

## **Patterns and vulnerabilities of Arctic Alaska to non-native plant invasion: estimating current and future susceptibility in the face of climate change and development**

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Non-native plant species currently are restricted to only the warmer margins of arctic Alaska. Here we explore the relationship of non-native plant establishment to climate and anthropogenic variables in arctic and subarctic Alaska for current and future climatic and development scenarios. The model outputs are then used to identify more problematic species and vulnerable regions. Results suggest that growing season length currently limits the establishment of non-native plant species in much of arctic Alaska and that non-native plants are currently found in warmer regions with anthropogenic disturbance. By 2060, the Arctic Coastal Plain is predicted to transition from largely resistant to non-native plant establishment to susceptible to weed establishment by the more cold-tolerant non-native species. Areas with greater than 150 frost-free days currently support more ecologically damaging species elsewhere in Alaska, and by 2060, areas this warm are predicted to expand north along the Chukchi Sea and to the south side of the Brooks Range. Overall, future scenarios suggest increasing vulnerability to invasion in both the arctic and subarctic regions due to the interaction of increasing growing season length and increasing anthropogenic disturbance.

# Patterns and Vulnerabilities of Arctic Alaska to Non-Native Plant Invasion:

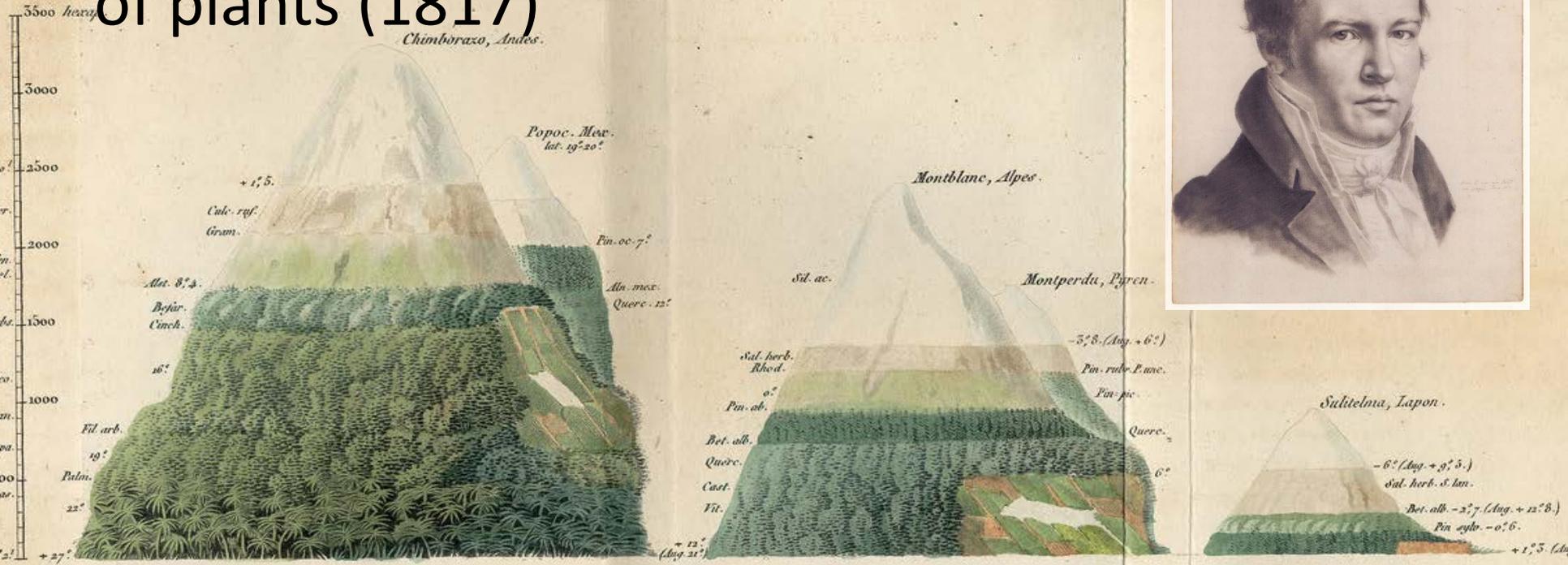
*Estimating current and future susceptibility in the face of climate change and development*



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Megumi Aisu, Justin Fulkerson, and Timm Nawrocki**

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Biological Sciences Department , University of Alaska Anchorage

# Humboldt's geographic distribution of plants (1817)



Plaga æquinoctialis, lat. 0°-10°  
 (Humboldt. Bonpland.)

Zona temperata, lat. 42°-46° bor.  
 (Wahlenberg. Buch.-Ramond. Decandolle.)

Zona frigida, lat. 68° bor.  
 (Buch. Wahlenberg.)

