Potential effects of Human Recreation on Abert’s Squirrels and Dusky Grouse: A Pilot Study

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Human Disturbance to Wildlife

- Physiological, behavioral, and demographic effects

- Consumptive
  - Hunting & Fishing
  - Roadkill

- Non-consumptive
  - Hiking
  - Sound effects
Human Recreation Disturbance

- Growing body of evidence for decreased:
  - Abundance, Survival, Occupancy, etc.
- Larson et al. (2016) systematic review of 274 journal articles
  - 93% of articles reported an effect of rec. on wildlife
  - 59% found a significant negative effect
  - Non-motorized more evidence for negative effect than motorized
- 4 million Coloradoans are outdoor recreators
- Boulder = large hiking an mt. biking community
Species of Interest

- Abert’s squirrel (*Sciurus aberti*)
- Dusky Grouse (*Dendragapus obscurus*)
Species of Interest

- Abert’s squirrel (*Sciurus aberti*)
  - Ponderosa pine obligate
    - Food, cover and nesting
  - Does not hibernate or cache large quantities of food
  - Boulder County indicator species
    - Apparent population declines in the Boulder area
Species of Interest

- Dusky Grouse (Dendragapus obscurus)
  - Prefers mixed conifer woodlands (i.e., Douglas fir, aspen & ponderosa stands)
  - Males create low hooting, females chirp
  - Anecdotal evidence populations are increasingly displaced by Boulder development
    - Similar reports from California and Montana
Recreation, Squirrels and Grouse

- Prior study found tree squirrels was significantly lower near trails (Lenth et al. 2008)
- Tree squirrel response to recreation higher in rural than in urban areas (Engelhardt & Weladji 2011)
- Lower occurrence and detections of other grouse species near park entrances and hiking trails (Immitzer et al. 2014, Moss et al. 2014)
Study Objectives & Hypotheses

1) Test the effectiveness of survey methods for the target species

2) Examine relationships between the types and intensity of recreation use and target species detections

- Hypotheses for both species:
  - Detections will be lowest in off-leash < on-leash < no dogs
  - Detections will be higher in areas with hiking only vs. mt. biking and hiking
  - Detections will decrease with increasing recreators
Methods & Materials
### Sampling Site Factors

- Sampled 24 different spatially balanced sites

<table>
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<th>Off-leash</th>
<th>On-Leash</th>
<th>No Dogs</th>
<th>Closed</th>
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Study Sites
Recreation Use Surveys & Camera Traps

- Installed cameras on trails
- Sampled recreation for \( \geq 14 \) days
- Classified photos
  - Hiker
  - Biker
  - Dogs
    - On-leash
    - Off-leash
Perpendicular to Trail Line Transects

- 200 m line transects
- 5 transects/site
- 17 1-m² quadrats/transect
  - Abert's feeding sign
- 1 point-center quarter vegetation survey/transect
Sampling Methods: Dusky Grouse

- Dropping counts
  - Same plot design as Abert’s
    - 200 x 1 m strip transect
- Acoustic monitoring
  - 16 GB total memory
  - 30 min → sunrise → 60 min
  - 60 min → sunset → 30 min
  - Used RavenPro to analyze data
- Recorded visual observations
Statistical Analysis

- Two-way ANOVA
  - Species detections vs. permitted activities and dog policies
- Power analysis for sample size
- Two-sample t-test & linear regression
  - Species detections vs. vegetation characteristics and recreation use intensity
Results
Abert’s Squirrel Detections

- Detected feeding sign in 18 of 24 sampling sites
  - $\bar{x} = 4.79$ quadrats/site
- Distance from trail
  - Did not find a relationship
  - $R^2 = 0.003$, $p = 0.847$
Abert’s Squirrel Detections

Mean Detections (±SE)

Off-leash
On-leash
No dogs
Closed

Mountain biking and hiking
Hiking only
Abert’s Squirrel Results

- ANOVA no significant variation in detections
  - Hiking only vs. Mt. bikes ($p = 0.715$)
  - Sample size 3x larger to find an effect of dog policy

