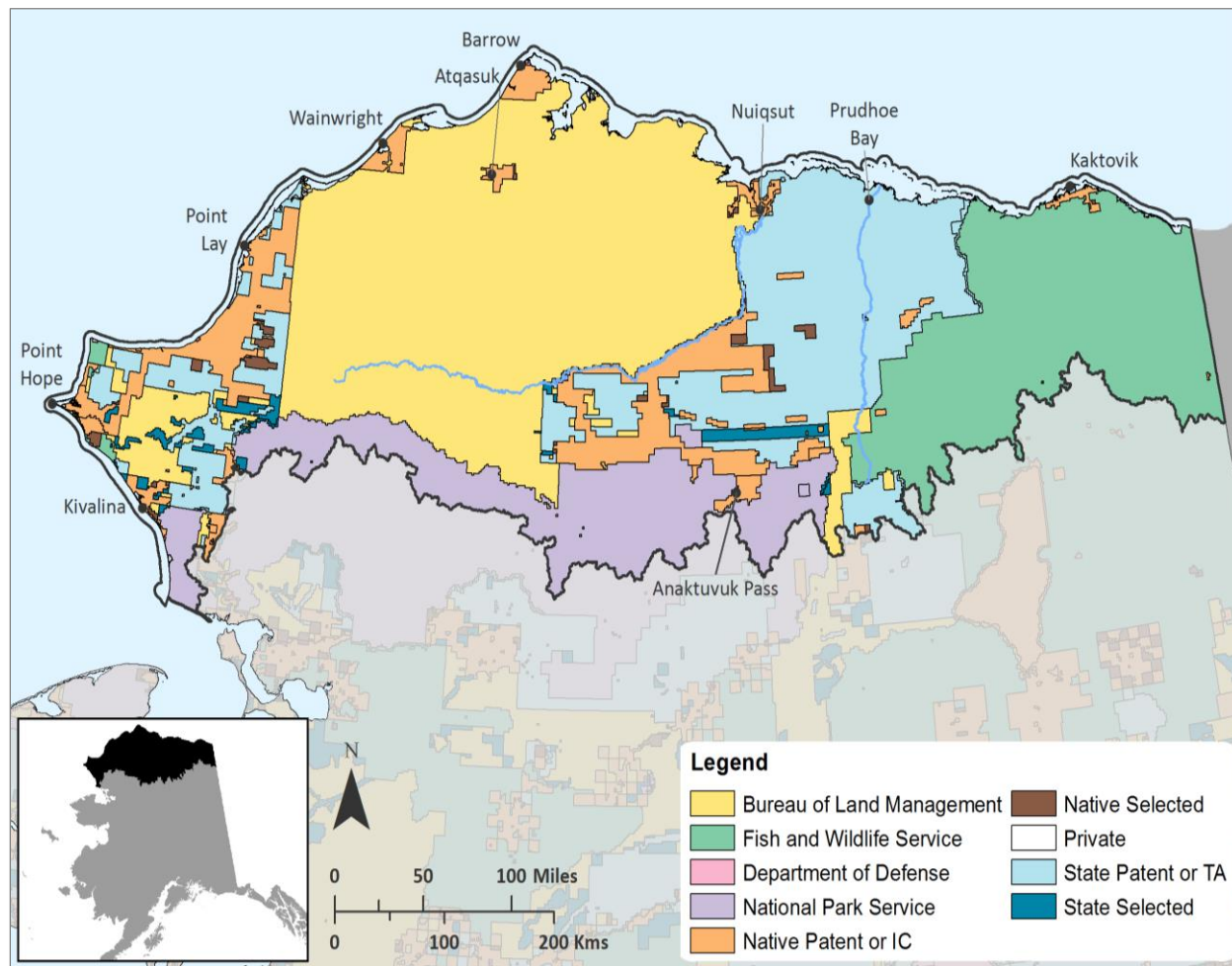


BLM

Rapid Ecoregional Assessment

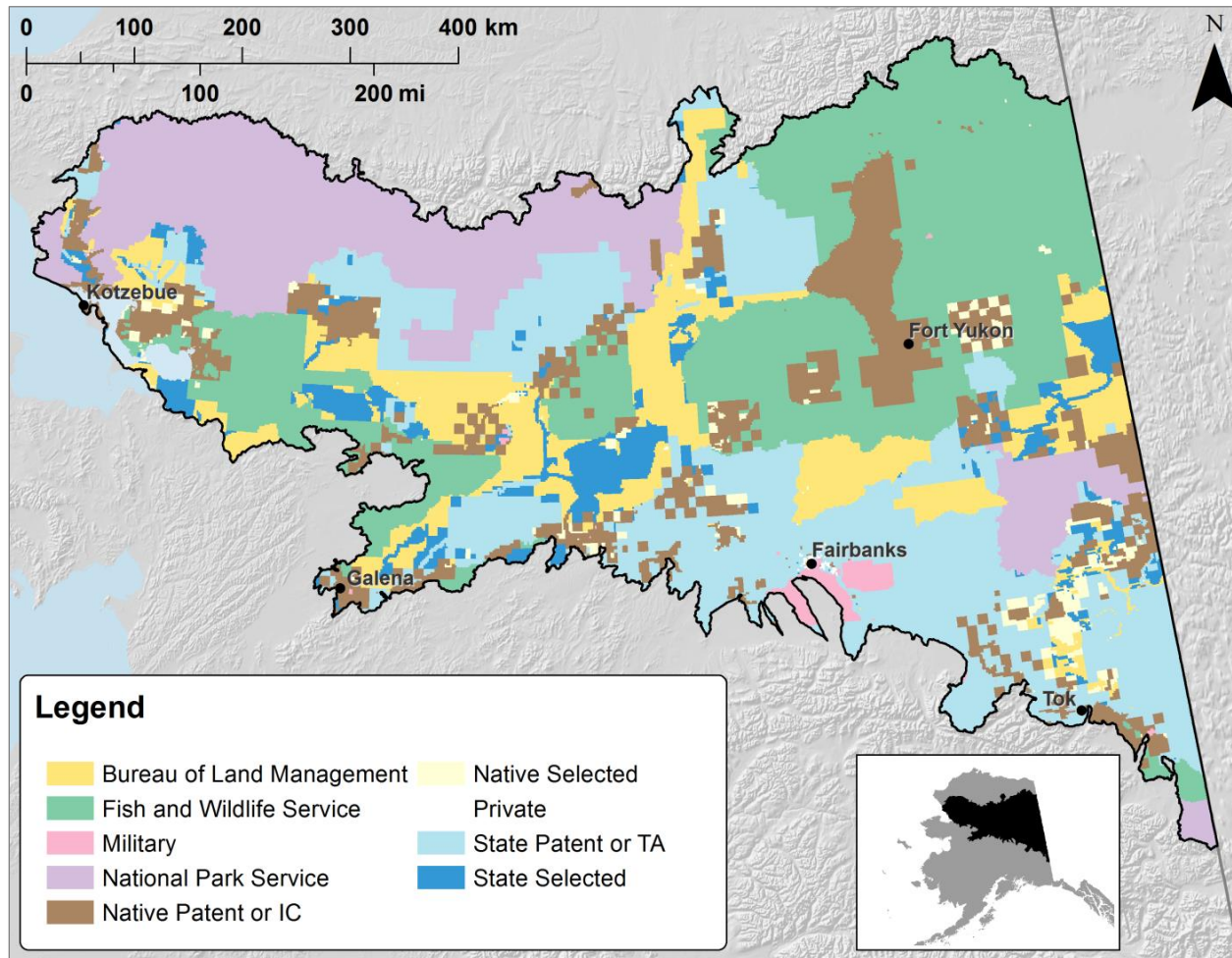
THE REA APPROACH

North Slope (NOS) Study Area Land Management Status (2013)



Land Ownership	Area (km ²)	Percent of Total Study Area
Bureau of Land Management	97,364	39%
State Patent or TA	49,493	20%
Fish and Wildlife Service	45,834	18%
National Park Service	29,165	12%
Native Patent or IC	23,134	9%
State Selected	3,009	1.2%
Native Selected	1,674	0.7%
Department of Defense	81	0.03%
Private	0.05	0.00%
Bureau of Land Management	97,364	39%

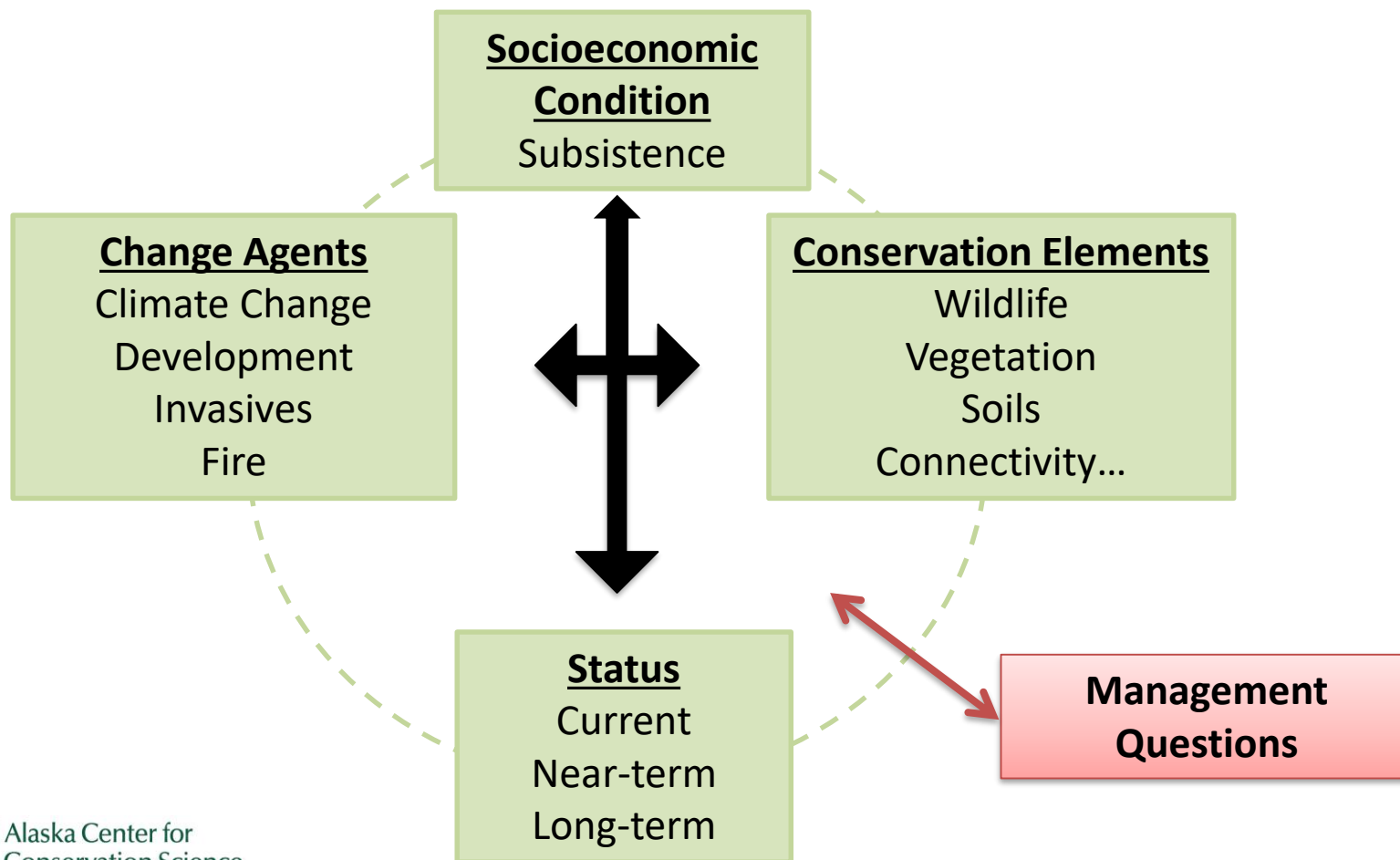
Central Yukon (CYR) Study Area Land Management Status (2015)



Land Ownership	Area (km ²)	Percent of Total Study Area
Fish and Wildlife Service	103,004	26%
State Patent or TA	93,758	24%
National Park Service	66,959	17%
Native Patent or IC	49,510	13%
Bureau of Land Management	48,318	12%
State Selected	20,108	5%
Native Selected	7,223	2%
Water	3,665	0.90%
Department of Defense	3,034	0.80%
Private	238	0.06%

What is an REA?

Rapid assessment of Conservation Elements, the Change Agents that impact them, and their current and future status.



General Limitations

- Limited to existing geospatial datasets
- Identify data limitations and deficiencies
- Focus on management questions
- Geoprocessing emphasis on ModelBuilder
- Easily repeatable processes

REA COMPONENTS

Core Components

- Conservation Element (CE) current distributions
- Change Agent (CA) current status
- CA near-term and long-term status
- CE overlap with CA change

Timeframes

- Current
 - North Slope: ~2013-2014
 - Central Yukon: ~2015-2016
 - Abiotic-related: 2010s decade
- Near-Term Future:
 - General: 2025
 - Abiotic-related: 2020s decade
 - North Slope Development: 2040 Low
- Long-Term Future:
 - General: 2060
 - Abiotic-related: 2060s decade
 - North Slope Development: 2040 High

Integration of Management and Science

Management Question Tract

Needs of resource managers

e.g.,:

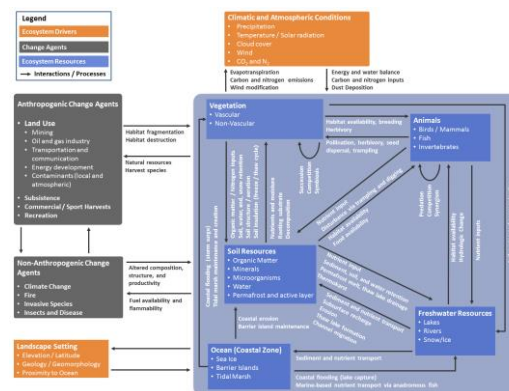
How will changes in precipitation, evapotranspiration, and active layer depth alter summer surface water availability in shallow-water and mesic/wet tundra habitats and how reliable are these projections?

CEs and CAs that are significant for resource managers

Management and ecosystem-derived CEs and CAs are integrated.

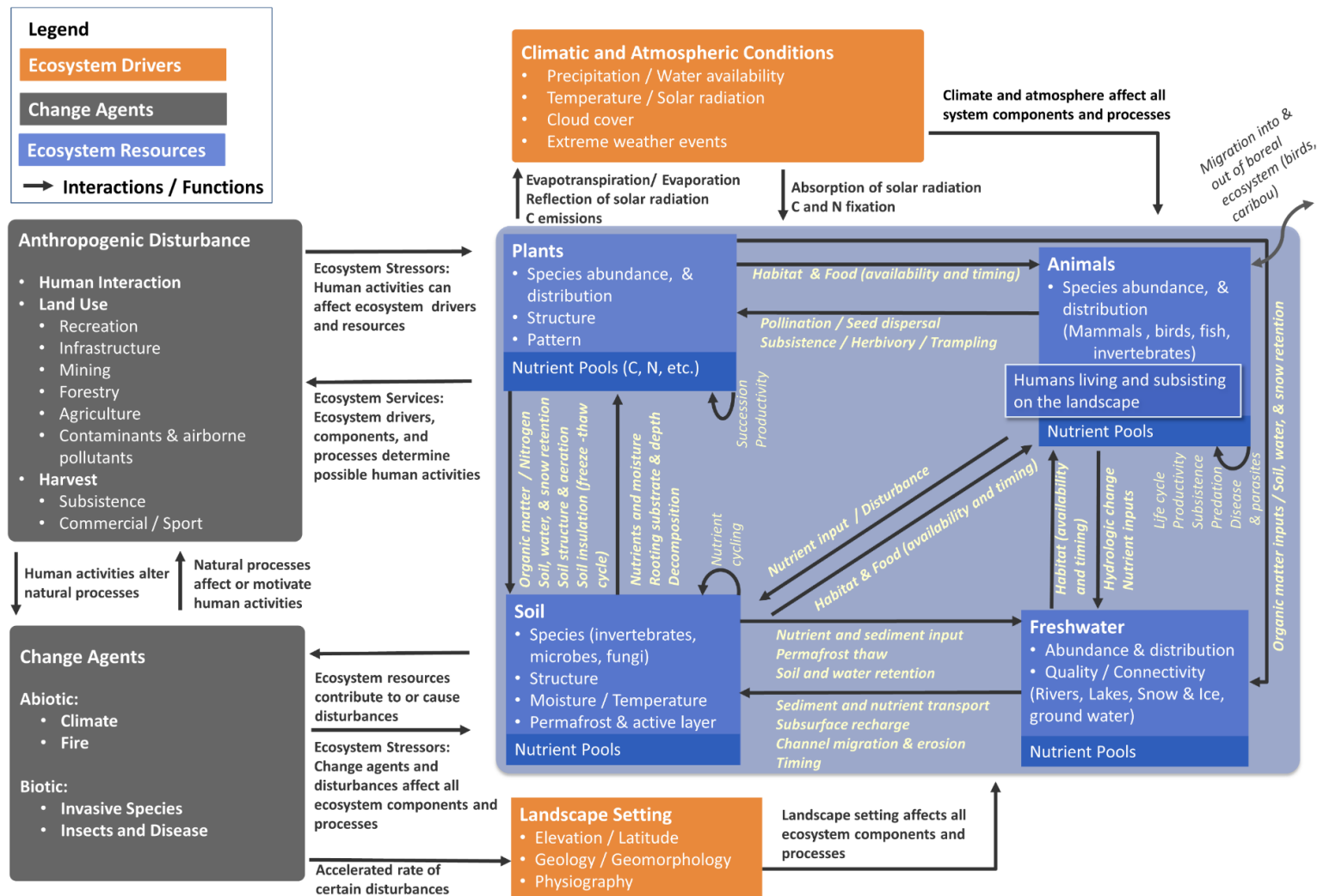
Science/Ecosystem Tract

Understanding of critical ecosystem components



Identification of regionally significant CEs and CAs

Conceptual Ecoregional Model



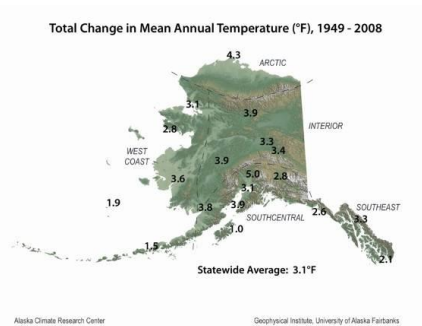
Similar for both REAs

Management Questions / Needs

- Ecoregional assessment is **guided and focused** by Management Questions
- Identify **regional** issues faced by land and other resource managers
- Provide a clear direction; **focus** the work effort
- Identify **data needs** and provide context to issues; avoid collecting irrelevant data

Change Agents

Features or phenomena that have the potential to affect size, condition, and landscape context of CEs



Climate



Permafrost



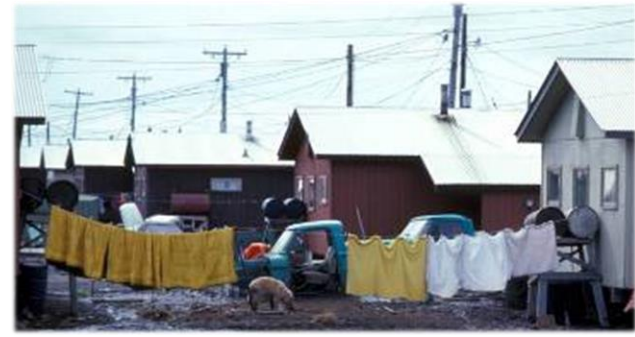
Fire



Invasive Species



Insect and Disease



Development

Conservation Elements

Biotic constituents or abiotic factors of regional importance in major ecosystems and habitats

