Inventory and Monitoring in Alaska National Parks and Wildlife Refuges

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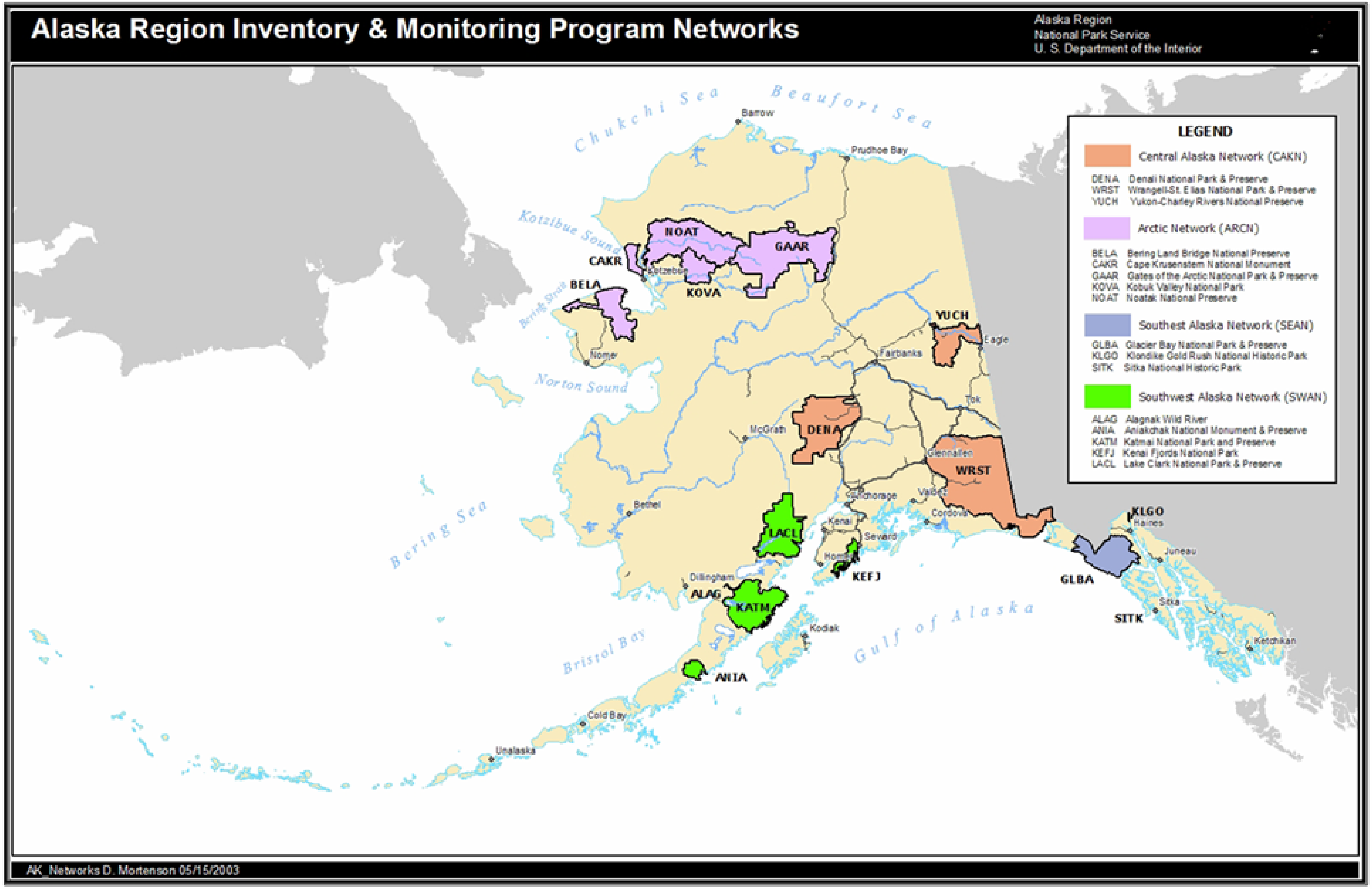
NPS Inventory . . .

Provide baseline information about park natural resources, including species diversity, distribution and abundance.

. . . and Monitoring

Determine the current condition of resources and how they change over time (*Monitoring Vital Signs*).


Alaska Region Inventory & Monitoring Program Networks
Alaska Region
National Park Service
U. S. Department of the Interior
Chukchi Sea
Beaufort Sea
Barrow
Prudhoe Bay
Kotzebue Sound
Bering Strait
Norton Sound
Bering Sea
Bristol Bay
Gulf of Alaska
NOAT
GAAR
CAKR
BELA
KOVA
Kotzebue
YUCH
Eagle
Fairbanks
Nome
Tok
McGrath
DENA
Glennallen
WRST
Valdez
Anchorage
Bethel
Kenai
Cordova
Seward
LACL
Homer
KEFJ
KLGO
Haines
Juneau
GLBA
Dillingham
ALAG
KATM
Kodiak
SITK
Sitka
Ketchikan
ANIA
Cold Bay
Unalaska
LEGEND
Central Alaska Network (CAKN)
DENA Denali National Park & Preserve
WRST Wrangell-St. Elias National Park & Preserve
YUCH Yukon-Charley Rivers National Preserve
Arctic Network (ARCN)
BELA Bering Land Bridge National Preserve
CAKR Cape Krusenstern National Monument
GAAR Gates of the Arctic National Park & Preserve
KOVA Kobuk Valley National Park
NOAT Noatak National Preserve
Southest Alaska Network (SEAN)
GLBA Glacier Bay National Park & Preserve
KLGO Klondike Gold Rush National Historic Park
SITK Sitka National Historic Park
Southwest Alaska Network (SWAN)
ALAG Alagnak Wild River
ANIA Aniakchak National Monument & Preserve
KATM Katmai National Park and Preserve
KEFJ Kenai Fjords National Park
LACL Lake Clark National Park & Preserve
AK_Networks D. Mortenson 05/15/2003

