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Final Project Outline

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*Introduction*

* Influence of human activity on wildlife
  + Landscape of fear and direct mortality via hunting/car strikes
  + Strong avoidance of large carnivores to areas with greater human activity
* Prugh et al. (2023) found that mesocarnivores will utilize what they referred to as a “human shield”1
  + Wolves and cougars strongly avoided areas with high human footprint
  + In presence of large carnivores, coyote and bobcat space use positively associated with human footprint index
  + There is an obvious risk/reward to this activity
    - Humans were 3x more lethal than large predators in this study
* Discuss mesocarnivore response to humans in absence of large predators **FIND CITATIONS**
* Does **temporal and** spatial use by mesocarnivores differ across a gradient of human activity?
  + Roads
  + Hiking trails

*Objectives*

* **Determine if space use of bobcats and coyotes is influenced by distance to hiking trails**
* **Determine if use with distance to hiking trail differs within versus outside of the “human shield”**

*Study Area*

* Okanogan study site in northern Washington, USA
  + ~5000 km2, mix of public and private lands
  + Predominately montane conifer forests at mid-to-higher elevations, agriculture at lower elevations
* Harvest regulations in Washington
  + Coyotes: year-round hunting, no bag limit
  + Bobcats: Sept 1 – March 15 (7.5 months), no bag limit

*Data*

* Locations of collared coyotes and bobcats2
  + GPS points
    - Locations recorded every 4 hours
  + Exclude individuals with <100 locations
* Human footprint index3
  + 1km resolution
  + Scale of human influence across the landscape (0% [wilderness] to 100% [urban])
  + Currently, I cannot determine how the authors obtained a raster of the data from TerrAdapt (I can only obtain a .png using the webtool), but I have reached out to the group that created this map for help
* Landcover4
  + 30m resolution
  + 16-class land cover type based on a modified Anderson Level II classification system
* Elevation5
  + ~10m resolution
  + Bare earth digital elevation model
* Hiking Trails6
  + GPS points

*Analyses* (including, but not limited to, type of data, study design type, proposed selection function, scale optimization, statistical model, mode of statistical inference, etc.)

* Response variable: mesocarnivore space use
* Covariates:
  + distance to trails
  + human footprint index
  + landcover type
  + elevation
  + season – winter vs non-winter
* These analyses are adapted from the original publication from which this data was procured (Prugh et al. 2023).
  + Fit integrated step selection functions (SSFs) of habitat selection by coyotes and bobcats in response to covariates
    - Fit fully random-effect SSFs to allow individual heterogeneity in responses to all covariates
    - Resample coyote and bobcat GPS tracks for temporal consistency using four-hour intervals
  + Construct seasonal utilization distributions
    - Individuals with >50 locations in a given season, construct winter (Dec-Mar) and non-winter (Apr-Nov) kernel density utilization distributions
    - Known habitat preferences controlled for by including a variable for proportion of forest cover within a 250m radius around each used and unused location
  + Using a hierarchical generalized mixed-effects model with a binomial distribution, model used-available data for bobcats and coyotes in response to distance from trail at human footprint index -0.5 (wilderness) to 0 and 0 to 0.5 (urban)