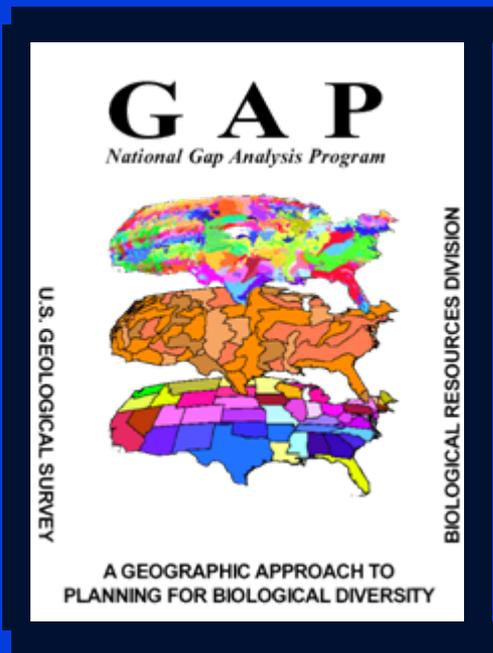
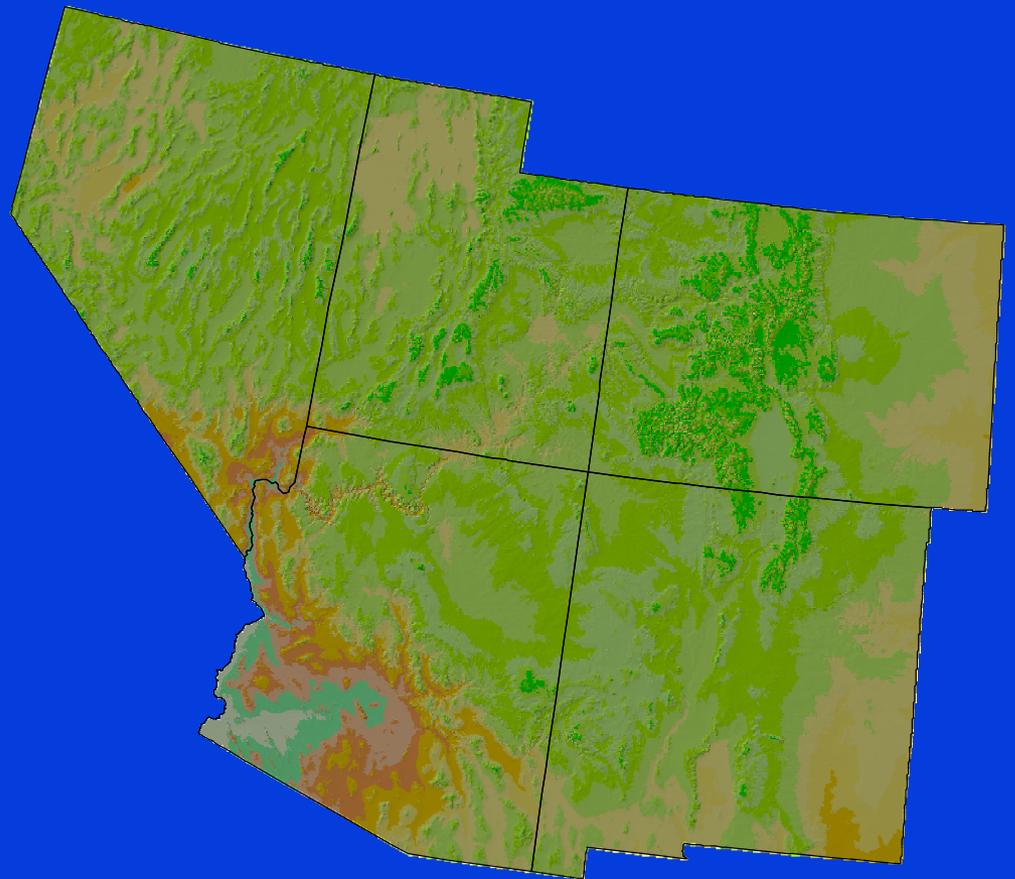


# An Approach for Determining Regional Land Cover and Vertebrate Species Habitat Distributions in the American Southwest: *the Southwest Regional Gap Analysis Project*

D. F. Bradford

W. G. Kepner

T. D. Sajwaj

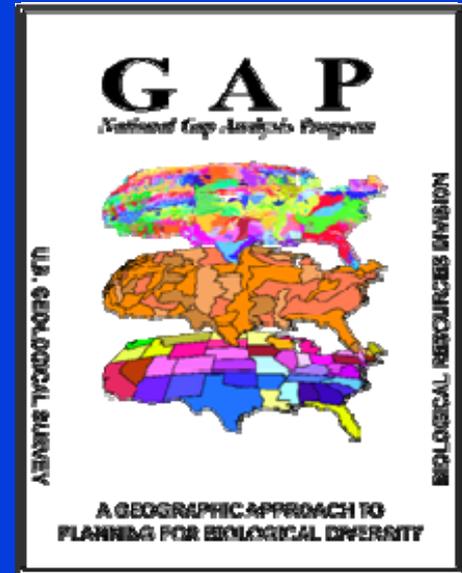


# Outline of Talk

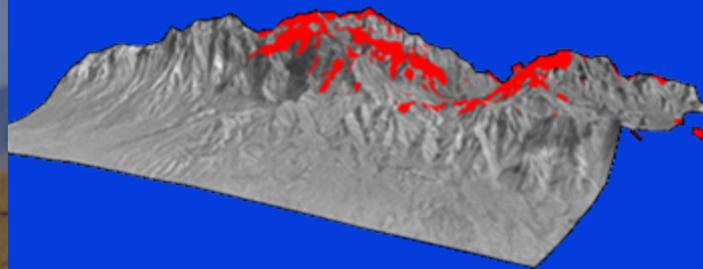
- Overview of Southwest ReGAP project
- Land cover map: development, quality, and limitations
- Vertebrate habitat distribution models: development and limitations

# What Is a “gap”?

A “gap” is the lack of representation or under-representation of an element of biodiversity (plant community or animal species) among areas intended for the long term maintenance of biodiversity.



*“Keeping Common Species Common”*



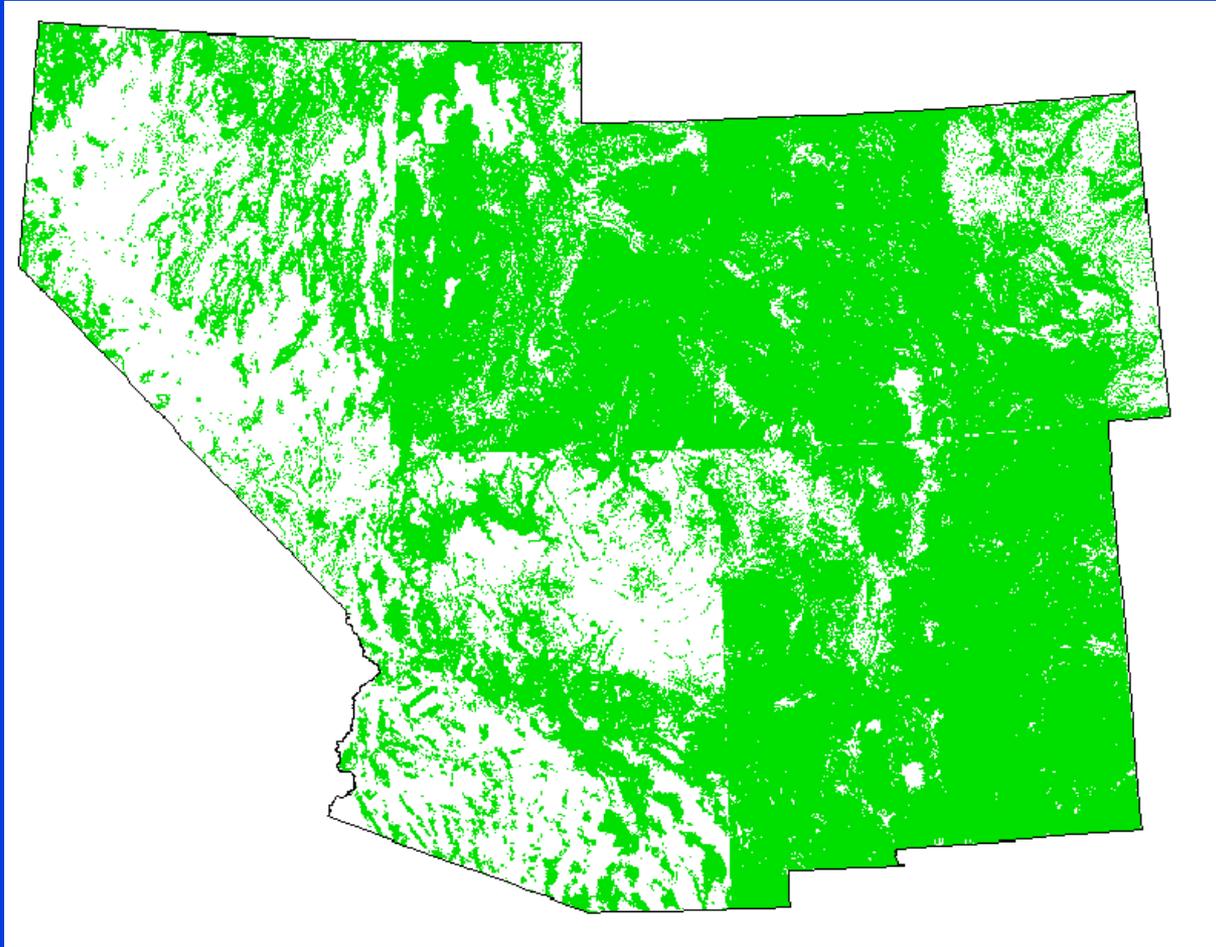
## GAP Objectives



1. Map the distributions of plant communities using NVCS.
2. Map predicted habitat distributions of vertebrate species.
3. Map the degree of management for biodiversity maintenance.
4. Analyze the representation of biotic elements in the conservation network to identify “gaps.”