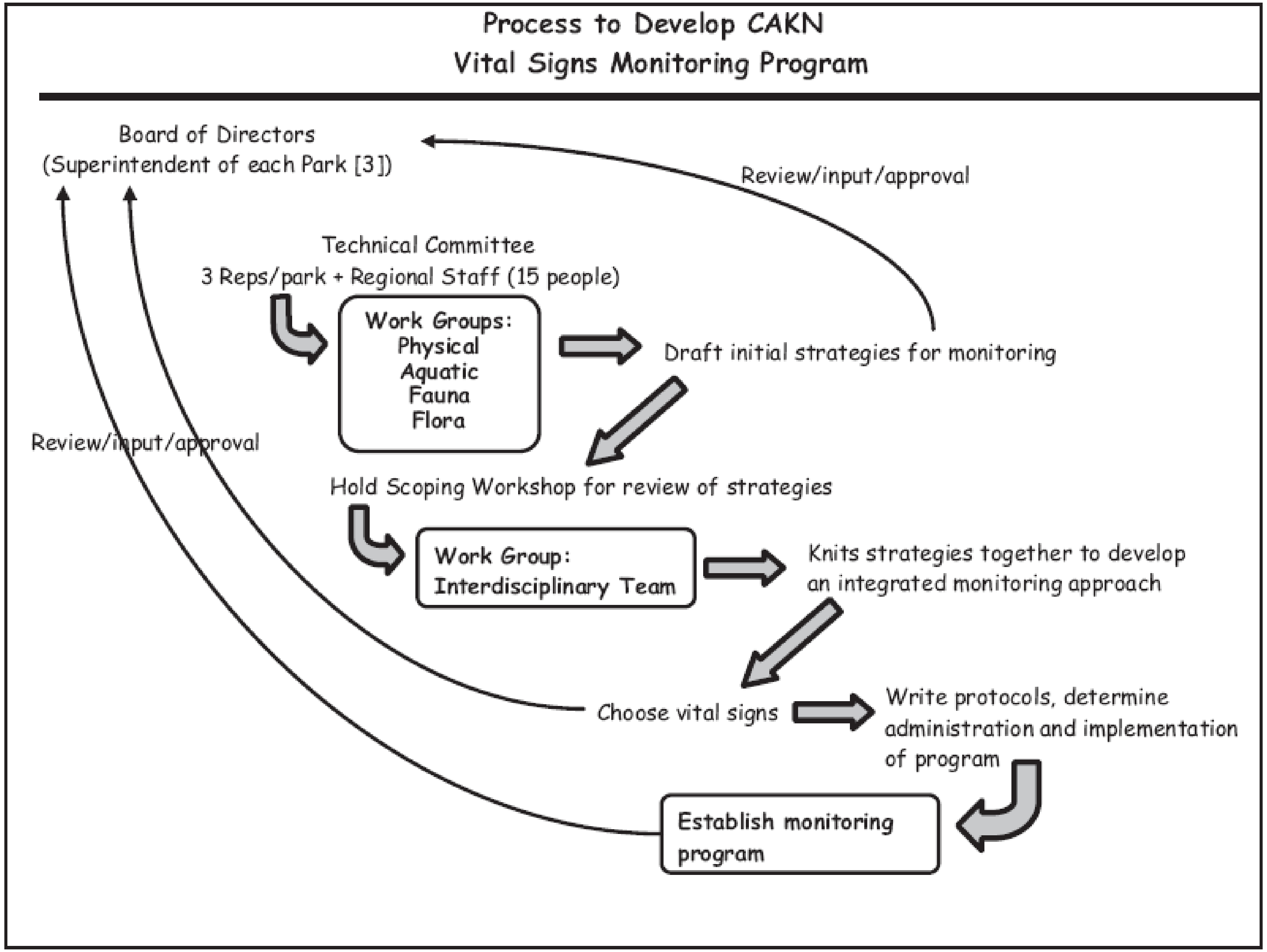


Fig. 1-6. Program development for the CAKN 2001–2004

Vital Signs of Alaska's Inventory and Monitoring Networks

Arctic Network

Wet and Dry Deposition
Air Contaminants
Climate and Weather
Snow and Ice
Coastal Erosion
Sea Ice
Permafrost
Surface Water Dynamics
Lagoon Communities
Lake Communities
Stream Communities
Invasive Species
Fish Assemblages
Bird Assemblages
Brown Bear
Caribou
Sheep
Moose
Musk Ox
Small Mammals
Vegetation
Point Source Human Effects
Consumptive Use
Visitor Use
Fire Extent and Severity
Landscape Dynamics

Central Alaska Network

Air Quality
Weather and Climate
Snowpack
Glaciers
Volcanoes and Tectonics
Permafrost
Surface Water Dynamics
Water Quality
Macroinvertebrates
Invasive Species
Insect Damage
Freshwater Fish
Passerines
Bald Eagles
Golden Eagles
Peregrine Falcons
Ptarmigan
Arctic Ground Squirrels
Snowshoe Hare
Small Mammals
Caribou
Moose
Sheep
Wolves
Brown Bear
Vegetation
Subarctic Steppe
Human Populations
Consumptive Use
Visitor Use
Trails
Fire Extent and Severity
Land Cover
Sound
Forage Quality
Phenology

