

How Wyoming's Big Game Make Their Epic Migrations

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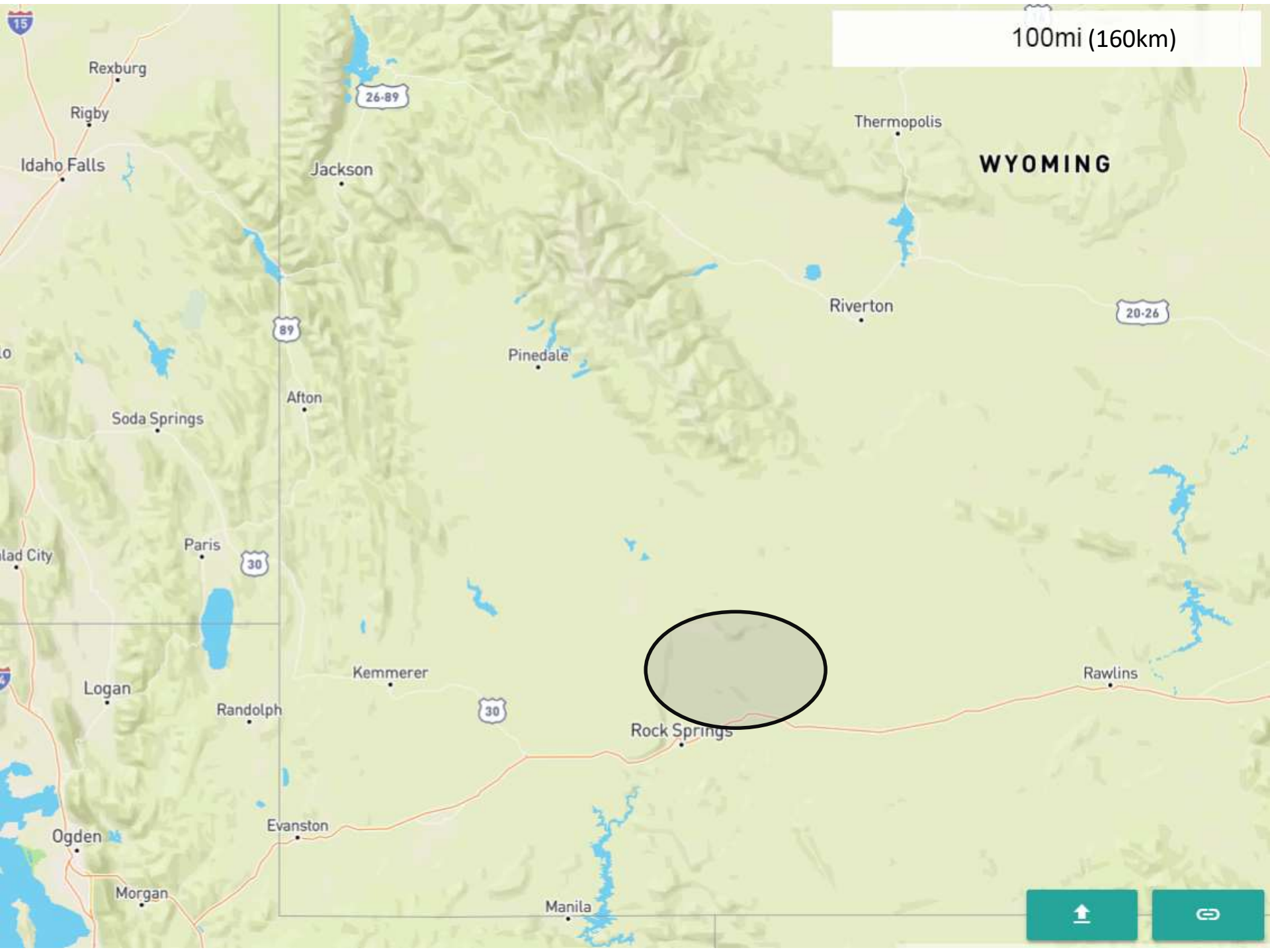
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100mi (160km)



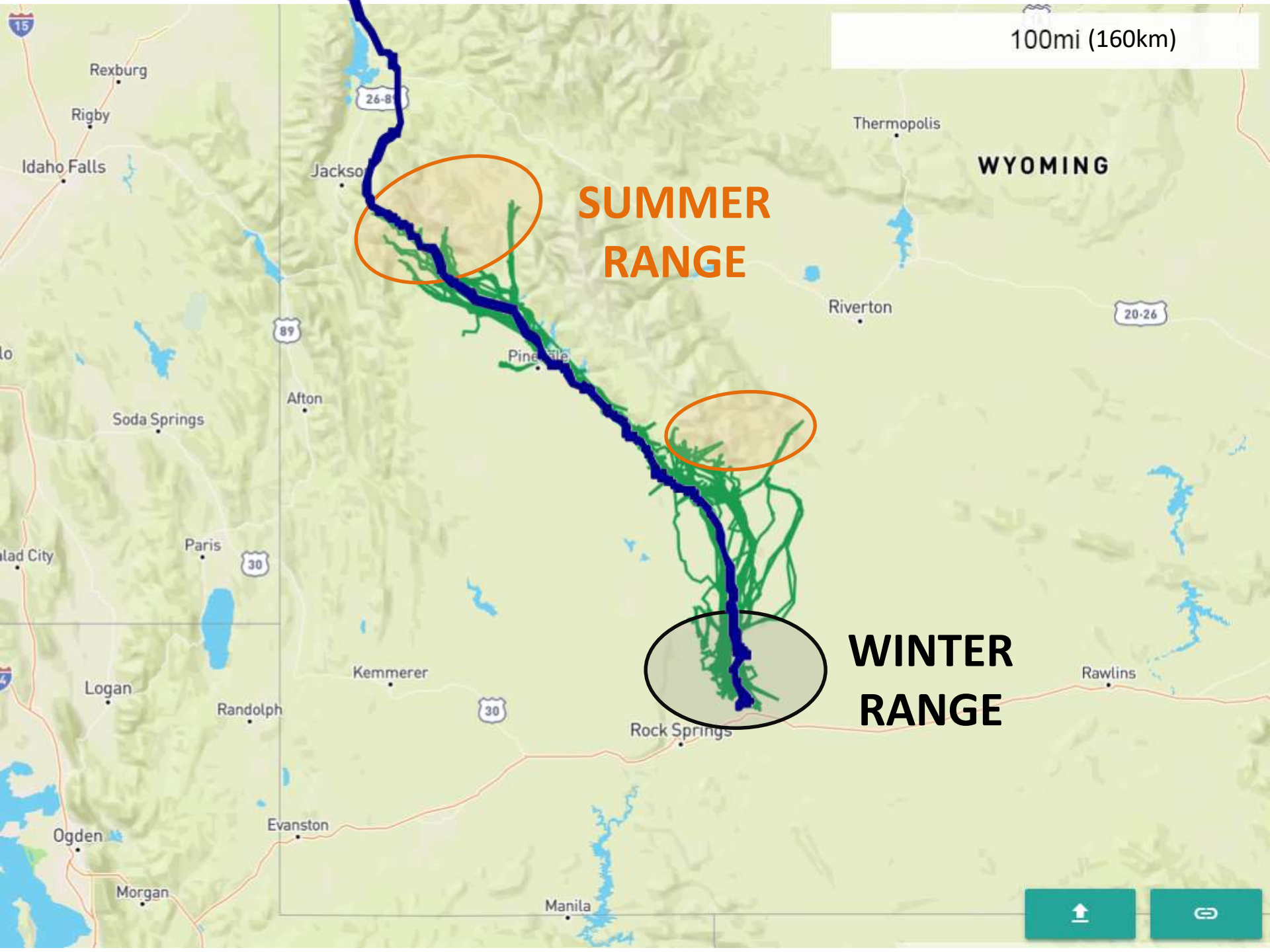
WYOMING

Rock Springs

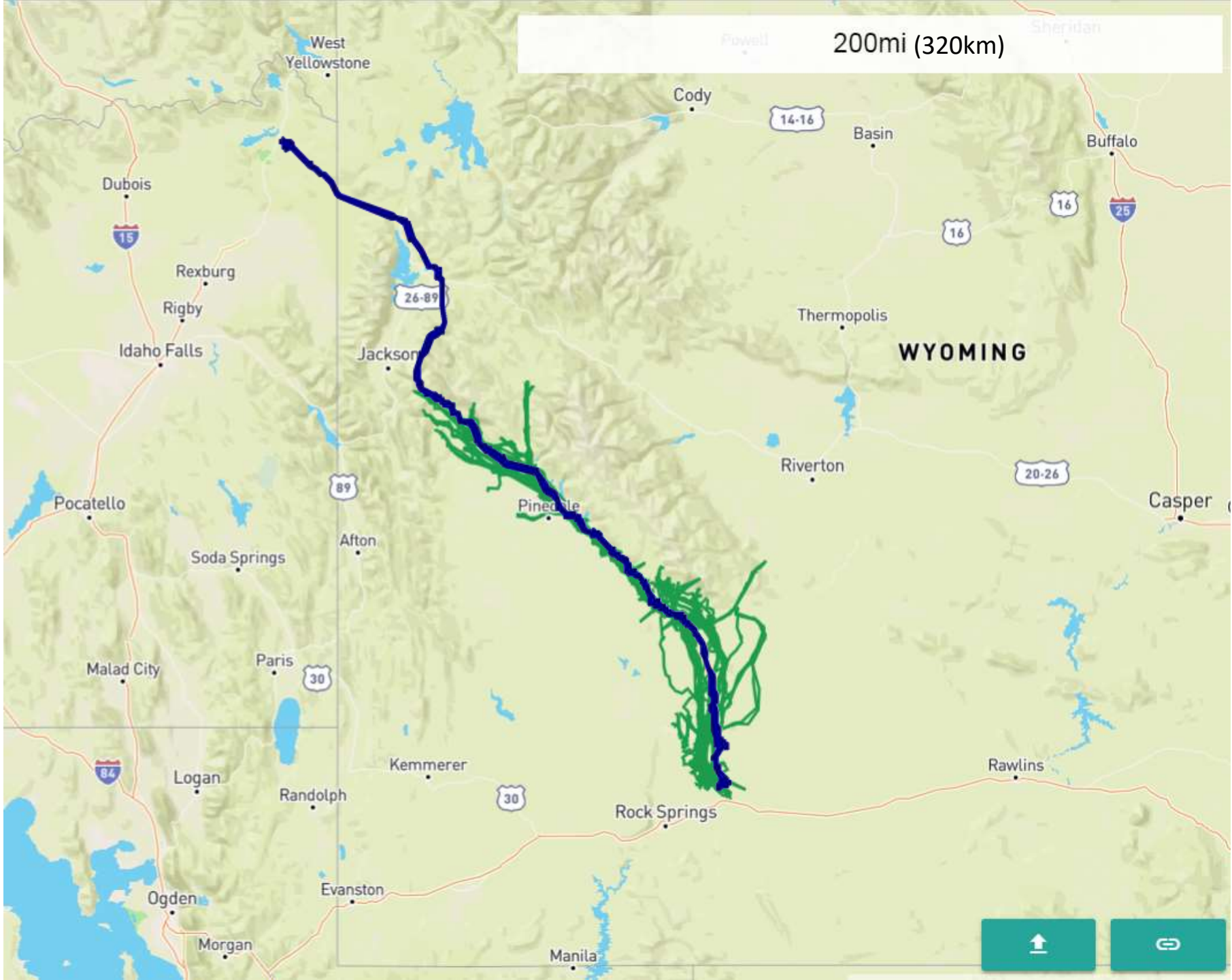
100mi (160km)

SUMMER RANGE

WINTER RANGE



200mi (320km)



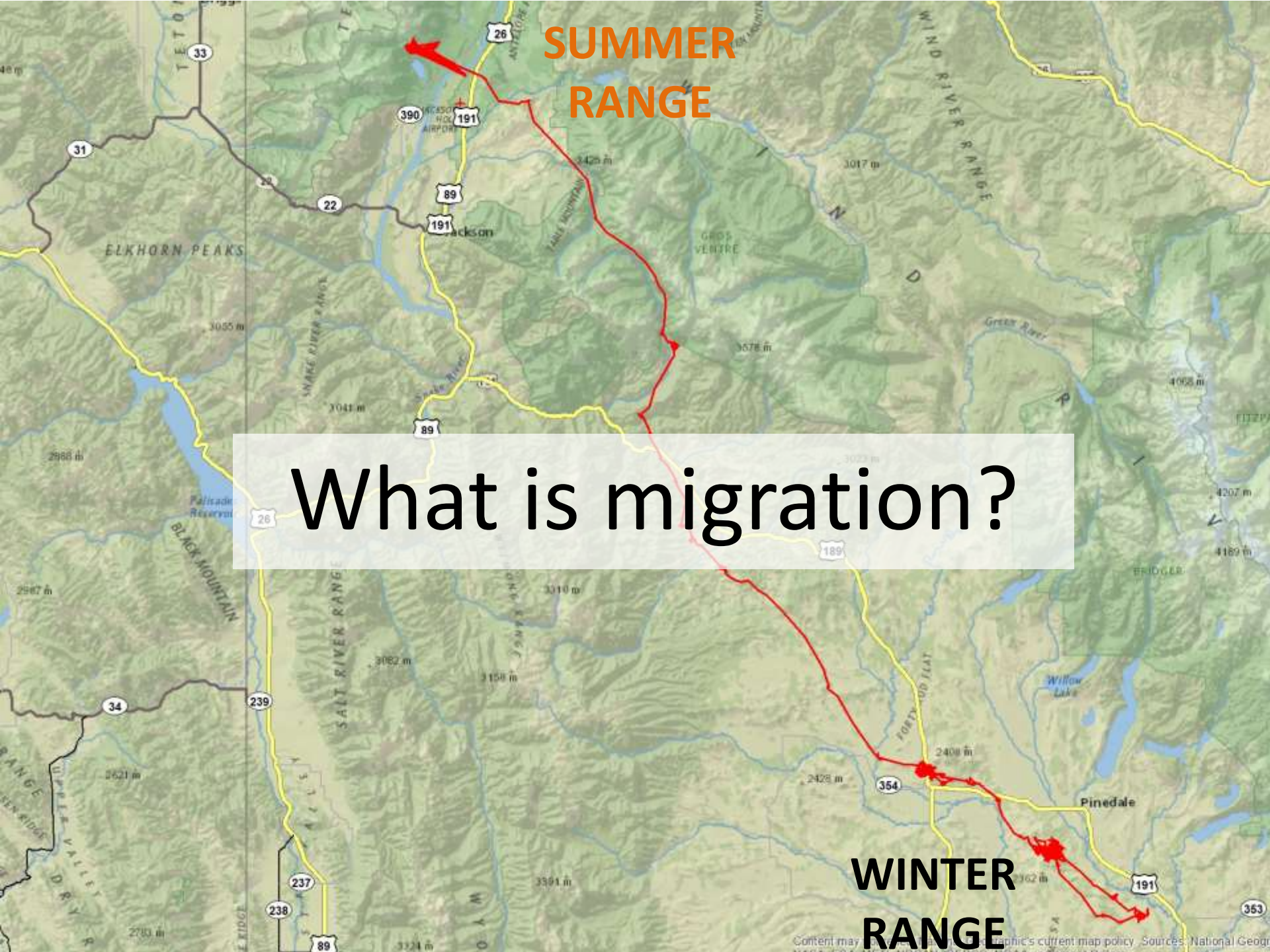
Deer 255
(Summer 2016)



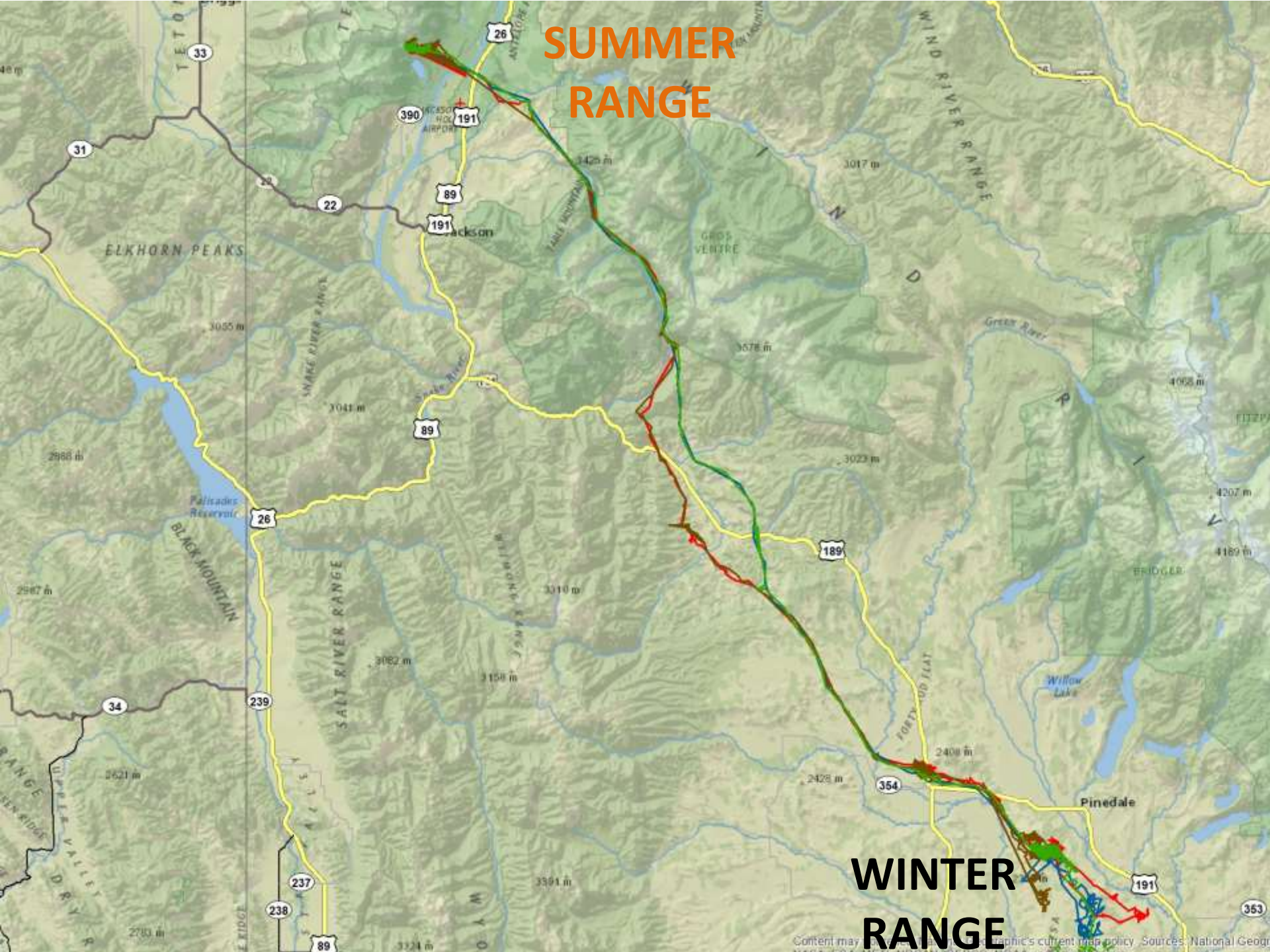
**SUMMER
RANGE**

What is migration?