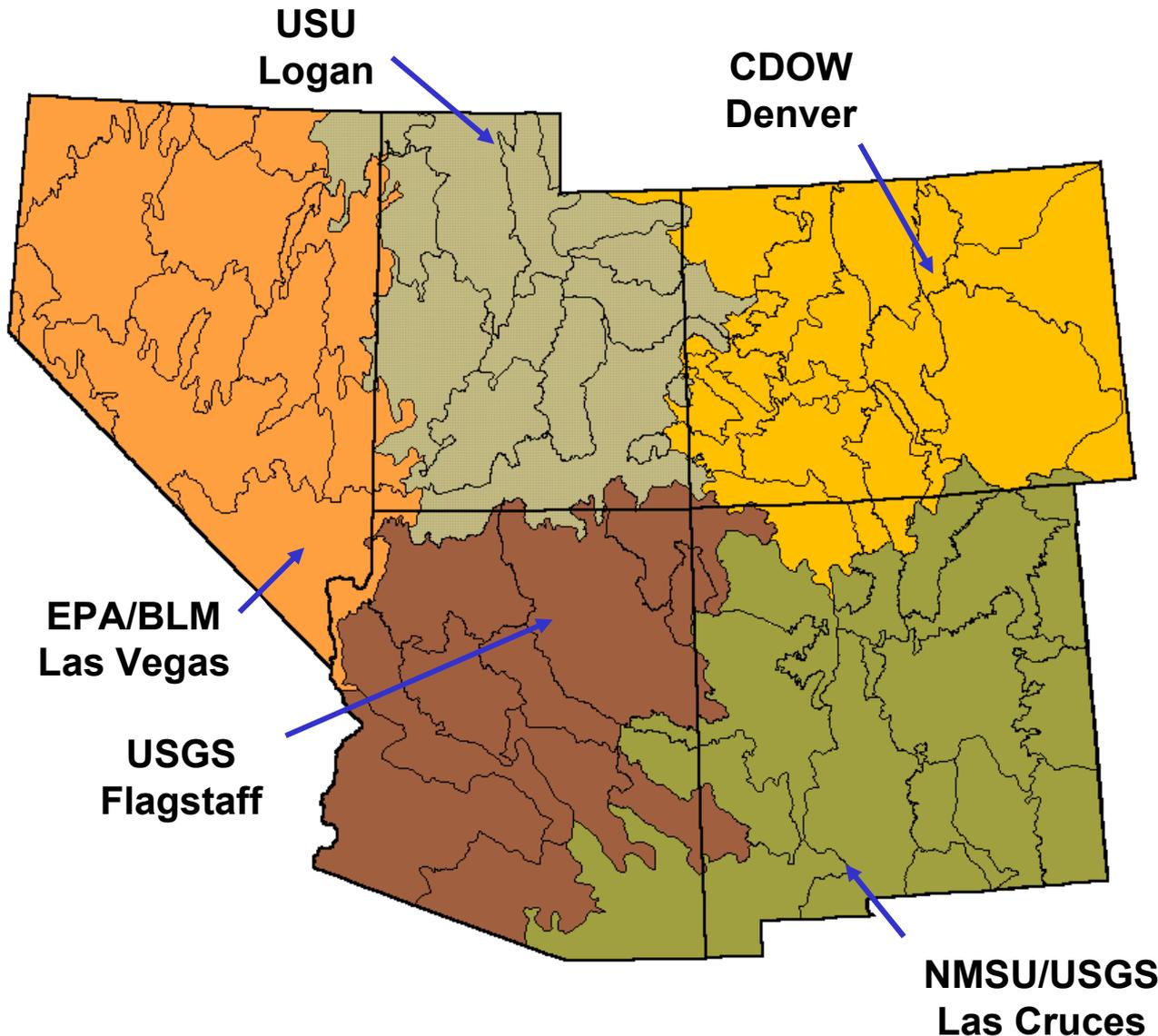
# ***Why SW Regional GAP?***

- ***Need for Regionally Consistent Maps***



**Predicted distribution of mule deer habitat (*Odocoileus hemionus*) in the five SWReGAP States.**

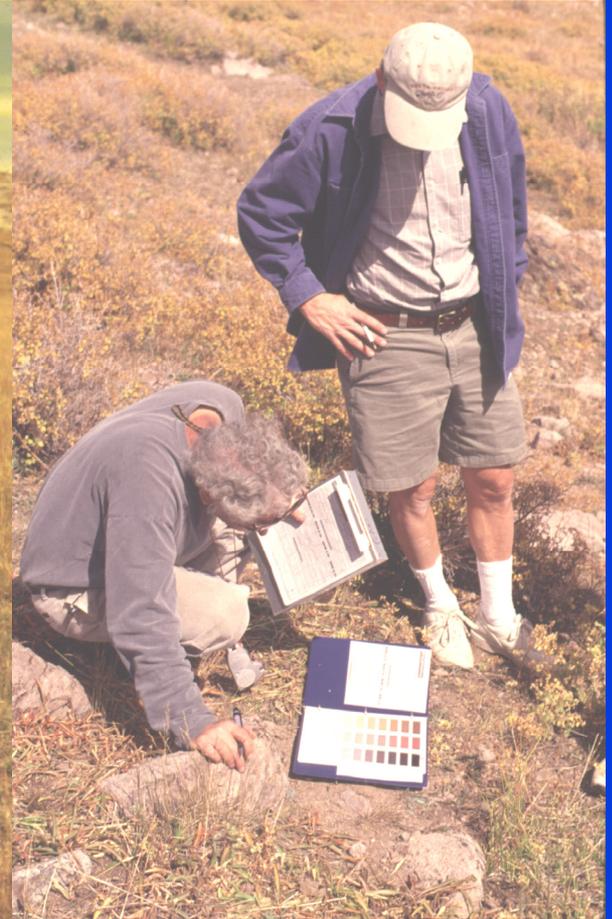
# Regional Approach



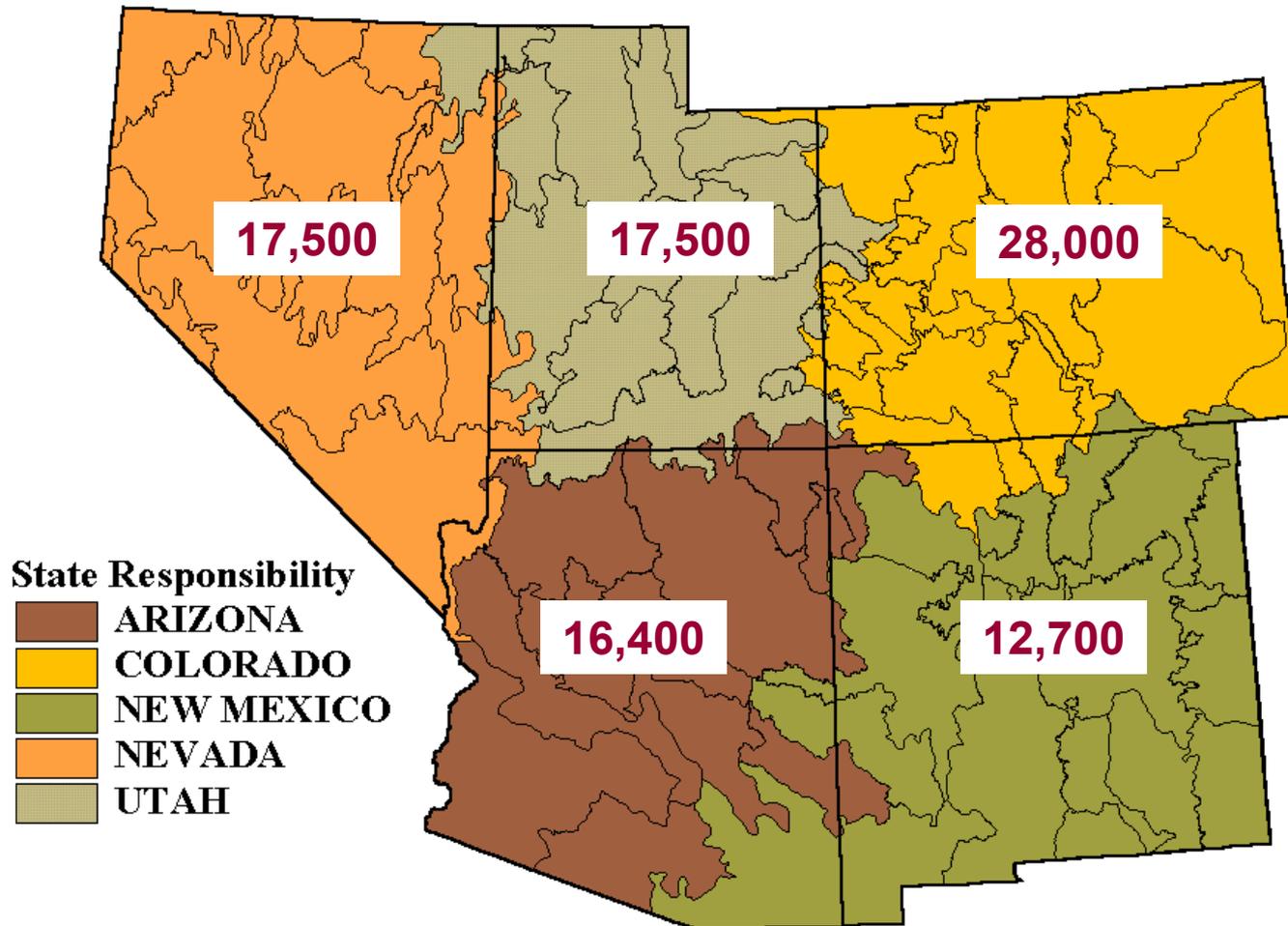
USGS  
NatureServe  
BLM

NMSU/USGS  
Las Cruces

# Land Cover Mapping Starts on the Ground



*Regional Total: 92,100 sites*