Common Themes:

- Climate Change
- Wildlife Populations
- Contaminants
- Water Quality

Southwest Alaska Network

Visibilty and Particulate Matter
Weather and Climate
Glaciers
Coastal Change
Volcanoes and Tectonics
Surface Water Dynamics
Marine Water Chemistry
Freshwater Chemistry
Invasive Species
Insect Damage
Kelp and Eelgrass
Intertidal Invertebrates
Resident Lake Fish
Salmon
Black Oystercatcher
Bald Eagle
Seabirds
Brown Bear
Wolf
Moose
Caribou
Sea Otter
Harbor Seal
Vegetation
Sensitive Vegetation
Communities
Consumptive Use
Visitor Use
Land Cover
Landscape Dynamics

Southeast Alaska Network

Visibility and Particulate Matter
Air Contaminants
Weather and Climate
Glaciers
Surface Hydrology
Oceanography
Macroinvertebrates
Freshwater Contaminants
Water Quality
Invasive Species
Insect Damage
Visitor Use
Airborne Sound
Underwater Sound
Land Cover
Phenology
Bald Eagles
Bears
Biodiversity
Landbirds
Forage Fishes
Harbor Seals
Intertidal Invertebrates
Killer Whales
Marine Predators
Kittlitz's Murrelets
Salmon
Ungulates
Western Toads
Wetlands
Humpback Whales
Steller Sea Lions
Vegetation
Consumptive Use

Goals of the NPS I&M Program

1. **Inventory** the natural resources to determine current condition.

2. **Monitor** park ecosystems to determine status and trend in condition.

3. Establish natural resource inventory and monitoring as a **standard practice** throughout the National Park system that transcends traditional program, activity, and funding boundaries.

4. **Integrate** natural resource inventory and monitoring information into NPS planning, management, and decision making.

5. Share NPS information and products with other natural resource organizations and form **partnerships** for attaining common goals and objectives.

One Vital Sign example

Protocol

National Park Service
U.S. Department of the Interior

Natural Resource Program Center

Protocol Narrative for Marine Nearshore Ecosystem Monitoring - DRAFT

Southwest Alaska Network

Natural Resource Report NPS/SWAN/NRR—2009/XXX

Annual Reports/ Peer Reviewed publications

Nearshore Marine Vital Signs Monitoring

Bodkin 2007 SWAN Nearshore Monitoring Annual Report
31 March 2008

Nearshore Marine Vital Signs Monitoring in the Southwest Alaska Network of National Parks

National Park Service
U.S. Department of the Interior

Natural Resource Program Center

Nearshore Marine Vital Signs Monitoring in the Southwest Alaska Network of National Parks

Natural Resource Technical Report NPS/SWAN/NRTR—2009/252

Resource Briefs

Southwest Alaska Network Inventory & Monitoring Program | National Park Service U.S. Department of the Interior
Alagnak Aniakchak Katmai Kenai Fjords Lake Clark

Marine Intertidal Invertebrates *Resource Brief*

Southwest Alaska Network Inventory & Monitoring Program | National Park Service U.S. Department of the Interior
Alagnak Aniakchak Katmai Kenai Fjords Lake Clark

Black Oystercatcher *Resource Brief*

Southwest Alaska Network Inventory & Monitoring Program | National Park Service U.S. Department of the Interior
Alagnak Aniakchak Katmai Kenai Fjords Lake Clark

Kelp and Eelgrass *Resource Brief*

Southwest Alaska Network Inventory & Monitoring Program | National Park Service U.S. Department of the Interior
Alagnak Aniakchak Katmai Kenai Fjords Lake Clark

Marine Birds *Resource Brief*

Southwest Alaska Network Inventory & Monitoring Program | National Park Service U.S. Department of the Interior
Alagnak Aniakchak Katmai Kenai Fjords Lake Clark

Sea Otter *Resource Brief*

Importance

Sea otters are a "keystone" species that can dramatically affect the structure and complexity of their nearshore environment. Sea otters prey on sea urchins ('grazers') that feed on kelp resulting in top-down cascading effects on the nearshore community structure. Heavy predation on sea urchins greatly alters the abundance and composition of lower trophic levels (e.g., kelps). Also, sea otters tend to have smaller home ranges in comparison to other marine mammal; require high caloric intake, have an incidence of disease that is correlated with contaminants; and have broad appeal to the public, which make them a prime species for monitoring. In September 2005, the Southwestern Alaska stock of sea otters, which includes the Katmai NPP (KATM) population, was federally listed as threatened.

USGS-BRD

James Bodkin, USGS, observes foraging sea otters (KEFJ, 2007)

Long-term Monitoring

Sea otter monitoring was initiated in 2006 and 2007, respectively, in KATM and Kenai Fjords NP (KEFJ). Aerial surveys (conducted every 3 years) are used to estimate abundance. Data are collected on foraging sea otters to estimate prey size distribution, species composition and energy recovery. To supplement these direct observations, prey remains are collected from sea otter spraint found at haul out sites. In addition, sea otter carcass surveys are completed annually. A tooth is extracted from collected skulls to determine the age of the sea otter. This information is used to develop age-specific survival

Discussion

There were an estimated 1,511 sea otters (Table 1) in KEFJ (2007) and 7,095sea otters in KATM (2008). Preliminary results of foraging observations illustrate differences in sea otter selection of prey species between the two parks. Mussels are the predominate prey item in KEFJ, whereas clams are the predominate prey in KATM. In 2009, we will continue collecting sea otter foraging and carcass data in both KATM and KEFJ.

