

# People and Their Environment: Planning for Genuine Co- Existence

*Brent Brock – Senior  
Ecologist, Future West*

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*Landscapes where people and wildlife  
live together and thrive*



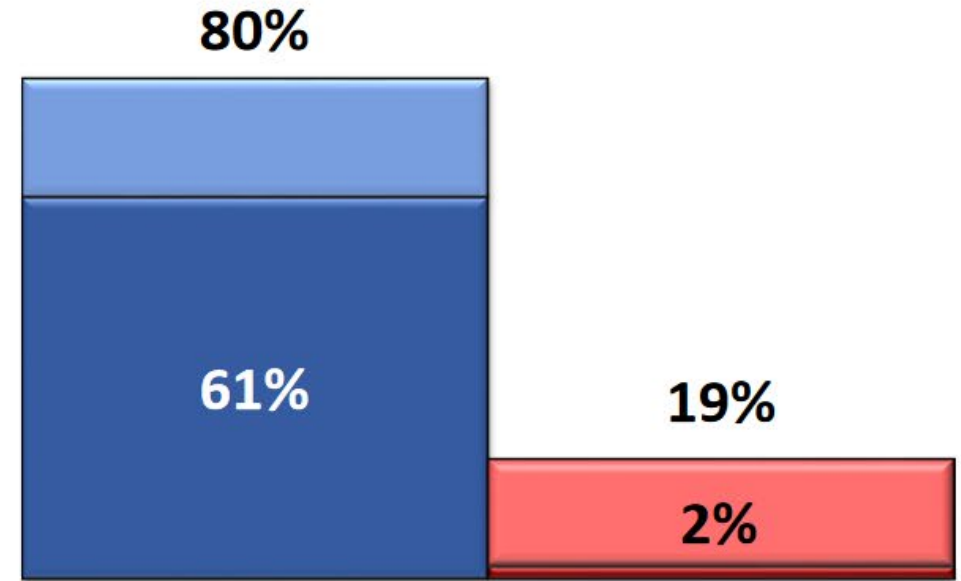
*Photo of Charlie Russell and grizzly bear by  
Maureen Enns Studios Ltd.*



Sources: Esri, HERE, Garmin, Intermap, increment P Corp., GEBCO, USGS, FAO, NPS, NRCAN, GeoBase, IGN, Kadaster NL, Ordnance Survey, Esri Japan, METI, Esri China (Hong Kong), (c) OpenStreetMap contributors, and the GIS User Community



# Four-in-five Montanans say that wildlife are an important part of their daily life.



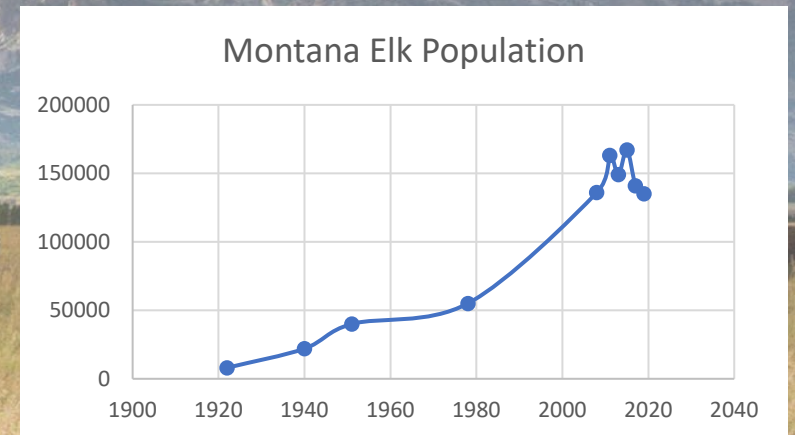
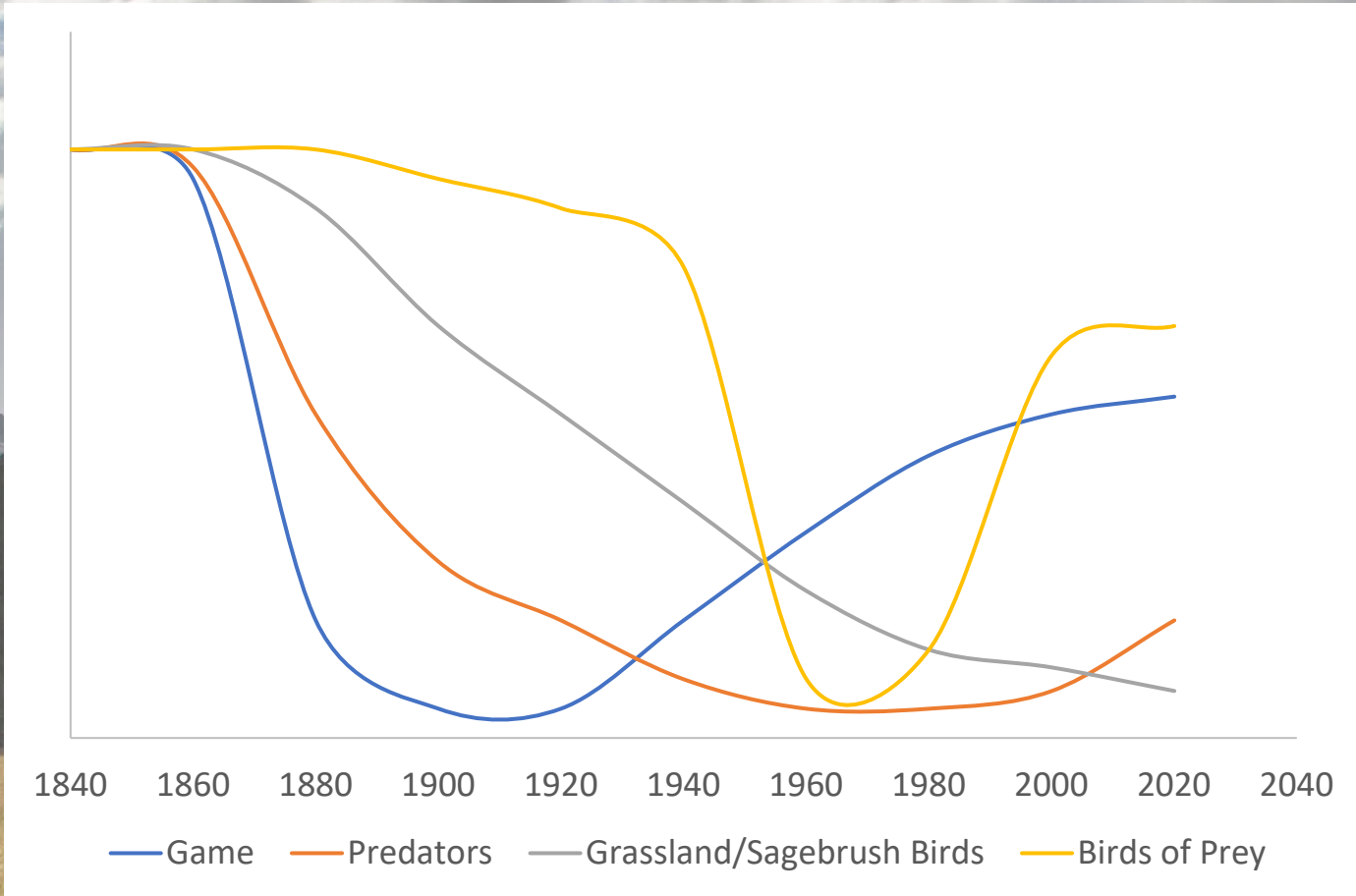
■ Strongly Agree  
■ Strongly Disagree

■ Total Agree  
■ Total Disagree

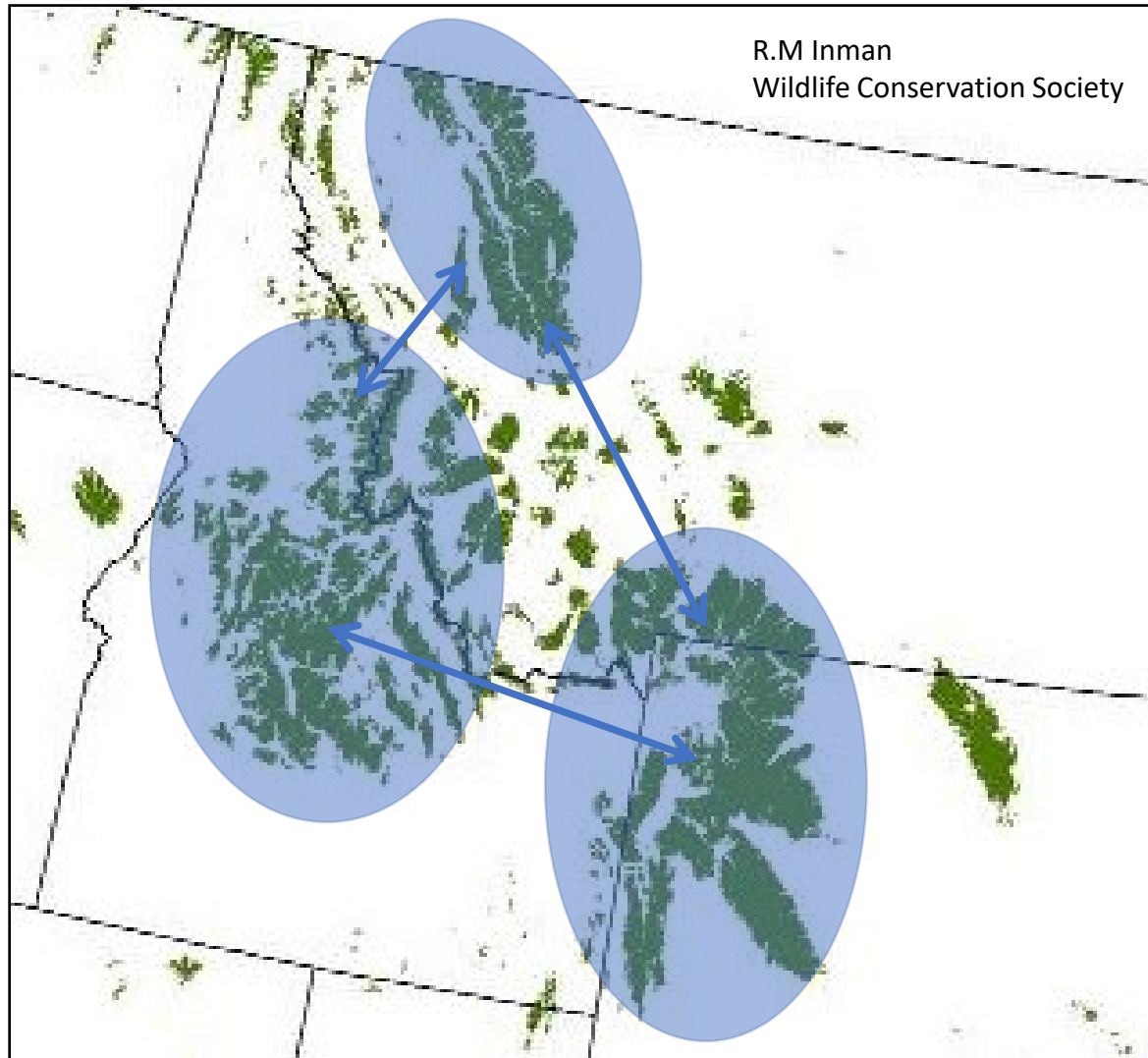
*Would you agree or disagree with the following statement: "Wildlife are an important part of my daily life."*



