



# Modeling Change



Collaborative climate research  
from the Scenarios Network for  
Alaska and Arctic Planning

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University of Alaska Fairbanks

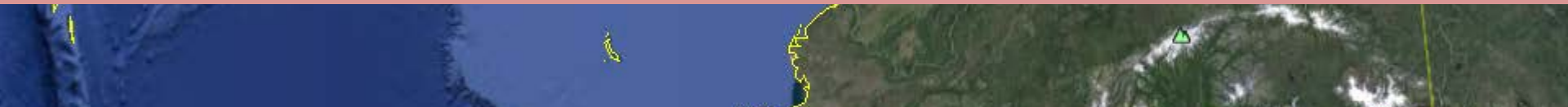




# **SNAP: science and collaboration**



## **How is Alaska Changing?**



## **How Can We Adapt to Change?**





# SNAP: science, and collaboration



## Scenarios Network

FOR ALASKA & ARCTIC PLANNING

# University Resources



**Scenarios Network**  
FOR ALASKA & ARCTIC PLANNING

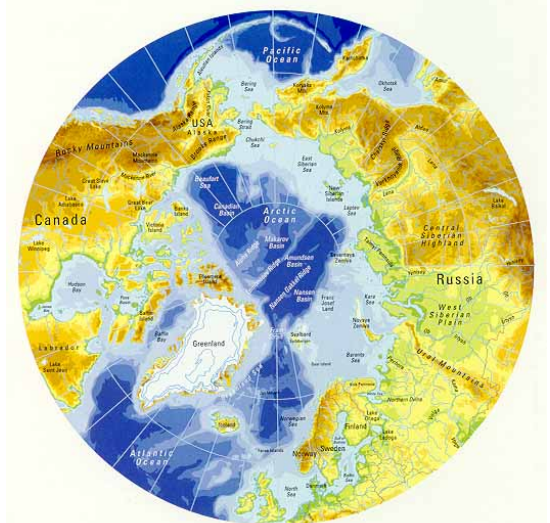


**UNIVERSITY**  
*of* **ALASKA**  
*Many Traditions One Alaska*





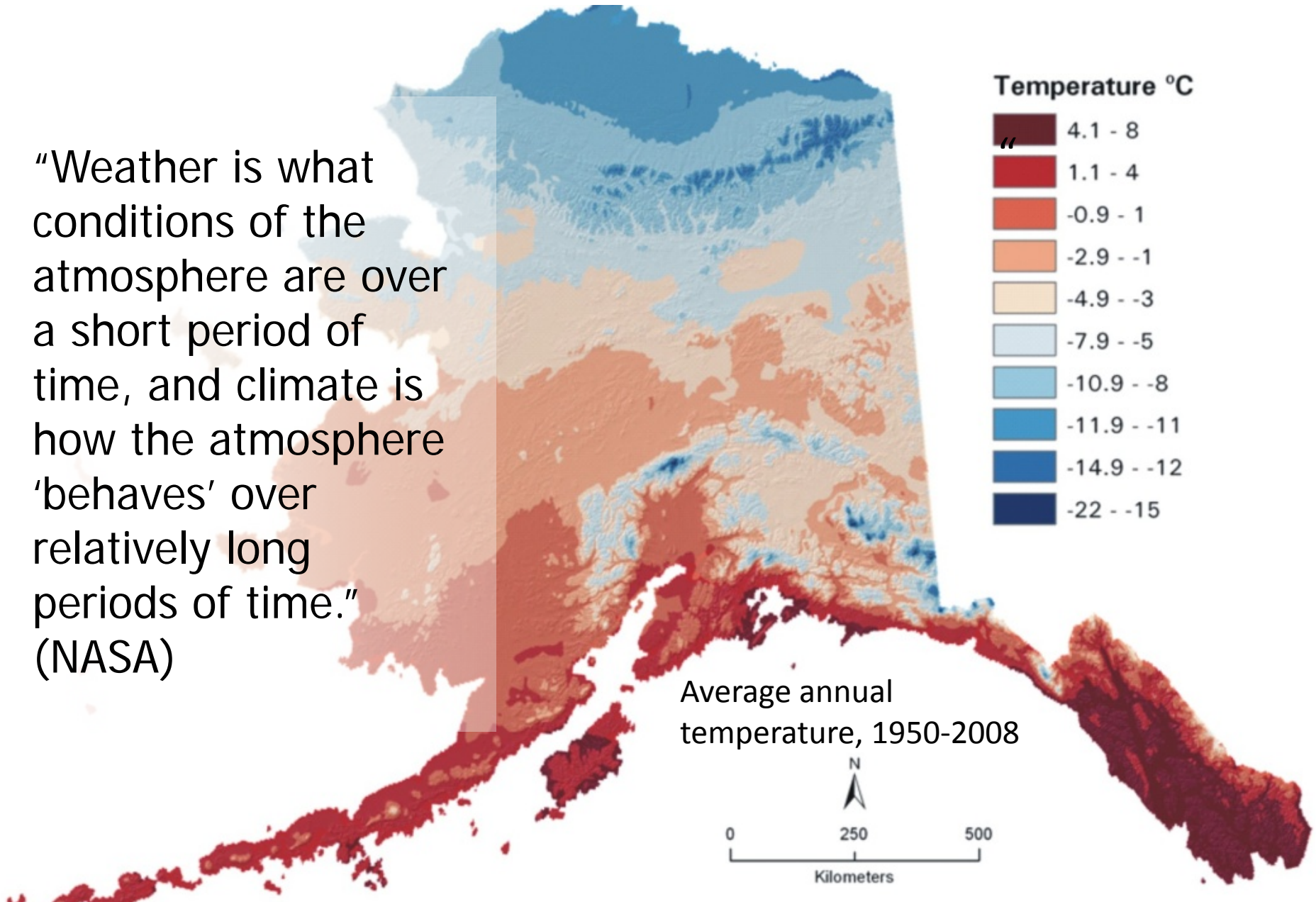
# Collaboration





# Climate Science

“Weather is what conditions of the atmosphere are over a short period of time, and climate is how the atmosphere ‘behaves’ over relatively long periods of time.”  
(NASA)



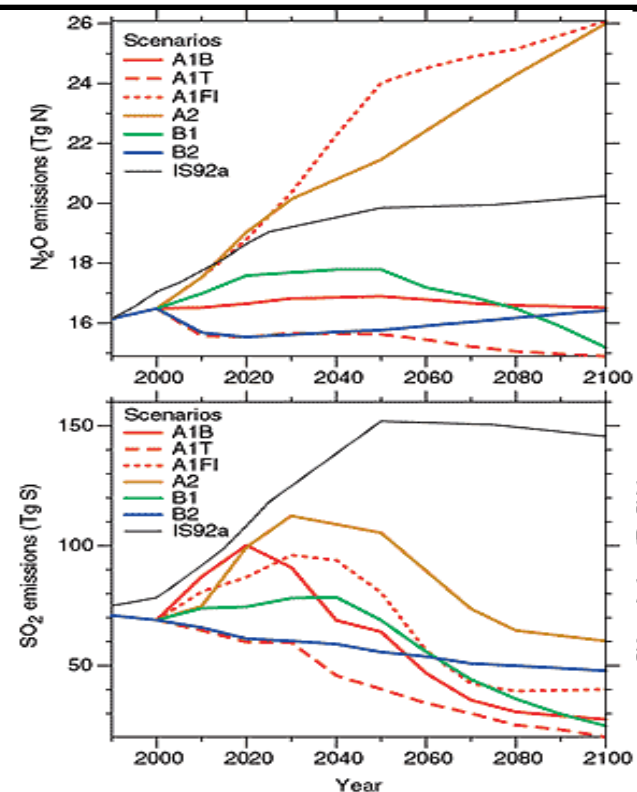
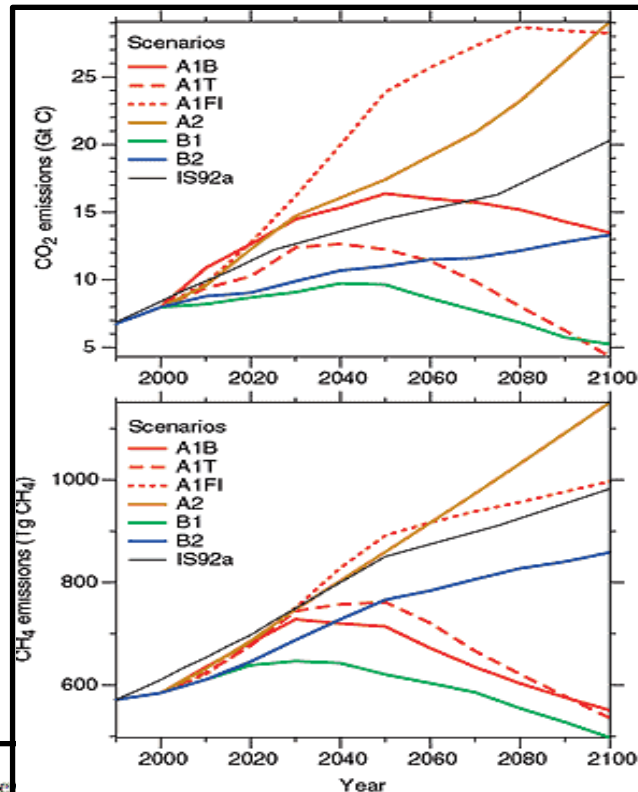
# Uncertainty

