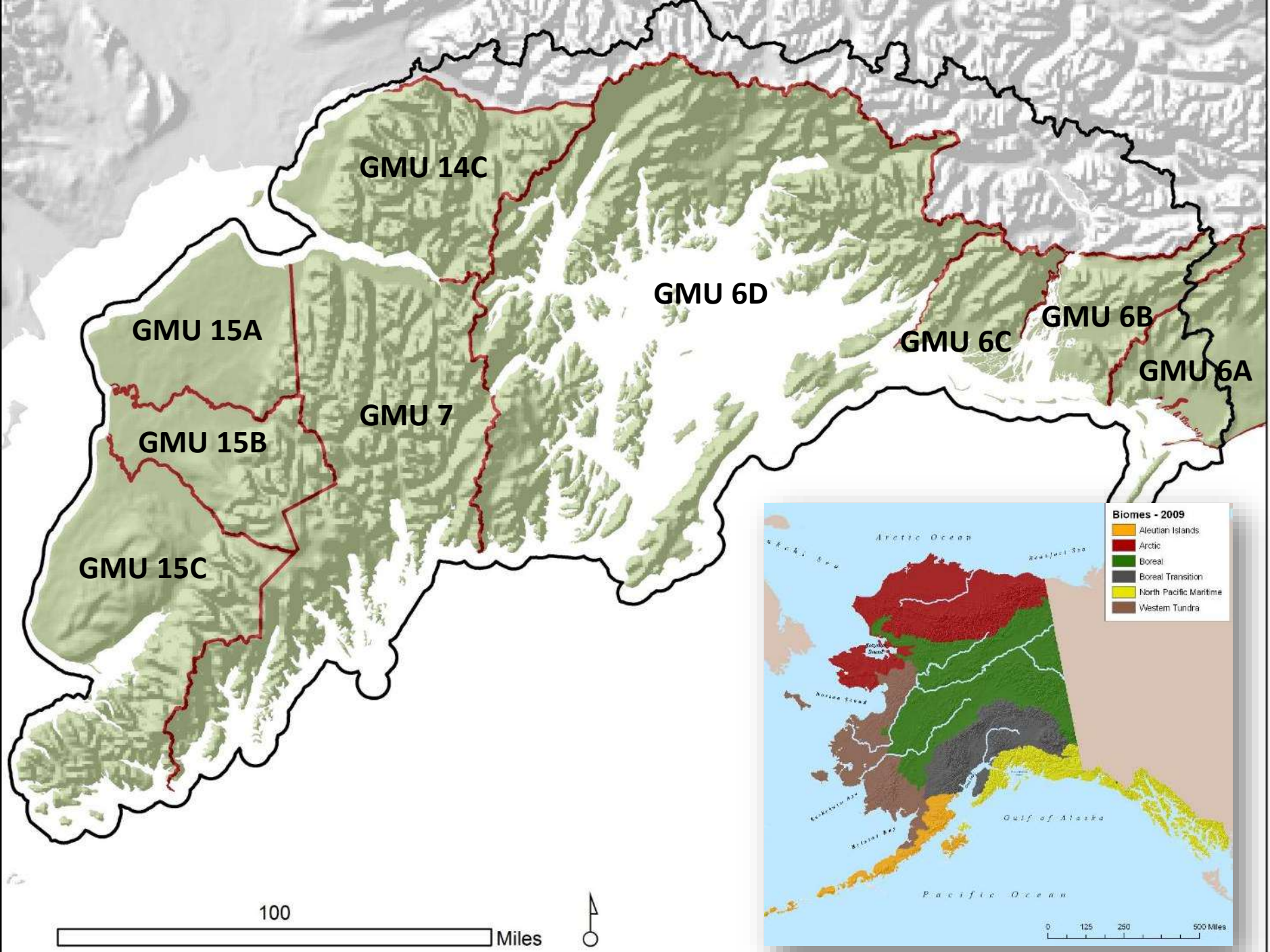


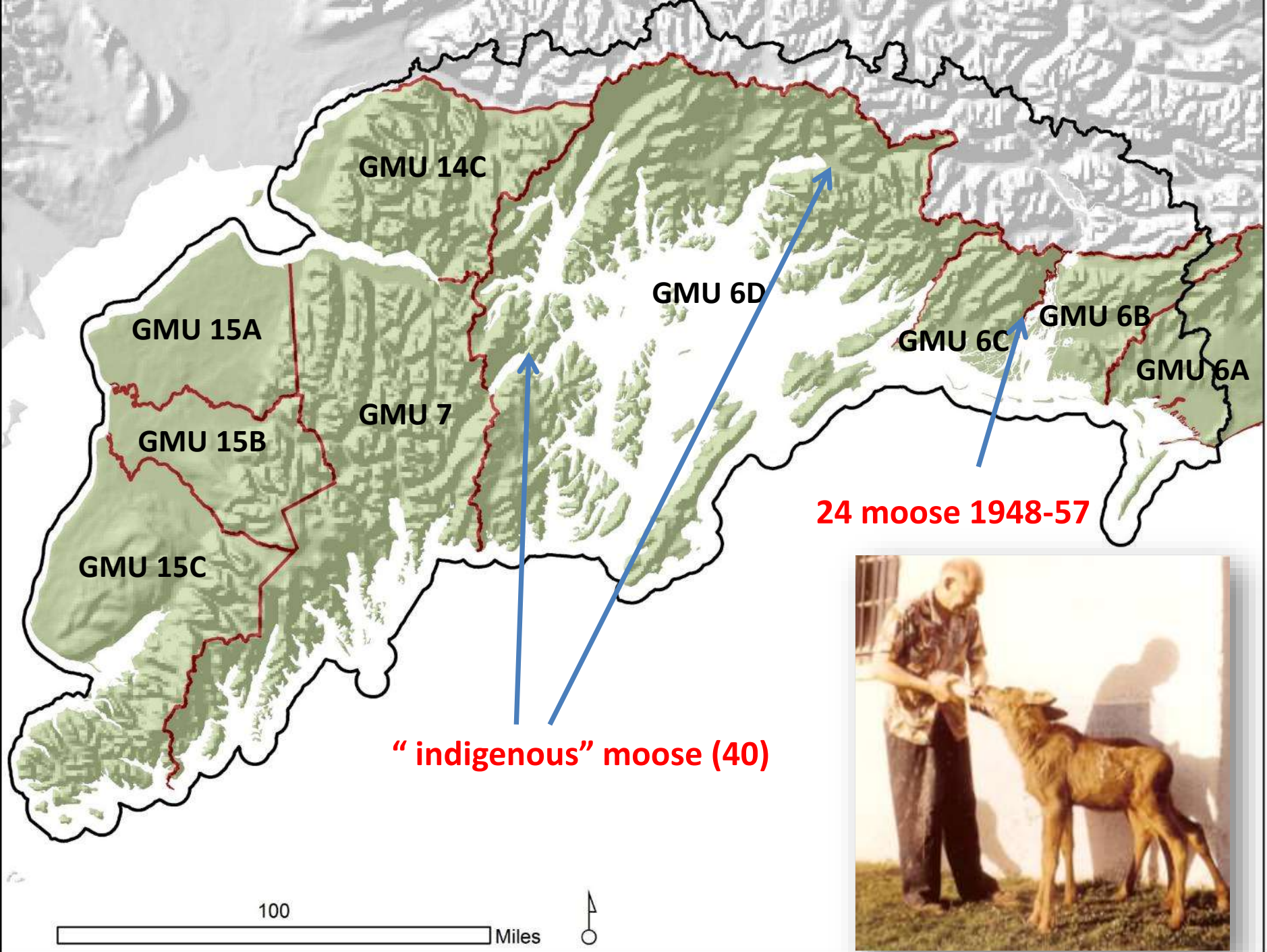
Effects of a Warming Climate on Caribou, Moose and Sitka Black-tailed Deer on the Kenai Peninsula and Prince William Sound