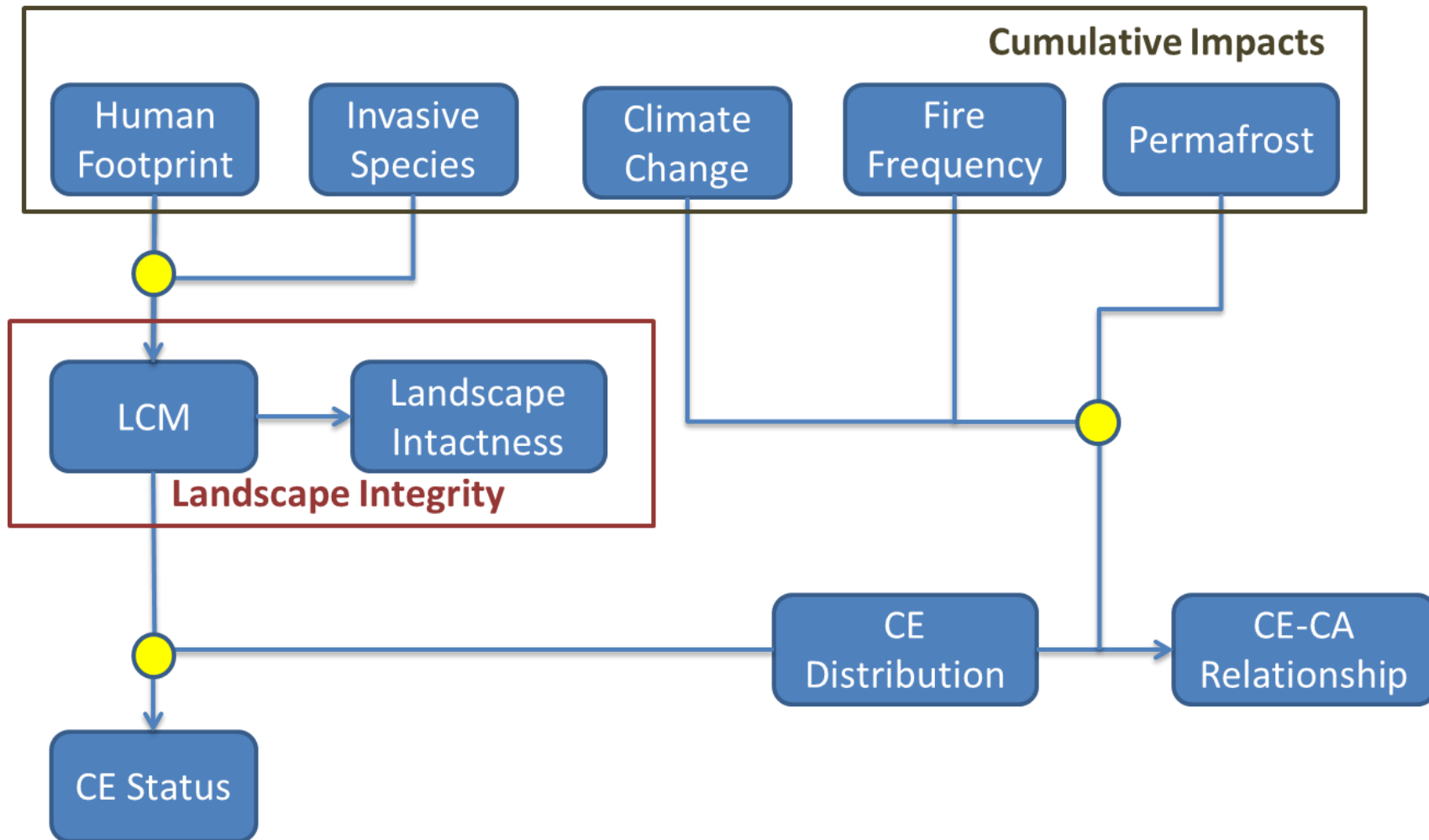


Coarse-filter: terrestrial vegetation and aquatic ecosystems that represent dominant ecological patterns



Fine-filter: species that represent critical ecosystem functions and services

Integrated Products



Differences

North Slope

- Executive summary
- Development scenarios
- Fire
- No Insect and Disease
- Invasive Climatic Analysis
- No Aquatic Fine-filter CEs
- No new distributions
- Management Questions

Central Yukon

- No executive summary
- Development time frames
- Fire
- Insect and Disease
- Invasive Vulnerability
- Aquatic Fine-filter CEs
- Unique distributions
- Management Questions

Despite differences, both REAs have the same conceptual, processing, and report framework

North Slope Rapid Ecoregional Assessment



Final report prepared for:
Bureau of Land Management
U.S. Department of the Interior

Edited by E.J. Trammell, M.L. Carlson, N. Fresco, T. Gotthardt,
M.L. McTeague, and D. Vadapalli.

July 2015

Central Yukon Rapid Ecoregional Assessment



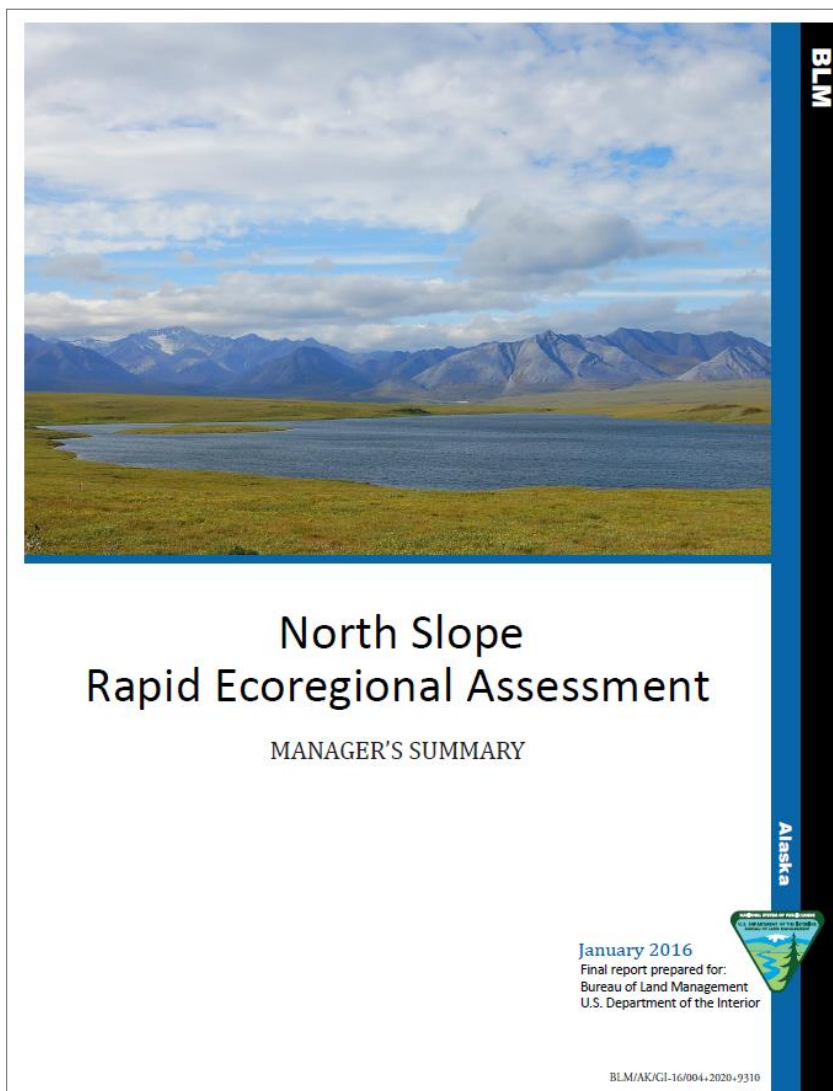
Final report prepared for:
Bureau of Land Management
U.S. Department of the Interior

Edited by E.J. Trammell, T. Boucher, M.L. Carlson, N.
Fresco, J.R. Fulkerson, M.L. McTeague, J. Reimer, and J.
Schmidt.

July 2016

OVERVIEW OF DOCUMENTS

Manager's Summary



Broad methods and major results

Intentional avoidance of technical detail

Only available for North Slope

Management Team for Central Yukon had concerns about lack of appropriate context for results

Technical Report

North Slope Rapid Ecoregional Assessment



Final report prepared for:
Bureau of Land Management
U.S. Department of the Interior

Edited by E.J. Trammell, M.L. Carlson, N. Fresco, T. [Gotthardt](#),
M.L. McTeague, and D. [Vadapalli](#).

July 2015

Central Yukon Rapid Ecoregional Assessment



Final report prepared for:
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Fresco, J.R. Fulkerson, M.L. McTeague, J. Reimer, and J.
Schmidt.

July 2016

Report structure the same for both REAs

Report Structure

- A. Cover Sheets
- B. Introduction
- C. Abiotic Change Agents
 - 1. Climate
 - 2. Fire
 - 3. Permafrost
- D. Biotic Change Agents
 - 1. Invasive Species
 - 2. Insect and Disease (CYR only)
- E. Anthropogenic Change Agents

Report Structure (Cont.)

F. Landscape and Ecological Integrity

1. Landscape Condition
2. Landscape Integrity
3. Cumulative Impacts

G. Terrestrial Coarse-filter CEs

H. Terrestrial Fine-filter CEs

I. Aquatic Coarse-filter CEs

J. Aquatic Fine-filter CEs

K. Data Gaps and Omissions

Technical report provides detailed descriptions, methods, datasets, results, and limitations

ACCS Data Catalog

The screenshot displays the ACCS Data Catalog interface. At the top, the UAA logo and 'Alaska Center for Conservation Science UNIVERSITY of ALASKA ANCHORAGE' are visible. A search bar is in the top right. Below the header, a navigation bar shows 'All Datasets' and 'Topics'. A breadcrumb trail reads 'Home / Dataset / Search'. On the left, a sidebar lists 'Content Types' with 'Dataset' selected, and a list of topics including Wildlife (11), Landscape Ecology (8), Vegetation (6), Freshwater (3), Invasive Species (3), Rapid Ecoregional Assessments (3), Anthropogenic (2), Climate (1), Climate Vulnerability Assessment (1), and Kachemak Bay (1). The main area shows '39 results' with a search bar, 'Sort by' (Date changed), and 'Order' (Descending) dropdowns. Two results are shown: 'Chugach Climate Vulnerability Assessment (CVA)' with a description and an 'html' tag, and 'Statewide Landscape Condition' with a description and 'data', 'pdf', and 'html' tags.

Intended to provide REA products to non-REA users

CHANGE AGENT DATASETS

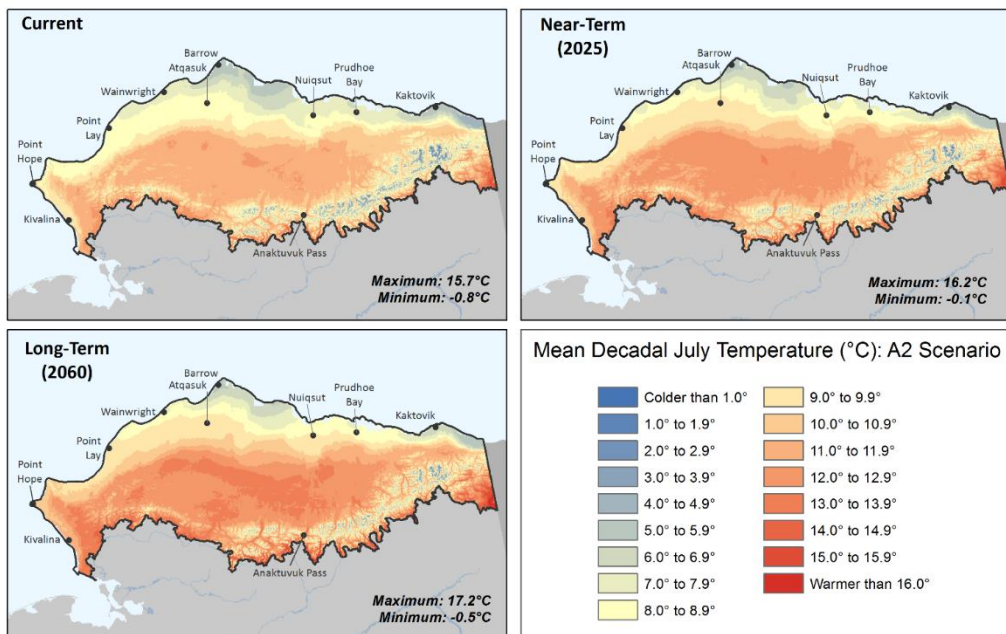
Climate Change

- Temperature
- Summer Warmth Index
- Precipitation
- Snow Day Fraction
- Day of Thaw
- Day of Freeze
- Growing Season Length
- Cliomes

