# Habitat Connectivity and Climate Change in Washington

WWHCWG, Climate Change Subgroup

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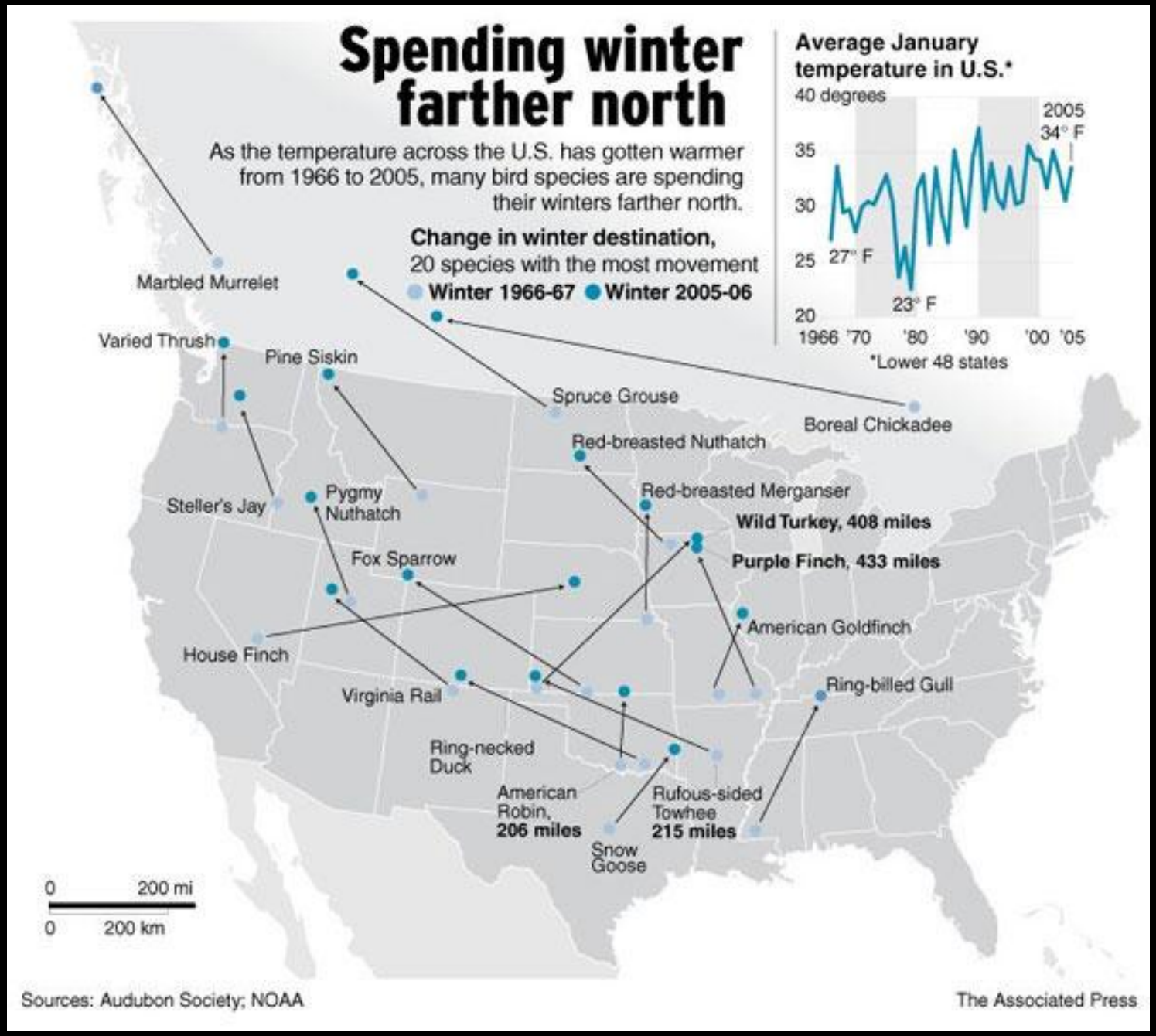
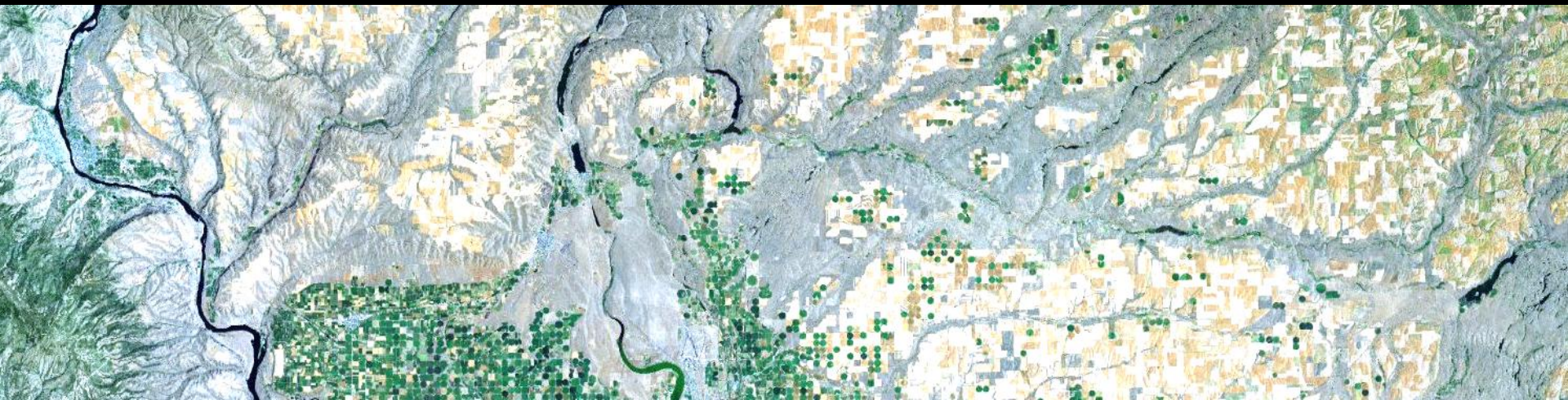
WASHINGTON WILDLIFE HABITAT
CONNECTIVITY
WORKING GROUP


Spending winter farther north
As the temperature across the U.S. has gotten warmer from 1966 to 2005, many bird species are spending their winters farther north.
Change in winter destination, 20 species with the most movement
Winter 1966-67
Winter 2005-06
Average January temperature in U.S.*
40 degrees
35
30
25
20
2005
34° F
27° F
23° F
1966 '70 '80 '90 '00 '05
*Lower 48 states
Marbled Murrelet
Varied Thrush
Pine Siskin
Spruce Grouse
Boreal Chickadee
Red-breasted Nuthatch
Steller's Jay
Pygmy Nuthatch
Red-breasted Merganser
Wild Turkey, 408 miles
Purple Finch, 433 miles
Fox Sparrow
American Goldfinch
House Finch
Virginia Rail
Ring-billed Gull
Ring-necked Duck
American Robin, 206 miles
Rufous-sided Towhee 215 miles
Snow Goose
0 200 mi
0 200 km
Sources: Audubon Society; NOAA
The Associated Press

# Habitat Connectivity for Climate Change Adaptation

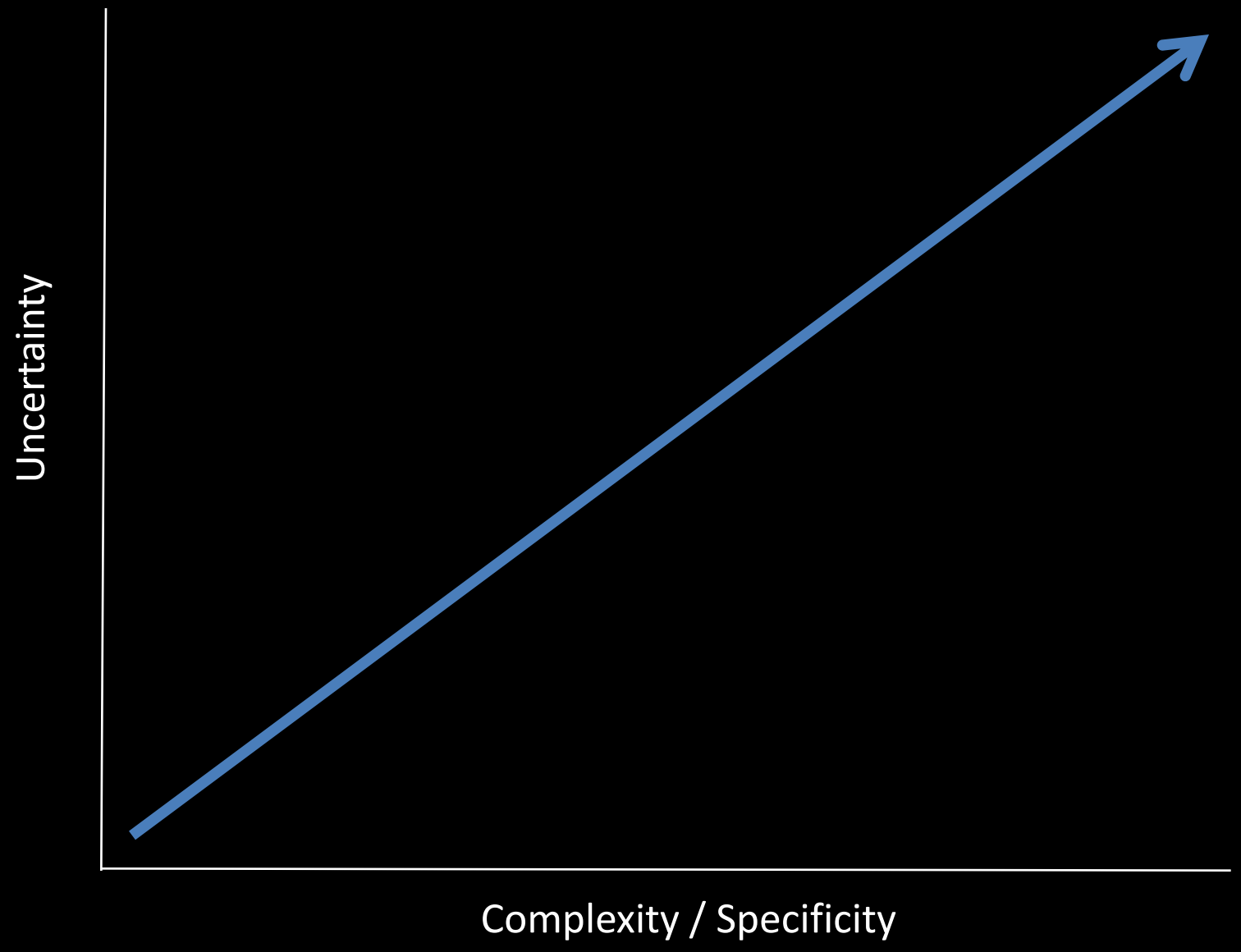
Robustly connected landscapes maximize evolutionary options for native species, and facilitate range shifts or community reassortment.



