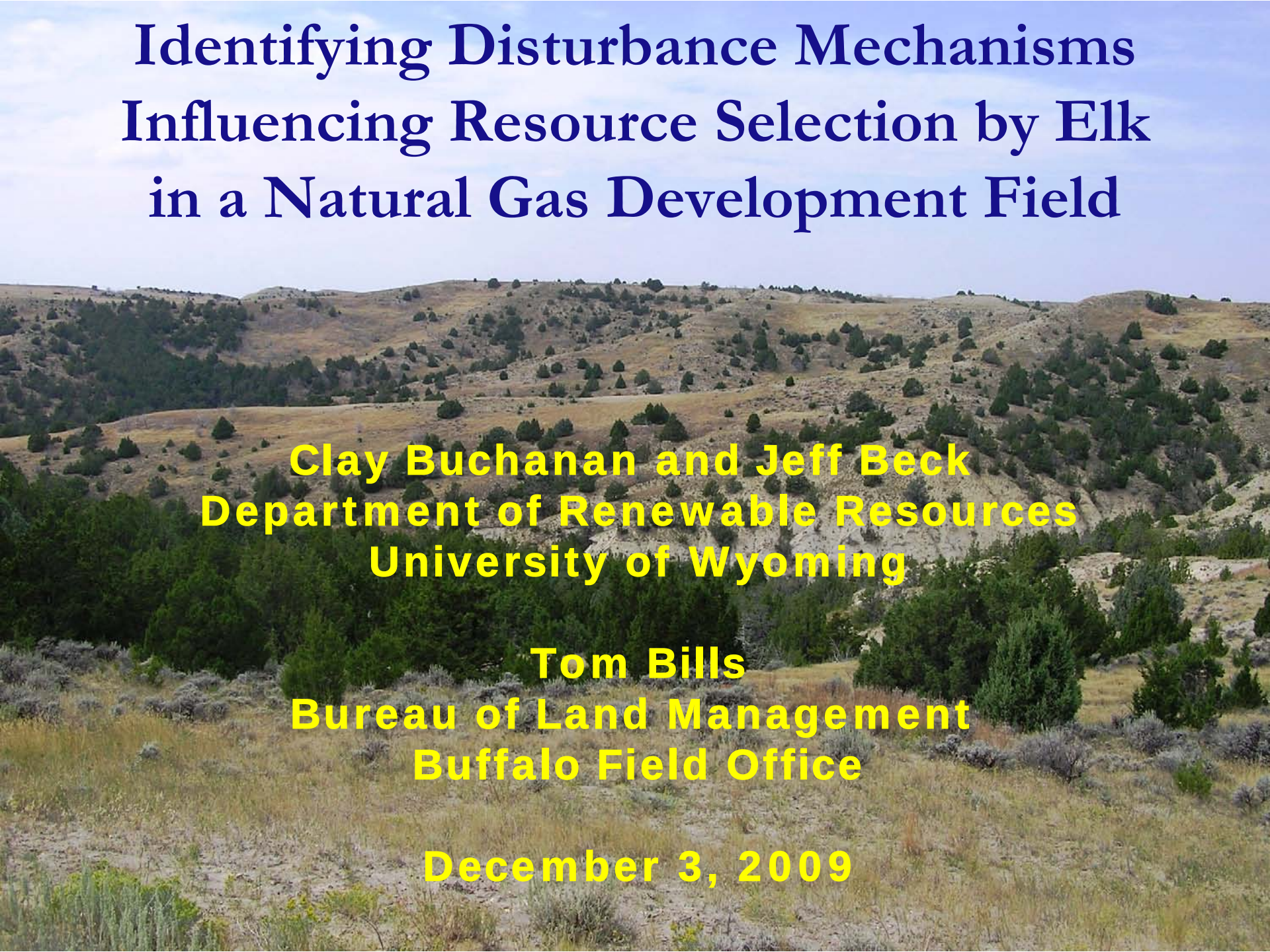
# Identifying Disturbance Mechanisms Influencing Resource Selection by Elk in a Natural Gas Development Field