**WINTER
RANGE**



**SUMMER
RANGE**



**WINTER
RANGE**

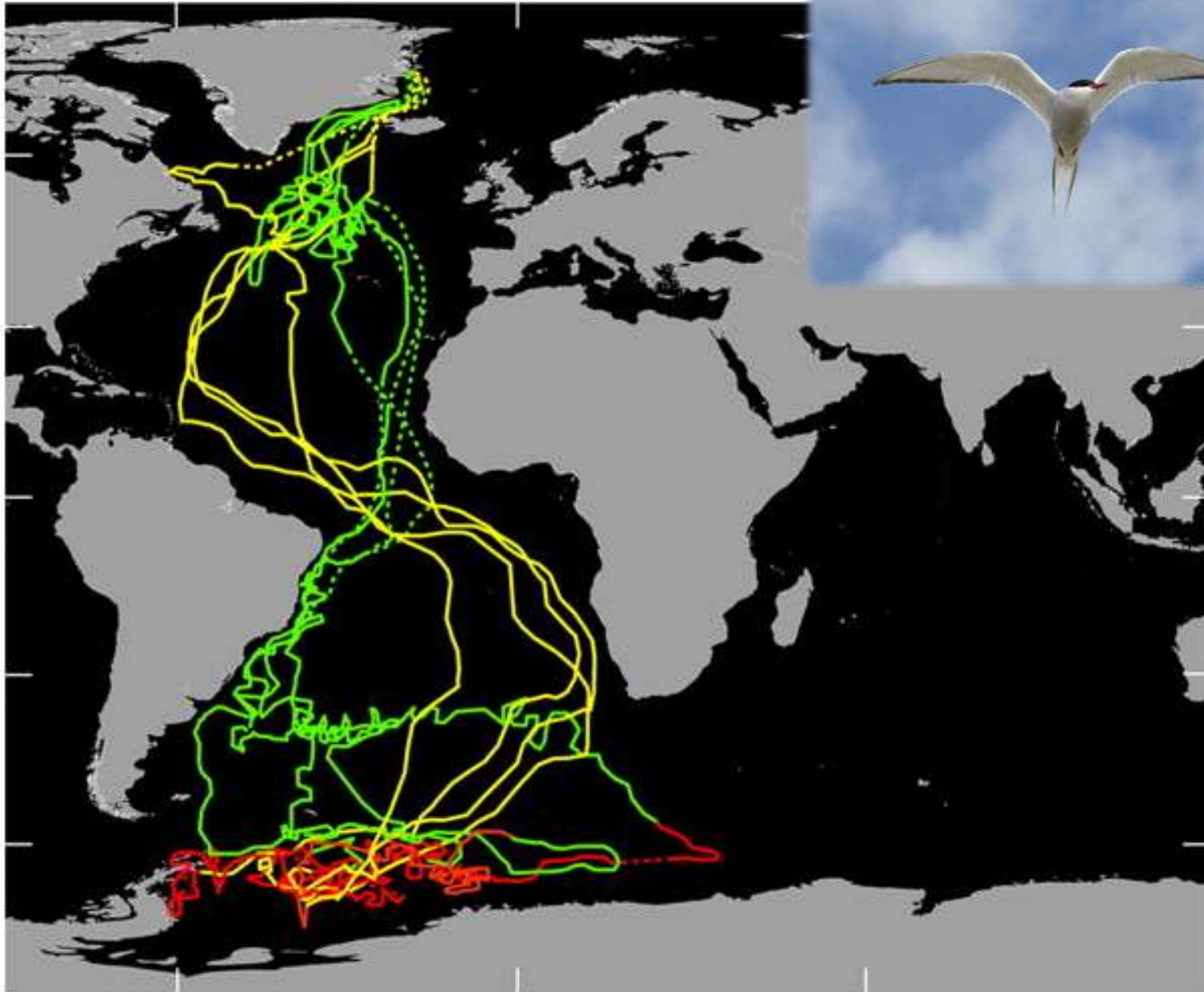
60°W

0°

Arctic tern



© A Trepte



30°N

0°

30°S

60°S



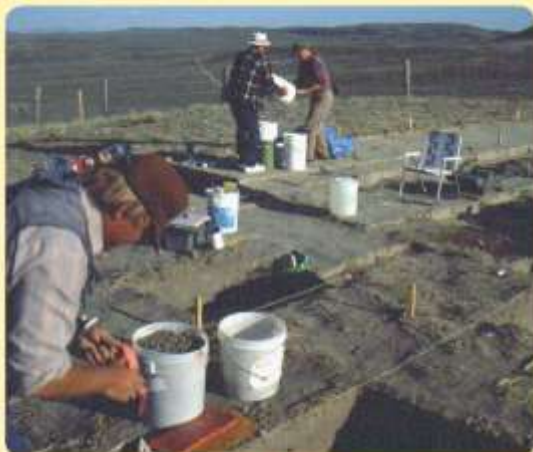
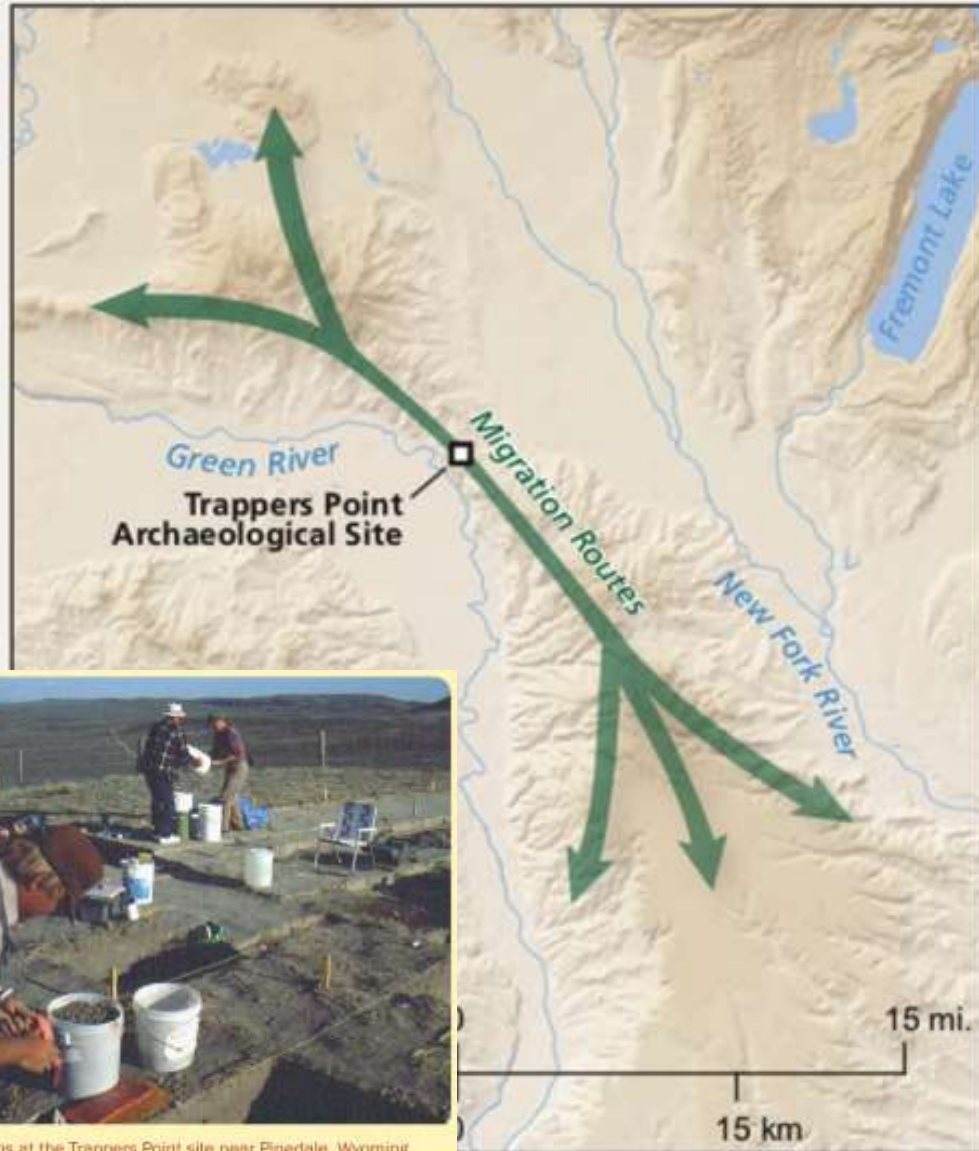
© Daniel Rosengren

Wyoming migrations are 1,000s of years old



Archaeological Kill Site: Evidence of Spring Migration 5,000 to 8,000 years old

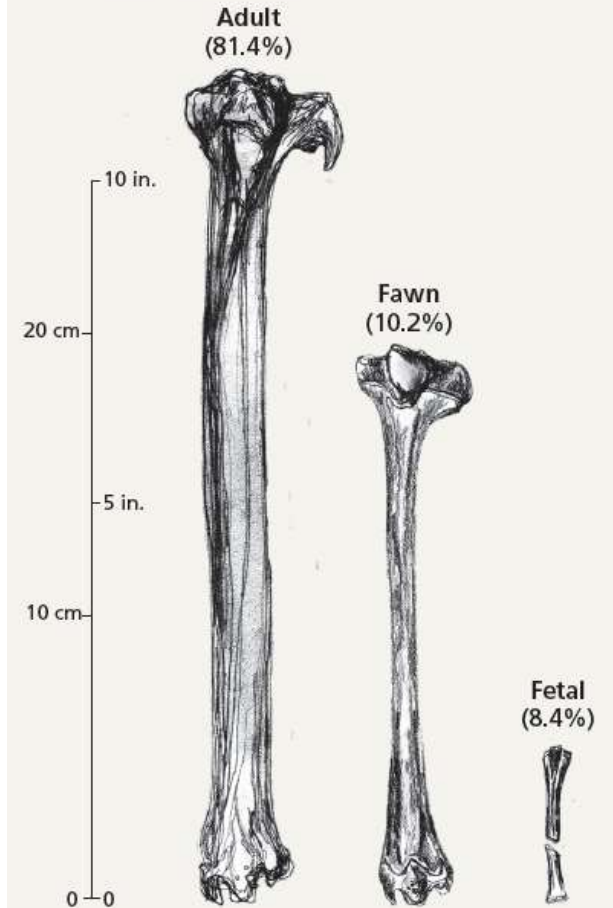
Trappers Point Site

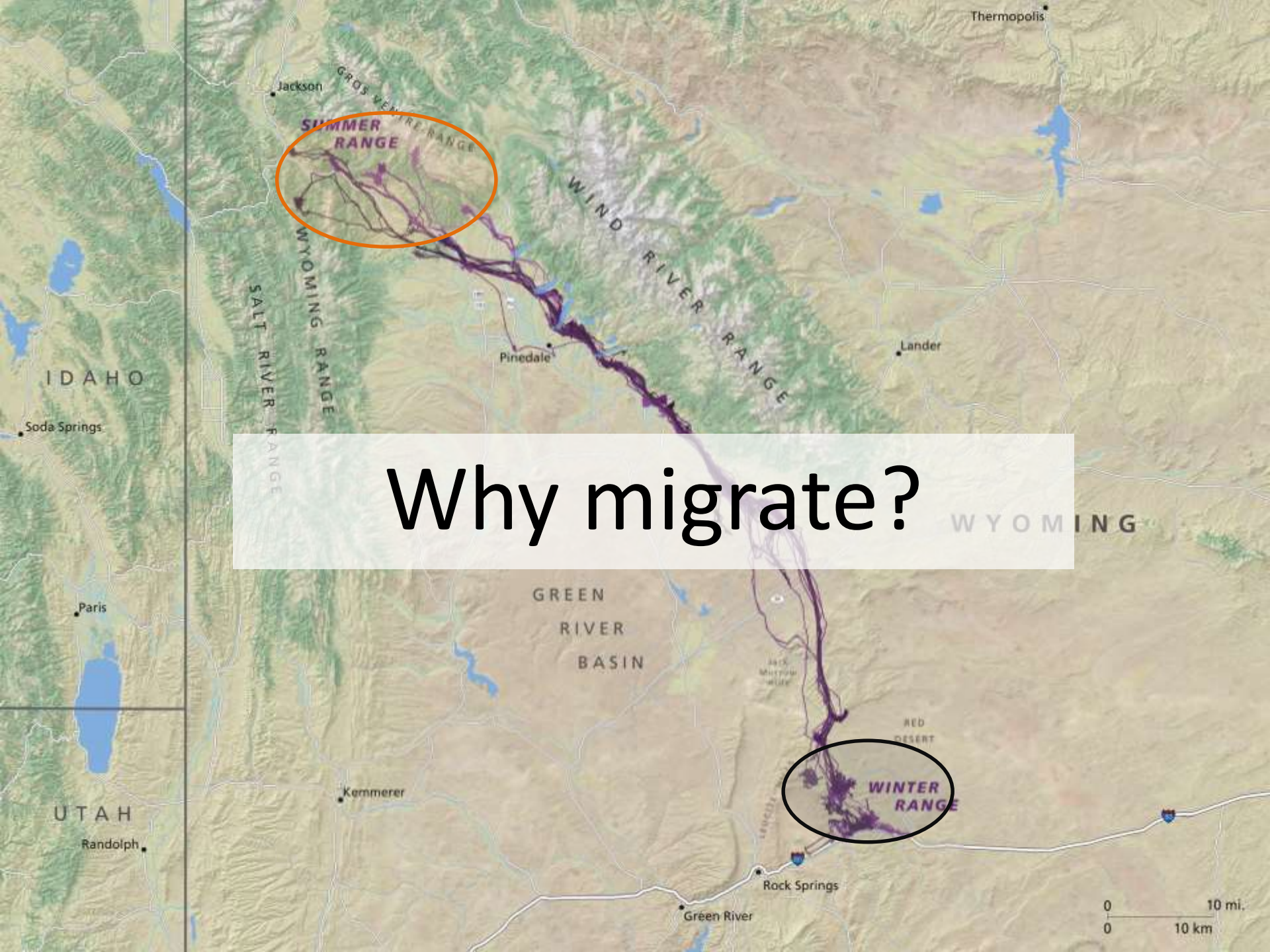


Excavations at the Trappers Point site near Pinedale, Wyoming.
Photo courtesy of Office of the Wyoming State Archaeologist.

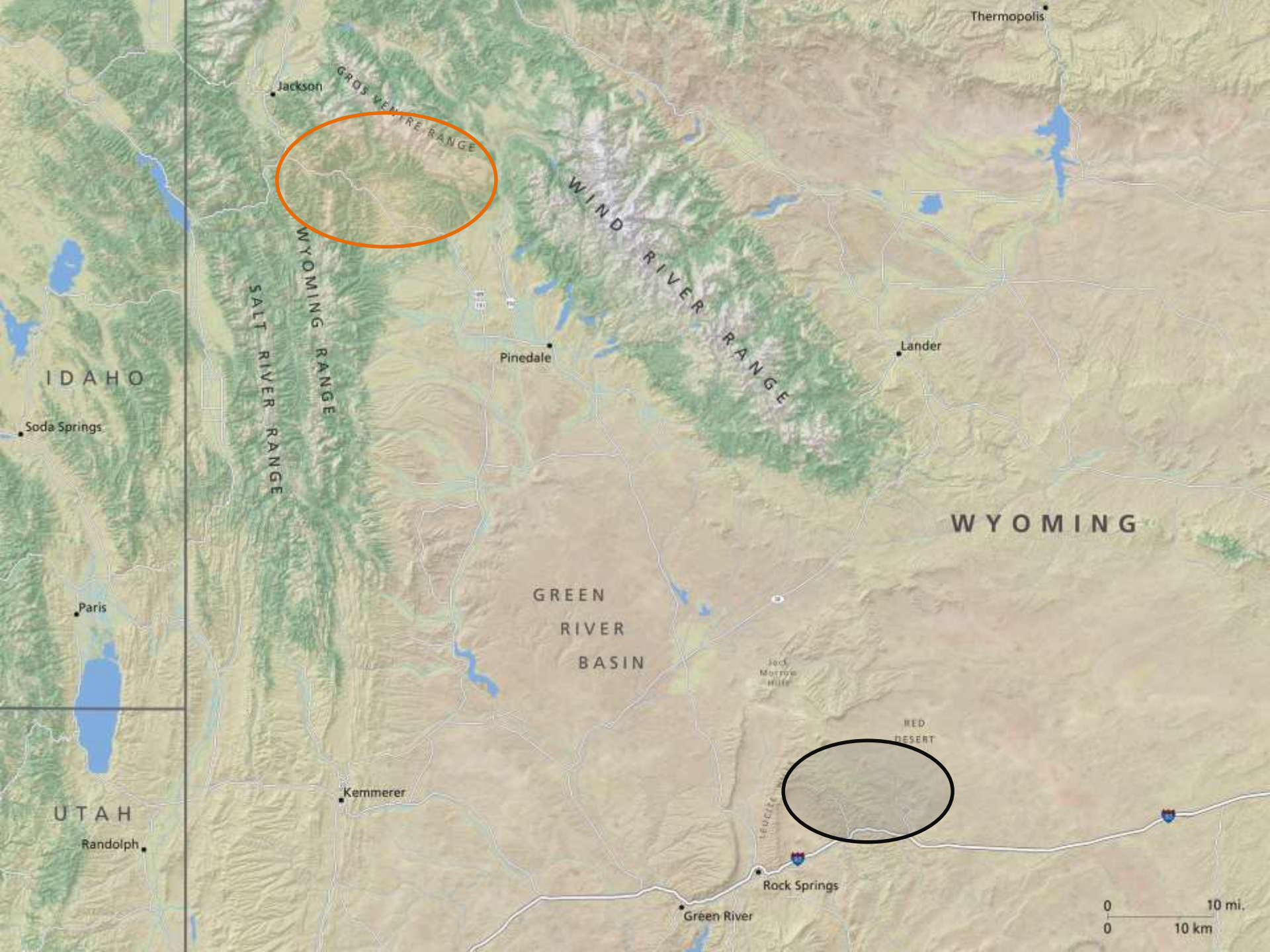
Remains at Trappers Point Site

1,534 total bones excavated





Why migrate?



Thermopolis



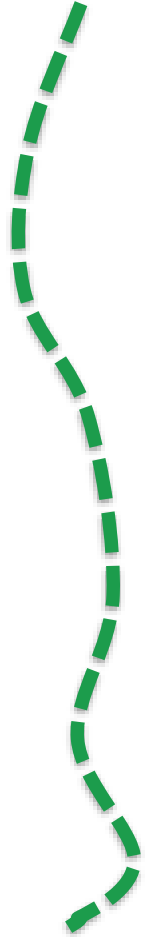
0 10 mi.
0 10 km



photo Joe Riis



**SUMMER
RANGE**



**WINTER
RANGE**

Migration
is the
solution



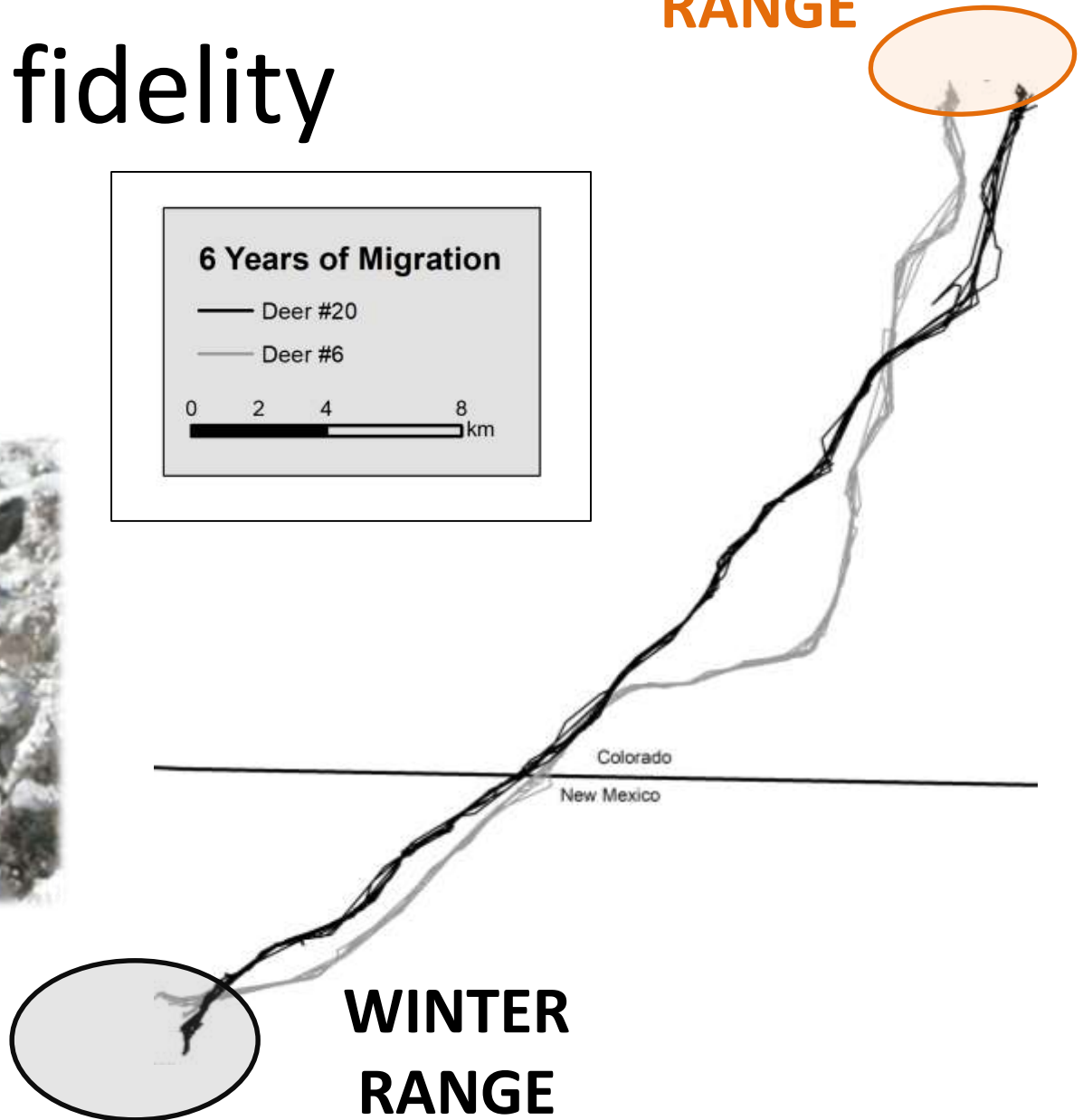
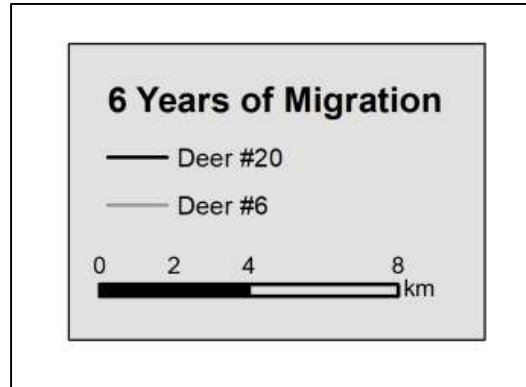
Deer 255 – 2016 Spring Migration

Deer 255 – 2018 Spring Migration



Big game have strong fidelity

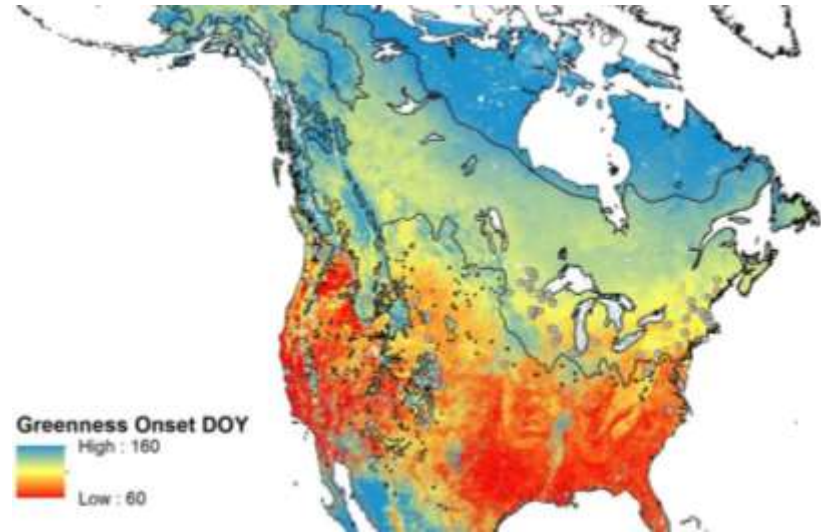
**SUMMER
RANGE**



**WINTER
RANGE**

How do animals migrate?