# Assessing Habitat Connectivity for Climate Change Adaptation

- Resilience & Resistance
  - Start with existing conditions
  - Larger, connected populations are less vulnerable to local disturbances and are more diverse
- Response
  - Identify patterns that can facilitate range shifts
  - Approaches range from simple to complex
  - All approaches involve substantial uncertainty

# The Big Choice in Modeling…



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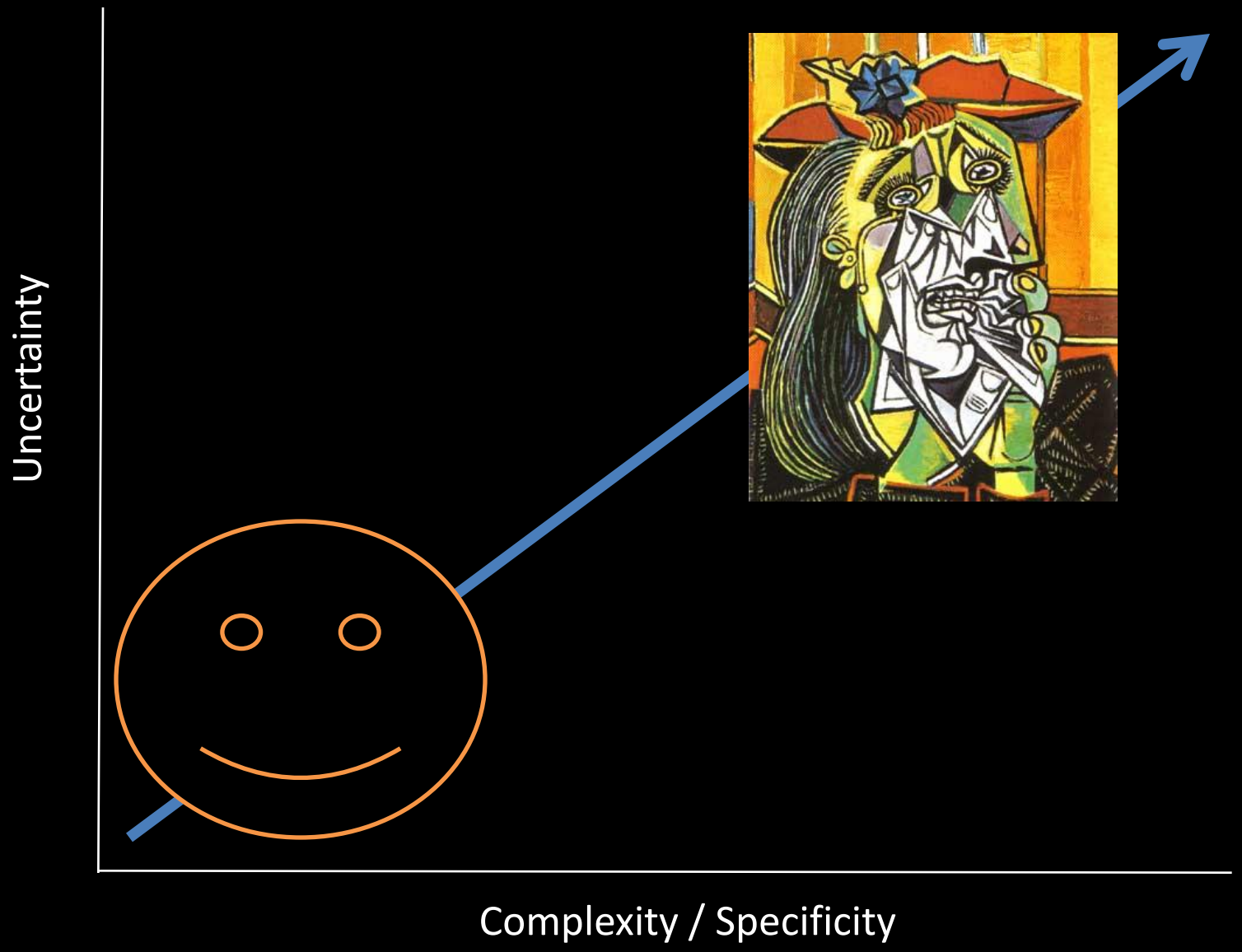
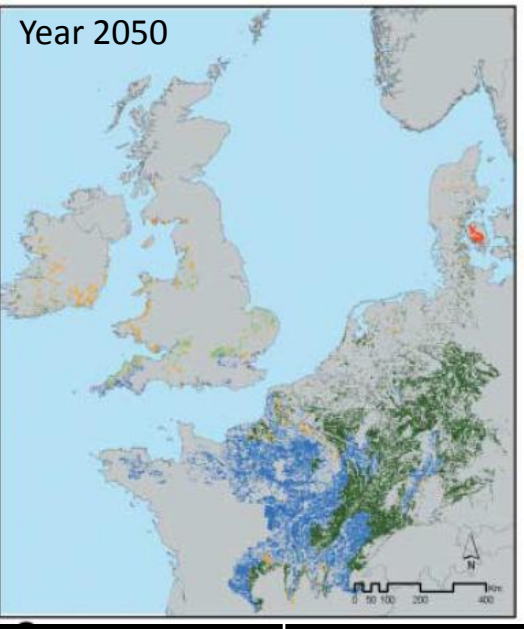
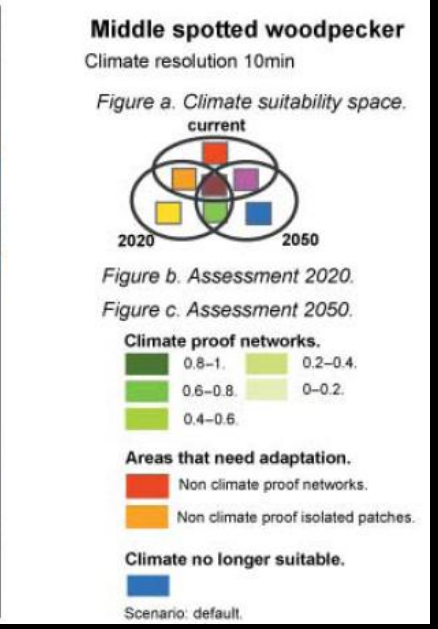





Uncertainty

Current climate

Downscaling

Future $CO_2$ emissions

Future climate

Downscaling

Future vegetation distributions

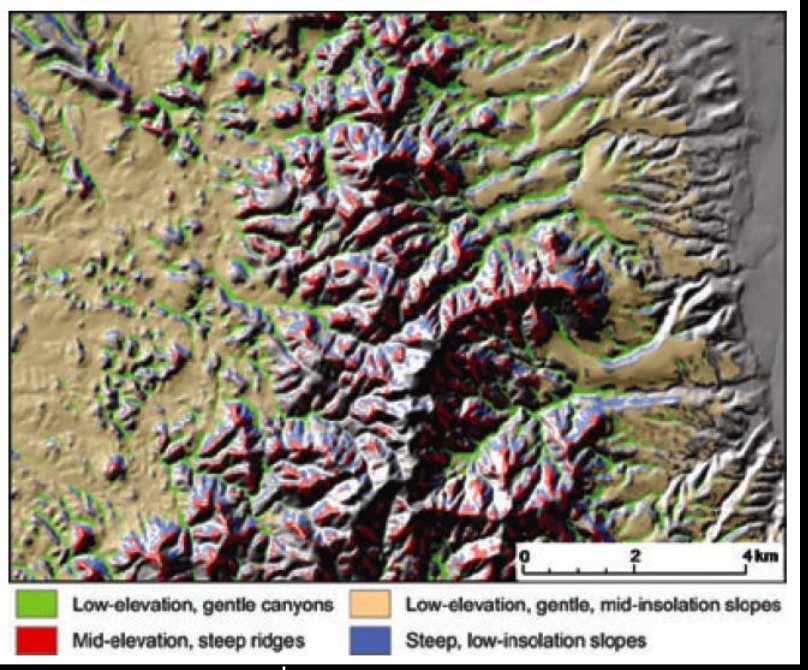
Future species distributions

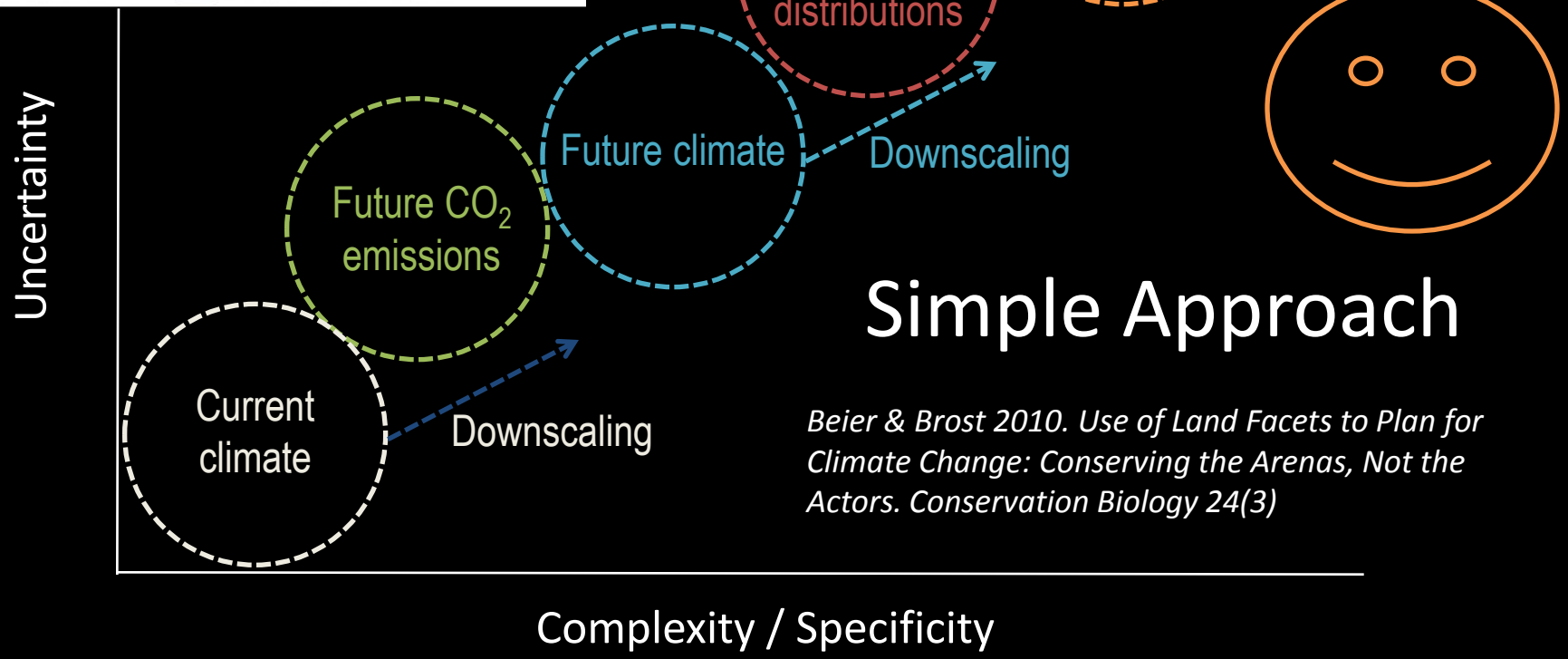
Species climate corridors

# Complex Approach

*Vos et al. 2008. Adapting landscapes to climate change: examples of climate-proof ecosystem networks and priority adaptation zones. Journal of Applied Ecology 45*