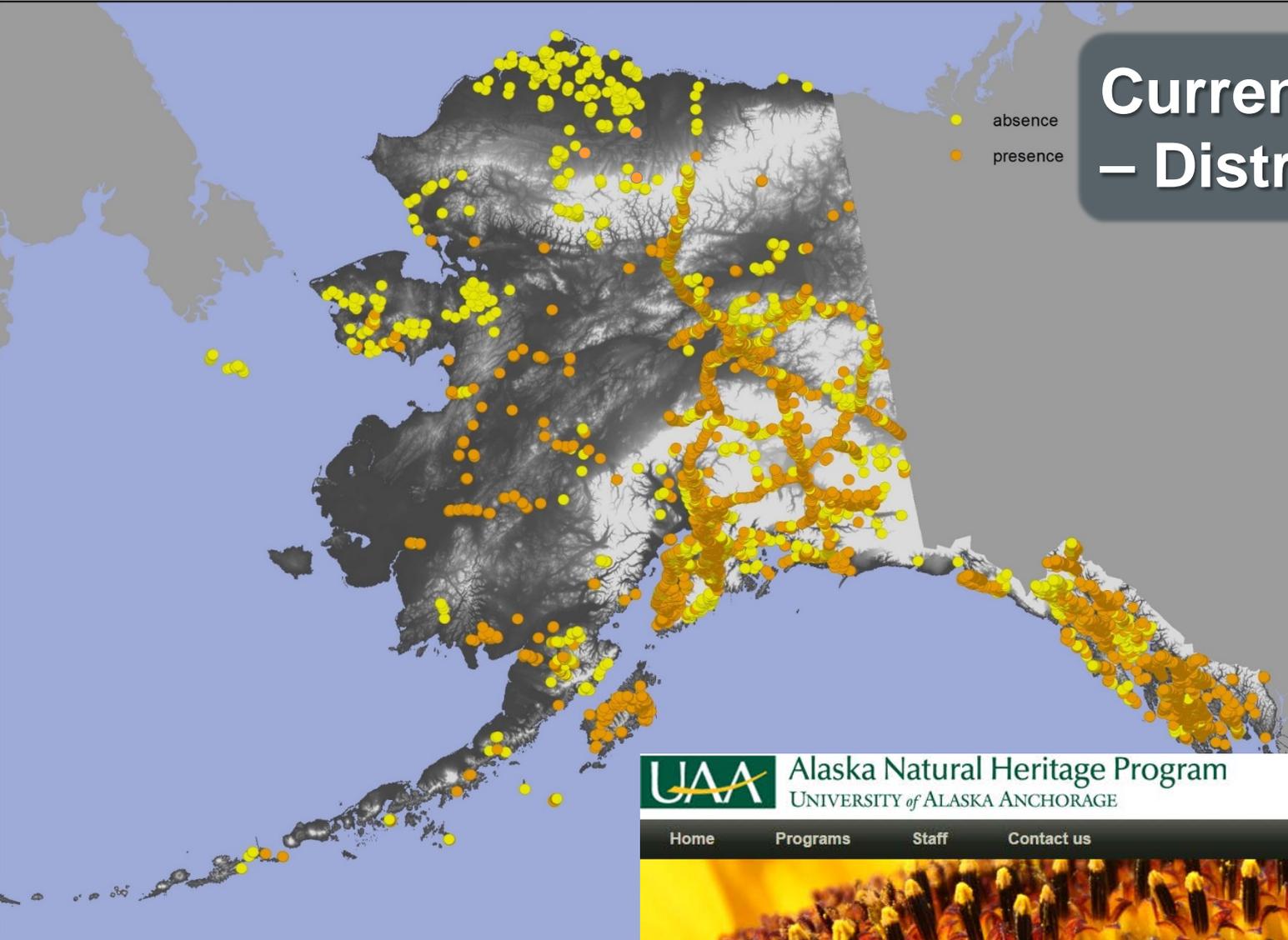
## Geographia plantarum lineamenta.

Plantarum nomina apposuiimus ea altitudine qua quæque crescere desinunt. Numeri nudi significant temperaturam mediam annuam, Thermometri cent. gradibus expressam: numeri uncis inclusi, temperaturam mediam mensis Augusti.

1. hexap. = 6 ped. par. = 1<sup>m</sup> 95.

# Current Status – Distribution

- absence
- presence



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**AKEPIC**

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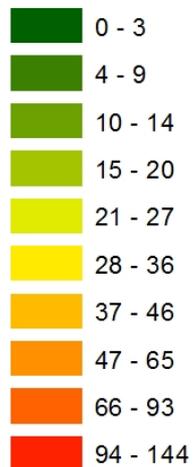
## What is AKEPIC?

**Map data**

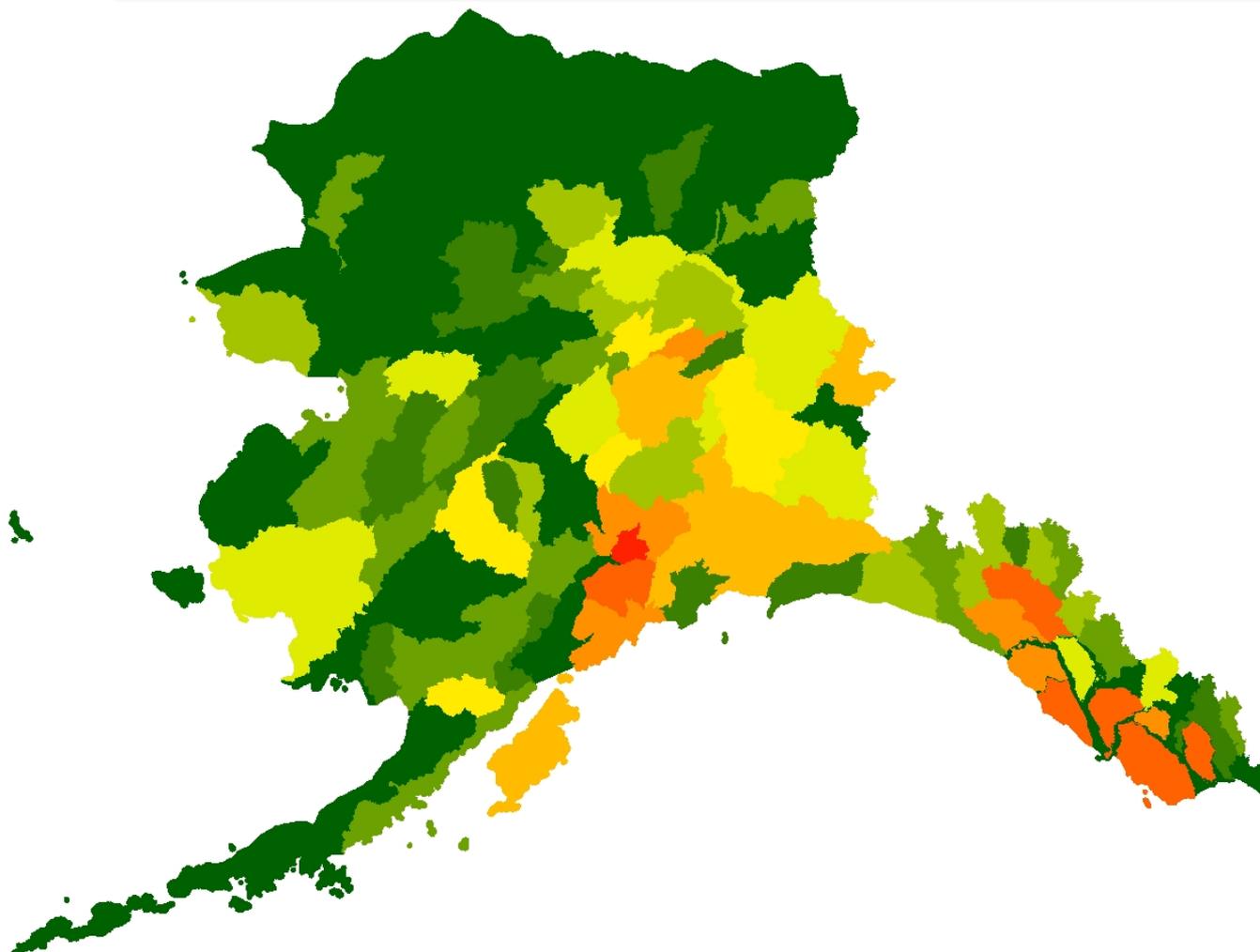
[AKEPIC Data Portal](#)  
Explore distributions of

