

Thinking Like A Spruce

The Case for Facilitating Ecological Transformation



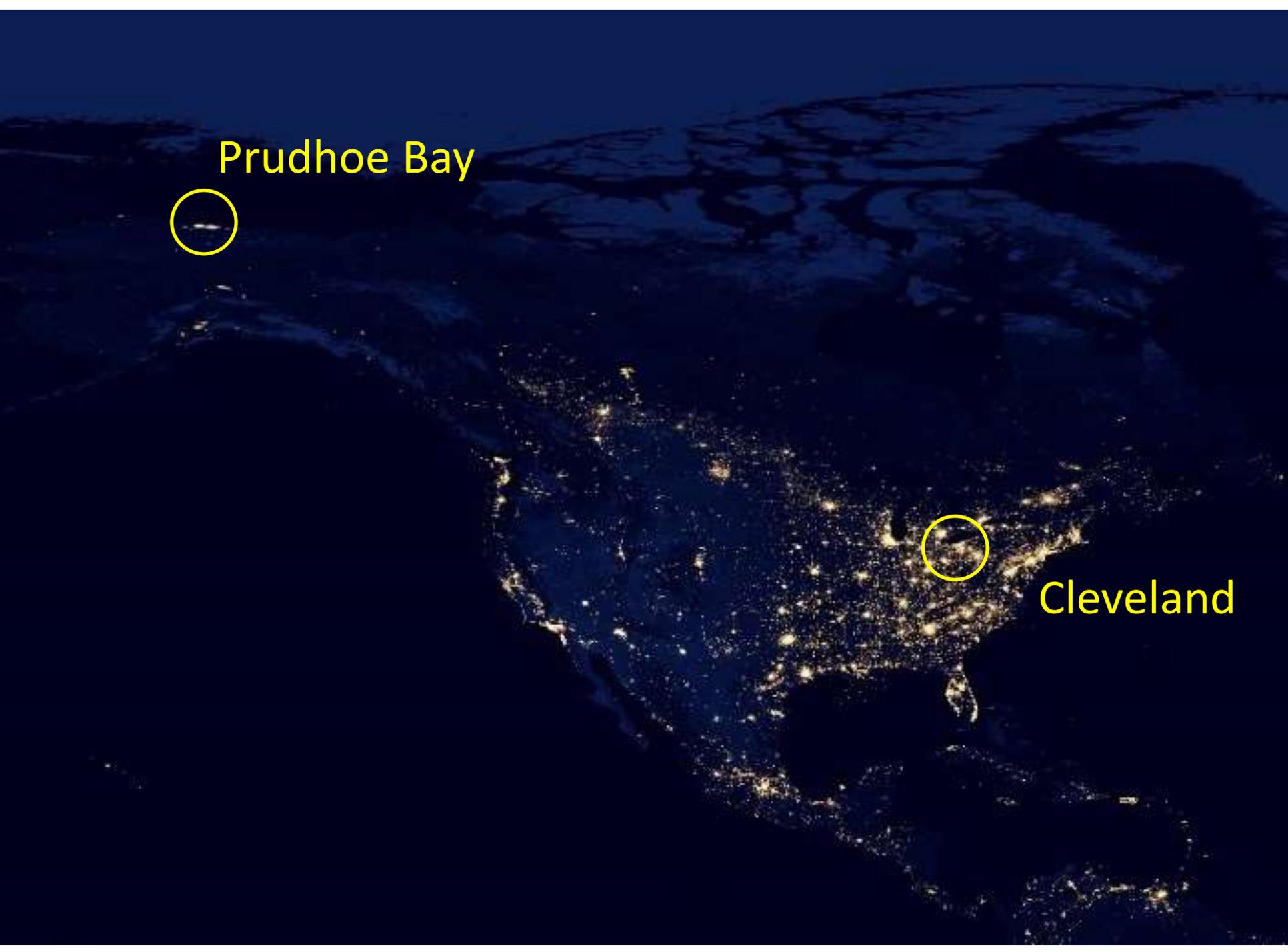
John Morton, Kenai National Wildlife Refuge



Prudhoe Bay



Cleveland





Utqiagvik (Barrow)

Beaufort Sea

Kaktovik

Pudhoe Bay

Chukchi Sea

Dalton Highway

Atigun Pass

Brooks Range

Coldfoot

Kotzebue



Yukon River

Fairbanks

Nome



Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

Thinking Like a Spruce









ORDER HERE

OPEN

Arctic Circle 60
Coldfoot 120

HOT S

A gravel road curves through a landscape of green grass and purple wildflowers. In the background, a dense forest of evergreen trees stretches across the horizon under a clear sky. A green road sign stands on the right side of the road, supported by two metal posts. The sign contains white text indicating distances to two locations. A yellow marker and a corrugated metal pipe are visible in the background near the road's edge.

