Agenda Item 7

Progress Update for Greater Sage-Grouse Habitat Modeling and Mapping

Presentation overview

1. Brief overview of habitat modeling process

2. New data layers and targeted products
   - New land-cover layers – higher resolution
   - New seasonal and updated annual habitat maps

3. Work flow timeline and delivery date

1. Modeling Process

1) **Compile GIS layers**

2) Overlay telemetry points and generate random points

3) Extract environmental information from points

4) Estimate model parameters (coefficients) of each environmental factor by contrasting the used from the random points

5) Predict the probability of occurrence for each grid cell using the model parameters

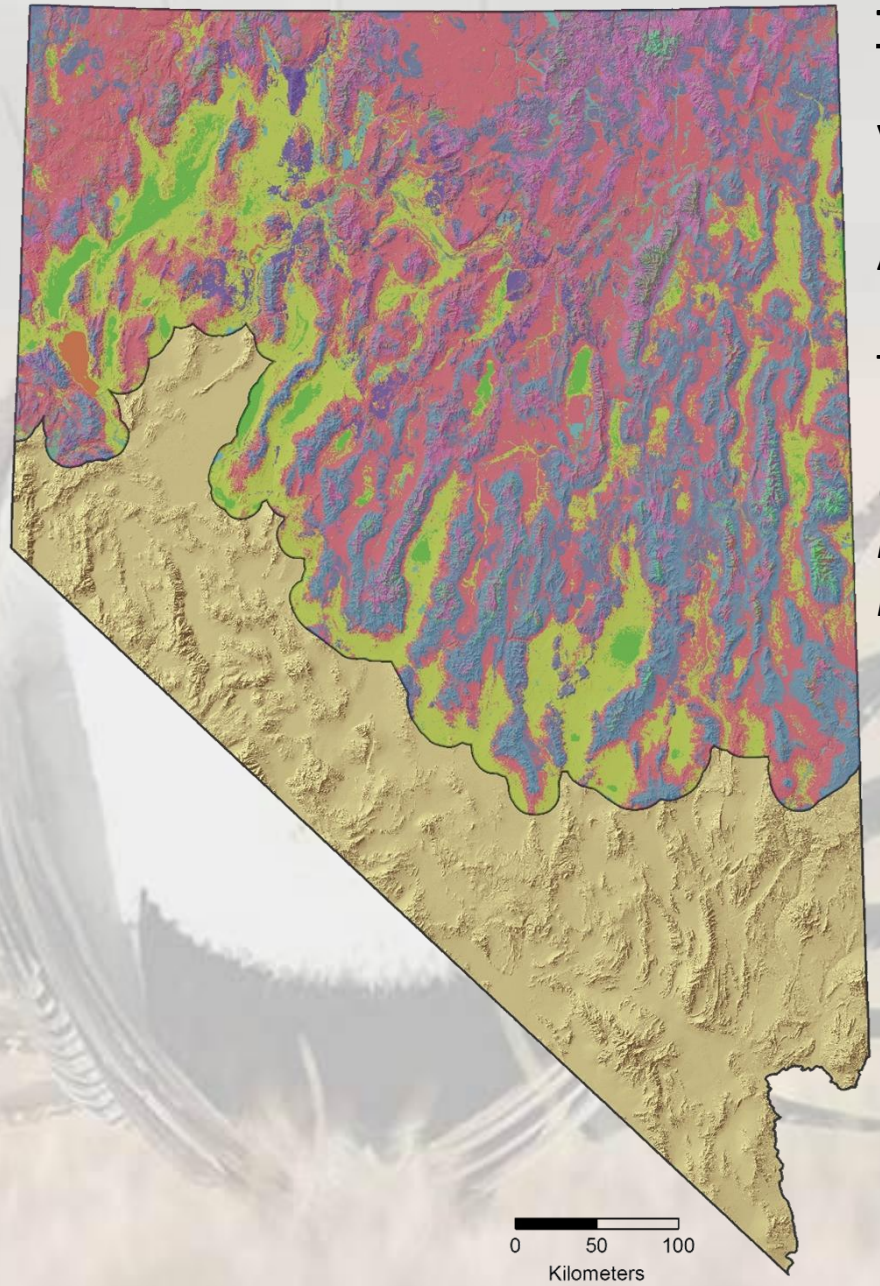
6) Create habitat suitability and management categories

Defining the Modeling Extent

Used existing PMU boundaries (10 km)

Approximated potential sage-grouse range

GIS Input Variables



Typical Covariates

Vegetation Communities

Agricultural Areas

Topographic Indices

Usually based on coarse resolution (≥ 30-m) imagery

-

1. Modeling Process

1) Compile GIS coverages for all areas

2) **Overlay telemetry points and generate random points**

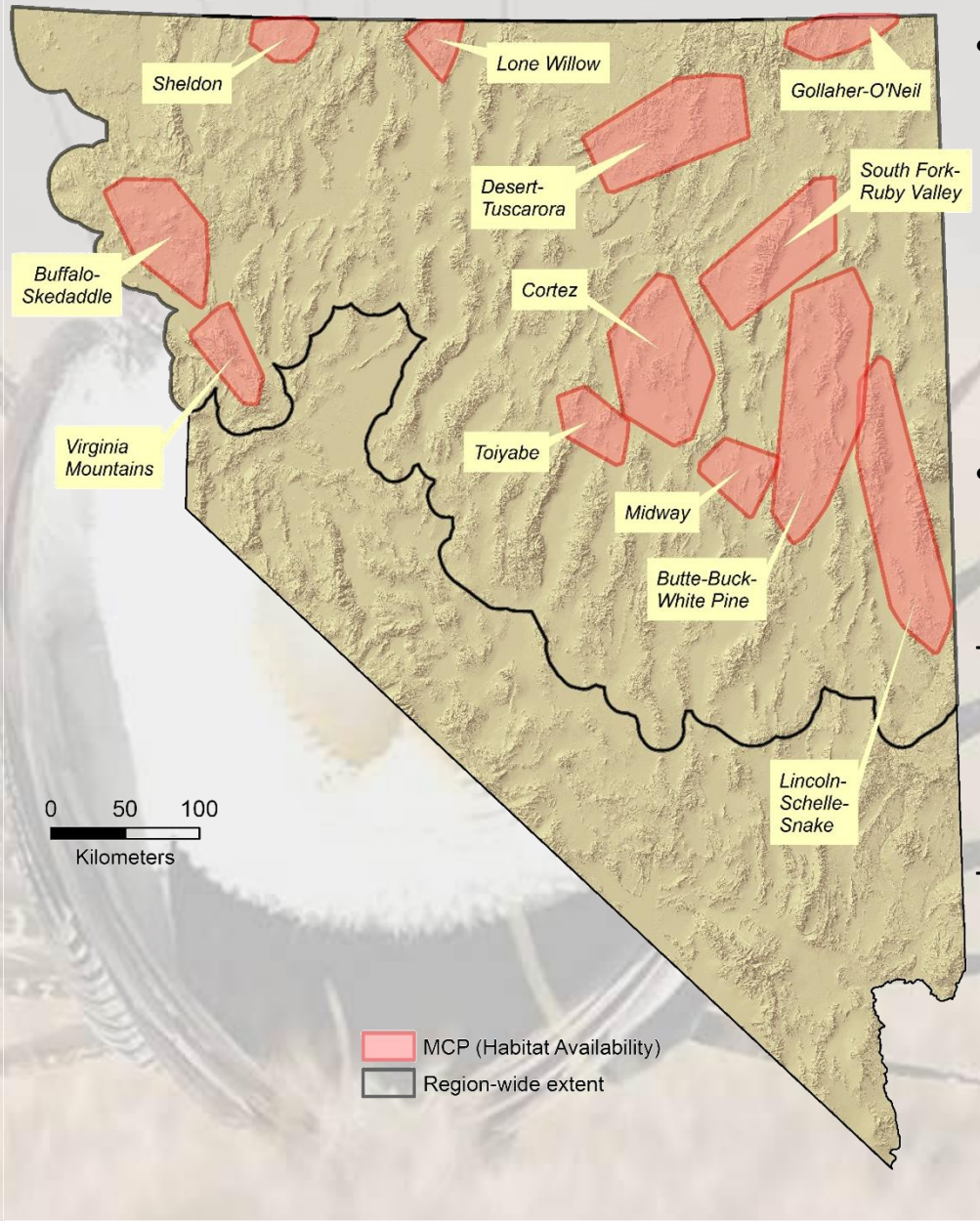
3) **Extract environmental information from points**

4) **Estimate model parameters (coefficients) of each environmental factor by contrasting proportions of used to random points**

5) Predict the probability of occurrence for each grid cell using the model parameters

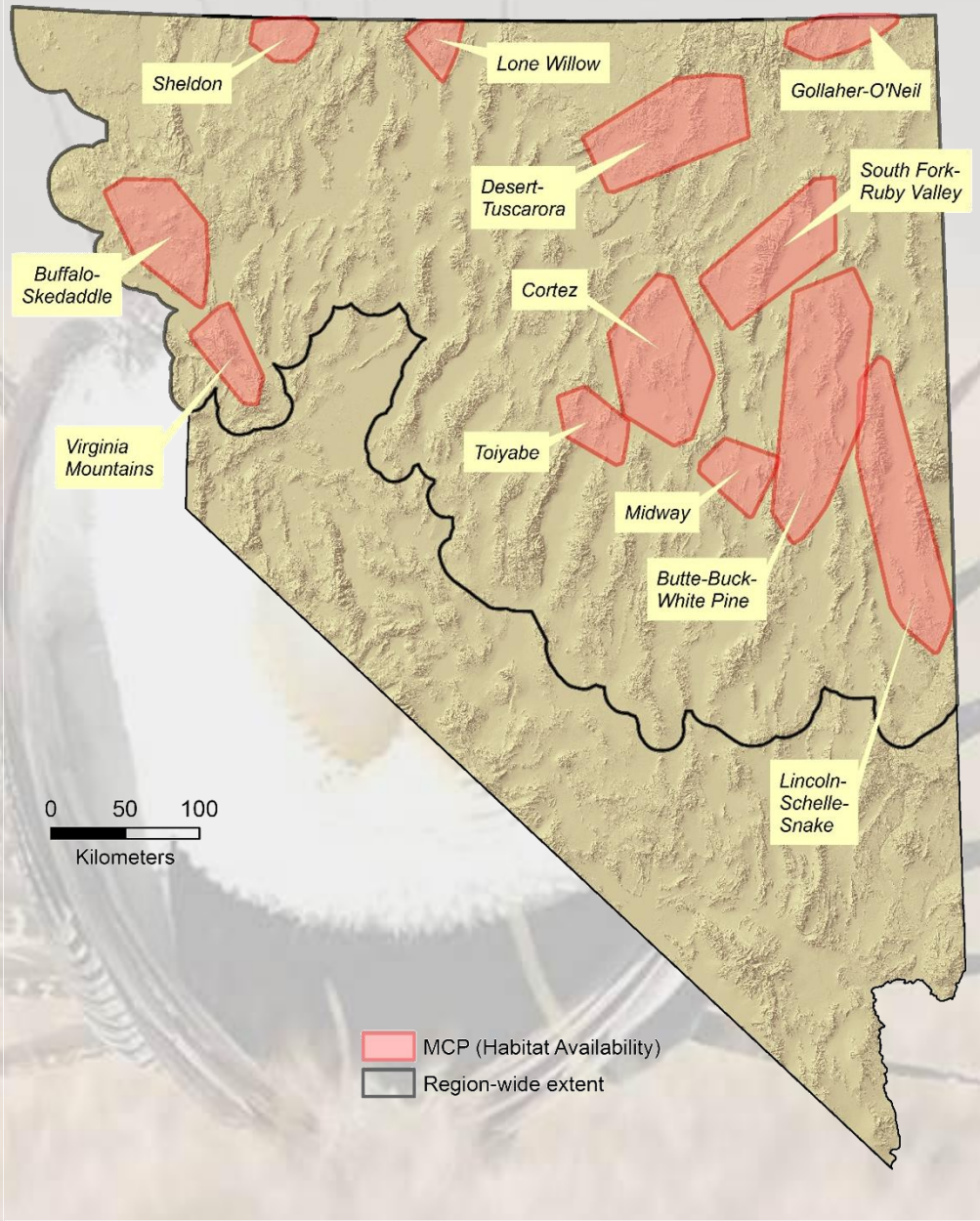
6) Create habitat suitability and management categories

Sub Regional Modeling



- Created 12 sub-regions for individual modeling based on PMUs and grouse movements
- >10 years of telemetry data
- > 31,000 telemetry location
- > 1,500 sage grouse