## InvasiveRichnessbyHUC8

Sum\_testID

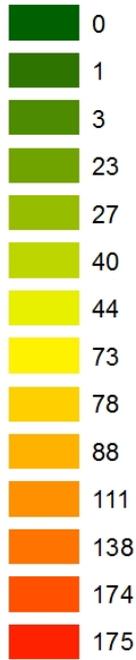


# Current Status - Geographic patterns of non-native plant diversity

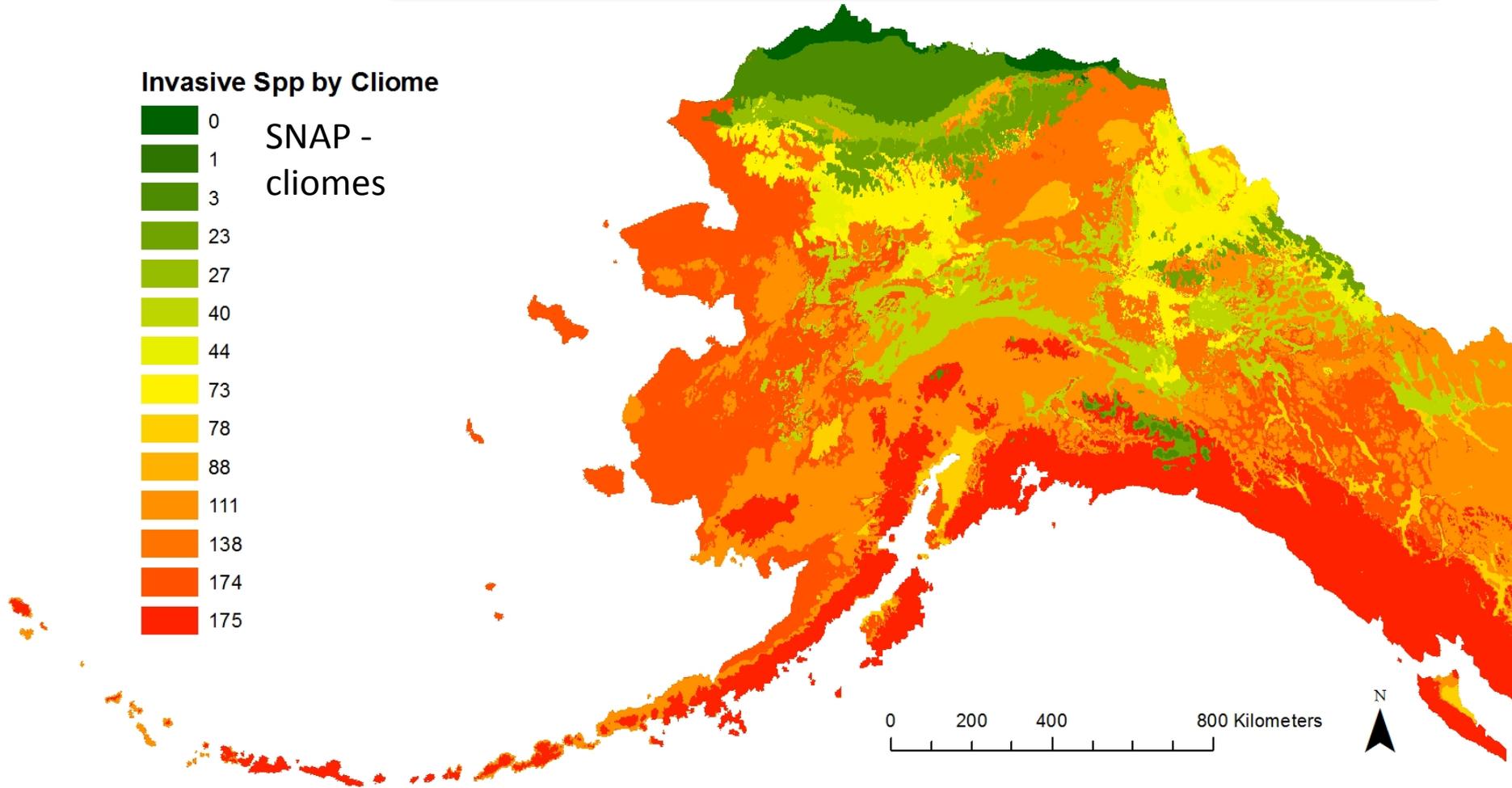


# Current Status - Geographic patterns of non-native plant diversity

Invasive Spp by Cliome



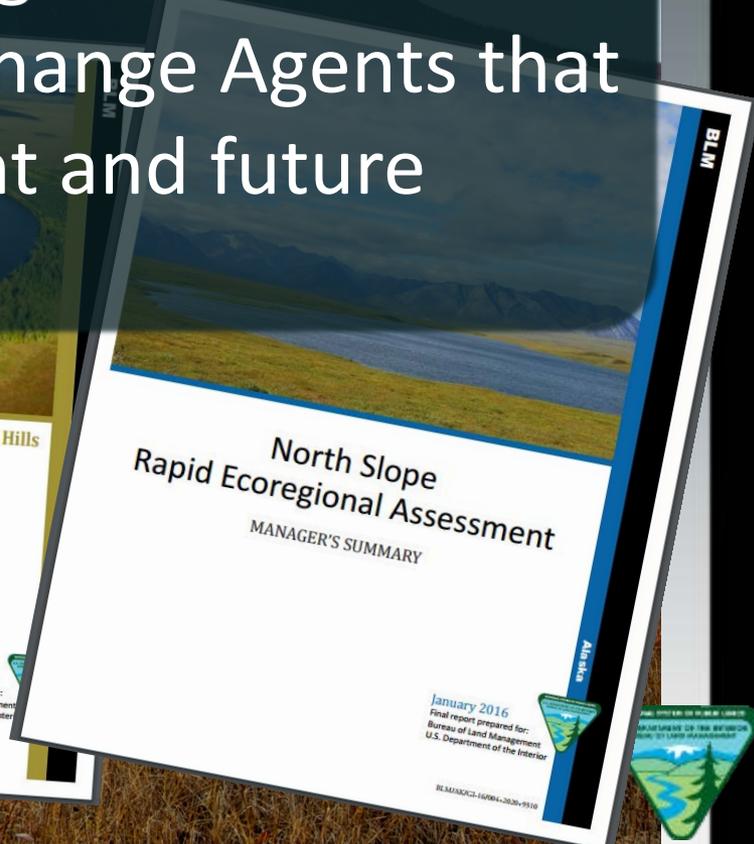
SNAP -  
cliomes



