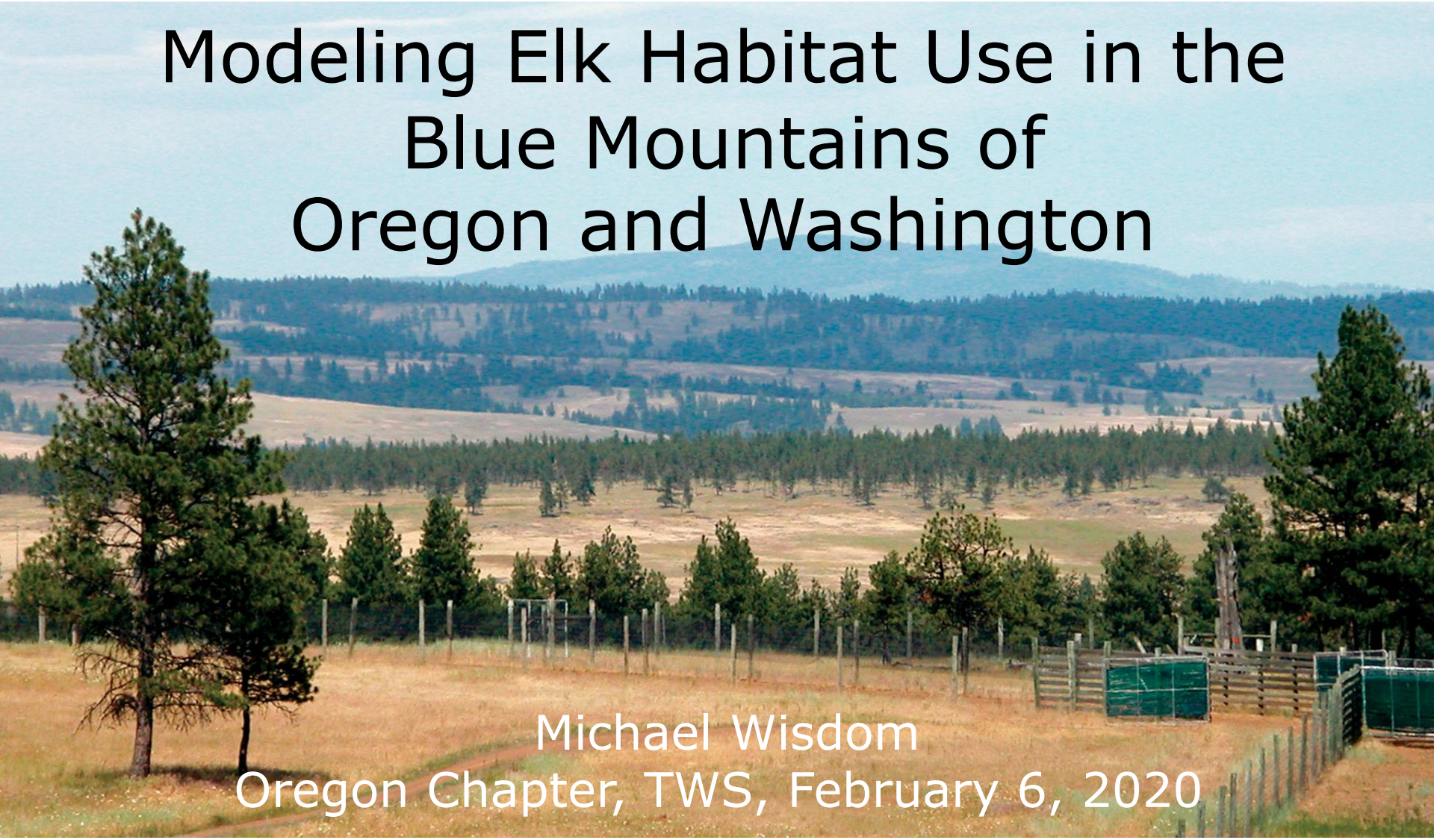
Modeling Elk Habitat Use in the Blue Mountains of Oregon and Washington



Michael Wisdom

Oregon Chapter, TWS, February 6, 2020

Collaborators

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- Rachel Cook, John Cook, National Council for Air and Stream Improvement
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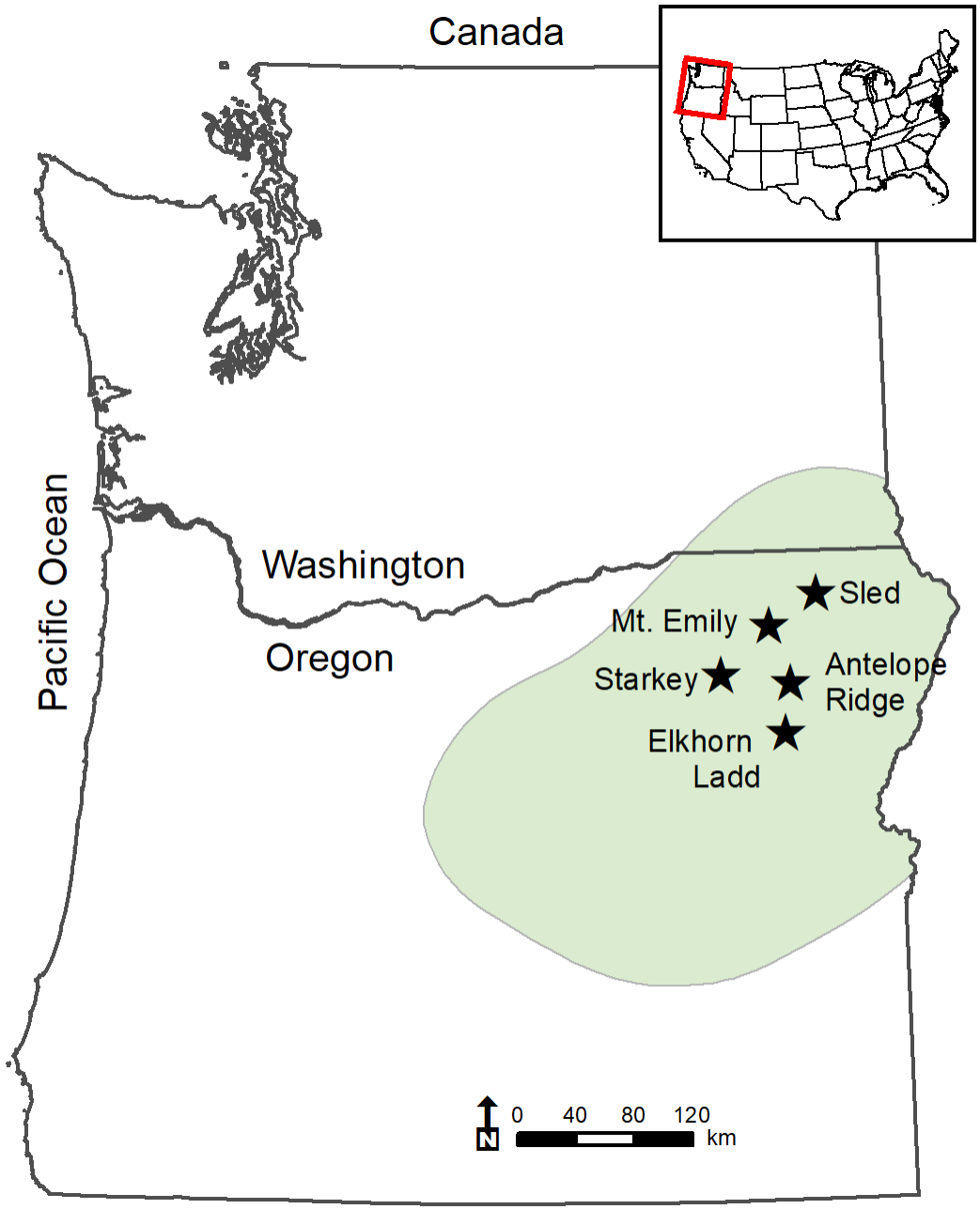
Partners (Staffing, Funding, or Data)

- American Forest Resource Council
- Blue Mountains Elk Initiative
- Boise Cascade Corporation
- Boone and Crockett Club
- Forest Capital LLC
- National Council for Air and Stream Improvement
- National Fish and Wildlife Foundation
- Oregon Department of Fish and Wildlife

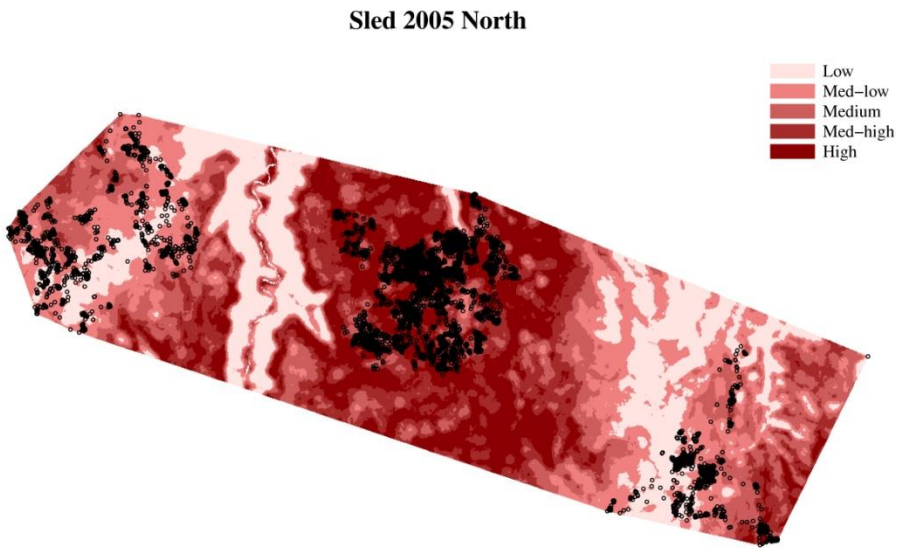
Partners (Staffing, Funding, or Data)

- Oregon Forest Industries Council
- Oregon State University
- Rocky Mountain Elk Foundation
- Sporting Conservation Council
- US Forest Service (WO, R6, Bl. Mtns. NFs, PNW)
- USDI Bureau of Land Management (WO, OR-WA)
- Washington Department of Fish and Wildlife
- WEST, Inc


Canada
Pacific Ocean
Washington
Oregon
Sled
Mt. Emily
Starkey
Antelope Ridge
Elkhorn
Ladd
N
0 40 80 120
km

Blue Mountains Elk Models 2014

- Nutrition Model
- Habitat Use Model



Modeling Objectives

- Improve management utility of nutrition and habitat use models built, validated, and beta tested from 2012-2014.