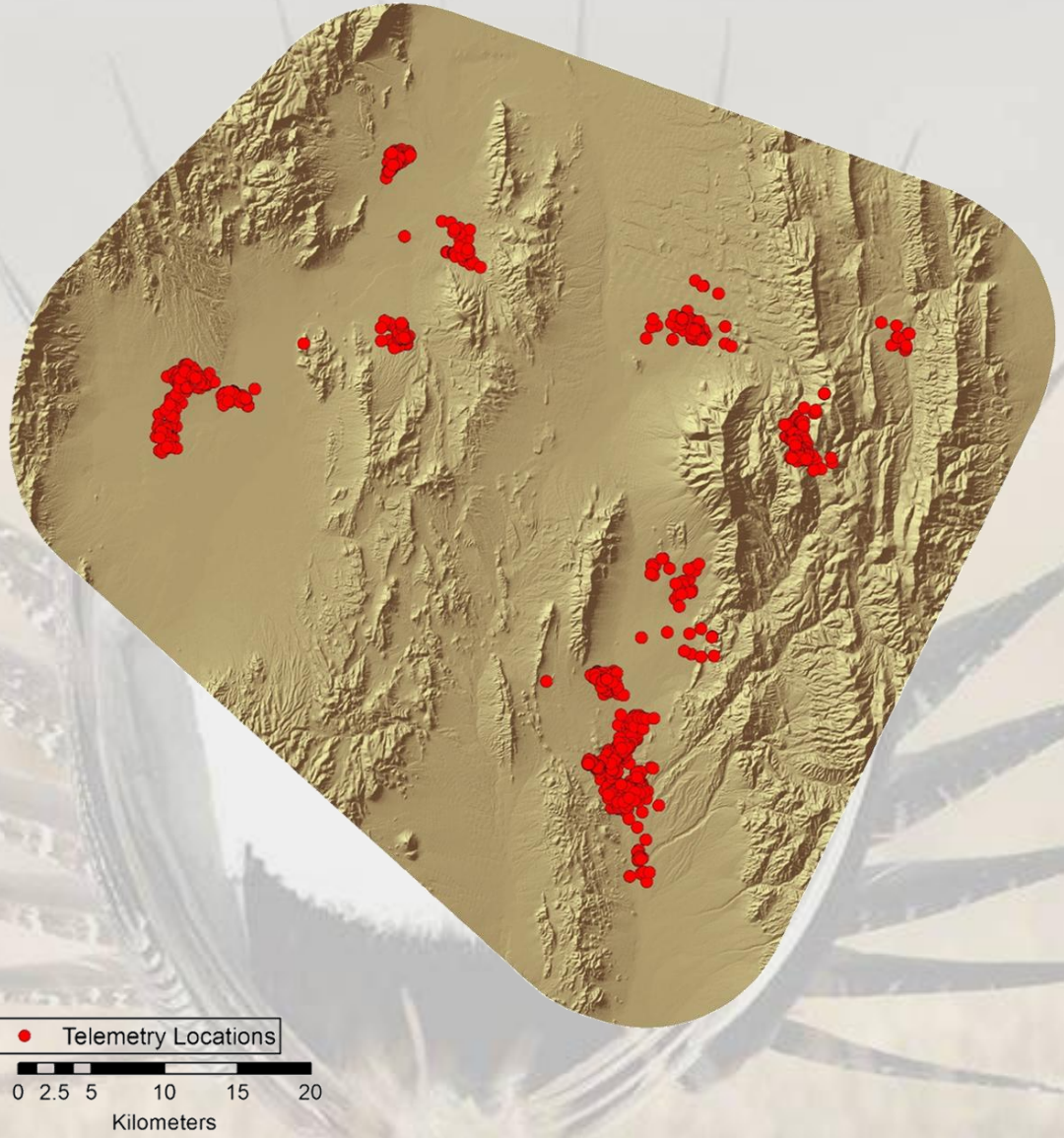
Sub Regional Modeling



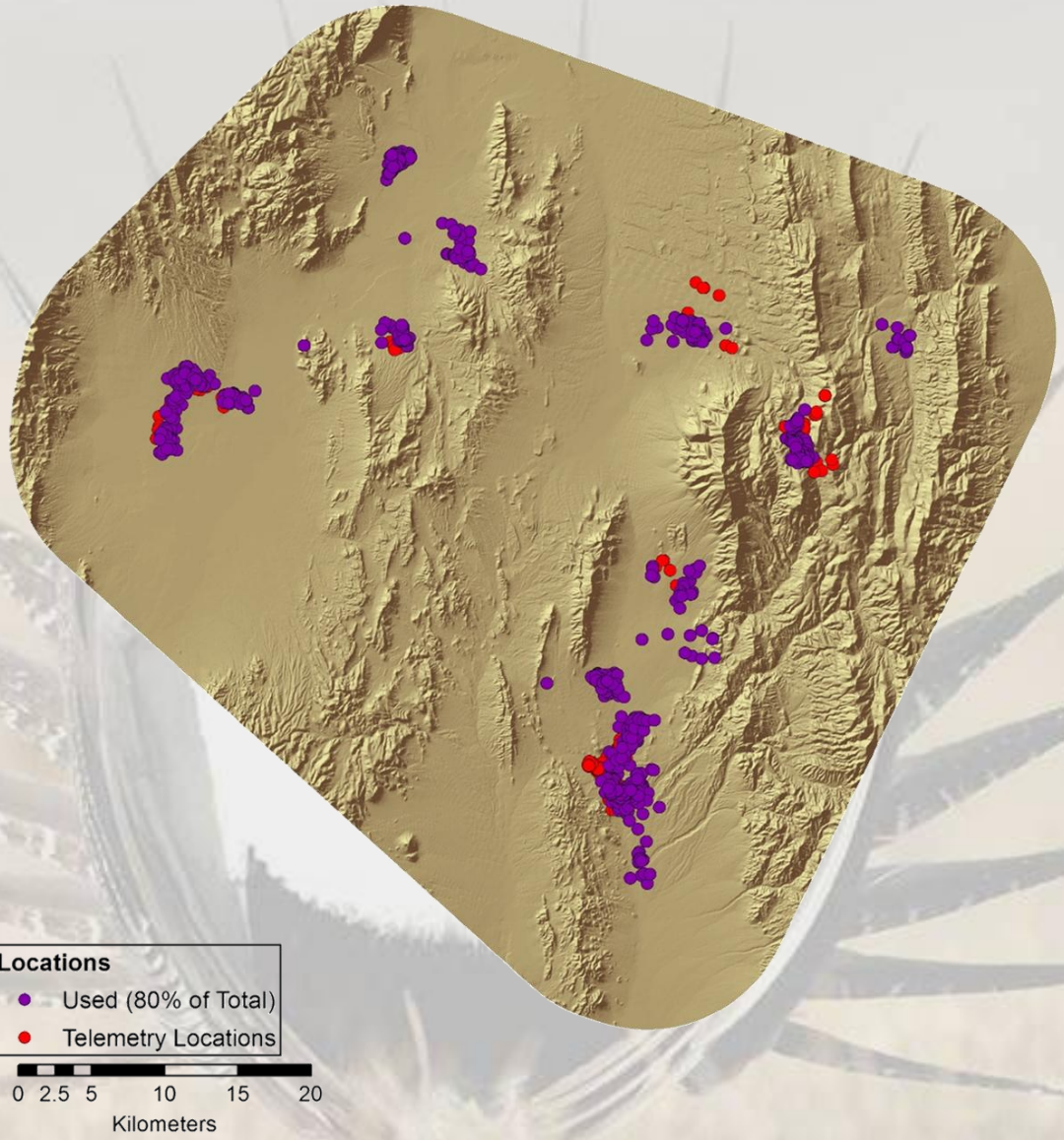
Three independent location datasets for each sub-region:

- **Model Training**
- **Categorization**
- **Validation**

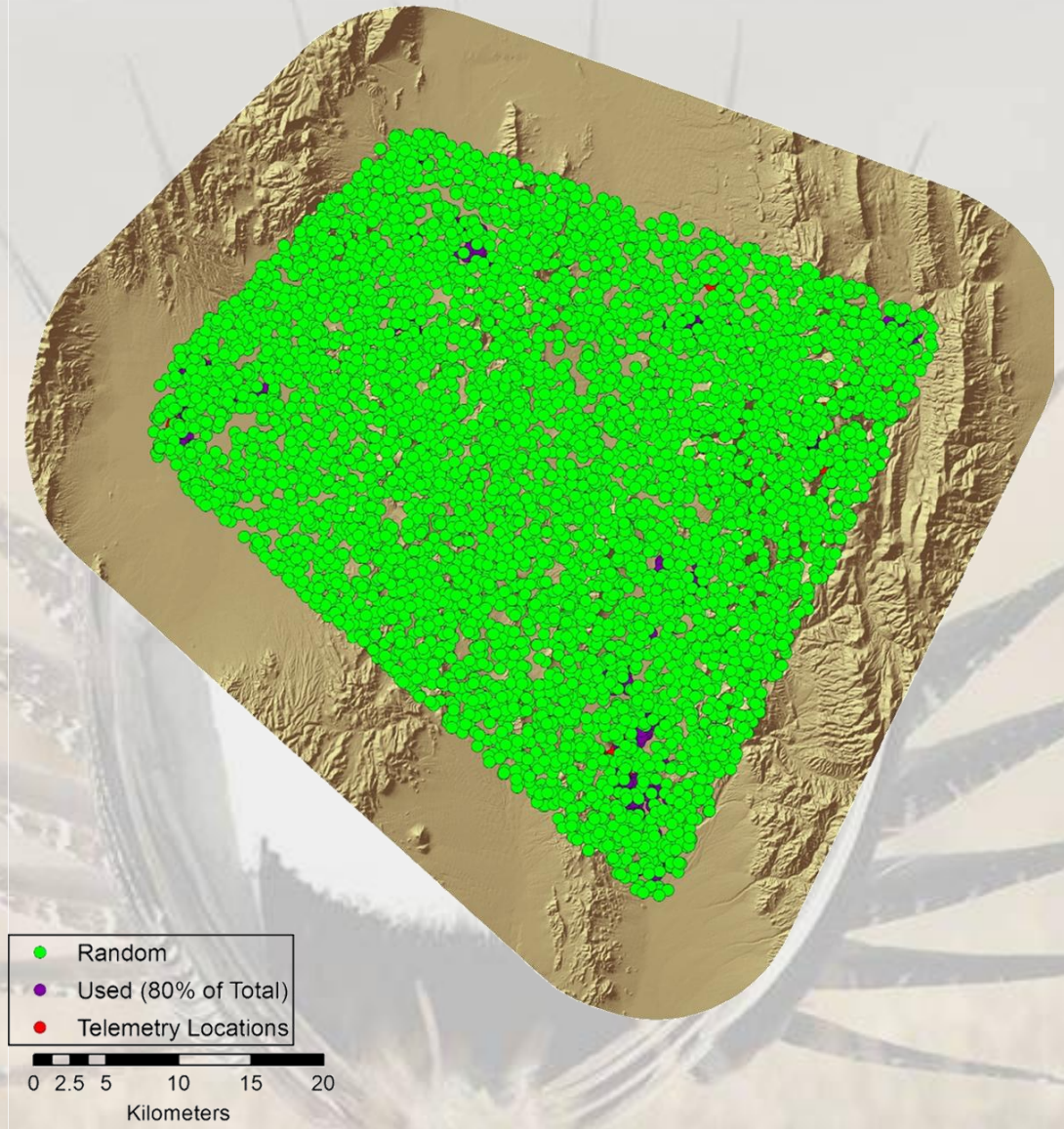
Use vs. Availability



Use vs. Availability



Use vs. Availability



1. Modeling Process

1) Compile GIS coverages for all areas

2) Overlay telemetry points and generate random points

3) Extract environmental information from points

4) Estimate model parameters (coefficients) of each environmental factor by contrasting the used from the random points

5) Predict the probability of occurrence for each grid cell across the project extent using the model parameters

6) Create habitat suitability and management categories

Habitat Suitability Index (HSI)

- Average sub-regional (n =12) RSF maps across the modeling extent
- Measures a relative probability of selection
- Continuous Index (0 to 1)

1. Modeling Procedure

1) Compile GIS coverages for all areas

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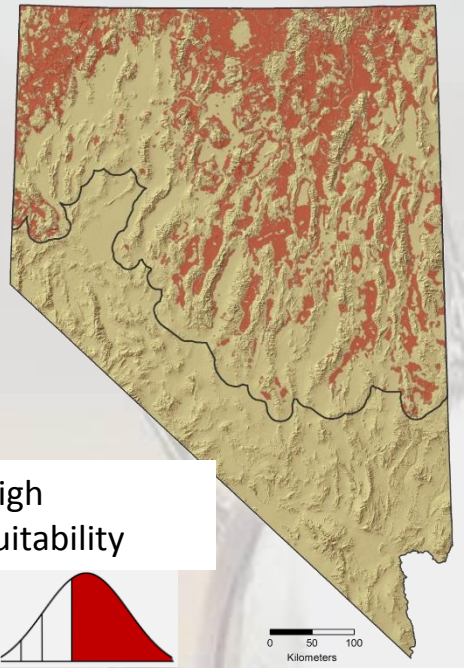
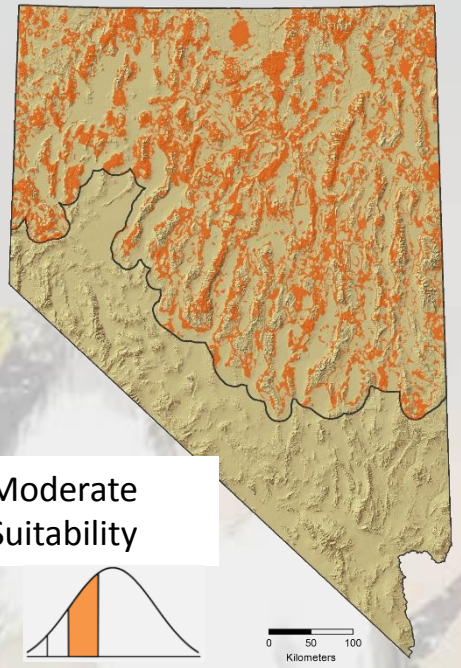
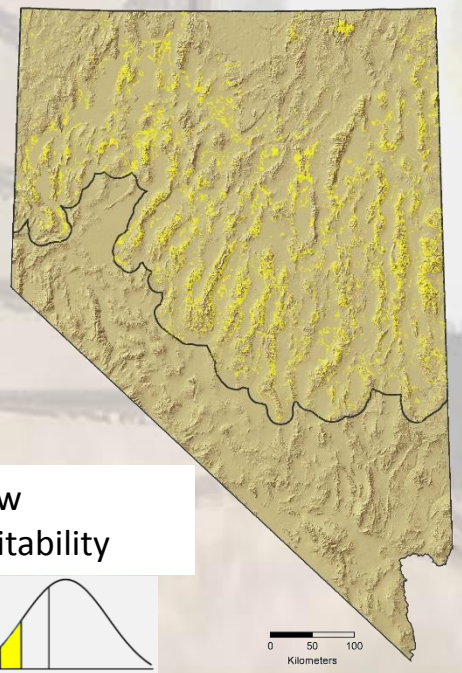


