



Natural colonization of novel areas in Alaska

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- **Mammals crossing eastern border**
 - **Fisher**
 - **Mountain lion**
 - **Mule deer and white-tailed deer**
- **Ungulate pathogens moving northwest**
- **Implications of biome shift for extant big game**

Fisher (*Martes/Pekania pennanti*)

Terrestrial mustelid, males ~10 lbs., females ~5 lbs.

Endemic to N.A. (<5/yr. caught in SE Yukon)

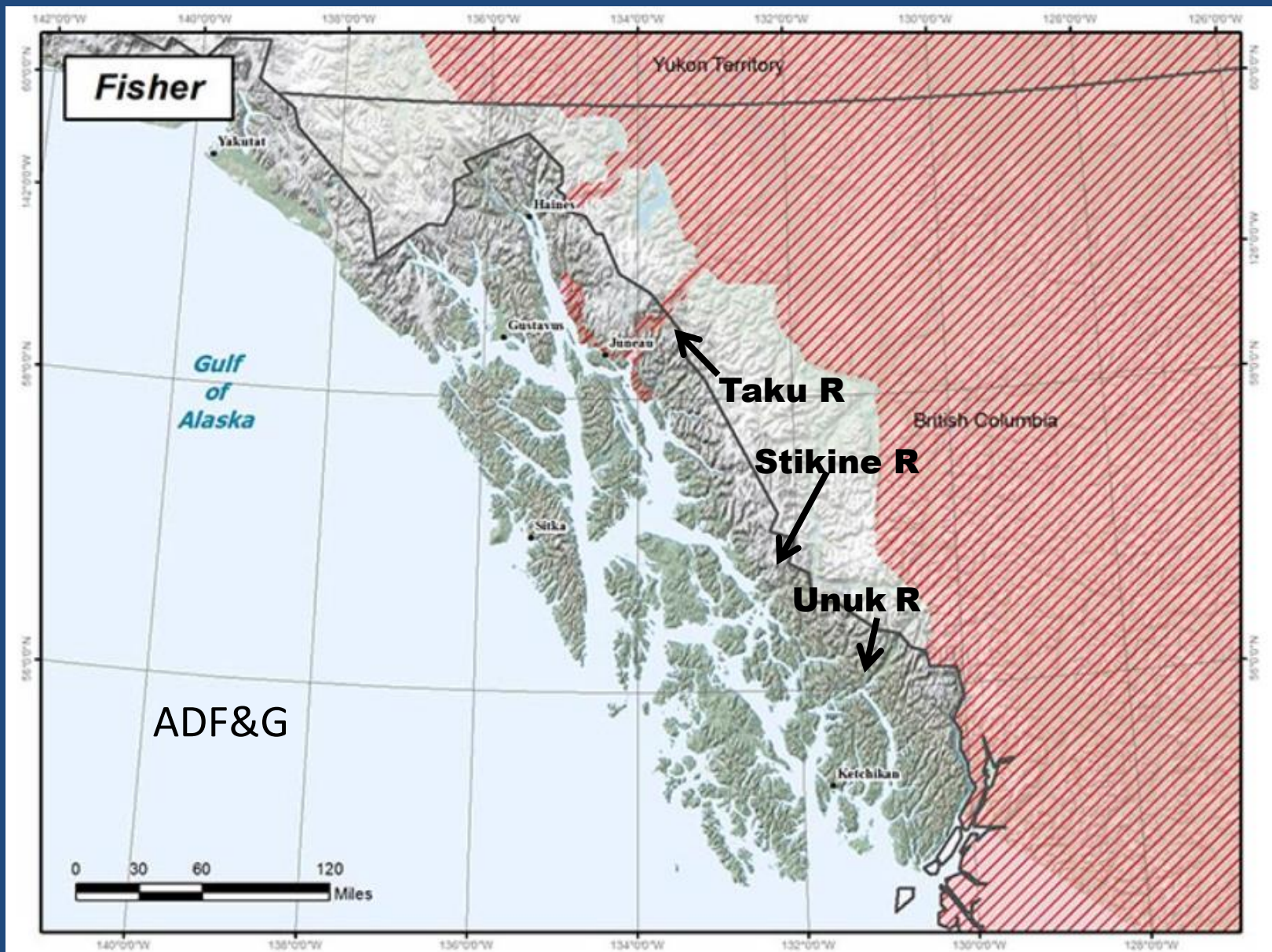


Camera trap image north of Juneau:



07/28/2017 06:22PM CAMERA 13

Fishers in SE AK appeared 1990s, trapping season 2013 (limit 1), catch 2-6/year, all near Juneau



Adult male fisher (PA)

note tail length relative to body



Ecological niche of fishers in mustelid community of Southeast AK

- **Fishers prey on small mammals, hares, grouse, porcupines (minimal infection from quills), mast**
- **Weasels and to lesser degree marten hunt small prey subnivean**
- **Foot loading: marten energetic advantage in deeper, less dense snow compared with fishers**
- **Fishers co-occur with these other mustelids in suitable habitat across N.A.**

Mountain lion (*Felis/Puma concolor*)

males 120-220 lbs., females 65-140 lbs.

Common in southern B.C.

Vancouver Island highest density

Whitehorse YT subadults 2015

2 confirmed in southern Southeast Alaska:

1989 shot near Wrangell

1998 snared on S. Kupreanof Island (?)

Credible sightings near Skagway, Juneau



Definitive evidence: vehicle mortality, images, predation kills/scat (DNA), confirmed tracks

CBC News · Posted: Jun 06, [2015](#) 7:00 AM CT | Last Updated: June 6, 2015



Tim Schirmer took this photo of two cougars on a rural road south of Whitehorse on the night of May 22. 'Then I got back in my car and got out of there,' he says. (Tim Schirmer/CBC)