# Central Yukon

## Rapid Ecoregional Assessment

Rapid assessment of an ecoregion's Conservation Elements, the Change Agents that impact them, and their current and future status

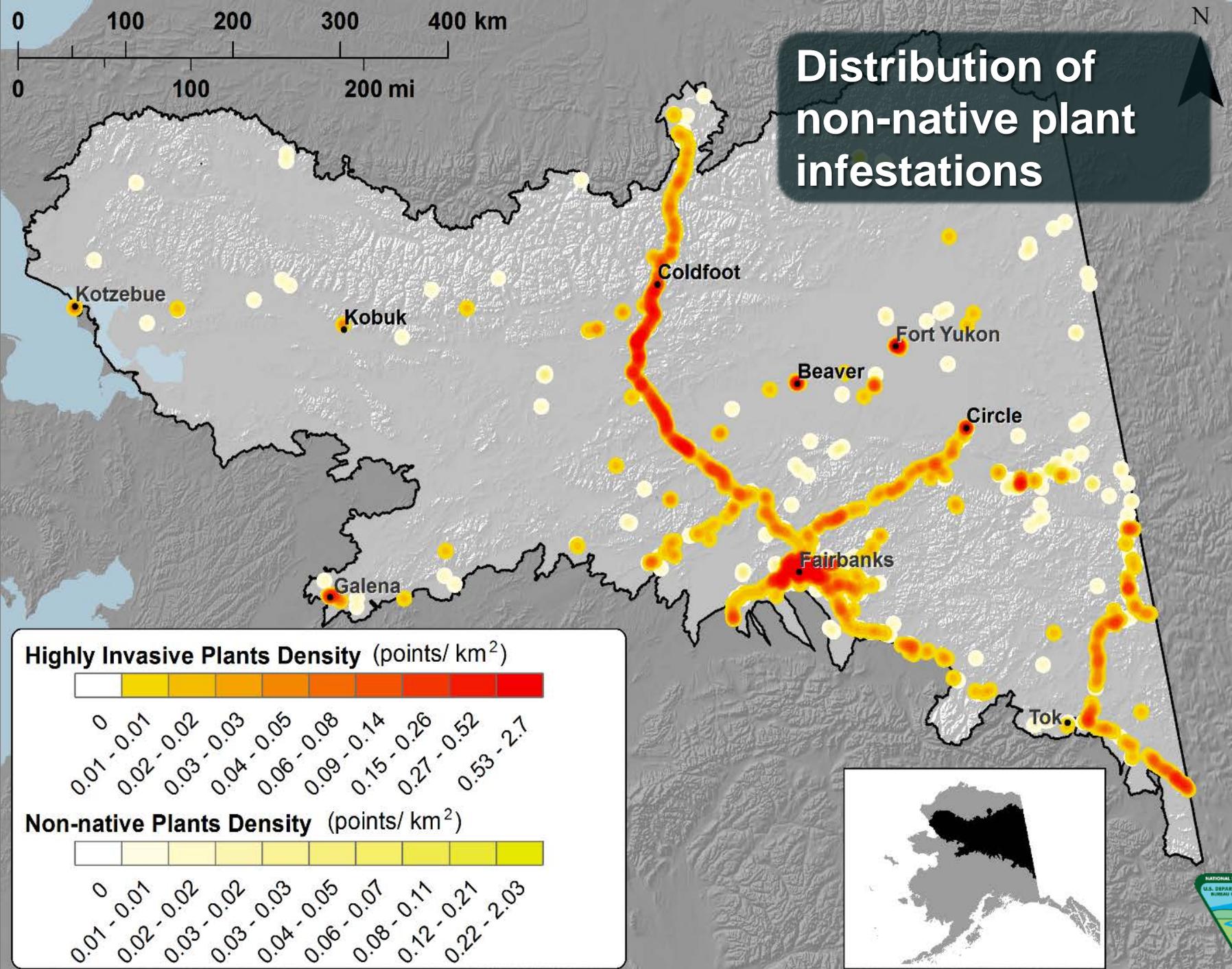


<http://accs.uaa.alaska.edu/rapid-ecoregional-assessments/>

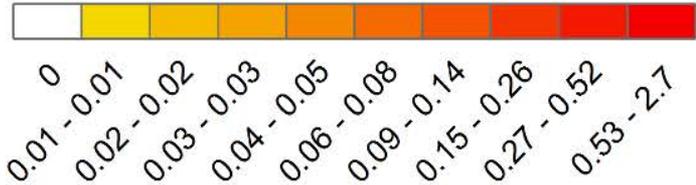




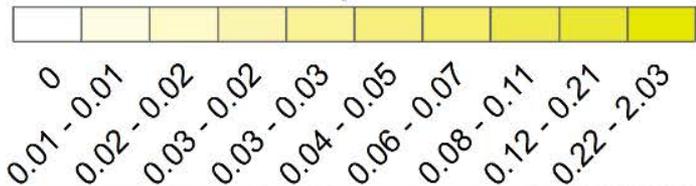
# Distribution of non-native plant infestations