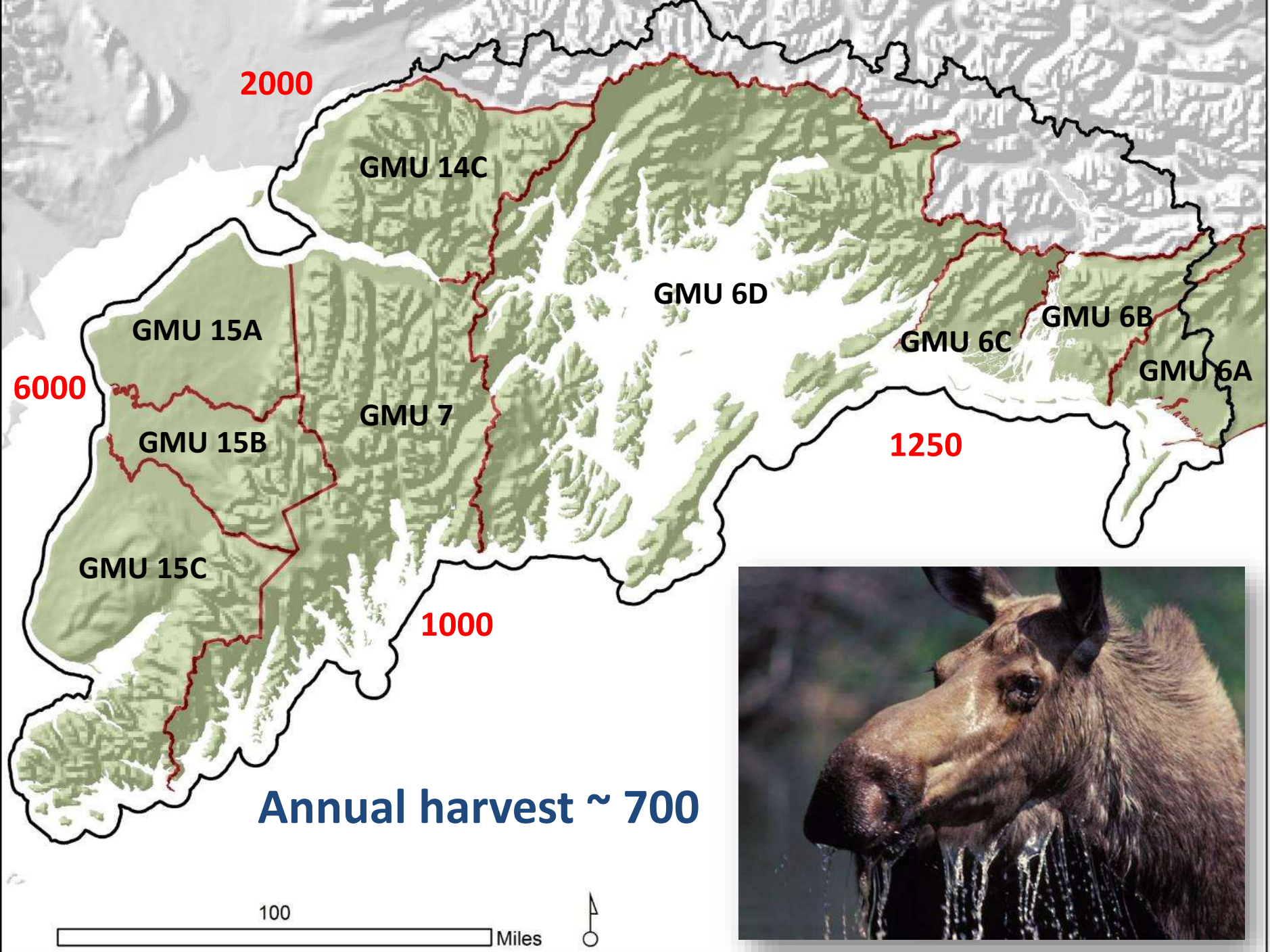


John Morton, PhD

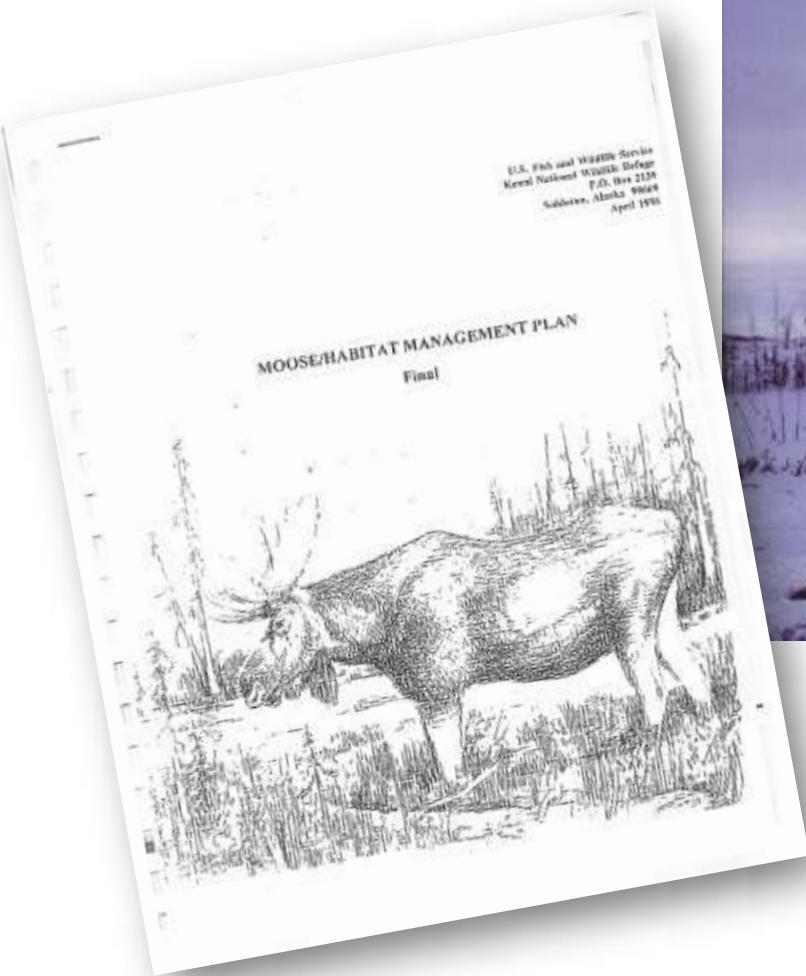


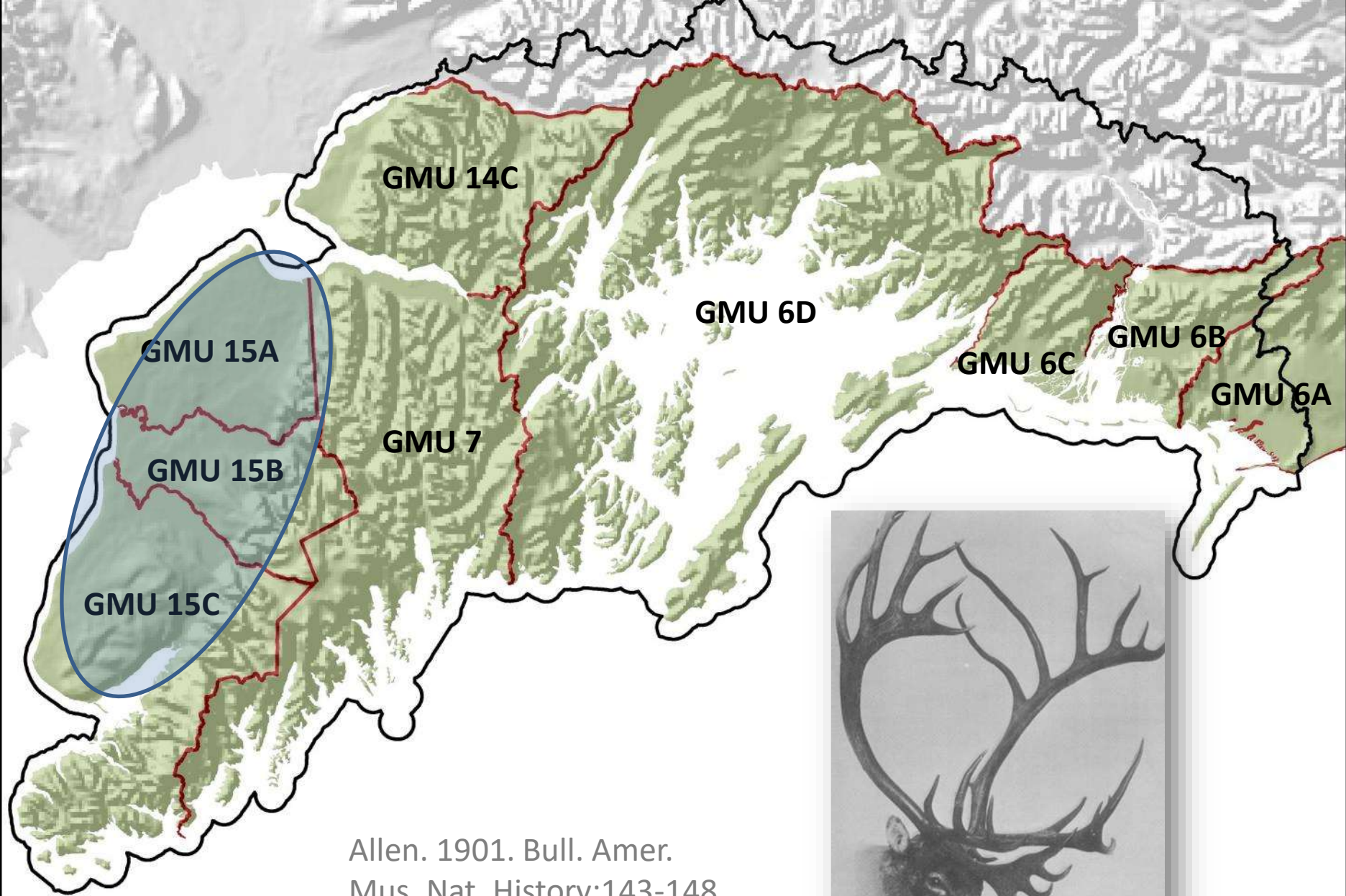






Kenai National Wildlife Refuge has long history of moose management





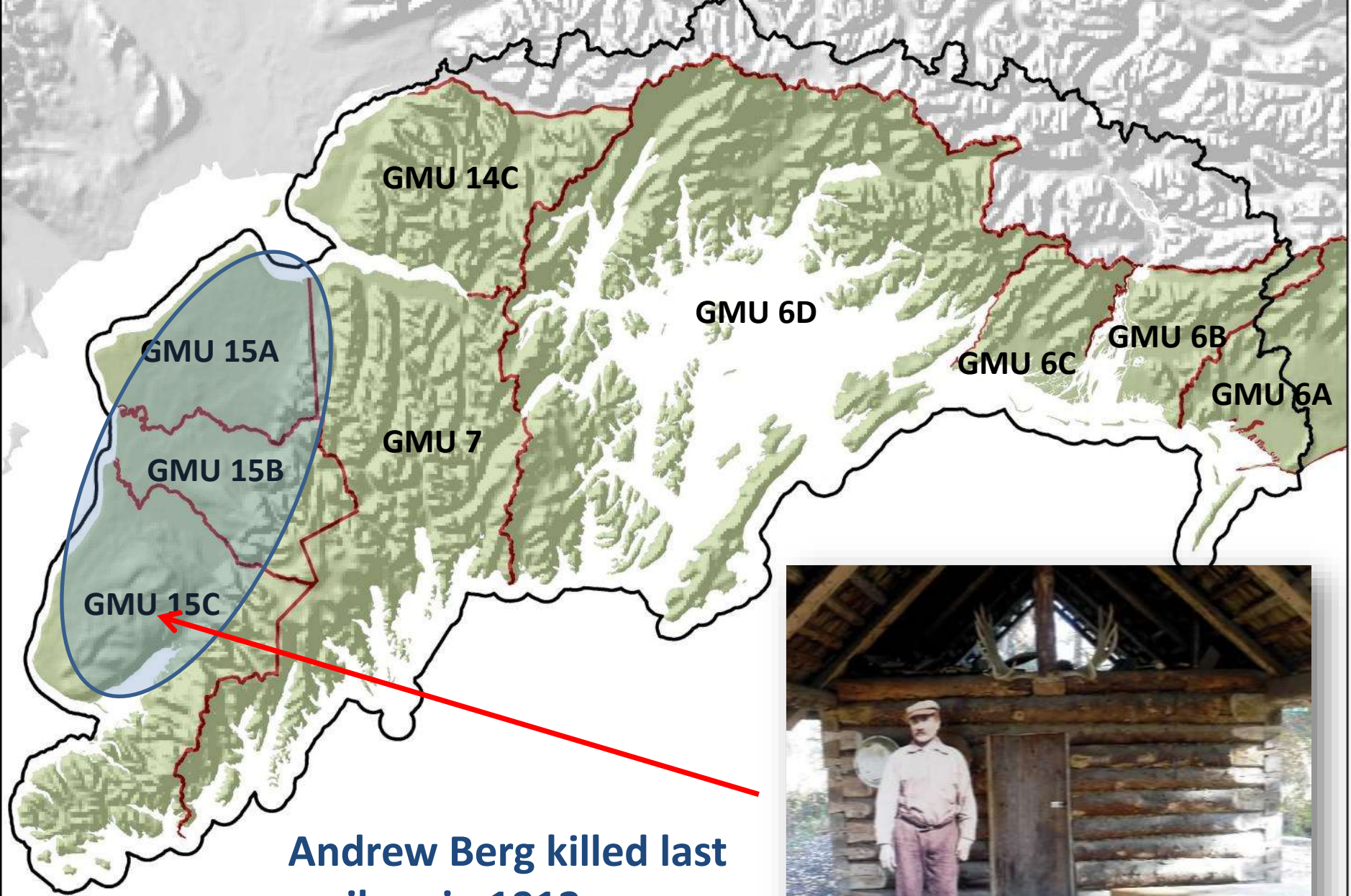
Allen. 1901. Bull. Amer.
Mus. Nat. History:143-148