- **No cougar hunting season in AK or YT**
- **Primary prey is deer**

Differentiating between lynx and mountain lion tracks



Mike Taras

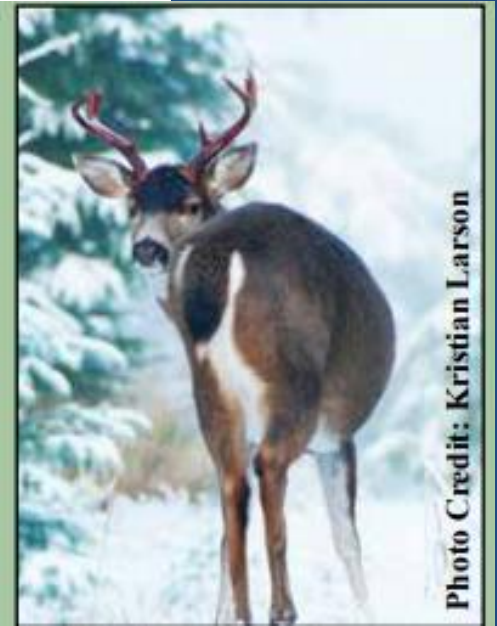
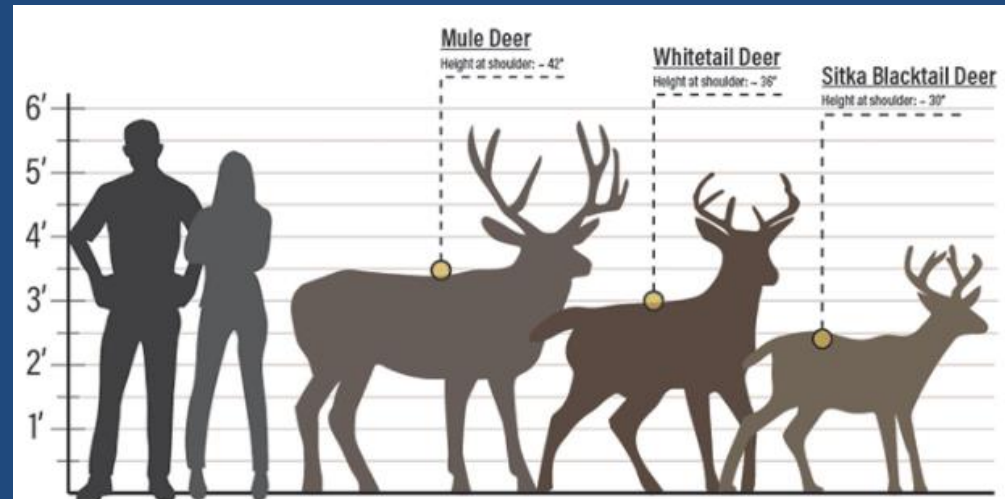
Alaska Department
of Fish and Game

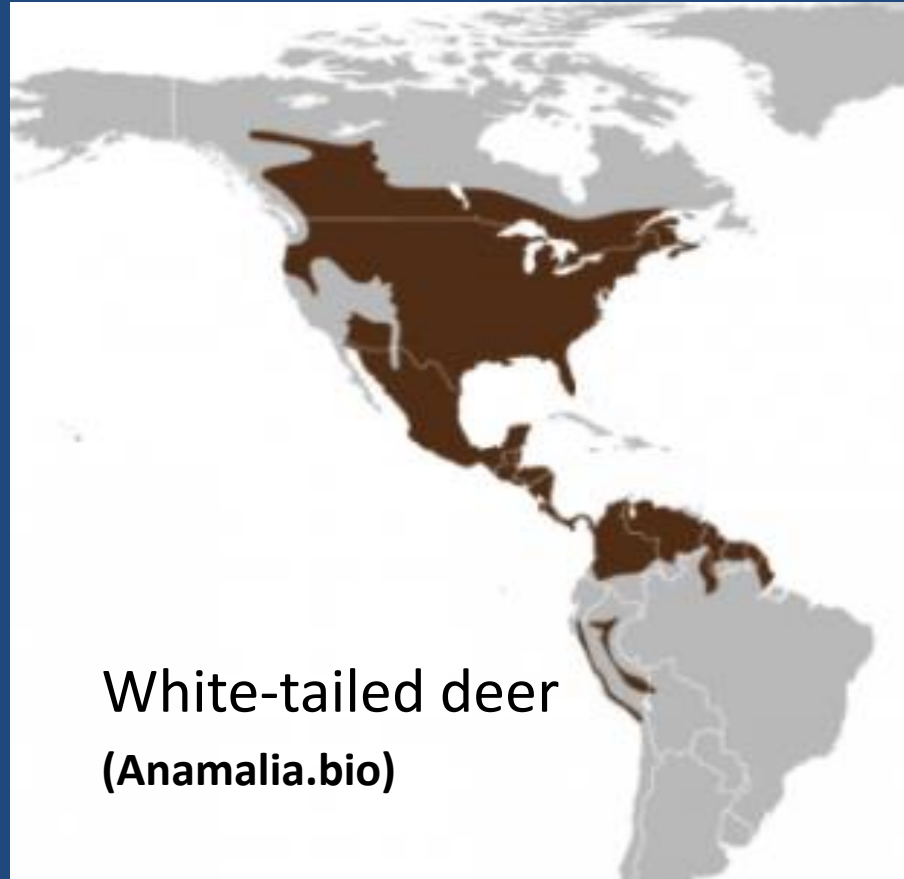
October 2021



Mule deer (*Odocoileus hemionus hemionus*)

White-tailed deer (*O. virginianus*)





