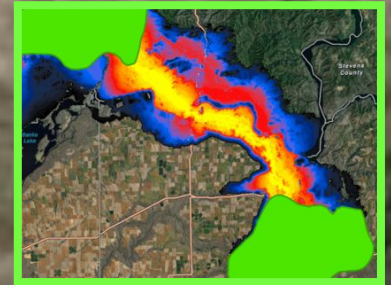


Washington Wildlife Habitat Connectivity Working Group - The Washington Connected Landscapes Project



Presented by: Joanne Schuett-Hames
Washington Department of Fish and Wildlife
Co-lead, WA Wildlife Habitat Connectivity Working Group

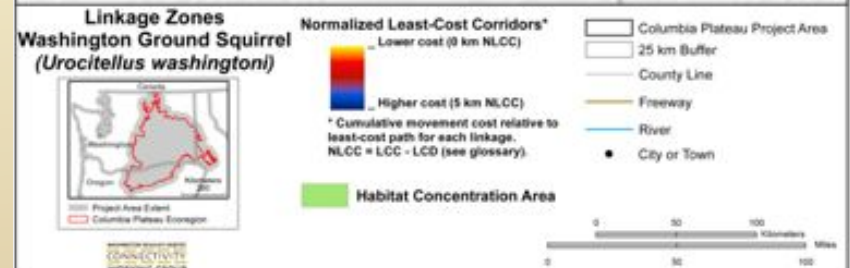
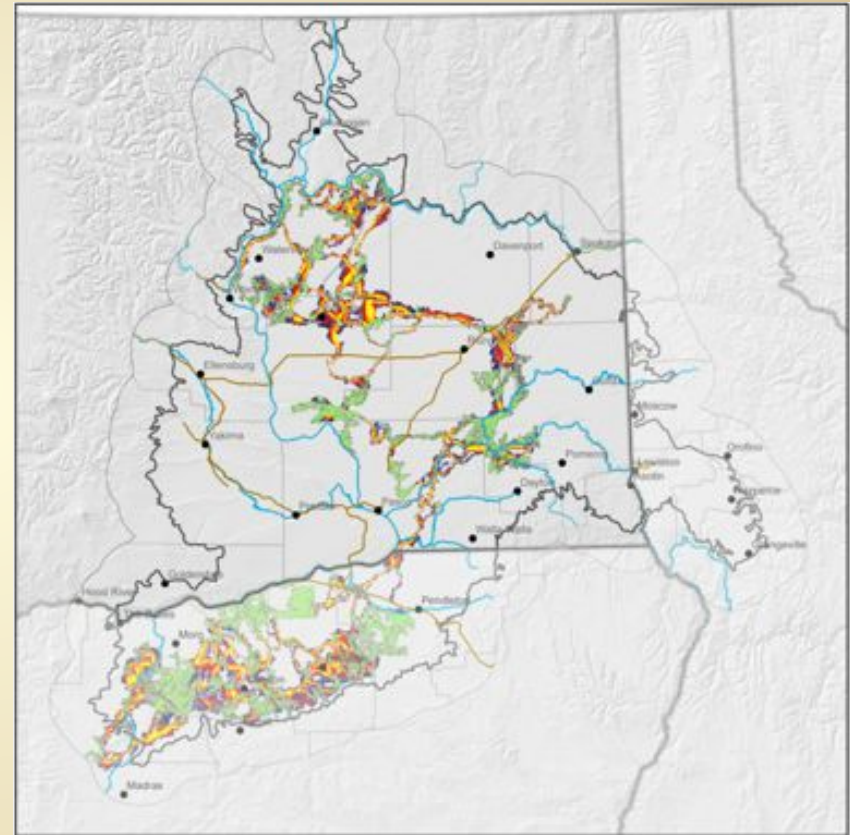
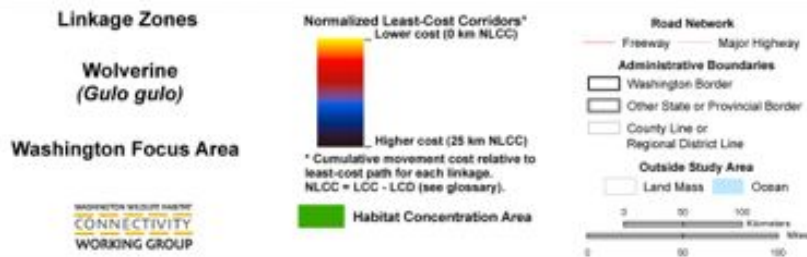
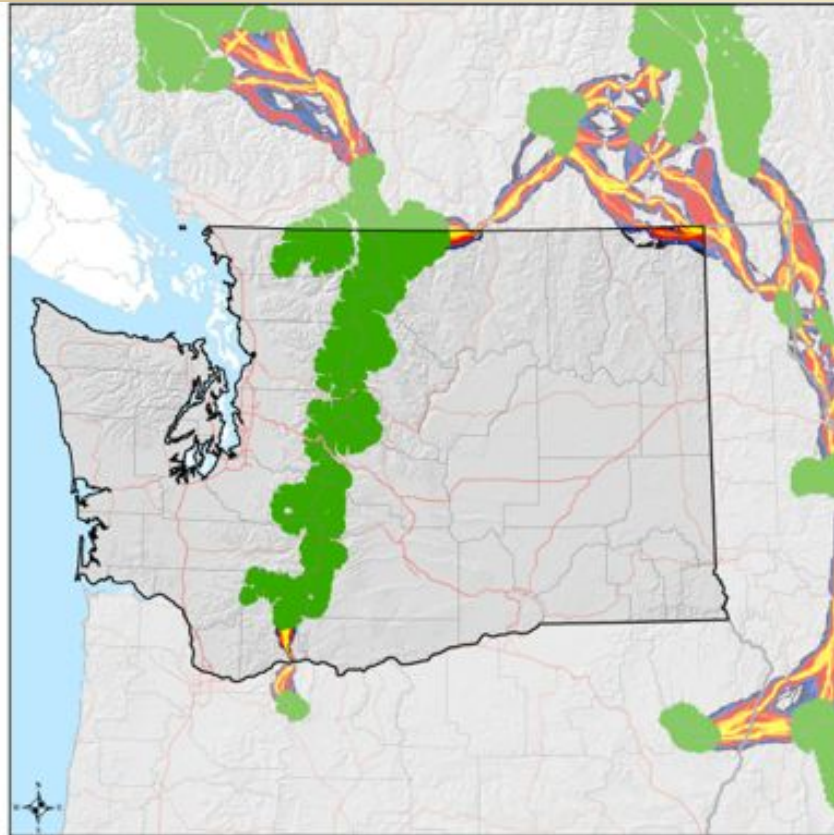
March 6, 2013
Crown Managers
Partnership
Cranbrook, BC

Photo: Rich Watson

Modeling Transboundary Connectivity

Statewide Scale

Ecoregion Scale



Transboundary BC / WA Connectivity

Framework

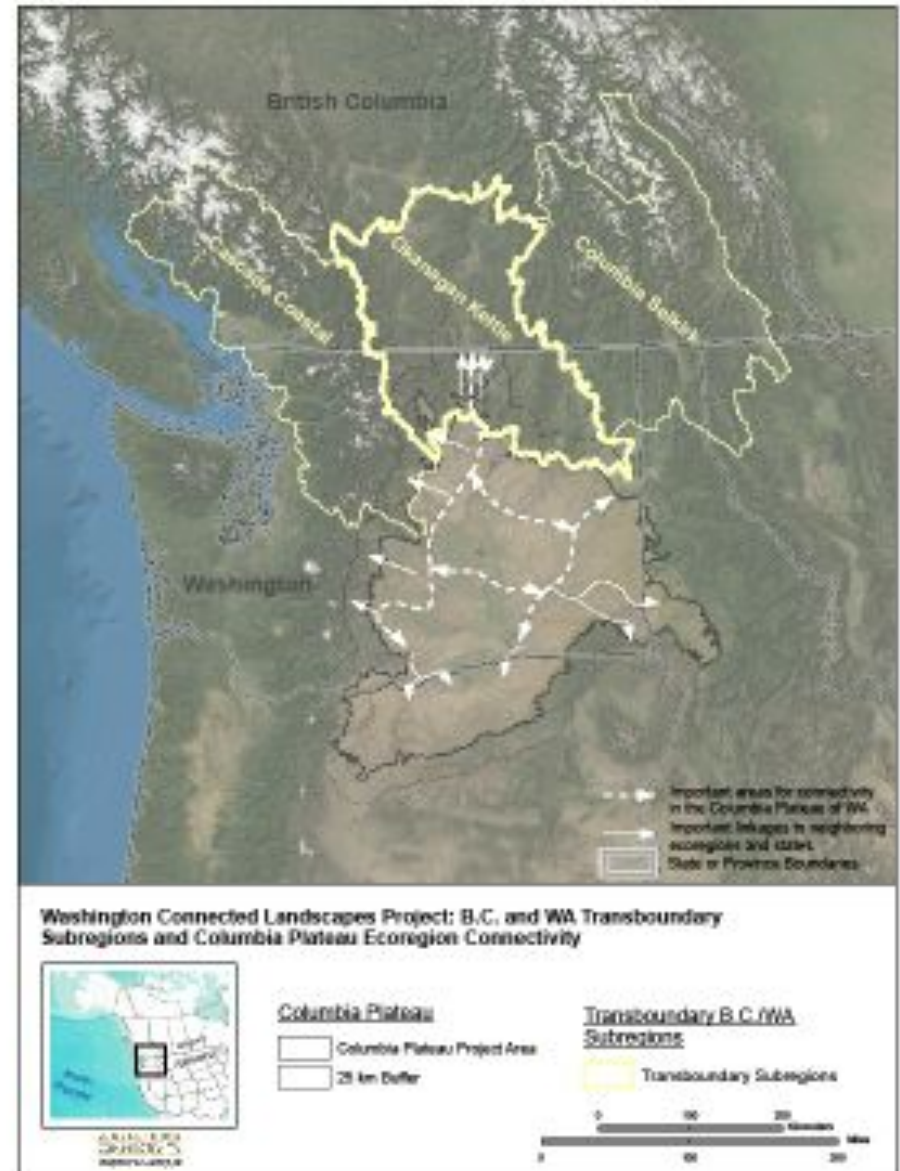
- Transboundary steering committee & analysis workgroups
- Products co-owned by BC & WA participants

Collaborative connectivity analyses

- Initial focus - Okanagan-Kettle
- Current conditions analyses
- Future land-use patterns
- Identify connectivity priorities

Climate-connectivity priorities

- WHCWG Climate subgroup / Okanagan-Kettle subregional team / conservation stakeholders
- ID linkages resilient to climate change & likely to promote climate-driven shifts in species ranges.
- User-driven materials to guide climate-connectivity decisions



Overview

- Background: WHCWG
- Approach
- Statewide analyses
- Ecoregion analyses - Columbia Plateau
- Model testing, validation, adaptive management
- Questions?



Mission Statement

WASHINGTON WILDLIFE HABITAT
CONNECTIVITY
WORKING GROUP

“To promote the long-term viability of wildlife populations in Washington State through a science-based, collaborative approach that identifies opportunities and priorities to conserve and restore habitat connectivity.”

WHCWG Structure

Full Working Group
Science, communications, policy



Core Team
Overall coordination of state
and ecoregional analyses
and other work elements



Subgroups

**Implementation
&
Communications**

**Current
Analyses**
Focus Areas:
- Columbia
Plateau
- BC / WA
Transboundary

**Climate
Change**

Interpretation

**Model
Testing,
Validation &
Adaptive
Management**

Acknowledgements:

Organizations with participants in Core Team & Subgroups of the WHCWG

Private:

- ❖ Conservation Northwest*
- ❖ Independent Researchers*
- ❖ Oriante Society
- ❖ The Nature Conservancy*
- ❖ The Wilderness Society
- ❖ Washington Conservation Science Institute*
- ❖ Gifford Pinchot Task Force
- ❖ South Okanagan-Similkameen Conservation Partnership

Public

- ❖ University of Washington*
- ❖ Western Transportation Institute*
- ❖ University of Idaho
- ❖ Washington Department of Fish and Wildlife*
- ❖ Washington Department of Transportation*
- ❖ Washington Department of Natural Resources*
- ❖ Washington State Parks and Recreation
- ❖ B.C. Ministry of Parks
- ❖ Western Governor's Association*
- ❖ U.S. Bureau of Land Management*
- ❖ U.S. Fish and Wildlife Service*
- ❖ U.S. Forest Service*

**Core Team Participant*

Acknowledgements:

Funding and In-Kind Support Critical to our Efforts

- ❖ Generous contributions of WHCWG participating organizations, reviewers, and other collaborators
- ❖ Great Northern and North Pacific Landscape Conservation Cooperatives
- ❖ Northwest Wildlife Conservation Initiative, supported by the Doris Duke Foundation
- ❖ U.S. Fish and Wildlife Service (State Wildlife Grants)
- ❖ U.S. Fish and Wildlife Service (WA Recovery Funding)
- ❖ Wildlife Conservation Society, supported by the Doris Duke Foundation
- ❖ Bureau of Land Management
- ❖ Wilburforce Foundation
- ❖ National Science Foundation
- ❖ TransWild Alliance
- ❖ 444S Foundation
- ❖ ARCS Foundation



Lower Crab Creek Linkage Area

Products Summary

Analyses:

- Statewide connectivity analysis (*WHCWG 2010*)
- Statewide climate connectivity analysis (*WHCWG 2011*)
- Columbia Plateau Ecoregion connectivity analysis (*WHCWG 2012; addendum products under development*)
- Columbia Plateau Ecoregion climate connectivity analysis (*WHCWG 2013*)

GIS Files:

- Analyses GIS files and metadata (statewide, climate, Columbia Plateau)

Model Testing and Validation Reports to be available in 2013:

- *Greater Sage-grouse*
- *Black Bear*
- *American Marten*

Available at:

<http://wacconnected.org>

<http://databasin.org> (interactive data layers)

Products Summary cont.