100

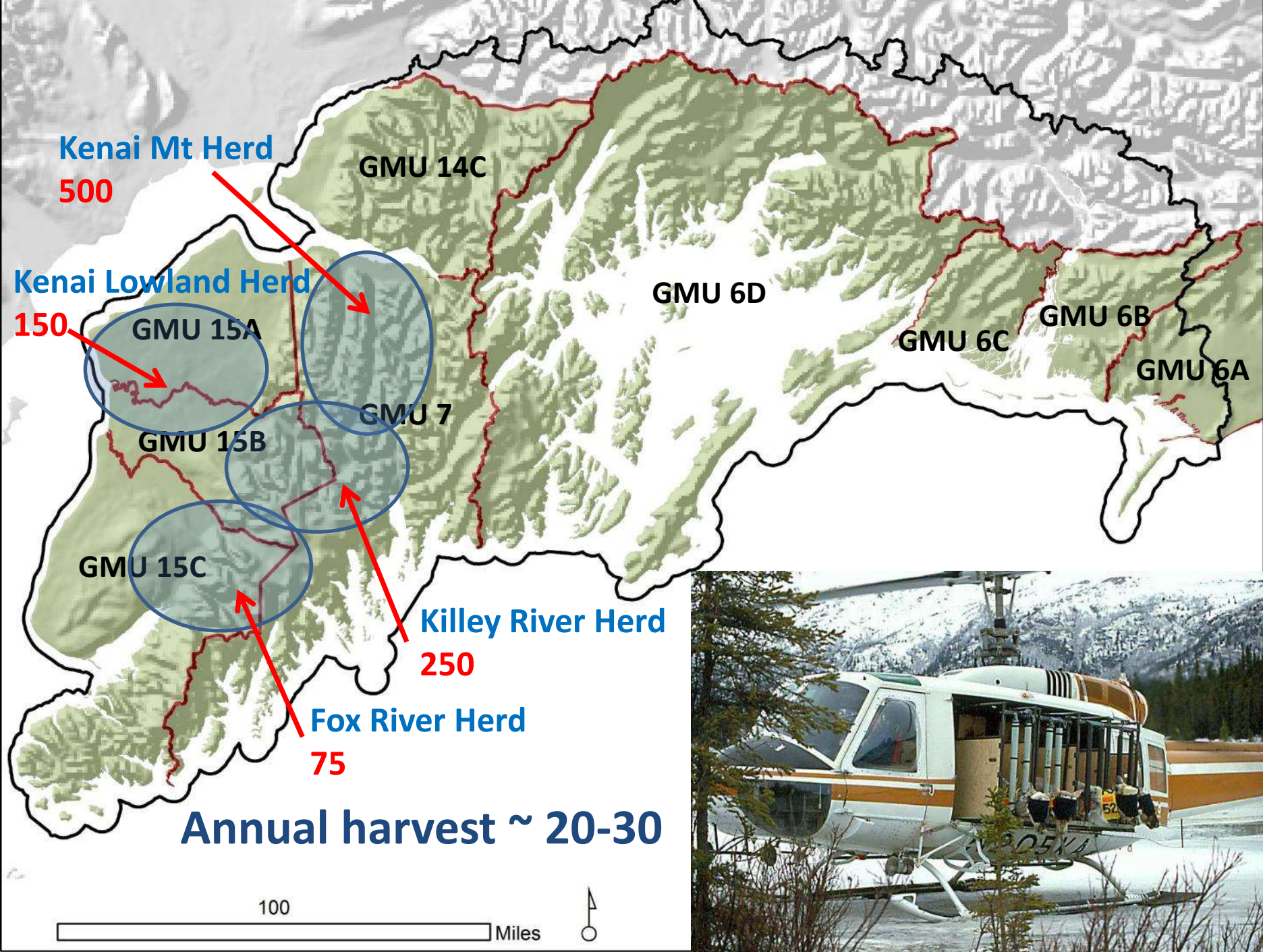
Miles





Andrew Berg killed last caribou in 1912





**KENAI PENINSULA
CARIBOU MANAGEMENT PLAN**

ALASKA DEPARTMENT OF FISH AND GAME

U.S. FOREST SERVICE

U.S. FISH AND WILDLIFE SERVICE

FINAL

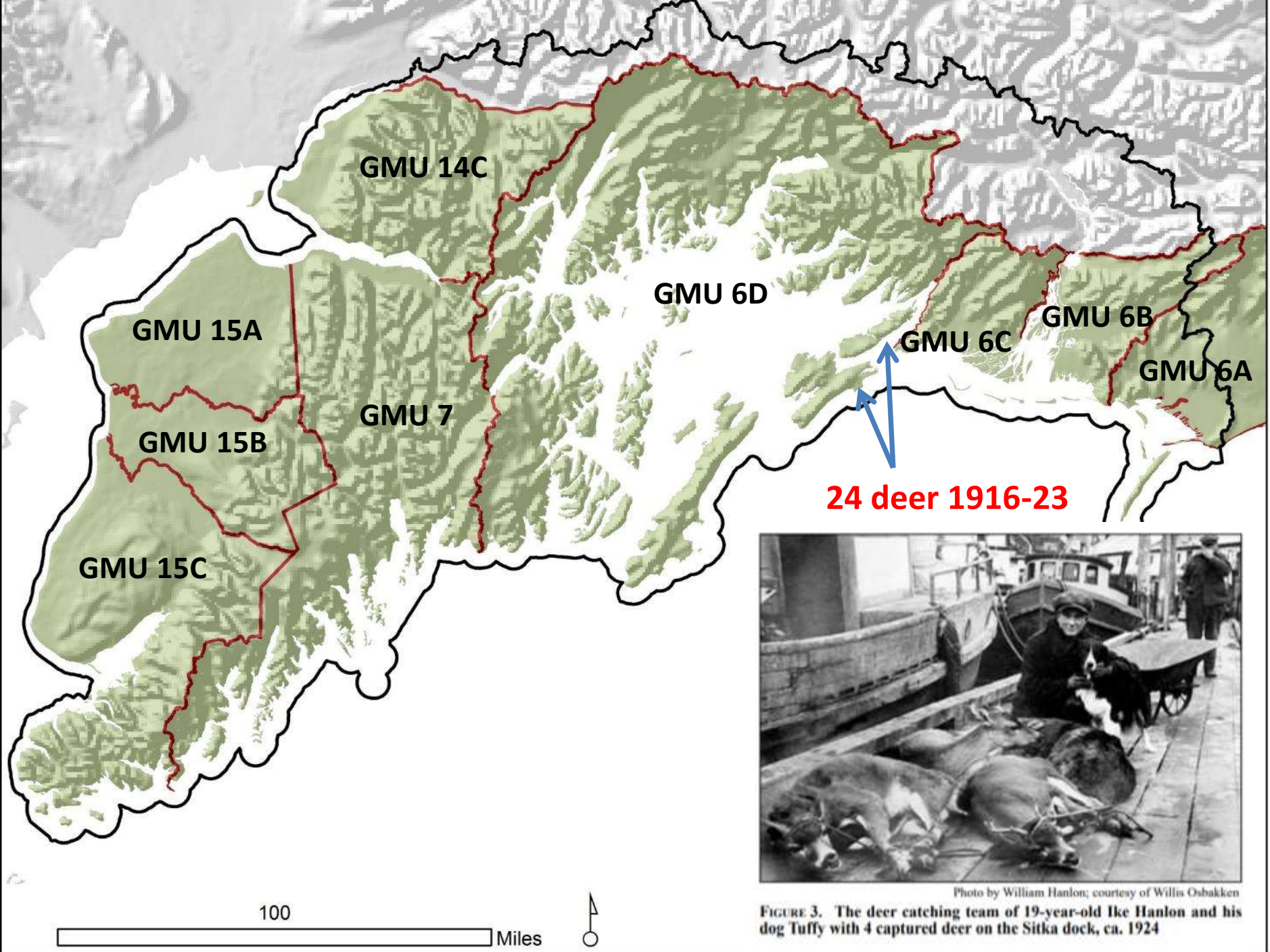
June 2003

Alaska Department of Fish and Game
43961 Kalifornsky Beach Rd., Suite B
Soldotna, AK 99669

USDA Forest Service
Chugach National Forest
Seward Ranger District
P.O. Box 390
Seward, AK 99664

U.S. Fish and Wildlife Service
Kenai National Wildlife Refuge
P.O. Box 2139
Soldotna, AK 99669



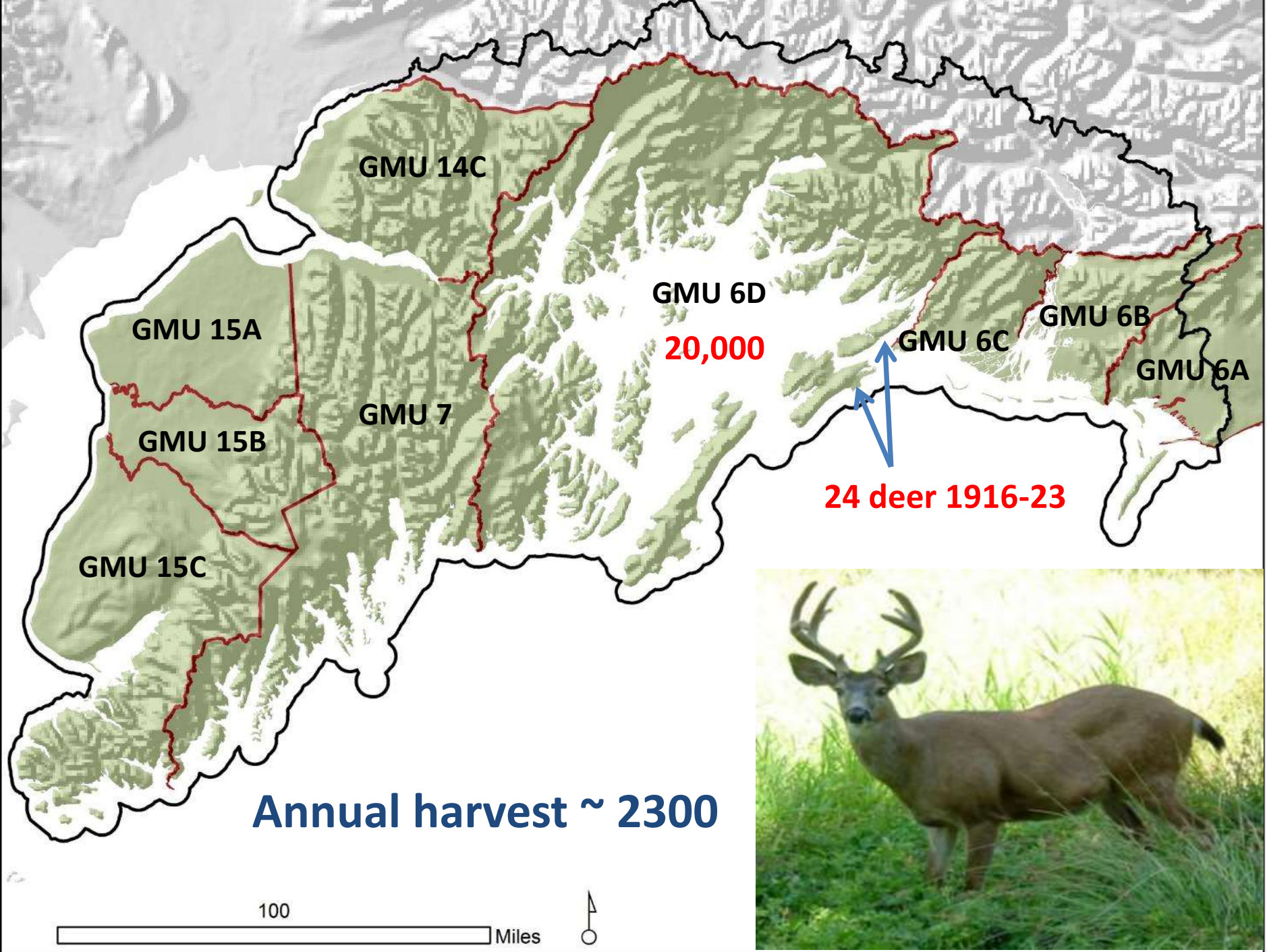


24 deer 1916-23



Photo by William Hanlon; courtesy of Willis Osbakken

FIGURE 3. The deer catching team of 19-year-old Ike Hanlon and his dog Tuffy with 4 captured deer on the Sitka dock, ca. 1924



What's on the Kenai Peninsula?

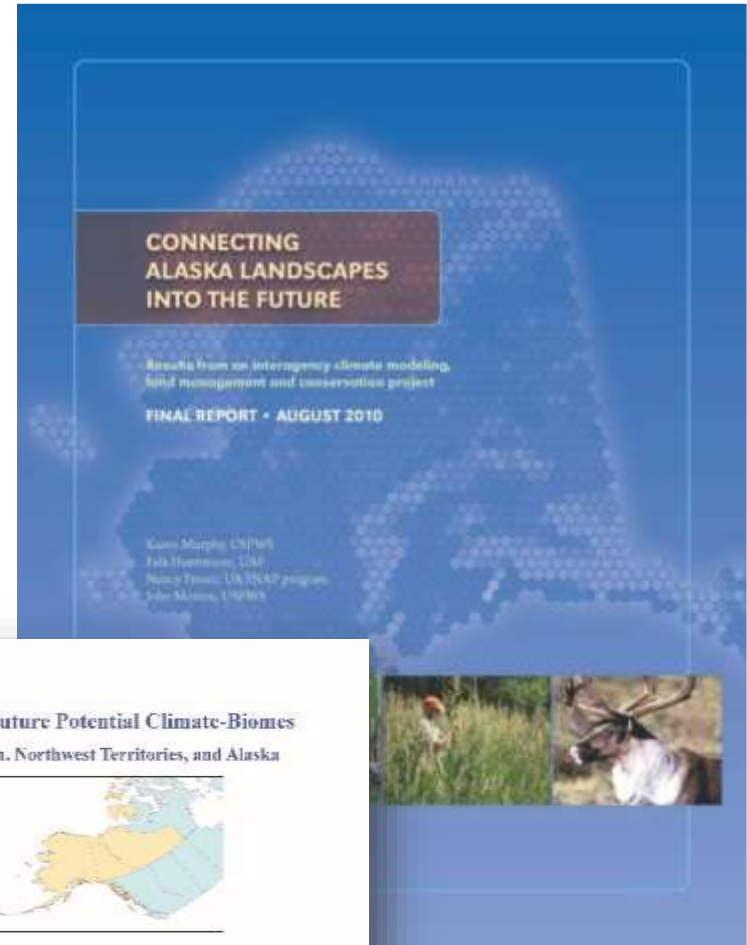


Resurrection River, Seward

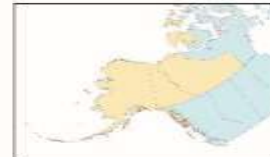


Sterling Highway, Sterling

Interagency effort to assess climate change effects on biome and species distributions using climate envelope models



