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Estimating Cattle Density Using Wildlife Cameras

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Introduction

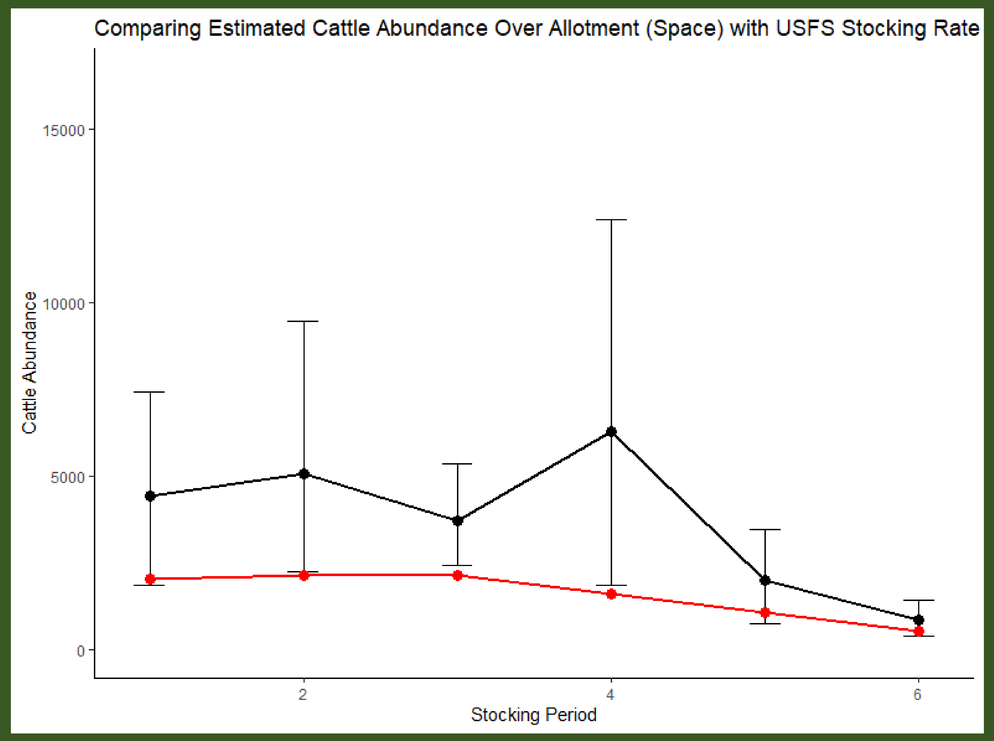
Wildlife cameras can be used to estimate the density of unmarked wildlife.

- **Random Encounter and Staying Time (REST) Model** relies on the connection among population density, mean number of camera trap detections during a sample period, and staying time of an individual in the camera's visual field
- **Comparing estimates** from the REST model has only occurred with recapture-based inference or to a known human density, but has never been compared to known population densities of free-ranging animals

Methods

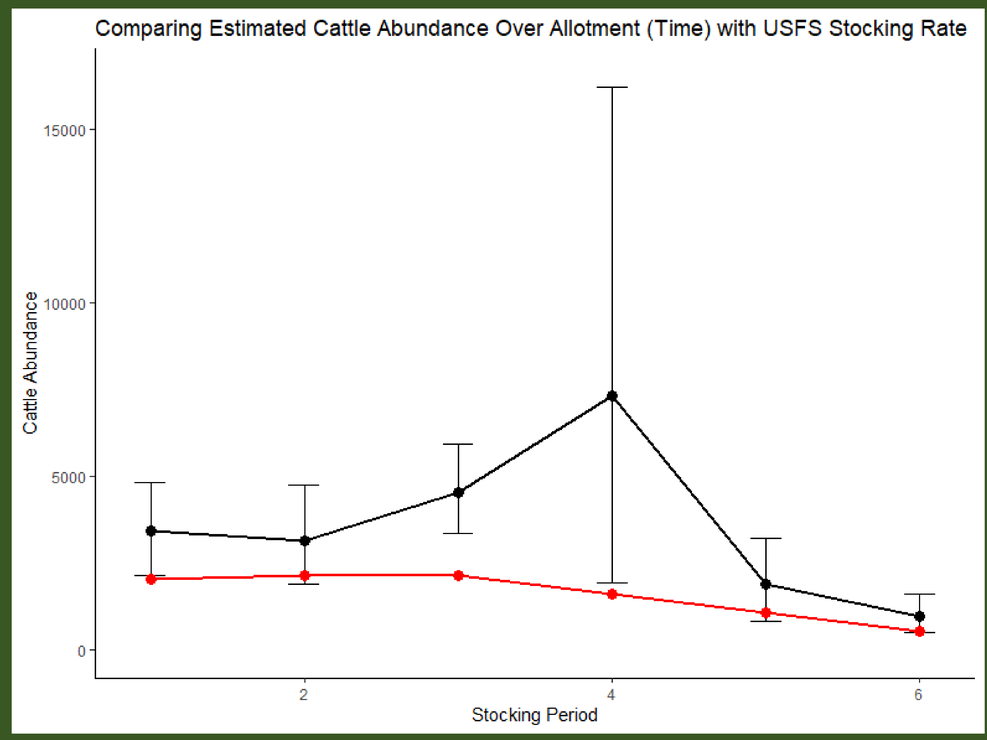
1. Classify camera photos
2. Calculate density using the REST Model
3. Use statistical technique (bootstrap) to generate samples with replacement to obtain a variety of different density estimates over space and time
4. Compare density estimates to U.S. Forest Service stocking rates

Accuracy of the REST model is inconclusive for estimating densities of unmarked wildlife.



The graph at the left displays our cattle abundance estimates with each 95% confidence interval (black), and the USFS stocking rates (red).

The 95% confidence intervals for stocking periods one, five, and six captured the true USFS stocking rate.



The graph at the right displays our cattle abundance estimates with each 95% confidence interval (black), and the USFS stocking rates (red).

The 95% confidence intervals for stocking periods two, five, and six captured the true USFS stocking rate.

Results

Photos Classified

- **516,724** total photos
- **140,176** wildlife photos
- **96,985** cattle photos
- **57,658** photos of cattle included in density calculations

USFS Stocking Rate Inconsistences

- **339,668 photos** of cattle on unstocked pastures during stocking periods
- **403 photos** of cattle present before stocking begins
- **1,108 photos** of cattle present after stocking ends
- Since we have occupancy of cattle on unstocked pastures, we cannot trust that the USFS stocking rates are accurate over the pasture level
- Thus, we assumed the USFS stocking rates were accurate on the allotment level

Abundance Estimates Across Allotment

- Estimates for both bootstrapping methods were **biased high**
  - Potentially because the average time we estimated that each cow stays in front of the camera is too high
  - Likely because our cameras are placed in areas where cow use is overrepresented

Coefficient of Variation

- Ranged between **0.1-0.5** for both bootstrapping methods, which were similar to other density estimation methods using wildlife cameras

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HONORS PROGRAM

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