# Back From the Brink: 130 Years of Conservation in the Northern Rockies

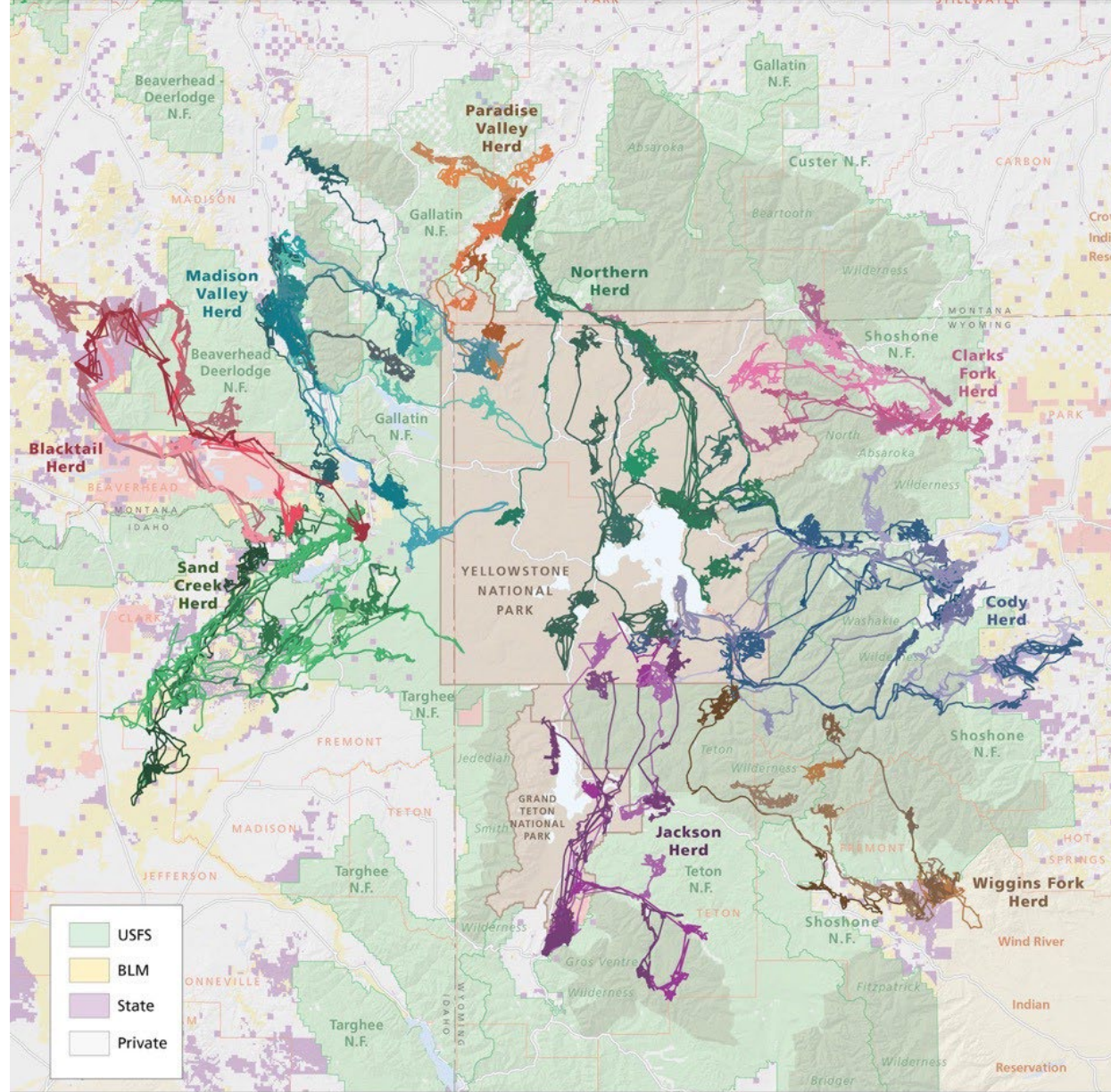


# An Inconvenient Truth – Nature Operates at Broad Scales

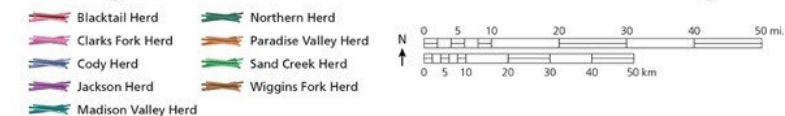




# Long Distance Migrations in the Greater Yellowstone Ecosystem



## Elk Migrations of the Greater Yellowstone Ecosystem



WYOMING MIGRATION INITIATIVE

© 2015 University of Wyoming  
 Source: Atlas of Wildlife Migration: Wyoming's Ungulates (in production)  
 Cartography: University of Oregon InfoGraphics Lab  
 Elk data contributed by: Wyoming Game and Fish Department, Montana Fish, Wildlife, and Parks, Idaho Fish and Game, National Park Service, US Fish and Wildlife Service, Wildlife Conservation Society, Wyoming Cooperative Fish and Wildlife Research Unit, Iowa State University, and Yale School of Forestry and Environmental Studies





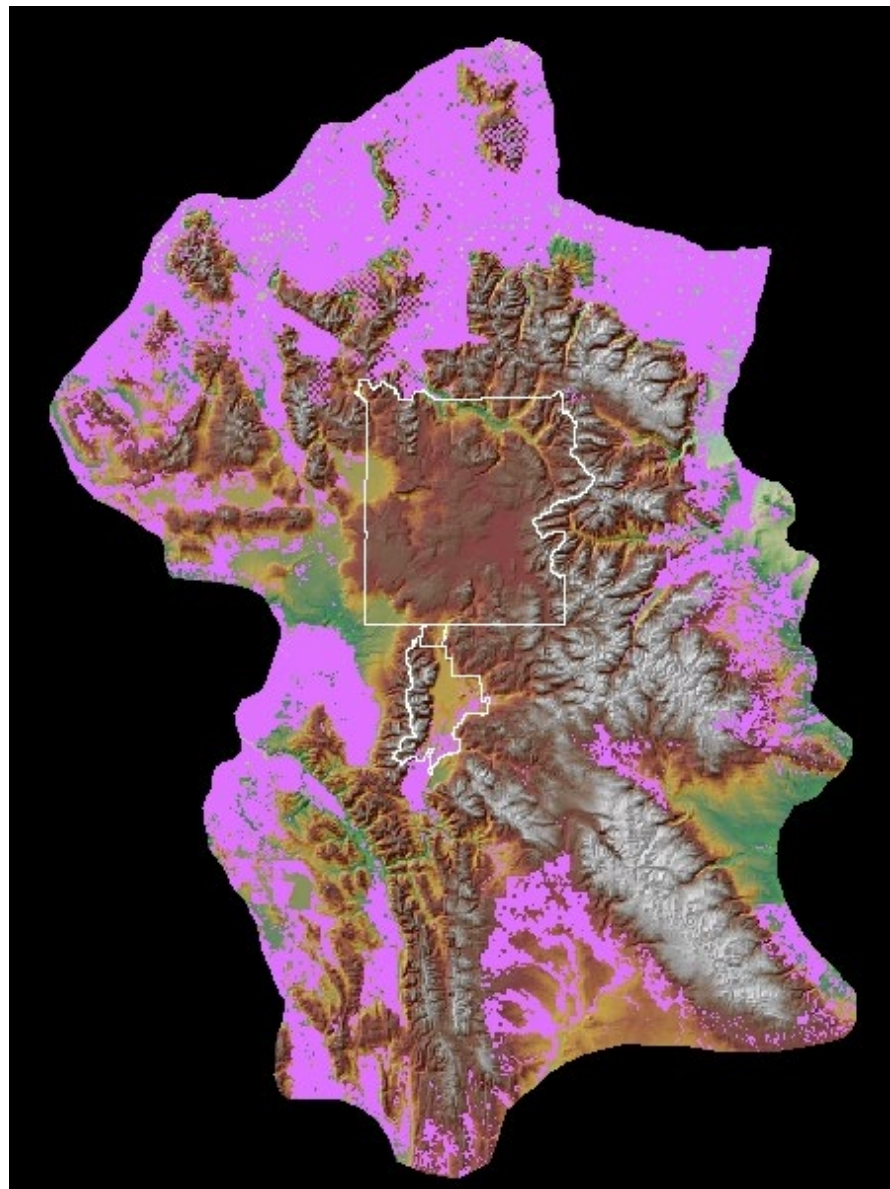
# Impacts can be Regional

From  
Con

*Table 1. Simulated population dynamics of yellow warblers in the study area with and without the influence of rural residences.*

<b>Ownership</b>	<b>Area (ha)</b>	<b>Estimated current population size</b>	<b>Simulated net change in annual population without home effect</b>	<b>Simulated net change in annual population with current home densities</b>
Private	808	2942	309	-85
Public—general	4251	2003	41	6
Public—nature reserves	984	804	-28	-35
<b>Total</b>			<b>322</b>	<b>-114</b>

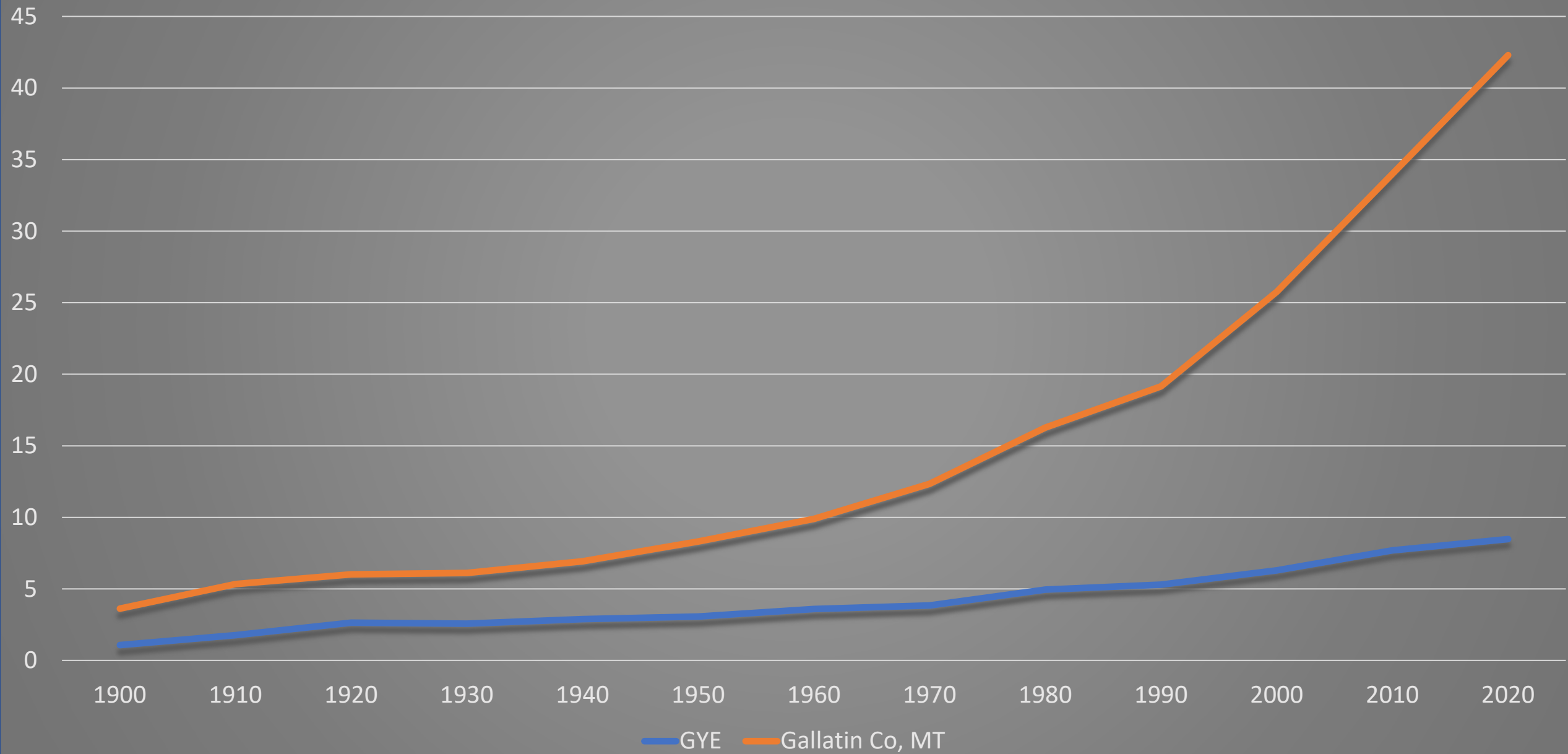
*Figure 2. Distribution of bird hotspots (bird species richness and total abundance  $\geq 60\%$  of maximum) across the study area (YNP, Yellowstone National Park; TNF, Targee National Forest; GNF, Gallatin National Forest).*

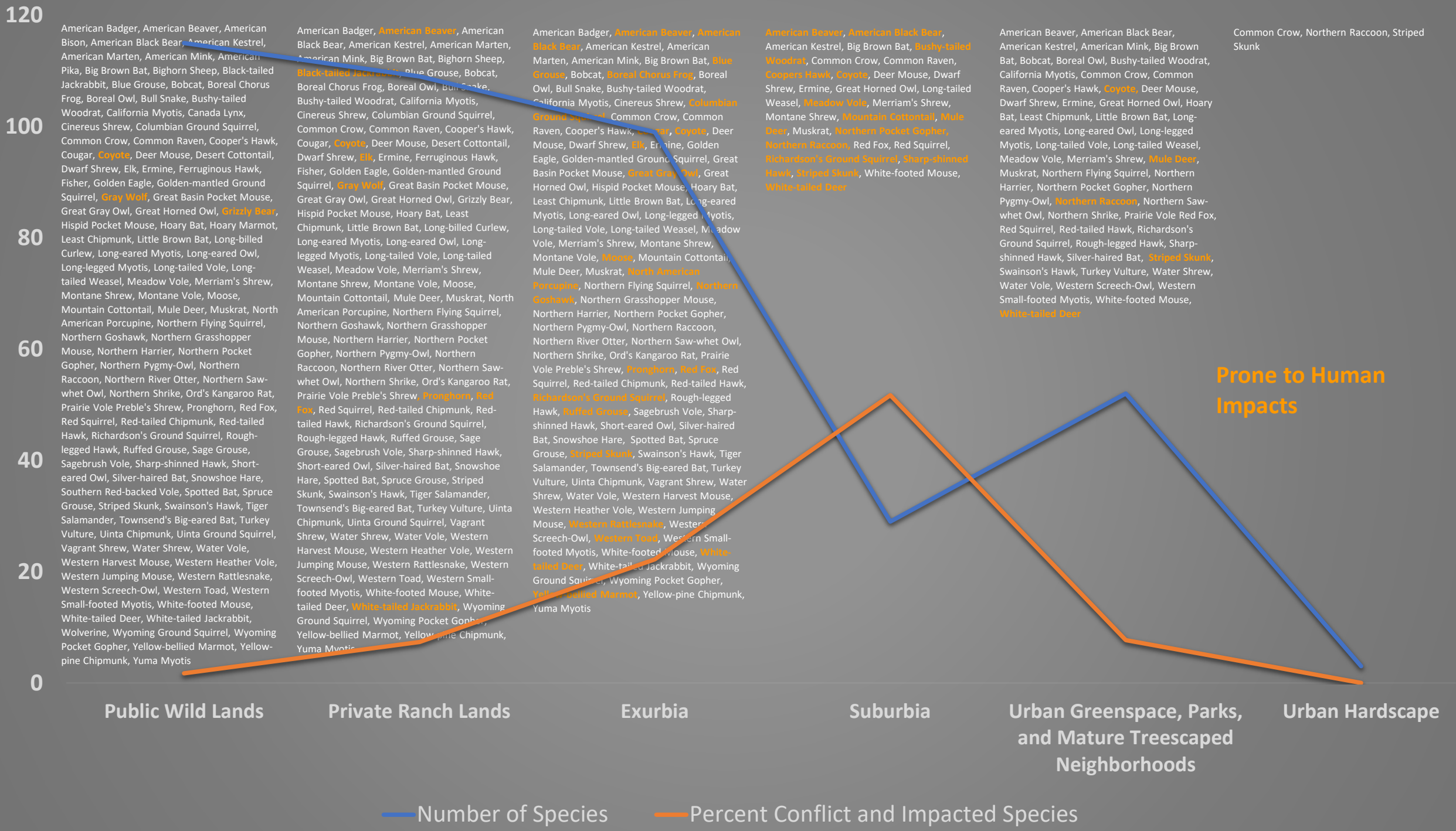


Lowlands are Mostly  
Privately Owned: Working  
Lands are Crucial for  
Wildlife