Current: 2010s decade

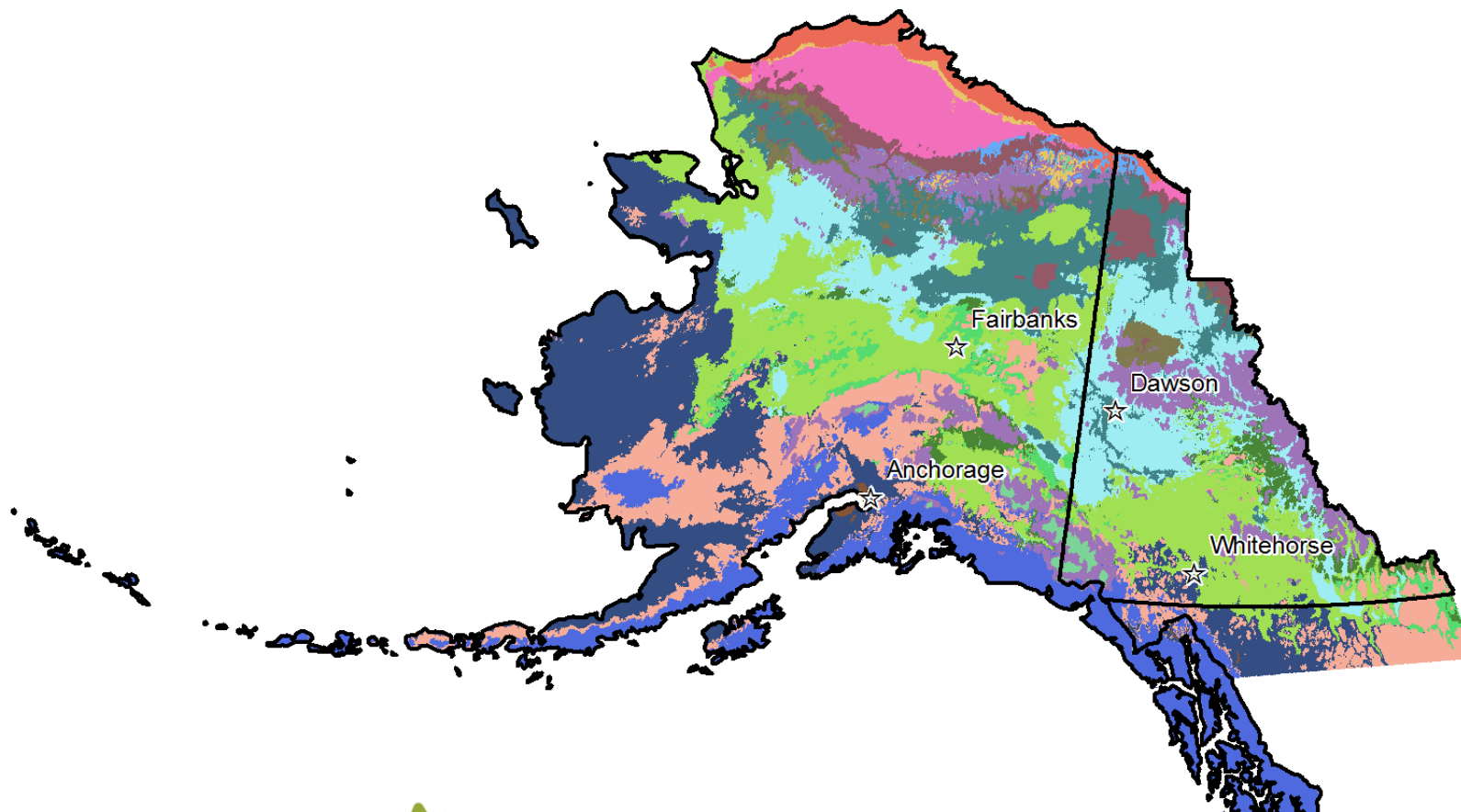
Near: 2020s decade

Long: 2060s decade



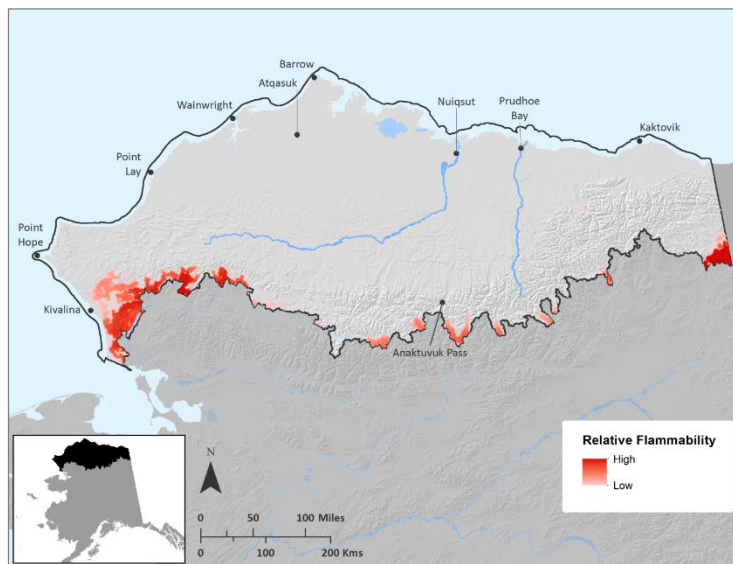
Cliomes

- Clusters of similar climate
- Predicted spatial shift of those clusters



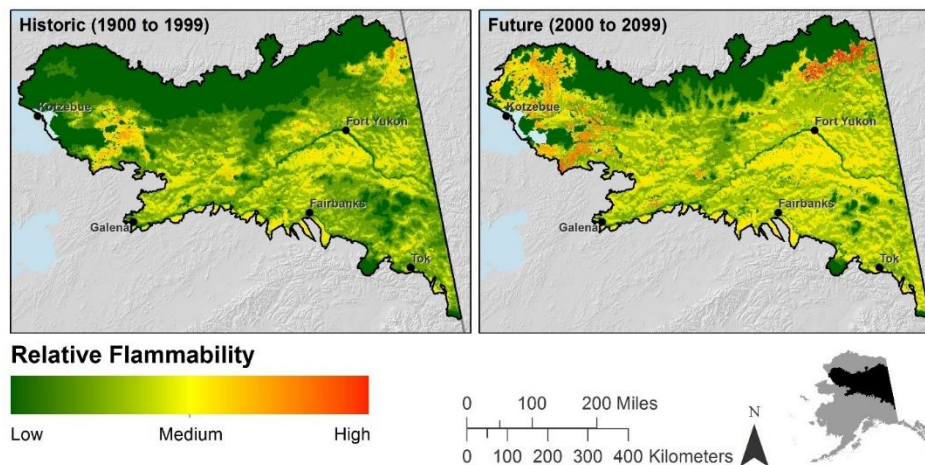
Fire

- Relative Flammability



North Slope

Unified: 1900-2090



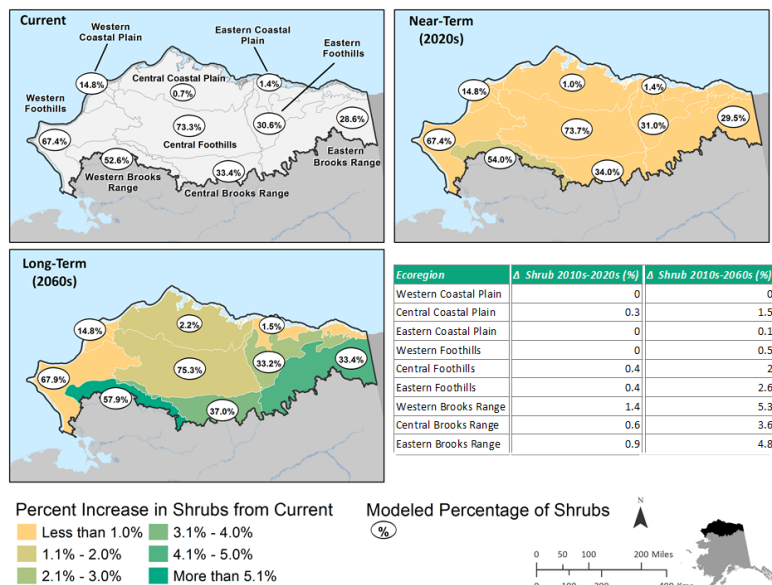
Central Yukon

Historic: 1900-1999

Future: 2000-2099

Fire

- ALFRESCO shift in shrub and forest extent

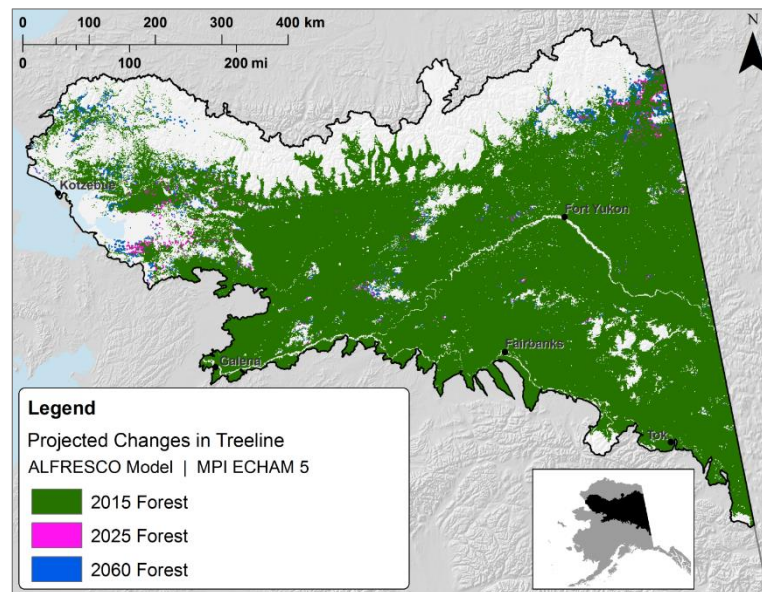


North Slope

Current: 2010s decade

Near: 2020s decade

Long: 2060s decade



Central Yukon

Current: 2015

Near: 2025

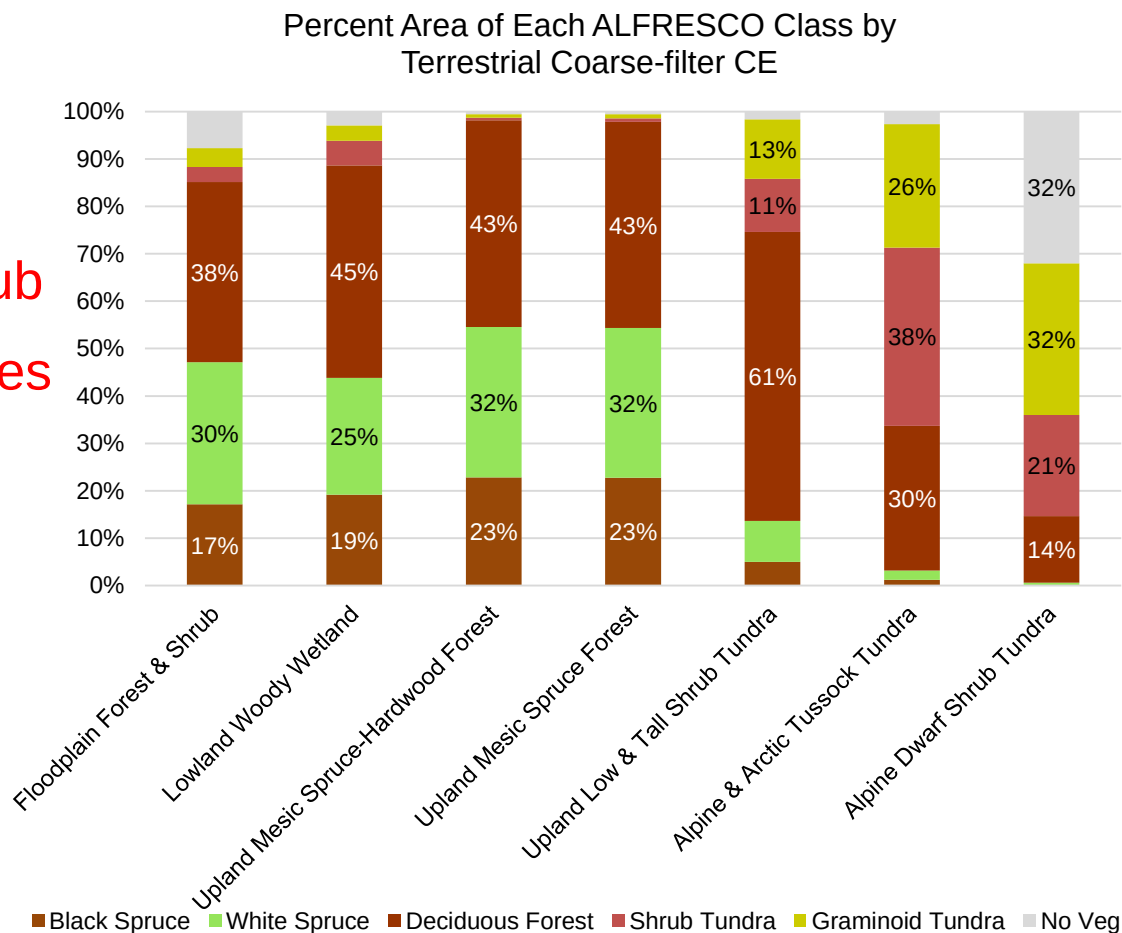
Long: 2060

Fire Caveats

ALFRESCO models vegetation **relative to fire class only**

ALFRESCO classes **do not correspond** to Existing Vegetation or Biophysical Setting

- Forest **includes shrub**
- Shrub tundra **includes tussock tundra**



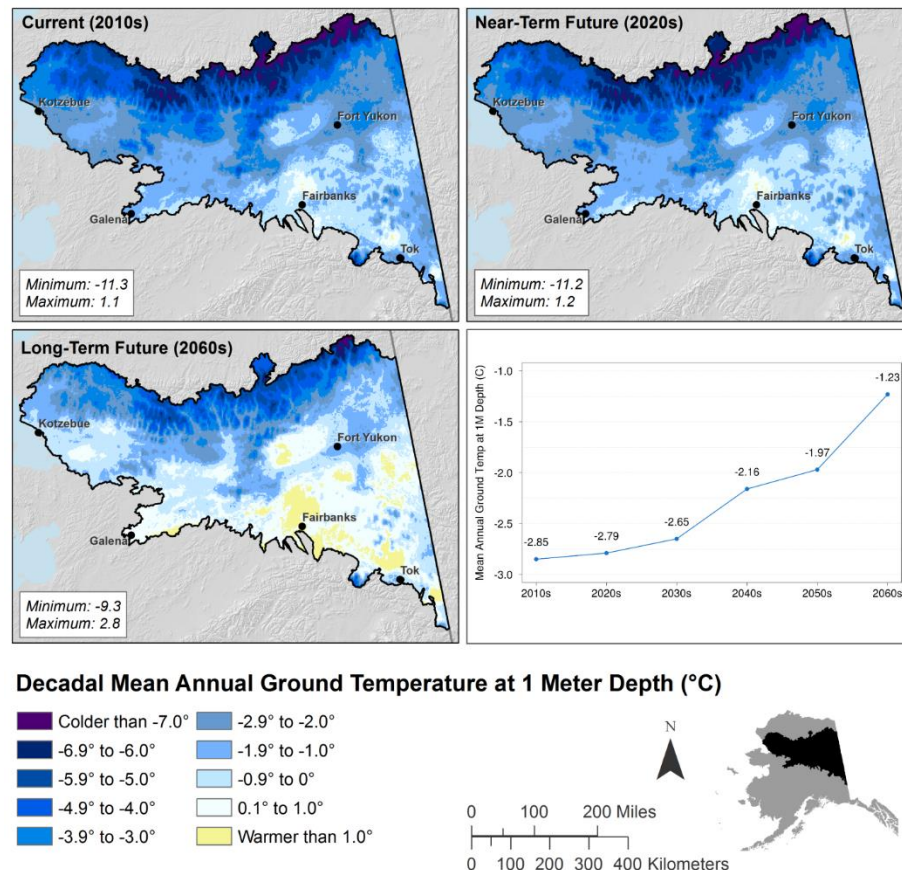
Permafrost

- Active Layer Thickness
- Mean Annual Ground Temp
- Change in permafrost
- Thermokarst predisposition

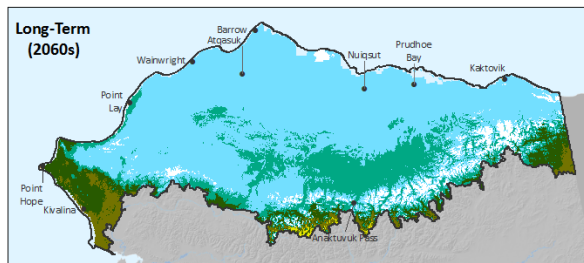
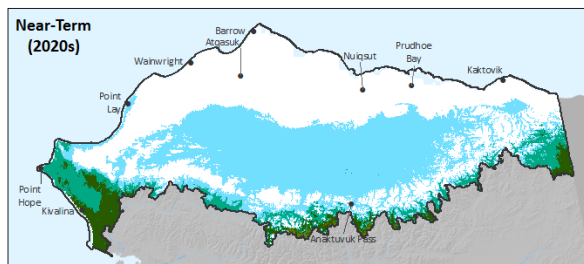
Current: 2010s decade

Near: 2020s decade

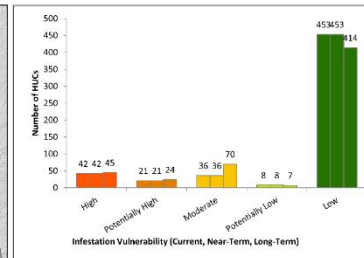
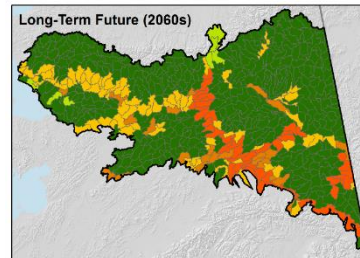
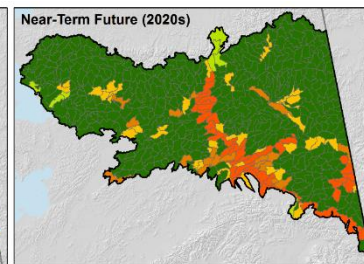
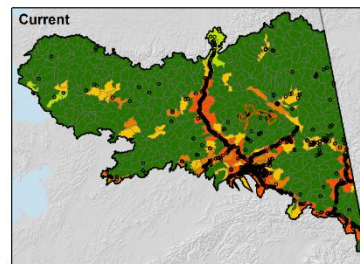
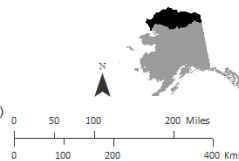
Long: 2060s decade



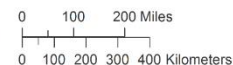
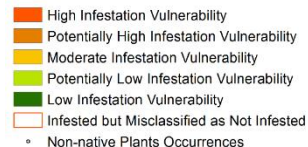
Invasive Species



Invasive Vulnerability



Legend



North Slope
Climatic Suitability

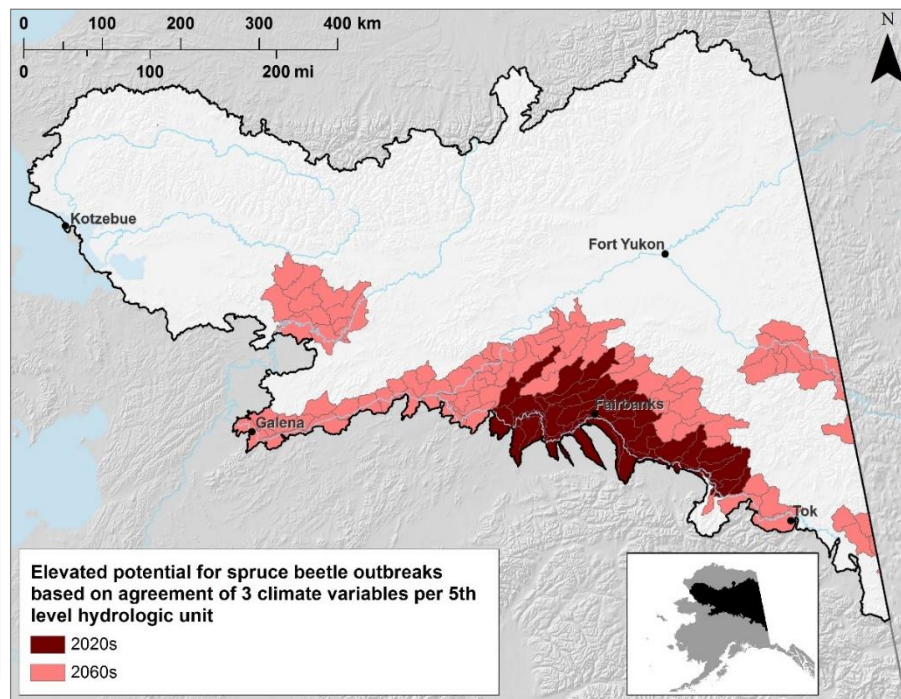
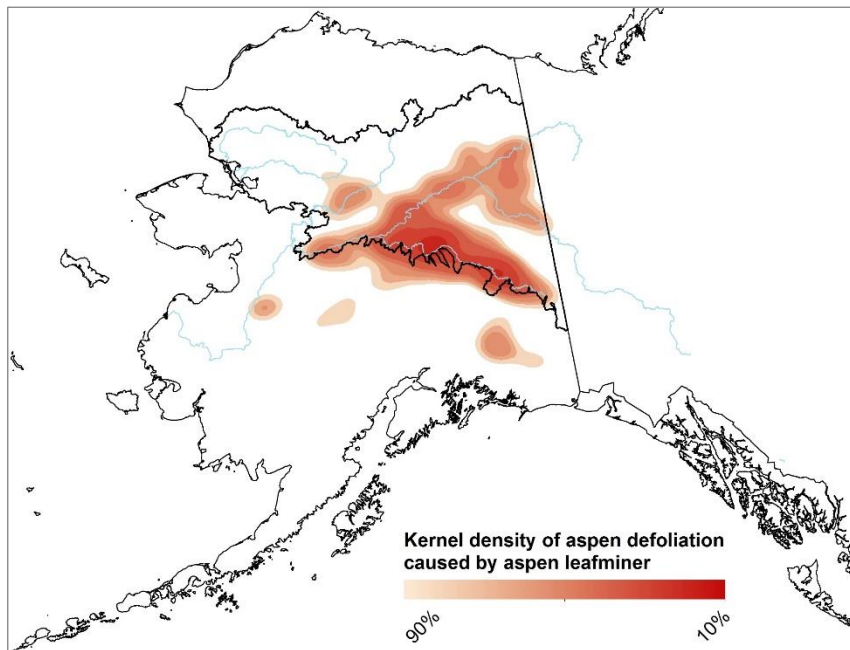
Central Yukon
Invasion Vulnerability

Current: 2010s decade

Near: 2020s decade

Long: 2060s decade

Insect and Disease



Forest Damage

Historic: 2000-2014

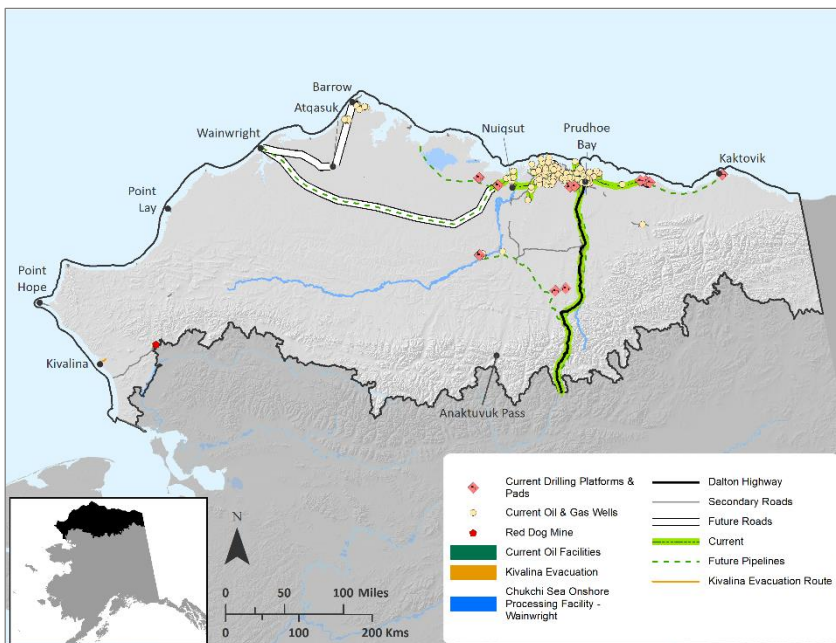
Climatic Vulnerability

Near: 2020s decade

Long: 2060s decade

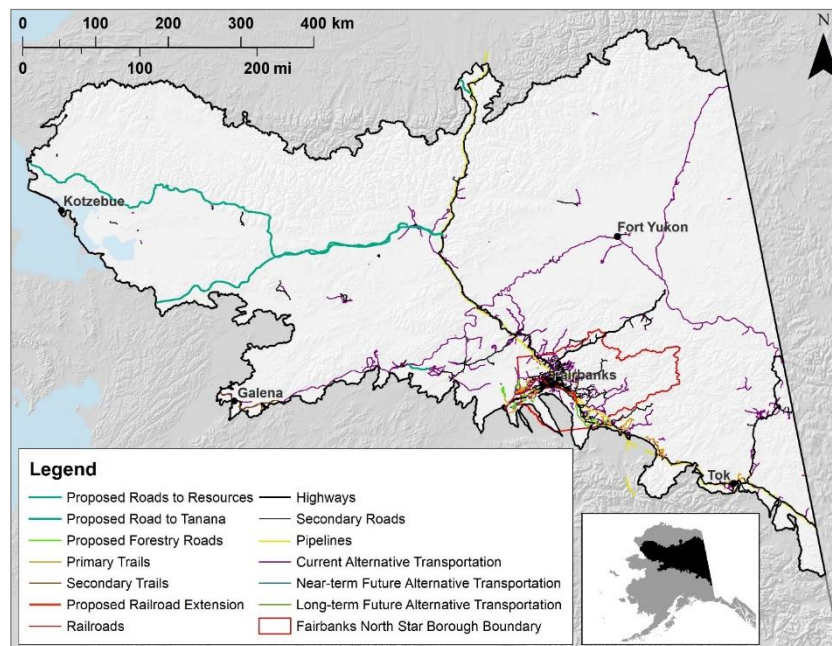
No insect and disease assessment for North Slope