Complexity / Specificity



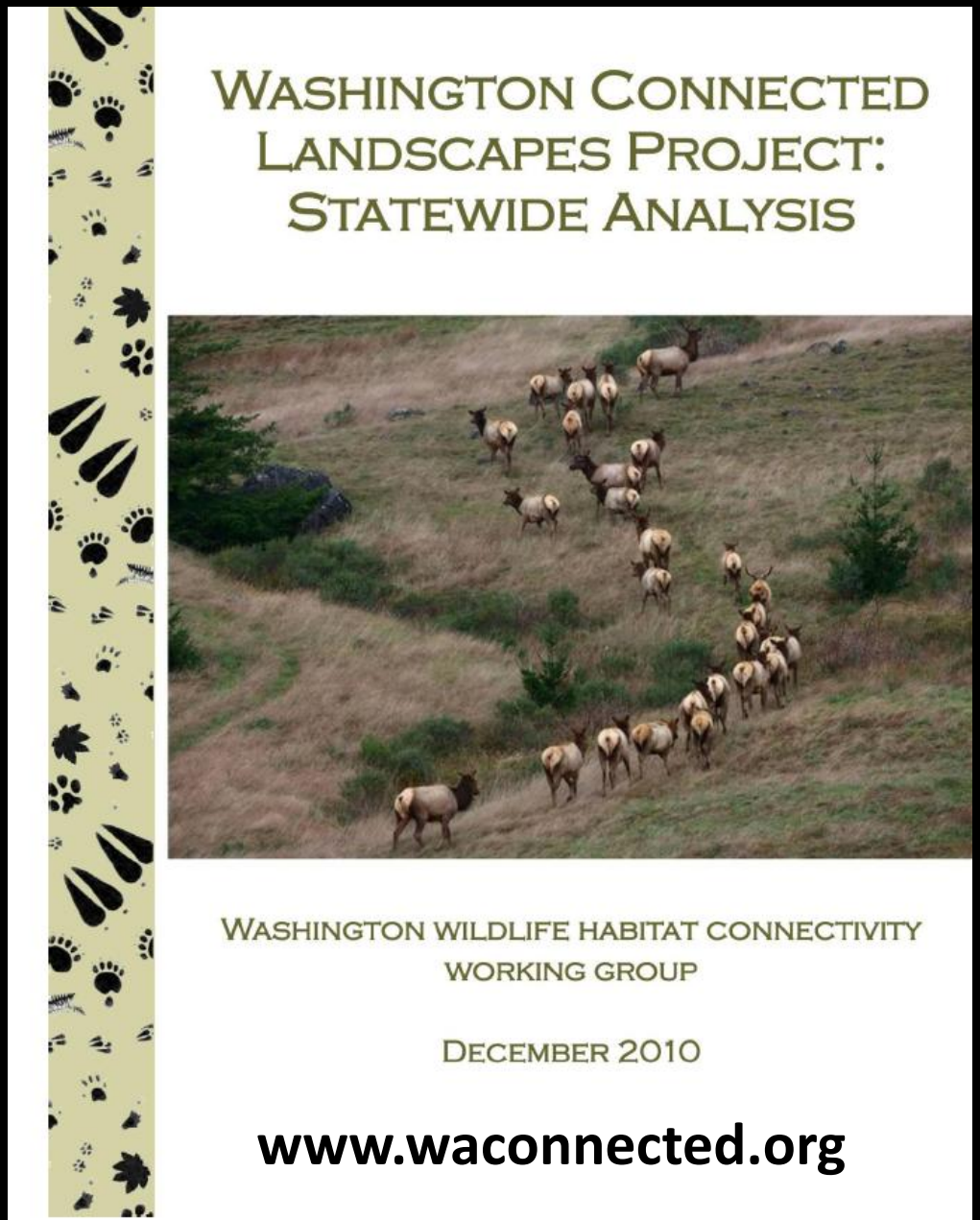

# Simple Approach

*Beier & Brost 2010. Use of Land Facets to Plan for Climate Change: Conserving the Arenas, Not the Actors. Conservation Biology 24(3)*

# The WWHCWG Approach

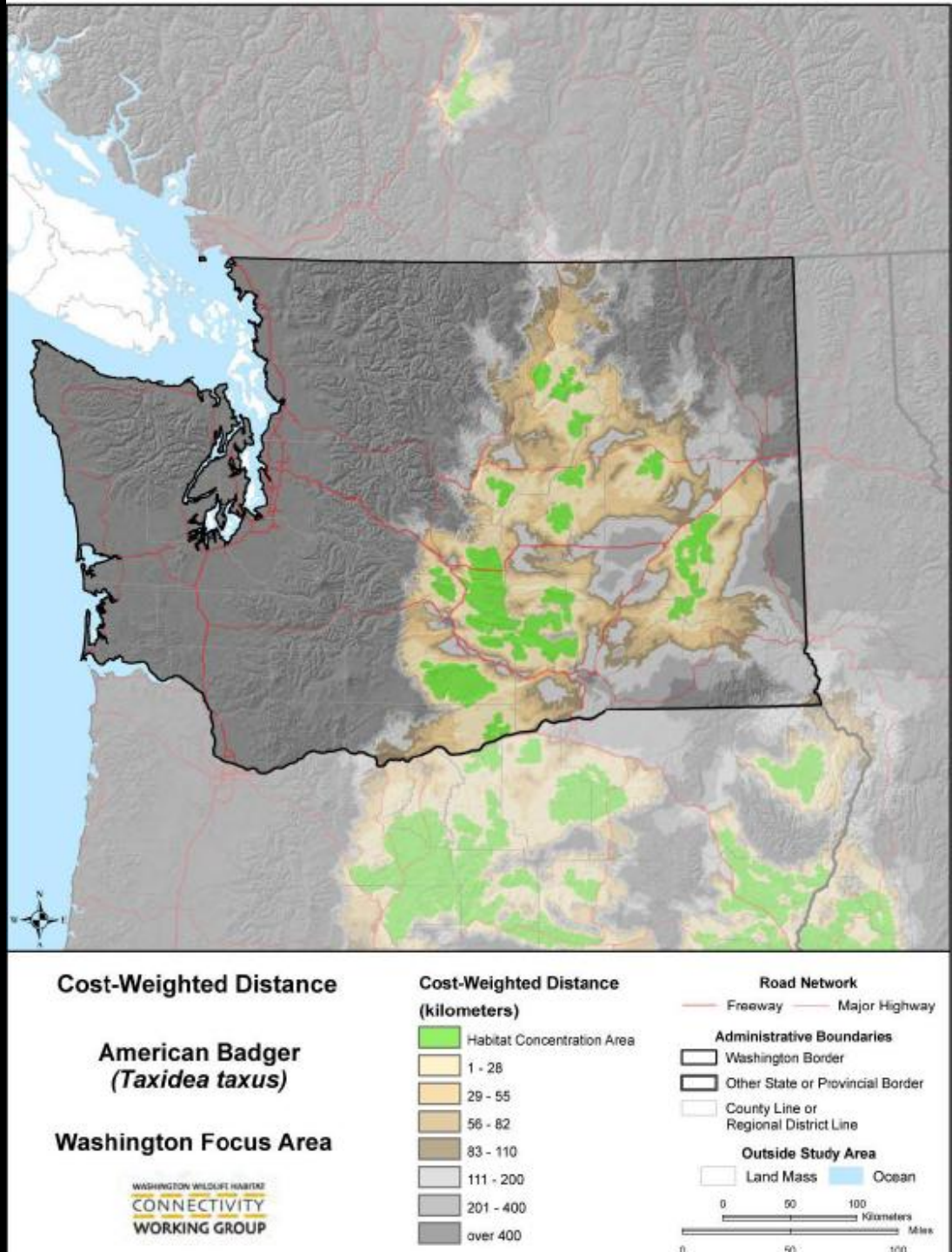
- Start with existing conditions
  - Statewide assessment of connectivity patterns for 16 focal species and Landscape Integrity (Dec. 2010)
- Identify connections along gradients in the current climate (Sept. 2011)
- Identify climate refugia based on topographic characteristics (2012)
- Species-specific habitat and range shift modeling with downscaled climate data (~2013)

# The Starting Point: Existing Conditions



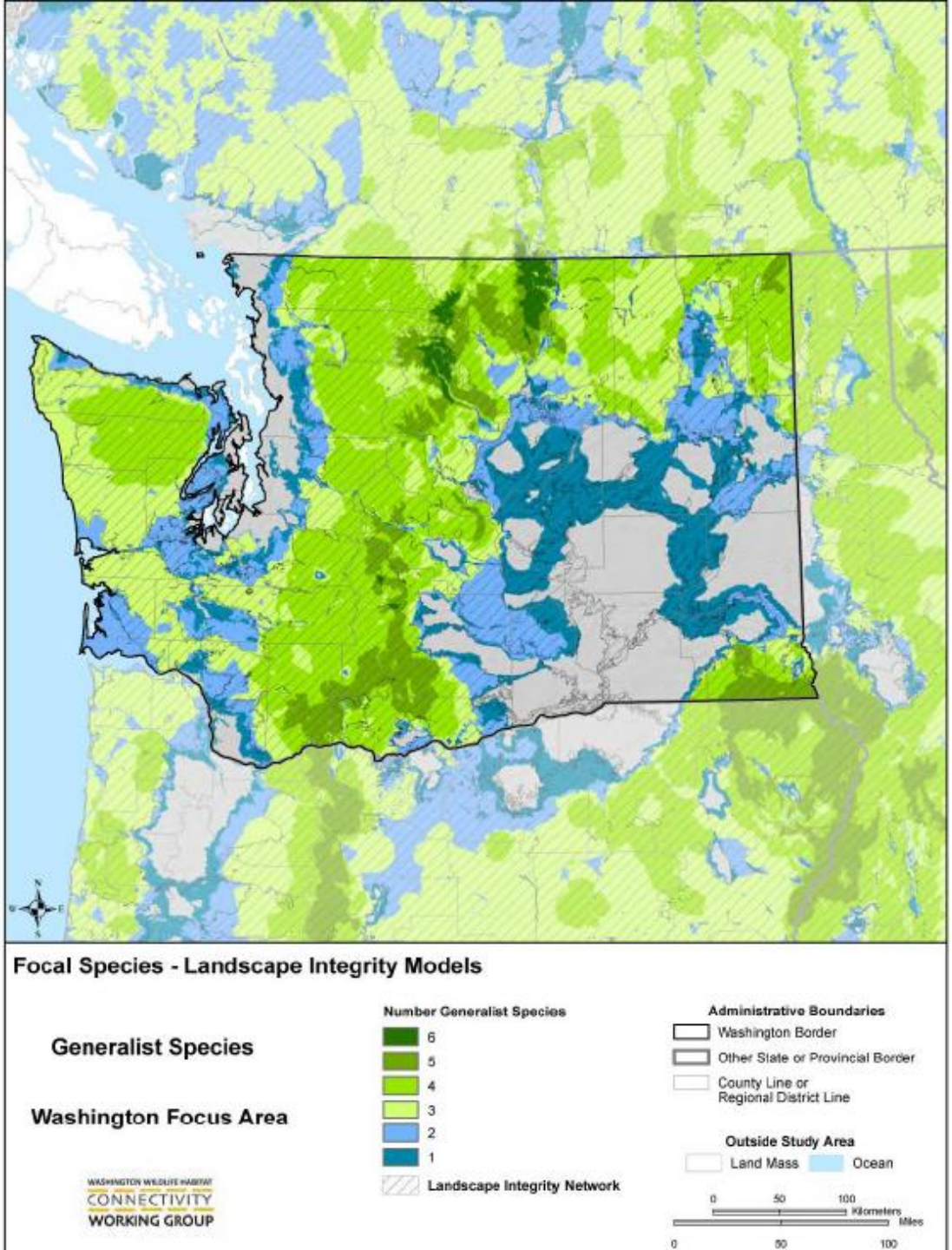
# Focal Species Existing Networks

- Sharp-tailed Grouse
- Greater Sage-Grouse
- American Badger
- Black-tailed Jackrabbit
- White-tailed Jackrabbit
- Mule Deer
- Bighorn Sheep
- Western Gray Squirrel
- American Black Bear
- Elk
- Northern Flying Squirrel
- Western Toad
- American Marten
- Canada Lynx
- Mountain Goat
- Wolverine