**Highly Invasive Plants Density** (points/ km<sup>2</sup>)

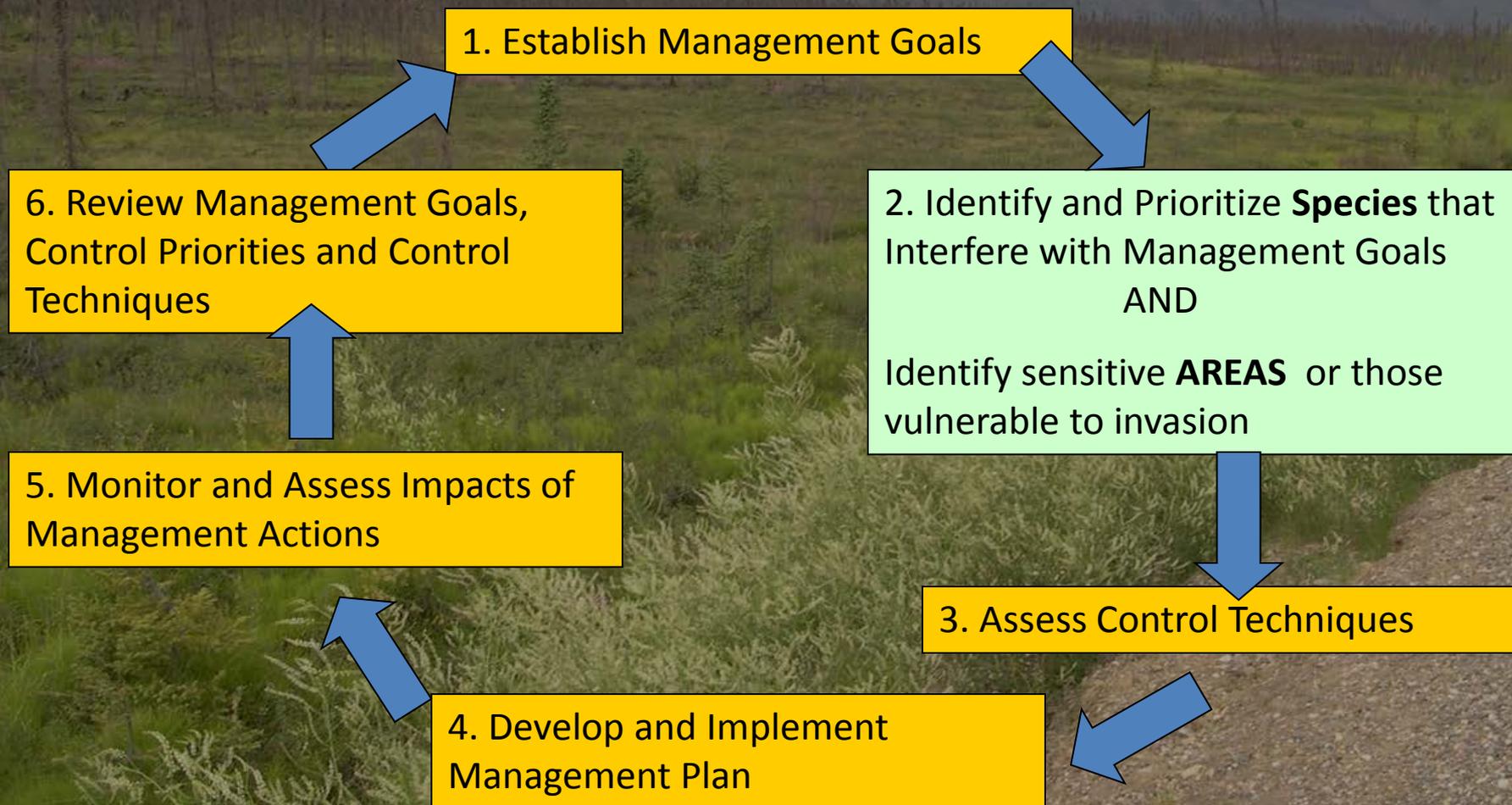


**Non-native Plants Density** (points/ km<sup>2</sup>)

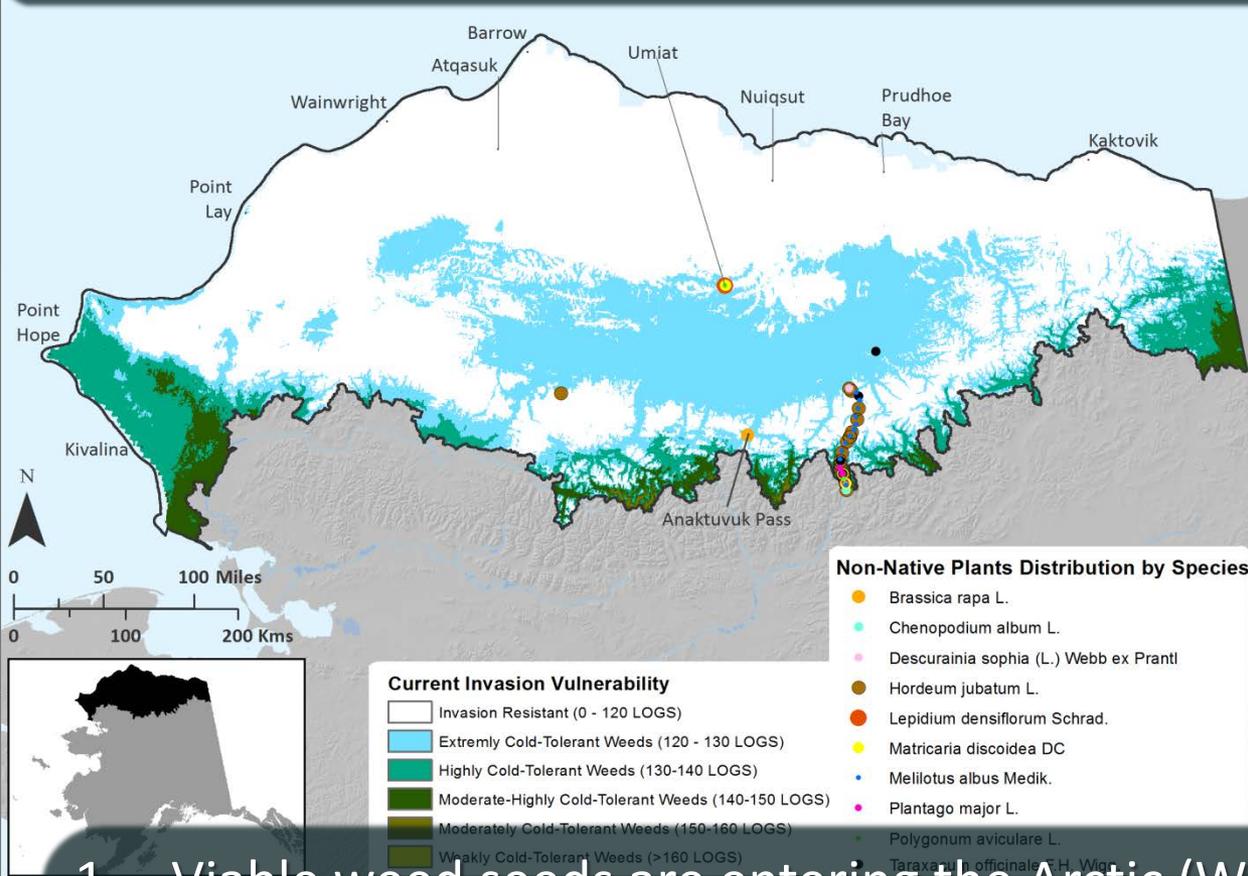


# Application of REA products

## Early Detection Rapid Response



# Current Non-Native Species in Arctic Alaska



1. Viable weed seeds are entering the Arctic (Ware et al. 2011)