Few climate  
stations

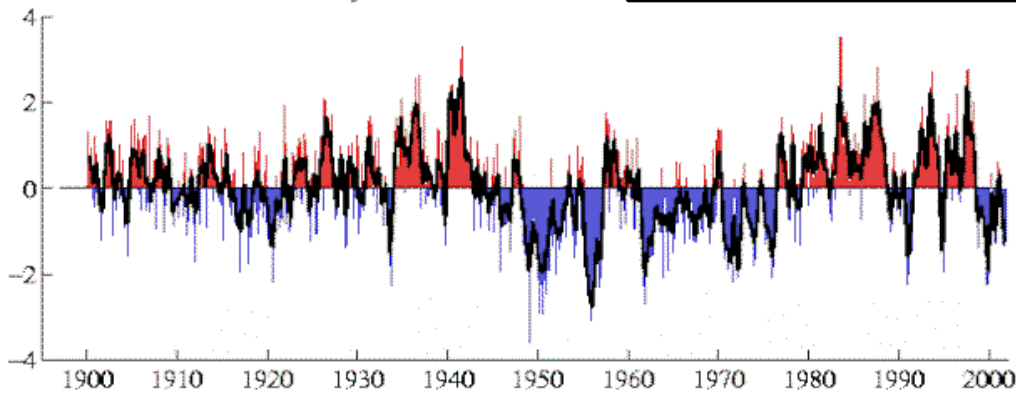
Variable  
precipitation

Complex modeling

Thresholds  
(tipping points)



monthly values for the PDO index



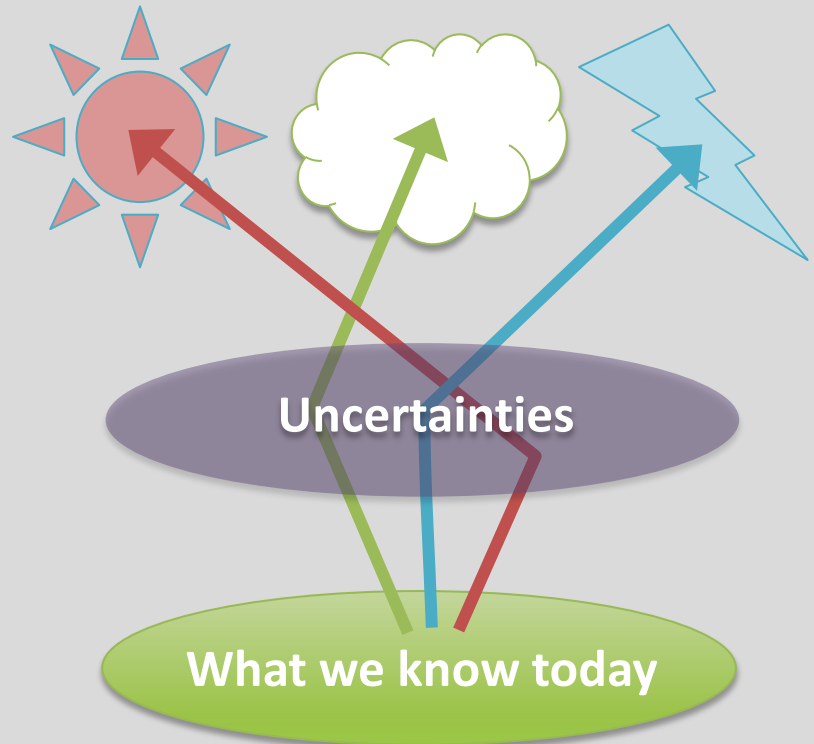
Pacific Decadal Oscillation  
Unknown human behavior

# Scenarios Planning

- Forecast Planning
- One Future



- Scenario Planning
- Multiple Futures





# Outreach



[snap.uaf.edu](http://snap.uaf.edu)  
Scenarios Network for Alaska & Arctic Planning

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Exploring our future in a changing Arctic

share

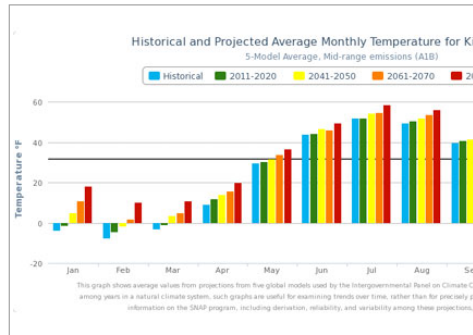
[contact](#) | [blog](#)

## Your Community

Change affects people and communities. Our Community Charts tool allows you to look at how temperature and precipitation regimes will be altered over the next 100 years, across Alaska and Western Canada.

[explore charts >>](#)

1 2 3 4 5 6



## SNAP

We develop plausible **scenarios** of future conditions through a diverse and varied **network** of people and organizations, which allow better **planning** for the uncertain future of Alaska and the Arctic.



## What we do

SNAP is all about helping people plan in a changing climate. We work with partners and **collaborators** on many **projects** to explore a range of future conditions based on the best scientific knowledge and data available. SNAP provides **resources** available and our **methods** known. SNAP has a **SNAP** that allows us to leverage each other's strengths in order to...



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**ACCAP**  
Alaska Center for  
Climate Assessment & Policy

[accap.uaf.edu](http://accap.uaf.edu)

Improving the ability of Alaskans  
to respond to a changing climate



### Adaptation

How can our communities adapt to a changing climate?



### Arctic Climate

How is climate change impacting the circumpolar climate?



### Forests & Wildfire

How do forests change, and how does climate change impact wildfires?



### Coastal & Marine

What happens to our oceans, coasts, fishing resources and coastal commerce?



### Native & Tribal

What unique challenges do Native and rural communities face, and how can they address them?



### Sea Ice

Where can I find how sea ice is mapped?



### ACCAP Statewide Climate Webinars

Our webinars are designed to promote dialogue among scientists, government, managers, industry, and individuals who need information related to climate change in Alaska to make well informed decisions.

### Upcoming Webinars

**Pollinator Attraction: How Do Non-Native Plants Change Pollination of Berry Plants Across Alaska?**

Christa Mulder and Katie Spellman

Register

What happens when a new plant comes into an area and is more attractive to pollinators? Does it improve pollination or lure away pollinators, or lead to the delivery of the wrong pollen? Christa Mulder and Katie Spellman

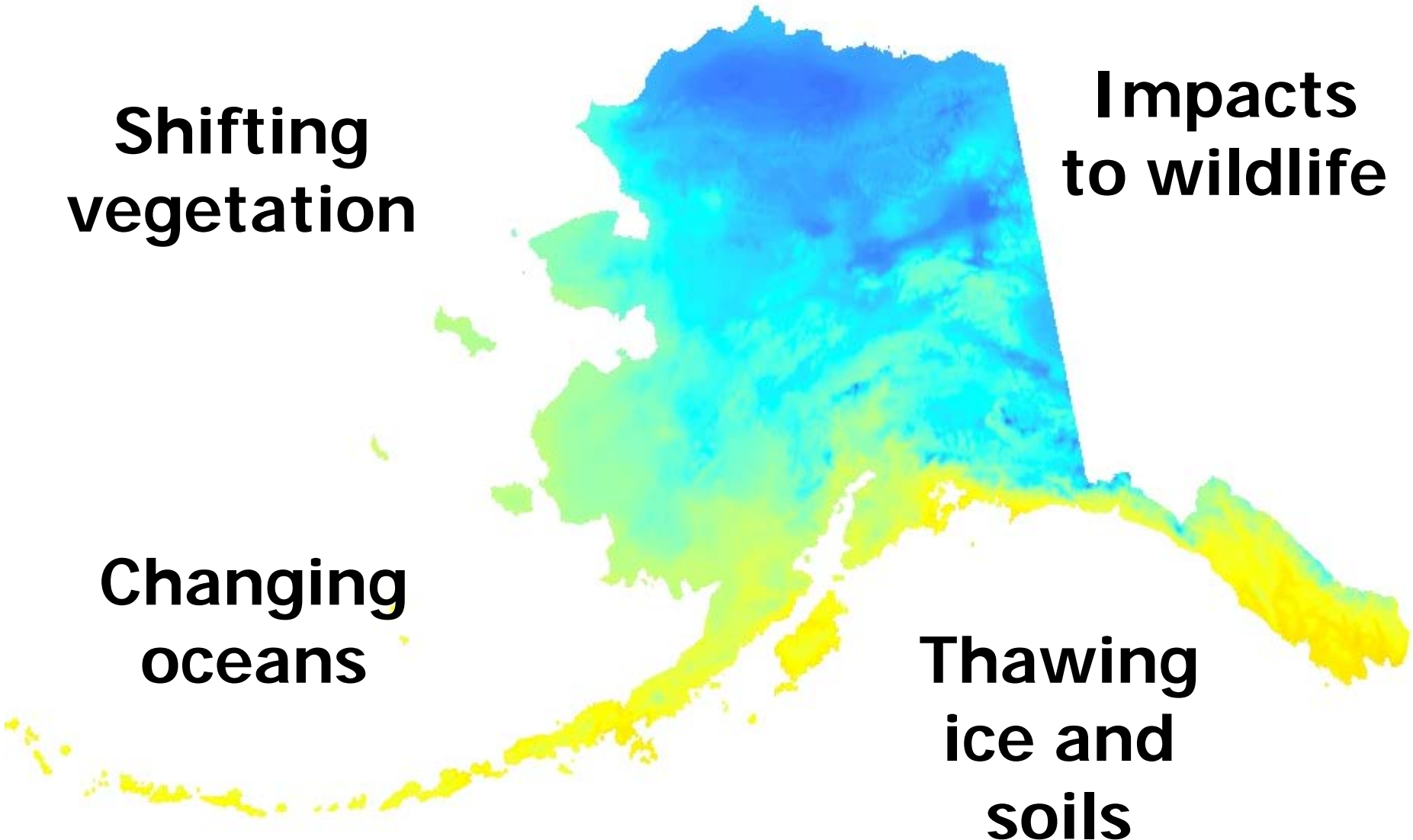
# How is Alaska Changing?