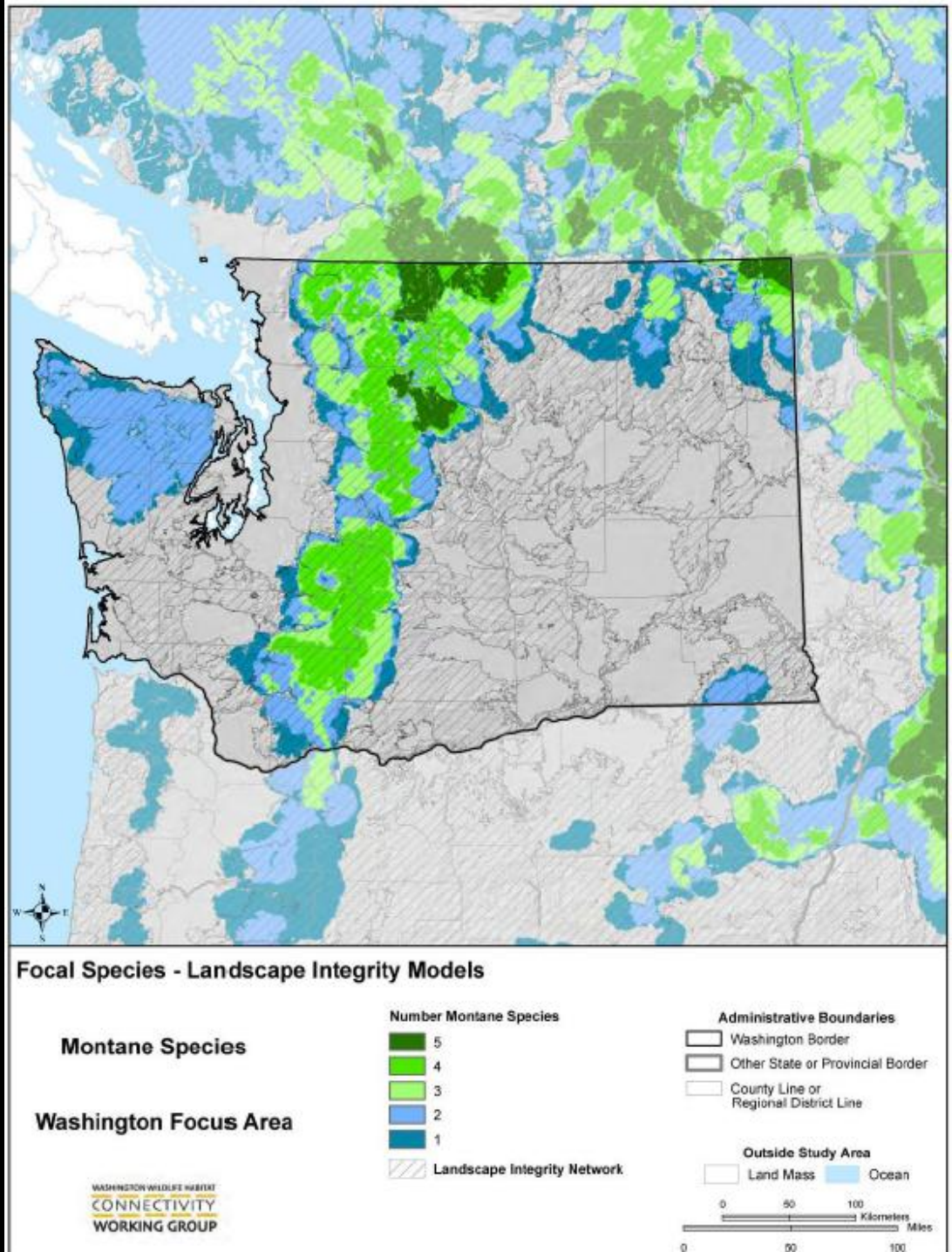
# **Connectivity Guilds:** Habitat Generalists

- Western Toad
- Elk
- Mule Deer
- Bighorn Sheep
- Western Grey Squirrel



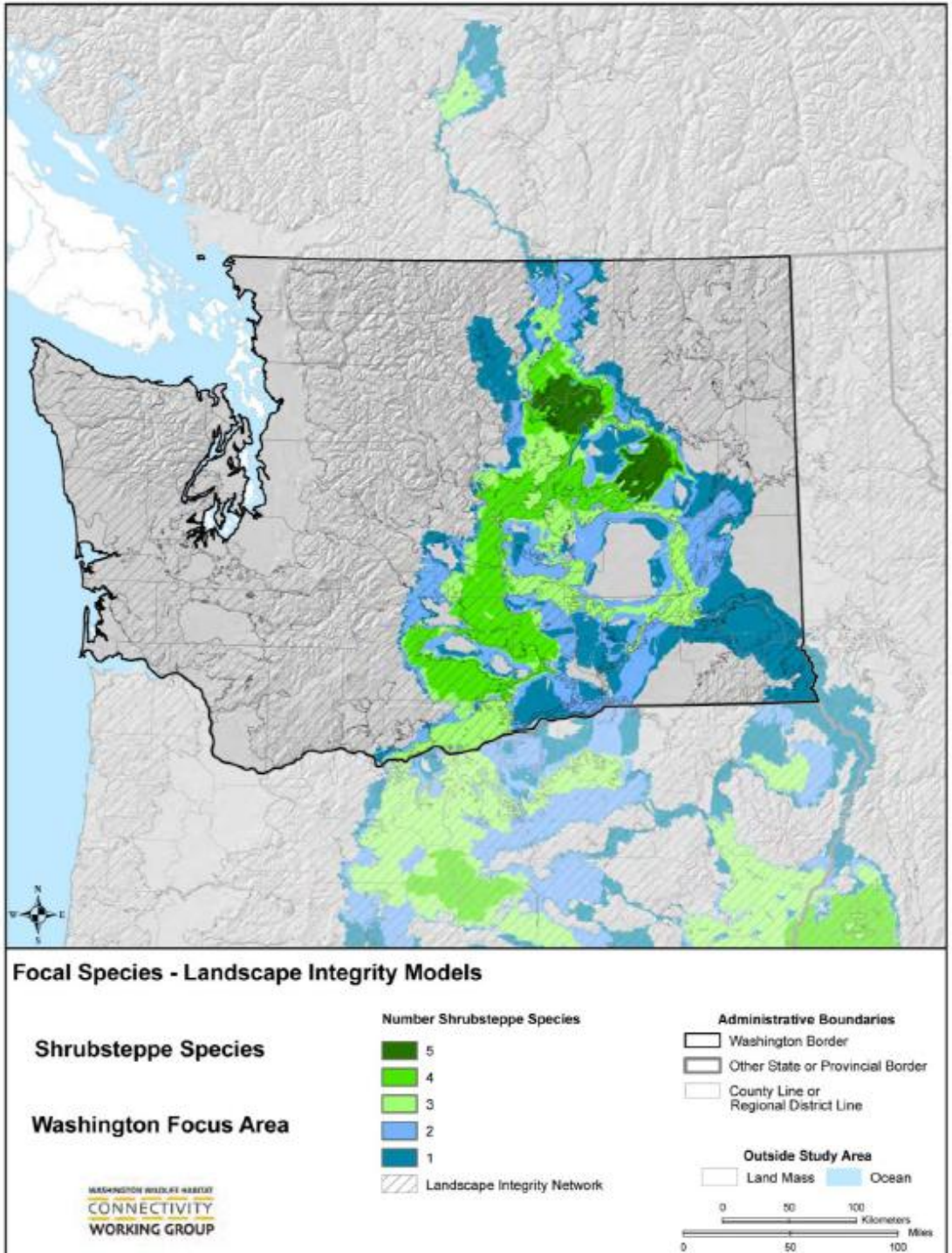
# **Connectivity Guilds:** Montane Species

- Lynx
- Wolverine
- Mountain Goat
- Black Bear
- Flying Squirrel
- Marten

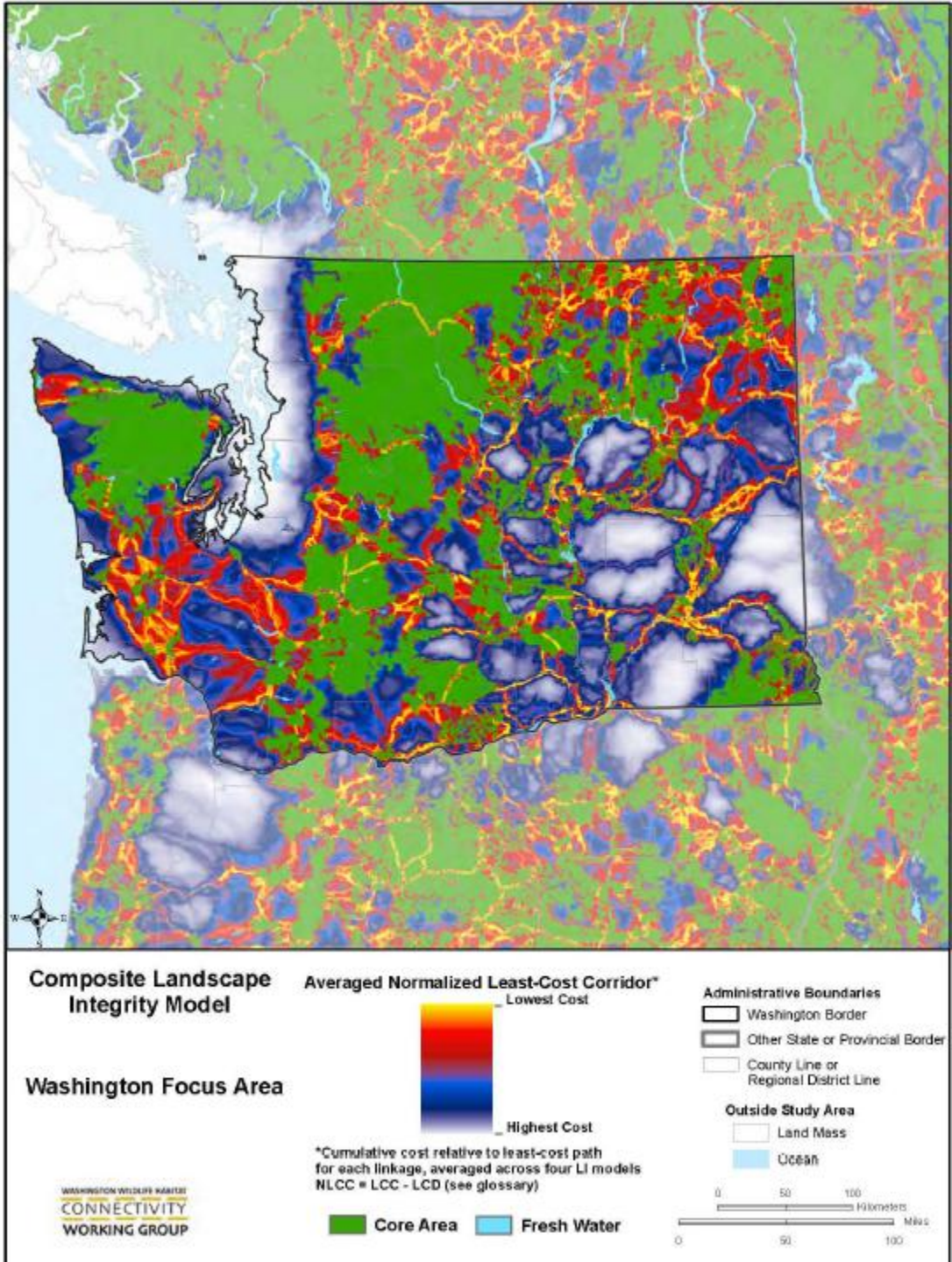


# **Connectivity Guilds:** Shrubsteppe Species

- Sharp-tailed Grouse
- Sage Grouse
- Black-tailed Jackrabbit
- White-tailed Jackrabbit
- Badger



