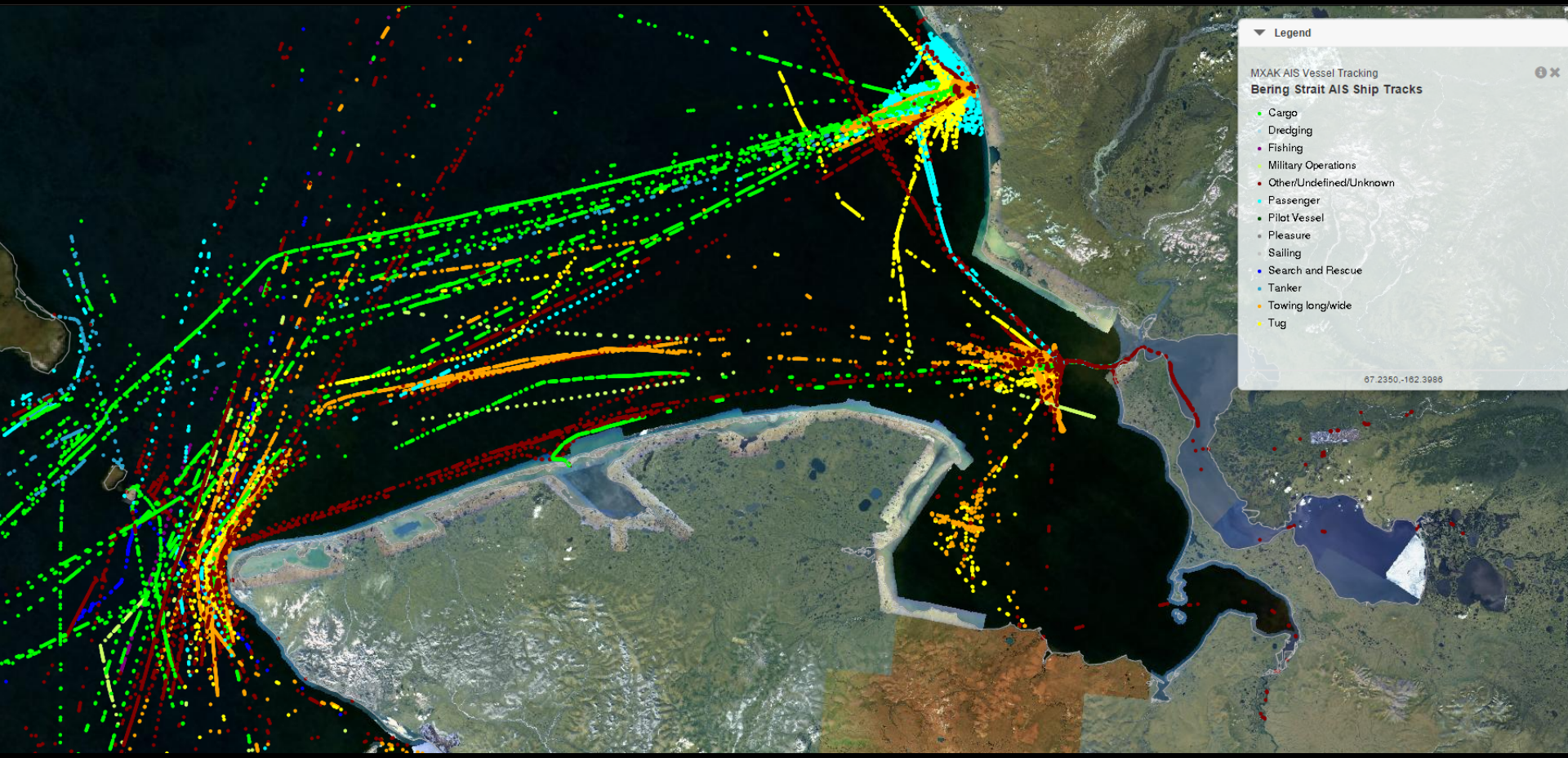
FIGURE 2. Study plot locations and winter ranges of the Western Arctic Caribou Herd, northwest Alaska, 2008. Plots designated as "Used" were determined by satellite telemetry locations of collared caribou. Plots designated as "Burned" did so recently (< 58 y). The darkly shaded polygons are the outlines of these recent burns (courtesy of the Alaska Fire Service). The current winter range is hatched, the historic winter range is identified by vertical lines, and a potential winter range (an area examined to see if caribou might expand their winter range there in the future) is identified by horizontal lines.

