Piceance Basin Mule Deer & Energy Development: Demographic influences and mitigation
How Could Energy Extraction On Winter Ranges Compromise The Ability of Mule Deer to Survive Winter?
Goal: Identify approaches to energy development that benefit mule deer populations

- **Objective 1:** Address development activity relative to mule deer migration (Patrick Lendrum, Idaho State University)

- **Objective 2:** Monitor deer response to development to inform development planning (Joe Northrup, CSU)

- **Objective 3:** Address newborn fawn survival in developed & undeveloped landscapes (Mark Peterson, CSU)

- **Objective 4:** Evaluate habitat treatments as mitigation
Measure Mule Deer Responses to Development & Mitigation

- Behavior/habitat selection (GPS collars ≥ 5 locations/day)
- Body condition (Dec & Mar)
- Newborn fawn survival
- Over-winter fawn survival
- Deer density (helicopter surveys)
Piceance Migration Summary

- Mule deer moved more quickly through the most developed areas.

- Selected habitats with increased cover.

- Avoided roads except in the most developed area:
  - High road densities may preclude avoidance.

- Selected areas close to well pads:
  - Predator avoidance? elk competition? foraging opportunities?
Atlantic Rim, WY mule deer migration


► Evaluated permeability of 2 migration routes north of Baggs, WY with progressing CBM development

► Addressed movement rates, stopover use, and migration routes as development progressed

► Identified potential threshold in development activity that alters migration behavior
Atlantic Rim Migration Summary

- Mule deer increased migration rates through developed areas and reduced rates through non-developed areas.
- Reduced stopover use in developed areas.
- Altered migration routes at high development densities (up to 2.8 pads/km²).
<table>
<thead>
<tr>
<th></th>
<th>Piceance Basin, CO</th>
<th>Atlantic Rim, WY</th>
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</thead>
<tbody>
<tr>
<td>Migration dist:</td>
<td>36 km (43 km)</td>
<td>40 km</td>
</tr>
<tr>
<td>Elevation:</td>
<td>~1980-2400 m</td>
<td>~2065-2385 m</td>
</tr>
<tr>
<td>Vegetation:</td>
<td>PJ woodland, mtn. shrub, aspen/conifer</td>
<td>sparse PJ/sage, sage, aspen/sage</td>
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<tr>
<td>Migration duration:</td>
<td>3-8 days</td>
<td>3 weeks</td>
</tr>
<tr>
<td>Stopover use:</td>
<td>uncommon</td>
<td>common</td>
</tr>
<tr>
<td>Pad density:</td>
<td>1.5–2.0/km²*</td>
<td>0.8–2.8/km²*</td>
</tr>
</tbody>
</table>

*Pad density calculations differ
Migration Implications

- Apparent threshold in development intensity that alters migration behavior
  - Migration rate, migration route, stopover use if present
- Demographic consequences?
  - Not evident in Piceance, not addressed in Atlantic Rim
- Habitat quality may enhance permeability
  - Increased security cover = increased permeability?
- Habitat quality related to rate of migration/stopover use?
- Clustered development along migration routes may alter migratory behavior
- Dispersed development along migration routes should enhance permeability and maintain migratory behavior
Deer Behavioral Responses

Environmental Covariates

Day

Night

Covariates: Edge, Slope, Elev, Roads, Roads^2, Tree

Coefficient values

Edges

Trees
Deer Behavioral Responses

Influence of roads

Day

Night

Coefficient values

Covariates

Edge, Slope, Elev, Roads, Roads$^2$, Tree

Coefficient values

Covariates

Edge, Slope, Elev, Roads, Roads$^2$, Tree
Deer Behavioral Responses

Day
Well Pads
Night
Behavioral Summary

• Temporal patterning modified by development
  – Open areas at night / cover during day
  – Roads (avoid during day, closer at night)
  – Producing pads (avoid during day, not at night)

• Drilling pads
  – Strong avoidance (at least 600-800 m)

• >25% severe winter range within these distances (night-time avoidance)

• However, deer behaviorally offset demographic influences under current conditions
Newborn Fawn Survival
Newborn Fawn Survival

![Chart showing newborn fawn survival rates in developed and undeveloped study areas.](chart)

- **Survived**: 0.49 in Developed, 0.05 in Undeveloped
- **Malnutrition**: 0.08 in Developed, 0.09 in Undeveloped
- **Unknown**: 0.14 in Developed, 0.09 in Undeveloped
- **Predation**: 0.33 in Developed, 0.39 in Undeveloped

The chart illustrates a comparison of fawn survival rates between developed and undeveloped areas.
Mortality cause

0 - 6 month fawn survival/mortality
June - Dec., 2012 - 2015

- Bear: 14.0%
- Cougar: 7.5%
- Bobcat: 2.8%
- Felid: 3.2%
- Coyote: 5.2%
- Eagle: 1.0%
- Unk predation: 11.3%
- Starvation/Disease: 3.2%
- Unknown: 8.8%
- Road kill: 0.8%
- Survived: 42.3%
Mule Deer Parturition

- Deer select areas with increased hiding cover, which tend to be farther from disturbed sites.

- Some evidence of lower newborn fawn survival under extreme environmental conditions (e.g., drought), but survival apparently not influenced during typical climate conditions.
Current Status

1. Completed pretreatment period (5 yrs) and continuing through year 4 of post-treatment addressing deer behavior/habitat selection

2. Completed pretreatment period addressing survival, body condition, & deer density

3. Monitoring 4\textsuperscript{th} growing season of post-habitat treatment phase

4. Two additional years of post-treatment monitoring
Pretreatment (2010)
1\textsuperscript{st} year post-treatment (2011)

2\textsuperscript{nd} year post-treatment (2012)

3\textsuperscript{rd} year post-treatment (2013)

4\textsuperscript{th} year post-treatment (2014)
Habitat Mitigation Results

- Excellent vegetation responses beginning years 3-4

- Evidence of deer use and improved winter fawn condition, but additional evaluation pending
Questions?