Sea otters

Alaska Refuge Inventory and Monitoring

Goals

Decision Support – Provide technical assistance and products to support management decisions

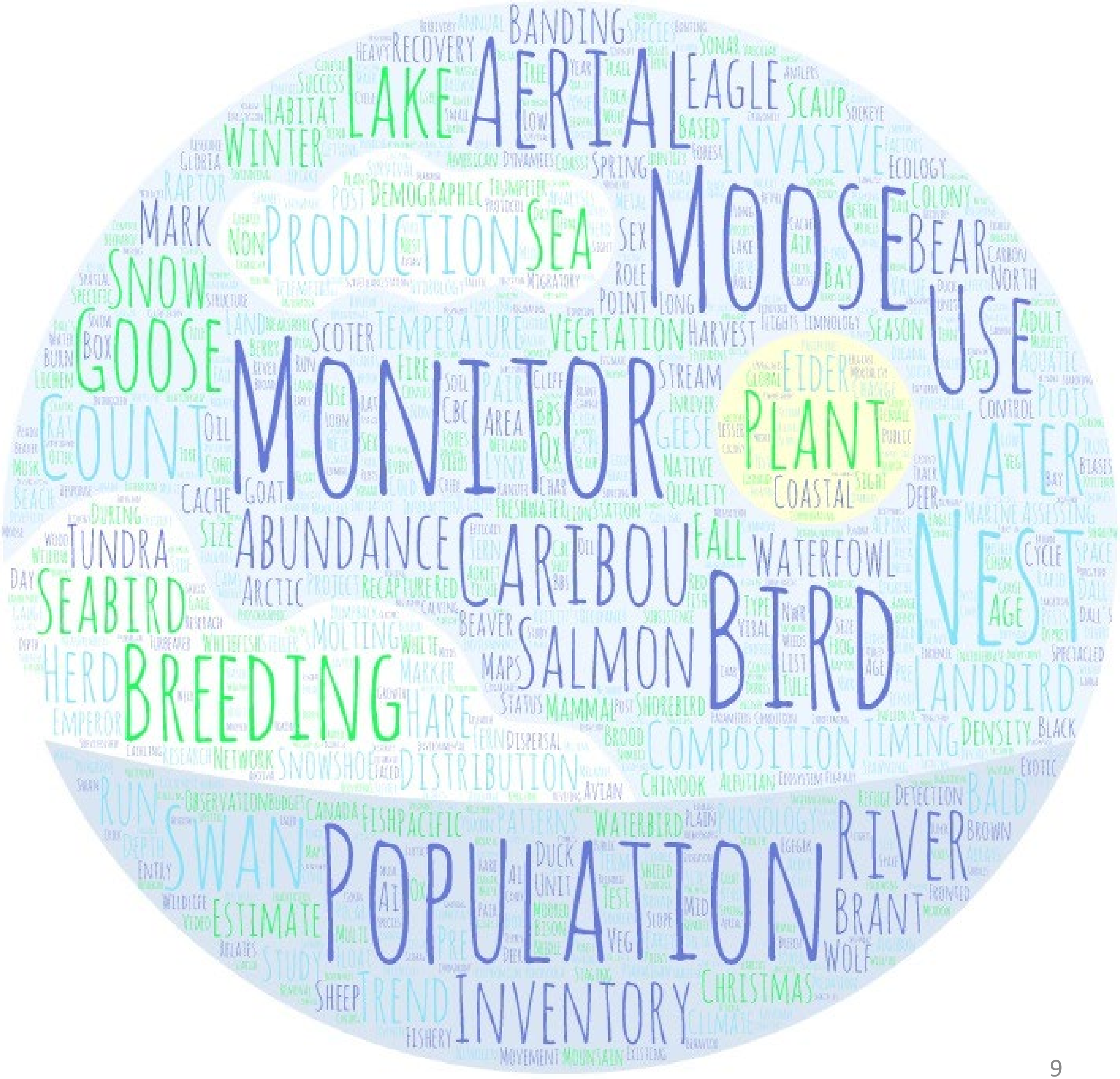
Science Rigor – Ensure scientific rigor and consistency