Human Footprint



North Slope

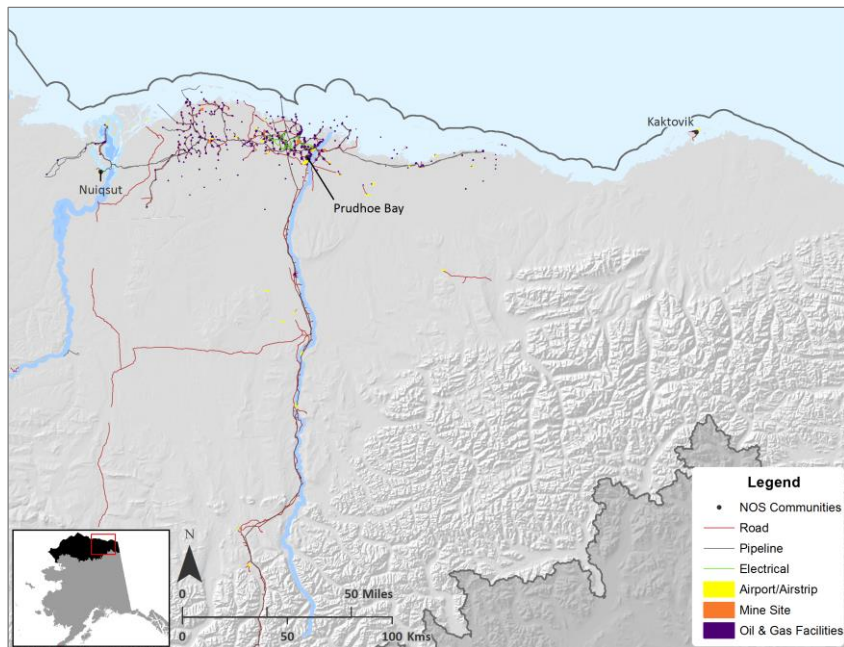
Development Scenarios (2040)



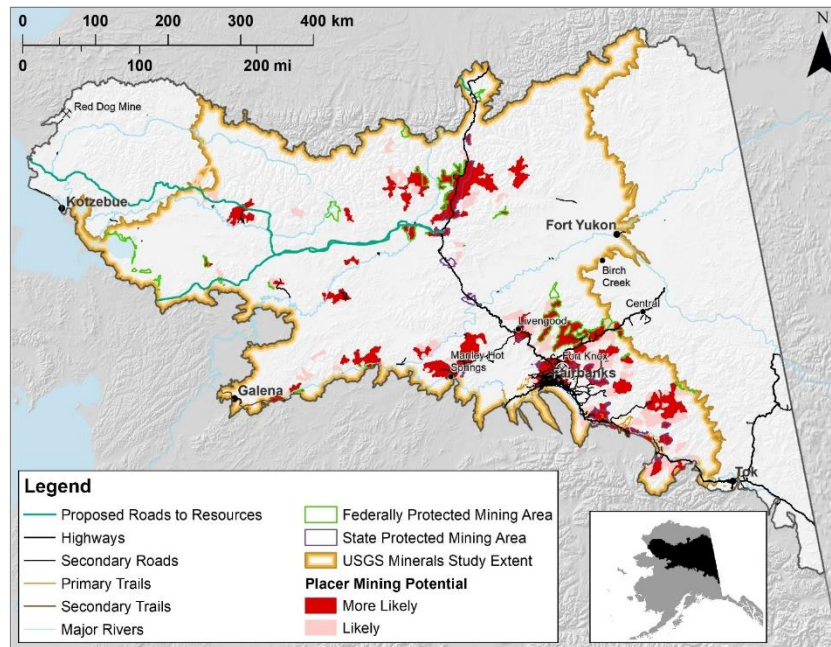
Central Yukon

Time frames (2025 and 2060)

Natural Resource Extraction

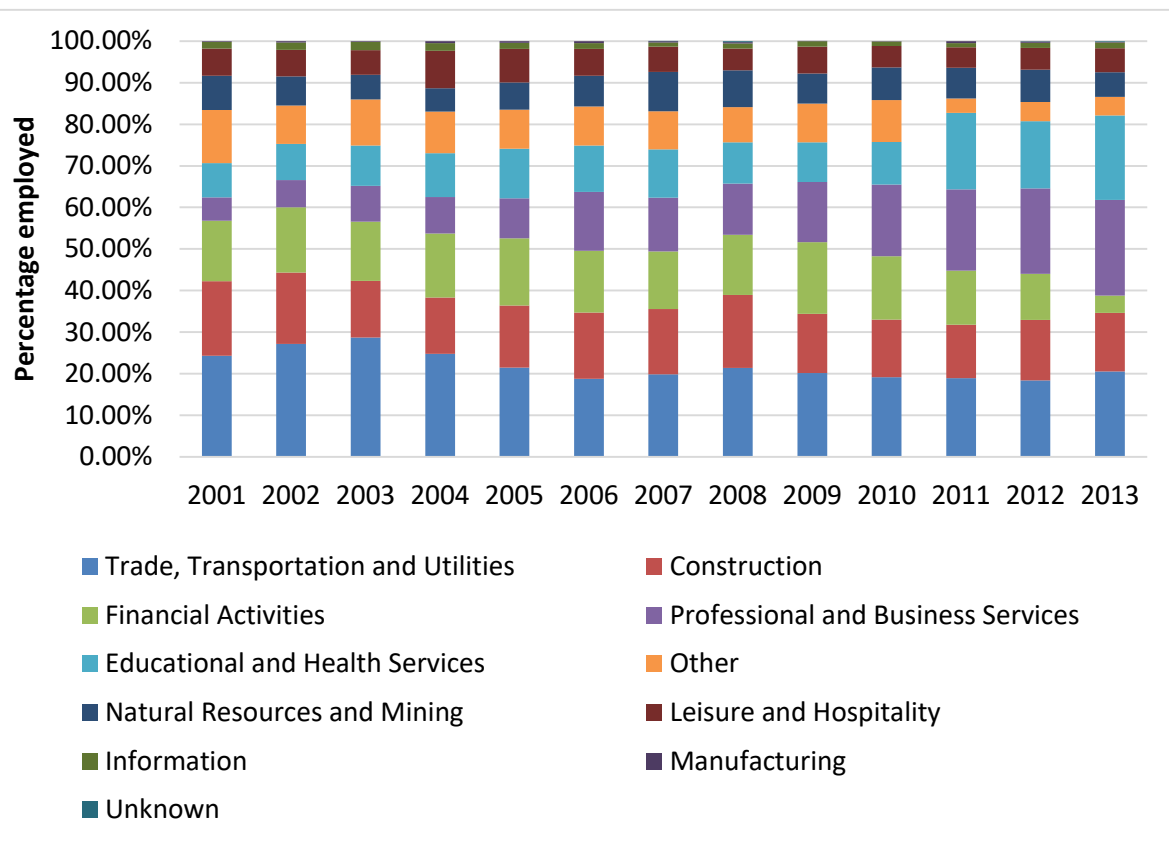


North Slope
Oil and Gas Focus



Central Yukon
Mining Focus

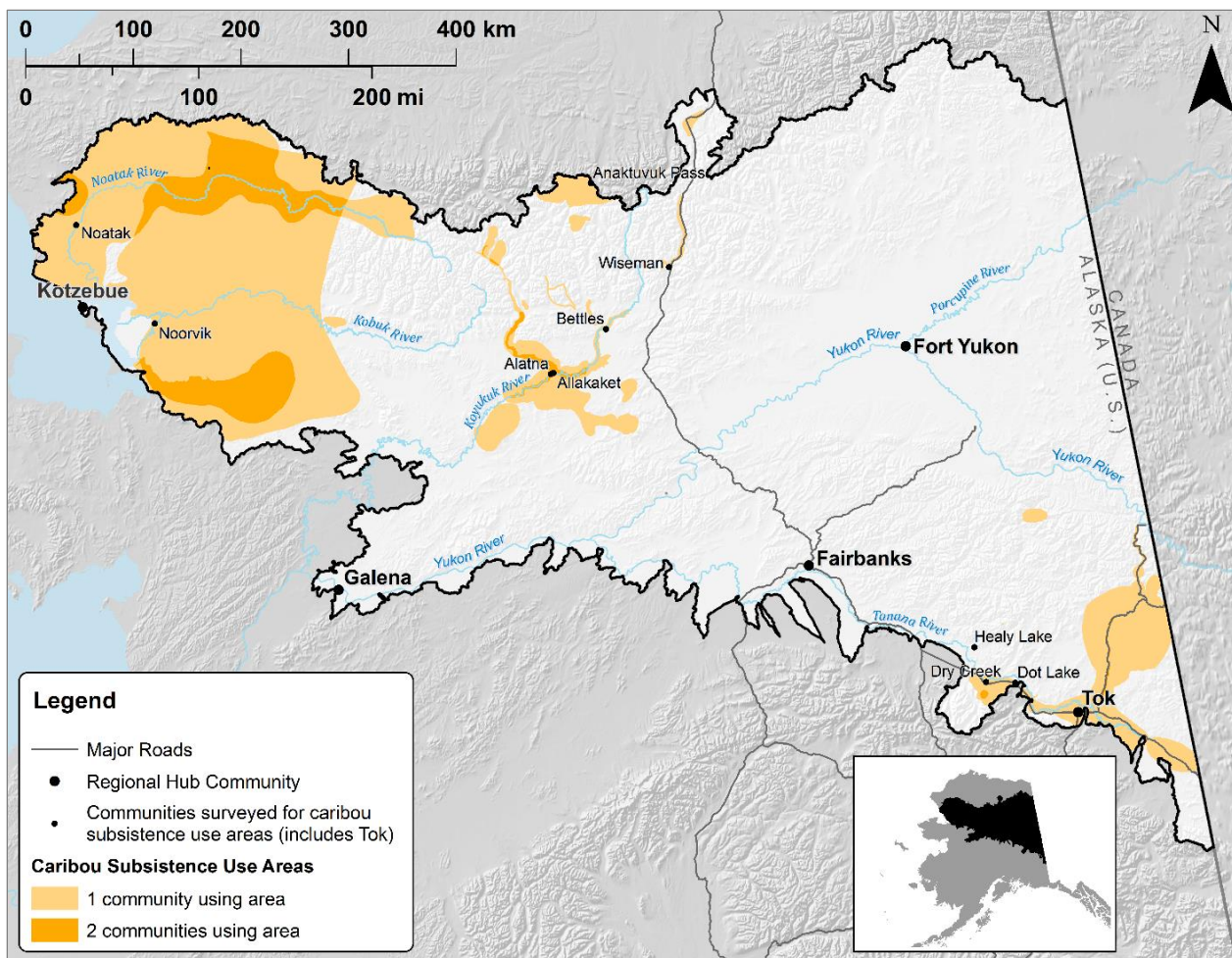
Socioeconomic Data



- Population and Demographics
- Education
- Income

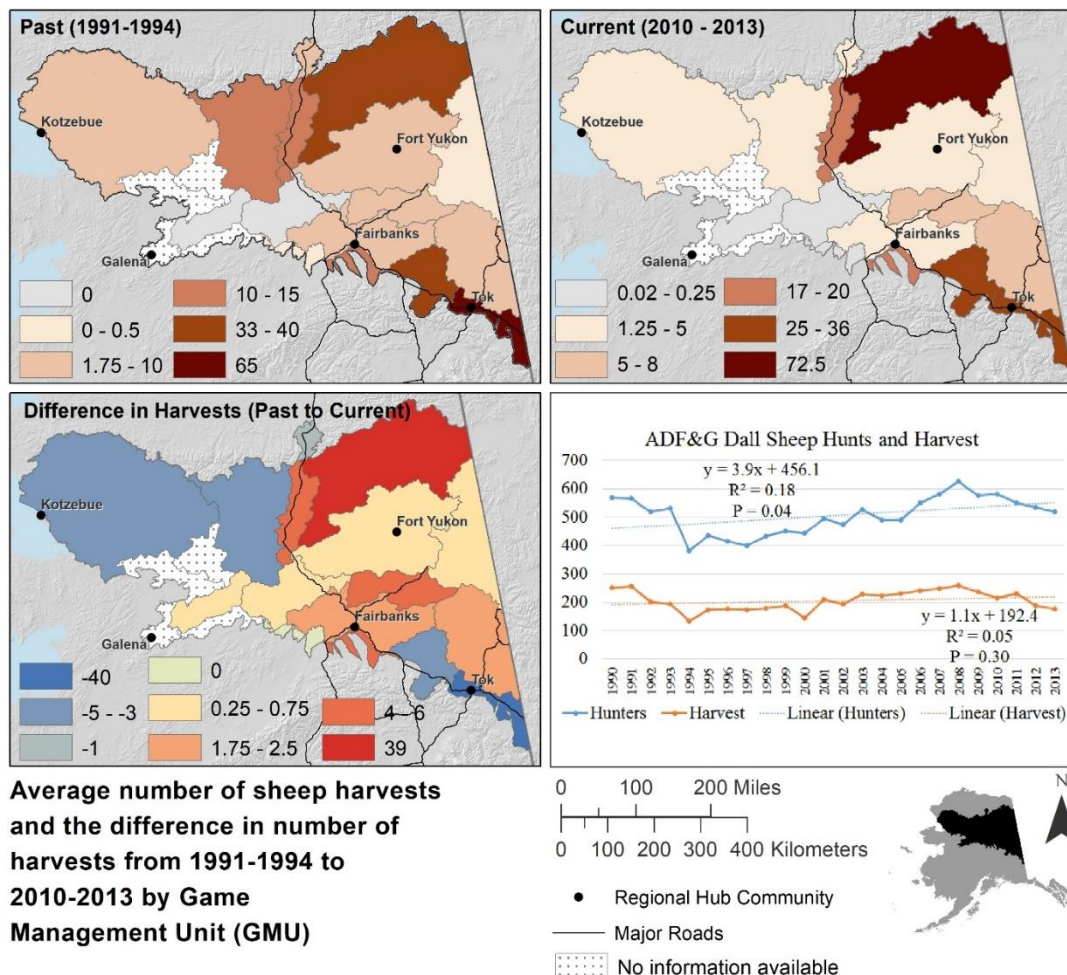
Example: employment by industry in the private sector – NOS study area including the oil industry and Red Dog Mine (2001-2013).

Subsistence



Example: caribou subsistence use areas

Sport Hunting and Fishing



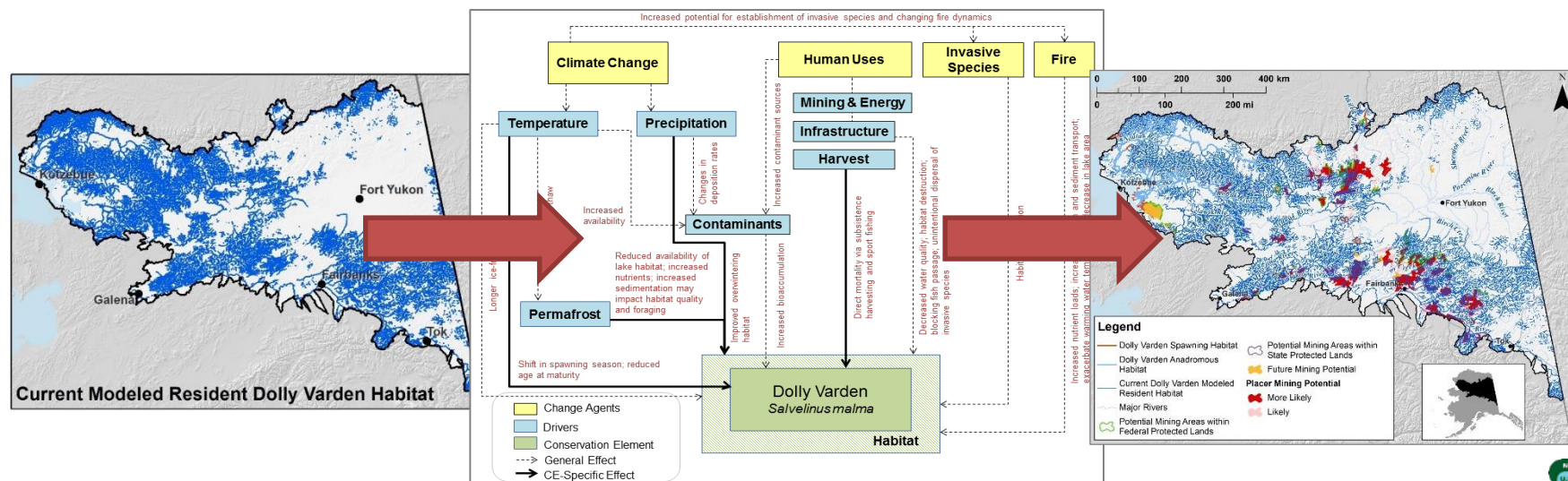
Average number of sheep harvests and the difference in number of harvests from 1991-1994 to 2010-2013 by Game Management Unit (GMU)

Spatial data for Central Yukon only

CONSERVATION ELEMENTS

Core Analyses of CEs

1. Current Distribution
2. Conceptual Model
3. Attributes and Indicators
4. Intersect the distribution of each CE with most important CA variables

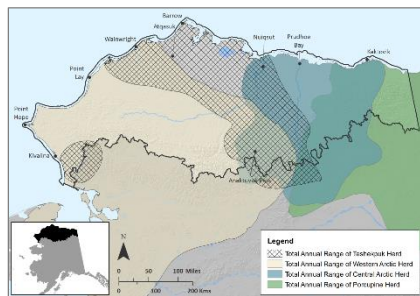


Distributions

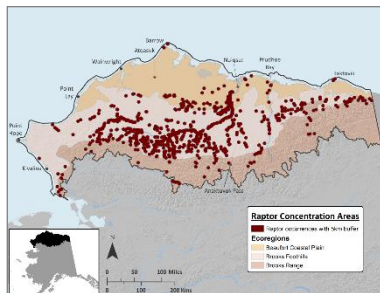
Types of distributions:

1. Range estimations
2. Occurrence data
3. Modeled habitat distribution
4. Remote sensing

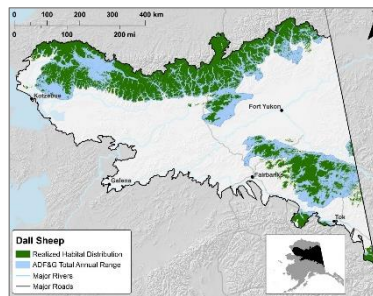
1.