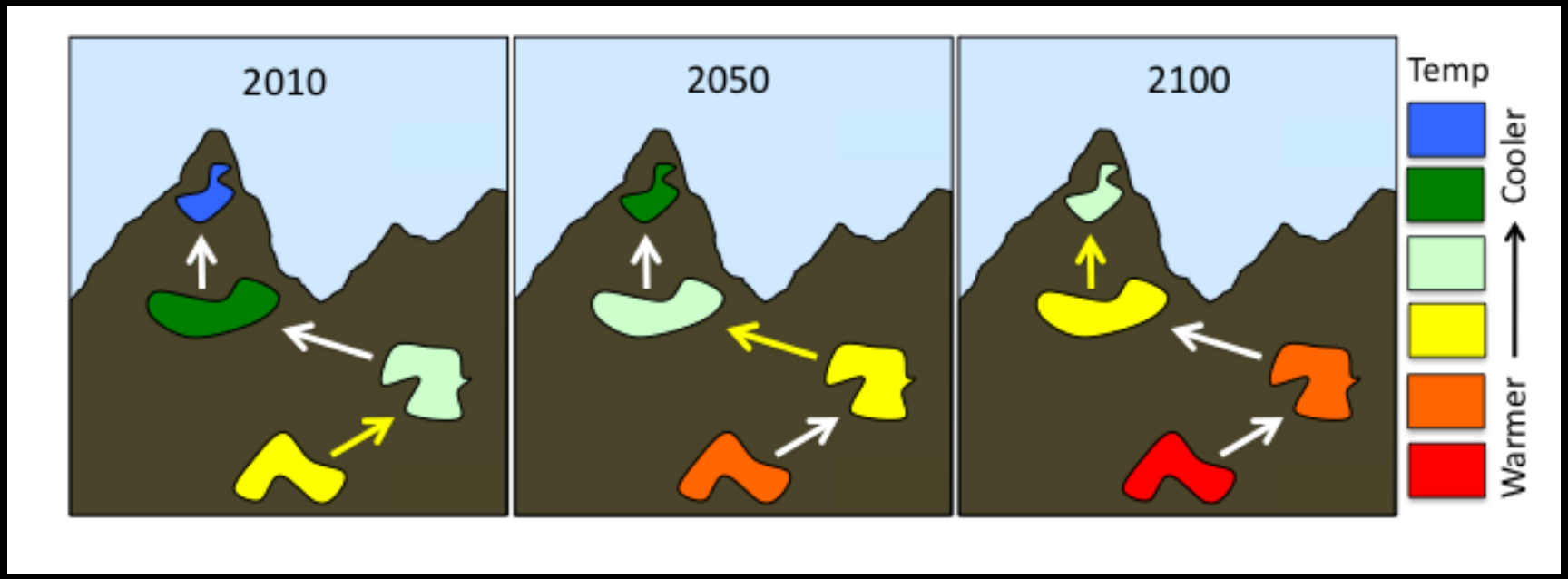
# Existing Landscape Integrity Network



# What About Climate Change Considerations?

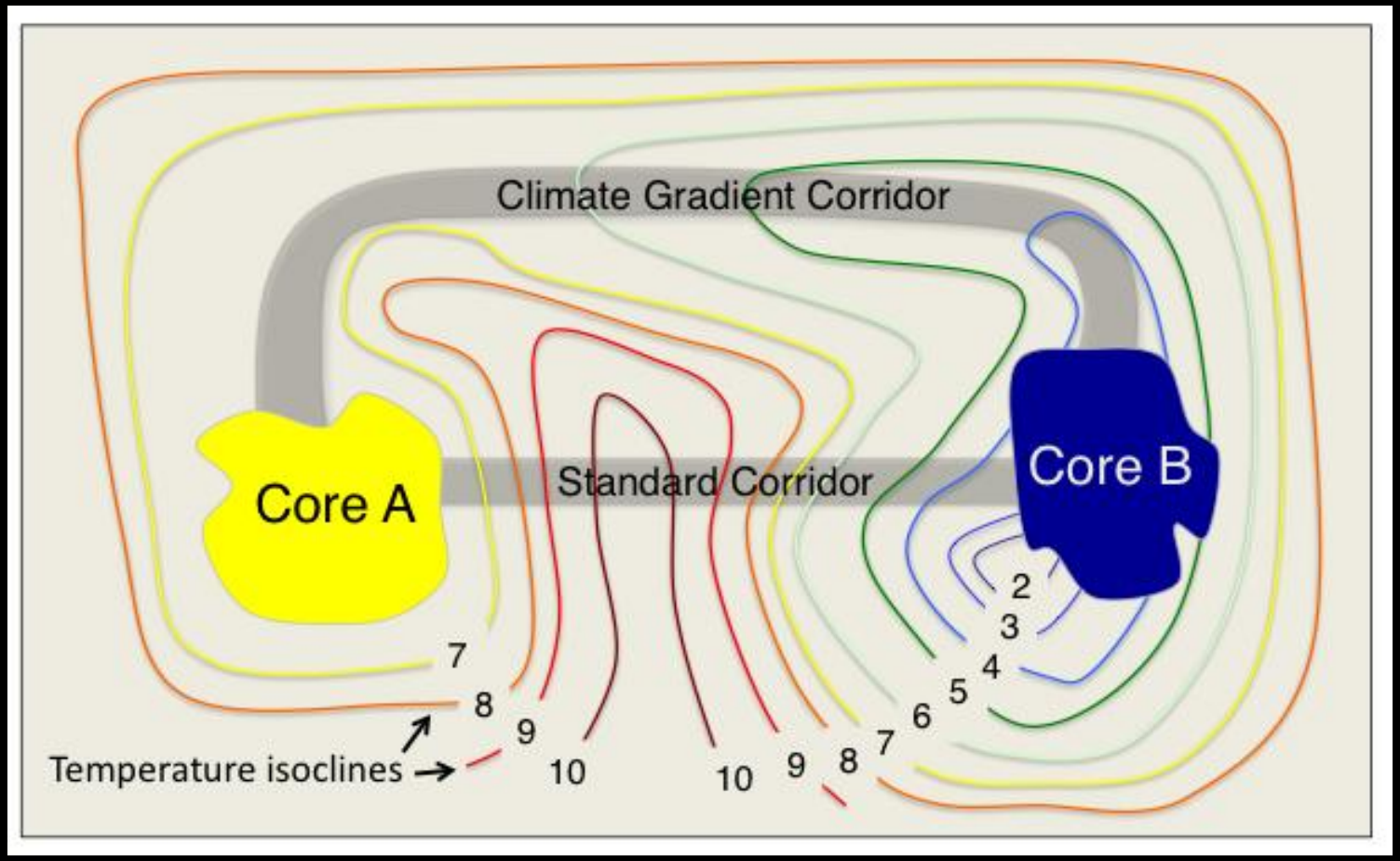
Adding in climate gradients…

# Climate Gradients



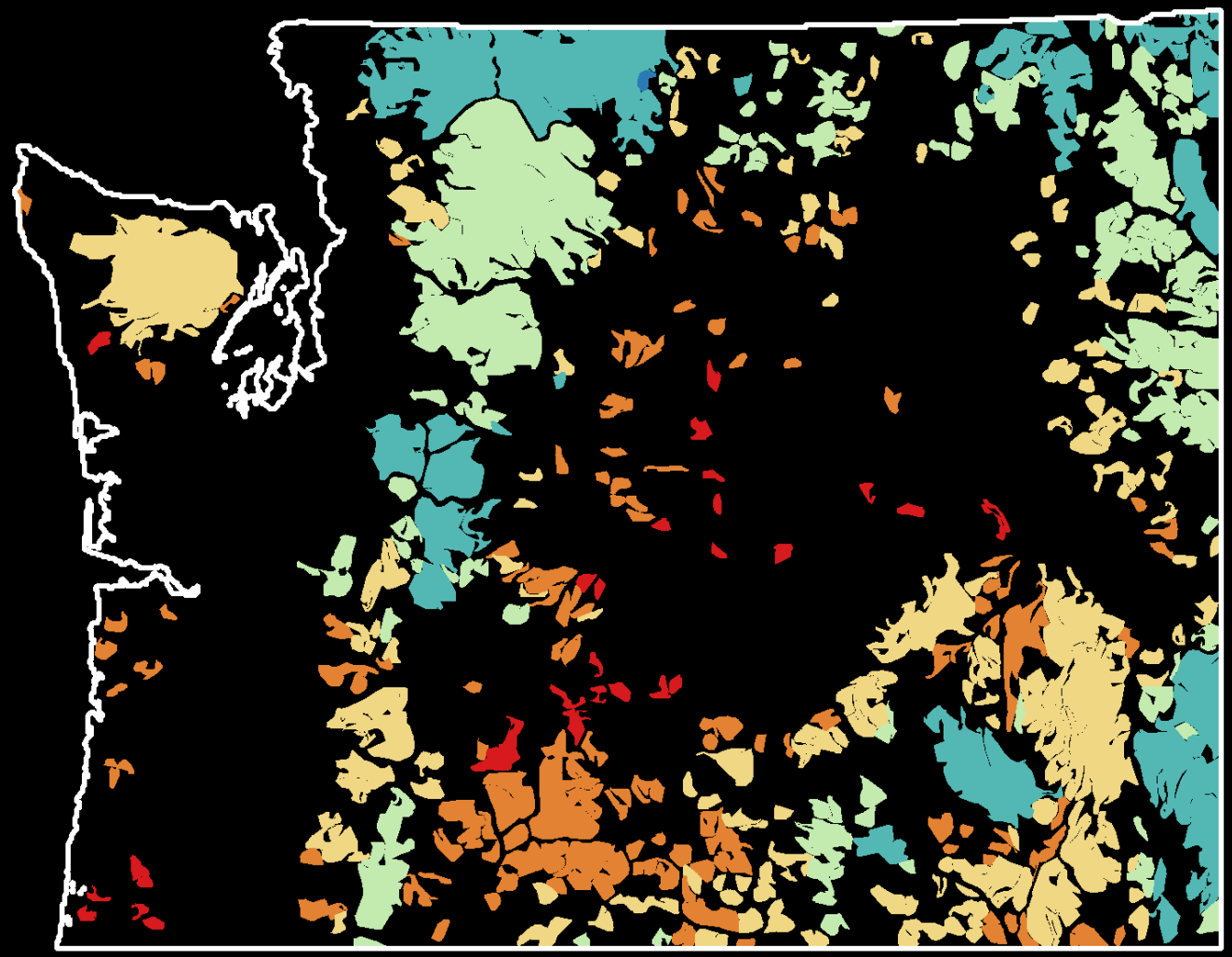

**Pathways Through a Changing Climate.** As the climate warms, corridors (arrows) between relatively warmer and cooler core areas offer wildlife opportunities to track their suitable climates across the landscape.

# Climate Gradient Corridors




While a standard corridor may seek to minimize the geographic distance between two core areas, a climate gradient corridor also seeks to minimize changes in temperature encountered between core areas.