Data Management – Ensure access to survey information

Project Coordination – Increase efficiency through collaboration

Communication – Transparency, credibility, awareness, and accountability

Refuge Specific Surveys

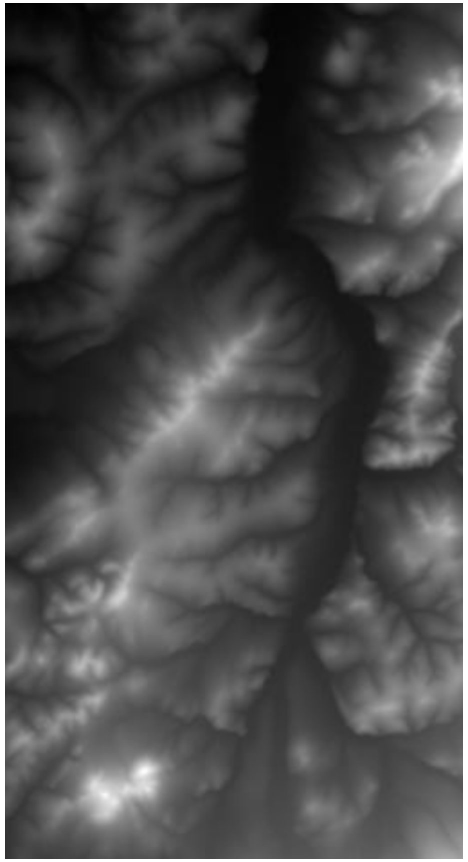


National Wildlife Refuge System

NATIONAL PARK SERVICE

Alaska Refuge Inventory and Monitoring

Baseline data	Inventories	Data Mgmt	Partnerships

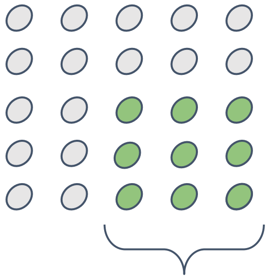


Appendix F. R code used for selection of Arctic PRISM plots using Random Tessellation Stratified procedure on the Yukon Delta Nati 2015-2016.

```
# R version 3.3.3 (2017-03-06)
# This code requires the following packages:
#   spsurvey (ver. 3.3)
#   raster (ver. 2.5-8)
#   RandomFields (ver. 3.1.50)
#   rgdal (ver. 1.2-18)
#   car (ver. 2.1-5)

# Example lines from data file “YK_plots.csv”:
#
#   CELLID Strata_ID      long      lat s.num stratum
#1     874   Upl_Nor -162.1853 63.38202     8 Uplands
#2     875   Upl_Nor -162.1774 63.38246     8 Uplands
#3     876   Upl_Nor -162.1694 63.38289     8 Uplands
#4     877   Upl_Nor -162.1615 63.38333     8 Uplands



library(spsurvey)
library(raster)
library(RandomFields)
#rm(list=setdiff(ls(), c("YKplots.raw")))

YKplots <- read.csv("YK_plots.csv")

##
## Create sp object
##
df0 <- YKplots
# use longlat
coordmat <- data.frame(xc = df0$long, yc = df0$lat)
df <- data.frame(CELLID = df0$CELLID, s.num = df0$s.num, stratum
sp_points <- SpatialPointsDataFrame(coords=coordmat, data=df,
proj4string=CRS("+proj=longlat +datum=NAD83"))

# Clean up
rm(df0, df)

# Example Stratified Design for YKD
Stratdesign <- list(
  "Coast"         = list(panel=c(PanelOne = 18), seltype = "Equa
  "Coast-YD"      = list(panel=c(PanelOne = 35), seltype = "Equa
  "Coastal Plain" = list(panel=c(PanelOne = 96), seltype = "Equa
  "Lowlands"      = list(panel=c(PanelOne = 20), seltype = "Equa
  "Mountains"     = list(panel=c(PanelOne = 10), seltype = "Equa
  "Riverine"      = list(panel=c(PanelOne = 20), seltype = "Equa
  "Tidal"         = list(panel=c(PanelOne = 41), seltype = "Equa
  "Uplands"       = list(panel=c(PanelOne = 60), seltype = "Equa

#set.seed(403)
Stratsites <- grts(design=Stratdesign,
  DesignID = "STRATIFIED",
  type.frame = "finite",
```