Yukon River 120
Fairbanks 255

WELCOME EVERYONE
Sourdough
Fuel *"Your warm friends since 1898"*
Coldfoot, Alaska







**FARTHEST NORTH
SPRUCE TREE**
ON THE ALASKAN PIPELINE
DO NOT CUT









Coldfoot 240
Fairbanks 494

NEXT SERVICES
240 MILES

SPEED
LIMIT
50

James W. Dalton
Highway

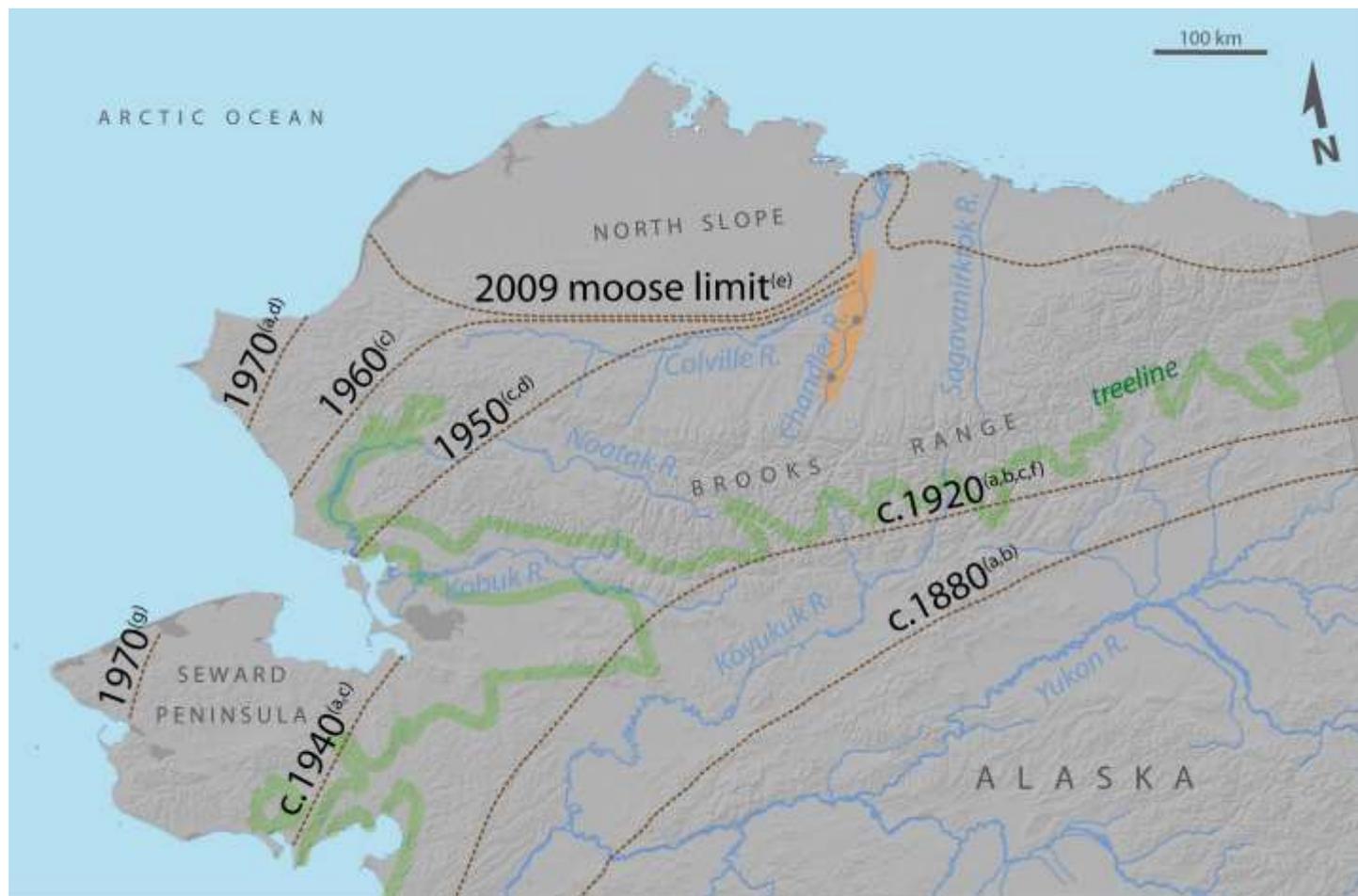
DRIVE
WITH
LIGHTS

WHEEL
SAFETY









Tape et al. 2016. Range expansion of moose in arctic Alaska linked to warming and increased shrub habitat. PLoS ONE 11(4):e0152636





Tape et al. 2018. Tundra be dammed: Beaver colonization of the Arctic. *Global Change Biology* 24:4478-4488.