- Strengthen the inference space of modeling with telemetry data from:

  --5 study areas, 18 years, and 300 female elk

  versus

  --original 2 areas, 9 years, and 136 female elk.

Modeling Objectives

- Build and validate a late-summer habitat use model for elk that reflects habitat requirements and contains covariates that can be managed.

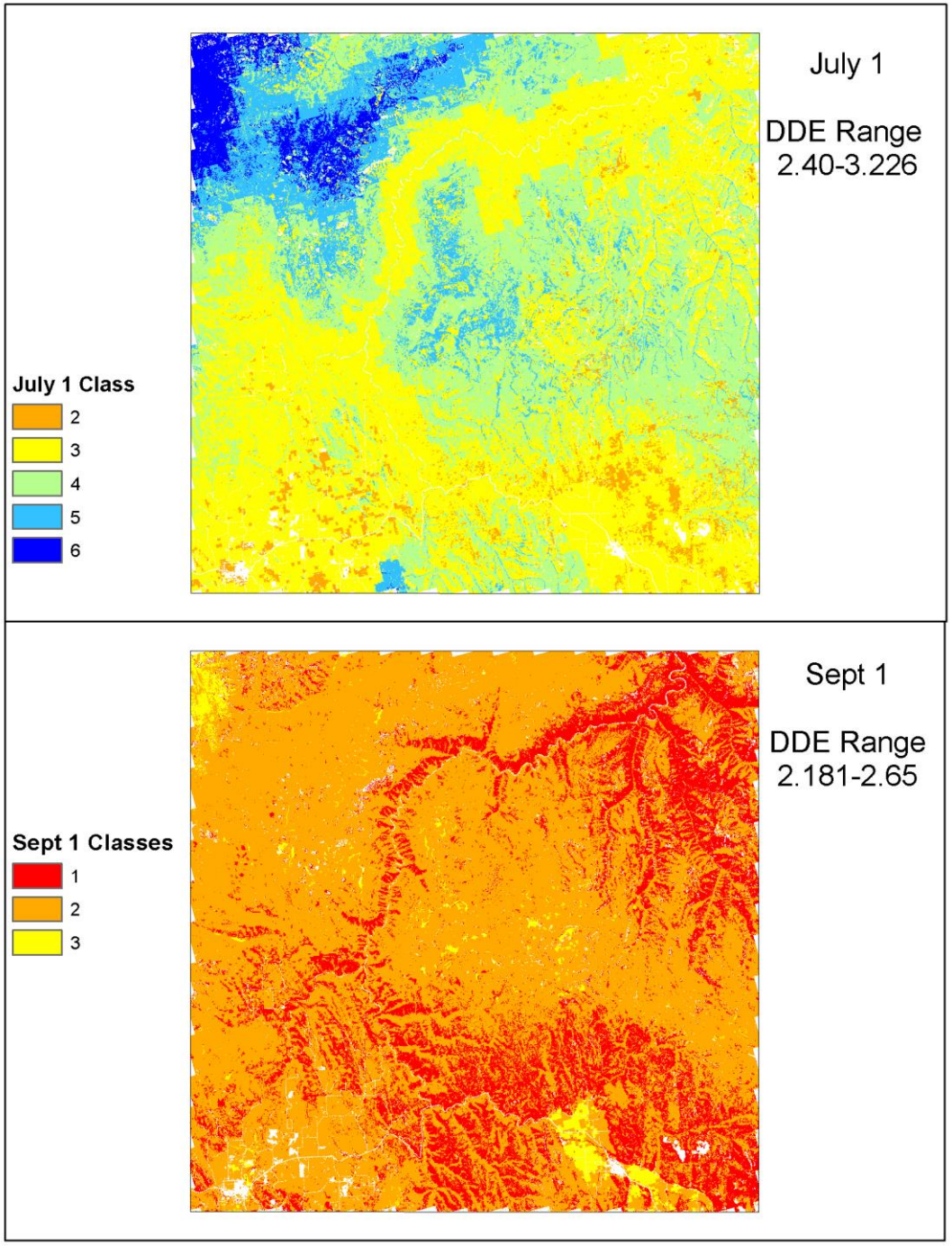
Modeling Work:

- Summer range (elk productivity)
- Female elk
- Focus on late summer (August data)
- Pre-hunt period (but populations are hunted)

Modeling Work:

Importance of late summer period:

- Better nutrition is spatially limited and below maintenance needs.
- Desire to retain elk on public lands entering the hunting seasons.


July 1
DDE Range
2.40-3.226
July 1 Class
2
3
4
5
6
Sept 1
DDE Range
2.181-2.65
Sept 1 Classes
1
2
3

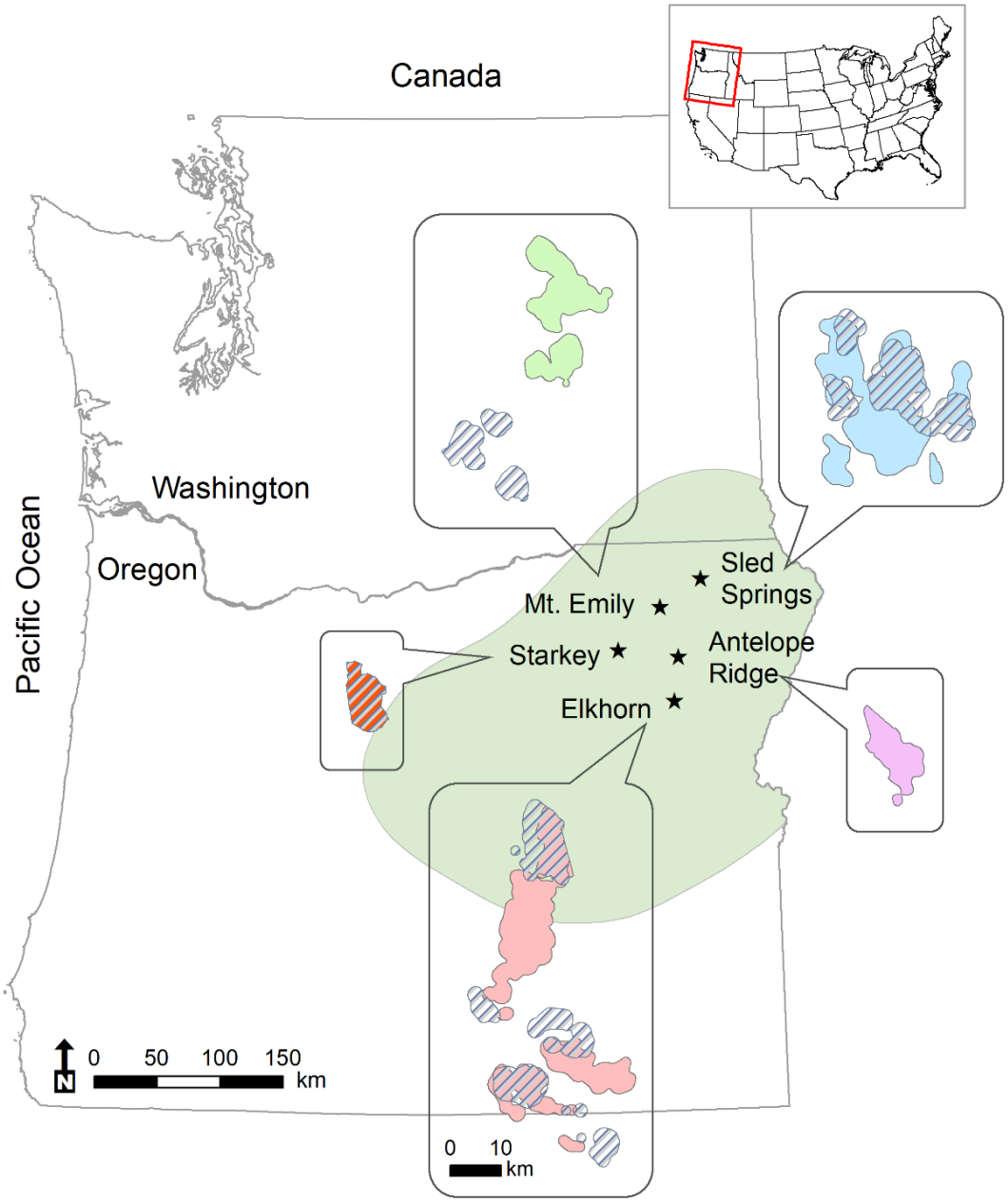
Modeling Work:

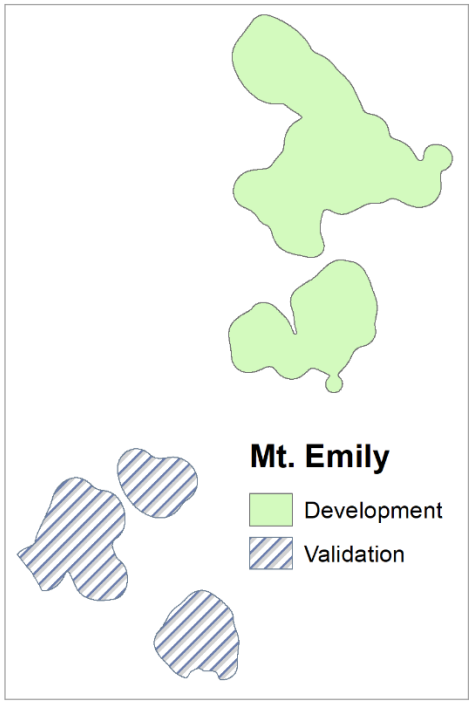
- Large (regional) landscapes, multiple land ownerships, integrated management strategies

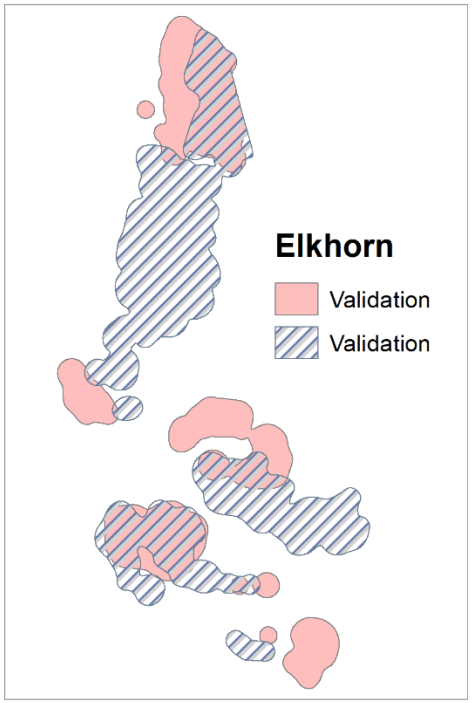
- Local landscapes, smaller projects within large landscapes

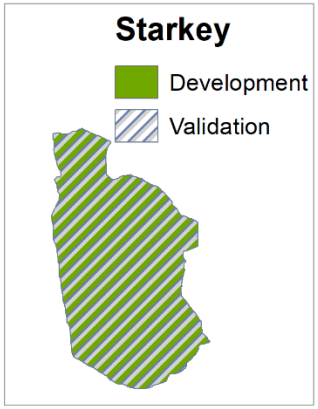
Study area	Modeling area	Use
Antelope Ridge	Antelope Ridge 2010	Development
	Antelope Ridge 2011	Development
	Antelope Ridge 2012	Development
Elkhorn	Elkhorn 2016	Validation
	Elkhorn 2017	Validation
Mt. Emily	Mt. Emily North 2011	Development
	Mt. Emily North 2012	Development
	Mt. Emily North 2013	Development
	Mt. Emily South 2013	Validation
Sled Springs	Sled Springs 2004	Development
	Sled Springs 2005	Development
	Sled Springs 2006 South	Development
	Sled Springs 2006 North	Validation
Starkey	Starkey 2002	Validation
	Starkey 2005	Validation
	Starkey 2008	Development
	Starkey 2009	Development
	Starkey 2010	Development

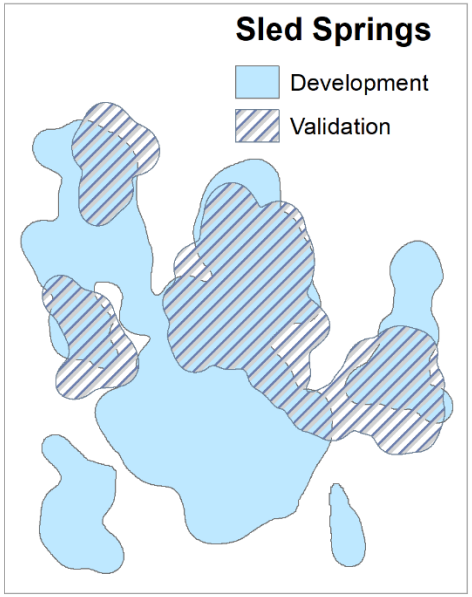
Study area	Modeling area	No. collared elk (locations/collar)	
Antelope Ridge	Antelope Ridge 2010	15	(159)
	Antelope Ridge 2011	16	(158)
	Antelope Ridge 2012	16	(150)
Elkhorn	Elkhorn 2016	24	(32)
	Elkhorn 2017	30	(28)
Mt. Emily	Mt. Emily North 2011	4	(156)
	Mt. Emily North 2012	4	(156)
	Mt. Emily North 2013	4	(151)
	Mt. Emily South 2013	3	(147)
Sled Springs	Sled Springs 2004	20	(1385)
	Sled Springs 2005	20	(1778)
	Sled Springs 2006 South	12	(1903)
	Sled Springs 2006 North	10	(1901)
Starkey	Starkey 2002	27	(128)
	Starkey 2005	28	(295)
	Starkey 2008	27	(734)
	Starkey 2009	14	(990)
	Starkey 2010	26	(143)

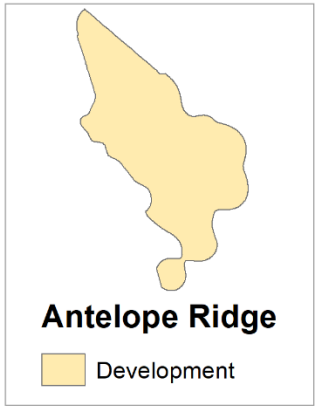

Canada
Washington
Oregon
Pacific Ocean
Mt. Emily
Sled Springs
Starkey
Antelope Ridge
Elkhorn
N
0 50 100 150
km
0 10
km


Mt. Emily
Development
Validation

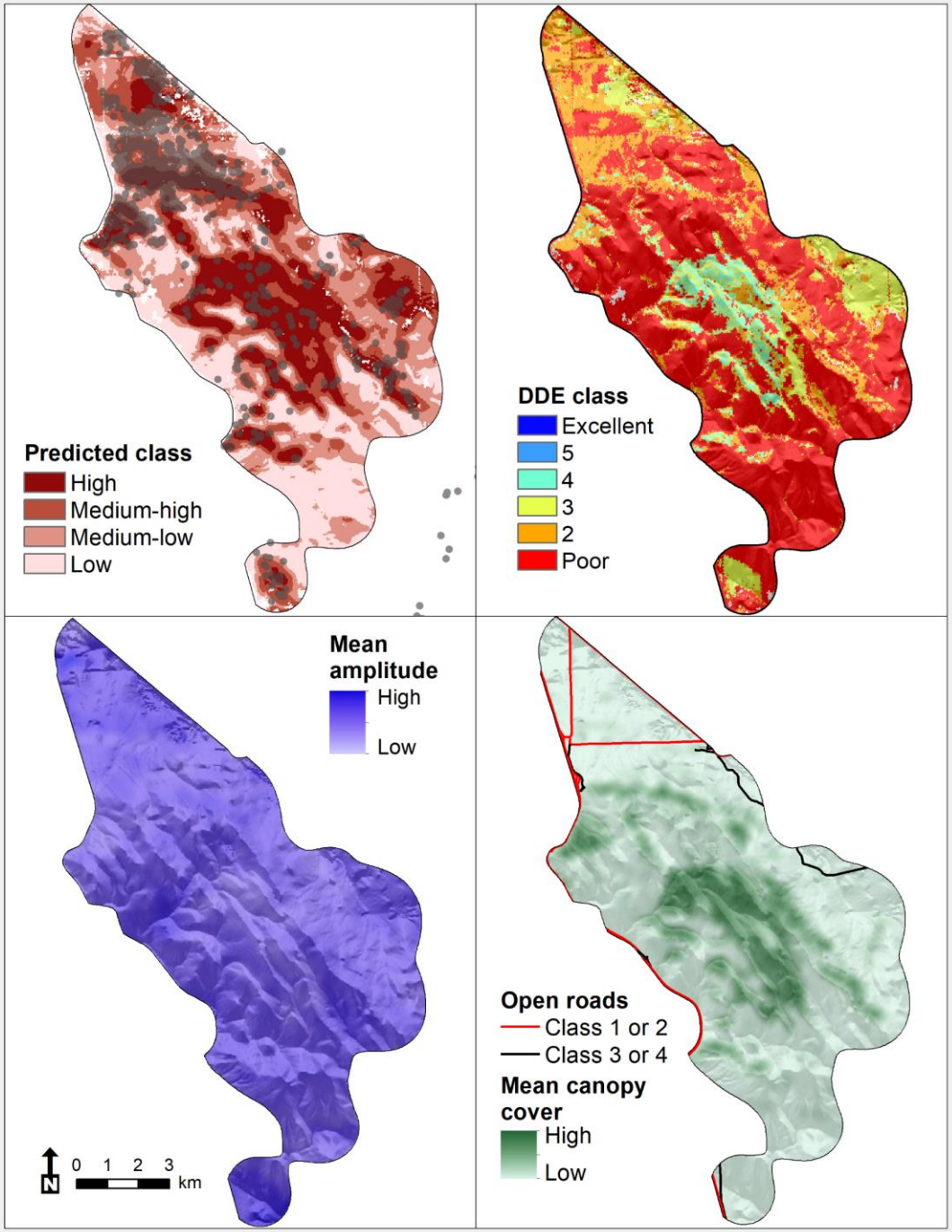

Elkhorn
Validation
Validation


Starkey
Development
Validation


Sled Springs
Development
Validation


Antelope Ridge
Development

Antelope Ridge 2012




Study Area
0 0.03 0.06 0.12 Miles
0 0.05 0.1 0.2 Km

Habitat Use Model

- **Nutrition**
- **Human Disturbance**
- **Vegetation**
- **Abiotic**

Probability of Elk Use

Over 50 Covariates Considered

Dietary digestible energy (DDE)