Northern Sea Route
Northwest Passage
Transpolar Route
Canadian Shipping Routes

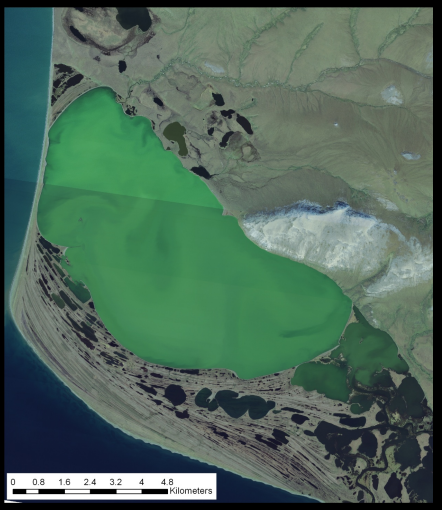
0 500 1,000 2,000 Miles

NOAA National Centers for Environmental Information (NCEI); International Bathymetric Chart of the Arctic Ocean (IBCAO); General Bathymetric Chart of the Oceans (GEBCO), Sources: Esri, GEBCO, NOAA, National Geographic, DeLorme, HERE, Geonames.org, and other contributors

Vessel Traffic Adjacent to the Arctic Parks



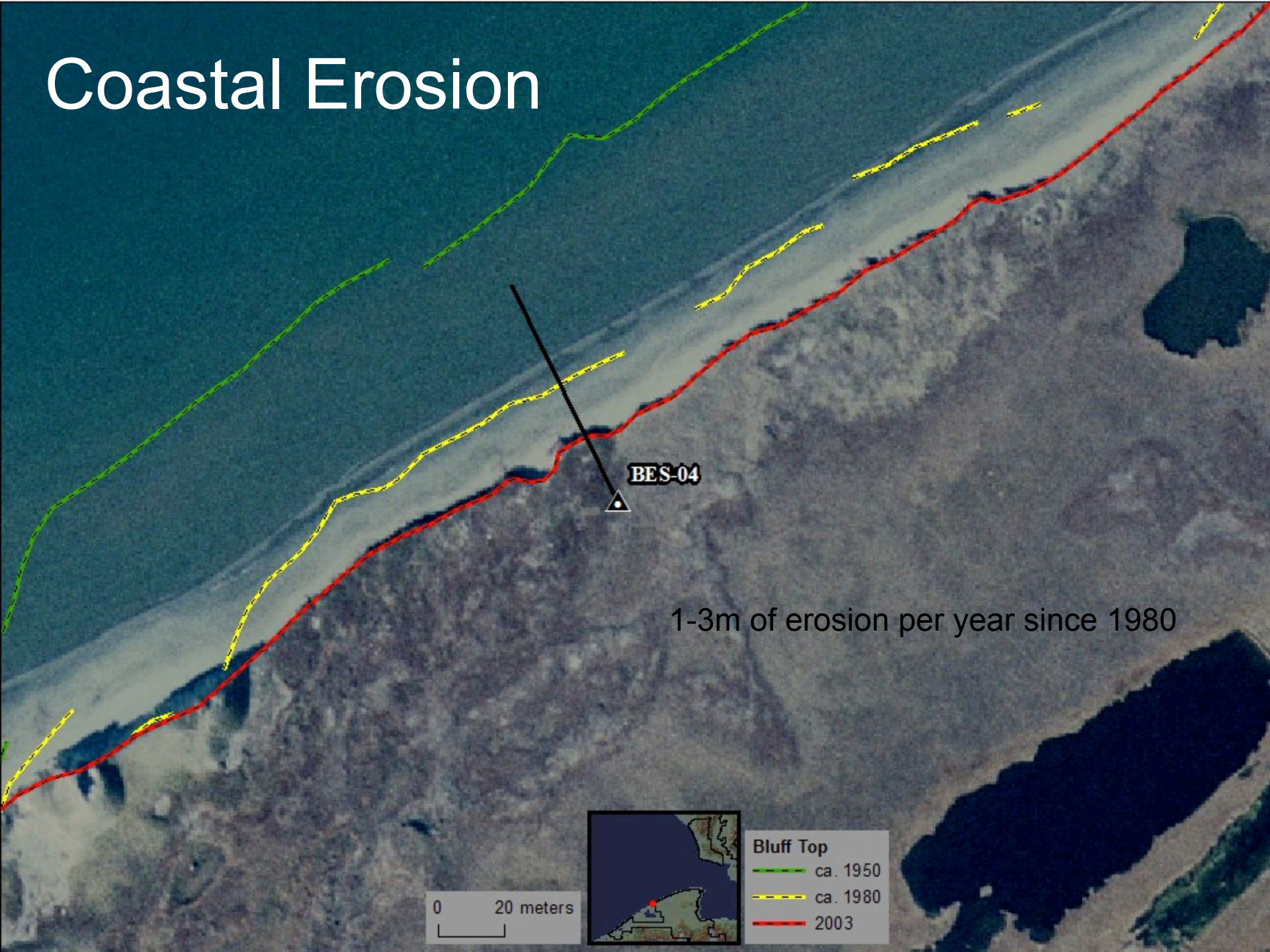
Lagoons