# Ecological Systems



**Groups of plant communities and sparsely vegetated habitats unified by similar ecological processes, substrates, and/or environmental gradients...and *spectral characteristics*.**

# Predictor Datasets: Imagery Derived

July-Aug



Sept-Oct



ETM Bands 5, 4, 3

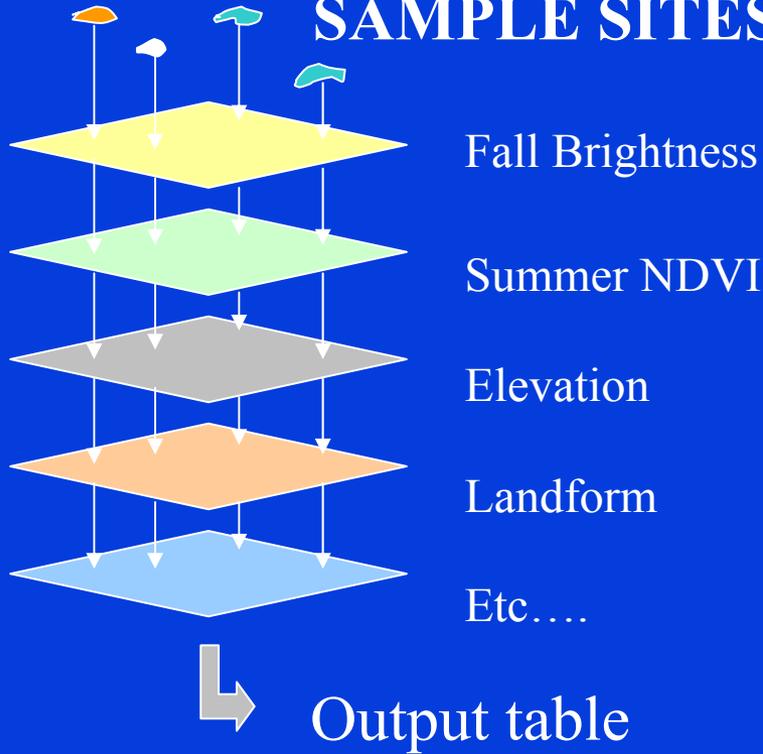


ETM Bands 5, 4, 3



# Predictor Layers

## SAMPLE SITES



*Imagery:* Landsat 7 ETM (1999-2002) for spring, summer & fall

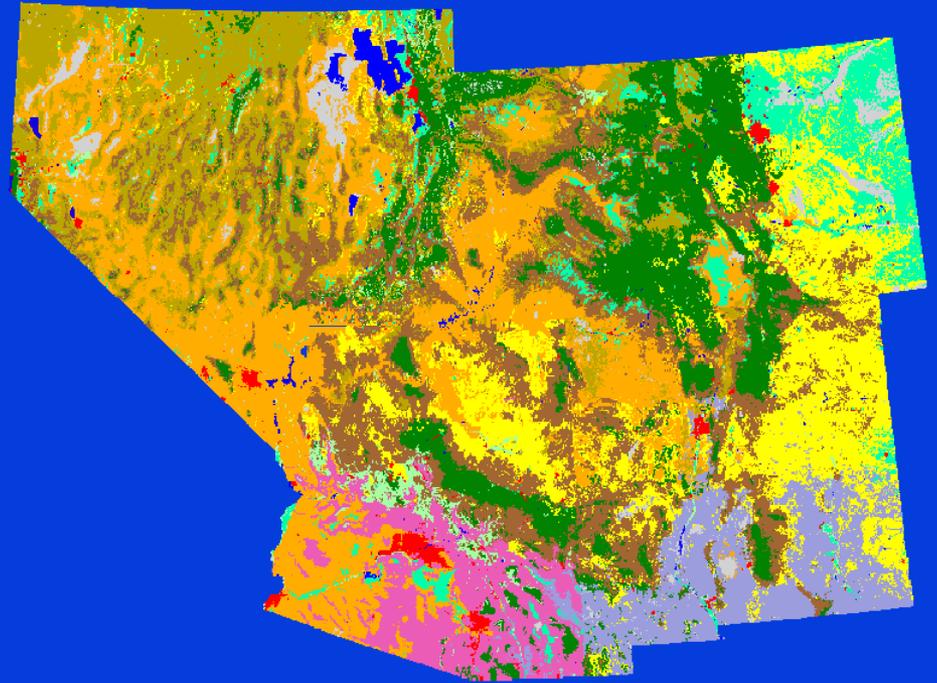
*NDVI, SAVI, Brightness, Greenness, Wetness, Landsat 7 Bands*