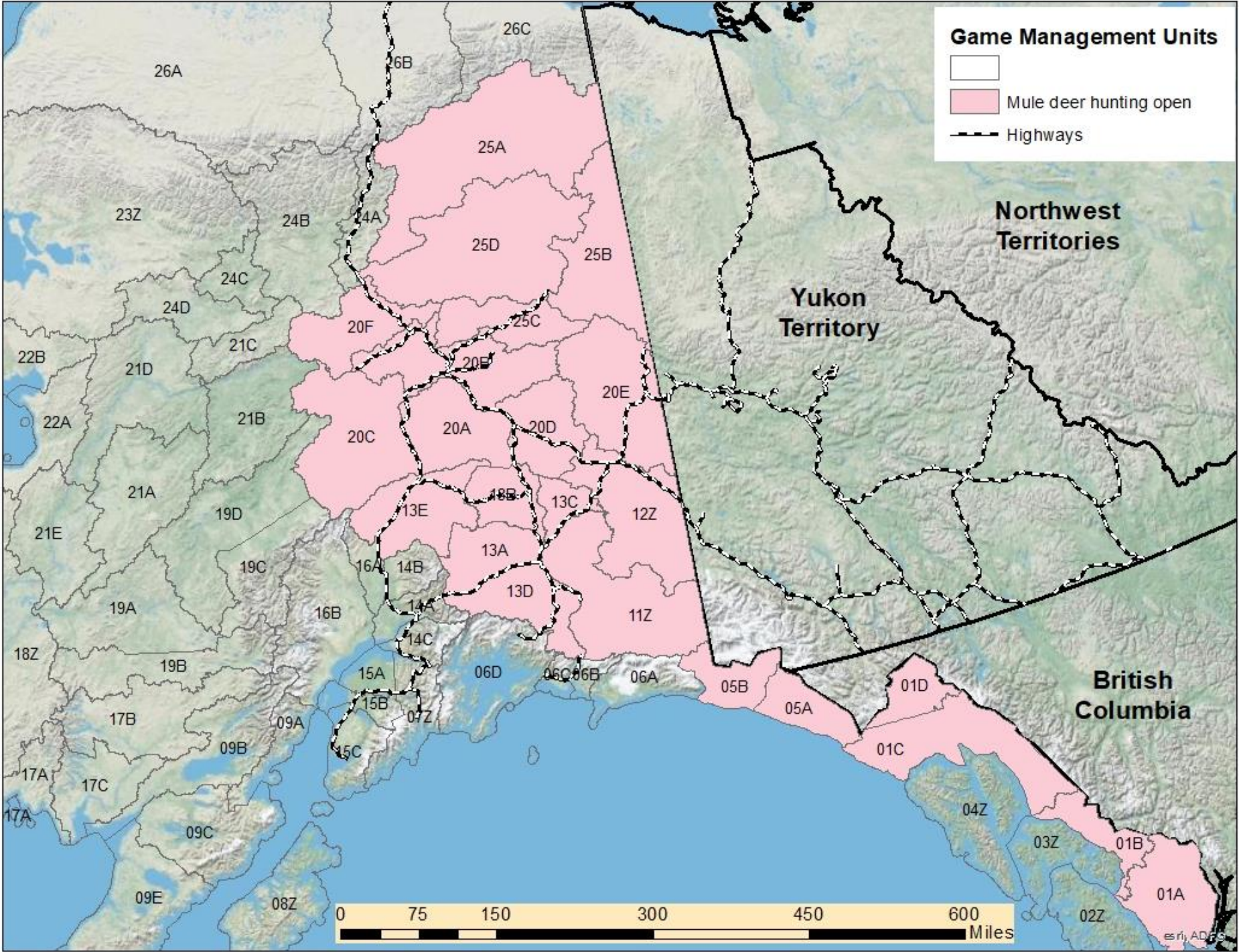
Mule deer in Alaska

- **Occasional sightings: Petersburg 1962, in eastern Interior since at least 1970s (mature dispersal?)**
- **South of Alaska Range (from YT)**
 - **2005 mature male along Gulkana River**
 - **2014 mature male upper Nabesna River**
- **2017 Eagle: male, female with yearling or fawn**
- **2016-17 Fairbanks suburbs:**
 - **fawn photographed**
 - **mature buck killed by vehicle (necropsy)**
- **2019-present Skagway (from BC)**
 - **fawns photographed**

- **Yukon has hunting permits, requires samples for parasite and disease surveillance**
- **AK since 2020: no closed season or bag on mule or white-tailed deer, requests samples**



Fairbanks, AK mule deer killed by motor vehicle/Alaska Department of Fish and Game photo



Epidemiological Triad

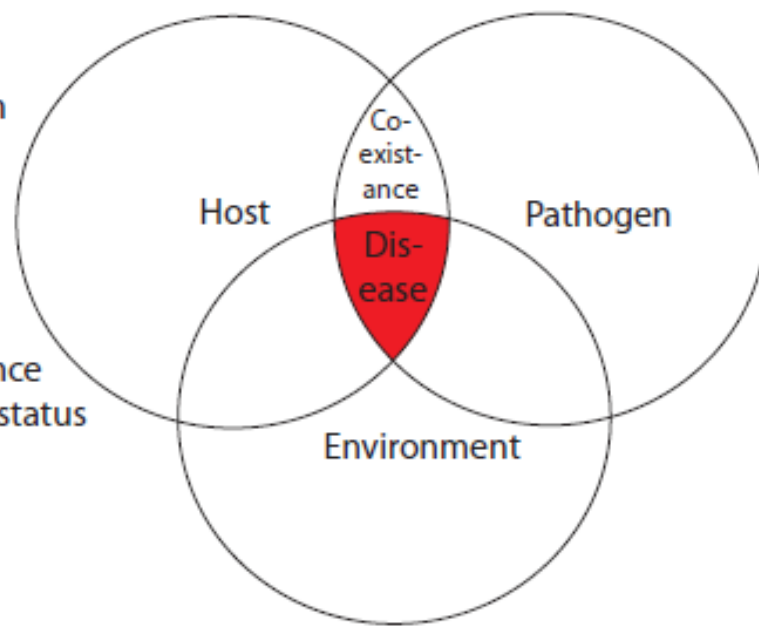
Interaction of the host, environment, and pathogen determine disease and pathogen ecology

PATHOGEN: an organism that can cause disease (parasite, virus, bacteria, fungus, etc.)

The mere presence or even infection with a pathogen does not always cause disease (reduced fitness of host)

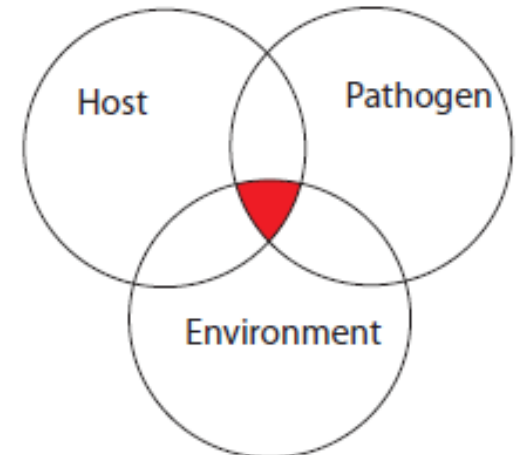
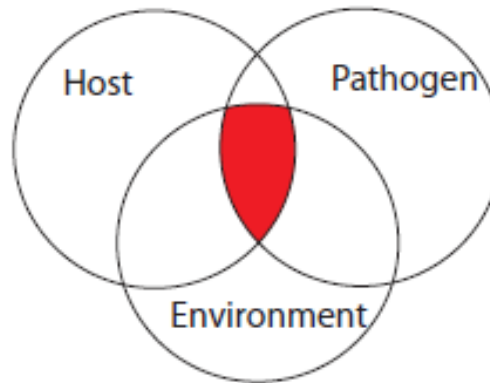
Changing climate may favor the pathogen or the host. There is a balance that can be tipped in different directions

Host:
hibernation
migration
insulation
range
condition
immune
competence
nutritional status