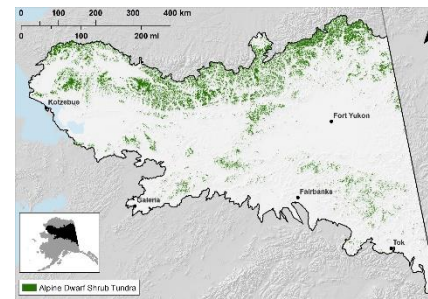
2.



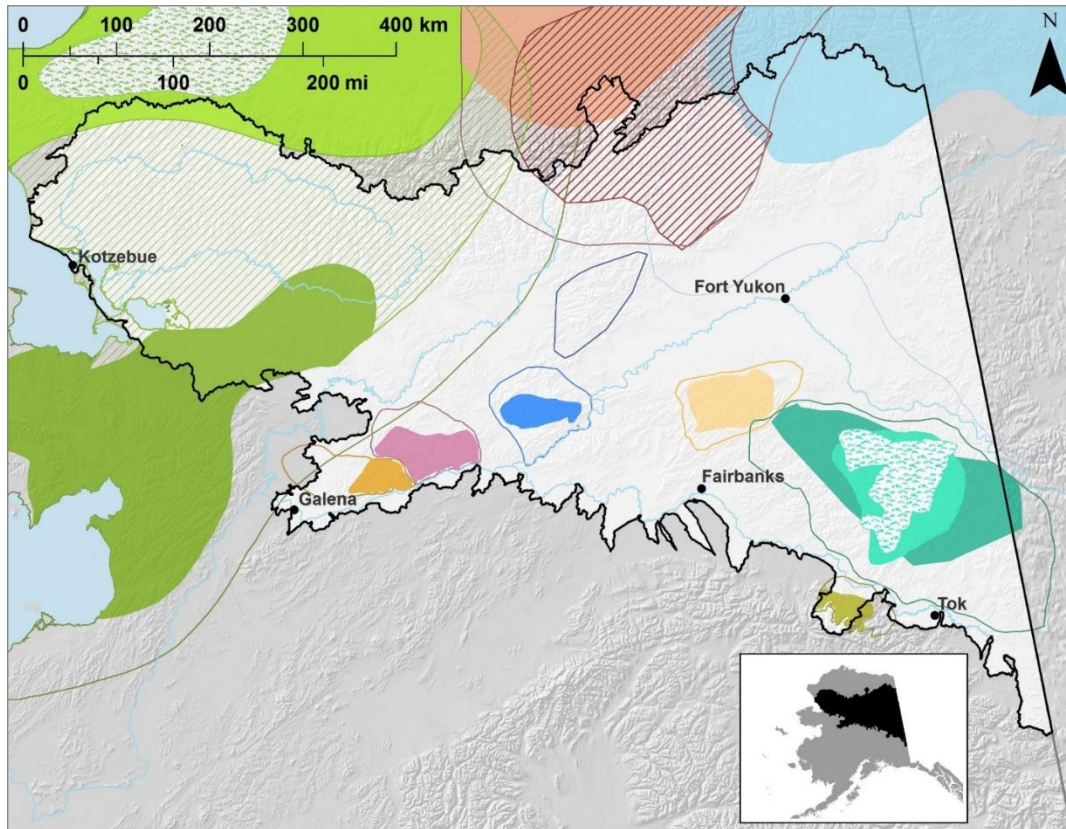
3.



4.



Range Estimation

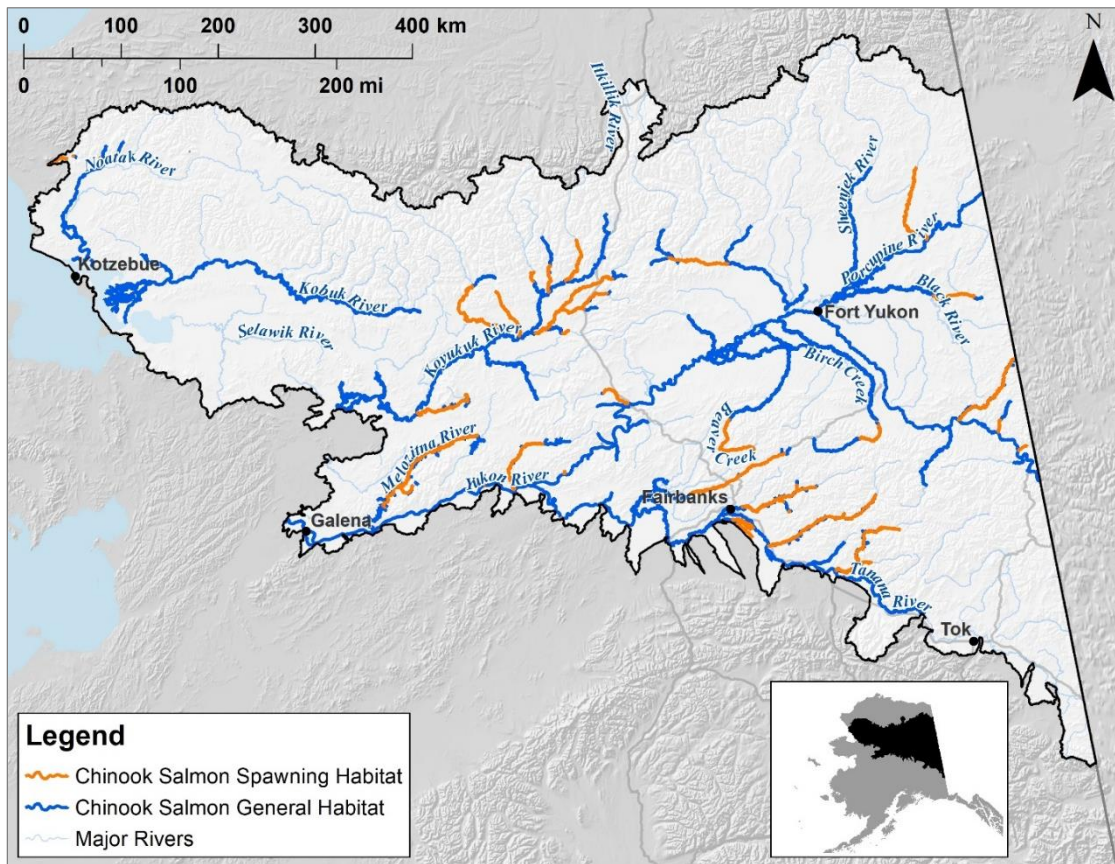


- Vague time-frame
- Not based directly on data
- Should be considered informed opinion
- Does not match range delineated by data

Example: historic caribou herd ranges

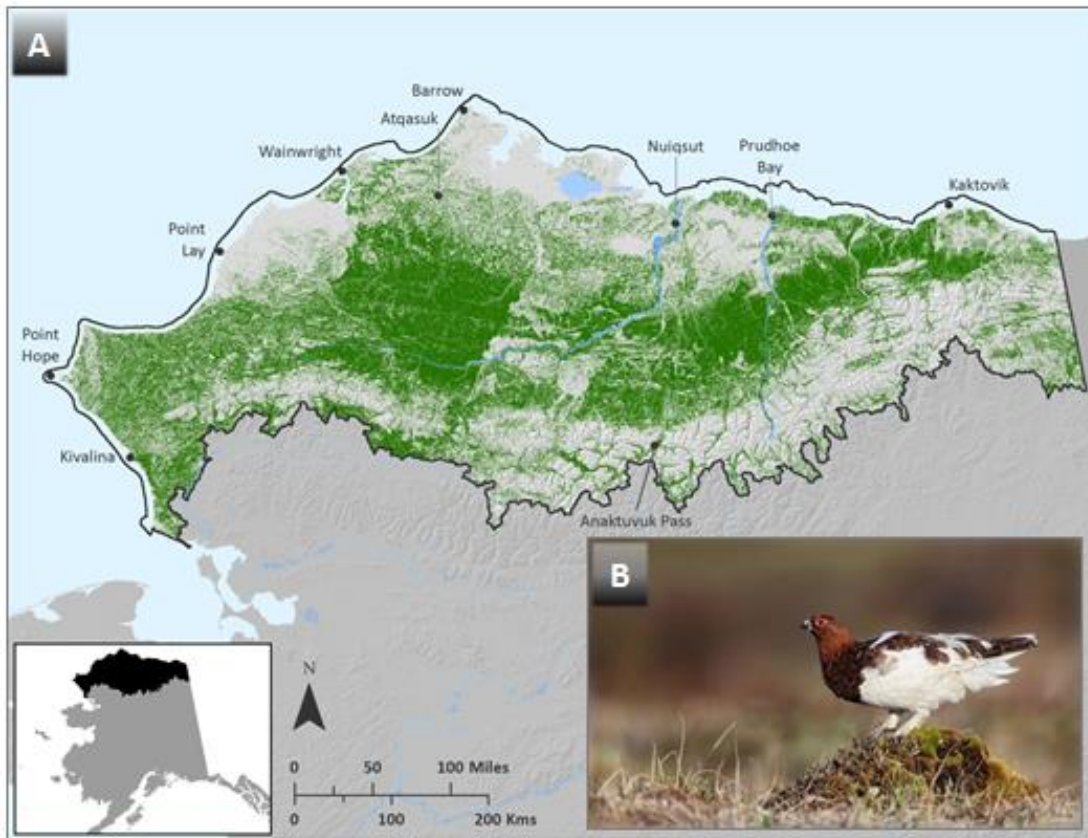
Occurrence Data

- Habitat is only shown where surveys have occurred
- Absence of delineated habitat does not mean absence of habitat
- Should be interpreted as confirmed locations



Example: general and spawning habitat of Chinook salmon

Modeled Potential Habitat: AKGAP

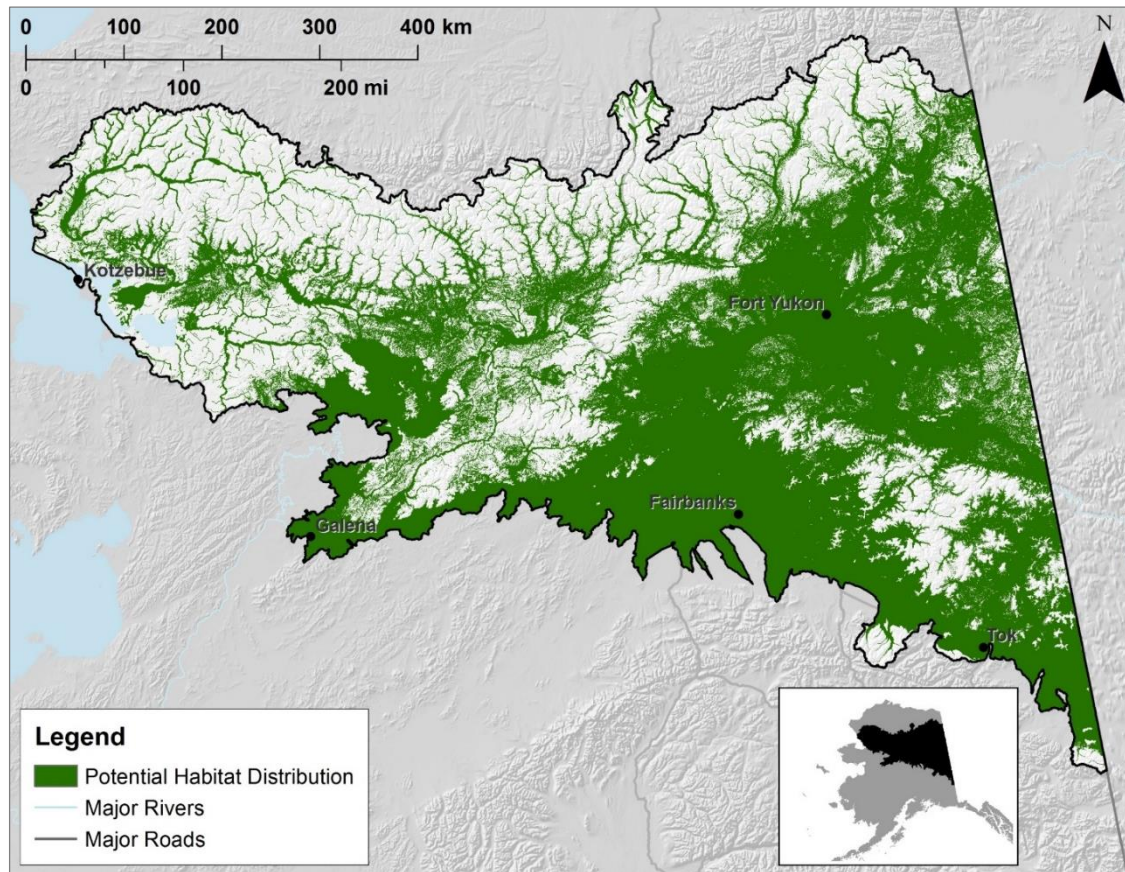


- Deductive presence-background
- Inductive
- Combined
- Habitat in absence of biohistoric factors and dispersal barriers



Example: willow ptarmigan (deductive; AUC = 0.524; CS = 0.95)

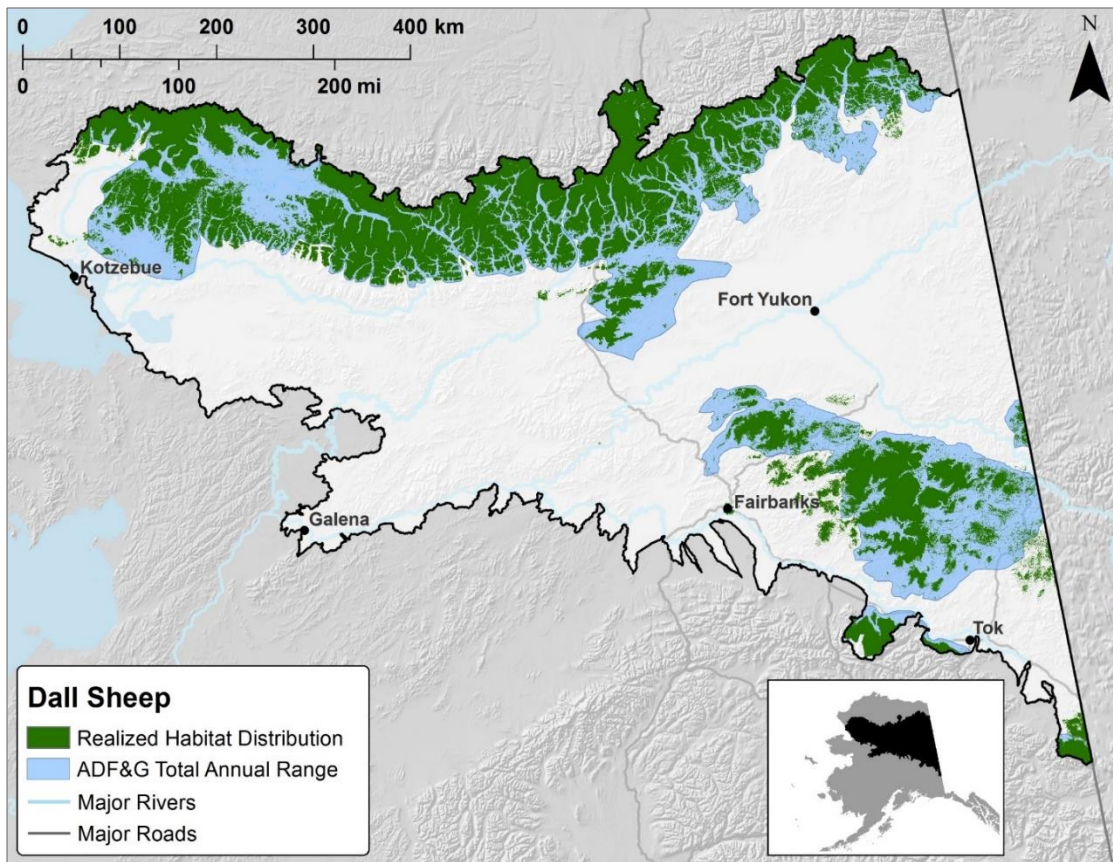
Modeled Potential Habitat: RF



- Deductive presence-pseudo-absence
- Pseudo-absences spatially and environmentally stratified
- Habitat in absence of biohistoric factors and dispersal barriers
- Reviewed by ADF&G or USFWS specialists

Example: snowshoe hare ($\kappa = 0.646$)

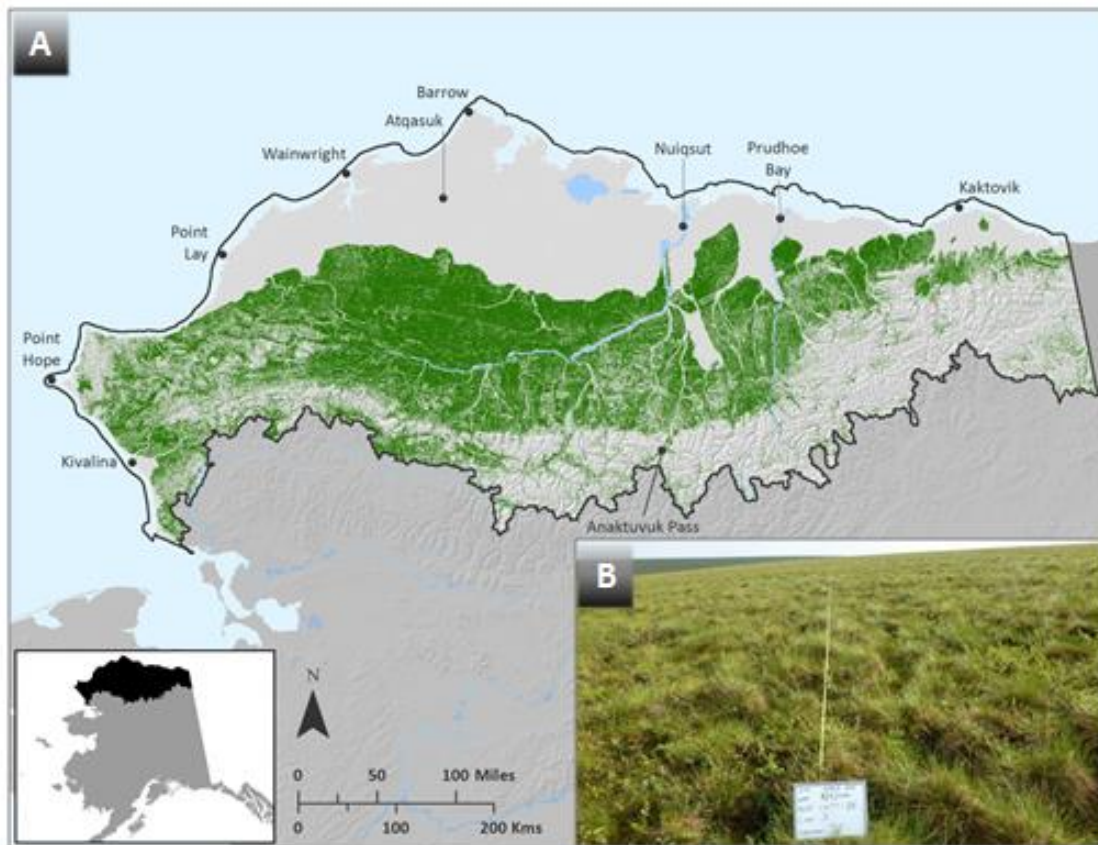
Modeled Actual Habitat: RF



- Deductive presence-pseudo-absence
- Pseudo-absences spatially and environmentally stratified
- Habitat reflects biohistoric factors and dispersal barriers
- Reviewed by ADF&G specialists

Example: Dall sheep ($\kappa = 0.795$)