*DEM:* Elevation, Aspect, Slope, Landform

*Vector:* Geology, Soils

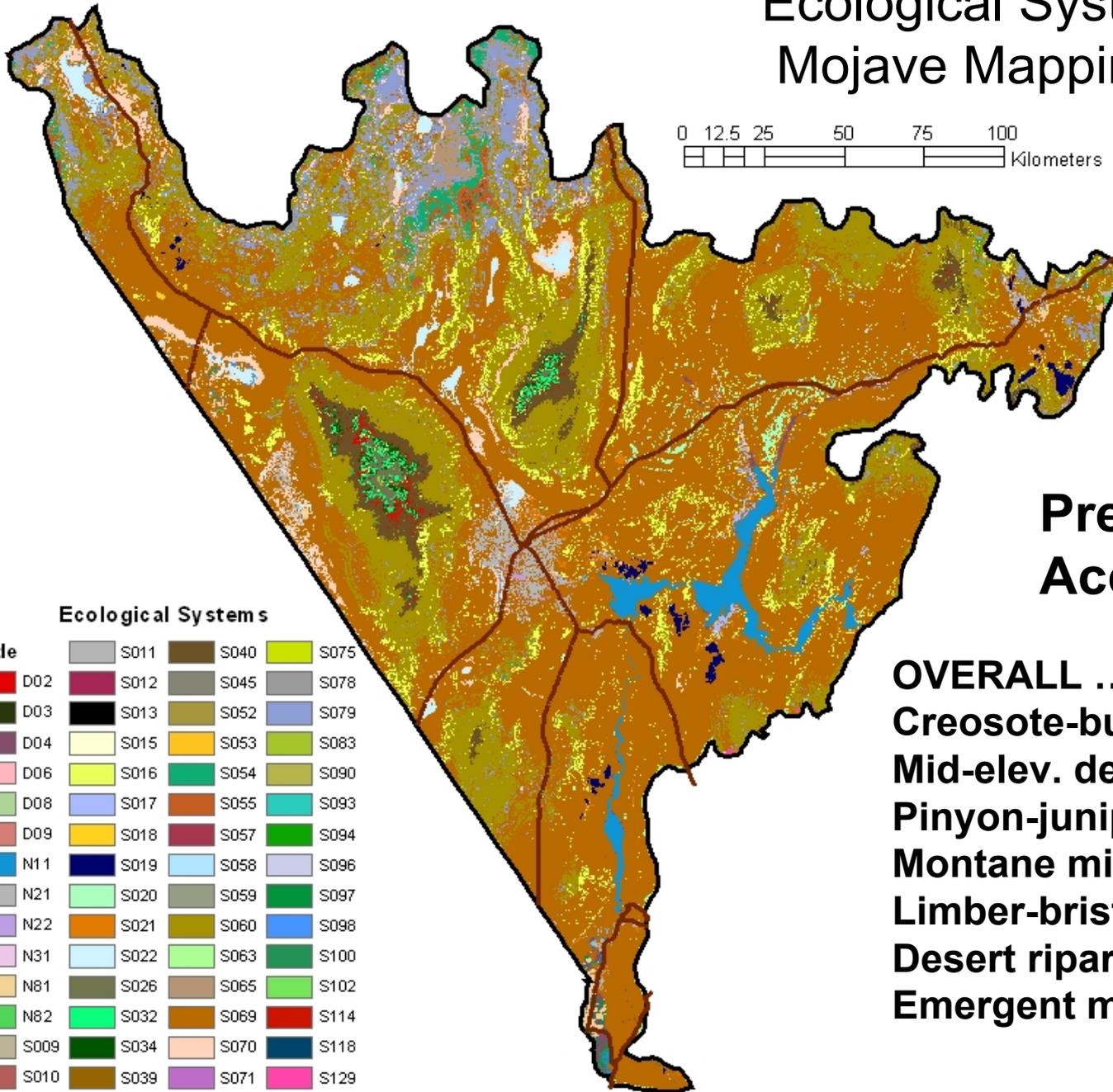
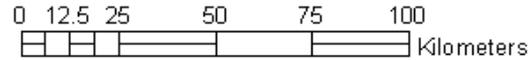
*Meteorological : DAYMET*

## Land Cover Map



- Classification Method: Classification trees (CART)
- Total Pixels: 1.5 billion
- Number of Cover Types: 125
- Minimum Mapping Unit: 5 pixels (0.4 ha)
- Accuracy Assessment: 20% training sites withheld

# Ecological Systems Map Mojave Mapping Unit



## Ecological Systems

Code	S011	S040	S075
D02	S012	S045	S078
D03	S013	S052	S079
D04	S015	S053	S083
D06	S016	S054	S090
D08	S017	S055	S093
D09	S018	S057	S094
N11	S019	S058	S096
N21	S020	S059	S097
N22	S021	S060	S098
N31	S022	S063	S100
N81	S026	S065	S102
N82	S032	S069	S114
S009	S034	S070	S118
S010	S039	S071	S129

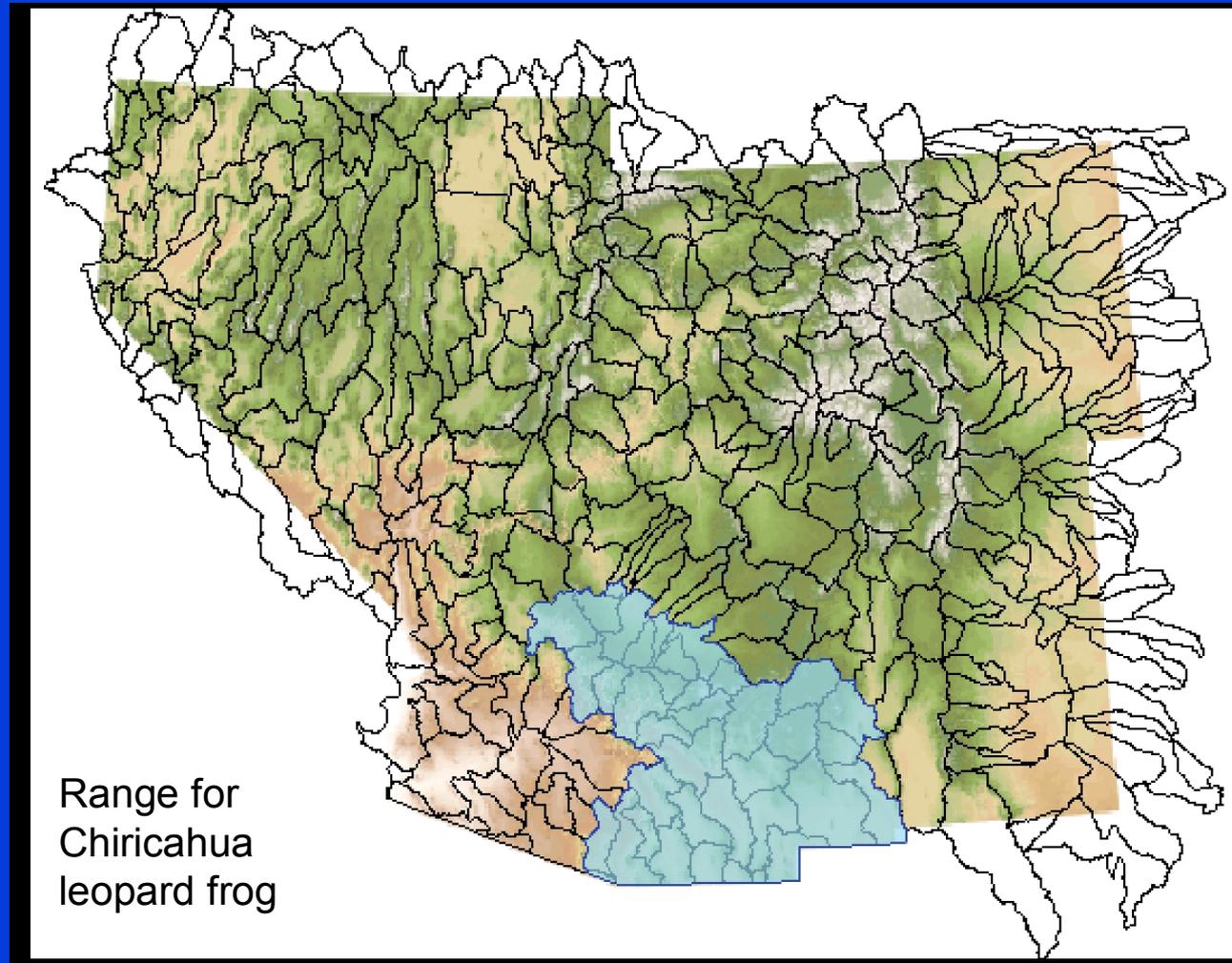
## Preliminary Accuracies:

<b>OVERALL</b> .....	<b>75%</b>
<b>Creosote-bursage</b> .....	<b>93%</b>
<b>Mid-elev. desert scrub</b> .....	<b>93%</b>
<b>Pinyon-juniper</b> .....	<b>53%</b>
<b>Montane mixed conifer</b> .....	<b>32%</b>
<b>Limber-bristlecone pine</b> ....	<b>46%</b>
<b>Desert riparian</b> .....	<b>43%</b>
<b>Emergent marsh</b> .....	<b>67%</b>

# Vertebrate Habitat Modeling (833 species)

Step 1. Compile literature for species range and habitat associations.

Step 2. Delineate range for mapping by hydrologic unit (& mtn. range).



Step 3. Identify habitat attributes that are mappable from available data sets.