Pathogen:
life cycle needs
freeze tolerance
vector requirements

Environment:
Extreme seasonality
marine or continental
vector habitat

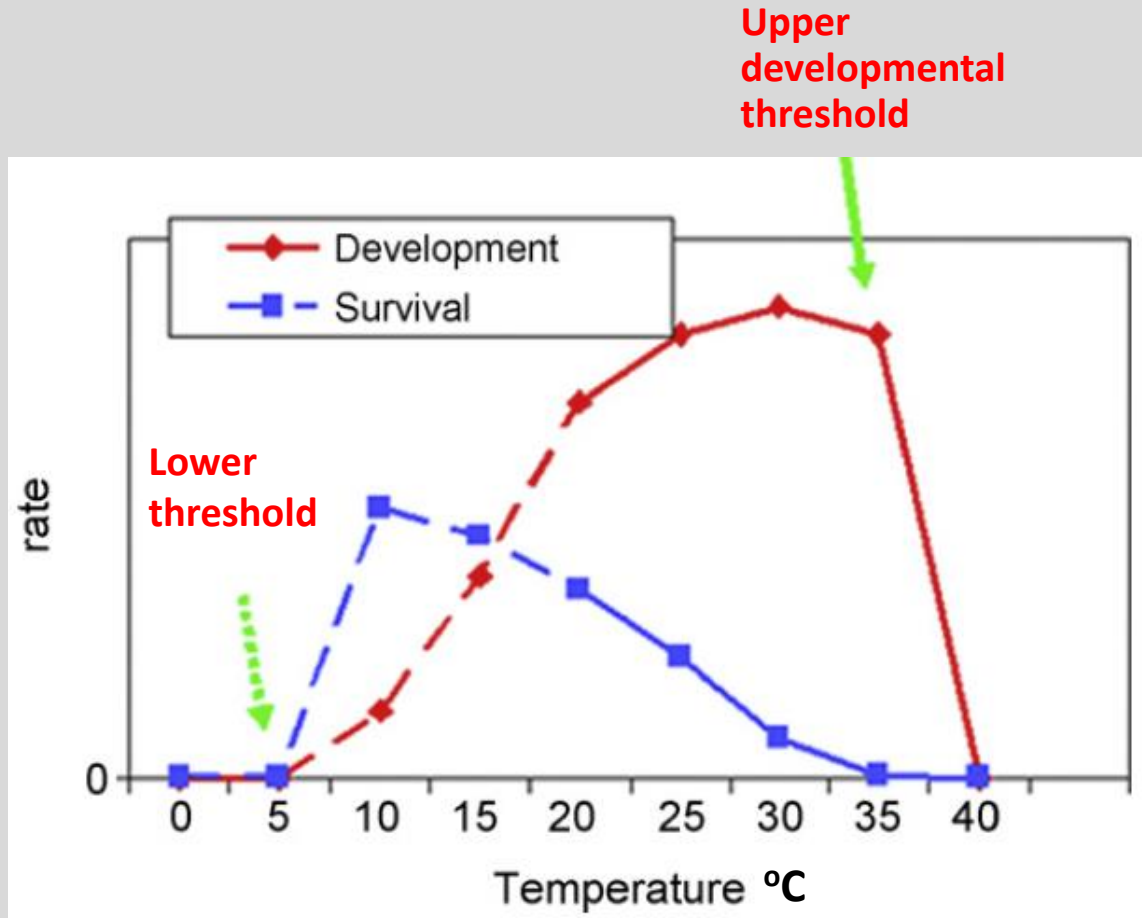


Hypothetical development and survival curves for parasitic nematodes

Parasites with free-living egg and larval stages (e.g., moose & caribou stomach worms) are exposed to the entire range of conditions.

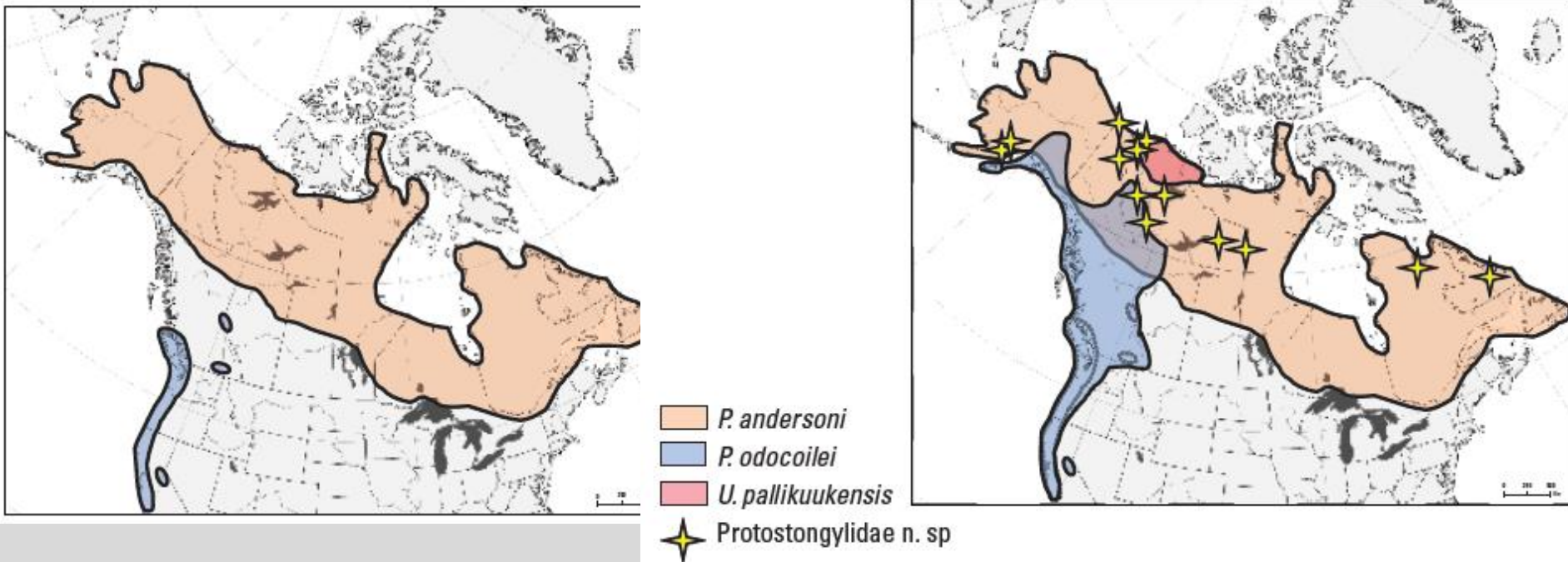
Parasites with invertebrate (snail/slug) intermediate hosts or vectors may only be exposed to the dashed regions of the lines because of the behavior of the intermediate host.

Note the trade-off between development and survival rates as temperatures increase.