# Human Population Density (People / sq mile)





120

100

80

60

40

20

0

American Badger, American Beaver, American Bison, American Black Bear, American Kestrel, American Marten, American Mink, American Pika, Big Brown Bat, Bighorn Sheep, Black-tailed Jackrabbit, Blue Grouse, Bobcat, Boreal Chorus Frog, Boreal Owl, Bull Snake, Bushy-tailed Woodrat, California Myotis, Canada Lynx, Cinerus Shrew, Columbian Ground Squirrel, Common Crow, Common Raven, Cooper's Hawk, Cougar, **Coyote**, Deer Mouse, Desert Cottontail, Dwarf Shrew, Elk, Ermine, Ferruginous Hawk, Fisher, Golden Eagle, Golden-mantled Ground Squirrel, **Gray Wolf**, Great Basin Pocket Mouse, Great Gray Owl, Great Horned Owl, **Grizzly Bear**, Hispid Pocket Mouse, Hoary Bat, Hoary Marmot, Least Chipmunk, Little Brown Bat, Long-billed Curlew, Long-eared Myotis, Long-eared Owl, Long-legged Myotis, Long-tailed Vole, Long-tailed Weasel, Meadow Vole, Merriam's Shrew, Montane Shrew, Montane Vole, Moose, Mountain Cottontail, Mule Deer, Muskrat, North American Porcupine, Northern Flying Squirrel, Northern Goshawk, Northern Grasshopper Mouse, Northern Harrier, Northern Pocket Gopher, Northern Pygmy-Owl, Northern Raccoon, Northern River Otter, Northern Saw-whet Owl, Northern Shrike, Ord's Kangaroo Rat, Prairie Vole, Preble's Shrew, Pronghorn, Red Fox, Red Squirrel, Red-tailed Chipmunk, Red-tailed Hawk, Richardson's Ground Squirrel, Rough-legged Hawk, Ruffed Grouse, Sage Grouse, Sagebrush Vole, Sharp-shinned Hawk, Short-eared Owl, Silver-haired Bat, Snowshoe Hare, Southern Red-backed Vole, Spotted Bat, Spruce Grouse, Striped Skunk, Swainson's Hawk, Tiger Salamander, Townsend's Big-eared Bat, Turkey Vulture, Uinta Chipmunk, Uinta Ground Squirrel, Vagrant Shrew, Water Shrew, Water Vole, Western Harvest Mouse, Western Heather Vole, Western Jumping Mouse, Western Rattlesnake, Western Screech-Owl, Western Toad, Western Small-footed Myotis, White-footed Mouse, White-tailed Deer, White-tailed Jackrabbit, Wolverine, Wyoming Ground Squirrel, Wyoming Pocket Gopher, Yellow-bellied Marmot, Yellow-pine Chipmunk, Yuma Myotis

American Badger, **American Beaver**, American Black Bear, American Kestrel, American Marten, American Mink, Big Brown Bat, Bighorn Sheep, **Black-tailed Jackrabbit**, Blue Grouse, Bobcat, Boreal Chorus Frog, Boreal Owl, Bull Snake, Bushy-tailed Woodrat, California Myotis, Cinerus Shrew, Columbian Ground Squirrel, Common Crow, Common Raven, Cooper's Hawk, Cougar, **Coyote**, Deer Mouse, Desert Cottontail, Dwarf Shrew, **Elk**, Ermine, Ferruginous Hawk, Fisher, Golden Eagle, Golden-mantled Ground Squirrel, **Gray Wolf**, Great Basin Pocket Mouse, Great Gray Owl, Great Horned Owl, Grizzly Bear, Hispid Pocket Mouse, Hoary Bat, Least Chipmunk, Little Brown Bat, Long-billed Curlew, Long-eared Myotis, Long-eared Owl, Long-legged Myotis, Long-tailed Vole, Long-tailed Weasel, Meadow Vole, Merriam's Shrew, Montane Shrew, Montane Vole, Moose, Mountain Cottontail, Mule Deer, Muskrat, North American Porcupine, Northern Flying Squirrel, Northern Goshawk, Northern Grasshopper Mouse, Northern Harrier, Northern Pocket Gopher, Northern Pygmy-Owl, Northern Raccoon, Northern River Otter, Northern Saw-whet Owl, Northern Shrike, Ord's Kangaroo Rat, Prairie Vole, Preble's Shrew, **Pronghorn**, **Red Fox**, Red Squirrel, Red-tailed Chipmunk, Red-tailed Hawk, Richardson's Ground Squirrel, Rough-legged Hawk, Ruffed Grouse, Sage Grouse, Sagebrush Vole, Sharp-shinned Hawk, Short-eared Owl, Silver-haired Bat, Snowshoe Hare, Spotted Bat, Spruce Grouse, Striped Skunk, Swainson's Hawk, Tiger Salamander, Townsend's Big-eared Bat, Turkey Vulture, Uinta Chipmunk, Uinta Ground Squirrel, Vagrant Shrew, Water Shrew, Water Vole, Western Harvest Mouse, Western Heather Vole, Western Jumping Mouse, Western Rattlesnake, Western Screech-Owl, Western Toad, Western Small-footed Myotis, White-footed Mouse, White-tailed Deer, **White-tailed Jackrabbit**, Wyoming Ground Squirrel, Wyoming Pocket Gopher, Yellow-bellied Marmot, Yellow-pine Chipmunk, Yuma Myotis

American Badger, **American Beaver**, **American Black Bear**, American Kestrel, American Marten, American Mink, Big Brown Bat, **Blue Grouse**, Bobcat, **Boreal Chorus Frog**, Boreal Owl, Bull Snake, Bushy-tailed Woodrat, California Myotis, Cinerus Shrew, **Columbian Ground Squirrel**, Common Crow, Common Raven, Cooper's Hawk, **Elk**, Ermine, Golden Eagle, Golden-mantled Ground Squirrel, Great Basin Pocket Mouse, **Great Gray Owl**, Great Horned Owl, Hoary Bat, Least Chipmunk, Little Brown Bat, Long-eared Myotis, Long-eared Owl, Long-legged Myotis, Long-tailed Vole, Long-tailed Weasel, Meadow Vole, Merriam's Shrew, Montane Shrew, **Moose**, Mountain Cottontail, Mule Deer, Muskrat, **North American Porcupine**, Northern Flying Squirrel, **Northern Goshawk**, Northern Grasshopper Mouse, Northern Harrier, Northern Pocket Gopher, Northern Pygmy-Owl, Northern Raccoon, Northern River Otter, Northern Saw-whet Owl, Northern Shrike, Ord's Kangaroo Rat, Prairie Vole, Preble's Shrew, **Pronghorn**, **Red Fox**, Red Squirrel, Red-tailed Chipmunk, Red-tailed Hawk, **Richardson's Ground Squirrel**, Rough-legged Hawk, **Ruffed Grouse**, Sagebrush Vole, Sharp-shinned Hawk, Short-eared Owl, Silver-haired Bat, Snowshoe Hare, Spotted Bat, Spruce Grouse, **Striped Skunk**, Swainson's Hawk, Tiger Salamander, Townsend's Big-eared Bat, Turkey Vulture, Uinta Chipmunk, Vagrant Shrew, Water Shrew, Water Vole, Western Harvest Mouse, Western Heather Vole, Western Jumping Mouse, **Western Rattlesnake**, Western Screech-Owl, **Western Toad**, Western Small-footed Myotis, White-footed Mouse, **White-tailed Deer**, White-tailed Jackrabbit, Wyoming Ground Squirrel, Wyoming Pocket Gopher, **Yellow-bellied Marmot**, Yellow-pine Chipmunk, Yuma Myotis

**American Beaver**, **American Black Bear**, American Kestrel, Big Brown Bat, **Bushy-tailed Woodrat**, Common Crow, Common Raven, **Cooper's Hawk**, **Coyote**, Deer Mouse, Dwarf Shrew, Ermine, Great Horned Owl, Long-tailed Weasel, **Meadow Vole**, Merriam's Shrew, Montane Shrew, **Mountain Cottontail**, **Mule Deer**, Muskrat, **Northern Pocket Gopher**, **Northern Raccoon**, Red Fox, Red Squirrel, **Richardson's Ground Squirrel**, **Sharp-shinned Hawk**, **Striped Skunk**, White-footed Mouse, **White-tailed Deer**

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Common Crow, Northern Raccoon, Striped Skunk

Public Wild Lands

Private Ranch Lands

Exurbia

Suburbia

Urban Greenspace, Parks, and Mature Treescaped Neighborhoods

Urban Hardscape

Number of Species

Percent Conflict and Impacted Species

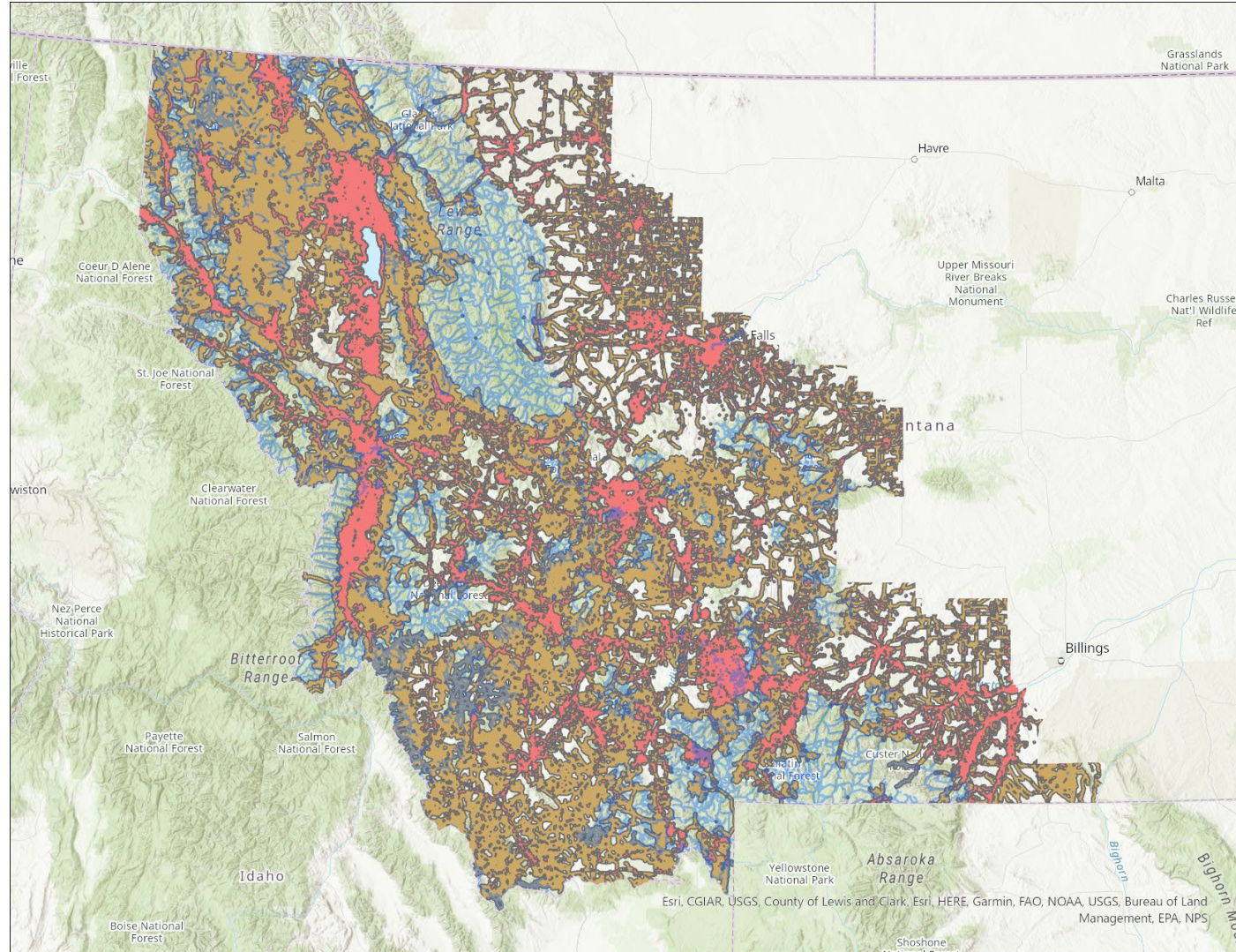
# The Big Four Impacts of Growth on Wildlife

- Rural Sprawl
- Transportation
- Recreation
- Shifting Social Values

Containing the development footprint is not enough. The cumulative human disturbance footprint must be managed to provide quiet space for wildlife to thrive.