1. Track resource waves

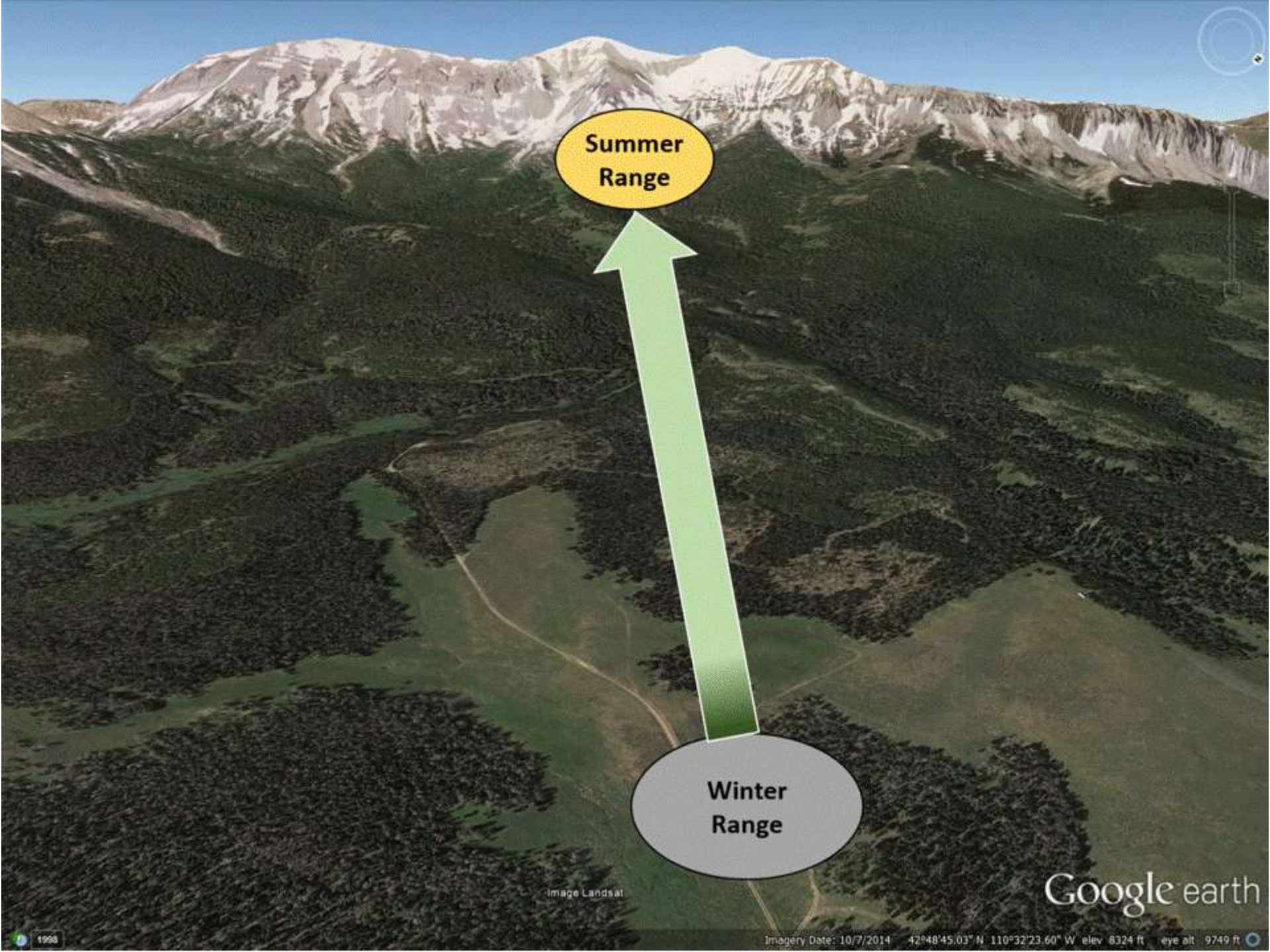


2. Use memory



Lassen NPS





Summer
Range

Winter
Range

Image Landsat

Google earth

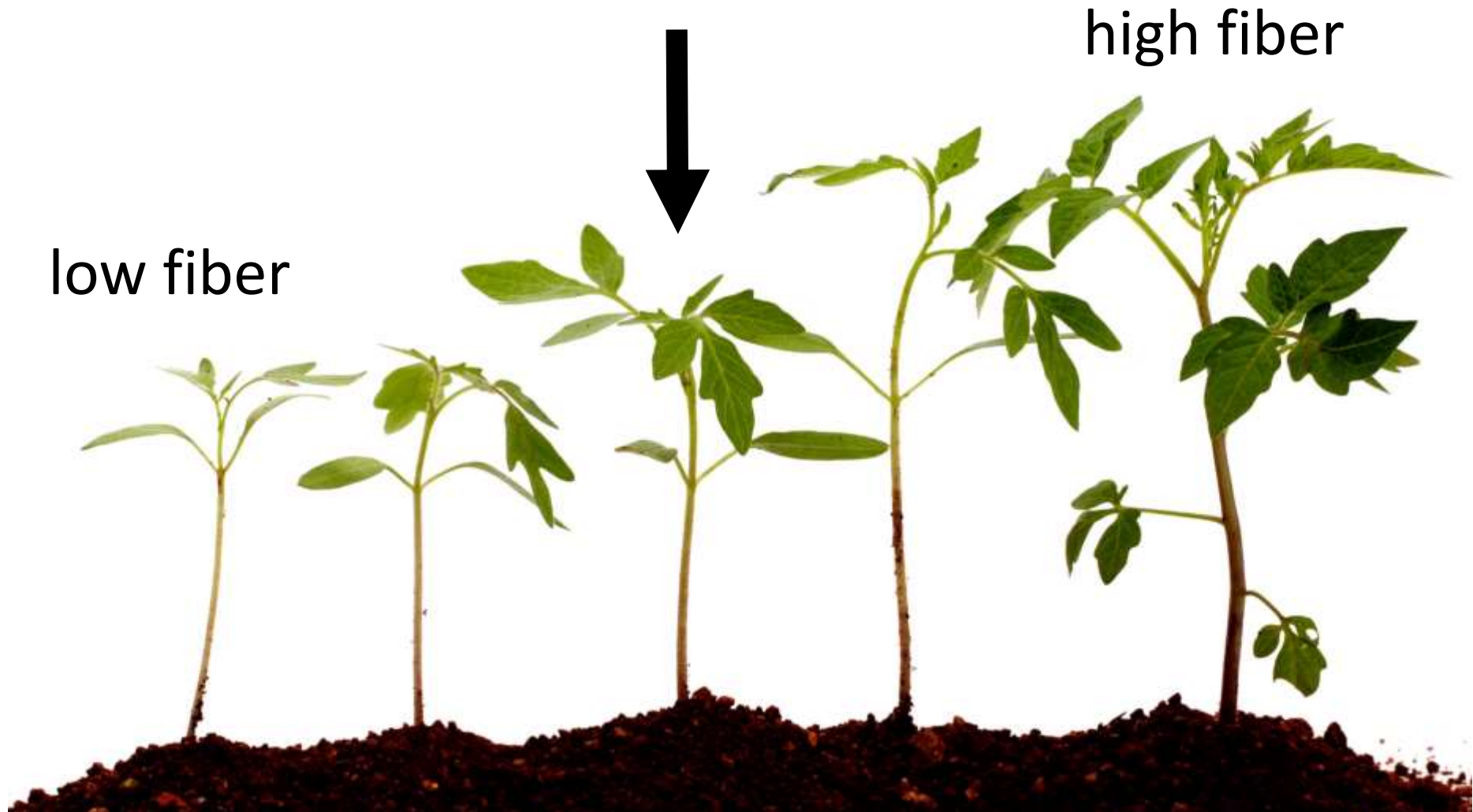
**Summer
Range**

**Winter
Range**

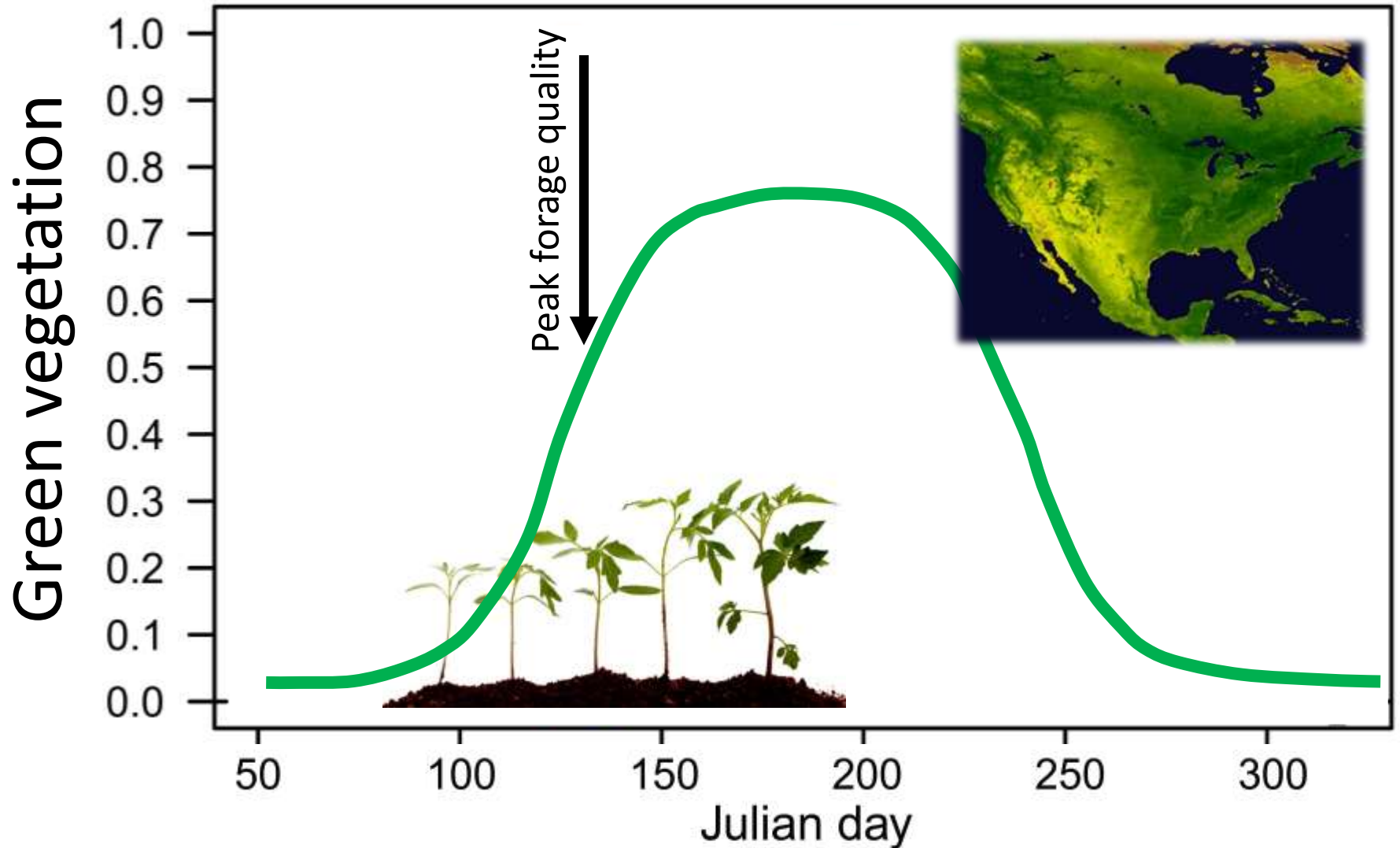
Image Landsat

Google earth

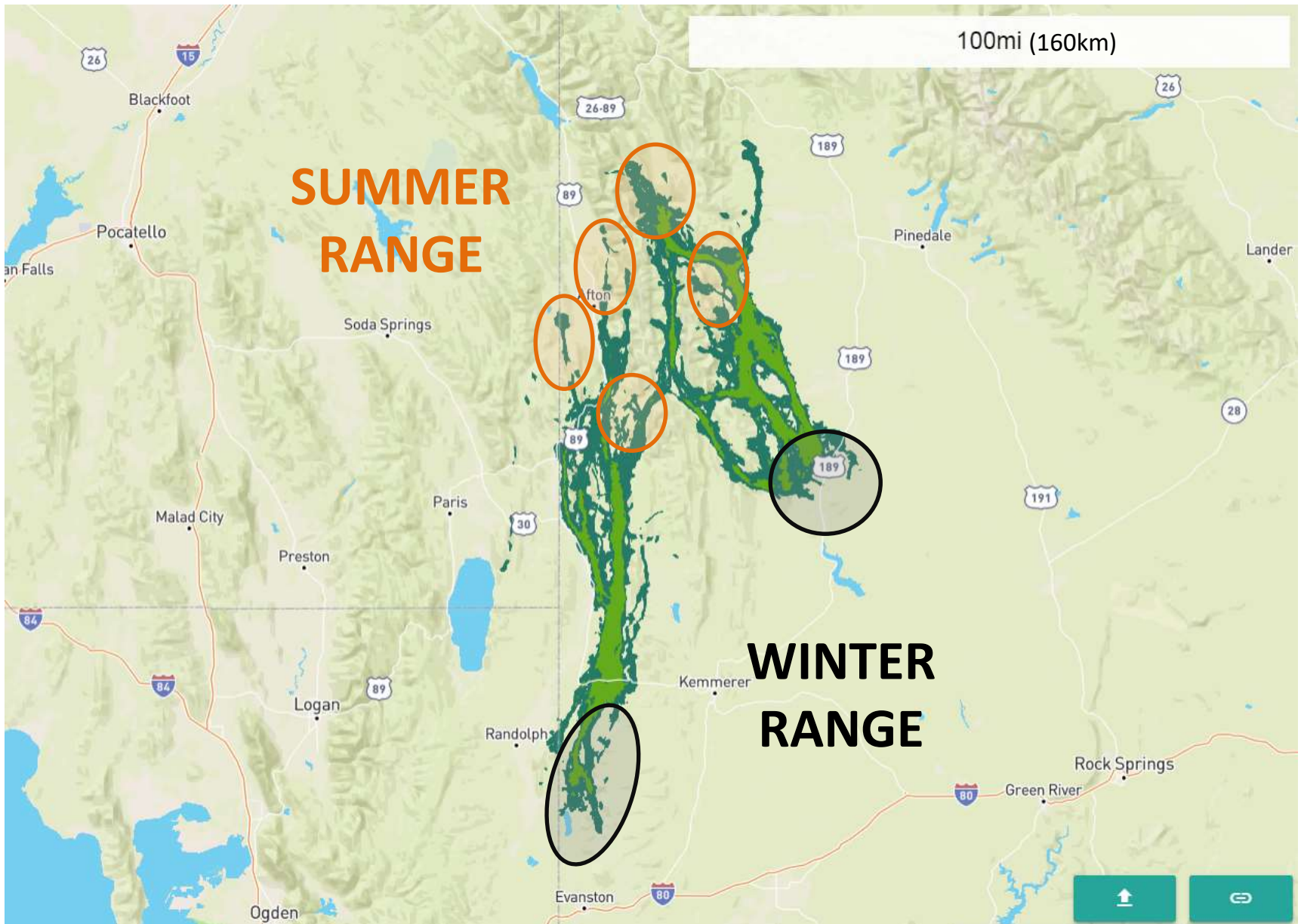
The importance of intermediate growth stage



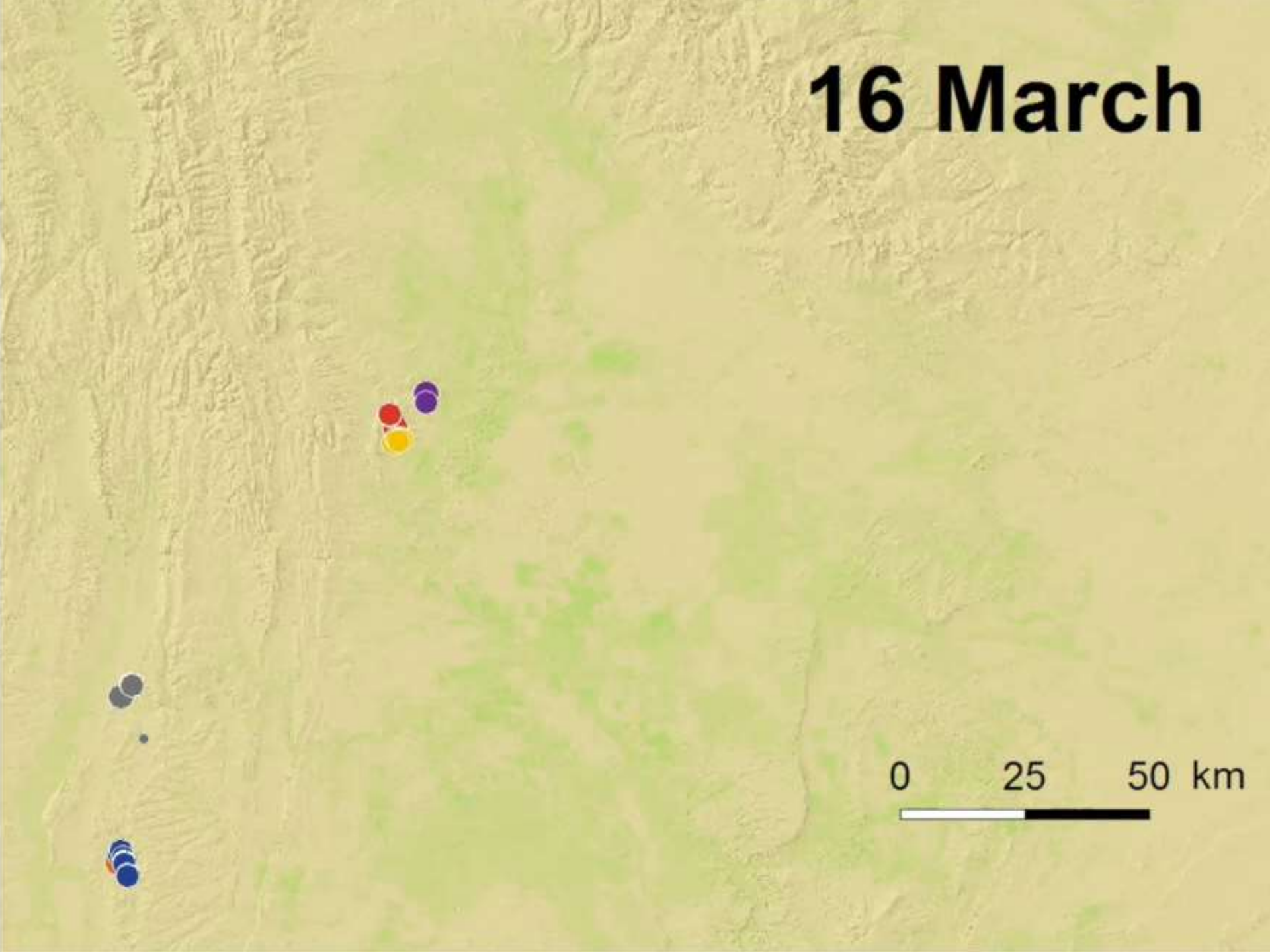
The importance of intermediate growth stage