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# Potential Impacts to Wildlife

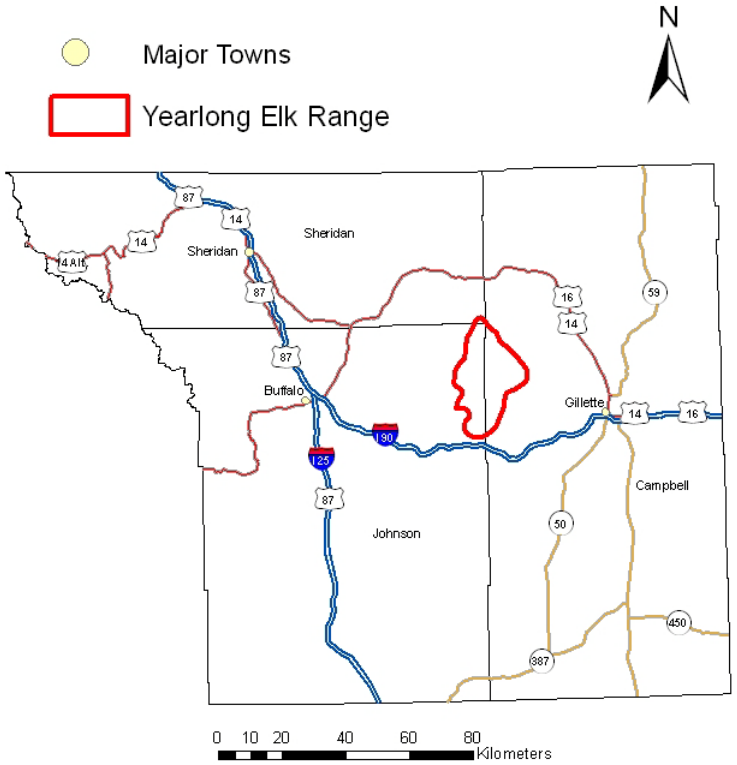
- **Direct**
  - Habitat loss
  - Fragmentation
  - Mortalities
- **Indirect**
  - Displacement due to avoidance behavior
  - Reduced fitness
    - Changes in trends in population parameters (e.g., calf:cow ratios)
    - Changes in resource selection
    - Changes to vital rates

# Ungulate Response to Energy Development

- Avoid infrastructure
- Modify migration patterns
- May select marginal habitats to avoid infrastructure (Sawyer et al. 2006)
- Mitigation efforts can reverse avoidance of infrastructure (Sawyer et al. 2009)
- Fitness may be compromised (Hebblewhite 2008)

# Fortification Creek Study Area

- **498-km² with 48.6-km² wilderness study area**
- **BEFORE First telemetry study in 1990s provides temporal control**
- **AFTER (During) Second telemetry study 2005–2007 pre-development**
- **AFTER (During) Cow elk equipped with real-time GPS collars in 2008**
- **Monitoring to continue for several years, but field work for this study 2009–2011**