**Shifting  
vegetation**

**Impacts  
to wildlife**

**Changing  
oceans**

**Thawing  
ice and  
soils**





# Shifting Vegetation

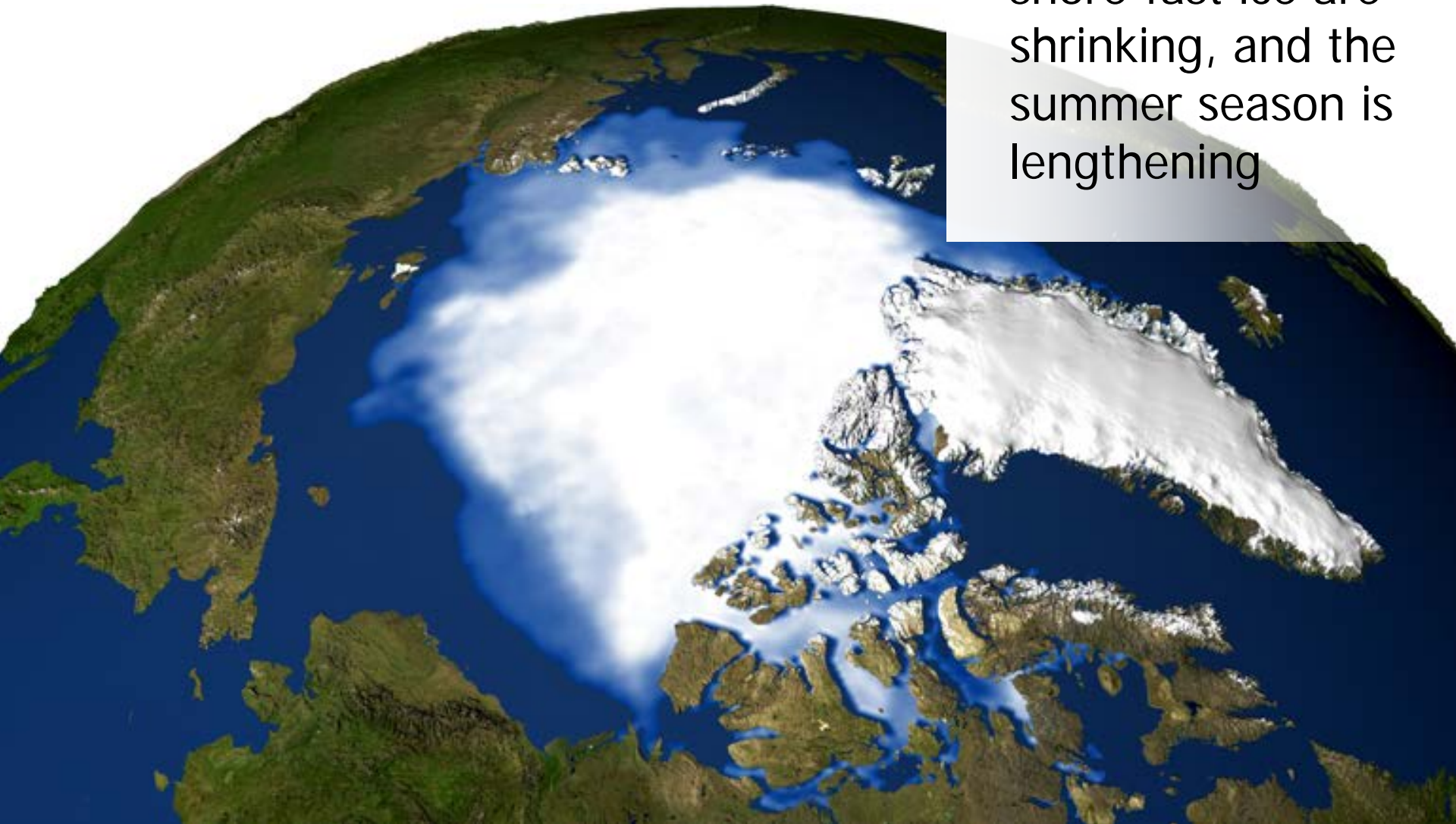
An aerial photograph of a mountainous landscape. A winding asphalt road curves through the terrain. The vegetation is patchy, with areas of dense green coniferous forest interspersed with areas of yellow and brown deciduous trees or shrubs. The overall scene suggests a transition zone between different biomes or a result of climate change.

Warming temperatures and changing hydrology will likely lead to a northward and upward moving treeline, habitat loss, and encroachment by invasive species.



# Changing Oceans

Arctic sea ice and shore-fast ice are shrinking, and the summer season is lengthening





# Impacts to Wildlife



<http://www.alaskadispatch.com>

Habitat may increase for some species and decrease for others.

# Thawing Ice and Soils

2004

Many glacier are receding.

*(Muir and Riggs Glaciers)*

Loss of sea ice  
will shrink  
habitat for polar  
bears, seals and  
seabirds.

1941





# Human Livelihoods



Farming and gardening may expand, with new crops possible



Traditional hunting, fishing, and gathering patterns may change

Data Source: Nowacki, G.J., P.Spencer, T. Brock, M. Fleming, and T. Jorgenson. 2001. "Ecoregions of Alaska and neighboring Territories. U.S. Geological Survey Miscellaneous Investigations series 1 map (in press).

## Alaska Ecoregions

### Boreal

Intermontane Boreal

- B2 - Ray Mountains
- B11 - Kuskokwim Mountains
- B6 - Yukon-Old Crow Basin
- B7 - Yukon River Lowlands
- B10 - Tanana-Kuskokwim Lowlands
- B12 - Kobuk Ridges and Valleys
- B13 - Yukon-Tanana Uplands
- B14 - Davidson Mountains
- B15 - North Ogilvie Mountains

Alaska Range Transition

- B3 - Alaska Range
- B4 - Lime Hills
- B5 - Cook Inlet Basin
- B8 - Copper River Basin

Coast Mountains Transition

- B1 - Klane Range
- B9 - Wrangell Mountains

### Polar

Ardic Tundra

- P1 - Brooks Foothills
- P3 - Brooks Range
- P9 - Beaufort Coastal Plain

Bering Tundra

- P4 - Seward Peninsula
- P5 - Kotzebue Sound Lowlands
- P7 - Bering Sea Islands

Bering Taiga

- P2 - Nulato Hills
- P6 - Bristol Bay Lowlands
- P8 - Yukon-Kuskokwim Delta
- P10 - Ahklun Mountains

### Maritime

Aleutian Meadows

- M1 - Aleutian Islands
- M7 - Alaska Peninsula

Coastal Rainforests

- M2 - Boundary Ranges
- M3 - Kodiak Island
- M4 - Alexander Archipelago
- M5 - Gulf of Alaska Coast
- M6 - Chugach-St. Elias Mountains

[http://www.lter.uaf.edu/about\\_us.cfm](http://www.lter.uaf.edu/about_us.cfm)