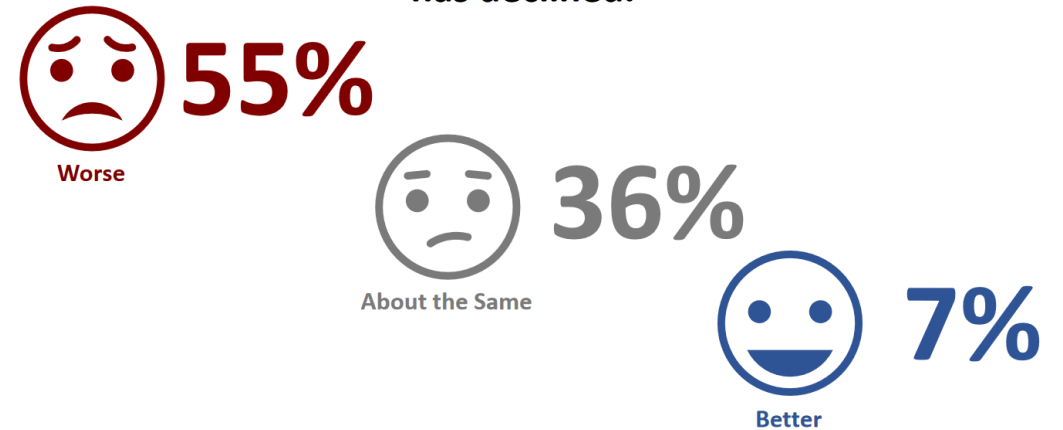


# Cumulative Human Footprint on Elk in Western Montana





A majority of Montanans say that quality of life has gotten worse in the last five years; near majorities of virtually every sub-group say it has declined.



Compared to five years ago, would you say that the quality of life in your area of Montana is better, worse, or about the same?



### Top 3 Reasons Newcomers are Moving to Montana

	Rural	Metro/Micro
To find a desirable natural environment (to have better access to the outdoors)	64%	60%
To find a less congested place to live	62%	48%
Take advantage of a slower pace of life	58%	43%

Montana Movers Study 2021 Report – Montana State University

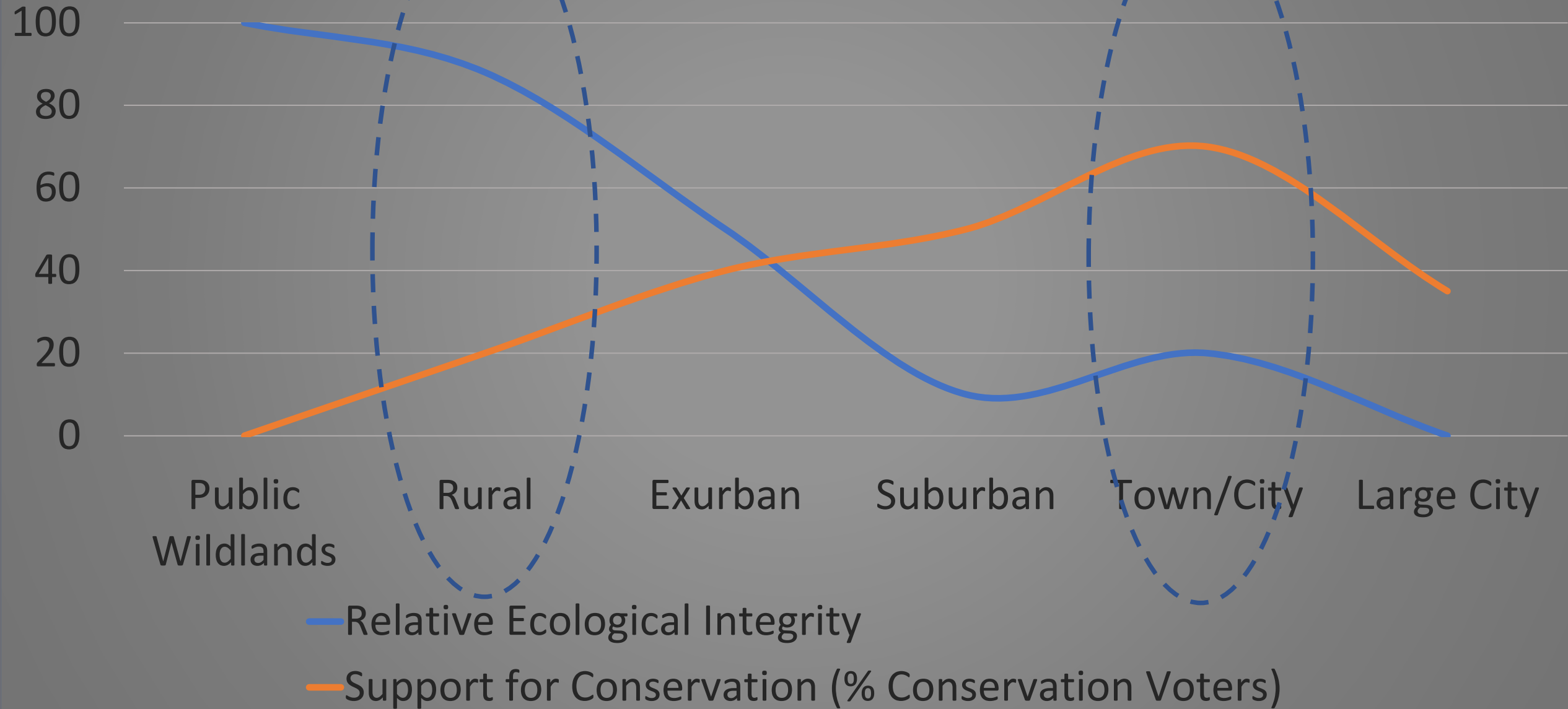
### Majorities say that a lack of affordable housing and development are both extremely or very serious problems in Montana.

Ranked by % Extremely/Very Serious	Extremely/Very Serious	Total Serious
Lack of affordable housing	77%	92%
Development sprawling into what were once ranches or open lands	52%	85%
Changing character of the state	45%	77%
Crowding and more people at places where you recreate outdoors	45%	76%
Loss of habitat for fish and wildlife	43%	77%
Loss of access to national forests, lakes and other public lands	41%	70%

The following is a list of issues some people say are problems in Montana. For each one, please indicate if you think it is an extremely serious problem, a very serious problem, a somewhat serious problem, or not a problem in the state.



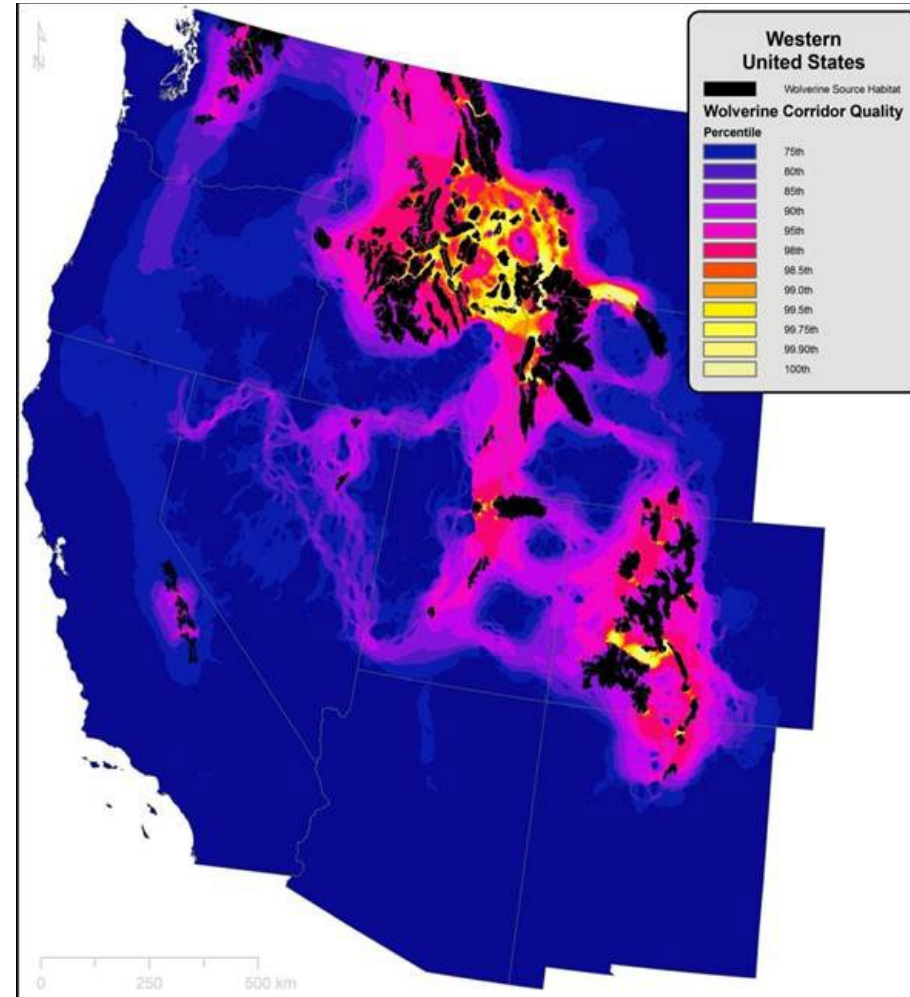
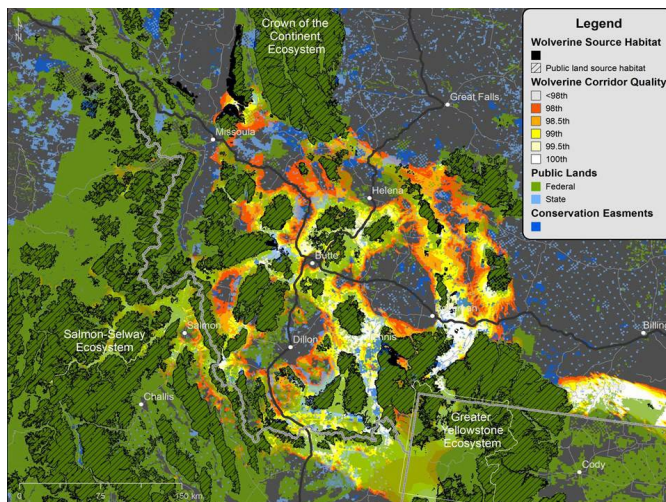
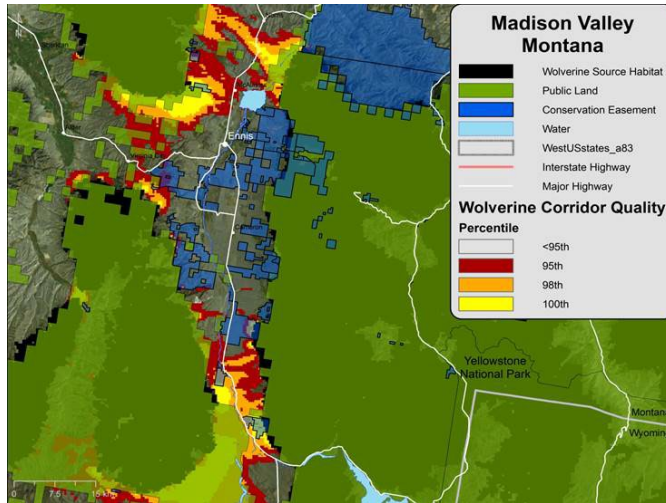
# Influence of Community Character on Wildlife Conservation





# SMALL AREAS LARGE IMPACT

R.M Inman  
Wildlife Conservation Society



# Wild Planner:

## GIS Tools for Land Use Planning and Wildlife



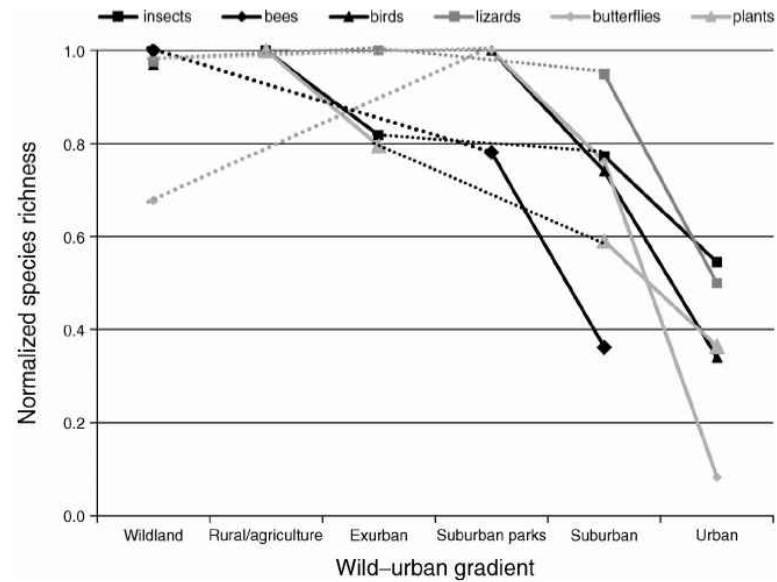
Landscape Level Conservation Planning: Addresses wildlife need for connected landscapes

Land Use Planning on Private Lands: Implemented at county to parcel scales

Need: Tools to integrate broad-scale conservation plans in local land use decisions



# What happens When We Build In Wild Places?



From Hansen et al. 2005. *Ecological Applications*, 15(6), 2005, pp. 1893–1905

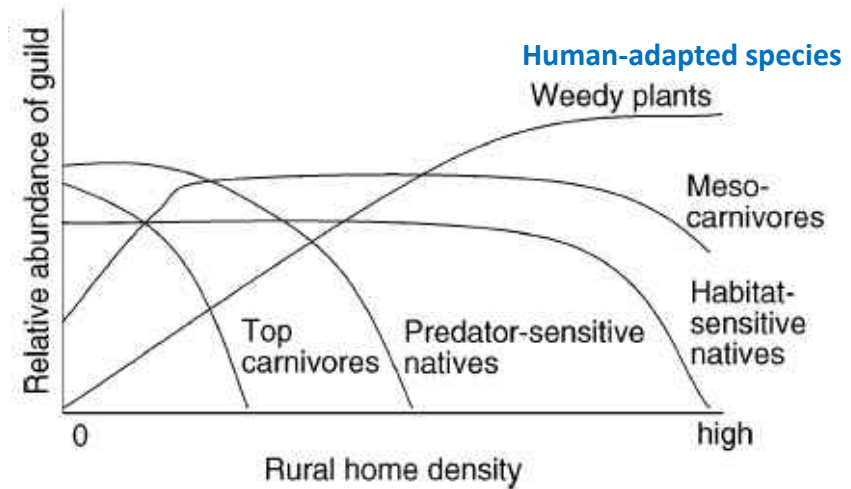


FIG. 4. Hypothesized responses of various guilds of species to rural home density.