# Linkages along climatic gradients: Mean temperatures of core areas

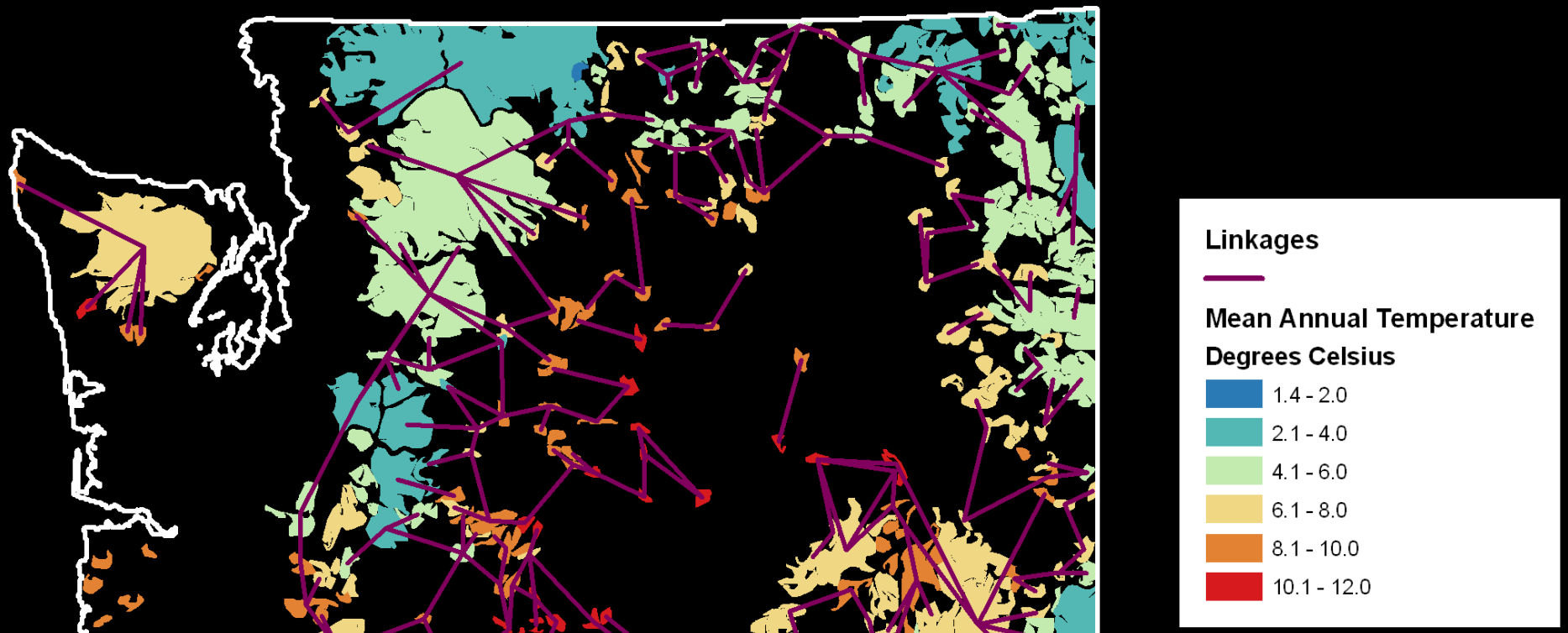


**Mean Annual Temperature**

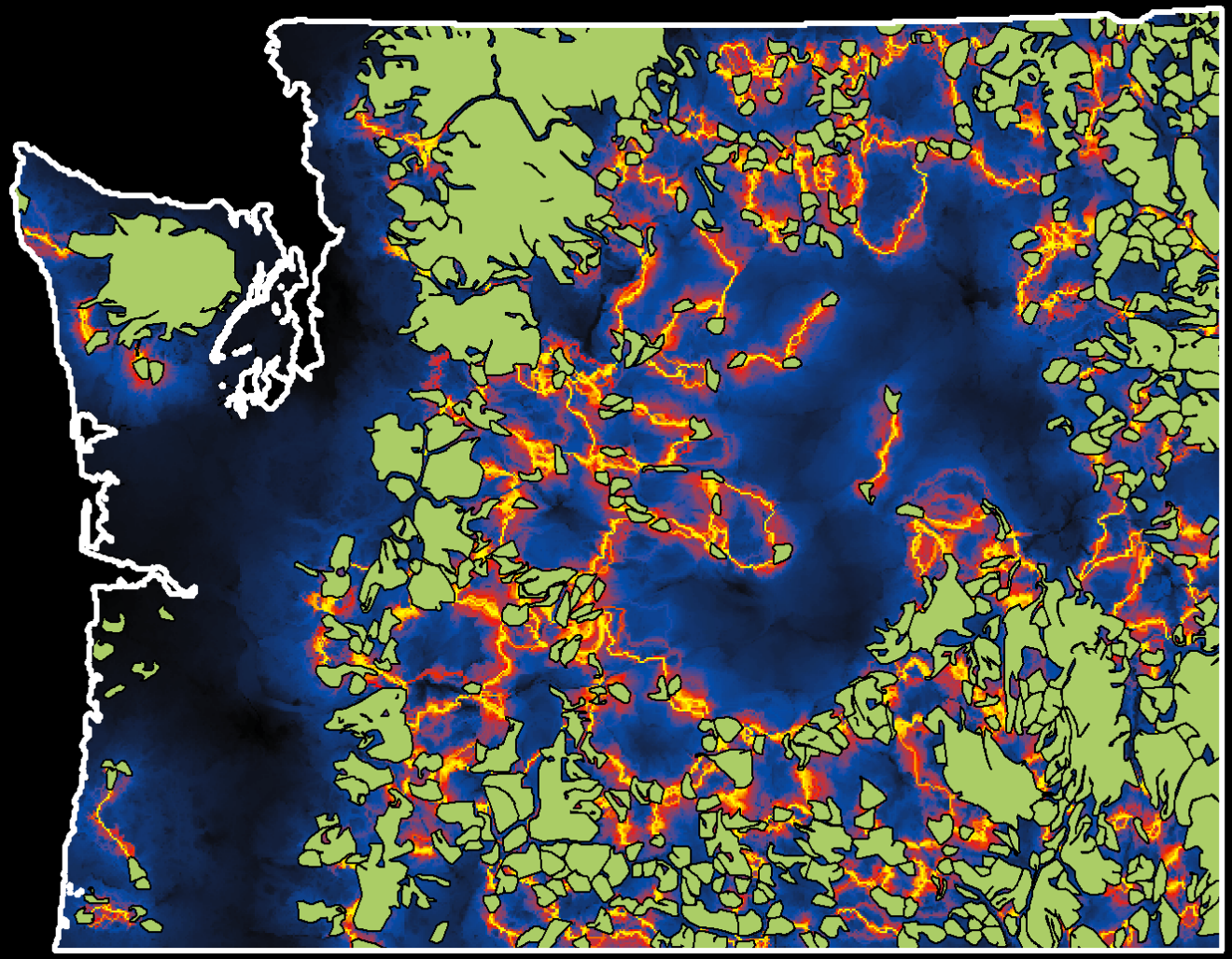
**Degrees Celsius**

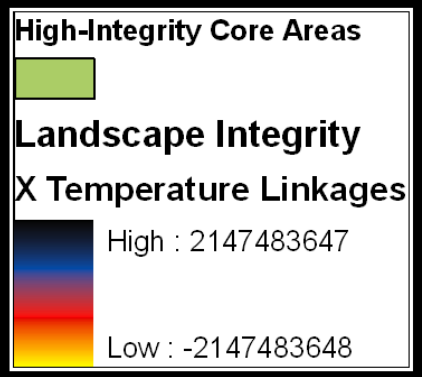
- 1.4 - 2.0
- 2.1 - 4.0
- 4.1 - 6.0
- 6.1 - 8.0
- 8.1 - 10.0
- 10.1 - 12.0

# Linkages along climatic gradients: Connecting warmer to cooler cores



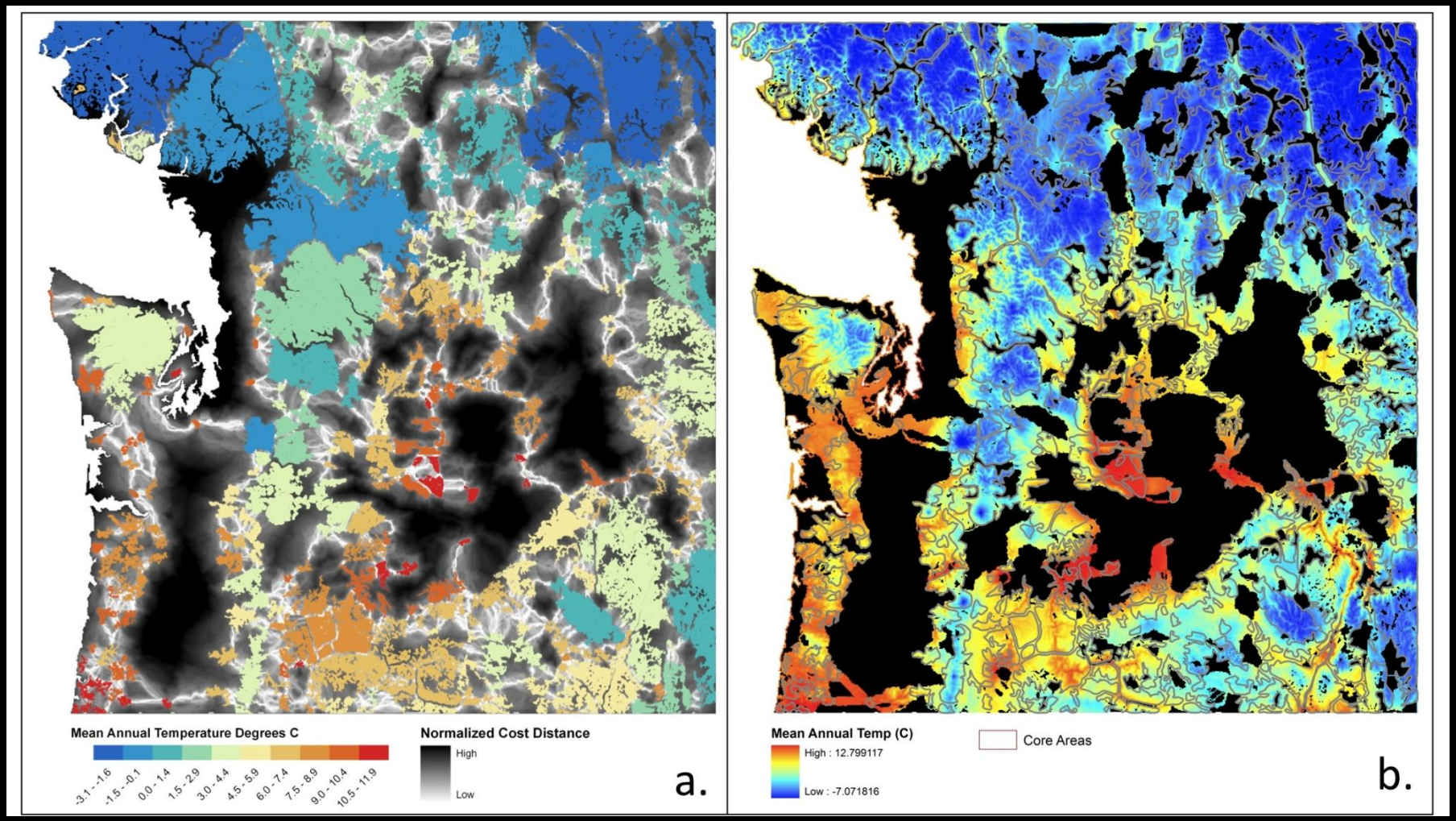
# Linkages along climatic gradients: Temperature and Landscape Integrity





