Testing Wildlife-Friendly Modifications to Manage Wildlife and Livestock Movements

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Technical Panel Meeting: September 5, 2019

Presentation Outline

- Problem Statement
- Objective 1: Methods, Results, Inferences
- Objective 2: Methods, Results, Inferences
- Objective 3:
- Conclusions

Problem Statements

- Fences along roadways serve as safety measures to protect humans from vehicular collisions with wildlife and livestock and consequently, can act as semi-permeable or complete barriers to wildlife movement

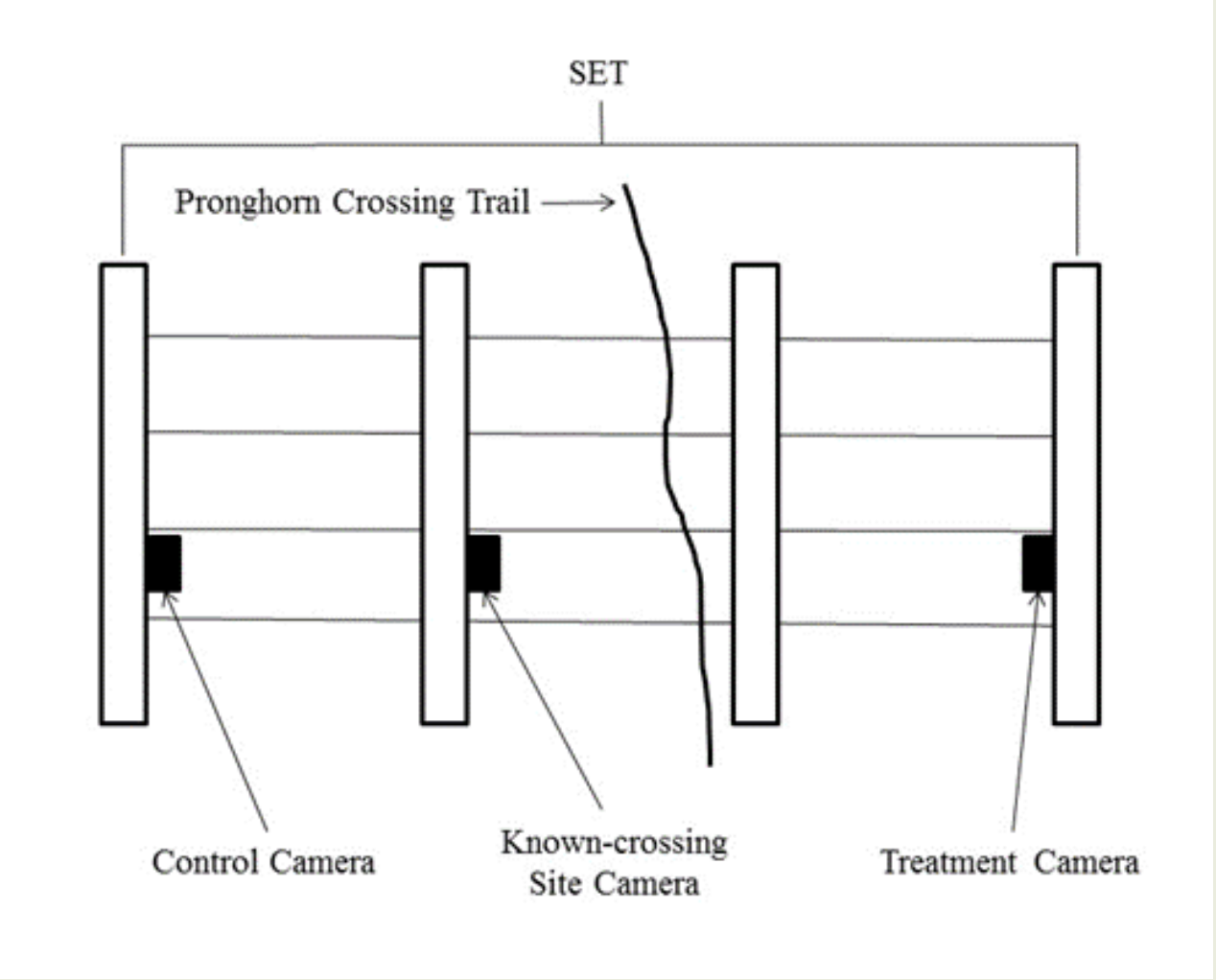
- There is not a clear understanding on the effects of fences on wildlife movements and large scale connectivity and in particular, a lack of approaches as where to mitigate wildlife-fence interactions to sustain connectivity across roads and highways.

Objective 1: Test various fence modifications to sustain wildlife movement and control livestock

- 1) *Evaluate effectiveness of various 'wildlife friendly' fence modifications that have previously been recommended by multiple management agencies to assess their effectiveness in allowing for continued wildlife movements while effectively controlling livestock*

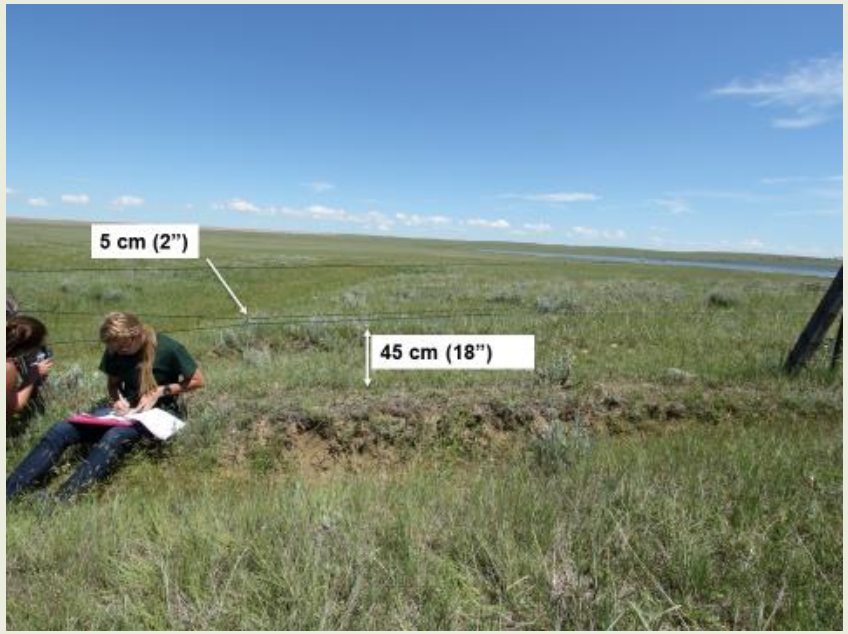
Objective 1 Methods: First Paper

- Use of Before-After-Control-Impact (BACI) experimental design to test the effectiveness of three fence modifications on pronghorn movement and assess minimum bottom wire height that sustain movements

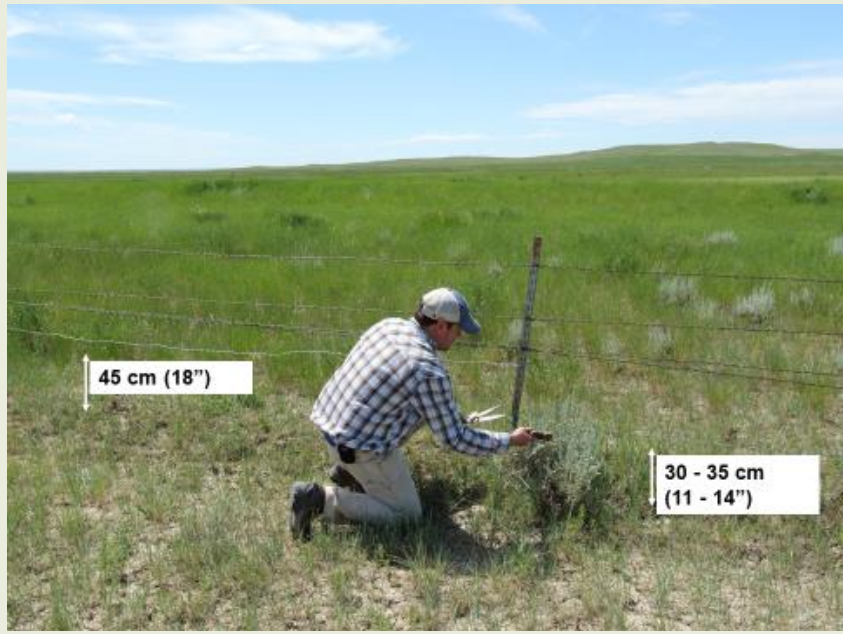


Objective 1 Methods: First Paper

Goat Bar

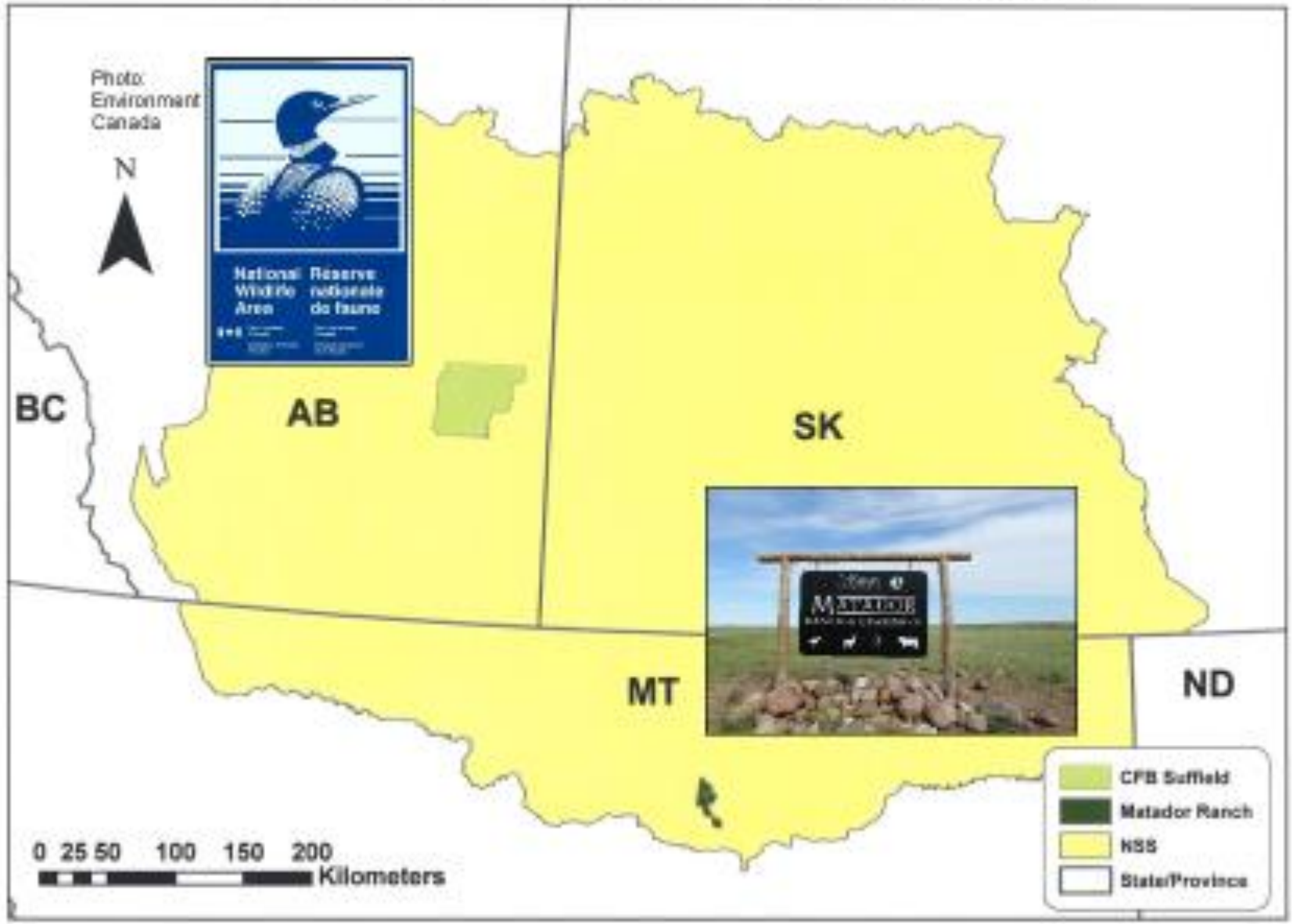


Carabiner

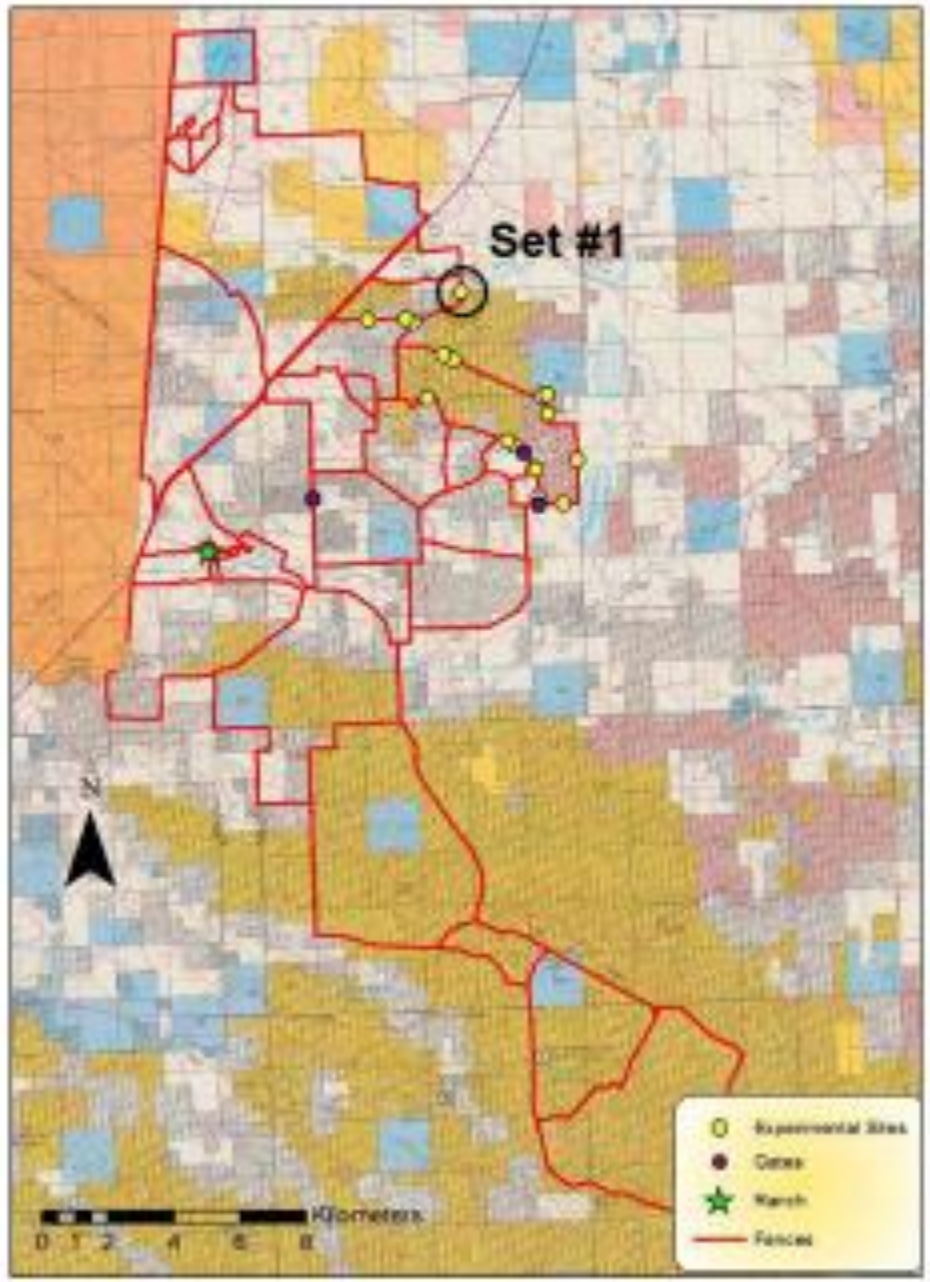


Smooth Wire

Study Areas within the Northern Sagebrush Steppe



Camera Locations- Matador



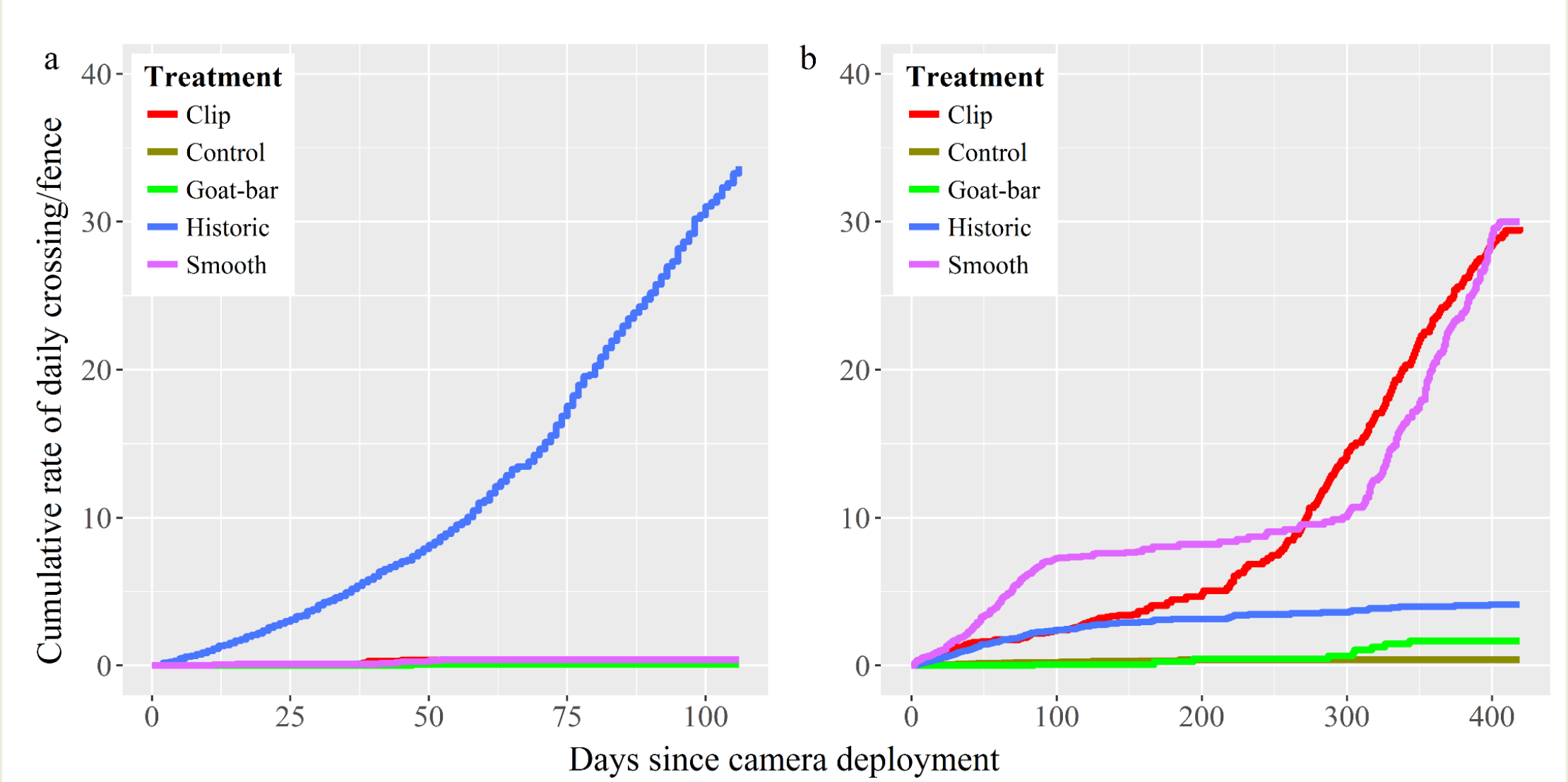
Set #1

Images, Images, Images!

Used standardized approach to record both wildlife and livestock behavior and interactions with fencing

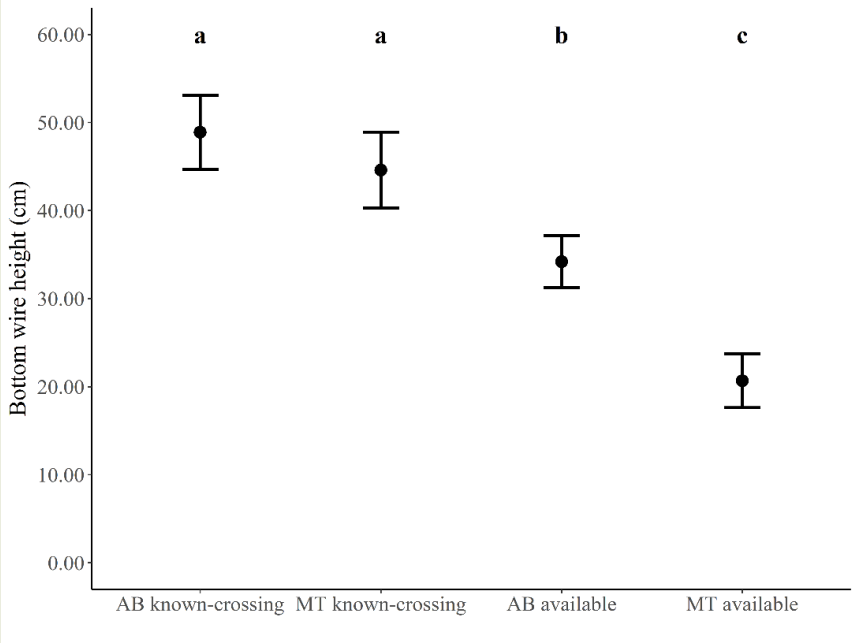
1.3 Million images processed in AB, 1.1 Million images processed in MT

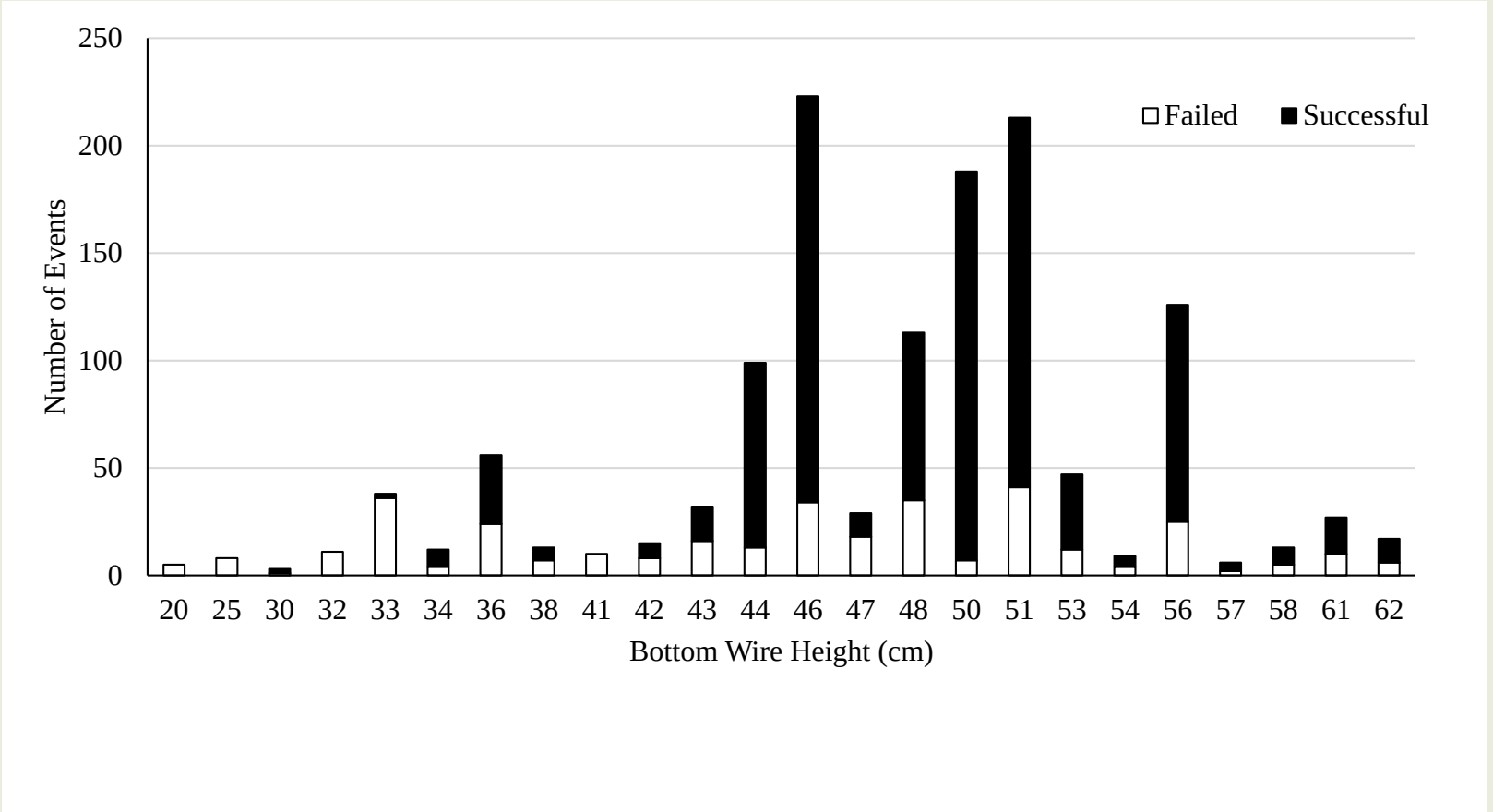
Objective 1 Results: First Paper



Objective 1 Results: First Paper

Assess bottom wire height on fence crossing selection



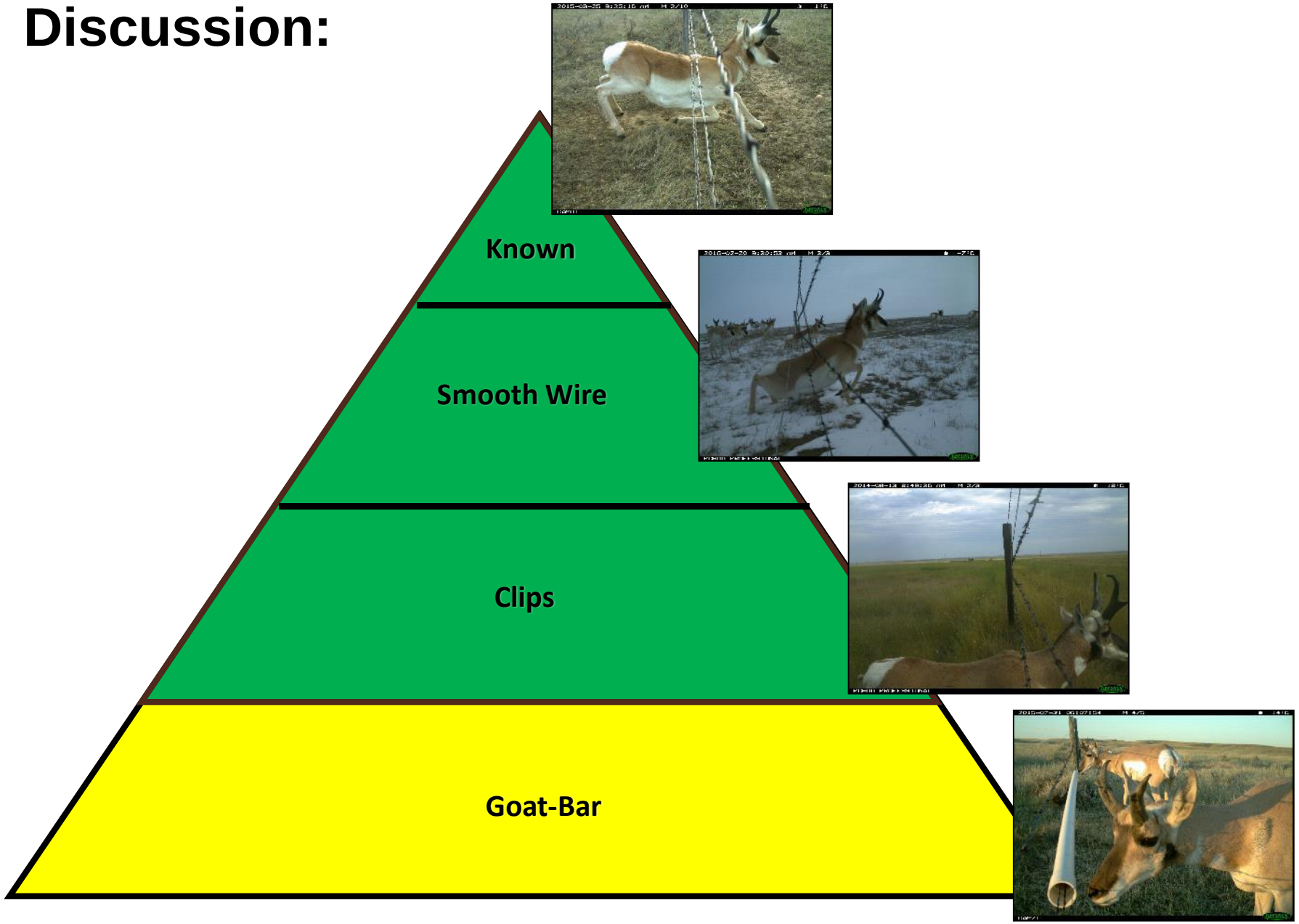


Before Period

Livestock Interactions

-Recorded livestock behaviors at fence panels in AB (Before only) and MT (Before and After)
-Although many failed ‘attempts’ were recorded, only 1 calf during the 2-year study crossed at a fence site (control, known-crossing, modification).
-Crossing was ‘through’ the fence at a goat-bar modification
-Observation: livestock spent an inordinate amount of time at goat-bar sites

Discussion:



Wildlife Society Bulletin; DOI: 10.1002/wsb.869

Wildlife Society Bulletin; DOI: 10.1002/wsb.898

Original Article

To Jump or Not to Jump: Mule Deer and White-Tailed Deer Fence Crossing Decisions

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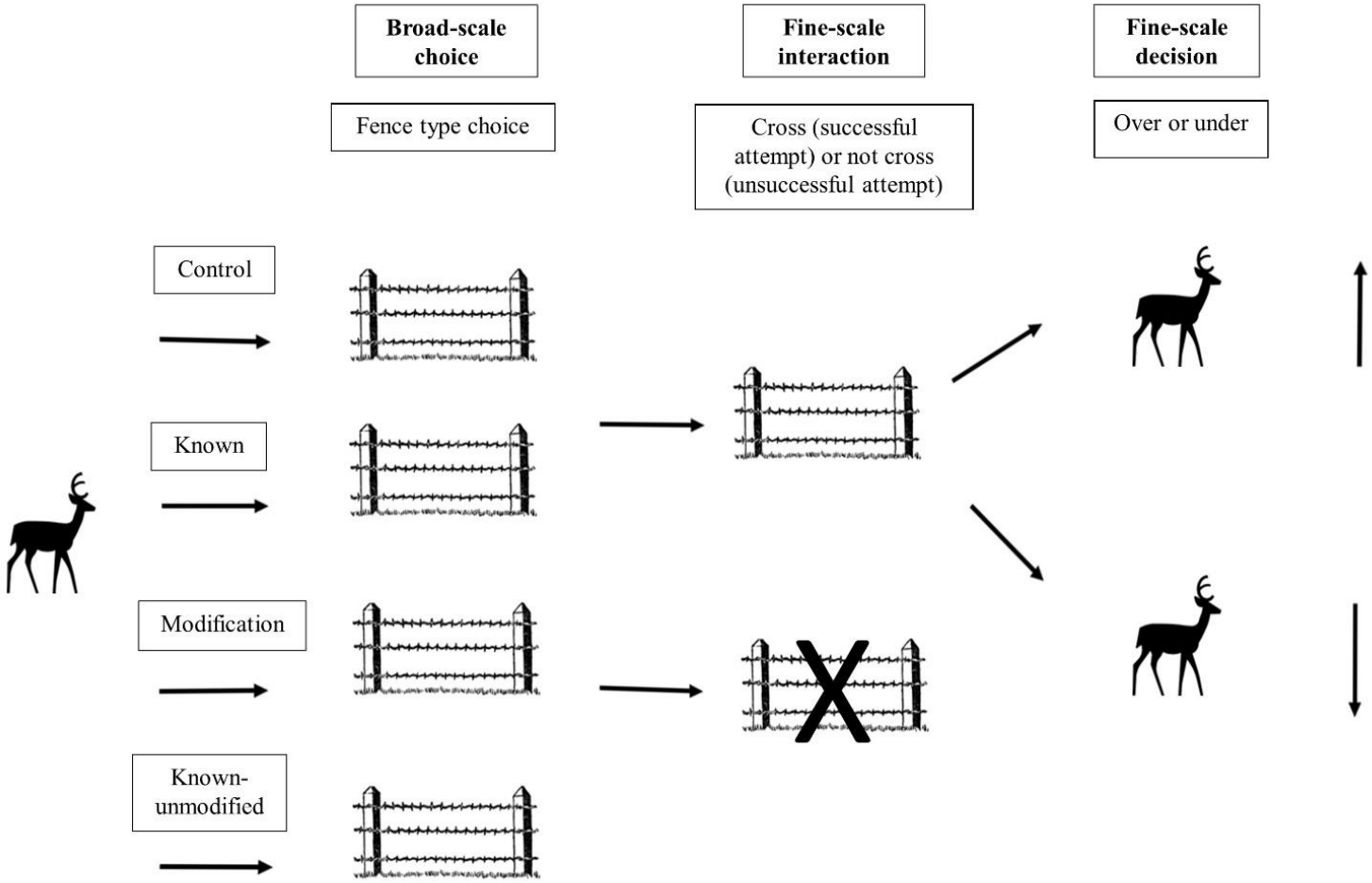
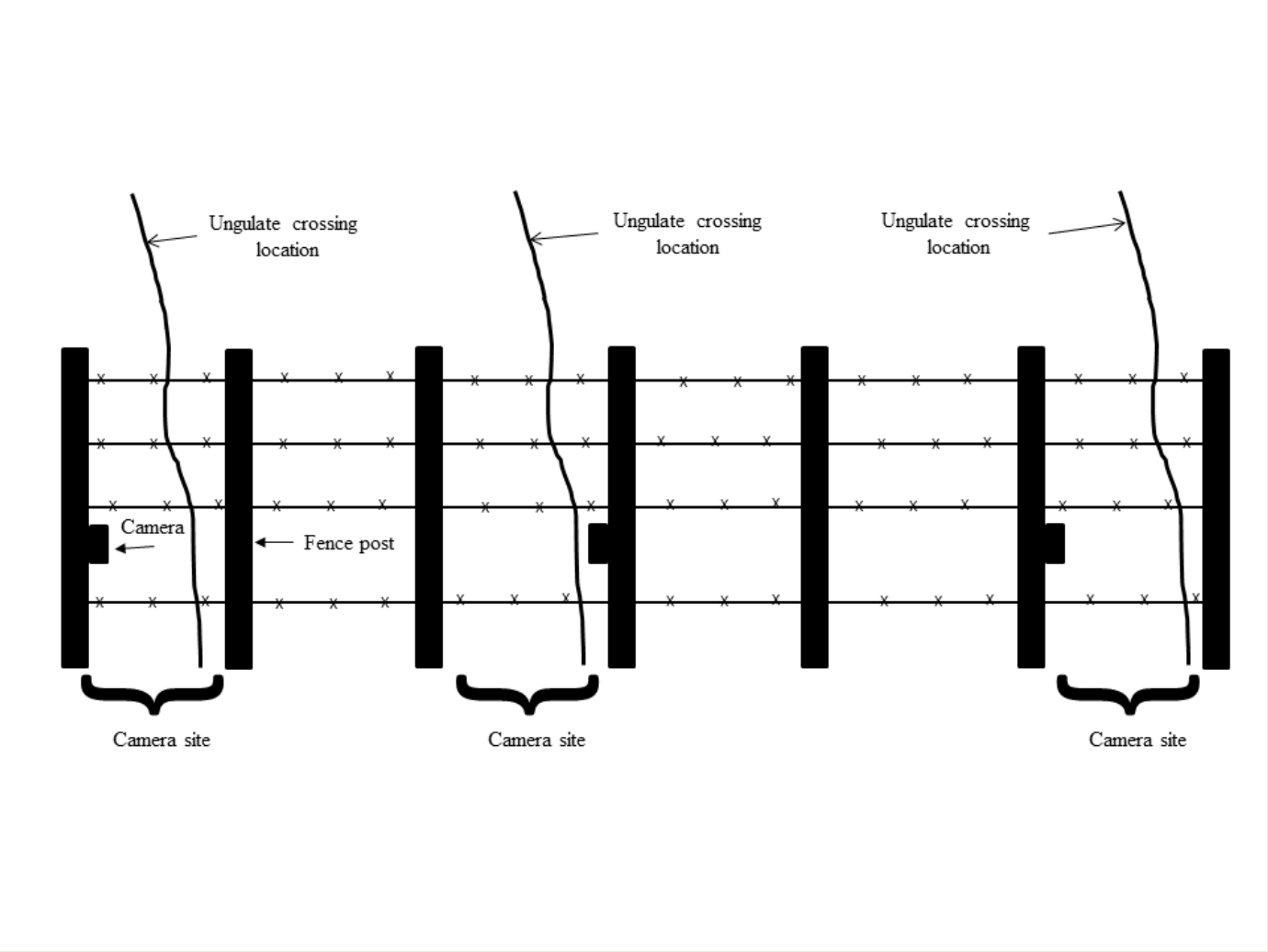
CHAD J. BISHOP, *Wildlife Biology Program, Department of Ecosystem and Conservation Sciences, W.A. Franke College of Forestry and Conservation, University of Montana, Missoula, 32 Campus Drive, Missoula, MT 59812, USA*

Multi-scale Fence Selection



Objective 1 Methods: Second Paper

- Use of Before-After-Control-Impact (BACI) experimental design to test the effectiveness of two additional fence modifications on ungulate movements



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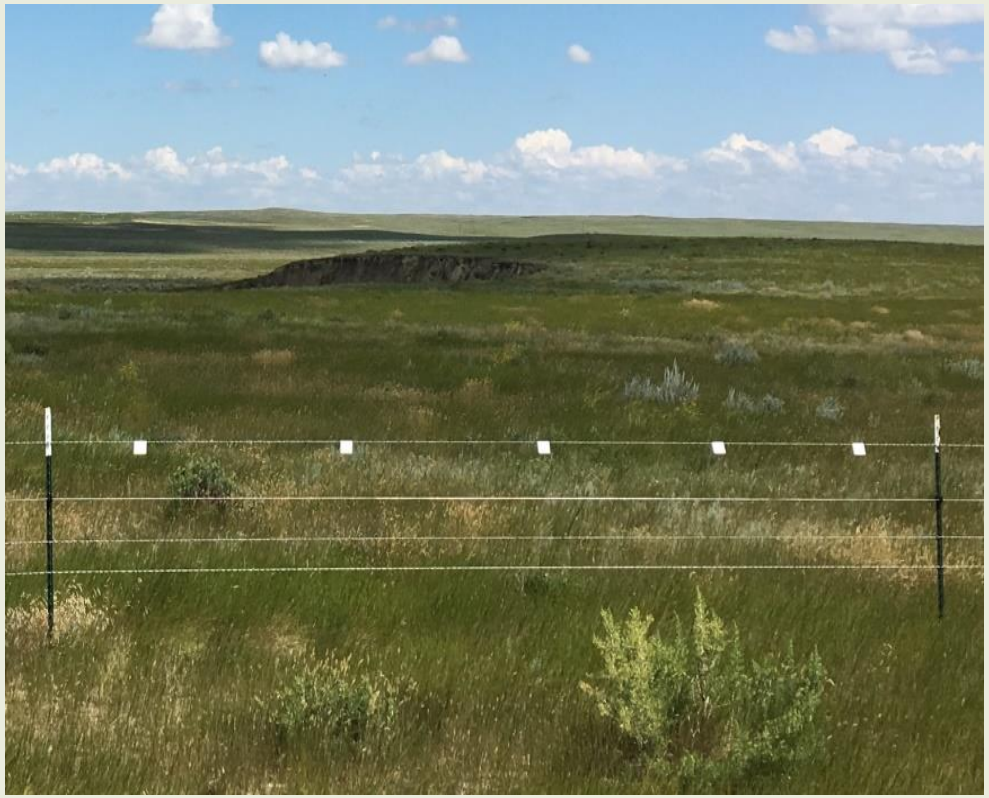
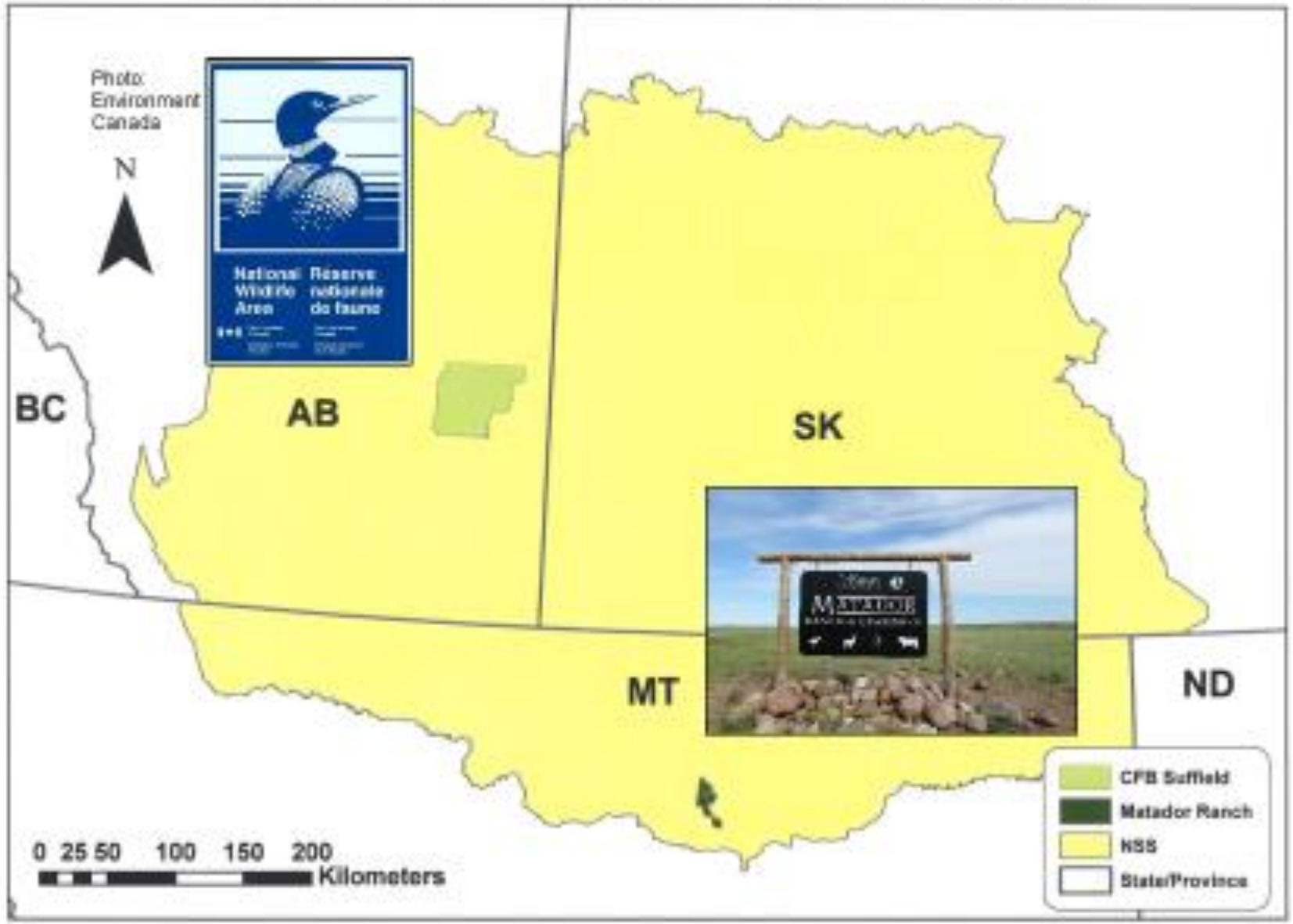
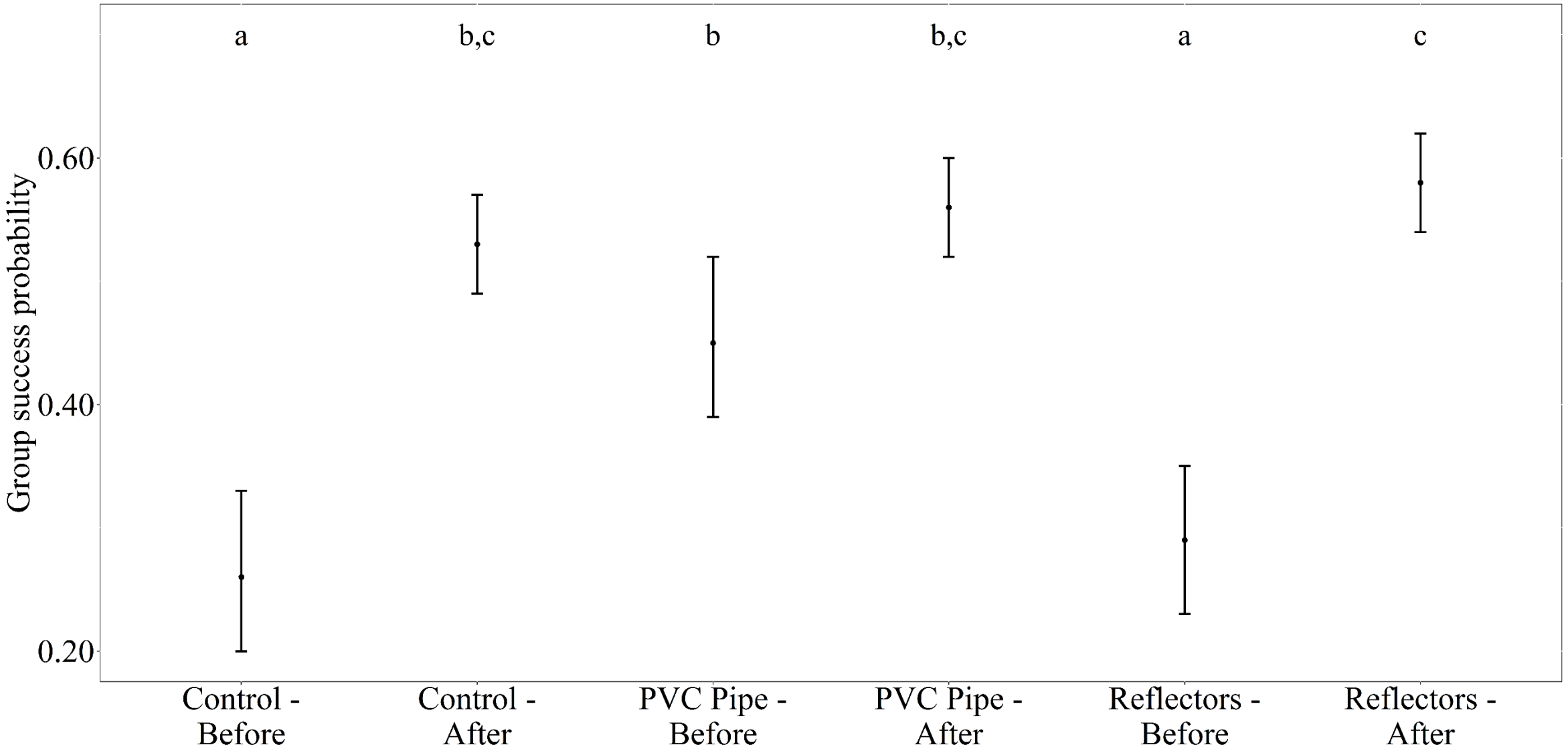


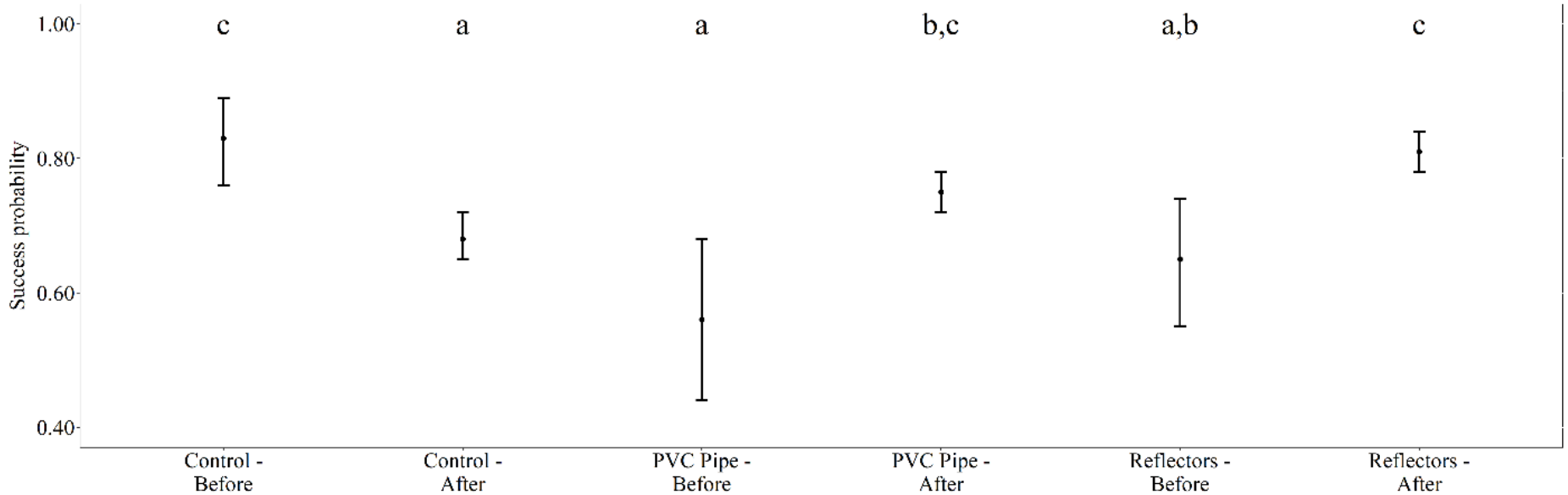
Study Areas within the Northern Sagebrush Steppe

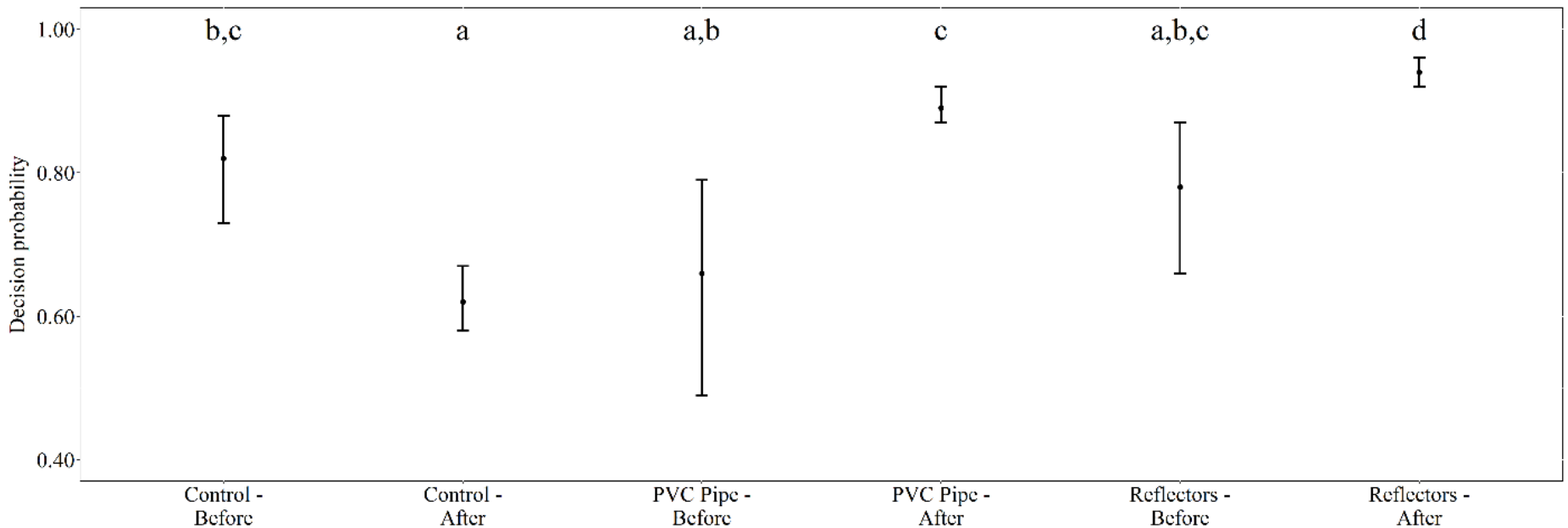


Pronghorn


a
b,c
b
b,c
a
c
0.60
0.40
0.20
Group success probability
Control - Before
Control - After
PVC Pipe - Before
PVC Pipe - After
Reflectors - Before
Reflectors - After

Mule Deer


c
a
a
b,c
a,b
c
1.00
0.80
0.60
0.40
Success probability
Control - Before
Control - After
PVC Pipe - Before
PVC Pipe - After
Reflectors - Before
Reflectors - After


b,c
a
a,b
c
a,b,c
d
1.00
0.80
0.60
0.40
Decision probability
Control - Before
Control - After
PVC Pipe - Before
PVC Pipe - After
Reflectors - Before
Reflectors - After

Objective 1 Inferences: Second Paper

- PVC pipe and Sage-grouse markers are not impacting the success of ungulate crossings.
- Modifications are creating a more visible fence and drawing animals in to then make fine scale selections and decisions. Decision results are not statistically significant but are biologically.
- Bottom wire height was in every model for every species.
- **Current field trials** include assessing electric fencing, PVC pipe and carabiner used to lower top wire – used to assess if deer species select to crawl under or jump over fencing.

Objective 2: Pronghorn habitat and fence density connectivity modeling

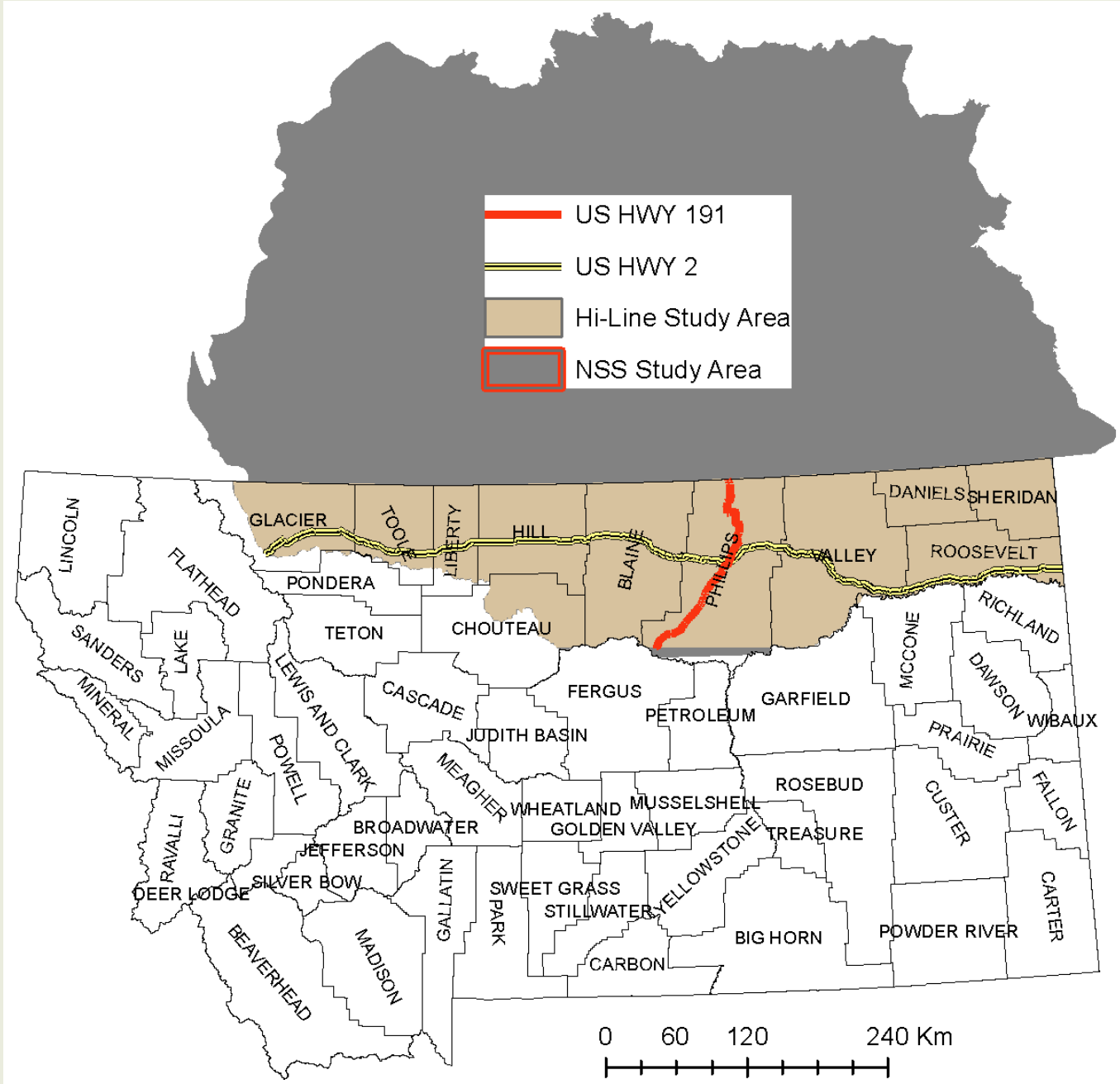
- 2) *Use the outputs of a previously developed and published fence density map and the results of the final evaluation of the effectiveness of various "wildlife friendly" fence modifications together, to guide MDT District Biologists and Right-of-Way Personnel in the application of effective "wildlife friendly" fences and other effective habitat connectivity measures on the landscape.*

Objective 2: Analytical Steps

1. Pronghorn movement modeling & study area
2. Fence density mapping
3. Road mortality data
4. Connectivity modeling

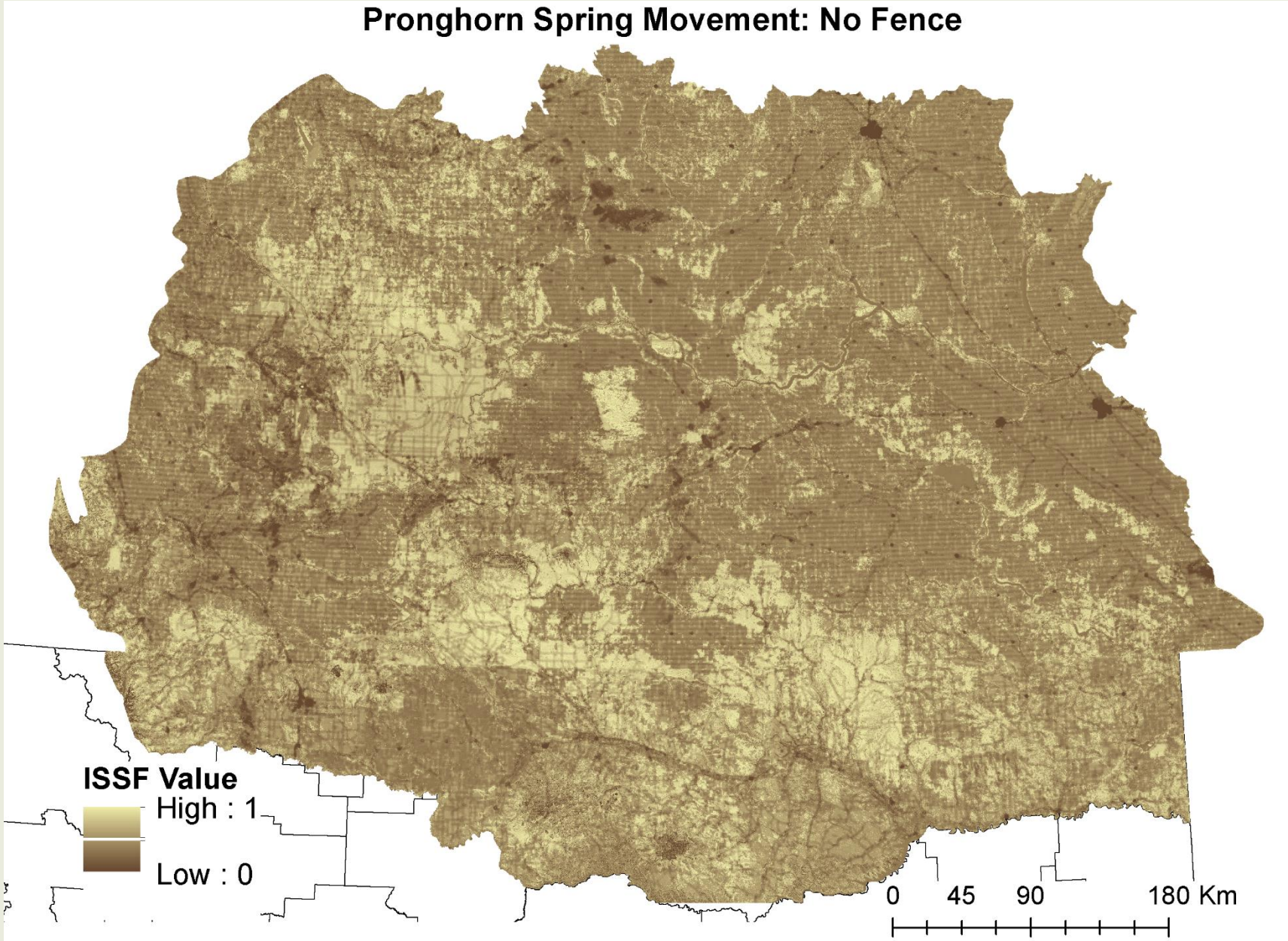
Step 1: Pronghorn movement modeling & study area

- Pronghorn movement modeling used for Northern Sagebrush Steppe (NSS) Study Area:
  - Jakes et al. 2015
  - Connectivity paths seeded in Canada, rather than restricting movement to MT Hi-Line.
- Analysis restricted to Hi-Line Study Area



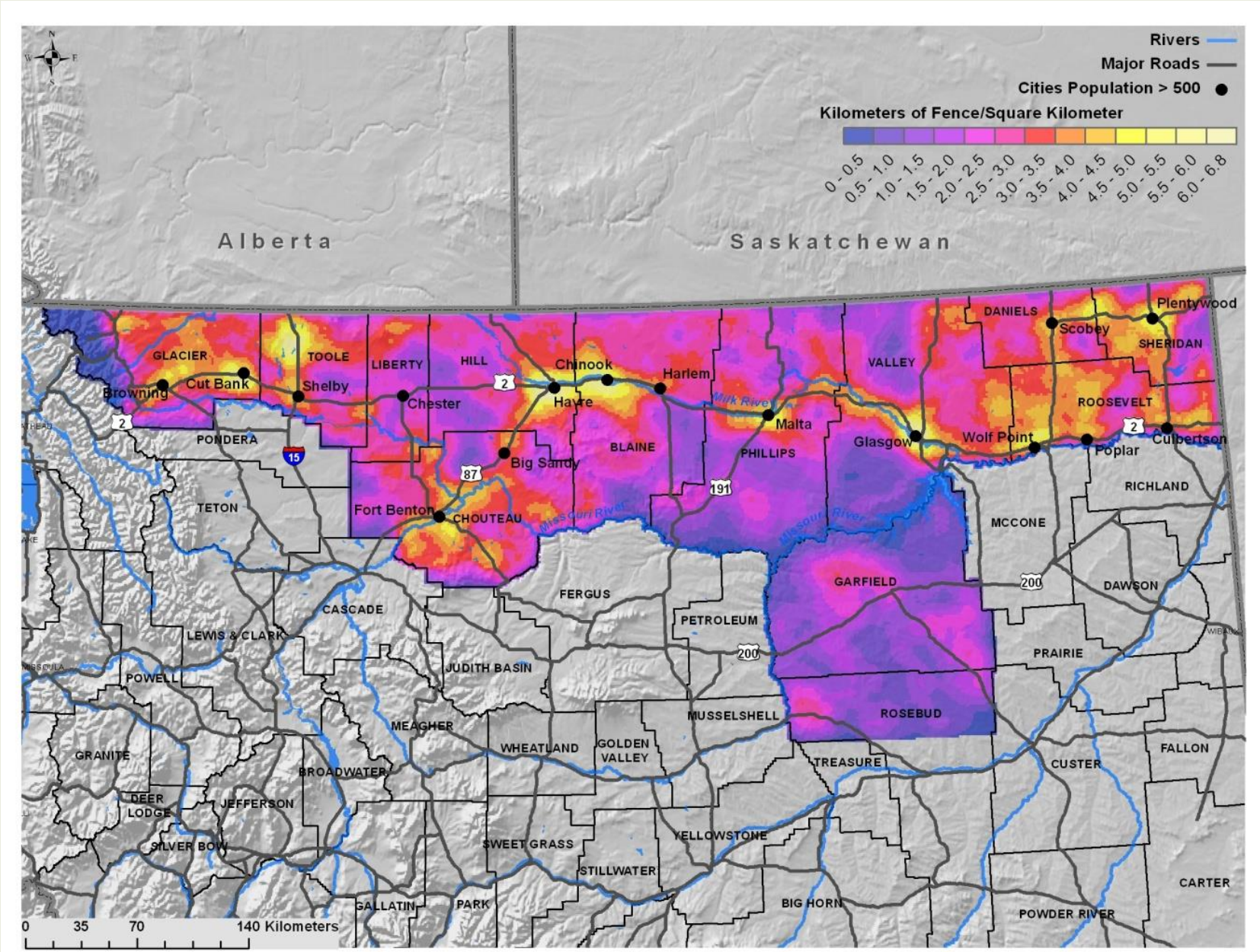
Step 1: Pronghorn movement modeling & study area

- Jakes et al. 2015 used environmental variables (slope, landcover, forage) and anthropogenic factors (gas well density and road density) to produce integrated step selection functions maps for:
  - SPRING (No fence)
  - FALL (No fence)
  - WINTER (No fence)



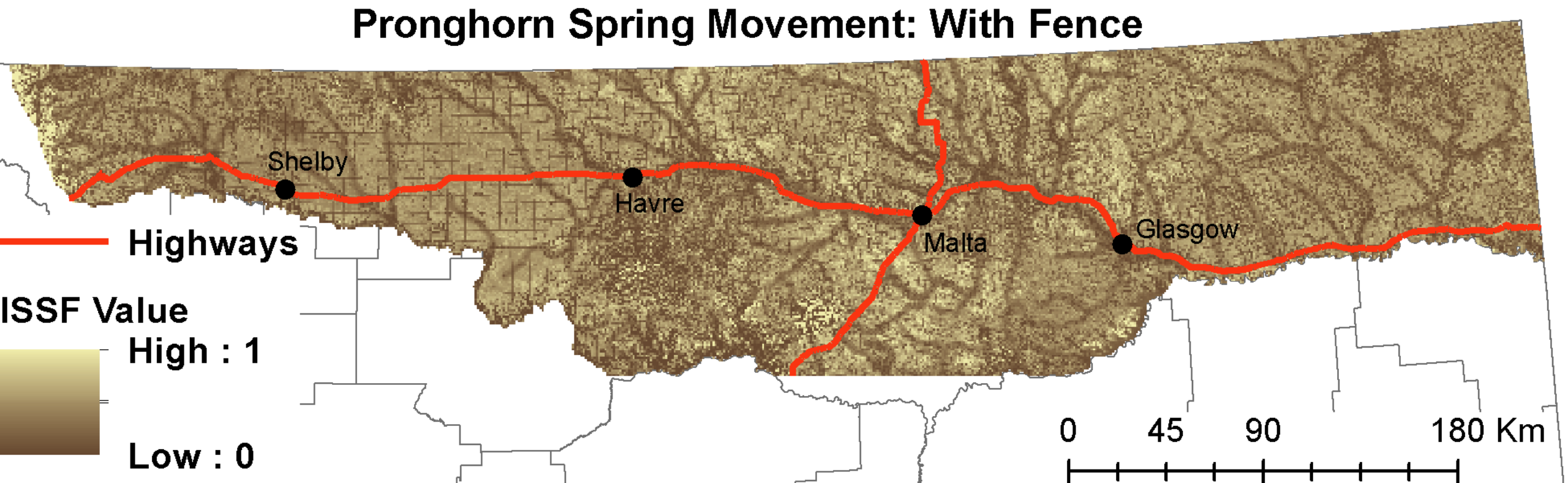
Step 2: Fence density mapping

- Fence density mapping created by Poor et al. 2014



Step 2: Fence density mapping

- This variable was integrated into the ISSF models to produce seasonal pronghorn movement maps with fence effects for:
  - SPRING (With fence)
  - FALL (With fence)
  - WINTER (With fence)



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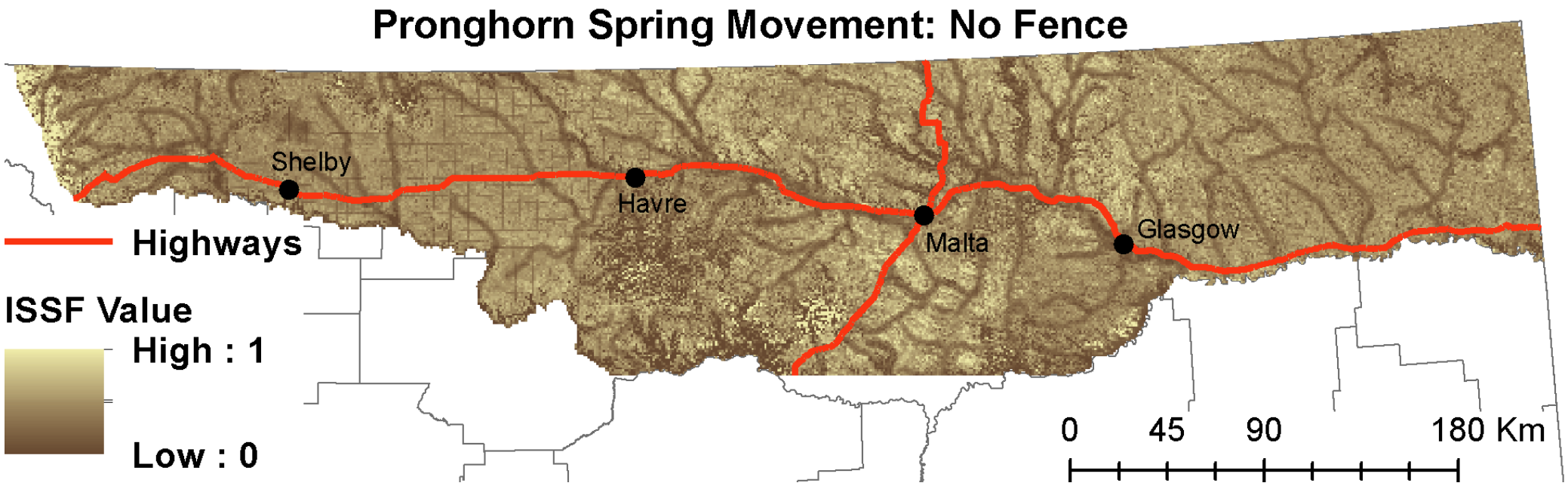
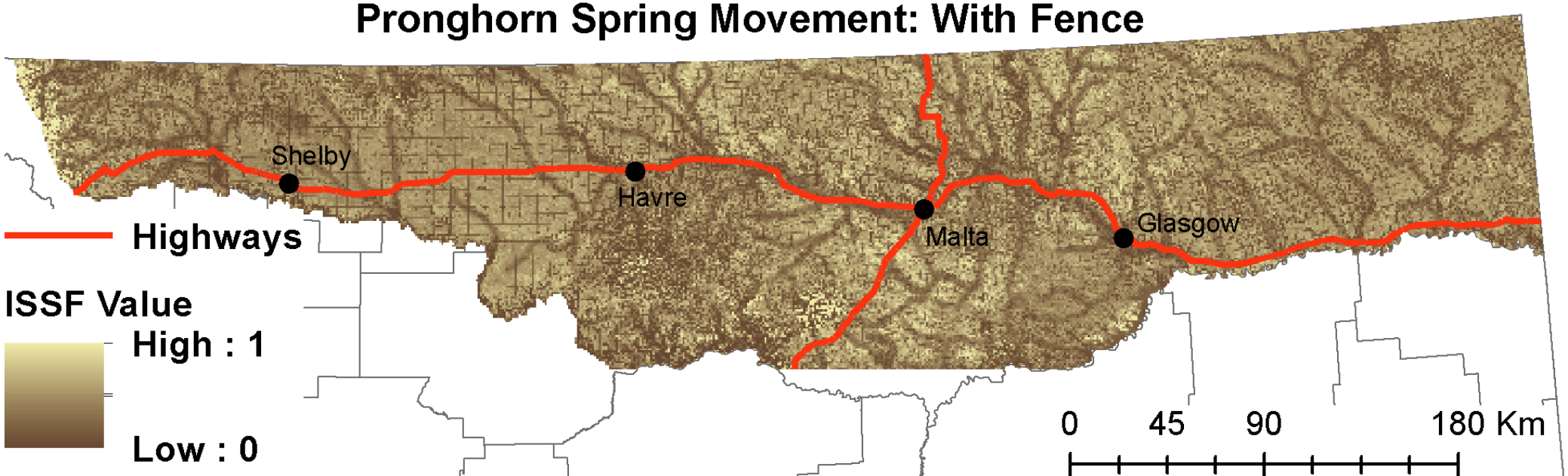


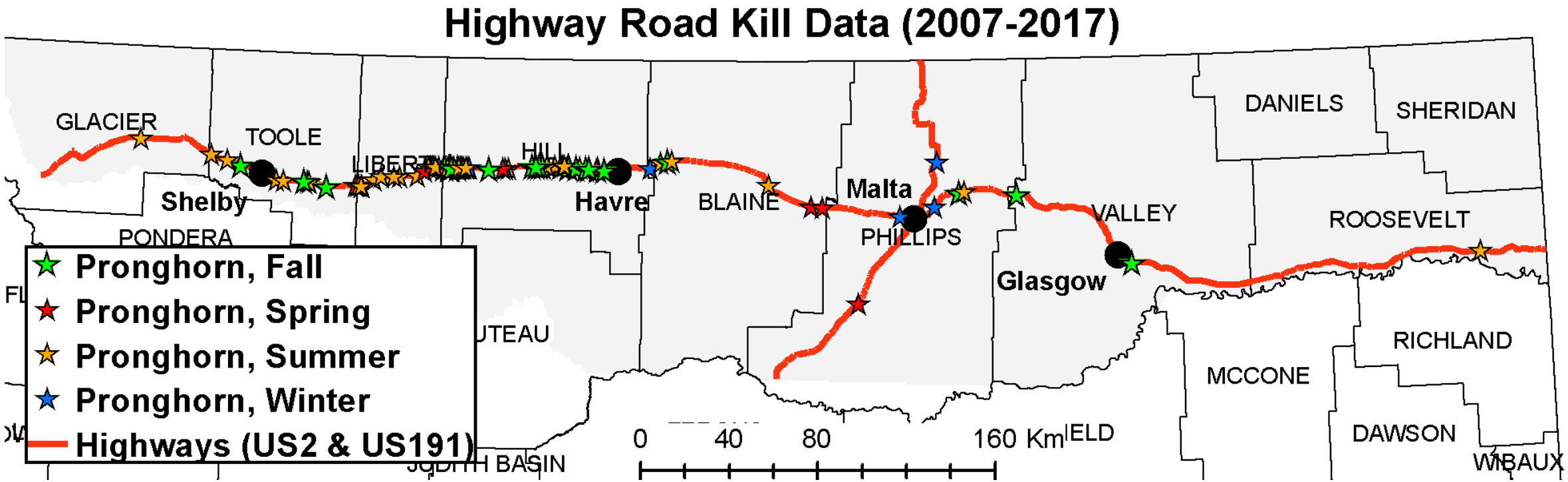


Step 3: Road mortality data Summary

- HWY data from MDT
  - Maintenance road kill data
  - Animal Vehicle Collision MHP data
  - 1/1/2007 – 12/31/2017
  - US Highway 2: M.P. 210.3 (west end) to M.P. 668 (east end, which is the ND State Line) - 457.7-miles total
  - US Highway 191: M.P. 0.0 (the U.S. 2/U.S. 191 Intersection at Malta) to M.P. 55 (the U.S./Canada Border at the Port of Morgan) - 55-miles
  - US Highway 191: M.P. 88.1 (the north end of the Fred Robinson Bridge) to M.P. 158 (the U.S. 191/U.S. 2 Intersection at Malta) - 69.9-miles

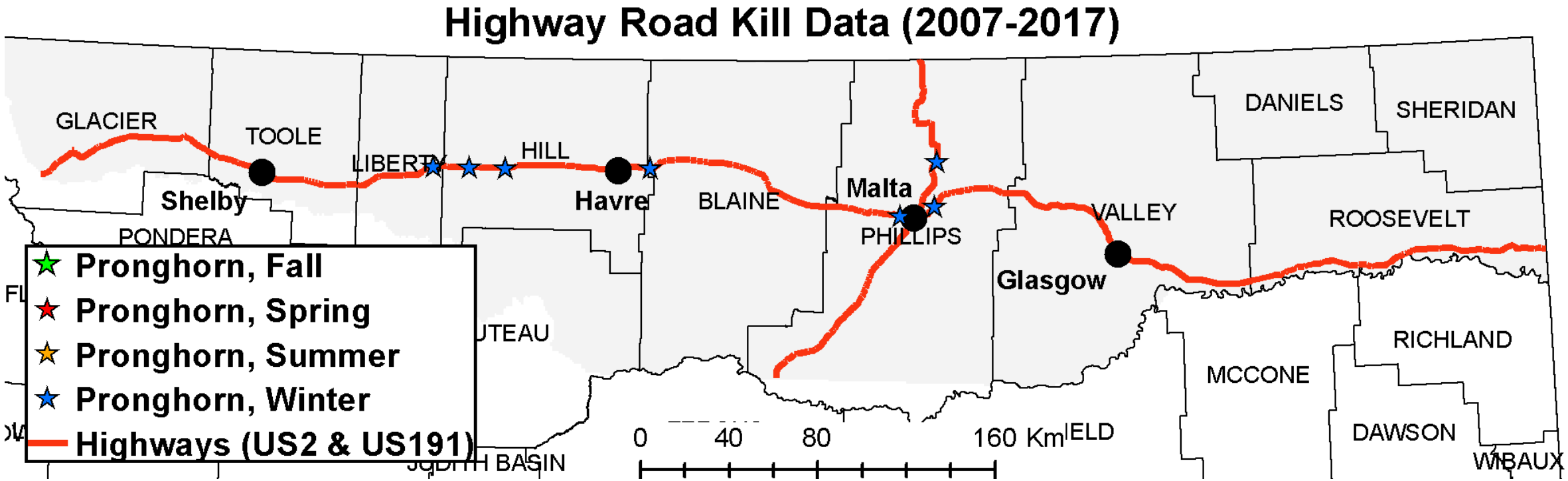
➢Only road kill data used

Step 3: Road mortality data Summary



Pronghorn, Fall = 33 Total
Pronghorn, Spring = 14 Total
Pronghorn, Summer = 57 Total
Pronghorn, Winter = 13 Total
Pronghorn, Total = 117 Total

Step 3: Road mortality data Summary



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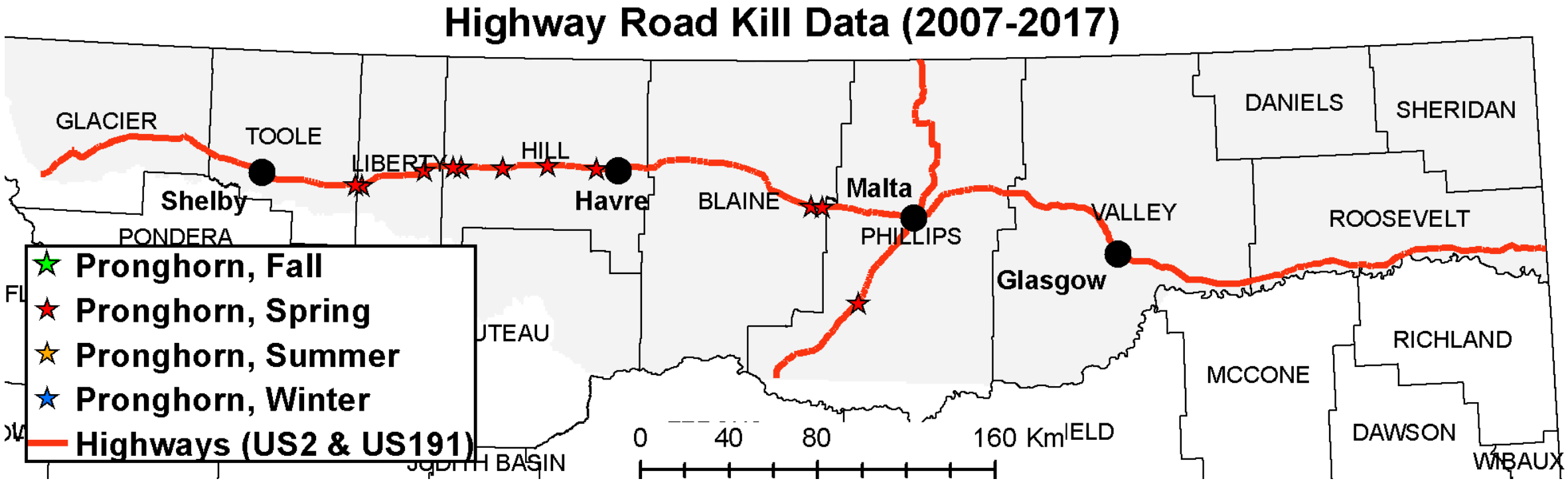

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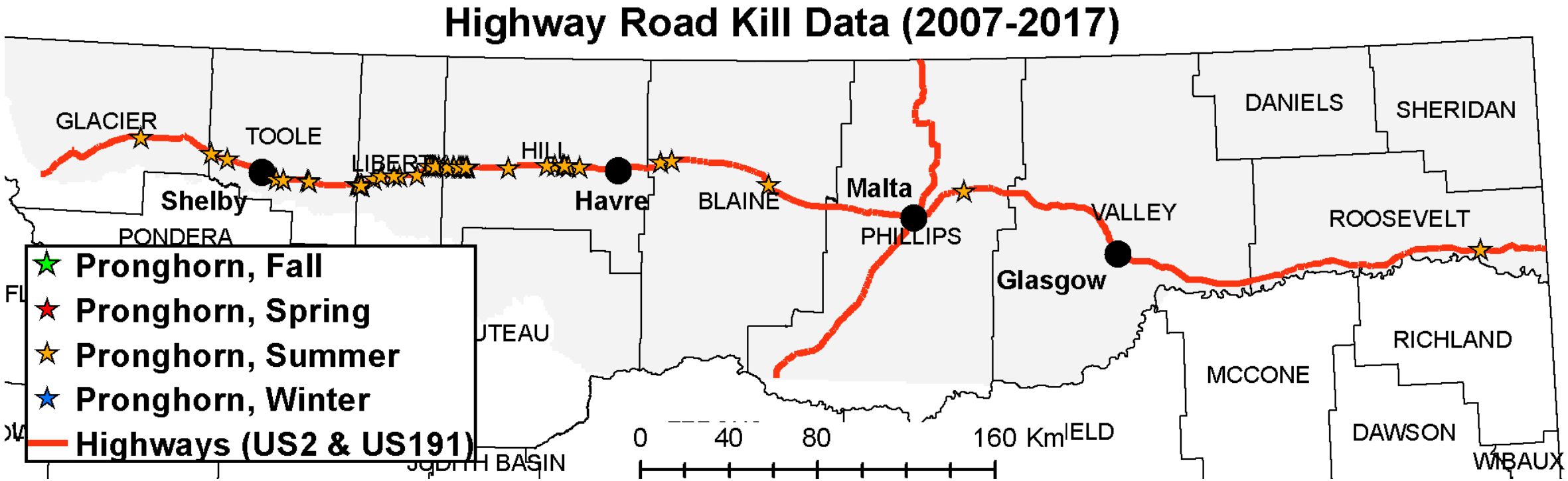

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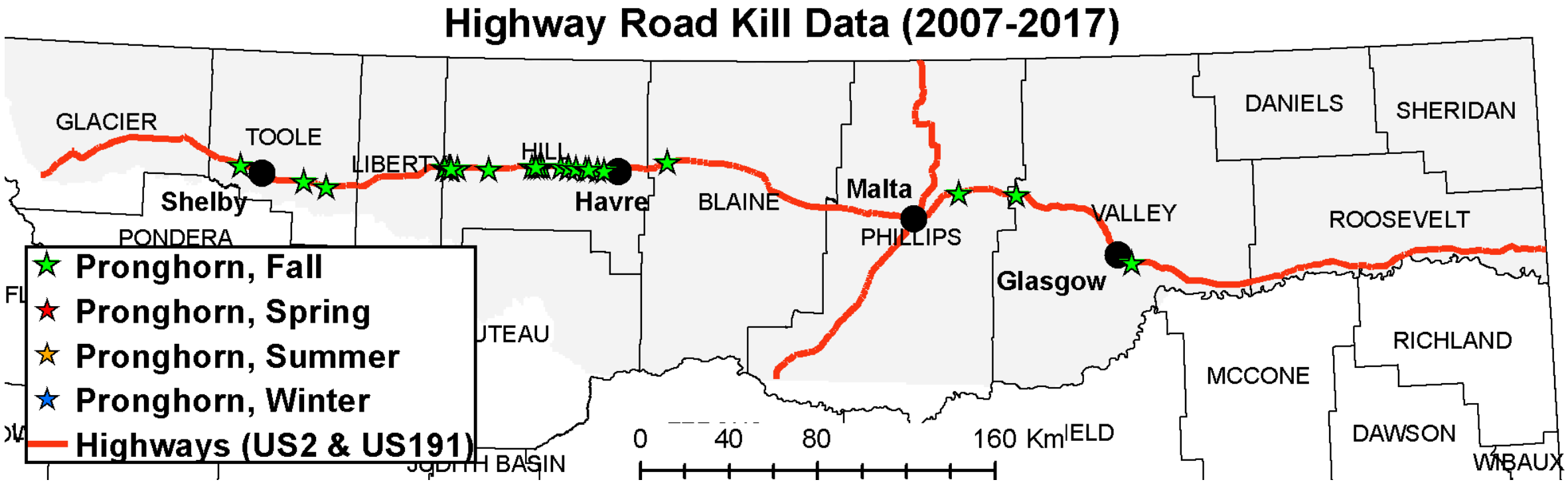

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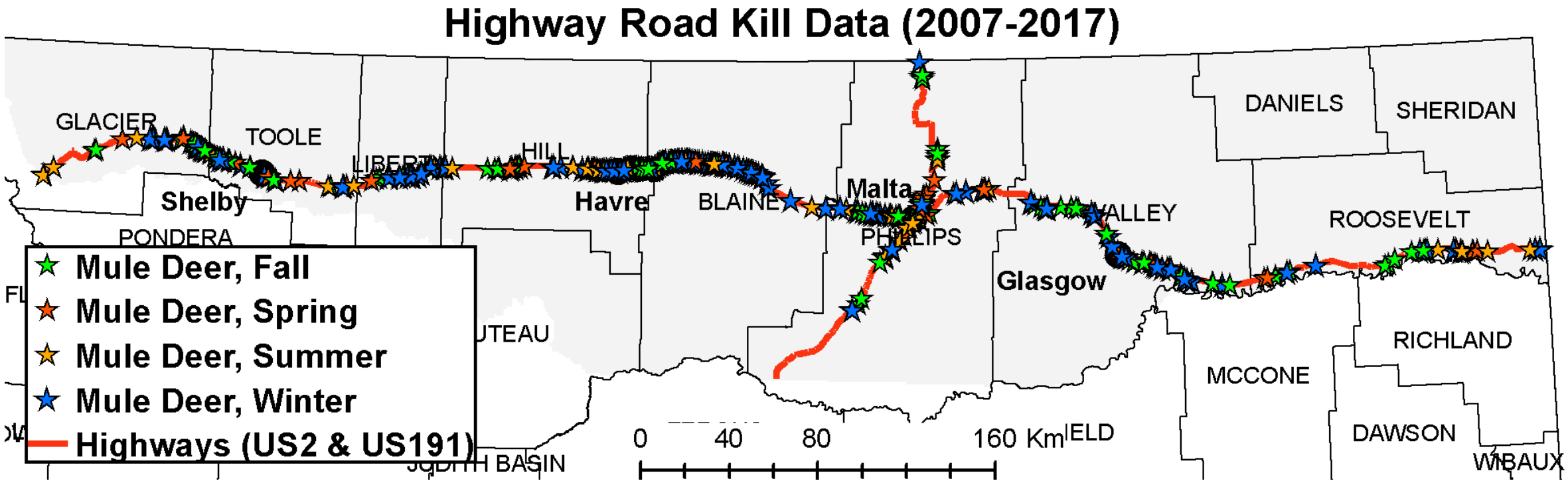
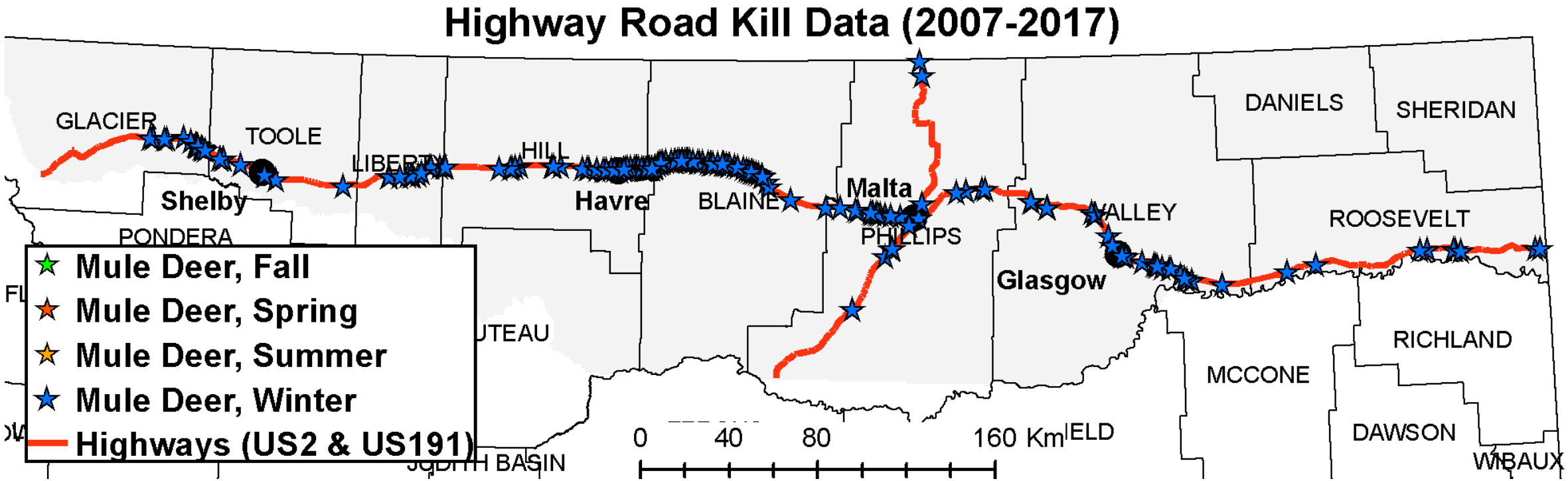


Mule Deer, Fall = 230 Total
Mule Deer, Spring = 149 Total
Mule Deer, Summer = 105 Total
Mule Deer, Winter = 348 Total
Mule Deer, Total = 832 Total

Step 3: Road mortality data Summary



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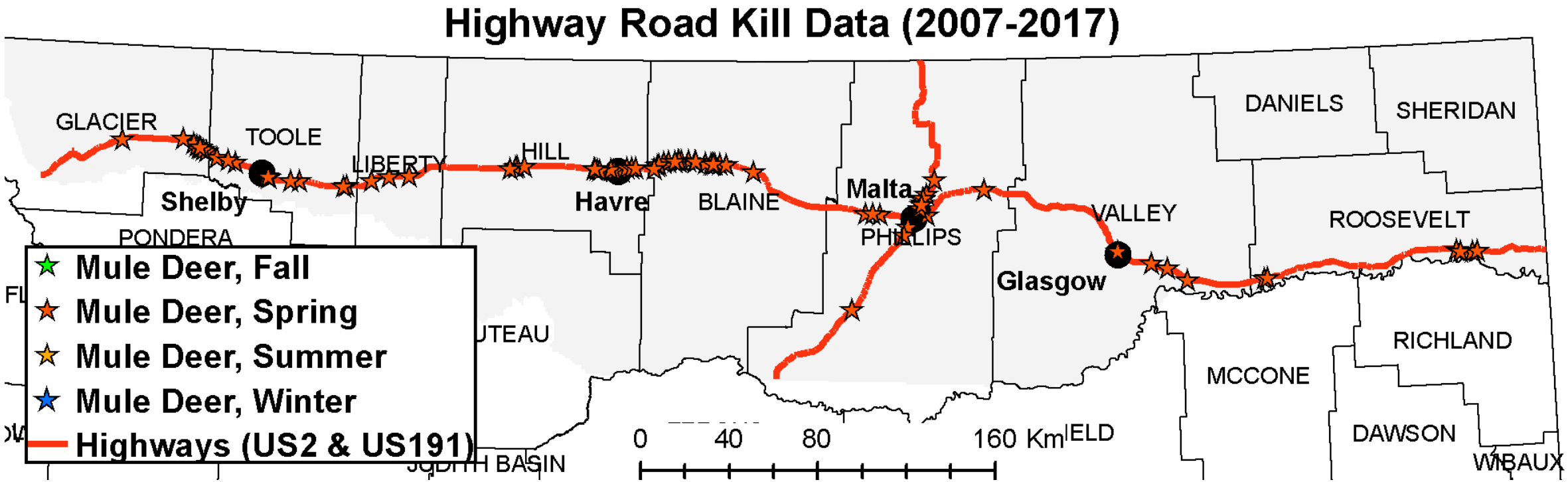

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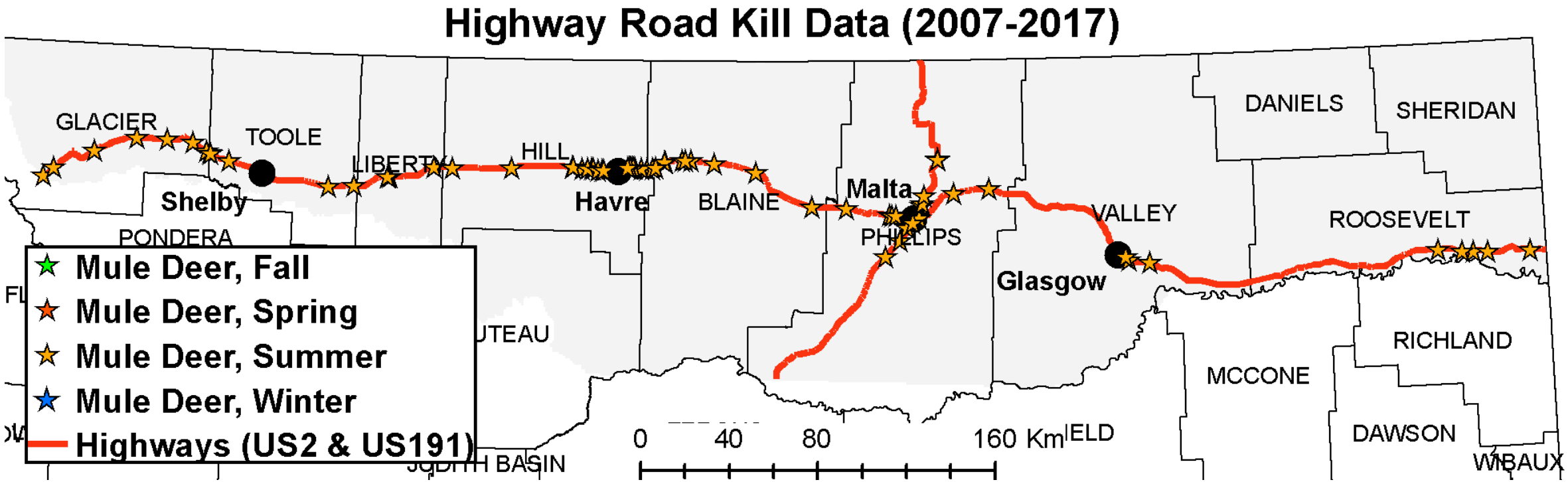

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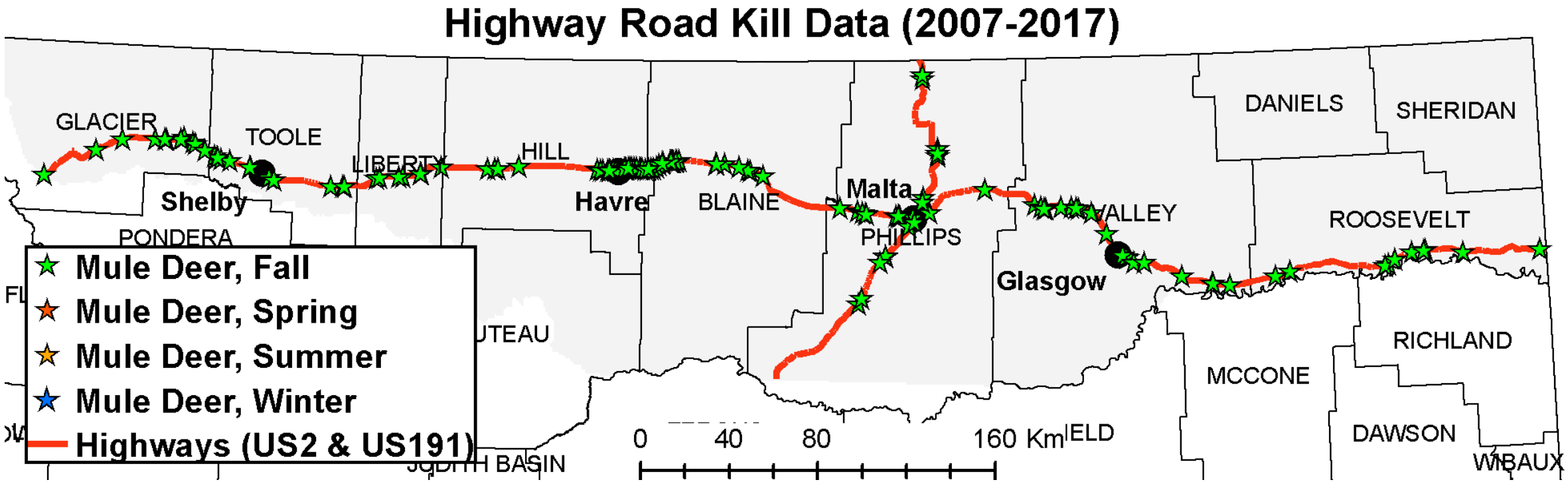

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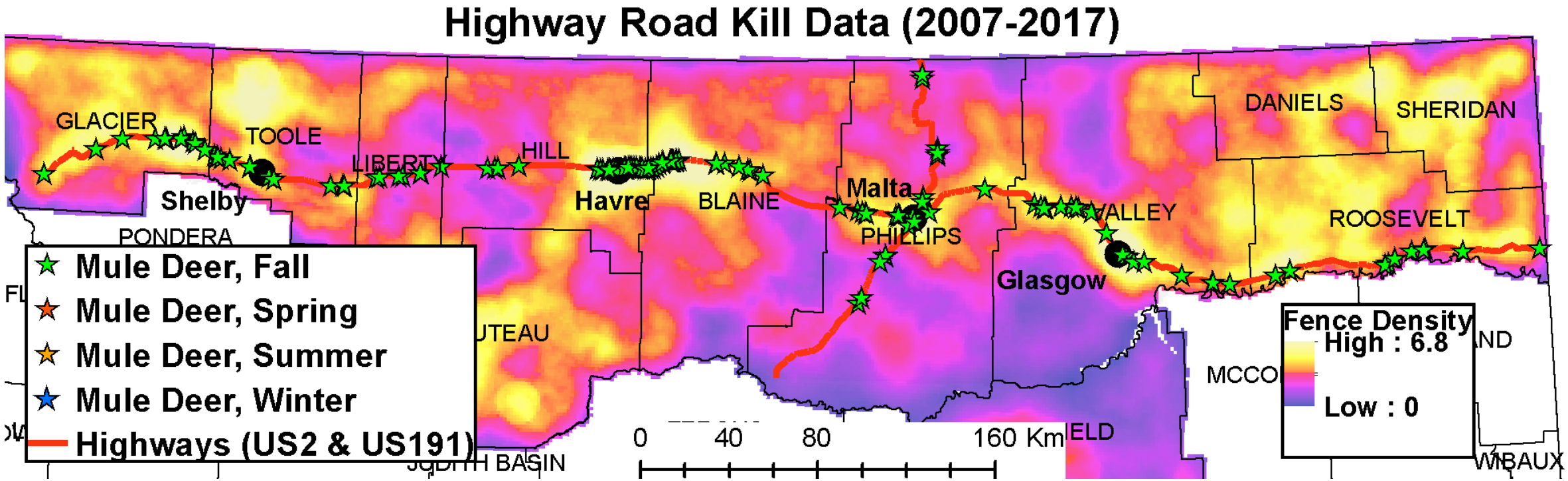

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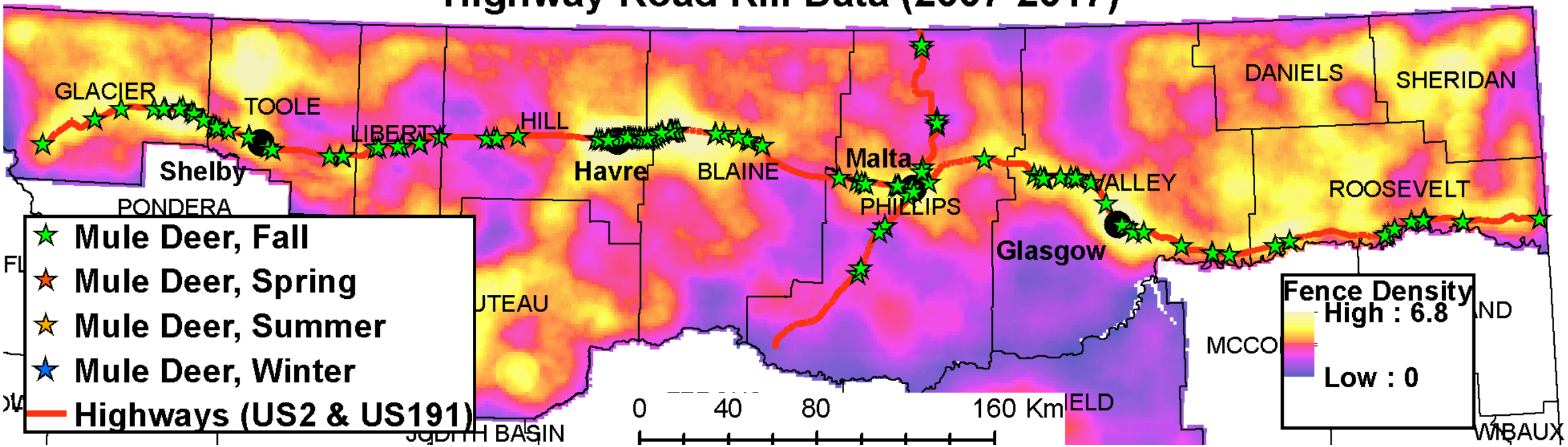
Highway Road Kill Data (2007-2017)



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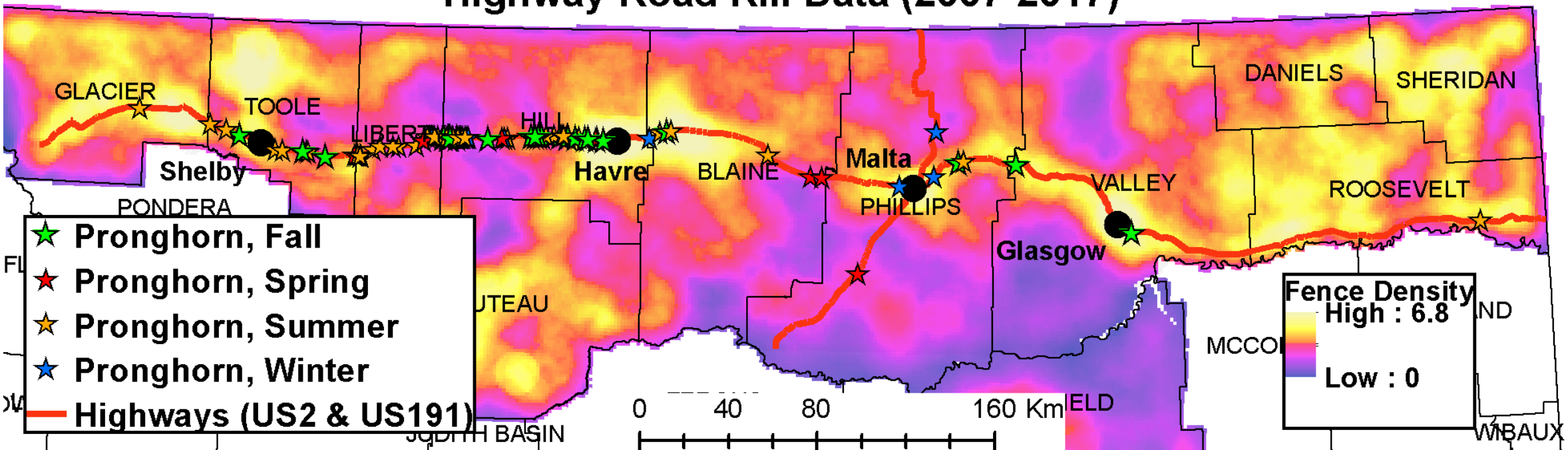
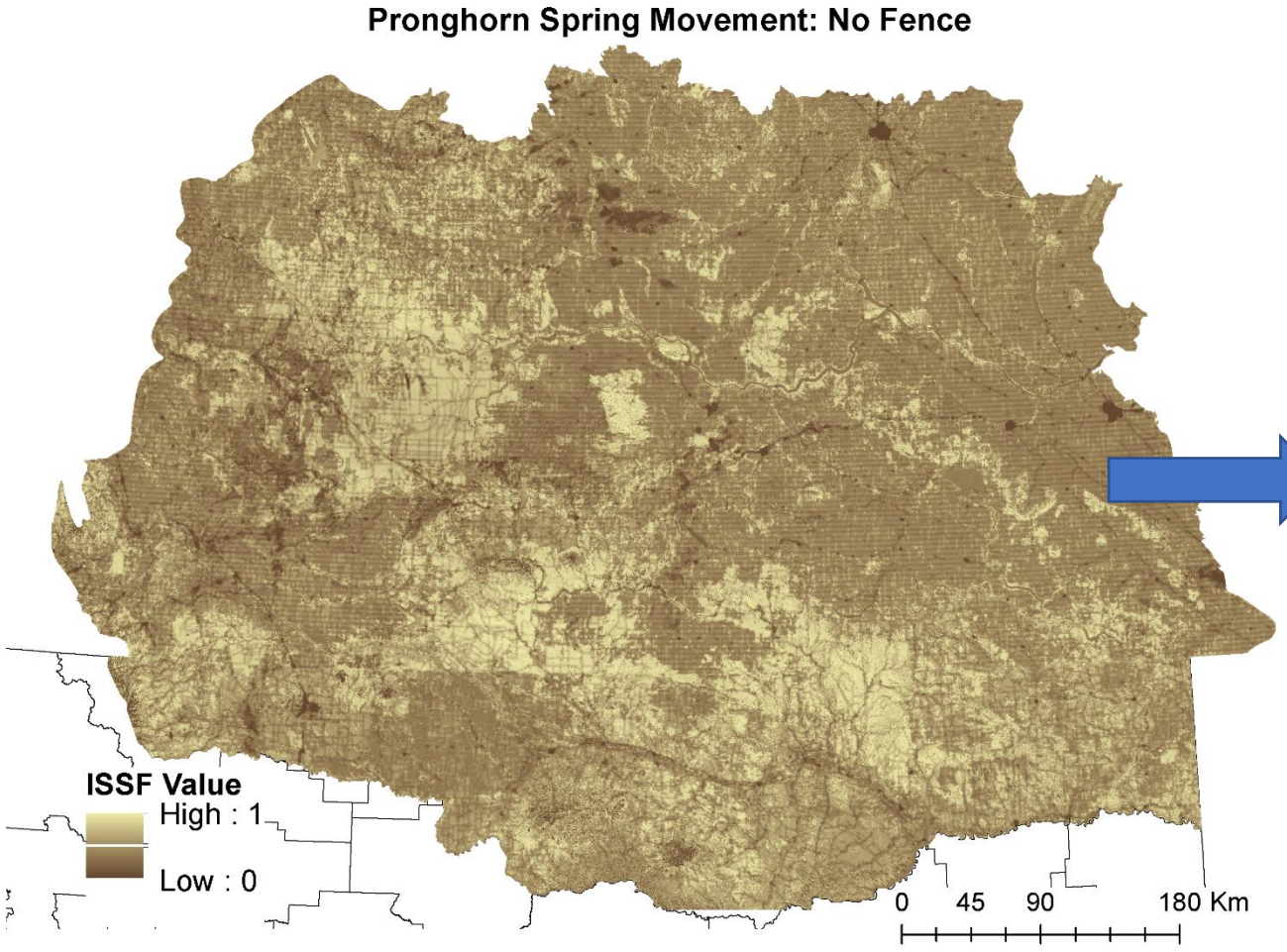


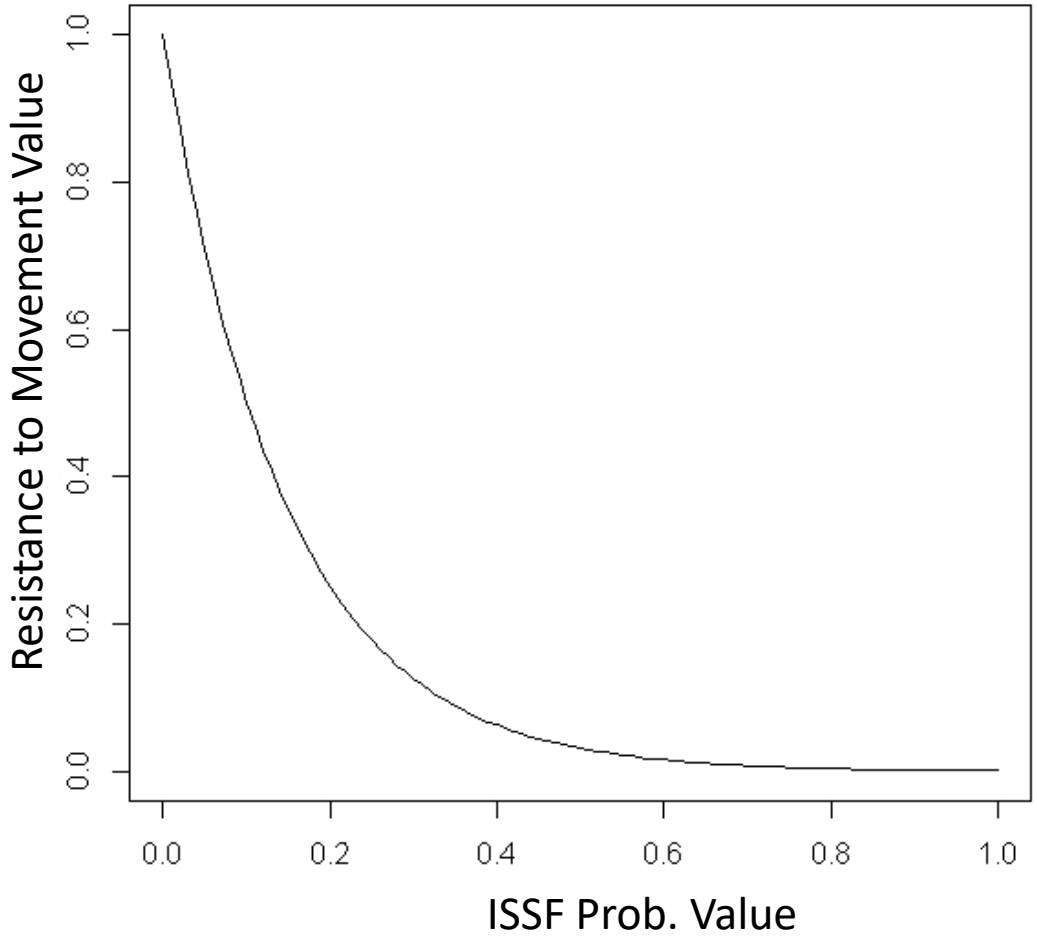
Step 4: Pronghorn connectivity modeling

1. Landscape connectivity modeling:
   a. “Measure of the ability of an organism to move among separated patches of suitable habitat that may be variously arranged.”
   b. Here, we use least-cost path modeling with resistance surfaces and ask algorithms to identify paths of least resistance through these surfaces.
   c. Very similar modeling framework to highway traffic routing.

2. Steps include
   a. Create resistance to movement surfaces
   b. Identifying source-destination points from species distributions

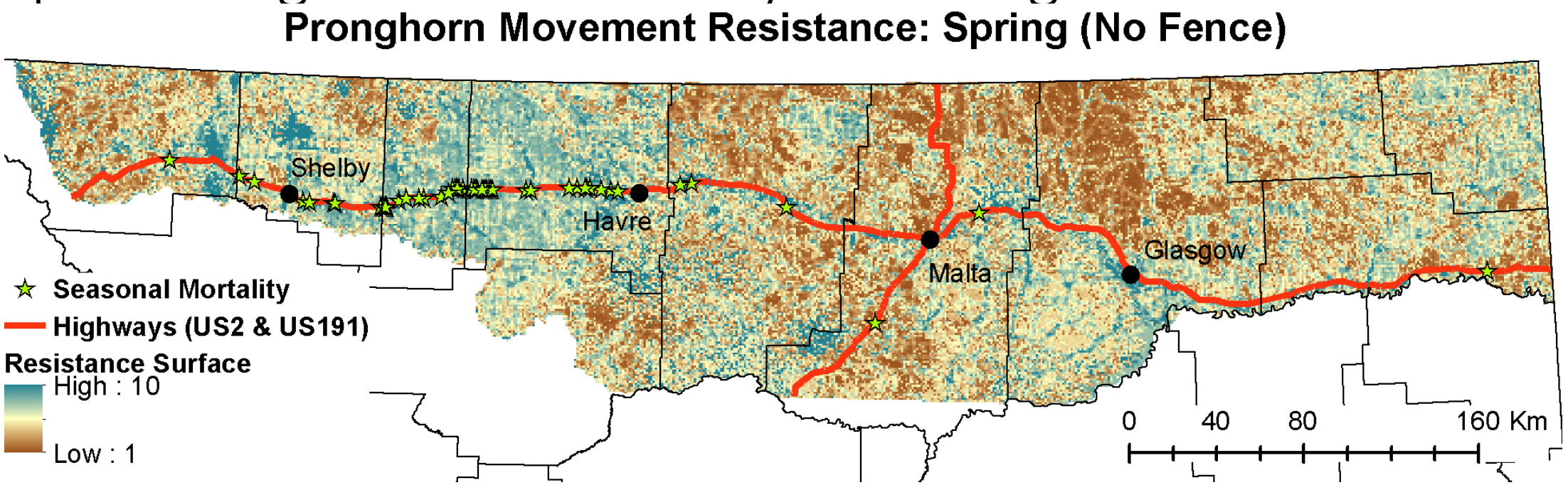
Step 4: Pronghorn connectivity modeling
Creating resistance to movement surfaces

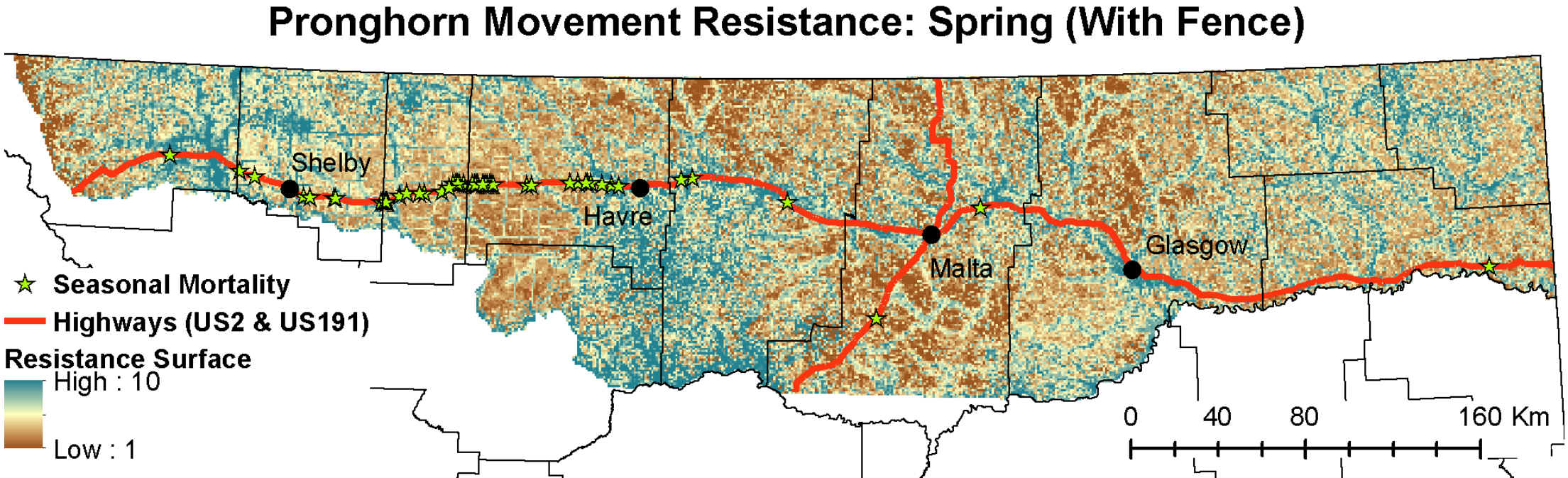




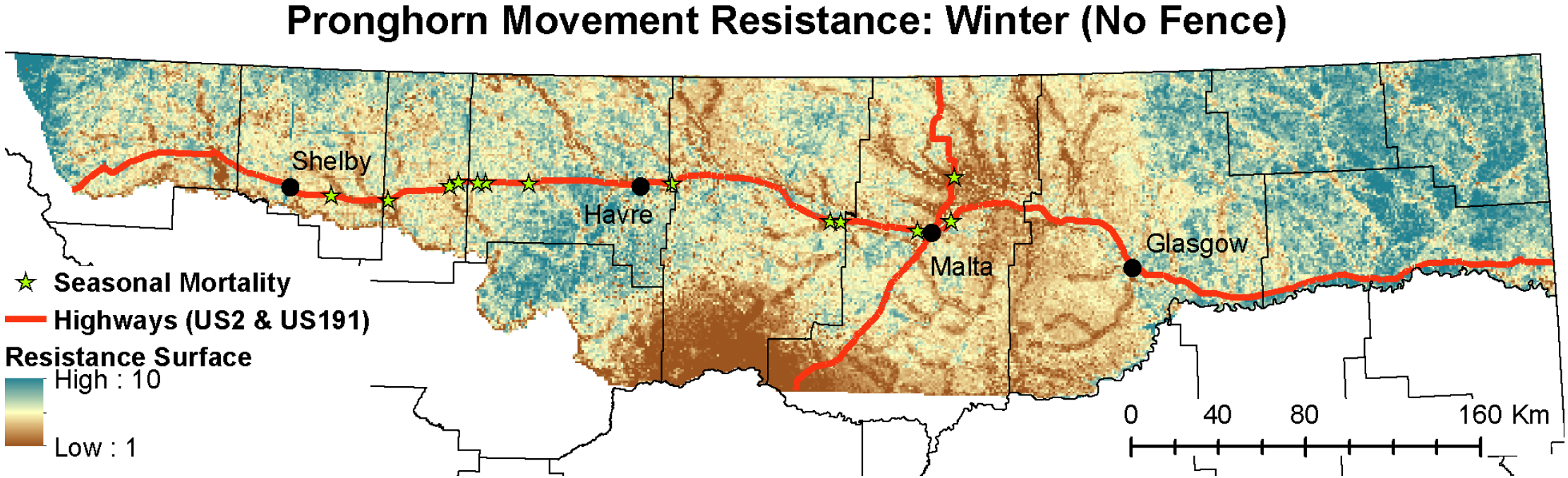
Keely et al. 2016; Mateo-Sanchez et al. 2011