  2. Yet, no weeds have been detected in surveys in Prudhoe Bay, Barrow, etc.
- Currently weeds are only known from areas with a 'growing season' of  $\geq 120$  days

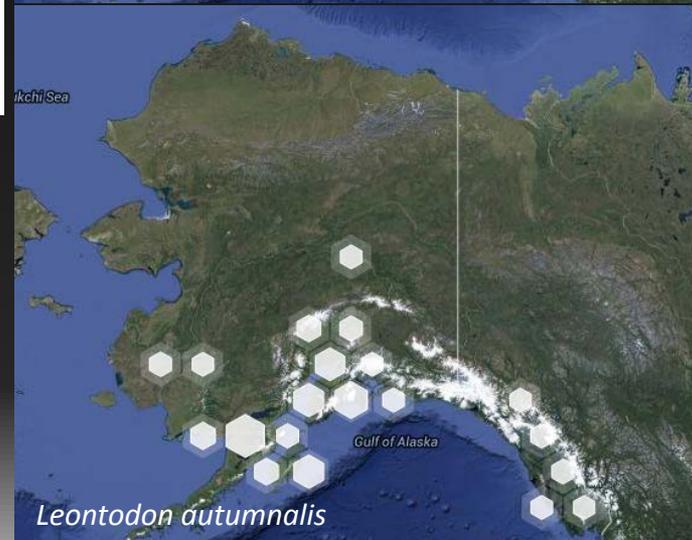
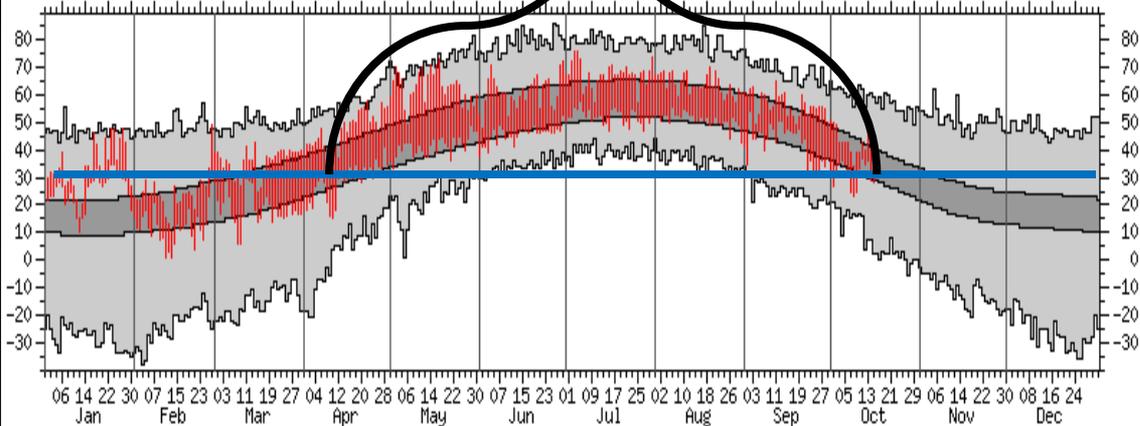
# Which Non-Native Species could become a problem in Arctic Alaska?