# Effects Extend Beyond Building Footprint

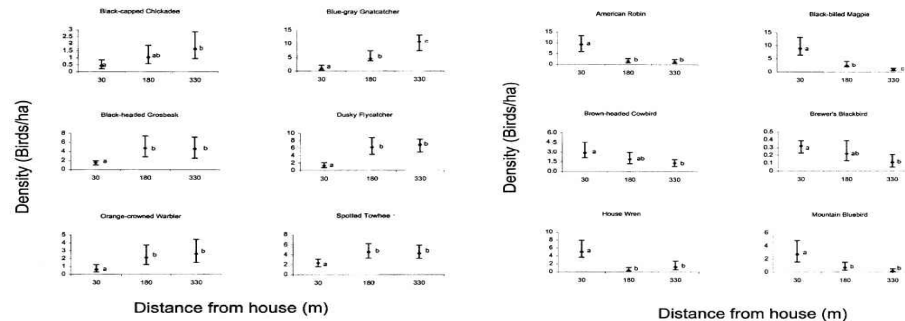


Figure 2. Density and 90% confidence interval of human-sensitive avian species at sampling points at increasing distances away from homes into natural areas. Density estimates with the same letter are not statistically significant at  $\alpha = 0.10$ .

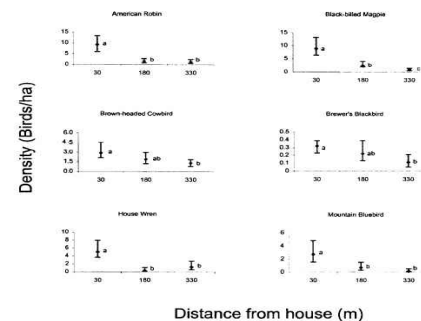


Figure 1. Density and 90% confidence interval of human-tolerant avian species at sampling points at increasing distances away from homes into natural areas. Density estimates with the same letter are not statistically significant at  $\alpha = 0.10$ .

From O'Dell and Knight. 2003. *Conservation Biology*, 15(4). 1143-1150

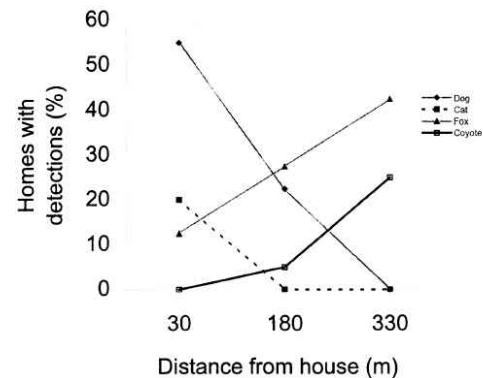


Figure 3. Percentage of houses at which each medium-sized mammal species was detected at each distance category.

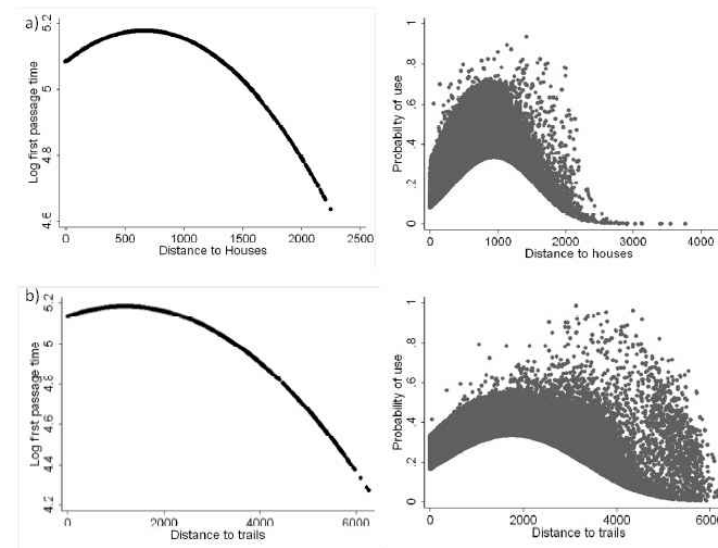


Figure 6. The distance (m) to houses (a) and trails (b) where first passage time and the relative probability of resource selection was maximized from generalized linear models developed from nine GPS collared adult female elk. The data was collected from 2007-2009 in the wildland-urban interface of Missoula, Montana, USA.

From Cleveland. 2010. MSc. Thesis. University of Montana.

Domestic Cats Kill  
10-30 Billion  
Wildlife Each Year.  
House Cats  
Severely Impact  
Wildlife Within  
100 Yards of  
Homes When  
Allowed to Roam  
Outdoors.





Ravens Nesting on Utility Poles Impact Sage Grouse Nests Up to 2 Miles Away



Wide Highways Create Complete Barriers for Flying Squirrels Causing Genetic Isolation

Elk Prefer Areas  $> \frac{1}{2}$  Mile  
from Homes.

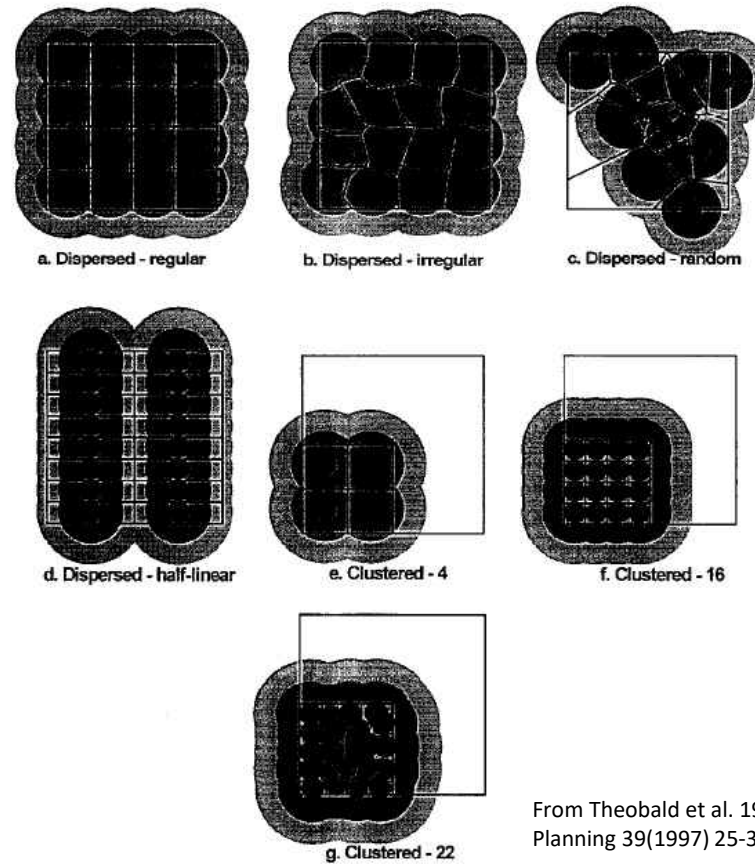
Elk Forced to Live Near  
Human Dwelling Become  
Habituated Leading to  
Damage Complaints, Disease,  
Loss of Migration Behavior,  
and Inability to Regulate  
Populations.





# Building Pattern and Cumulative Effects

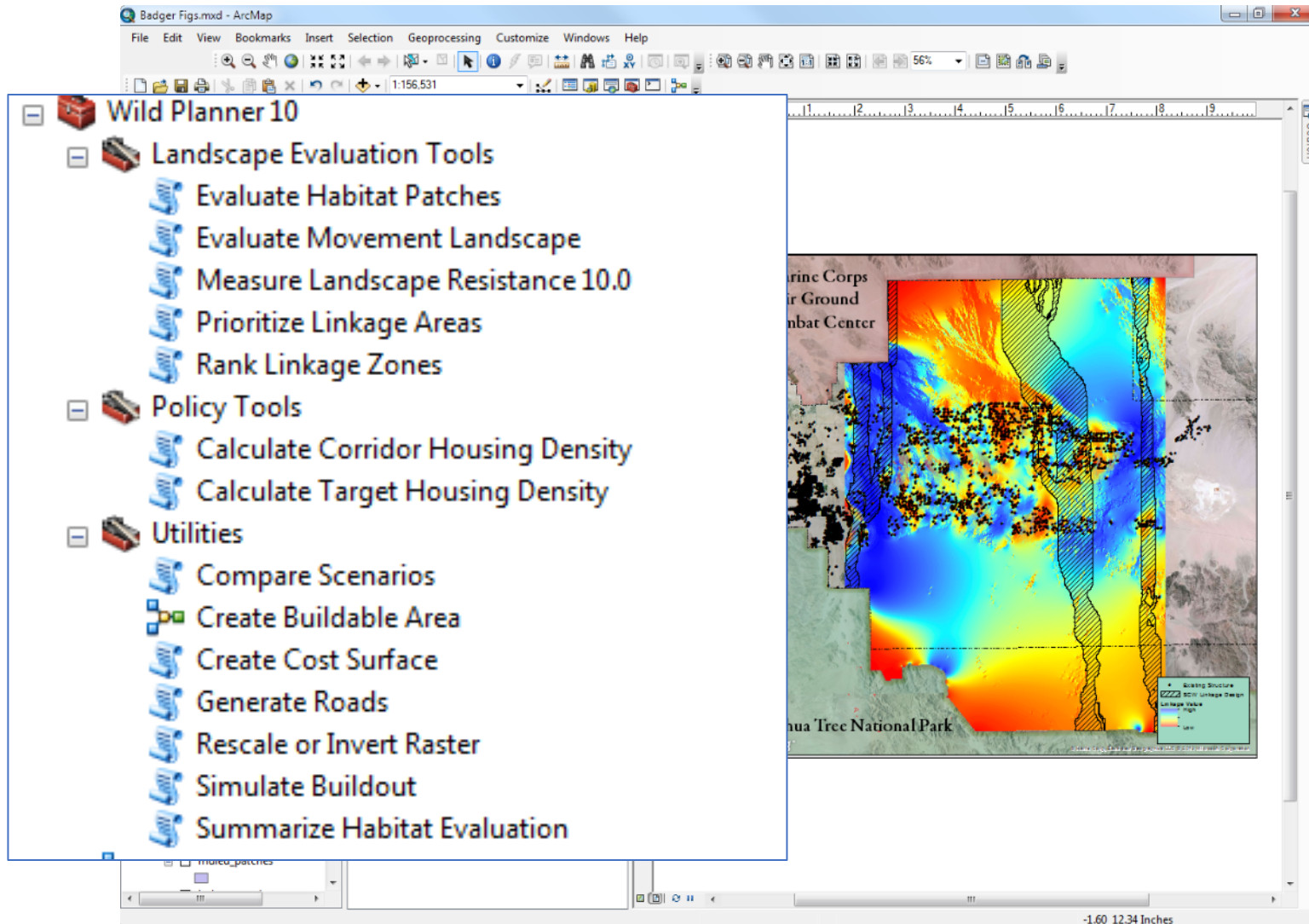
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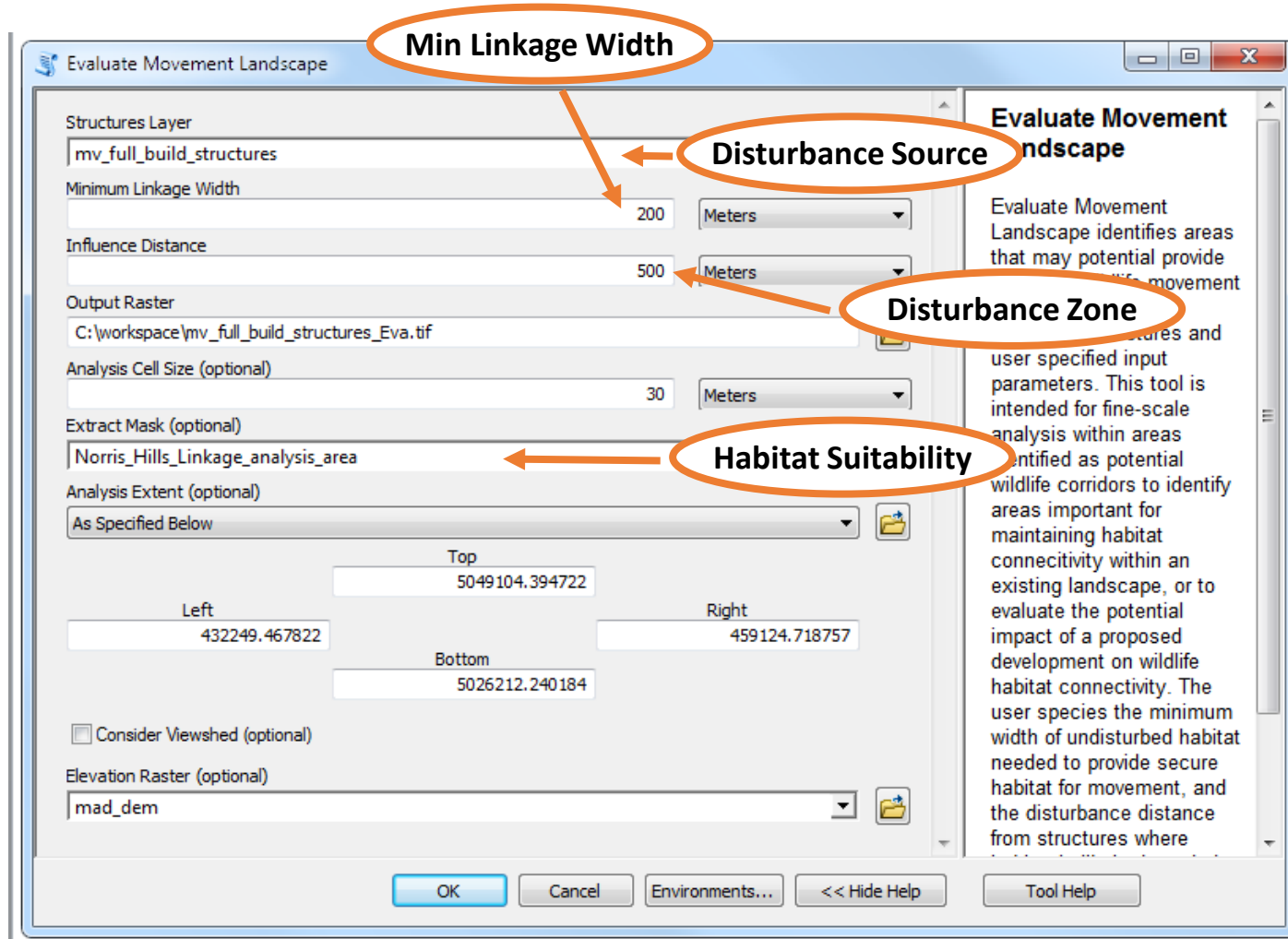
From Theobald et al. 1997. *Landscape and Urban Planning* 39(1997) 25-36