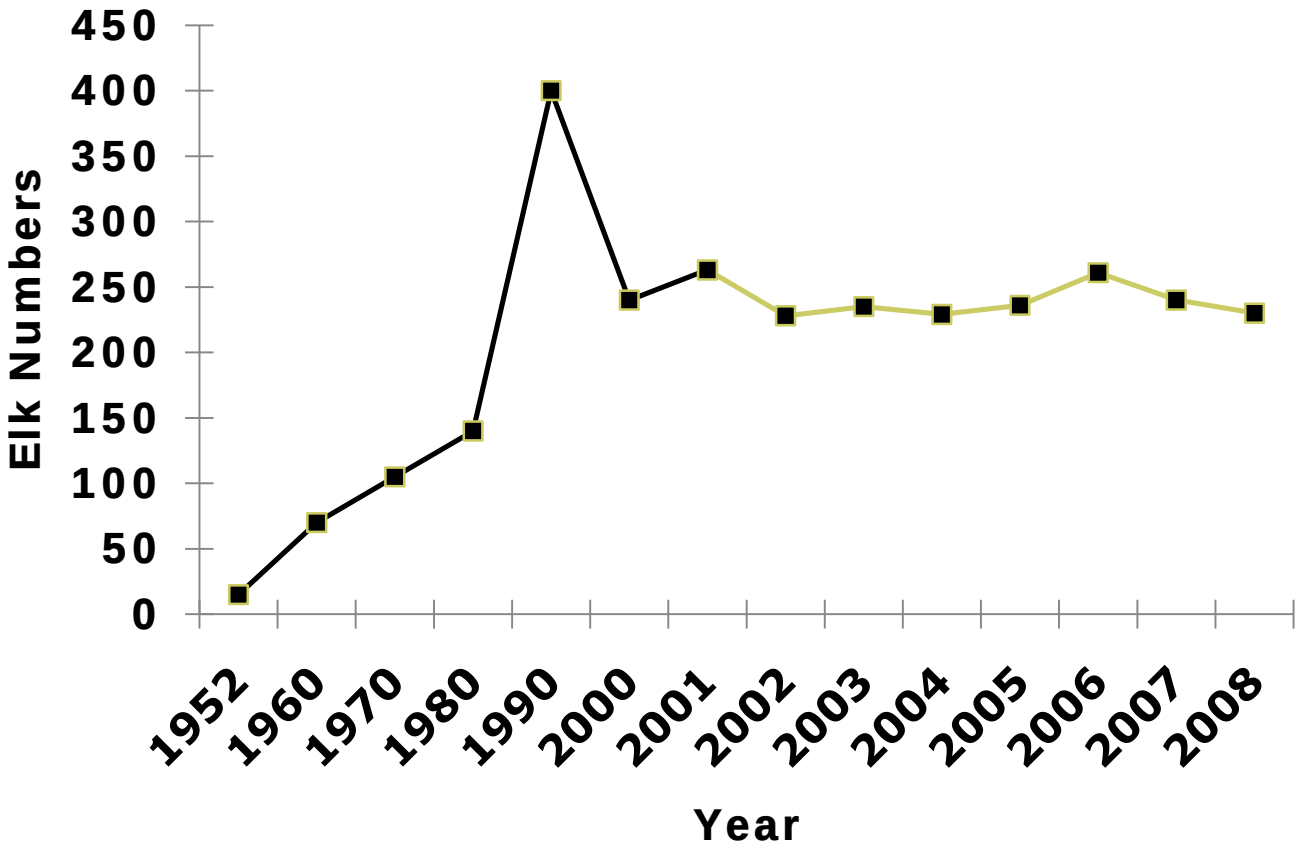
# Elk Herd Demographics (WGFD)

- 230 elk in Fortification Creek Area
- Population numbers and ratios managed through fall harvest

Bull and calf numbers per 100 cows

| Year | Bulls | Calves |
|---|---|---|
| 2004 | 29 | 32 |
| 2005 | 61 | 39 |
| 2006 | 44 | 69 |
| 2007 | 33 | 30 |
| 2008 | 38 | 58 |

# Population Trends



# Hypotheses

- **To optimize fitness, animals inhabiting areas undergoing energy development are confronted with two choices**
  - **Emigrate to undisturbed, offsite habitats**
  - **Occupy increasingly disturbed habitats**
    - -Habituate to compromised resource conditions
    - -Shift resource selection to ameliorate consequences of disturbance

- **Animals occupying increasingly disturbed landscapes may exhibit cumulative effects**
  - Lower body condition
  - Lower reproductive output
  - Lower survival

# General Objectives

1. **Obtain landscape-level information from elk and their habitats in an area undergoing CBNG development**

   - **Disturbance (noise, traffic, visual obstruction)**
     - ***How do disturbance levels change elk habitat selection?***
   - **Forage quantity and quality**
     - ***Will elk select less optimal habitats as development proceeds?***
   - **Elk parameters (body condition, cow:calf ratios, survival)**
     - ***Will selection of less optimal habitats lead to reduced population performance?***

2. **Provide management recommendations to assist in maintaining or restoring habitat functionality for elk in areas undergoing development**