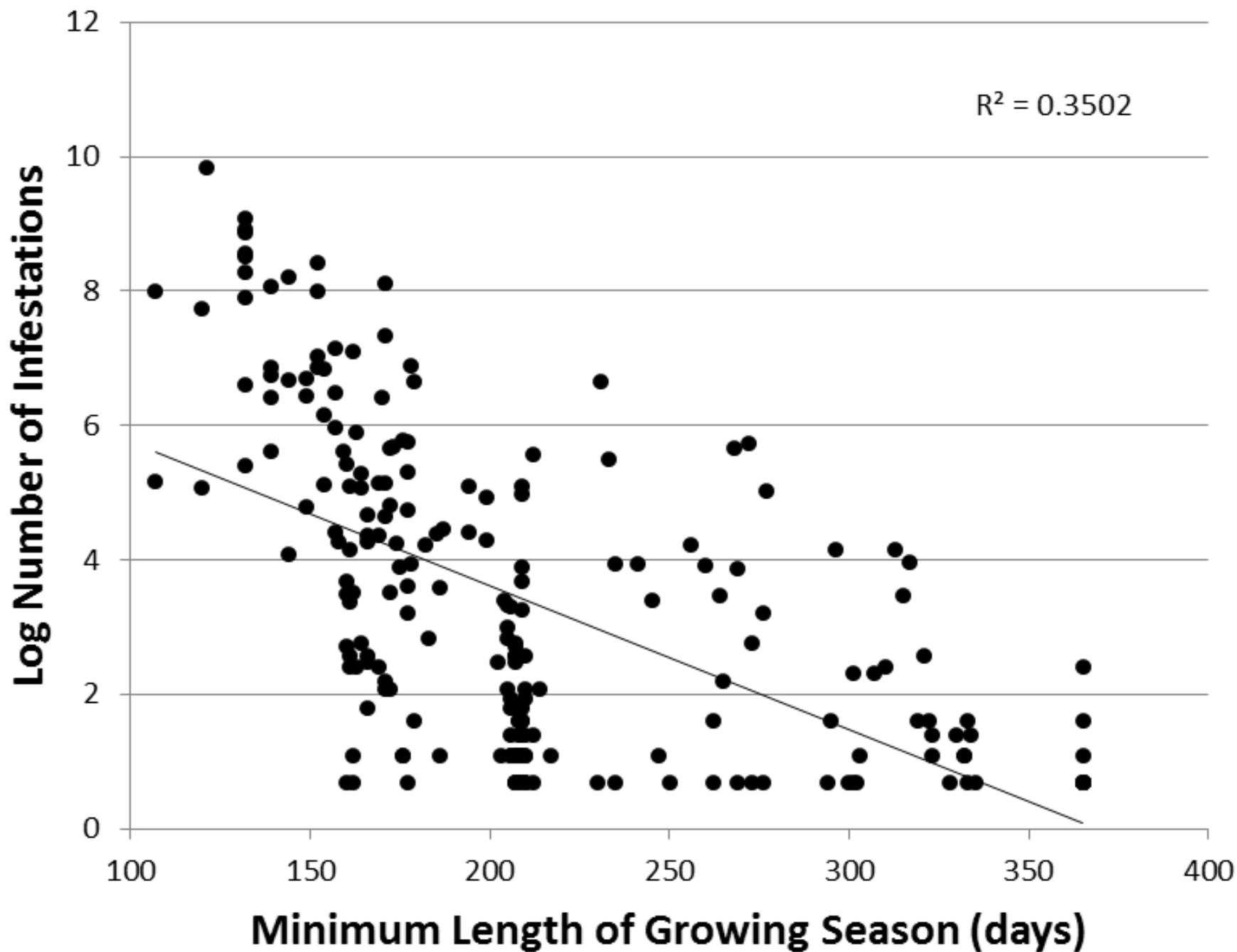
## “Length of Growing Season”