Fig. 1. Typical spatial patterns of residential subdivisions. Each subdivision is 258 ha (640 acres) and includes 16 parcels unless noted otherwise. The white mark is the building location, surrounded by 100 m (dark shade) to 500 m (light shade) zones of disturbance.

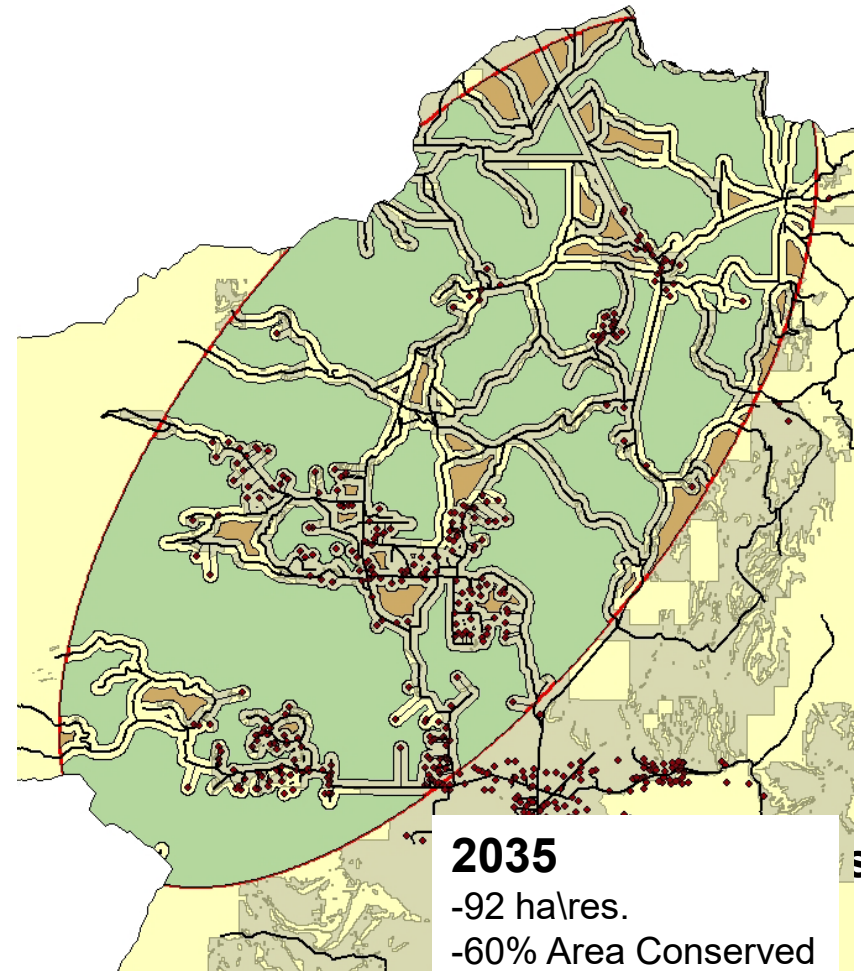
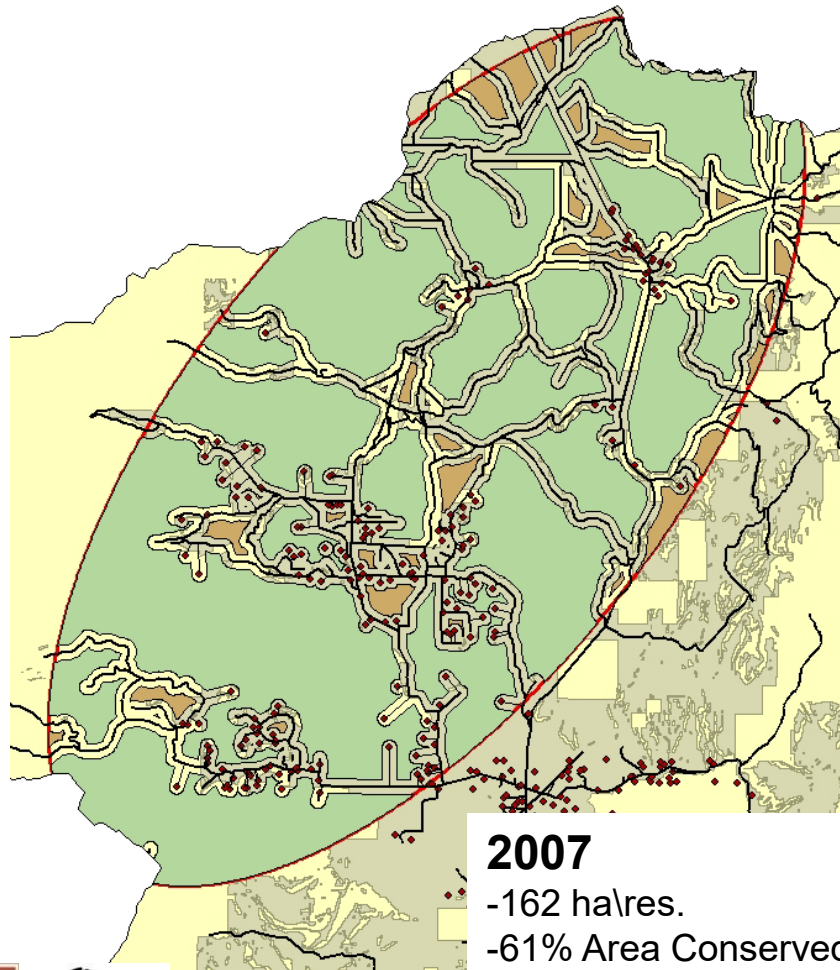
# The Wild Planner Toolbox



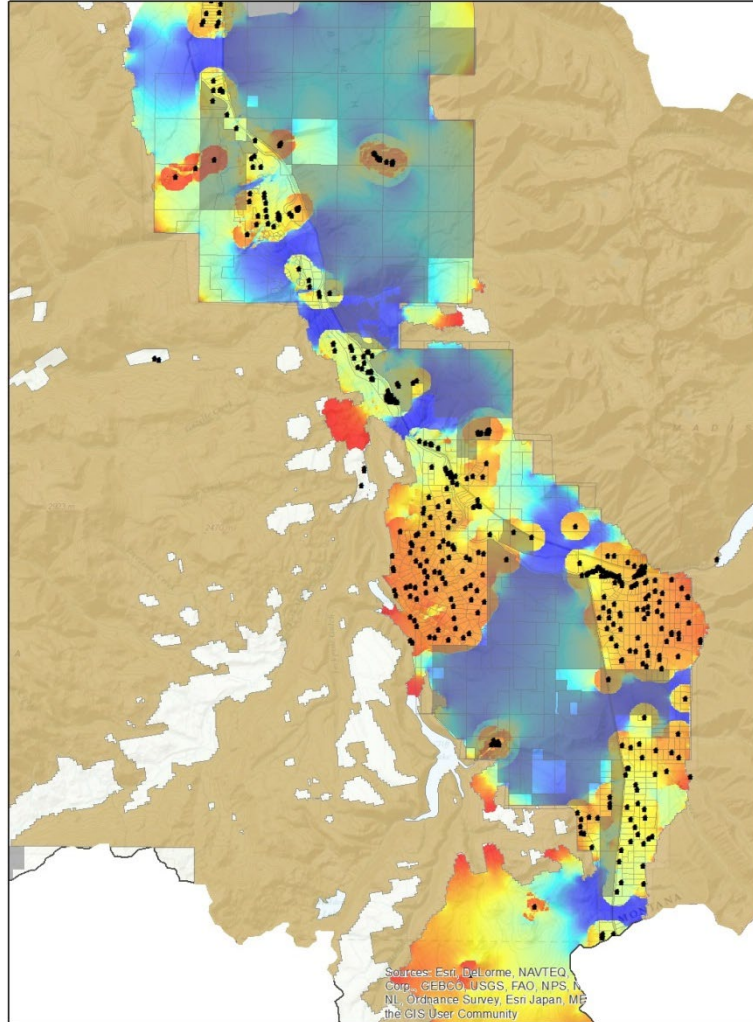
# Example Wild Planner Graphical User Interface



# Predicting change in elk habitat

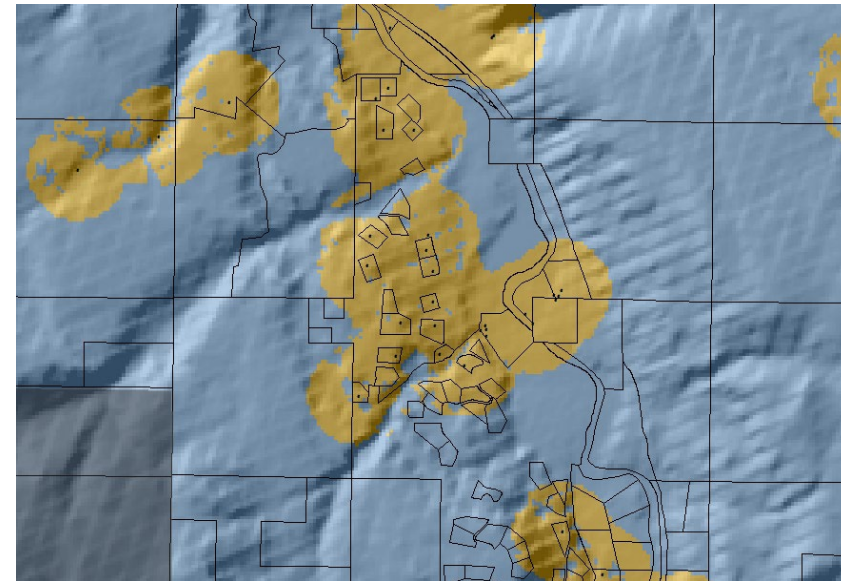
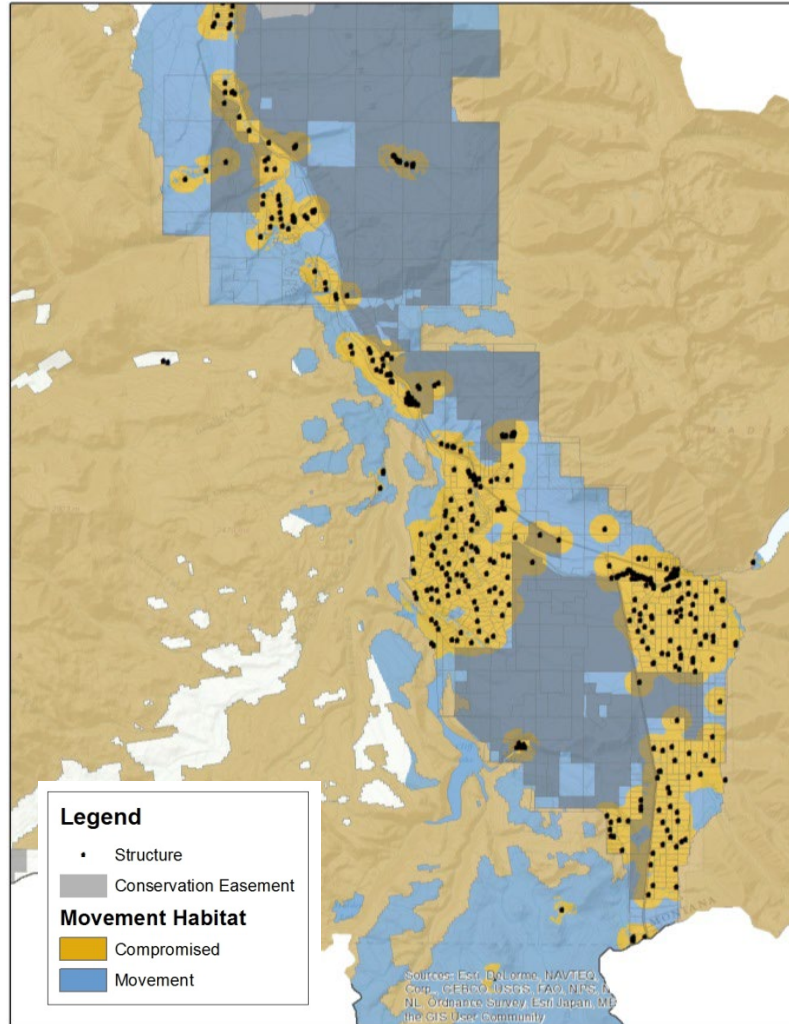


