Greater Sage-Grouse Migration Ecology and Response to Bentonite Mining in the Bighorn Basin, Wyoming

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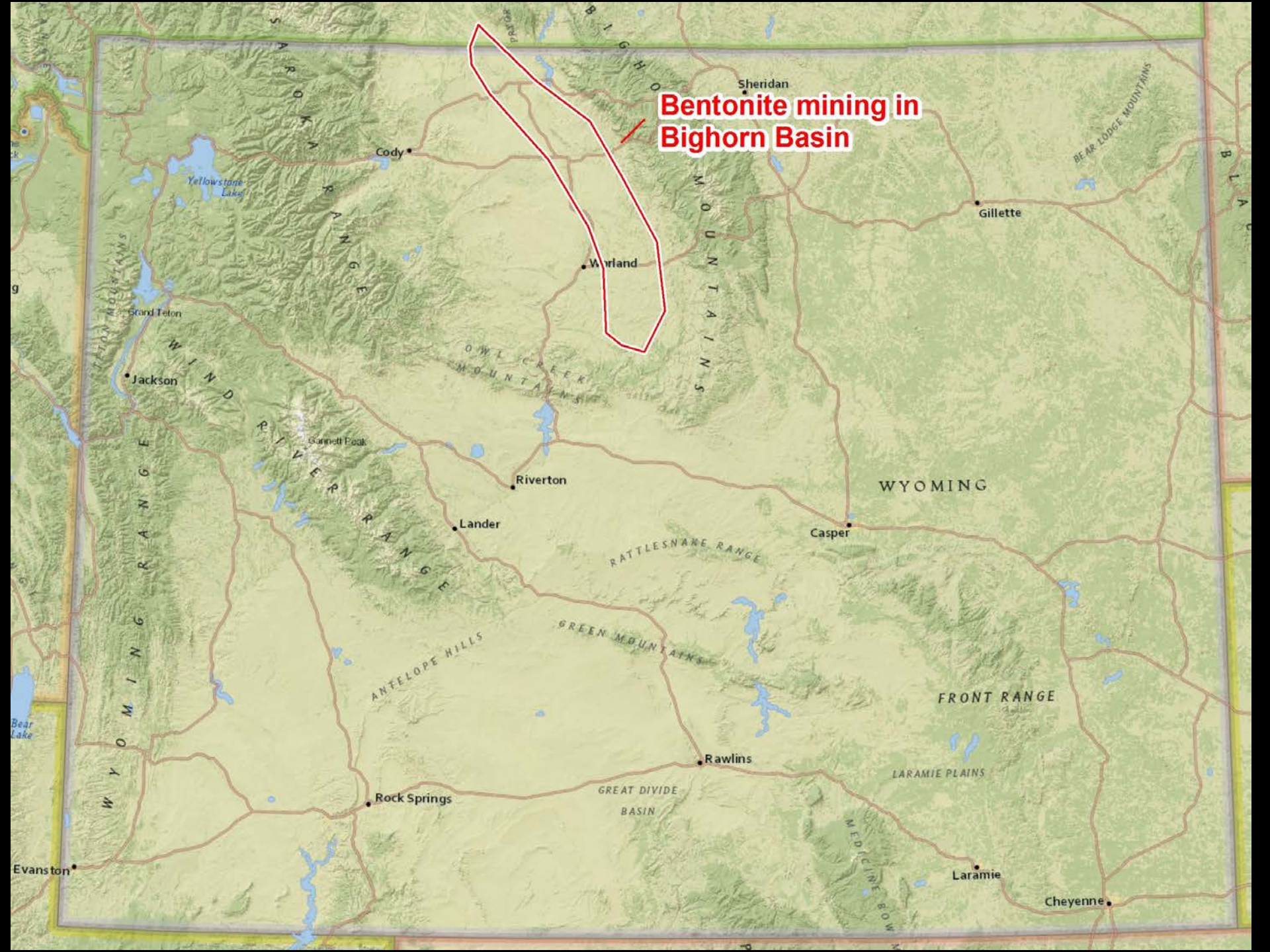
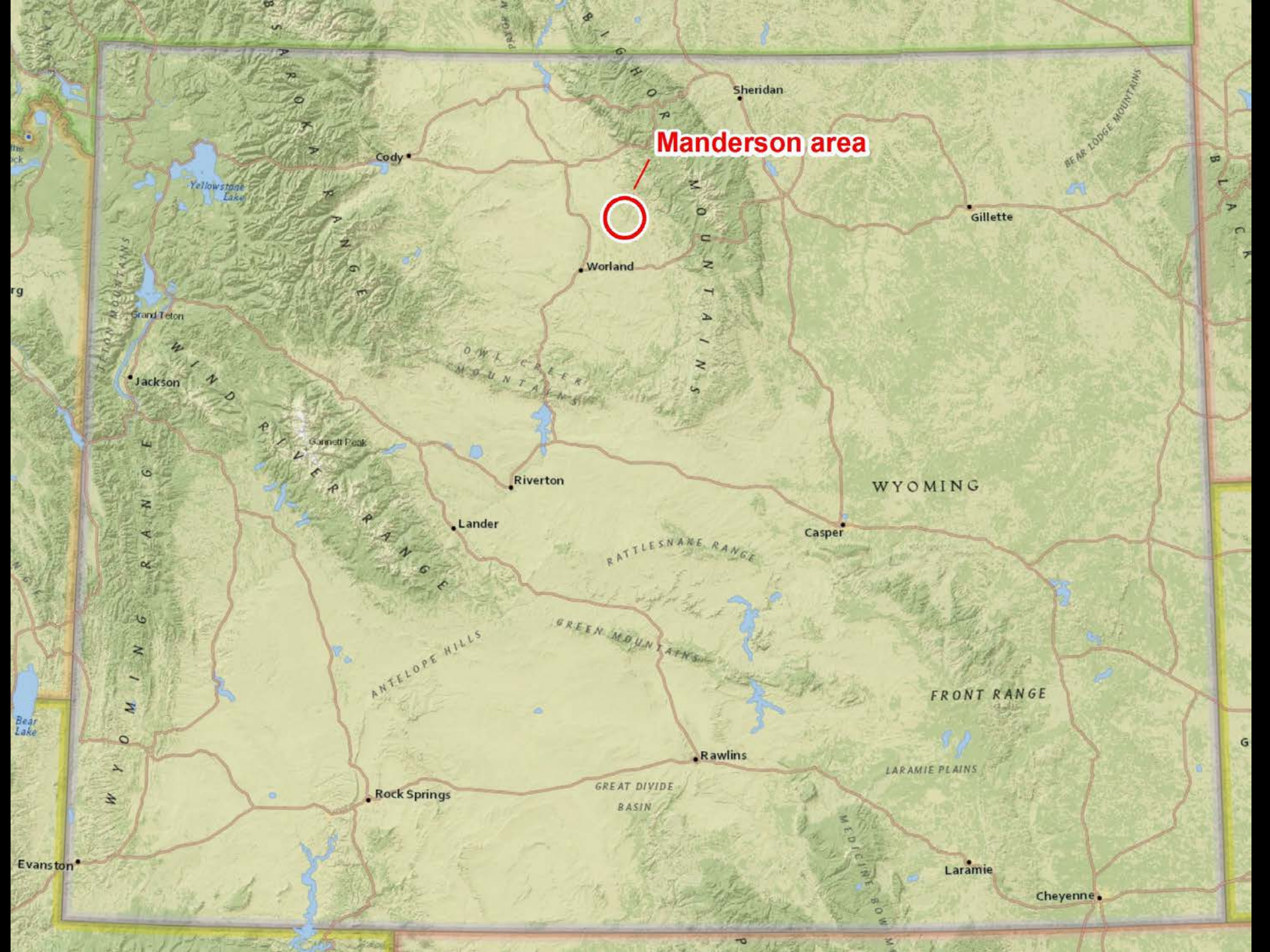

