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.
Bering Land Bridge National Park and Preserve
Cape Krusenstern National Monument
Noatak National Preserve
Kobuk Valley National Park
Gates of the Arctic National Park & Preserve

Arctic Parks
Areas of research and monitoring

- Biological Elements
  - Brown Bears
  - Caribou
  - Dall’s Sheep
  - Landbirds
  - Landbirds
  - Muskox
  - Yellow-billed Loons
  - Terrestrial Vegetation

- Water
  - Coastal Lagoons
  - Streams and Large Lakes
  - Shallow Lakes

- Ecosystem Processes
  - Fire Extent and Severity
  - Terrestrial Landscape Dynamics

- Geology and Soils
  - Coastal Erosion
  - Permafrost

- Air and Climate
  - Air Quality
  - Climate and Weather
  - Snowpack
  - Wet and Dry Deposition
Vegetation and Habitat Change

Nimiuktuk River in NOAT

1950

2003

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

Courtesy Ken Tape
Ecotype Map of the Arctic Network

The classification of local-ecosystems (ecotypes) combines physiography (e.g., rivers, lakes, coastal topography), geology and vegetation from the landcover spectrally derived from the satellite image processing. These layers are used to model ecotypes in a way that best partitions geology, hydrology, pedology, and vegetation characteristics. Map projection: Albers Alaska, NAD 83, meters.

Ecotype Class

- Upland White Spruce Forest
- Upland Sandy Barrens
- Upland White Spruce-Lichen Woodland
- Lowland Sedge-Dwarf Shrub
- Alpine Tundra
- Upland Willow Low Shrub
- Upland Birch-Crataegus-Willow Low Shrub
- Upland Willow-Crataegus Shrub
- Upland Willow-Crataegus-Willow High Shrub
- Lowland Black Spruce Forest
- Lowland Lakes
- Lowland Willow Low Shrub
- Lowland Willow High Shrub
- Lowland Alder Low Shrub
- Riverine Alder or Willow Tall Shrub
- Riverine Poplar Forest
- Riverine White Spruce-White Spruce-Poplar Forest
- Riverine White Spruce-Willow Forest
- Riverine Willow Wetland
- Riverine Willow Wetland
- Coastal Barrens
- Coastal Peatland-Growth
- Coastal Sagebrush-Shrub
- Coastal Sagebrush-Grass Meadow
- Coastal Sagebrush-Grass High Shrub
- Coastal Willow Wetland
- Coastal Willow Wetland
- Snow
- Shadow/Determinate
- Human Modified Barrens

Figure 20

Landcover Map
Arctic Park Network

View location map to left
Approximate scale = 1:1,600,000
Landcover

- Forest
- Alpine/Barrens/ Dwarf Shrub-Lichen
- Dwarf Birch Tussock Shrub Tundra
- Wetlands
- Dunes
- Shrub Thickets
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.

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

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
Species with $\geq +5\%$ (increase) or $\leq -5\%$ (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
Biggest Habitat Gainers

**Birds**
- Red-Tailed Hawk
- Sharp-Shinned Hawk
- Northern Goshawk
- **Spruce and Ruffed 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

Habitats:
- Low shrub, dwarf shrub
- Herbaceous, grassland
- Freshwater
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
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

1-3m of erosion per year since 1980
Coastal bluff erosion, CAKR

Eroding archaeological site at Cape Espenberg, BELA

Eroding peat, Cape Espenberg, BELA

Gravel bar accretion at CAKR

Coastal bluff erosion, CAKR

Eroding archaeological site at Cape Espenberg, BELA

Gravel bar accretion at CAKR

~50 m
Erosion/Accretion
in Bering Land Bridge NP and Cape Krusenstern NM

Mean Erosion: ~0.5m/yr

Erosion and Yedoma
Using Mosses and Lichens to Detect Contaminant Deposition and Ecological Change in Alaska’s Parklands

Goals
- Link tissue to deposition
- Critical loads

- Monitor spatial patterns and levels of pollutants
- Monitor sensitive terrestrial communities for impacts
Contaminants and Vegetation along Red Dog Mine Haul Road

Lichen Species Richness

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

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