Predicting Future Potential Climate-Biomes for the Yukon, Northwest Territories, and Alaska



A climate-linked cluster analysis approach to analyzing possible ecological refugia and areas of greatest change

Prepared by the Sciences Network for Arctic Planning and the SWHMJ Life University of Alaska Fairbanks

on behalf of

The Nature Conservancy's Canada Program
Arctic Landscape Conservation Cooperative
The US Fish and Wildlife Service
Ducks Unlimited Canada
Government of Canada
Government Northwest Territories



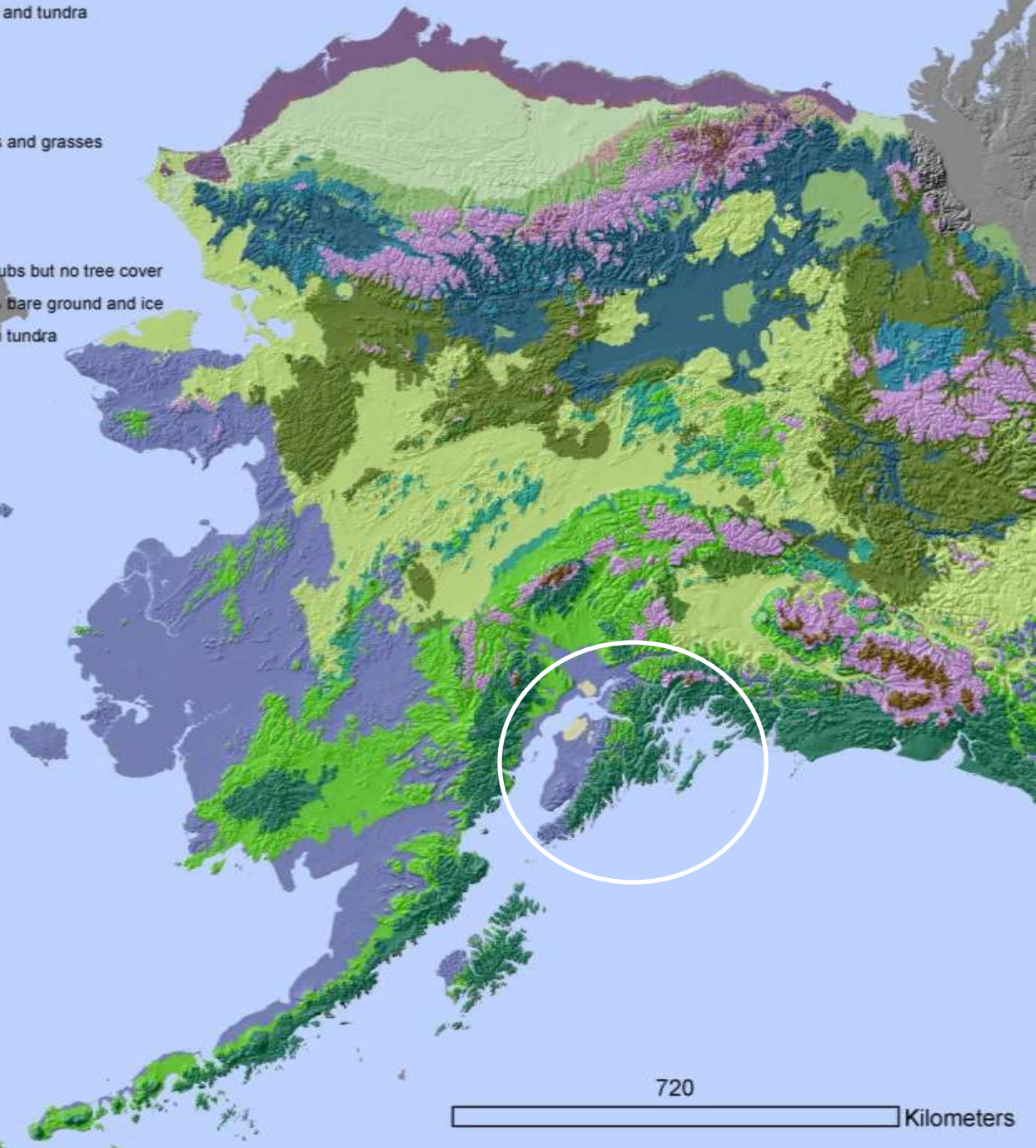
2012



- Arctic tundra with denser vegetation and more shrub cover including some small trees
- Boreal forest with coastal influence and intermixed grass and tundra
- Coastal rainforest, wet, more temperate
- Cold northern boreal forest
- Densely forested southern boreal
- Dry boreal wooded grasslands - mixed coniferous forests and grasses
- Dry sparsely vegetated southern arctic tundra
- Mixed boreal forest
- More densely forested closed-canopy boreal
- More densely vegetated arctic tundra with up to 40% shrubs but no tree cover
- Northern Arctic sparsely vegetated tundra with up to 25% bare ground and ice
- Northern boreal / southern arctic shrubland, with an open tundra
- Northern boreal coniferous woodland, open canopy
- Prairie and grasslands
- Southern boreal / aspen parkland
- Southern boreal, mixed forest
- Sparsely vegetated boreal with elevation influences

2009

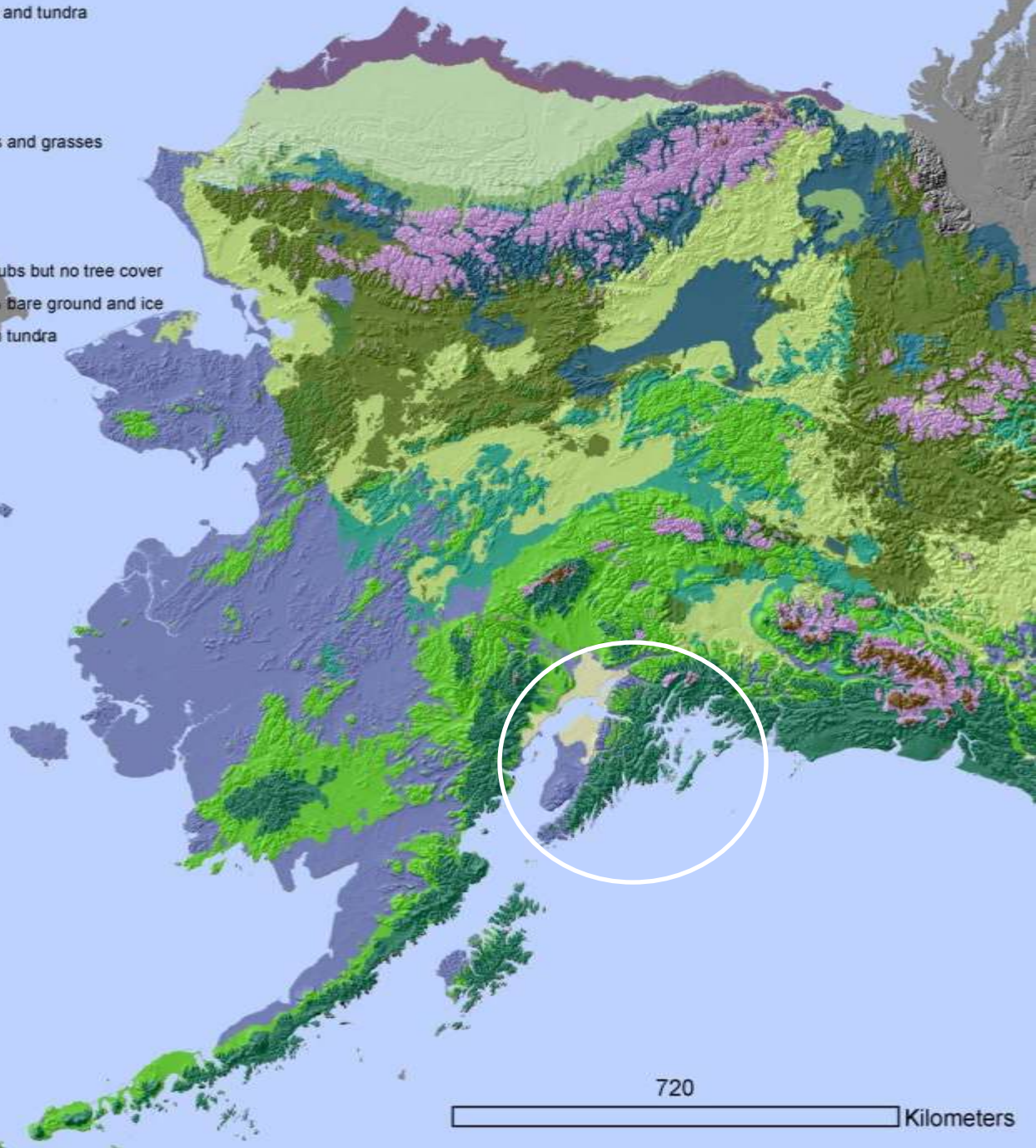
720 Kilometers



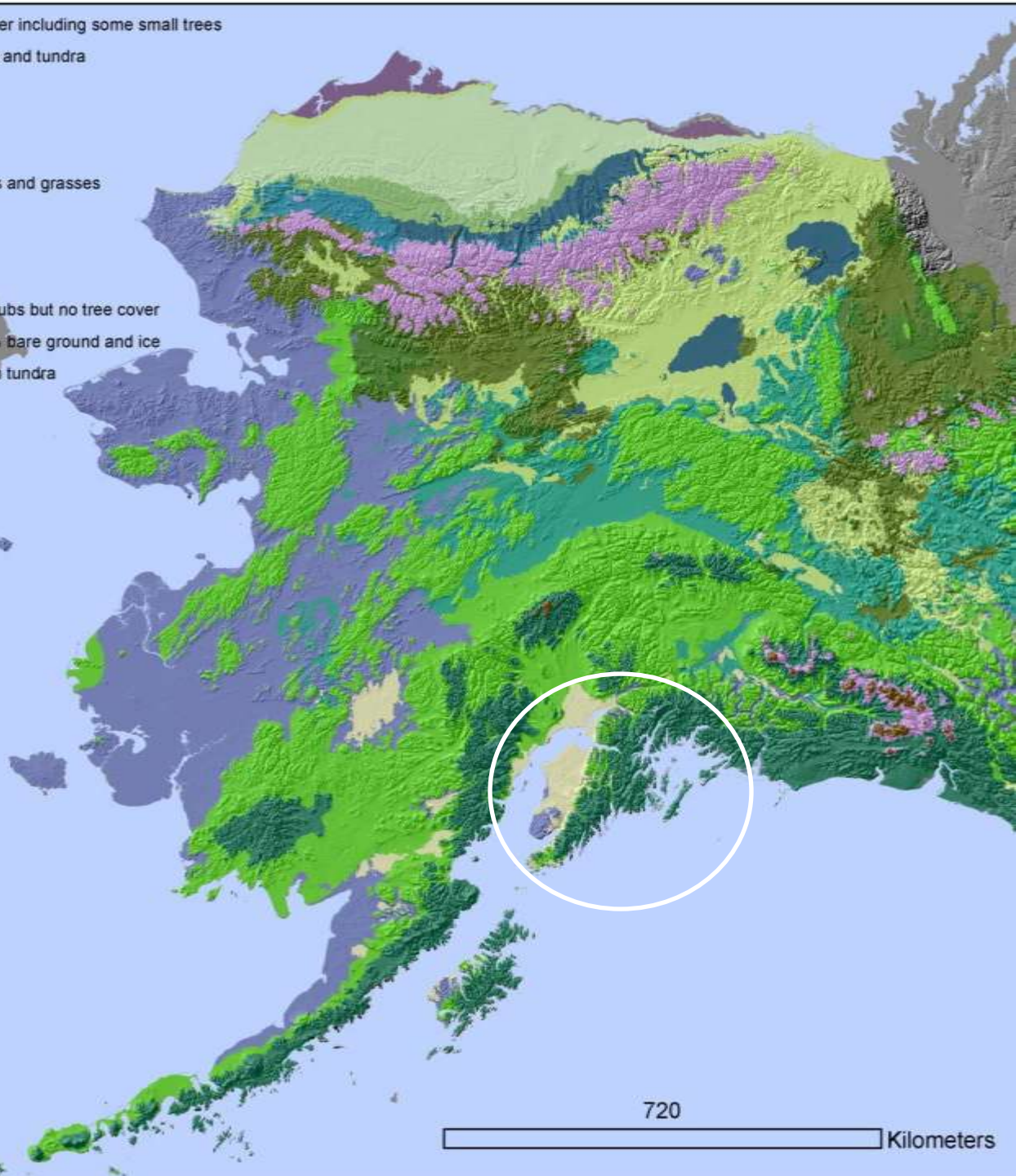
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- Southern boreal / aspen parkland
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- Sparsely vegetated boreal with elevation influences

