**Erica Zaja**

Idea post meeting: **Caribou movement data VS Habitat map**

**Possible research questions: How is Mountain Caribou (*Rangifer tarandus*) movement affected by habitat change in British Columbia?**

**How is the Porcupine Caribou herd (migration?) affected by shrubification in Northern Alaska?**

**Datasets:**

* Google Earth Engine: NDVI vegetation change in British Columbia
* **Mountain caribou in British Columbia-gps (2001-2016) - downloaded csv file** [**https://www.datarepository.movebank.org/handle/10255/move.955**](https://www.datarepository.movebank.org/handle/10255/move.955)
* **Porcupine caribou Herd** <https://catalog.data.gov/dataset?q=porcupine+caribou+herd&sort=score+desc%2C+name+asc&as_sfid=AAAAAAVkyuEO6_imG5g3XShopgdatMrb4oxngePMAutcoIVz3ASylYJjWYpD6RDzHFYR7TU6p8EQPOMpUnfy0wIO5RNYjwVv-lUbSPUr6GM3EjK8UKRhsj1oKIz_dnsIy3BxCC8%3D&as_fid=ac32b54adbfcdcdf8dbd1bed5ffe7f3a2be82a89>
* **Shrub map (north slope Alaska)** <https://arcticdata.io/catalog/view/doi%3A10.18739%2FA25Q4RN03>

**Developments**:

Vegetation change over the years?

Do caribou use different habitats in different years?

Threat classification?

**Resources:**

**Papers:**

* Mountain Caribou- Province of British Columbia <https://www2.gov.bc.ca/assets/gov/environment/plants-animals-and-ecosystems/species-ecosystems-at-risk/brochures/mountain_caribou.pdf>
* State of Southern Mountain Caribou Habitat in BC: Exceeding Disturbance Limits <https://www.wildernesscommittee.org/sites/default/files/2020-01/State%20of%20southern%20mountain%20caribou%20habitat%20exceeding%20disturbance%20limits.pdf>
* Mapping out a future for ungulate migrations <https://science.sciencemag.org/content/372/6542/566>

**Websites:**

* Porcupine caribou management board[**https://pcmb.ca/habitat**](https://pcmb.ca/habitat)

**Mapping in R:**

* Plotting movement data in R <https://www.r-bloggers.com/2021/04/plotting-movement-data-in-r-using-ggmap-and-ggplot/?fbclid=IwAR3kqqMUrqT3OE45tsf0068JiN7HKhSel_-uEK3XHGRjeOn5voEszDzKugQ>
* Mapping animal movement in R <https://methodsblog.com/2021/03/22/mapping-animal-movement-in-r-the-science-and-the-art/?fbclid=IwAR3kqqMUrqT3OE45tsf0068JiN7HKhSel_-uEK3XHGRjeOn5voEszDzKugQ>

**Other Databases:**

* Arctic Data Centre <https://arcticdata.io/>
* Polar data catalogue <https://www.polardata.ca/>
* Dryad <https://datadryad.org/stash>
* Figshare <https://figshare.com/>

**Questions:**

* Any recommendations on useful tutorials for mapping movement data? Same question but for using Google Earth Engine?
* I can’t seem to find the dates of the NDVI records I find on Google Earth (<https://developers.google.com/earth-engine/datasets/tags/ndvi>)
* Not sure what Isla meant with using threat classifications?

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Ideas pre-meeting (broad):

Main subject: **Herbivores and shrubification**

Research question: **How does (will?) shrubification of the Arctic (specific location, Canada?) affect (migratory) behaviour of Mountain caribou (*Rangifer tarandus*)?**

Thoughts/development:

* **Model to predict future change in migratory behaviour under different climate change (shrubification) scenarios**
* Integrate with **behavioural ecology of herbivore** (feeding behaviour etc.)
* Include: Changes in animal movement, influences of predation (grey wolf), interactions with other species, interaction with changing habitat (how caribou affect shrub cover)

Possible datasets:

* **Arctic animal movement data from Movebank** (<https://www.movebank.org/cms/movebank-content/arctic-animal-movement-archive> )
* **Mountain caribou in British Columbia-gps (2001-2016) - downloaded csv file** [**https://www.datarepository.movebank.org/handle/10255/move.955**](https://www.datarepository.movebank.org/handle/10255/move.955)
* Dolphin\_Union\_Caribou\_UAV (2015) <https://www.movebank.org/cms/webapp?gwt_fragment=page=studies,path=study416289710>
* Western Arctic Herd caribou GPS Locations 2009-2018 NW Alaska <https://irma.nps.gov/DataStore/Reference/Profile/2260262>
* **Team Shrub datasets** (<https://teamshrub.com/data-and-code/>)
* Woody plant encroachment intensifies under climate change across tundra and savanna biomes. <https://github.com/marianagarciacriado/WoodyEncroachmentHub>
* Radial growth of tundra shrubs (1990-2014) at four sites in Northern Canada (Yukon, Quebec) <https://data.bas.ac.uk/full-record.php?id=GB/NERC/BAS/PDC/01086>

Useful links:

* **The herbivory network** [**https://herbivory.lbhi.is/**](https://herbivory.lbhi.is/)
* Lecture: Climate disruption, animal migrations and equity in conservation science <https://ubc.zoom.us/rec/play/H9rmcQFw6-BU8E9sq3fQYpSozVS1eCH_TYE-LVE_7LZJro8rUTckmJzgCkaLueTkBKVIfydivo764BmM.UAYMkdv9hy8op4ss?continueMode=true>

Interesting papers:

* Arctic greening from warming promotes declines in caribou populations <https://advances.sciencemag.org/content/3/4/e1601365> “climate-induced greening has been accompanied by a deterioration of pasture quality.”
* Observed and predicted effects of climate change on Arctic caribou and reindeer <https://cdnsciencepub.com/doi/full/10.1139/er-2017-0032>
* Beating Around the Bush: Arctic Shrubs May Help Explain Caribou Declines <https://deeply.thenewhumanitarian.org/arctic/articles/2017/04/27/beating-around-the-bush-arctic-shrubs-may-help-explain-caribou-declines>  “in North America, the animal’s preferred diet of lichen is often being displaced by shrubs of birch and alder, which contain toxins that make them unpleasant”
* Using seasonal landscape models to predict space use and migratory patterns of an arctic ungulate “**To predict changes in distribution and shifting migratory areas over the past decade, we used GPS telemetry data from adult females to develop predictive ecological niche models of caribou across northwestern Alaska.”** <https://movementecologyjournal.biomedcentral.com/articles/10.1186/s40462-019-0162-8>
* Shrub expansion in tundra ecosystems: dynamics, impacts and research priorities <https://www.researchgate.net/publication/283418677_Shrub_expansion_in_tundra_ecosystems_dynamics_impacts_and_research_priorities>

Trophic interactions and abiotic factors drive functional and phylogenetic structure of vertebrate herbivore communities across the Arctic tundra biome <https://onlinelibrary.wiley.com/doi/10.1111/ecog.04347>