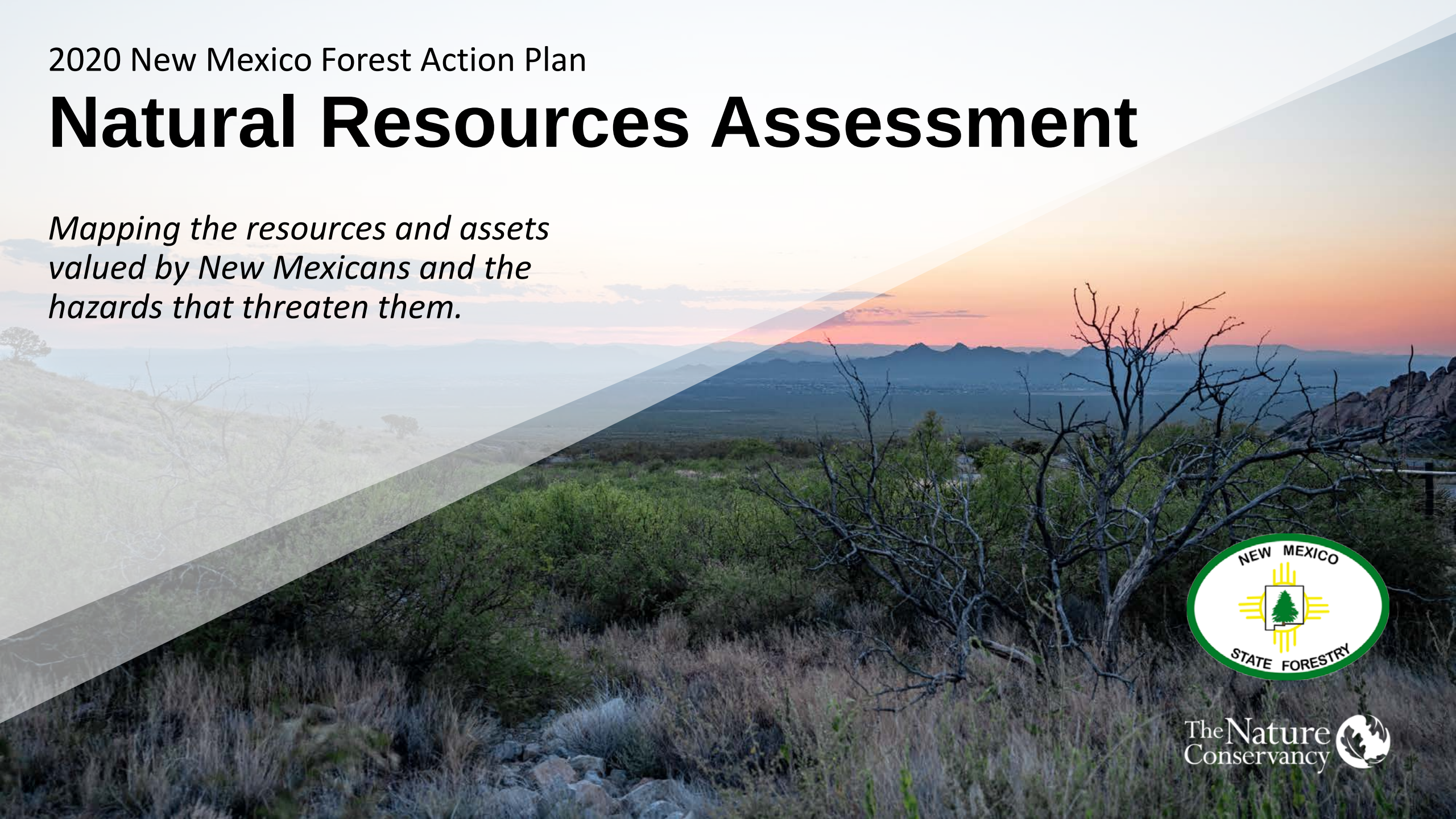
2020 New Mexico Forest Action Plan

Natural Resources Assessment

Mapping the resources and assets valued by New Mexicans and the hazards that threaten them.



Forest Action Plan

- State Forest Action Plans
  - Required by 2008 Farm Bill

- Natural Resources Assessment
  - Documents the conditions and trends of forest resources

- Forest Strategy and Action Plan
  - Outline a plan of action to:
    1. Conserve Working Landscapes
    2. Protect Watersheds from Harm
    3. Enhance Public Benefit from Natural Resources

FAP Structure

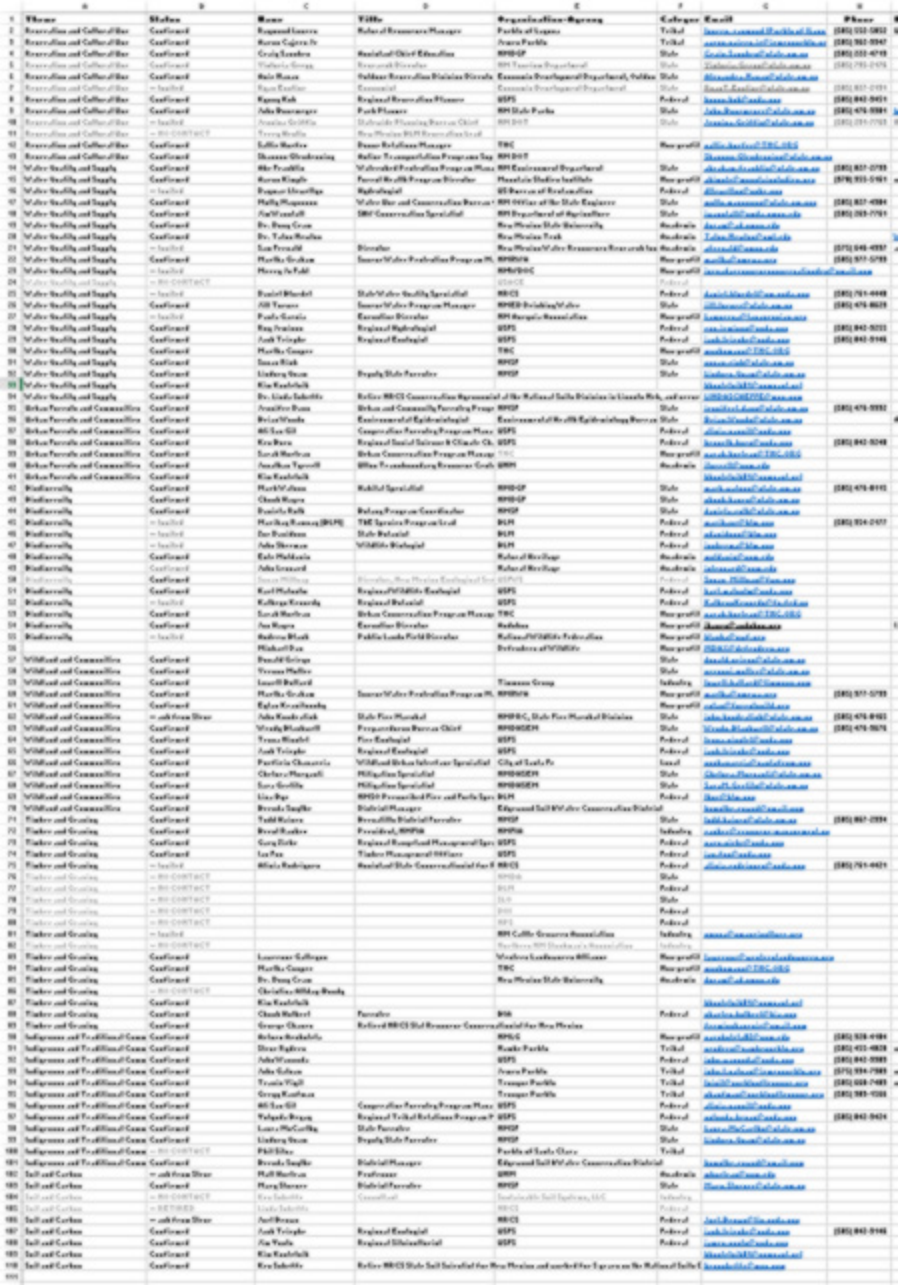
- Natural Resources Assessment
  - Map Resources & Assets
  - Map Hazards
  - Map Risk

- Action Plan
  - Identify Strategies to Mitigate Risk and Enhance Value of Resources and Assets

Assessment Approach

- Science Based & Data Driven
  - Use Best Available Data

- Collaborative Approach
  - Eight Technical Panels convened
  - Over 100 Subject Matter Experts



Themes: Resources and Assets We Value

- Wildland Communities
- Water Quality and Supply
- Carbon Balance: Biomass and Soils
- Timber and Grazing
- Biodiversity
- Indigenous and Traditional Communities
- Recreation and Cultural Use
- Urban Forests and Communities

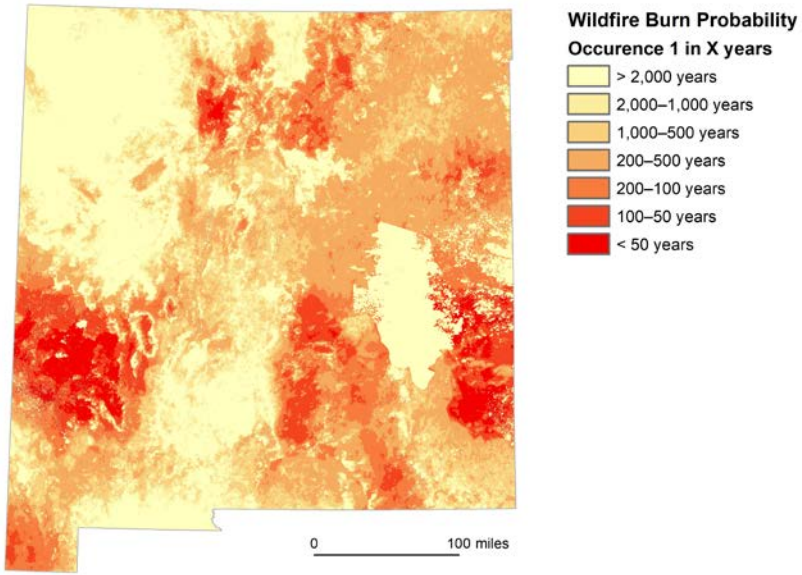
Threats: Hazards We Worry About

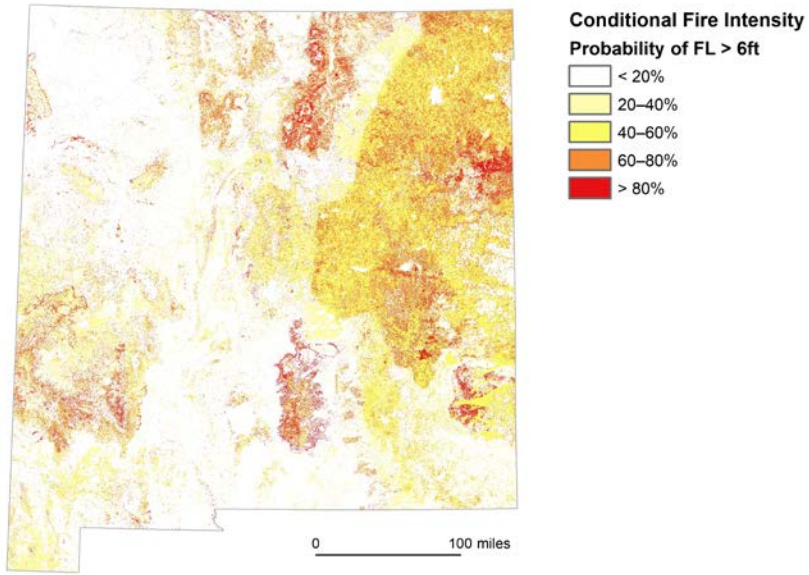
- Wildfire Hazard
- Post-wildfire Hazards
  - Debris Flow
  - Flooding
  - Erosion & Sedimentation
- Disease and Insects
- Development & Fragmentation
- Climate Change
- Use & Activity

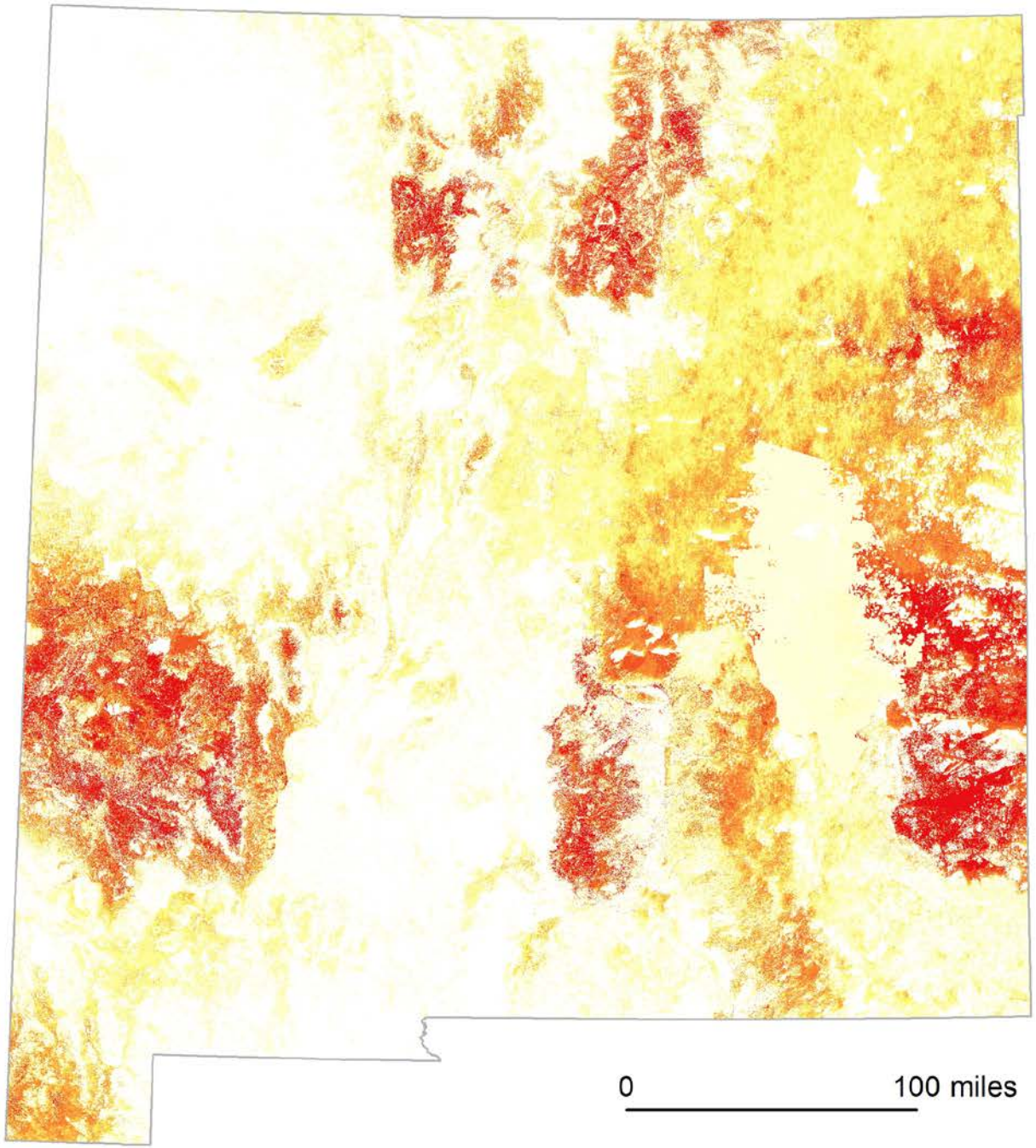
Threat: Wildfire Hazard

Wildfire Hazard

- Hazard is a function of the expected:
  - Probability of a Wildfire
  - Intensity of the Wildfire







Wildfire Hazard

Likelihood of FL > 6ft

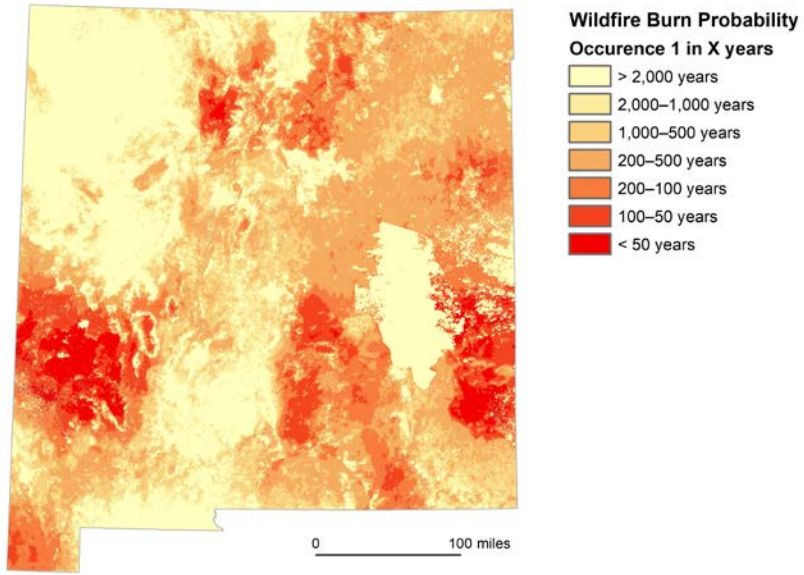
- 0
- 0.001 - 0
- 0.001 - 0.001
- 0.002 - 0.001
- 0.002 - 0.001
- 0.002 - 0.002
- 0.003 - 0.003
- 0.004 - 0.005
- 0.006 - 0.008
- 0.009 - 0.048

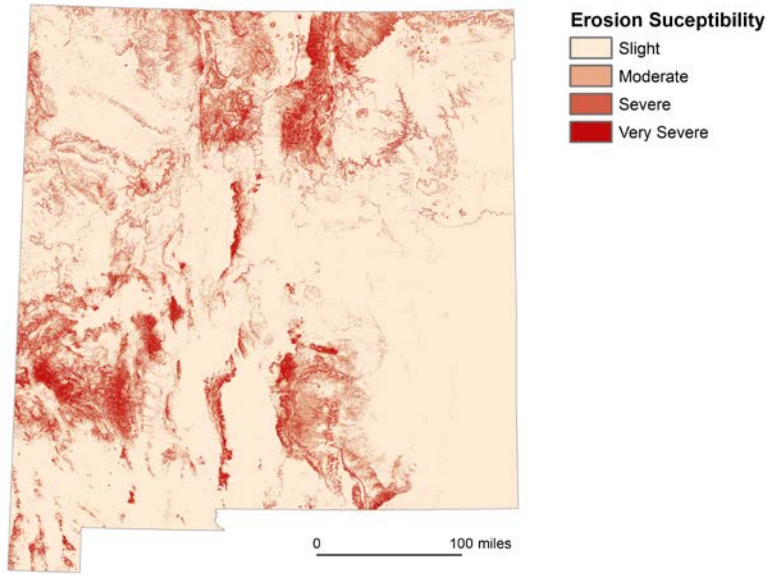
- Next fire season, what is the likelihood of a fire burning with flame lengths greater than 6 feet?