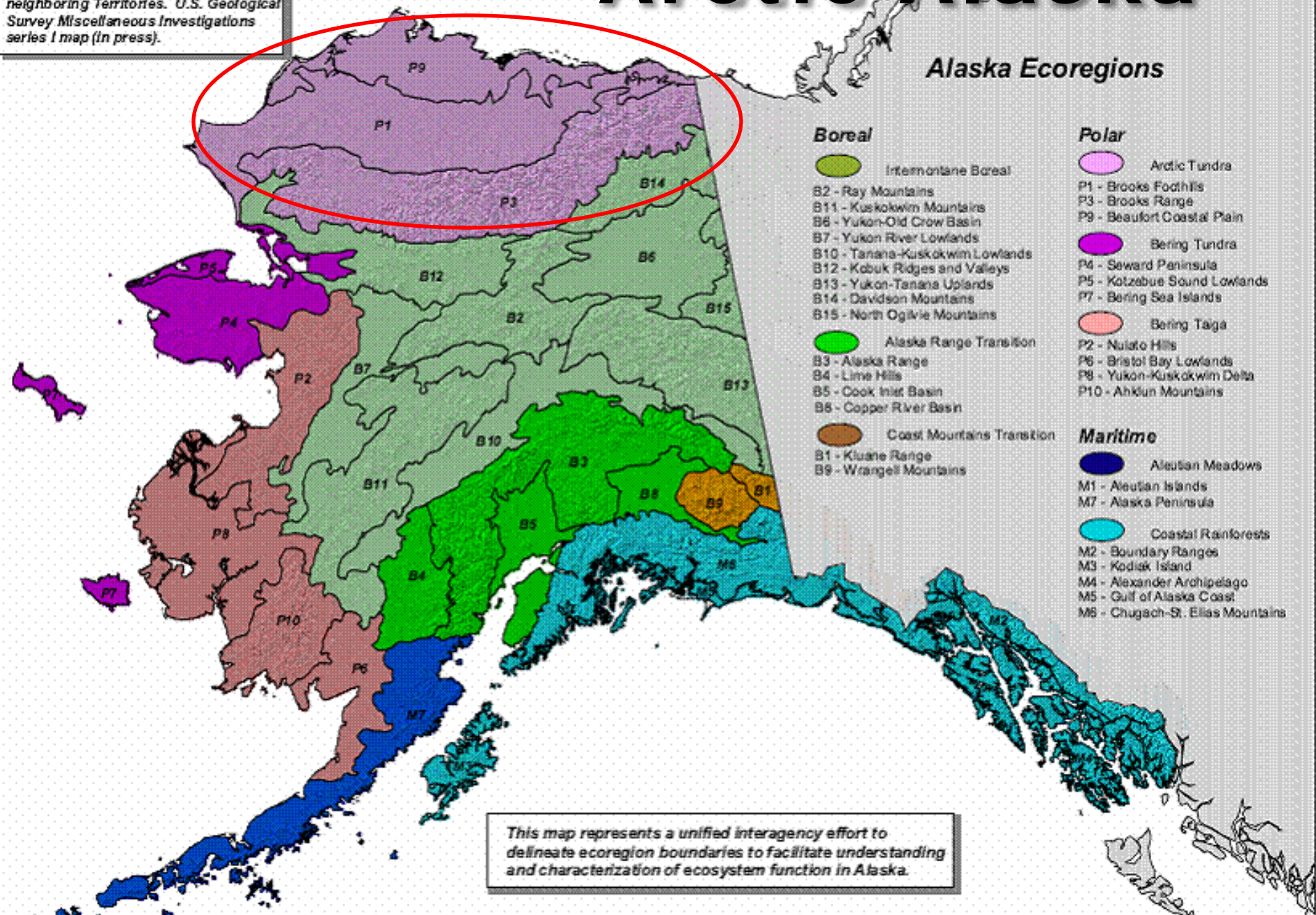
This map represents a unified interagency effort to



Data Source: Nowacki, G.J., P.Spencer, T. Brock, M. Fleming, and T. Jorgenson. 2001. "Ecoregions of Alaska and neighboring Territories. U.S. Geological Survey Miscellaneous Investigations series 1 map (in press).

# Arctic Alaska

## Alaska Ecoregions



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- M5 - Gulf of Alaska Coast
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This map represents a unified interagency effort to delineate ecoregion boundaries to facilitate understanding and characterization of ecosystem function in Alaska.





A decline in arctic sea ice will improve ship accessibility in the Arctic Ocean.

Reduction in sea ice threatens food security for subsistence hunters.



Arctic Transportation Networks (ATN) Project



Alaska North Slope Oil and Gas Transportation Support System

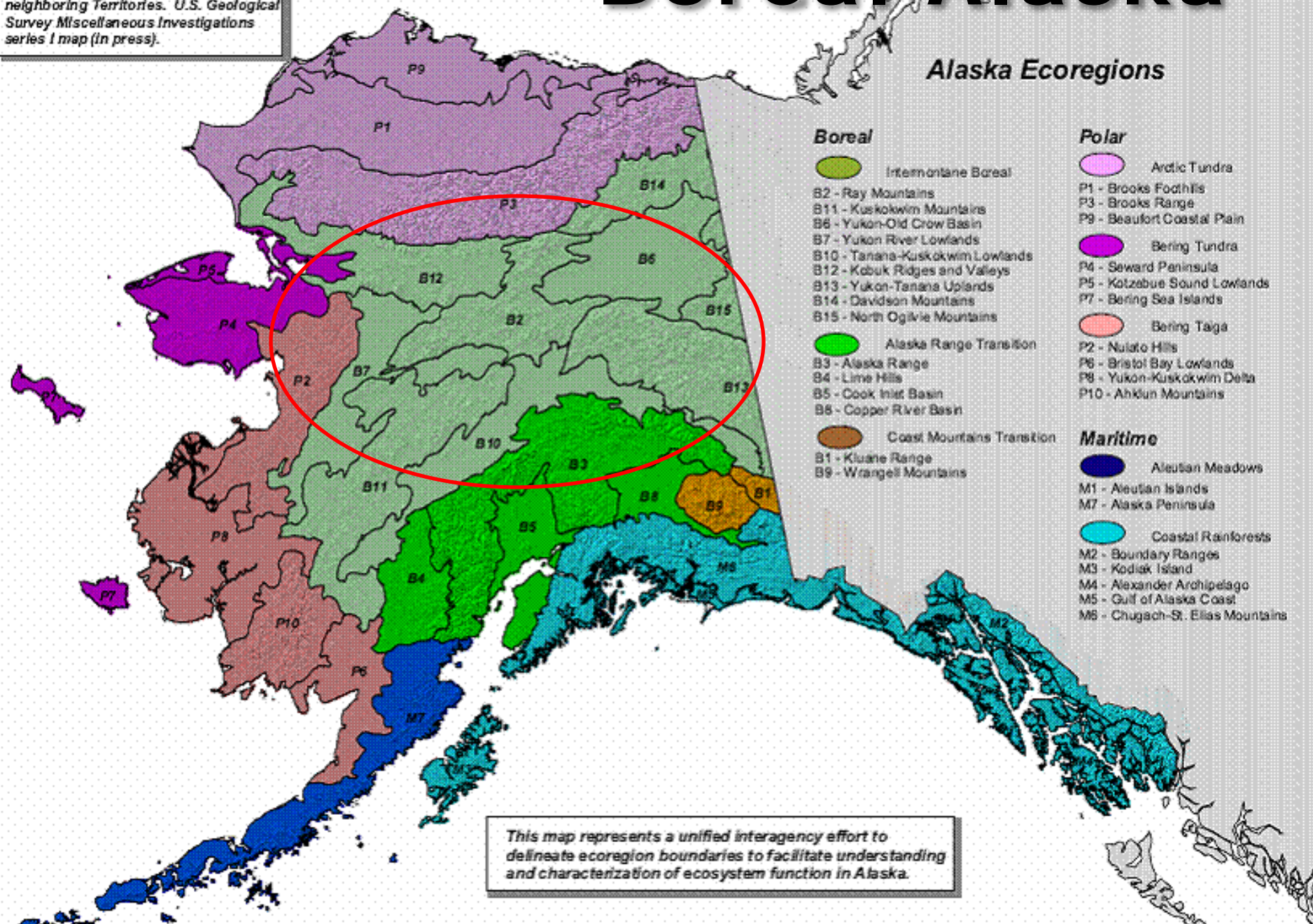
Shorter season for tundra travel.



Data Source: Nowacki, G.J., P.Spencer, T. Brock, M. Fleming, and T. Jorgenson. 2001. "Ecoregions of Alaska and neighboring Territories. U.S. Geological Survey Miscellaneous Investigations series 1 map (in press).

# Boreal Alaska

## Alaska Ecoregions



This map represents a unified interagency effort to delineate ecoregion boundaries to facilitate understanding and characterization of ecosystem function in Alaska.



Interior Alaska is projected to become warmer and drier over the next century.

Warming and drying will lead to increased fire risk.





