Factors Influencing Movement of Pronghorn at Multiple Spatial Scales

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Outline

• Introduction
• Identify Pronghorn Behavior & States
• Pronghorn Migration at Multiple Scales
• Creating a Connectivity Network Across the NSS
• Fencing Research to Sustain Connectivity
Migration

• Adaptive strategy to exploit resources based on endogenous & exogenous control factors
• Across taxa – undistracted movements interspersed with stopover sites
• The ability to move influences reproductive rates and survivorship during seasons
• Partial migration – Observed at population level
Pronghorn: Life History & Management

Approximate distribution of pronghorn (O’Gara and Yoakum 2004); 64% contraction from pre-contact populations

Photo: J. Carlson
The Changing Face of Grasslands
Functional Connectivity

The degree to which landscapes sustain movements within and among a mosaic of habitat types and land uses
Purpose

To develop a multi-scale hierarchically nested modelling approach to predict pronghorn migrations for use in designing a connectivity network at the northern edge of their range.
Collar Deployment

• GPS Collars deployed in winter on female pronghorn:
  - Dec 2003 – Feb 2007: 75 within AB (3 Years)
  - Jan 2008 – Feb 2011: 110 across MT and SK (3 Years)

Photo: J. Carlson
Pronghorn and Prairie Conservation

The Northern Sagebrush Steppe

Map of The Northern Sagebrush Steppe with regions labeled AB, SK, MT, and ND. The map includes a legend for different land use types such as water, exposed land, shrubland, wetland, grassland, agriculture, fire disturbance, and forest types.
Identifying Behaviors & States

Movement Behaviors

[Graph: ET27: Migrant]

[Graph: ET119: Resident]

# Days from Capture

Movement States

NSD

[Graph: ET17 Spring Migration Daily Relocations]
Multi-Scale Sampling

Pronghorn Migration Second-order Sampling Design Across the NSS

AB
SK
MT

2nd Order Case Points
2nd Order Control Points
NSS
States/Provinces

Kilometers
0 50 100 150 200 250 300 350 400
Movement Model Variables

**Environmental**
- Landcover (12 Categories)
- Slope
- VRM
- Aspect
- NDVI (Annual & Decade)
- Snowcover (Annual & Decade)
- Hydrography (2 scales)

**Anthropogenic**
- Road Density (Paved & Unpaved)
- Oil/Gas Well Density
- Distance to Nearest Spudded Well
Results: Spring Pathway Selection

18 variables:
Grass (+), All Roads (-), NDVI (+), Slope^2(-), Slope (+), Hydro 1000m (-)
Multi-Scale Spring Pathway Selection

ISSF Map: Spring Movement

Scale_{2nd} \times Scale_{3rd} = Scale_{ISSF}
Stopover Sites

- Evaluated stopover sites from migratory pathways
- 75% of all stopover sites identified during spring
- 29% of spring migrations included stopover sites
- Strongest factors influencing stopover site selection included NDVI (+), Aspect (+), Shrubland (-), Exposed Land (-), Well Density (-); Ag. Croplands was reference
Anthropogenic Influences

- Using $\Delta AIC_c$, mean weights of evidence supported “Base” models at the 3\textsuperscript{rd} order and “Human” models at the 2\textsuperscript{nd} order at influencing migratory pathway selection.
- Avoidance is achieved at the second order.

<table>
<thead>
<tr>
<th>Order</th>
<th>Base ($w$)</th>
<th>Human ($w$)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Third</td>
<td>0.764</td>
<td>0.236</td>
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<tr>
<td>Second</td>
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*"Human" models include road and well variables whereas "Base" models do not.
Migration Pathway Selection

• ISSF maps accounted well for multi-scalar selection of movement pathways. Major factors: Grass, road-density, NDVI, slope

• Stopover sites were selected in areas with higher forage quality, north-facing slopes and lower well densities

• Pathway selection was hierarchically nested: highly influenced by anthropogenic features at a broad scale, but much less of a factor at a finer scale. Decisions have already been made
Approaches to Connectivity Networks

- A regional network of habitat patches linked by functional corridors
- Seasonal ISSF maps as cost-surface
- Native habitat patches ~ >200 km$^2$
- Connectivity ID’s within & between patches
- LCP validated against relocation data
Corridor Widths

Identified to optimize conservation/management efforts

**Optimal Spring Corridor Width**

<table>
<thead>
<tr>
<th>Spring Connectivity Raster</th>
<th>% Point - % Area</th>
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<tbody>
<tr>
<td>NSS</td>
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<tr>
<td>200Km</td>
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<td>200m</td>
<td>0.00</td>
</tr>
<tr>
<td>100m</td>
<td>0.00</td>
</tr>
</tbody>
</table>
Connectivity Network
Priority Corridors

• Three spring migrators use priority corridors between and within native patches
• Migration stalled between native patches - TransCanada HWY and associated linear features
• Appropriate area for conservation actions
Conclusions

- Analytical approaches to identifying pathways and stopover sites
- Developed scale-integrated relative probability map
- Developed approaches to map connectivity
- Connects both major and satellite patches
- Connectivity networks can be used as a tool for conservation planning
Design for other Migratory Species

Mule Deer

Greater sage-grouse

Bison?
Management Recommendations

• Manage landscapes for long-distance movements, during specific time periods

• Use ISSF & connectivity network maps for spatiotemporal management

• Focus management actions on three priority corridors

• Other opportunities include fence modification; conservation easements; over-pass structures
Direct Mortality
Stress and Injuries
Hair loss & Scarring
Barrier
Management Guidelines
Project Objective

1) To test various fence modifications and investigate which ones improve fence permeability for pronghorn movements
   1. Goat-bar (PVC-modified Fence)
   2. Quick-link Modified Fence
   3. Smooth Wire

2) What are the characteristics that make a good fence crossing site for pronghorn?
Site Setup:

- Pronghorn Crossing Trail
- Control Camera
- Known Crossing Site Camera
- Treatment Camera
- Lowered
- Set #1
Goat-Bar

Known

Smooth Wire

Clips

Goat-Bar
Future Research

• Test additional fence modifications for other species and investigate ungulate effort and use

• Construct seasonal range models and investigate effects of barriers (e.g., fences) on multi-scale seasonal range & movements

• Test pronghorn as an umbrella for other native grassland/sagebrush species
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Collaborators

Alberta Conservation Association
The Nature Conservancy
WWF
The University of Montana
University of Calgary
National Fish and Wildlife Foundation
Montana Fish, Wildlife & Parks
U.S. Department of the Interior
Bureau of Land Management
Alberta Fish & Game Association
Cabela's
Miistikas Institute
Saskatchewan Environment and Resource Management
Petro-Canada
Alberta Sport, Recreation Parks & Wildlife Foundation
PFRA/ARAP