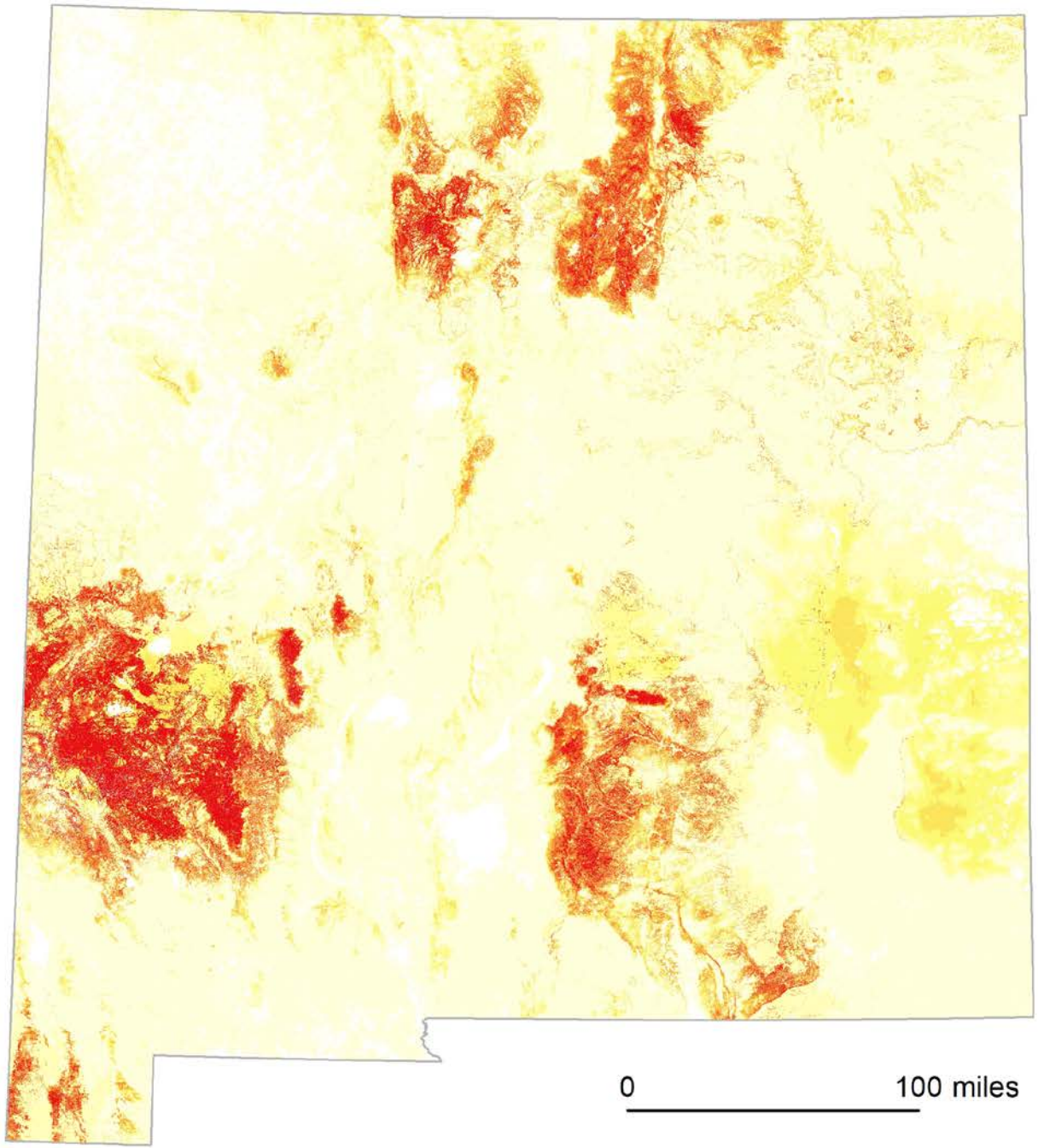
Threat: Post-wildfire Hazards

Post-Wildfire Erosion Hazard

- Erosion hazard is a function of the expected:
  - Probability of a Wildfire
  - Intensity of the Erosion



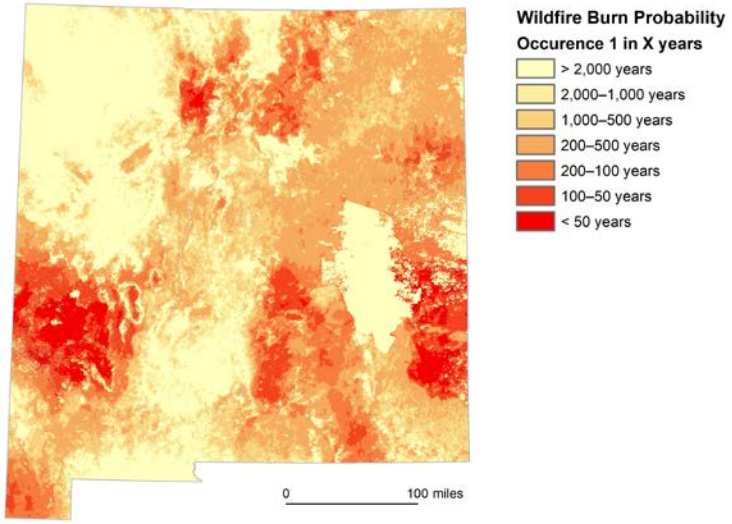


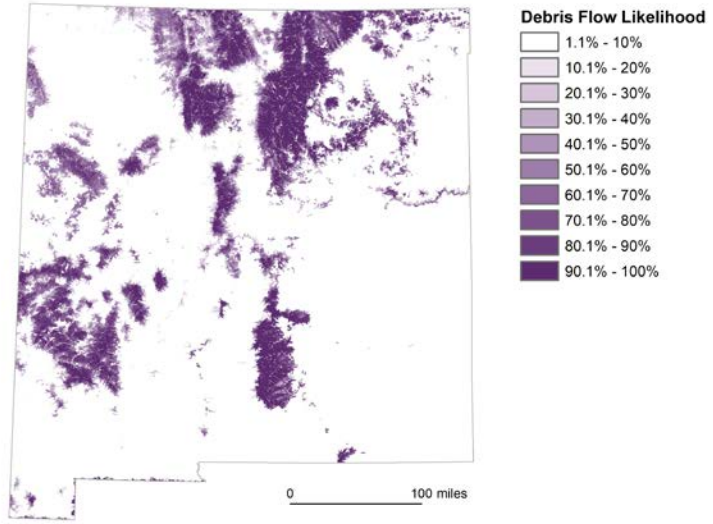


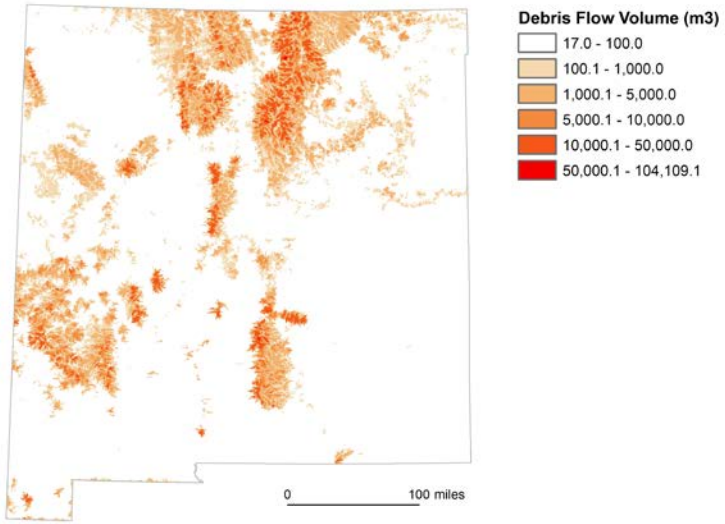
- Areas susceptible to erosion that are likely to experience wildfire.

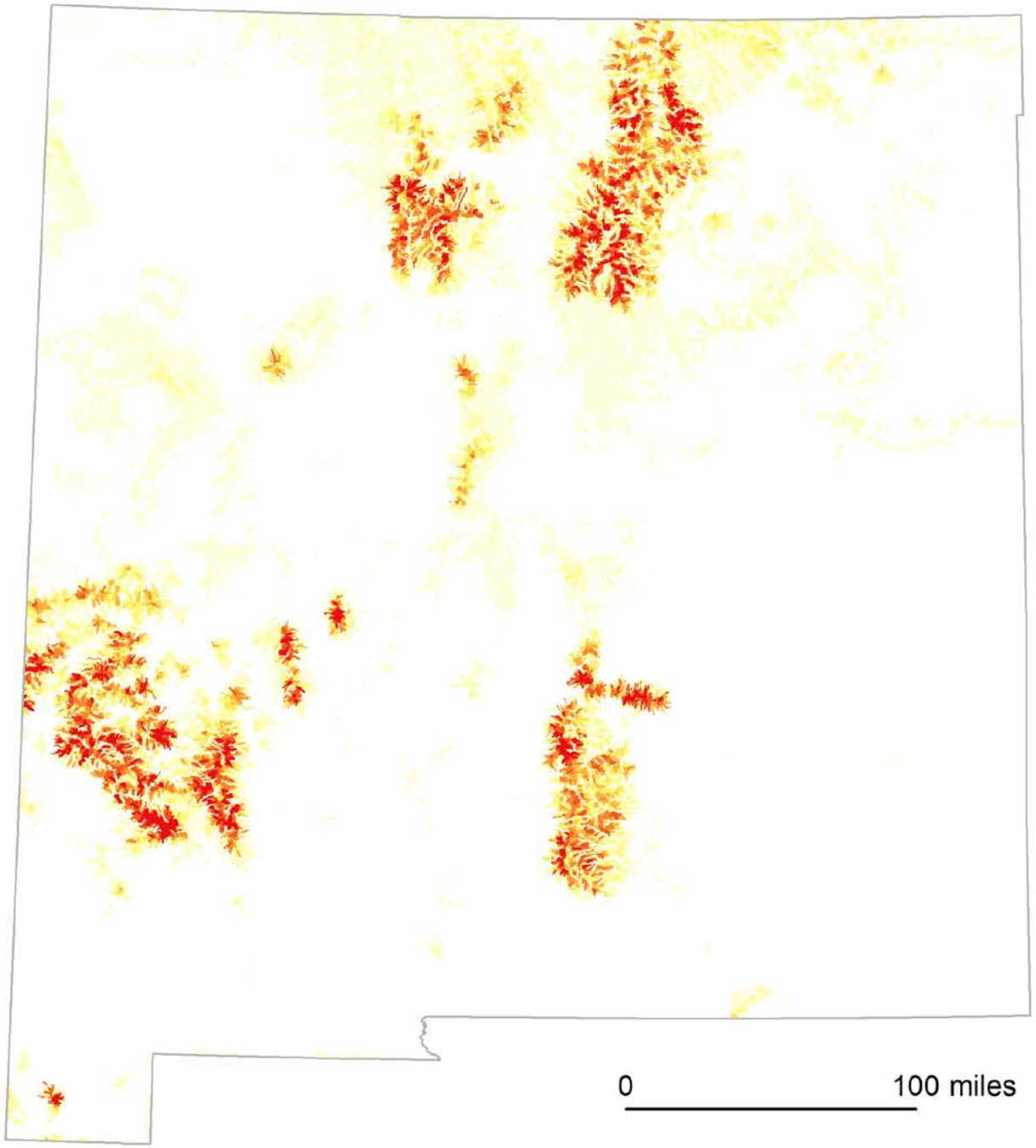
Post-wildfire Debris-flow Hazard

- Debris flow hazard is a function of the expected:
  - Probability of a wildfire
  - Probability of debris Flow
  - Volume of debris flow