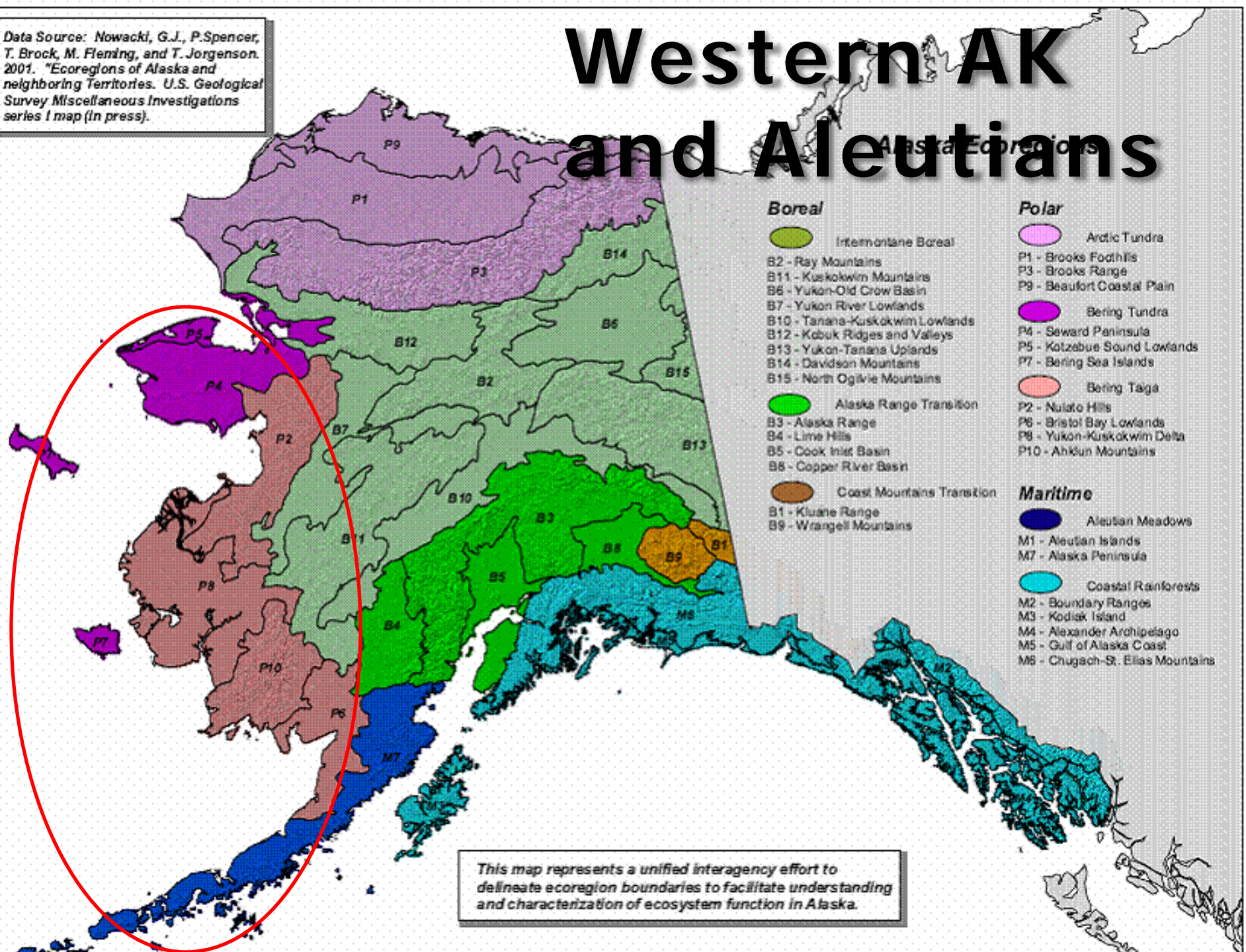


Climate change will cause widespread loss of permafrost, and contribute to the drying of wetlands, streams, and lakes.



Data Source: Nowacki, G.J., P.Spencer, T. Brock, M. Fleming, and T. Jorgenson. 2001. "Ecoregions of Alaska and neighboring Territories. U.S. Geological Survey Miscellaneous Investigations series 1 map (in press).

# Western AK and Aleutians







Loss of landfast sea ice and coastal permafrost increases storm erosion.



The Iñupiaq village of Shishmaref is eroding at an average of 3-5 feet per year.

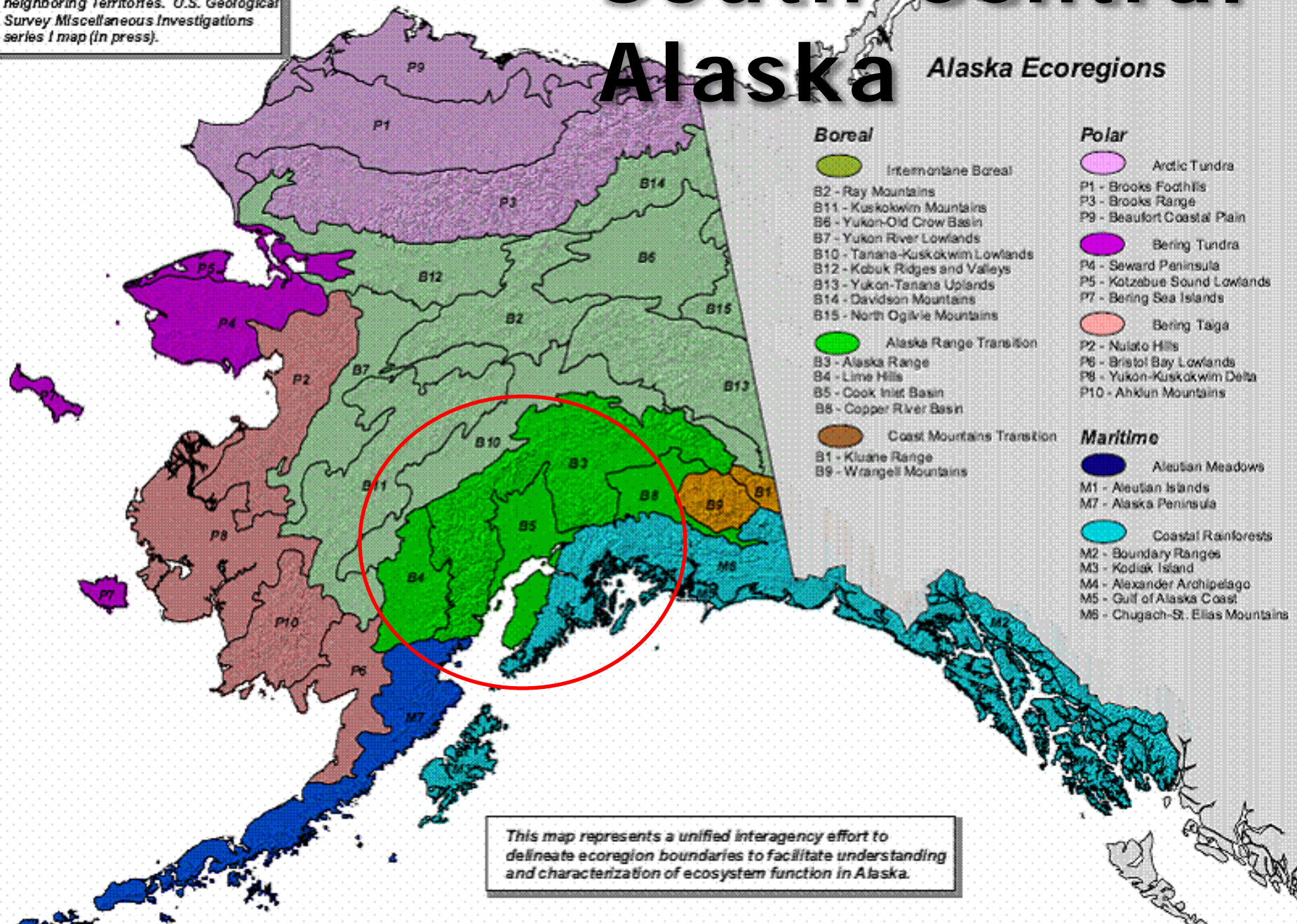


Shishmaref has chosen to relocate, to preserve the culture and integrity of their community.

Data Source: Nowacki, G.J., P.Spencer, T. Brock, M. Fleming, and T. Jorgenson. 2001. "Ecoregions of Alaska and neighboring Territories. U.S. Geological Survey Miscellaneous Investigations series 1 map (in press).


# South-Central Alaska

## Alaska Ecoregions



This map represents a unified interagency effort to delineate ecoregion boundaries to facilitate understanding and characterization of ecosystem function in Alaska.