NOAA - Anchorage

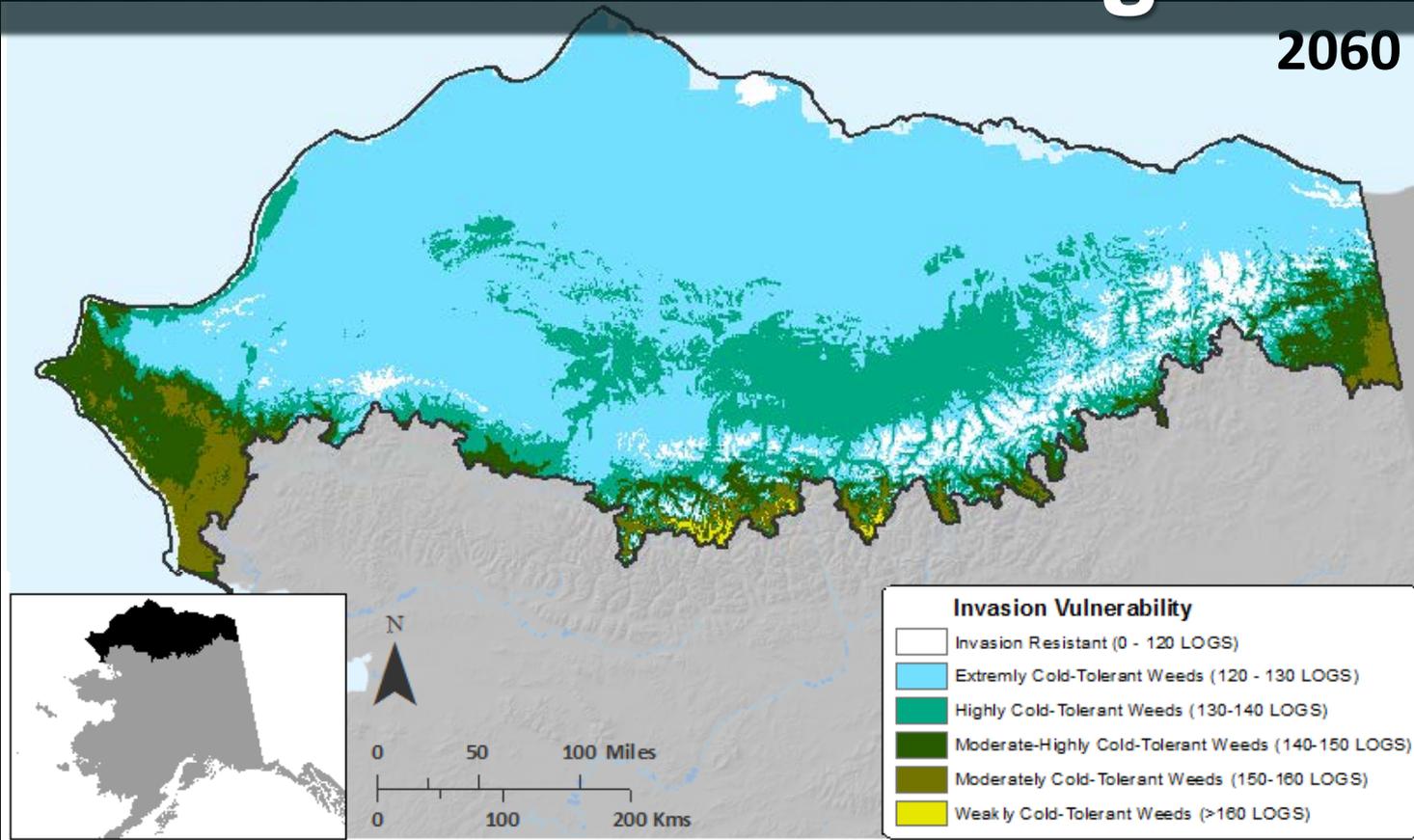
PAFC 2014 Temperatures

Observed Normals Extremes





# Current & Future Growing Season



- Transition from largely inhospitable to vulnerable to extremely cold-tolerant weeds
- Southern margin projected to be vulnerable to establishment of moderately cold-tolerant weeds

# Invasion Vulnerable Arctic Habitats

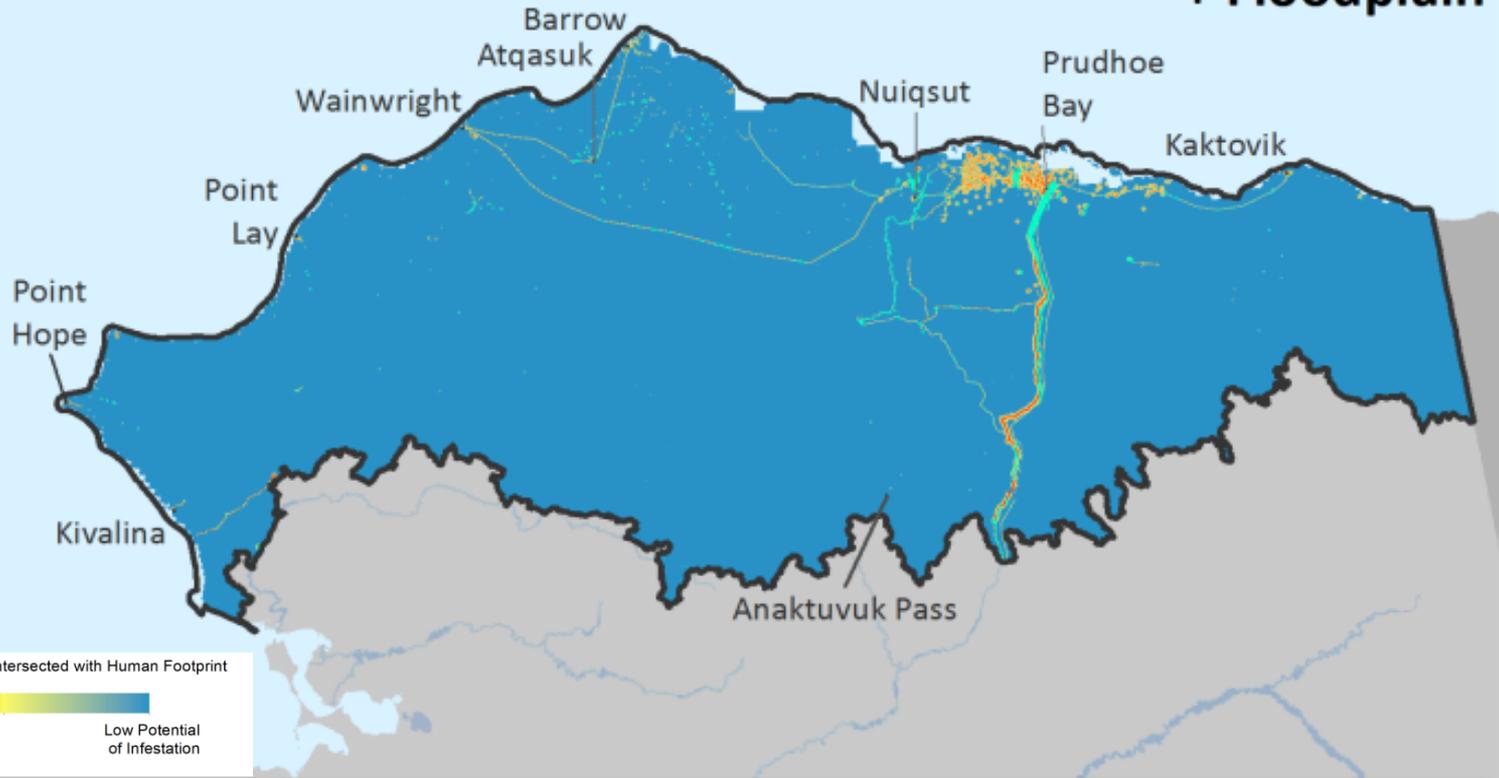
Human footprint and intersecting floodplains with warmer climates are anticipated to be most vulnerable areas to invasion



# Invasion Vulnerable Areas

Long-Term LOGS (2060) x High Scenario LCM (2040)

+ Floodplain



- Specific areas most susceptible?
  - Warm areas *and* population centers, road corridors, floodplains

# A Cautionary Tale...



# Questions...