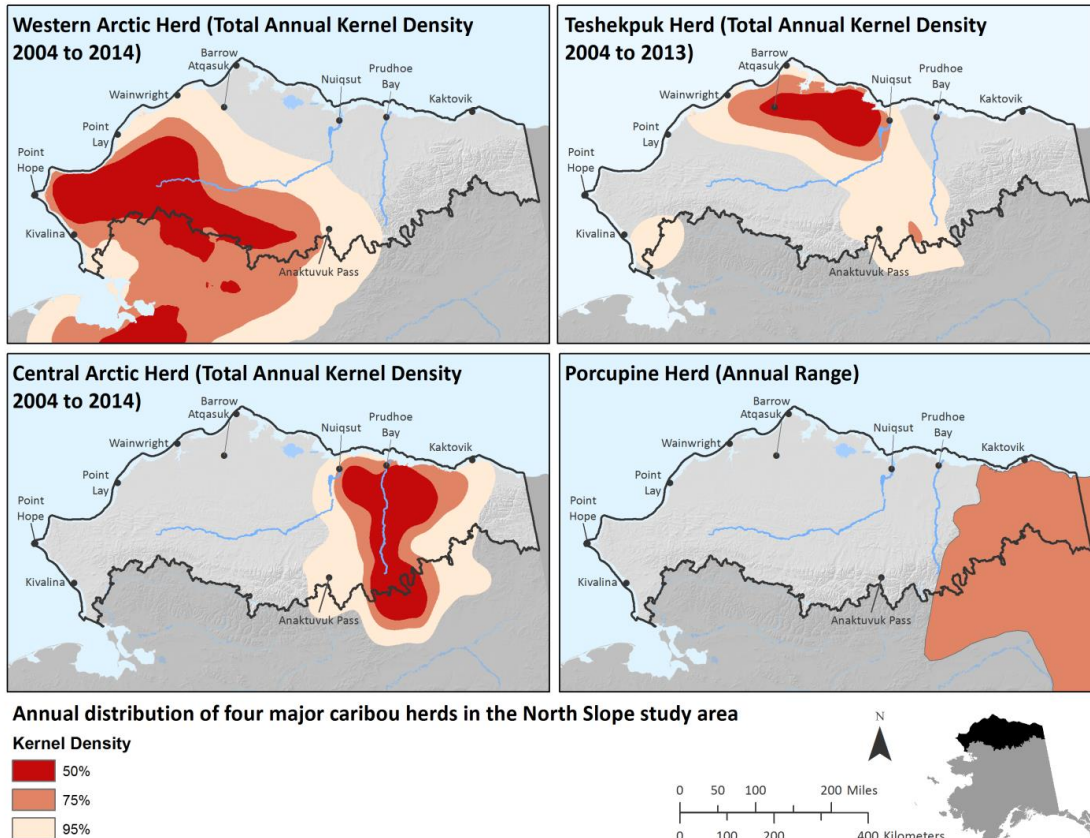
Remote Sensed: Vegetation



- Includes mosaicked data
- Spatial structure to error
- Edge distortions
- No independent accuracy assessment

Example: foothills tussock tundra (accuracy unknown)

Collar Data: North Slope Caribou



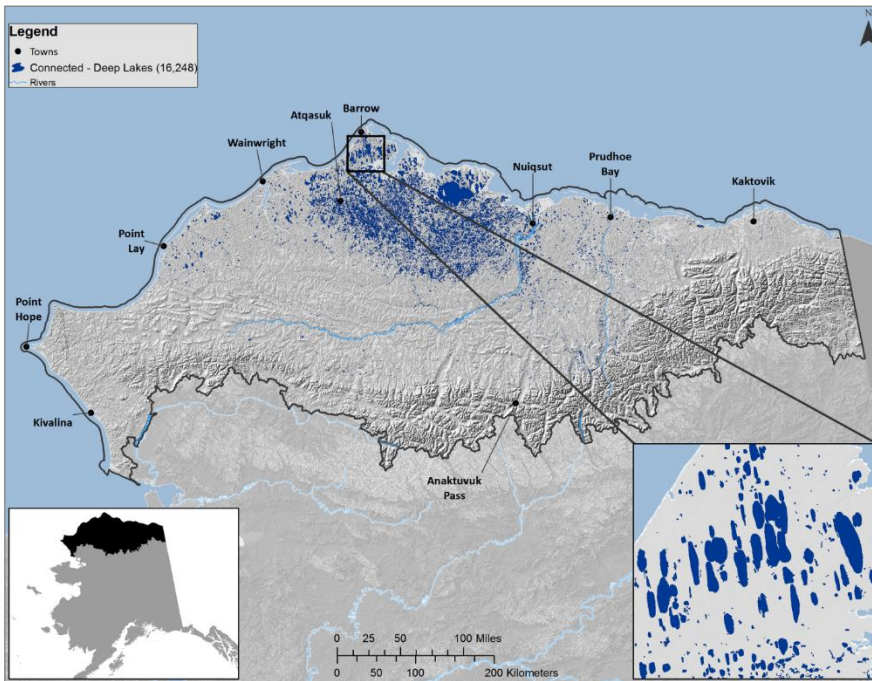
- Kernel densities of annual range produced by ADF&G
- Largest kernel is 95% interval
- Input data for collared females 2004 to 2014
- No indication of seasonality

Example: North Slope caribou herd annual ranges

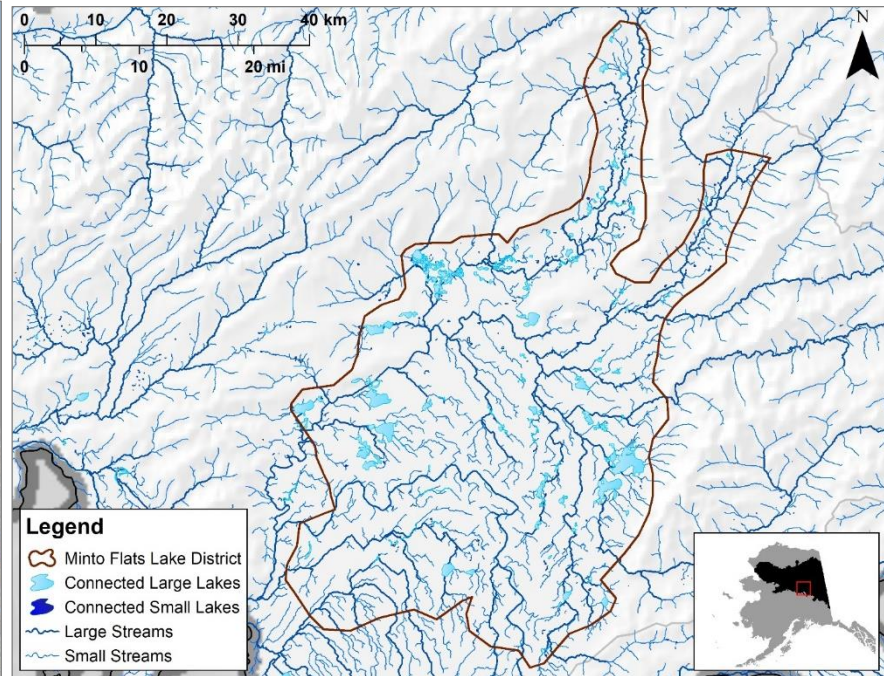
Aquatic Habitats

Aquatic habitats are a data gap in both REAs

Coarse aquatic features mapped instead



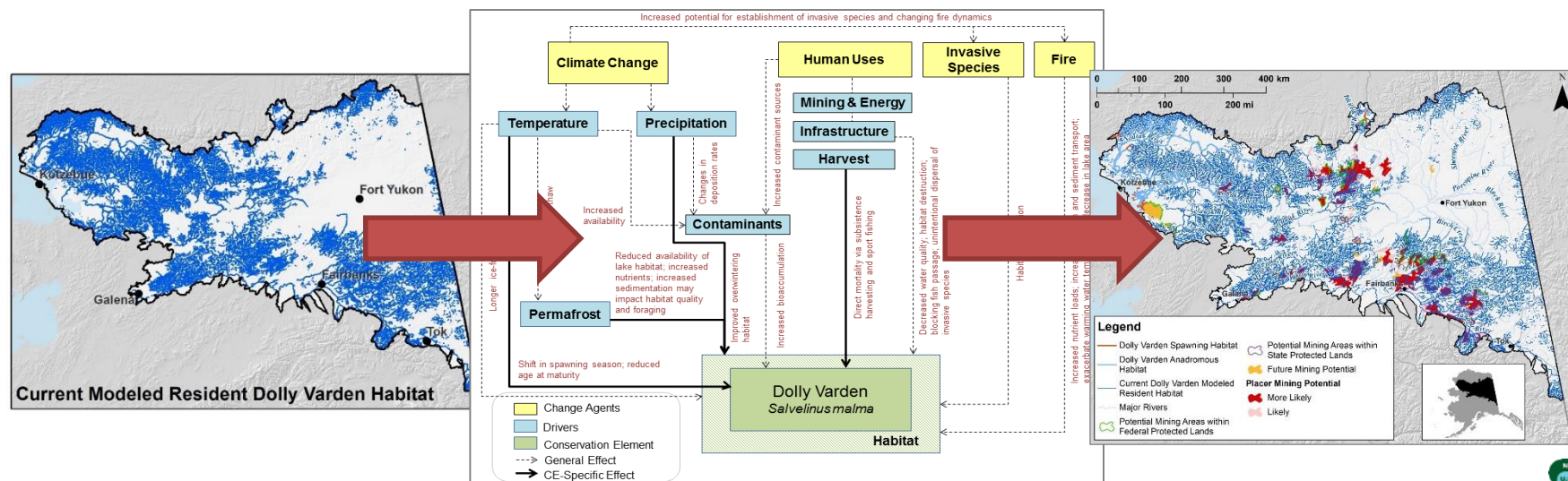
Derived from NHD



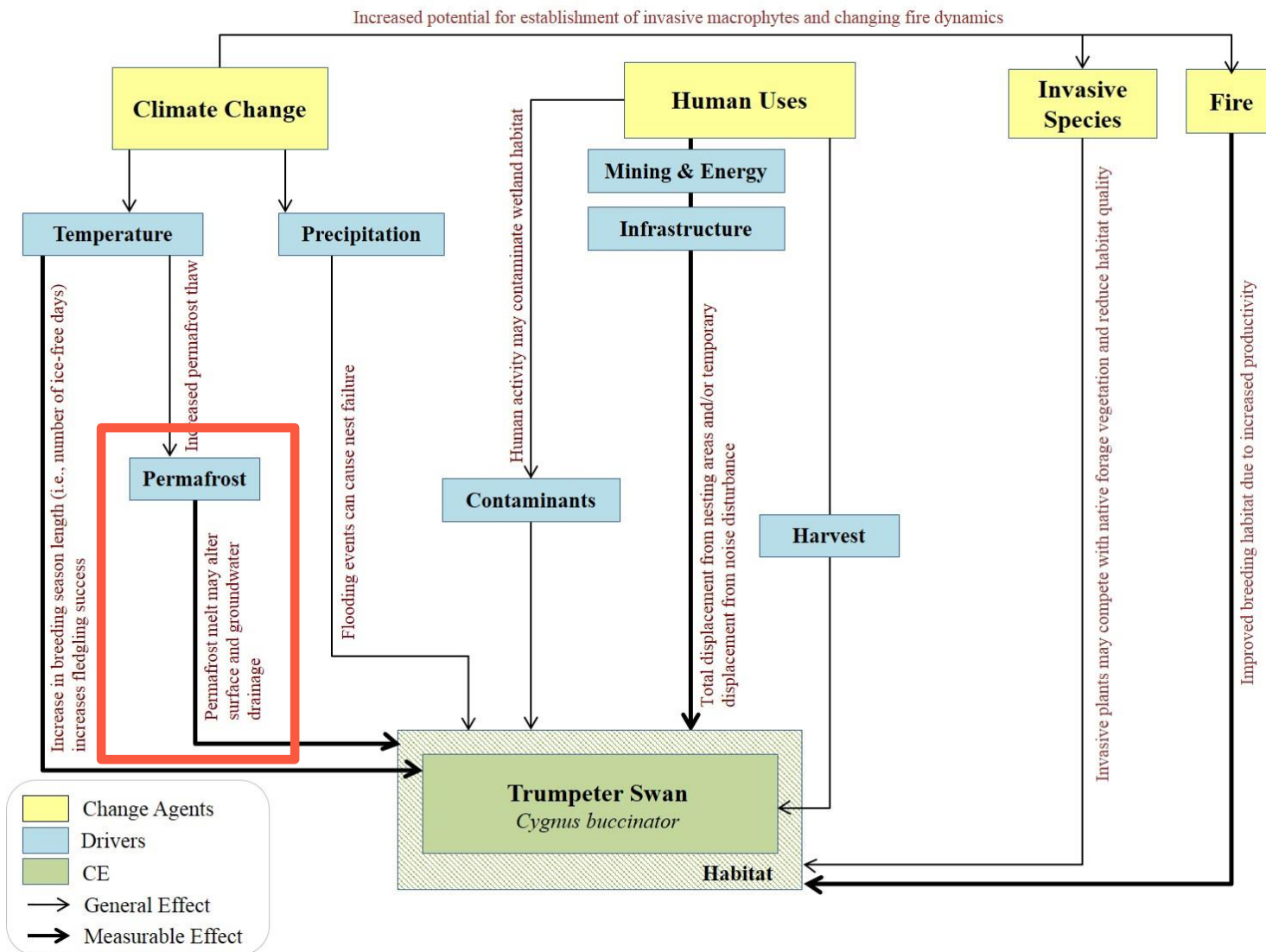
Derived from DEM

Core Analyses of CEs

1. Current Distribution
2. Conceptual Model
3. Attributes and Indicators
4. Intersect the distribution of each CE with most important CA variables

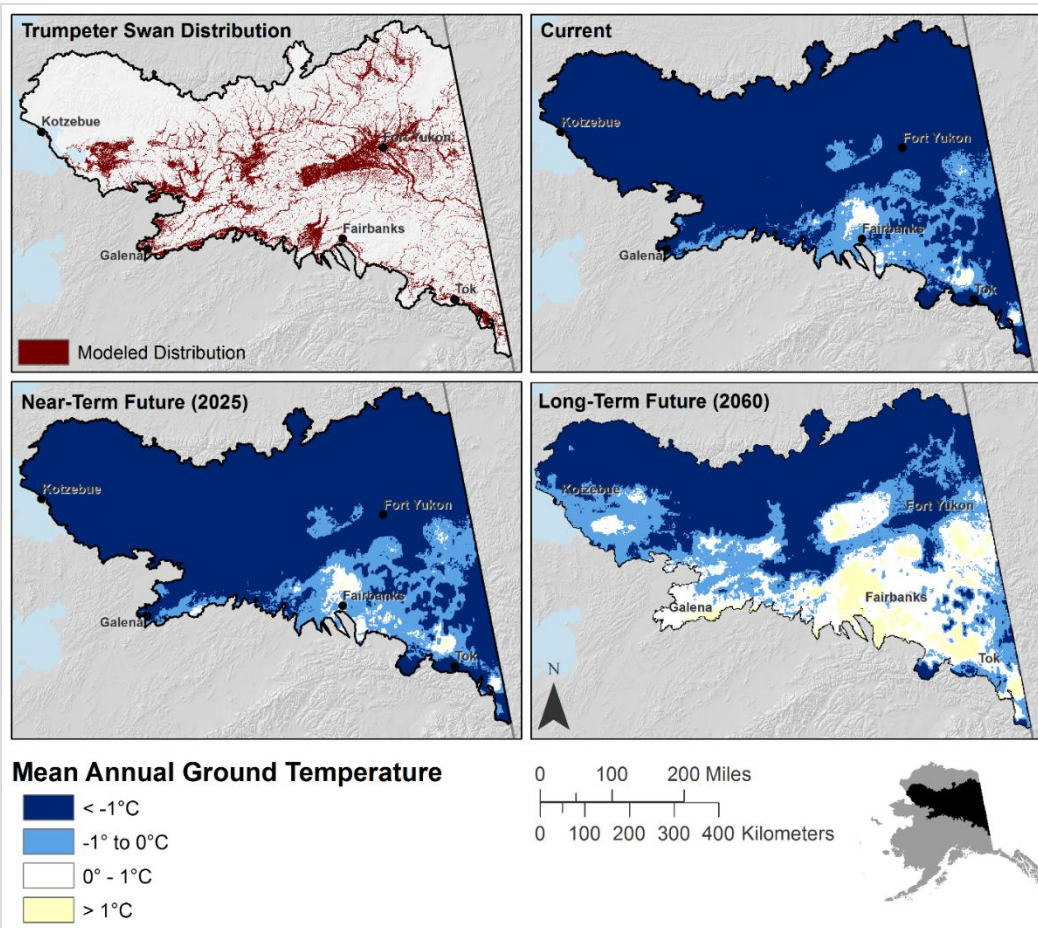


CE Conceptual Model



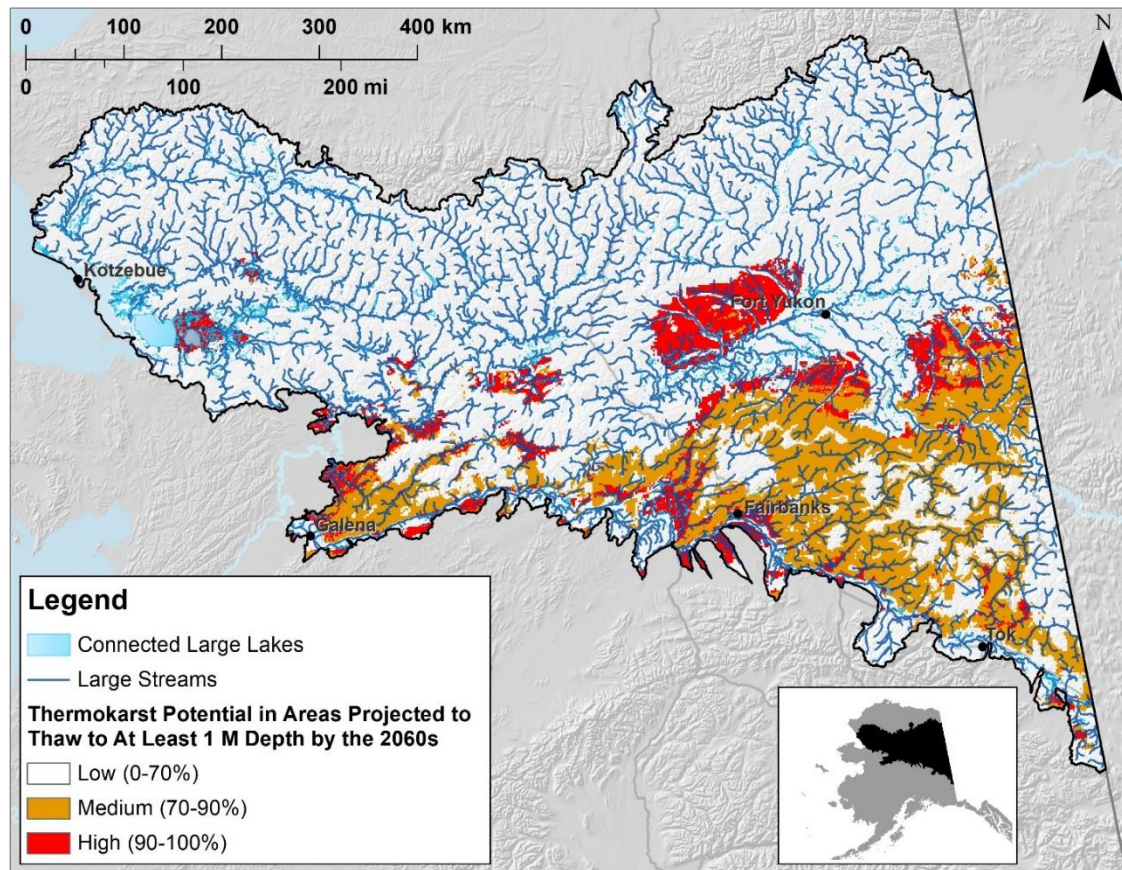
CE x CA Comparison

Areas projected to undergo significant permafrost thawing may be susceptible to changes in drainage that might affect habitat.