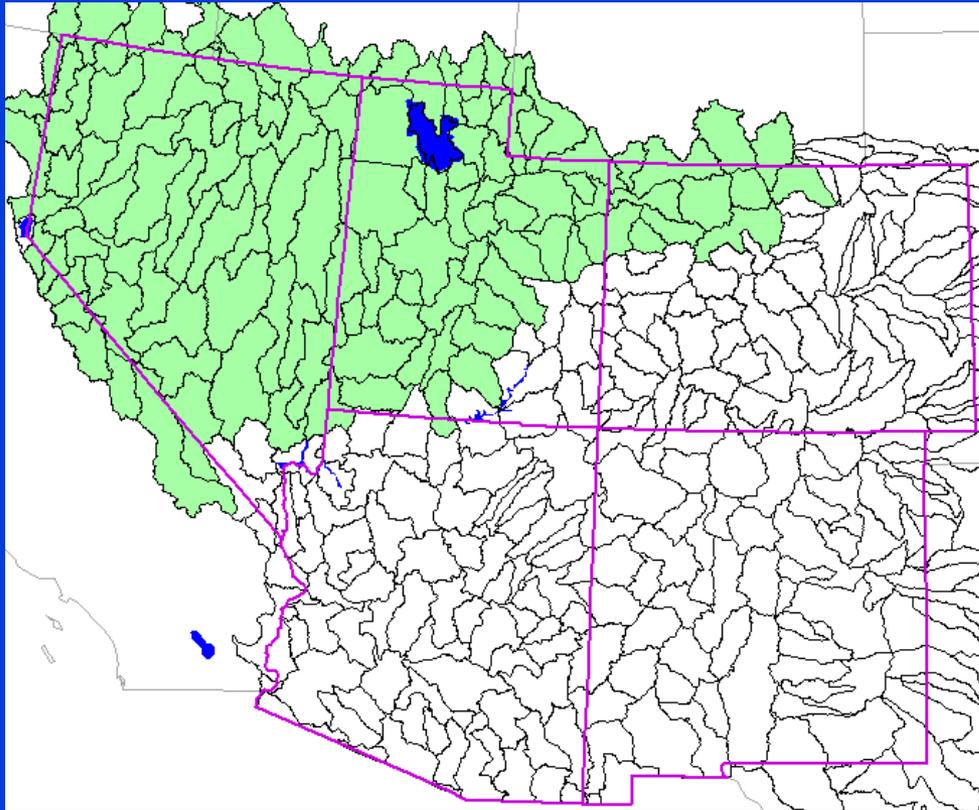
## Habitat Variables

- Land Cover \*
- Elevation (min/max) \*
- Slope/Aspect/Landform \*
- Hydrology (Proximity) \*
- Soil \*
- Patch Size \*
- Temp (min/max)
- Precipitation (min/max)
- Other Data Sets

\* Core Attributes -  
Layers that should be  
reviewed in identifying  
attributes



# Sagebrush Vole (*Lemmiscus curtatus*)



Elevation: 1770 - 3050 m

Land Cover Types:

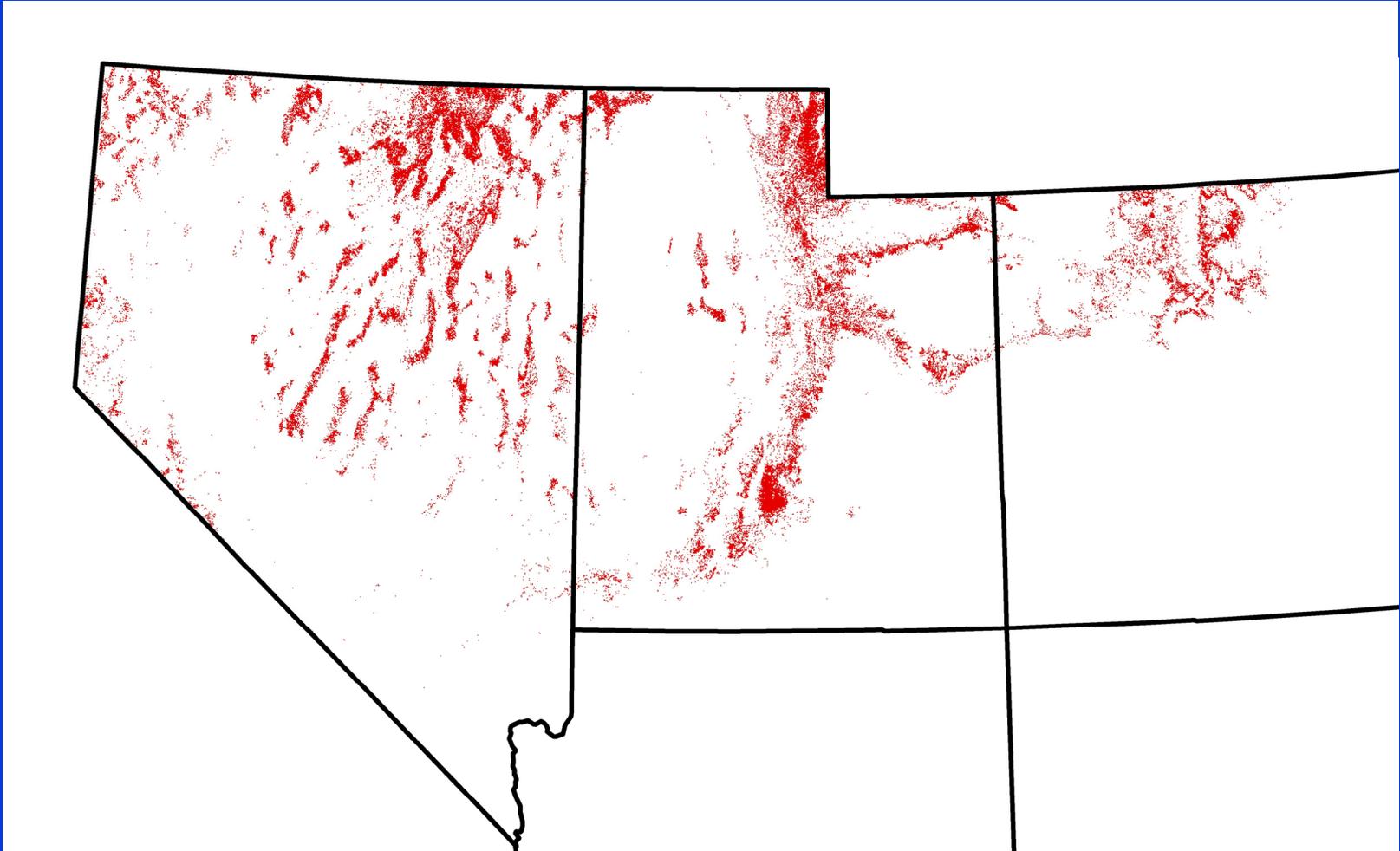
1. Inter-mountain Basins Big Sagebrush Steppe
2. Inter-mtn. Basins Montane Sagebrush Steppe
3. Inter-mtn. Basins Big Sagebrush Shrubland

## Citations:

	Title
	Hall, E. Raymond. 1981. Mammals of North America (2nd ed.). Wiley, New York.
	California Department of Fish and Game. 2003. Wildlife Habitat Relationships System. <a href="http://www.dfg.ca.gov/whdr">http://www.dfg.ca.gov/whdr</a>
	Hall, Raymond E. 1946. Mammals of Nevada. University of California Press, Berkeley and Los Angeles, California.
	Fitzgerald, J.P., C. A. Meaney, and D. M. Armstrong. 1994. Mammals of Colorado. Denver Museum of Natural History.
	Carroll, L.E., and H.H. Genoways. 1980. <i>Lagurus curtatus</i> . Mammalian Species 124: 1-6.