2039

720 Kilometers



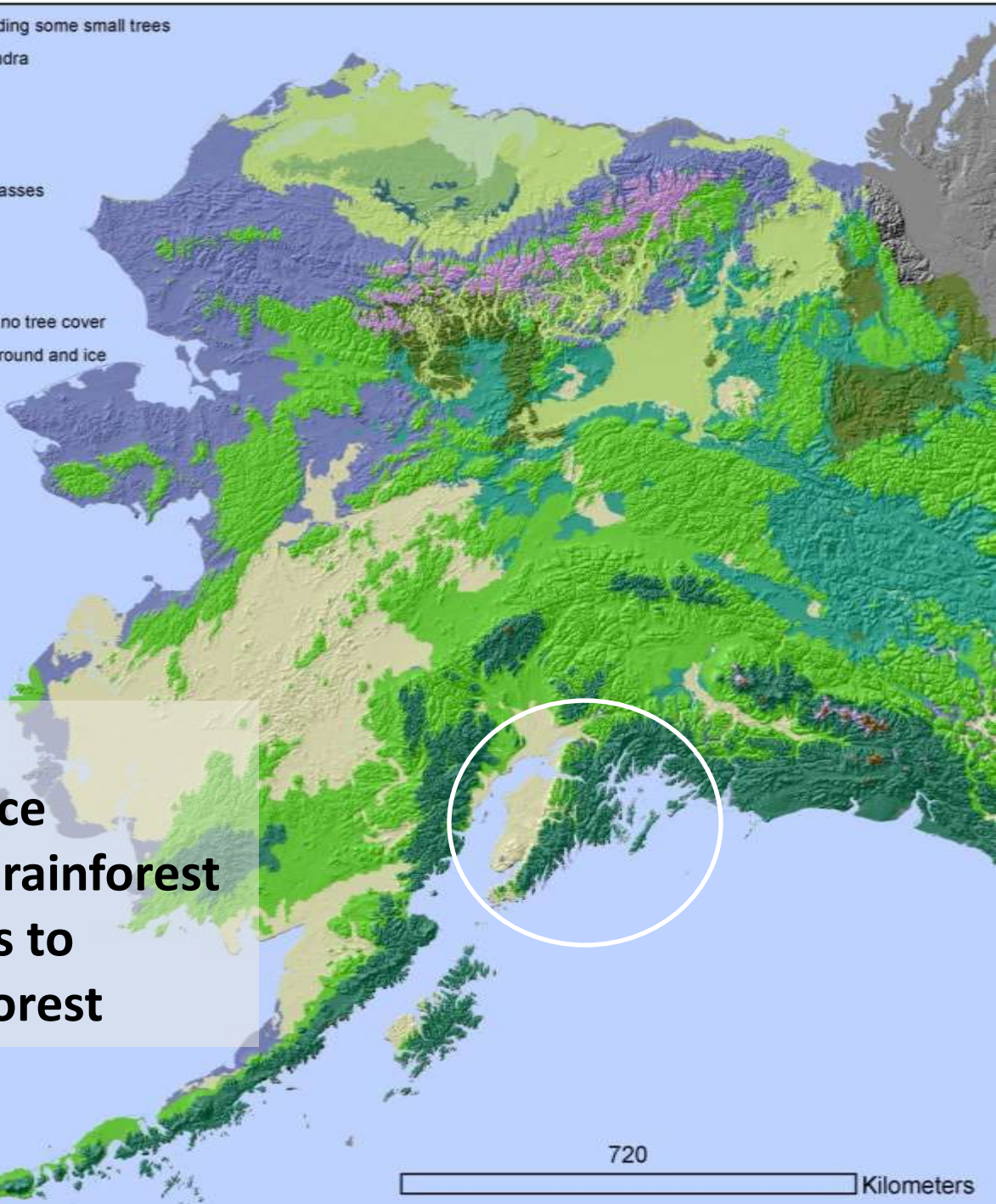
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- Sparsely vegetated boreal with elevation influences





2069

720 Kilometers

-  Arctic tundra with denser vegetation and more shrub cover including some small trees
-  Boreal forest with coastal influence and intermixed grass and tundra
-  Coastal rainforest, wet, more temperate
-  Cold northern boreal forest
-  Densely forested southern boreal
-  Dry boreal wooded grasslands - mixed coniferous forests and grasses
-  Dry sparsely vegetated southern arctic tundra
-  Mixed boreal forest
-  More densely forested closed-canopy boreal
-  More densely vegetated arctic tundra with up to 40% shrubs but no tree cover
-  Northern Arctic sparsely vegetated tundra with up to 25% bare ground and ice
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-  Southern boreal / aspen parkland
-  Southern boreal, mixed forest
-  Sparsely vegetated boreal with elevation influences



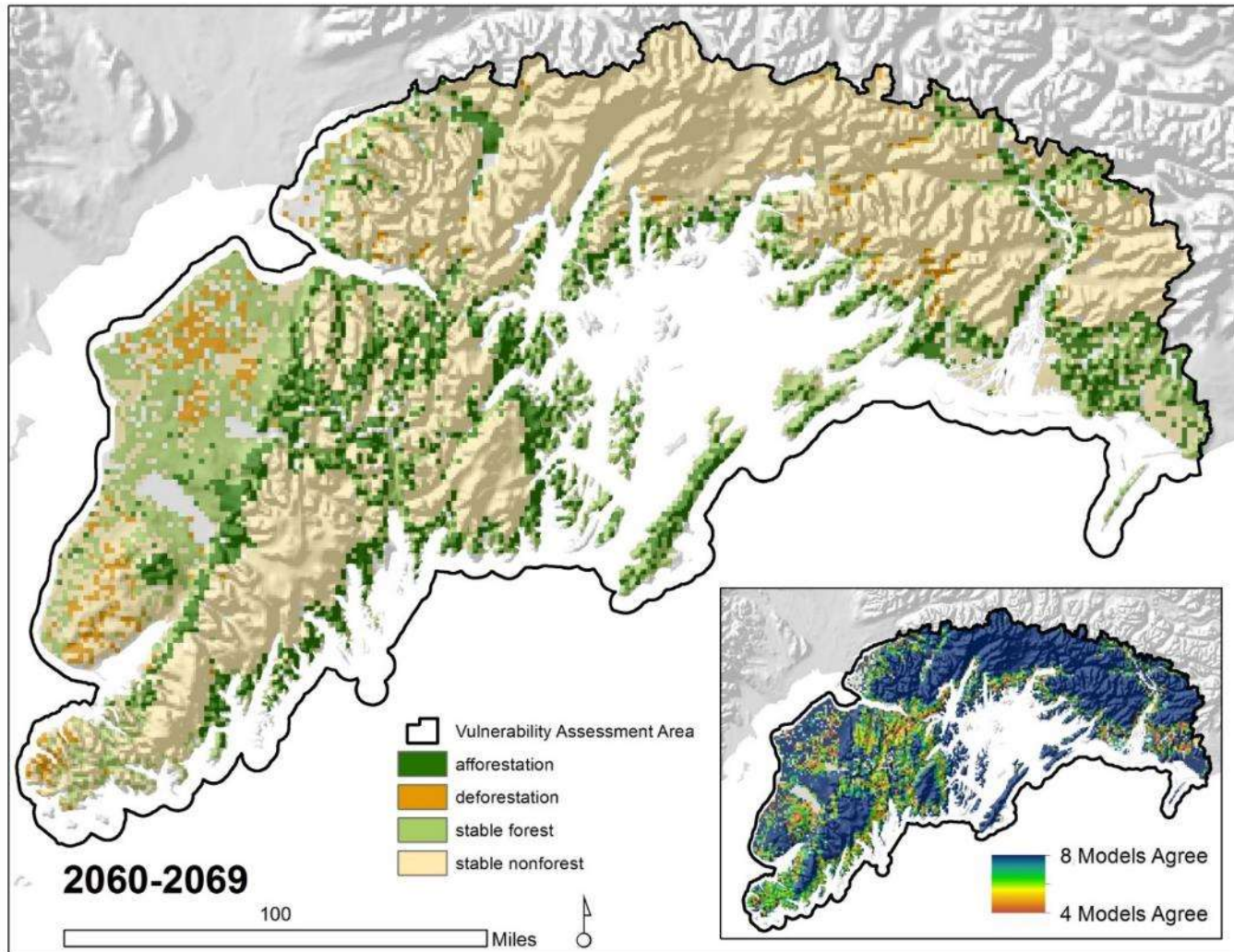
By 2100...

-  **eastern Kenai and Prince Williams Sound remains rainforest**
-  **western Kenai converts to grasslands from boreal forest**

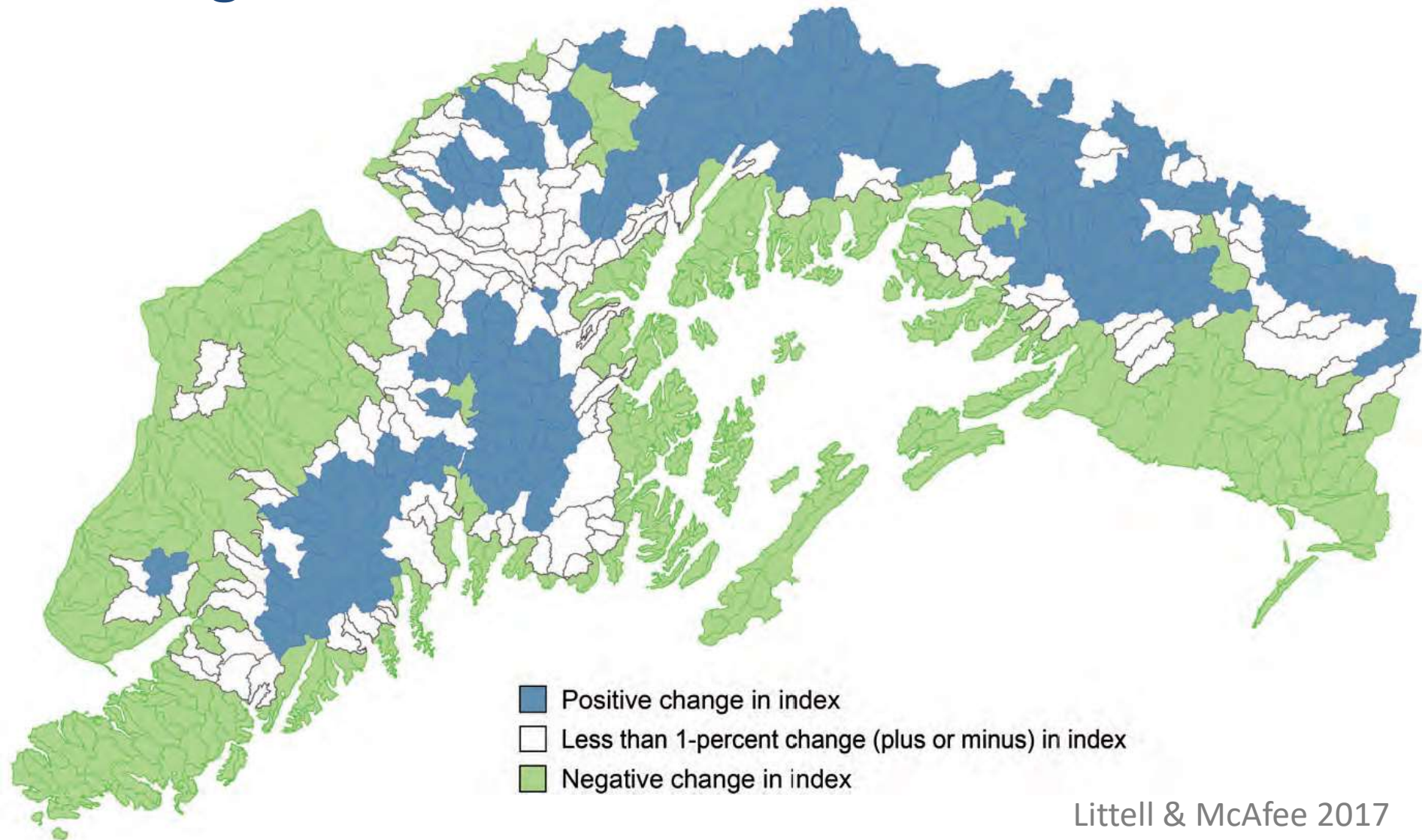
2099



Deforestation of western Kenai with mostly coastal (and some alpine) afforestation in PWS by 2069