- Significantly more detections with:
  - ↑ Large trees ($R^2 = 0.269$, $p = 0.009$)
  - ↓ Douglas fir ($R^2 = 0.177$, $p = 0.041$)
  - ↑ equestrian visitation ($p = 0.008$)
  - ↑ cyclist visitation ($R^2 = 0.179$, $p = 0.039$)
  - ↑ total visitation ($R^2 = 0.181$, $p = 0.038$)
Dusky Grouse Droppings Detections

- Detected droppings at 8 of 24 sites
  - $\bar{x} = 1.38$ line quadrats/site
- Distance from trail
  - Did not find a relationship
    - $R^2 = 0.022$, $p = 0.574$
- Live observations at 7 of 8 sites
Dusky Grouse Droppings Detections

![Bar chart showing mean detections (±SE) for different land use scenarios: Off-leash, On-leash, No dogs, Closed. The chart compares mountain biking and hiking and hiking only, with the latter generally showing higher mean detections.](chart.png)
Dusky Grouse Vocalizations

- Detected probable calls at 5 of 8 sampling sites
  - Detected droppings at all 5 locations
Dusky Grouse Results

- Mixed ANOVA results
  - Hiking only vs. mt. bikes ($p = 0.062$)
  - On-leash vs. off-leash vs. no dogs ($p = 0.180$)
- 3x larger sample size to find an effect of hiking vs. mt. biking
- 4x larger sample size to find an effect of dog policy
- Significantly more detections with:
  - ↓ cyclist visitation ($p = 0.035$)
Discussion
Discussion: Abert’s Squirrels

- Strong correlation between squirrels and vegetation
- Unexpected positive correlation with some recreation
  - Potential habituation with recreation
  - Unmeasured environmental variable
    - Interactions with pine squirrels (*Tamiasciurus hudsonicus*)
  - Mismatched temporal response
    - Activity patterns, physiological condition
- Potential limitations in survey design
Discussion: Dusky Grouse

- Dropping counts and acoustic monitoring were successful in detecting grouse
- Live observations at almost all sites with dropping or acoustic detections
- No grouse droppings in areas that permitted mt. biking
  - Mt. biking visitation levels and other sampling location variables not strongly correlated (e.g., elevation)
Study Design & Conclusions

- All sampling methods were effective
- Large time commitment for each sampling site
- Low number of sample sites (n=24)
  - Several different factors
- Limitations in site placement
- Simplify study design to spatially balanced points
  - 5 circular plots (5 m radius)/ point
  - Droppings and/or acoustic monitoring
  - Distance to trail an easier to define
  - Could incorporate multi-species study at each point
Conclusions

- No effect of recreation on Abert’s squirrels observed from this study
- Effects of recreation on Dusky Grouse warrants further study
  - Improvements in study design should better elucidate potential recreation impacts
  - Multiple detection methods may improve detection probabilities
  - Community-level assessments
Acknowledgements

- Grete Wilson-Henjum, Field Technician
- Susan Spaulding, BCPOS
- Will Keeley, OSMP
- Dave Hoerath, BCPOS
- Michelle Durant, BCPOS
- Courtney Larson, CSU
- Sasha Keyel, CSU
- Jessica Sushinsky, WCS
Multiple forms of outdoor recreation popular in Colorado
- 4 million Coloradoans participate
- 140 million days of activity North Central region (CPW 2013)

Boulder area
- Convenient access to open spaces
- Large hiking and mountain biking community
- What effect is this having on species of interest?
Dusky Grouse Results

- Detected probable calls at 5 of 8 sampling sites
  - Detected droppings at all 5 locations
- Male calls in a 100 – 600 Hz single band
  - Very brief 0.2 – 0.5 seconds
- Female calls up to 5000 Hz broadband signature
  - Variable duration 0.1 – 2 seconds