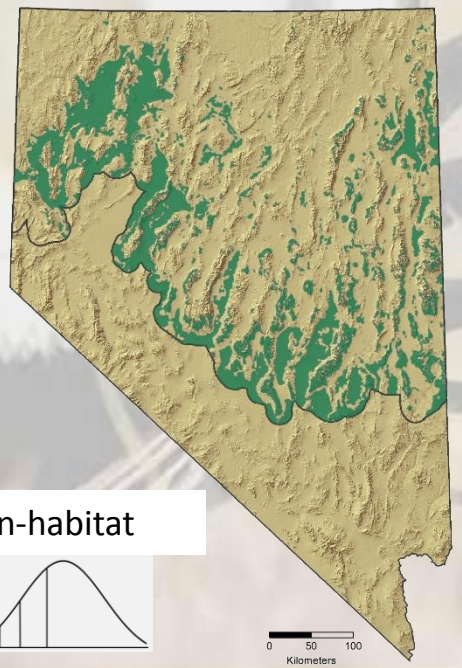
High Suitability



Moderate Suitability



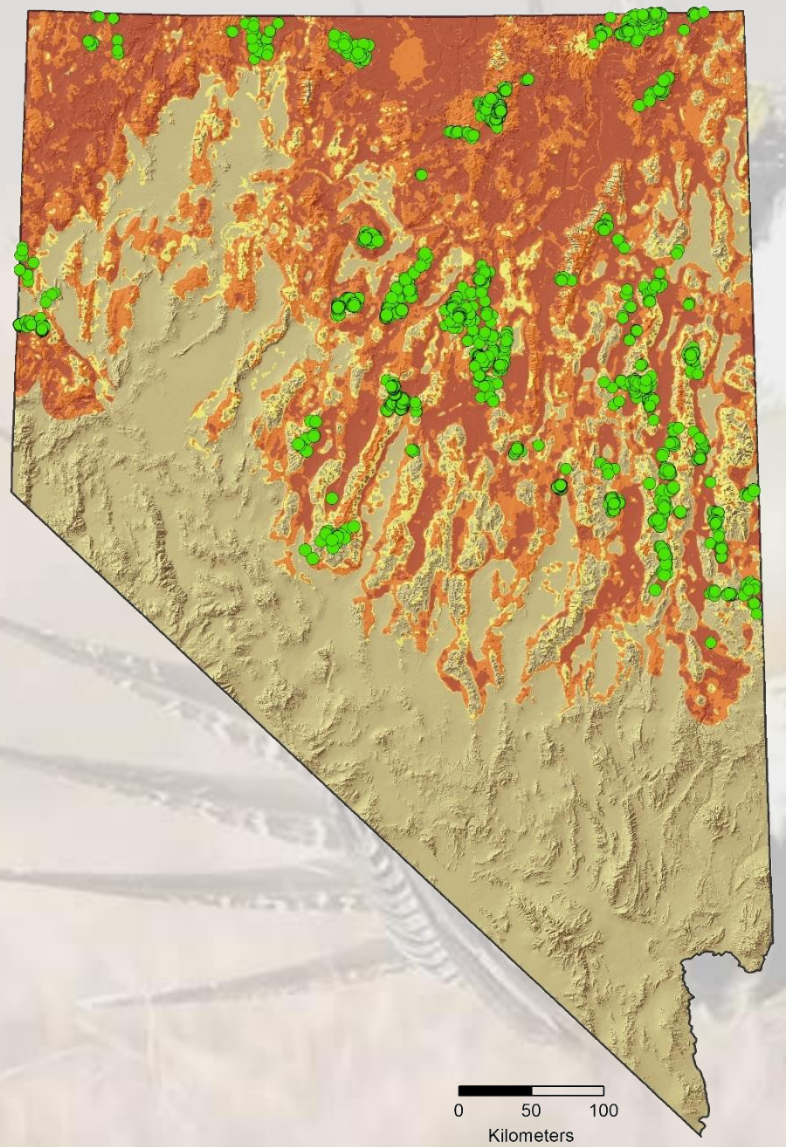
Low Suitability



Non-habitat

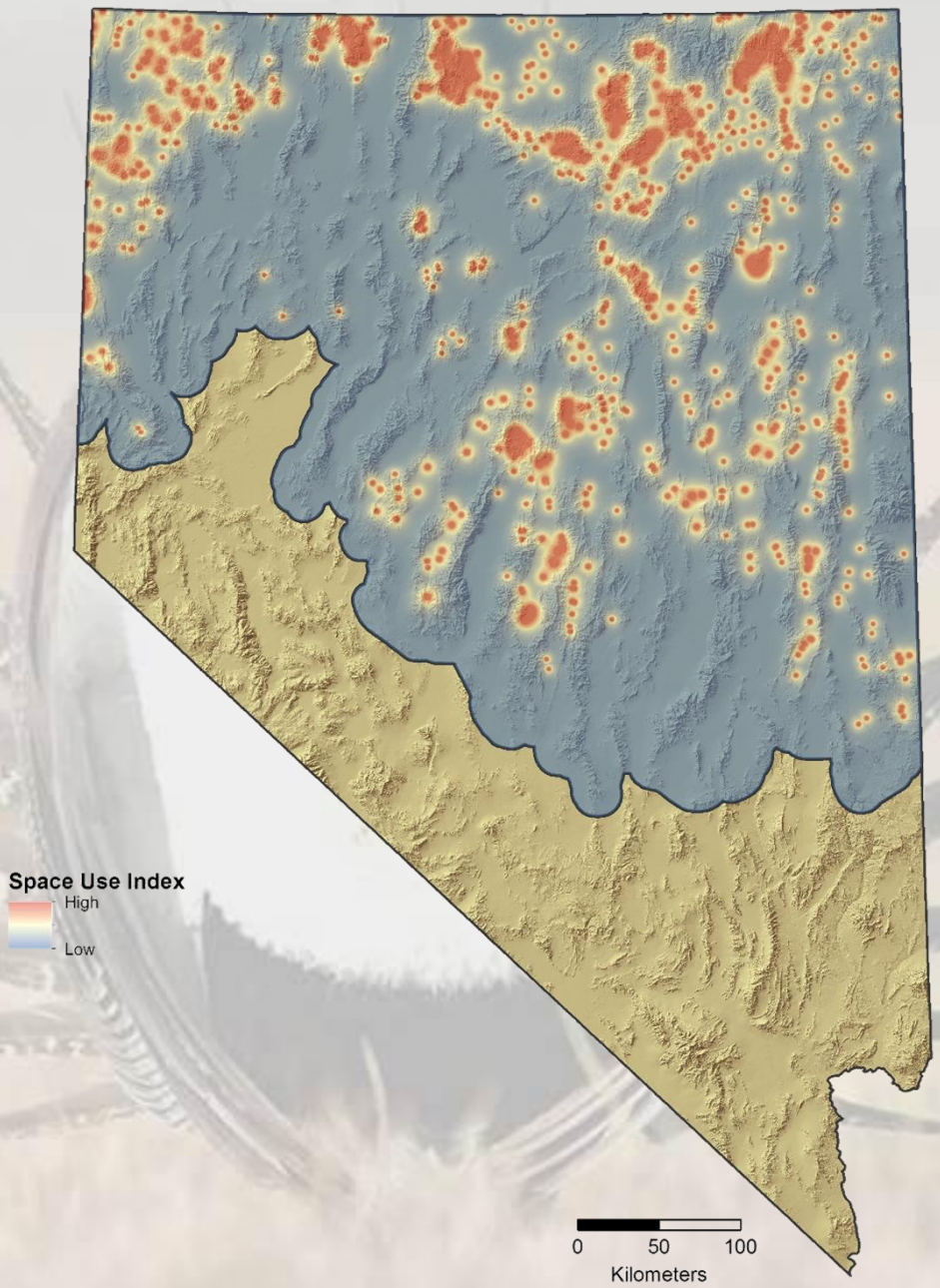
- **Extract HSI values to categorization data set (originally set aside)**
- **Use variance of the HSI distribution to determine suitability cutoffs (e.g. standard deviations)**

Validate Categories



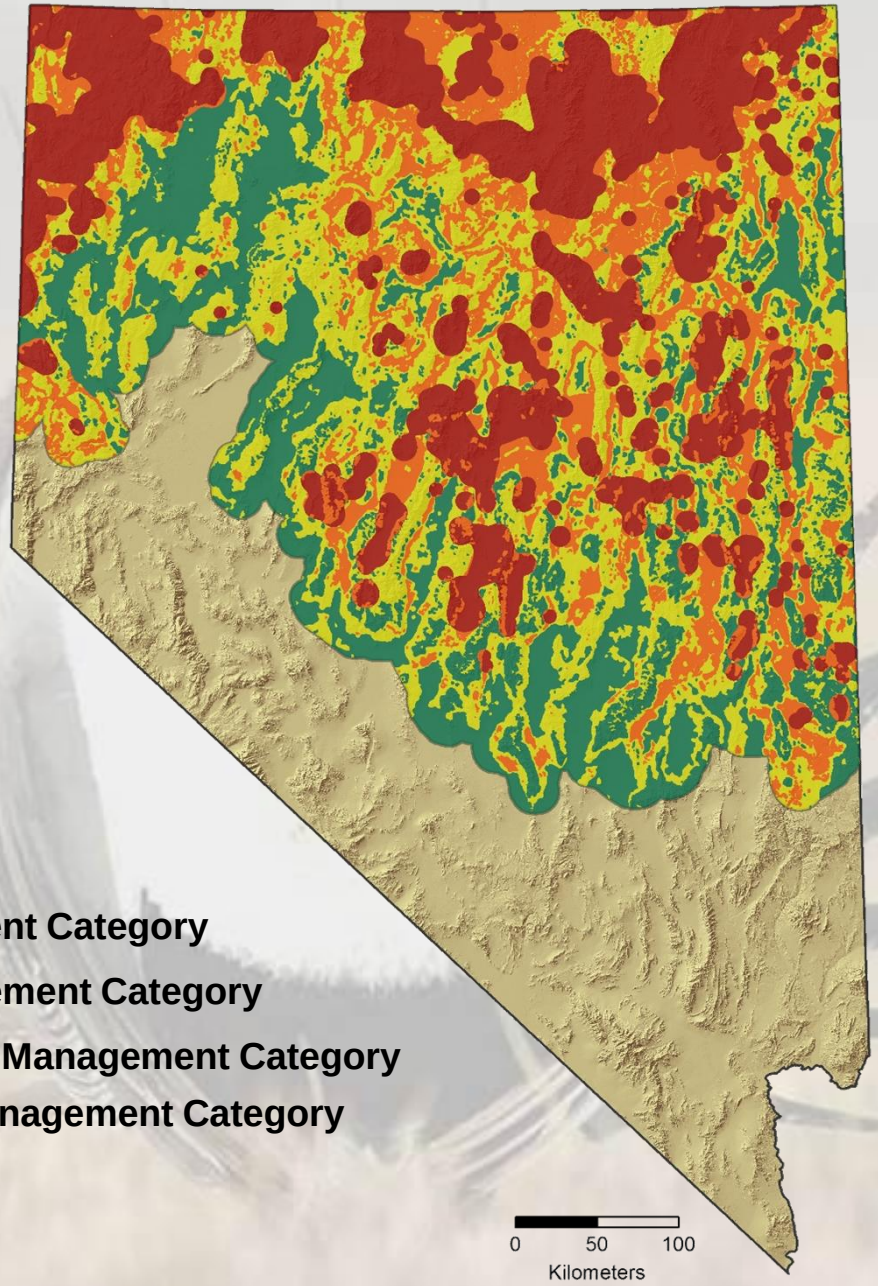
Category	Expected	Observed
High	69%	68%
Moderate	15%	20%
Low	9%	7%

Space Use Index (SUI)



- **Product of lek density, sage-grouse abundance, and distance to lek**
- **Use the 85% percentile to delineate ‘high use’**

Management Categories



- Management categories based on intersection of habitat suitability and space use
- Classification cutoffs and categories set by management team (e.g., SETT)

Core Management Category

Priority Management Category

Low to General Management Category

Non-Habitat Management Category

2. New data layers and methods

- Original map is quite good, but we can do better
- Provide the best product using the best available and ‘hot of the press’ data
- ‘Worth the wait’, better in = better out

Existing Information

GIS layers

(Good)	**Existing vegetation layers with low resolution (i.e., 30-m LANDSAT based**
(Better)	High resolution map layers (i.e., < 2m)

Sage-grouse data

Good	**Map annual habitat while accounting for seasonal differences)**
(Better)	Map seasonal habitat relevant to sage-grouse life history and annual habitat

New Information

GIS layers

(Good) Existing vegetation layers with low resolution (i.e., 30-m LANDSAT based)

(Better) High resolution layers (i.e., < 2m)

Sage-grouse data

(Good) Map annual habitat while accounting for seasonal differences)

(Better*) Map seasonal habitat relevant to sage-grouse life history stages

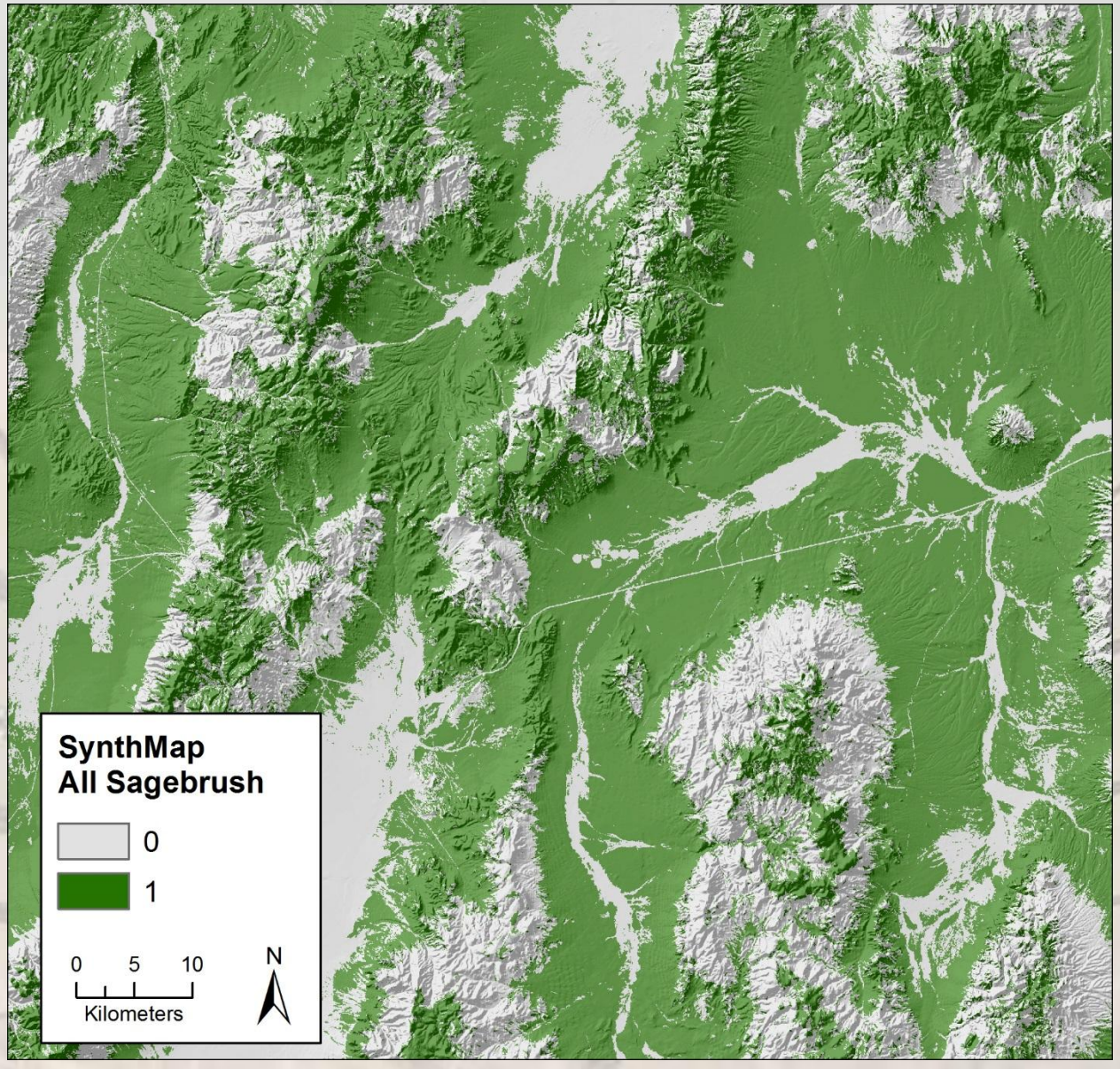
New High Resolution Land-Cover

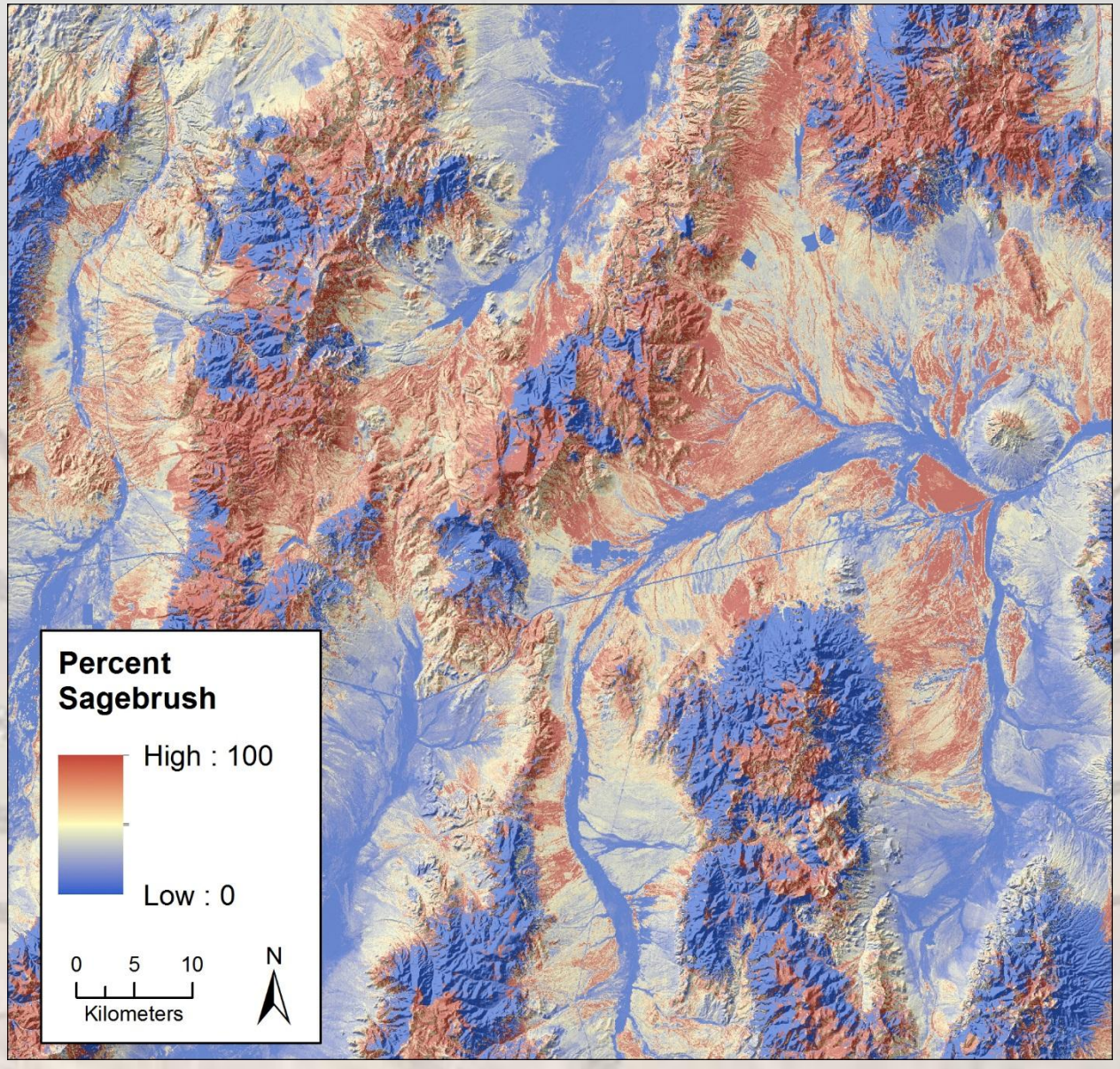
- Sagebrush Ecosystem Quantification Products for the Great Basin
  - USGS-Earth Resources Observation Sciences Lab (C. Homer)