Example: trumpeter swan and permafrost

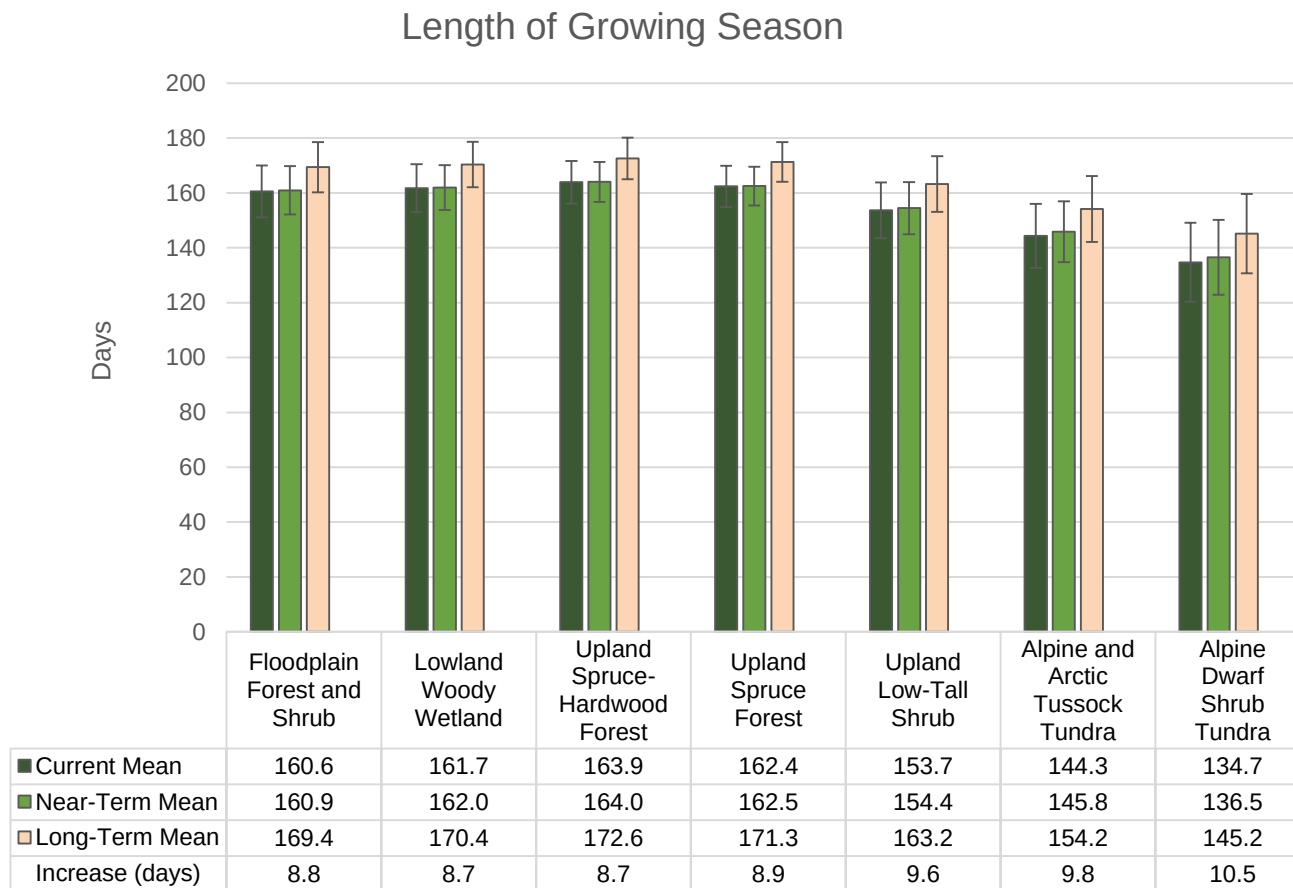
CE x CA Comparison



- Increased groundwater
- Decreased bank stability
- Higher export of nutrients and major ions to streams

Example: large streams and permafrost

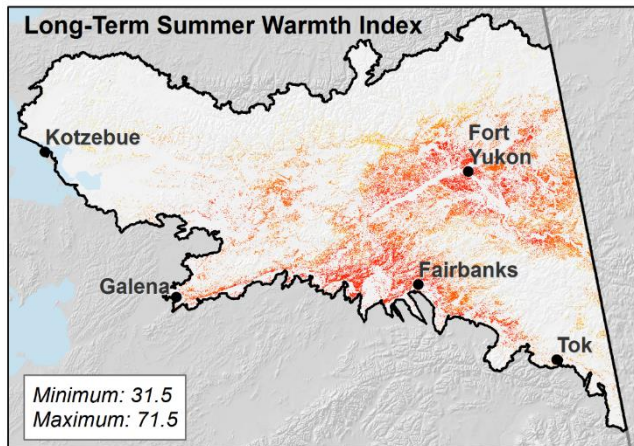
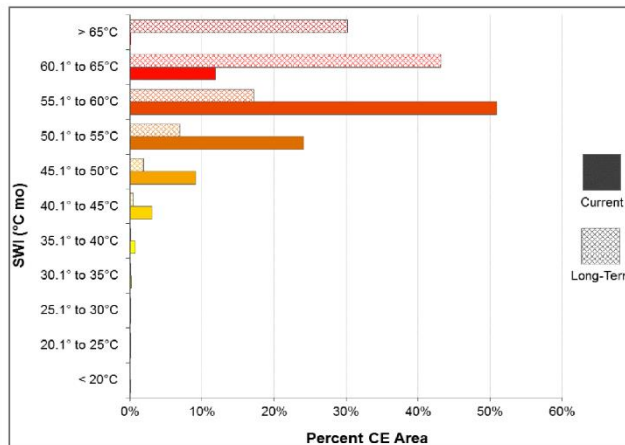
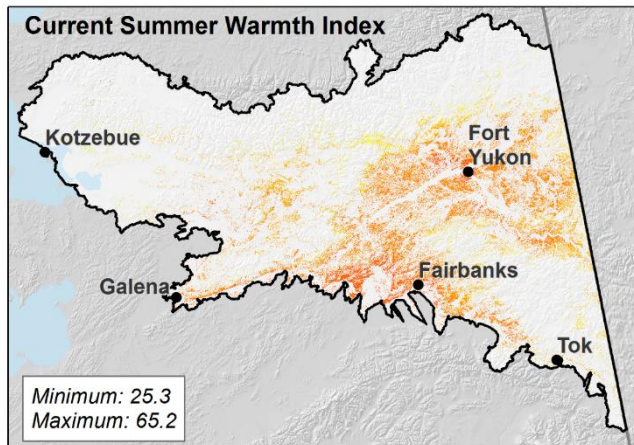
CE x CA Intersection



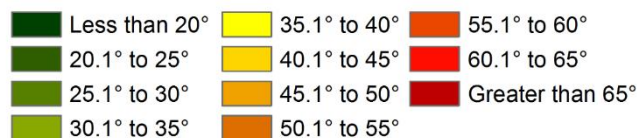
Example: growing season length per biophysical setting

CE x CA Intersection

Upland Mesic Spruce-Hardwood Forest



Summer Warmth Index (°C mo): A2 Scenario



Example: summer warmth index in biophysical setting

INTEGRATED PRODUCTS

Integrated Analyses

To effectively manage resources the BLM needs information at multiple scales:

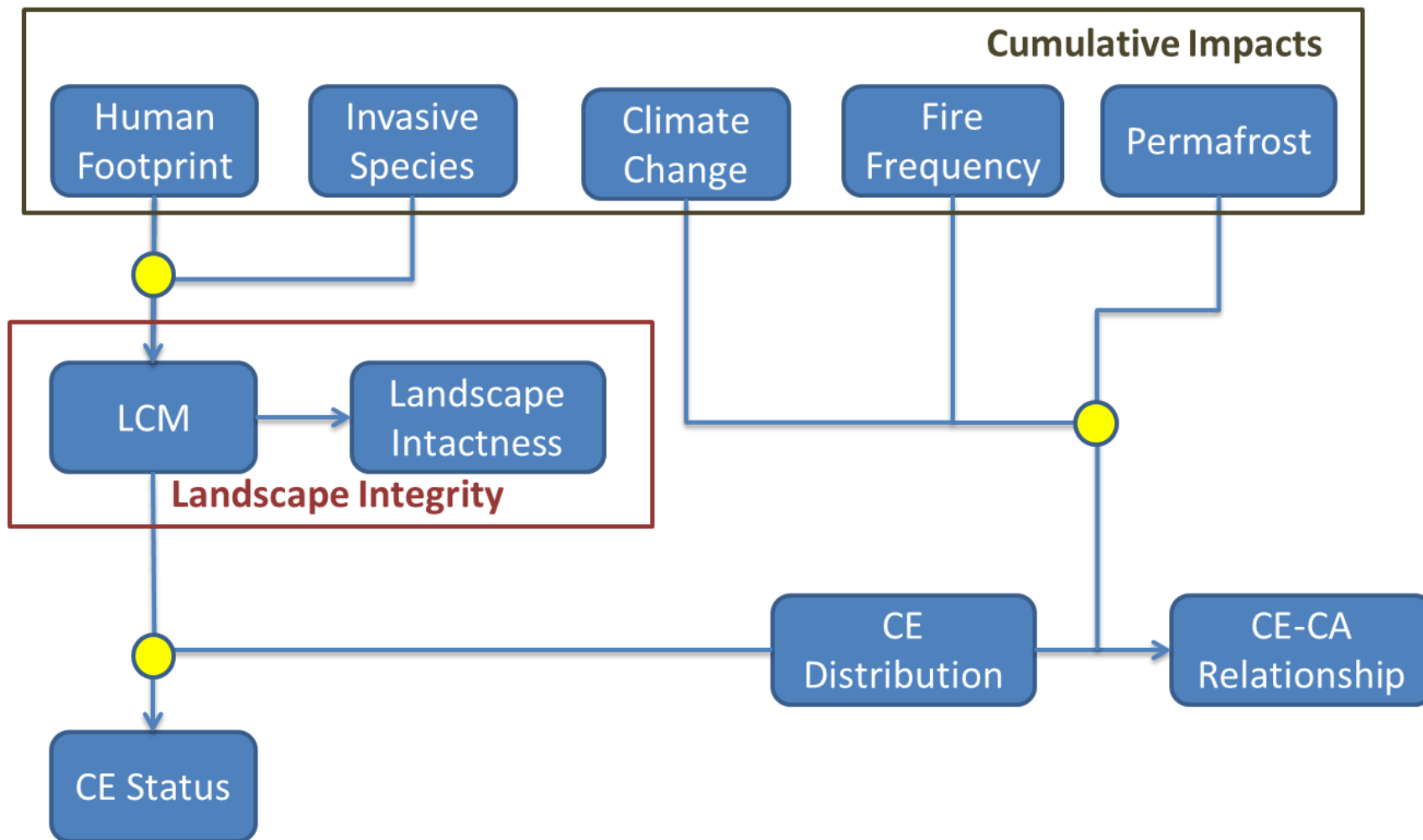
- Resource extent
- Condition and trends
- Stressors
- Location and nature of authorized uses, disturbances, and projects

Integrated Analyses

Intactness is quantifiable estimate of naturalness measured on a gradient of anthropogenic influence.

- **Landscape Condition:** impact of human activities
- **Landscape Integrity:** fragmentation of habitat from anthropogenic activities
- **Cumulative Impacts:** ecosystem stress as number of significantly changing Change Agents

Integrated Products

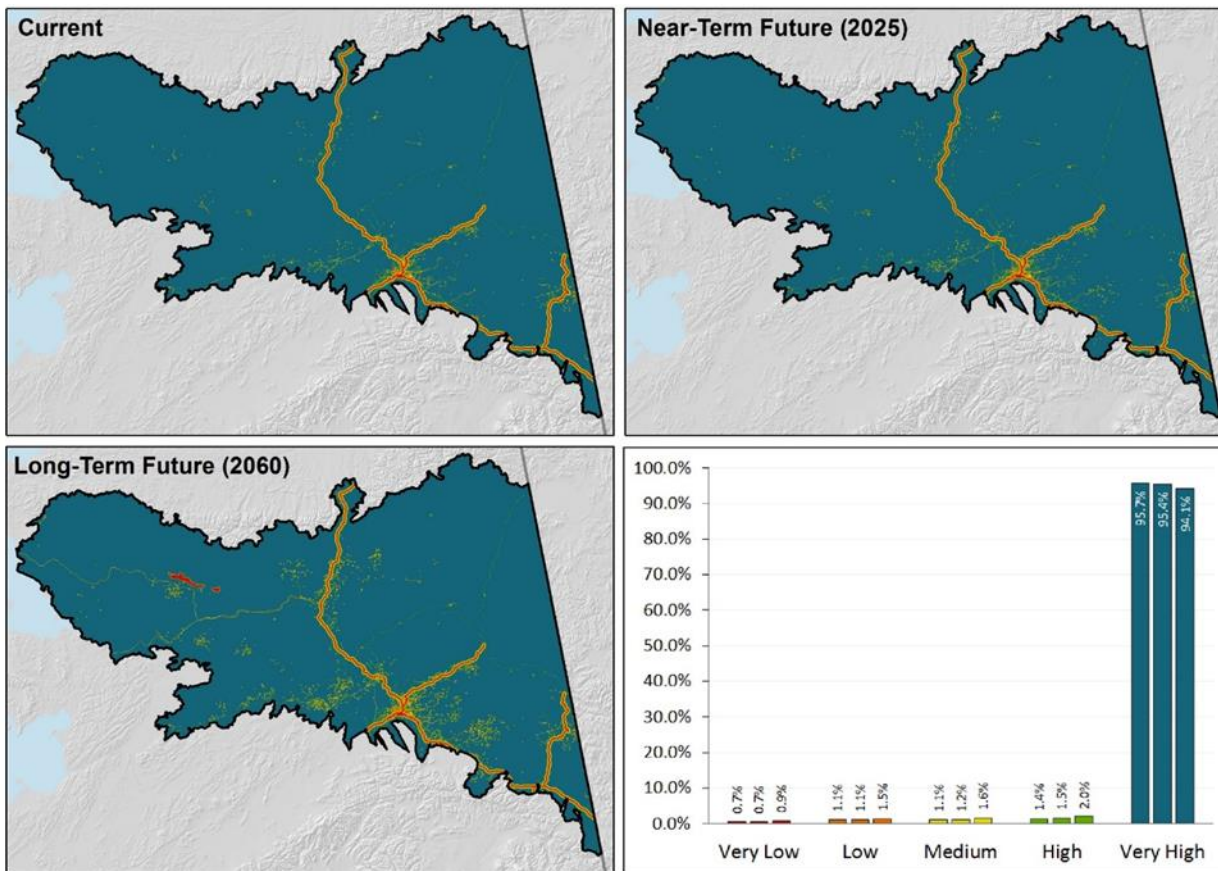


Landscape Condition Model

Theme	Site Impact Score	Decay Distance (m)
Transportation		
Highways (Dalton Highway included)	0.05	5,000*
Secondary Road	0.2	500
Nome Road	0.2	500
Road to Umiat	0.2	500
Yukon River	0.7	500
Trails	0.7	500*
Historical Trails	0.8	250
Urban and Industrial Development		
High Development	0.05	2,000
Medium Development	0.5	1,000*
Low Development	0.6	1,000*
Current & Future Mining	0.05	1,500*
Historic Mining	0.5	500
Future Pipeline	0.5	500
Industrial Lines	0.5	500
Contaminated Sites	0.5	100
Formerly Used Defense Sites	0.5	100
Material Sites	0.5	100
Northern Rail Line Expansion	0.7	500
Rail Road	0.7	500
Managed and Modified Land Cover		
Forestry	0.9	200
Invasive Species	0.5	200
Agriculture	0.3	200

- Measure impact of human activity on a landscape.
- Weights relative influence of different impacts
- Score of 0 represents most impacted
- Score of 1 represents highest condition

Landscape Condition Model

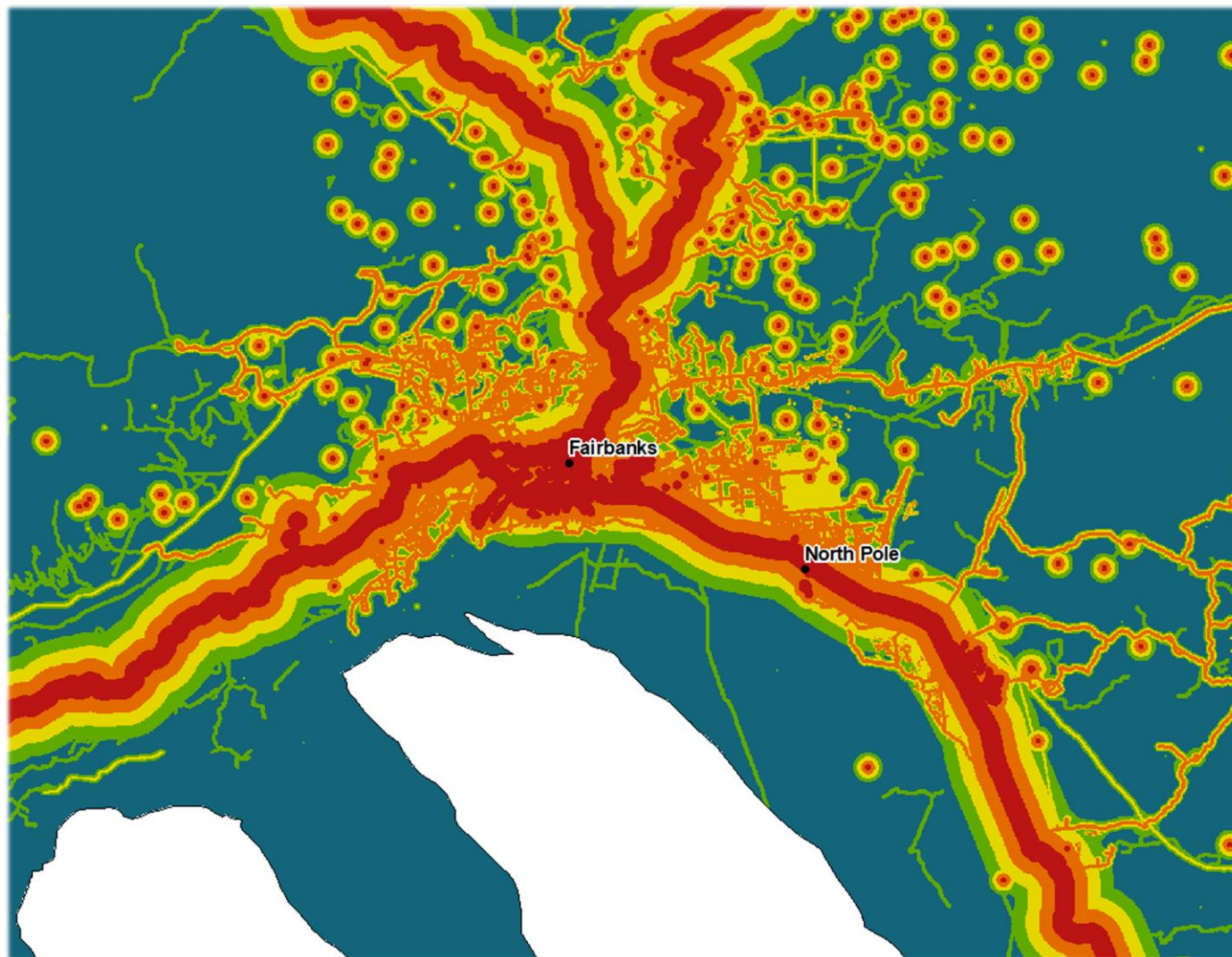


Landscape Condition Score

- 0.0 - 0.2: Very Low
- 0.2 - 0.4: Low
- 0.4 - 0.6: Medium
- 0.6 - 0.8: High
- 0.8 - 1.0: Very High