Known species diversity before 1995

Known species diversity since 1995

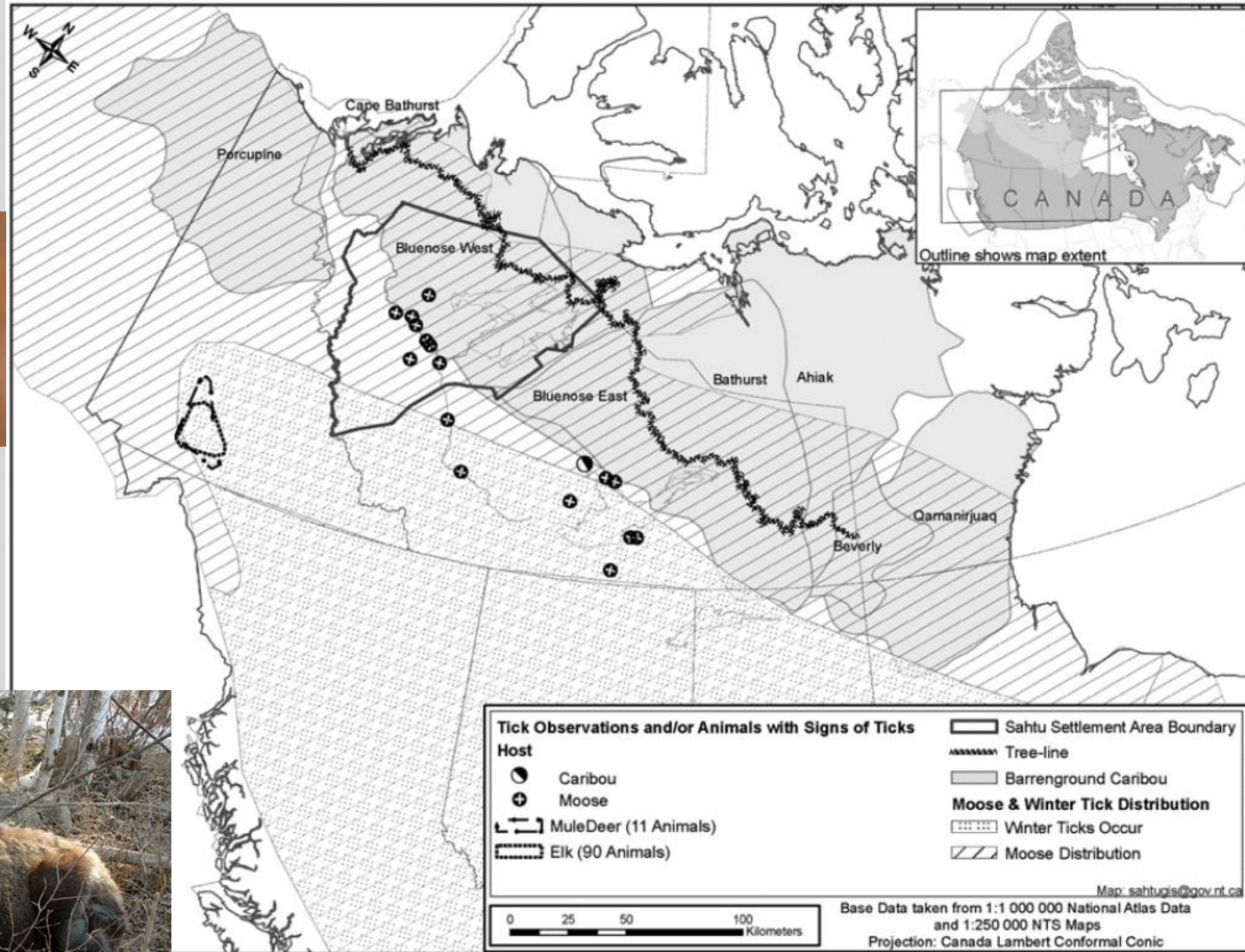


Geographic ranges for protostrongylid (lung) parasites in northern ungulates including barren ground caribou, wild thinhorn sheep, mountain goat, woodland caribou, black-tailed deer, and mule deer

Hoberg et al. 2008 Infectious diseases 14:10-17

Moose Winter Tick

Dermacenter albipictus



Warming climate increases tick threat for moose in lower latitudes

- Climate warming → less spring snow → ticks survive longer → reproduce in greater numbers
- Winter ticks account for 41% of all deaths of moose in New Hampshire (nearly all calf mortality)
- Moose population declines linked directly to winter ticks also in Maine, Vermont, Montana and Minnesota
- Minnesota: 30% of collared **adult** mortalities due to parasites
 - primary problem is winter ticks
 - 42% of found dead adult moose had brain worm (white-tailed deer is main vector)
 - liver flukes (w-t deer also main vector)

Winter ticks in the Yukon

- Early 1990s, southeast Yukon, winter ticks on horses and a moose
- Mid-1990s, Winter ticks on elk and mule deer in south-central Yukon

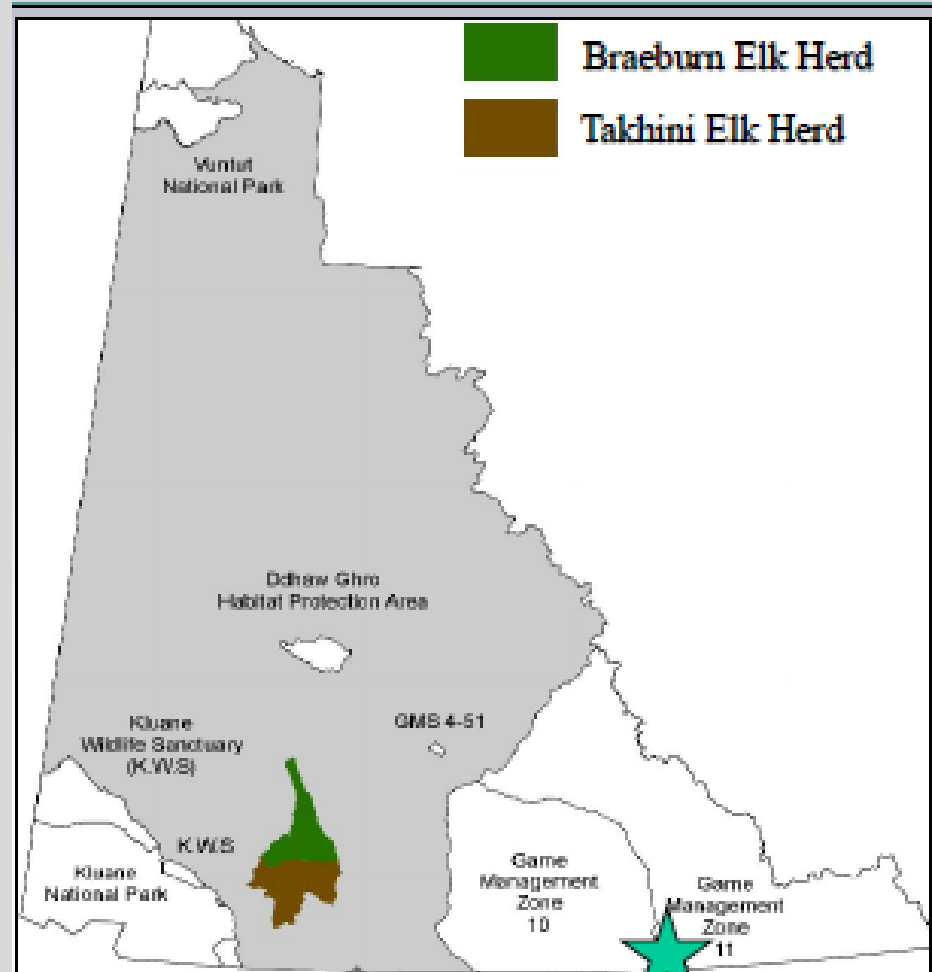


Fig. 2. Map of the Yukon showing range of Braeburn and Takhini elk herds, and site of first report of winter tick in Yukon (★)