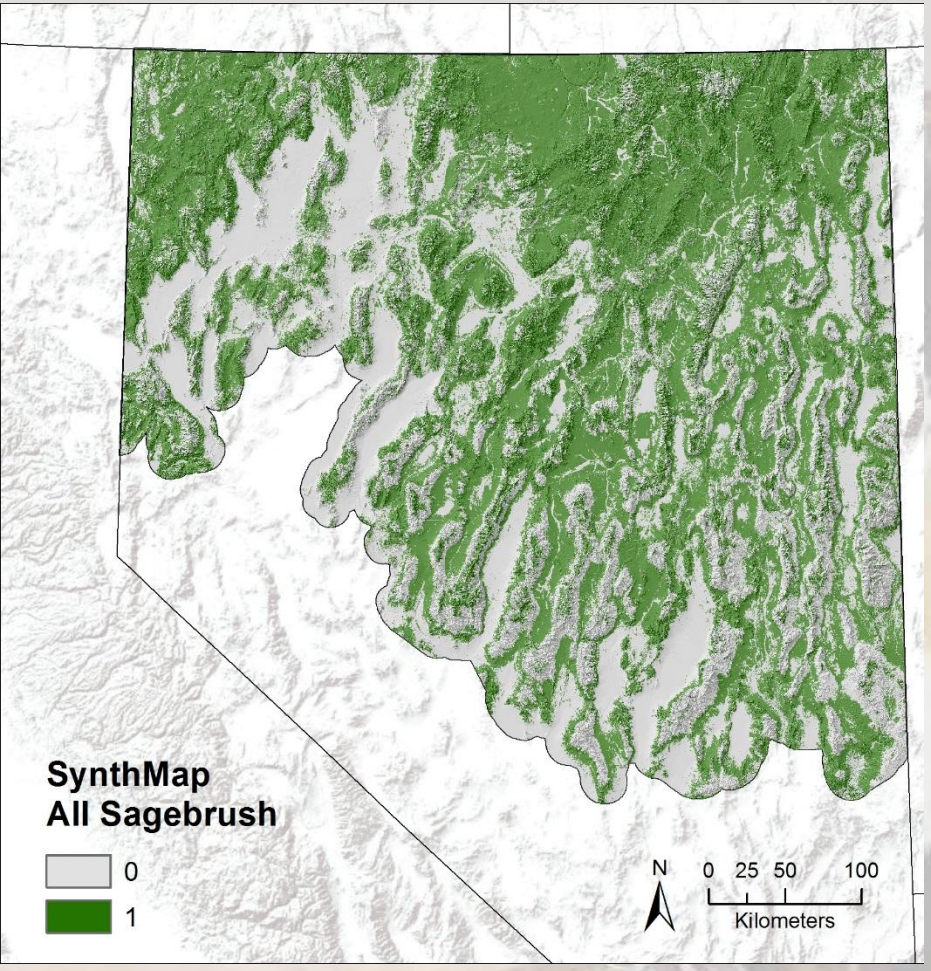
- Integrates high-resolution WorldView 2 (< 2m) satellite imagery with larger scenes of Landsat 8 (30-m) imagery

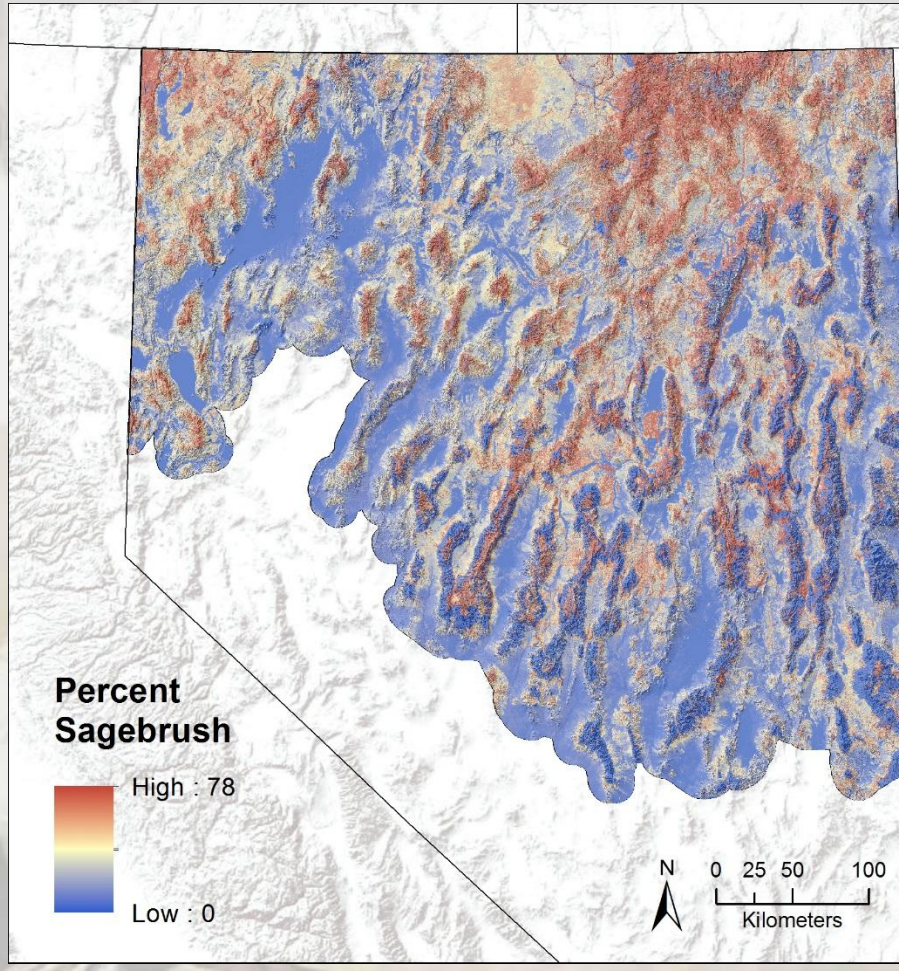
- Model output = 30-m pixels with landcover expressed as percent cover (0 – 100%)

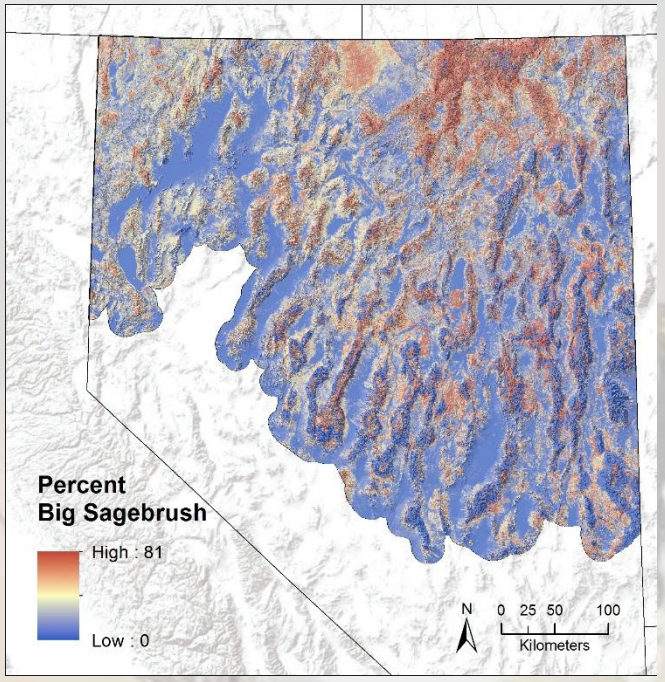
- In contrast, Landsat-based Nevada SYNTH map expresses landcover as a binary (0 or 1) value at 30-m resolution