Refuge Planning

All ROC



Priority ROCs

Step 1

Priority Resources of Concern

Step 2

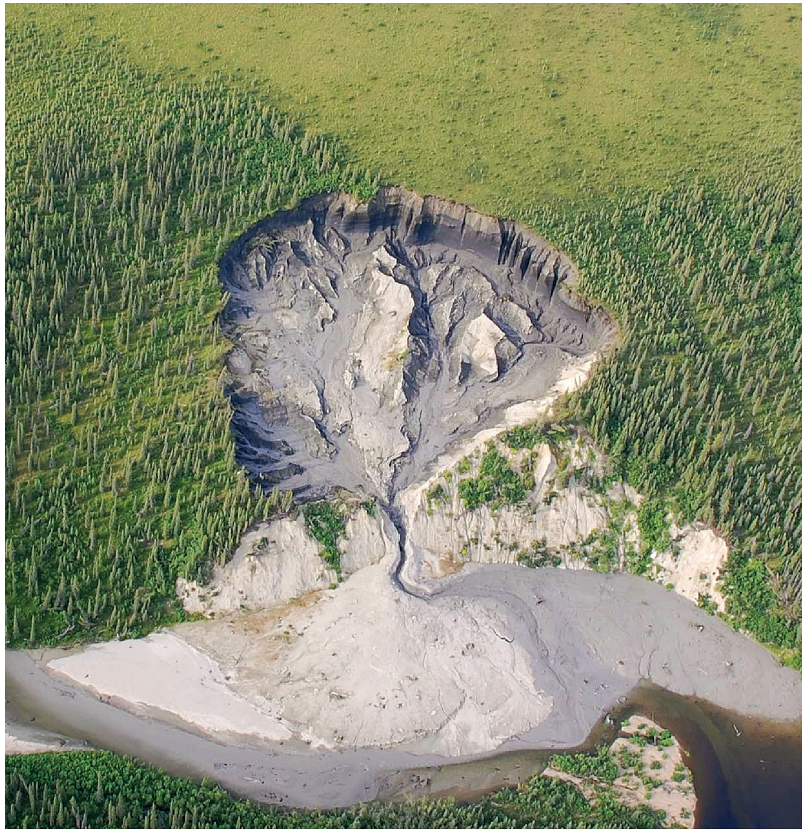
SMART Conservation Objectives

Step 3

Inventory & Monitoring Plan

Step 4

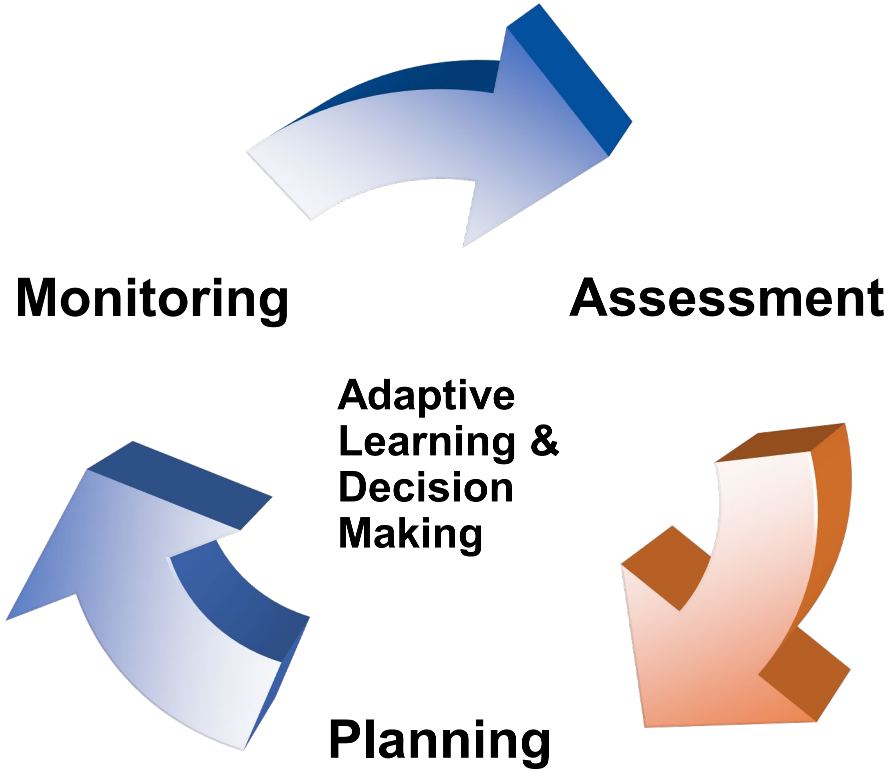
Implement IMP



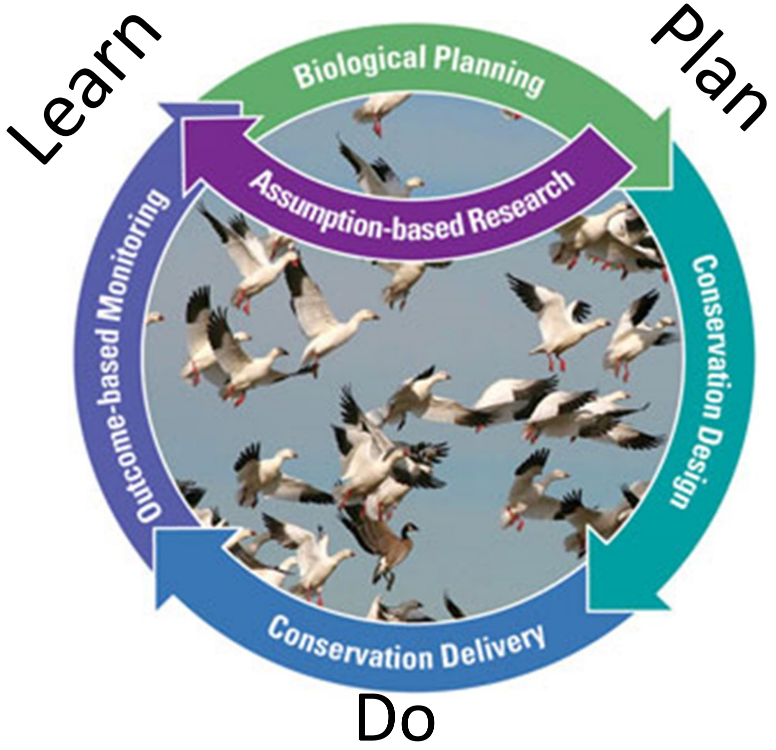
? Resist – Accept – Direct ?

Adaptive Management – Data Life Cycle

NPS



FWS - SHC



Similarities

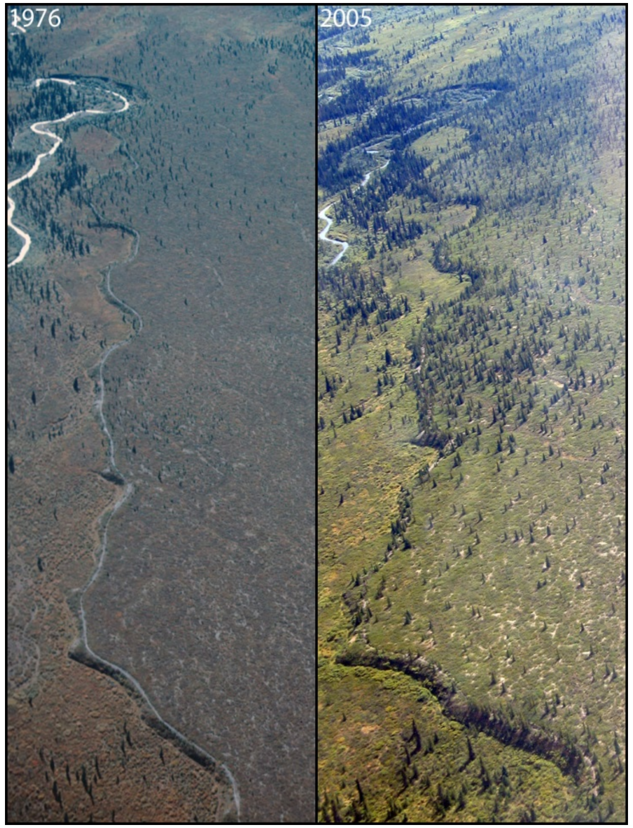
- ANILCA
- Emphasis on protocols
  - Park/Refuge specific
  - Regional
- Regionwide inventories
  - Remotely sensed data – IfSAR for better DEMs
  - Collaboration on land cover mapping (vegetation)
- Planning
  - Park Vital Signs ←→ Key ecological attributes for Refuge ROCs
  - Upfront investment in survey design
- Partnerships
  - Leverage people and programs to do monitoring (USGS, Universities, etc.)
- Accountability - data management and reporting
  - Ensuring full data life cycle