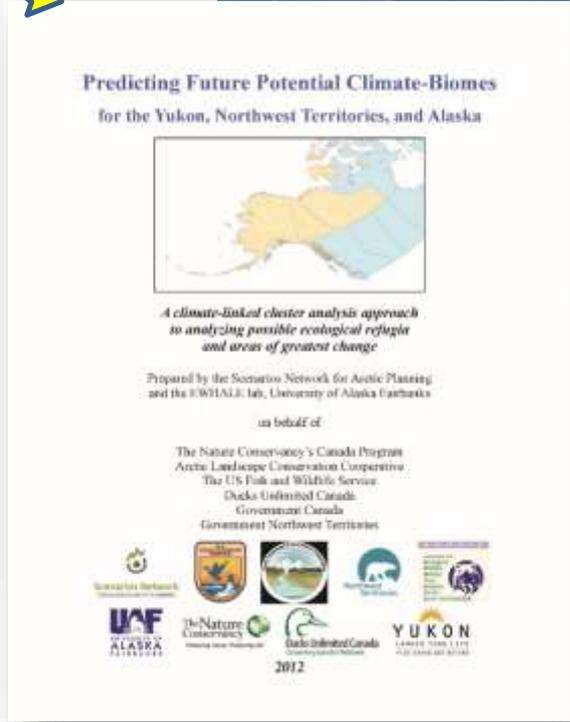
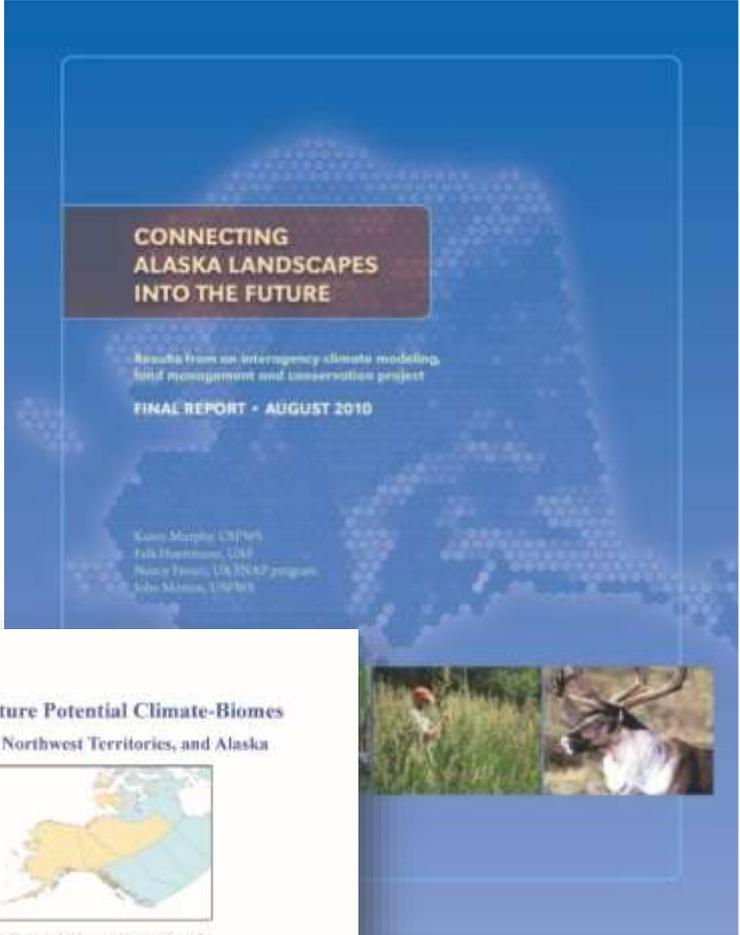
**Balsam poplar
(*Populus balsamifera*)
well above treeline**



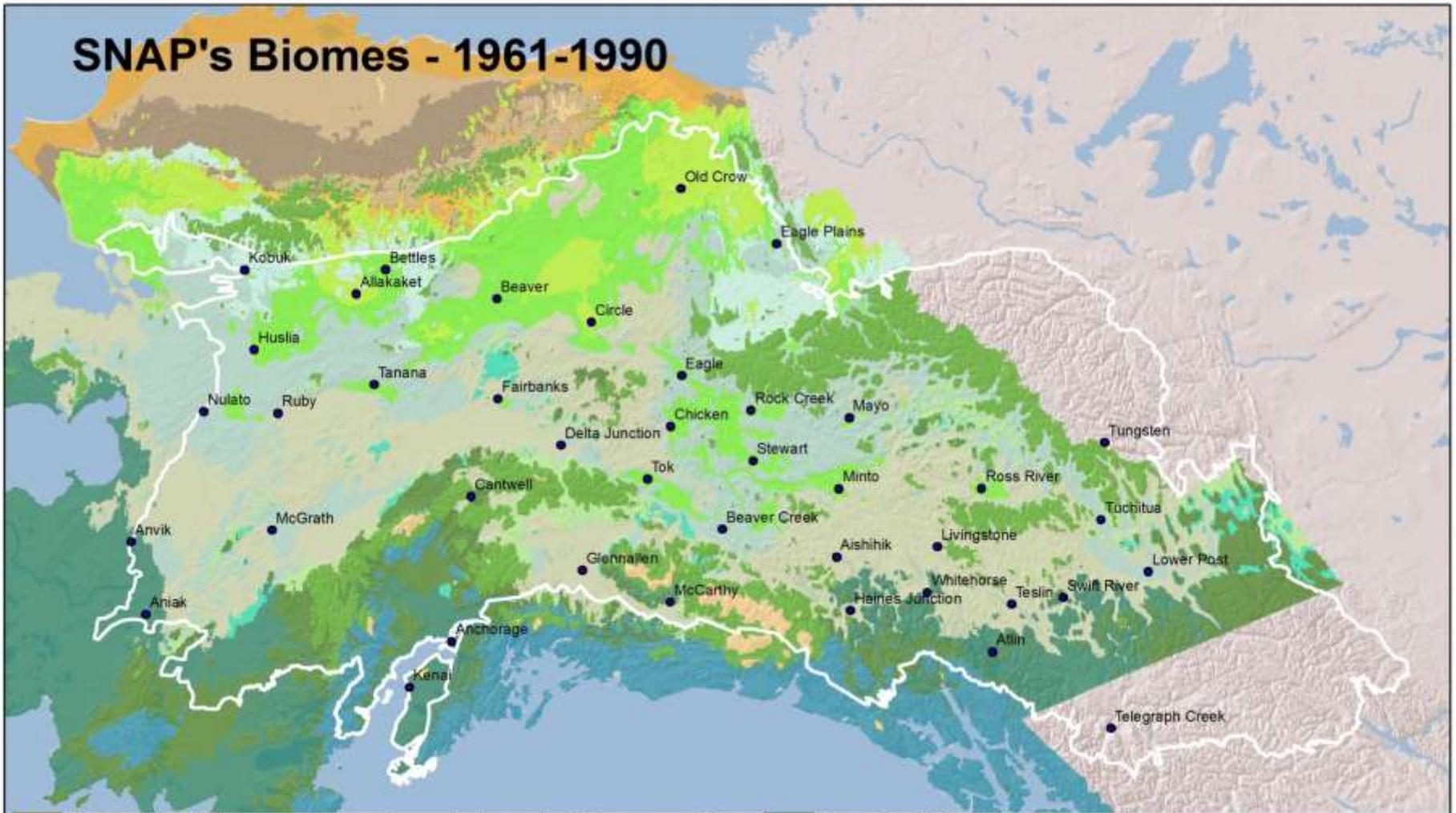
Breen, 2014, Balsam poplar (*Populus basamifera* L.) on the Arctic Slope of Alaska. *Phytocoenologia* 44:1-17.

Saarela et al., 2012, Balsam poplar beyond the tree line in the western Canadian mainland Arctic (Northwest Territories). *Arctic* 65:1-12.

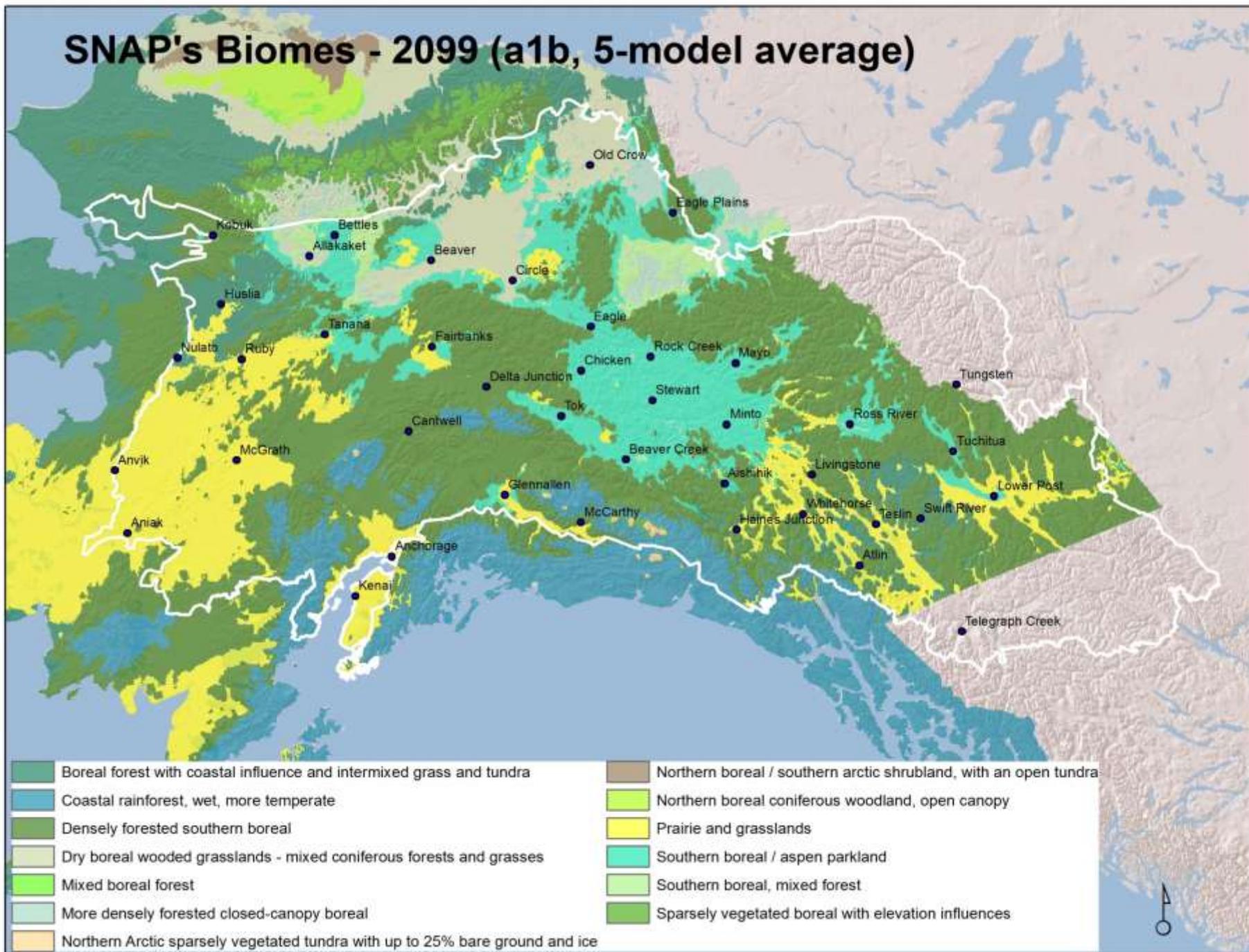
Interagency effort to pioneer assessment of climate change effects on biome and species distributions using climate envelope models



SNAP's Biomes - 1961-1990



SNAP's Biomes - 2099 (a1b, 5-model average)



“Topographically mediated climate poses a strong environmental barrier (i.e., the Brooks Range) to species migration, causing a pronounced time lag [**1,000 years**] in forest expansion, or even preventing expansion altogether if temperature increases are $< 6^{\circ}$ C. Migration corridors (i.e., low mountain passes and river valleys) or **human introduction of trees** will be critical for successful northward movement of [**spruce**] forest through the Brooks Range in northern Alaska”

— Rupp, Chapin & Starfield 2001

Modeling the influence of topographic barriers on treeline advance at the forest-tundra ecotone in northwestern Alaska. *Climatic Change* 48: 399–416





A photograph of a beach at sunset. The sky is a mix of blue, purple, and orange. The ocean is calm and reflects the sky. In the foreground, there is a dark, sandy beach. In the middle ground, several polar bears are wading in the shallow water. They are surrounded by many seagulls. One seagull is flying in the sky on the left side.

2 questions we need to ask ourselves....