Bentonite mining in
Bighorn Basin
Sheridan
Cody
Yellowstone Lake
Gillette
Worland
Grand Teton
Jackson
Gannett Peak
Riverton
Lander
Casper
WYOMING
Rawlins
Rock Springs
Evanston
Laramie
Cheyenne
Bear Lake
ABSAROKA RANGE
BIGHORN MOUNTAINS
BEAR LODGE MOUNTAINS
OWL CREEK MOUNTAINS
WIND RIVER RANGE
WYOMING RANGE
RATTLESNAKE RANGE
GREEN MOUNTAINS
ANTELOPE HILLS
GREAT DIVIDE BASIN
FRONT RANGE
LARAMIE PLAINS
MEDICINE BOW

Gardner’s saltbush community

Wyoming big sagebrush community


Manderson area
Sheridan
Cody
Yellowstone Lake
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WYOMING
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GREAT DIVIDE BASIN
FRONT RANGE
LARAMIE PLAINS
BEAR LODGE MOUNTAINS

ACC's commitment to sage-grouse

- Future mining in sage-grouse habitat
- Address habitat loss and fragmentation
- Work toward preserving sage-grouse
- Develop methods to reclaim sagebrush communities
- Learn more about the ecology of local sage-grouse

ACC's commitment to sage-grouse

- Guiding research:
  - Oil and gas impacts to grouse populations in prime habitat
- ACC concerns:
  - Bentonite mining impacts different?
  - NE Bighorn Basin is fringe habitat

History

- Winter 2009 – 2010
  - ACC and WGFD endorse pilot project
    - Capture and radio-mark grouse
    - Identify nesting, brood-rearing, and wintering areas
    - Identify important habitat within those areas
- Fall 2010
  - ACC and UWYO cooperative research agreement
- Spring 2011