Accepted biomass (AB)

Total forage biomass (FB)

Distance to:
- Any road
- Open road
- Class 1 and 2 roads
- Class 3 and 4 roads
- Class 2 and 3 roads

Density of above road classes

Security (combinations of topography and cover)

Proportion of vegetation classes

Overstory canopy cover (CC)

Dominant CC class

Distance to:
- cover-forage edge
- cover patch

Amplitude, EVI, other Greenness Metrics

Percent slope

Dominant slope class

Percent area in:
- flat to gentle slopes
- moderate to steep slopes
- very steep slopes

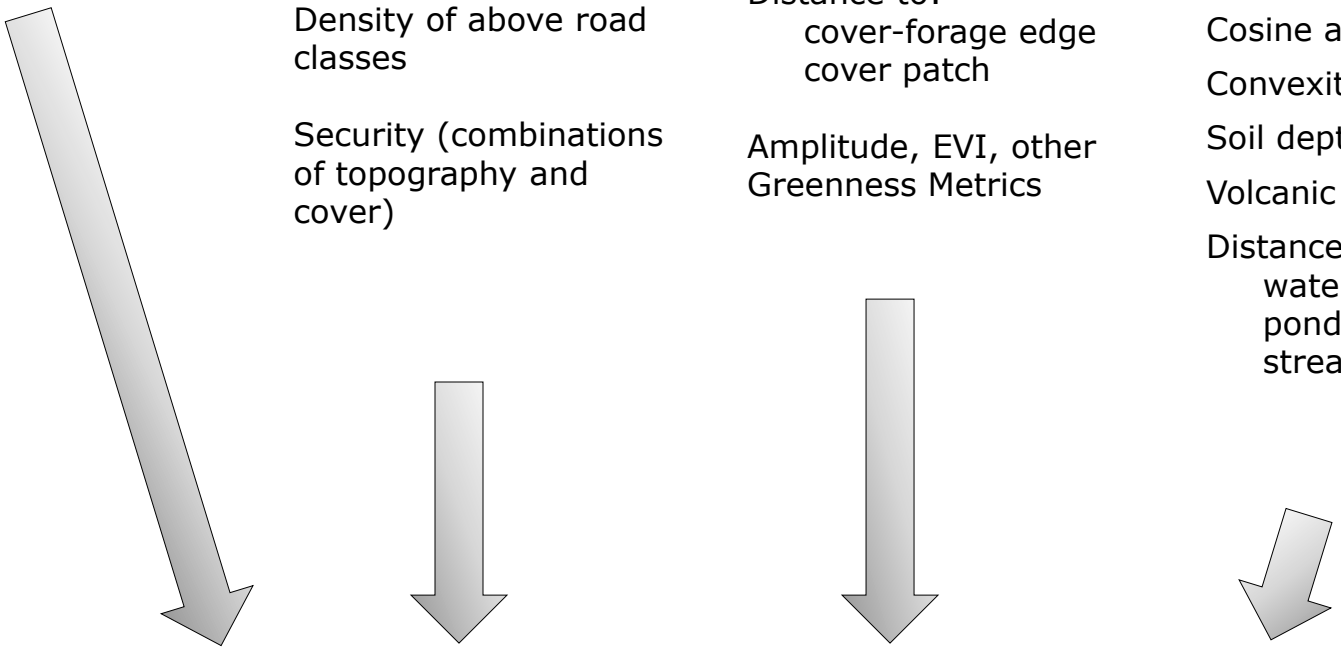
Cosine and sine of aspect

Convexity

Soil depth

Volcanic ash depth

Distance to:
- water
- pond
- stream

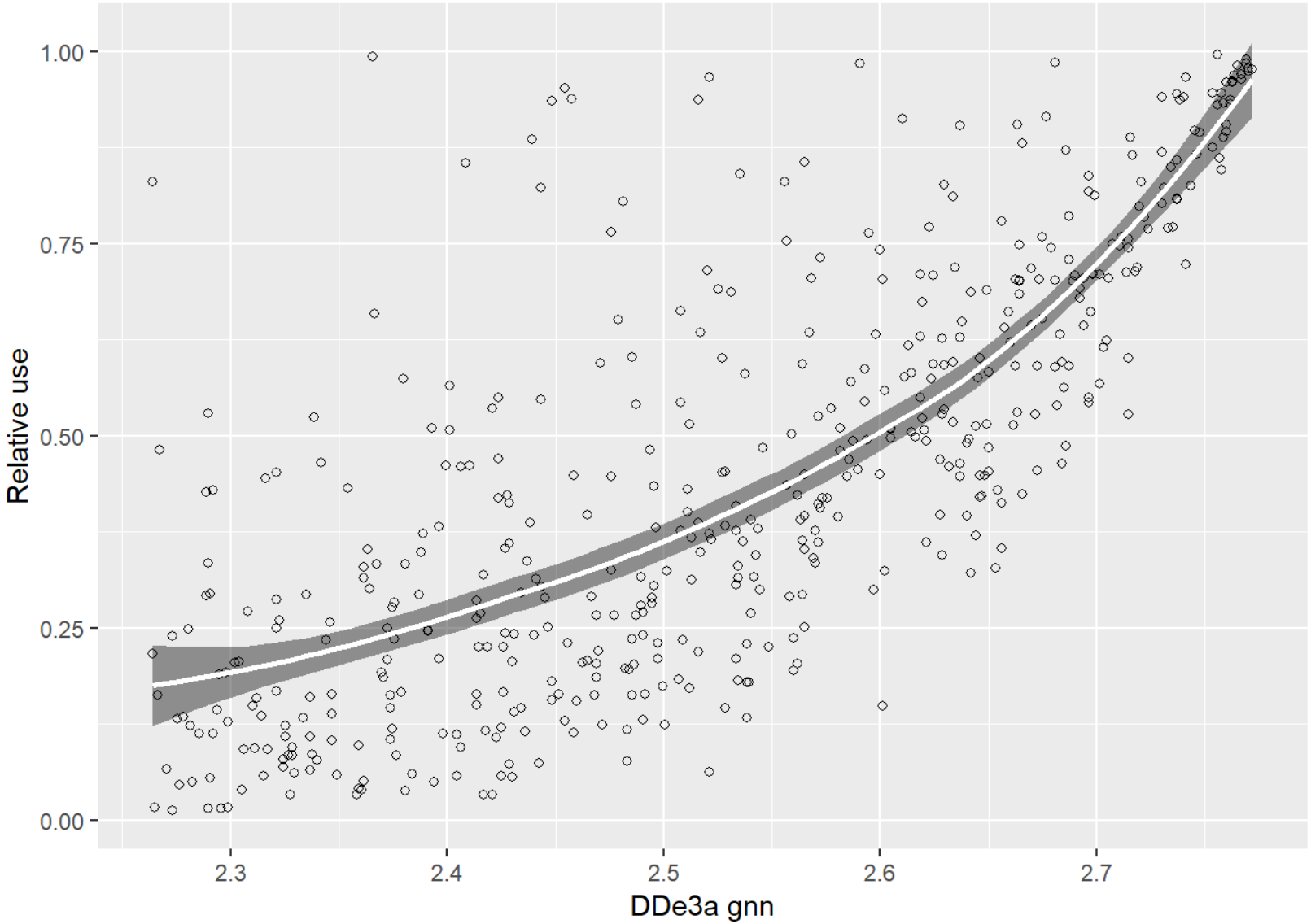


Reduced Set of Covariates in Competing Models

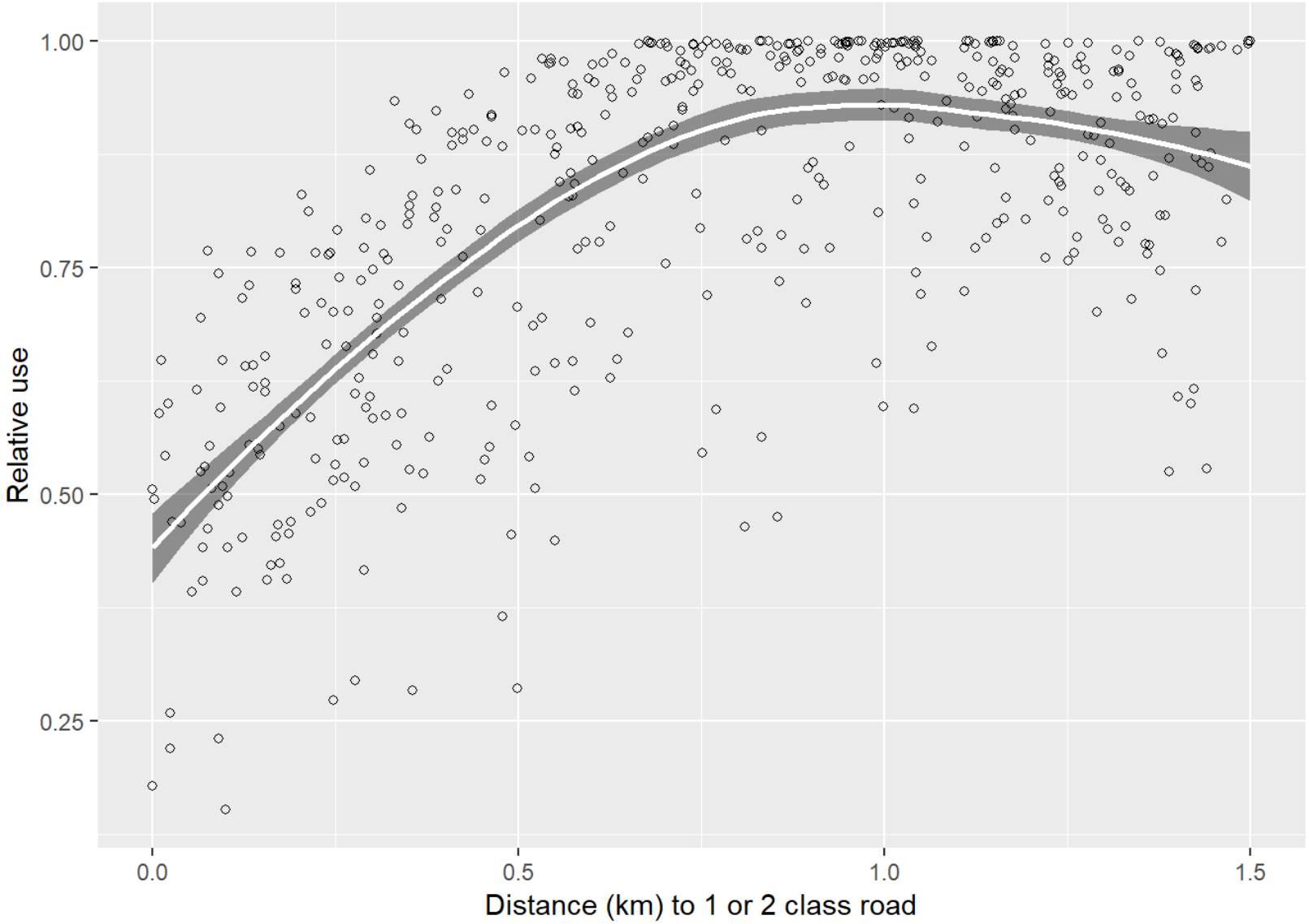
Habitat Use Model (6 covariates)

1. Dietary Digestible Energy of Forage
2. Distance to Class 1 or 2 Open Roads
3. Distance to Class 3 or 4 Open Roads
4. Amplitude
5. Overstory Canopy Cover
6. Cosine of Aspect (northeast aspects)

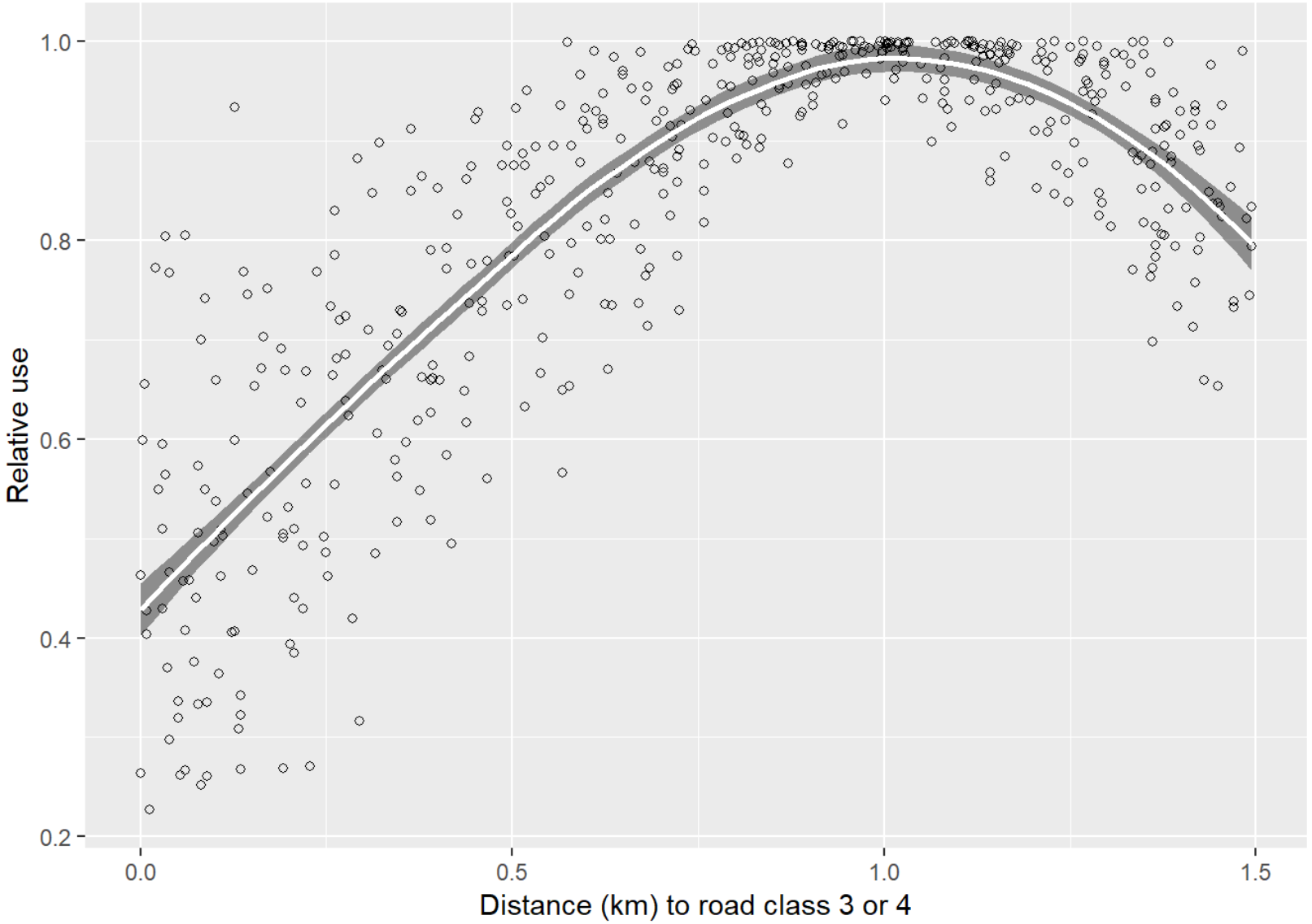
Use increases with increasing dietary digestible energy



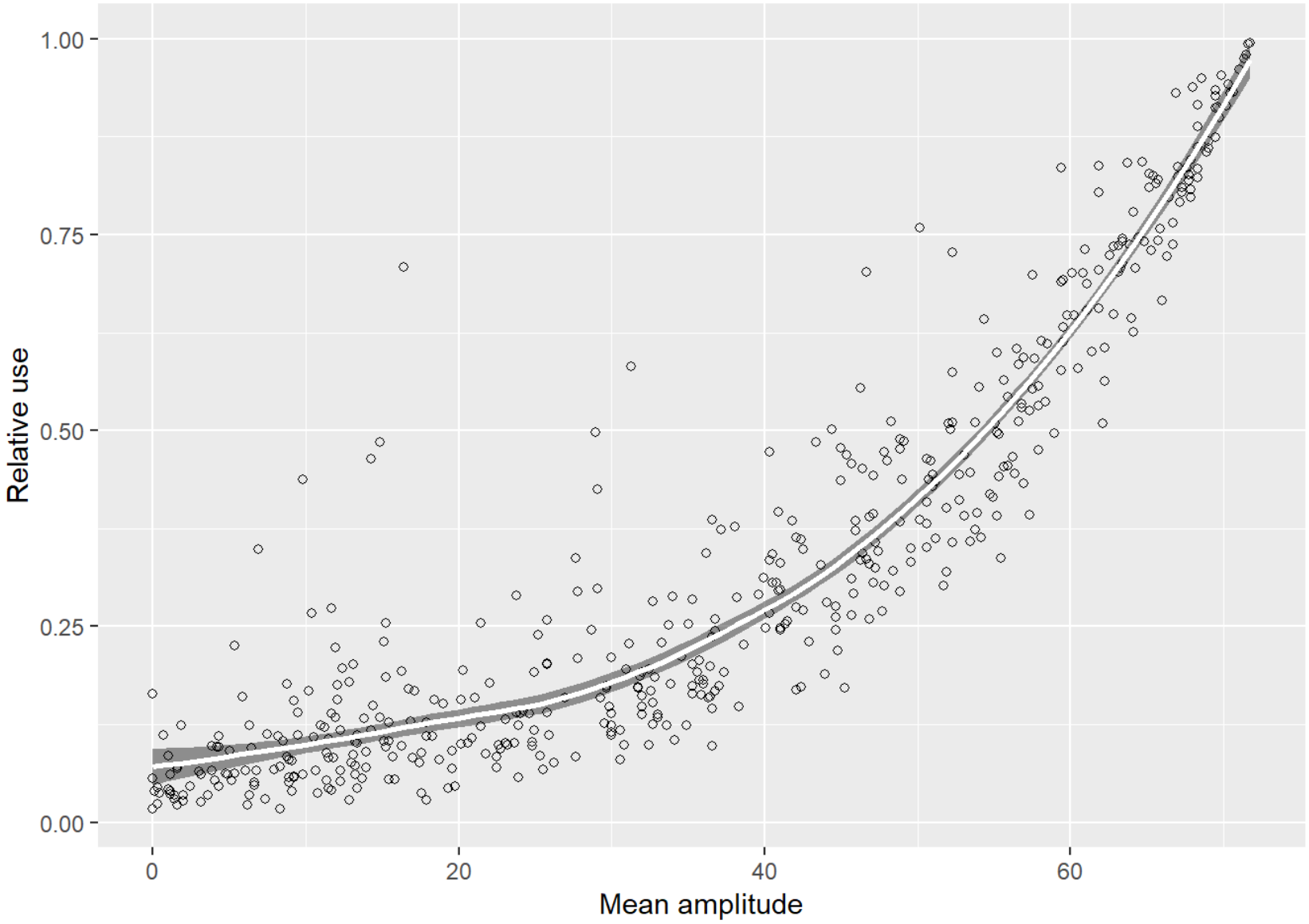
Use increases with increasing distance from Class 1 & 2 roads (highways and county roads) to distances of ≈ 1 km