# CIRCUITSCAPE ESTIMATES OF GRIZZLY BEAR MOVEMENT



- Assumes best movement areas in low housing densities with preferred land cover
- Identifies potential bottlenecks to movement

# LOW CONFLICT MOVEMENT HABITAT FOR GRIZZLY BEARS

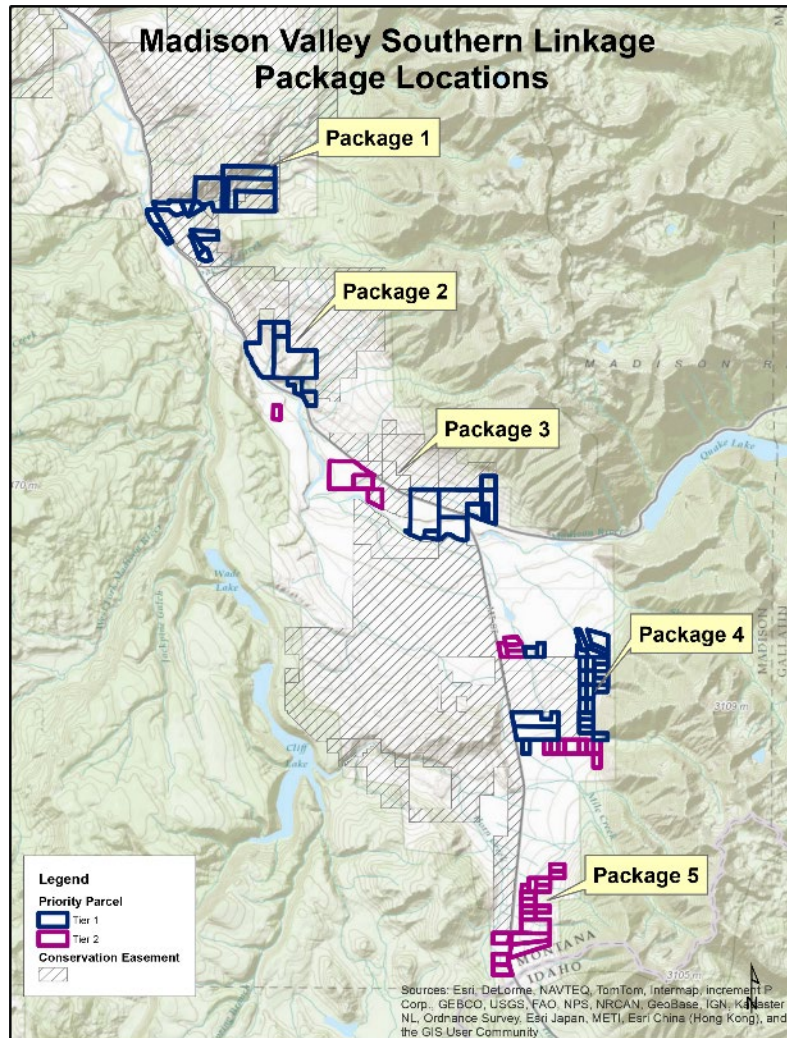




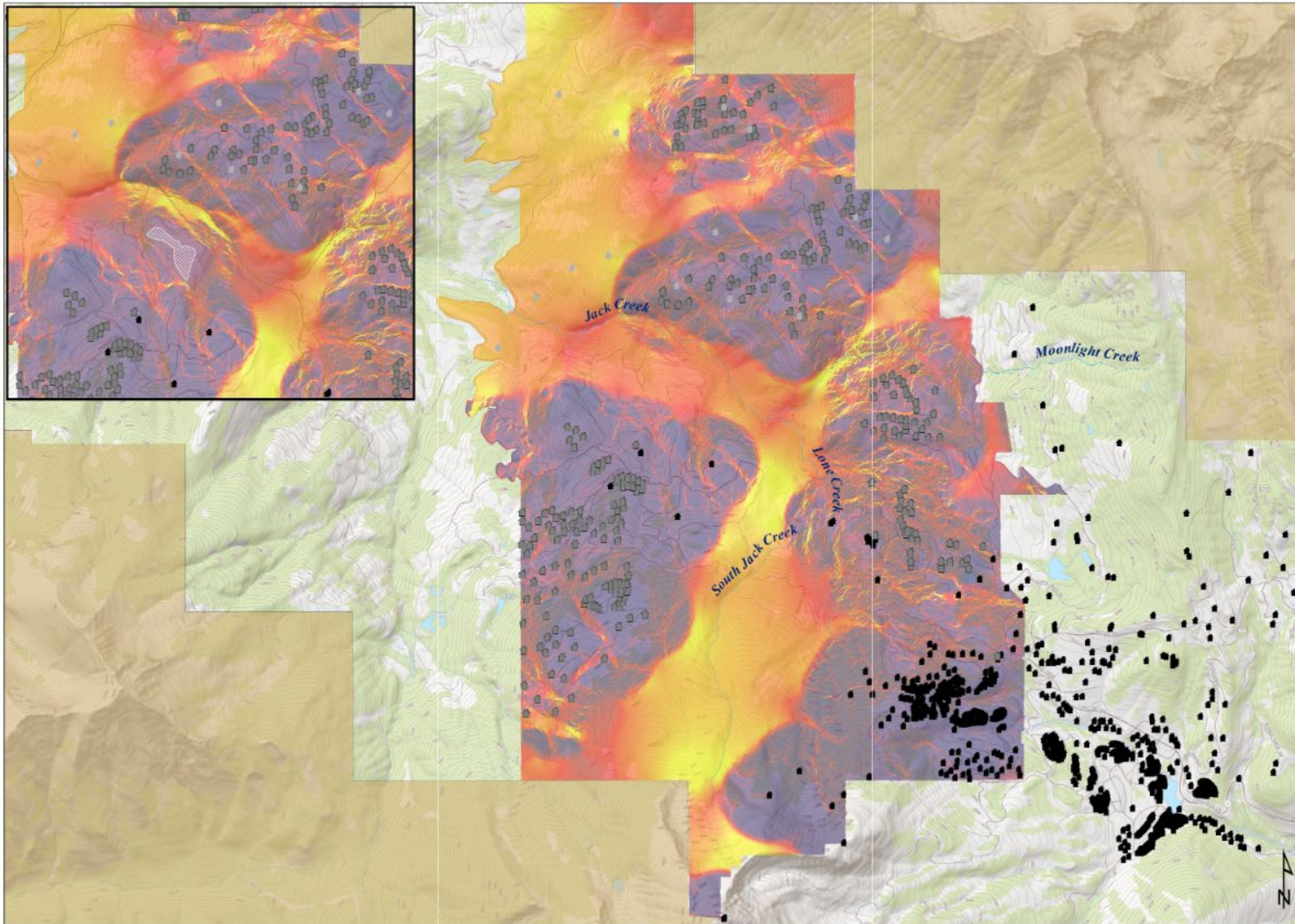




# Priority Parcels



- Key parcels identified for each linkage
- Tier 1 parcels (blue) provide best linkages
- Tier 2 parcels (purple) provide sub-optimal (less “quiet”) linkages but still worth considering



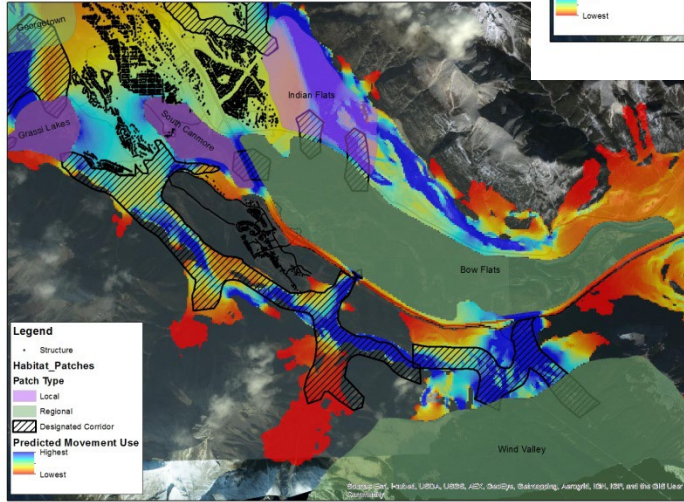
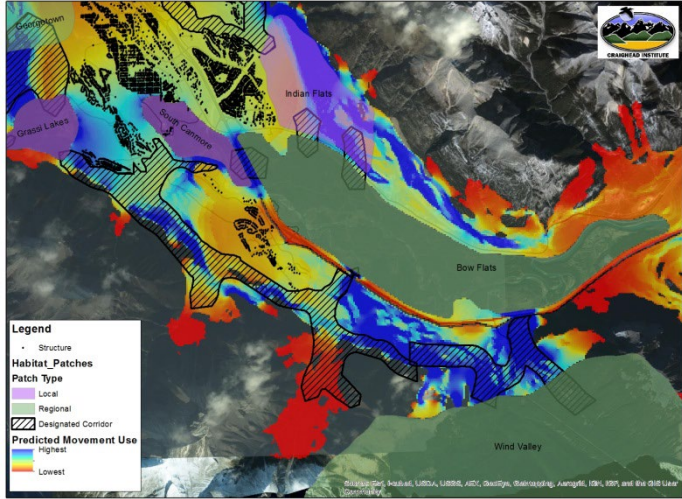
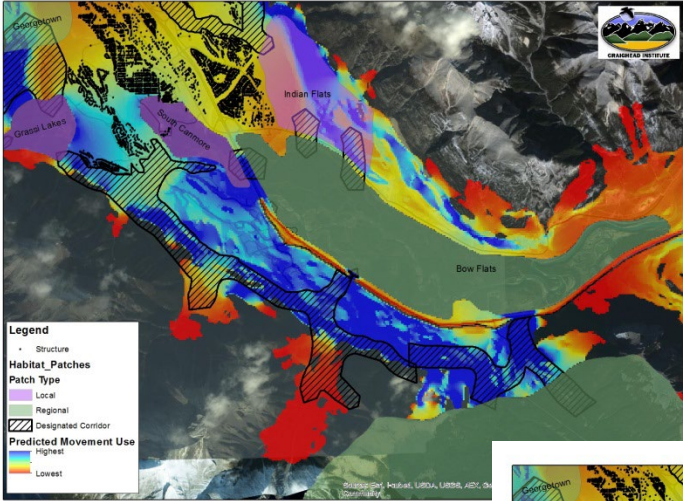
Moonlight Basin:  
South Jack