Expected snowpack changes (-20% to +10%) through 2069



Most salient landcover trends

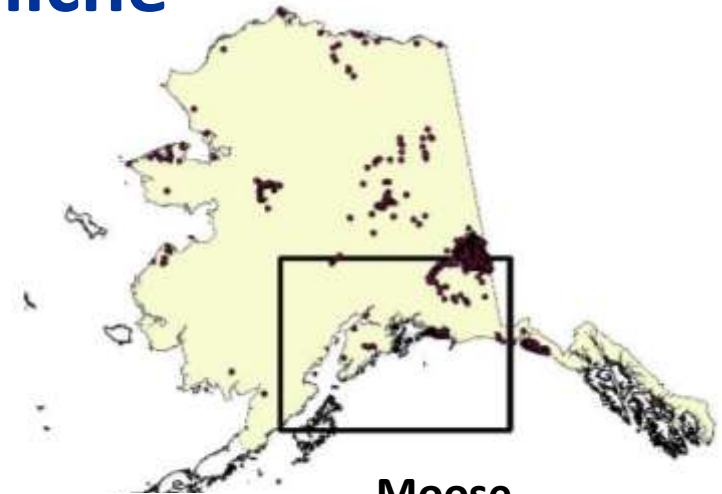
- ✓ **Afforestation of alpine tundra**
- ✓ **Deforestation of southwestern Kenai Peninsula**
- ✓ **Afforestation and reduced snow depth along Prince Williams Sound coastline**



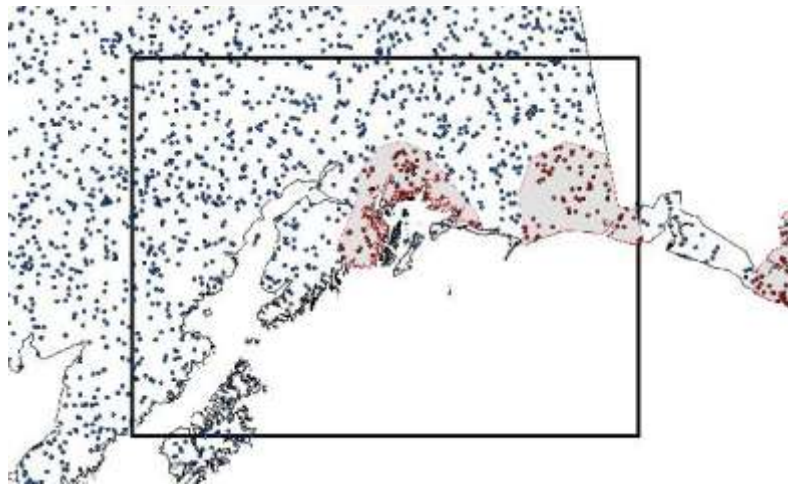
Climate envelope modeling (RandomForest) of species niche



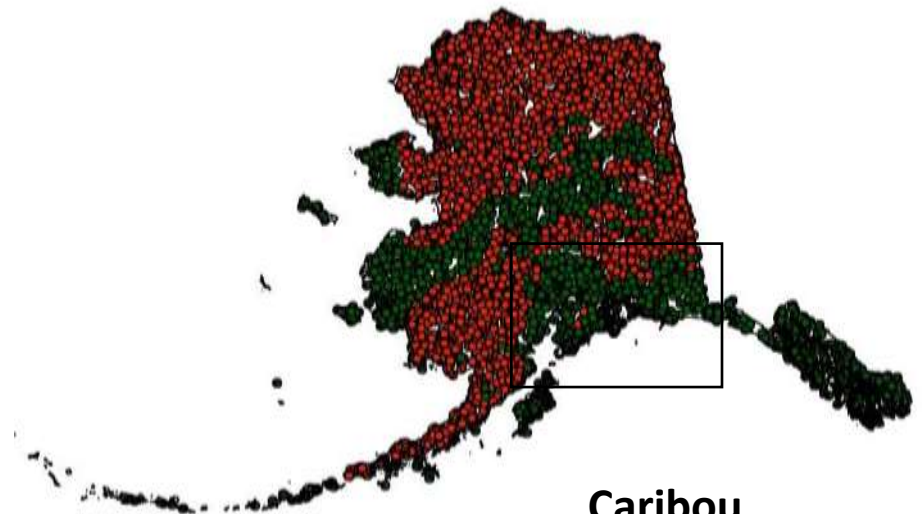
Falk Huettmann (UAF)



Moose



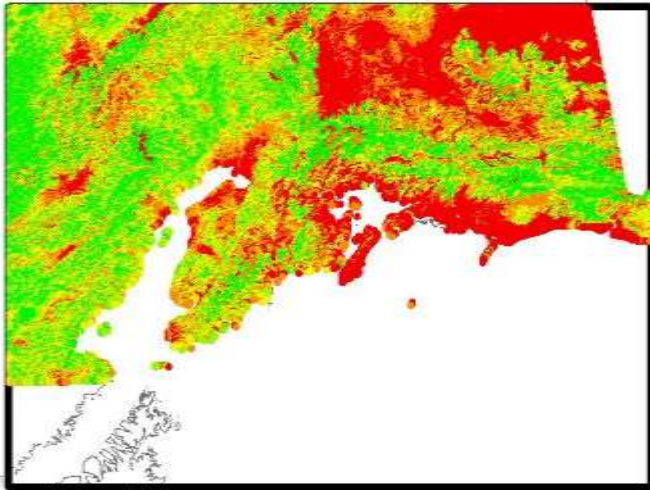
Sitka Black-tailed Deer



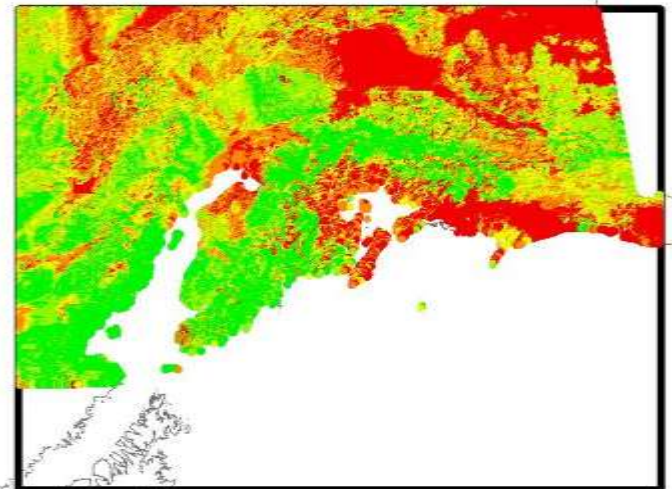
Caribou

Potential distribution in 50 years

1971-2010



2069 (decadal mean)

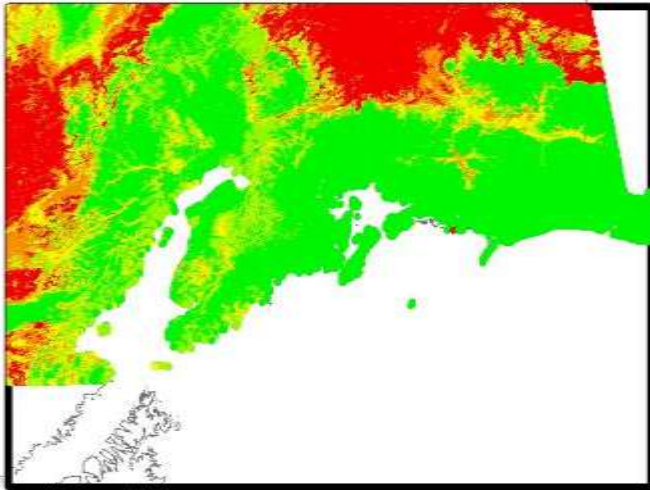


Suggested interpretation:

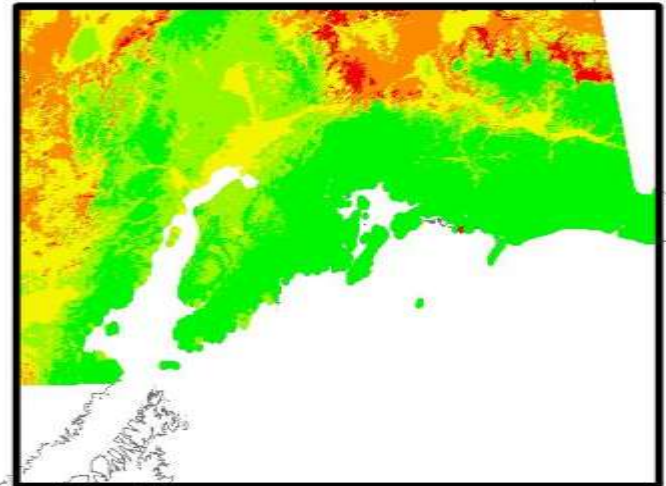
- ✓ Medium-weak moose models
- ✓ Decay of classic niche locations
- ✓ Well distributed to less so, particularly on Kenai Peninsula
- ✓ Spatial shift inland and northward

Potential distribution in 50 years

1971-2010



2069 (decadal mean)

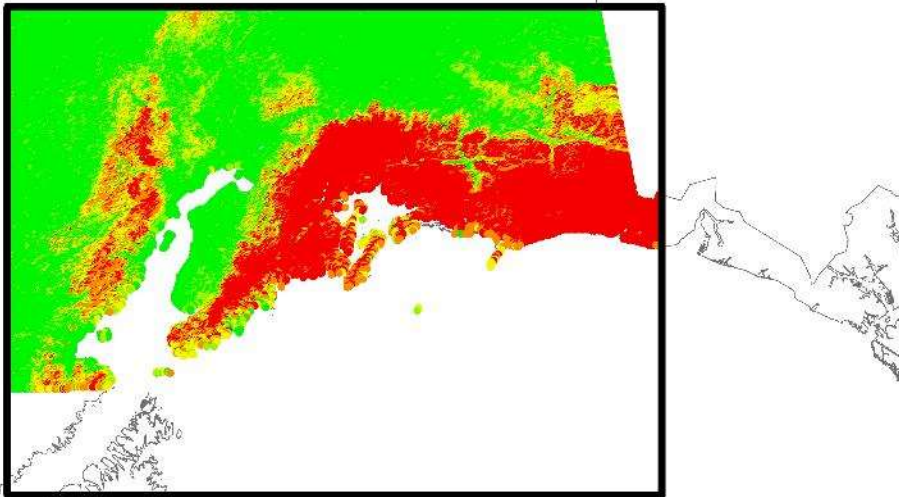


Suggested interpretation:

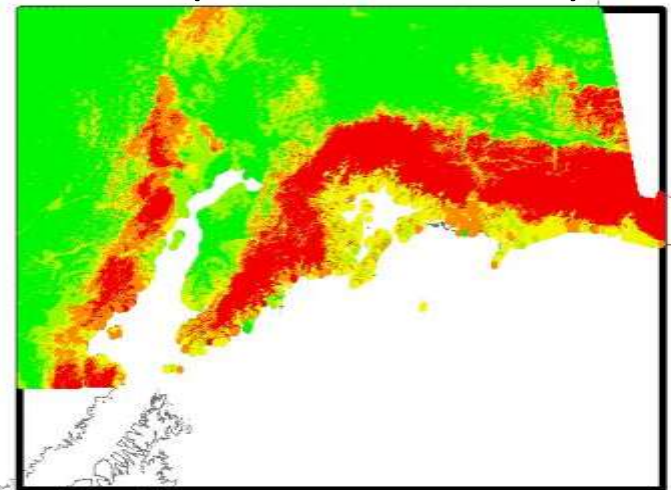
- ✓ General decay of the classic niche
- ✓ Poor distribution to worse
- ✓ Spatial shift northward and into some higher elevations