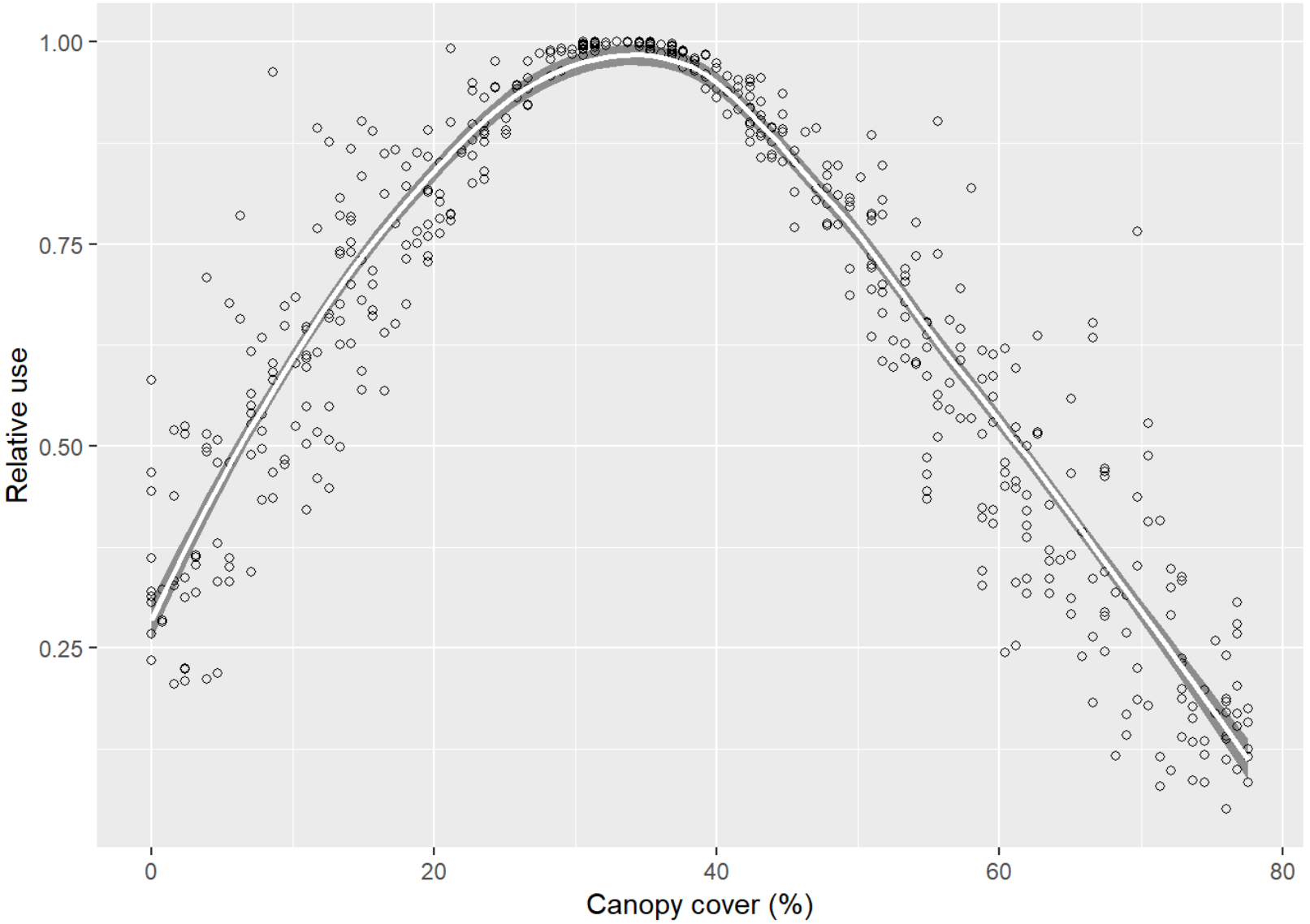
Use increases with increasing distance from Class 3 & 4 roads (2-digit FS roads and direct branches) to distances of ≈ 1 km



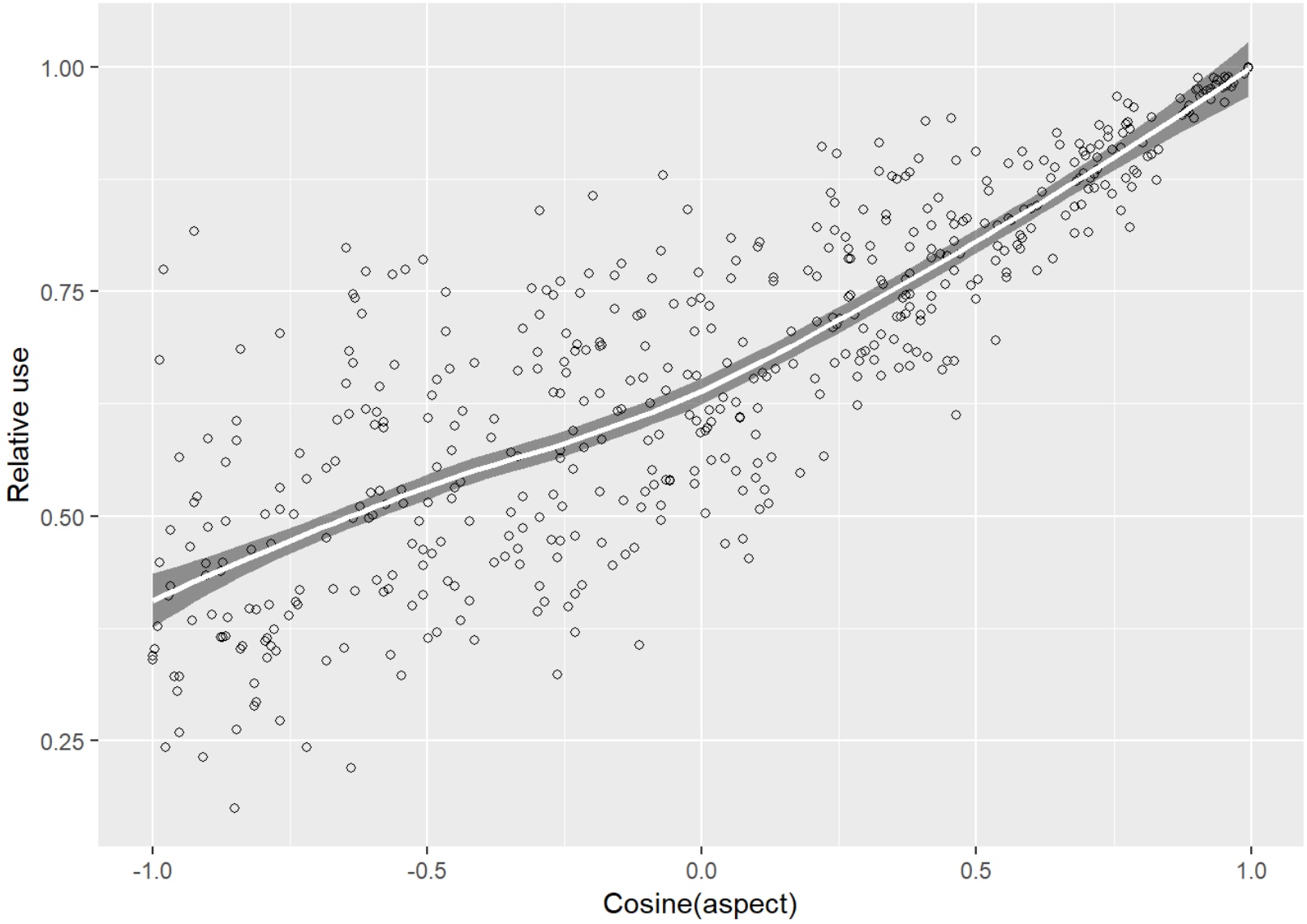
Use increases with increasing amplitude (i.e., increasing vegetation productivity ≈ increasing forage biomass)