Winter tick intervention attempts in the Yukon

- 2007 - YT government intensively managed 2 elk herds to reduce density (reduce tick spread)
 - 2010-12 survey Takhini elk 100% infected
- Winter ticks have been found on mule deer in parts of Yukon **where there are no elk**
 - 2014 survey of 33 mule deer showed 58% infected

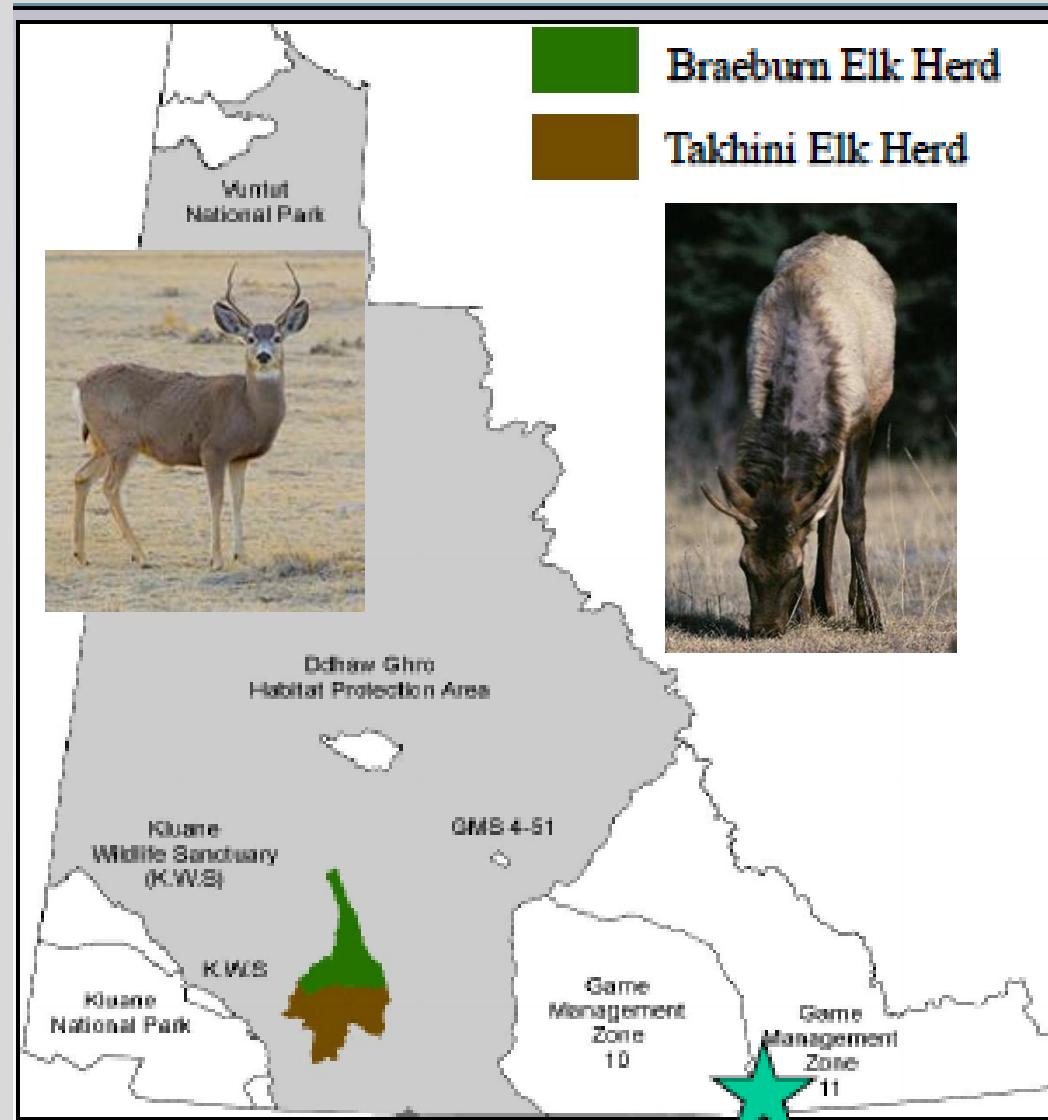


Fig. 2. Map of the Yukon showing range of Braeburn and Takhini elk herds, and site of first report of winter tick in Yukon (★)

Winter Ticks can survive in Alaska

- Survival trials 30 years ago in Fairbanks, Palmer and Soldotna
- 3 years of successful engorged female tick survival, oviposit, egg hatching and viable larvae.
- Conclusion: *D. albipictus* could become established in Interior and Southcentral AK if introduced
- Early snow and later spring was probably a barrier then and before, but climate change has impacted tick ranges
- Tick survival is now enhanced (not every AK spring has less snow...) and host range has expanded (**mule deer**)

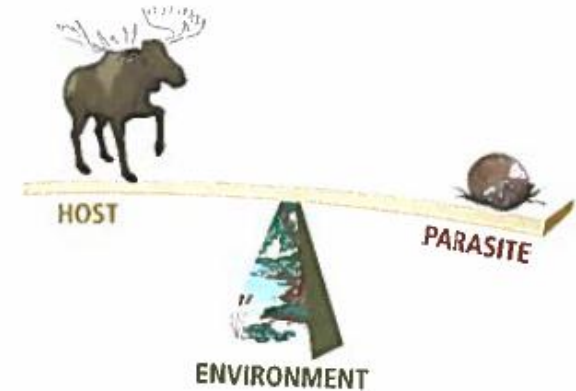
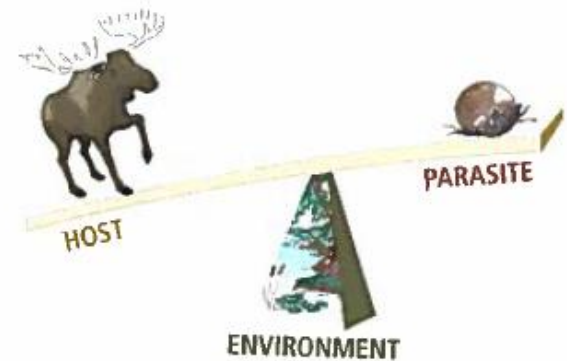


FIGURE 1.1. One can think of the equilibrium that exists in most host-parasite relationships, wherein host and parasite usually co-exist quite well, as a teeter-totter with the environment as a fulcrum.