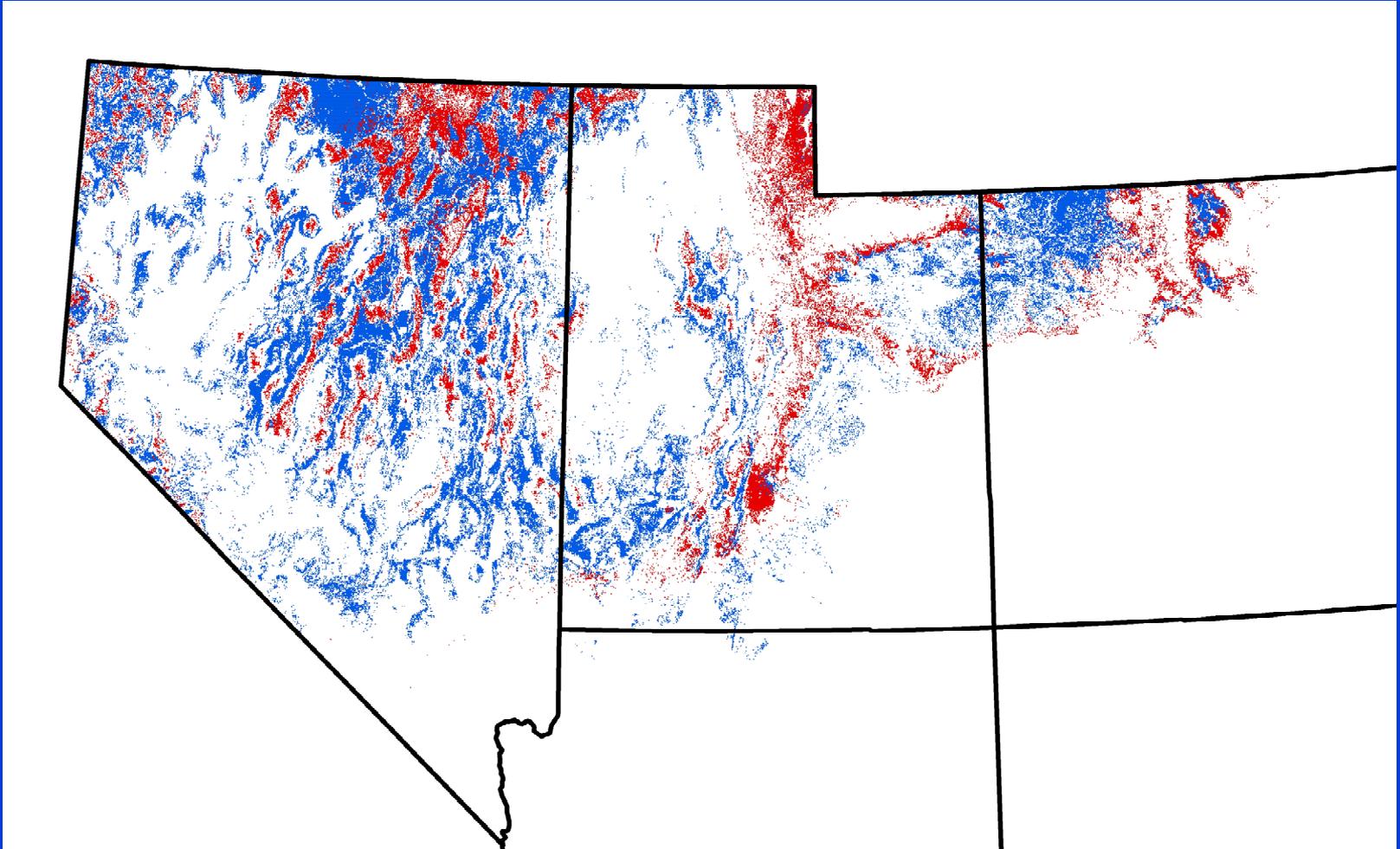
# Sagebrush Vole Model 1

- Elevation: 1770 - 3050 m
- Cover: Sagebrush steppe types only



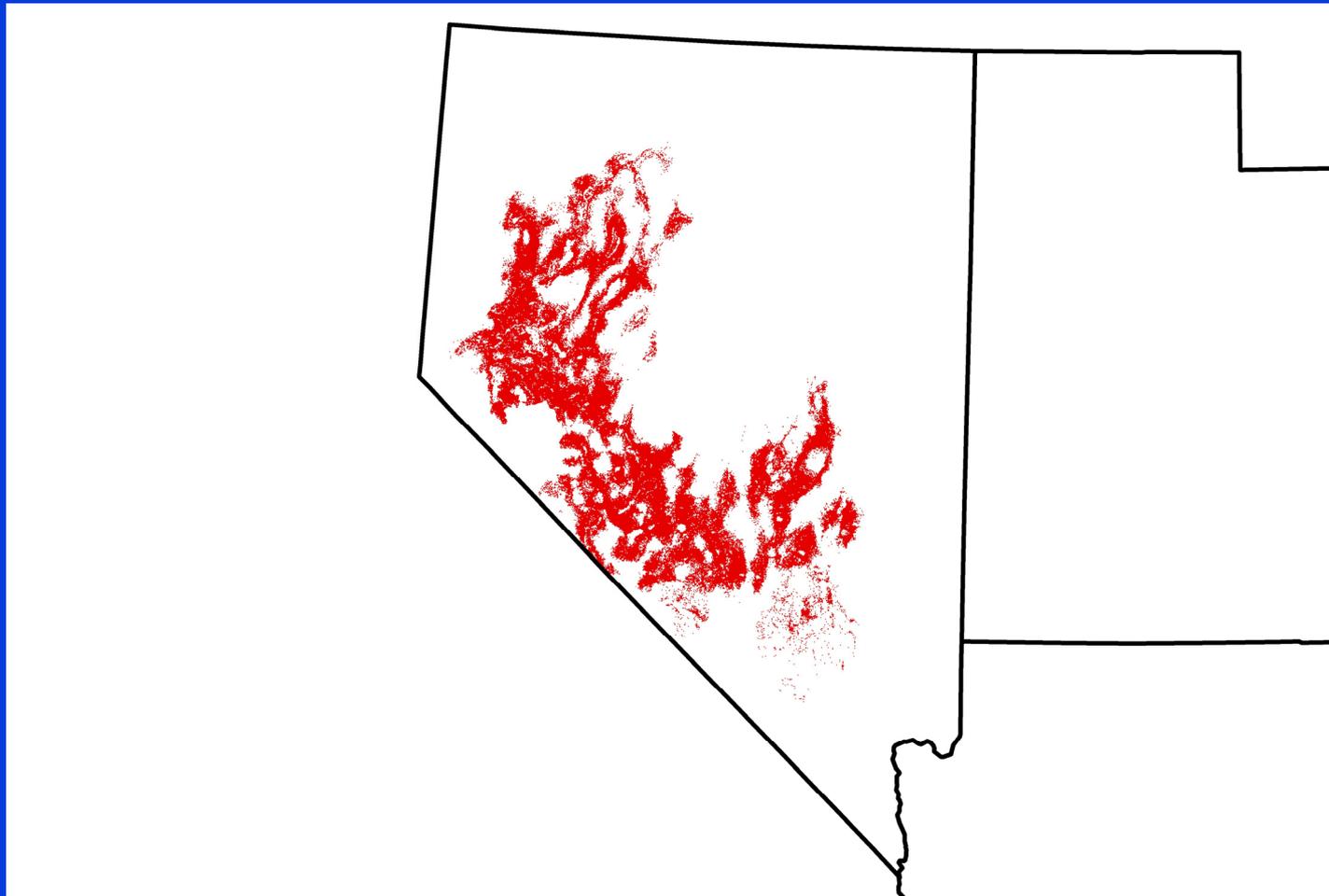
## Sagebrush Vole Model 2

- Elevation: 1770 - 3050 m
- Cover: Sagebrush steppe + big sagebrush shrubland



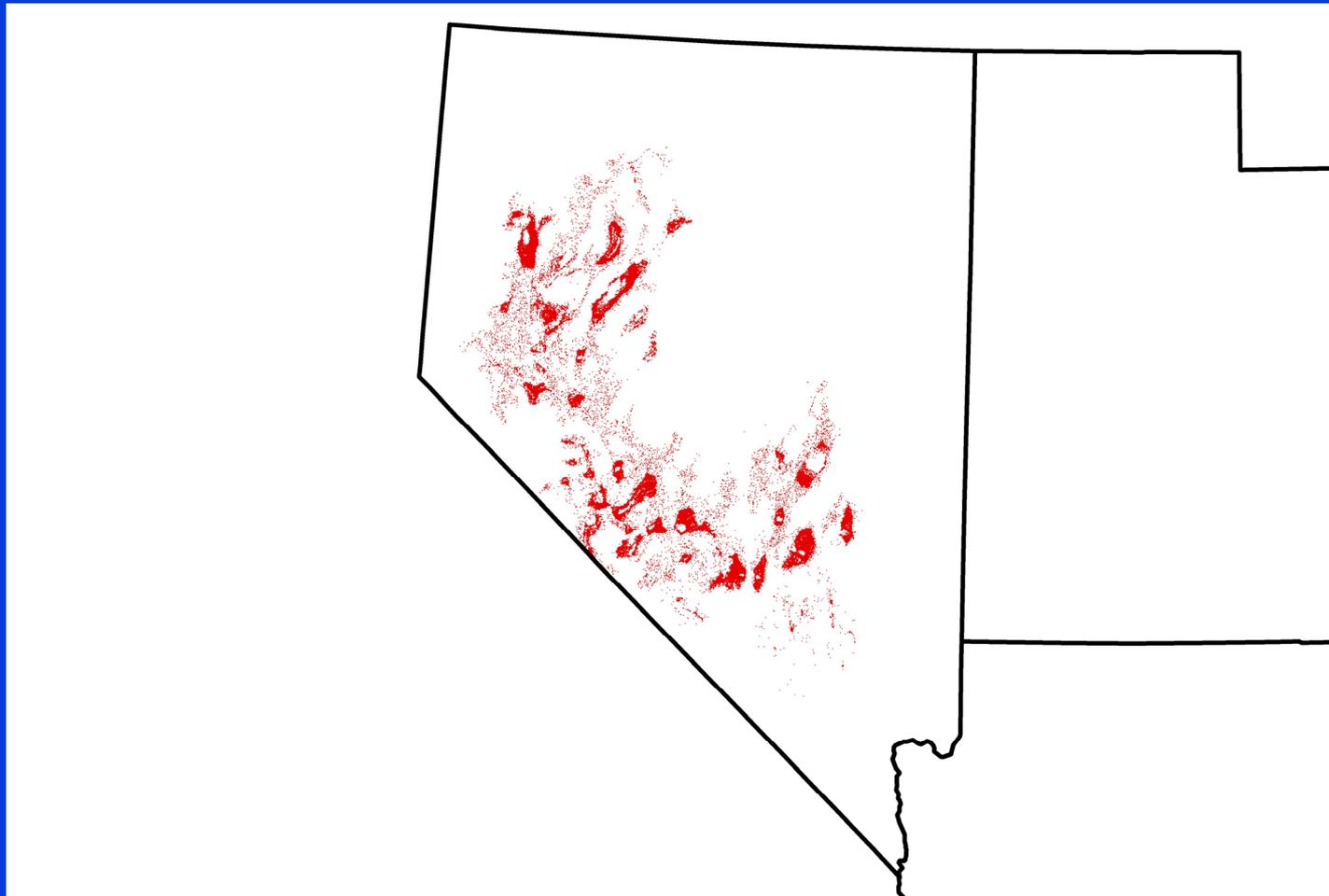
# Pale Kangaroo Mouse Model 1

- Elevation: 1190 - 1740 m