Wyoming range mule deer

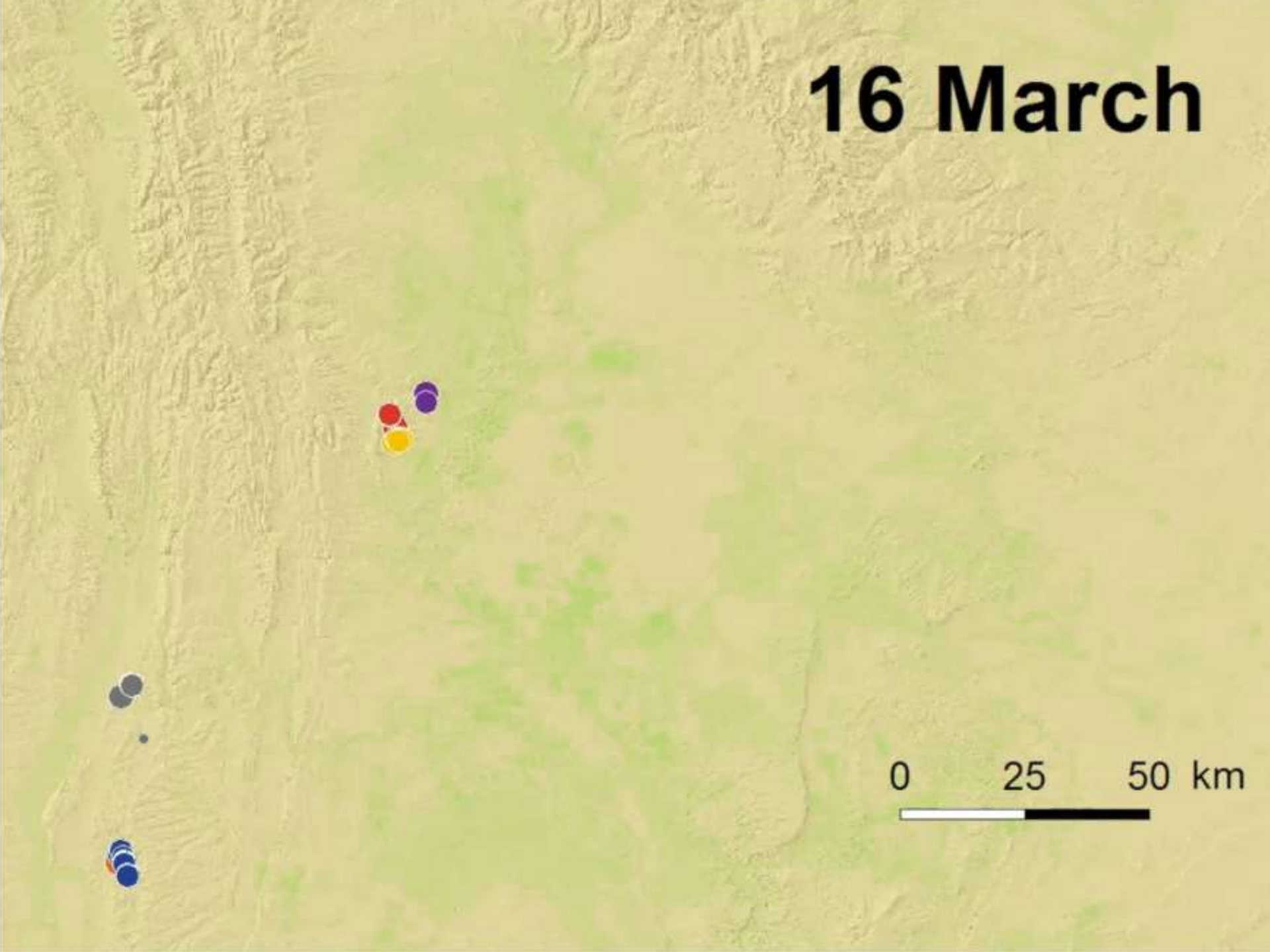


16 March



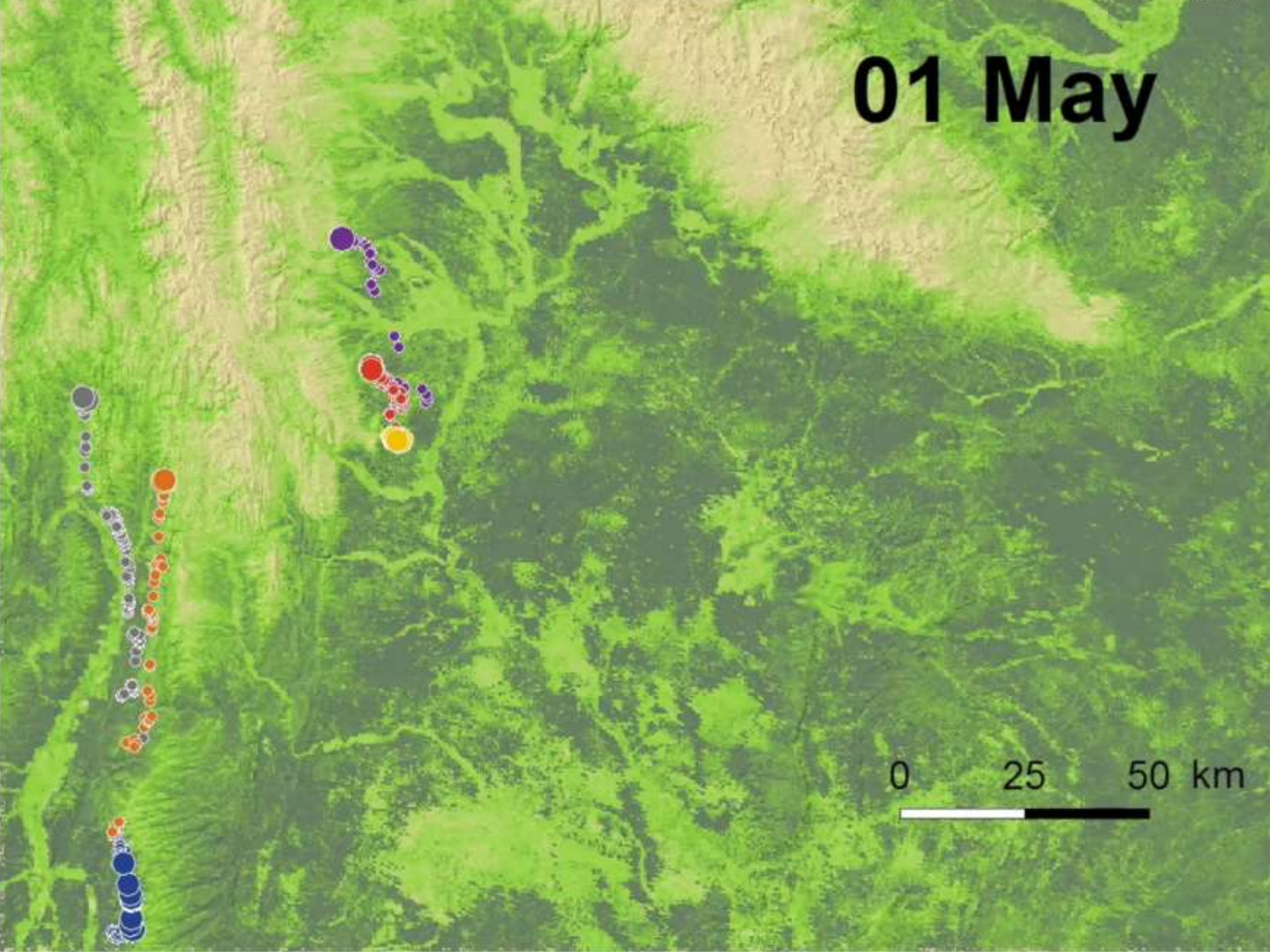
0 25 50 km

16 March



0 25 50 km

01 May

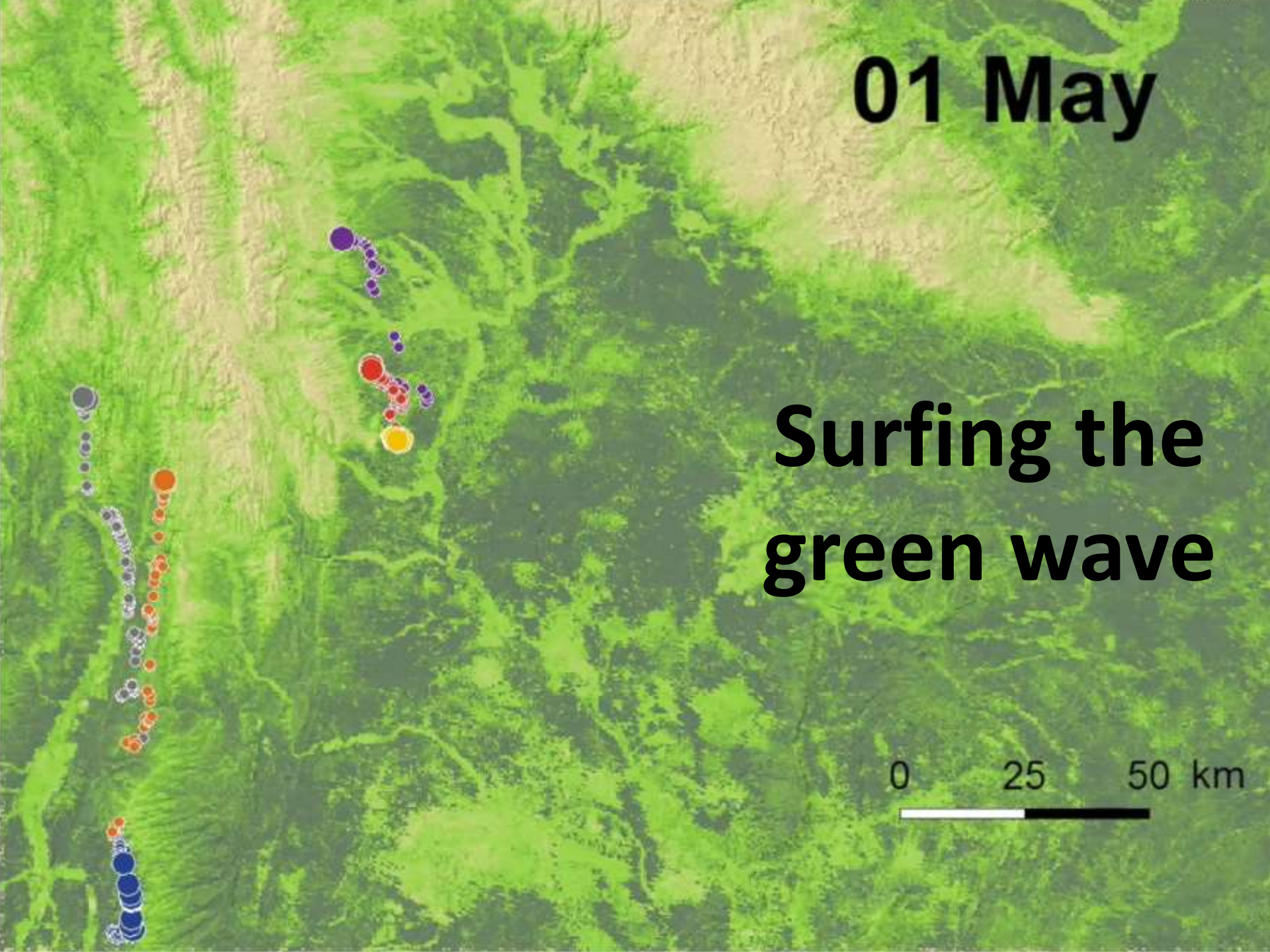


0 25 50 km

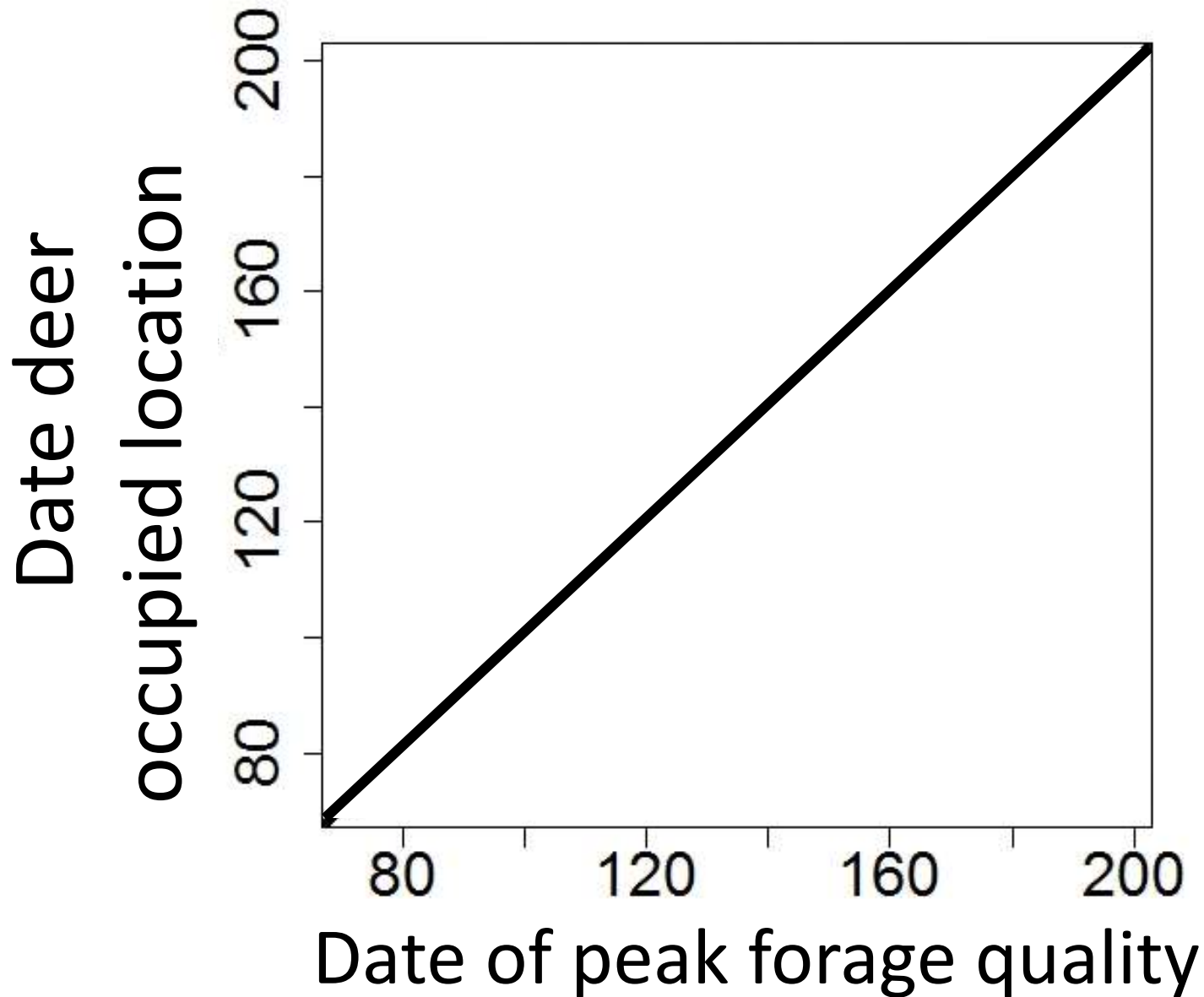
01 May

**Surfing the
green wave**

0 25 50 km

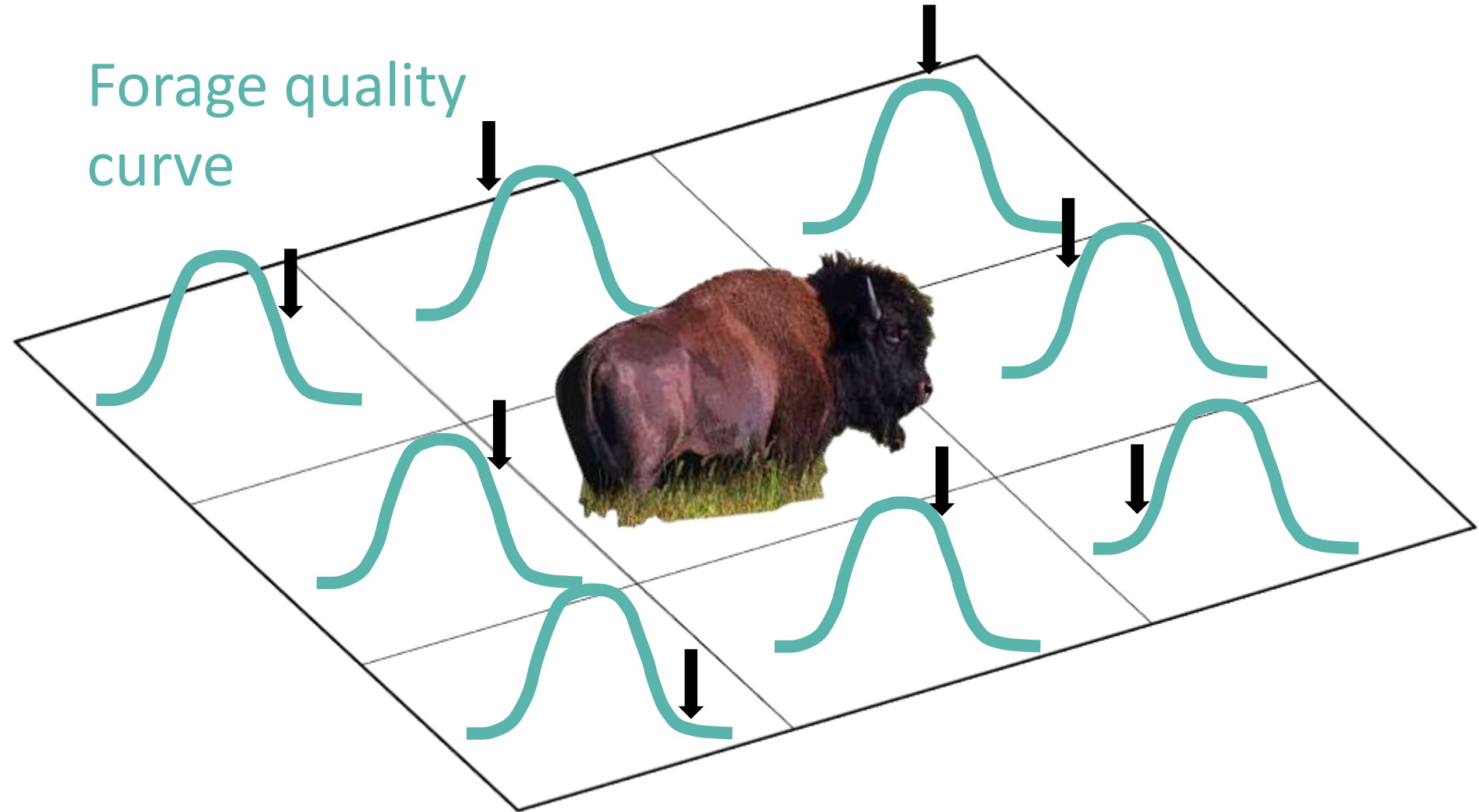


Green wave surfing in mule deer

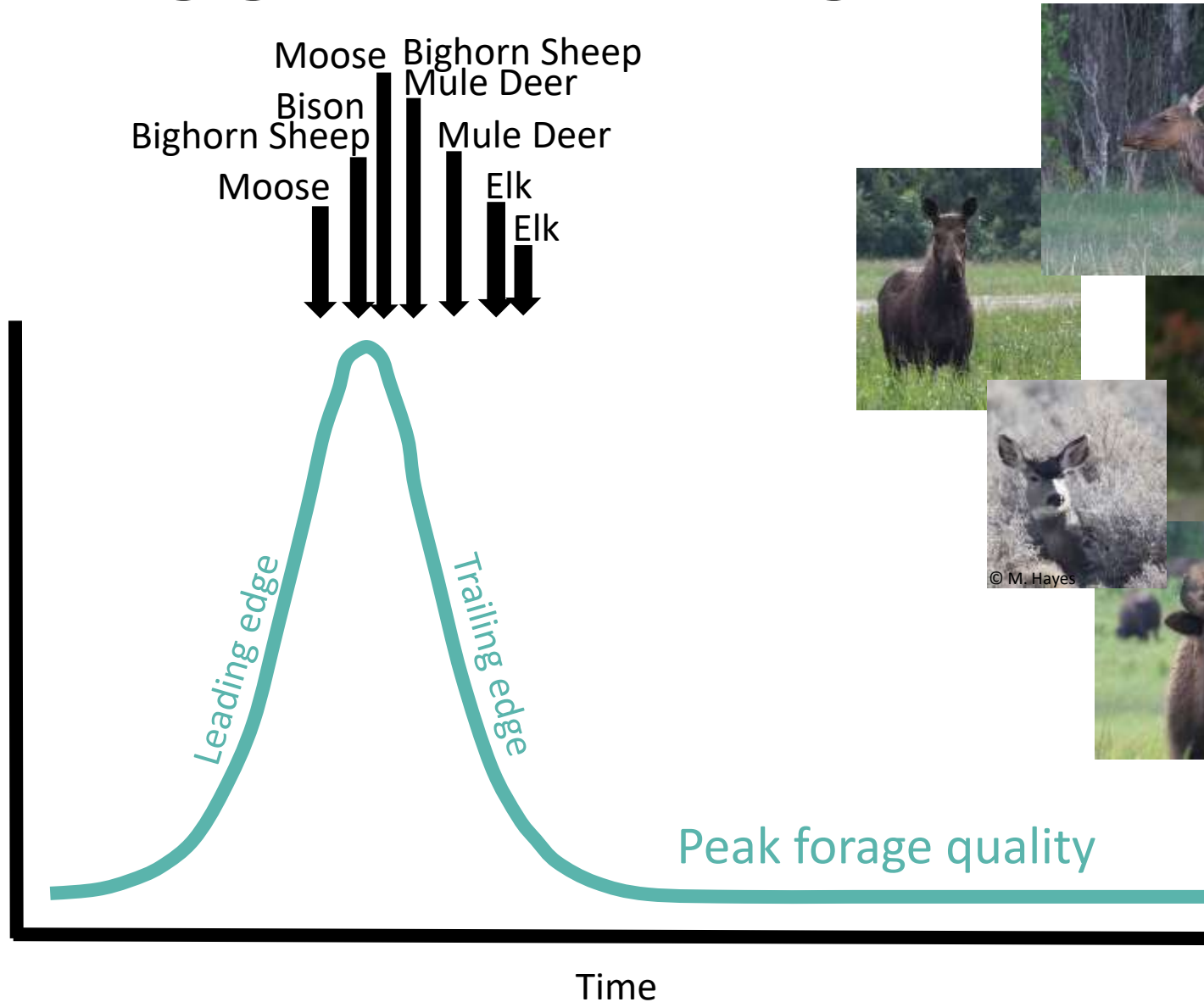


Selecting patches at peak forage quality

Forage quality
curve



All big game surf the green wave





50mi (80km)

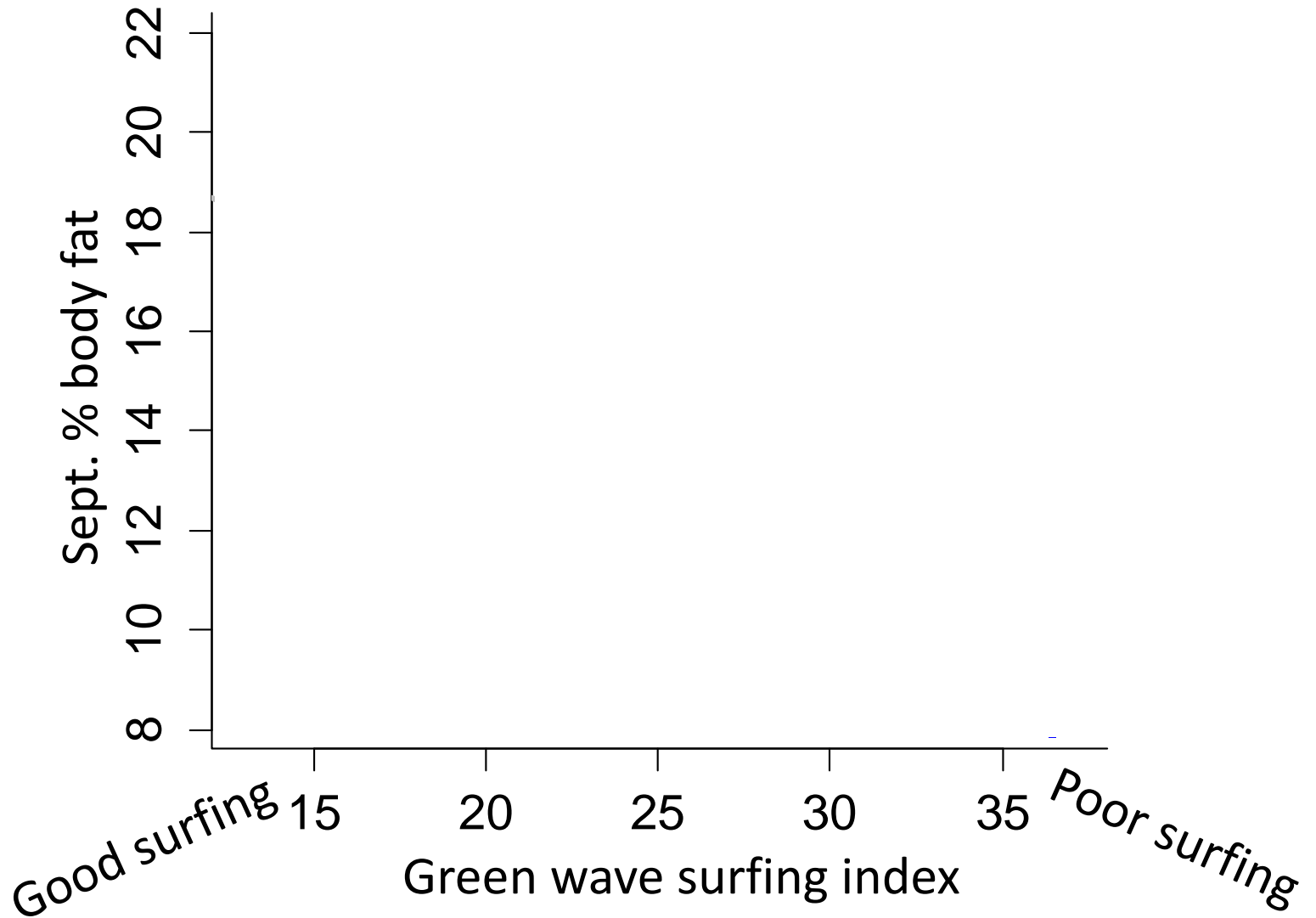
Clarks Fork Elk

**SUMMER
RANGE**

**WINTER
RANGE**

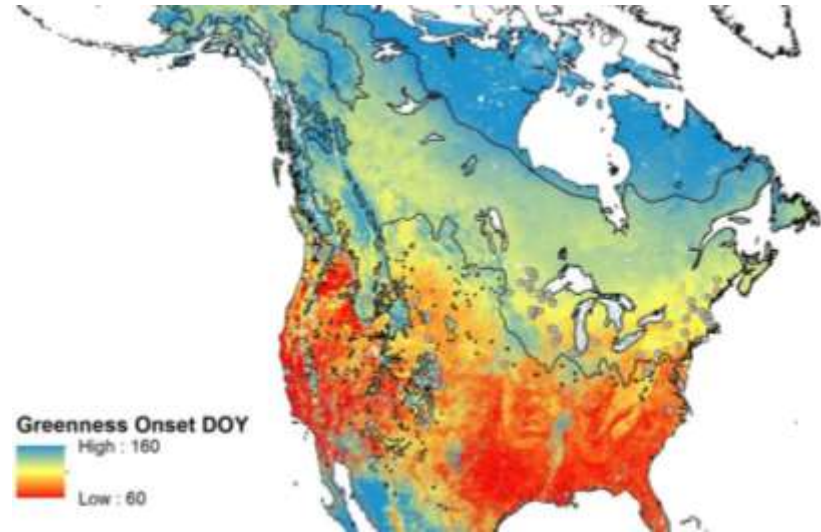


Surfing results in fatter elk



How do animals migrate?

1. Track resource waves