Potential distribution in 50 years

1971-2010



2069 (decadal mean)



Suggested interpretation:

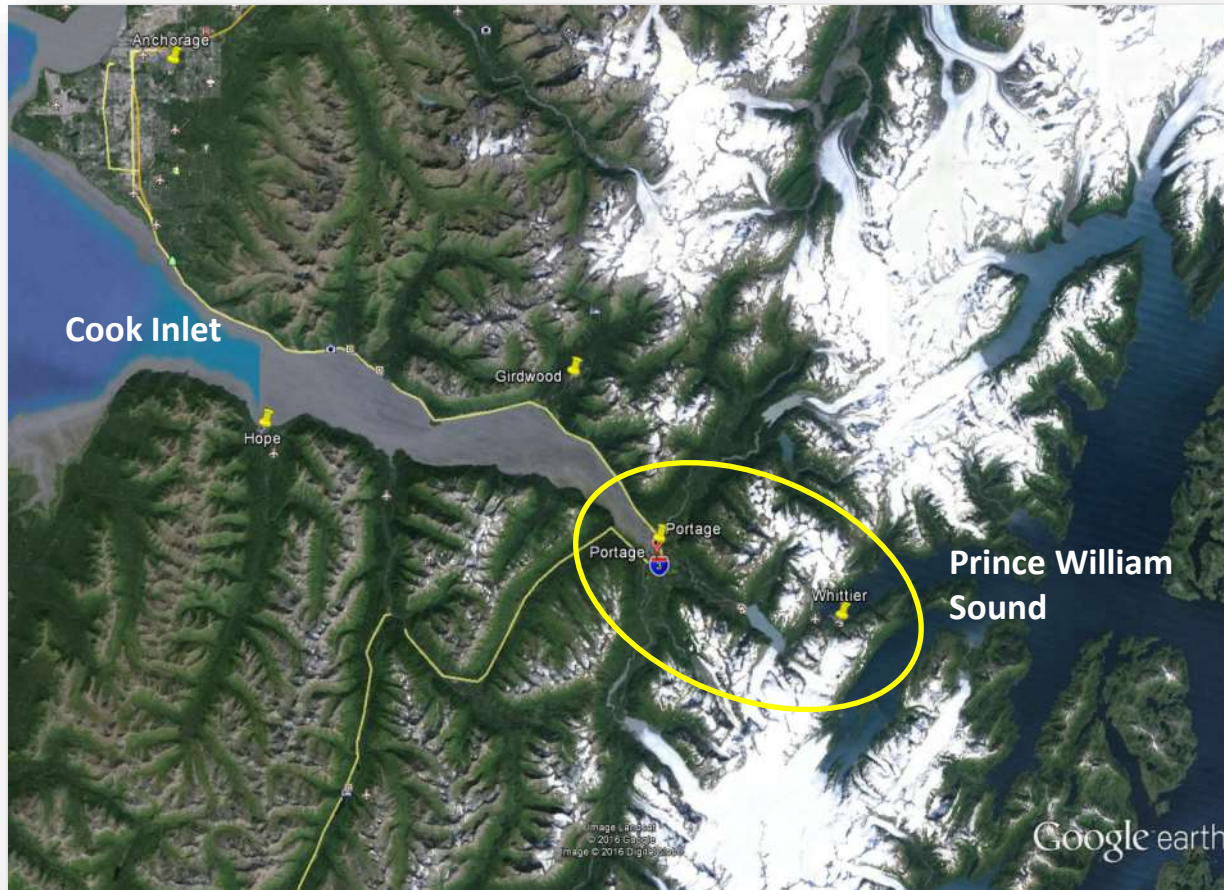
- ✓ decay of classic niche core (coastal)
- ✓ Spatial shift northward and higher elevations
- ✓ Although reduced potential niche, realized niche is likely to increase on Kenai Peninsula

Message from climate envelope models

- ✓ **Realized niche is a small subset of potential climate niche**
- ✓ **Expect expanding distribution northward and towards higher elevations (inland)**
- ✓ **Caribou and deer do not overlap**
- ✓ **Moose are widely but patchily distributed, sympatric with deer in coastal areas and caribou in western Kenai Peninsula**

Forecasted change	Response: + = INCREASE,- = DECREASE, ? = UNCERTAIN, 0 = NO CHANGE					
	Moose (n ~ 10,000)		Caribou (n ~ 1,000)		Sitka black-tailed deer (n ~ 20,000)	
	Distribution	Abundance	Distribution	Abundance	Distribution	Abundance
BEST GUESS (assumes no unexpected change in mechanistic drivers)	-	+	-	-	+	+
Higher temperatures	?	?	?	?	?	?
Glacial retreat	0	0	+	0	0	-
Decreased snow depth (particularly at lower elevations)	-	-	0	+	+	+
Increased fire frequency and intensity on western Kenai Peninsula	0	+	0	-	0	0
Increased activity of spruce bark beetle and other forest defoliators	?	?	0	-	?	?
Afforestation of alpine tundra	+	+	-	-	+	0
Deforestation of southwest Kenai Peninsula	-	-	0	0	0	0
Afforestation of coastline	+	?	0	0	+	+
Increased richness and abundance of terrestrial exotic invasive plants	?	?	0	-	?	?
New wildlife diseases (brucellosis, CWD, winter tick, meningal worm)	0	-	0	-	0	-