# Capture and Marking

- 39 cow elk – March 2008
- 20 cow elk – December 2008
- 1 legal harvest – fall 2008
- 57 marked cow elk

(~25% of population)

  - 38 GPS
  - 19 VHF

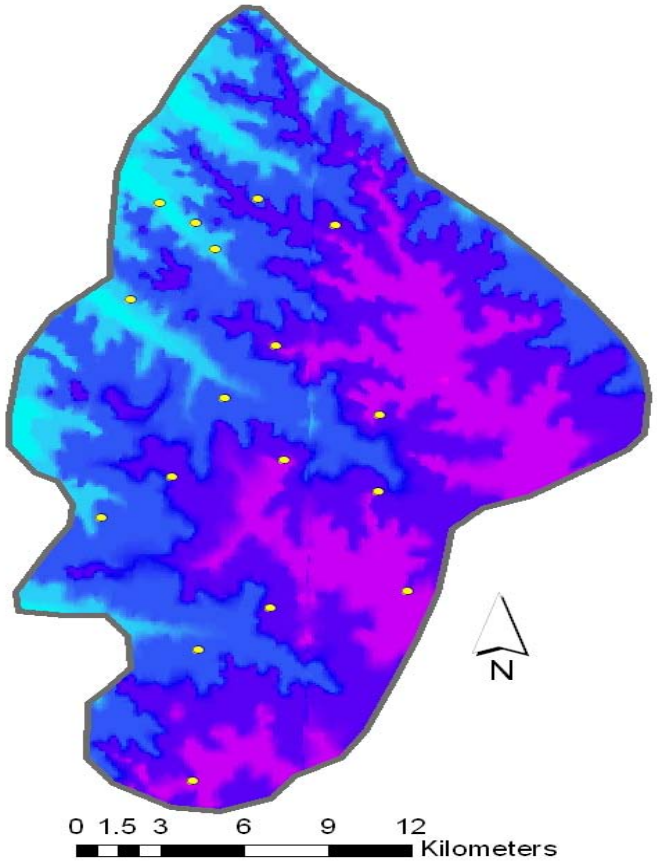
# Field Methods – Population Monitoring

- Demography
  - Cow:calf and cow:bull ratios
  - 4 helicopter flight surveys
    - -Early spring
    - -Post–parturition
    - -Pre–hunt
    - -Post–hunt
- Elk survival
  - -Seasonal and yearlong

# Field Methods – Disturbance Monitoring

- Noise – May–August
  - Zoom H2 recording units
  - Random placement

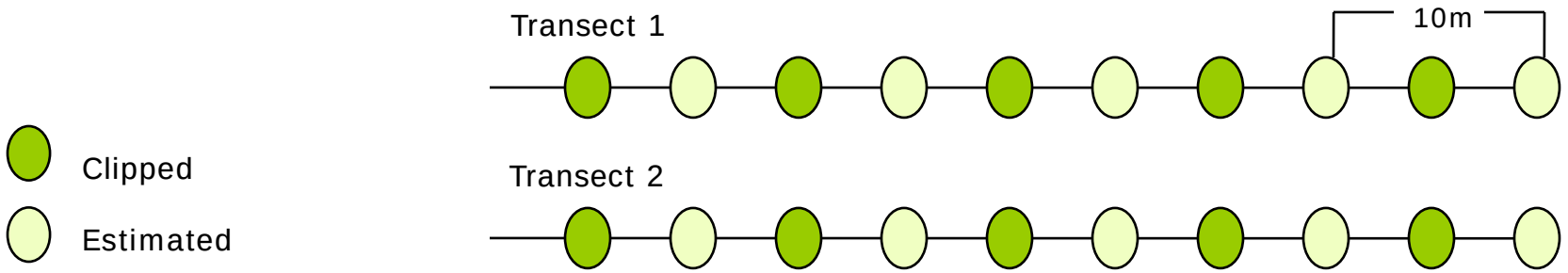
- Traffic – May–August
  - TrailMaster 1500 Traffic Monitors
  - Placed on roads throughout yearlong range




**Sound Recording Stations**

# Field Methods – Forage Quantity and Quality

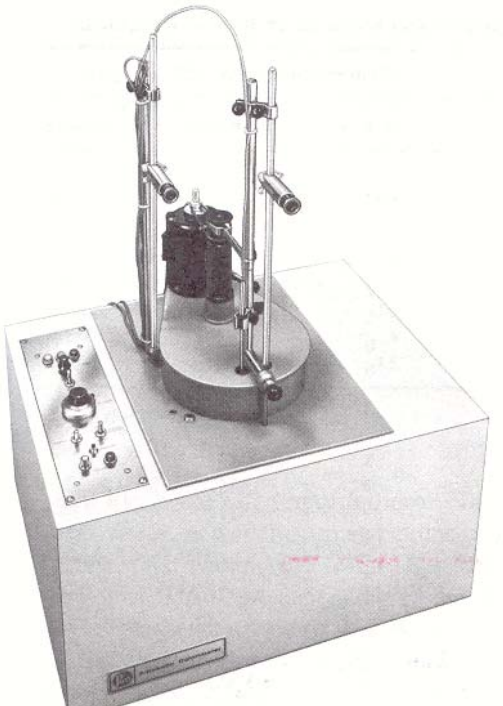
- 10 sampling sites each in 3 cover types (strata)
  - Random placement in juniper, and sagebrush on cool and warm aspects
- 2 parallel 50-m transects to perform double sampling
  - Estimate forbs and grasses every 10 m
  - Clip forbs and grasses every other 10 m
  - Use linear regression equation to predict forage in estimated-only quadrats
- 2 sampling bouts to match forage phenology
  - Early summer – May 20–May 31
  - Late summer – July 20–July 31



# Lab Methods – Forage Quality

- Crude protein – Dr. Brett Hess' Ruminant Nutrition Laboratory, University of Wyoming