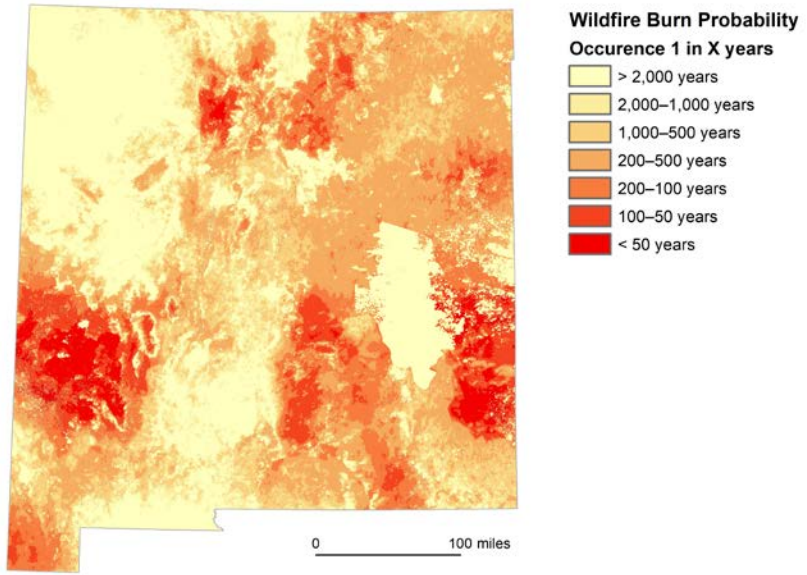


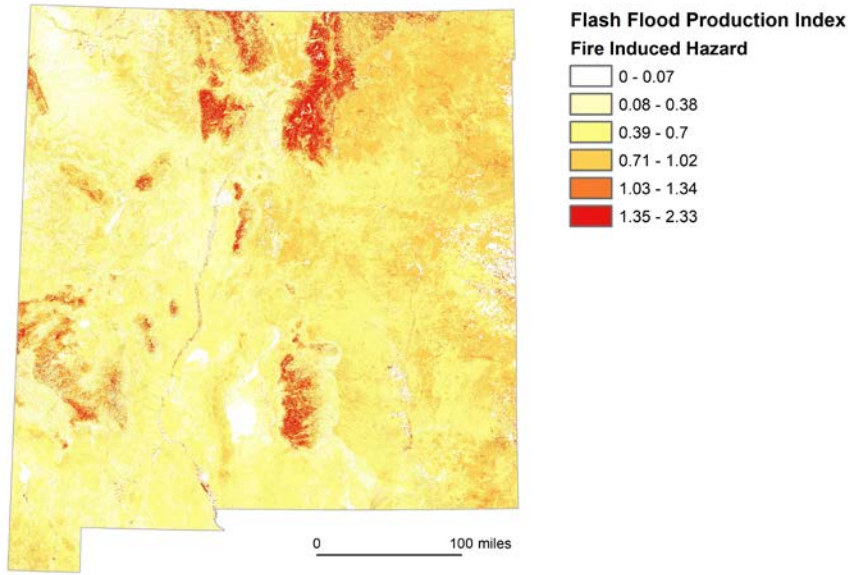


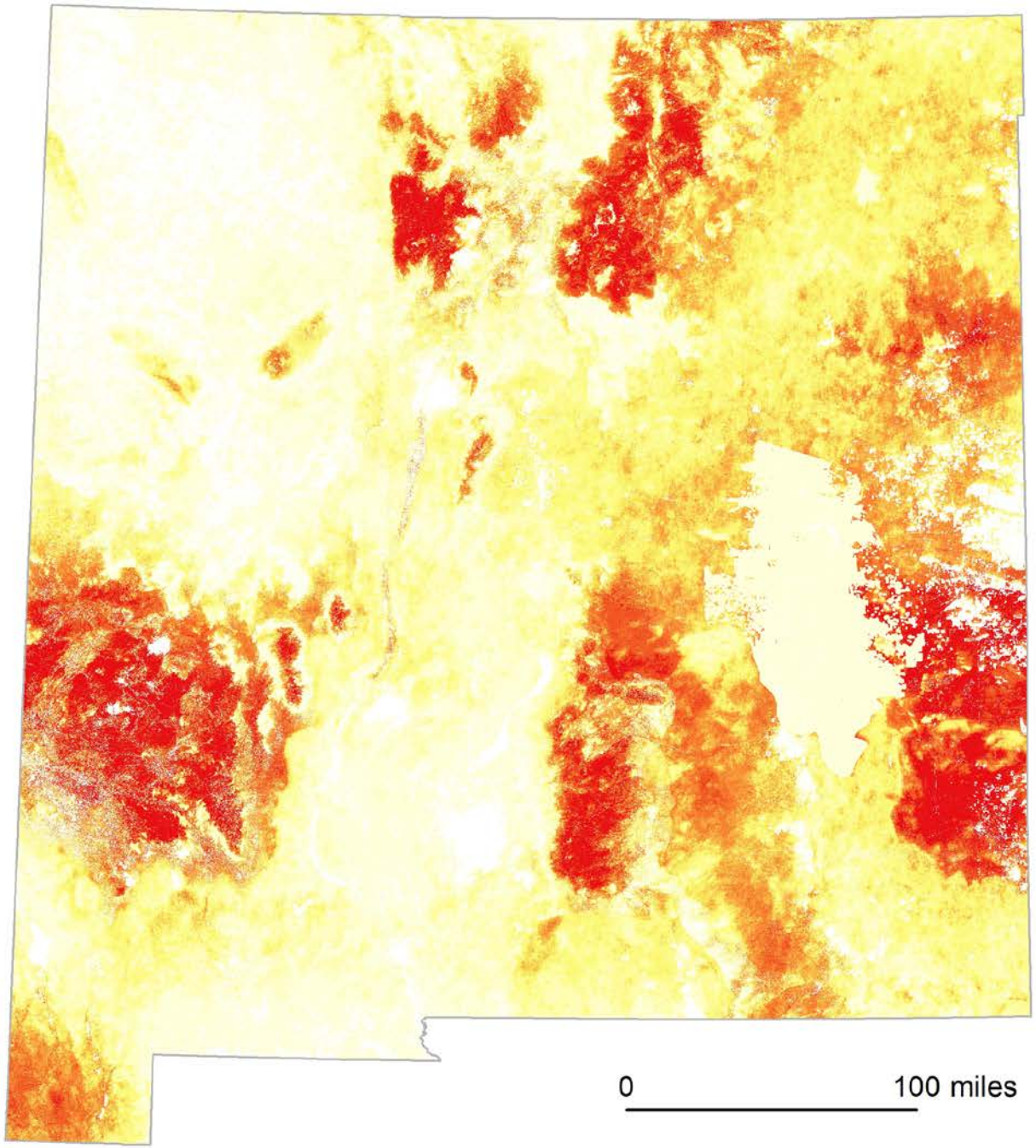
- Areas susceptible to post-fire debris flow and likely to be burned.

Post-wildfire Flash Flood Hazard

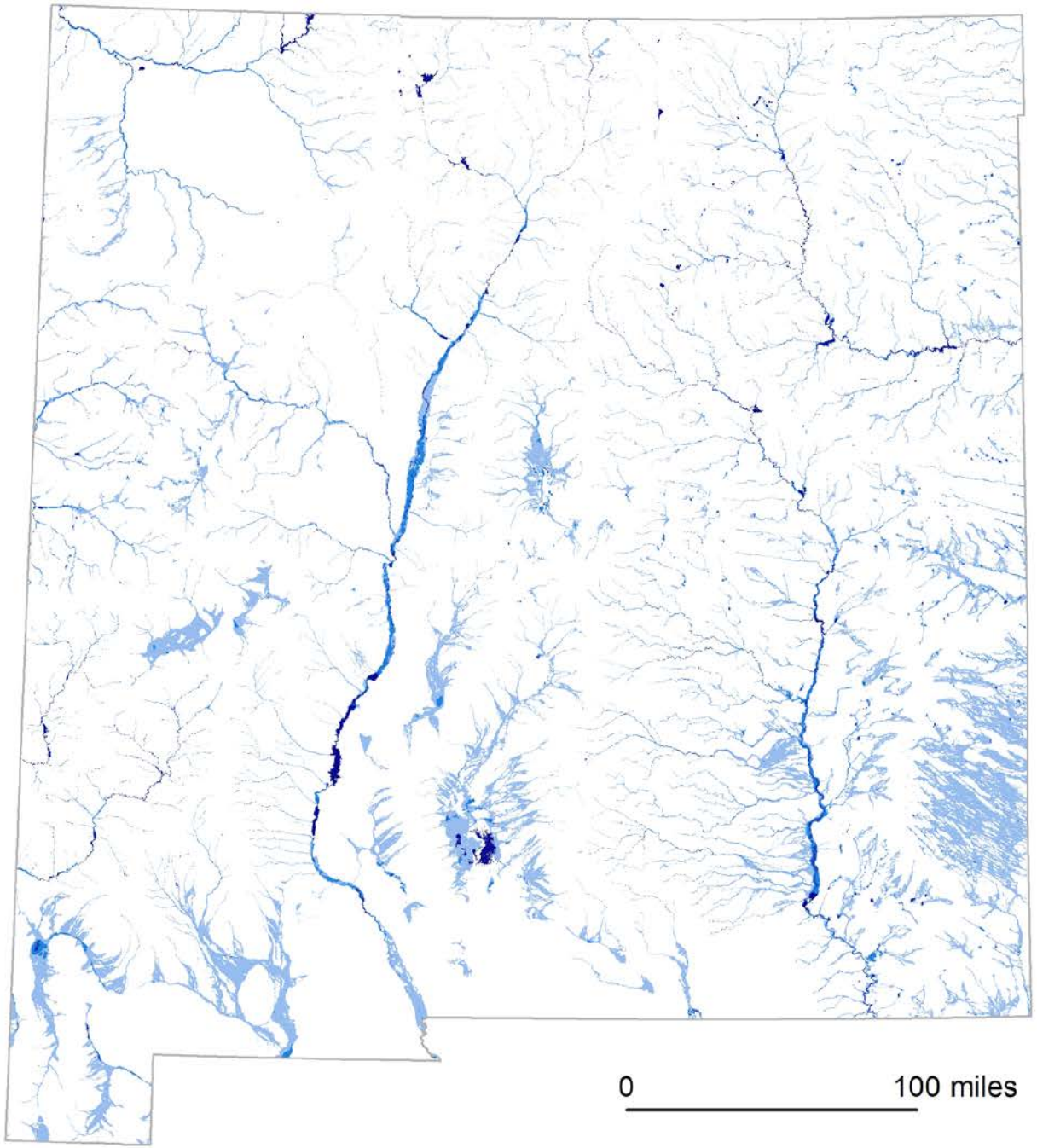
- Post-fire flash flood hazard is a function of the expected:
  - Probability of a wildfire
  - Intensity of a flash flood







- Areas with high production of post-fire flash floods and high likelihood of wildfire

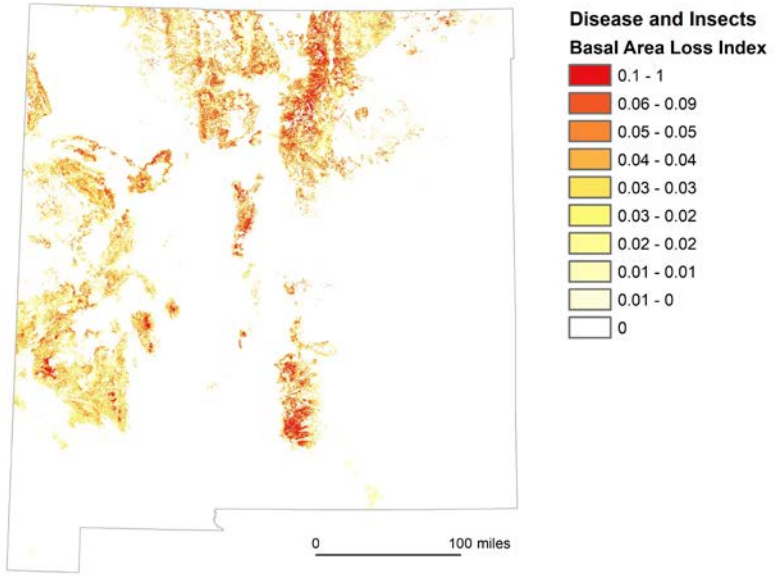


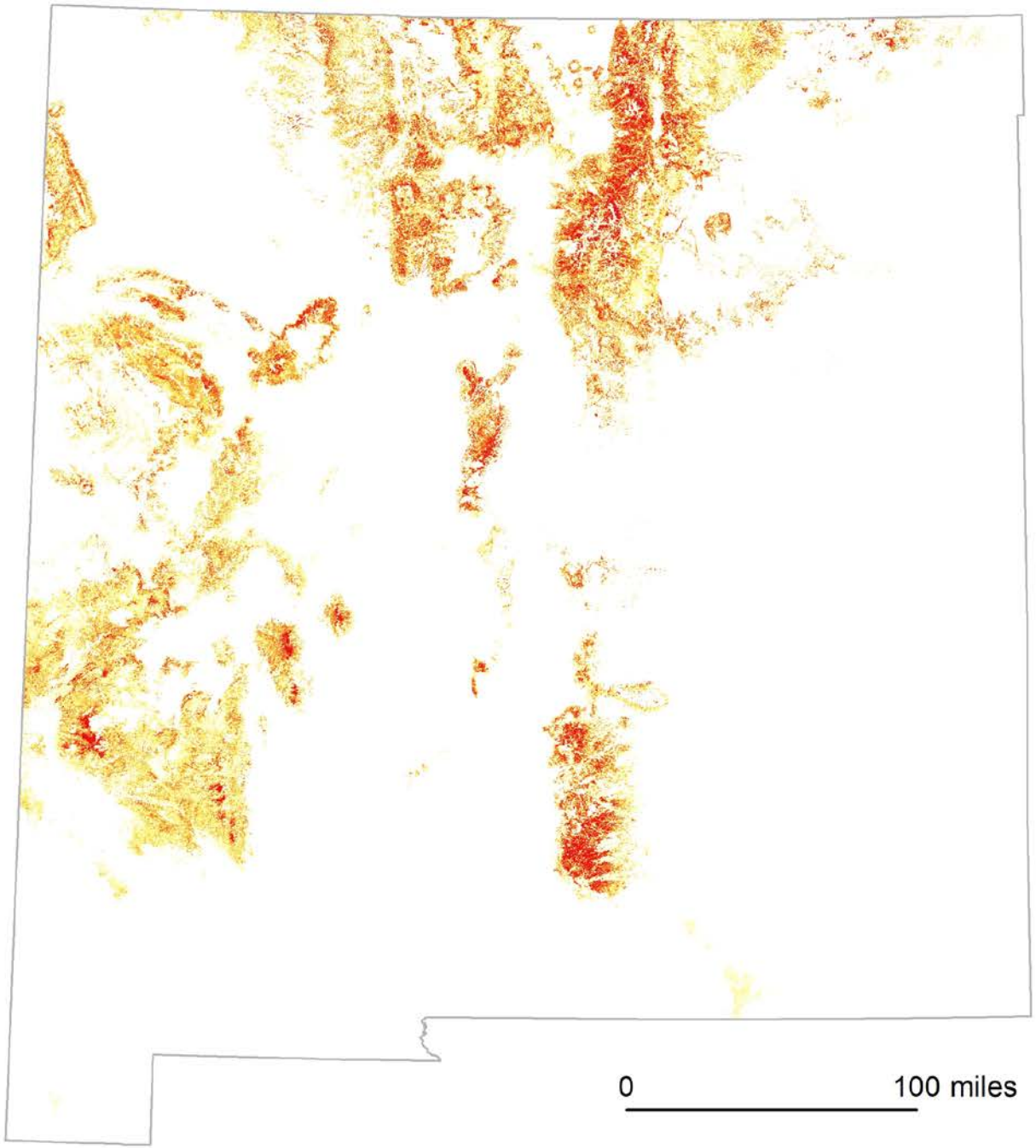
- “500-year Floodplain” can be used to identify Resources and Assets that will be exposed to post-fire floods
- 500-year events happen every year following a wildfire

Threat: Disease and Insects

Disease and Insects

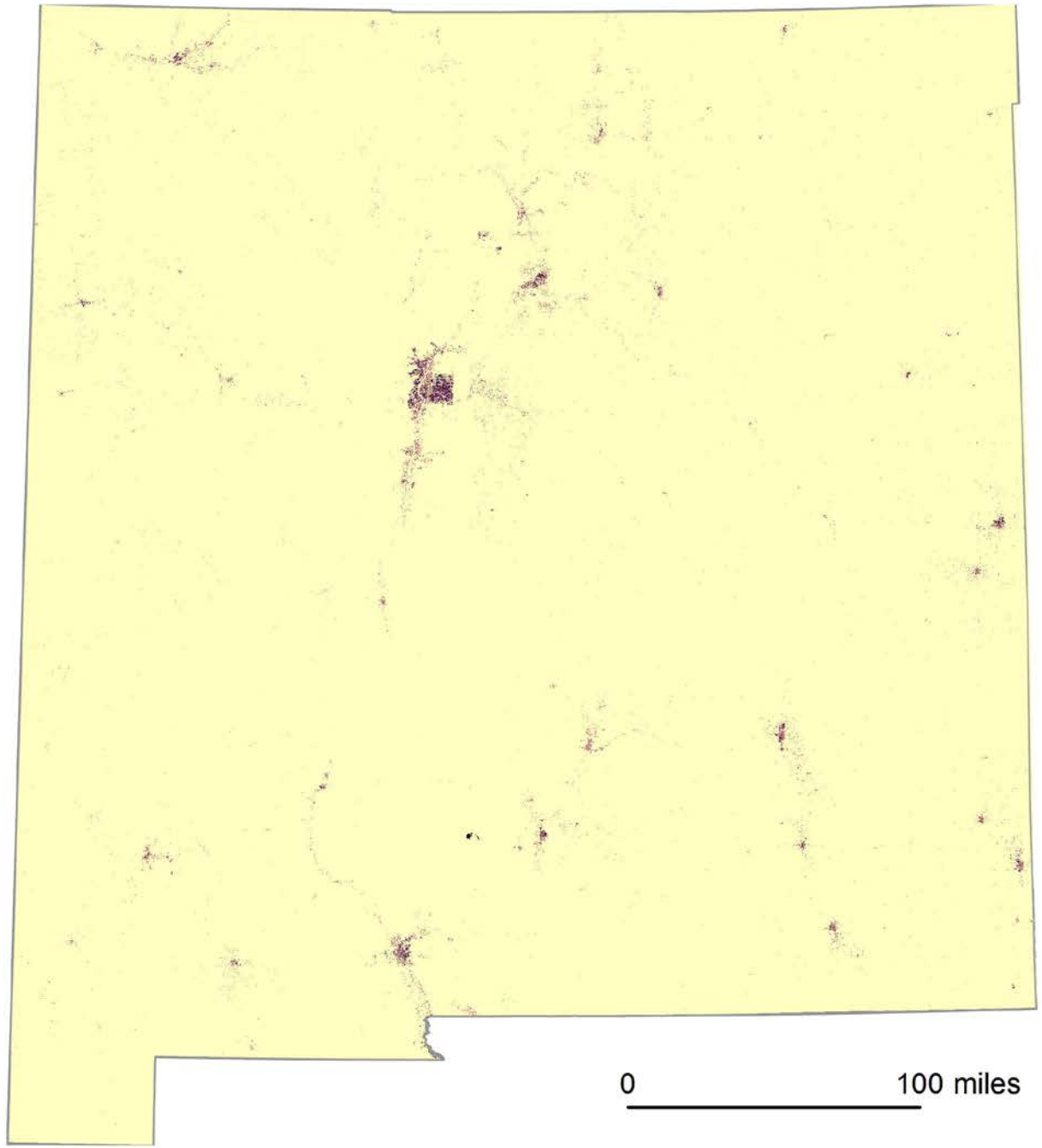
- Disease and Insect Hazard Mapped for U.S. (NIDRM)
  - Intensity of Basal Area Loss by 2027





- All forests are at risk.
- Absolute basal area loss (pictured) is highest in forests.