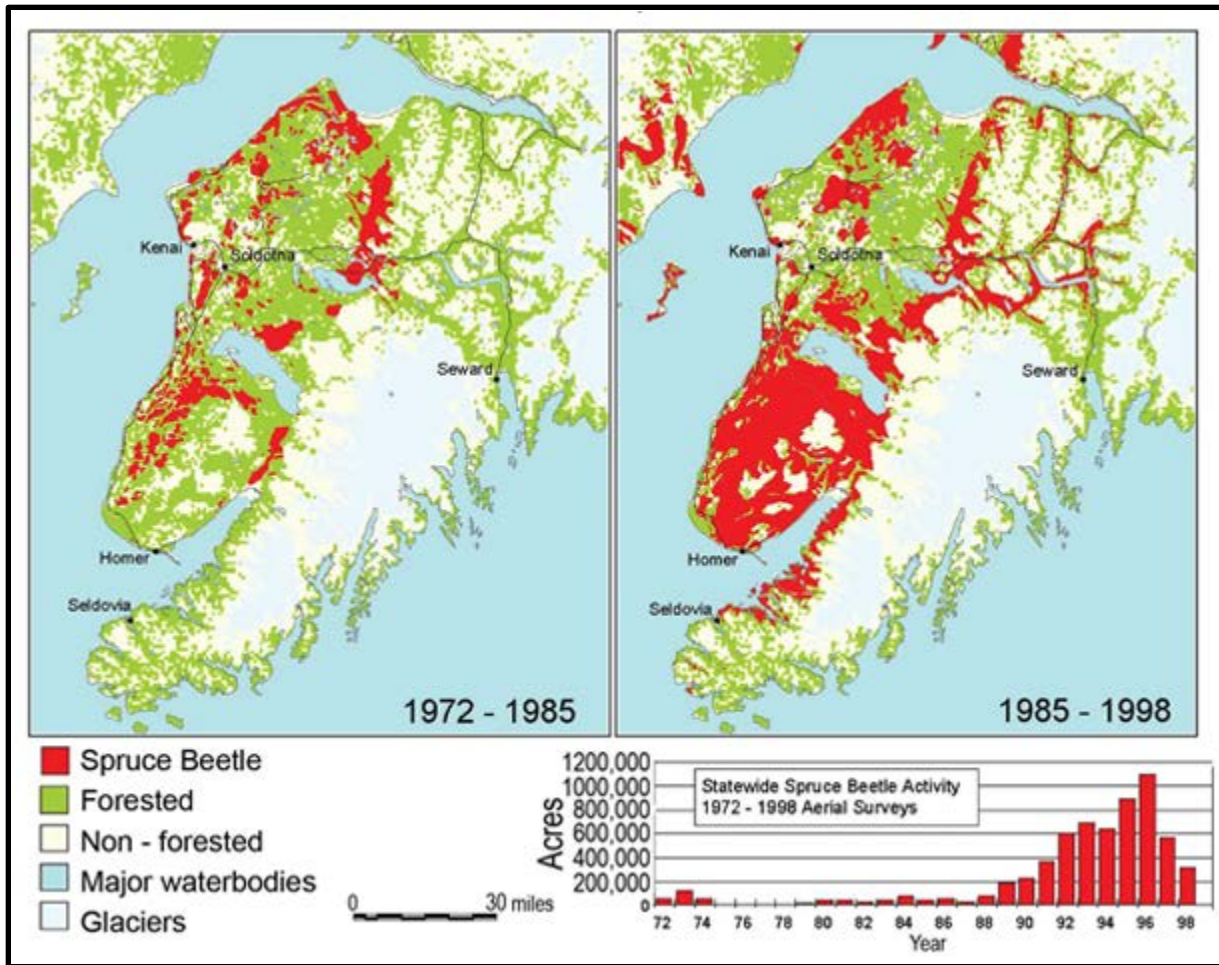


Forest fires are likely to increase.

Ocean acidification may impact fisheries.

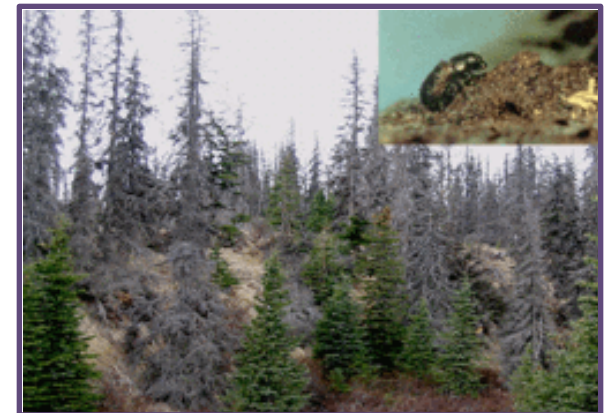






Increases in temperature are expected to result in more insect outbreaks.

*Berman, M., G. P. Juday, and R. Burnside 1999*

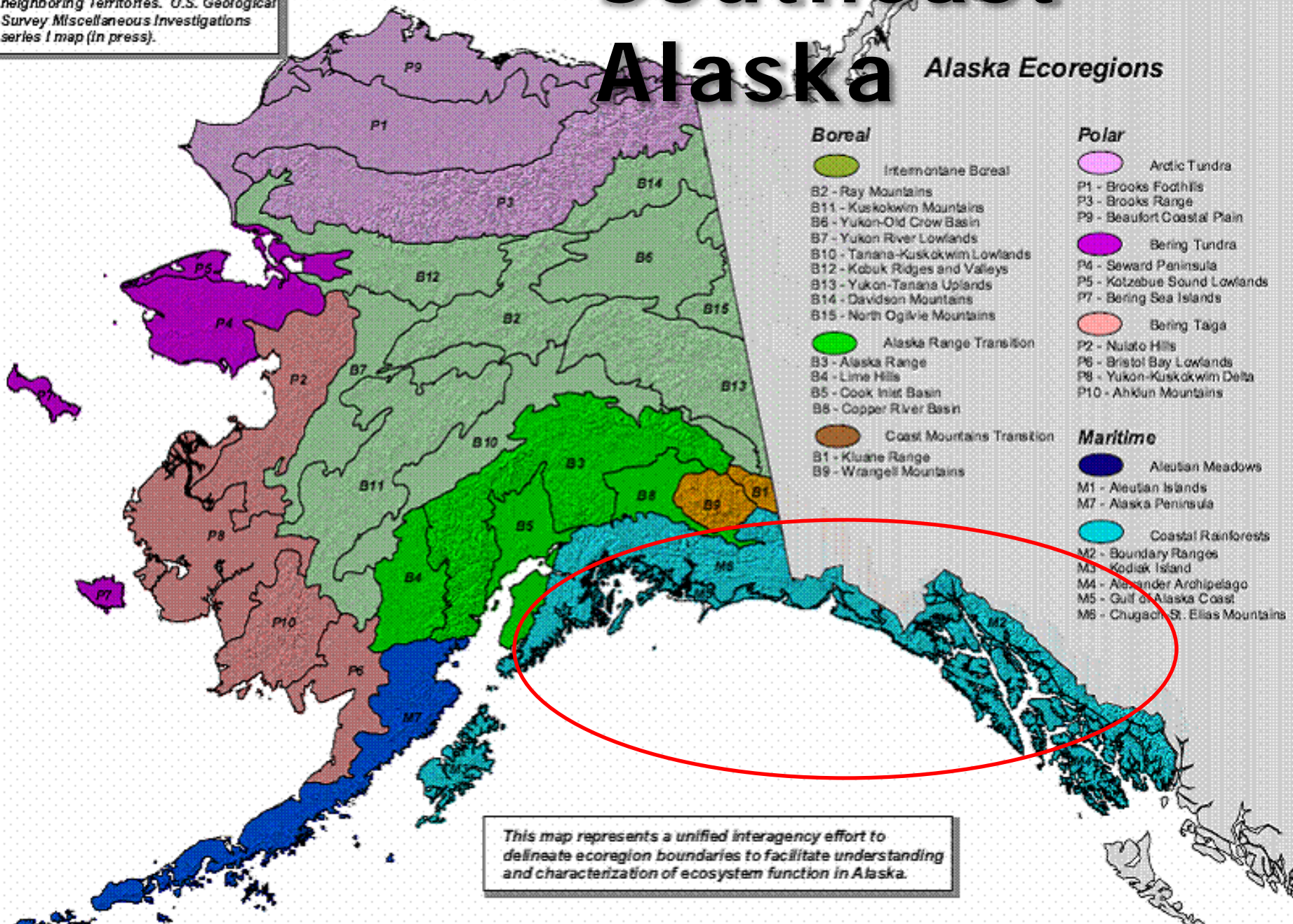




Data Source: Nowacki, G.J., P.Spencer, T. Brock, M. Fleming, and T. Jorgenson. 2001. "Ecoregions of Alaska and neighboring Territories. U.S. Geological Survey Miscellaneous Investigations series 1 map (in press).

# Southeast Alaska

## Alaska Ecoregions



This map represents a unified interagency effort to delineate ecoregion boundaries to facilitate understanding and characterization of ecosystem function in Alaska.





Marine species may be impacted by ocean acidification.





Winter precipitation is shifting from snow to rain.