What's the risk of doing nothing?

What's the risk of doing something wrong?

----Rosa Meehan

10 Feb 2010

Bird vetch
Creeping thistle
White sweetclover
Narrowleaf hawksbeard



1950

- *Cirsium arvense*
- *Crepis tectorum*
- *Melilotus albus*
- *Vicia cracca*



Utqiagvik (Barrow)

Beaufort Sea

Kaktovik

Chukchi Sea

Brooks Range

Atigun Pass

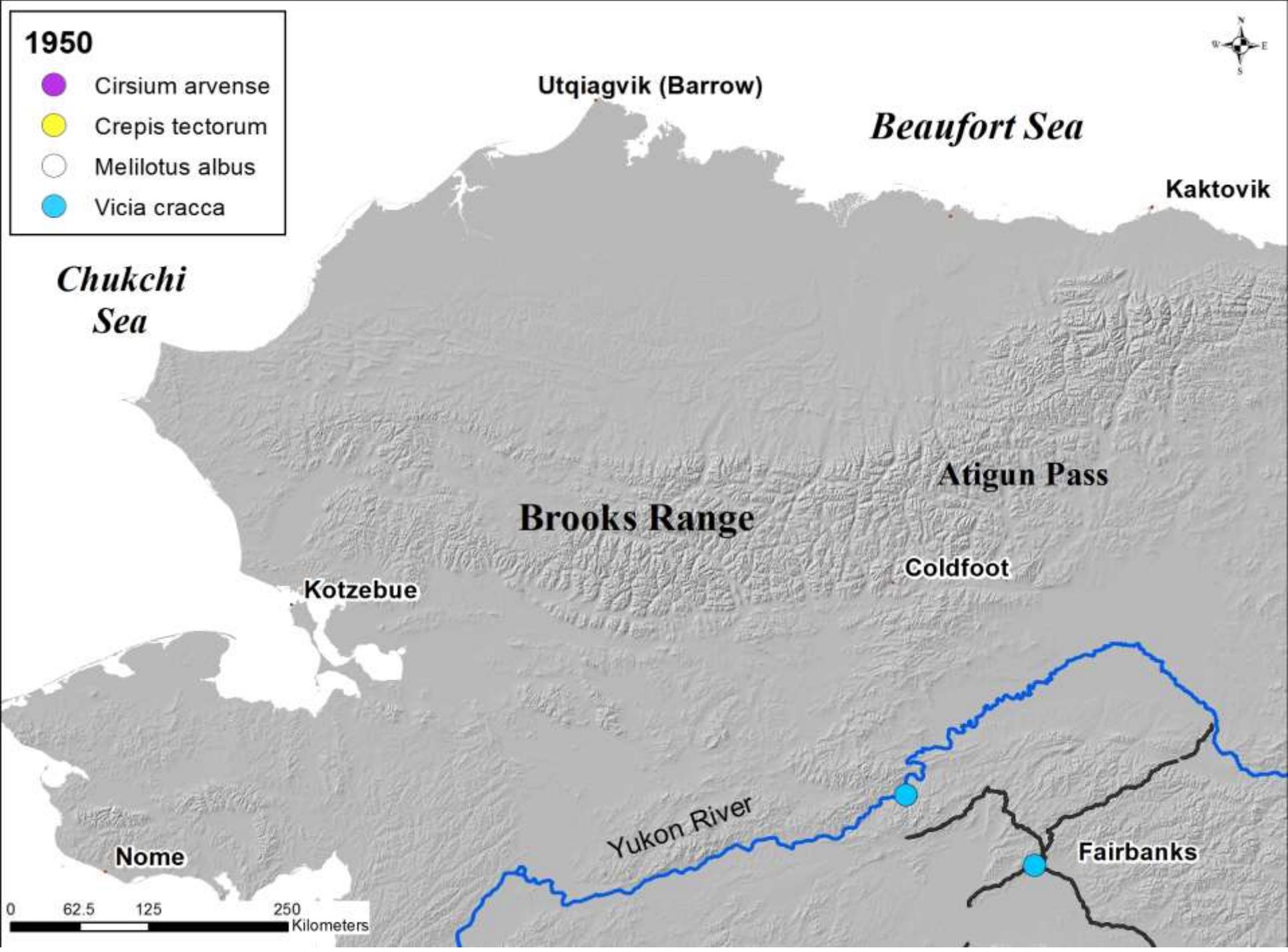
Kotzebue

Coldfoot

Nome

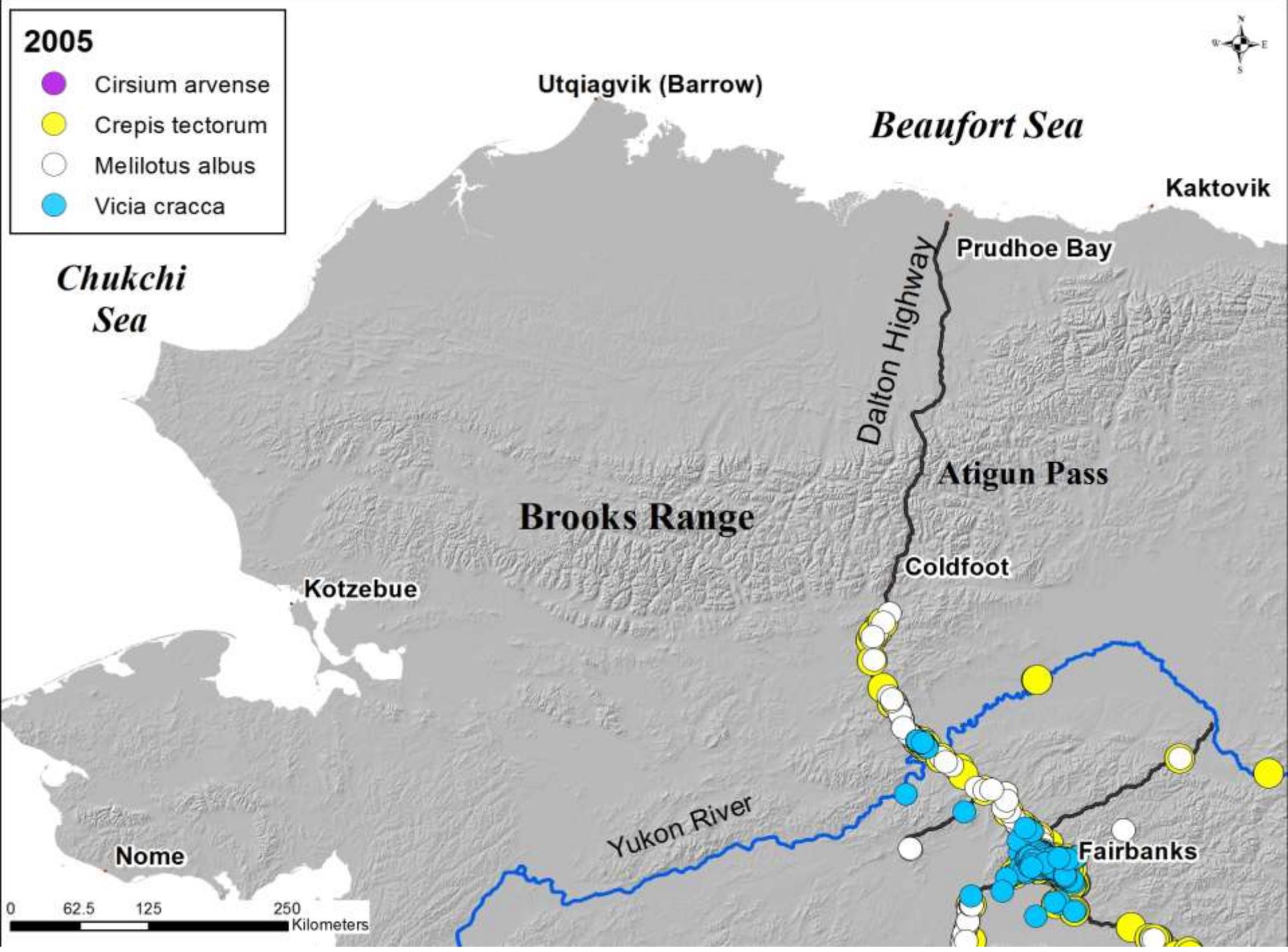
Yukon River

Fairbanks



2005

- *Cirsium arvense*
- *Crepis tectorum*
- *Melilotus albus*
- *Vicia cracca*



Utqiagvik (Barrow)