GIS Toolkits:

- Linkage Mapper GIS toolkit (*McRae, B.H. & D. Kavanagh 2012*)
- HCA Mapping GIS toolkit (*Shirk, A. 2011*)
- Climate Mapper GIS toolkit (*McRae, B.H. & D. Kavanagh 2013*)
- Barrier Mapper Connectivity Analysis Software (*McRae, B.H. 2012*)
- Centrality Mapper Connectivity Analysis Software (*McRae, B.H. 2012*)
- Pinchpoint Mapper Connectivity Analysis Software (*McRae, B.H. 2012*)



Extensive Use of Analyses

Examples:

- WSDOT - state highway retrofits
- USFS & BLM planning
- USFWS --- supporting biological opinions, HCPs, refuge planning
- EPA – using climate results to ID green infrastructure
- WDFW - informing recovery plans
- WDFW, others - guiding on-the-ground species recovery
- WDFW, CNW, others - in support of land acquisitions
- Western Electric Coordinating Council -- transmission line planning
- WGA Crucial Habitat Project – inclusion of connectivity data



Photo by Gregg Thompson

Approach: Analysis Scales

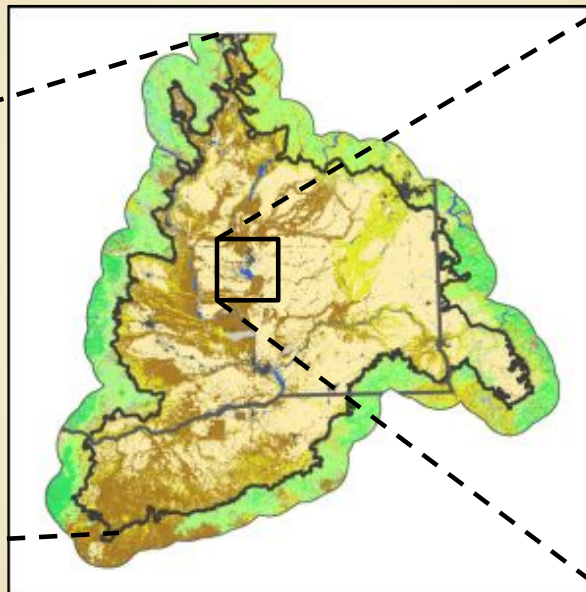
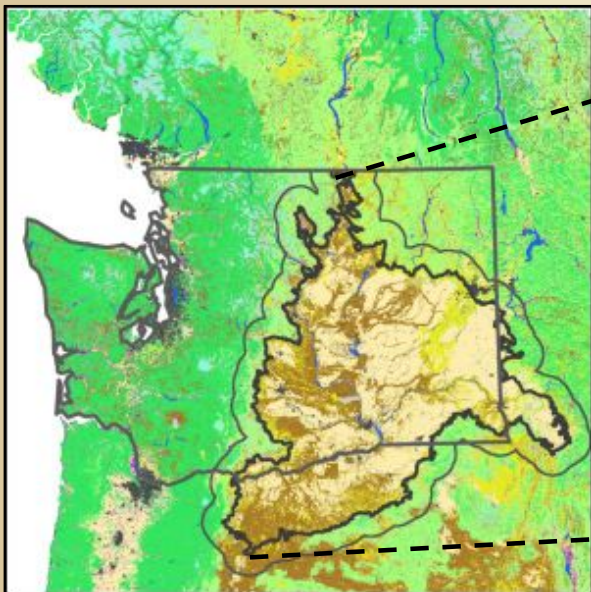
Statewide Scale

Ecoregion Scale

Local Scale

Coarse

Fine



- Emphasizes wide-ranging wildlife species and broad patterns of ecological integrity
- Identifies areas important for statewide connectivity
- Informs finer-scale analyses

- Emphasizes wildlife species with smaller geographic ranges
- Focuses on particular habitat types
- Increases resolution of HCAs and linkage patterns
- Identifies areas important for ecoregional connectivity
- Identifies areas where local-scale analyses are warranted

- Emphasizes wildlife species with small ranges or local significance
- Can be accomplished by local organizations
- Provides sufficient detail for project-scale action

Analysis Scales

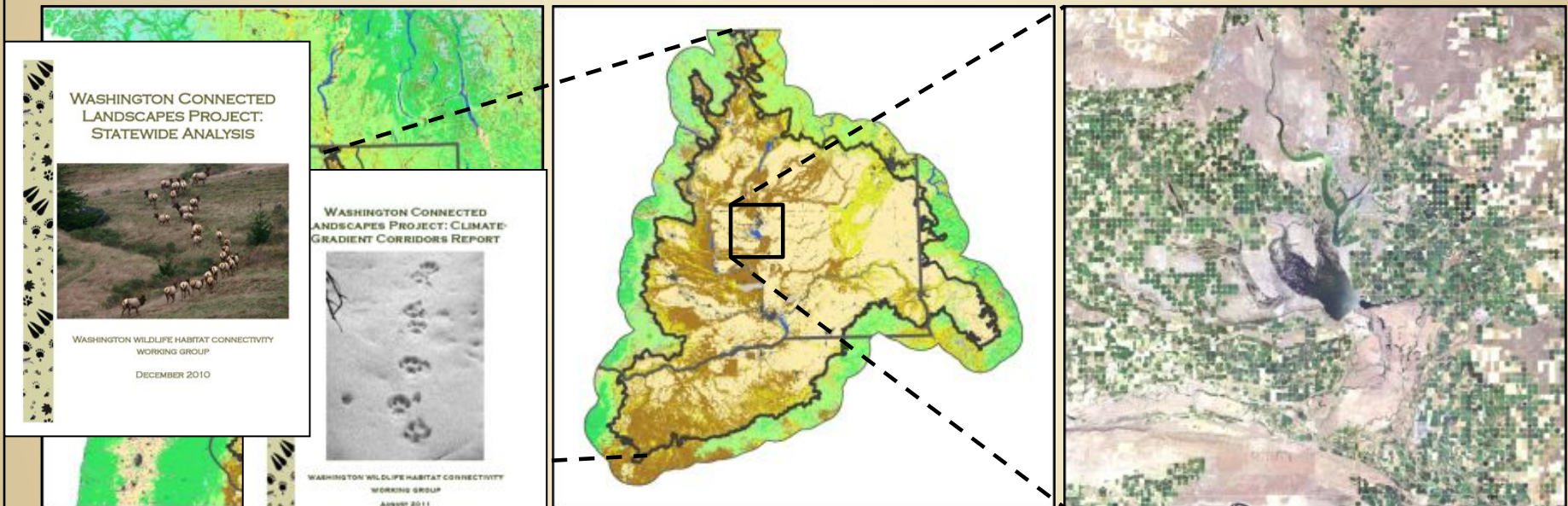
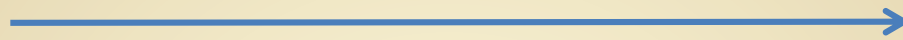
Statewide Scale

Ecoregion Scale

Local Scale

Coarse

Fine



- Emphasizes wide and broad patterns of ecological integrity
- Identifies areas important for statewide connectivity
- Informs finer-scale analyses

- Emphasizes wildlife species with smaller geographic ranges
- Focuses on particular habitat types
- Increases resolution of HCAs and linkage patterns
- Identifies areas important for ecoregional connectivity
- Identifies areas where local-scale analyses are warranted

- Emphasizes wildlife species with small ranges or local significance
- Can be accomplished by local organizations
- Provides sufficient detail for project-scale action

Analysis Scales

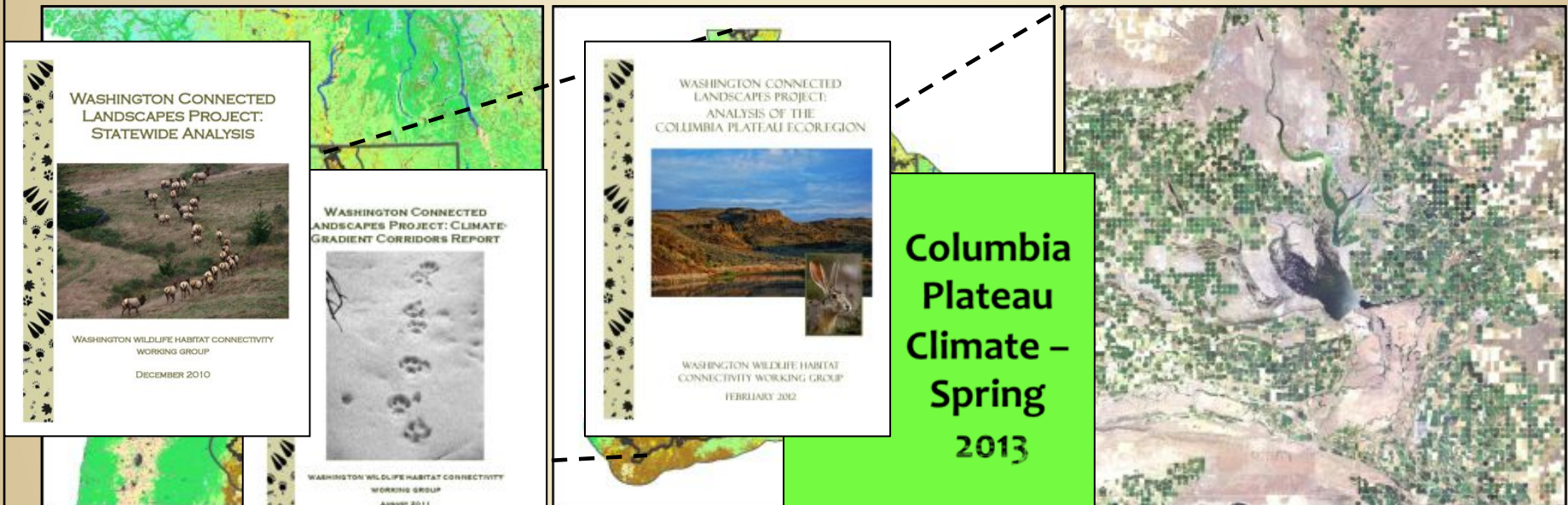
Statewide Scale

Ecoregion Scale

Local Scale

Coarse

Fine



- Emphasizes wide geographic ranges and broad patterns of ecological integrity
- Identifies areas important for statewide connectivity
- Informs finer-scale analyses

- Emphasizes wildlife species with large geographic ranges
- Focuses on particular habitat types
- Increases resolution of HCAs and linkage patterns
- Identifies areas important for ecoregional connectivity
- Identifies areas where local-scale analyses are warranted

- Emphasizes wildlife species with small geographic ranges or local significance
- Can be accomplished by local organizations
- Provides sufficient detail for project-scale action

Analysis Scales

Statewide Scale

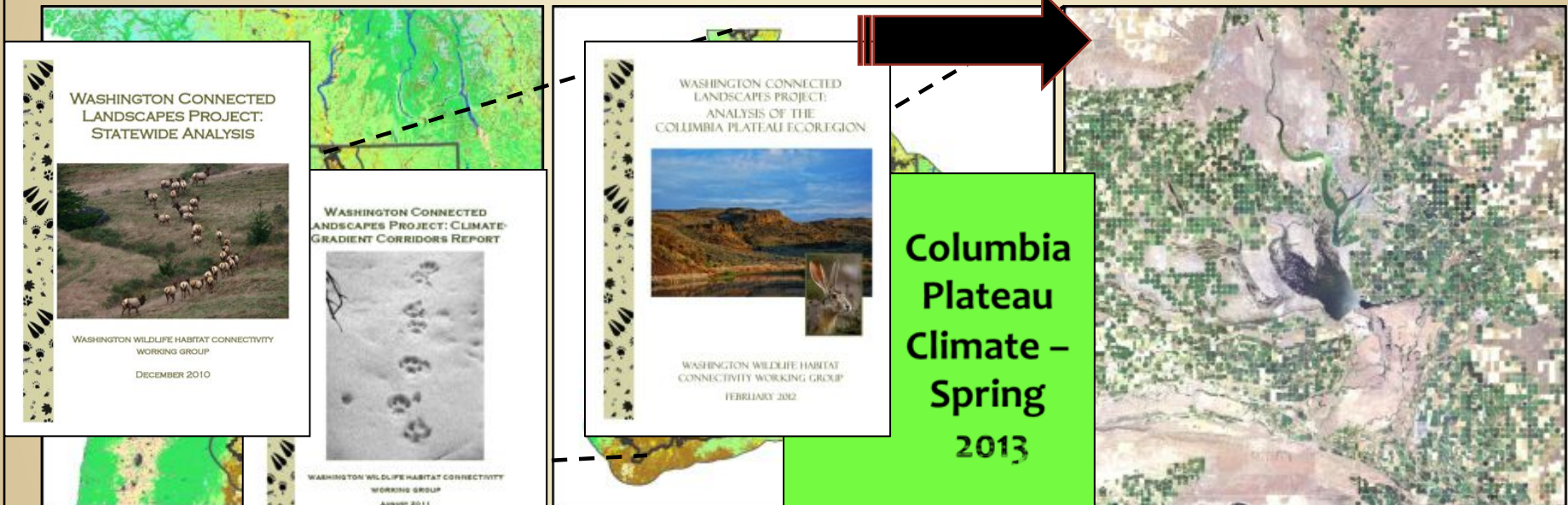
Coarse

Ecoregion Scale

Phase II Products

Local Scale

Fine



- Emphasizes wide geographic ranges and broad patterns of ecological integrity
- Identifies areas important for statewide connectivity
- Informs finer-scale analyses

- Emphasizes wildlife species with large geographic ranges
- Focuses on particular habitat types
- Increases resolution of HCAs and linkage patterns
- Identifies areas important for ecoregional connectivity
- Identifies areas where local-scale analyses are warranted

- Emphasizes wildlife species with small geographic ranges or local significance
- Can be accomplished by local organizations
- Provides sufficient detail for project-scale action

Analysis Scales

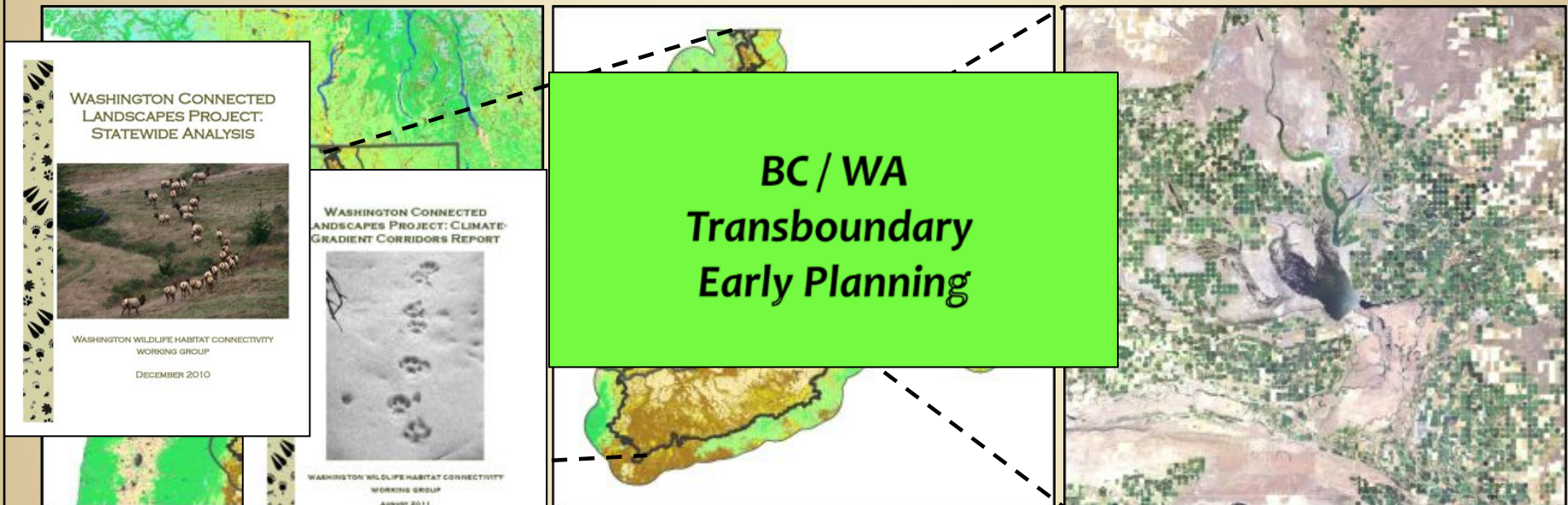
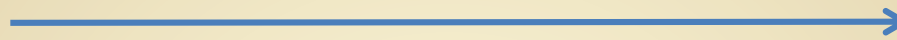
Statewide Scale

Ecoregion Scale

Local Scale

Coarse

Fine



**BC / WA
Transboundary
Early Planning**

- Emphasizes wide and broad patterns of ecological integrity
- Identifies areas important for statewide connectivity
- Informs finer-scale analyses

- Emphasizes wildlife species with smaller geographic ranges
- Focuses on particular habitat types
- Increases resolution of HCAs and linkage patterns
- Identifies areas important for ecoregional connectivity
- Identifies areas where local-scale analyses are warranted

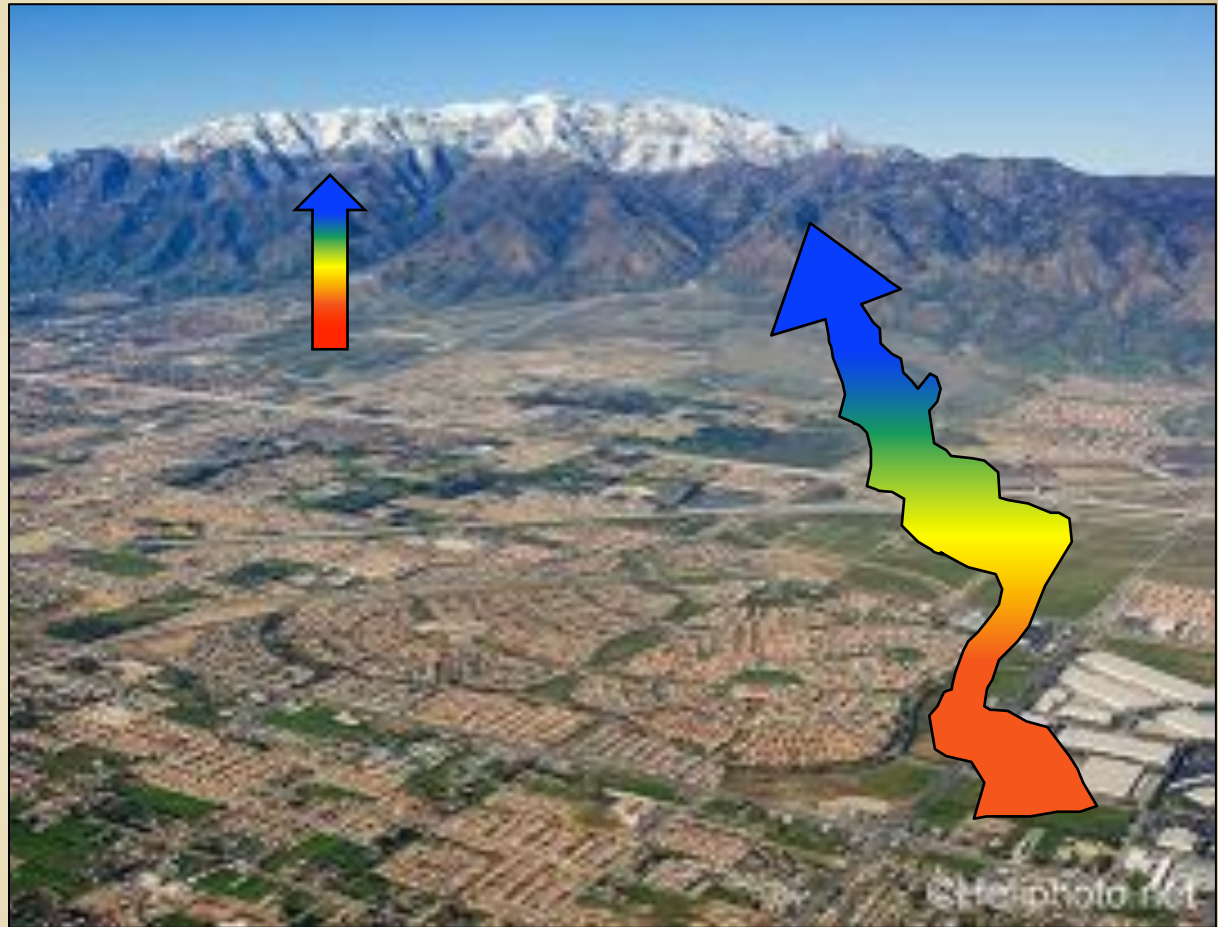
- Emphasizes wildlife species with small ranges or local significance
- Can be accomplished by local organizations
- Provides sufficient detail for project-scale action

Statewide Current Conditions and Climate Connectivity Analyses

Photo credit M. Vasquez

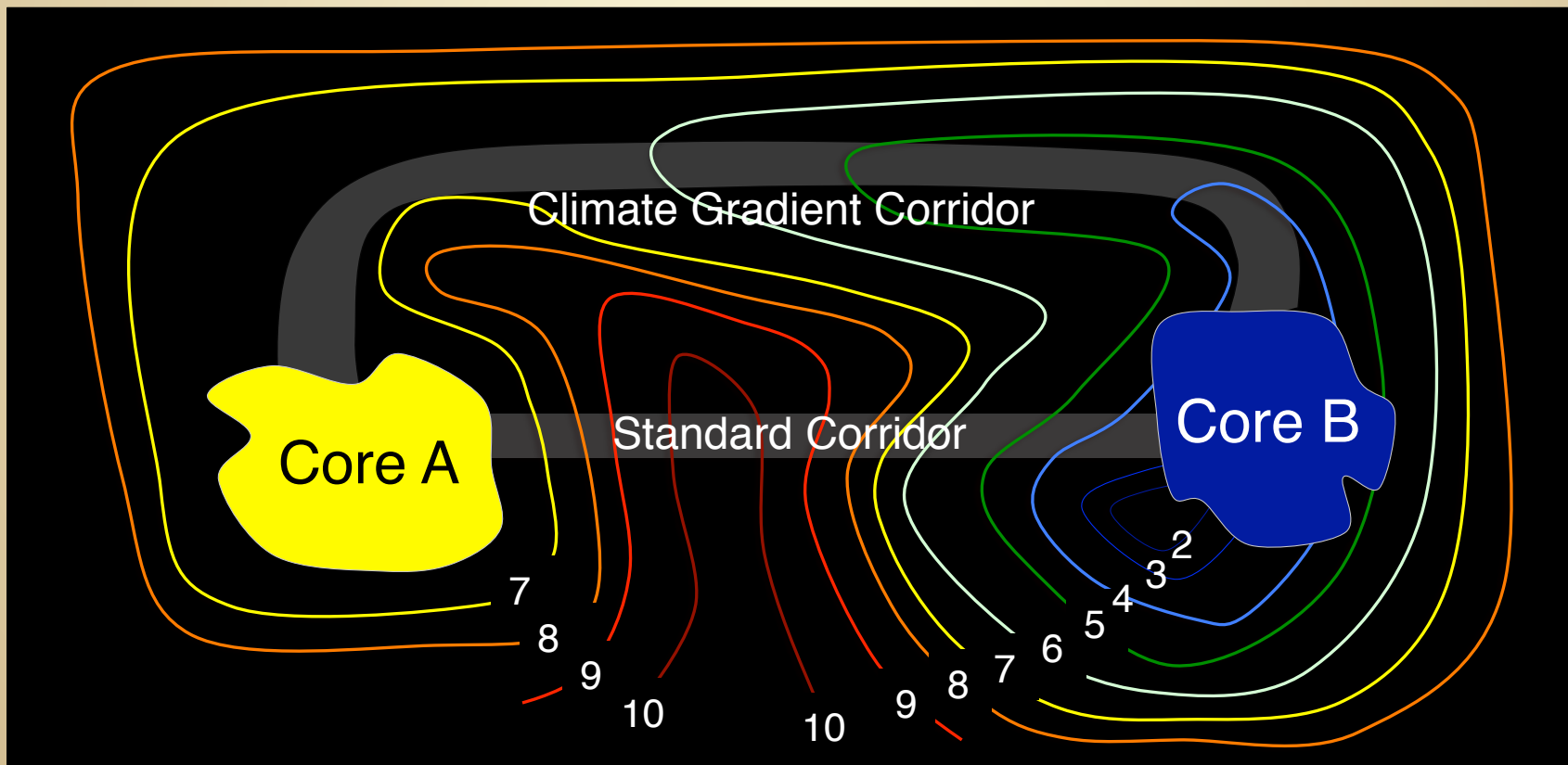
Statewide Climate Gradient Corridors

- Connectivity along climatic gradients that species ranges may follow as they track changing climate
- Methods include least cost paths, incorporating temperature and landscape integrity

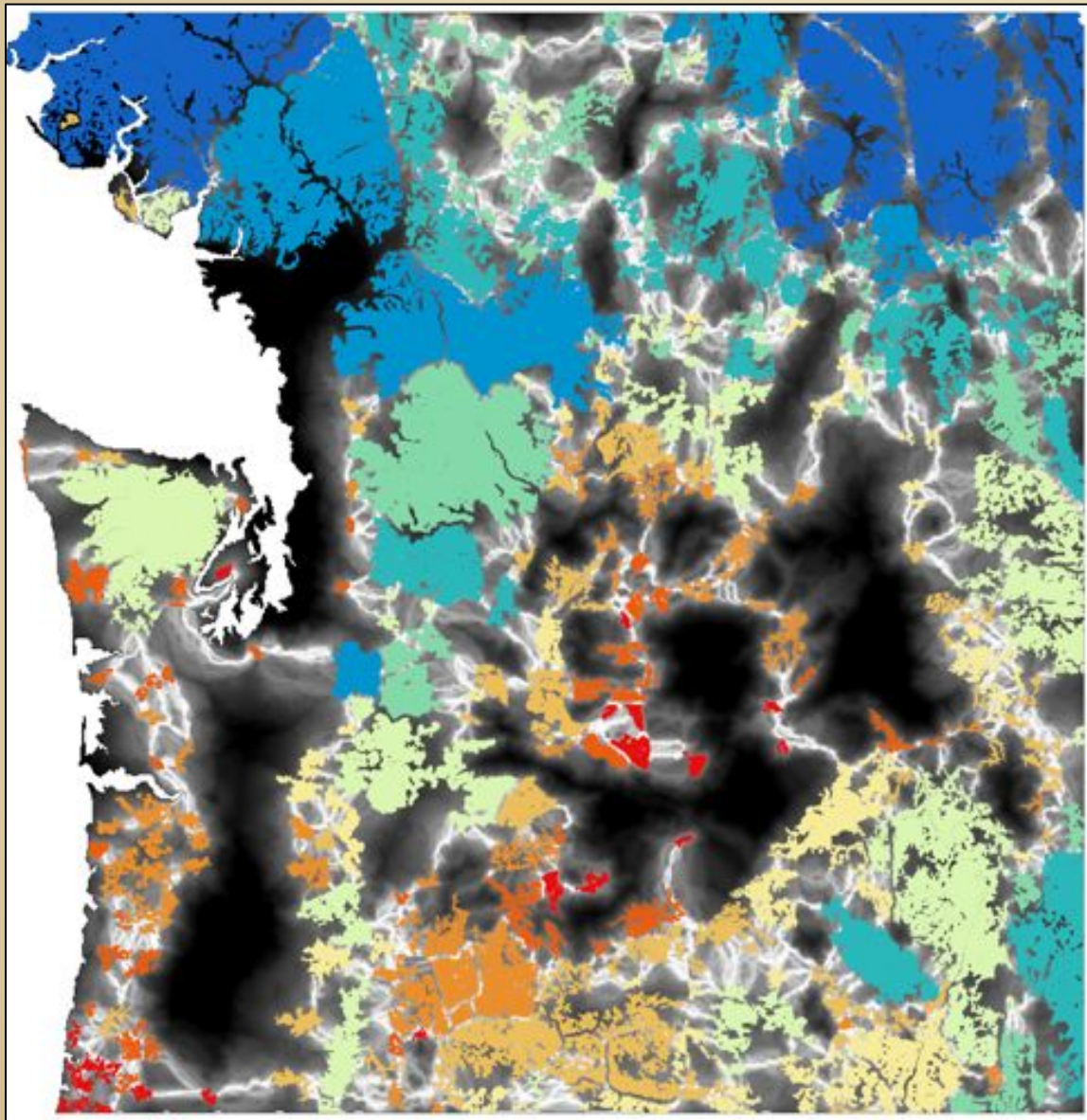


A pathway through a changing climate

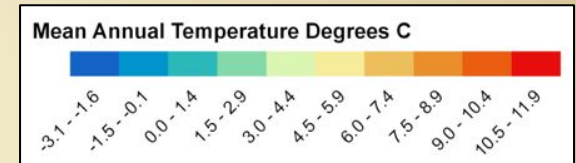
- Connect warm areas to cool
- With corridors that:
 1. Avoid areas of heavy land use
 2. Minimize changes in temperature



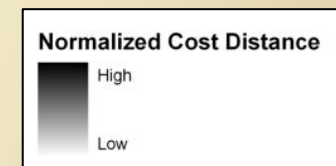
Climate Gradient Corridor Network



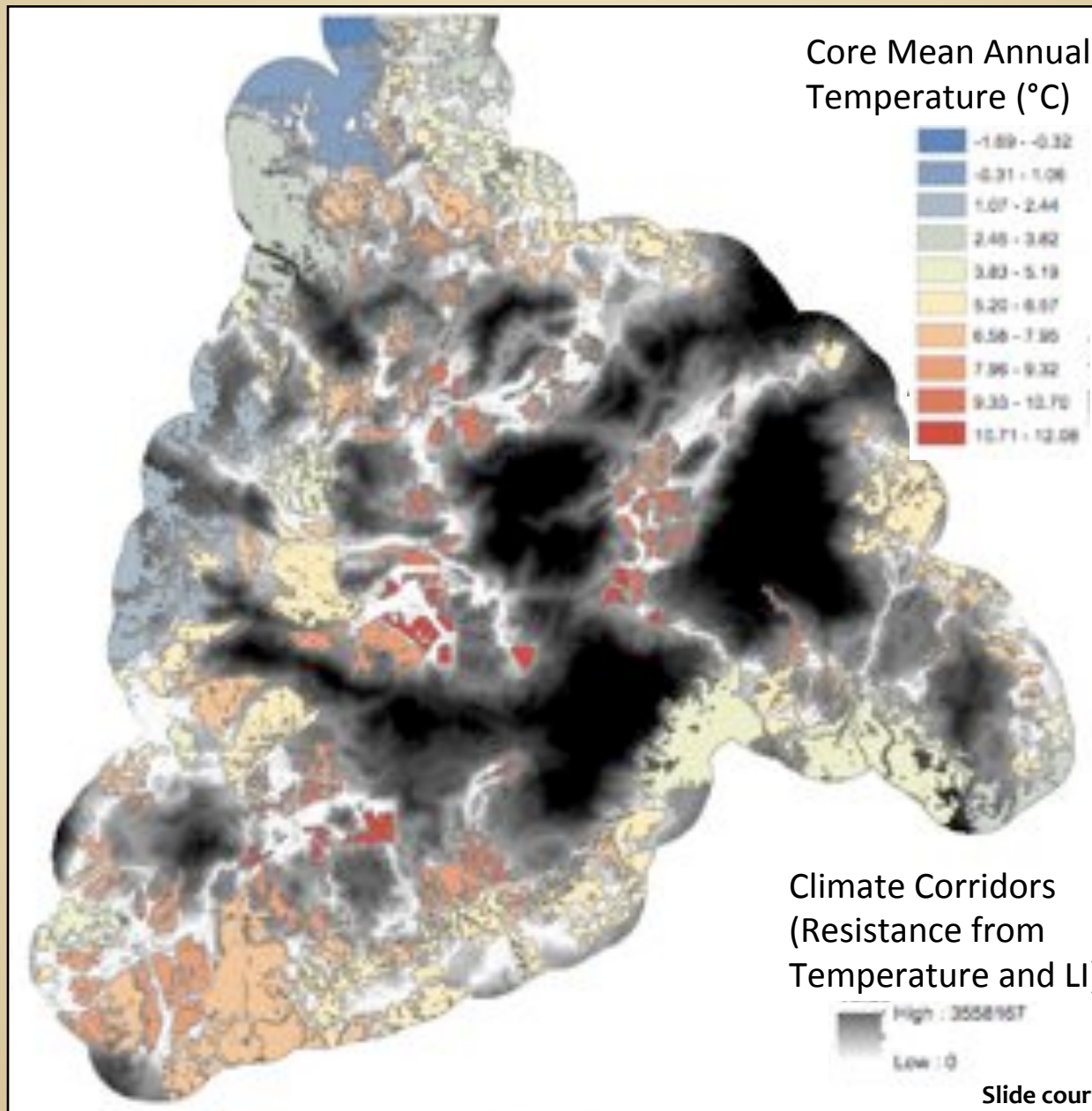
Patch Temperature



Corridors



Columbia Plateau Climate Corridor Network



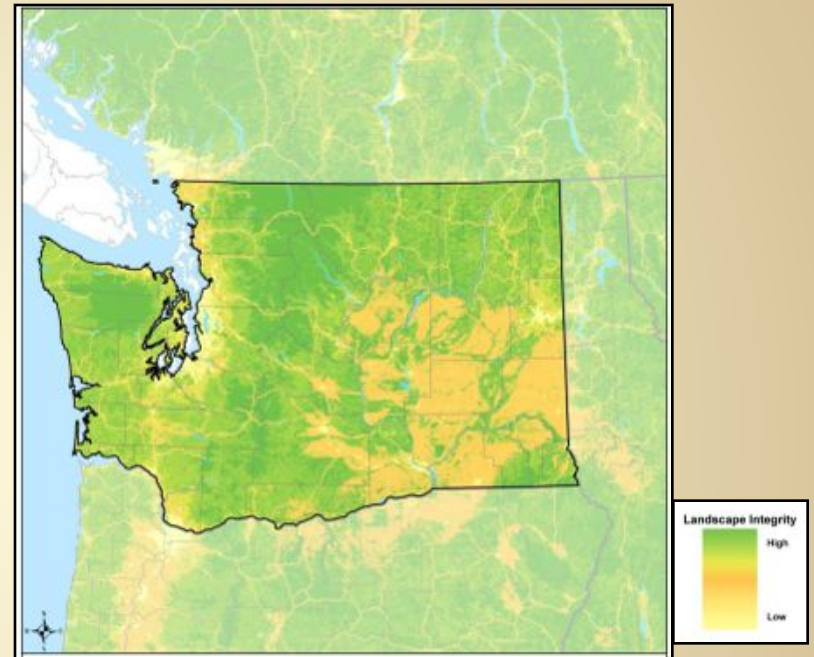
Slide courtesy of Meade Krosby (UW)

Current Conditions: Two Modeling Approaches



Focal Species

- Depicts connectivity based on the habitat associations and behavior of species
- Represents functional needs of many species



Landscape Integrity

- Emphasizes connectivity of areas where human influence is most limited
- Based on indicators of natural conditions

Statewide Connectivity Analysis (Current Conditions): Methods

Focal Species

Landscape Integrity

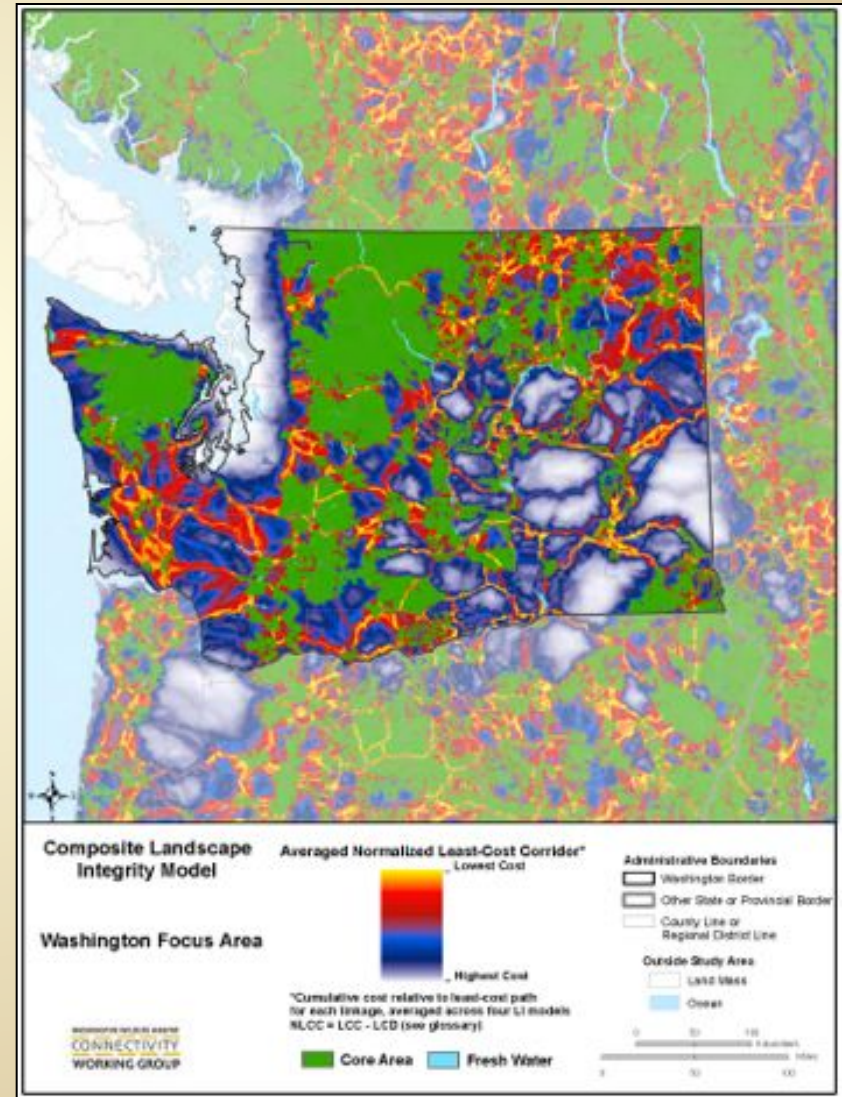
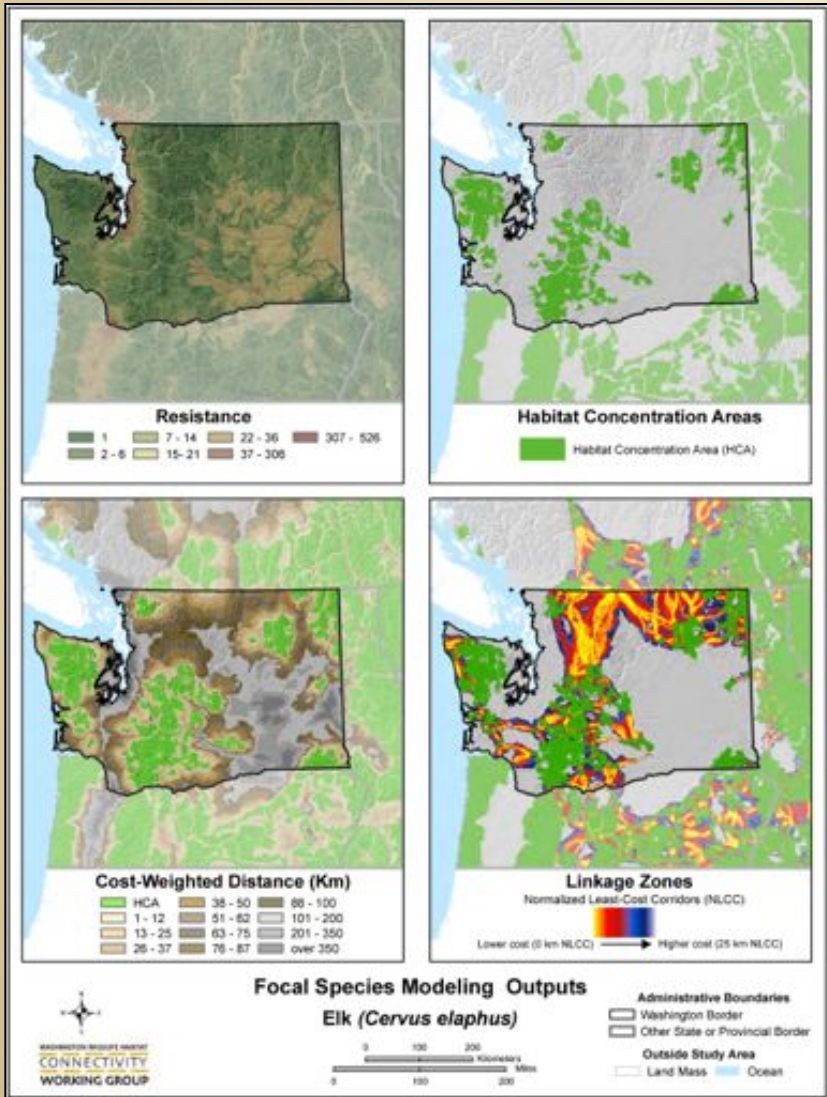


Statewide Products Examples

Focal Species

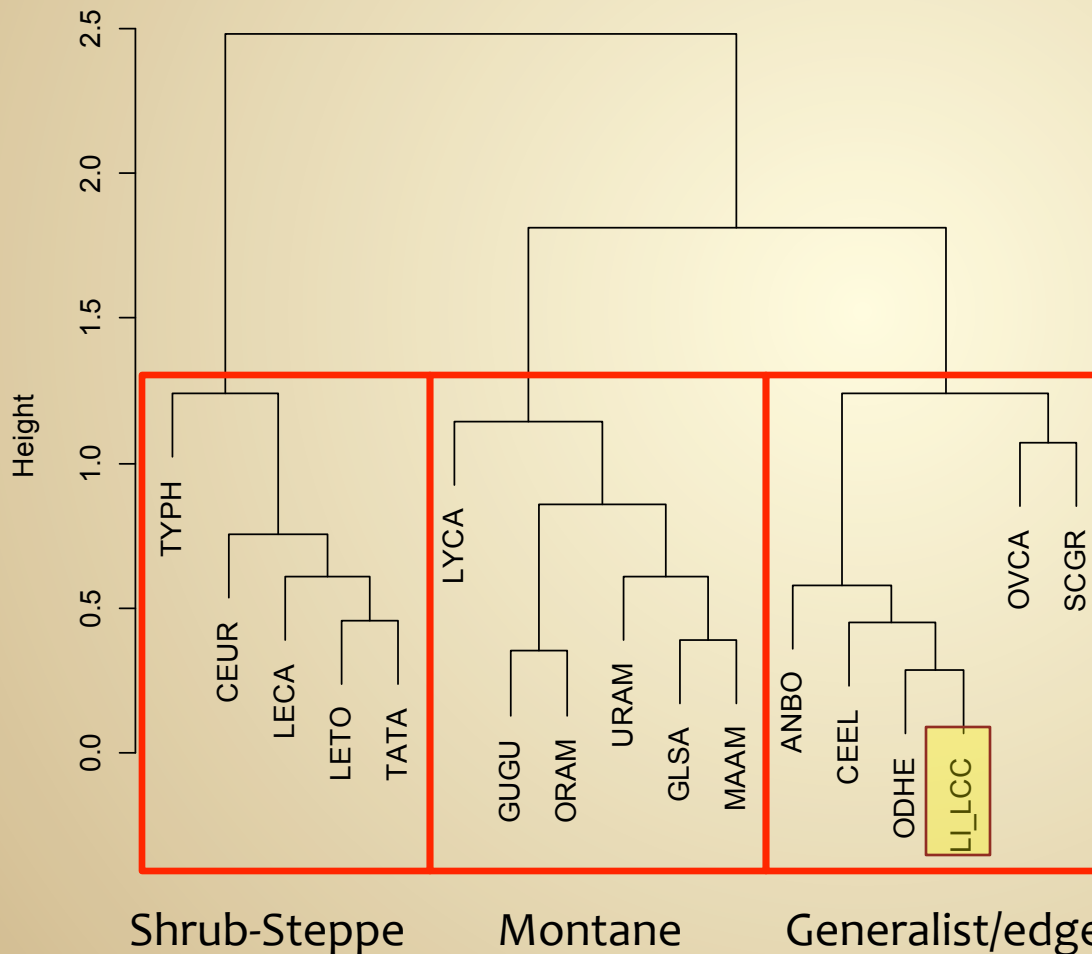


Landscape Integrity



Statewide Connectivity: Correspondence Analysis across Species

Cluster Dendrogram



Shrub-Steppe Associates

- TYPH Sharp-tailed Grouse
- CEUR Greater Sage-Grouse
- LECA Black-tailed Jackrabbit
- LETO White-tailed Jackrabbit
- TATA Badger

Montane Associates

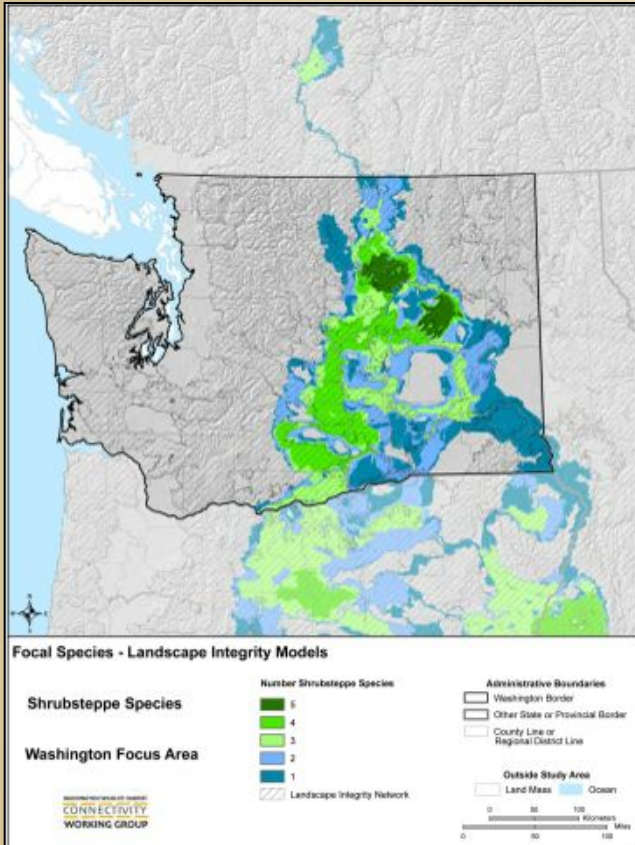
- LYCA Lynx
- GUGU Wolverine
- ORAM Mountain Goat
- URAM Black Bear
- GLSA Flying Squirrel
- MAAM Marten

Habitat Generalists & Edge Spp.

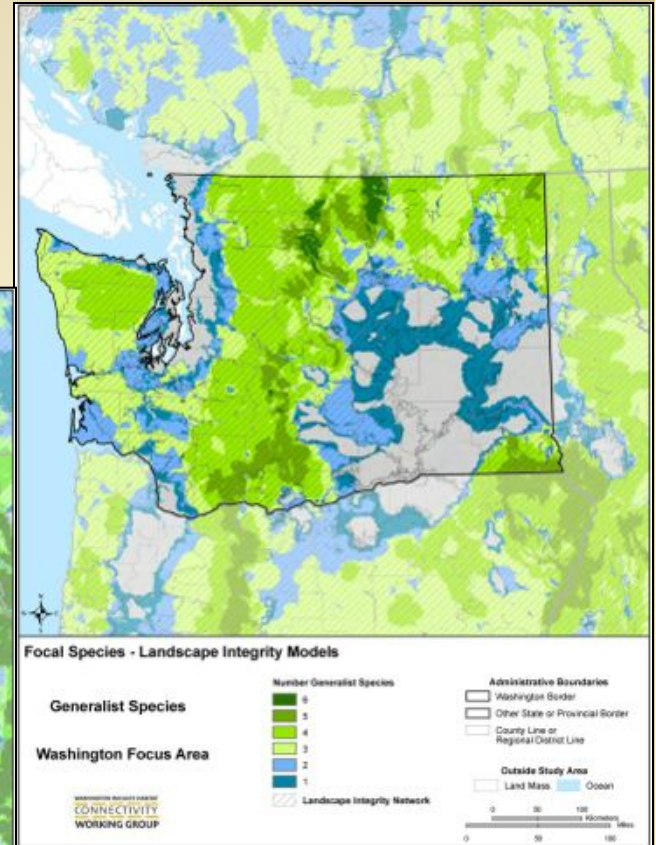
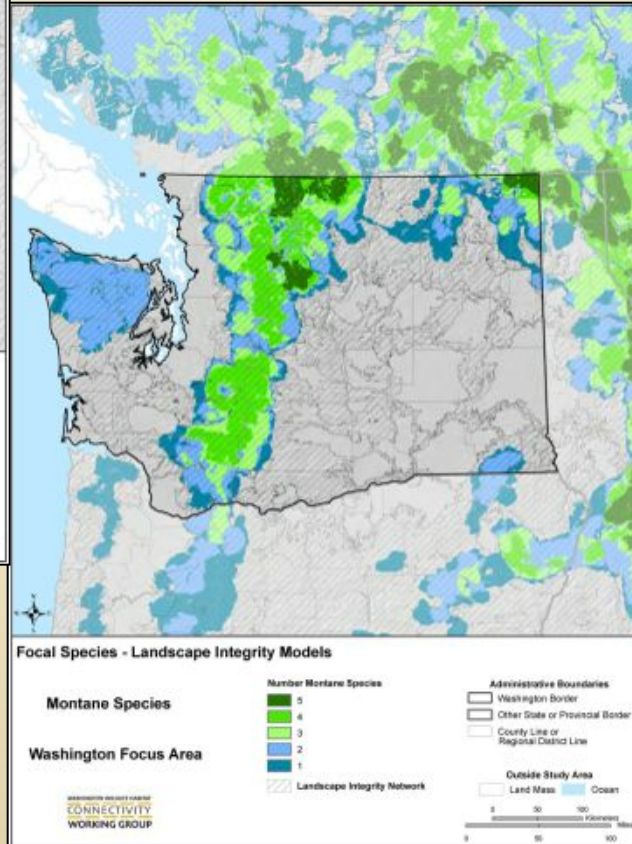
- ANBO Western Toad
- CEEL Elk
- ODHE Mule Deer
- OVCA Bighorn Sheep
- SCGR Western Grey Squirrel

Statewide Guilds

Montane
(6 species)



Shrub-Steppe
(5 species)



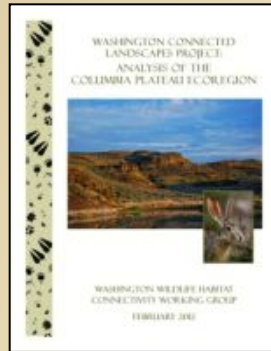
Generalist/Edge
(5 species and
landscape integrity)

Columbia Plateau Ecoregion Phase I Current Conditions Connectivity Analyses



Photo by Joe Rocchio

Columbia Plateau Ecoregion Current Conditions Connectivity Analysis: Phase I



- 11 focal species chosen specifically for this ecoregion
- Includes species with smaller home ranges and movement distances
- Additional data layers-- powerlines, windturbines, irrigation, agricultural detail, soils, topographical complexity
- 30m cell size (vs. 100m)
- Extensive participation of regional field biologists and other experts

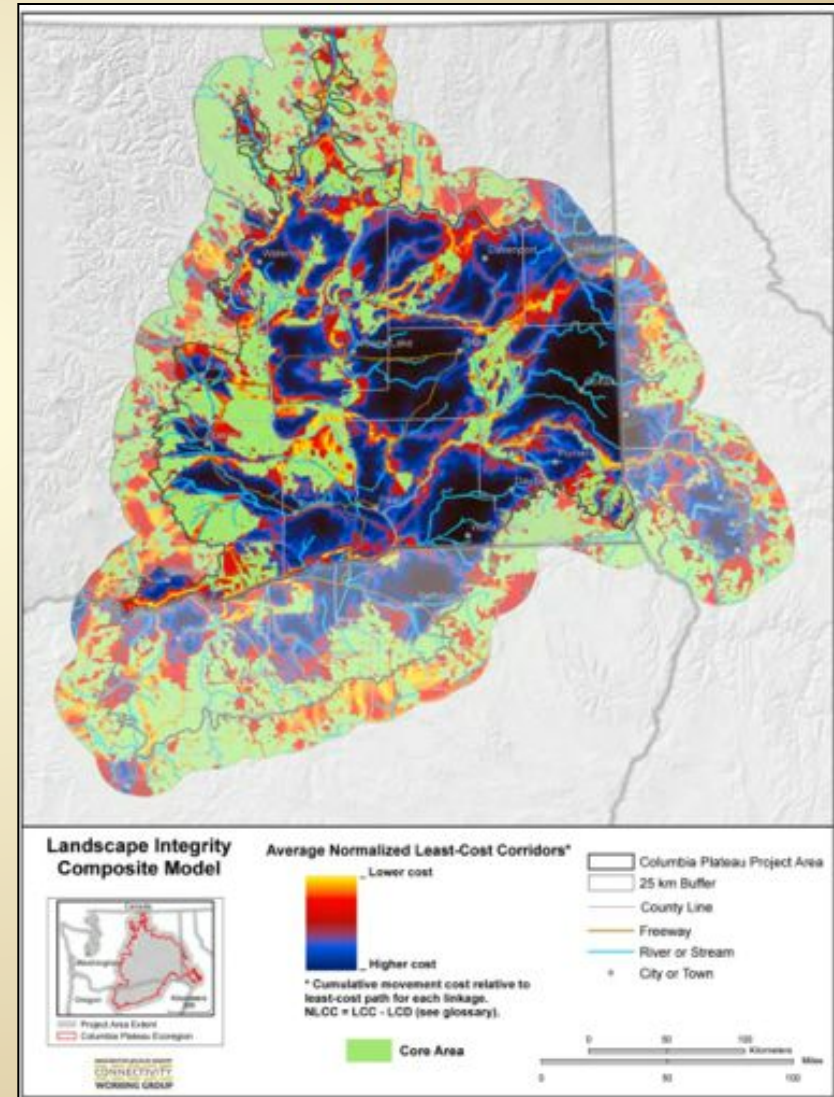
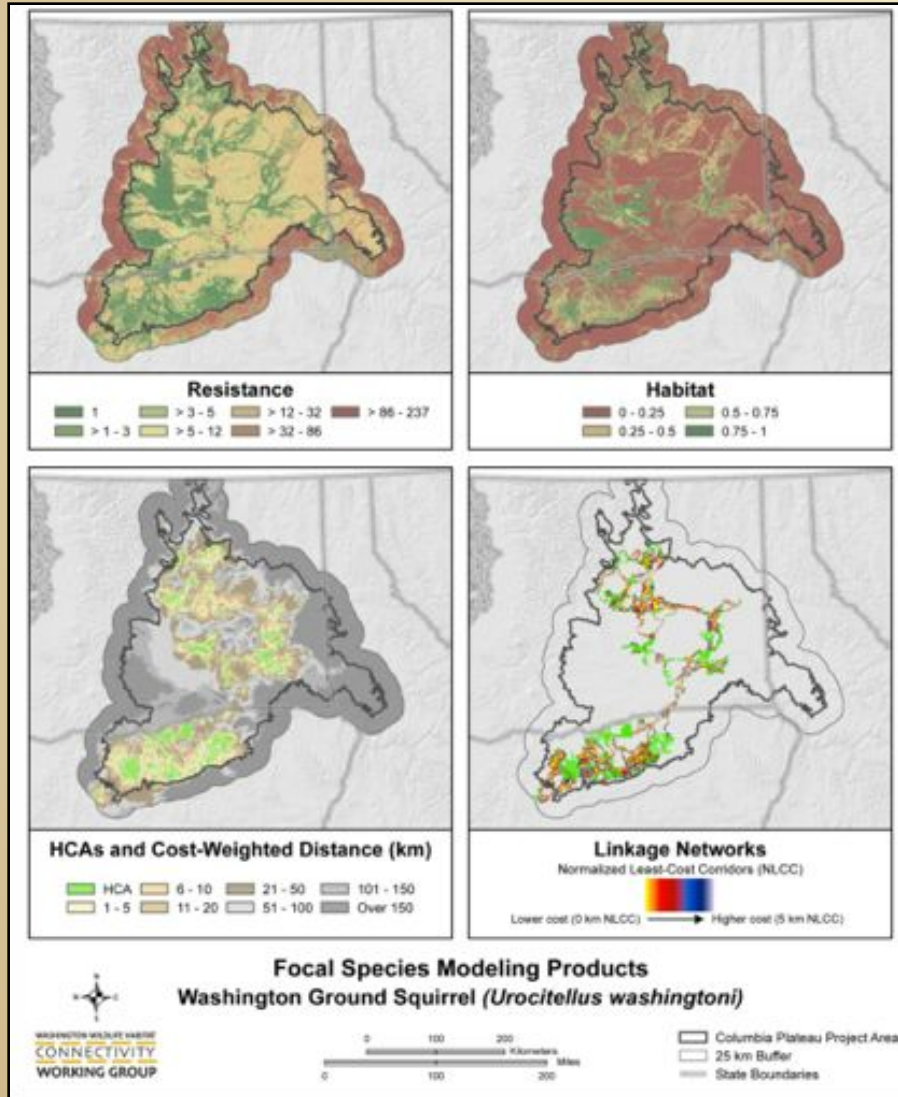


Columbia Plateau Ecoregion Products

Focal Species



Landscape Integrity



Products

Habitat Models



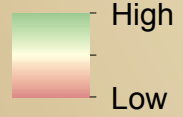
Slide courtesy of Andrew Shirk

Products

Habitat Models



Habitat Value



Products

Resistance Models



Photo by Woodrow Myers

Products

Resistance Models

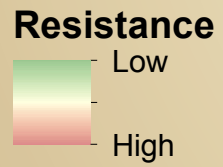
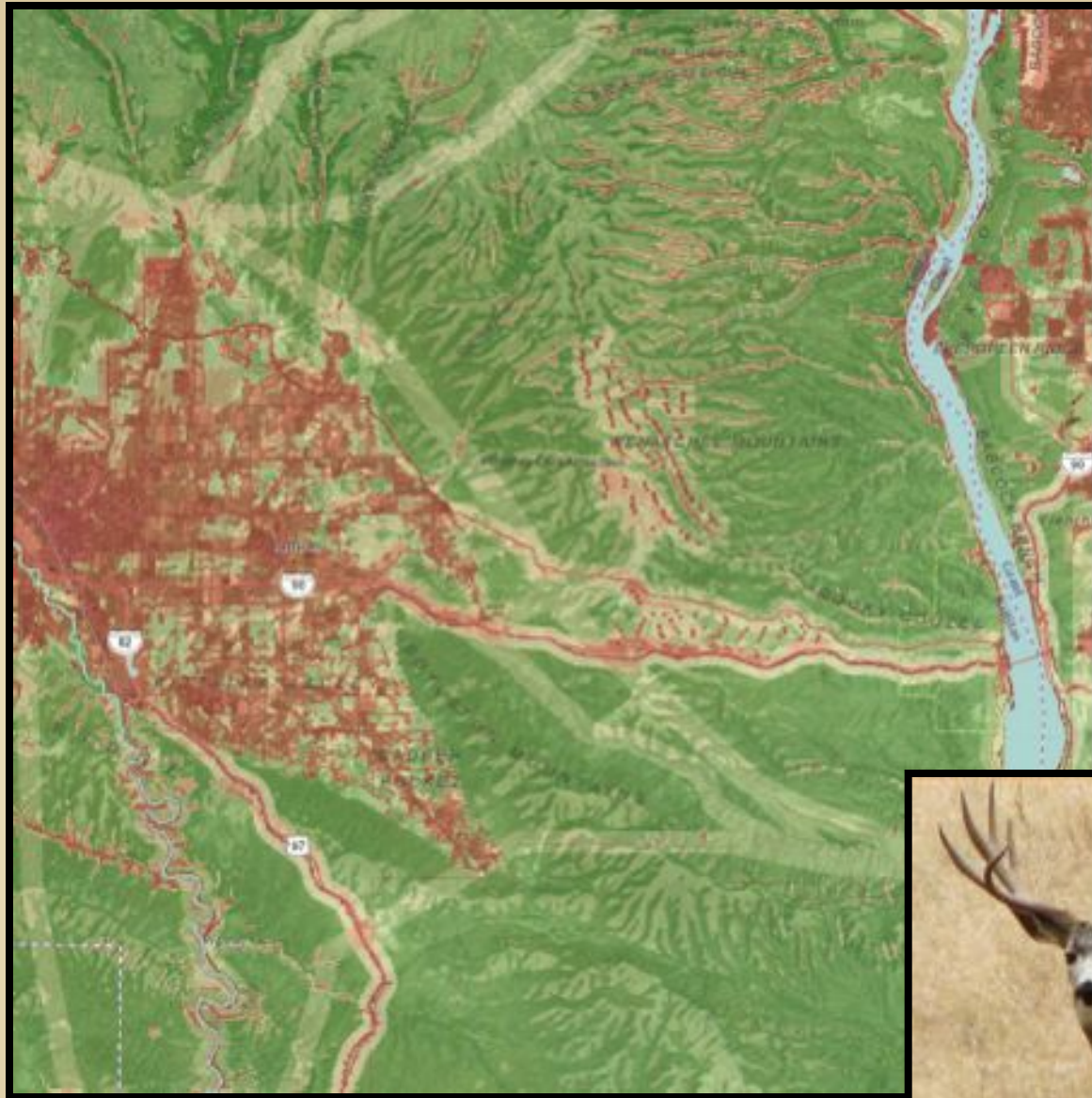
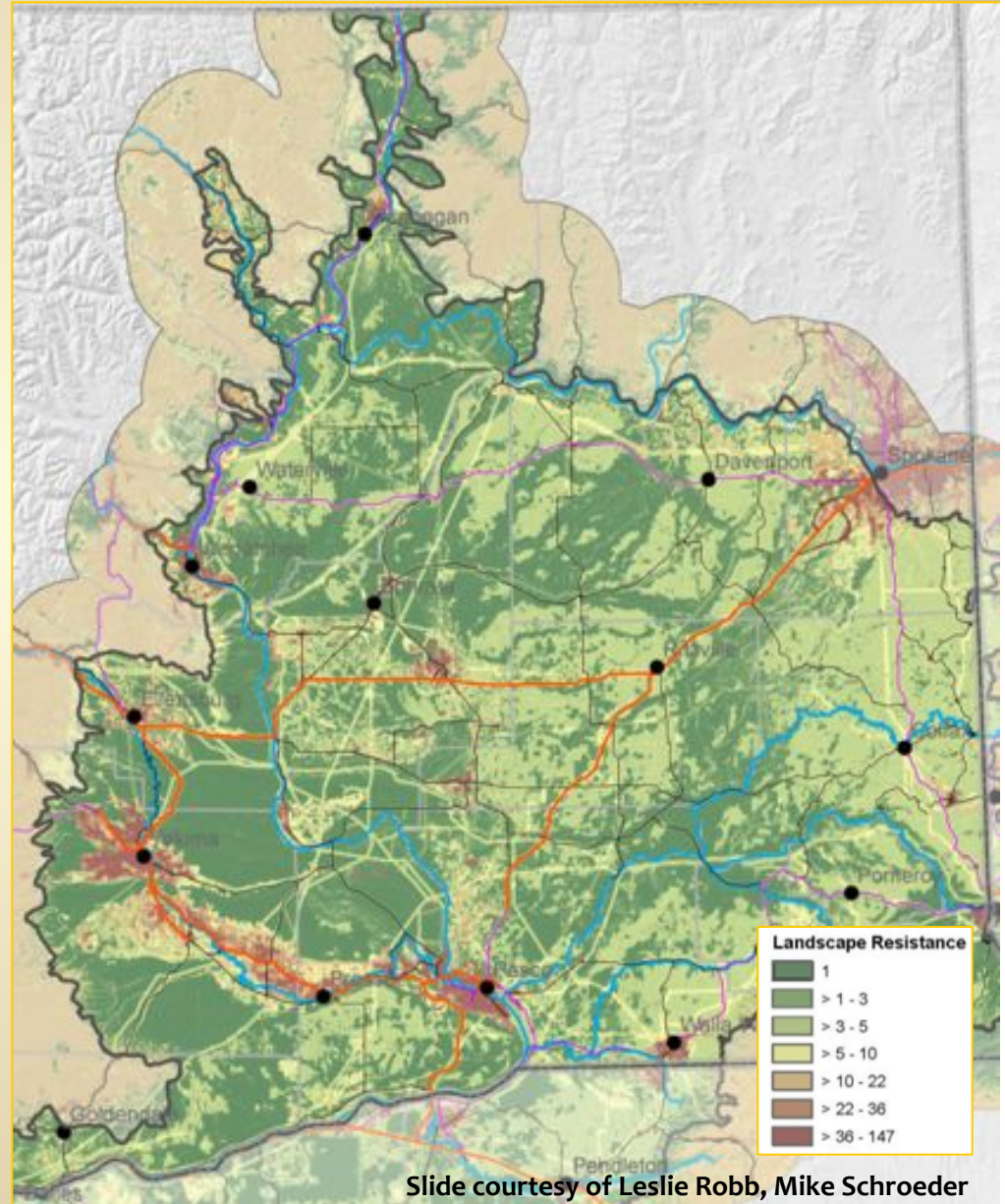


Photo by Woodrow Myers

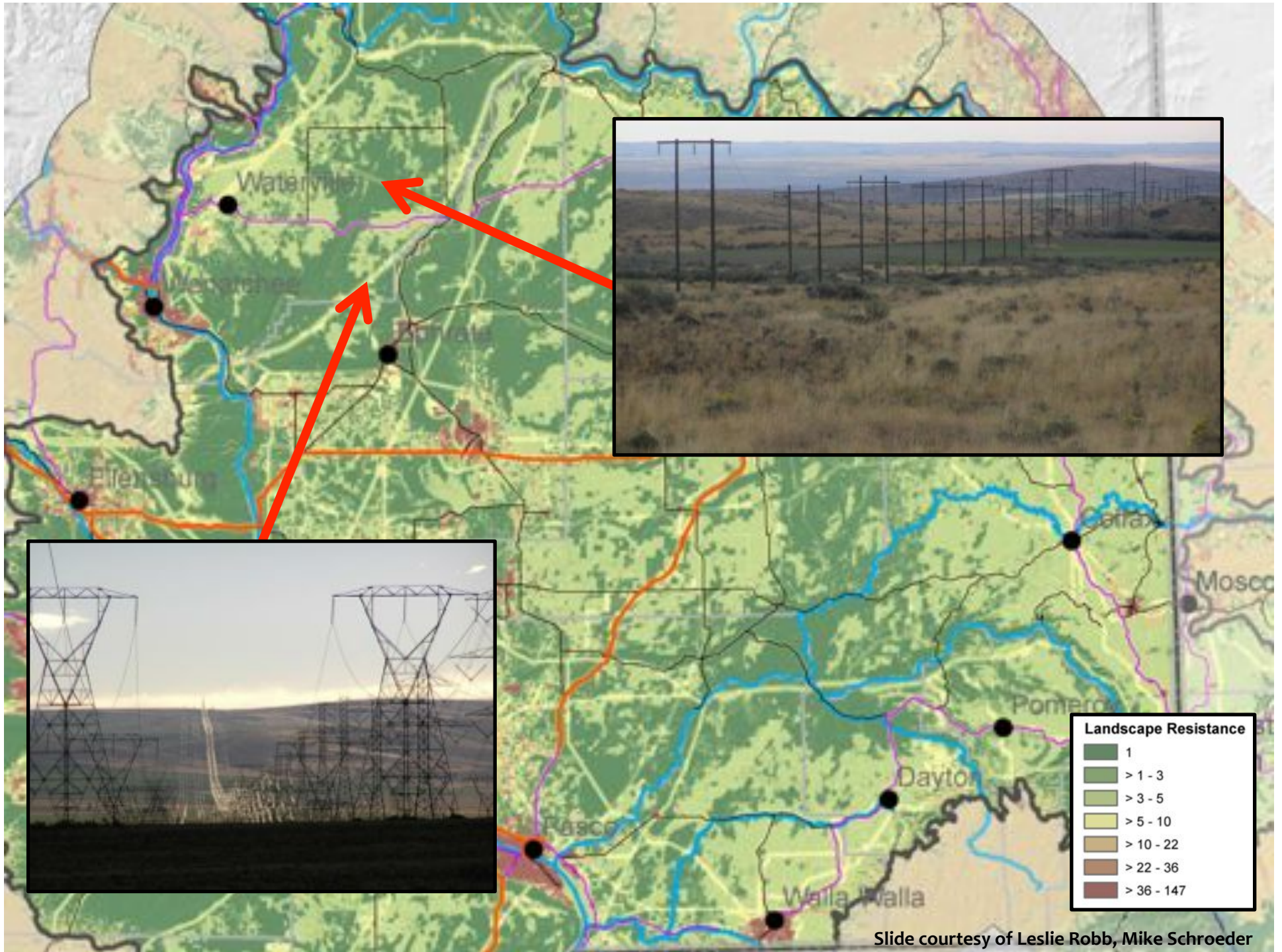
Greater Sage-Grouse – Resistance Surface



Right: light yellow lines represent linear features such as transmission lines



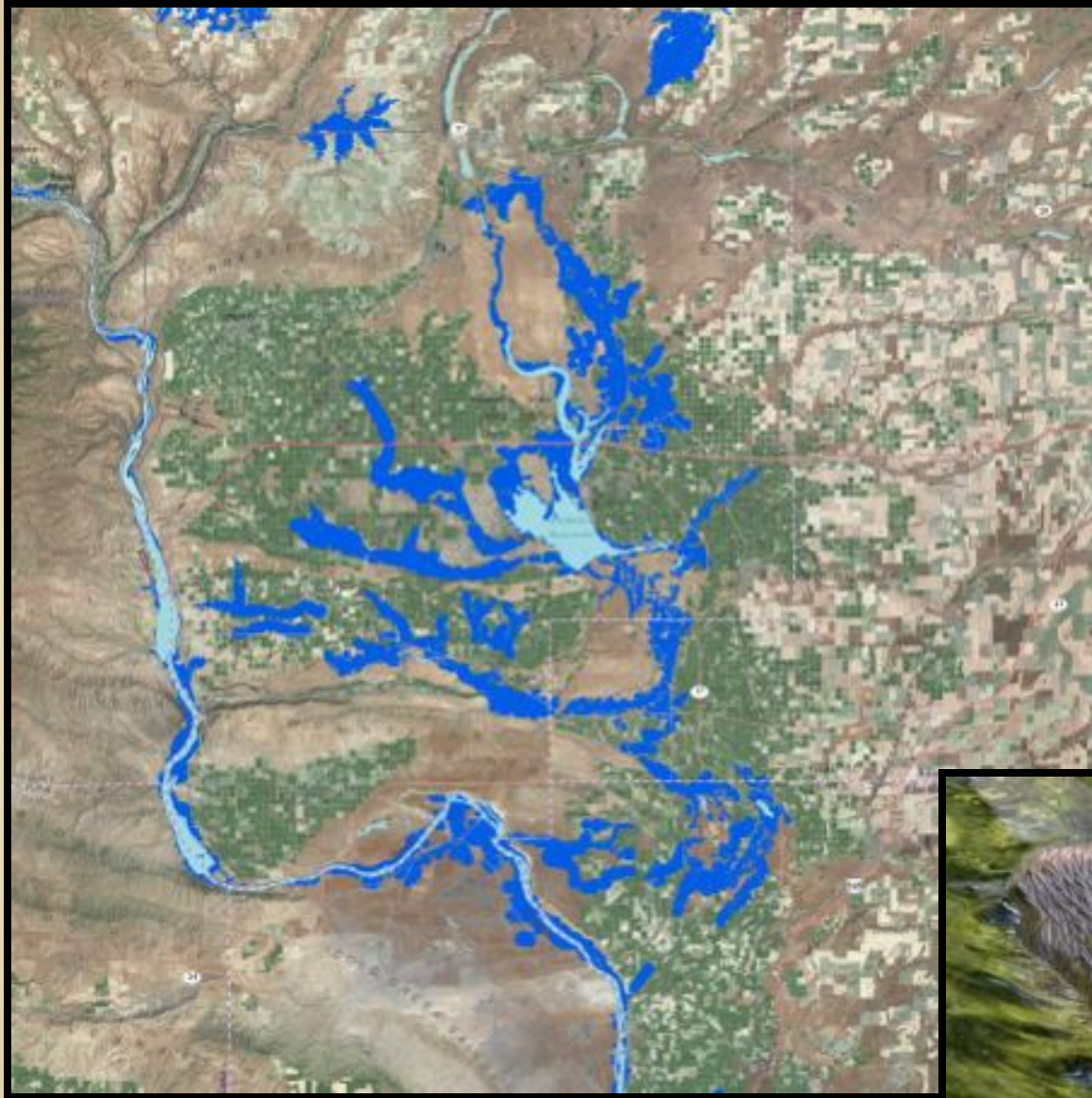
Slide courtesy of Leslie Robb, Mike Schroeder



Slide courtesy of Leslie Robb, Mike Schroeder

Products

CWD
Models

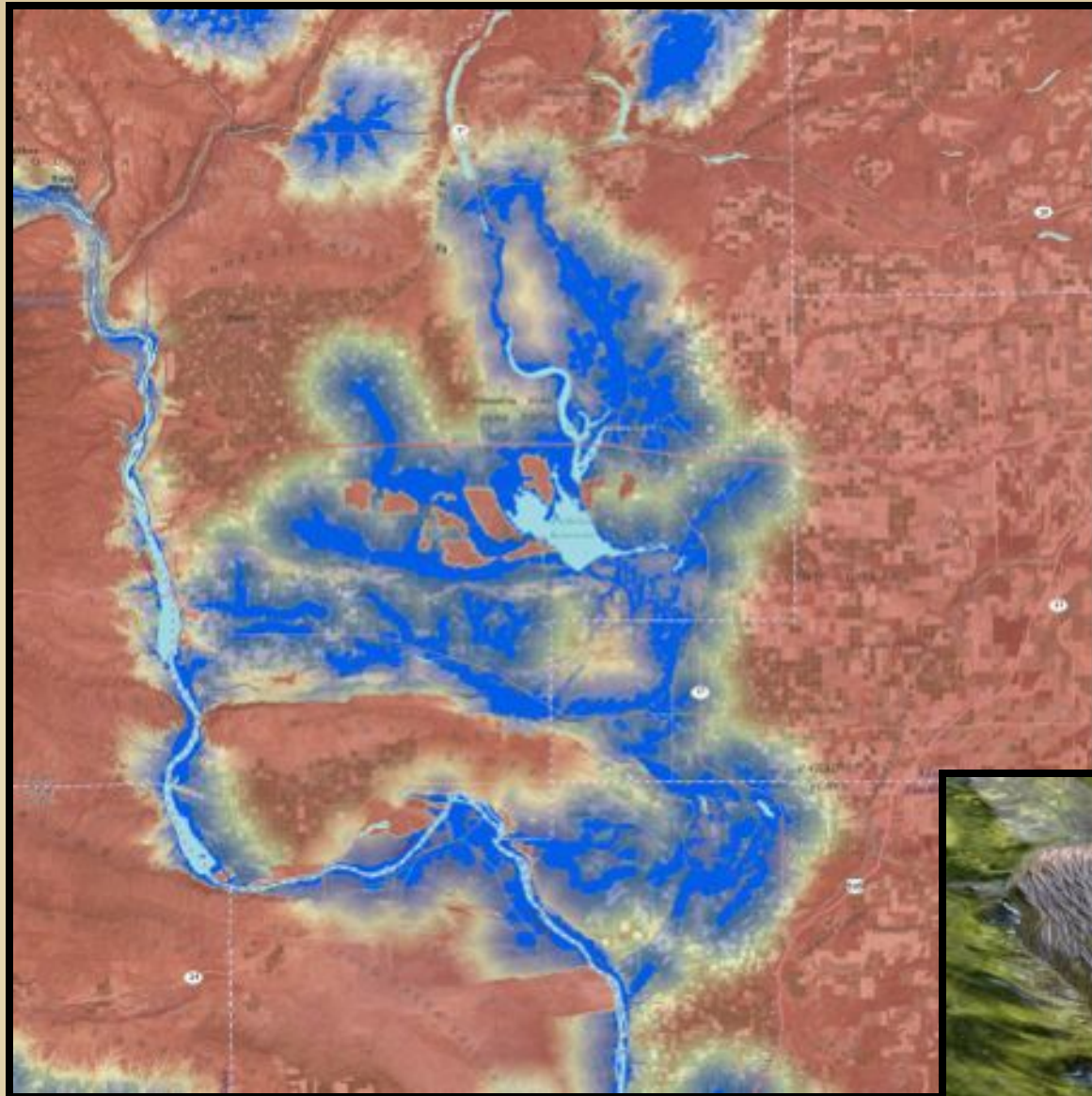


 HCA



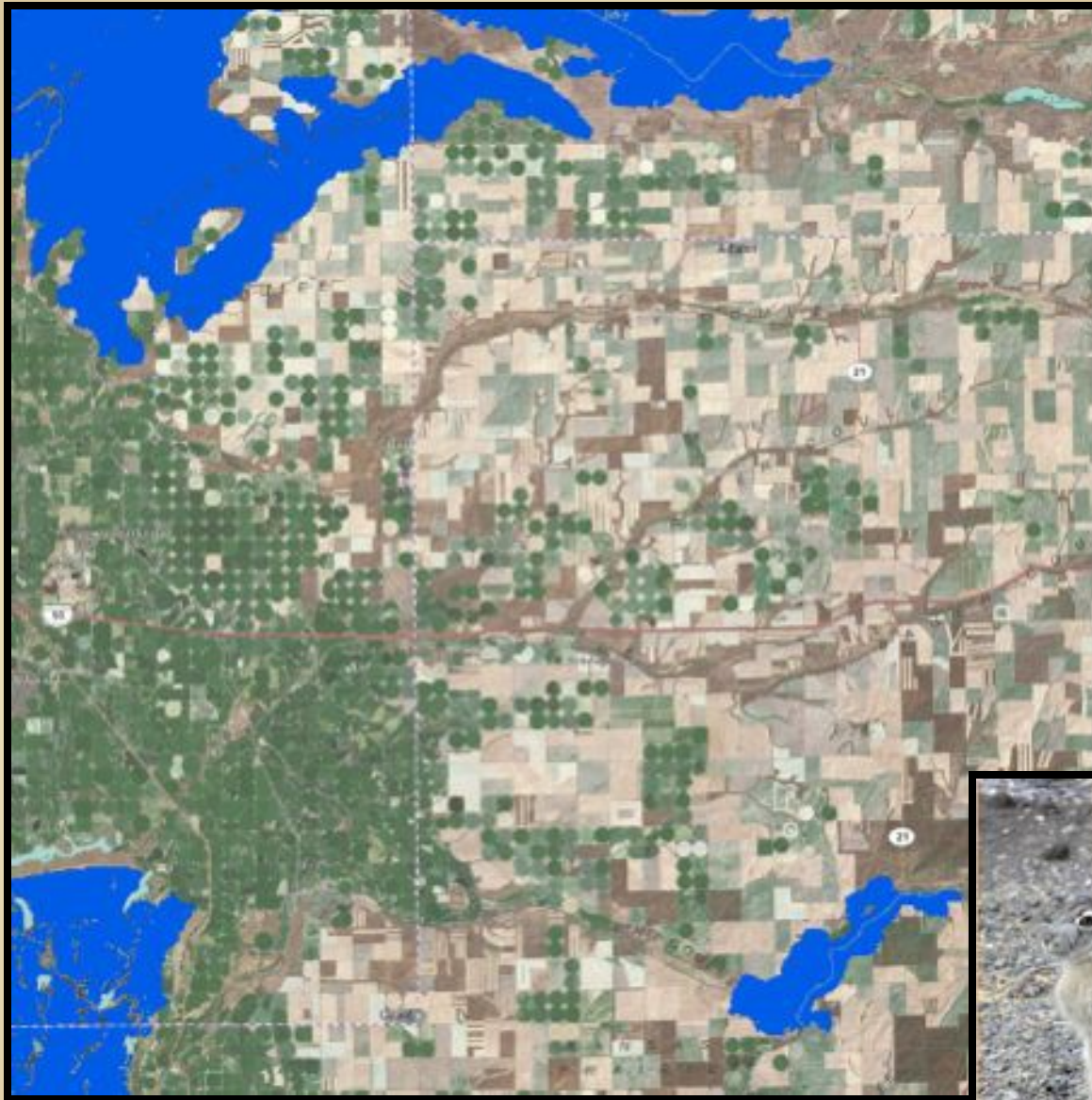
Products

CWD
Models



Products

Linkage Models

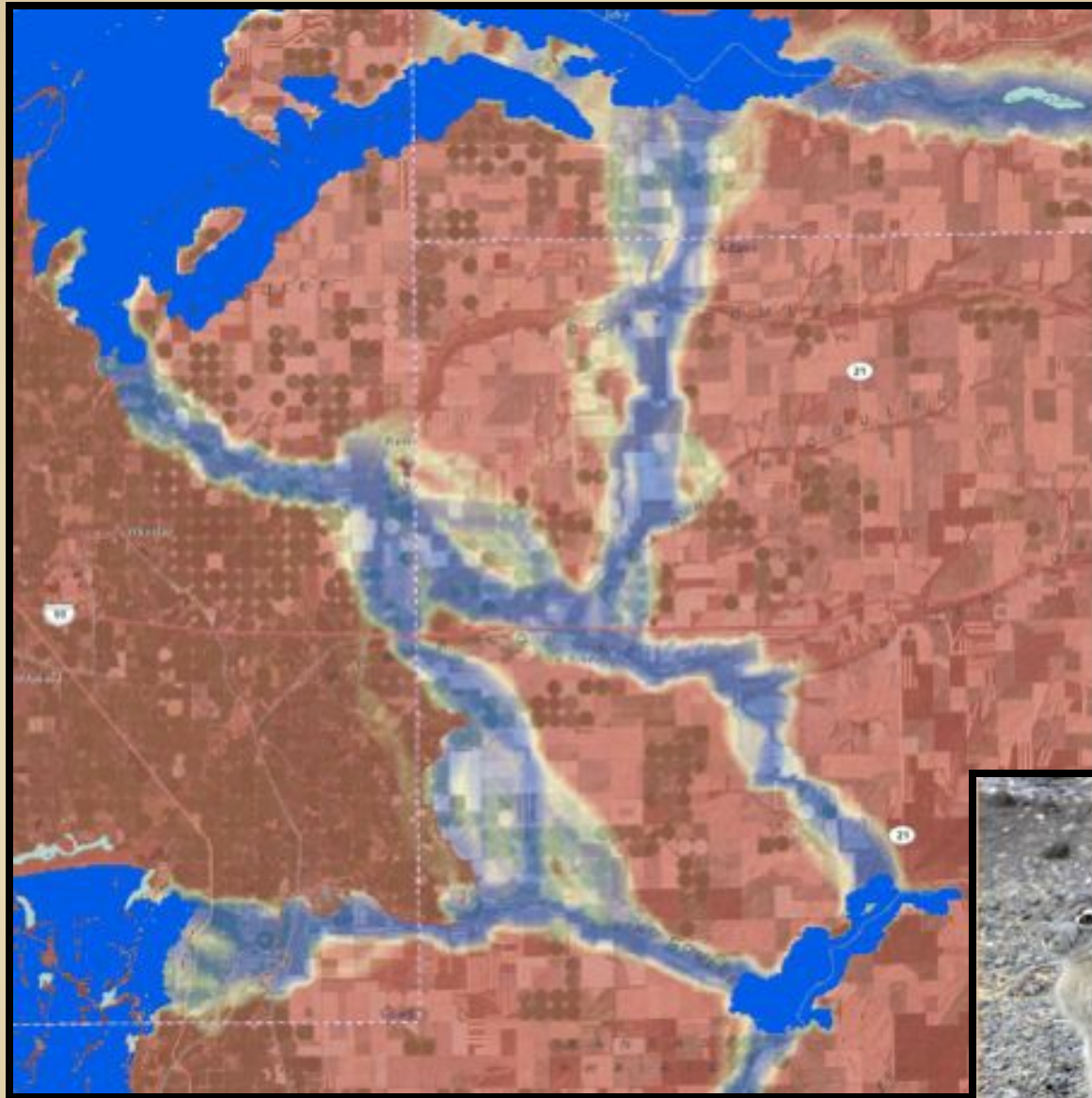


 HCA

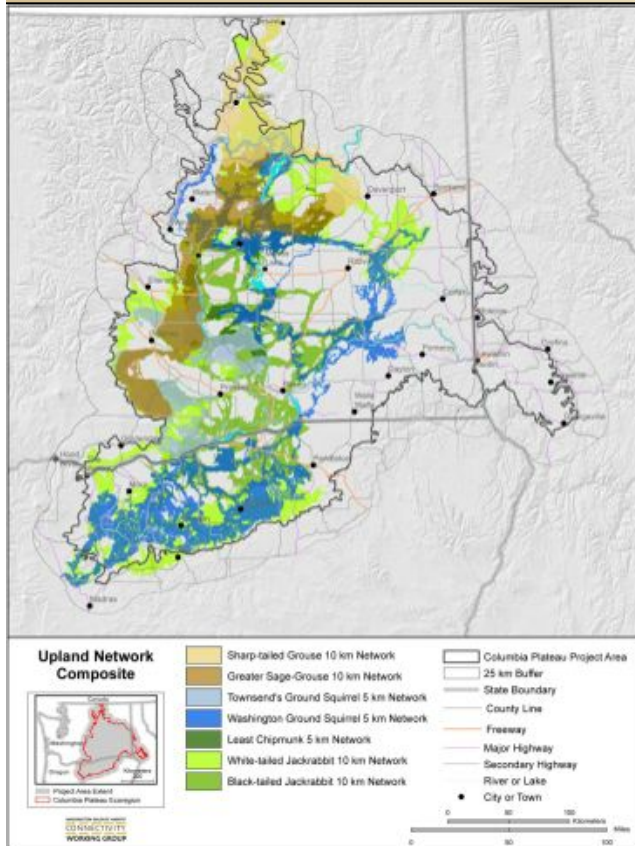


Products

Linkage Models

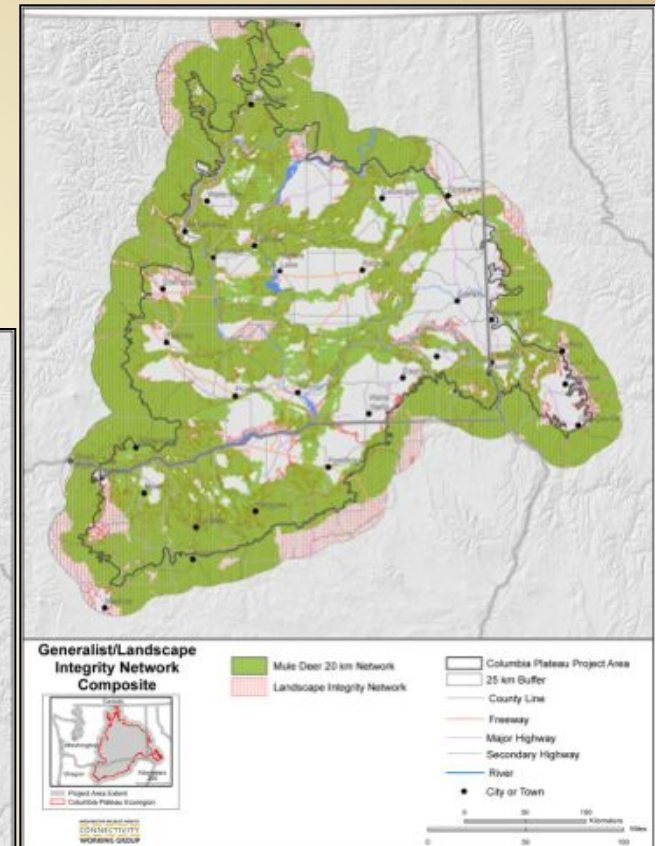
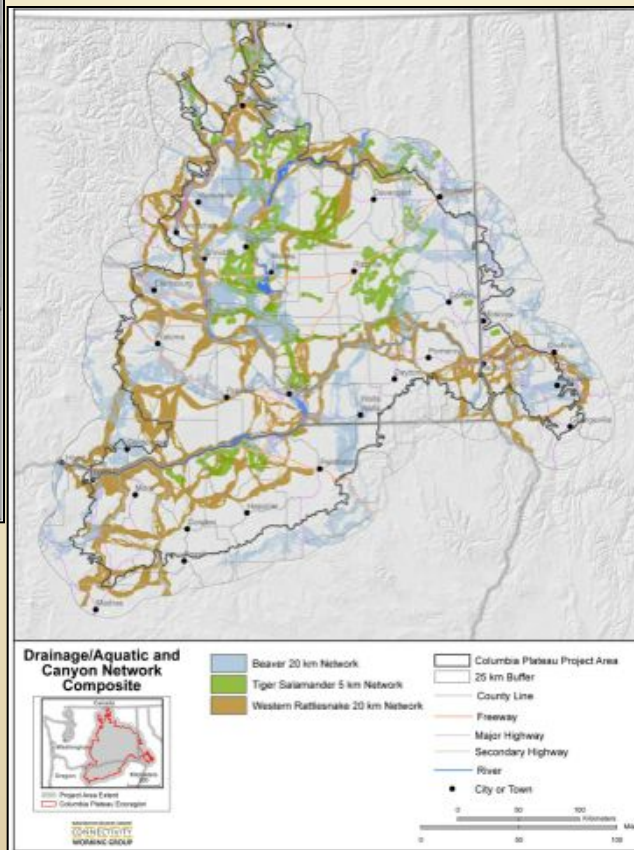


Columbia Plateau Connectivity Networks



Upland Network Composite
(7 shrub-steppe species)

Drainage/Aquatic and
Canyon Composite
(3 species)

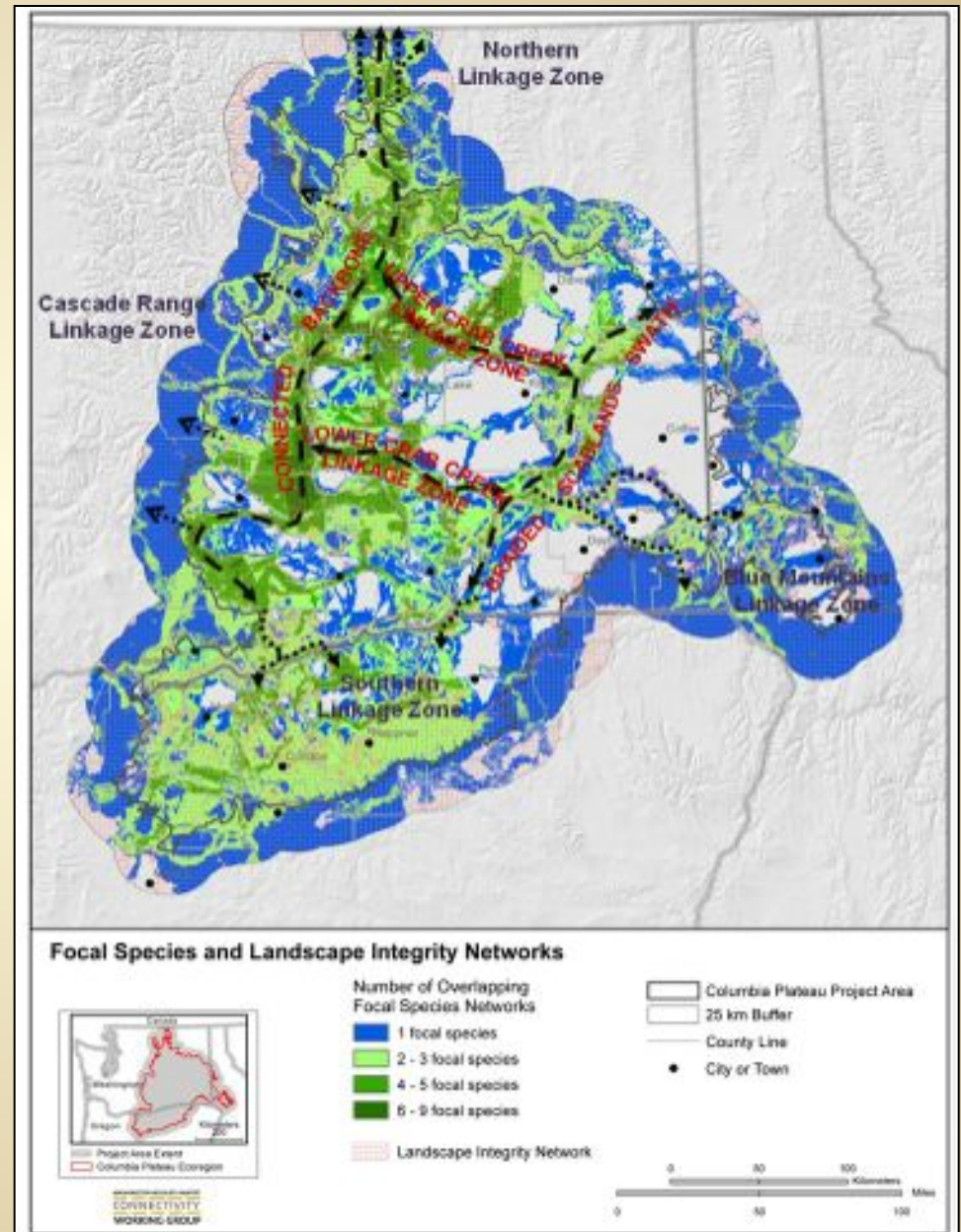


Generalist/Landscape Integrity Network Composite
(1 species and LI)

Vision for a Connected Columbia Plateau

Major linkage zones of the Columbia Plateau Ecoregion

- Solid colors reflect the number of focal species' networks particular areas include
- Hatching represents the landscape integrity composite network
- Dashed arrows highlight important areas for connectivity in Washington
- Dotted arrows highlight important linkage zones to neighboring ecoregions and states



Columbia Plateau Ecoregion Phase II Analyses

- Linkage Network Centrality
- Linkage Pinch-Points
- Barriers and Restoration Opportunities

Columbia Plateau Phase II Goal

*“Bridge Columbia Plateau
Ecoregion connectivity analysis
results and products to detailed
products for use by managers,
biologists, and others that seek to
implement wildlife habitat
connectivity”*



Photo by Ryan Shaw

Linkage Network Centrality

Metric that ranks the relative importance of a linkage or habitat concentration area for keeping the overall network connected.



Photo by Gregg Thompson

Linkage Pinch-Points

“Bottlenecks” where wildlife movement is funneled within linkages. Areas vulnerable to being severed.

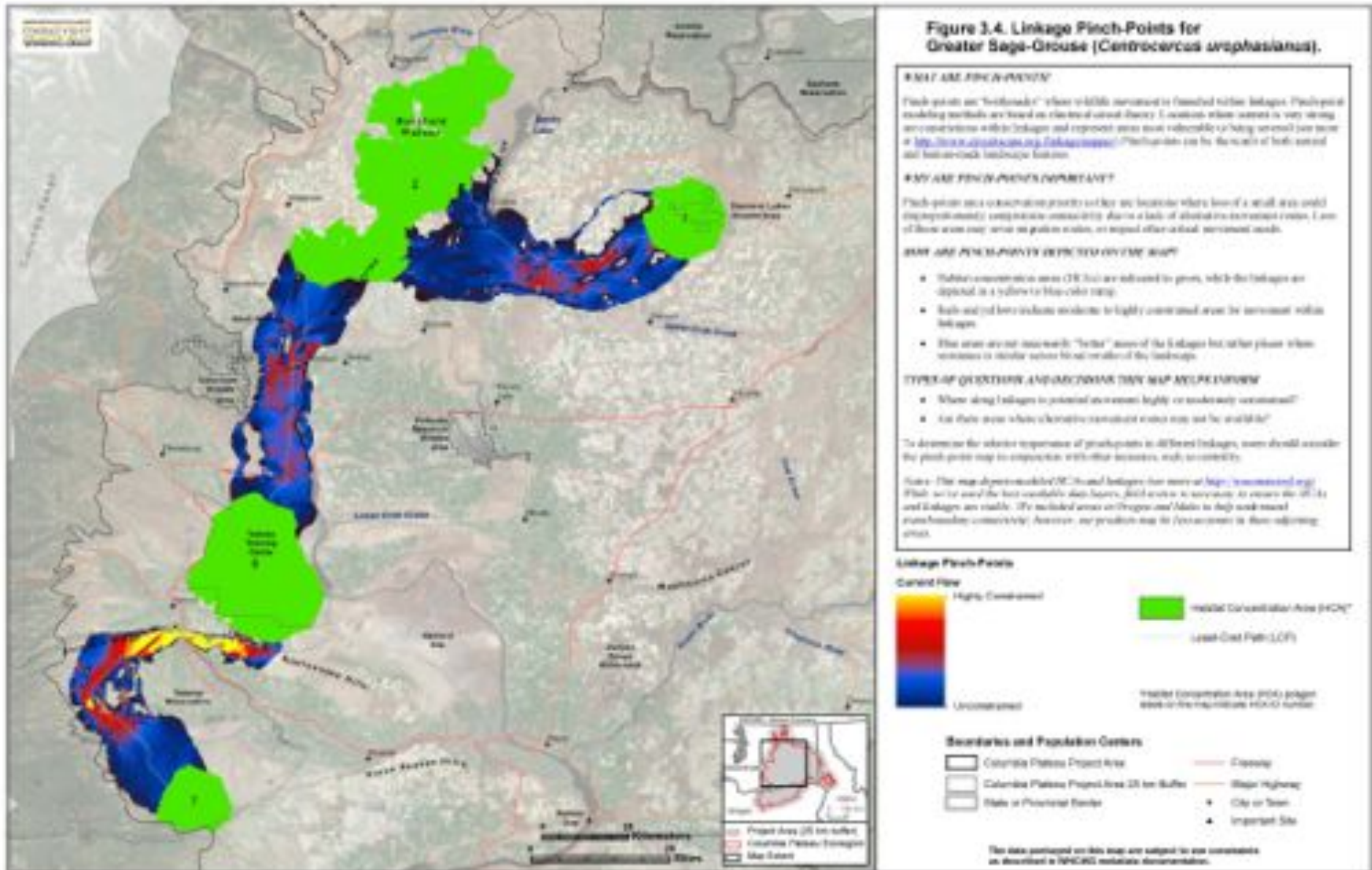


Photo by Michael A. Schroeder



Photo by Rob Bennetts

Linkage Pinch-Points



Barriers/Restoration Opportunities

Barriers are areas of the landscape that impede movement. If barriers are restored or enhanced we may improve connectivity.

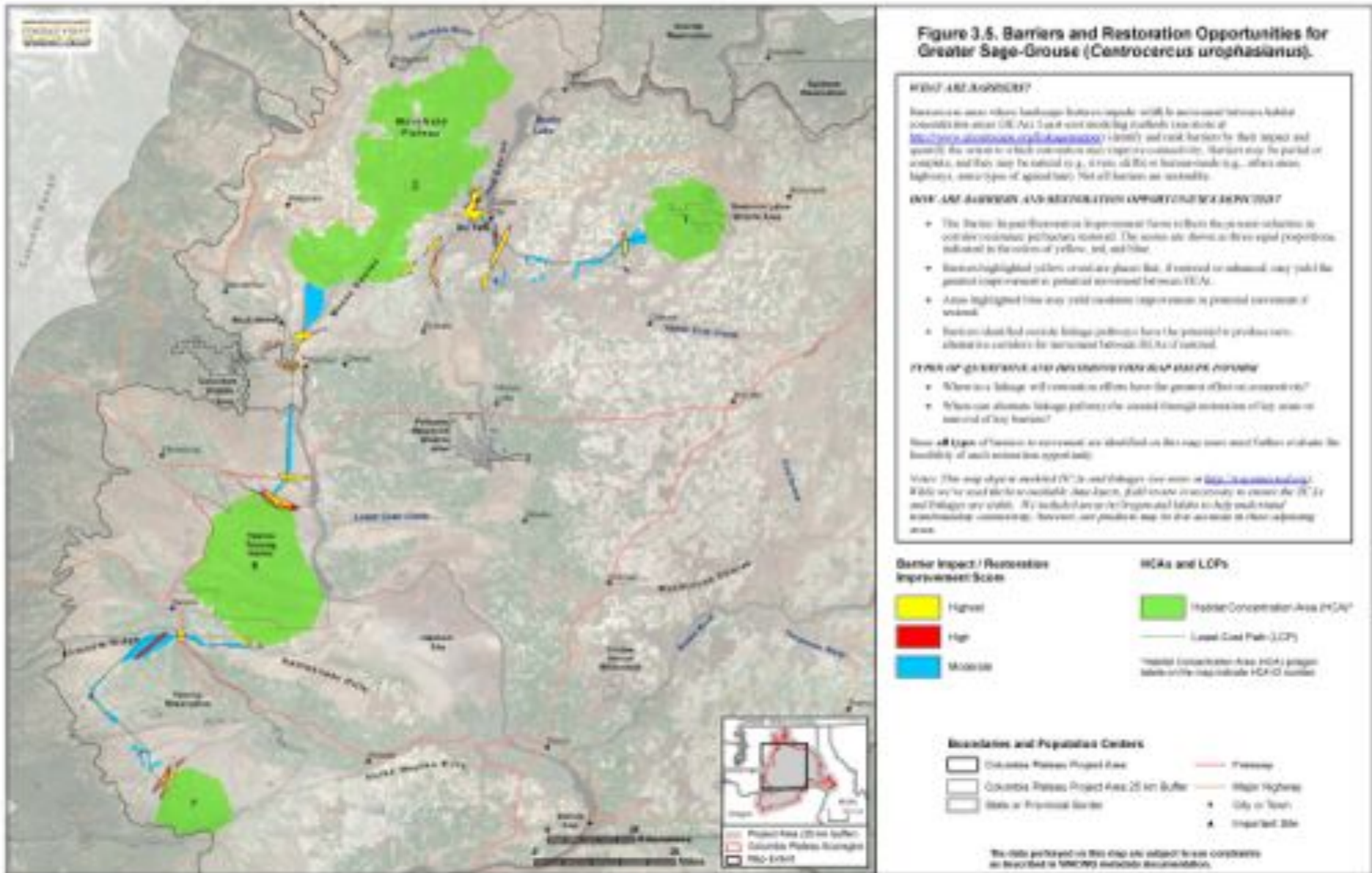


Photo by Khanh Tran



Photo by Michael A. Schroeder

Barriers/Restoration



Model Testing, Validation, and Adaptive Management



Photo by Michael A. Schroeder

Conceptual Approach

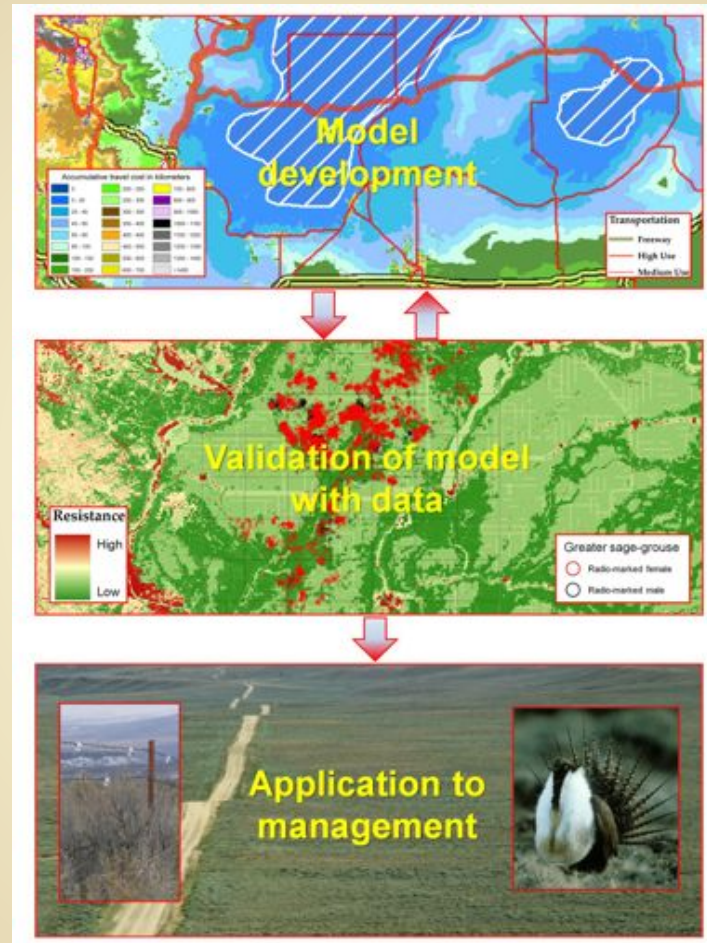


Figure: Greater Sage-grouse model validation. (Credits: Mike Schroeder, Leslie Robb)

Three Categories



Limited locational and/or genetic data available

- Need: field data to improve confidence in range location(s) and extent
- Need: genetic data to identify population structure
- Examples: Black bear, American Marten, Black-tailed Jackrabbit, White-tailed Jackrabbit, Least Chipmunk

• Photo credit: Robert Long, Paula MacKay



Using (and/or supplementing) existing data sets to test accuracy of models

- Need: test model outputs to identify how well they represent field data
- Need: for species such as Greater Sage-Grouse, this will directly support essential conservation needs
- Examples: Greater Sage-Grouse, Mule Deer

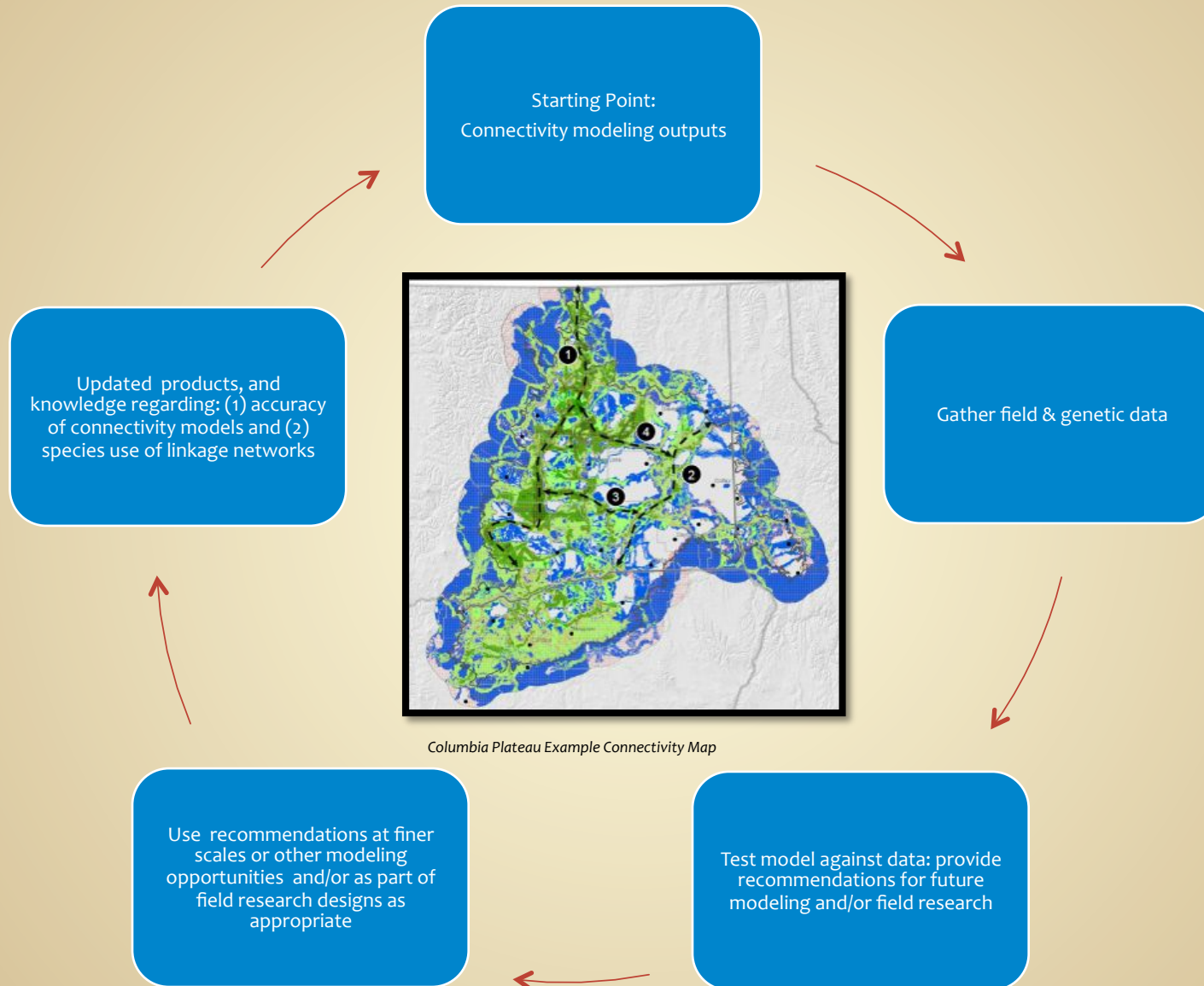
• Photo credit: Khanh Tran



Ensuring linkages are effective for species movement

- Need: On the ground conservation effectiveness; we need to know corridors and permeable landscapes function successfully for a spectrum of movement needs, including seasonal migrations, and gene-flow between populations
- Example: A. Gregory research in Douglas County to determine whether an existing corridor is effective at maintaining genetic connectivity, and linking gene flow to landscape attributes

Work Flow



Columbia Plateau Example Connectivity Map

Questions?



www.waconnected.org