Landscape Condition Model

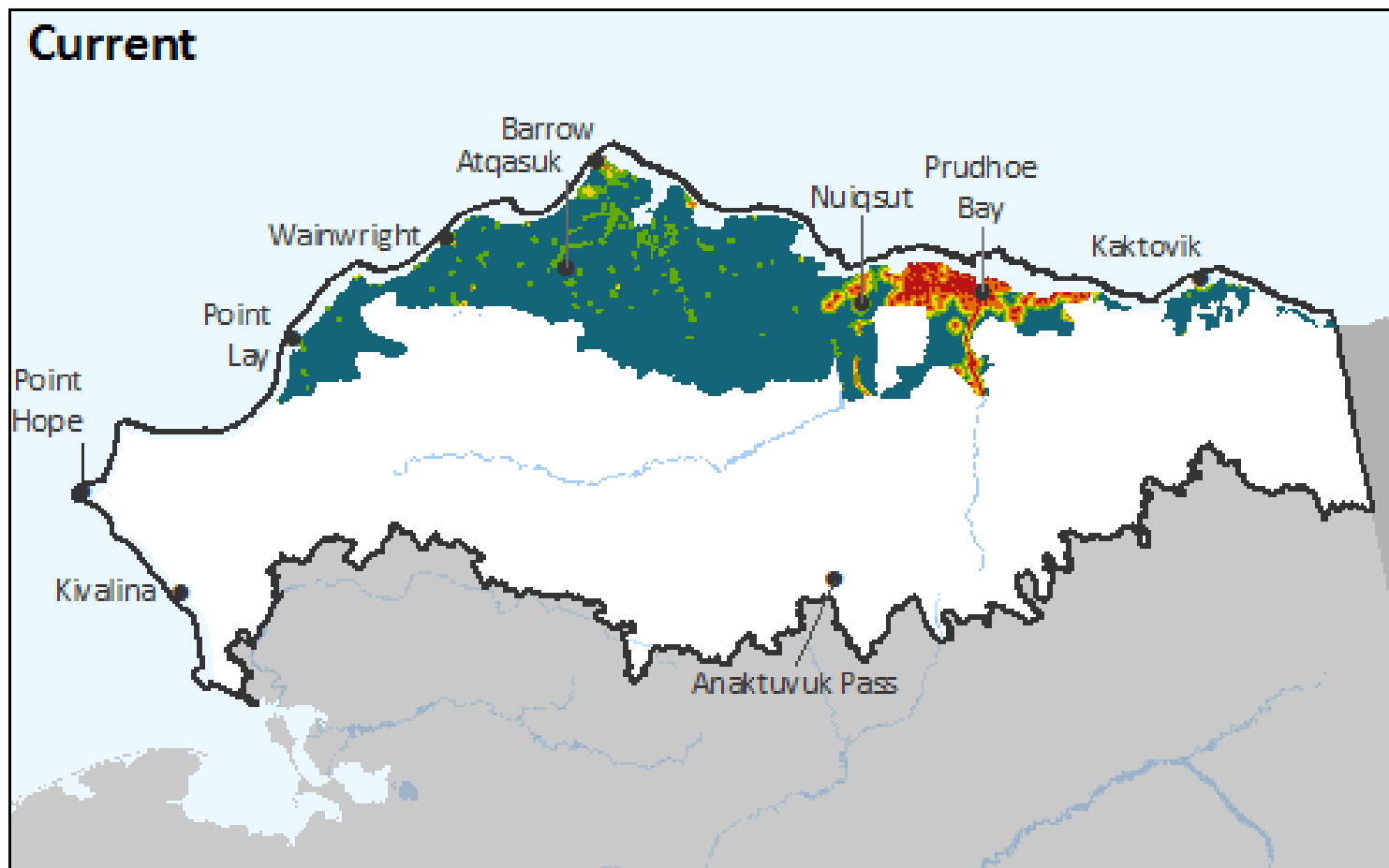


Species Status

Scenario	Dataset	Distance Decay (m)				
		LCM	GWFG	Caribou -calving	Raptor conc.	Lapland longspur
<u>C,M,H</u>	Dalton ("Highway" in the dataset)	5000	5000	4000*	5000	5000
<u>C,M,H</u>	Oil Facilities (High Developed)	2000	10000*	4000*	3000*	5000*
H	Wainwright Chukchi Sea Onshore Processing Facility (High Developed)	2000	5000*	4000*	5000*	5000*
M, H	Point Thomson Airstrip (High Developed)	2000	5000*	4000*	5000*	5000*
<u>C,M,H</u>	Mining at Red Dog	1500	1500	1500	1500	1500
<u>C,M,H</u>	Village digitized plus <u>ports</u> (Medium Developed)	1000	5000*	1000	3000*	5000*
H	Barrow US Coast Guard Station (Medium Developed)	1000	1000	1000	1000	1000
<u>C,M,H</u>	Camps 20m buffer (Medium Developed)	1000	5000*	1000	3000*	1000
<u>C,M,H</u>	Secondary Roads	500	3000*	4000*	3000*	500
M, H	Future Roads	500	3000*	4000*	3000*	500
<u>C,M,H</u>	Oil/ gas Wells (AOGCC, Chukchi)	500	10000*	4000*	3000*	500
<u>M,H</u>	Future Drilling Sites	500	10000*	4000*	3000*	500
<u>C,M,H</u>	Industrial Lines (Power Lines, Pipelines)	500	500	500	500	500
<u>M,H</u>	Future Pipelines	500	500	500	500	500
<u>C,M,H</u>	Alt Transportation (Lower Colville River)	500	500	500	500	500
<u>C,M,H</u>	AKEPIC Non-Native Plant Occurrences	200	200	200	200	200

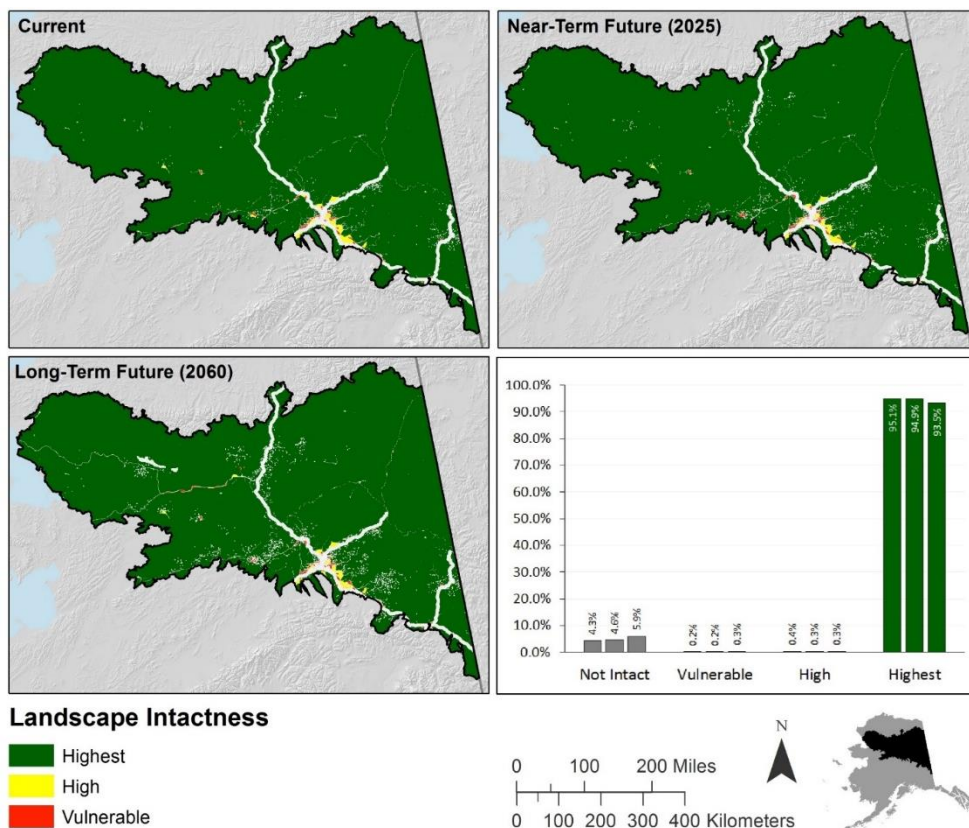
Species-specific landscape condition assessments modify decay distance based on documented species impacts

Species Status



Oil facility decay distance of 10 km for greater white-fronted goose

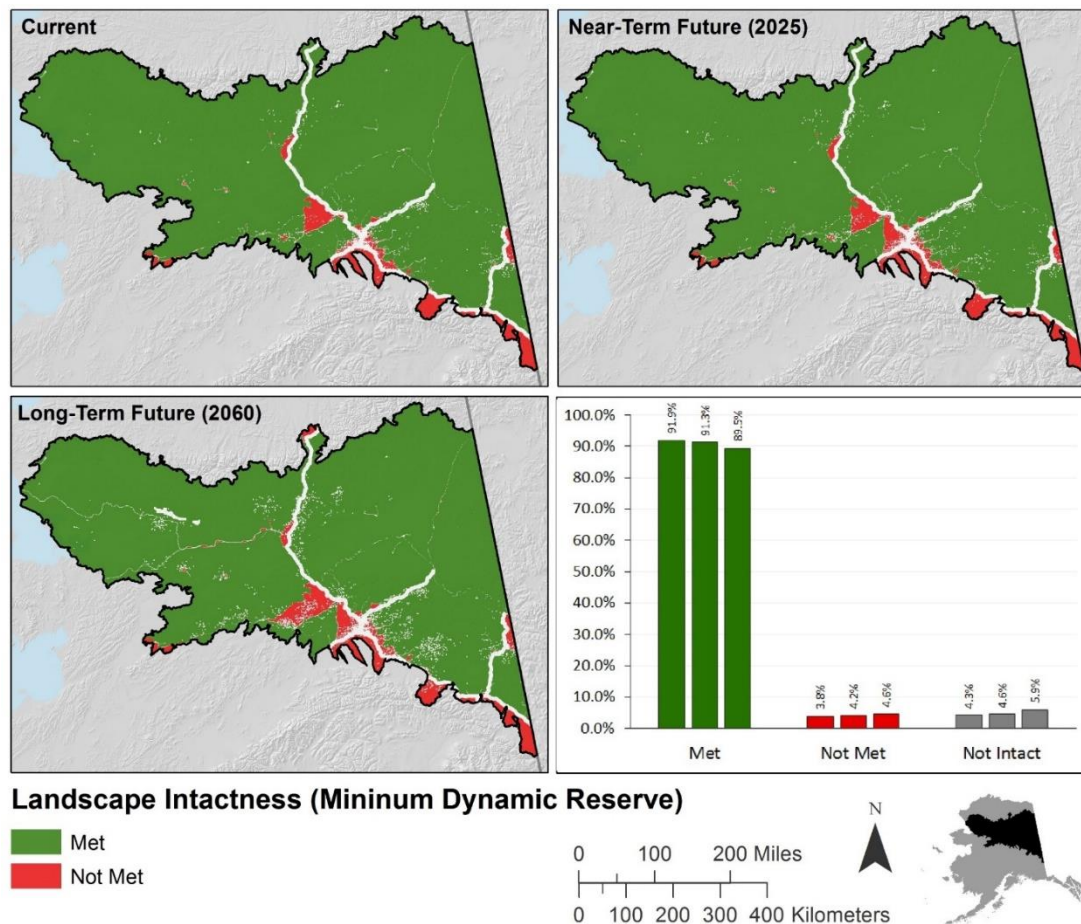
Landscape Intactness



Designation	Size Threshold (acre)
Highest Landscape Integrity	$\geq 50,000$
High Landscape Integrity	$< 50,000 \geq 10,000$
Vulnerable to change	$< 10,000$
Not Intact	N/A

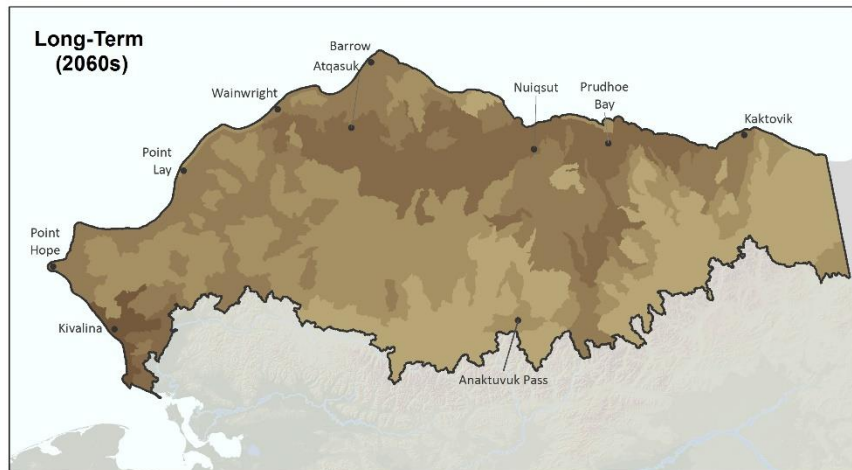
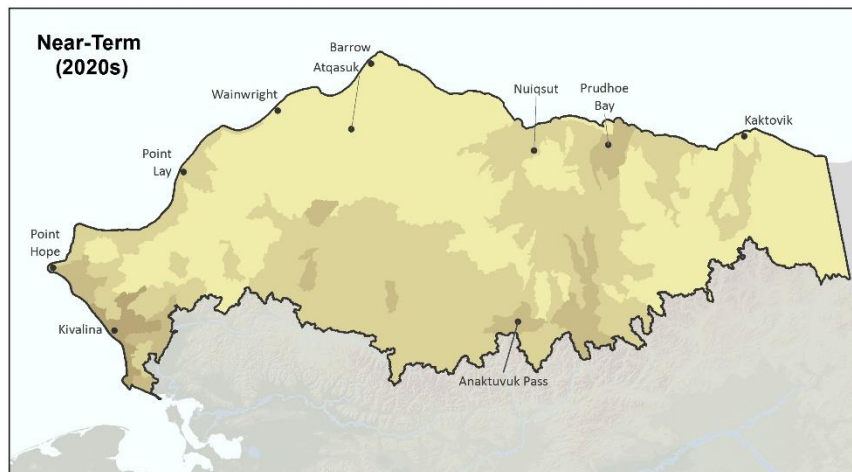
The degree to which an intact landscape is fragmented as a quantitative measure of naturalness

Landscape Intactness

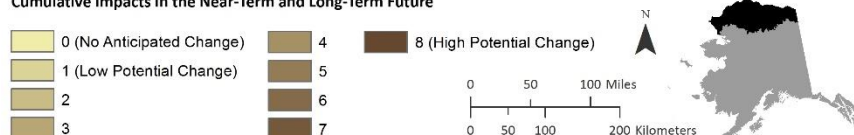


Minimum Dynamic Reserve based on BEACONS model;
only available for Central Yukon

Cumulative Impacts: NOS

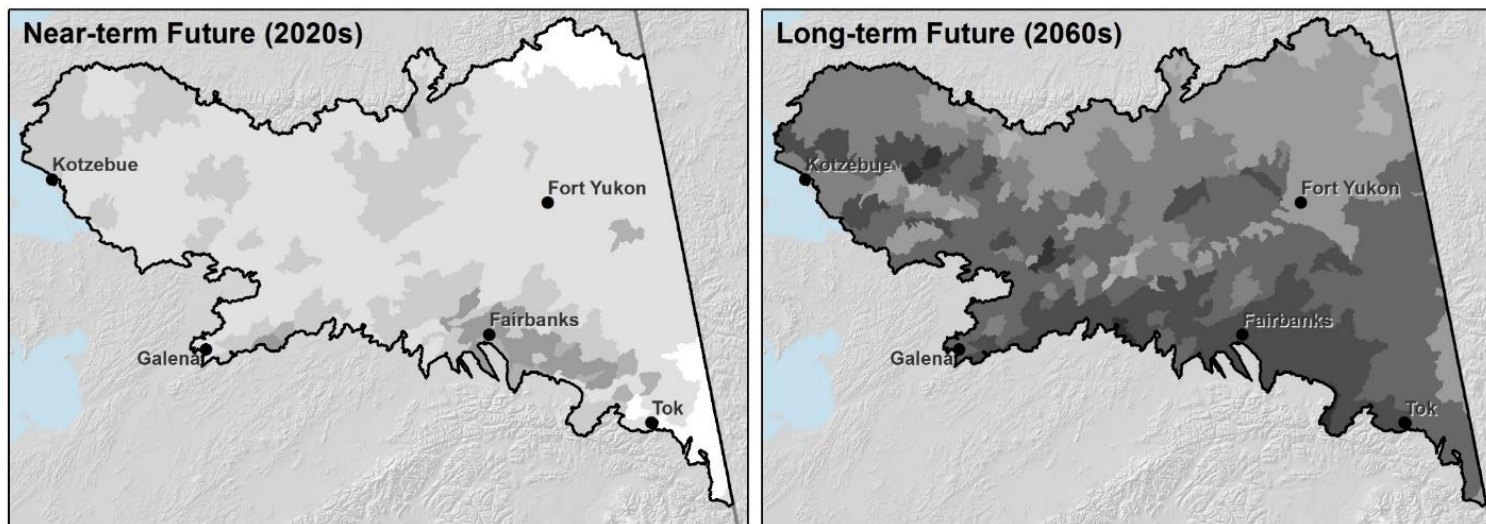


Cumulative Impacts in the Near-Term and Long-Term Future



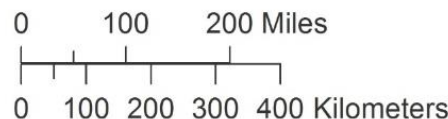
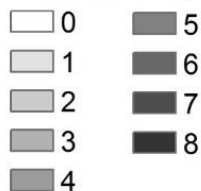
- Mean January Temperature
- Mean July Temperature
- Annual Precipitation
- Change in Permafrost
- Change in Active Layer
- Change in Relative Flammability
- Landscape Condition
- Invasive Species Vulnerability

Cumulative Impacts: CYR



Cumulative Impact Score

Number of significantly changing variables



- Mean January Temperature
- Mean July Temperature
- Annual Precipitation
- Change in Permafrost
- Change in Active Layer
- Change in Relative Flammability
- Landscape Condition
- Invasive Species Vulnerability