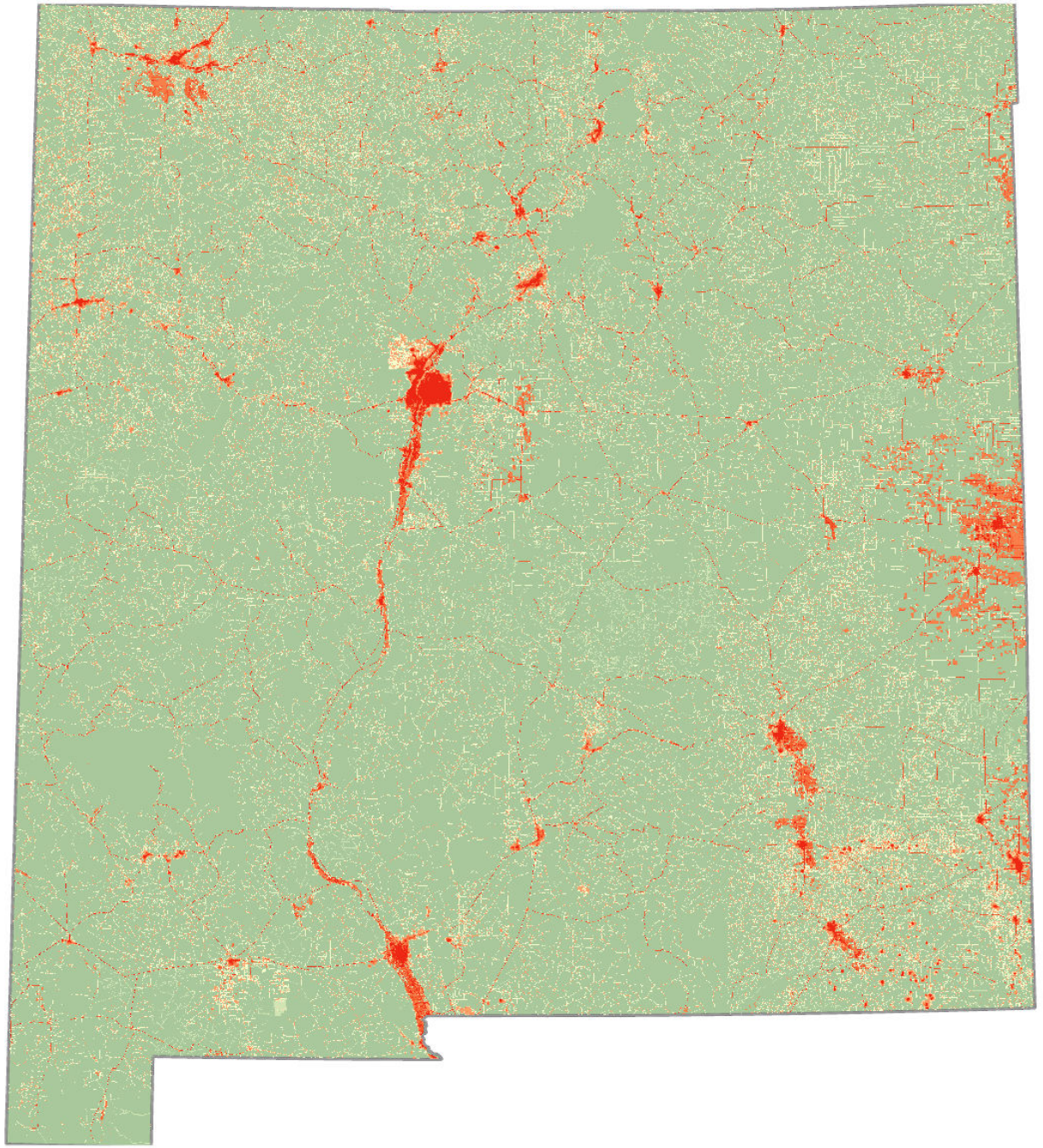
Threat: Development and Fragmentation



Building Footprints

Percent coverage

- <= 100
- <= 40
- <= 29.8
- <= 22.75
- <= 18.04
- <= 12.94
- <= 9.02
- <= 5.88
- <= 2.75
- <= 0



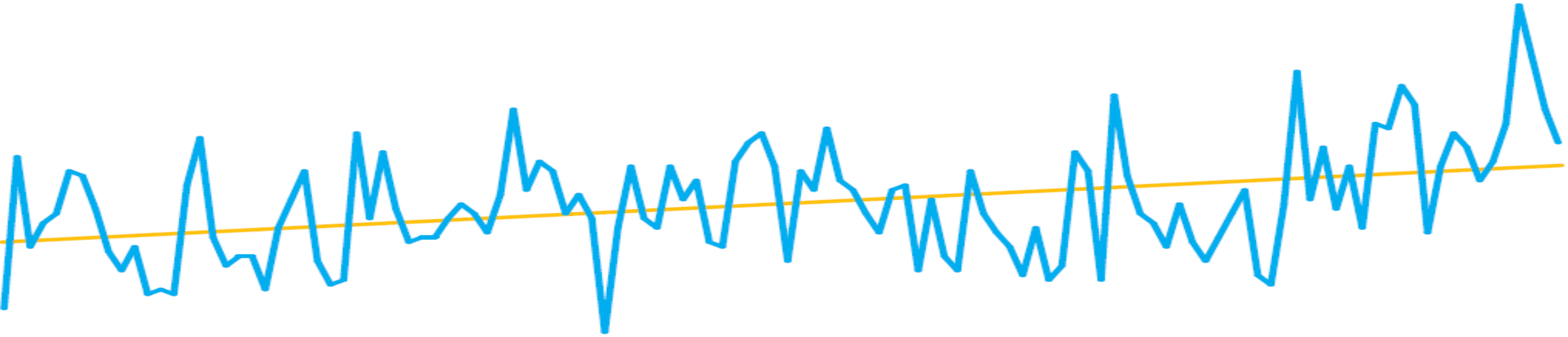
Development / Fragmentation

Model of degree of human modification as described in 2016 technical report by Conservation Science Partners.

- <= 100
- <= 59.24
- <= 50.31
- <= 33.22
- <= 15.75
- <= 15.36
- <= 10.32
- <= 9.93
- <= 6.44
- <= 6.05

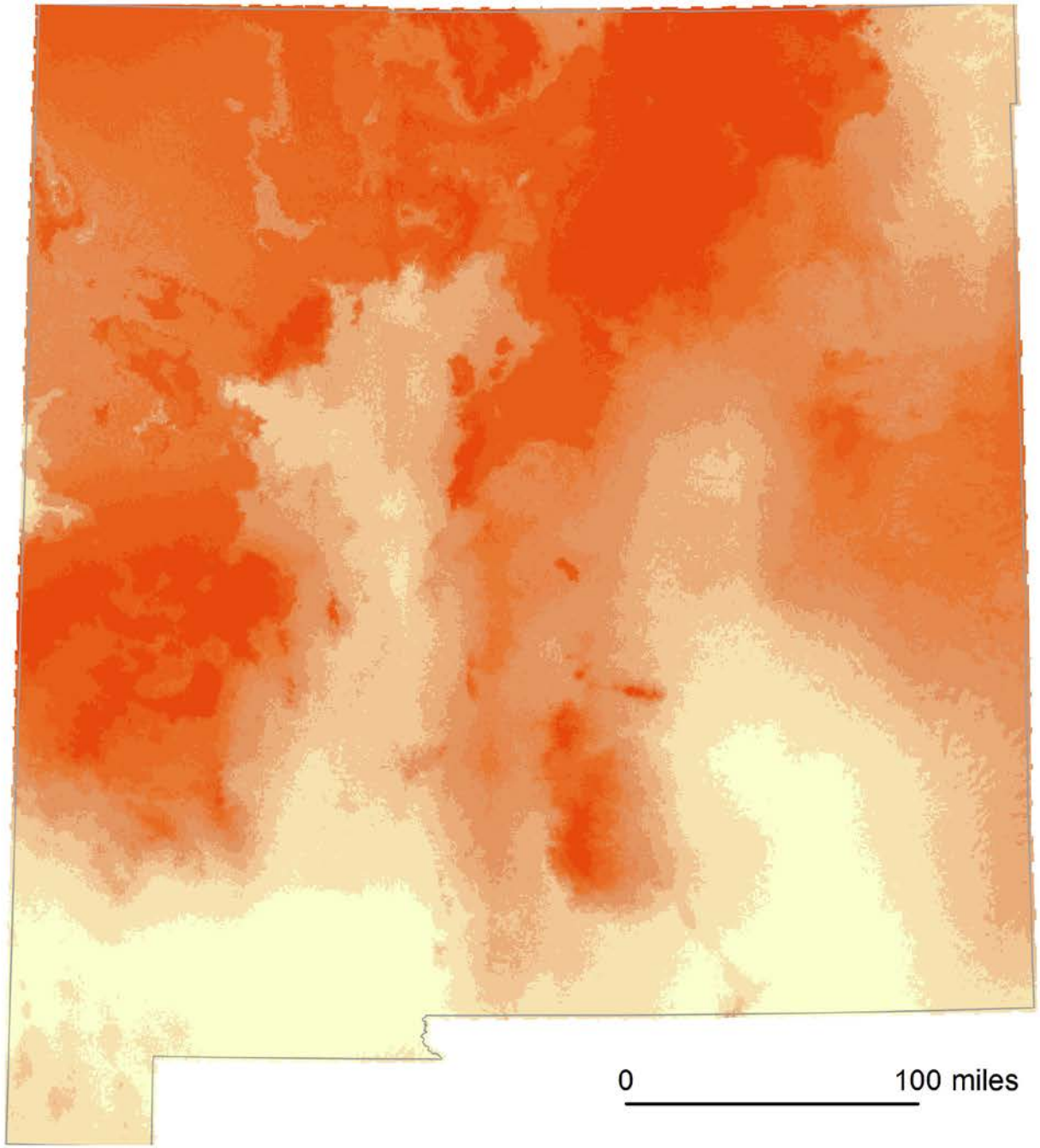
(2018 data used in analysis; older, coarse data shown at left, per use agreement)

Threat: Climate Change



Climate Dissimilarity

- Represents how different the future climate will be at a location be from its current climate
- When combined with resources and assets, is a measure of *exposure* to climate change
- Complementary metrics:
  - (a) Absolute magnitude of dissimilarity, and
  - (b) Dissimilarity relative to historical interannual climatic variability



Climatic dissimilarity (Absolute magnitude)

Multivariate climate space between 1971-2000 climate normals and future (2071-2100) projected climate under RCP8.5: high emission scenario

- <= 0.98
- <= 0.78
- <= 0.74
- <= 0.72
- <= 0.71
- <= 0.7
- <= 0.68
- <= 0.67
- <= 0.66
- <= 0.63

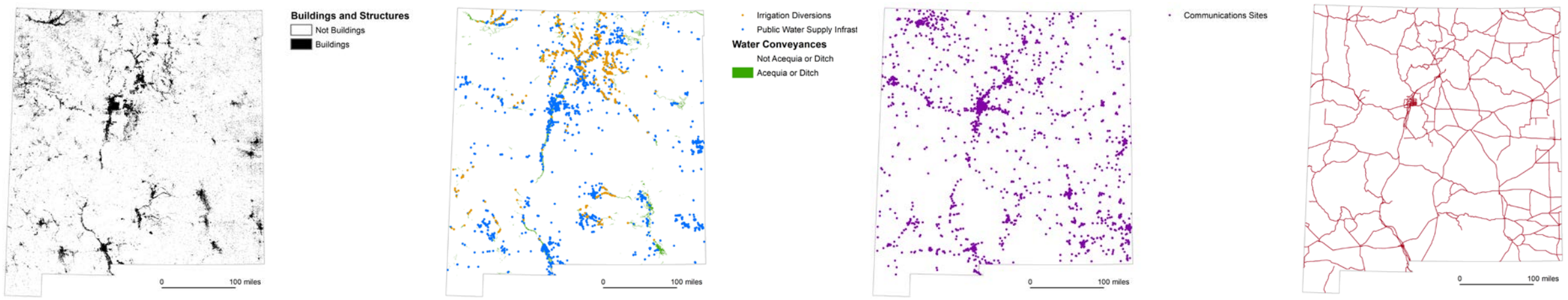
Themes: Resources and Assets We Value

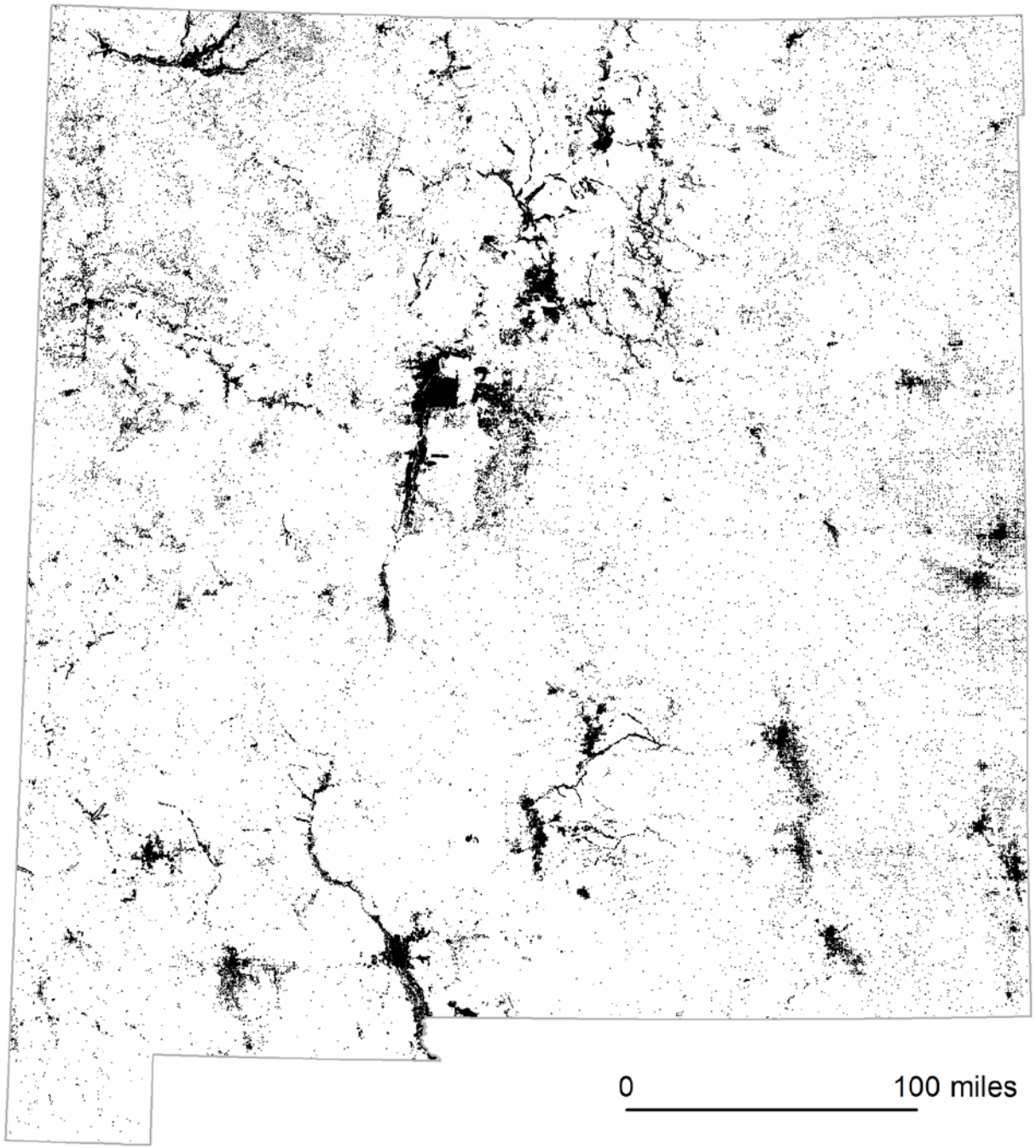
- Wildland Communities
- Water Quality and Supply
- Carbon Balance: Biomass and Soils
- Timber and Grazing
- Biodiversity
- Indigenous and Traditional Communities
- Recreation and Cultural Use
- Urban Forests and Communities

Theme: Wildland Communities

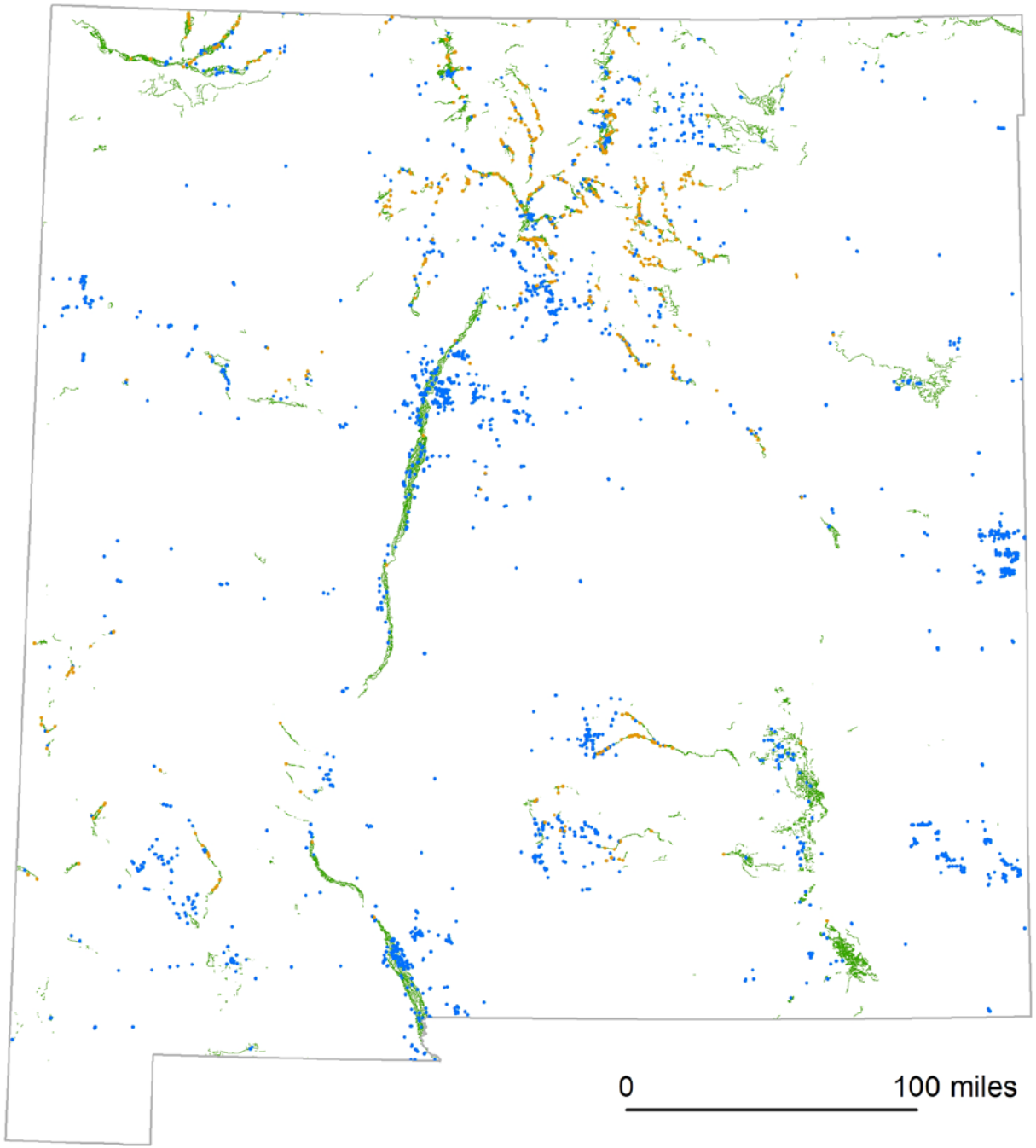
Wildland Communities

- Wildland Community values:
  - Buildings and structures representing homes, schools, businesses, etc.
  - Water Supply Infrastructure for irrigation and public water supplies
  - Communications Sites critical for emergency response
  - Major Roads used for access/egress and relied upon for commerce

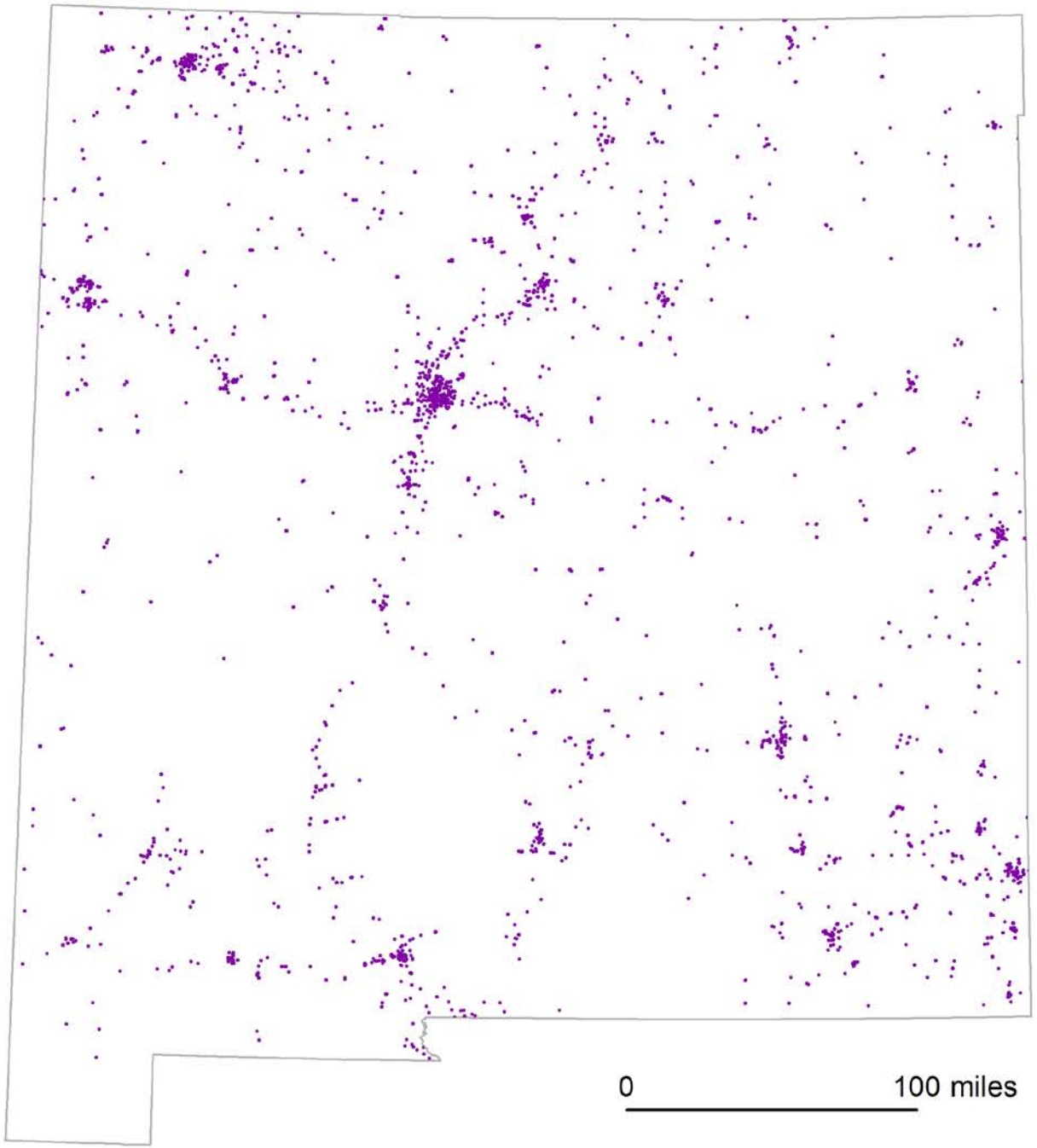




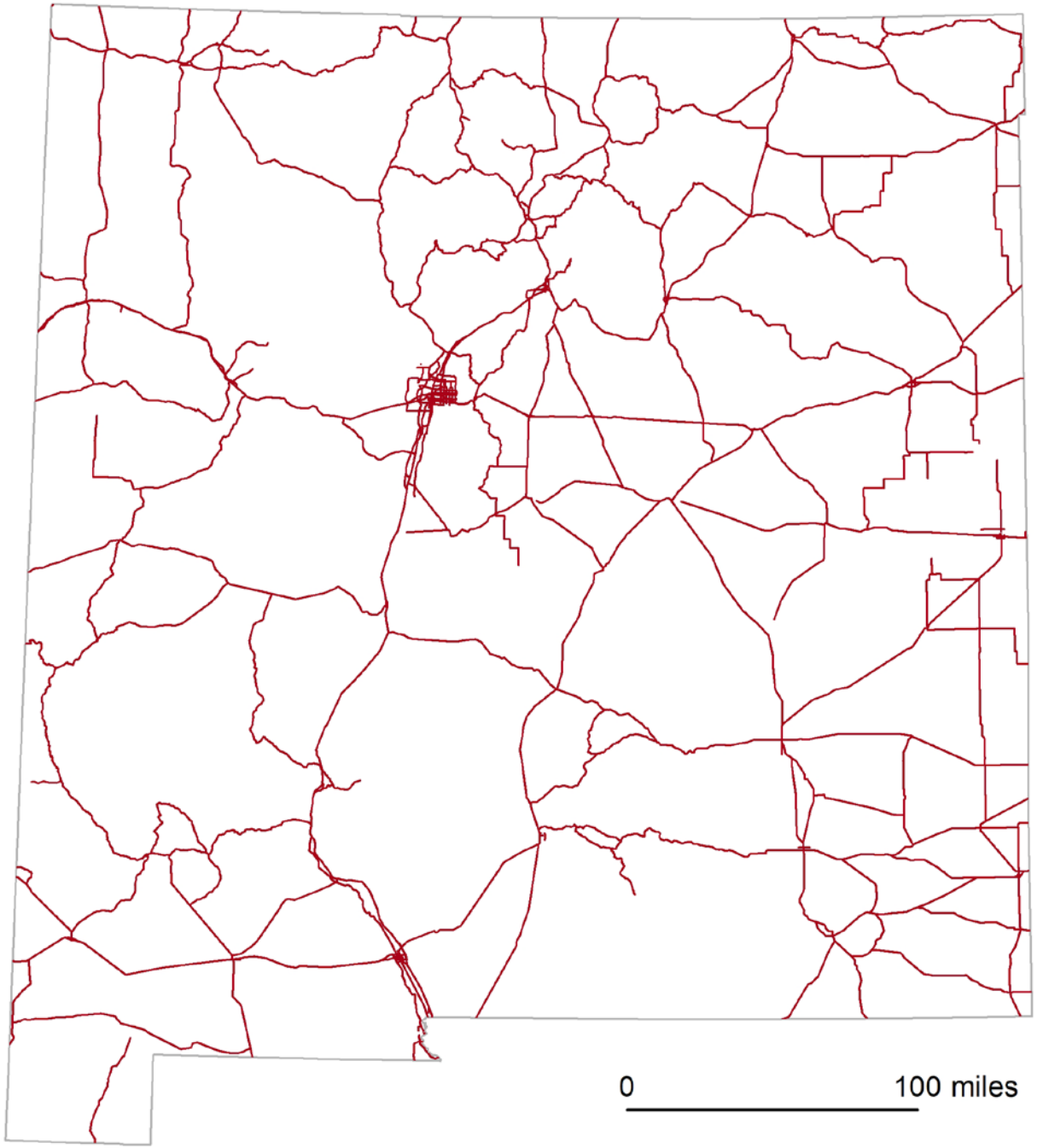
- Microsoft building footprints
- Manually screened for accuracy
- Current through mid-2010s



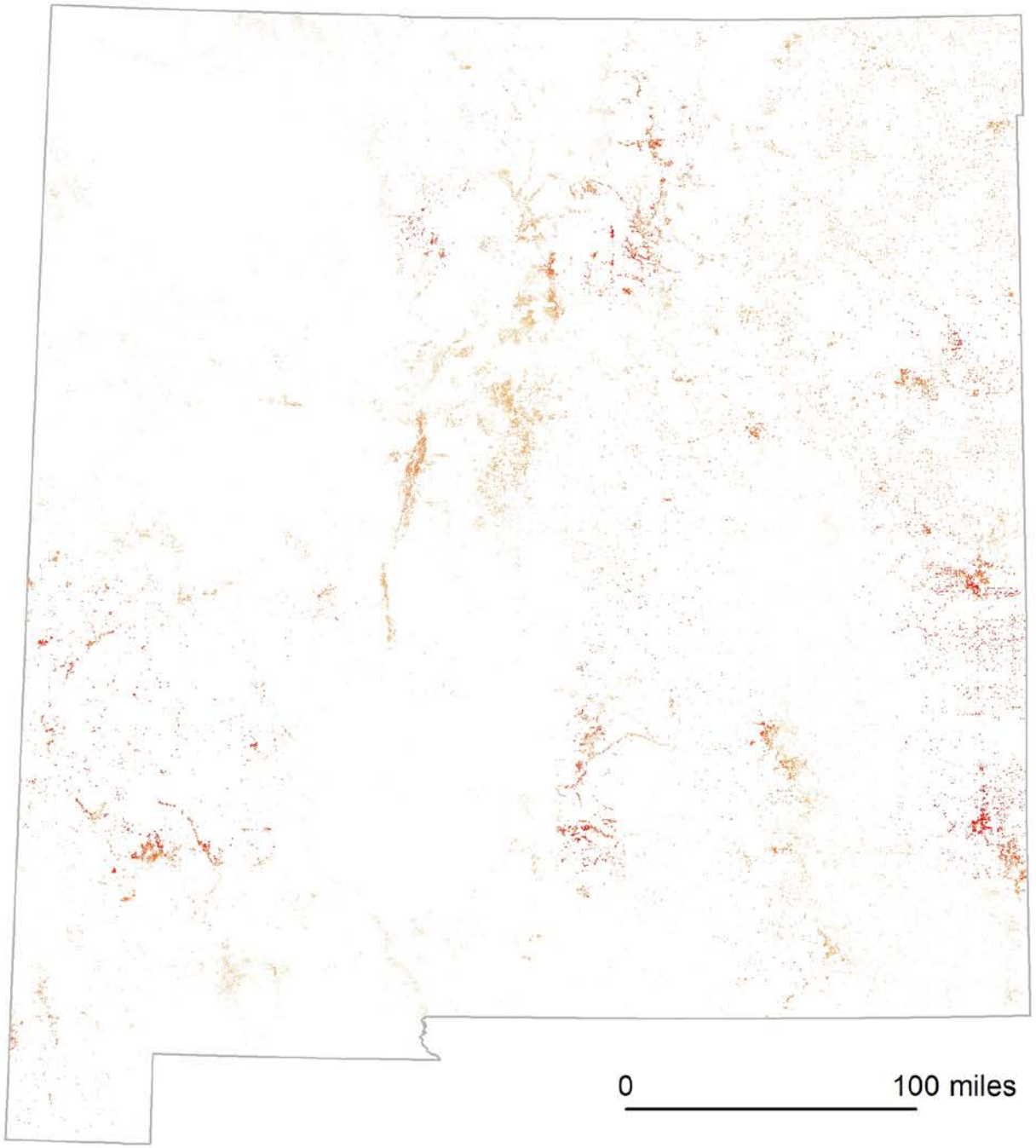
- Public Water Facilities from NMED
- Irrigation Conveyances from NMOSE
- “Water Infrastructure”



- Comms Sites from FCC
- Accessed via WFDSS
- Excludes Private and Commercial “Land Mobile”



- National Highway Planning Network
- From BTS
- Includes most major routes

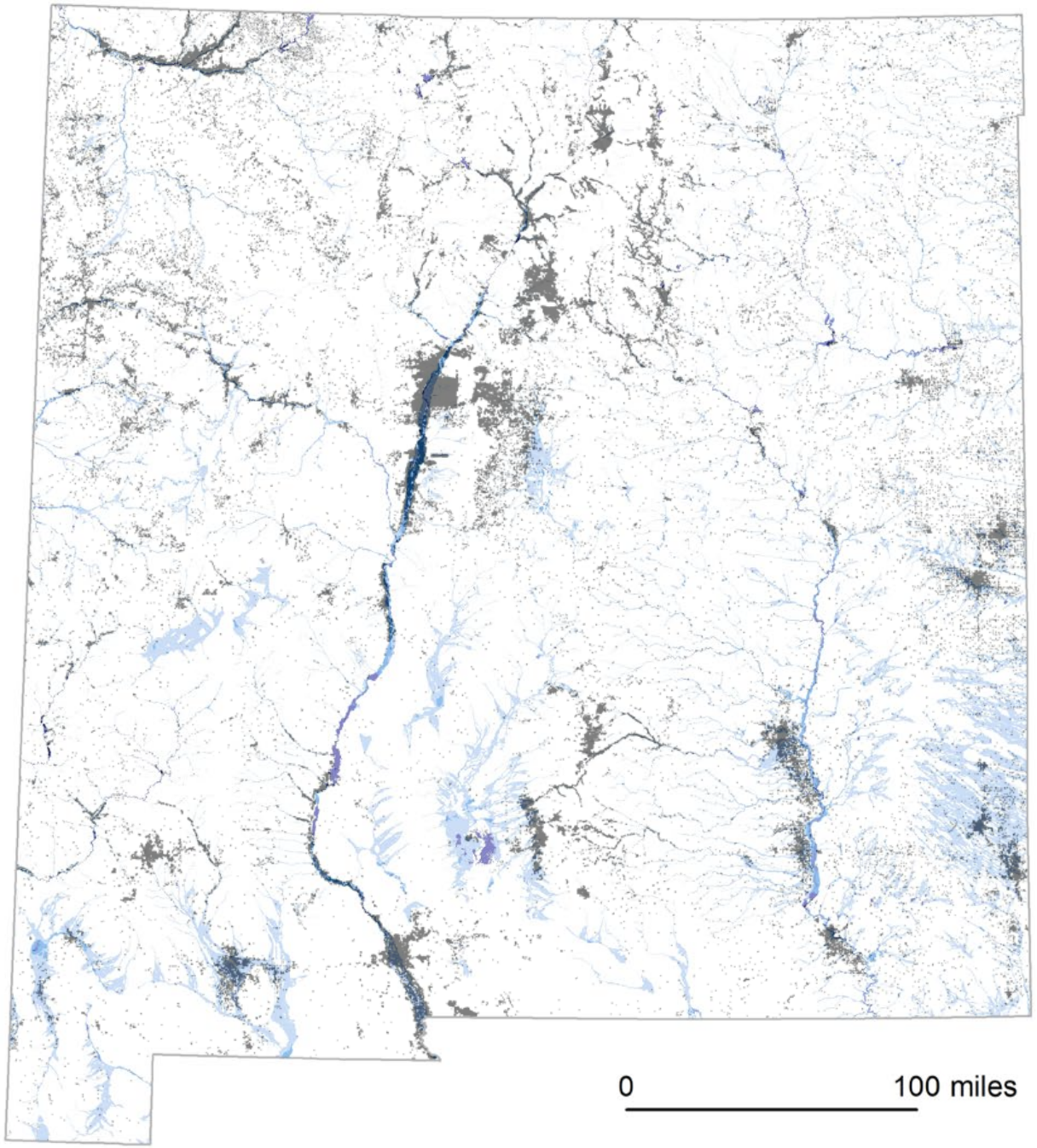


Wildfire Risk to Buildings

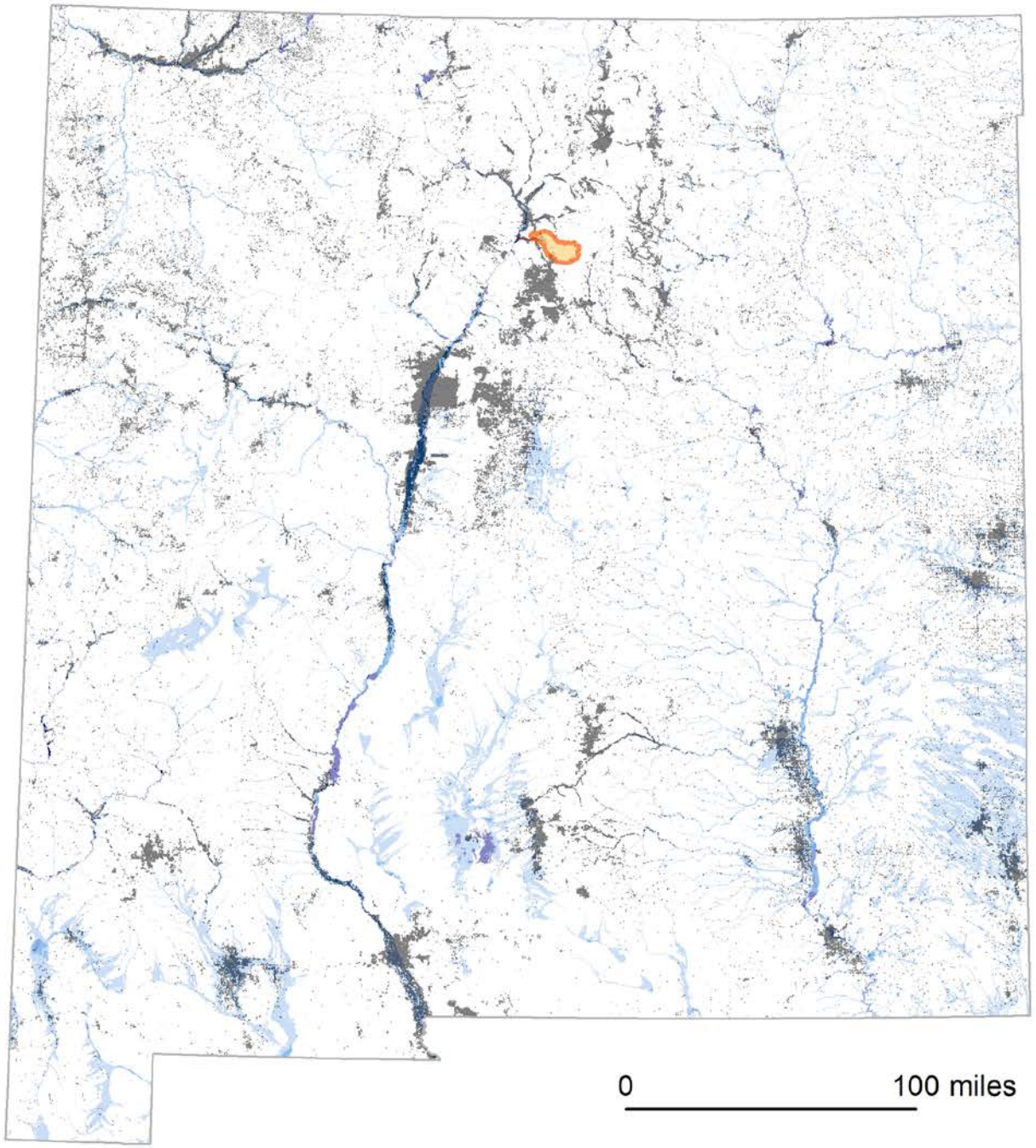
Annualized Probability of Building Loss

- 0
- 0.001 - 0
- 0.001 - 0.001
- 0.002 - 0.001
- 0.002 - 0.001
- 0.002 - 0.002
- 0.003 - 0.003
- 0.004 - 0.005
- 0.006 - 0.008
- 0.009 - 0.048

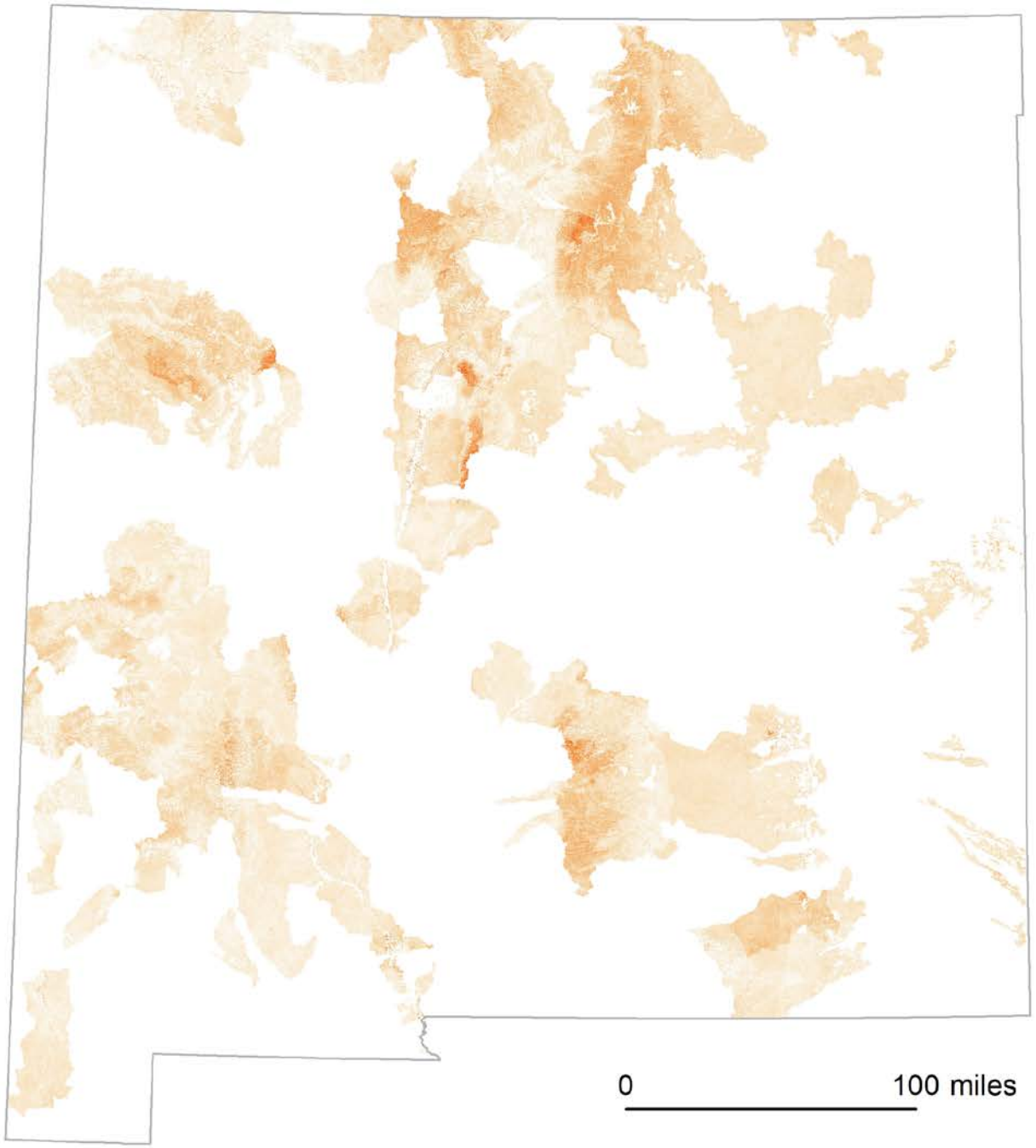
- Risk is a function of
  - burn probability
  - fire intensity
  - building density



- Buildings in 500-year floodplain
- Risk is a function of the FFPI and burn probability in the immediate upstream watersheds and the number of structures in the floodplain.



- Upstream sources of flood risk to downstream development.



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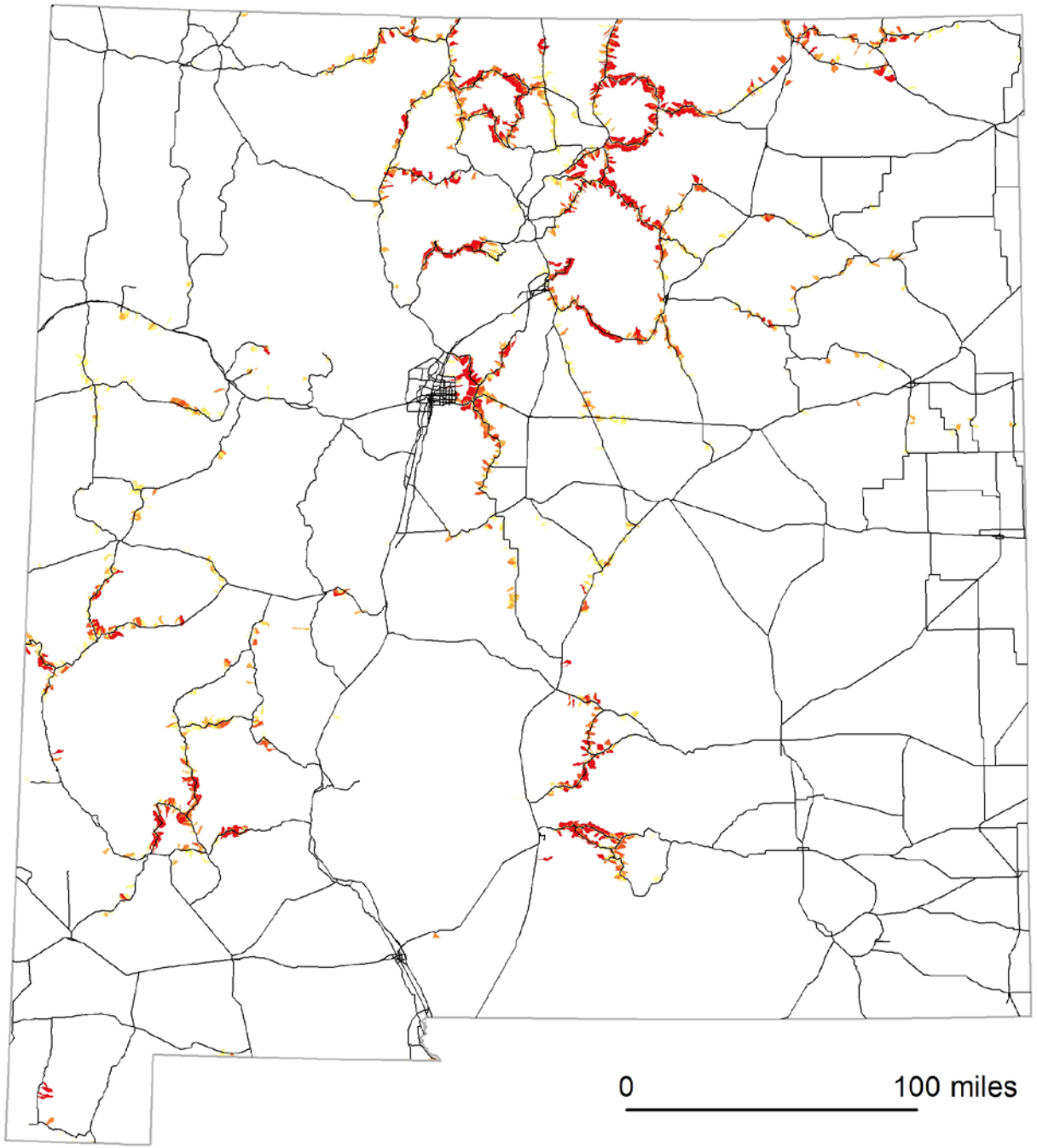


Major Roads

Debrisf-flow Hazard to Roads

Exposure to Prob. Weighted Volume

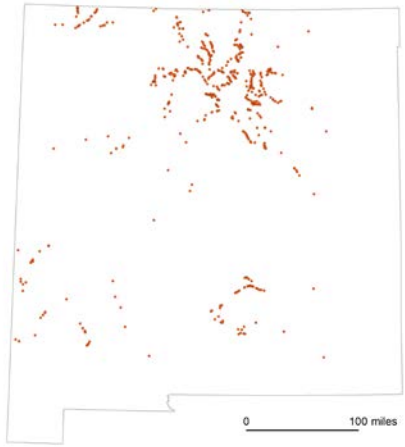
64.433599 - 602.073157
602.073158 - 1005.961196
1005.961197 - 1456.071829
1456.071830 - 2041.099069
2041.099070 - 2848.581067
2848.581068 - 3904.058219
3904.058220 - 5671.497046
5671.497047 - 8587.398802
8587.398803 - 15264.576386
15264.576387 - 195351.766166

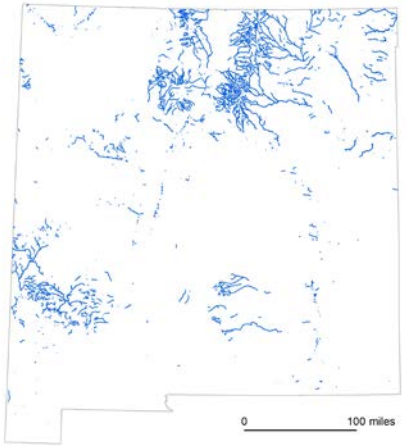
- Roads aren't very susceptible to fire
- Post-fire debris flow can be very damaging to roads

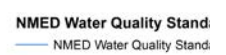
Theme: Water Quality and Supply

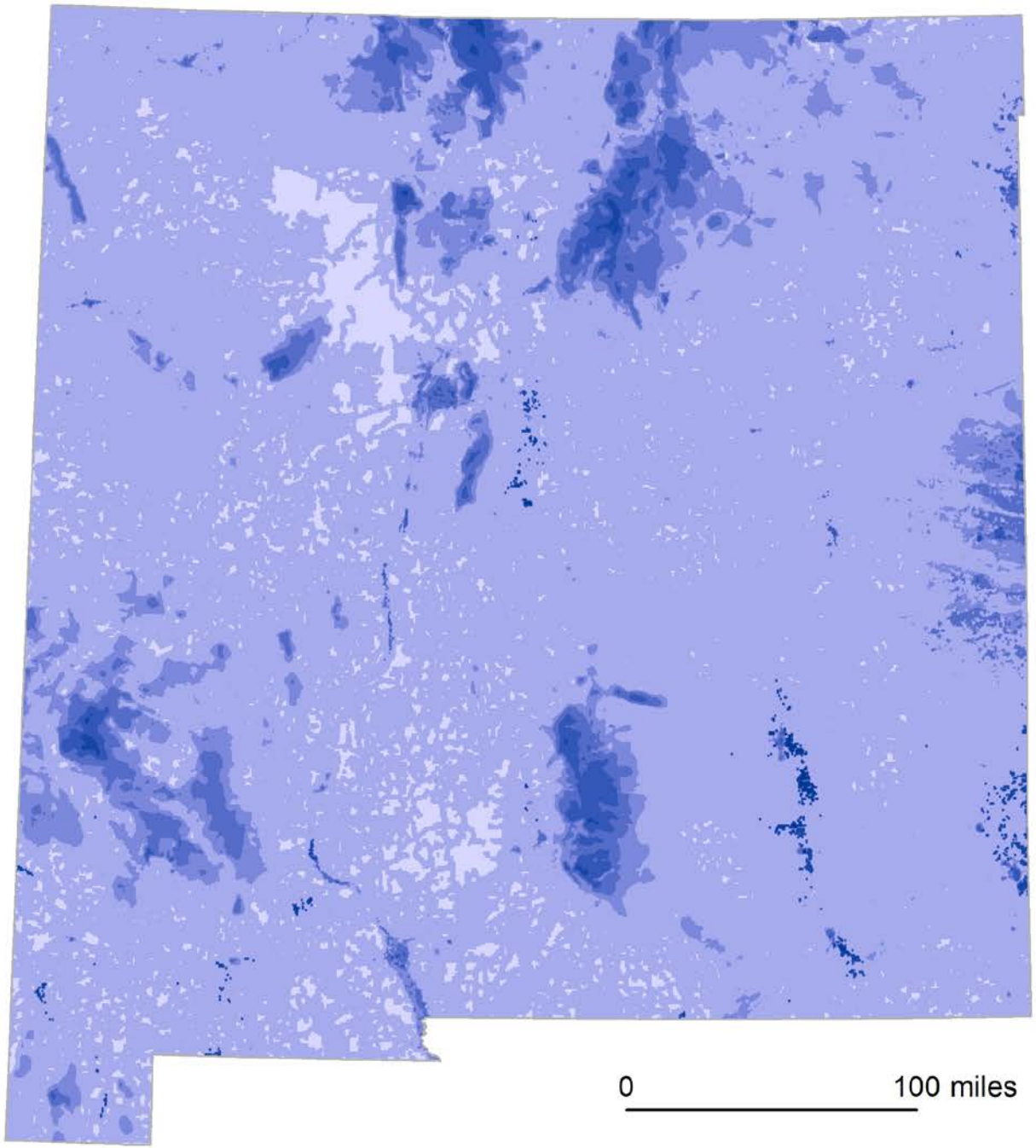
Water Quality and Supply

- Water Quantity:
  - valued by irrigators and public water systems
- Water Quality:
  - valued at Points of Diversion and to meet NMED Water Standards
- Water Transmission:
  - valued by downstream water users and for compact delivery

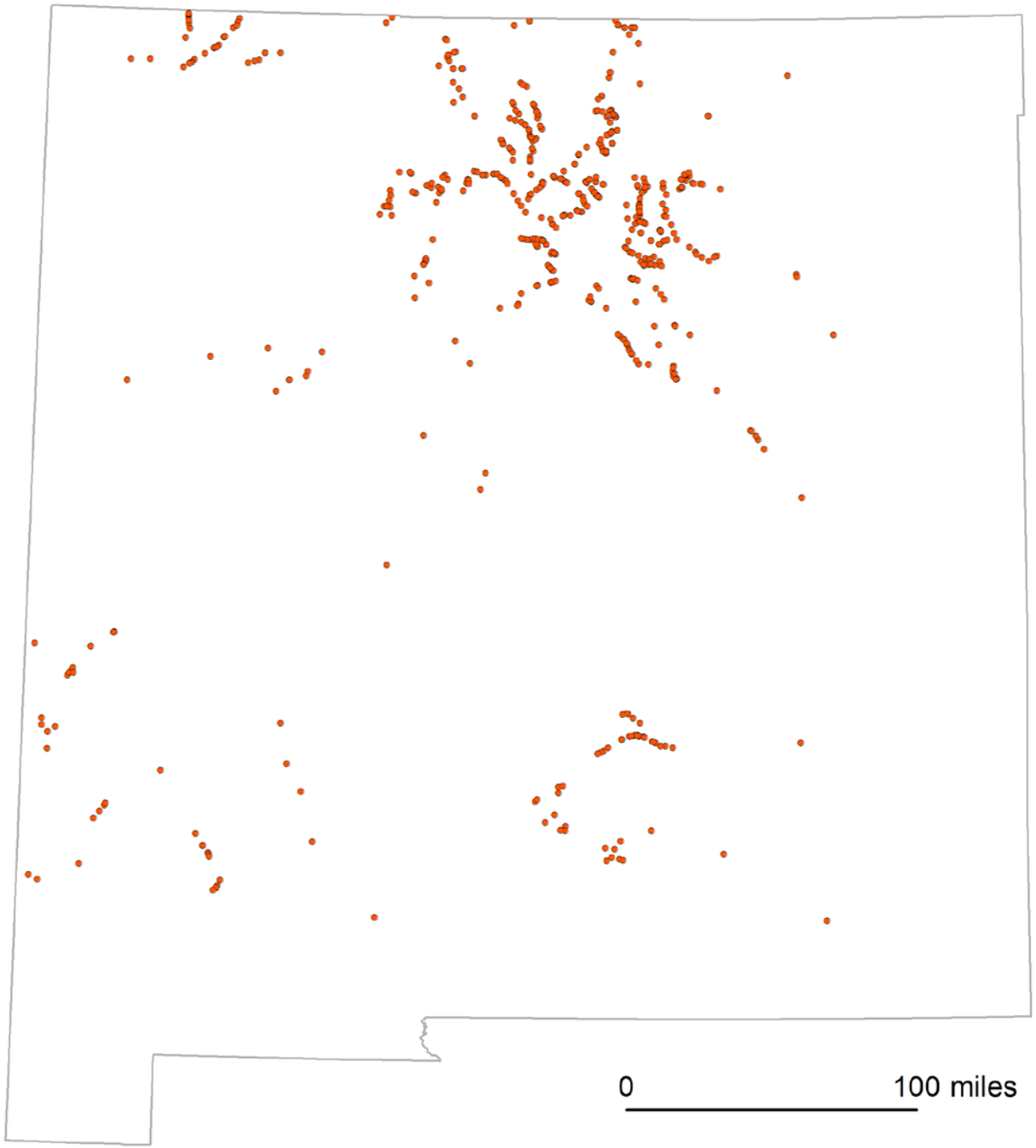








- Where is water used by irrigators?
- How many irrigators rely on each diversion?



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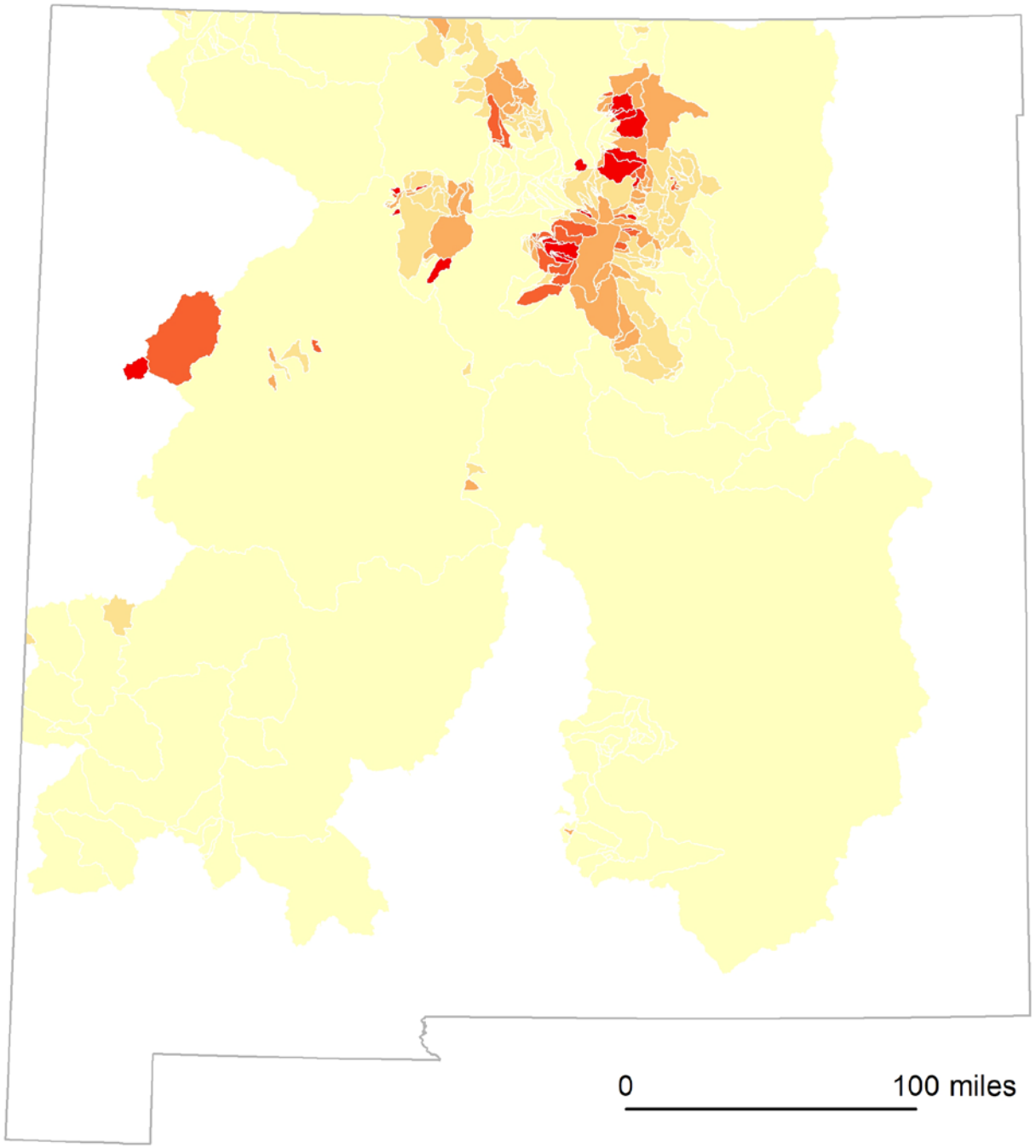

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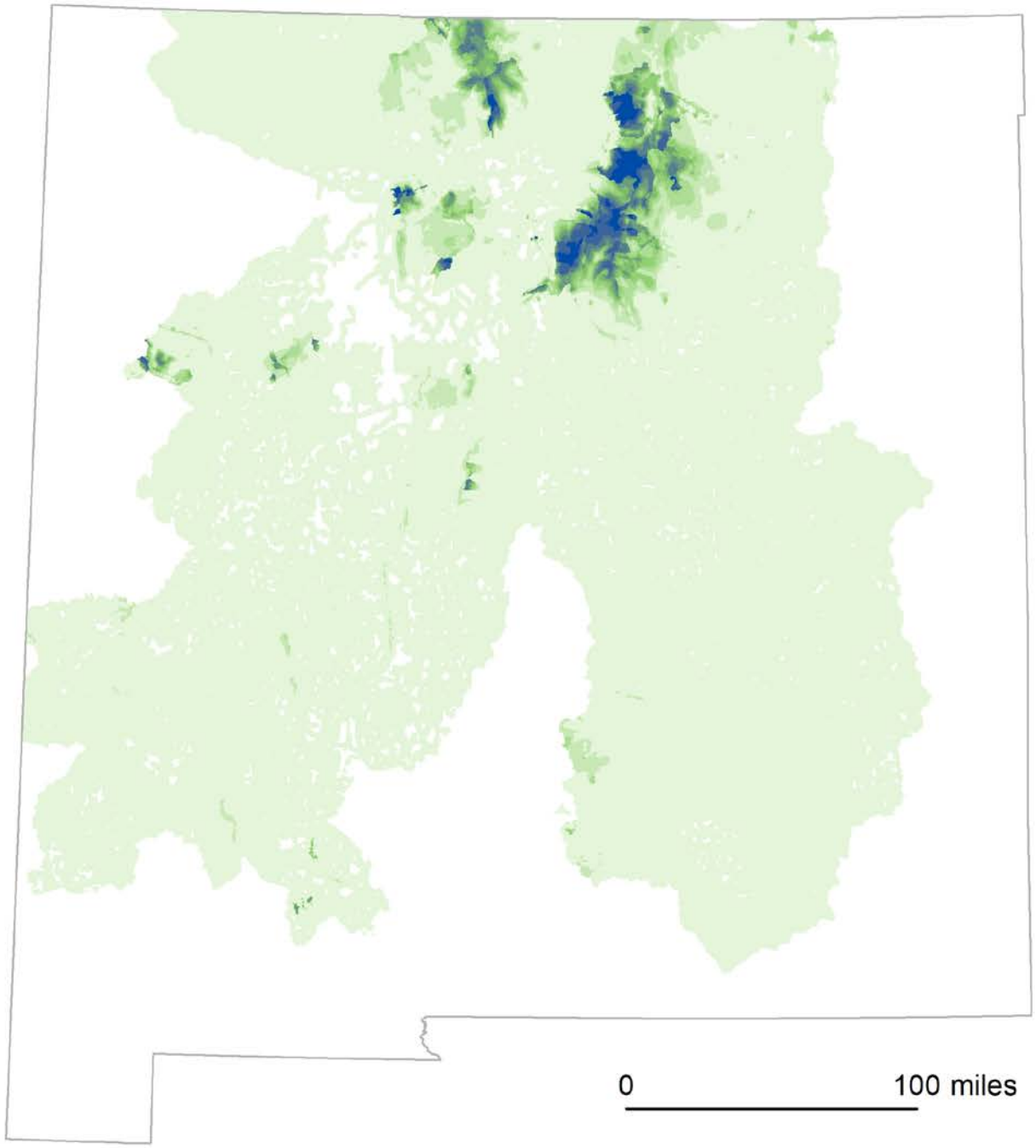
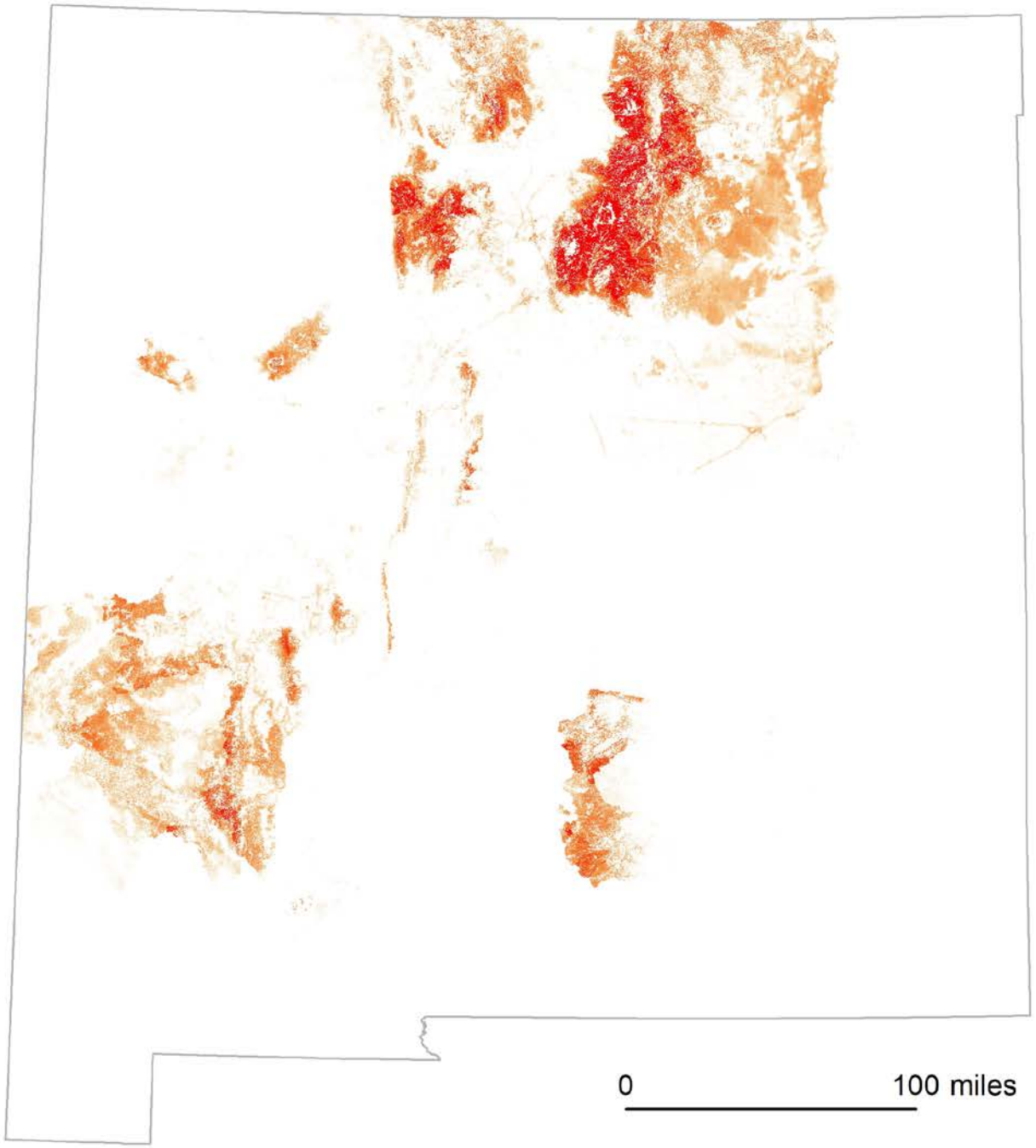


Annual Surface Water Runoff

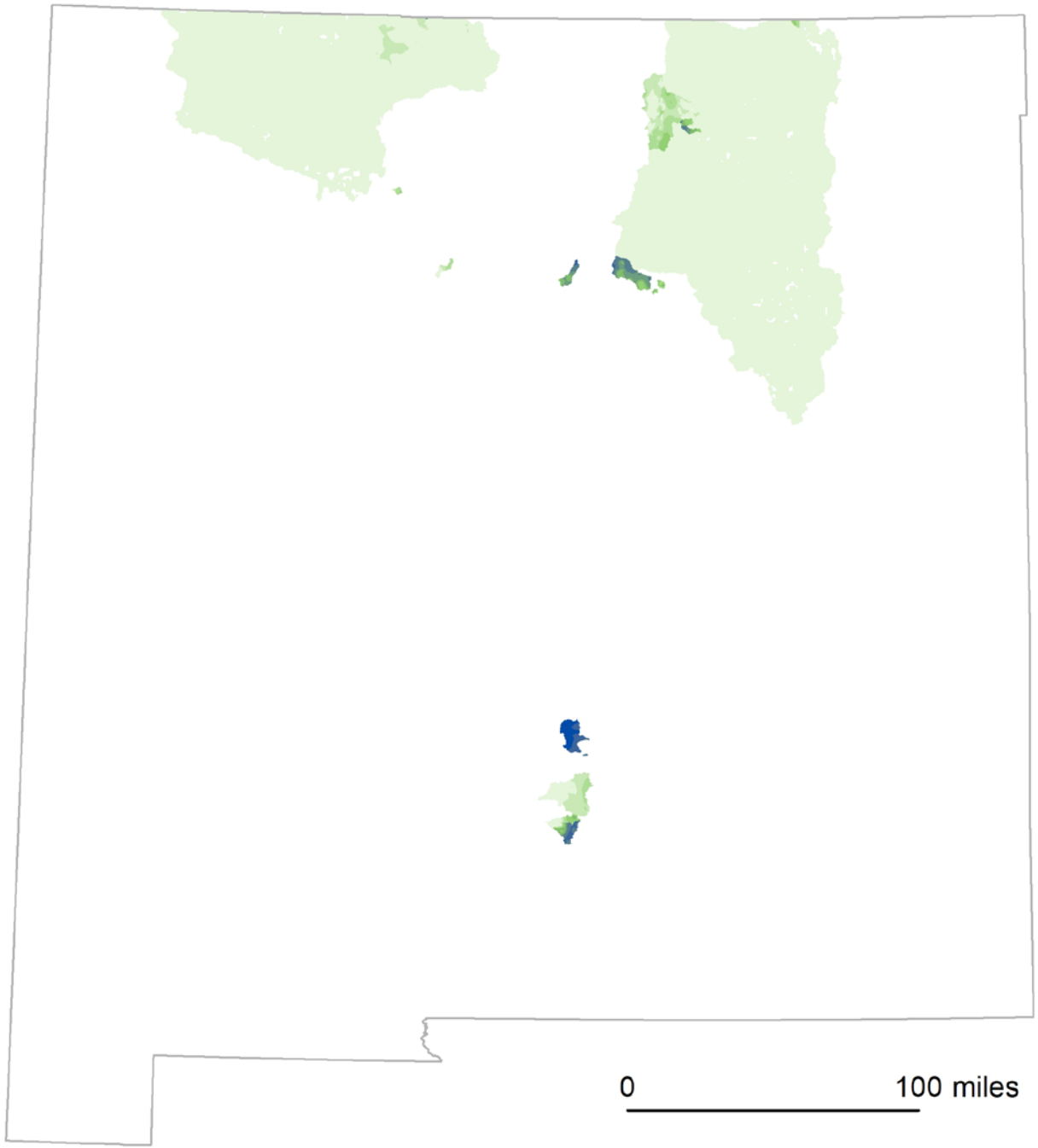
Index of Downstream Irrigators per AF

- 0.072 - 1 *Top 10%*
- 0.04 - 0.071
- 0.028 - 0.039
- 0.021 - 0.027
- 0.017 - 0.02
- 0.013 - 0.016
- 0.009 - 0.012
- 0.005 - 0.008
- 0.001 - 0.004
- 0

- Value is highest where there are many irrigators per AF of available runoff.
- Each drop matters to more irrigators.
- Upstream sources are mapped (clipped here)



- Risk is highest where burn probability and intensity are highest and where there are many irrigators per AF of available runoff.