This delicate balance can be thrown out of kilter when there is a change in the environment—say, a bad winter—that puts stress on the host's food supply and moves the fulcrum to favour the parasite. Host resistance then works to fight the infection and rebalance the relationship.



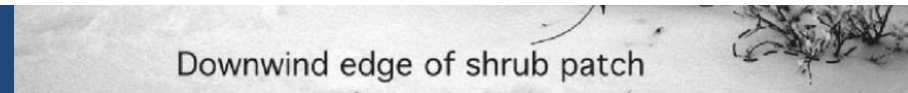
Photo: Dawn Stronstad

Biome Shift: shrub and conifer expansion into coastal and alpine tundra



Shrubs/trees favor moose over caribou, mountain goats, Dall sheep

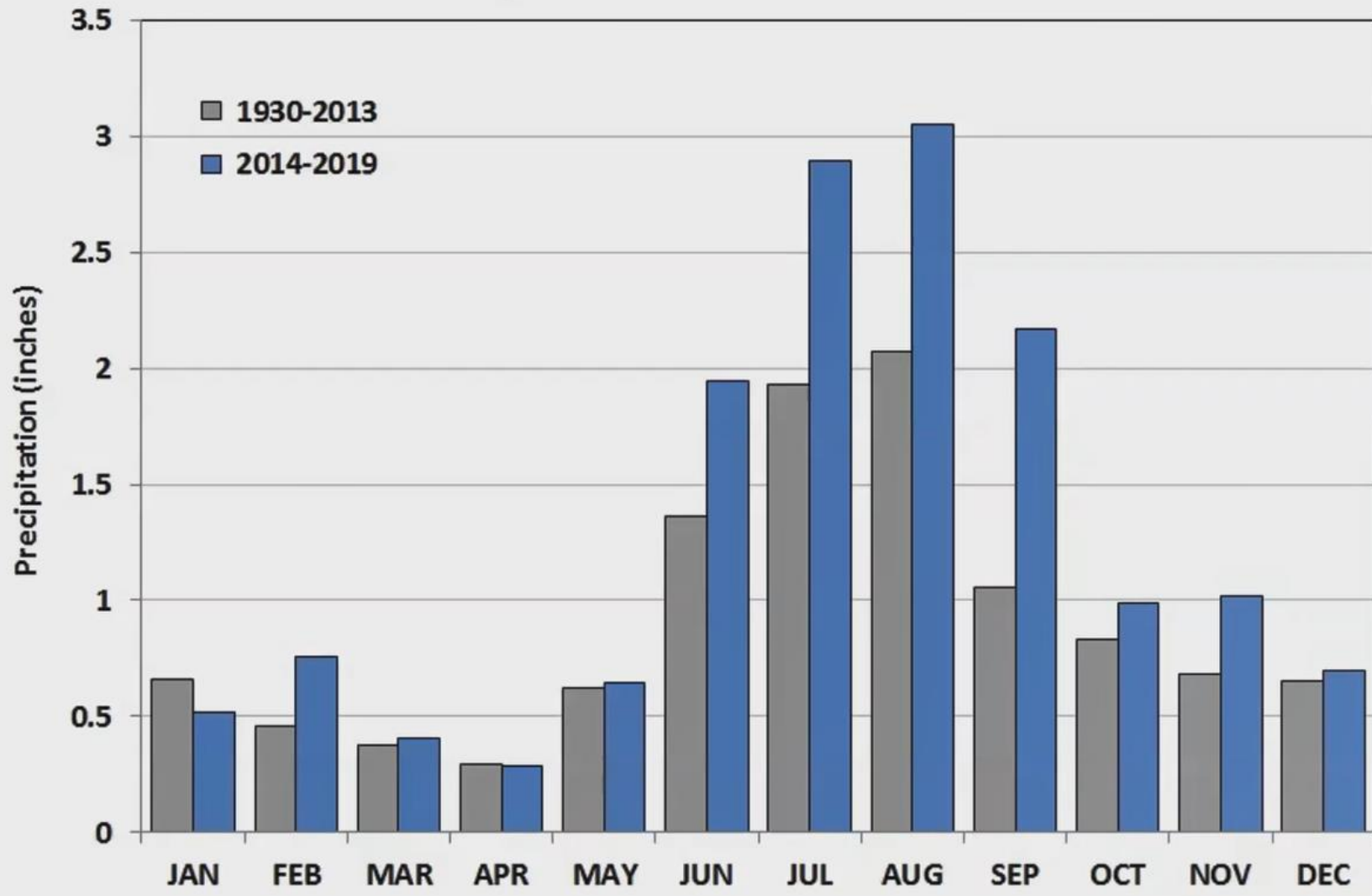
- More browse above snow for moose winter range
- Shading of grasses, forbs, and lichens for grazers
- Vertical structure: predator concealment, snow capture (+insect relief), less windy near ground (-insect harassment)