2. Use memory



Memory capabilities in animals are extraordinary



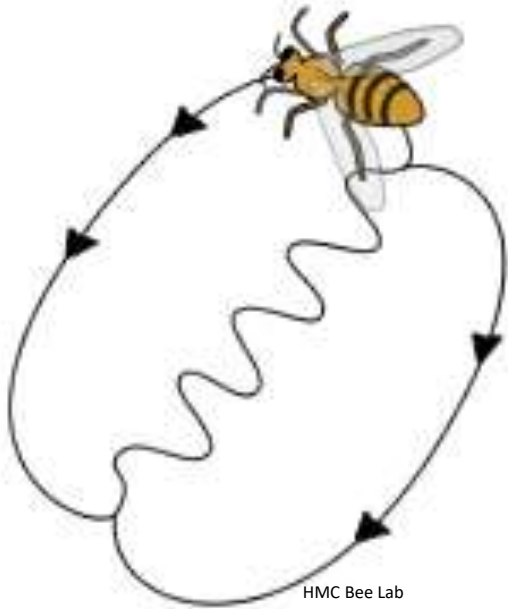
(Inoue and Matsuzawa 2001, *Current Biology*)

Memory capabilities in animals are extraordinary



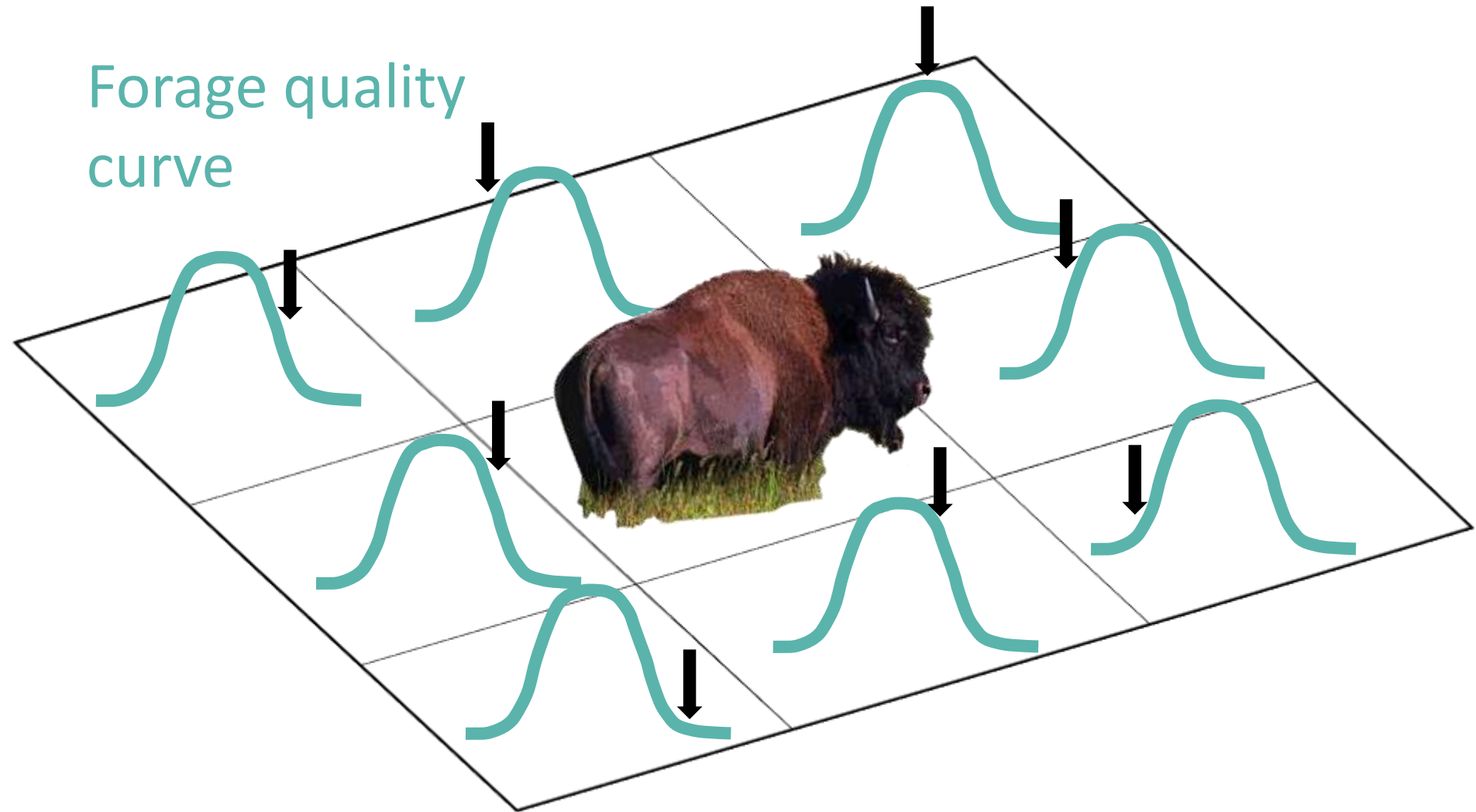
Ingrid Taylor/Creative Commons

Memory capabilities in animals are extraordinary



Good forage, and I've been here before

Forage quality curve



Landscape

Tracking

Elevation

Slope

Aspect

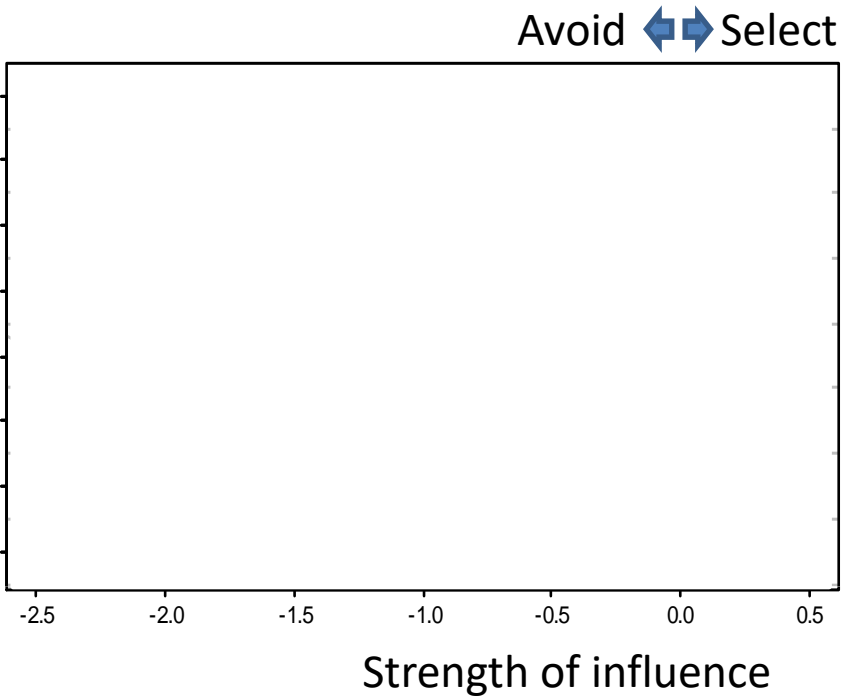
% tree cover

Dist to roads

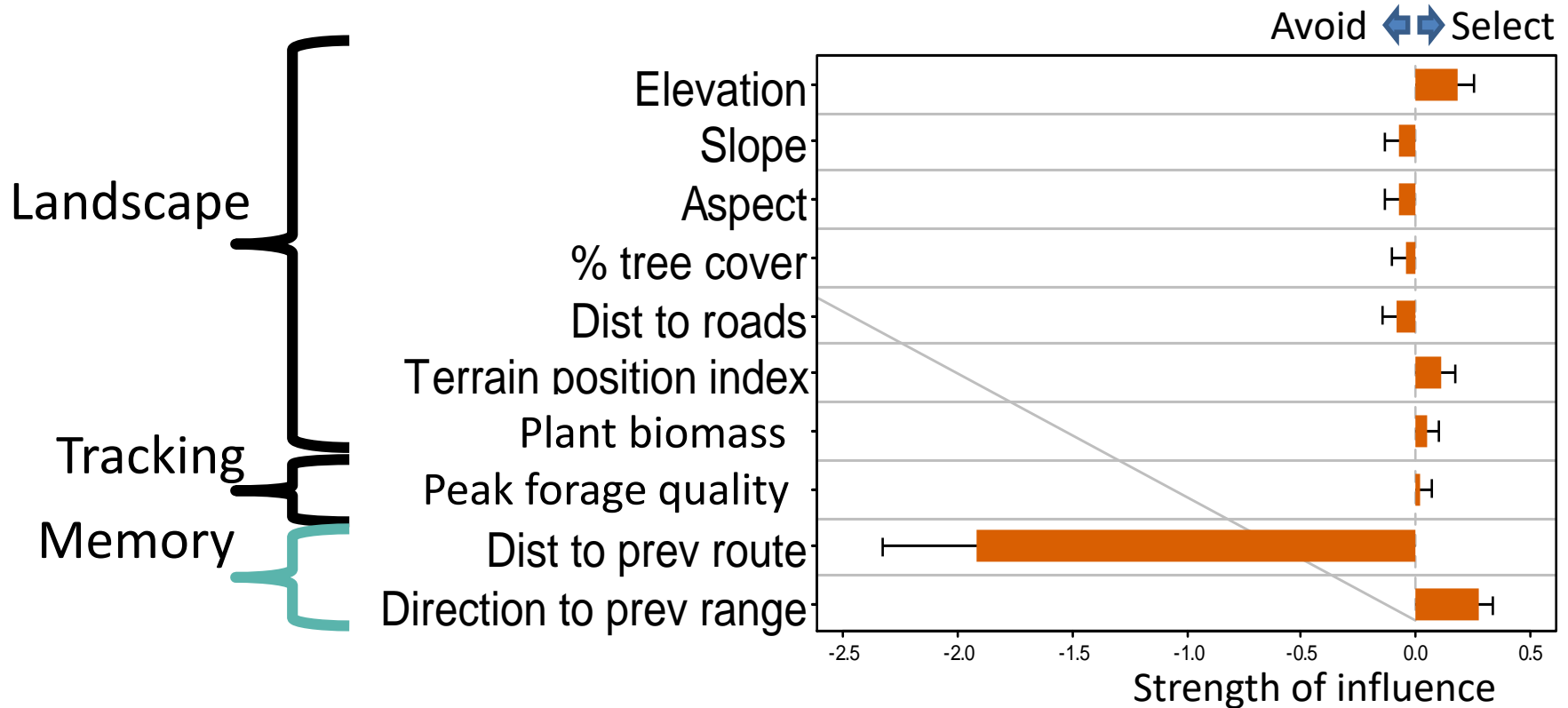
Terrain position index

Plant biomass

Peak forage quality



Memory underlies migratory behavior



*Memory influences deer migration by 5 to 28 times more than other variables

How does migration develop?

Alerstam *et al.* 2003



Mueller *et al.* 2013

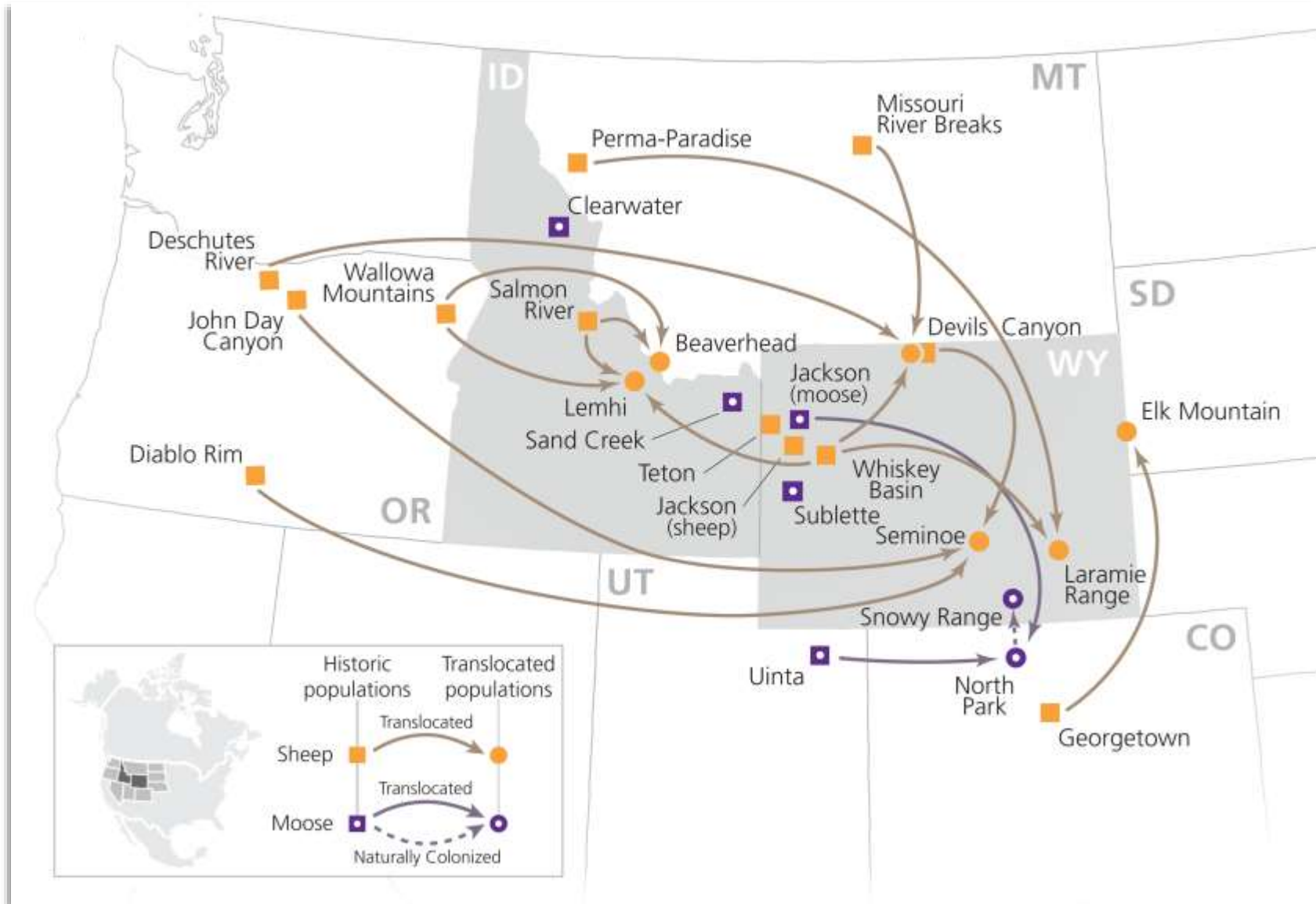


Innate

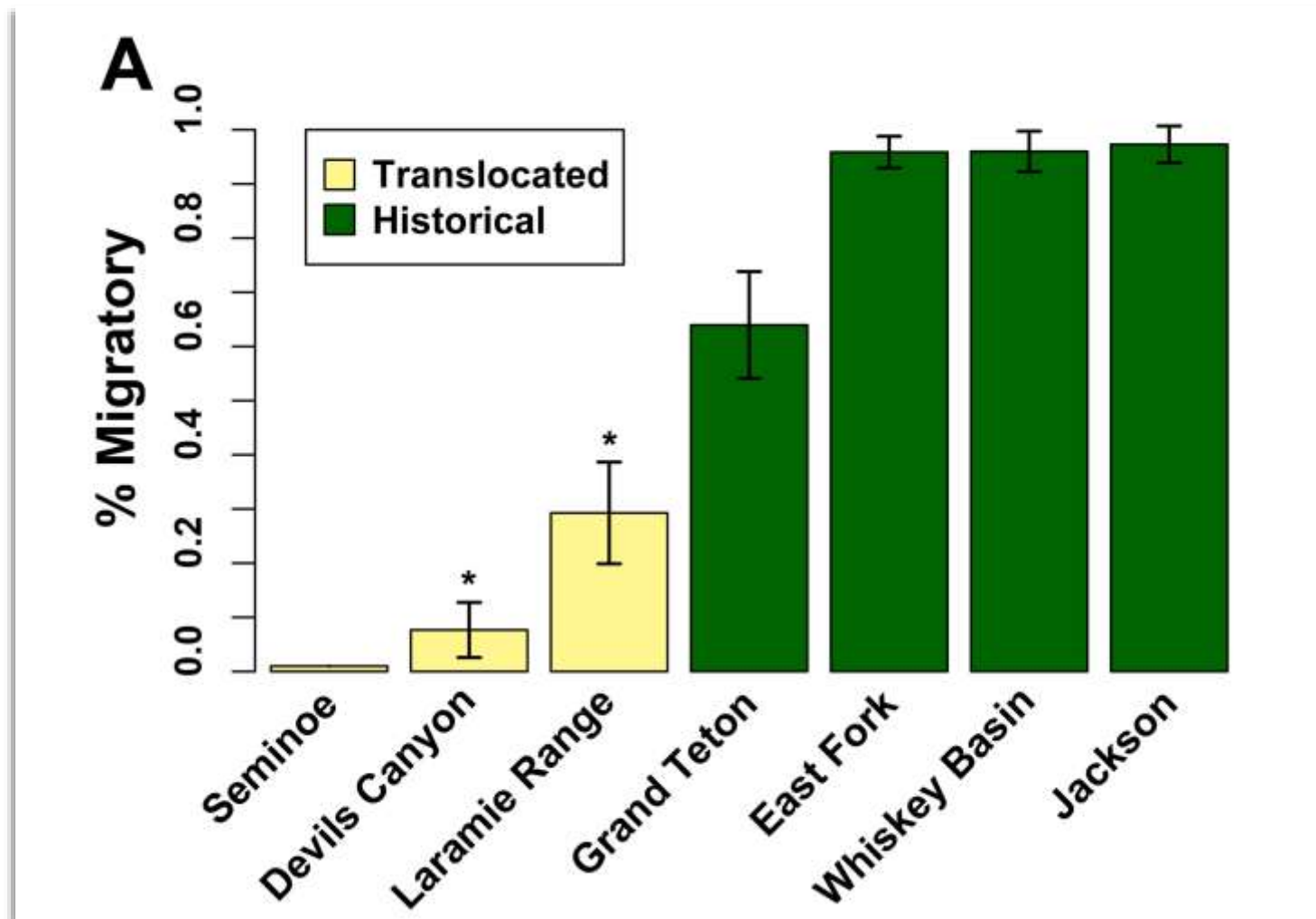
Learned

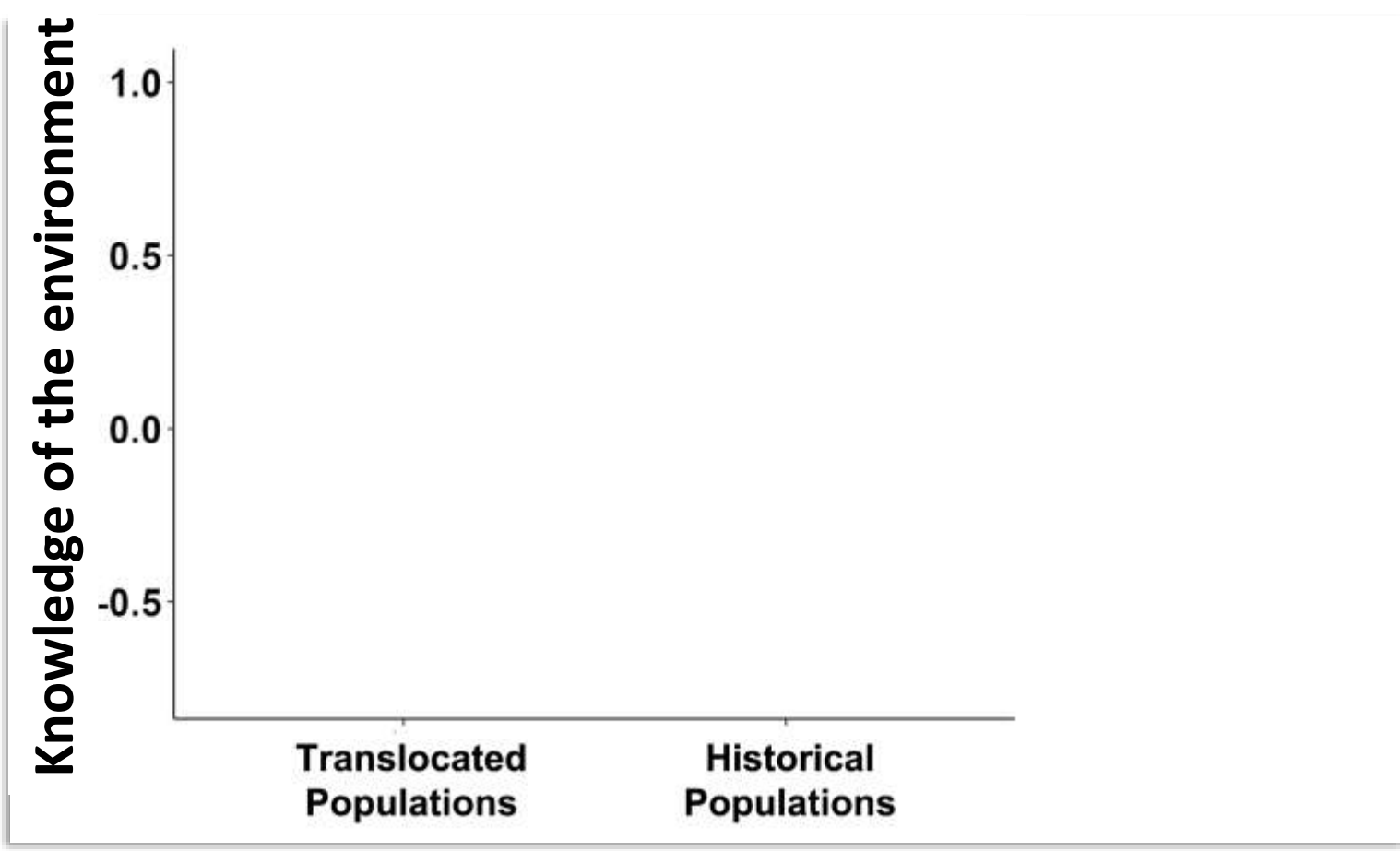


Translocations allow for an experiment

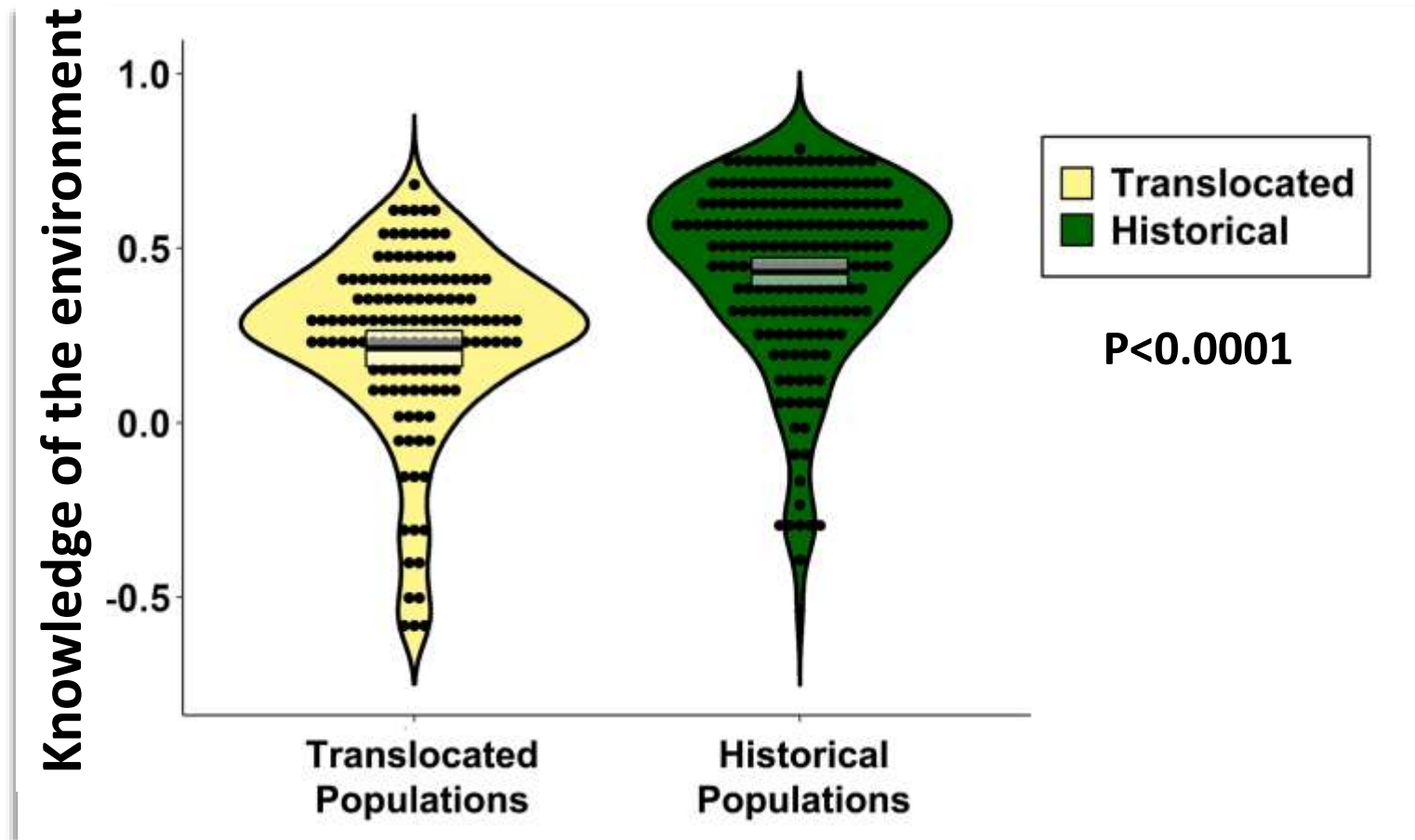


Translocated animals don't migrate



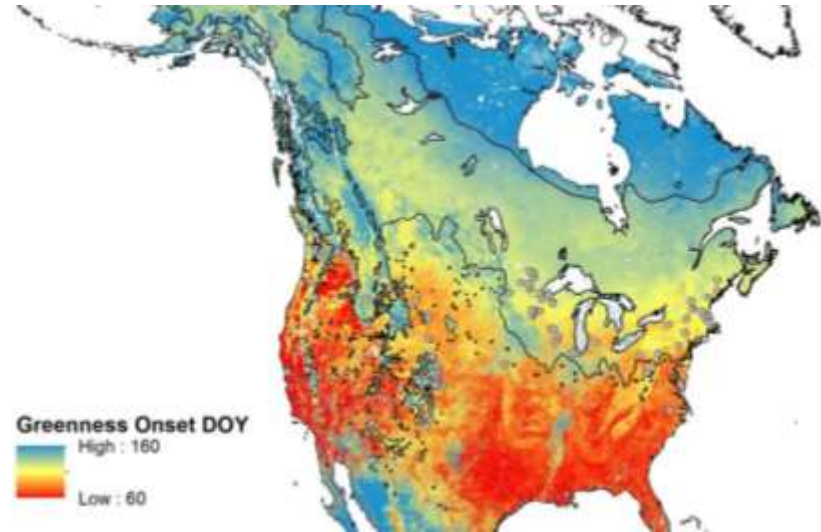


Established sheep had 2x more knowledge than translocated sheep



How do animals migrate?