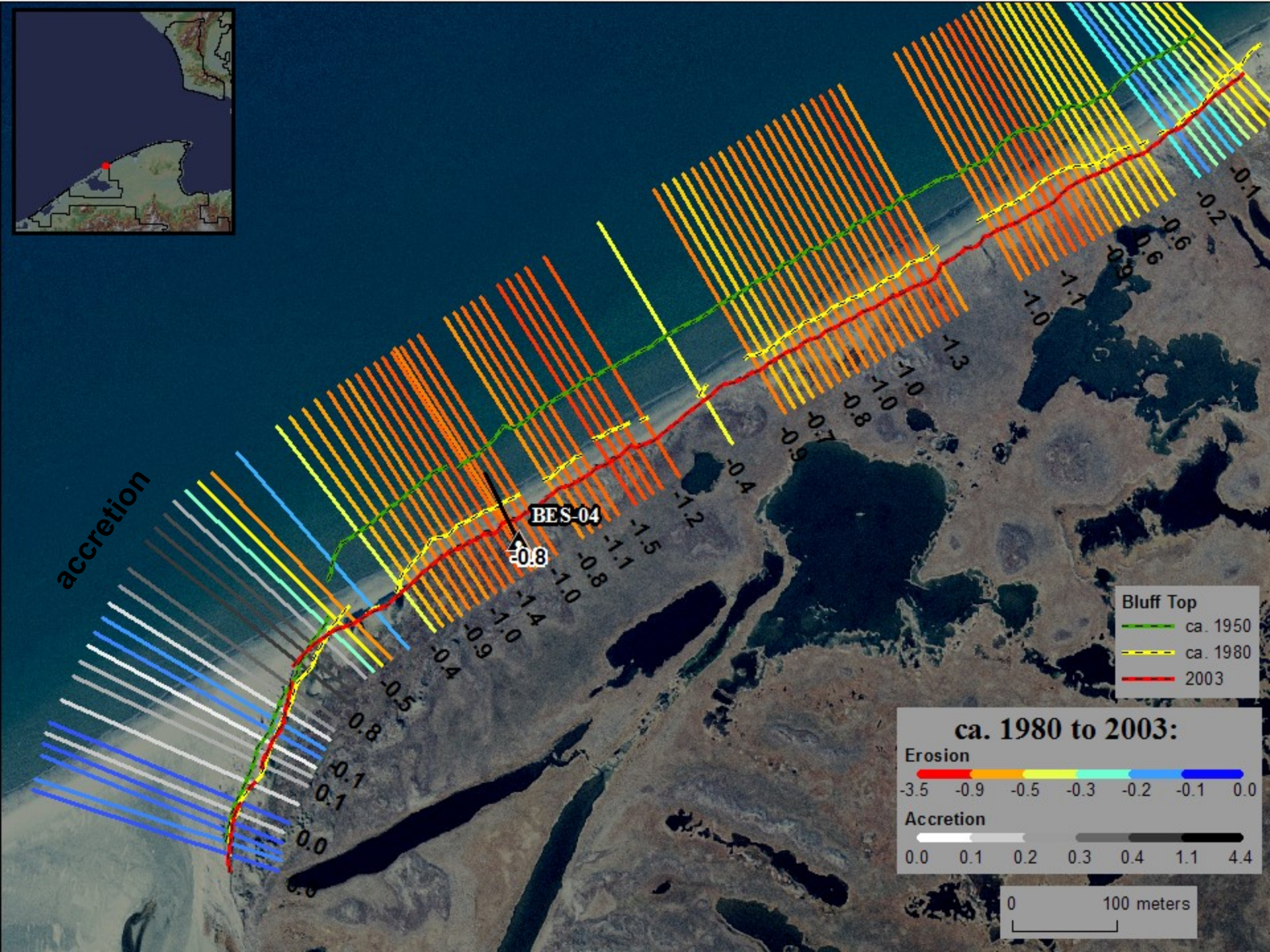


Yellow-billed Loons

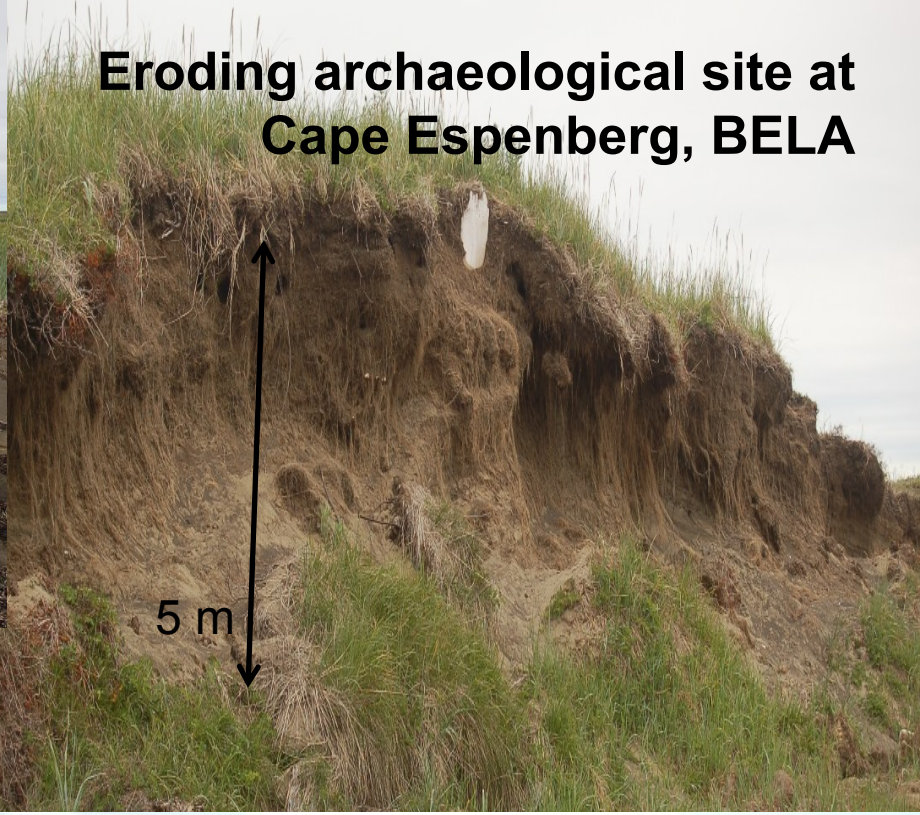
- One of 10 rarest breeding birds of the U.S.
- Global population ~16,650-21,000
- 20-25% of global population lives seasonally in Alaska (summer breeding population < 5000)

