Bighorn Sheep Movement and Disease Dynamics

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Background

This animation shows the health status of Hells Canyon bighorn sheep populations over time.

Pneumonia Mortality Not Detected

All Age Mortality

Lamb Mortality

Adult Mortality

- Pneumonia
- Management Strategies (Translocation)

Research Objectives

1. Predictive model of pneumonia outbreaks and infection
2. Identify differences in movement and inter-population contact rates

Data

- Disease Over Time
  - Population's pneumonia status 1995 – 2015
- Herd/Population Layer
  - Used for identifying contacts between herds
- VHF Data
  - Lat-long locations
- Individual Sheep Demography
  - 1997 – 2012
  - Sex and residency-status
- Compiled Population Demography
  - Each population for a range of years
    - Ranges 1970 - 2015
    - Mostly 1995 – 2015
- Translocation Events

Issues with the Data

- Disease Over Time
  - 16 years x 22 herds
  - (really 16 x 15)
- Herd/Population Layer
  - Unknown methodology
- VHF Data
  - Visual Confirmation
  - Within row group sizes not adding up
  - Shorter temporal resolution
  - Handling visual confirmation
  - Group disagreeing with compiled demographics
- Individual Sheep Demography
  - Ambiguous population names
- Compiled Population Demography
  - Each population for a range of years
    - Ranges 1970 - 2015
    - Mostly 1995 – 2015
- Translocation Events
  - Abstract information

Model Improvement Strategy

- Relatively weak model at face value
- VHF locations → Spatial Contact network
  - Neglected in research
  - Potentially lots of information embedded within
  - Addresses second question looking at how movement patterns vary between resident and translocated sheep
- Standard model vs. spatial contact network informed
  - Networks can be subdivided into resident, resident-translocated, and translocated sheep

Conflicts and Rabbit Holes

- Temporal aspect of Pneumonia outbreaks with different classes
  - Focus on invasion/first outbreak?
- Sparsity in VHF entries
  - Where are they in between recordings?
- Extracting and integrating information from the networks
  - I.e. how many steps forwards and backwards to include?
  - I.e. should steps from infected populations be weighted more?
- Biological assumptions behind pulling networks out of another
- Time-series analysis
- Home-ranges, Utilization Distributions, Core-ranges
  - In-progress along with friction cost surfaces

Currently

- Networks – shortened temporal range

- Models
- Results