Rapid elevational shifts in Denali's passerine community parallel vegetation change

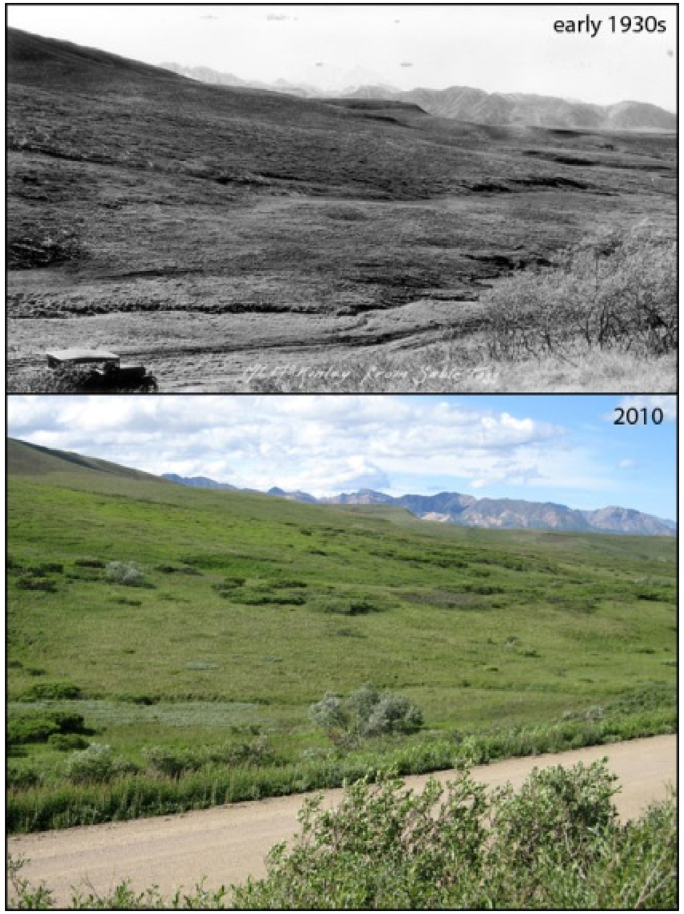
- Jeremy Mizel
- Josh Schmidt
- Carol McIntyre
- Maggie MacCluskie
- Carl Roland

Changes in woody vegetation distribution in Denali

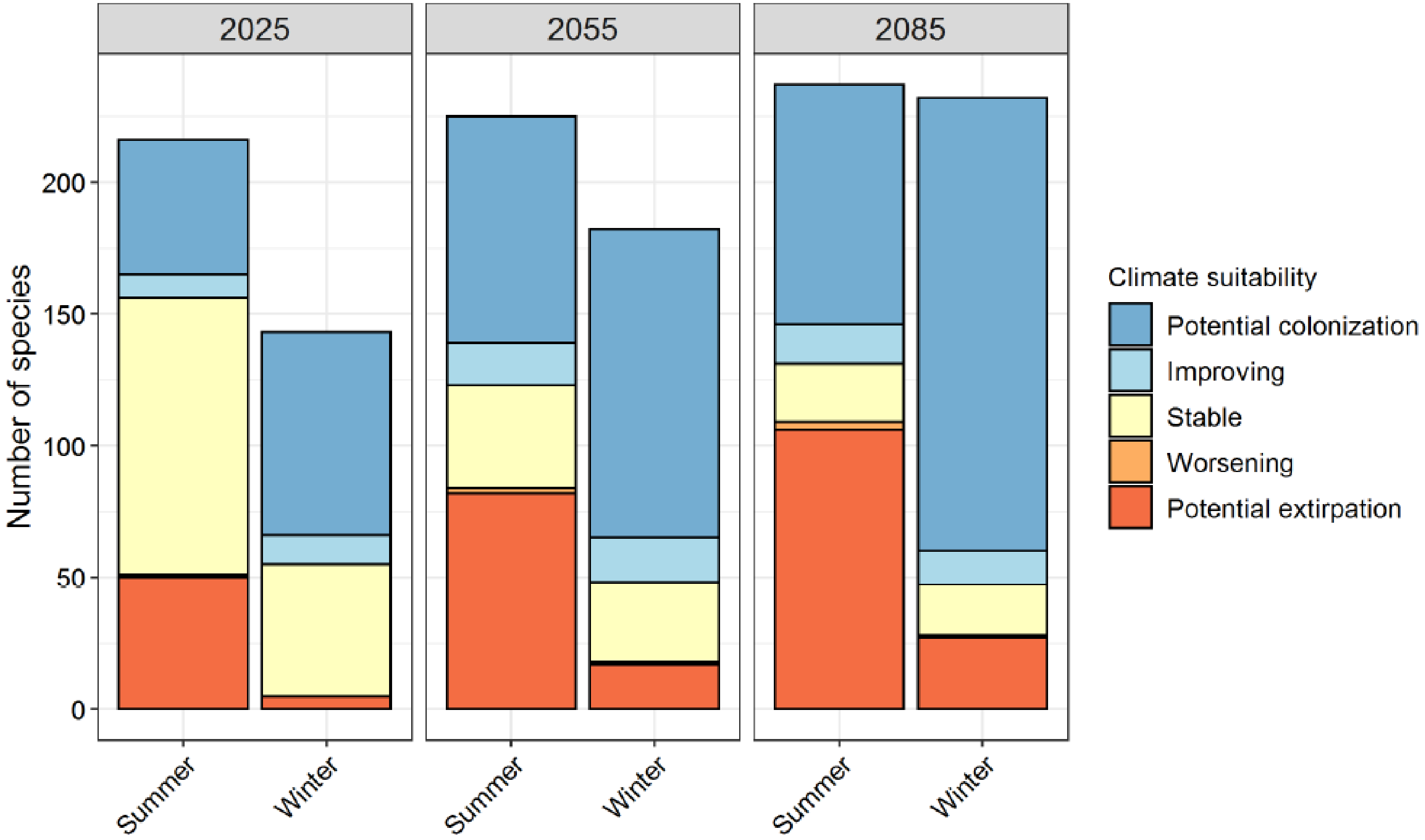
Increasing spruce in subalpine:
1976 (L)/2005 (R)