Project Cooperators

American Colloid Company

University of Wyoming

Wyoming Game and Fish Department

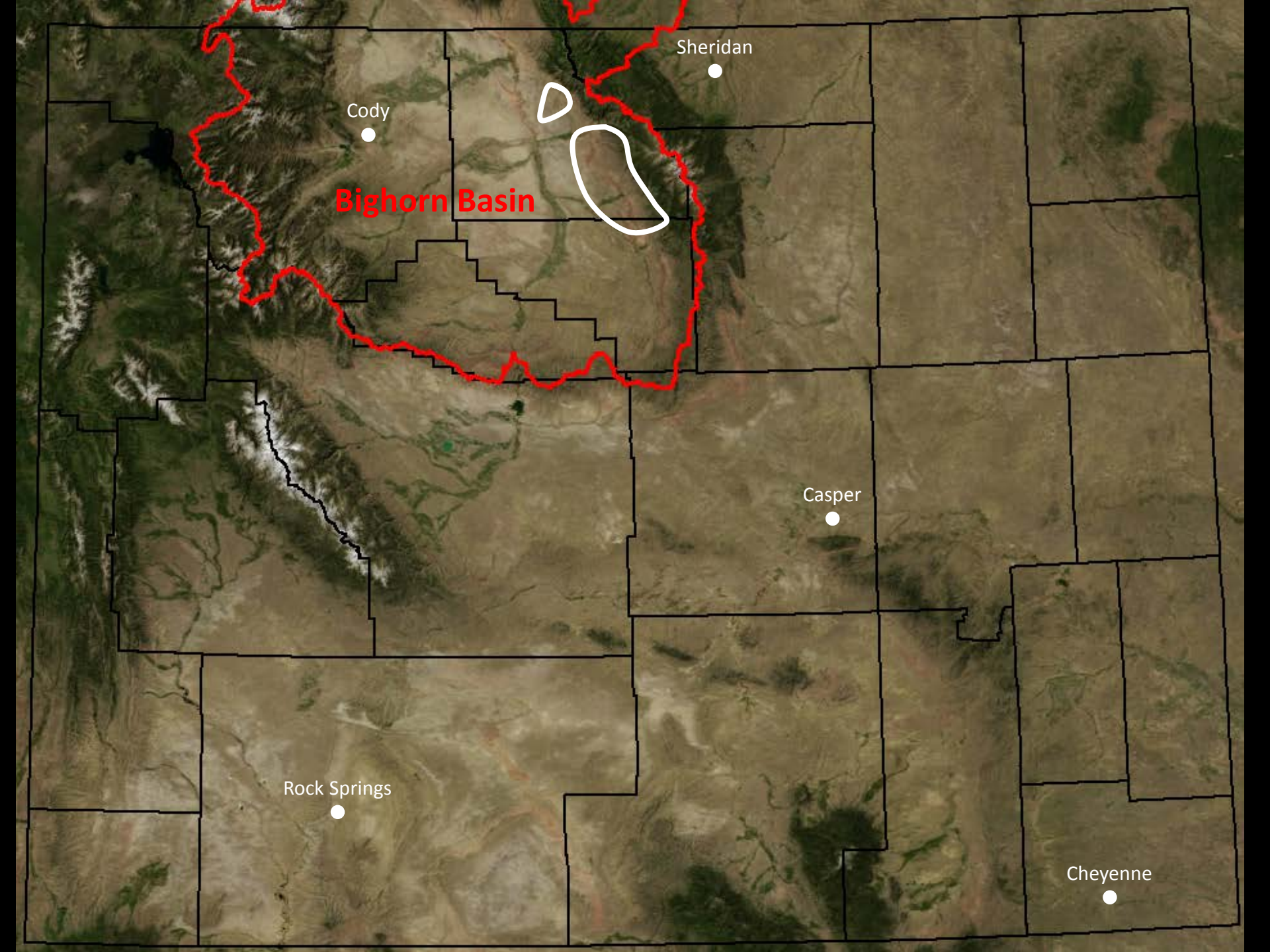
Bureau of Land Management

Bentonite mining companies

Private landowners

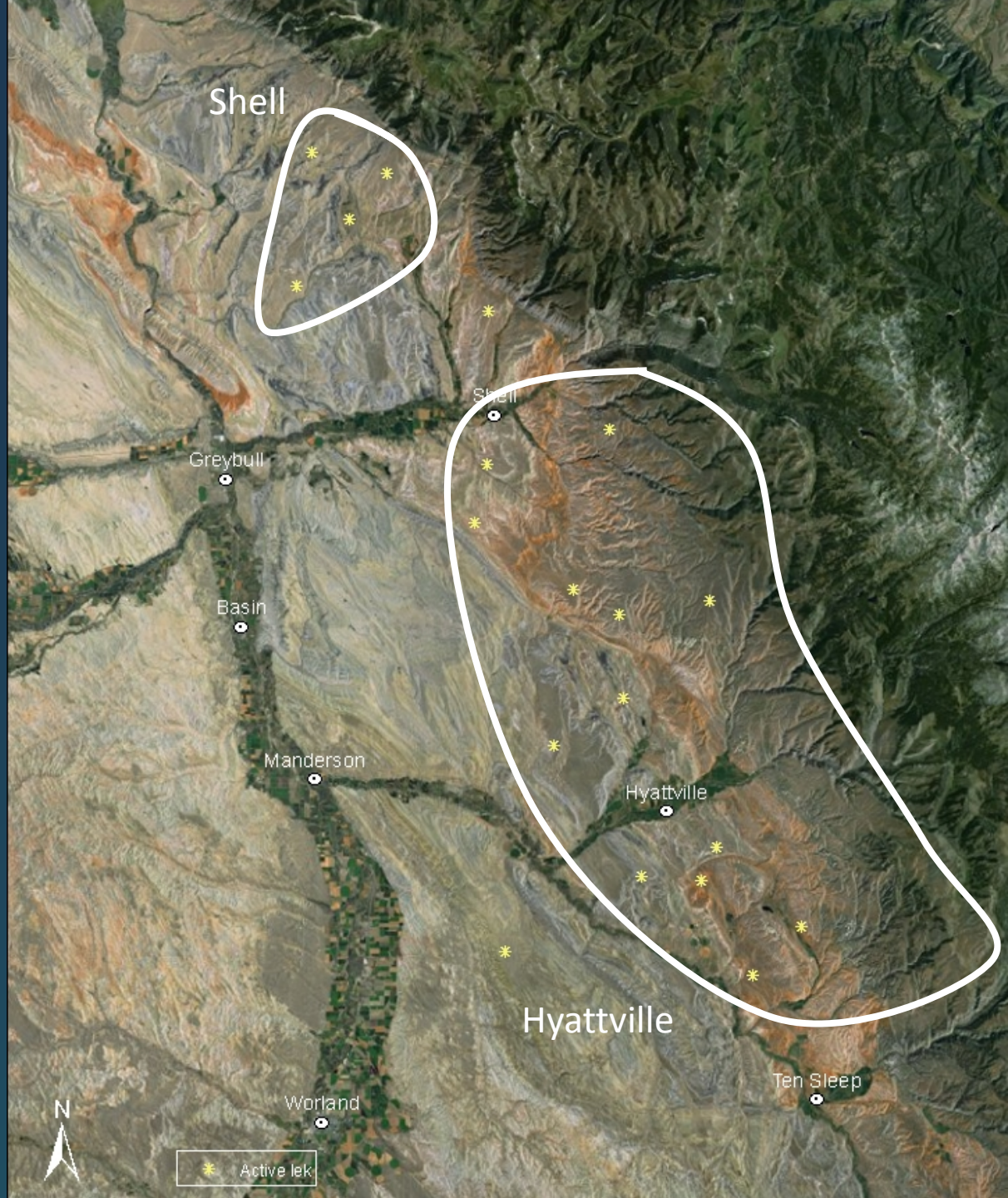
Objectives:
2011-2013

1. Demographic response to mining