1. Track resource waves



2. Use memory

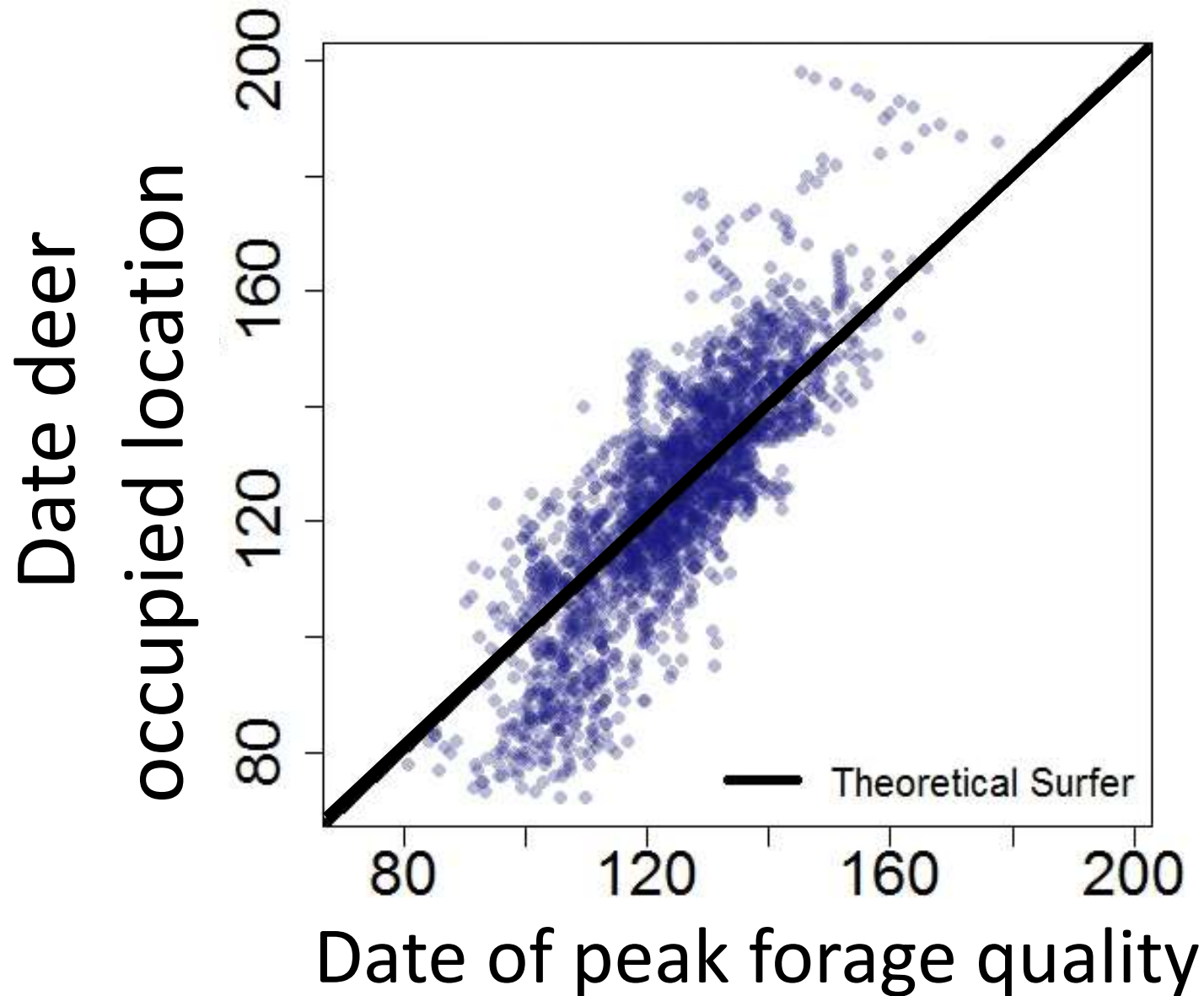




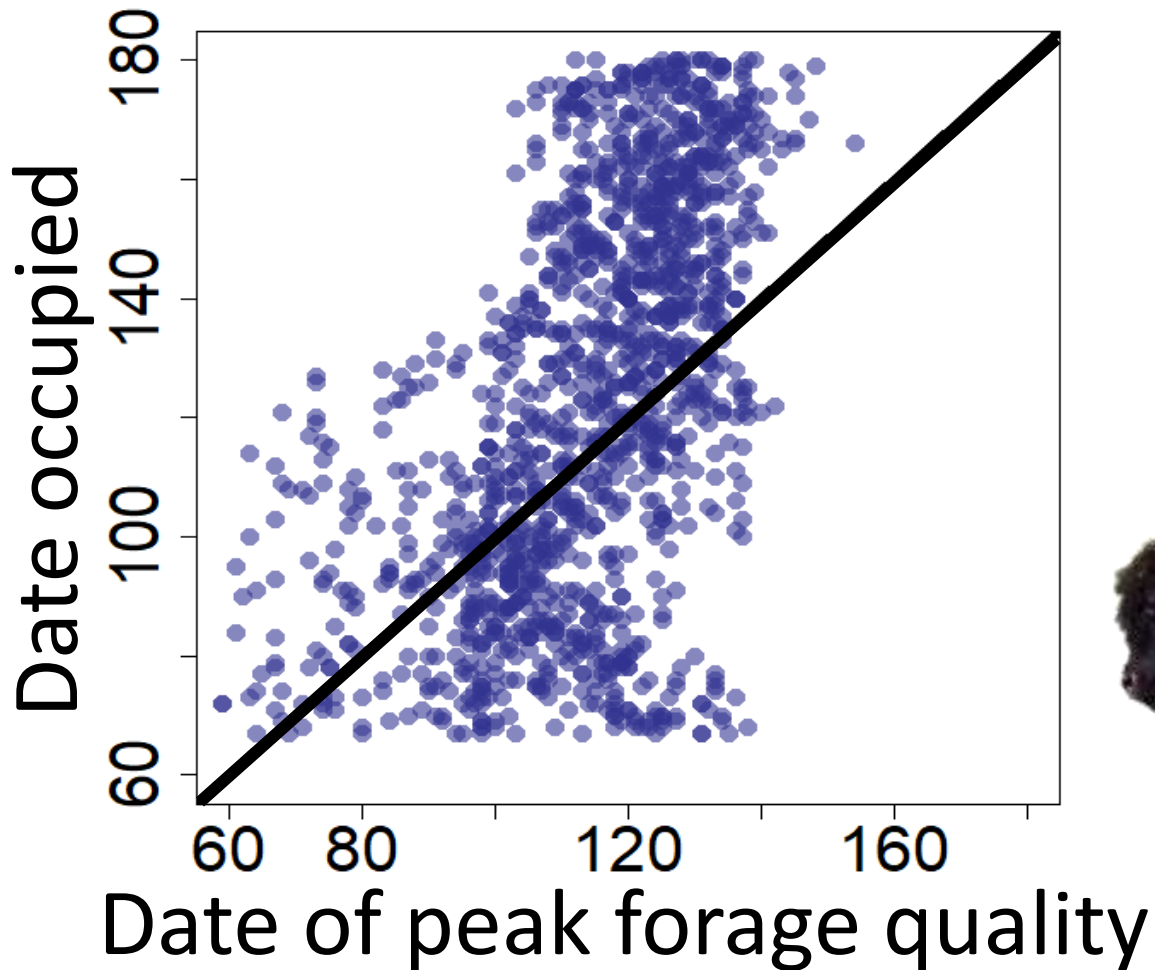
NPS / Jacob W. Frank

NPS / Dan Stahler

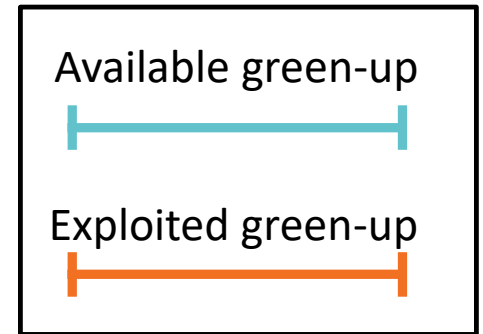
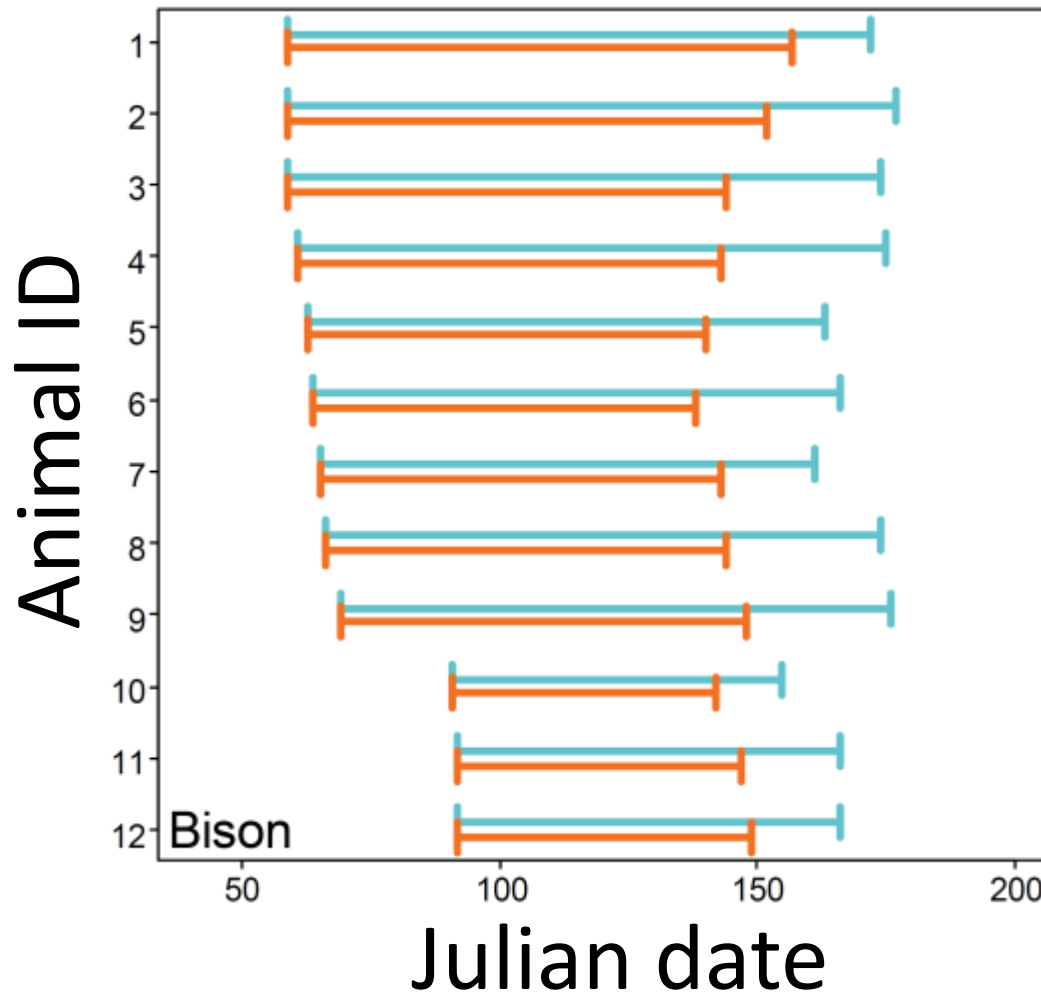
Green wave surfing in mule deer



Bison surf the green wave ...
... sometimes



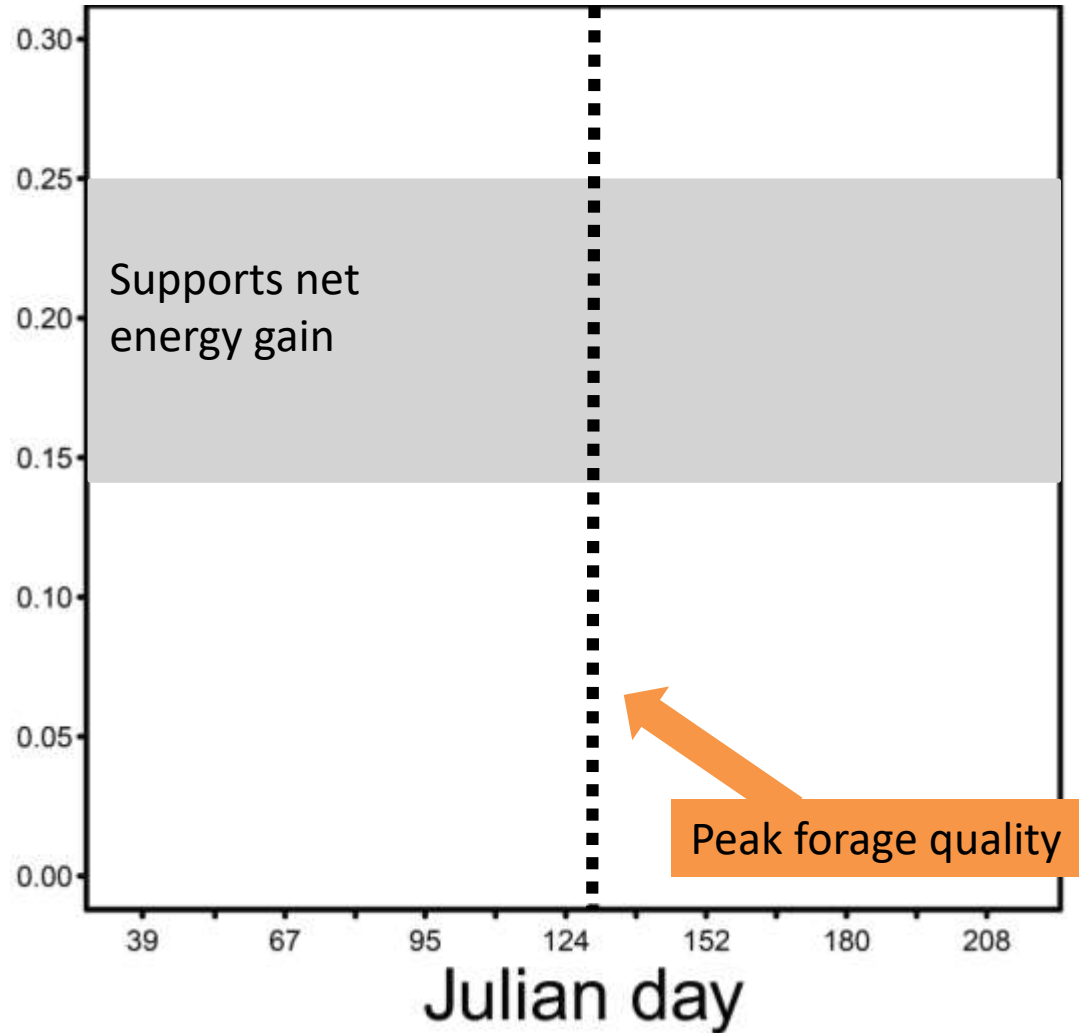
Bison fall behind the green wave



What is the diet of bison?



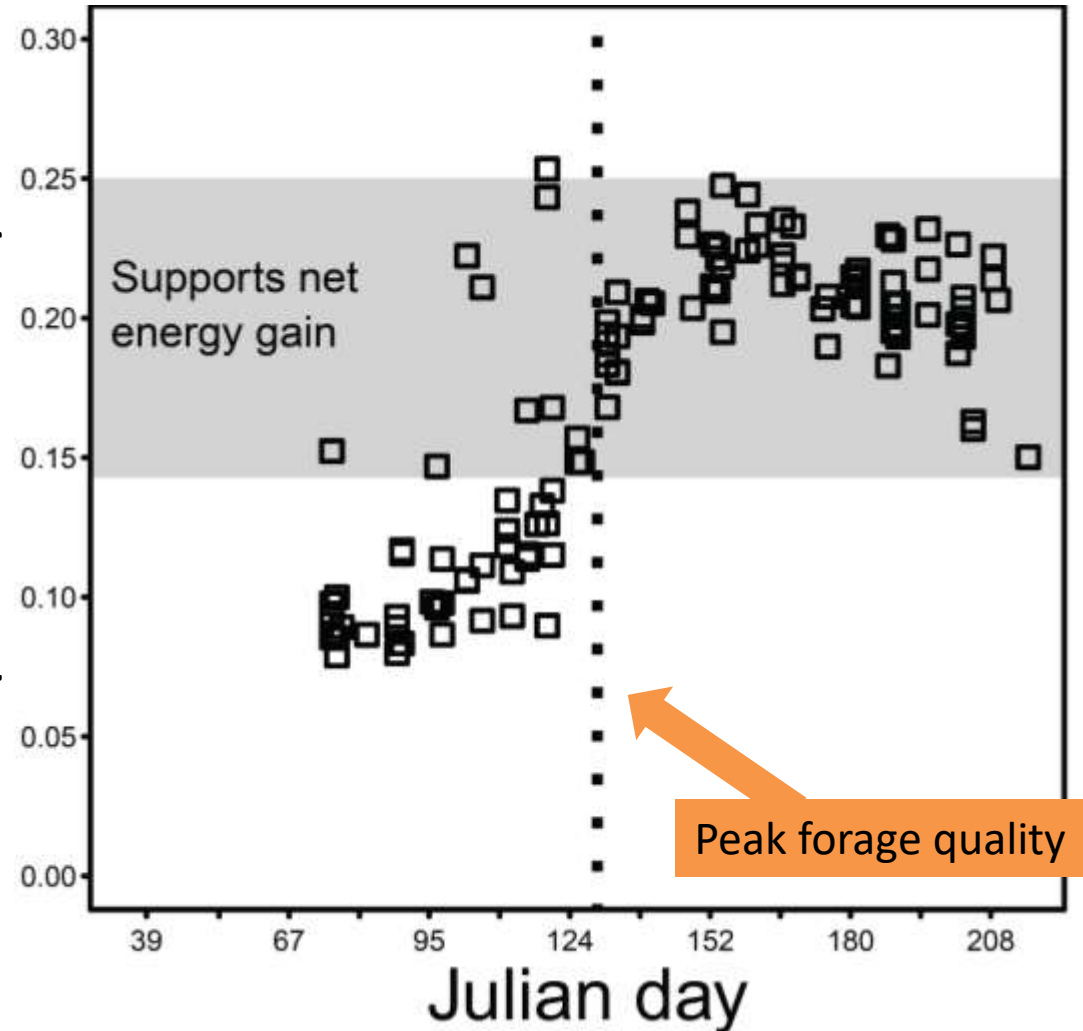
Quality of bison diet
(Fecal CP:DOM)



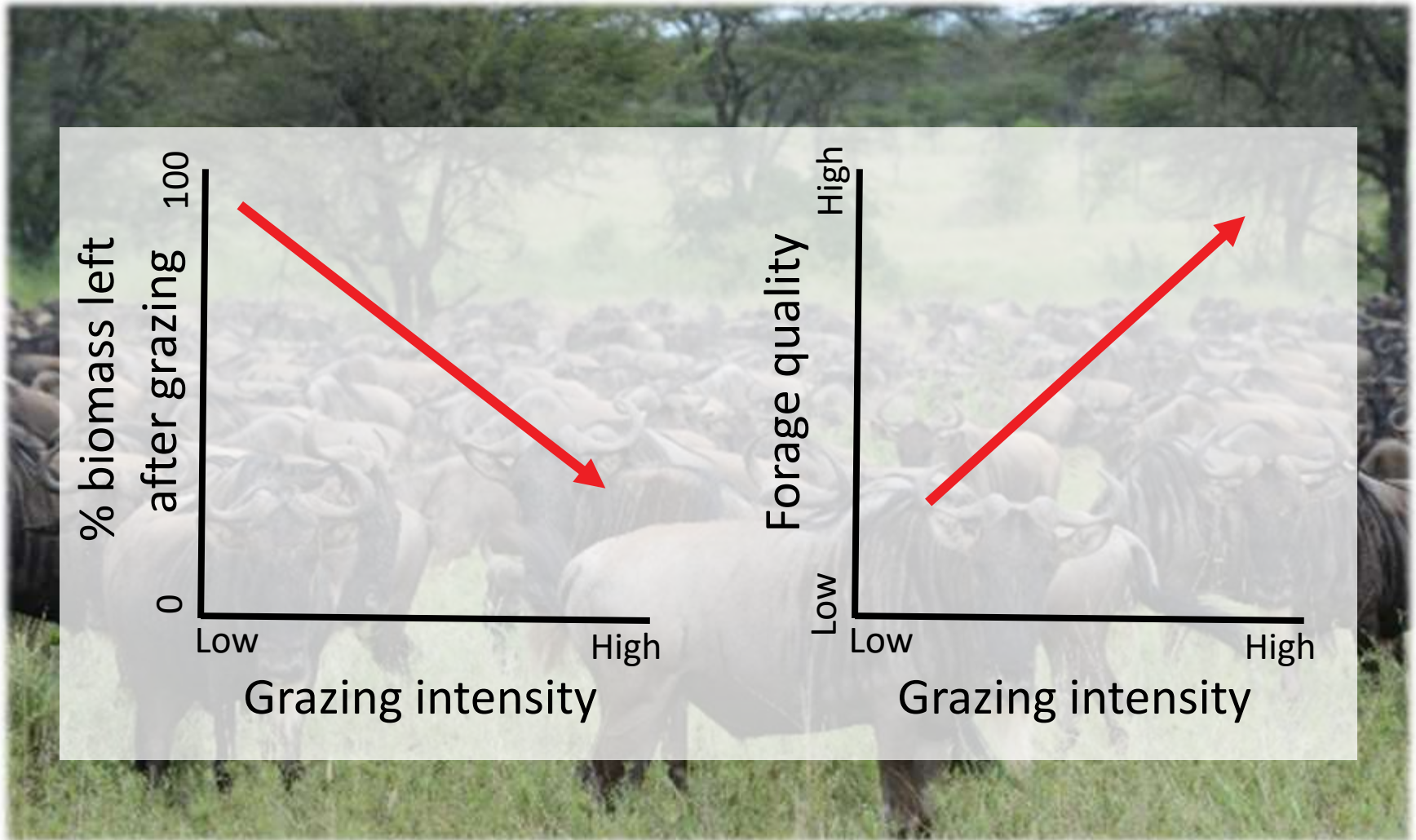
Bison maintain high quality diet even after peak green-up



Quality of bison diet
(Fecal CP:DOM)



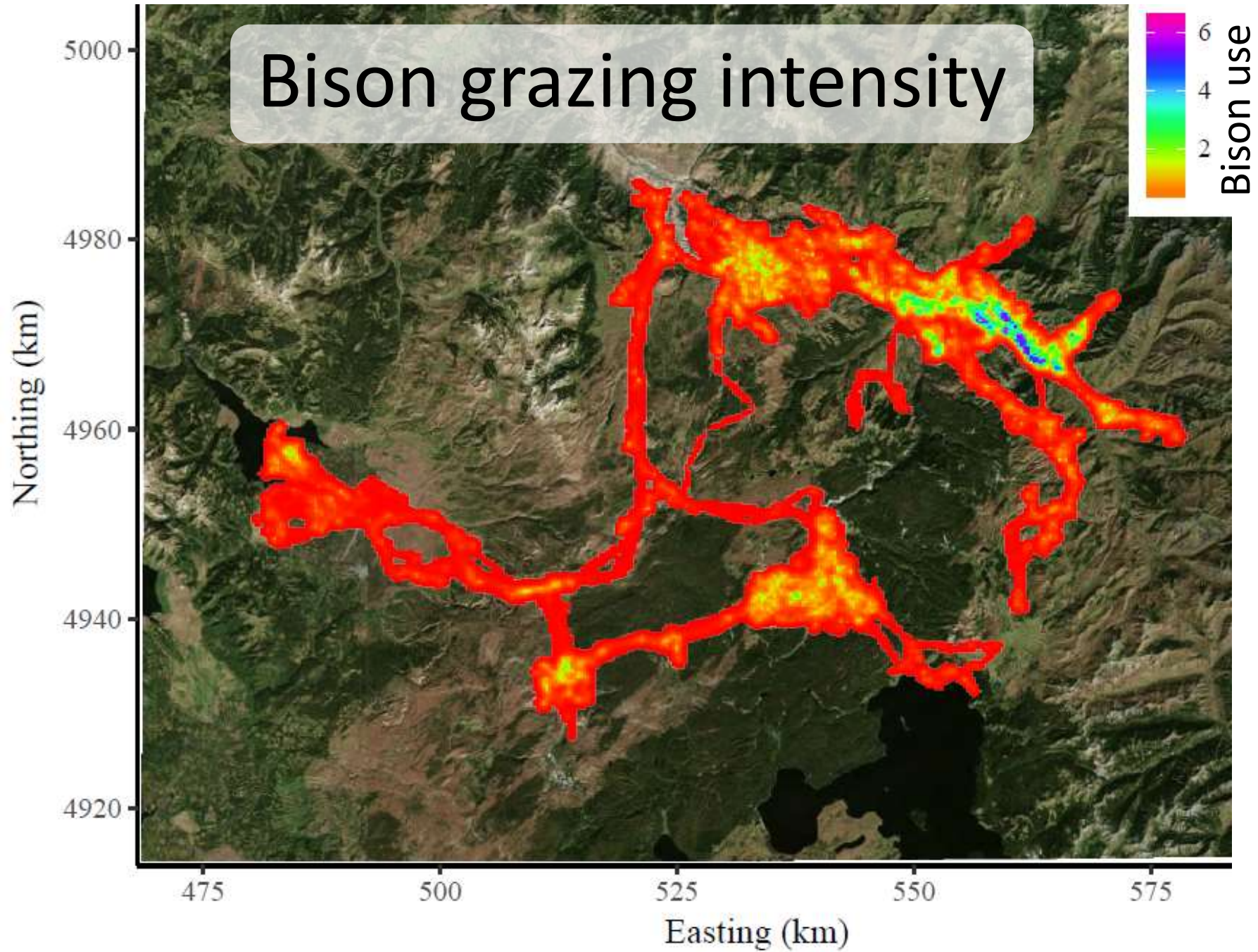
Are bison creating grazing lawns?