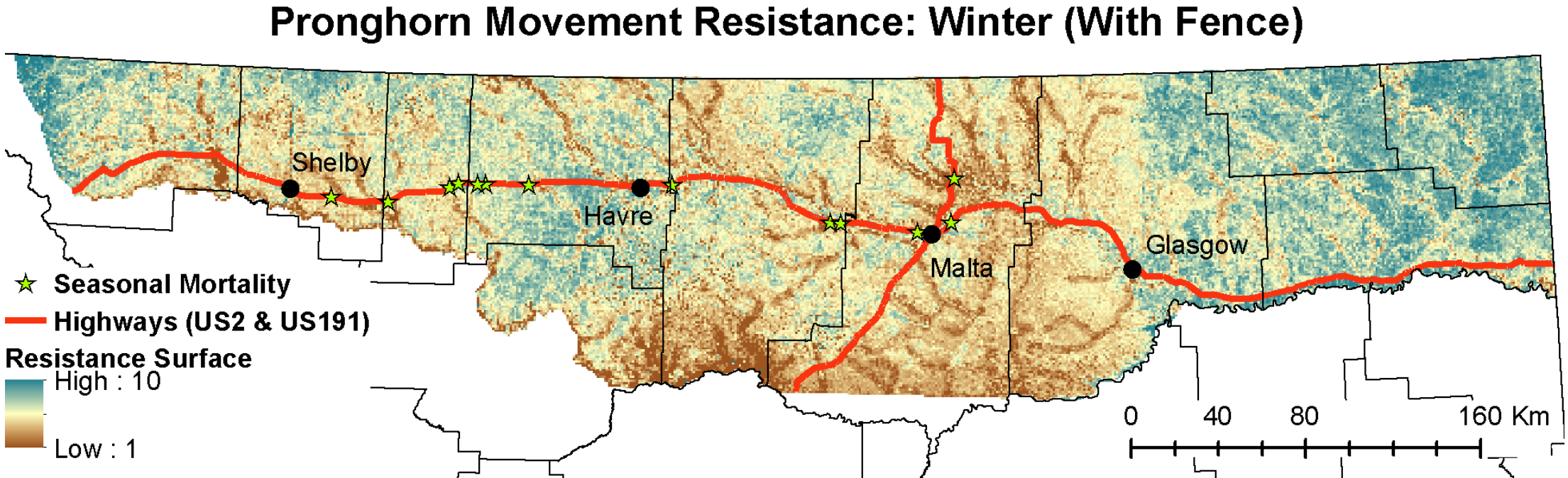
Step 4: Pronghorn connectivity modeling: Resistance surfaces



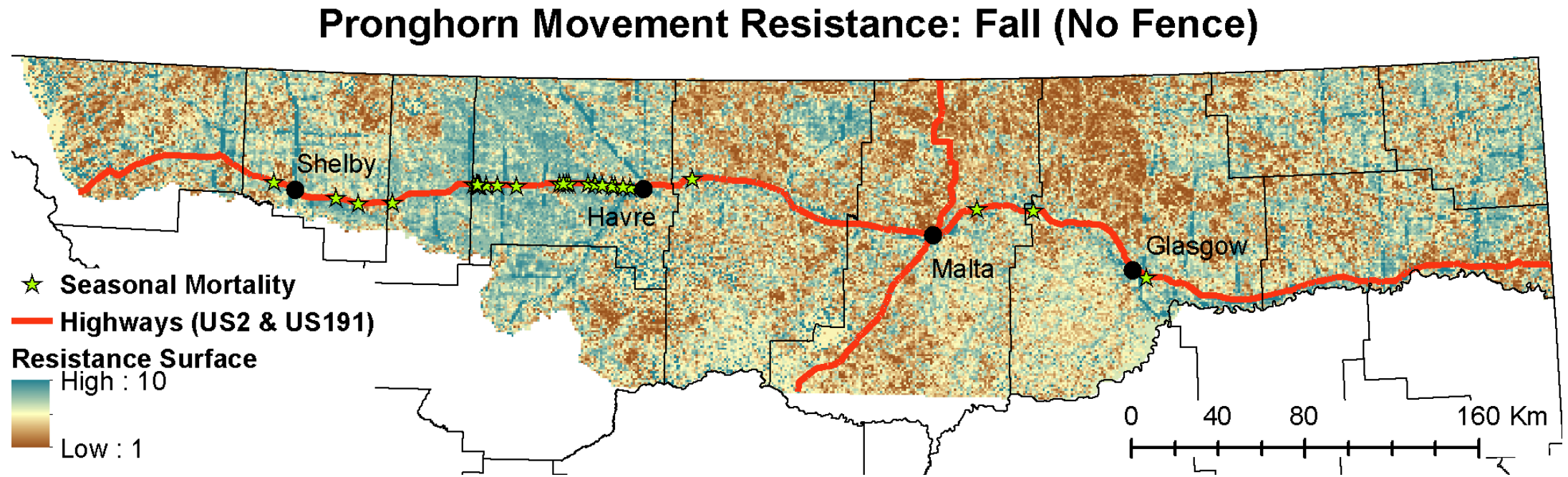


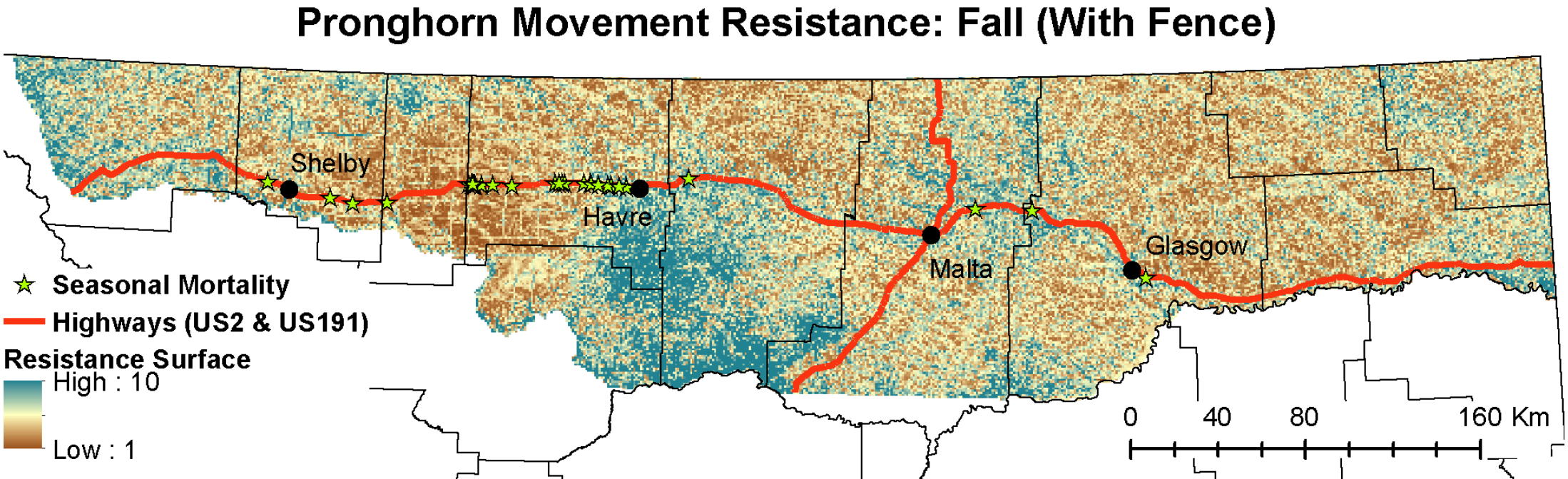
Step 4: Pronghorn connectivity modeling: Resistance surfaces