- Digestible energy – Wildlife Habitat Lab, Washington State University

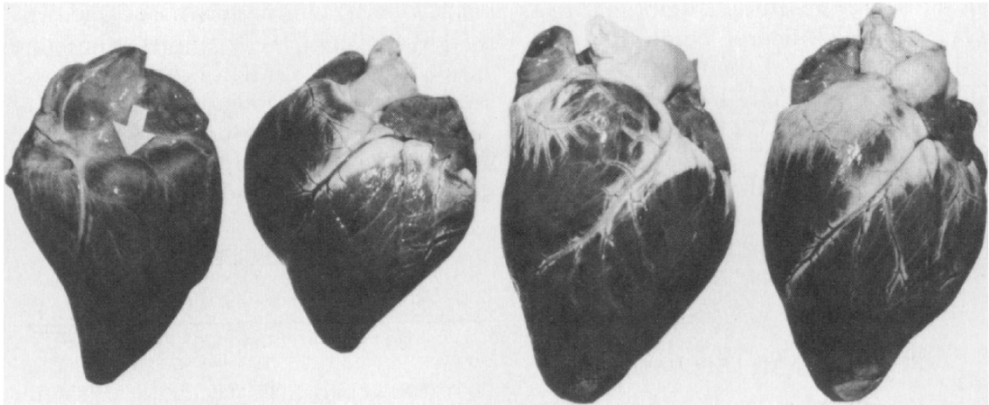


# Field Methods – Elk Body Condition

**Objective** – to evaluate elk body condition in disturbed (Fort Creek) and non-disturbed (Rochelle Hills) sites

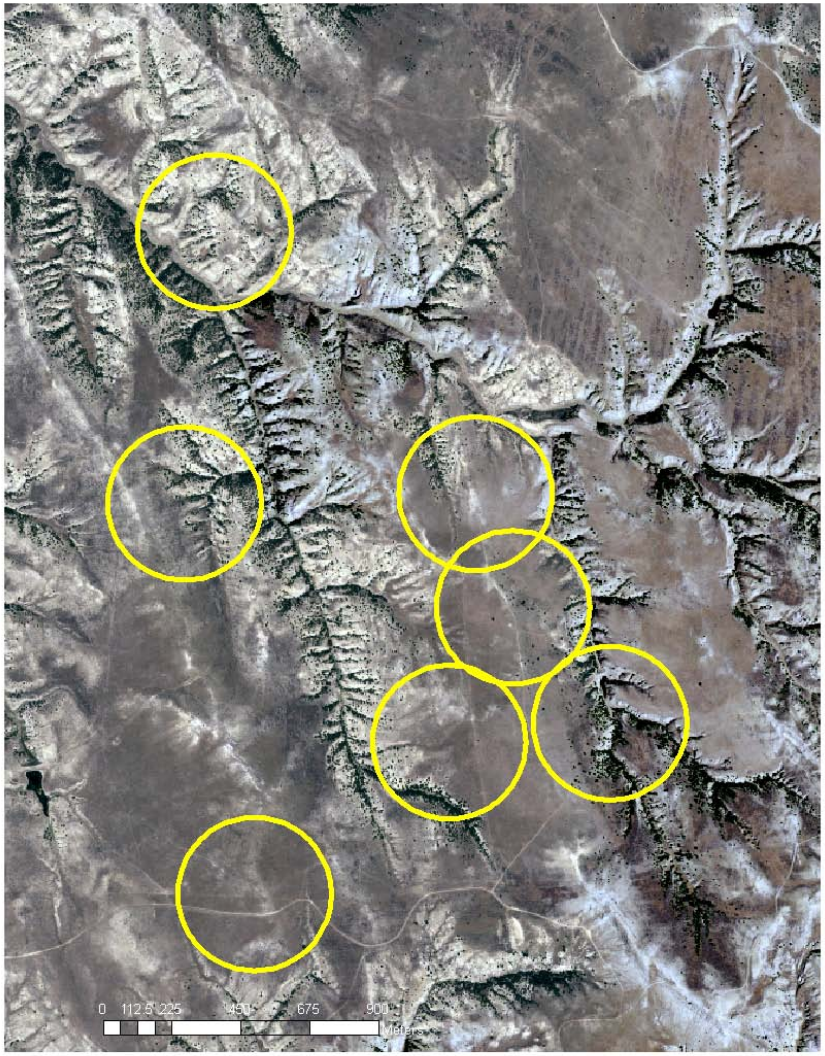
- Collect **hearts and kidneys** from hunter-harvested elk in third and fourth weeks of October

- Follow modified Kistner et al. (1980) scoring method based on organ fat deposition



