Plants and animals on the move: the borealization of a rapidly warming Alaska



20th Annual NATJA Conference





Krill dieoff near Shishmaref in 2019



Horned puffin carcasses near Nome in 2020

Crab crisis in Bering Sea a sign of 'borealization' and big changes in the future, scientists warn

By Yereth Rosen, Alaska Beacon Updated: February 6, 2023 Published: February 6, 2023



North

A remote camera captures walruses on the beach at Point Lay, Alaska, on Sent 7 The LLS

KT00

Climate change seen as suspected factor in Western Arctic Caribou Herd decline December 30, 2022 by Yereth Rosen, Alaska Beacon

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Boreal forest

Arctic tundra

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



CONNECTING **ALASKA LANDSCAPES INTO THE FUTURE** Results from an interagency climate modeling, land management and conservation project **FINAL REPORT • AUGUST 2010 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 Scenarios Network for Arctic Planning and the EWHALE lab, 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 Canada Jovernment Northwest Territories















In 2000, 100% is TUNDRA

- tundra < 40% shrubs and no trees (23%)
- tundra but sparsely vegetated (35%)
- shrubland with open tundra (30%)



By 2100, >55% is CONIFER

- dry boreal wooded grasslands (28%)
- northern boreal coniferous woodlands (9%)
- mixed boreal forest (46%)

Predicting Future Potential Climate-Biomes for the Yukon, Northwest Territories, and Alaska. 2012. Scenarios Network for Arctic Planning and EWHALE lab, UAF









Departing Alaskan species





Arriving Alaskan species

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

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

Arriving Alaskan species





"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° C"

- 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

In western Brooks Range, white spruce are expanding beyond treeline >4 km per decade



67.65

Dial et al. 2022. Sufficient conditions for rapid range expansion of a boreal conifer. Nature 608:546–551

– 158.1 – 158 Longitude (°)



Arriving "Alaskan" species

Arriving Alaskan species





Dunmall et al. 2022. First juvenile chum salmon confirms successful reproduction for Pacific salmon in the North American Arctic. Canadian Journal of Fisheries and Aquatic Sciences 7:703-707

White-tailed and mule deer in Alaska?



Sikta black-tailed deer



28 2019-2020 Alaska Hunting Regulations



Fishers are colonizing Southeast Alaska from



Kupferman et al. 2021. Spatial and temporal partitioning of mustelids in Southeast Alaska. Ecosphere 12:10.1002/ecs2.3827

American marten walking out of the Kenai Mountains



Baltensperger, Morton & Huettmann. 2017. Expansion of American marten (*Martes americana*) distribution in response to climate and landscape change on the Kenai Peninsula, Alaska. J Mammology 98:703-714

Lutz spruce: hybridizing to get over the Kenai mountains...



Morton et al. 2023. The dynamics of a changing Lutz spruce (*Picea x lutzii*) hybrid zone on the Kenai Peninsula, Alaska. Canadian J. Forest Research 53:365-378





Kenai Peninsula







Putting climate change stories in context: Some things to remember

- Alaska is warming 2–4 times faster than elsewhere
- Species are generally moving northward in latitude and upward in elevation (albeit at different rates!)
- "Borealization" is a term
- Climate change knows no boundaries
- No new normal...escalator of change