- Cover: Salt desert scrub & greasewood types



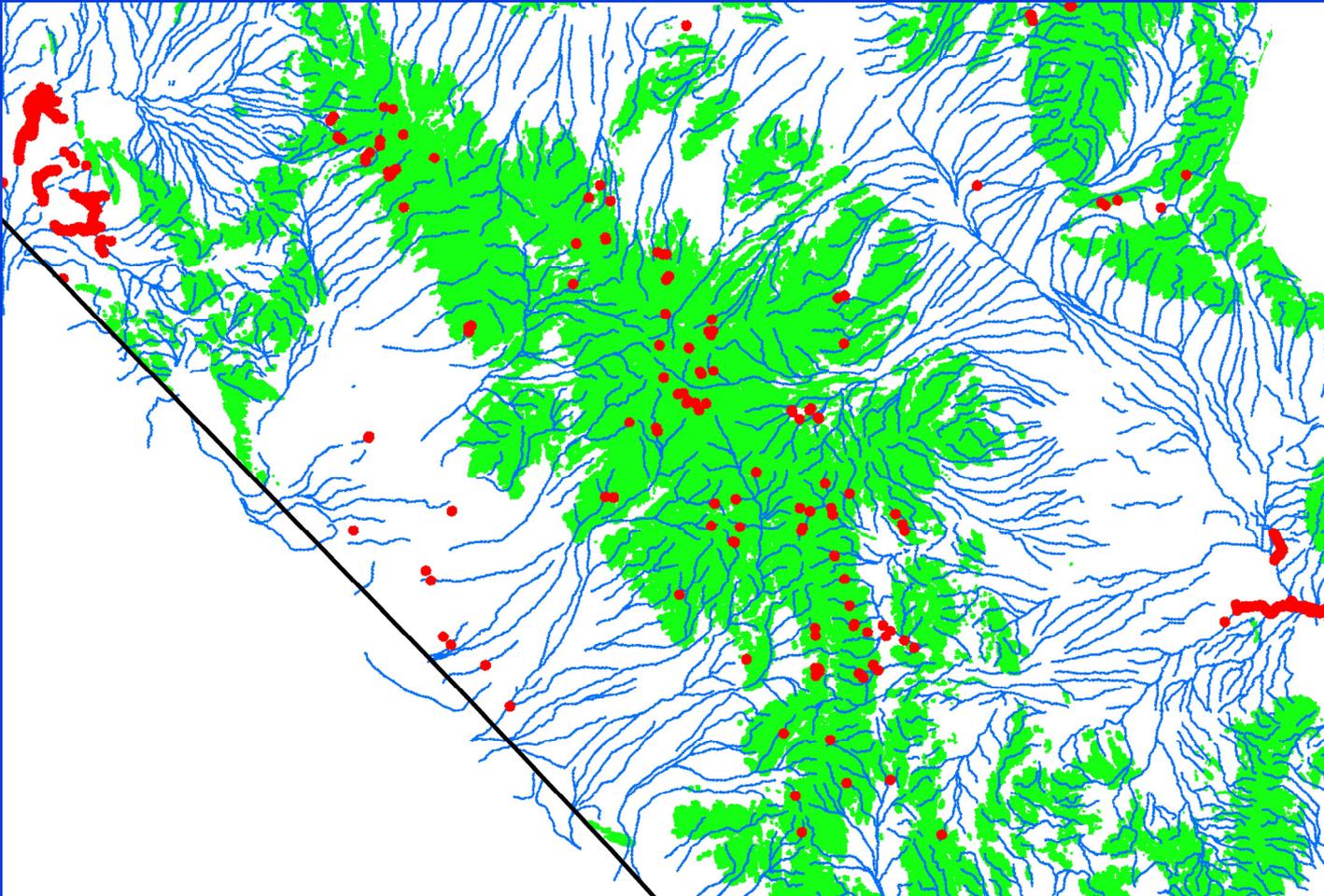
## Pale Kangaroo Mouse Model 2

- Elevation: 1190 - 1740 m
- Cover: Salt desert scrub & greasewood types
- Land form: Valley flats; toe slopes, swales



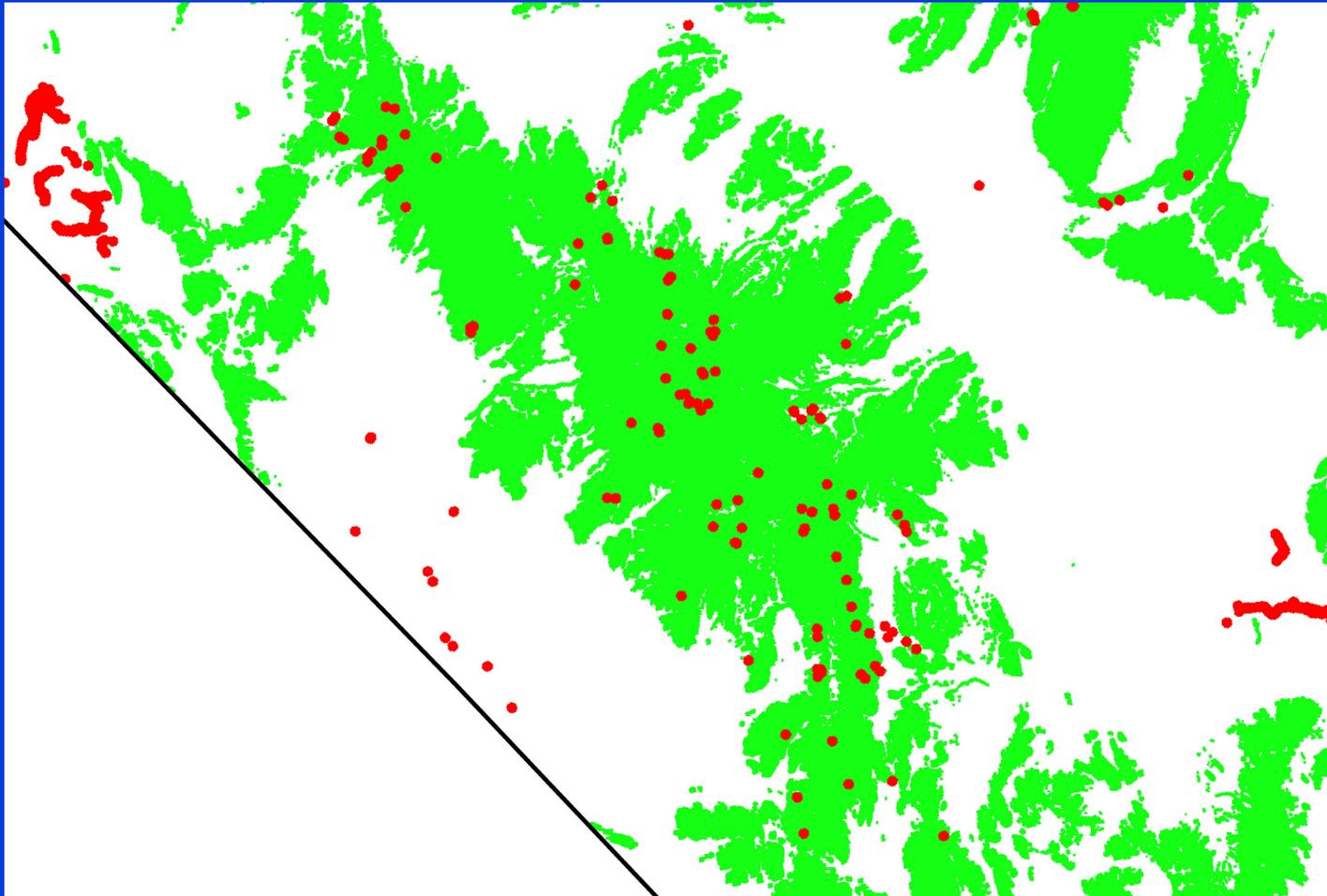
# Pacific Treefrog Model 1

- Elevation: 0 - 3535 m
- Hydrology: Permanent streams, small lakes, springs, wetlands + intermittent streams