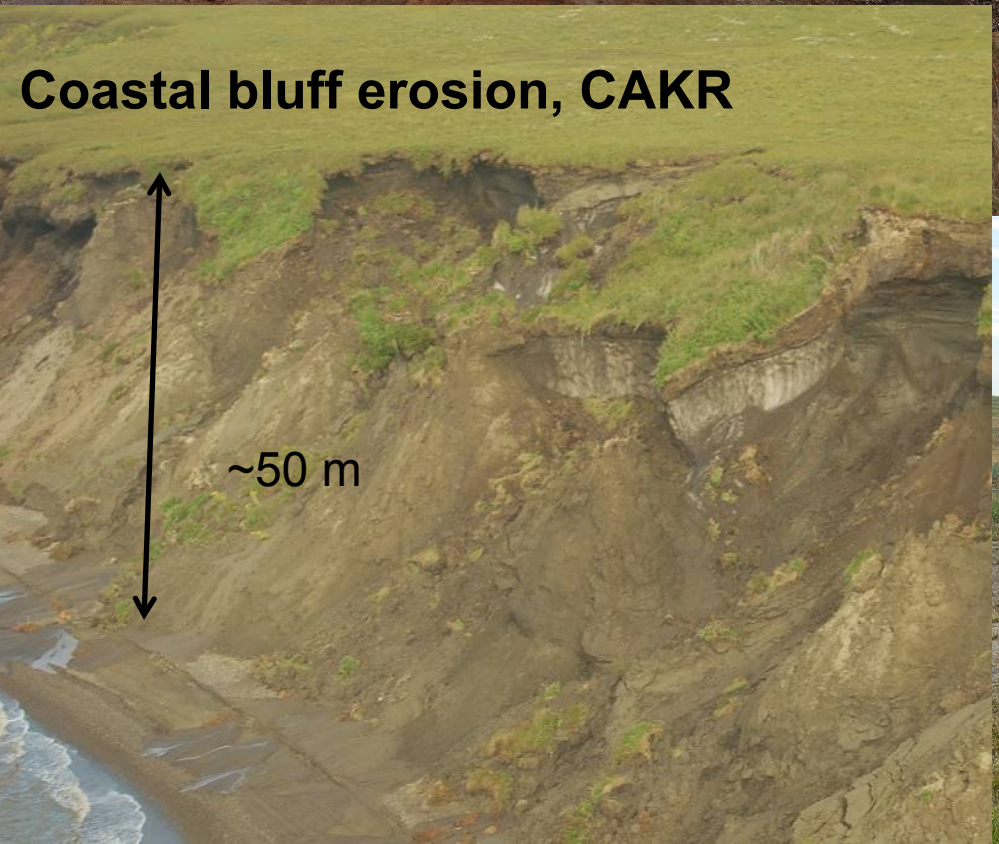
Coastal Erosion




accretion
BES-04
-0.8
Bluff Top
ca. 1950
ca. 1980
2003
ca. 1980 to 2003:
Erosion
-3.5 -0.9 -0.5 -0.3 -0.2 -0.1 0.0
Accretion
0.0 0.1 0.2 0.3 0.4 1.1 4.4
0 100 meters