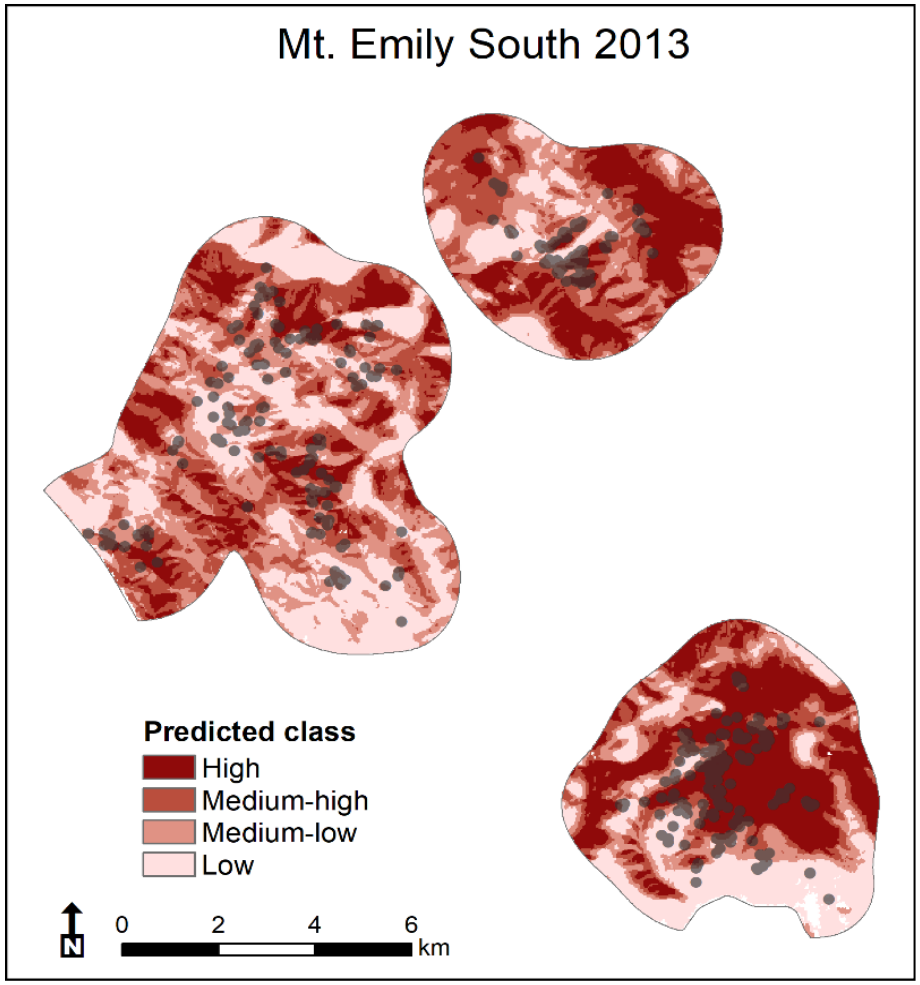


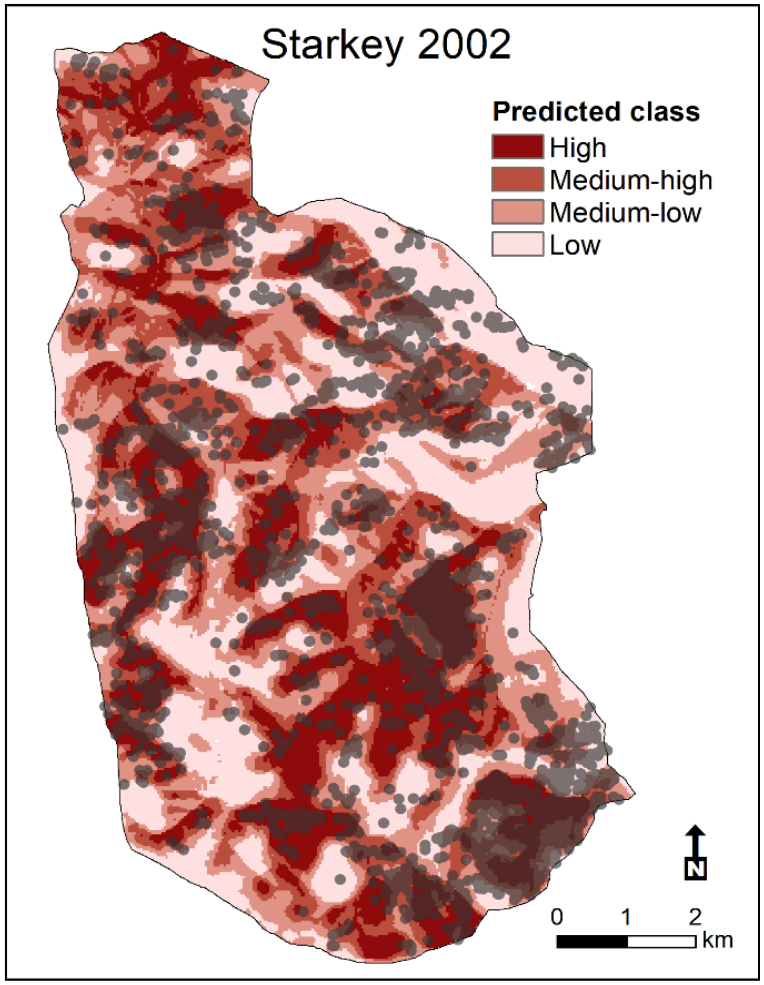
Use is highest at intermediate canopy cover of ≈ 35%



Use increases with increasing northerly and easterly aspects

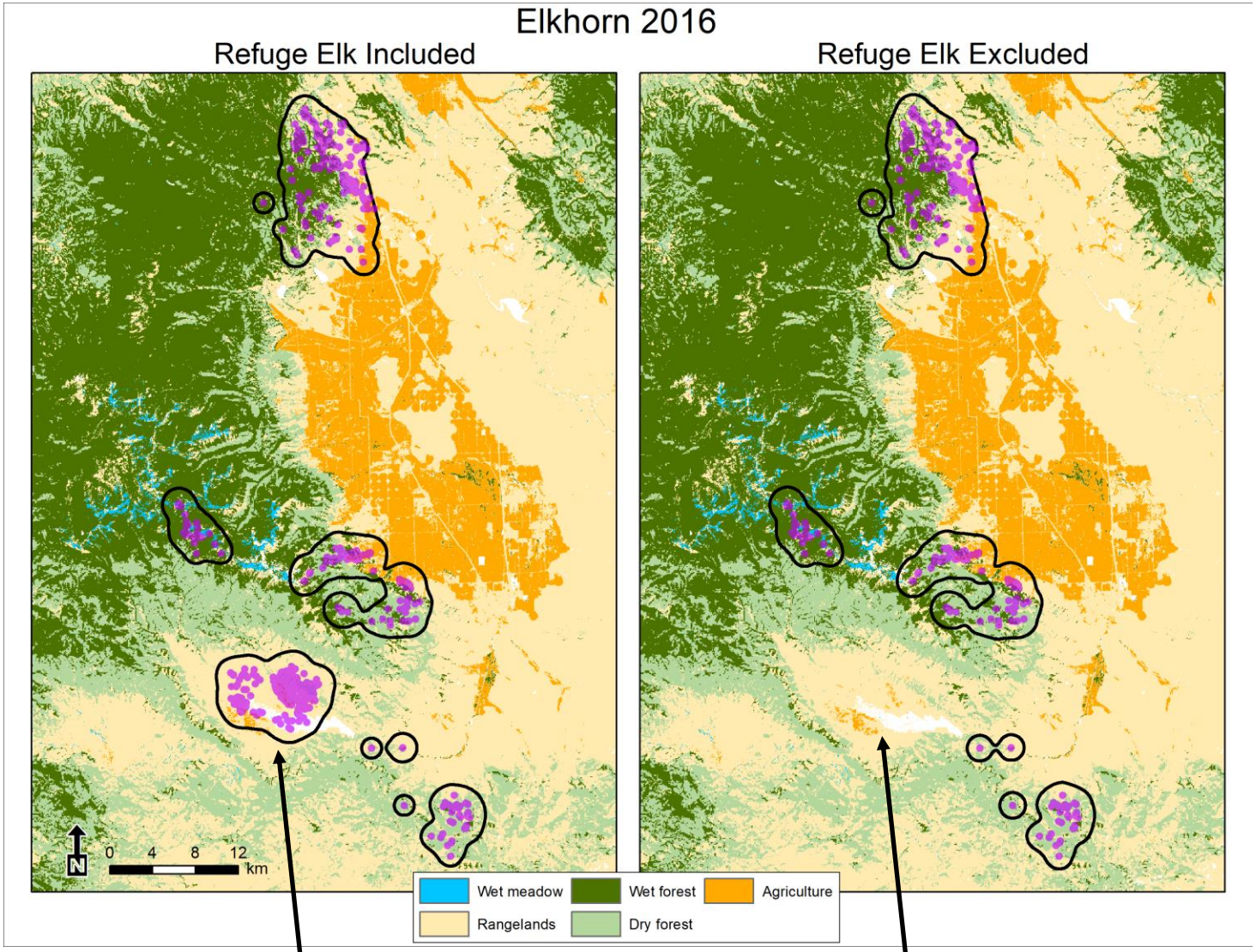






Example maps of predicted habitat use by elk with the top-ranked model in relation to elk locations (observed use, black circles)

Modeling Area	Purpose	Spearman's Rank Correlation of Predicted vs. Observed
Elkhorn 2016	Validation	-0.35 (0.84)
Elkhorn 2017	Validation	0.78
Mount Emily 2013 South	Validation	0.54
Sled Springs 2006 North	Validation	0.51
Starkey 2002	Validation	0.97
Starkey 2005	Validation	0.85
Mean among areas		0.75



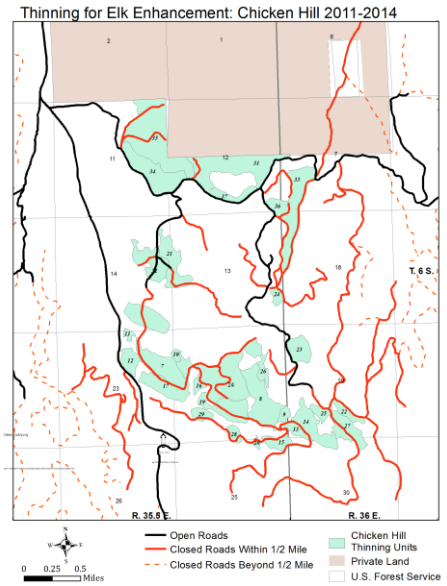
Refuge Elk

Rangeland PVT of Low Nutrition, Amplitude, and Canopy Cover; South Aspect; Highway 7 Intersects Area

Modeling Area	Purpose	Spearman's Rank Correlation of Predicted vs. Observed
Antelope Ridge 2010	Development	0.97
Antelope Ridge 2011	Development	0.92
Antelope Ridge 2012	Development	0.97
Mount Emily 2011	Development	0.86
Mount Emily 2012	Development	0.94
Mount Emily 2013 North	Development	0.93
Sled Springs 2004	Development	0.84
Sled Springs 2005	Development	0.68
Sled Springs 2006 South	Development	0.80
Starkey 2008	Development	0.99
Starkey 2009	Development	0.96
Starkey 2010	Development	0.99
Mean among areas		0.90

Management Utility

- Updated model contains covariates representing habitat requirements.
- Nutrition, amplitude, and canopy cover are predictors of energy acquisition.
- Roads are predictors of energy loss (broad-scale shifts in distribution, nutritional opportunities forgone).