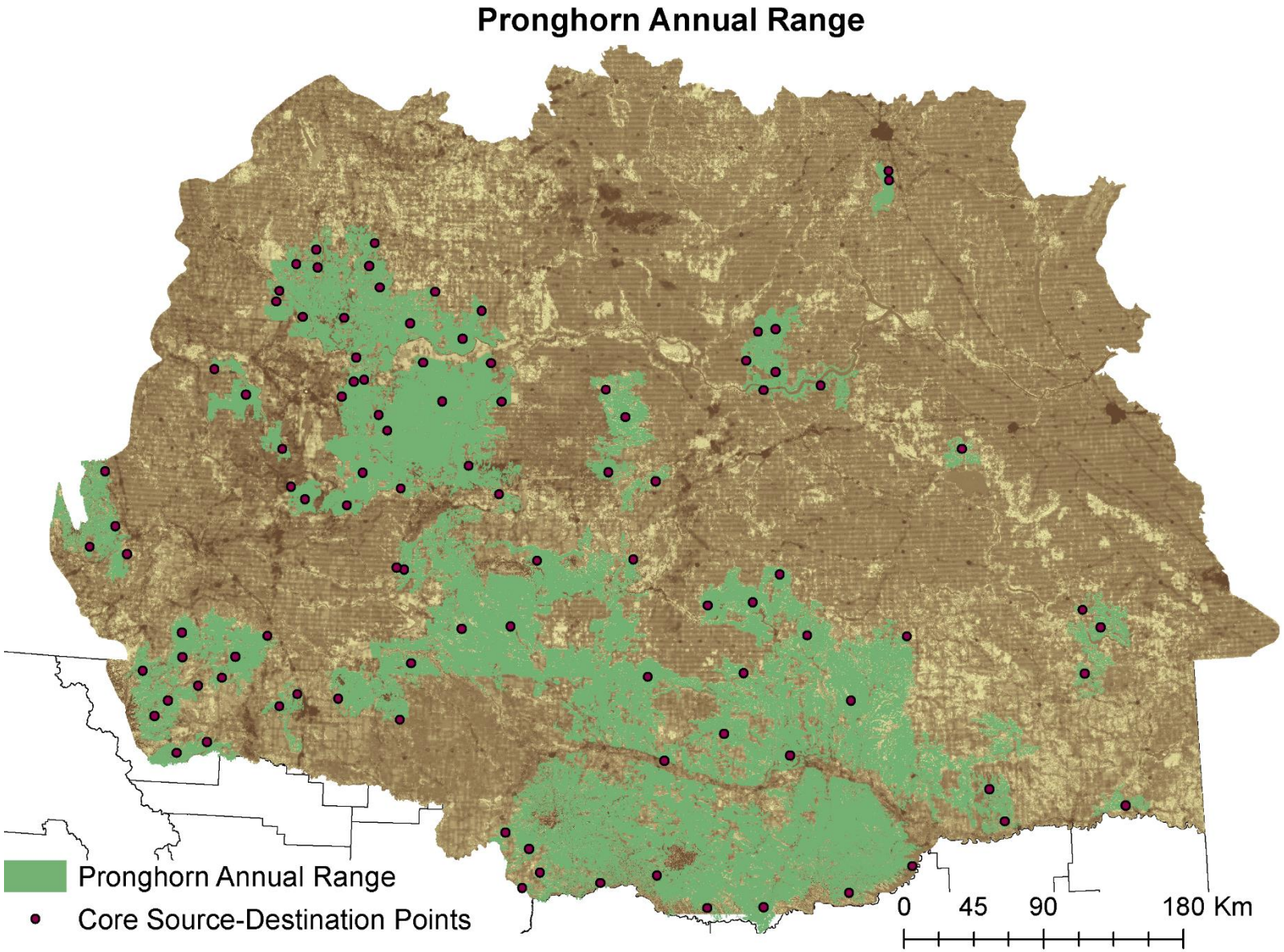


Step 4: Pronghorn connectivity modeling: Resistance surfaces



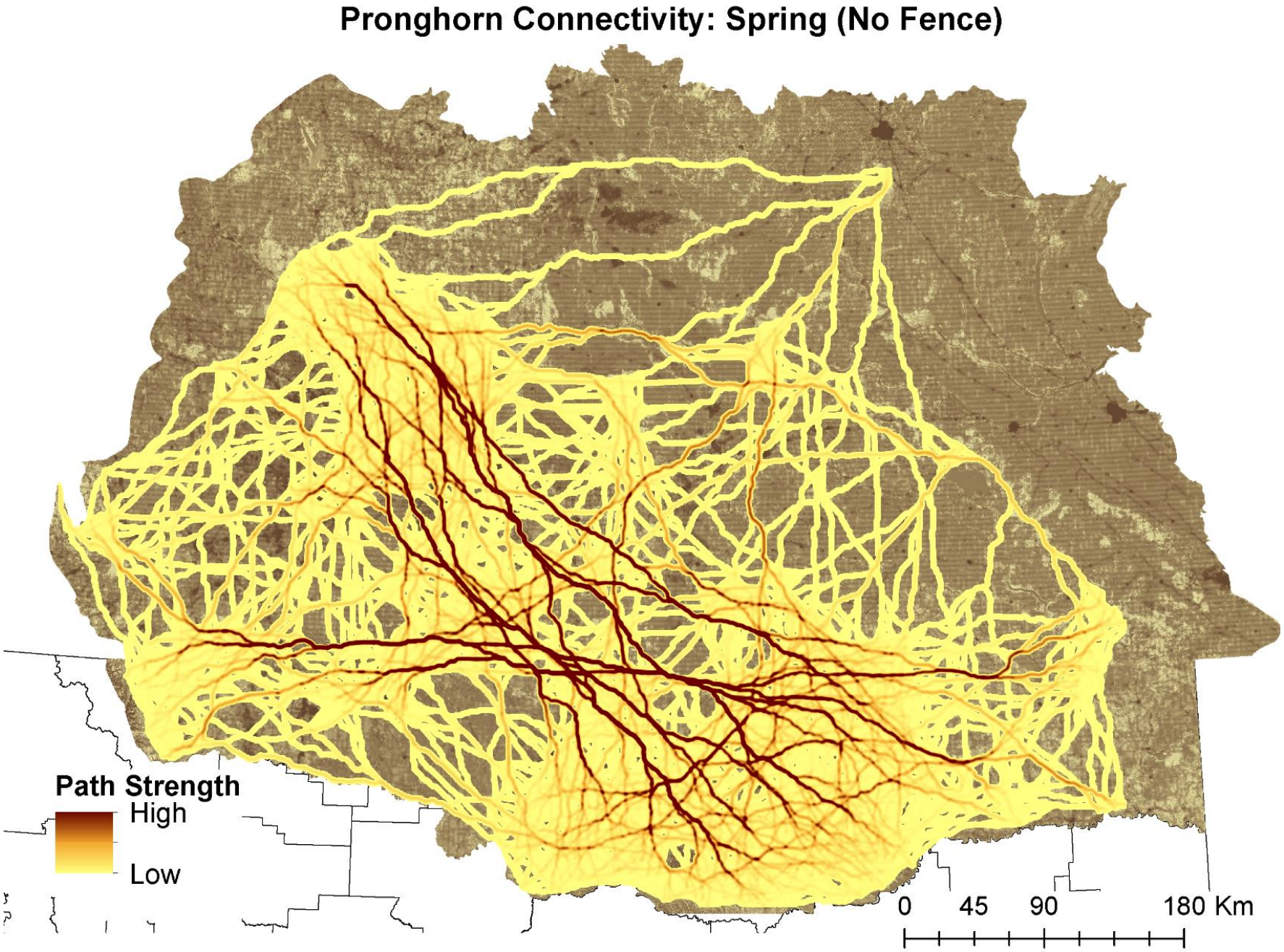


Step 4: Pronghorn connectivity modeling
Seeding source-destination points

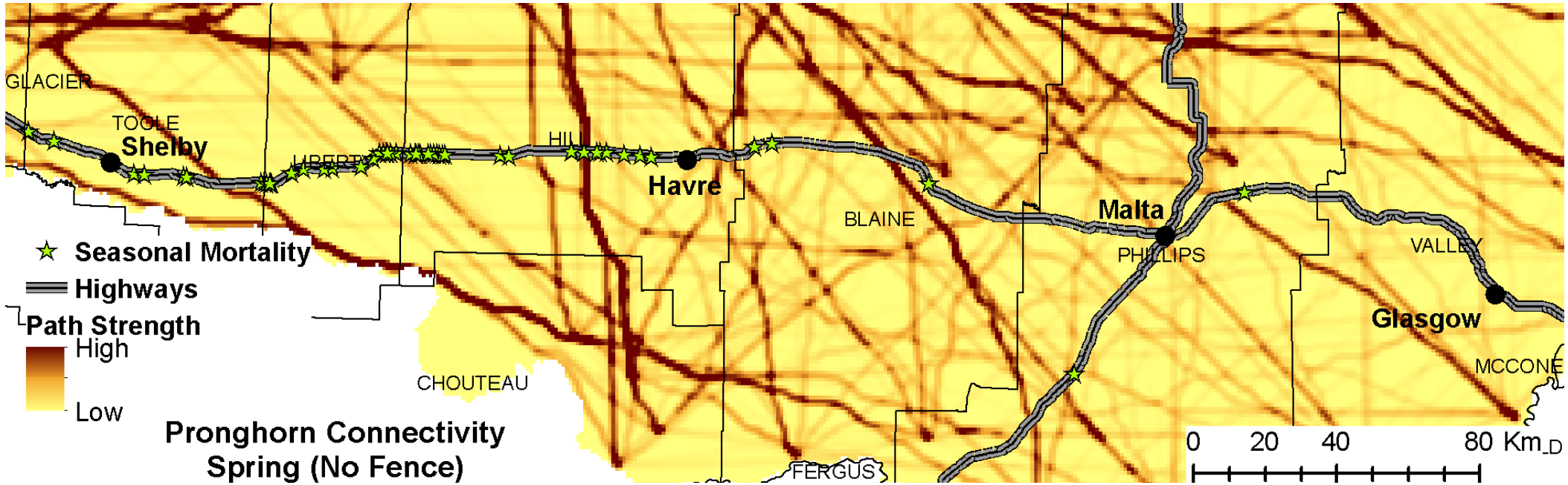


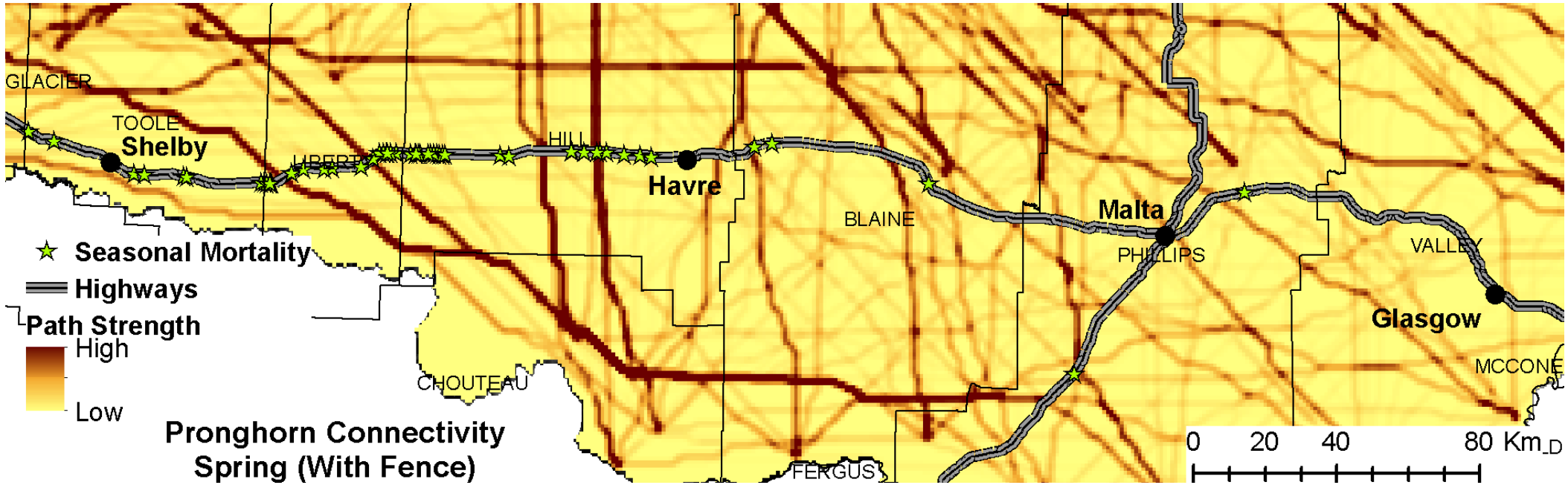
Jakes et al. 2015

Step 4: Pronghorn connectivity modeling: Results

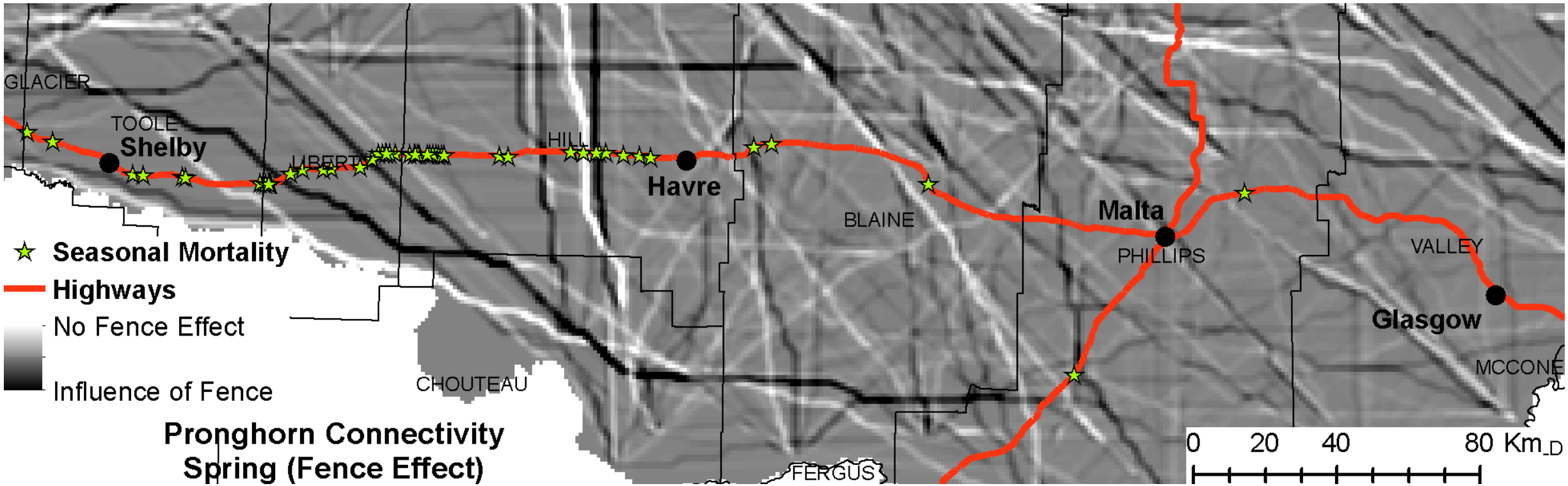


Step 4: Pronghorn connectivity modeling: Results

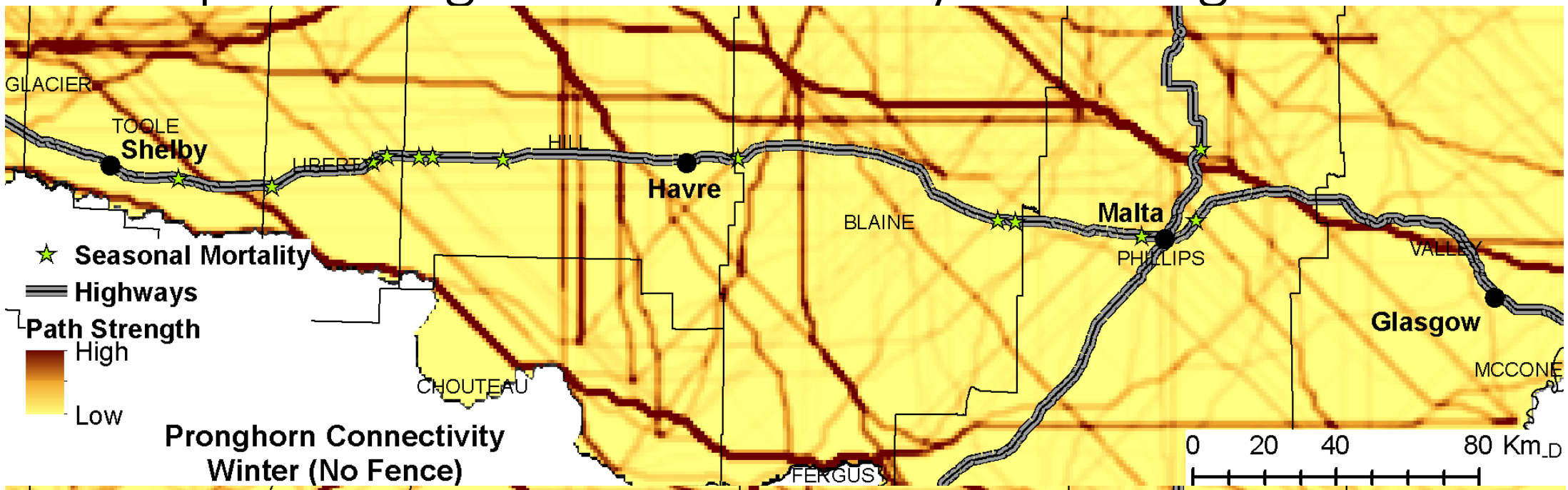


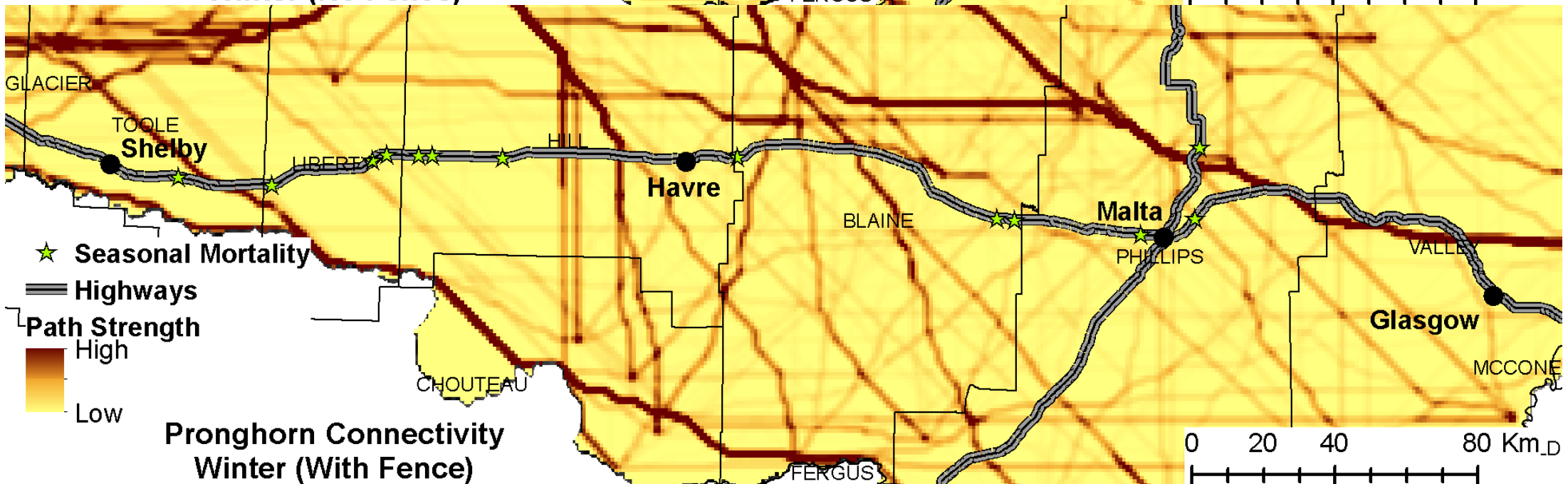


Step 4: Pronghorn connectivity modeling: Results

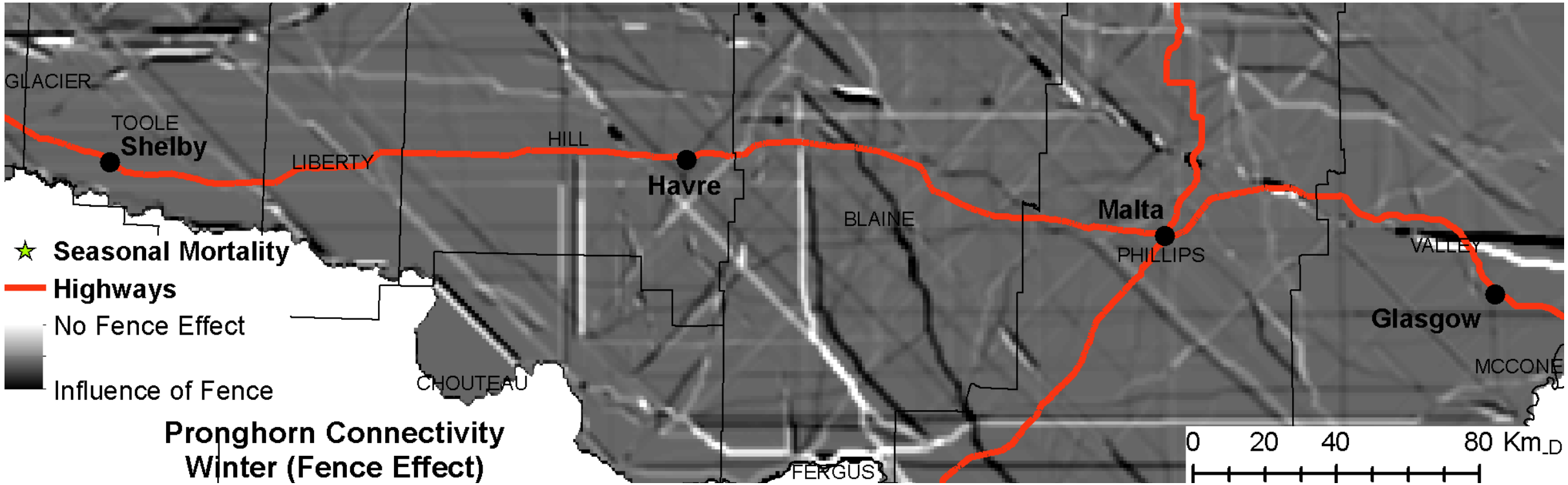


Step 4: Pronghorn connectivity modeling: Results

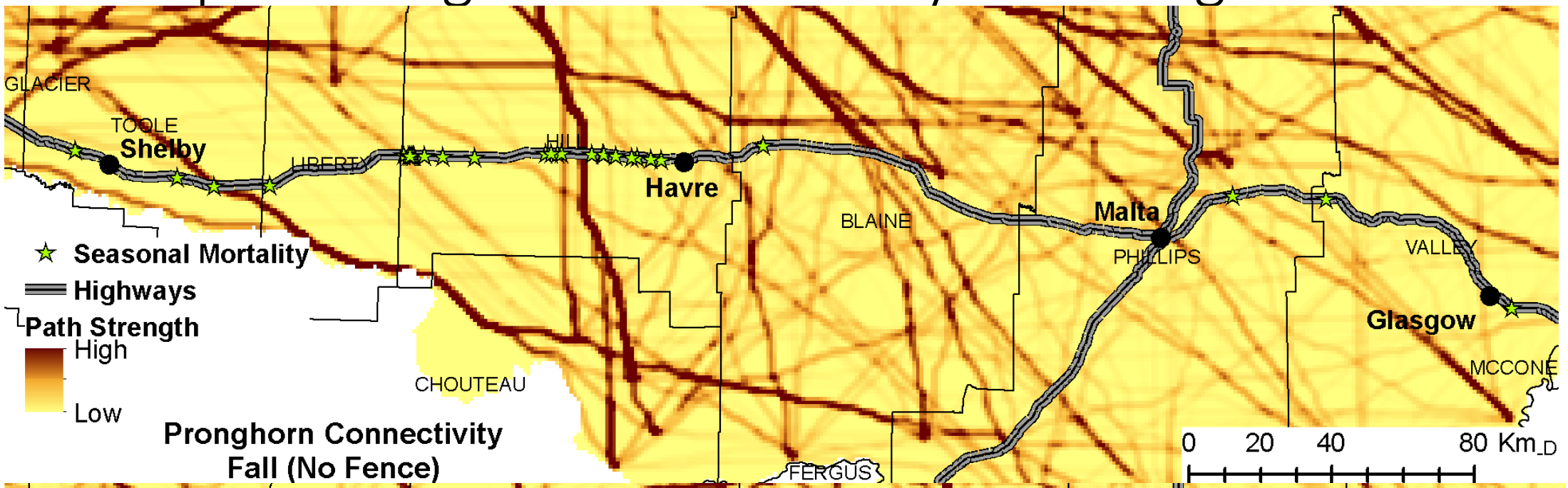


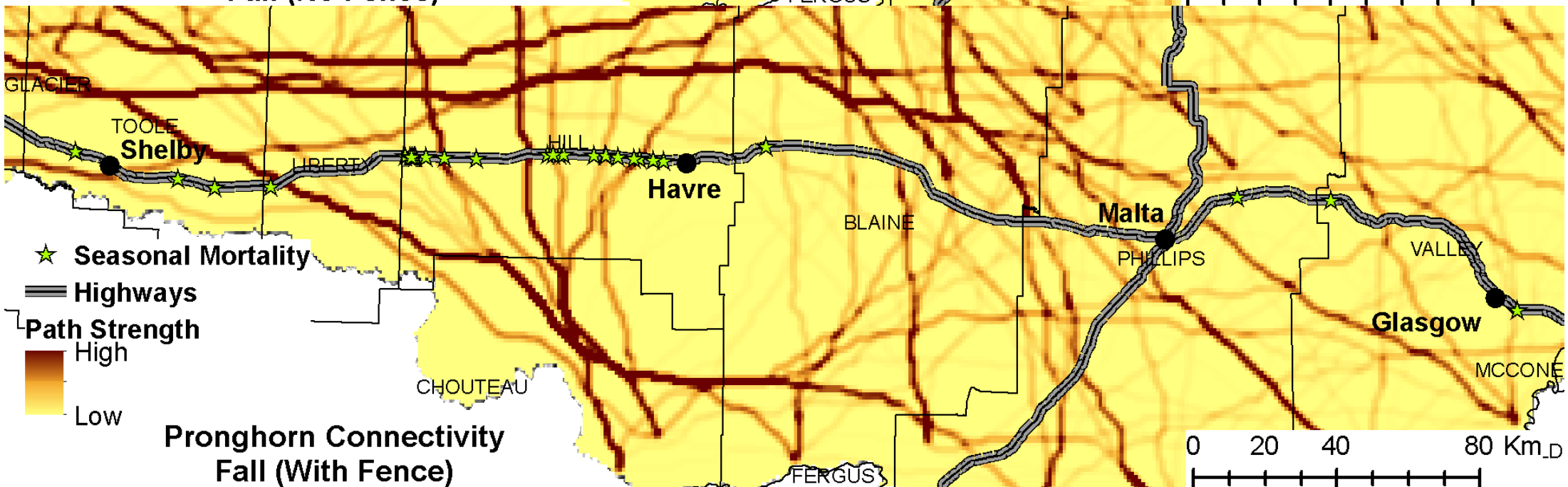


Step 4: Pronghorn connectivity modeling: Results

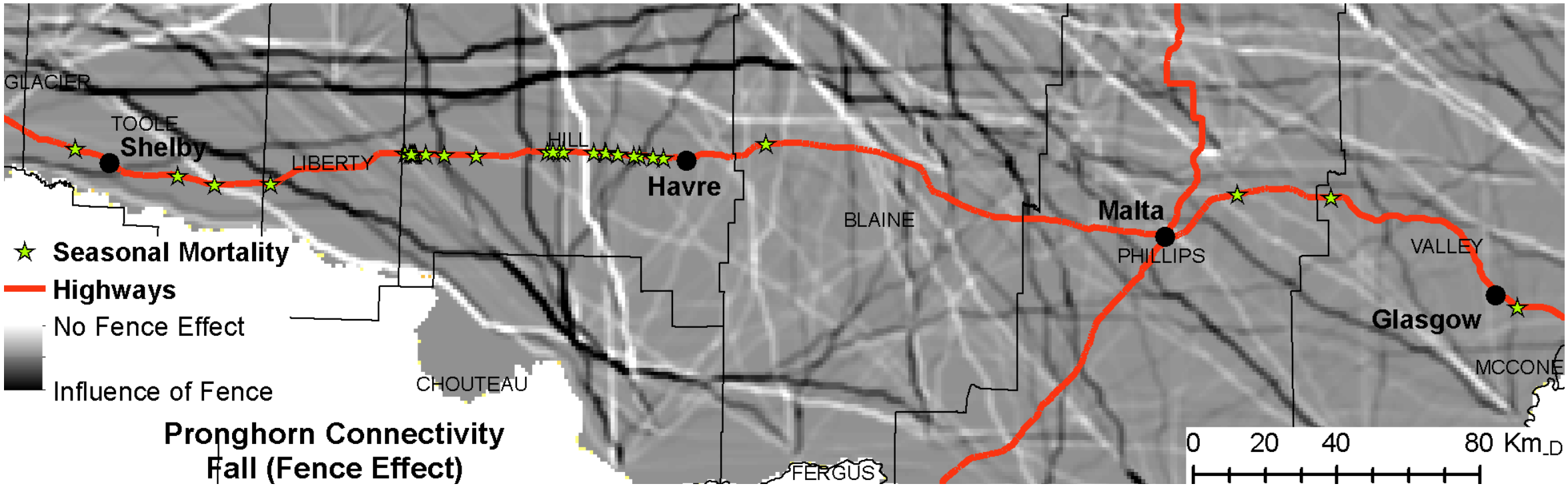


Step 4: Pronghorn connectivity modeling: Results





Step 4: Pronghorn connectivity modeling: Results



Objective 2: Summary

Pronghorn

- More mortalities in West (Liberty/Hill) – Ecological trap?
- However, no carcass data from Winter 2010-2011 in East.
- Fences in East are acting as barrier and individuals moving to West for crossings (FALL and SPRING)
- Winter movements based more on memory vs Fall/Spring movements based on spatiotemporal factors.

Mule Deer

- Increased mortalities in areas with higher fence densities. Pop./Traffic?
- More mortalities during Fall and Winter.

Objective 3: Present and demonstrate importance of wildlife friendly fences to stakeholders

- 3) *Effectively demonstrate and present the importance of developing fence density maps for other important ecological areas, to create scientifically and economically defensible positions for MDT to use, in the justification for and the effectiveness of "Wildlife Friendly" fences and other habitat connectivity measures on the landscape as a prudent use of their limited resources.*

Presentations

- Presentations given over last 1.5 Years on Fence Ecology and Fence Modifications
  - National, regional, statewide conferences;
  - Local meetings;
  - Wildlife Biology classes at UM
- Ranchers Stewardship Alliance Conservation Committee – Malta, MT 9/10/2019
- MT FWP Region 6 and U.S. BLM Valley County Resource Office – Glasgow, MT 9/12/2019 (if desired)
- MT Department of Transportation – Helena, MT

Conclusions & Future Work

- Raising wire to 18” allows for wildlife movement while keeping cattle in intended pastures.
- Fence crossing success is multi-scale process
- If modify fencing along the roadside, then have to do it on both sides of road. PVC on top could be of value for wildlife visualization.
- Fence type (i.e. woven wire) may be more influential to pronghorn movement than fence density.
- Multi-species wildlife friendly fence design and connectivity assessments.
- Pronghorn Xing smartphone application can assist (noticed carcass database incomplete).

Funding Support

- Montana Department of Transportation
  - CFDA #20.205
  - Highway Planning and Construction Program
  - Project #9596-617

MONTANA MDT DEPARTMENT OF TRANSPORTATION

VISION ZERO
zero deaths · zero serious injuries
MONTANA DEPARTMENT OF TRANSPORTATION