# The Climate Gradient Network

**Core Area Temperature** **Temperature Gradient Map**



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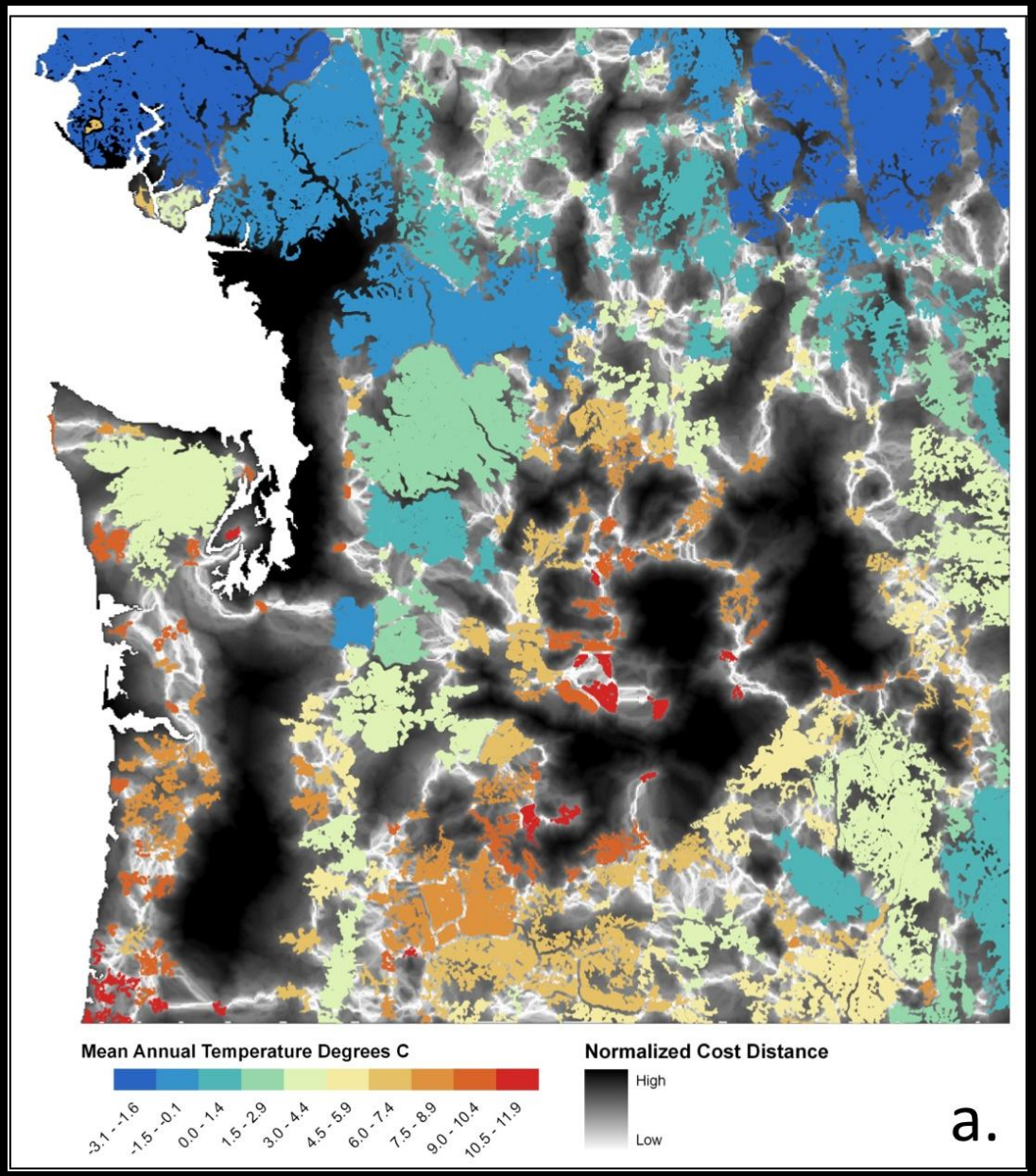

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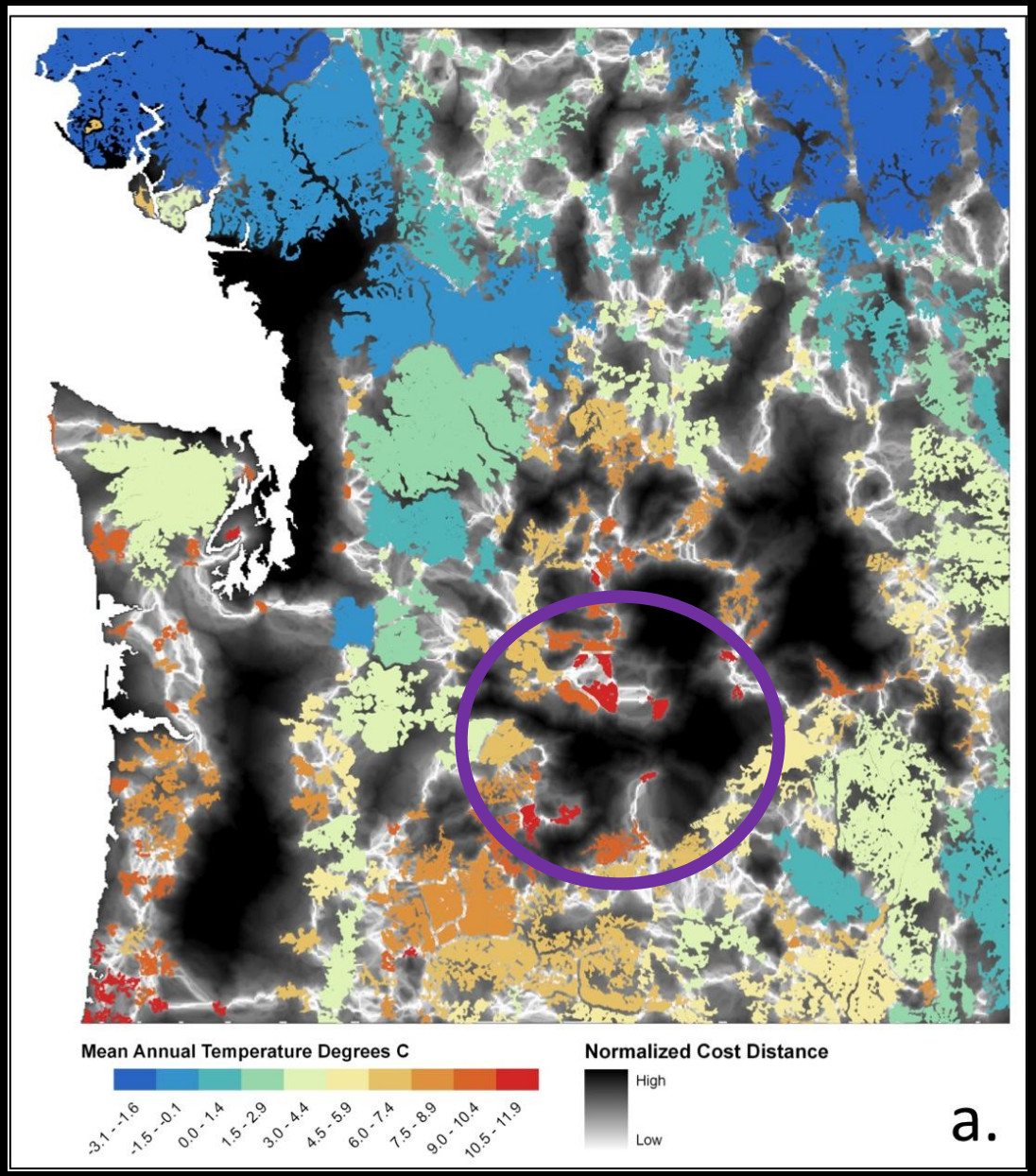

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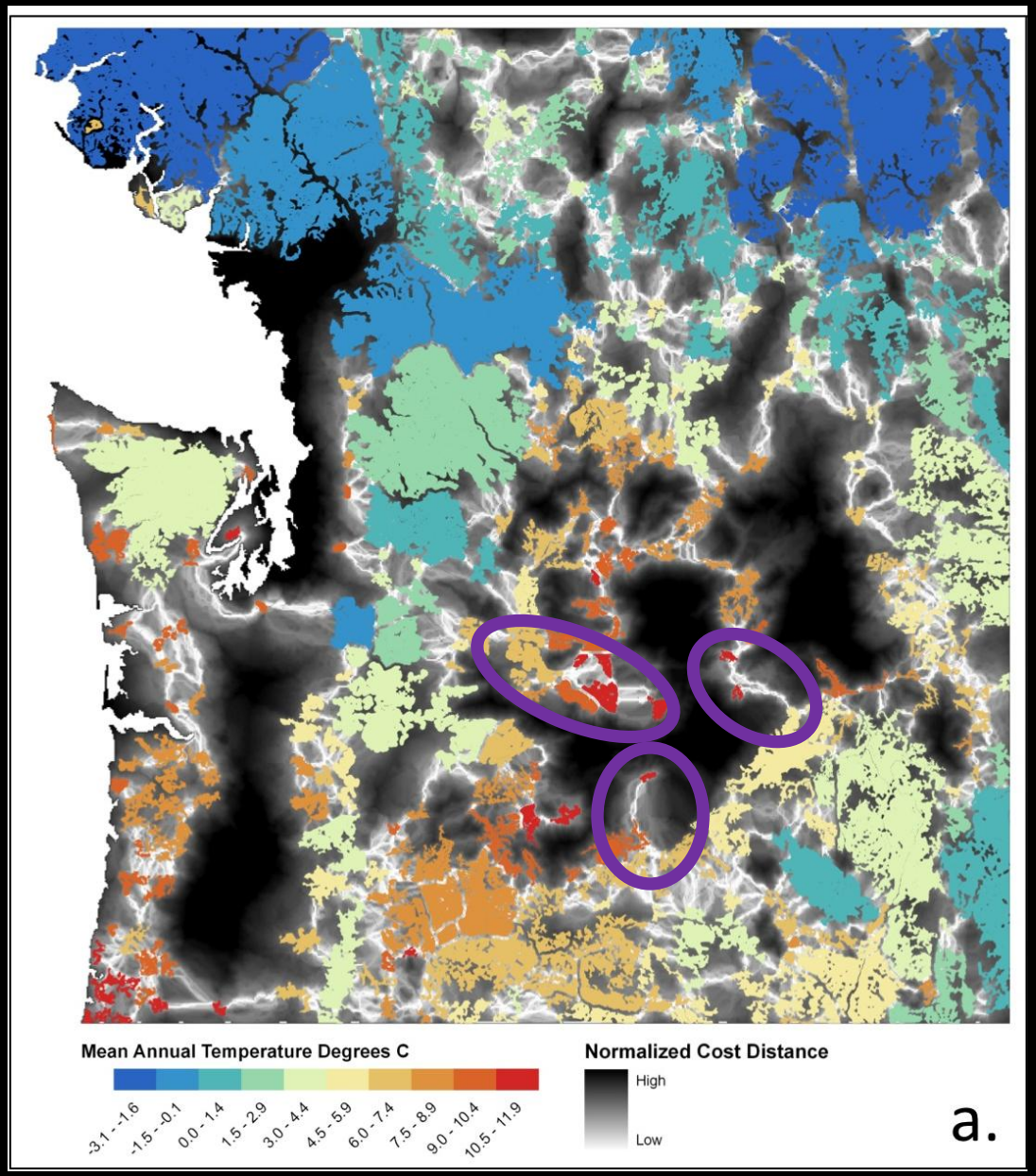

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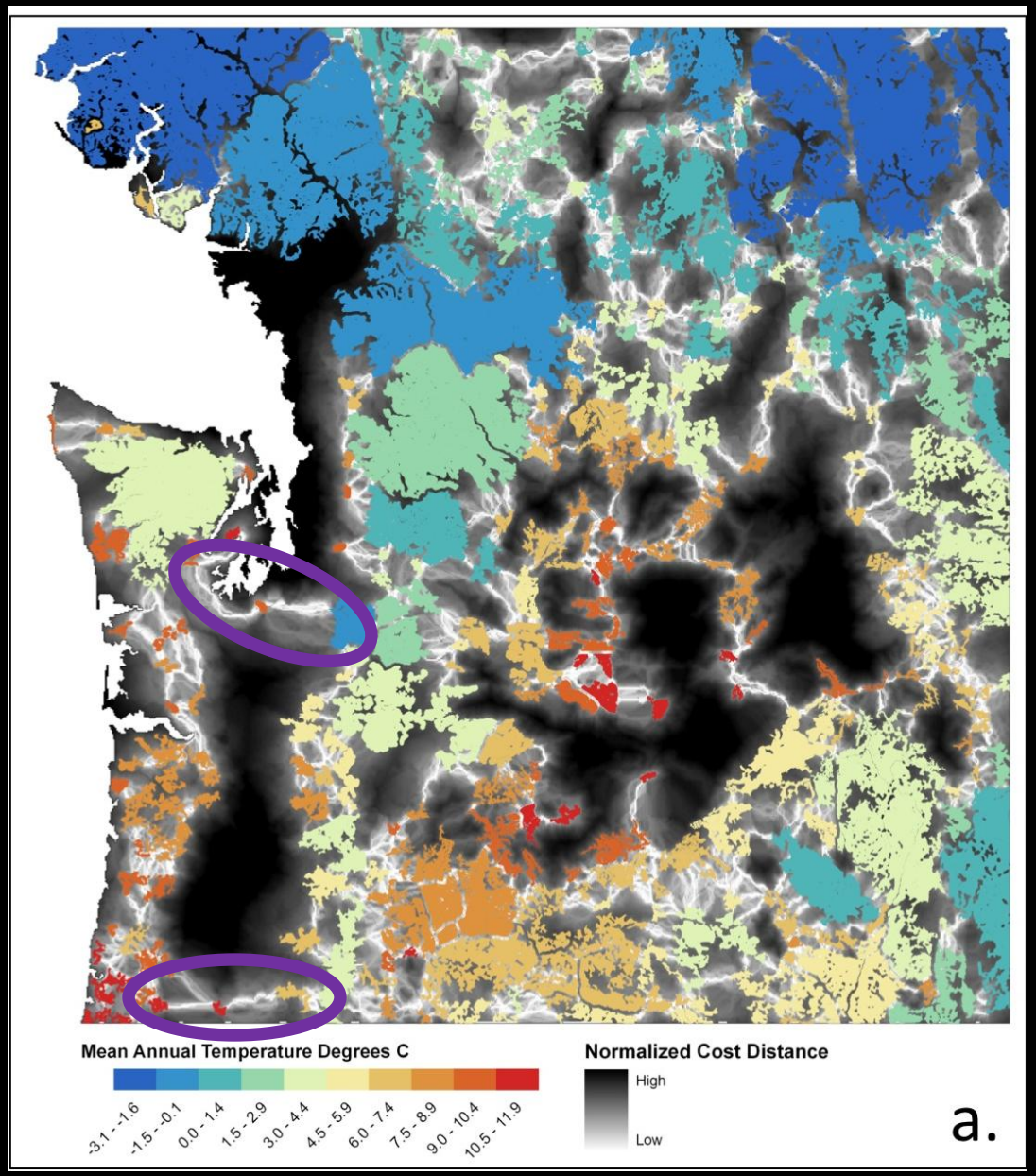

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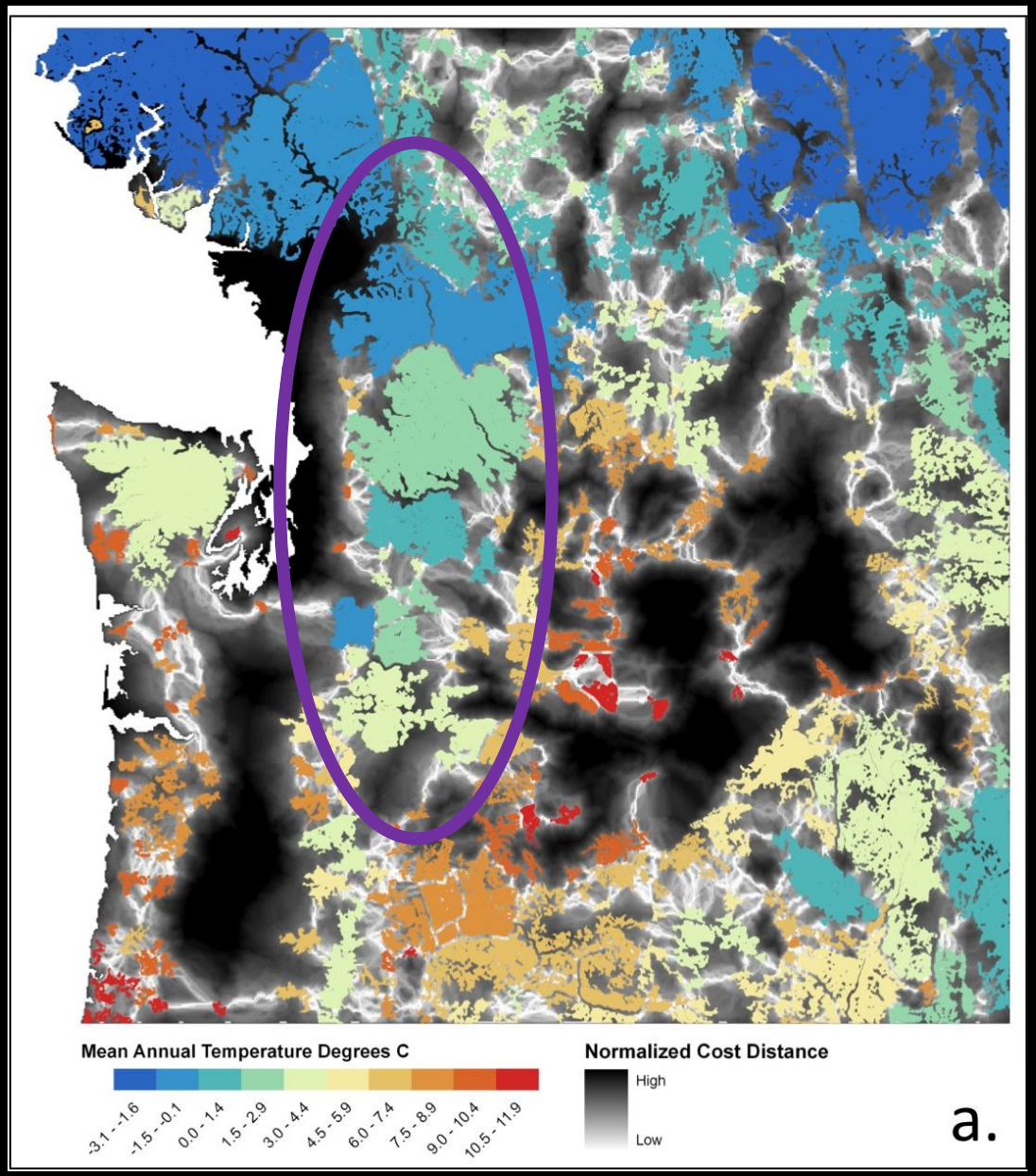

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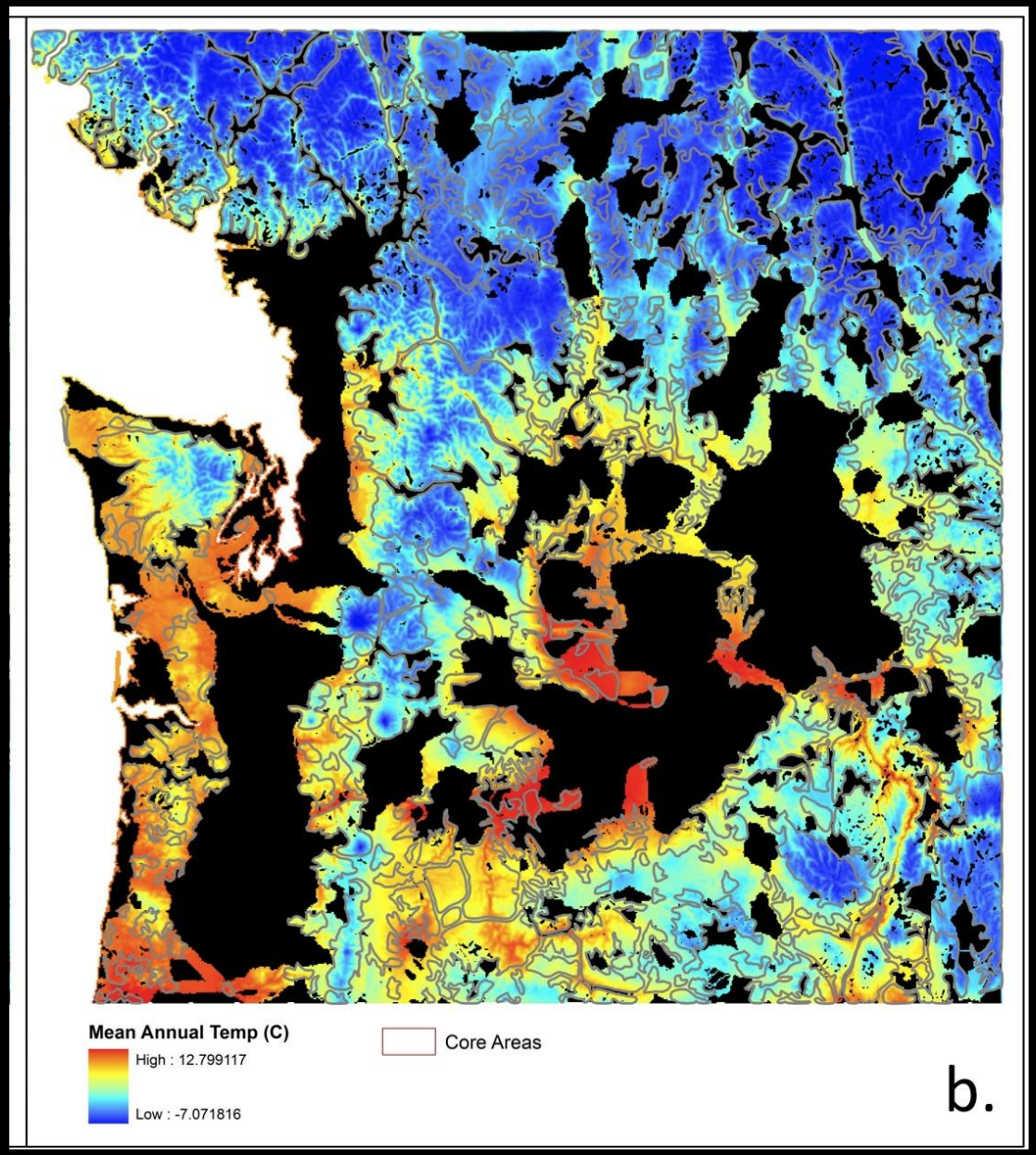

# Climate Gradients

- Key Assumptions:
  - Species ranges will move to track suitable climates
  - Climatic gradients between core areas will remain largely constant
  - Species range shifts will be more likely through natural areas
- Key Limitations:
  - The network configuration is substantially influenced by the core area distribution
  - Networks do not capture habitat conditions or interactions between species
  - At this scale elevation is a more important determinant of climate gradients than latitude

# The WWHCWG Approach

- Start with existing conditions
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## Welcome

Elk in Cascades meadow

The Washington Wildlife Habitat Connectivity Working Group is an open collaborative science-based effort to produce tools and analyses that identify opportunities and priorities to provide habitat connectivity in Washington and surrounding habitats.

The people of Washington State treasure our state's wildlife and natural places. However, as our state becomes increasingly populated and developed, connections across the landscape necessary for wildlife survival are being broken. Wildlife require the ability to move from one habitat to another in search of mates, food, shelter, and new homes as conditions change.

Recognizing that our landscape is changing across the West and that healthy fish and wildlife populations contribute significantly to our quality of life, the Western Governors' Association launched the Wildlife Corridors Initiative, which called for identification of key wildlife migration corridors and crucial wildlife habitats in the west to inform future discussions and efforts. In Washington State, the Washington Wildlife Habitat Connectivity Working Group (WHCWG) is responding to this call.