Temperate rainforests and forested wetlands are affected by seasonal changes in runoff and snow cover



# **How Can We Adapt to Change?**

**Current Science**

**Scenarios Planning**

**Modeling Change**

**Technology**

**Innovation**

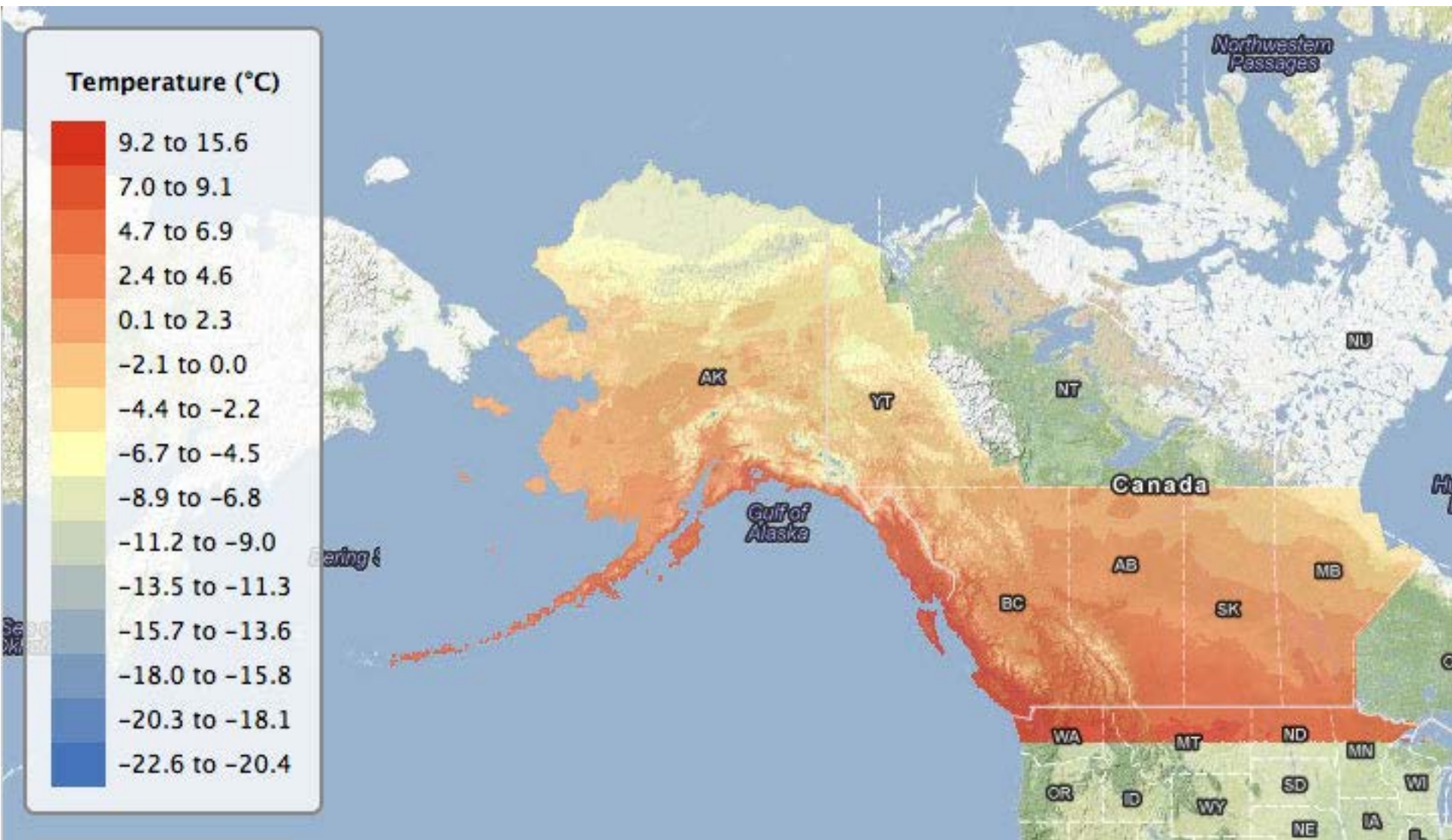
**Education and Outreach**

**Positive Strategies**

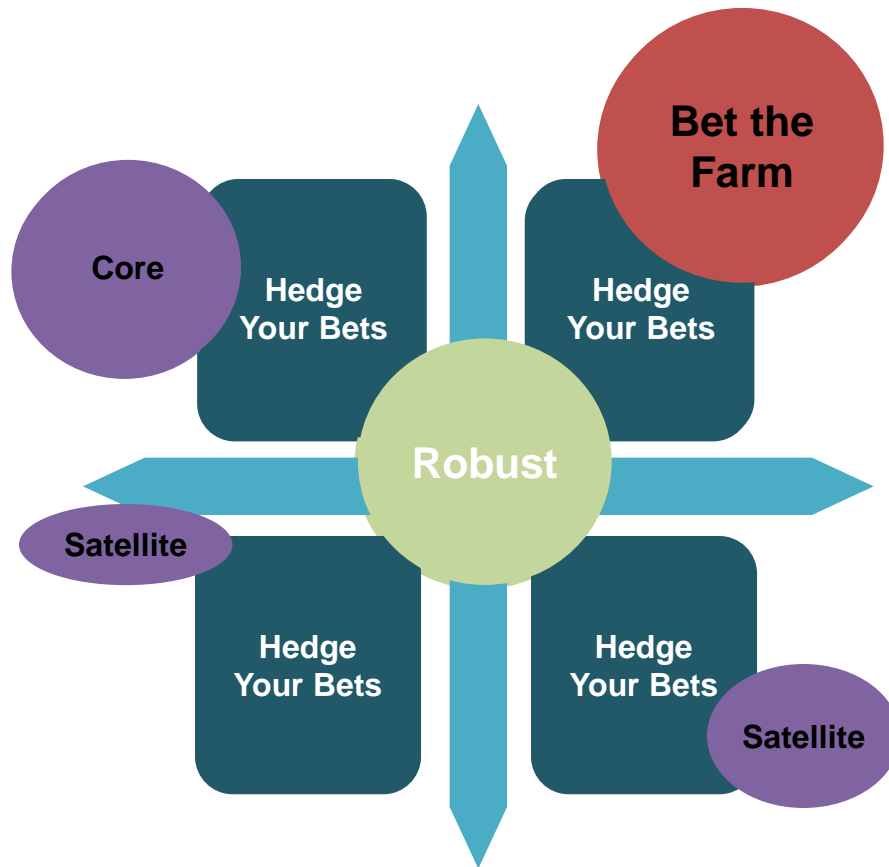




# Current Science



# Scenarios Planning



*Adapted from Global Business Network (GBN)*

**Robust:** Pursue options that would work out well in any scenario

**Bet the Farm:** Make one bet that a certain future will happen

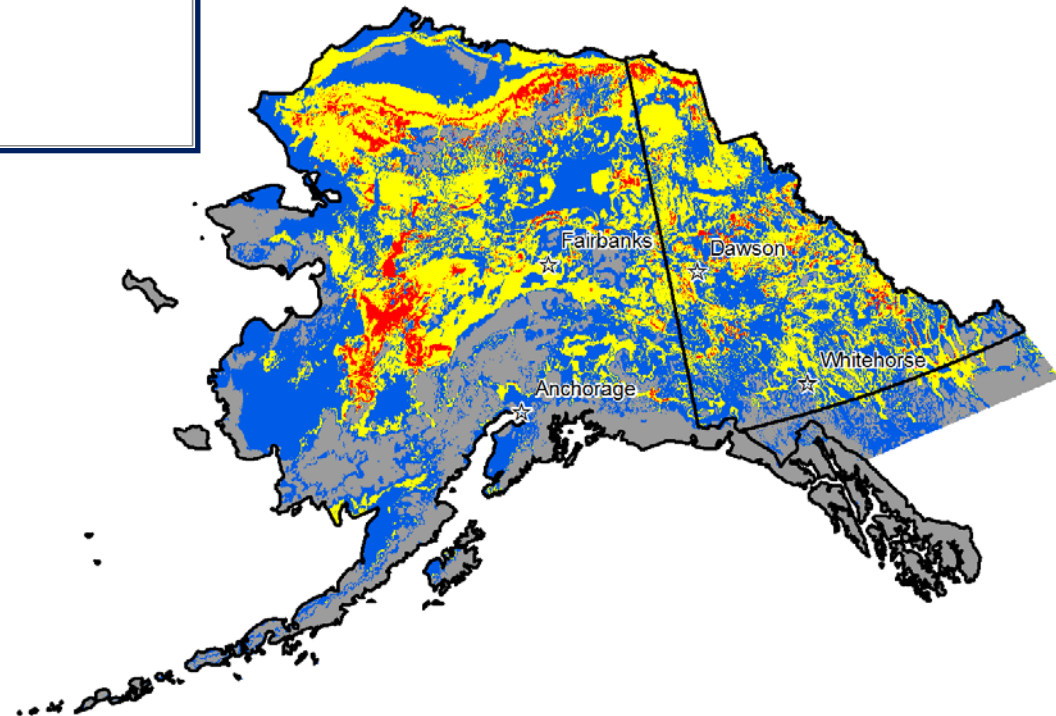
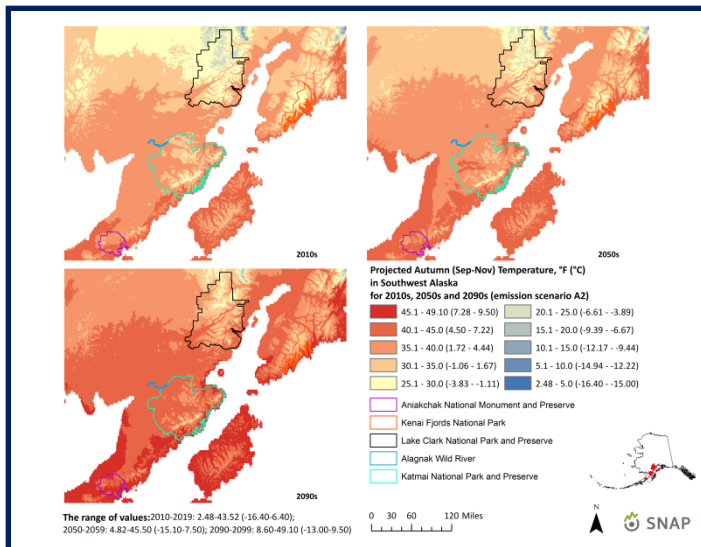
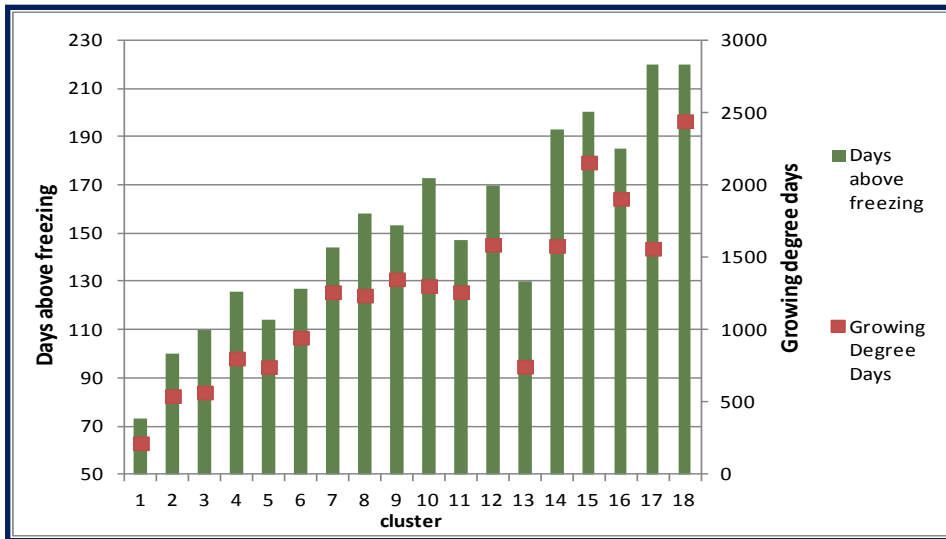