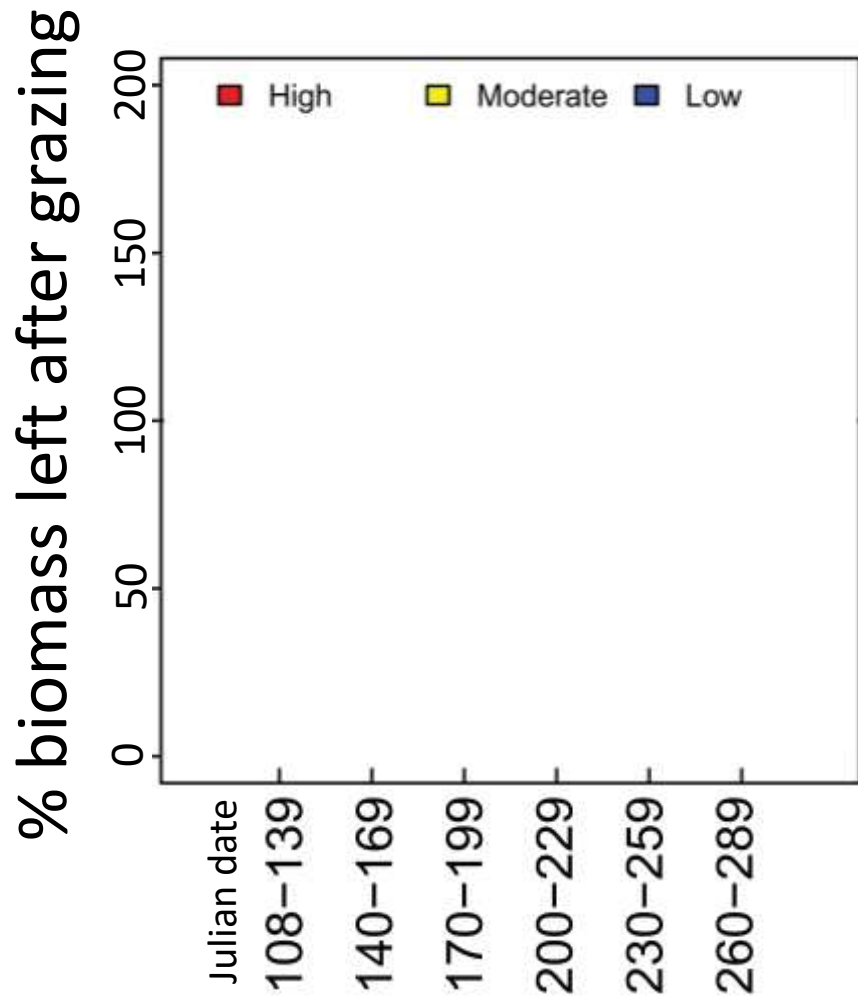


25 grazing exclosures

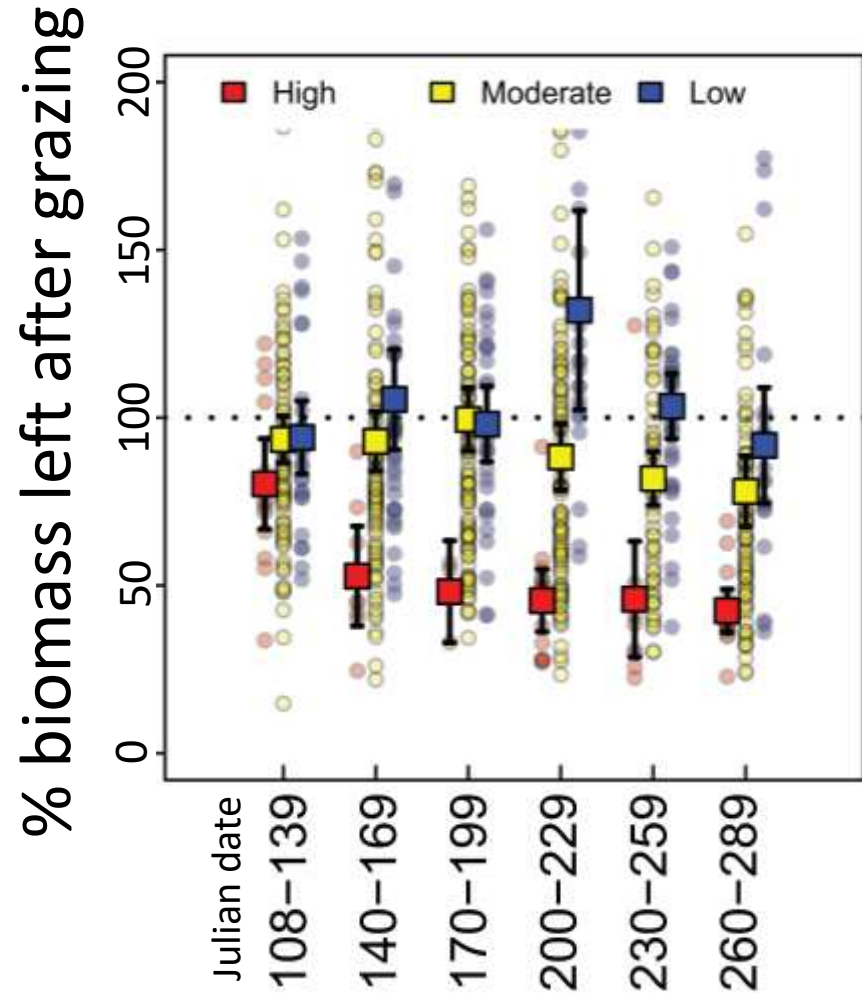


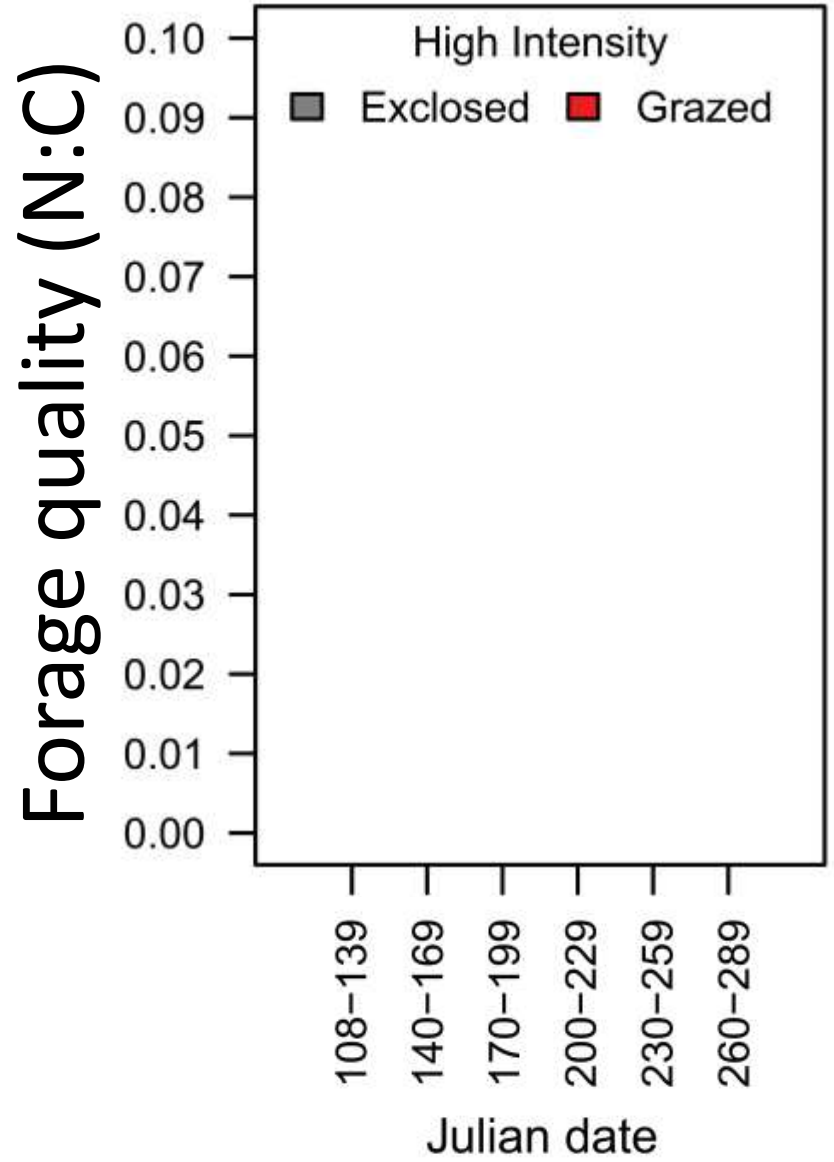
Bison grazing intensity



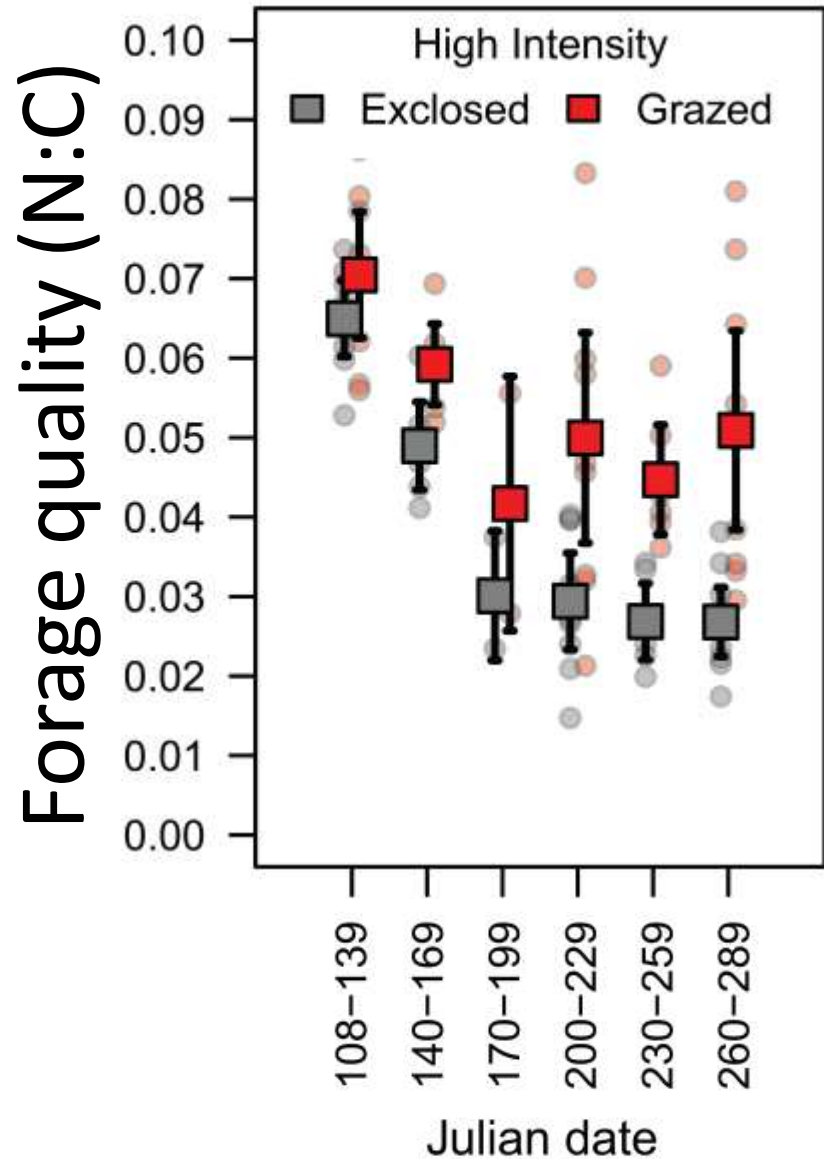


Bison consume 50% of available biomass in high use areas

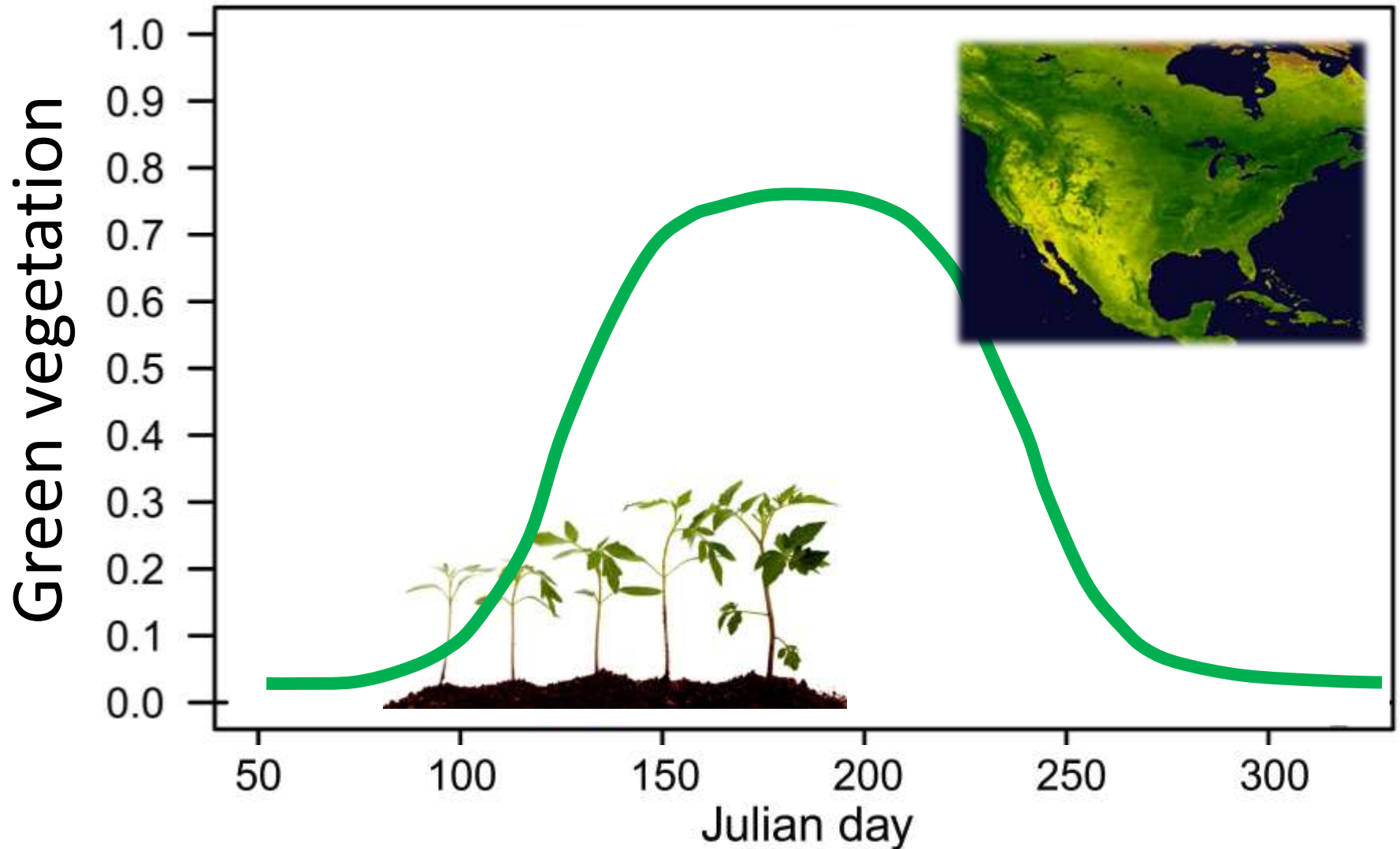




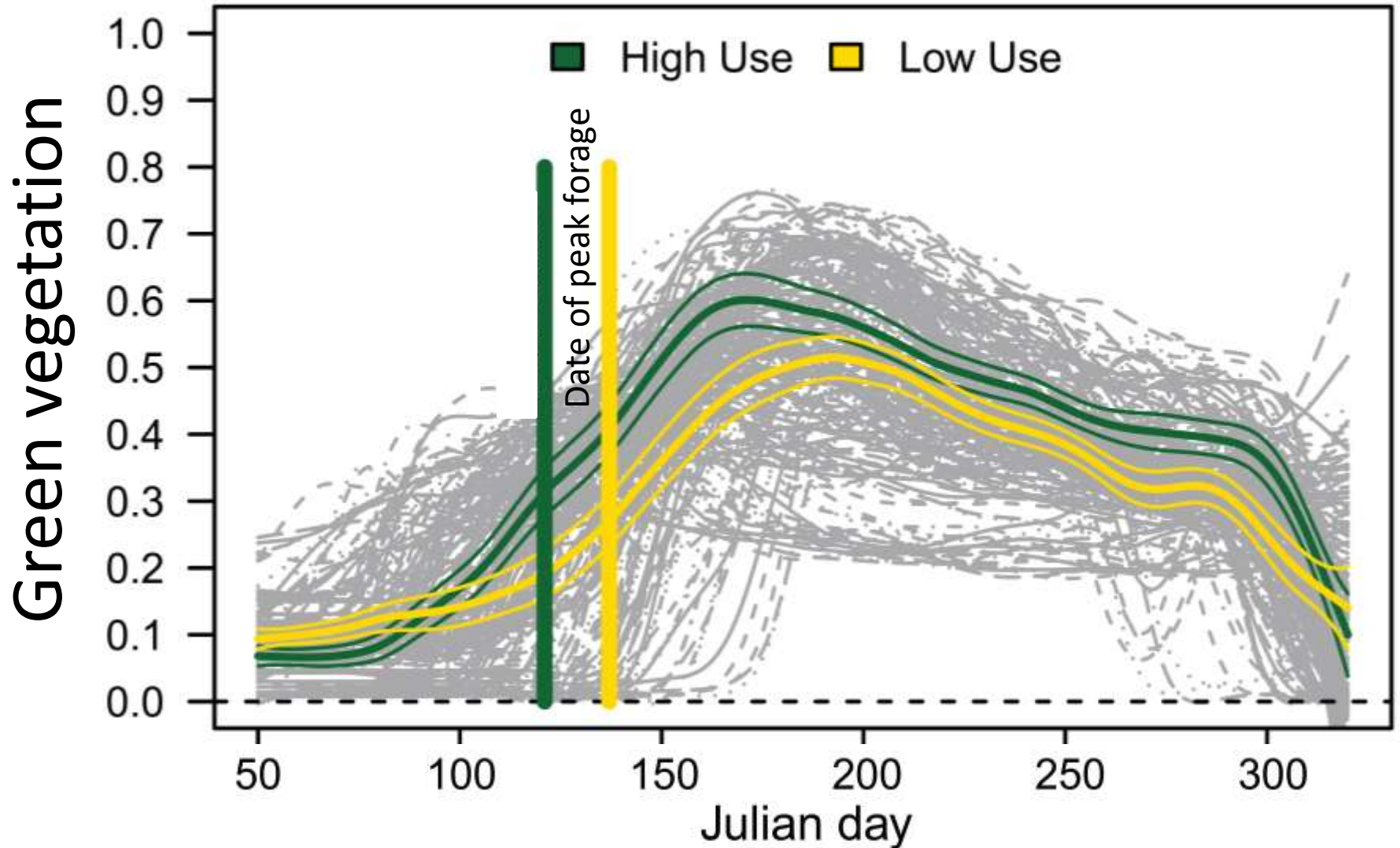
Grazing increases forage quality



Do grazing lawns effect the green wave?



Bison influence plant phenology





NPS / Dan Stahler

Take-home messages

- Big game migrate by tracking resource waves and remembering past experience
- Knowledge of how to migrate is socially transmitted and takes generations to learn
- Bison migrating in large groups can alter the green wave to create their own grazing lawns

Partners and funding sources

Wyoming Game and Fish Department
US Fish and Wildlife Service
Yellowstone and Grand Teton Parks
Bridger-Teton National Forest
The Nature Conservancy
US Geological Survey
WY Geographic Information Science Center
U of Oregon Infographics Group

US Geological Survey (WLCI)
WY Game and Fish Department

Knobloch Family Foundation
George B. Storer Foundation

Wy Gov Big Game License Coalition
National Park Service/Foundation
Wildlife Heritage Foundation of Wyoming
Muley Fanatic Foundation
Rocky Mountain Elk Foundation
Teton Conservation District
Jackson Hole Community Foundation
Foundation for Wild Sheep
US Fish and Wildlife Service
UW School of Energy Resources
US Forest Service
Bow Hunters of Wyoming

Bureau of Land Management
Wy Animal Damage Management Board
Wy Outfitters and Guides Association
Wy Dept of Transportation
Boone and Crocket Club
Greater Yellowstone Coordinating Committee
Cody Country Outfitters and Guides
WWNRT
The Nature Conservancy
Mule Deer Foundation
NRCS

Thank you!