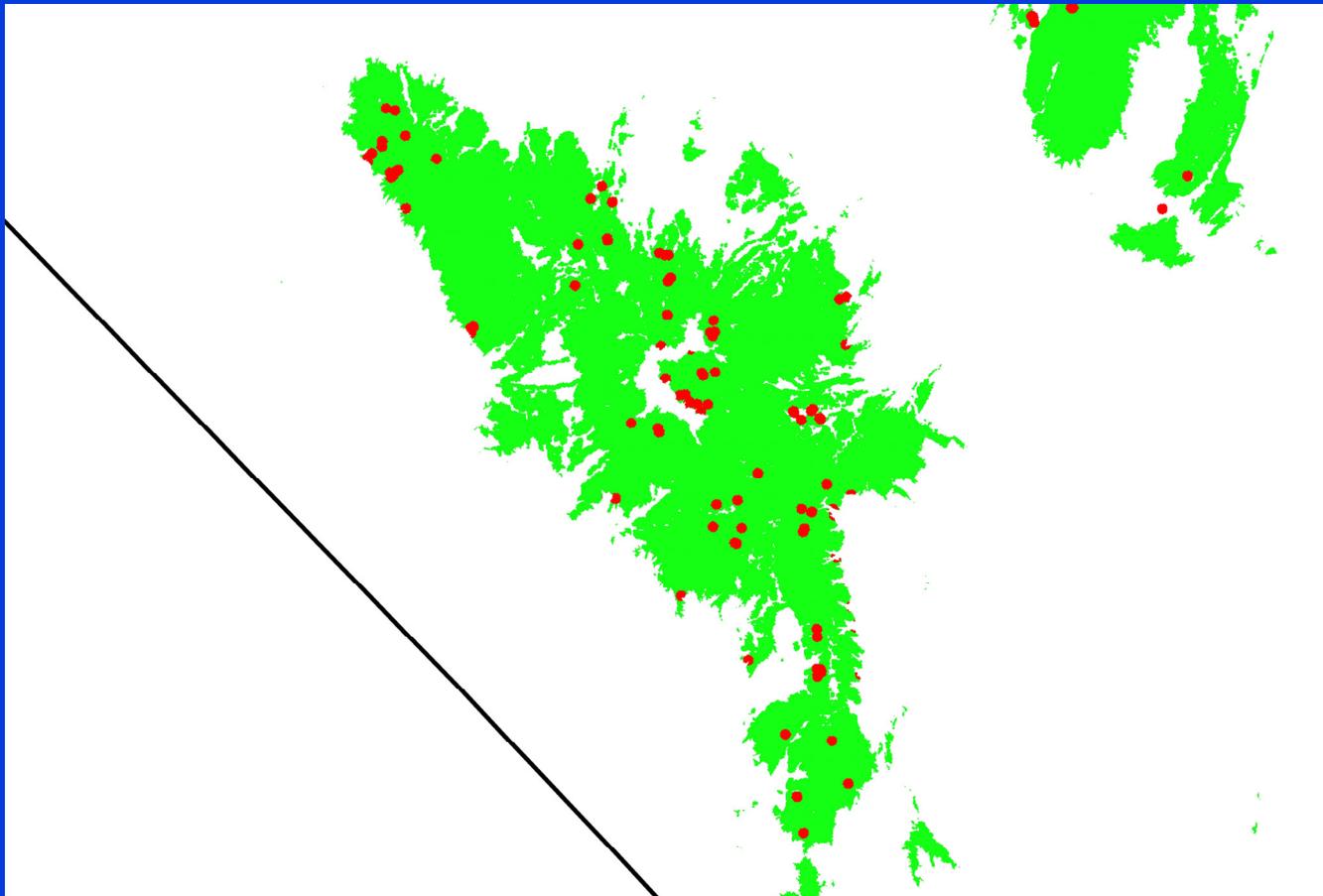
## Pacific Treefrog Model 2

- Elevation: 0 - 3535 m
- Hydrology: Permanent streams, small lakes, springs, wetlands (no intermittent streams)



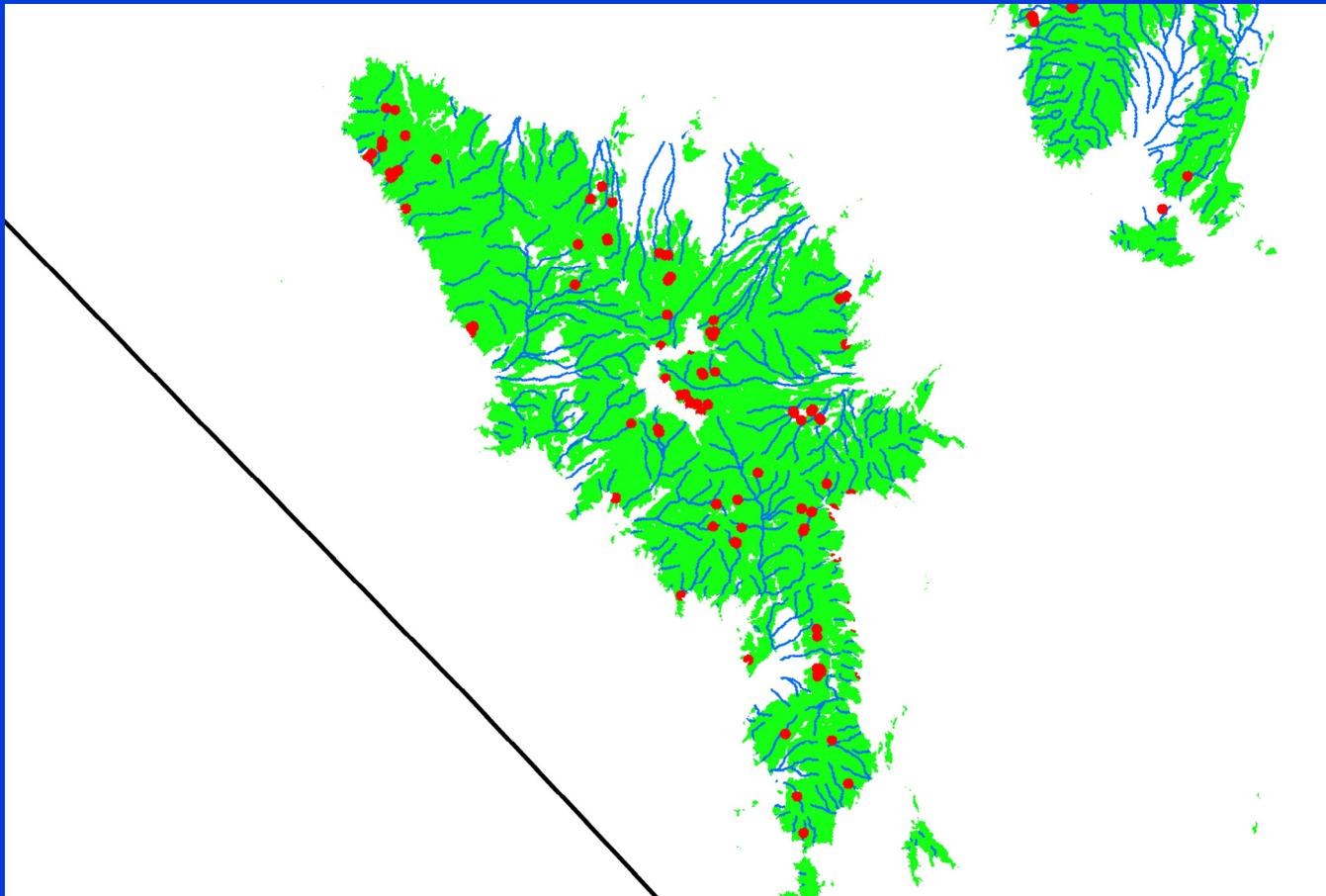
# Inyo Shrew Model 1

- Elevation: 1670 - 3000 m
- Hydrology: Permanent streams, small lakes, springs, wetlands



## Inyo Shrew Model 2

- Elevation: 1670 - 3000 m
- Hydrology: Permanent streams, small lakes, springs, wetlands + **intermittent streams**



## Take Home Messages - I

1. SWReGAP provides data sets that can be used to evaluate patterns over large areas, e.g., biodiversity, entire distributions of species & communities, & protection status.
2. Data sets provide context for how a local resource fits into the larger spatial perspective.
3. Land cover accuracies vary -- caution must be employed depending on the cover class of interest and how the data will be used.

## Take Home Messages - II

4. Despite its limitations, the SWReGAP land cover map is the best that will be available over such a large area for some time.
5. Similarly, SWReGAP habitat models are the only source for predicted distribution of habitat for all terrestrial vertebrates over a large area, but caution must be employed in using these models.
6. A different type of research is needed for predicting habitat distribution -- focus on entire ranges for multiple species, and grappling with low accuracies.

*David Bradford*  
[bradford.david@epa.gov](mailto:bradford.david@epa.gov)

*William Kepner*  
[kepner.william@epa.gov](mailto:kepner.william@epa.gov)

*Todd Sajwaj*  
[tsajwaj@lmepo.com](mailto:tsajwaj@lmepo.com)

[http://leopold.nmsu.edu/  
fwscoop/swregap/default.htm](http://leopold.nmsu.edu/fwscoop/swregap/default.htm)