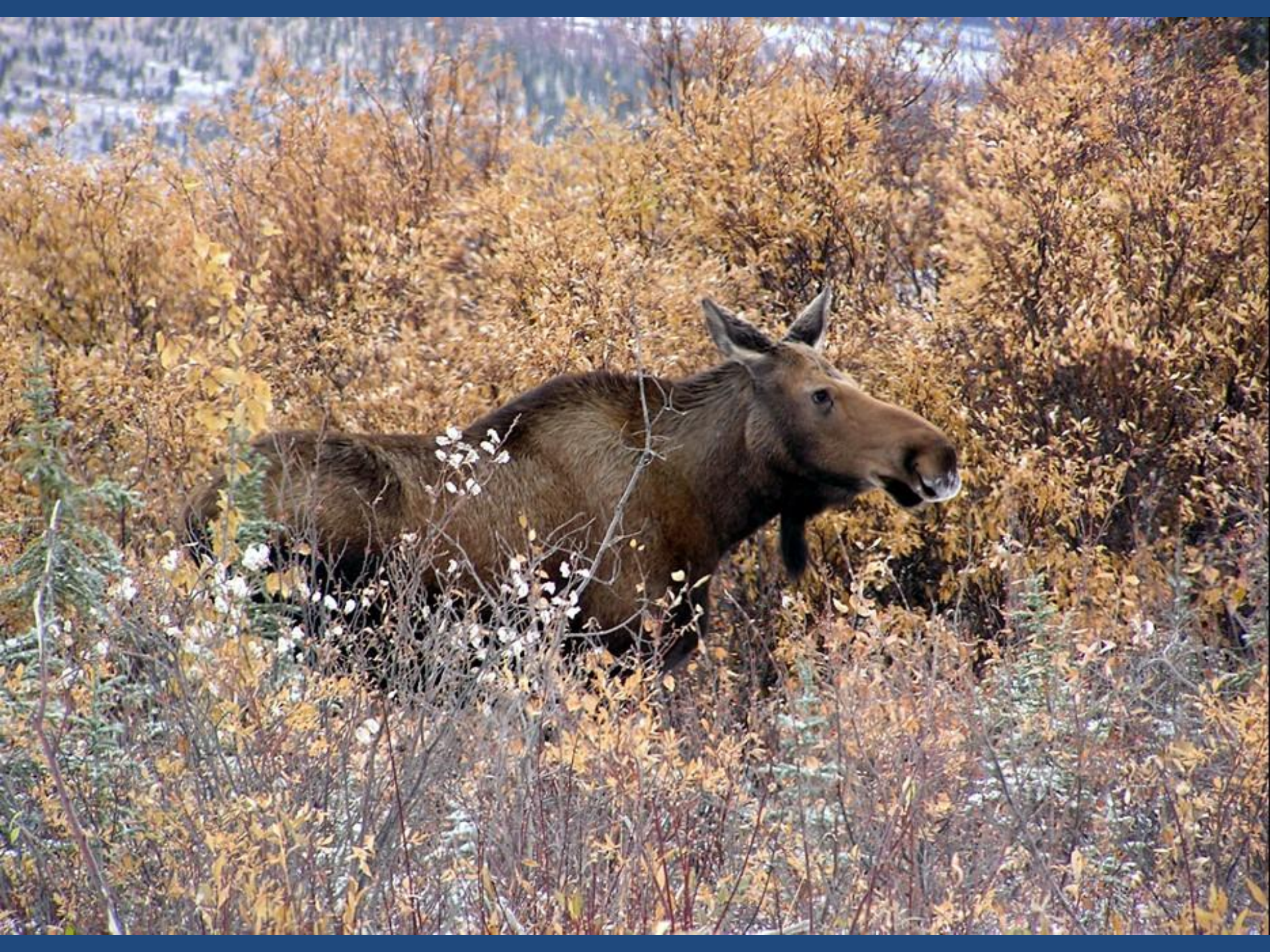
Sturm et al. 2005 *BioScience*

More growing season rain in Interior = growth of flammable vegetation

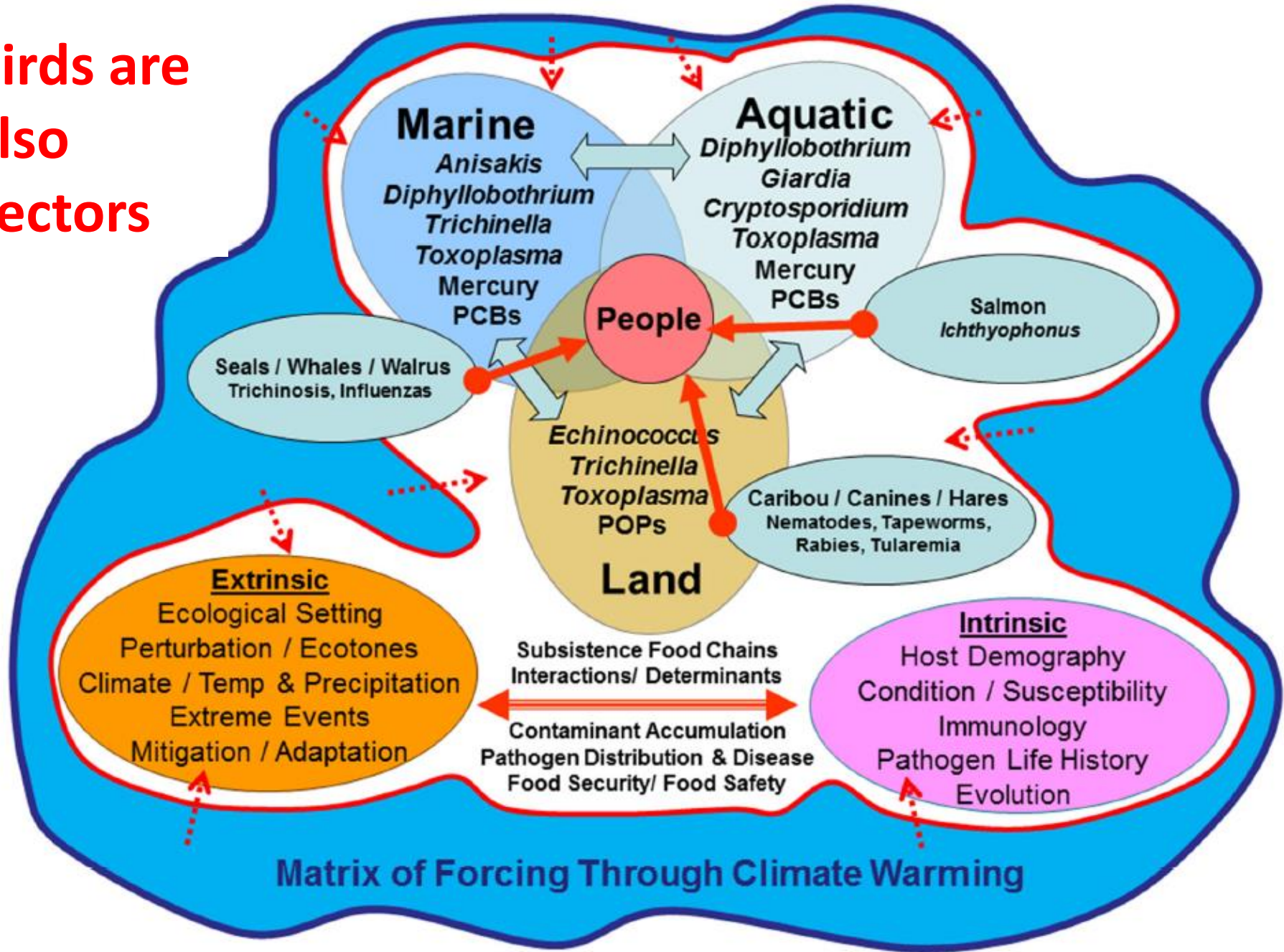
Monthly Mean Precipitation
Fairbanks, AK 1930-2013 vs 2014-2019



Data source: Rich Thoman, UAF



Birds are also vectors



Life cycle of *Umingmakstrongylus pallikuukensis*

(Muskox lungworm)

Rapid range expansion:

