You are here

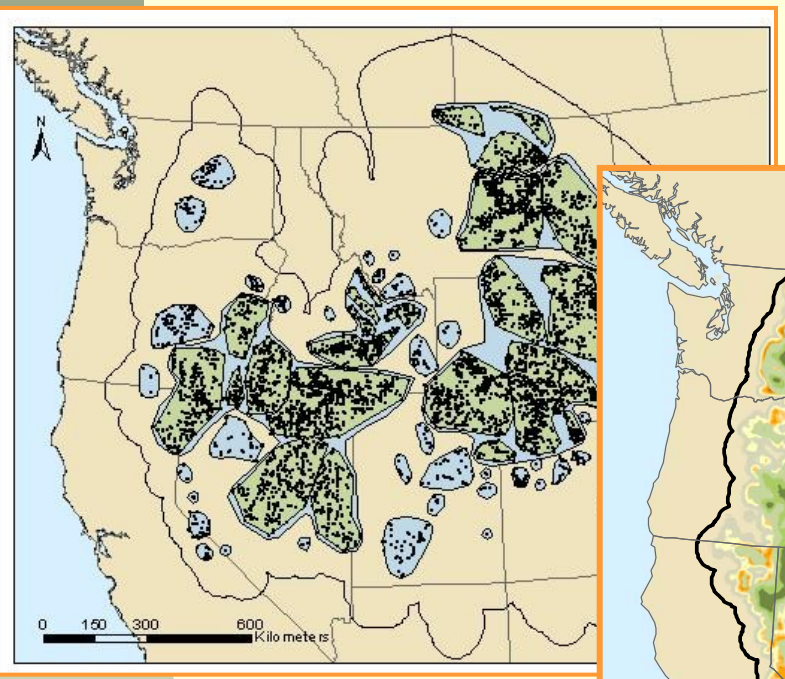
Washington Initiative **State Office** **Resource Area**

Great Basin Restoration Site Specific Restoration

Biome Ecoregion Landscape Sites

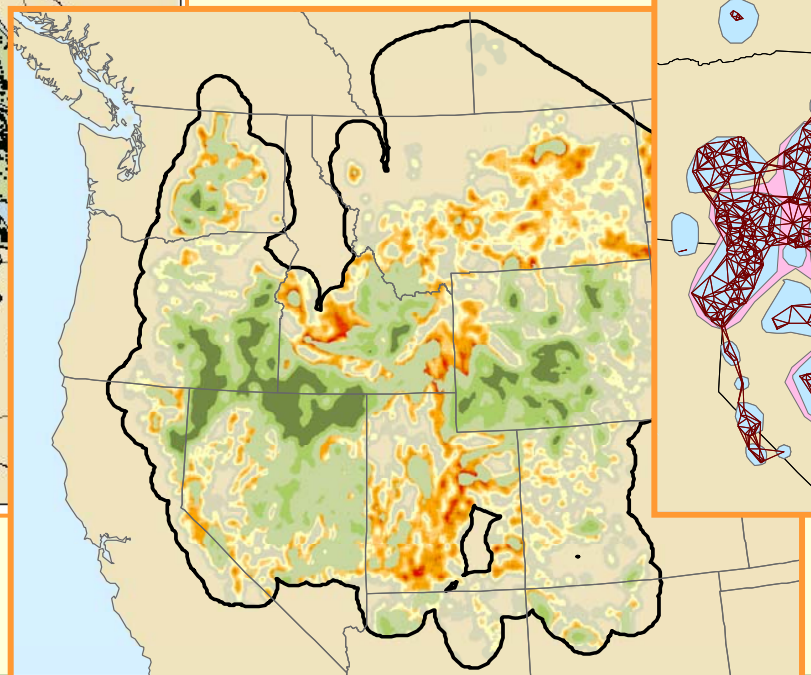
Multispecies Single Species

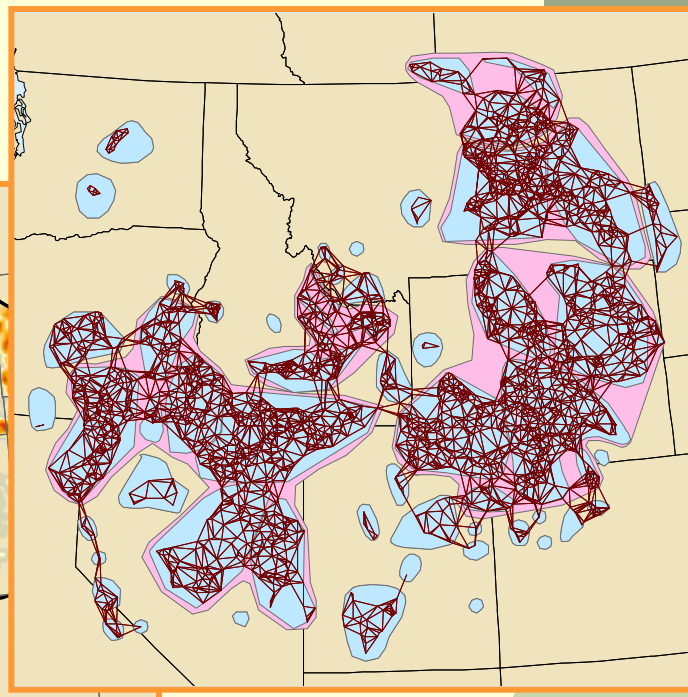
Species Range Population Range Individual Range



Populations

Habitat

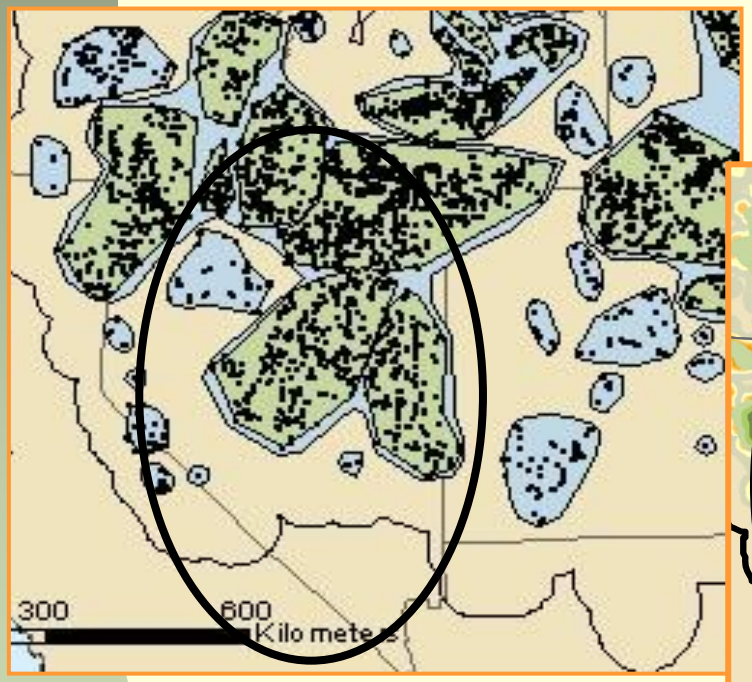




Connectivity

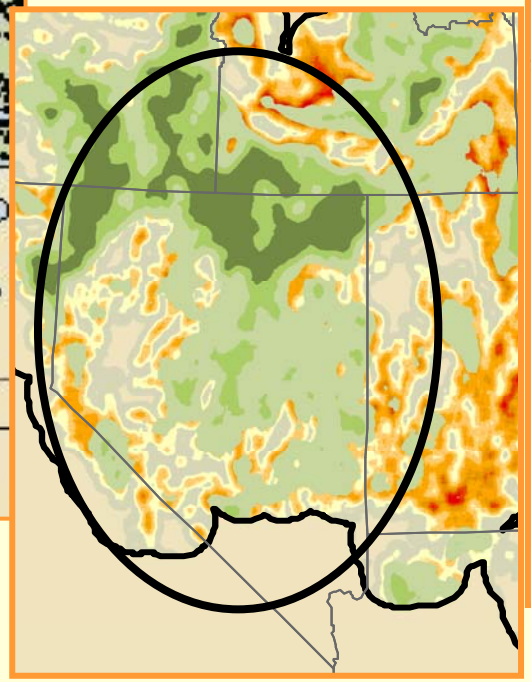
You are here

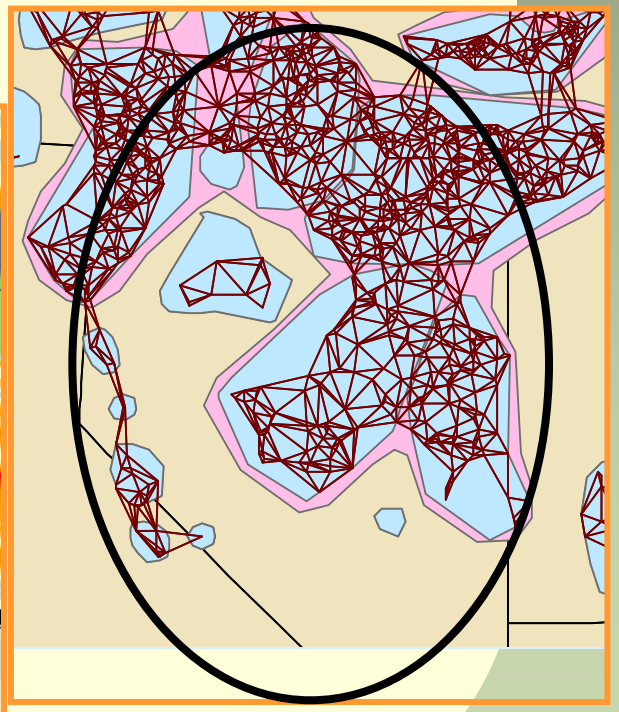
Washington Initiative	State Office	Resource Area
Great Basin Restoration	Site Specific Restoration	
Biome Ecoregion	Landscape	Sites
Multispecies		Single Species
Species Range	Population Range	Individual Range



Populations

Habitat





Connectivity

You are here

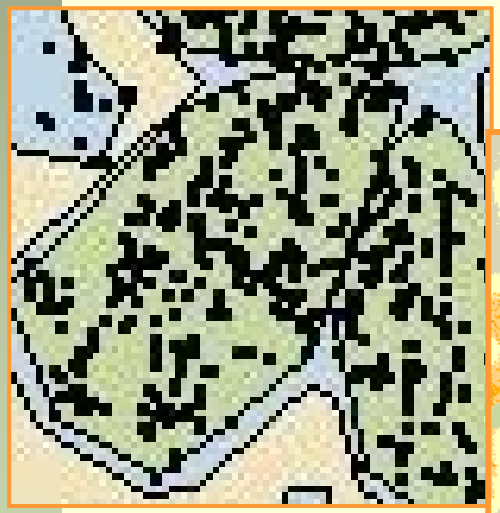
Washington Initiative **State Office** **Resource Area**

Great Basin Restoration Site Specific Restoration

Biome Ecoregion Landscape Sites

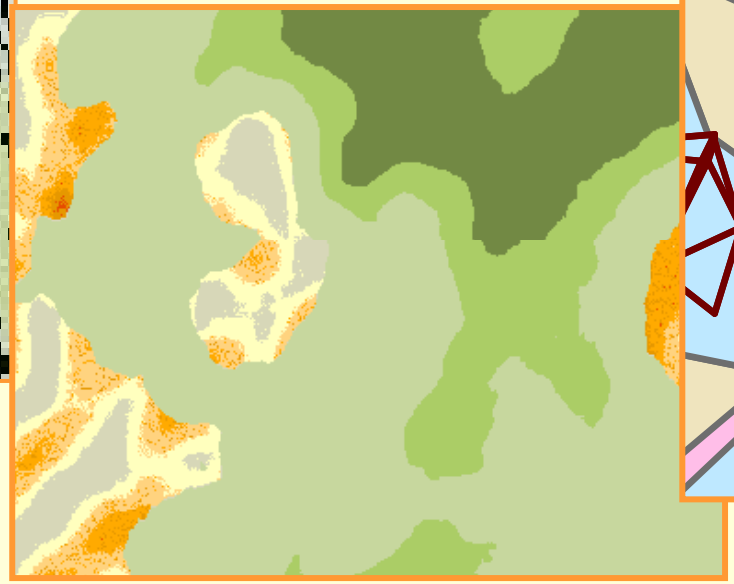
Multispecies Single Species

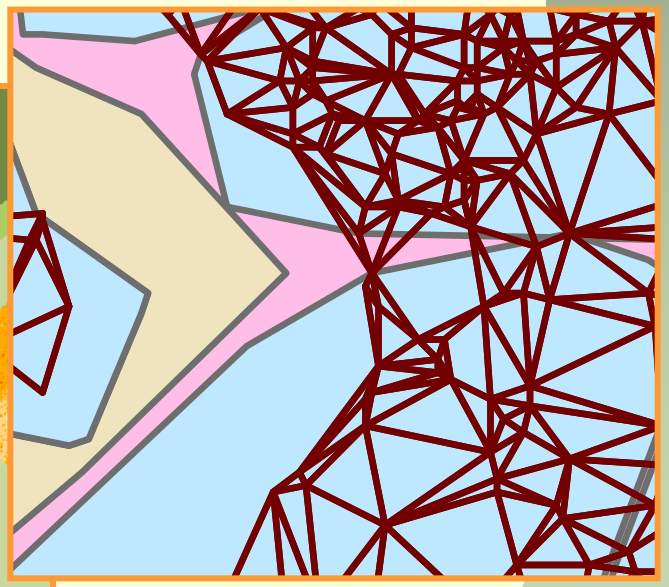
Species Range Population Range Individual Range



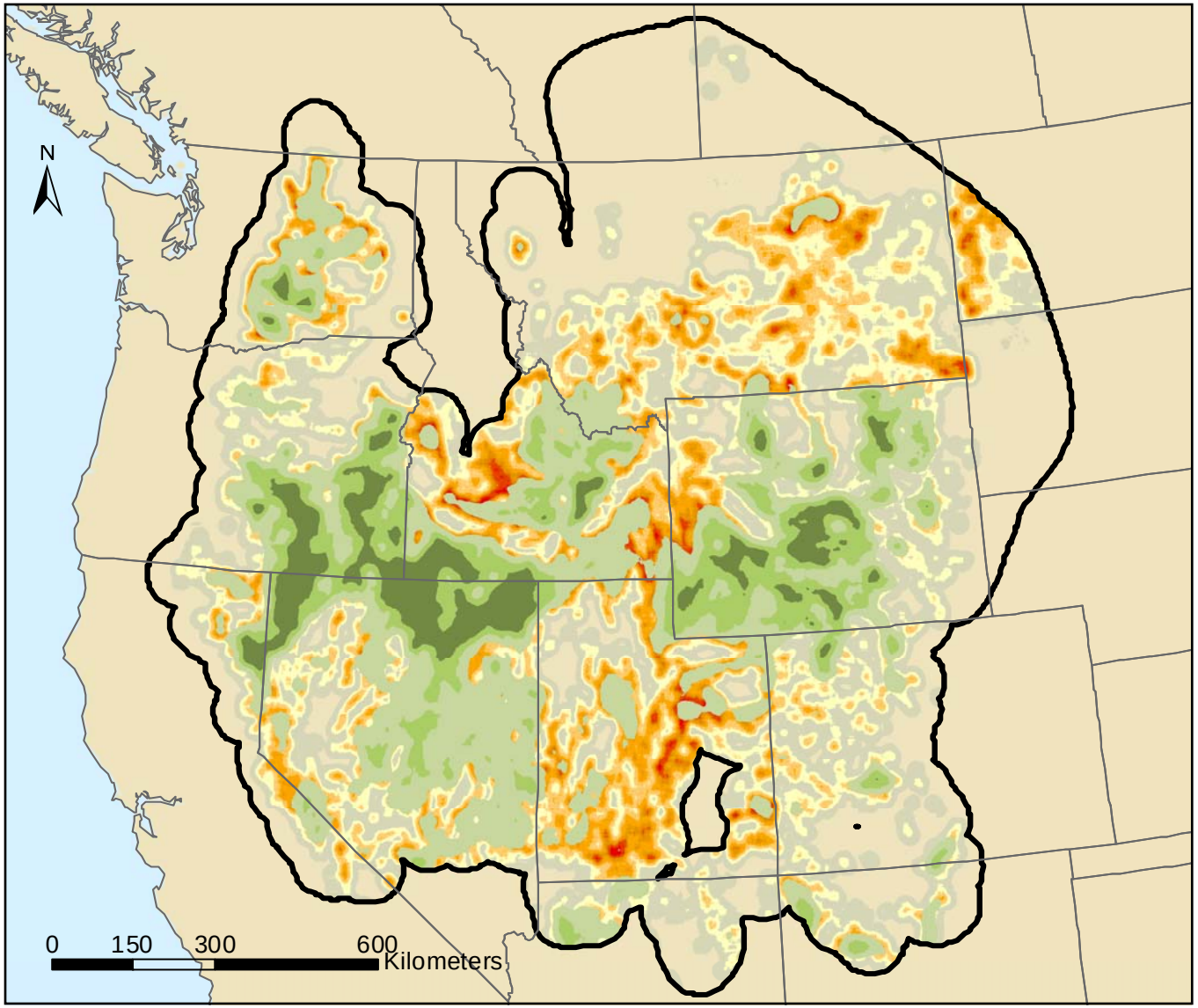
Population

Habitat





Connectivity



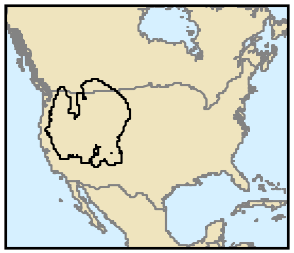
Large-Scale (18km) Fragmentation

- 146 - 290
- 291 - 434
- 435 - 579
- 580 - 723
- 724 - 868
- 869 - 1,012

Sagebrush (%)

- < 30
- 30 - 60
- 60 - 80
- 80 - 100

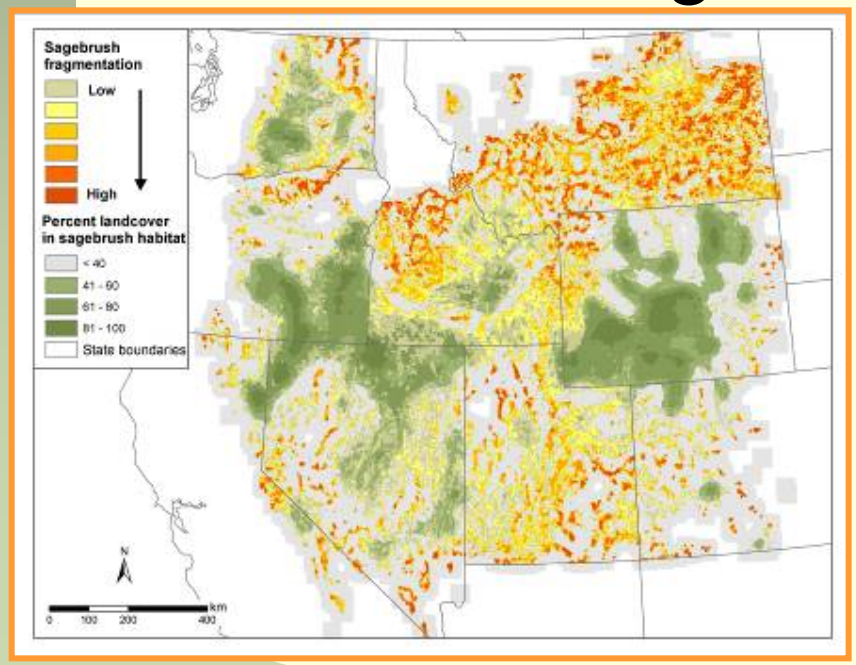
State/Province Boundaries



Sagebrush

Primary limitations to conservation

- Invasive plant species and altered fire
- Land use and the “human footprint”
- Climate change



Poster Person: Sagebrush

Brewer's Sparrow

Population decline: 3.2%/year

Poster Person: Sagebrush

Greater Sage-grouse

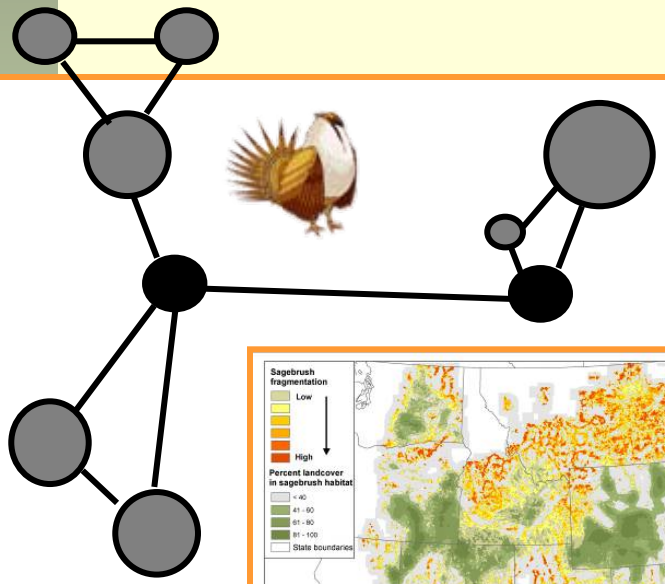
Population decline: 2.0%/year

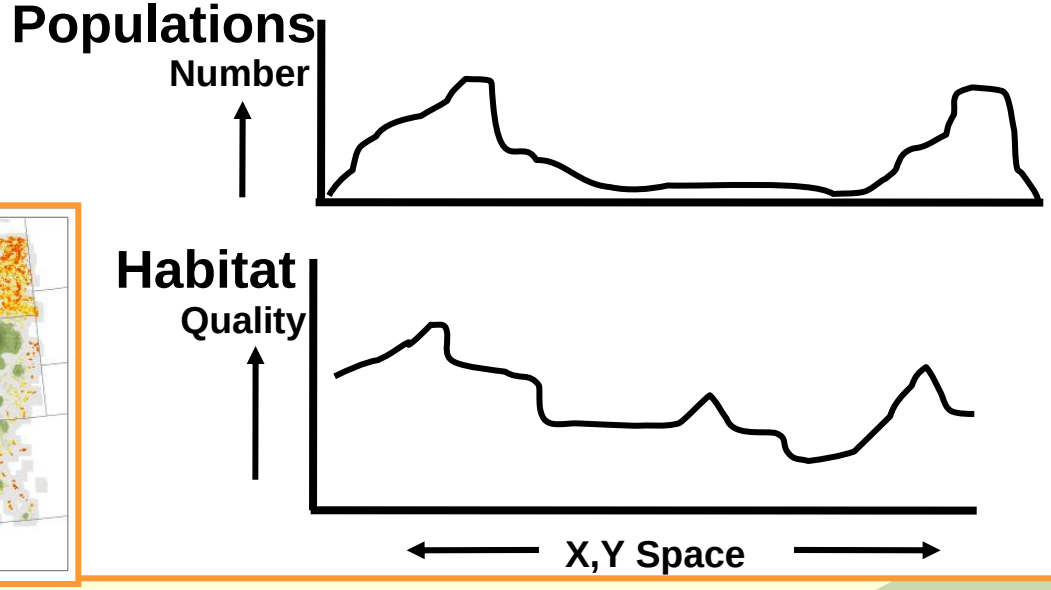
Brewer's Sparrow

Population decline: 3.2%/year

Connecting Pattern and Process in Greater Sage-Grouse Populations

Steven T. Knick and Steven E. Hanser
USGS Forest and Rangeland Ecosystem Science Center
Boise, ID





Greater Sage-Grouse

- Depend on sagebrush habitats
- Relatively long-lived (3-7 years)
- Low reproductive output (2 young/female annually)
- >2,500 km^2 annual range
- >150 km between seasonal ranges

Greater Sage-grouse

Eastern Nevada

Greater Sage-Grouse
Why is conservation so challenging?

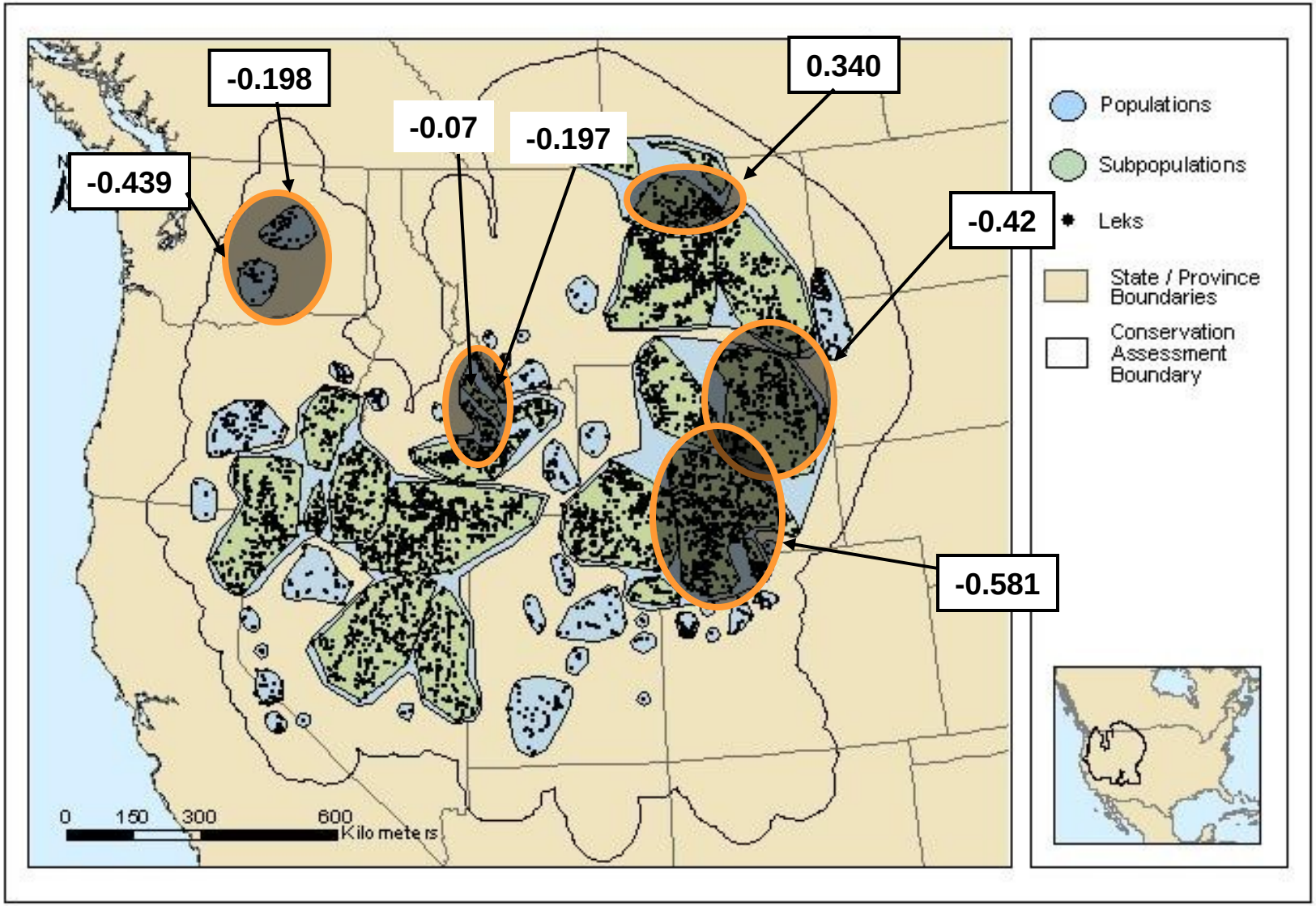
- Broad range-wide distribution
- Diversity of sagebrush environments
  - Complex dynamics
- Wide variety of system stressors
- Multiple land ownerships
  - Public lands managed for multiple use
  - Not all lands are equal

Objectives

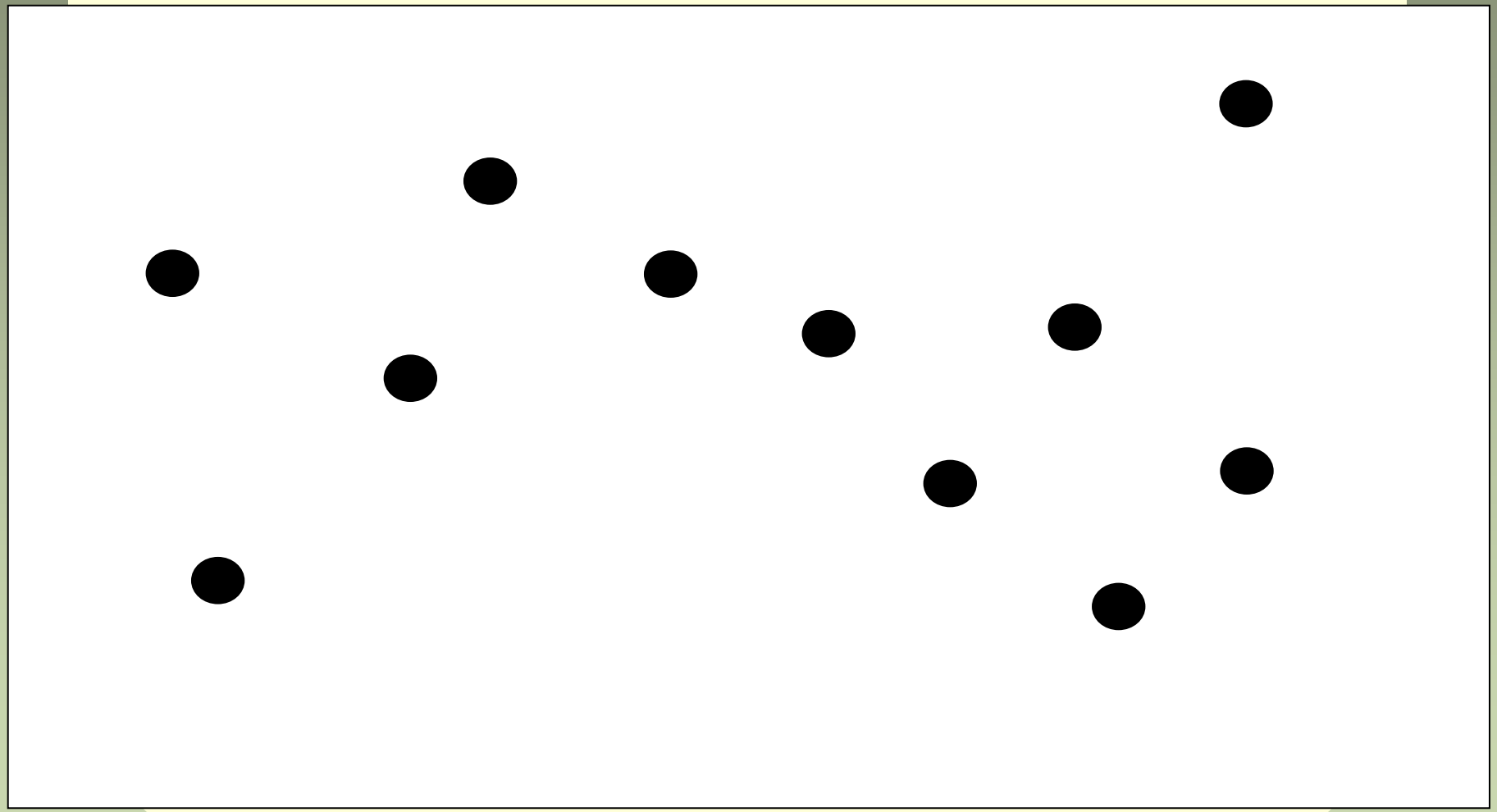
- Delineate the spatial network of sage-grouse across range-wide distribution
- Identify leks and regions important for maintaining connectivity within the spatial network
- Relate change in connectivity (lek persistence) to environmental variables

Northern Wyoming

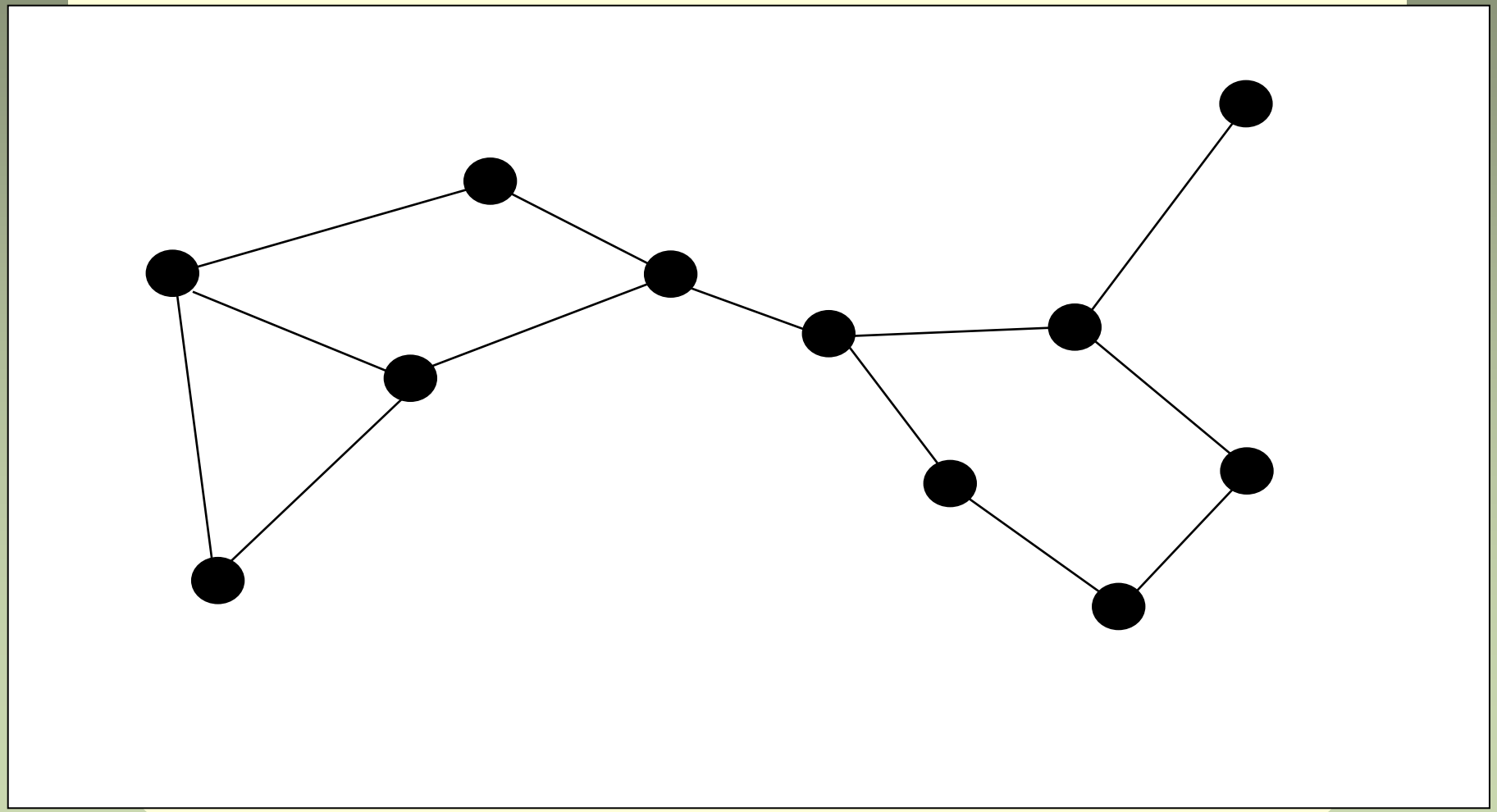
Greater Sage-grouse Populations



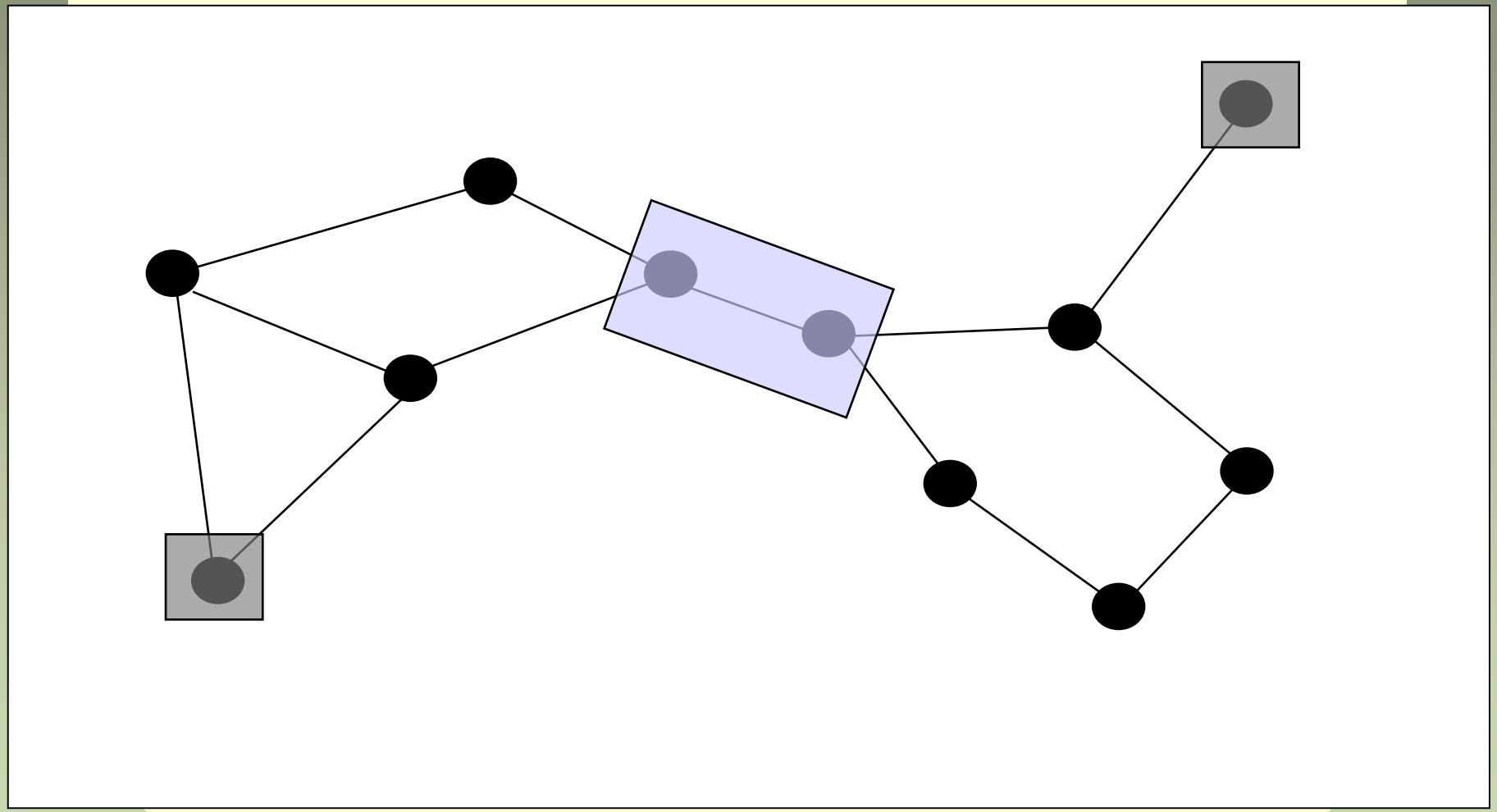
Graph Analysis: Nodes (vertices)



Graph Analysis: Links (edges)



Graph Analysis: Stepping Stones



Probability of Connectivity

Number of leks

Size of leks *i* and *j*

Product of all probable steps (dispersal distance) between *i* and j

$$PC = \frac{\sum_{i=1}^{n} \sum_{j=1}^{n} \overbrace{a_i a_j} p_{ij}^{*}}{A_L^2}$$

Total number of sage-grouse

Connectivity varies with:

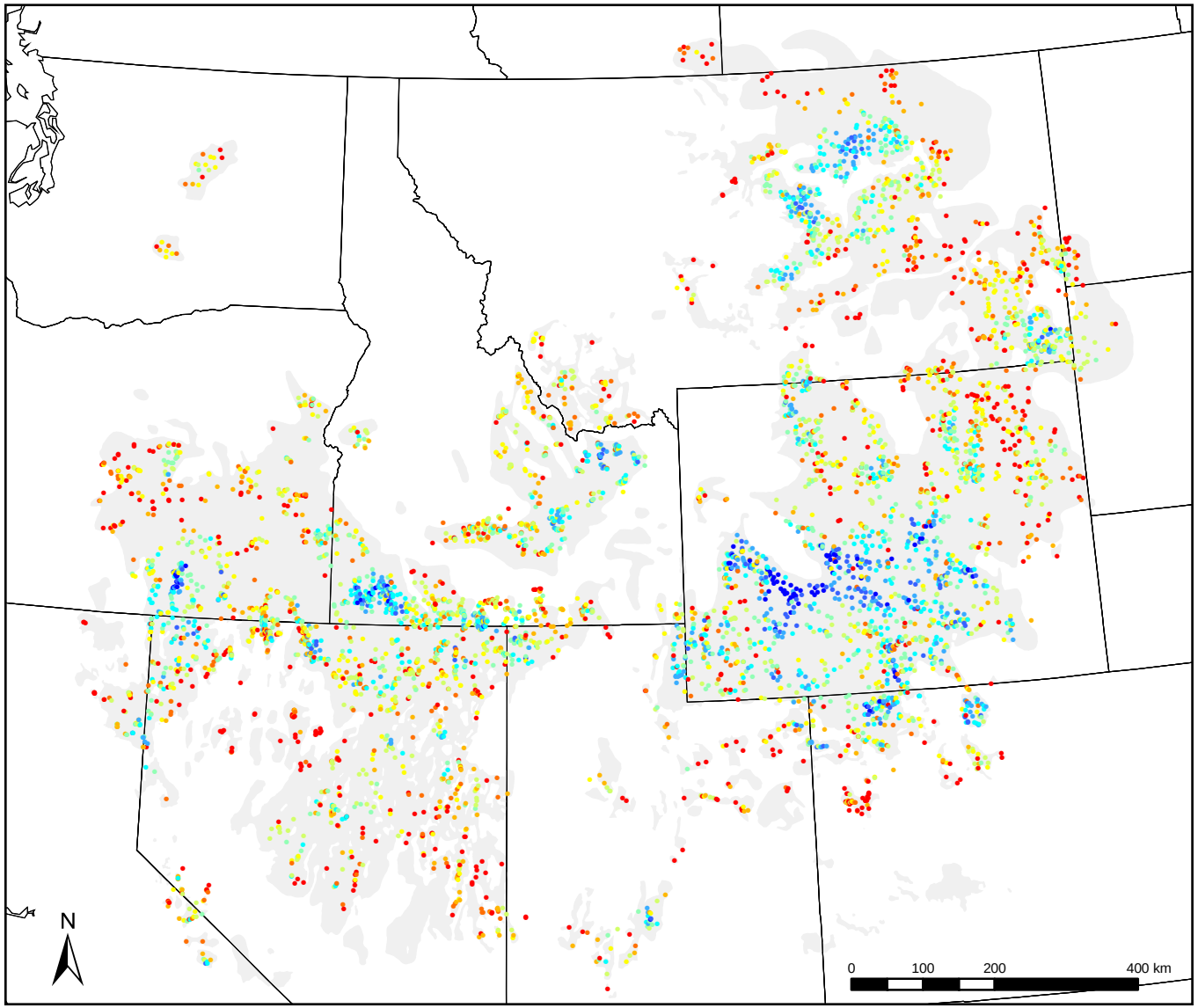
(1) distance between leks

(2) differences in lek size

(3) loss of connected leks

(4) loss of key stepping stone leks

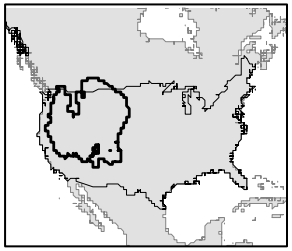
Lek Importance

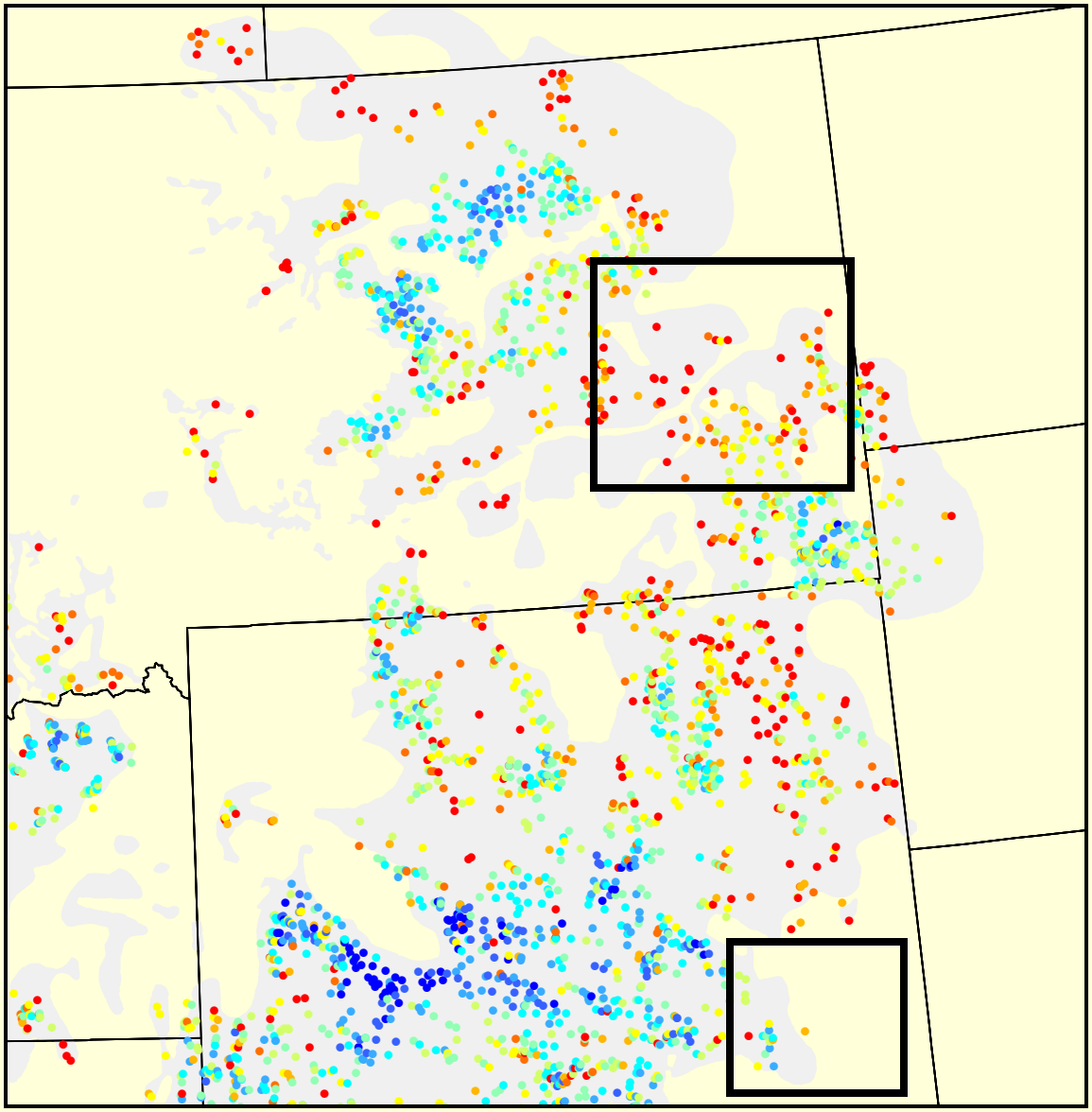


Lek Importance

- 0 - 0.001
- 0.001 - 0.002
- 0.002 - 0.004
- 0.004 - 0.008
- 0.008 - 0.016
- 0.016 - 0.032
- 0.032 - 0.064
- 0.064 - 0.128
- 0.128 - 0.256
- 0.256 - 1.123