   – Survival, nest success, brood success
2. Landscape habitat selection relative to mining
3. Microhabitat selection for guiding reclamation
4. Describe migration ecology

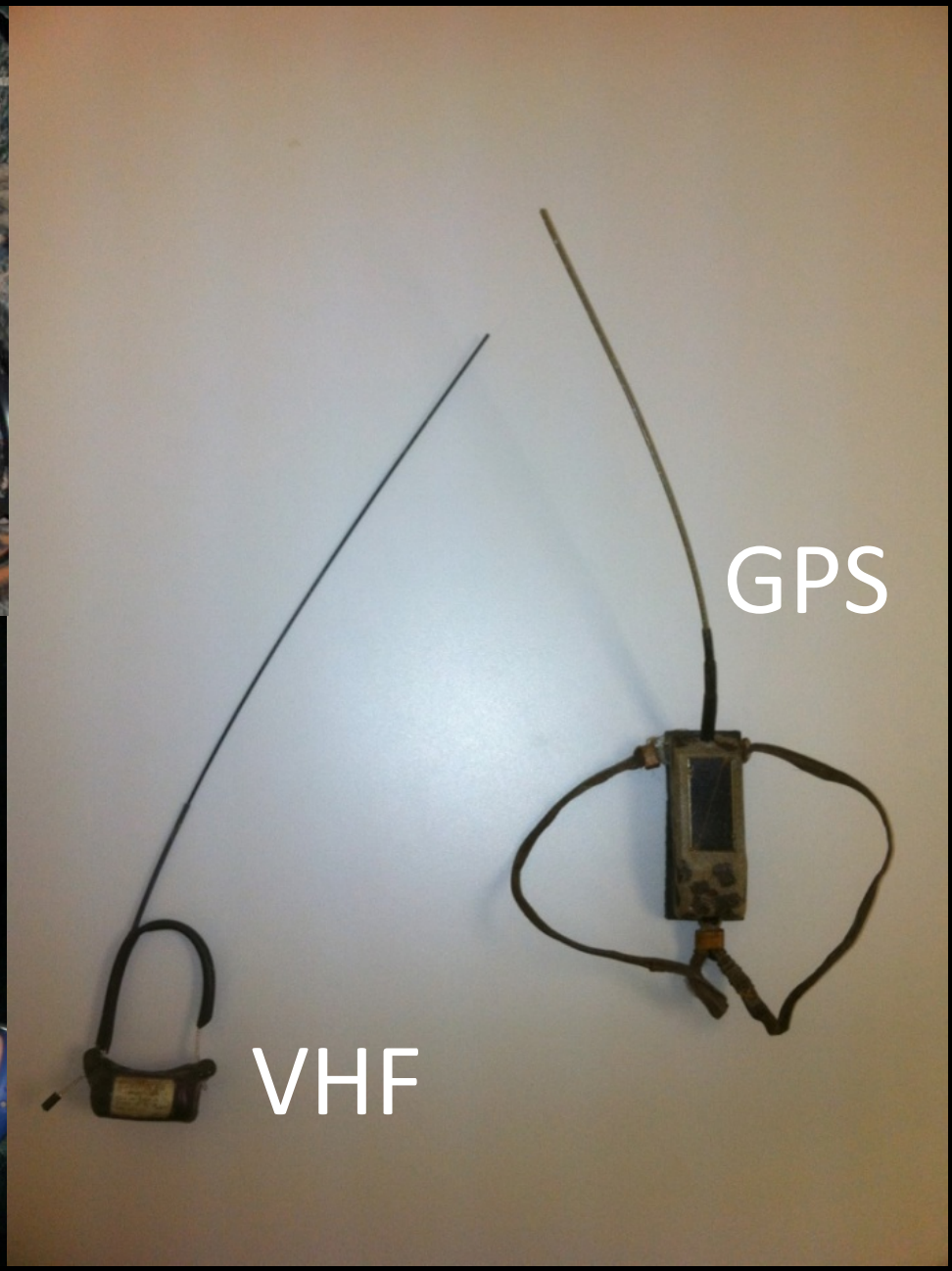

Sheridan
Cody
Bighorn Basin
Casper
Rock Springs
Cheyenne

Study areas:

- Shell Core Area
  - With active bentonite mining
  - 4 active leks
- Hyattville Core Area
  - Plans to expand mining
  - 13 active leks



Spotlighting



1. Demographic response to mining: Survival

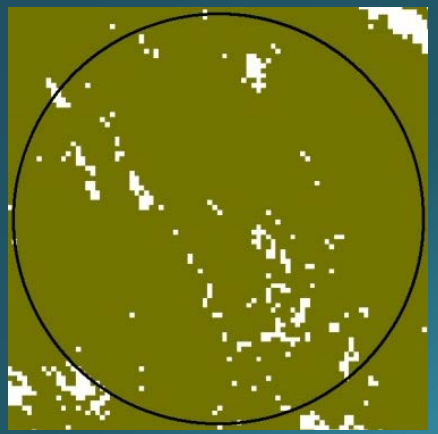
- Female
  - Mostly VHF transmitters
  - 2011-2013: Shell *n*=48, Hyattville *n*=144
- Male
  - Mark-recapture
  - Marked only with metal leg band
  - 2011-2013: Shell *n*=28, Hyattville *n*=82

1. Demographic response to mining: Nest and brood success

- Nest success
  - 2011-2013: Shell *n*=53, Hyattville *n*=145
- Brood success
  - 1 chick surviving to 5 weeks post hatch
  - 2011-2012: Shell *n*=11, Hyattville *n*=41

1. Demographic response to mining: Observations and future plans

- Some differences between study areas but not consistent with season/year
- Look at birds relative to exposure to mining
  - Distance to mining disturbance
  - Proportion of landscape with mining disturbance
  - Disturbance calculated 2 ways:
    - All disturbance combined including reclaimed areas
    - Only active mining areas

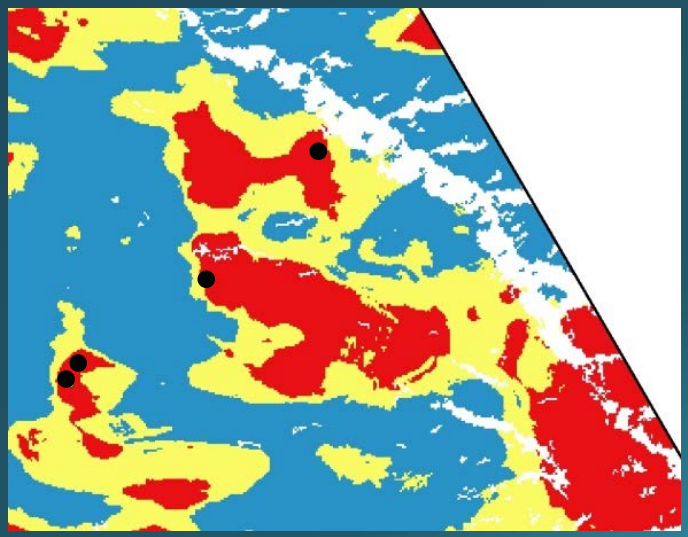


1. Demographic response to mining: Observations and future plans

- Male mark-recapture
  - Low recapture rate with metal bands
  - Genetic marker alternative:
    - Feathers collected from leks

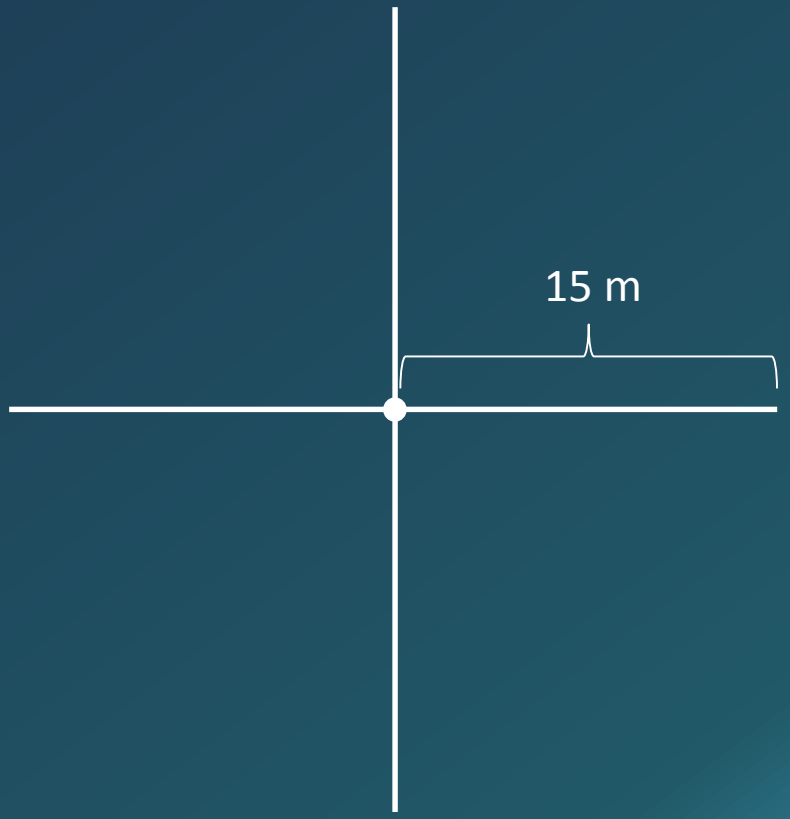
2. Landscape habitat selection:

- Identify landscape habitat characteristics that explain grouse presence
  - Avoidance of mining activity?
    - Different types of disturbance
  - Winter and breeding seasons
  - Collecting winter, nest, and brood locations that will be compared to random points