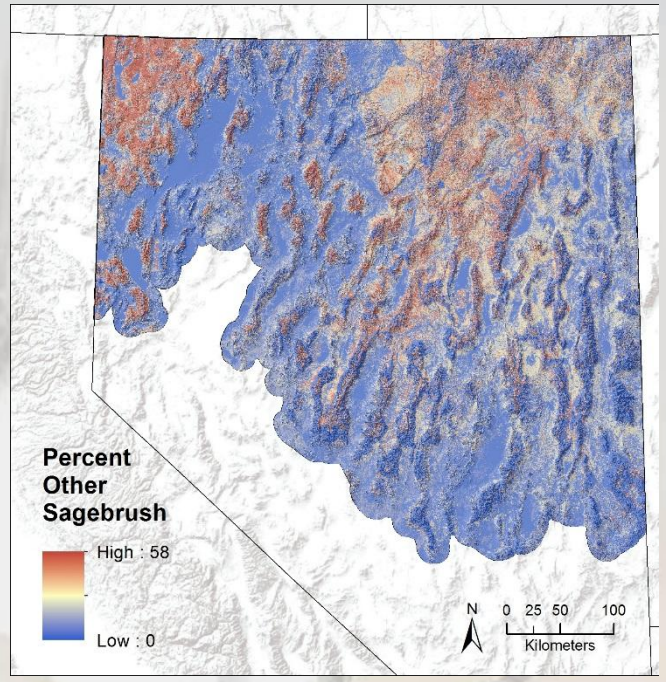

SynthMap
All Sagebrush
0
1
0 5 10
Kilometers
N

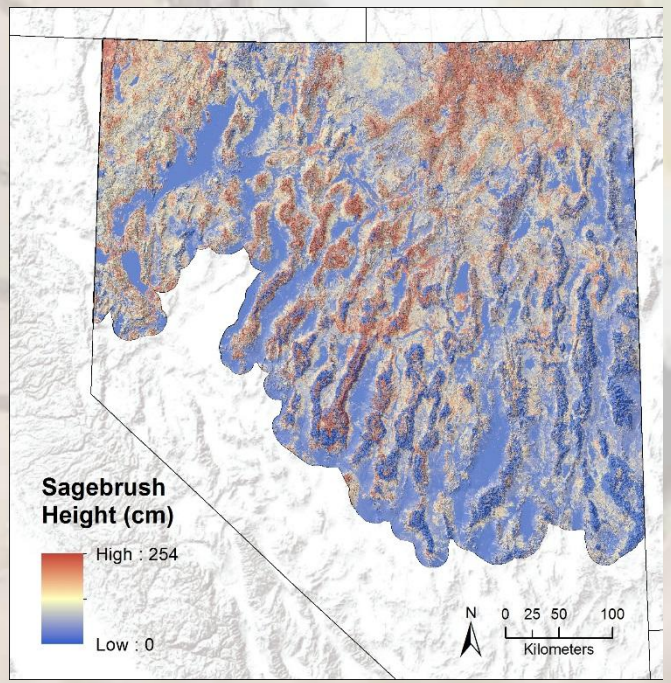

Percent Sagebrush
High : 100
Low : 0
0 5 10
Kilometers
N

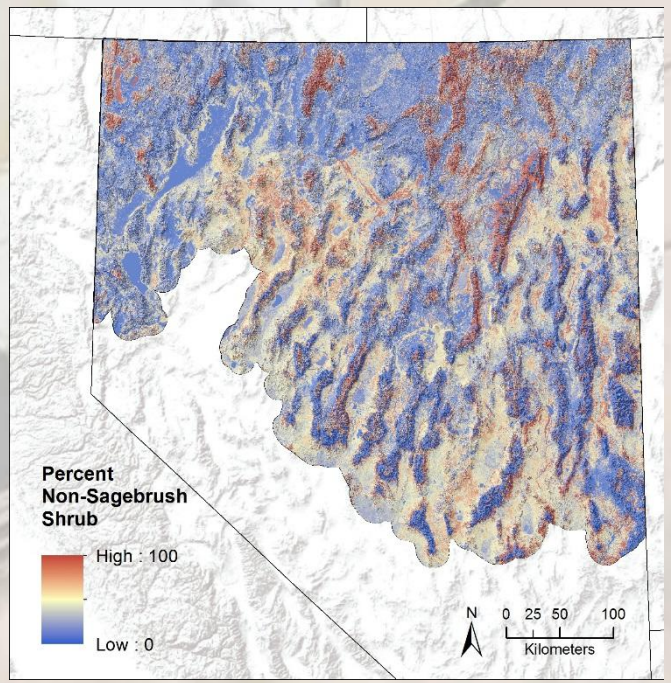

SynthMap
All Sagebrush
0
1
N
0 25 50 100
Kilometers

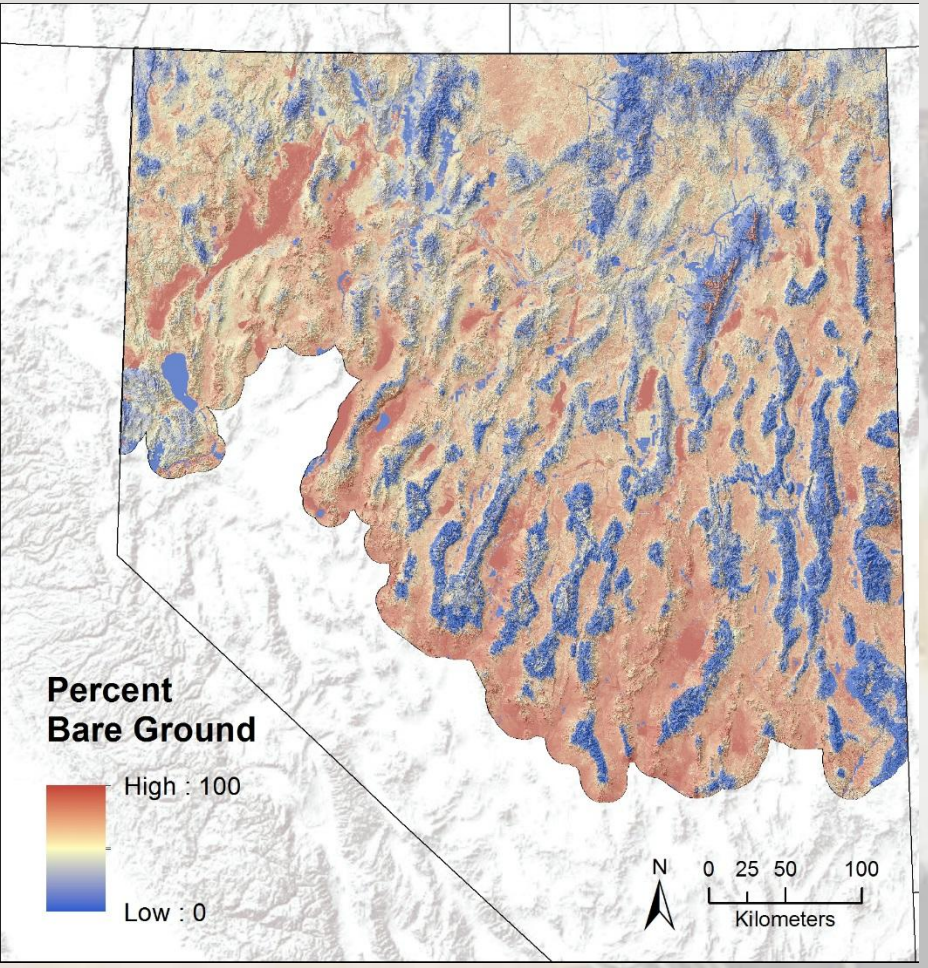

Percent
Sagebrush
High : 78
Low : 0
N
0 25 50 100
Kilometers

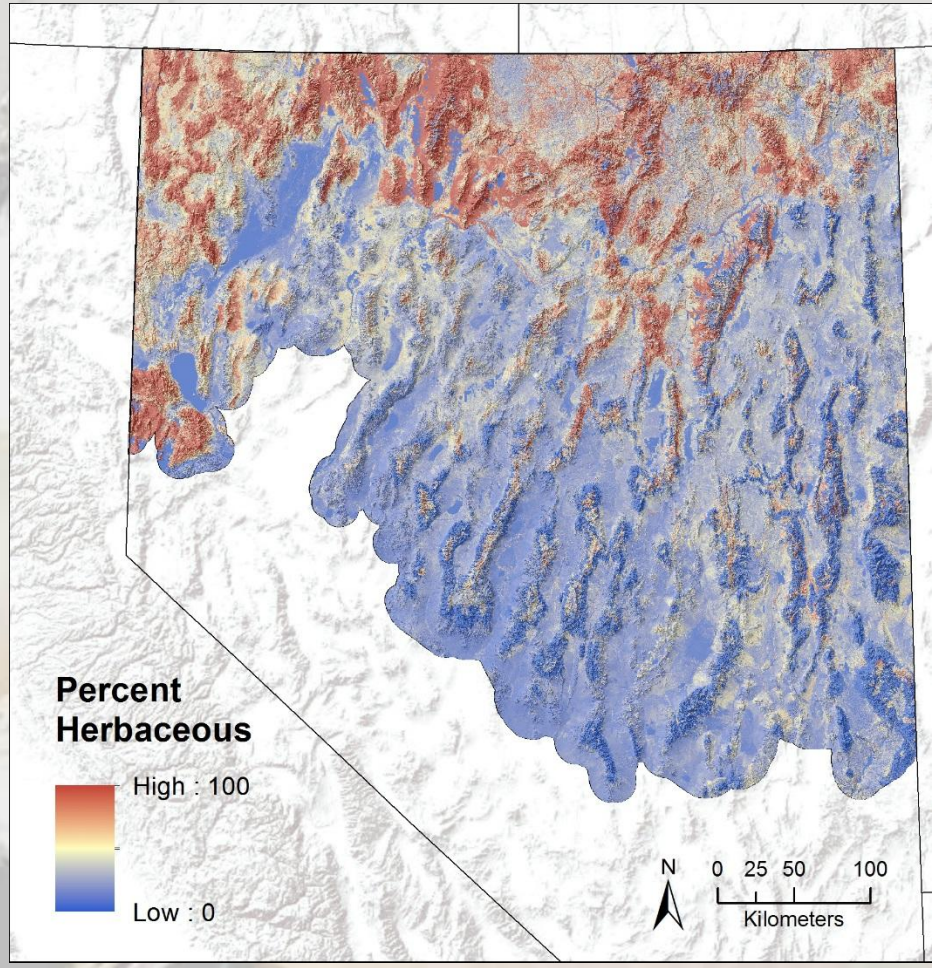

Percent
Big Sagebrush
High : 81
Low : 0
N
0 25 50 100
Kilometers


Percent
Other
Sagebrush
High : 58
Low : 0
N
0 25 50 100
Kilometers


Sagebrush
Height (cm)
High : 254
Low : 0
N
0 25 50 100
Kilometers

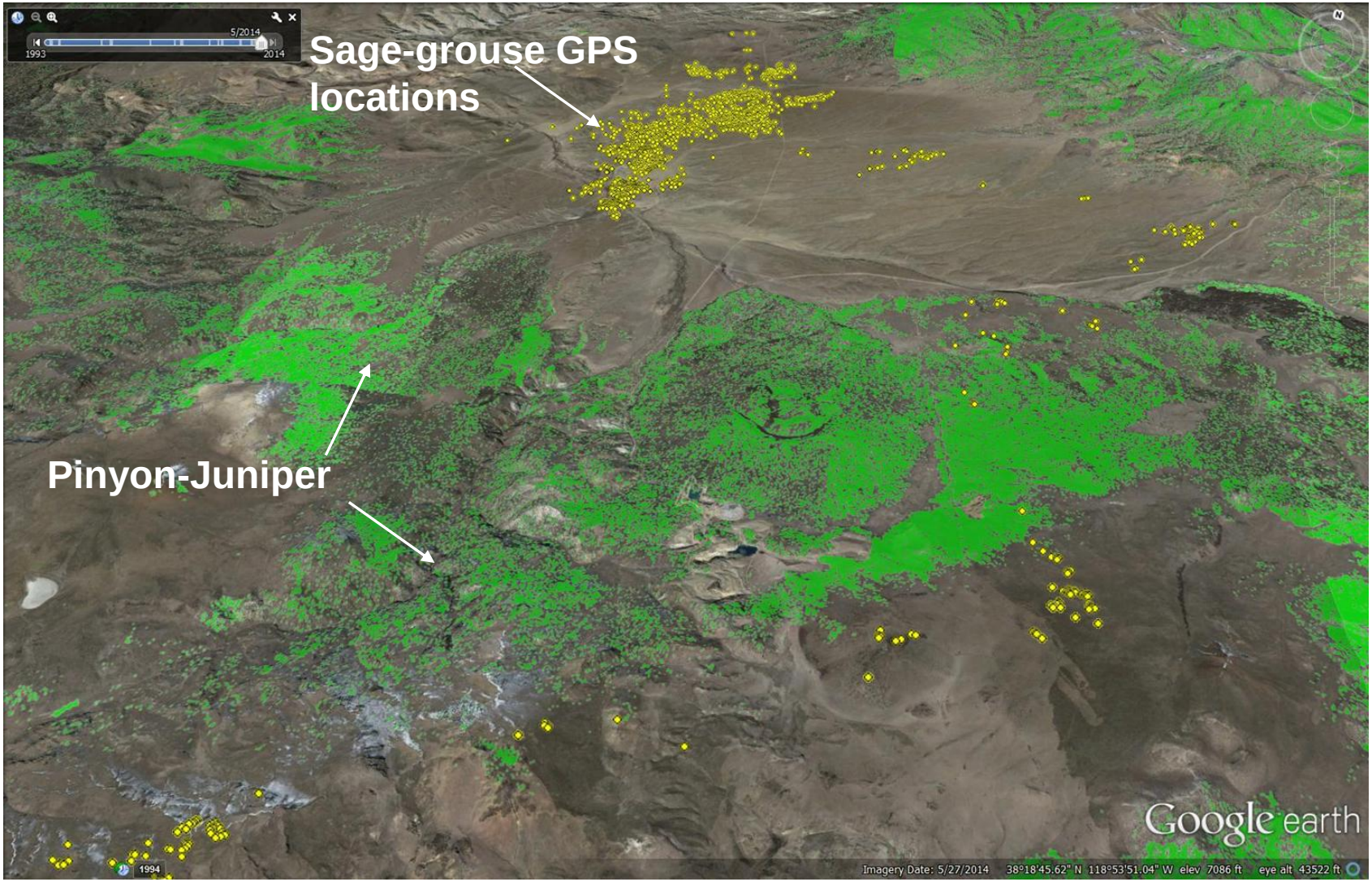

Percent
Non-Sagebrush
Shrub
High : 100
Low : 0
N
0 25 50 100
Kilometers


Percent
Bare Ground
High : 100
Low : 0
N
0 25 50 100
Kilometers


Percent
Herbaceous
High : 100
Low : 0
N
0 25 50 100
Kilometers

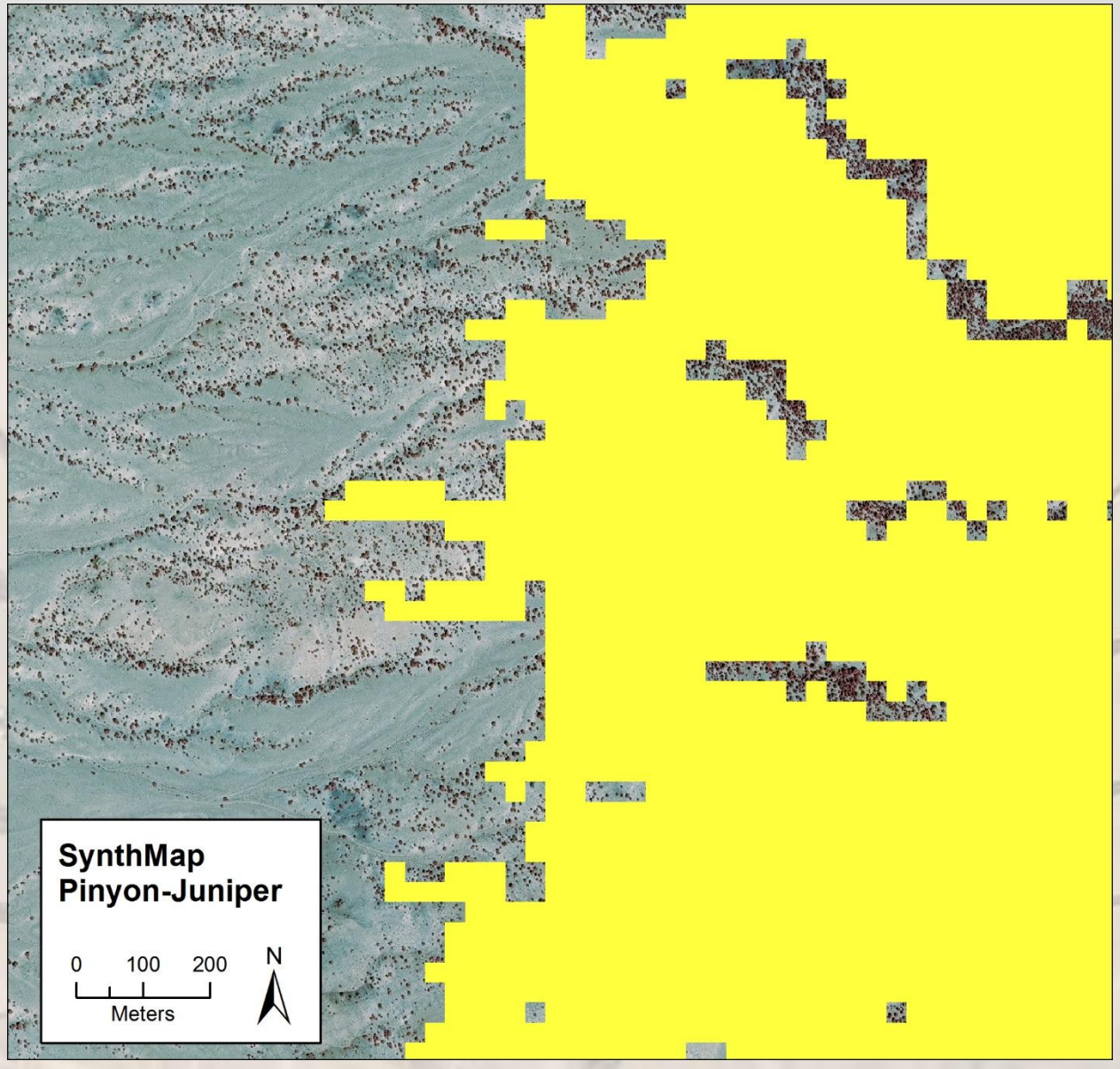
Conifer (pinyon-juniper) Mapping

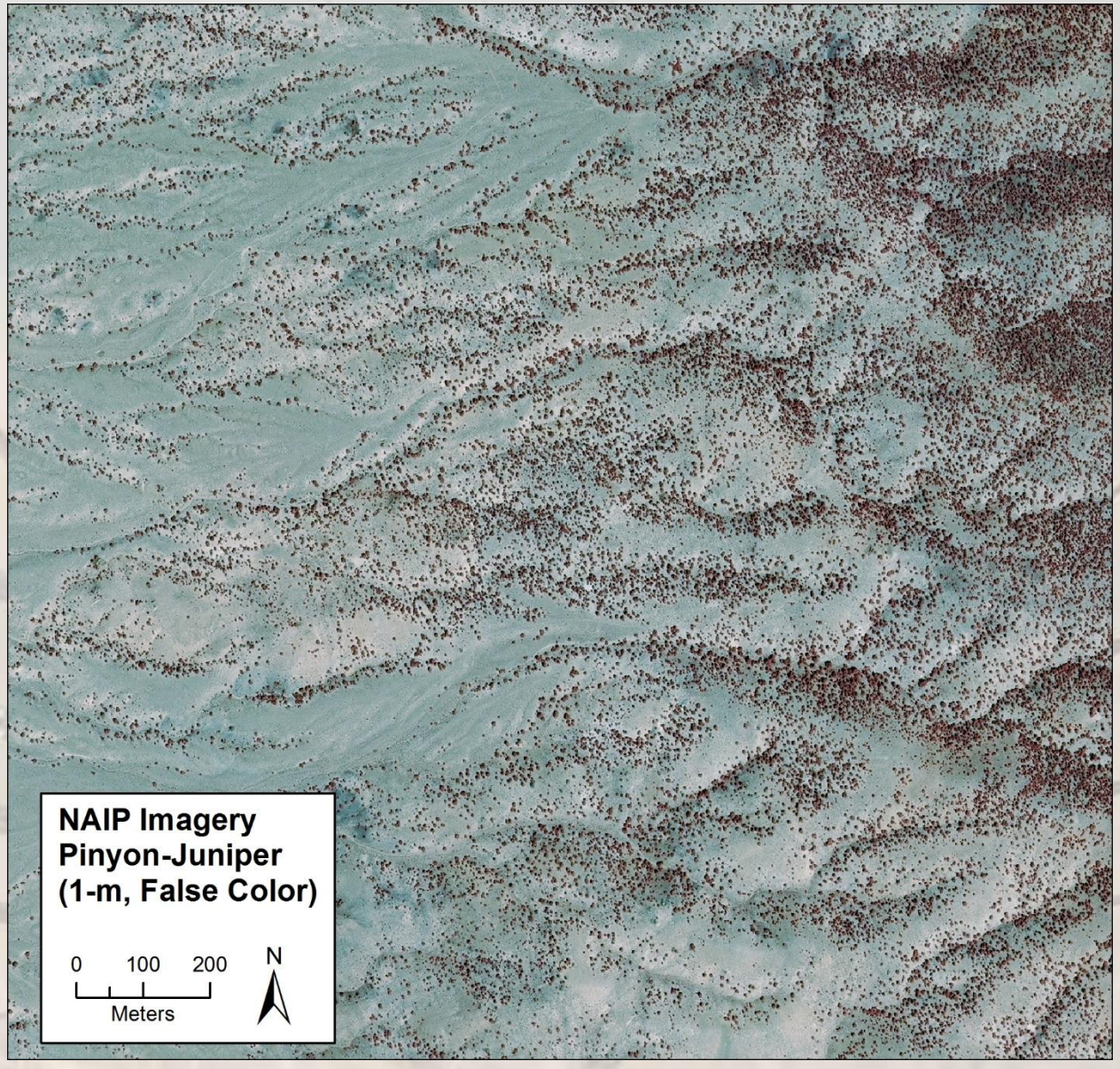
- **Existing 30-m resolution PJ insufficient for habitat mapping**
- **Sage-grouse show strong avoidance of PJ**
- **Low cover of PJ over sagebrush can greatly diminish value of otherwise suitable habitat.**
- **‘In house’ and multi-year effort-map to PJ at 1-m resolution to greatly improve habitat models.**

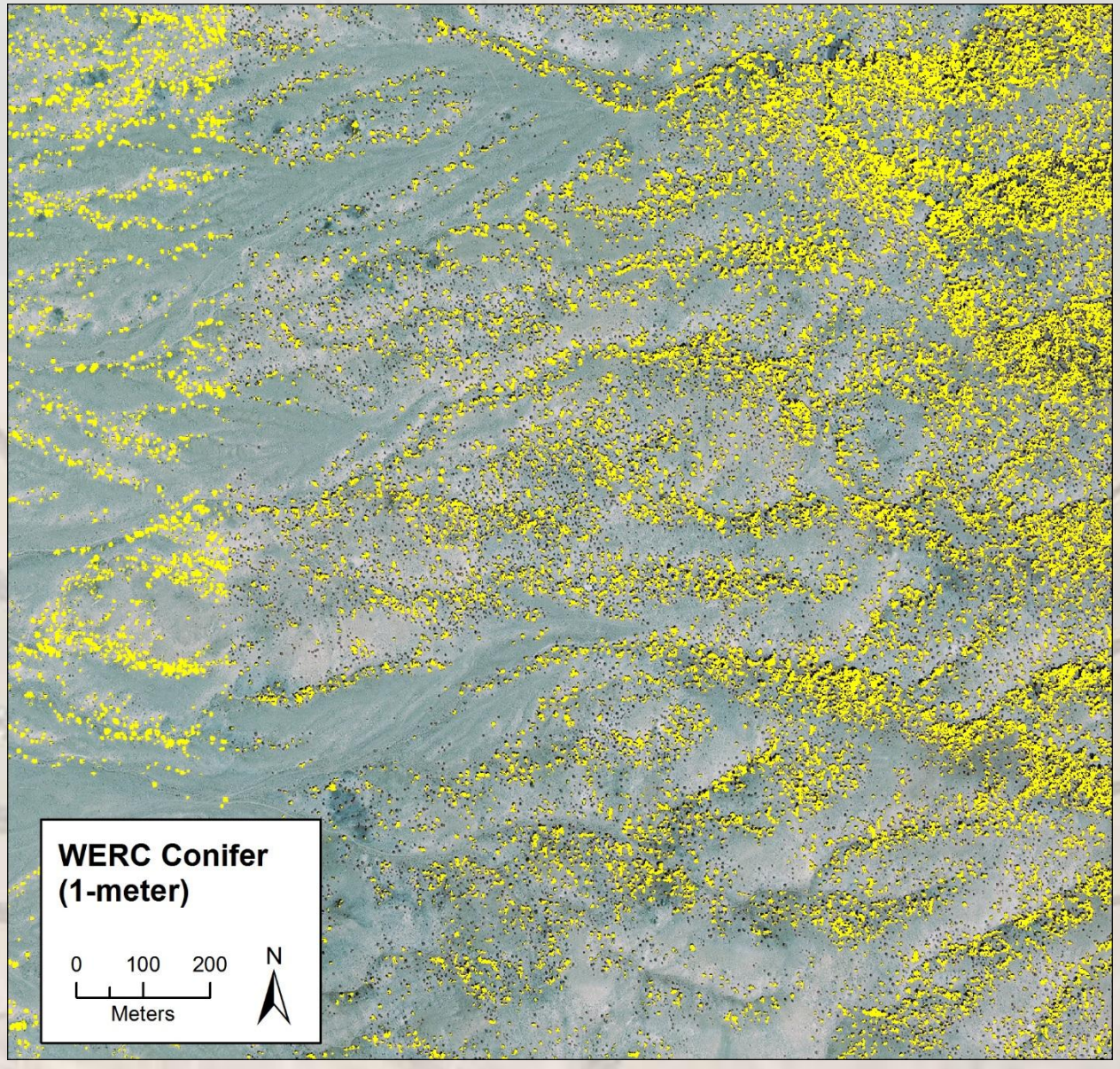

Sage-grouse GPS locations
Pinyon-Juniper
5/2014
1993
2014
1994
Google earth
Imagery Date: 5/27/2014 38°18'45.62" N 118°53'51.04" W elev 7086 ft eye alt 43522 ft

Sage grouse habitat selection decreases as they encounter more and more pinyon-juniper

PJ Mapping Overview

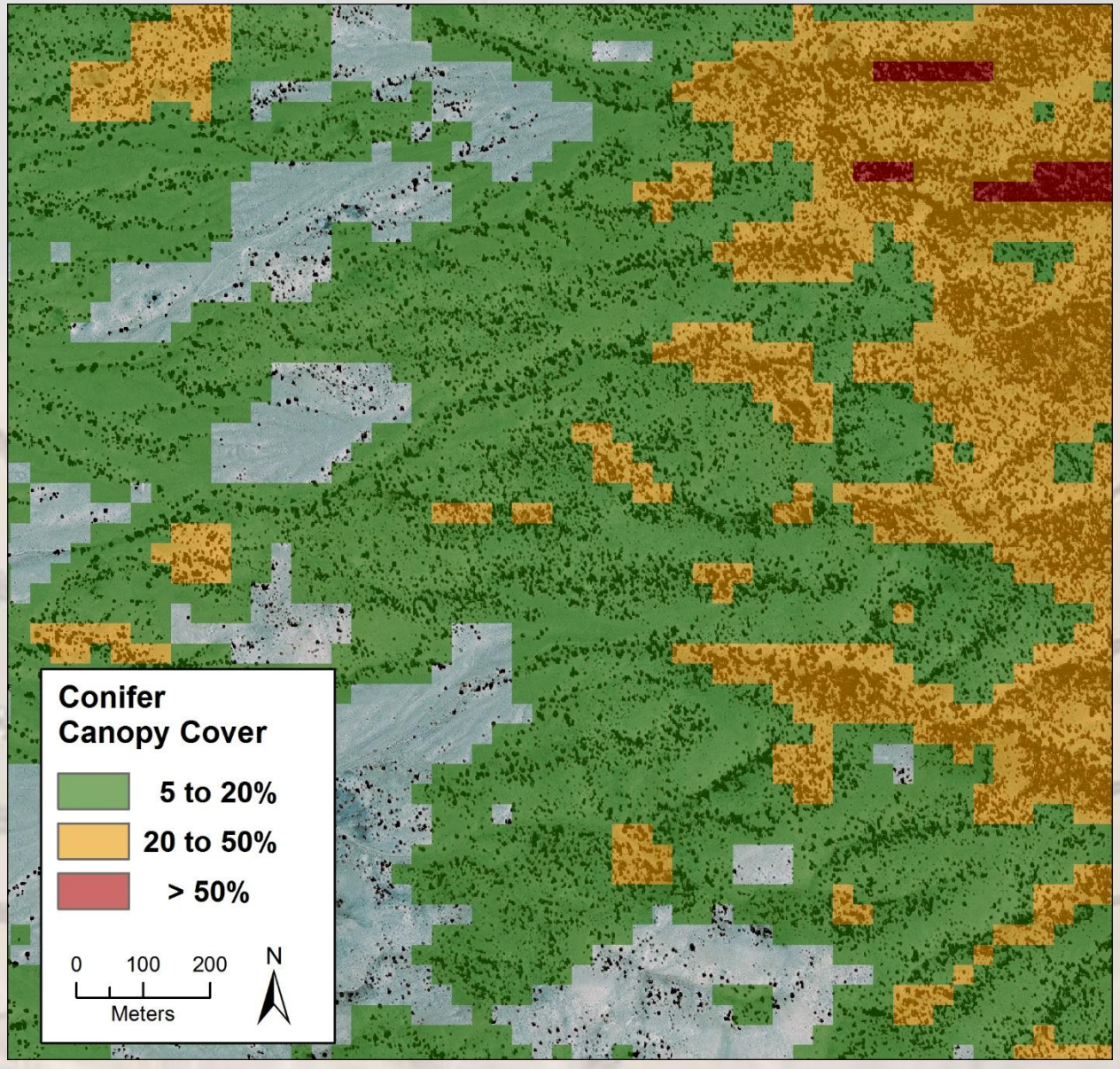



NAIP Imagery
Pinyon-Juniper
(1-m, False Color)
0
100
200
Meters
N



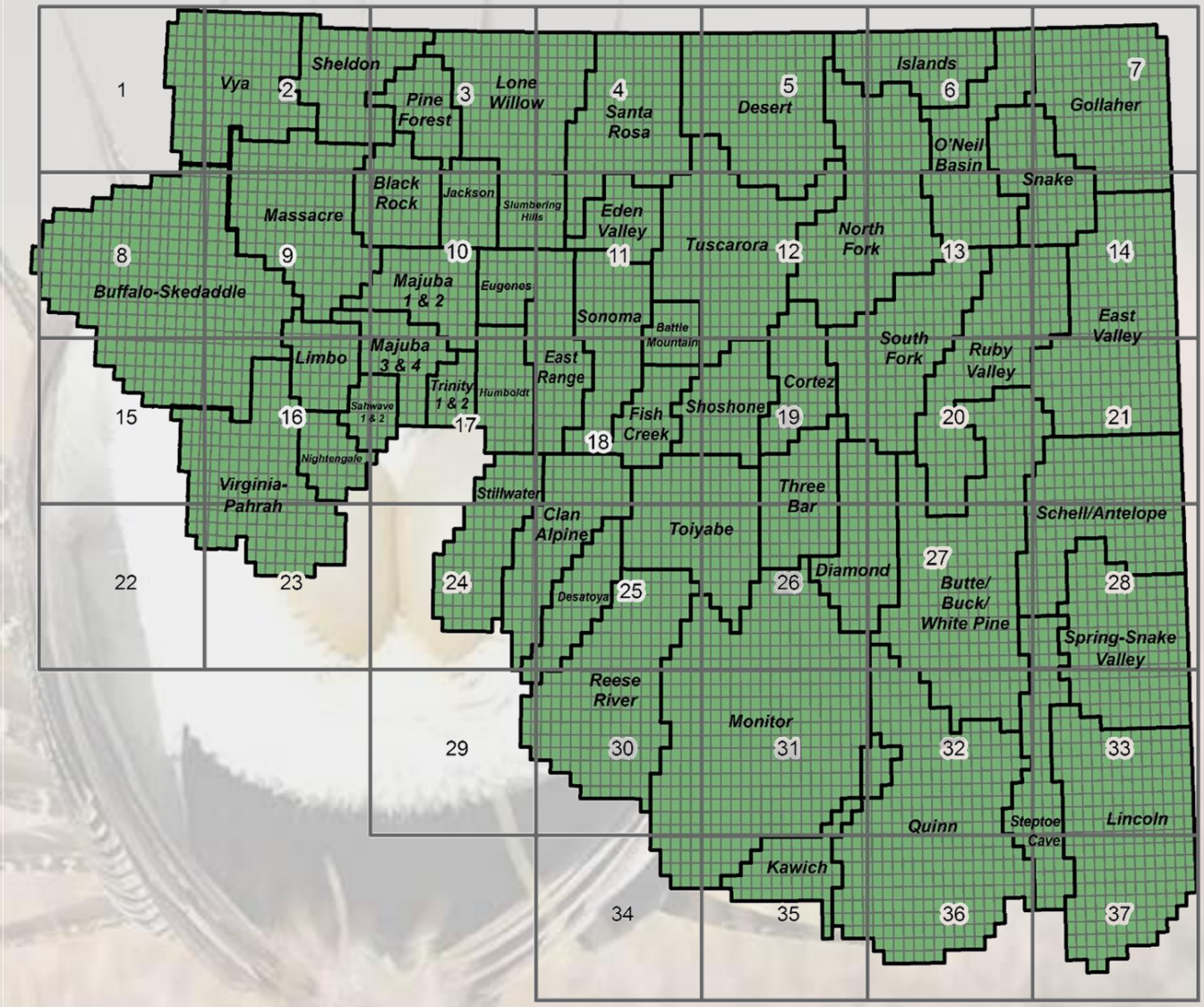
Use object recognition software

Continuous surface that can be modeled as a percentage



Can also be reclassified into ecologically relevant cover classes for a wide range of management applications.

- **Over 7,000 tiles state-wide analyzed.**
- **Time and computationally intensive process**
- **Now in the process of accuracy assessment of mosaic map**



4-point conifer mapping scorecard

Overall Grade	1. Accuracy	2. Seamlines	3. Image Quality	4. Classification
A	90 - 100%	Slight seams	Good clarity	Conifers well classified.
B	80 - 90%	Some seams, no acute edges	~ 1 - 10 % low quality / shadows	Low misclassification
C	70 - 80%	Some seams, 1-2 acute edges	~ 10 - 50% low quality / shadows	Moderate misclassification
D	60 - 70%	Multiple seams / acute transitions	> 50% low quality / shadows	High misclassification

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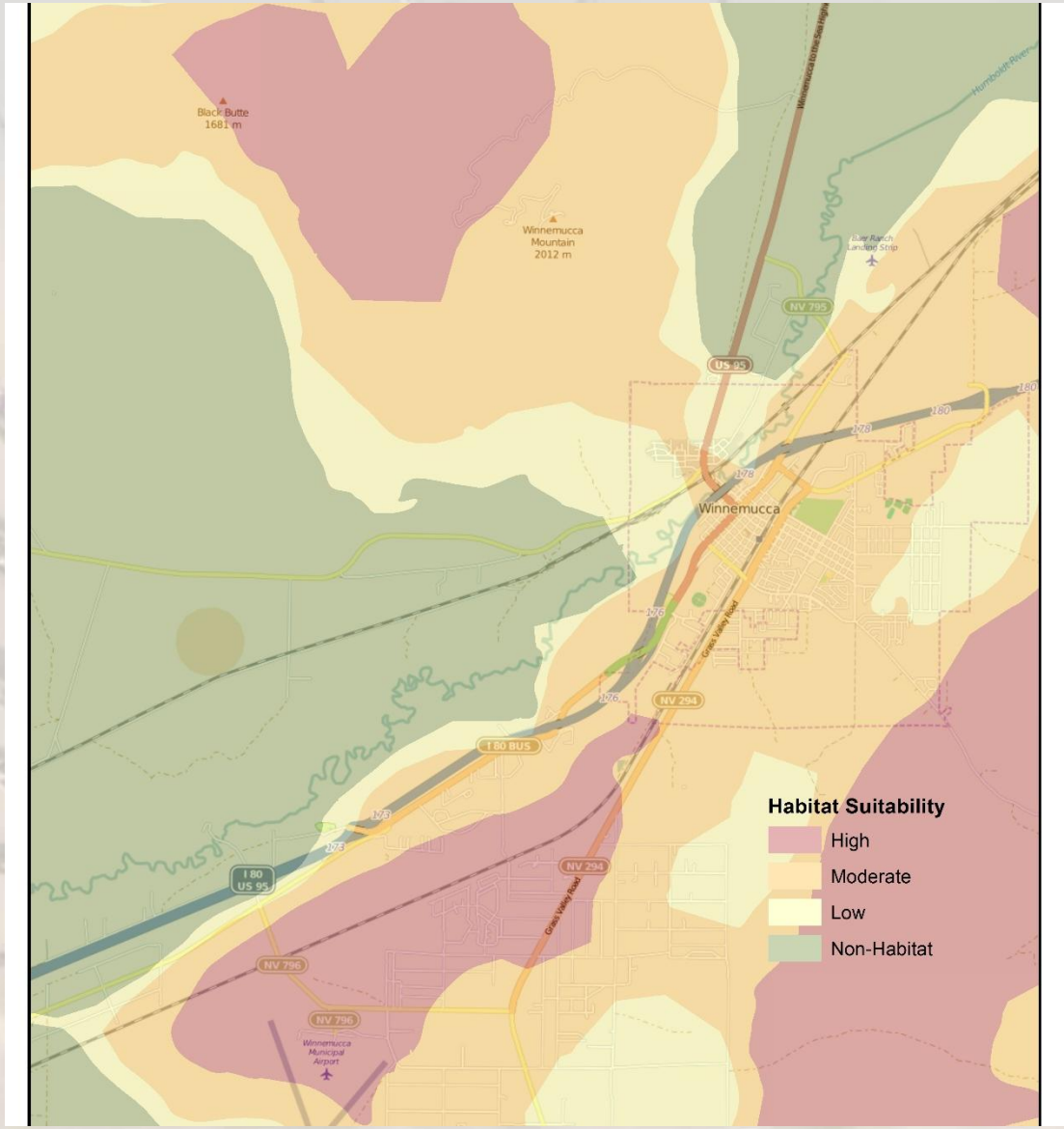
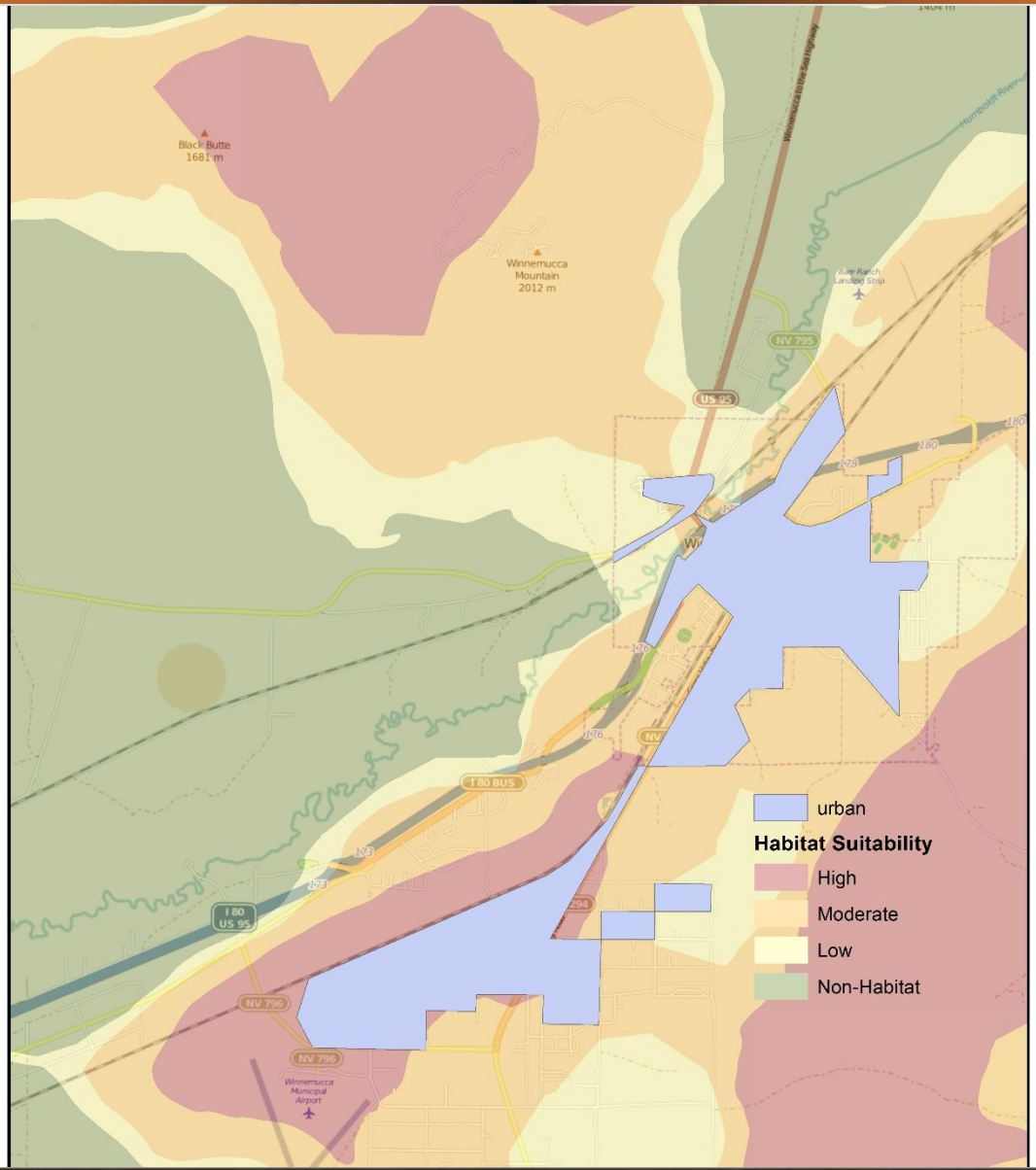
- ***Overall accuracy rate of 80% and overall grade of 3.0***
- ***Refinements to map ongoing***

Urban Areas


Black Butte
1681 m
Winnemucca
Mountain
2012 m
Winnemucca
Grass Valley Road
NV 795
US 95
I 80
NV 294
I 80 BUS
NV 796
Winnemucca
Municipal
Airport
Habitat Suitability
High
Moderate
Low
Non-Habitat

Urban Areas



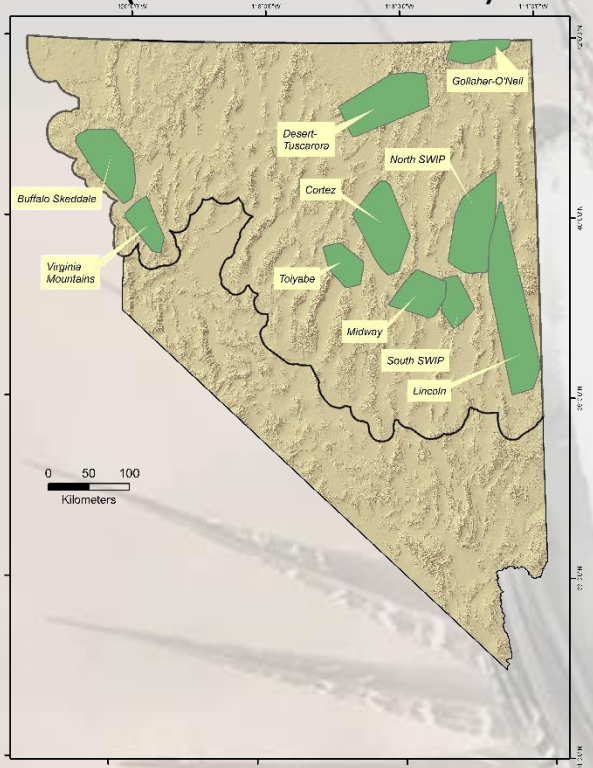
- **Urban areas will be masked with best available GIS layer**
- **Some surface disturbances may not be masked – limitation of available data**

Landcover Update Summary

Previous (30 m based)	Updated (< 2m based)
Bare ground	% Bare ground
All sagebrush	% Big sagebrush
All sagebrush	% Other sagebrush (low)
Lowland shrub	% Non-sagebrush
Upland shrub	% Non-sagebrush
Pinyon Juniper	% Pinyon Juniper
none	% Pinyon Juniper Understory
none	% Herbaceous (interspace)
none	Urban masked

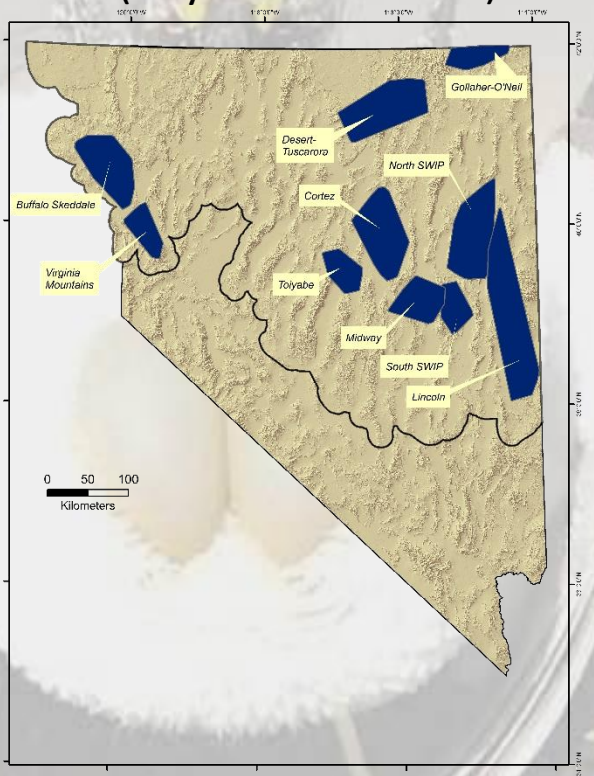
Seasonal mapping

Breeding
(mid March – June)



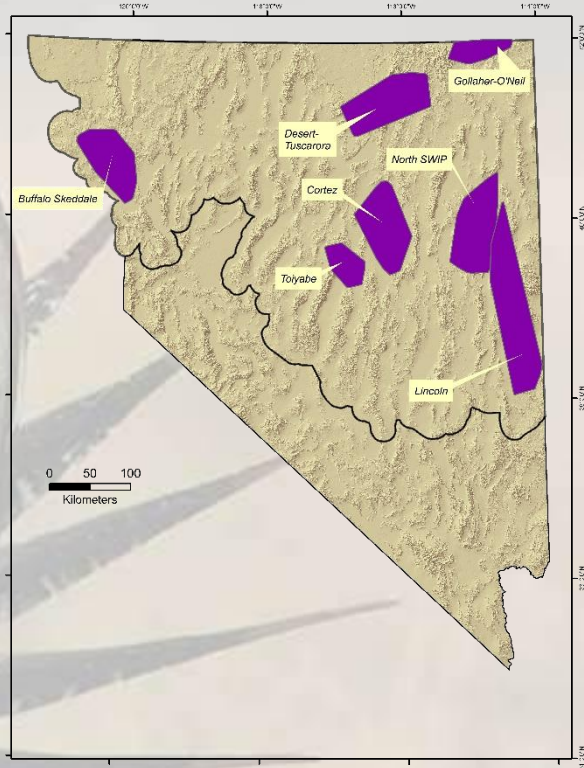
n = 14,058

Brood rearing
(July –mid October)



n = 11,743

Winter
(November - March)

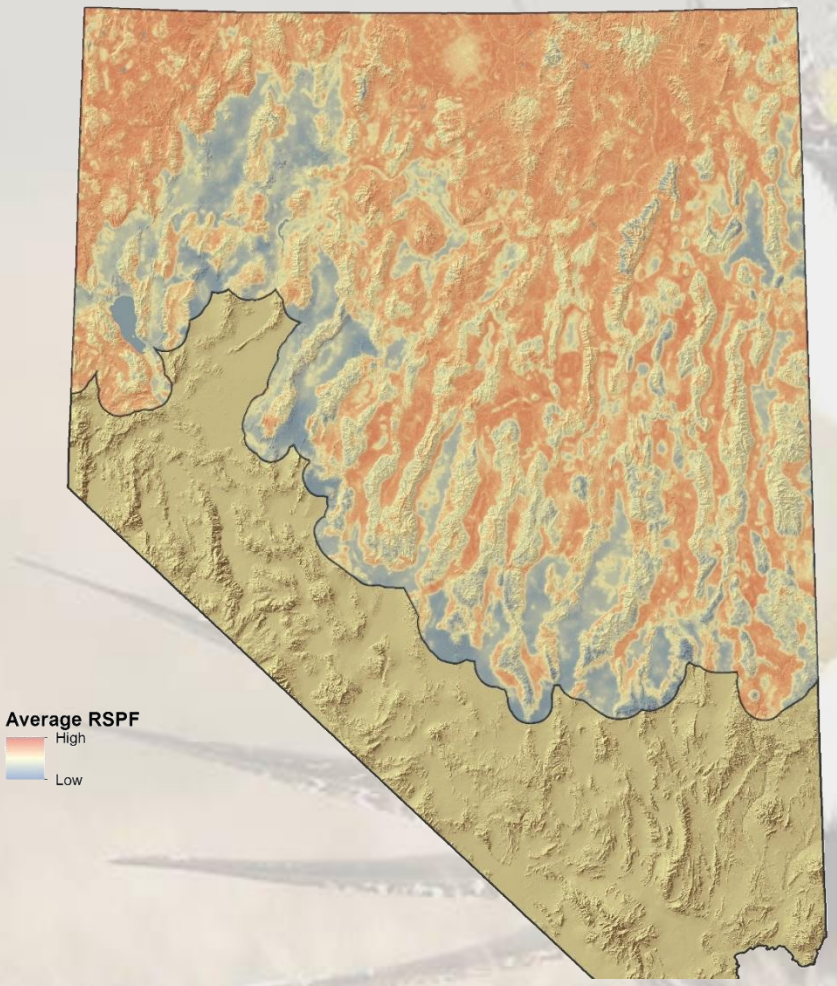


n = 4,862

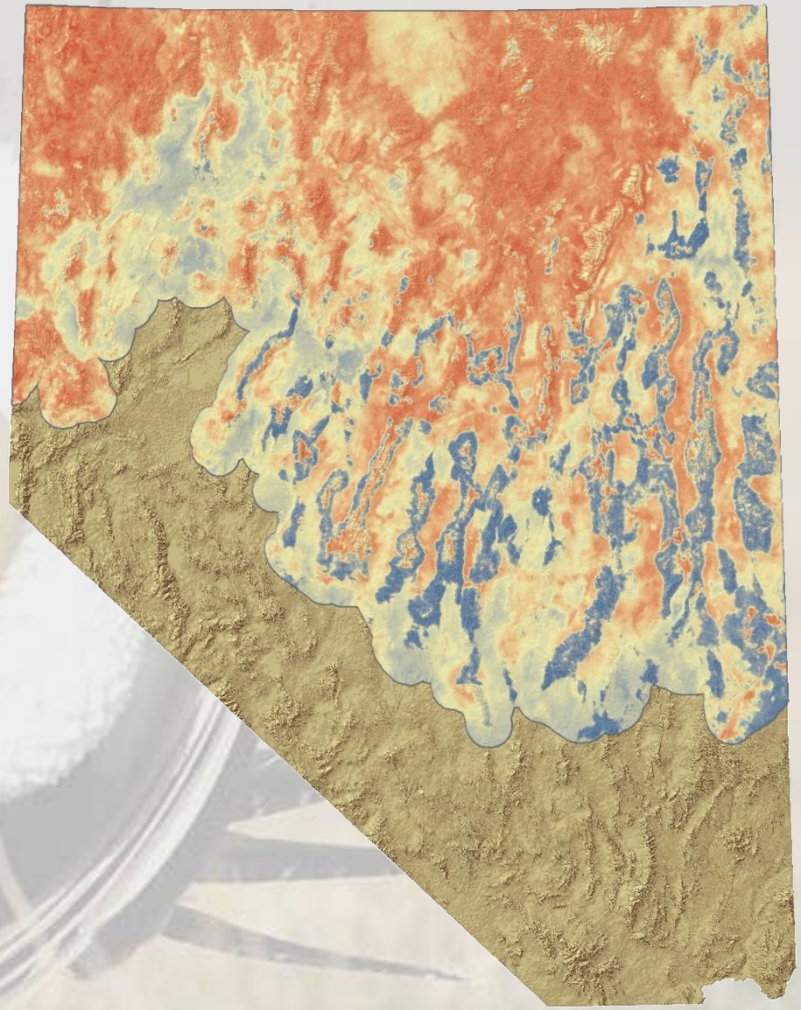
Seasonal mapping

- **Minimum 100 locations and 20 marked grouse per sub-region required (some sub-regions dropped out**
- **Habitat modeling procedure identical to those used previously, only the input layers differ (e.g., updated land-cover, recent telemetry points)**
- **Seasonal maps can 'stand-alone' for mitigation process (step 4)**
- **Can also be averaged to create a seasonally adjusted annual map, or modeled with all sub-regions using seasonal weights**
  - **Fewer sub-regions for seasonal models**
  - **Will compare output of 2 approaches**

Original Annual Map (30-m landcover base)



Revised Annual Map (1-m landcover base)



Preliminary Information—Subject to Revision. Not for Citation or Distribution

Summary of 'what's new'

- **High resolution (< 2 m) for landcover types most relevant to sage-grouse**
  - **Big-sagebrush, low-sagebrush, non-sage shrub, bare ground, herbaceous interspace, pinyon-juniper, and pinyon-juniper understory**
- **Urban areas 'masked out'**
- **Original map: 12 sub-regional RSFs. Updated with new landcover**
- **Seasonal maps: 24 season-sub-regional RSF combinations**

3. Progress Timeline

- **Dec – Feb:** Seasonal telemetry data compilation and error checking

  Updated space use model

- **May – June:** 'Usable' and high resolution PJ map complete.

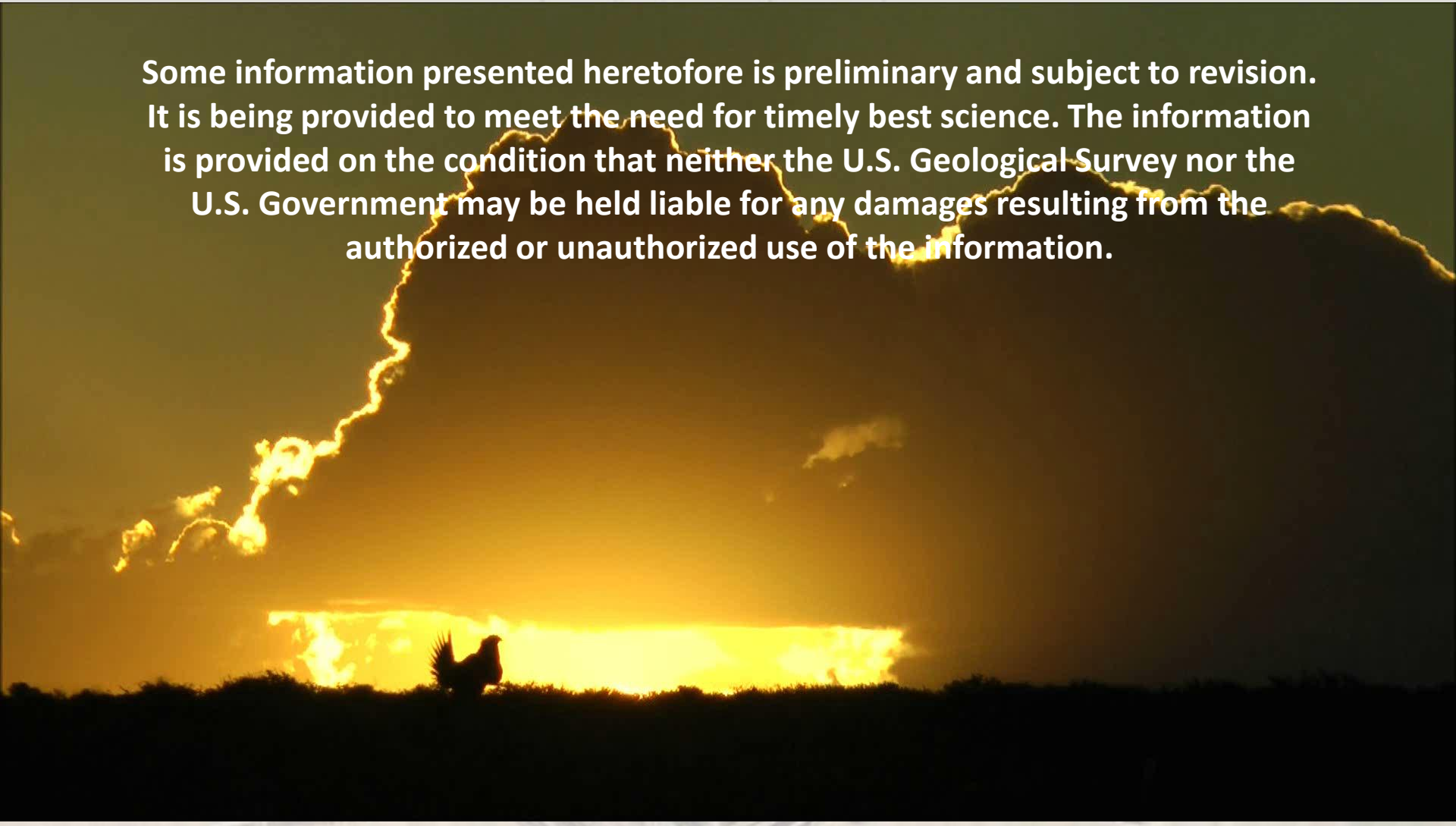
- **Late July:** USGS resolution sagebrush and other landcover layers released. 'First to use'

- **July – Aug:** GIS extraction and RSF modeling

Product Delivery

- **September 1. Draft revised annual map and new seasonal maps.**

- **Additional USGS internal review required before release of final product**
  - **General process already vetted for original map (USGS Open File Report and Journal of Applied Ecology)**
  - **Anticipate quick turn-around of USGS review of new mapping products and metadata (~ 1 month)**

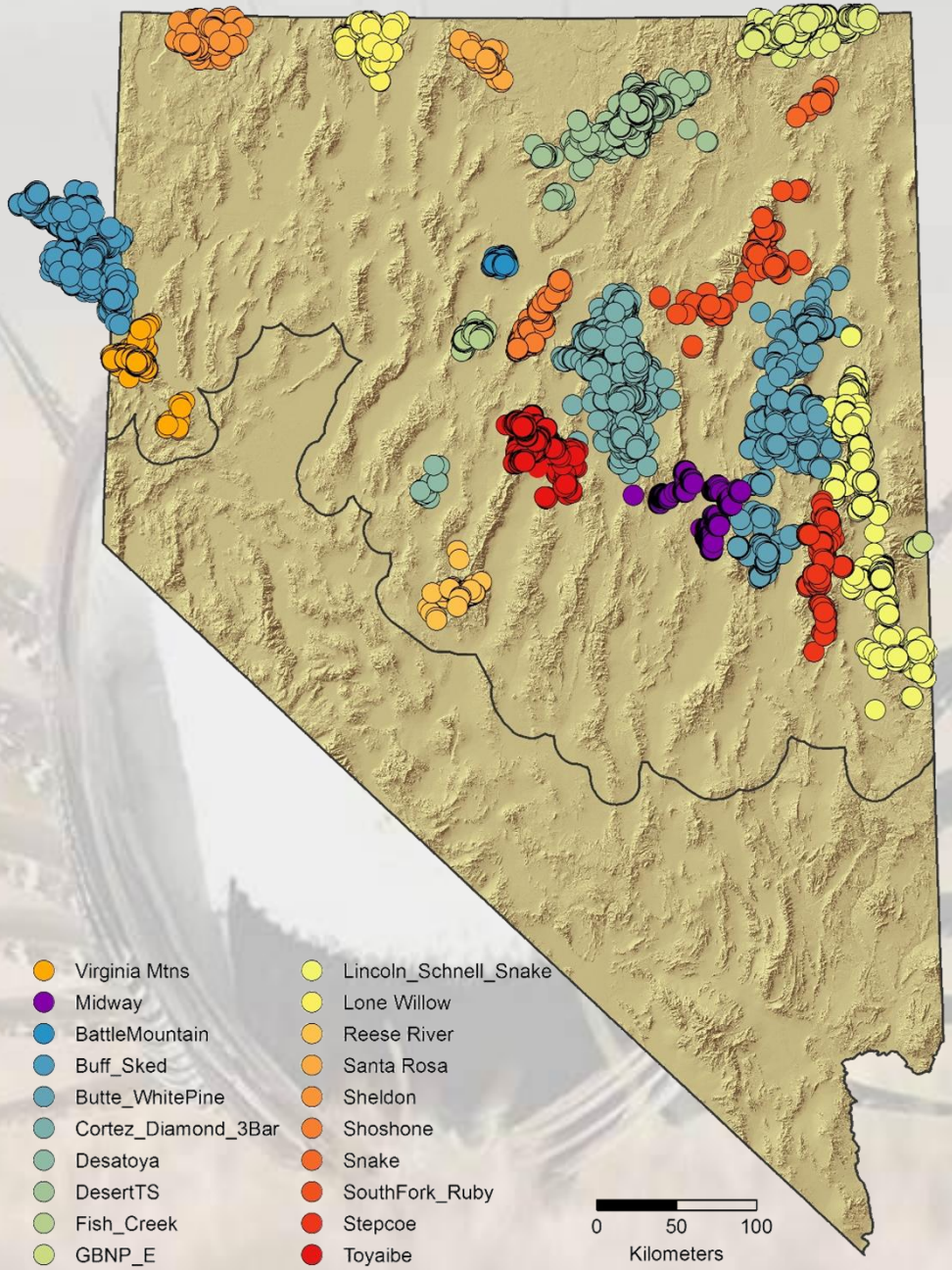


Some information presented heretofore is preliminary and subject to revision. It is being provided to meet the need for timely best science. The information is provided on the condition that neither the U.S. Geological Survey nor the U.S. Government may be held liable for any damages resulting from the authorized or unauthorized use of the information.

USGS
science for a changing world

Three independent datasets:

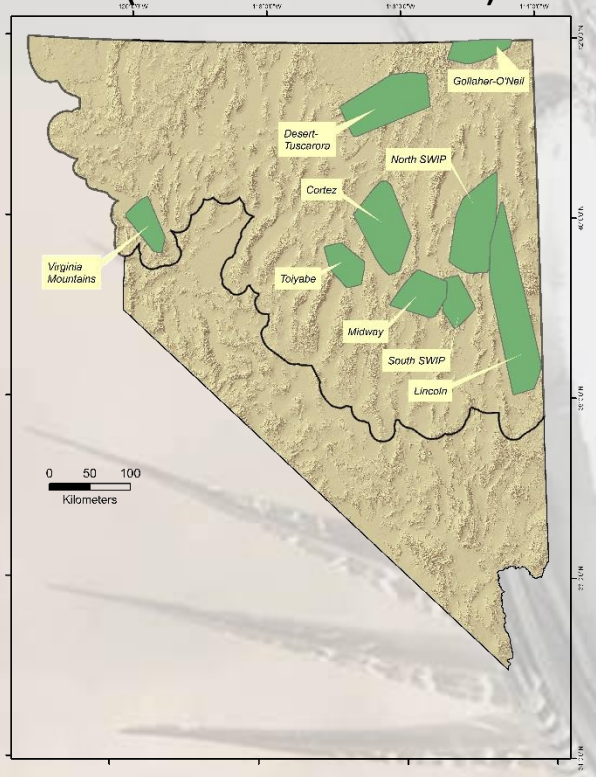
- **Model Training**
- **Category Training**
- **Validation**



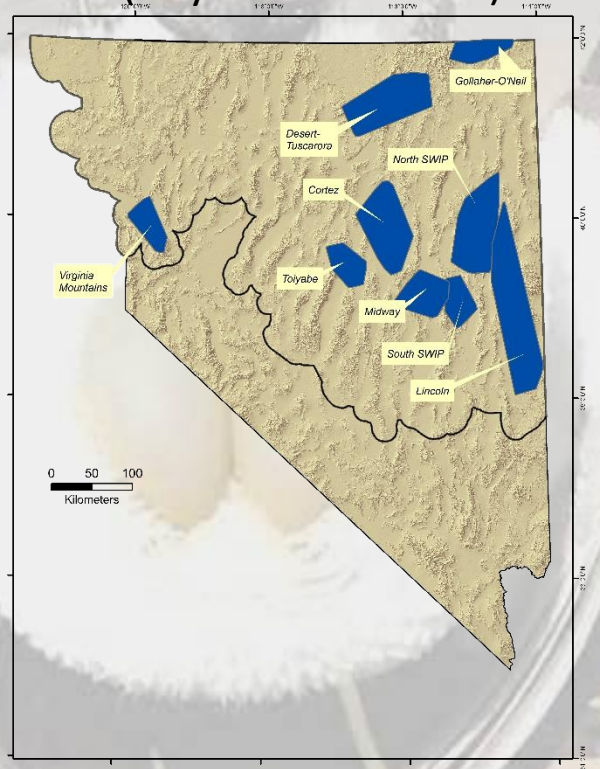
- **>10 years of telemetry data**
- **> 31,000 telemetry locations**
- **> 1,500 sage grouse**
- ***Grouped by PMU boundaries and distance (30 km)***
- ***Included all of Buffalo-Skeddadle PMU to improve power***

Seasonal mapping

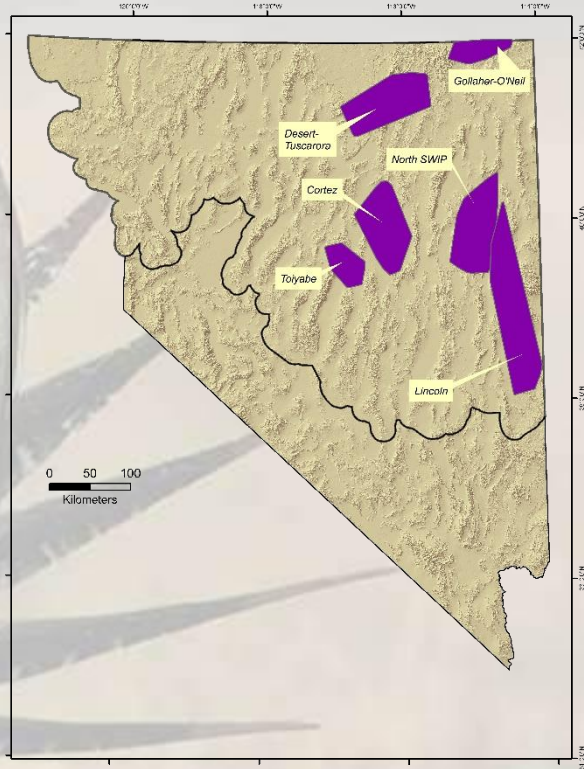
Breeding
(mid March – June)



Brood rearing
(July –mid October)



Winter
(November - March)



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