Eroding peat,
Cape Espenberg, BELA

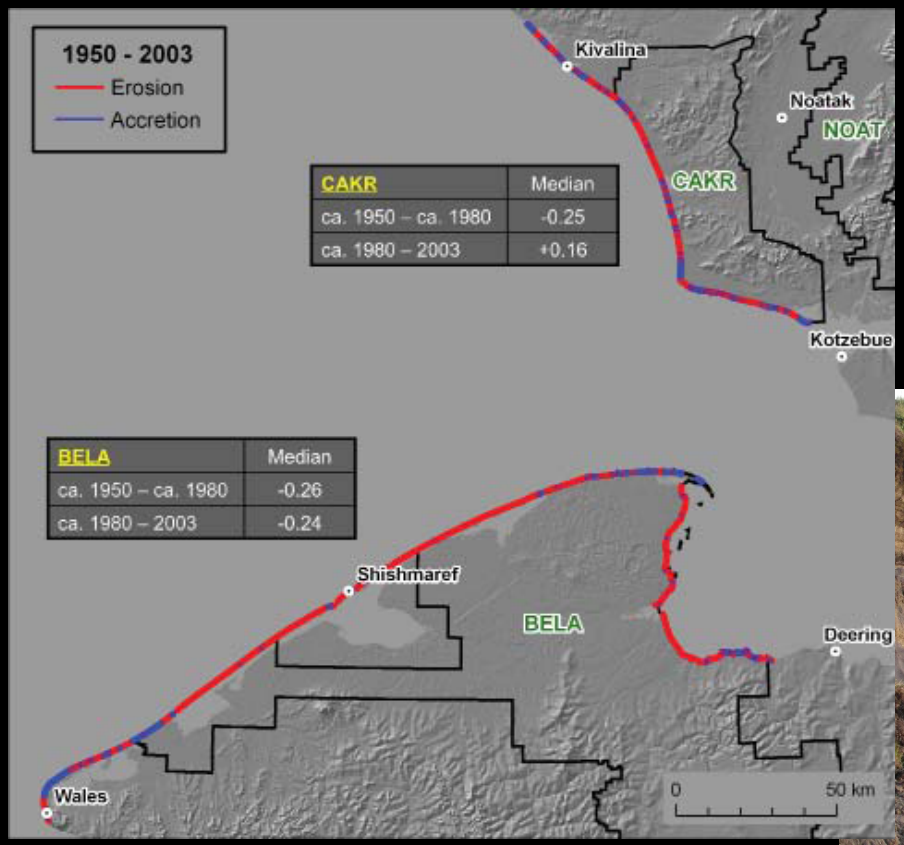

Eroding archaeological site at
Cape Espenberg, BELA
5 m


Coastal bluff erosion, CAKR
~50 m


Gravel bar accretion at CAKR

Erosion/Accretion

in Bering Land Bridge NP and Cape Krusenstern NM



CAKR	Median
ca. 1950 – ca. 1980	-0.25
ca. 1980 – 2003	+0.16

BELA	Median
ca. 1950 – ca. 1980	-0.26
ca. 1980 – 2003	-0.24

Mean Erosion : ~0.5m/yr

Erosion and *Yedoma*

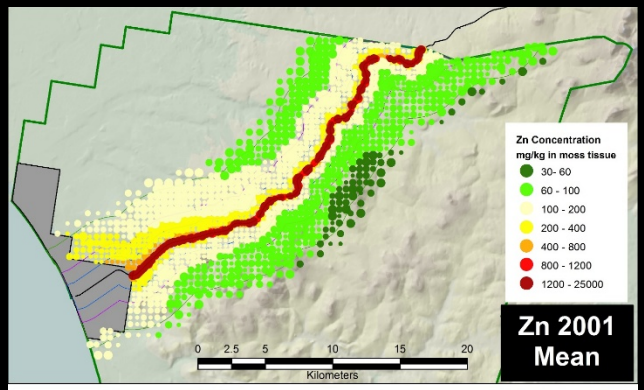
Using Mosses and Lichens to Detect Contaminant Deposition and Ecological Change in Alaska's Parklands