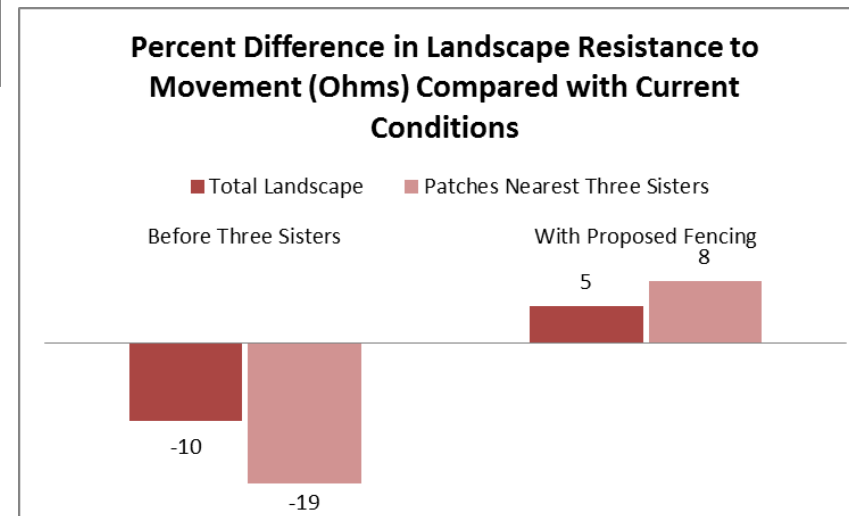
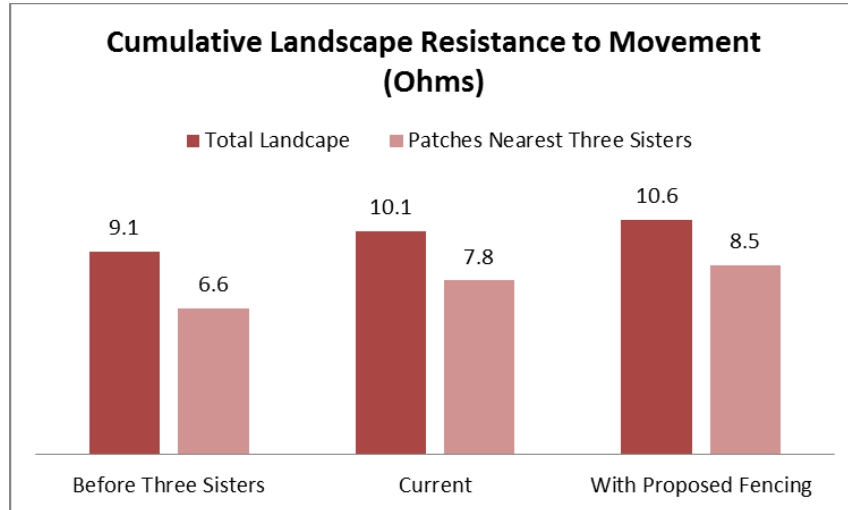
MOONLIGHT  BASIN



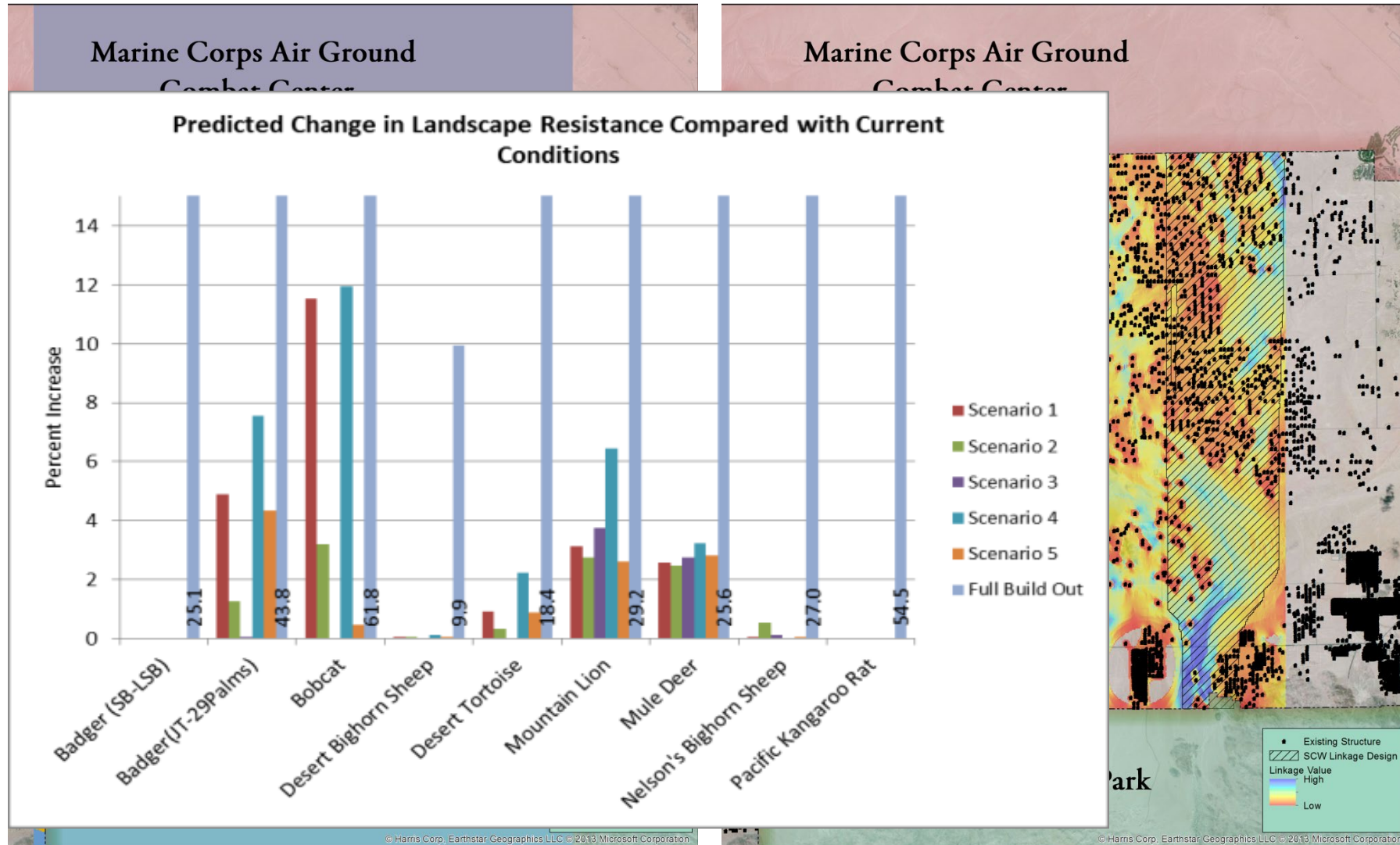
# Three Sisters Mountain Village Canmore, Alberta

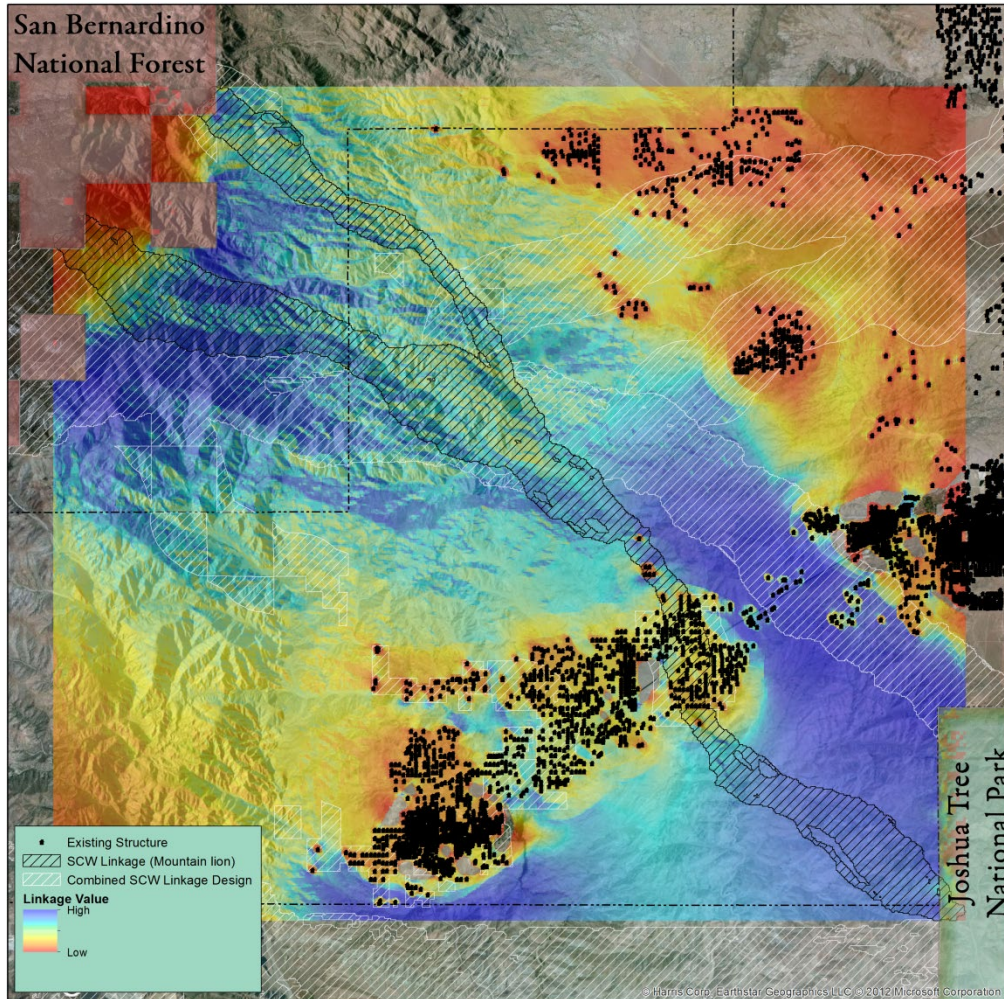


# Three Sisters Mountain Village Canmore, Alberta

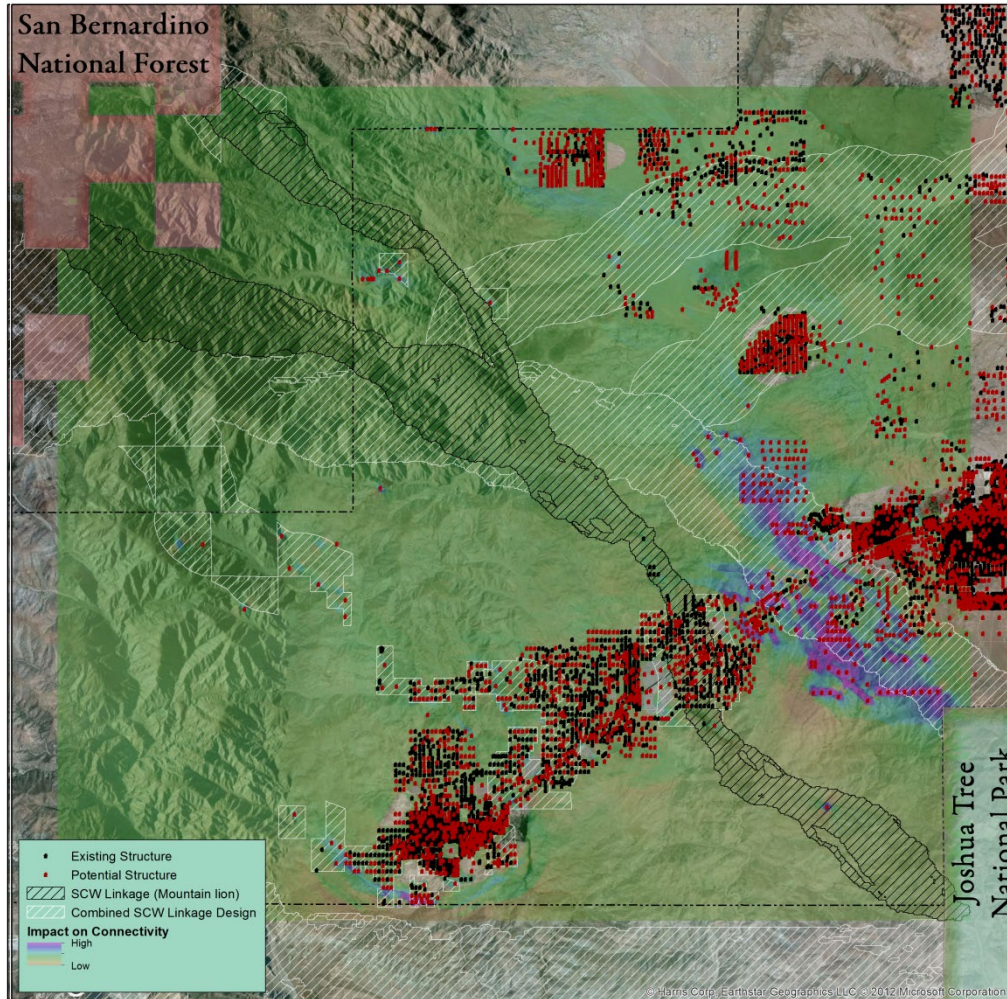


# BOBCAT CONNECTIVITY – MORONGO BASIN, CA





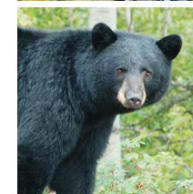
## Refining Regional Connectivity Maps



## Comparing Scenarios

# Planning for Wildlife

- Regional Planning is Essential – local plans should integrate with broad scale regional planning for wildlife.
- Consider Full Impacts of Population Growth
  - Habitat Loss in Built Environment
  - Traffic and Transportation Network
  - Increased Recreation in Natural Areas
  - Changes in Community Character and Social Values
- Set subdivision design and review standards to minimize impacts on wildlife habitat and encourage sound stewardship.
- Acknowledge limits on growth to sustain wildlife and community character.



## FISH AND WILDLIFE RECOMMENDATIONS FOR SUBDIVISION DEVELOPMENT IN MONTANA

A WORKING DOCUMENT  
APRIL 2012





# Planning for the Big Four

---

- Built Environment
  - Retain as much naturally vegetated land as possible.
  - Increase Natural Areas Within Built Environment (Consider Wildlife Needs).
  - Require and Enforce Covenants in Exurban Areas to Improve Stewardship.
- Transportation
  - Think Permeability Rather than Corridors
- Recreation
  - Regional Plan to Concentrate Impacts Near Population Centers
- Social Values
  - Retain Regional Mix of Rural and Small Urban Communities



# QUESTIONS?

Brent Brock

Senior Ecologist, Future West

[brent@future-west.org](mailto:brent@future-west.org)