3. Microhabitat selection:

- Plots at all nests: 2011-2012 *n*=127
- Plots at early (0-5 weeks) brood locations: 2011-2012 *n*=98
- Paired random plot
  - Random direction and distance from 100-500 m away



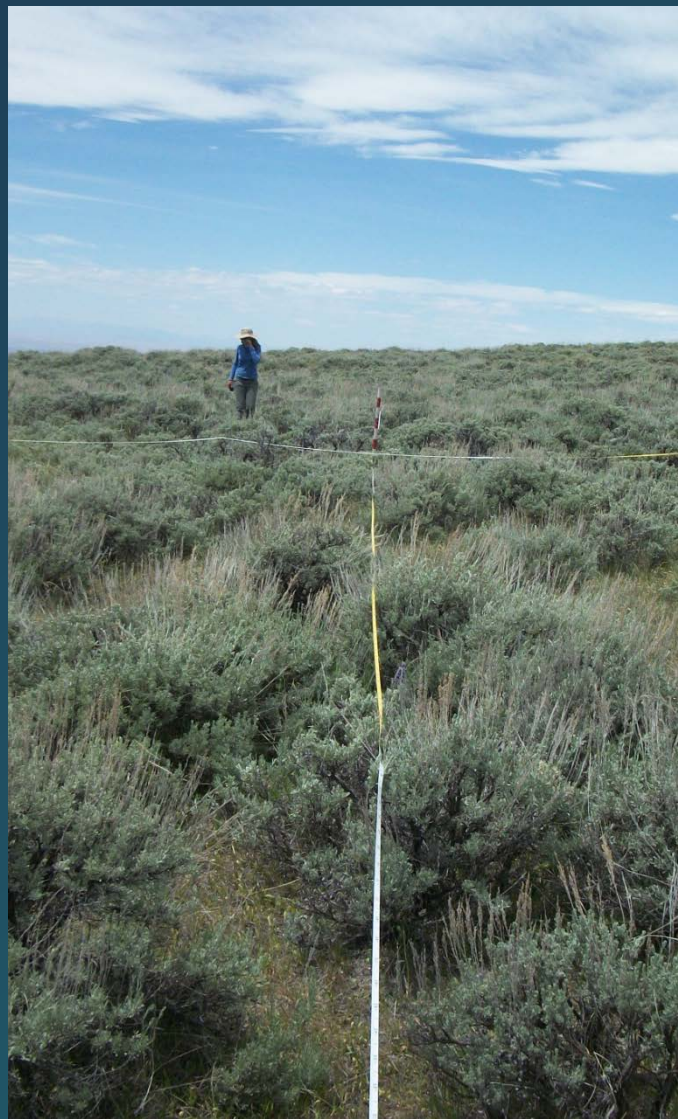
3. Microhabitat selection:

~30 variables:

- Topography
  - Aspect
  - Slope
- Nest shrub
  - Species
  - No.
  - Size
  - VO
- Shrubs
  - Cover
  - Height
  - Density
  - Diversity
- Vision obstruction
- Grass
  - Per. height
  - Residual hgt.
- Cover
  - Annual grass
  - Per. grass
  - Residual
  - Food forbs
  - Non-food forbs
  - Bare ground
  - Cactus
  - Cryptobiotic crust
  - Rock/gravel
  - Litter
  - Food forb richness

3. Microhabitat selection: Observations and future plans

- Nesting microhabitat
  - Some difference in selection between study areas because of differences in what is available
  - Variables selected for are related to concealment cover
- Brood microhabitat
  - Little difference