State/Province Boundaries





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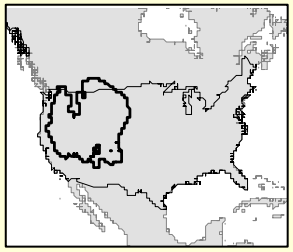
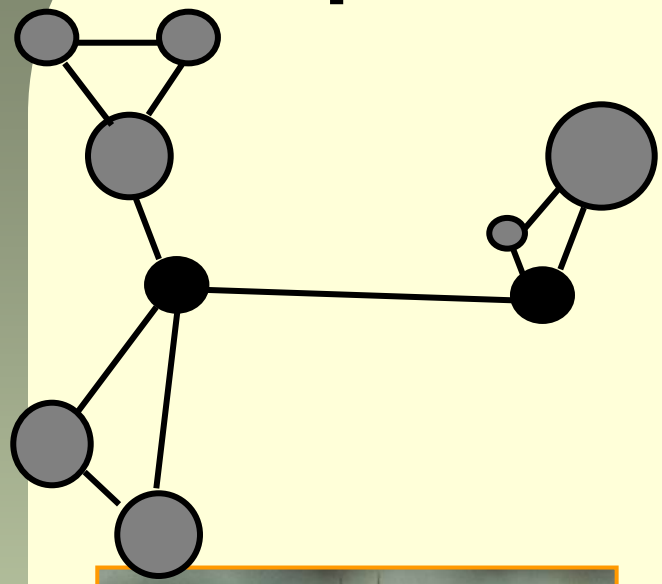
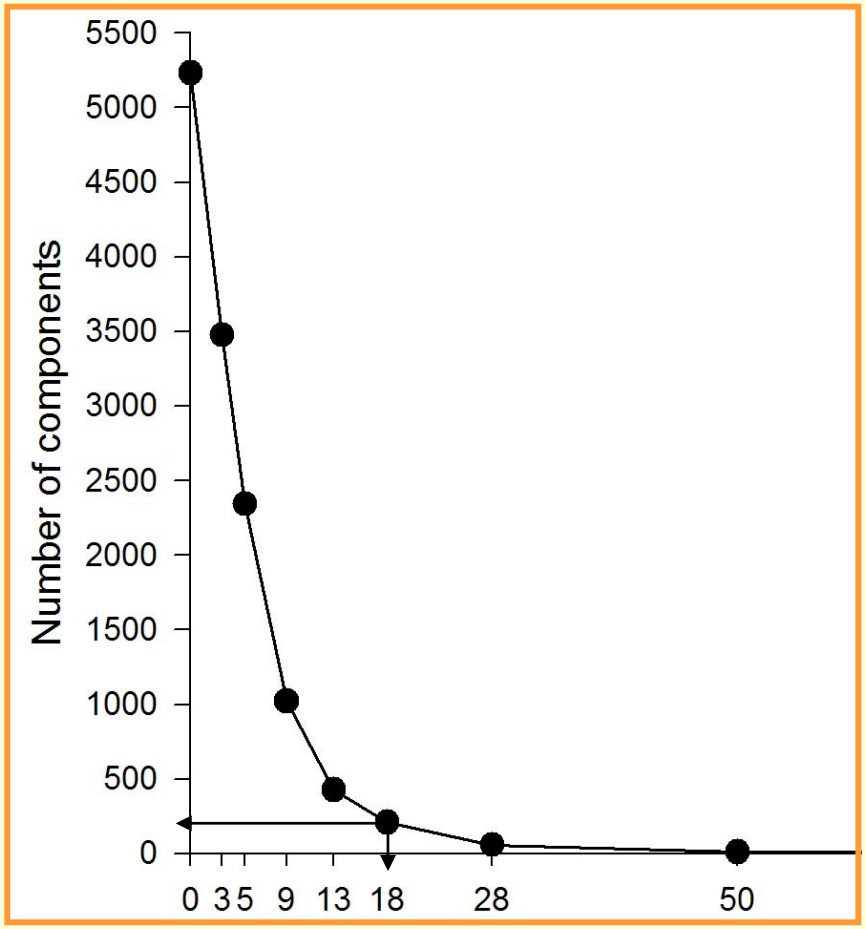
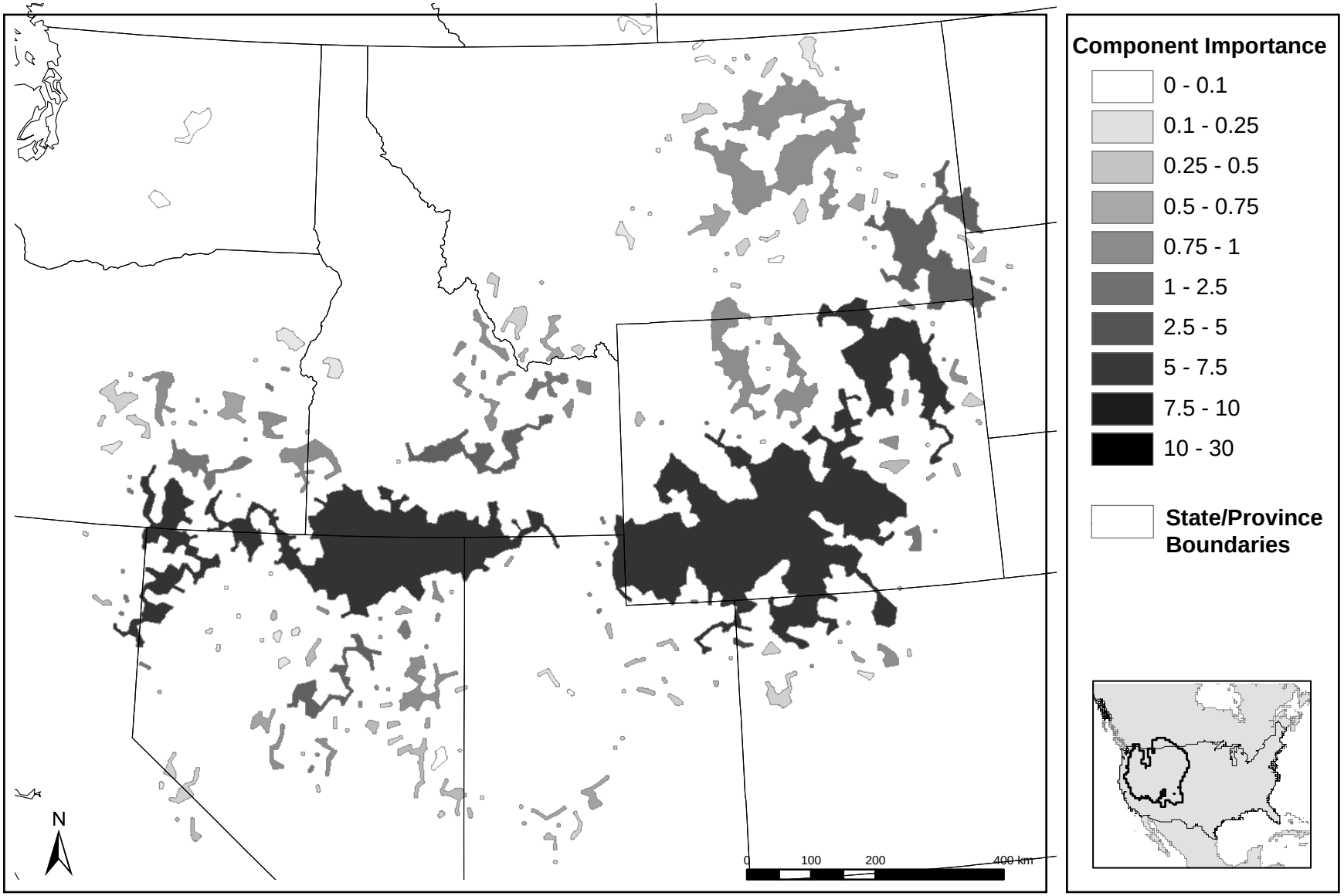


Population Components

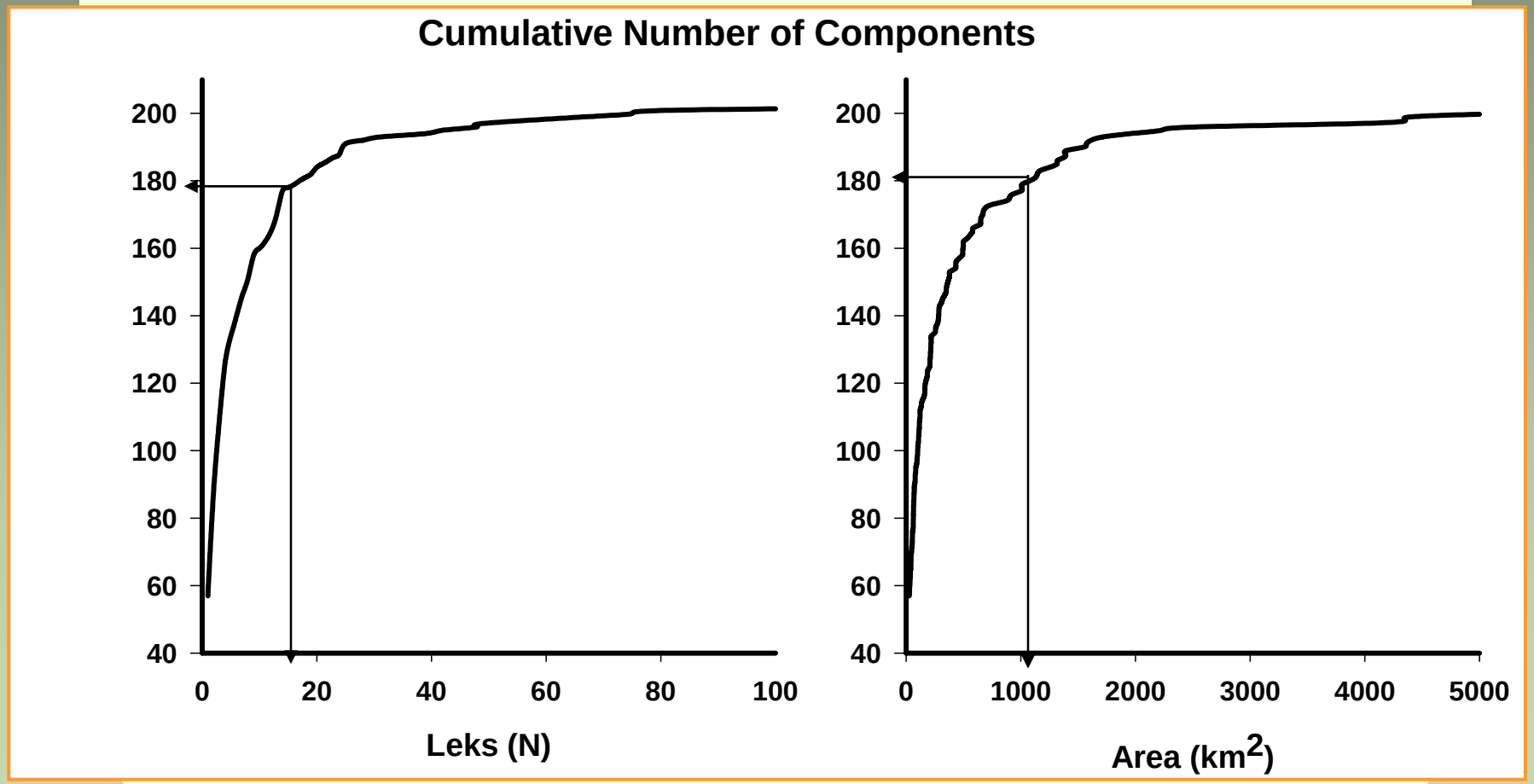




Sage-Grouse: Components



Sage-Grouse Components: Size and Area



Loss of Connectivity

1965-1974

Leks (N)	789
Interval	1965-1974
Count (avg)	25.1
dPC	0.20
Link dist.(km)	8.85
Links (N)	3,758
Links/lek	4.76
gamma	0.80

1980-1989

Leks (N)	630	
Interval	1965-74	1980-89
Count(avg)	27.1	20.1
dPC	0.21	0.22
Link dist.(km)	8.77	8.71
Links (N)	2,962	2,740
Links/lek	4.70	4.35
gamma	0.79	0.73

Leks (N)	159
Interval	1965-1974
Count (avg)	16.8
dPC	0.14
Link dist.(km)	9.14
Links (N)	796
Links/lek	5.01

1998-2007

Leks (N)	455		
Interval	1965-74	1980-1989	1998-07
Count (avg)	29.2	23.6	22.0
dPC	0.24	0.26	0.27
Link dist.(km)	8.64	8.57	8.30
Links (N)	2,087	1,957	1,553
Links/lek	4.59	4.30	3.41
Gamma	0.77	0.72	0.57

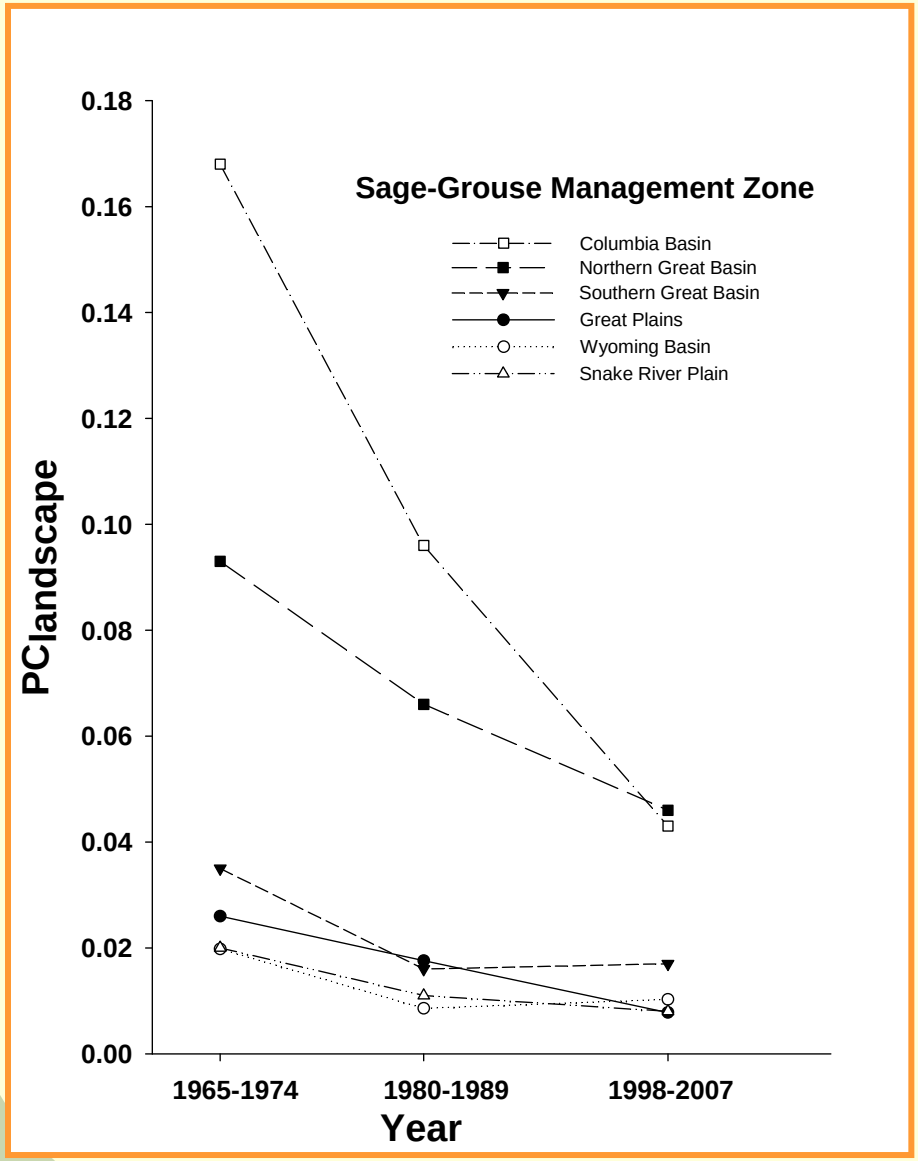
Leks (N)	175	
Interval	1965-1974	1980-1989
Count(avg)	21.6	11.1
dPC	0.16	0.11
Link dist.(km)	9.12	9.01
Links (N)	875	783
Links/lek	5.00	4.47

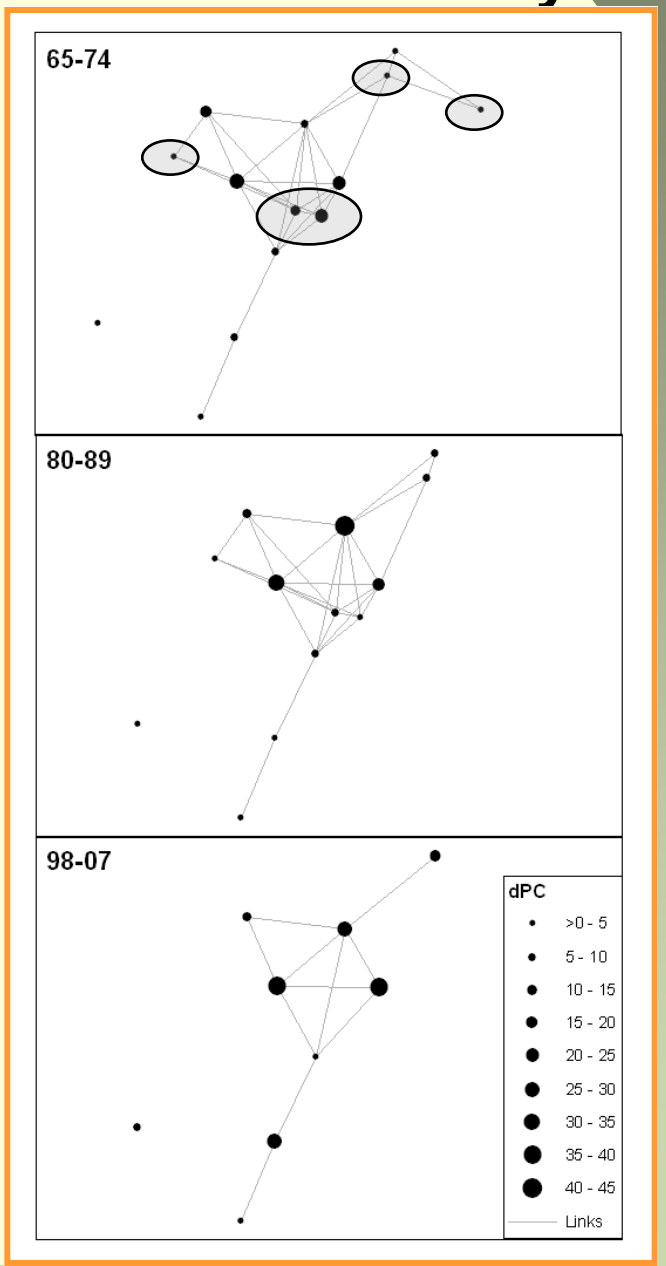
Persist

Abandoned

1. **Larger leks**
2. **Higher importance**
3. **Less isolated leks**

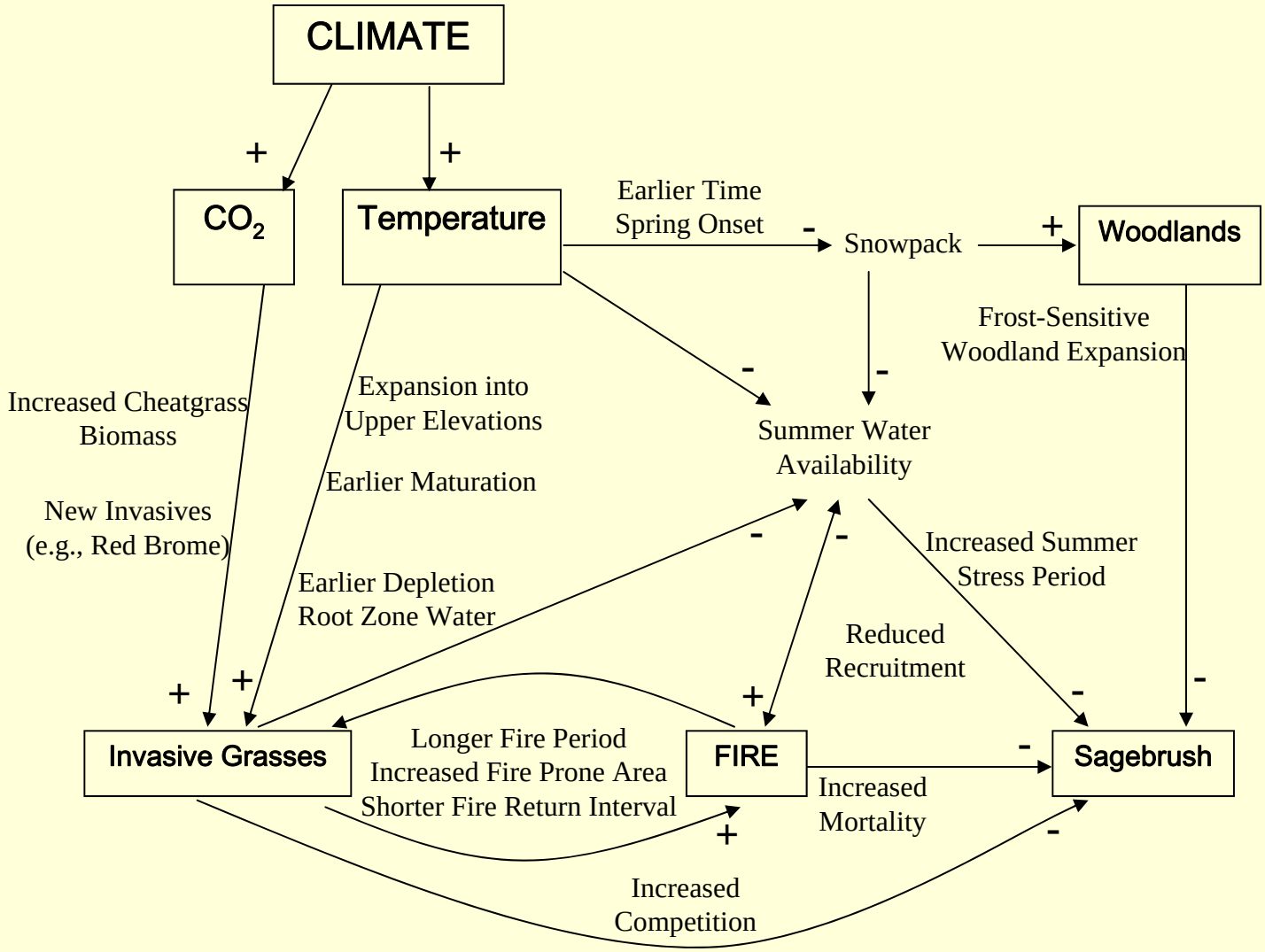
Temporal Changes in Sage-Grouse Connectivity





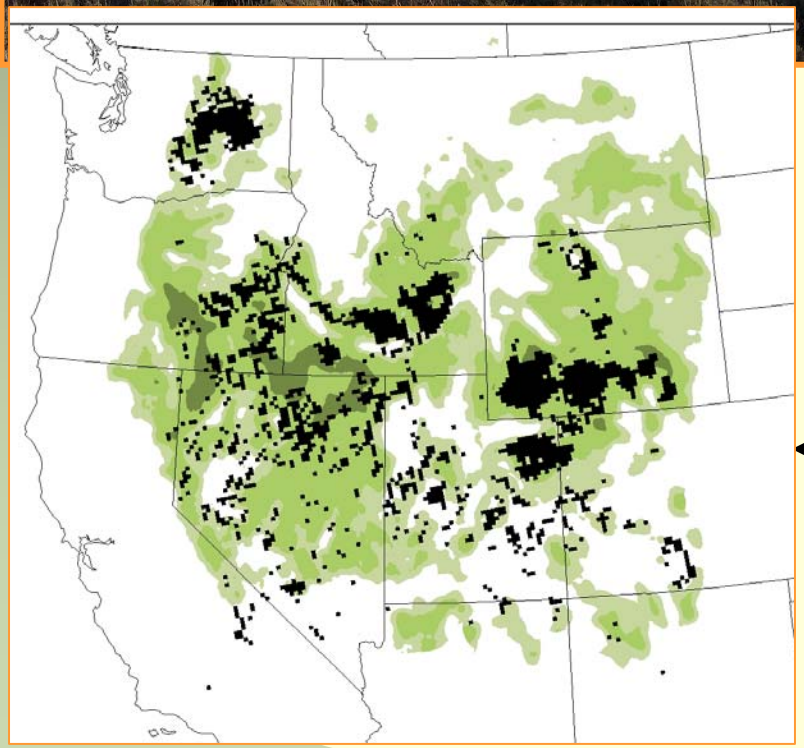
Hazard Model: Lek Persistence

					95% CI	
Variable	Buffer (km)	Coefficient	se	Hazard ratio	lower	upper
Lek Connectivity (dPC)		-1.18	0.43	0.31	0.16	0.58
Fire	54	2.12	0.52	9.00	3.25	24.95
Human Footprint	5	0.27	0.07	1.31	1.15	1.50

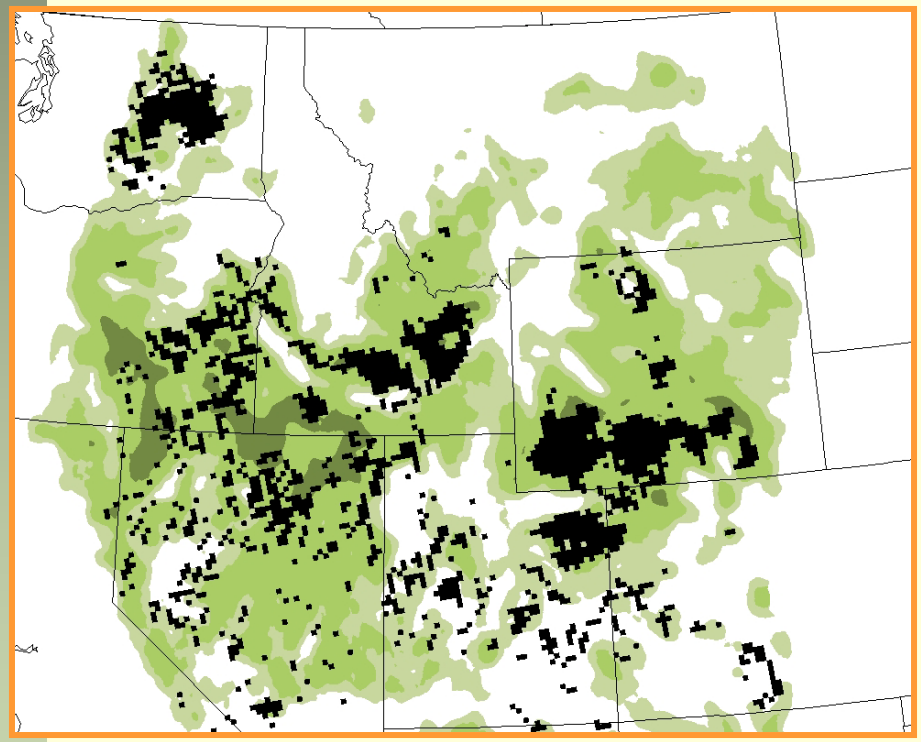

CLIMATE
+
+
CO_2
Temperature
Earlier Time
Spring Onset
-
Snowpack
+
Woodlands
Frost-Sensitive
Woodland Expansion
-
-
Increased Cheatgrass
Biomass
Expansion into
Upper Elevations
Summer Water
Availability
Earlier Maturation
New Invasives
(e.g., Red Brome)
-
-
Increased Summer
Stress Period
Earlier Depletion
Root Zone Water
Reduced
Recruitment
+
+
+
-
-
Invasive Grasses
Longer Fire Period
Increased Fire Prone Area
Shorter Fire Return Interval
FIRE
-
Sagebrush
Increased
Mortality
+
-
Increased
Competition

Sagebrush
Climate change

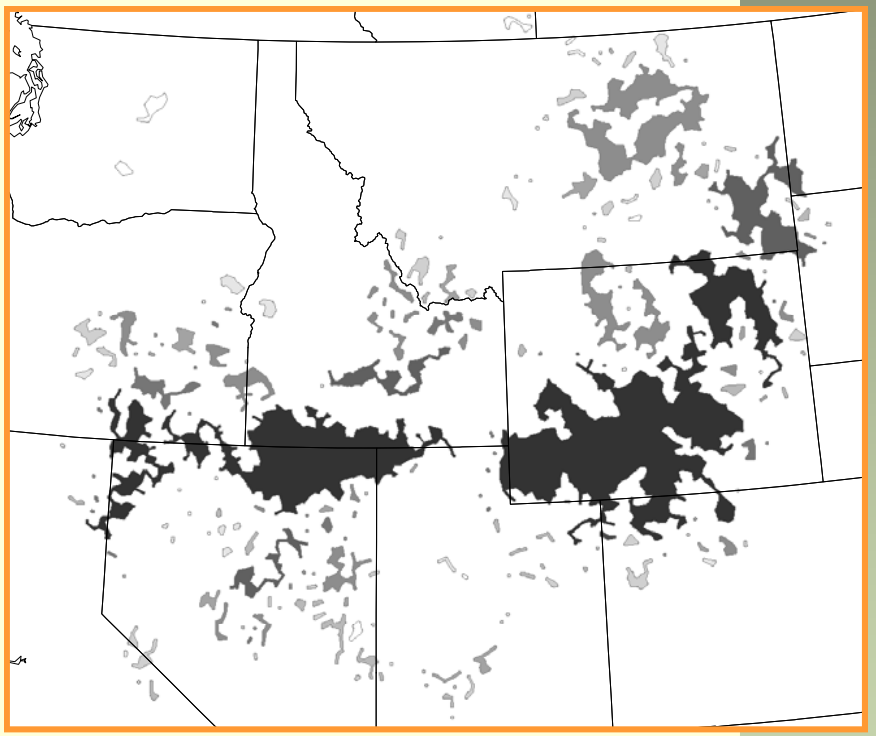
Increased CO_2
Increased temperature
Increased extreme weather events
Warmer winters
Earlier onset of spring
Decreased summer precipitation



Predicted Sagebrush Distribution



Current Sage-Grouse Distribution



Summary and Implications

- Connectivity across Sage-Grouse range delineated by important leks and regions
- Range-wide distribution may consist of numerous relatively small interconnected units
- Leks that persisted were larger and more connected to other leks in the spatial network.
- Disturbance rather than habitat variables were important determinants of lek persistence

Southwestern Idaho

Conclusions

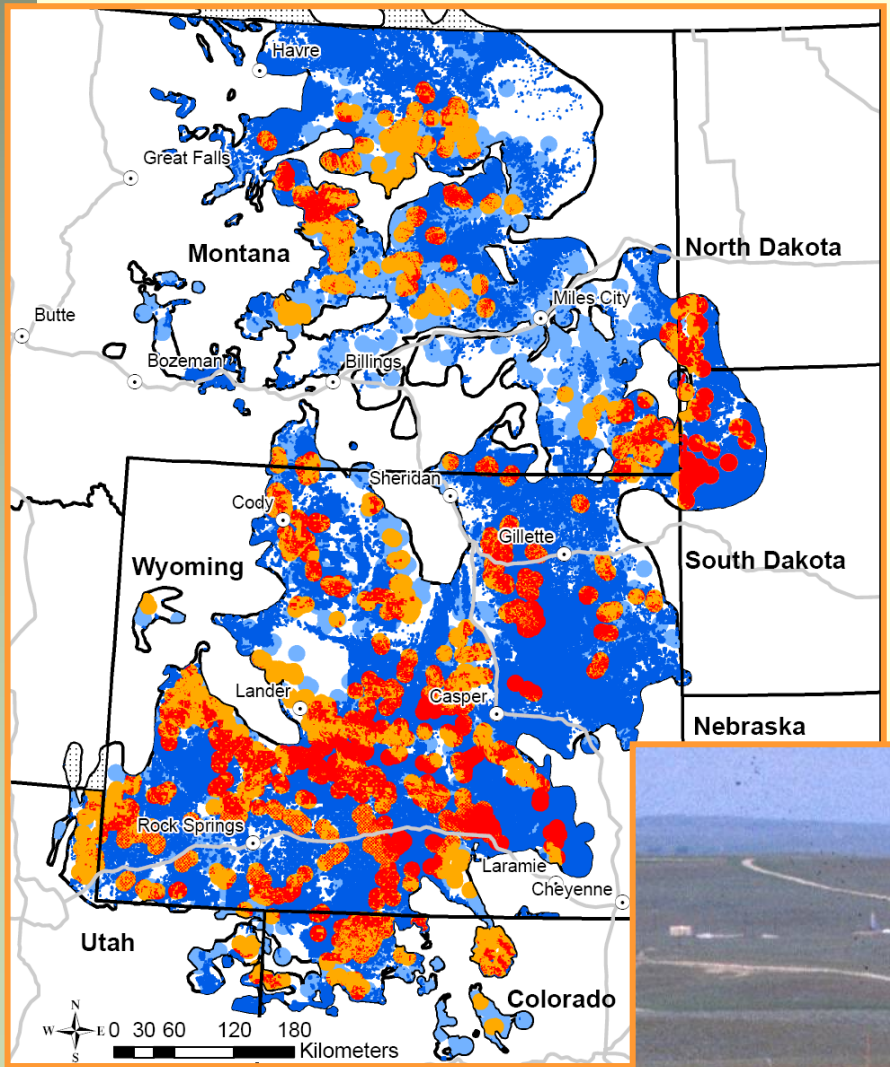
- Sage-grouse populations reduced
- Immediate stressors on sagebrush are invasive plant species, fire, human footprint
- Connectivity and core areas concepts delineated high priority areas for conservation and restoration
- Climate change

History and our current use of the vast landscapes dominated by sagebrush can tell us much about land use, priorities, values, and resource management. The future will tell others about the effectiveness of conservation actions we implement today.

(Knick and Connelly, Introduction)

Sage-Grouse and Energy

Core areas



Sage-Grouse	Potential Energy Development
High	High
High	Low
Low	Low
Low	High