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Dalton Highway

Atigun Pass

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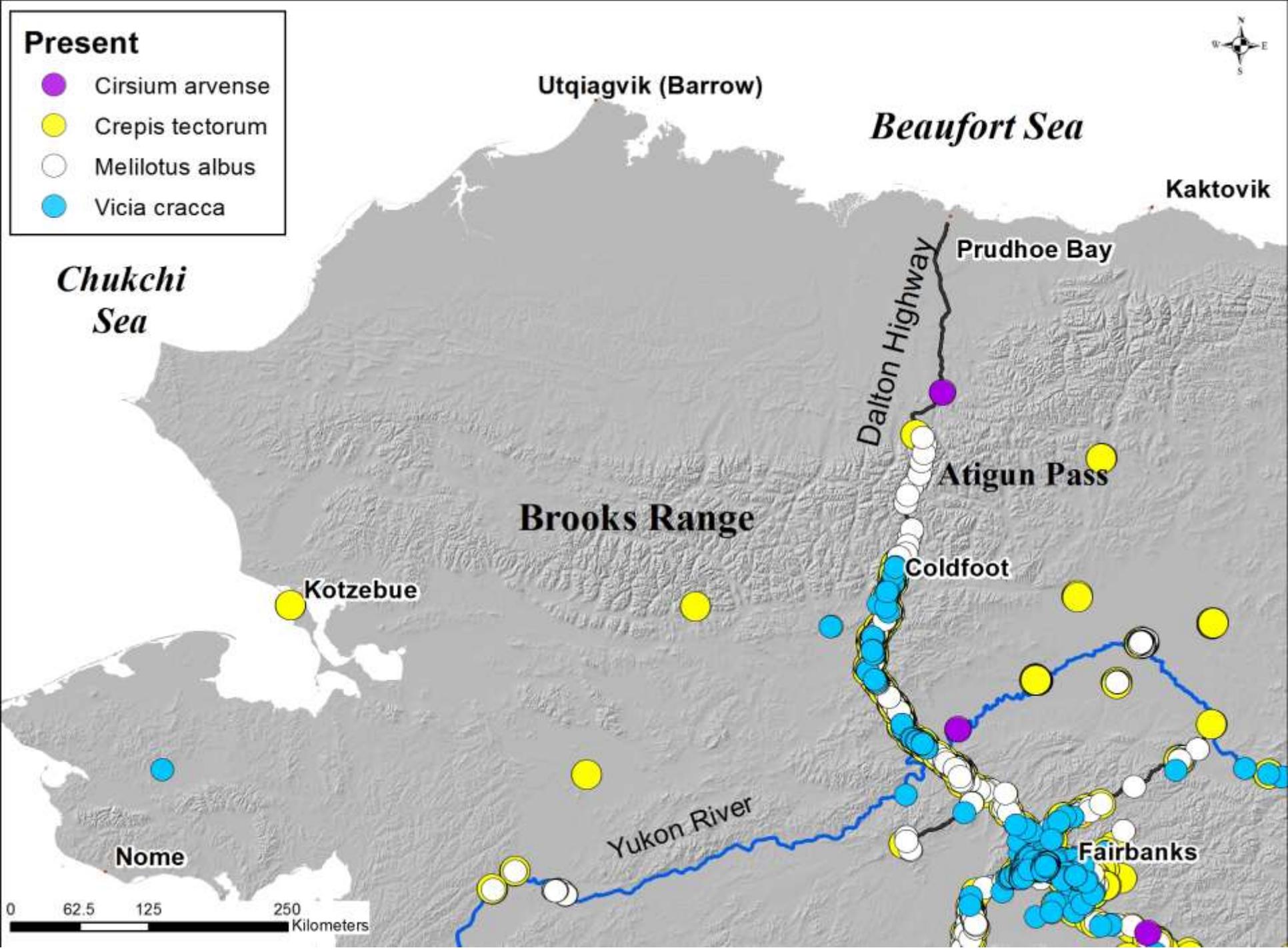
Nome

Fairbanks

0 62.5 125 250 Kilometers

Present

-  *Cirsium arvense*
-  *Crepis tectorum*
-  *Melilotus albus*
-  *Vicia cracca*



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0 62.5 125 250 Kilometers





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“These ideas, collectively, raise two basic issues: Can the land adjust itself to the new order? Can the desired alterations be accomplished with less violence?”

— Aldo Leopold 1949

Two sides of the same coin

Translocate



Eradicate

With one hand you giveth...and the other you taketh

Thinking Like A Spruce



- A warming climate, invasive species and humans share two common traits – they know no boundaries and they have, for now, similar trajectories
- We are not grappling well with the 6th extinction
- We will have novel assemblages but not of “native” species and not necessarily diverse
- In a no-analog human-driven future, there are no optimal choices, just bad decisions
- The land does not understand human will or intent or our values – it only responds to outcome

**"Hope is the active engagement with
uncertainty and the possibilities it holds"**

—Rebecca Solnit