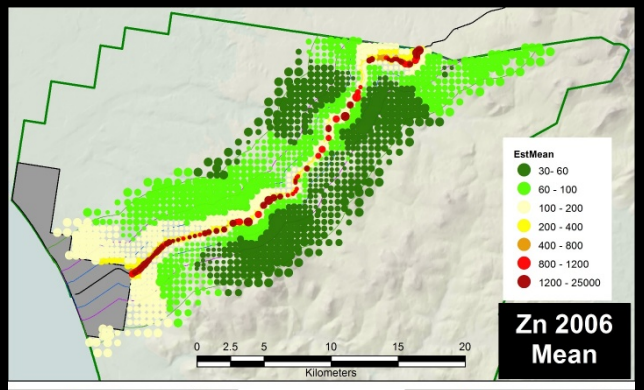
- Monitor spatial patterns and levels of pollutants
- Monitor sensitive terrestrial communities for impacts

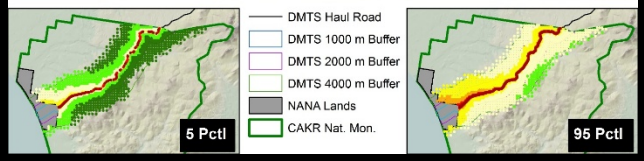
Goals

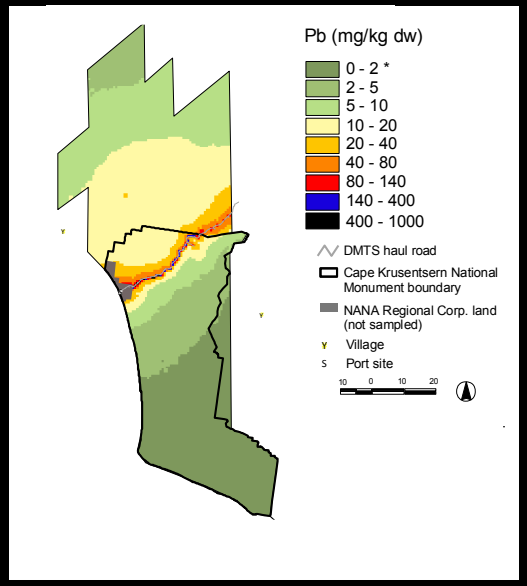
- Link tissue to deposition
- Critical loads

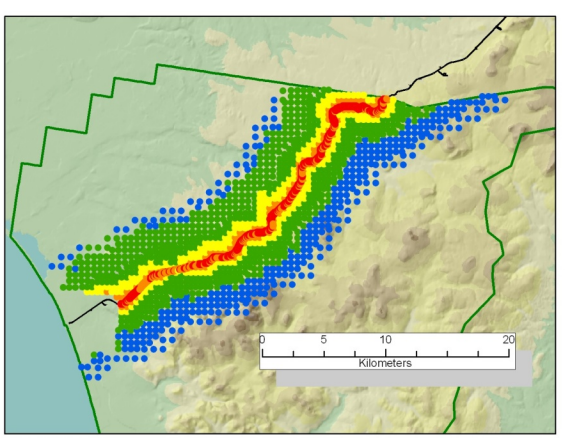
Contaminants and Vegetation along Red Dog Mine Haul Road











Lichen Species Richness

EstMean

- 1-12
- 13-22
- 23-30
- 31-45
- 46-58

Red Dog Road

Monument Outline- CAKR

Questions or information?

- **Weather and Climate – Pam Sousanes**
- **Wet and Dry Deposition – Peter Neitlich**
- **Snow and Ice – Pam Sousanes**
- **Coastal Erosion – Dave Swanson**
- **Air Contaminants – Jim Lawler**
- **Permafrost – Dave Swanson**
- **Lagoon communities – Tahzay Jones**
- **Lake Communites – Amy Larsen, Jon O'Donnel**
- **Landbirds – Jeremy Mizel**
- **Brown Bears – Hillary Robison**
- **Caribou – Kyle Joly**
- **Dall's sheep – Kumi Rattenbury**
- **Muskox – Jim Lawler**
- **Vegetation – Dave Swanson, Peter Neitlich**
- **Fire effects and Severity – Jennifer Barnes**
- **Landscape Patterns and Dynamics – Dave Swanson**
- **Yellow-billed Loons – Mel Flamme**

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http://science.nature.nps.gov/im/units/arcn

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