3. Microhabitat selection: Observations and future plans

- Expand brood microhabitat plots
  - Insect biomass and forb biomass

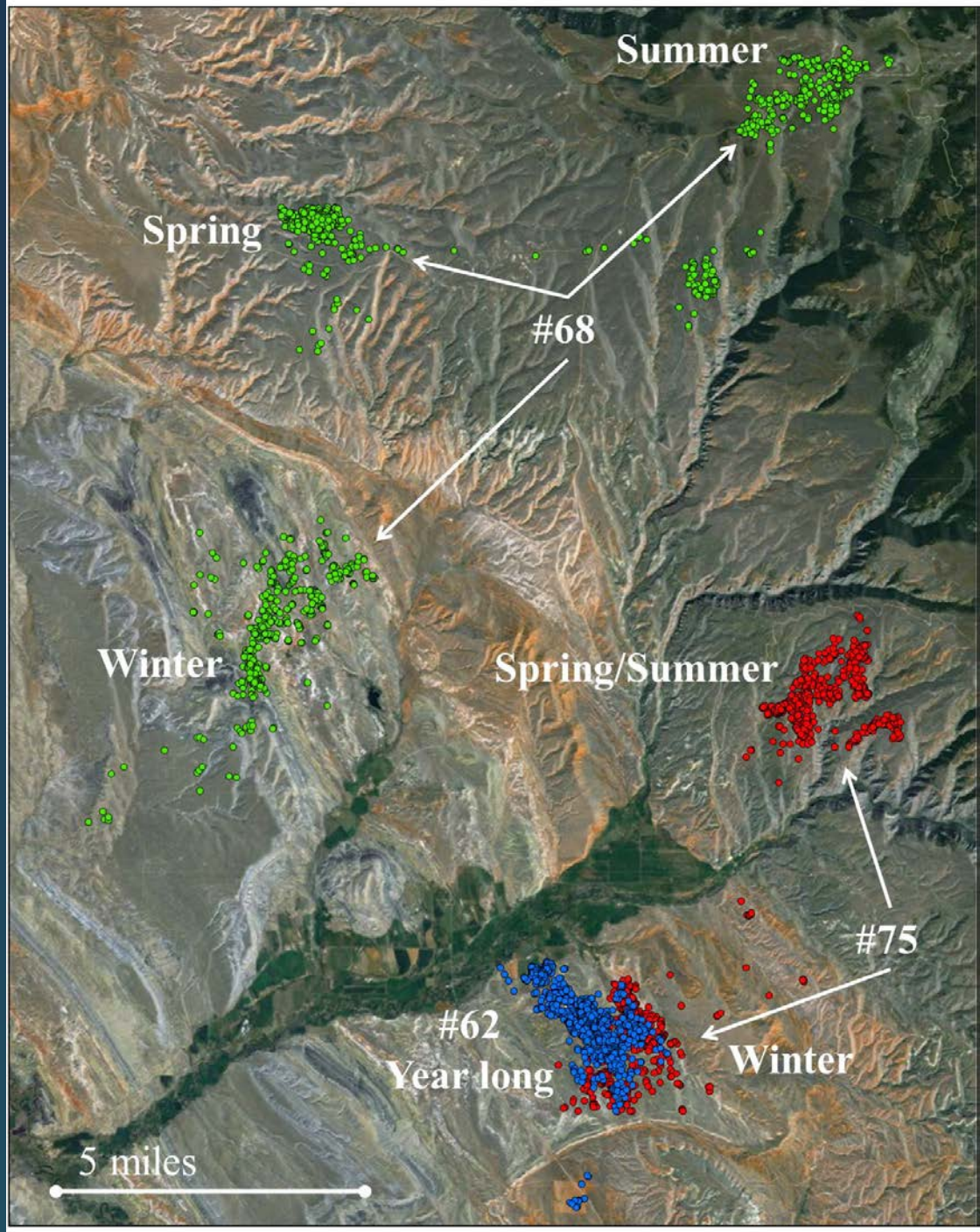
- Do broods select for areas with more forbs and/or insects?
- Do chicks select for more forbs or insects in their diet?
- Is there an optimal diet that maximizes chick growth?

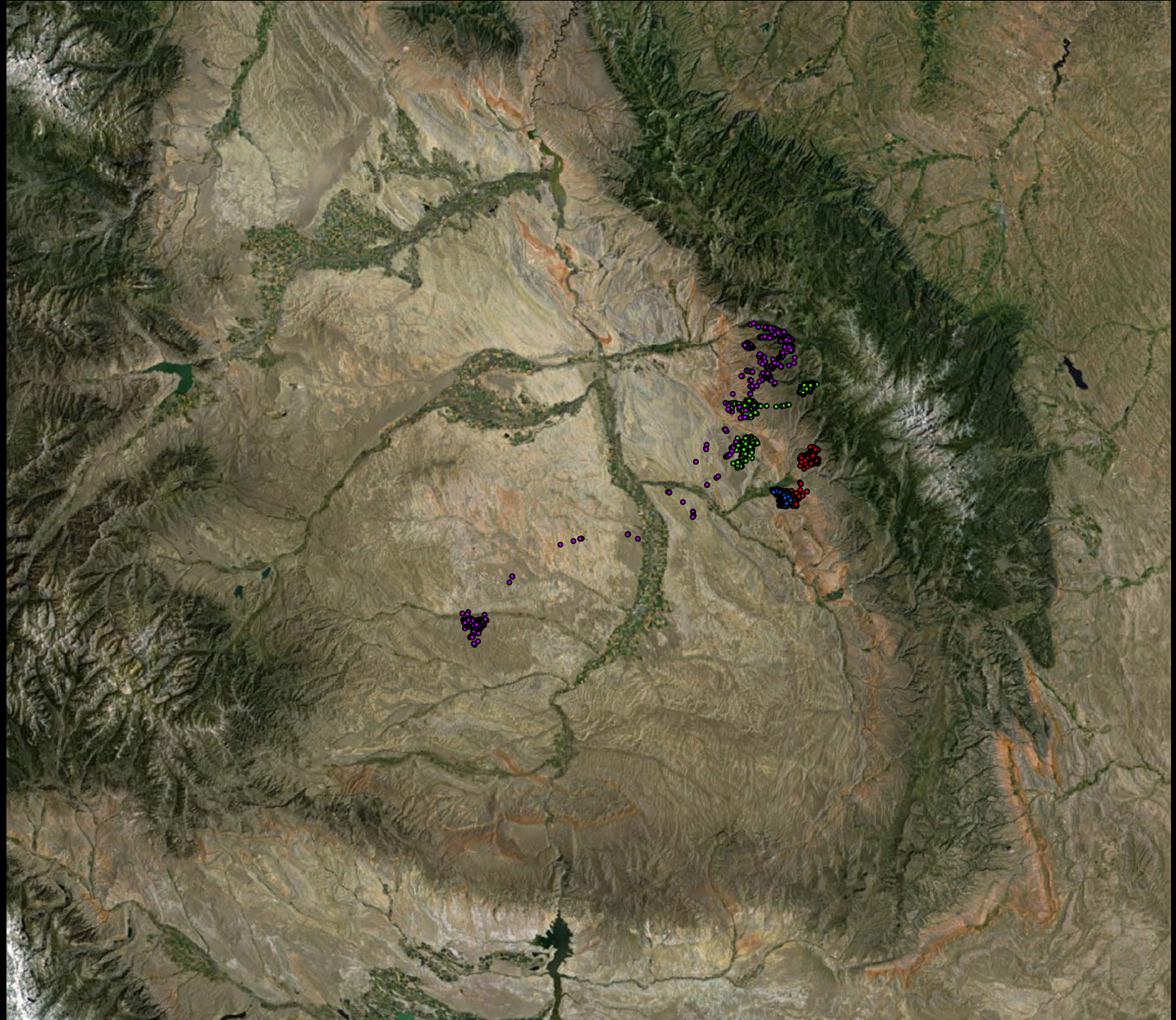
4. Migration ecology:

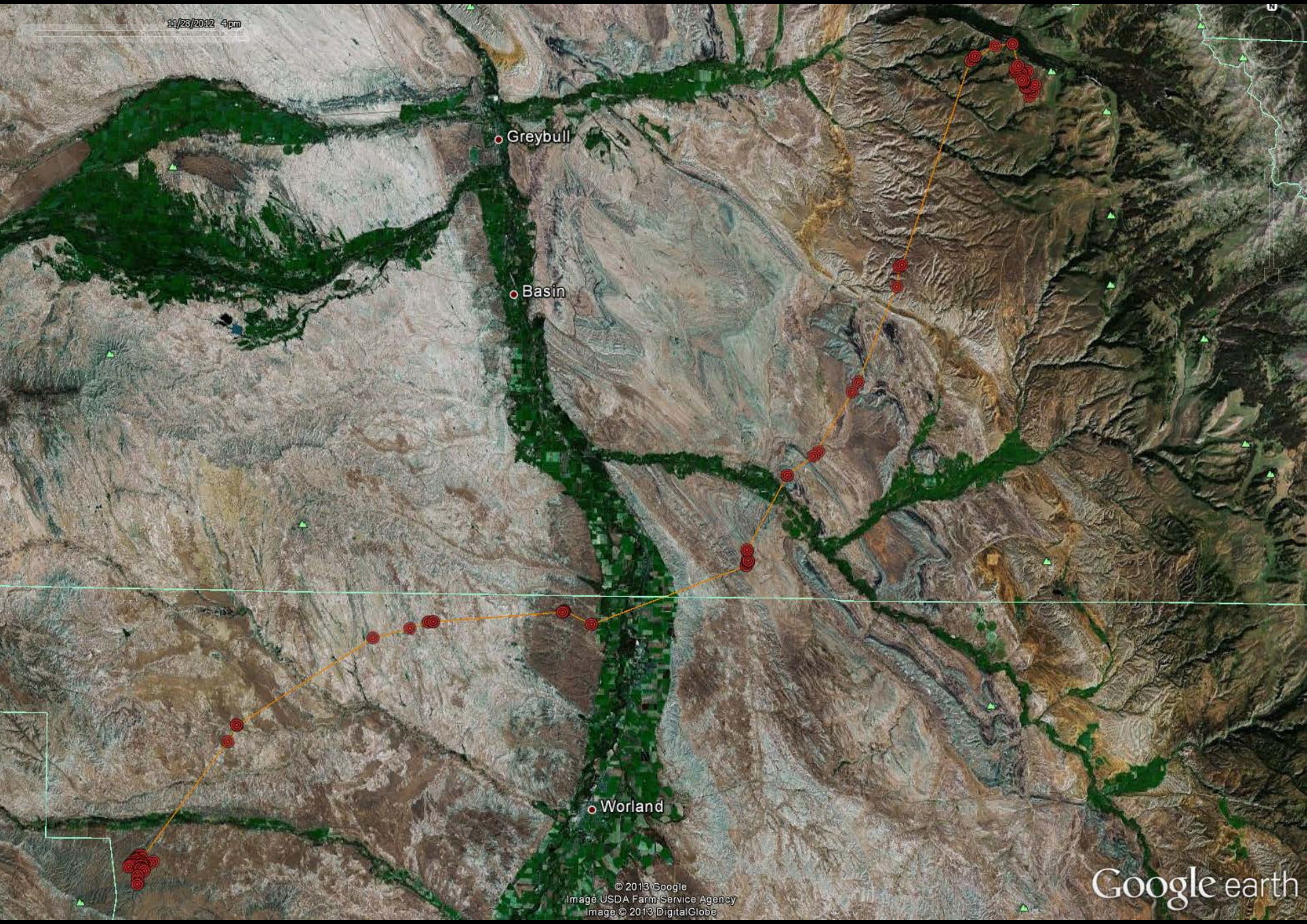
- Mostly GPS transmitters
  - 2011: males *n*=10, females *n*=10
  - 2012: males *n*=5, females *n*=20
  - 2013: females *n*=19
  - 4-6 locations per day (including 1 at night) depending on season

4. Migration ecology: Observations

- Variation in:
  - Sex
  - Distance
  - Duration
  - Timing
  - Destination
  - Number of unique seasonal ranges






11/28/2012 4 pm
Greybull
Basin
Worland
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Google earth

4. Migration ecology:
Future plans

- Model routes and habitat used
- Compare survival and reproductive success of hens relative to migration behavior
  - Stable isotope markers
    - Deuterium (^{2}H) – more abundant at lower elevations
    - Nitrogen-15 (^{15}N) – more abundant in fertilized cropland

Summary:

- Survival, nest success, and brood survival relative to bentonite mining
- Landscape habitat selection relative to bentonite mining
- Nesting and early brood-rearing microhabitat selection for guiding reclamation
- Describing migration ecology

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