10-mile wide isthmus is a migration barrier



Wilson et al. 2015

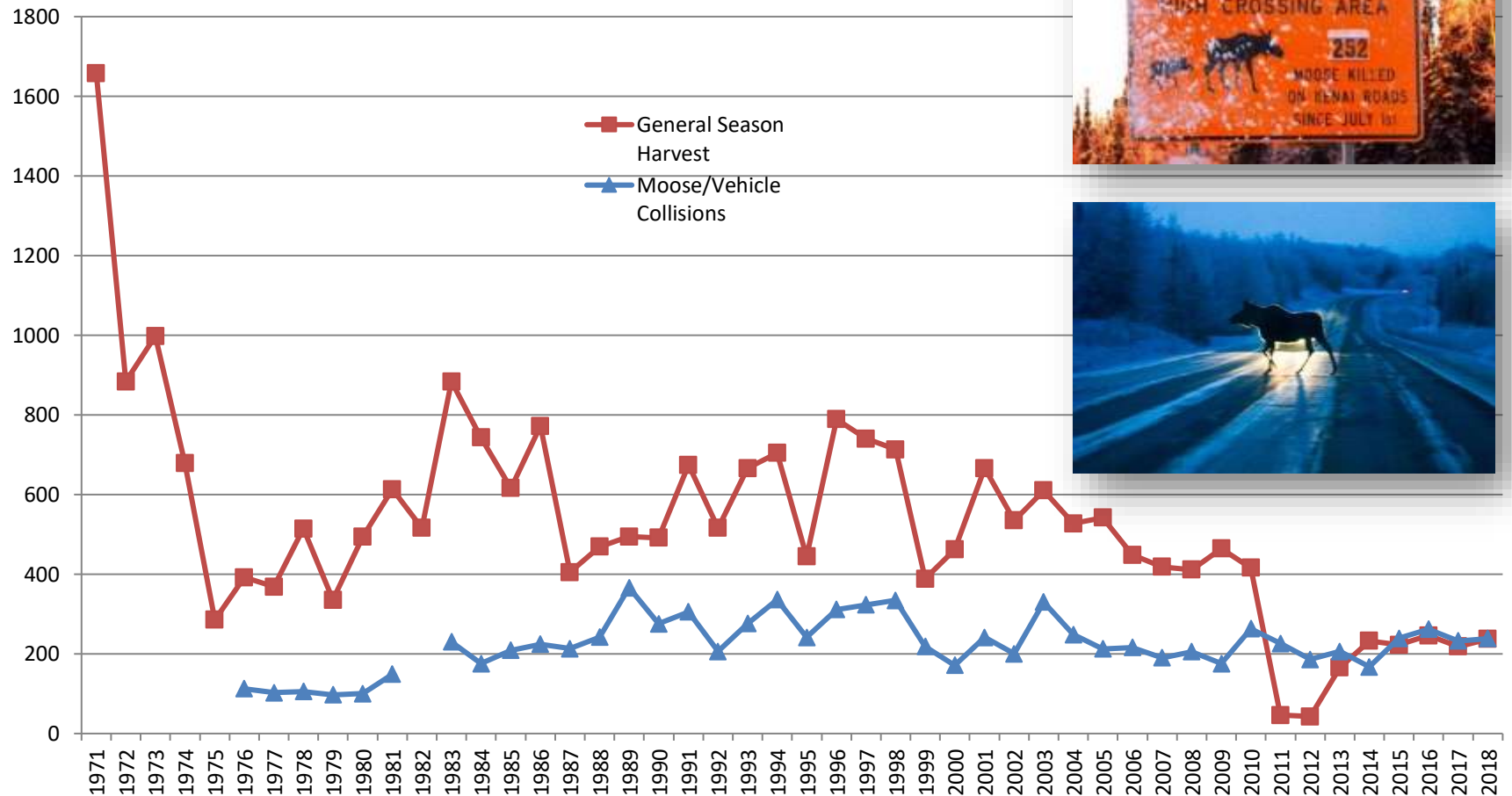


Tomasik and Cook 2005



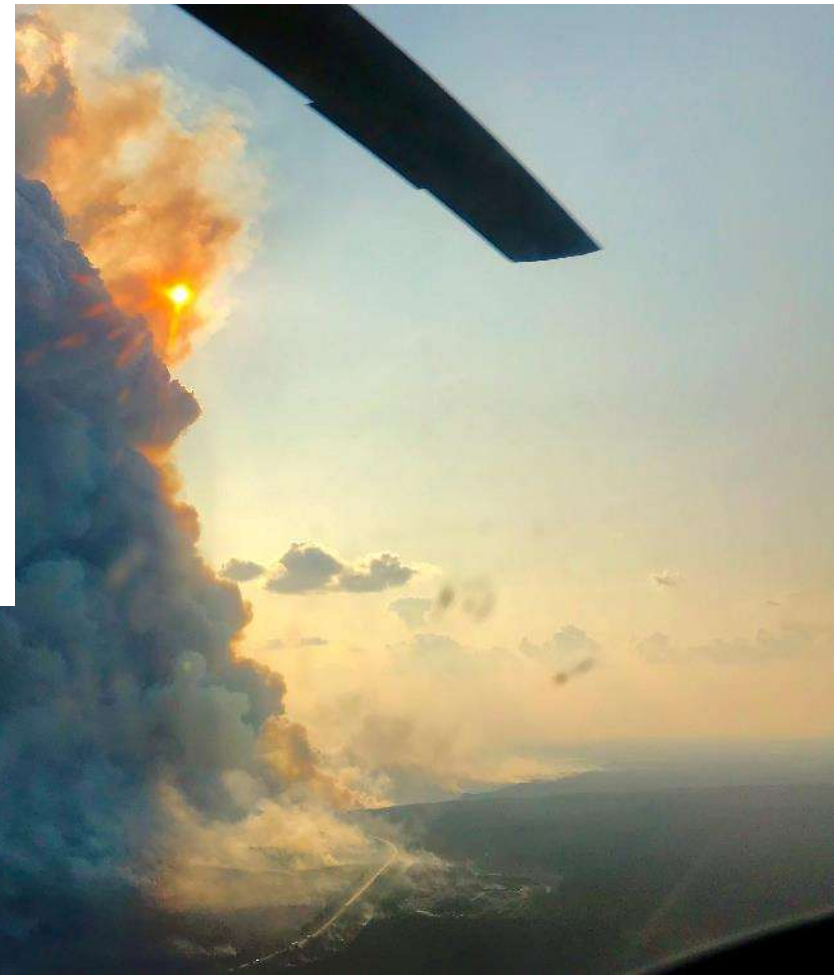
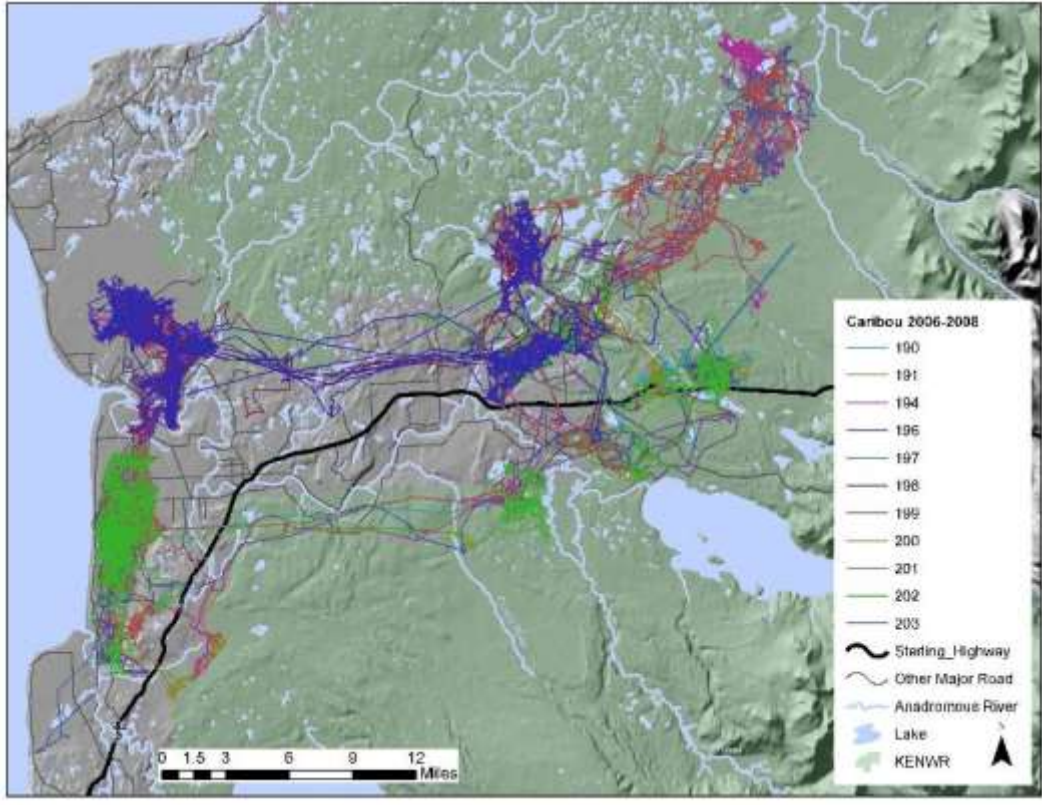
Jackson et al. 2008

Vehicle collisions kill as many moose as harvested by hunters (~250 per year)



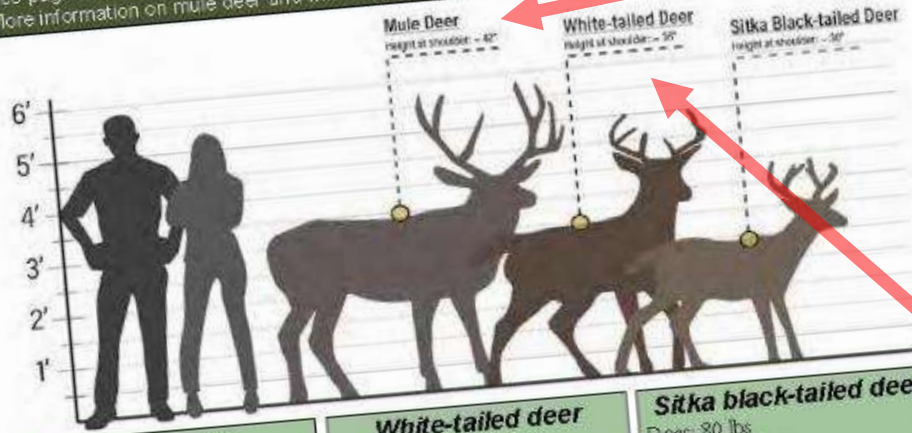


Kenai Lowland Caribou Herd



Deer in Alaska

In response to concerns over mule and white-tailed deer entering Alaska, the Board of Game made it possible for hunters to harvest those deer in **Units 1, 5, 11-13, 20, and 25** (no closed season, no limit, any mule deer or any white-tailed deer). Hunters must contact the nearest ADF&G office prior to harvesting the deer, and must return the entire carcass, including the hide, to ADF&G. Providing the required specimens helps ADF&G learn more about these animals and conduct disease surveillance. See page 4 for office contact information, or go online to <http://hunt.alaska.gov>. More information on mule deer and white-tailed deer is available at <http://alaska.gov/CE5V>.



Mule deer
 Does: 110-165 lbs
 Bucks: 150-250 lbs
 Distinguishing characteristics: bifurcated antlers - each beam forks (bucks), antlers are larger when compared to Sitka black-tailed deer, black tipped tail, and large, mule-like ears. Not common in Alaska.



Photo Credits: Bruce Steiner, Fish Division of WDFW Resources

White-tailed deer
 Does: 100-160 lbs
 Bucks: 150-225 lbs
 Distinguishing characteristics: antlers that have one main beam with individual tines growing off of it (bucks), outside of tail is brown, and underside of tail is bright white and visible when nervous or fleeing. Not common in Alaska.

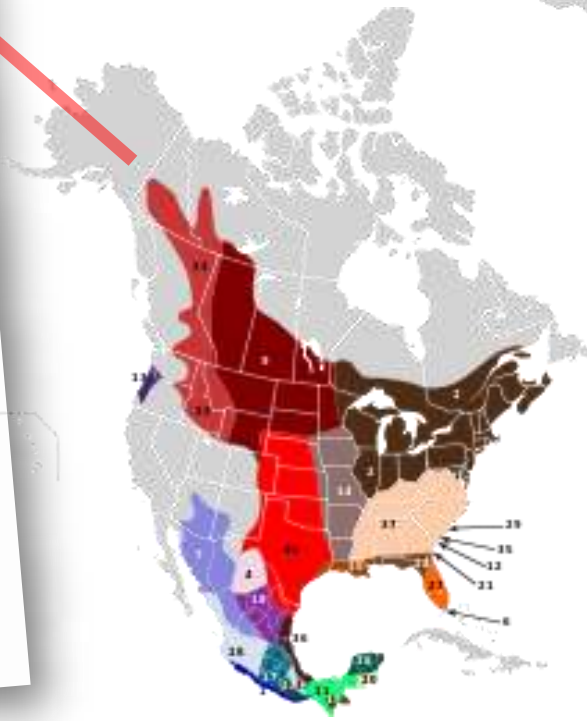


Photo Credit: National Park Service

Sitka black-tailed deer
 Does: 80 lbs
 Bucks: 120-200 lbs
 Distinguishing characteristics: bifurcated antlers - each beam forks (bucks), antlers are smaller when compared to mule deer, outside of tail is entirely black or dark brown, and the face is dark. Common in Southeast Alaska, Prince William Sound, and Kodiak.



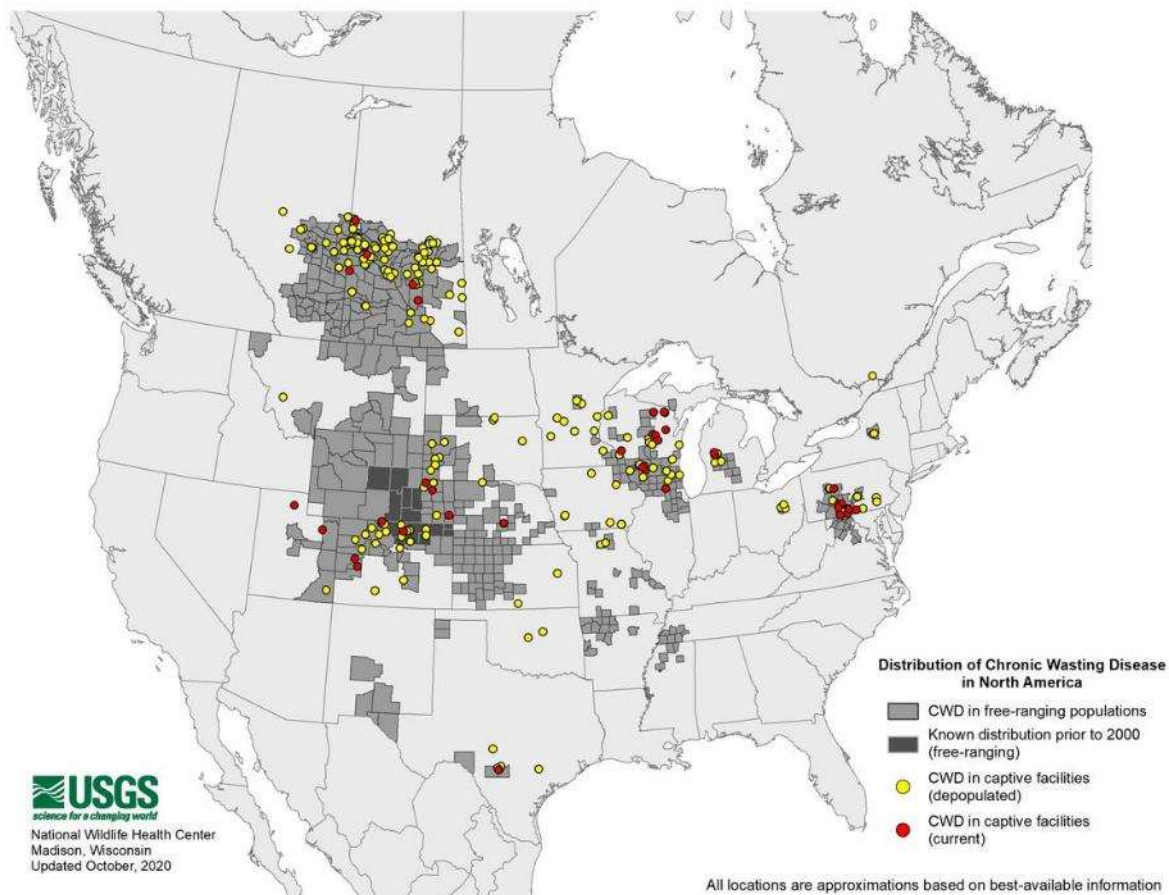
effective July 1, 2019 through June 30, 2020



Chronic Wasting Disease (CWD) is not that far away...



- ✓ 2012 - 1st confirmed moose in Alberta
- ✓ 2018 - positive in 12% of 4,222 mule deer
- ✓ 2018 – positive in 2.3% of 3,070 white-tailed deer



Winter tick (*Dermacentor albipictus*) is closer...

- ✓ Not in AK but on moose, caribou and deer in Yukon, Alberta, NWT, BC
- ✓ Can survive in Fairbanks and Palmer
- ✓ Brown dog tick*, American dog tick, Rocky Mountain wood tick, lone star tick, wood tick, deer tick, Pacific coast tick, iguana tick
- ✓ Rocky Mountain spotted fever, tick paralysis, Lyme disease, Q-fever, tularemia



Mycoplasma ovipneumoniae (MOVI) is already here...

- ✓ present in mountain goats and Dall sheep in Wrangells and Kenai Mountains
- ✓ 4% of 1,500 domestic sheep and goats in AK





United States Department of Agriculture

Climate Change Vulnerability Assessment for the Chugach National Forest and the Kenai Peninsula



Forest
Service

Pacific Northwest
Research Station

General Technical Report
PNW-GTR-950

May
2017

- ✓ Current distributions artifacts of glacial history and 20th century translocation and reintroduction
- ✓ Moose **increase** due to continued colonization of PWS, afforestation of Kenai lowlands and alpine tundra, and increasing fires on western peninsula
- ✓ Caribou **decrease** to afforestation of alpine tundra
- ✓ Sitka deer **increase** due to declining snow depths along coast and dispersal onto peninsula
- ✓ **In longer term, uncertainty increases due to interactions between novel pathogens with changing ecological drivers**