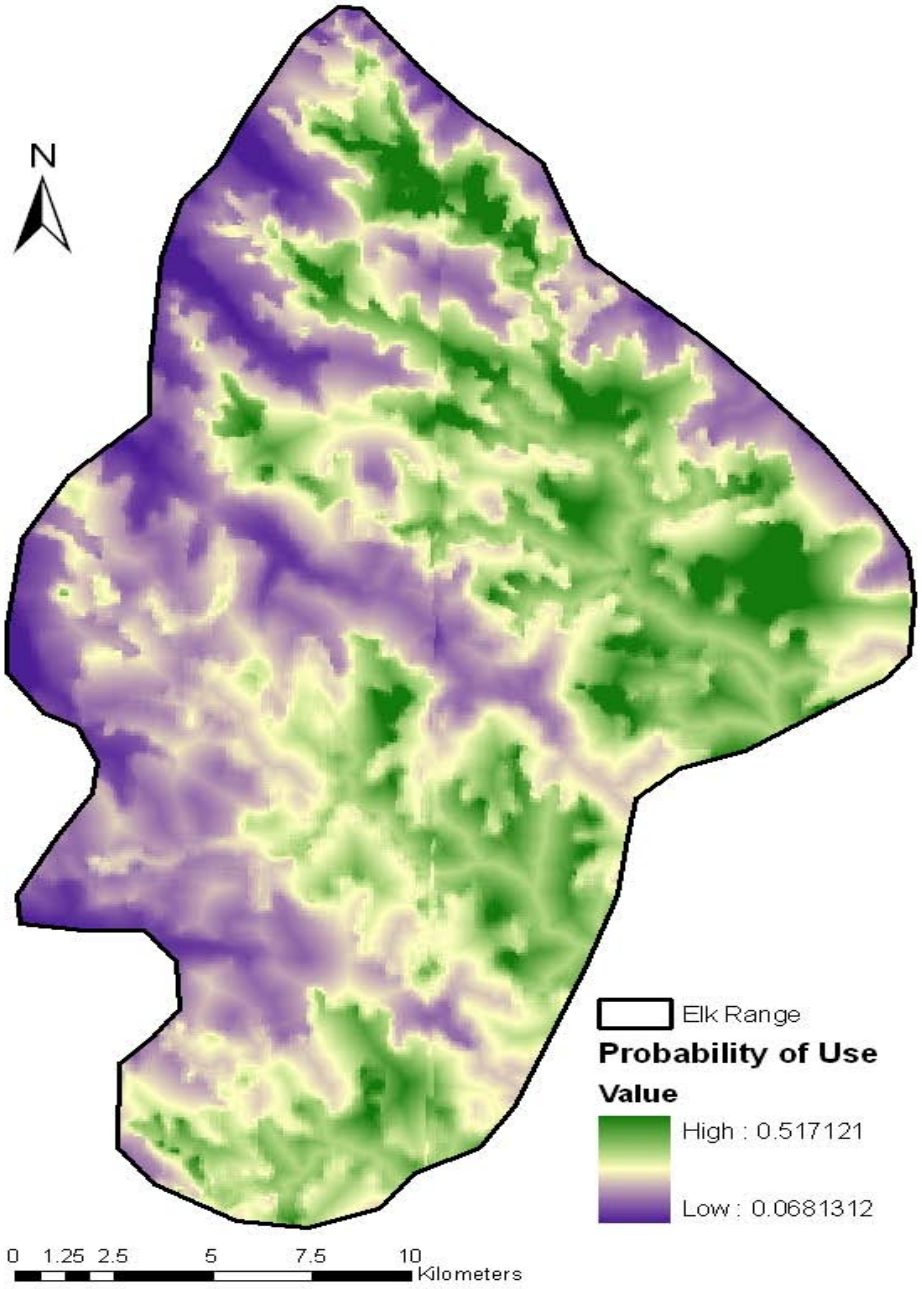
# Habitat Selection – Sampling Methods

- Random 250 m sampling units
- Response variable is the number of elk relocations in each sampling unit
- Predictor variables assessed within each sampling unit include:
  - Anthropogenic disturbance (noise and traffic)
  - Cover type
  - Distance to water
  - Distance to disturbance
  - Forage quantity/quality
  - Topography



**1992–1996**
**BEFORE**
**DEVELOPMENT**
**Probability**
**of Elk Occurence**

**Roads (–) and**
**Elevation (+) best**
**predictors**
**($\Delta$AICc ≥4.56, $w_i$ = 0.871)**



# Habitat Selection – Modeling

- Create resource selection probability functions for each elk
  - Identify variable coefficients for each elk
- Average coefficients to create population level model
- Create yearly probability of use maps
  - Compare **AFTER DEVELOPMENT** models to **BEFORE DEVELOPMENT** model
  - Compare changes in probabilities of use throughout development
- Identify relative effect of disturbance mechanisms compared to other mechanisms

# 2009 Field Season Summary

- >80,000 elk relocations
- Forage quantity and quality collected twice at 30 sites
- 15 noise monitors – collected thousands of hours of sound
  - Station designs held up well to weather
  - Will adjust sampling scheme due to power capacity
- 18 traffic monitors
  - Recorded over 45,000 traffic events
- Fall 2009 body condition collection
  - *n* = 9 samples from Fortification Creek
  - *n* = 13 samples from Rochelle Hills

# Intended Management Implications

- To provide managers with information to:
  - Plan future CBNG development projects to minimize disturbances
  - Restore habitat functionality through reducing or removing the disturbance factors that lead to avoidance of areas undergoing energy development

# Acknowledgments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# Questions?