**Hedge Your Bets:** Make several bets of equal size

**Core / Satellite:** Place one major bet, with small bets as a hedge against uncertainty



# Modeling Change

SNAP focuses not only on modeling, but also on interpretations of model outputs.



# Technology

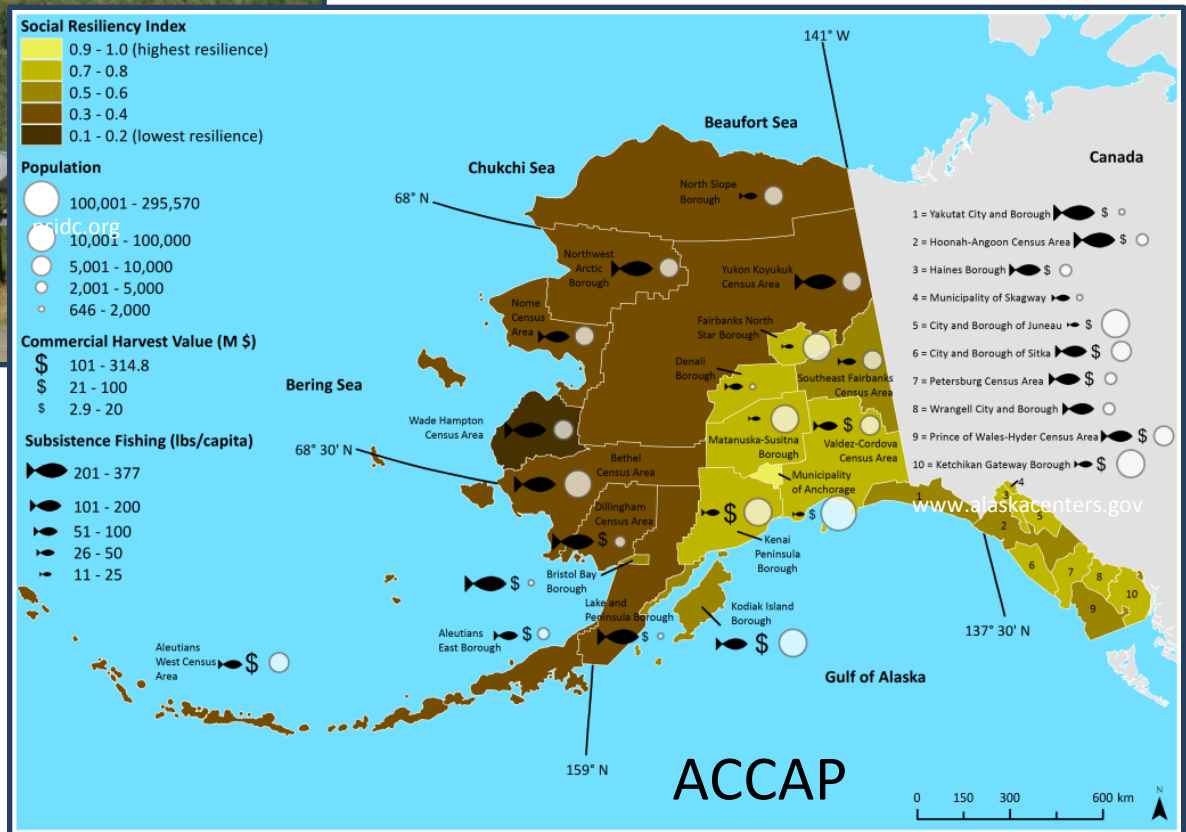
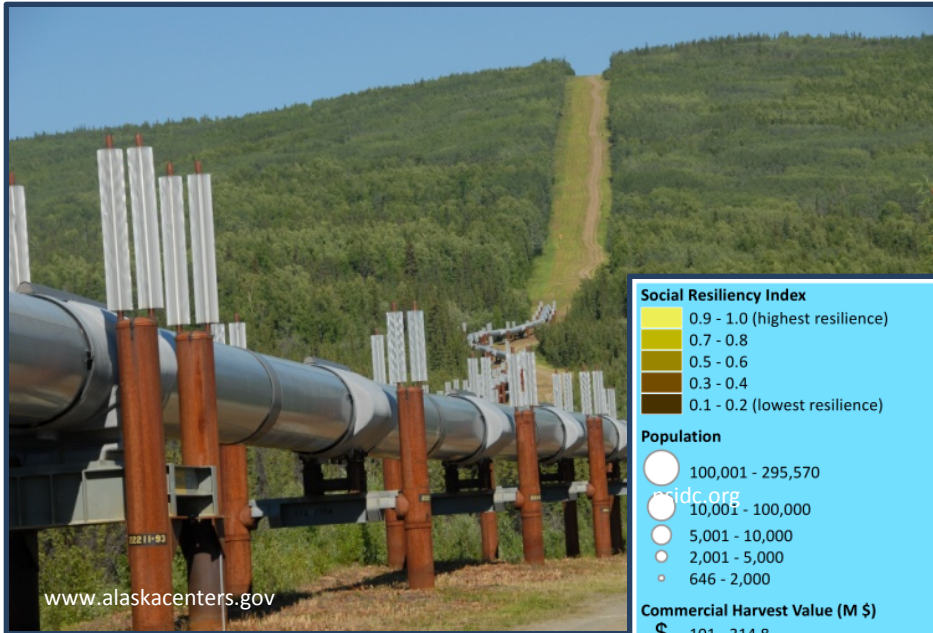


Funding for new technologies can save money in the long run.





# Innovation



Understanding challenges in advance allows time to find solutions.

# Education and Outreach



A large part of SNAP's mission is to make our work available to the public.



Social change must be part of adaptive solutions.



# Positive Strategies



Alaska may reap economic rewards in some arenas, if planning keeps pace with change.



**Questions?**