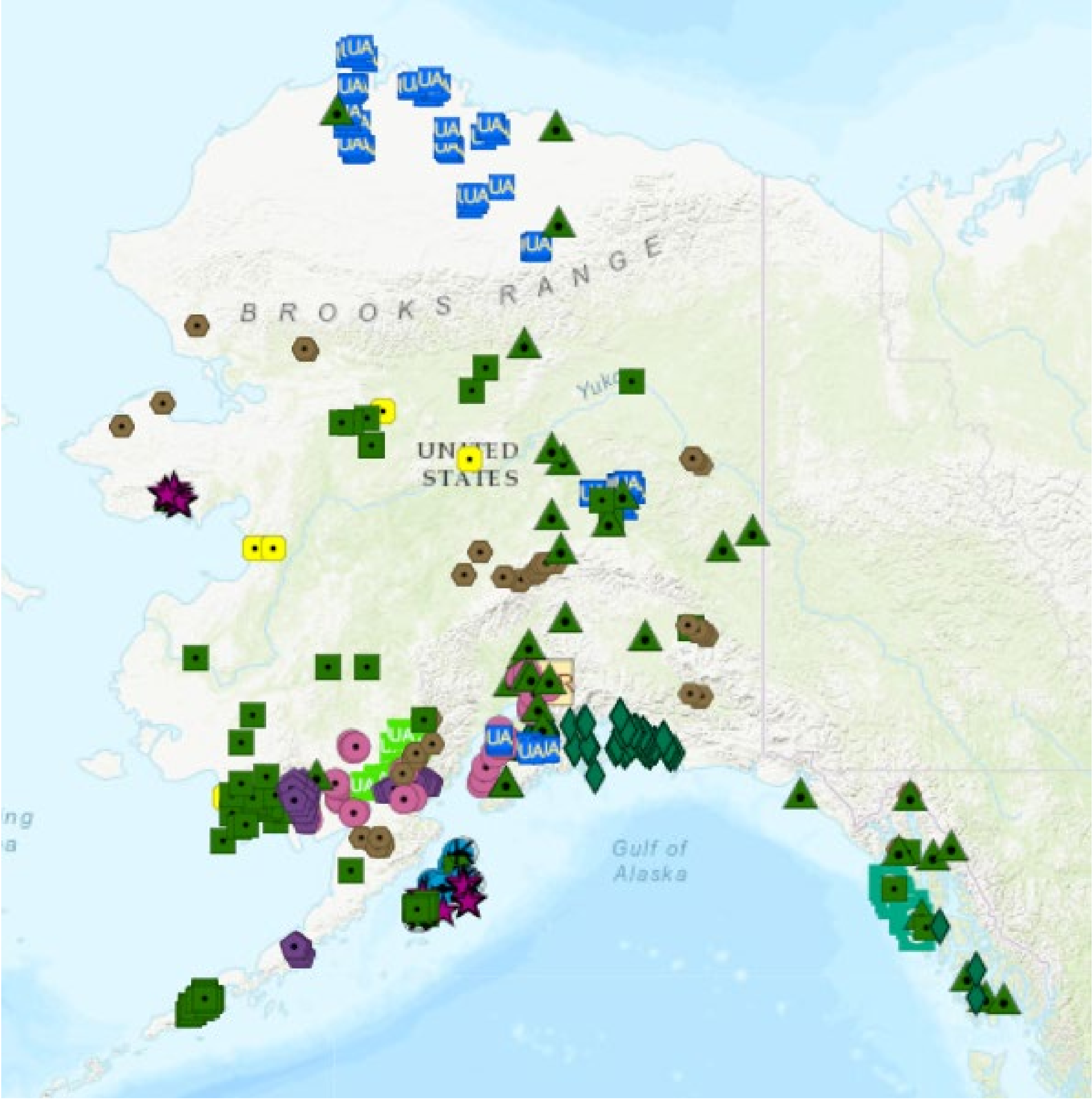
Floodplain shrub colonization
1976(T)/2005(B)



Collaborations – Audubon bird models



Collaborations – Water temperature modeling



Thank You!