Management Utility

- Updated model contains covariates that can be directly managed to increase or decrease elk use.
- Canopy cover can be manipulated to increase nutrition and elk use.
- Roads can be opened or closed to increase or decrease elk use.
- Integrated management of covariates is key (i.e., limiting motorized access in areas of high nutrition).

Management Utility

- Desired distribution of hunted populations across public and private lands can be achieved with integrated management of vegetation (nutrition) and human disturbance (roads).

Thinning to reduce canopy cover to ≈ 30%

Before

After

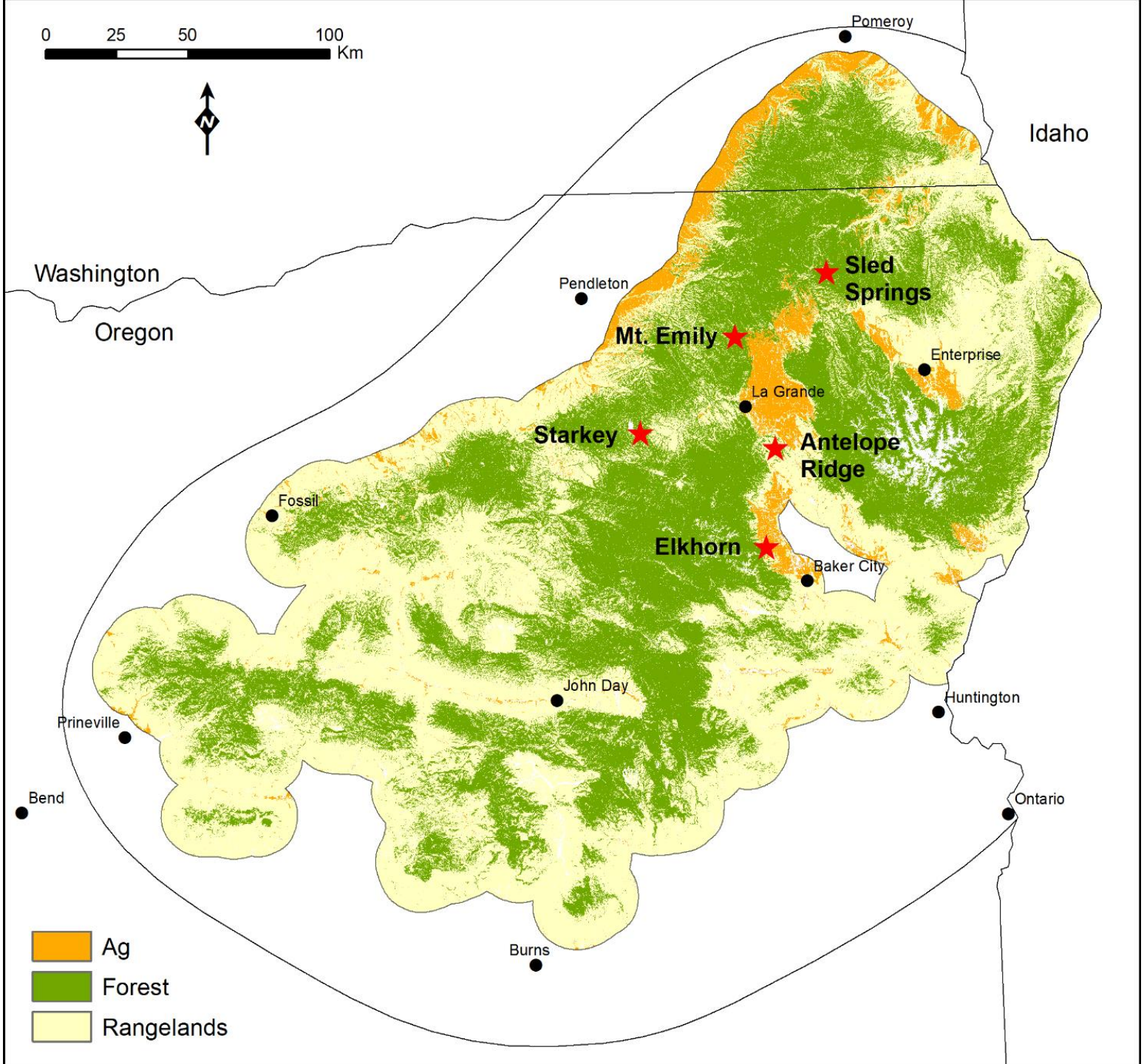
Low

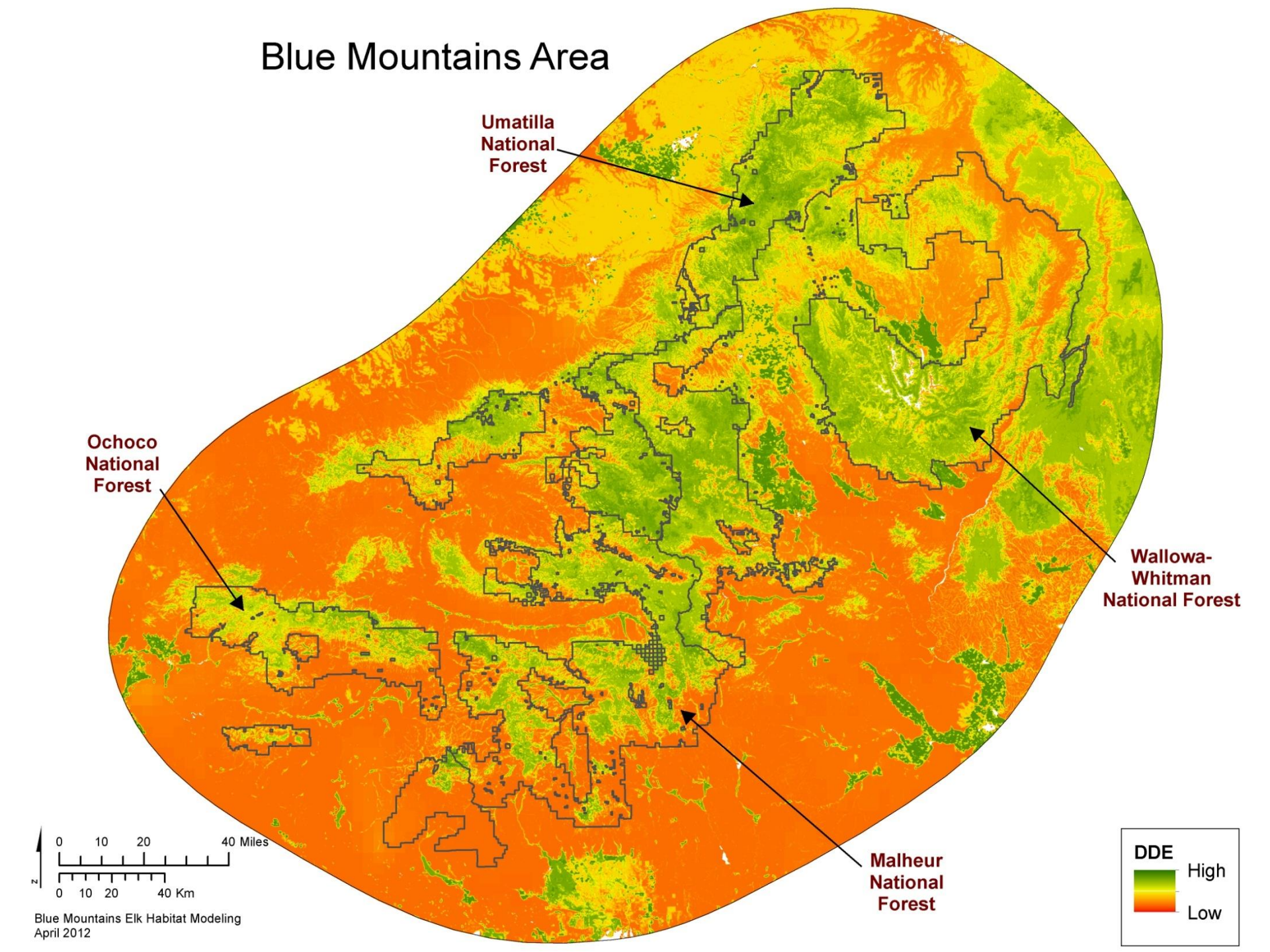
High

Roads

Elk Dietary Digestible Energy

Questions?


0
25
50
100
Km
N
Pomeroy
Idaho
Washington
Oregon
Pendleton
Sled Springs
Mt. Emily
Enterprise
La Grande
Starkey
Antelope Ridge
Fossil
Elkhorn
Baker City
John Day
Huntington
Prineville
Bend
Ontario
Burns
Ag
Forest
Rangelands


Blue Mountains Area
Umatilla National Forest
Ochoco National Forest
Wallowa-Whitman National Forest
Malheur National Forest
0 10 20 40 Miles
0 10 20 40 Km
N
Blue Mountains Elk Habitat Modeling
April 2012
DDE
High
Low