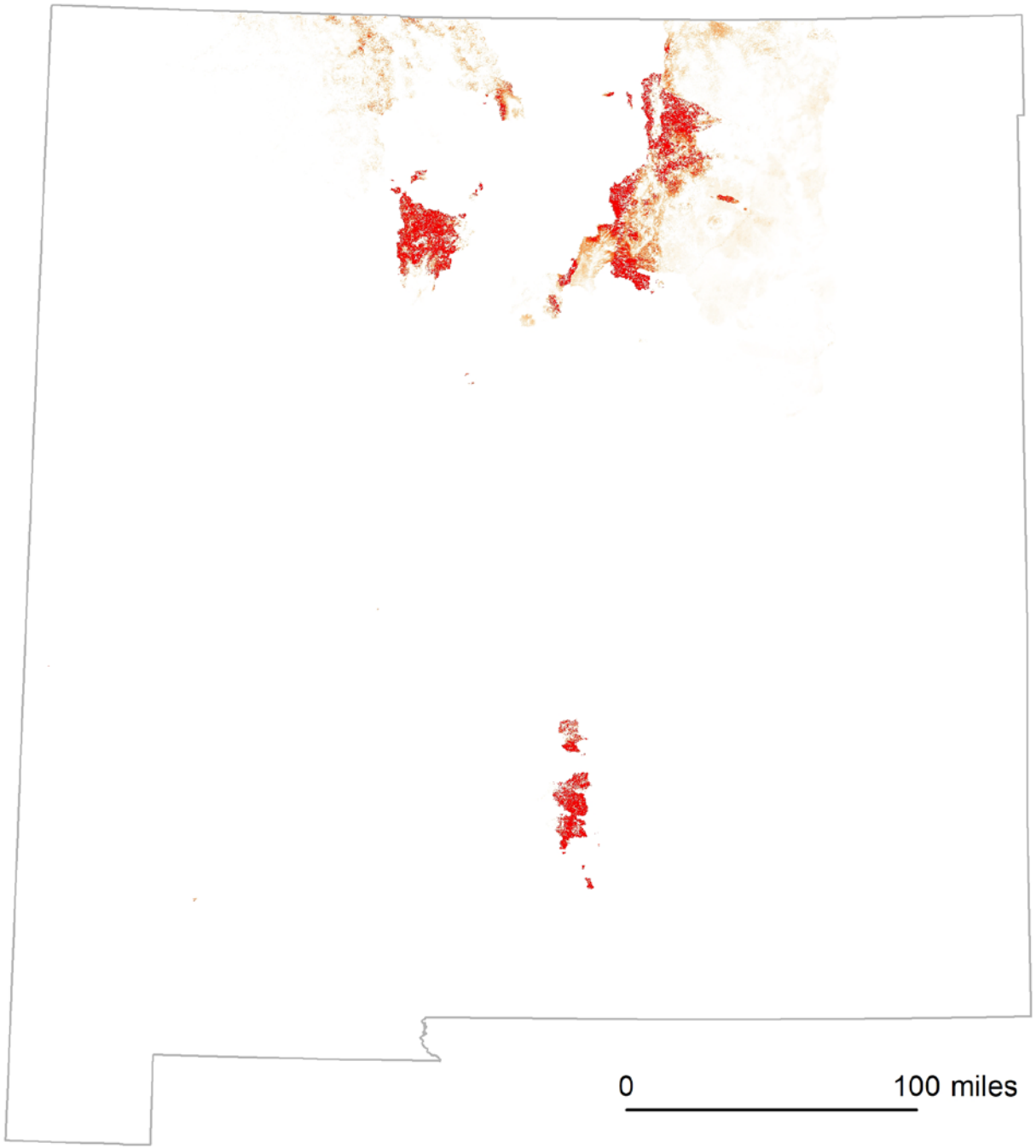


Annual Surface Water Runoff

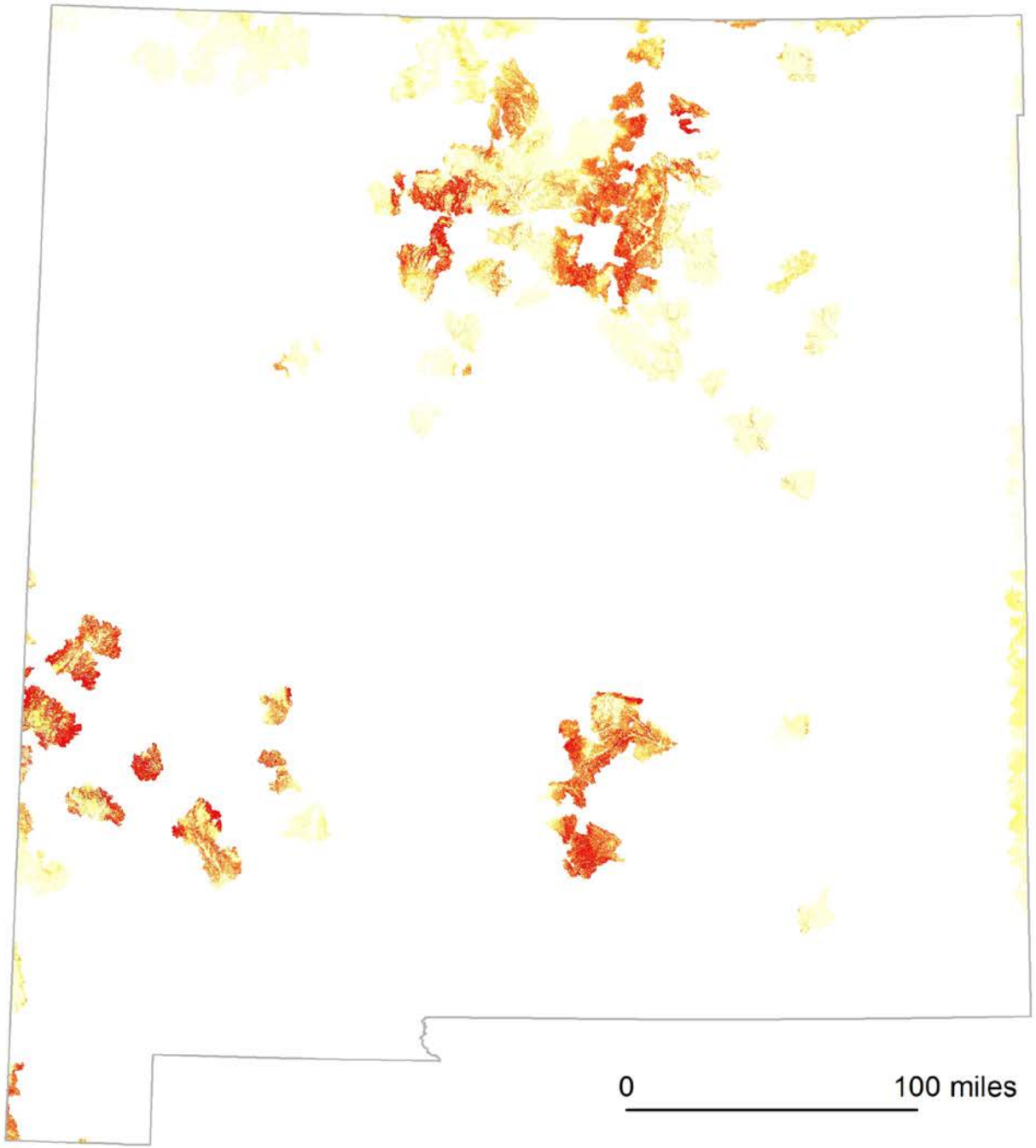
Index of Public System Users per AF

0.17 - 1	*Top 10%*
0.1 - 0.16	
0.07 - 0.09	
0.06 - 0.06	
0.04 - 0.05	
0.03 - 0.03	
0.02 - 0.02	
0.01 - 0.01	
0.01 - 0	
0	

- Same beneficiary mapping process as irrigators, but with population served
- Surface water supplies only
- Will be updated to include spring sources



- Risk is highest where burn probability and intensity are highest and where there are many people served by downstream public water systems per AF of available runoff.

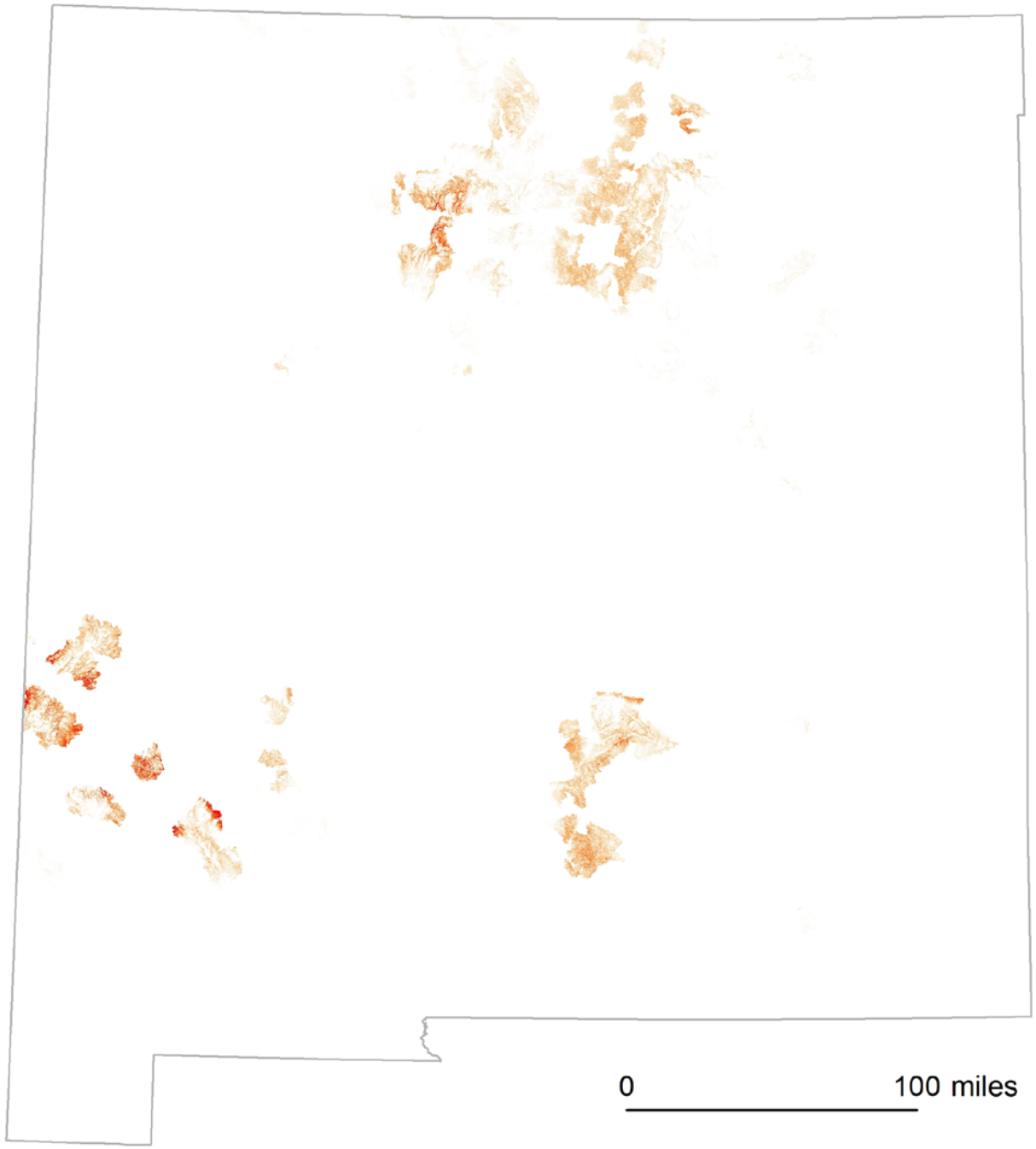


Post-wildfire Erosion Risk to Diversions

Index of Erosion Hazard

- 0.17 - 1 *Top 10%*
- 0.1 - 0.16
- 0.07 - 0.09
- 0.05 - 0.06
- 0.03 - 0.04
- 0.02 - 0.02
- 0.02 - 0.01
- 0.01 - 0.01
- 0.01 - 0
- 0

- Water quality impacts points of diversion and stream segments.
- Areas immediately upstream from the point of diversion pose the greatest threat.



- Water quality impacts points of diversion and stream segments.
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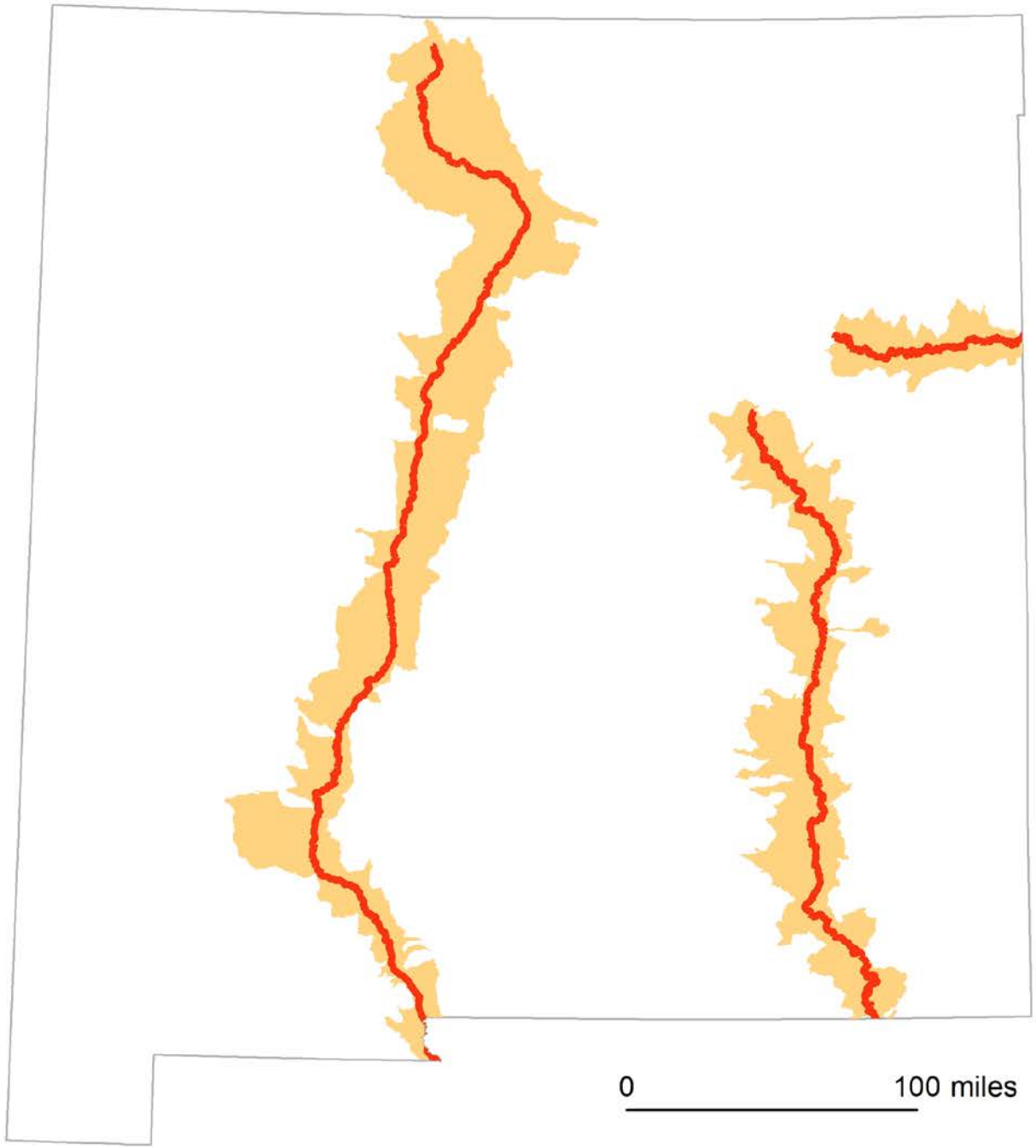
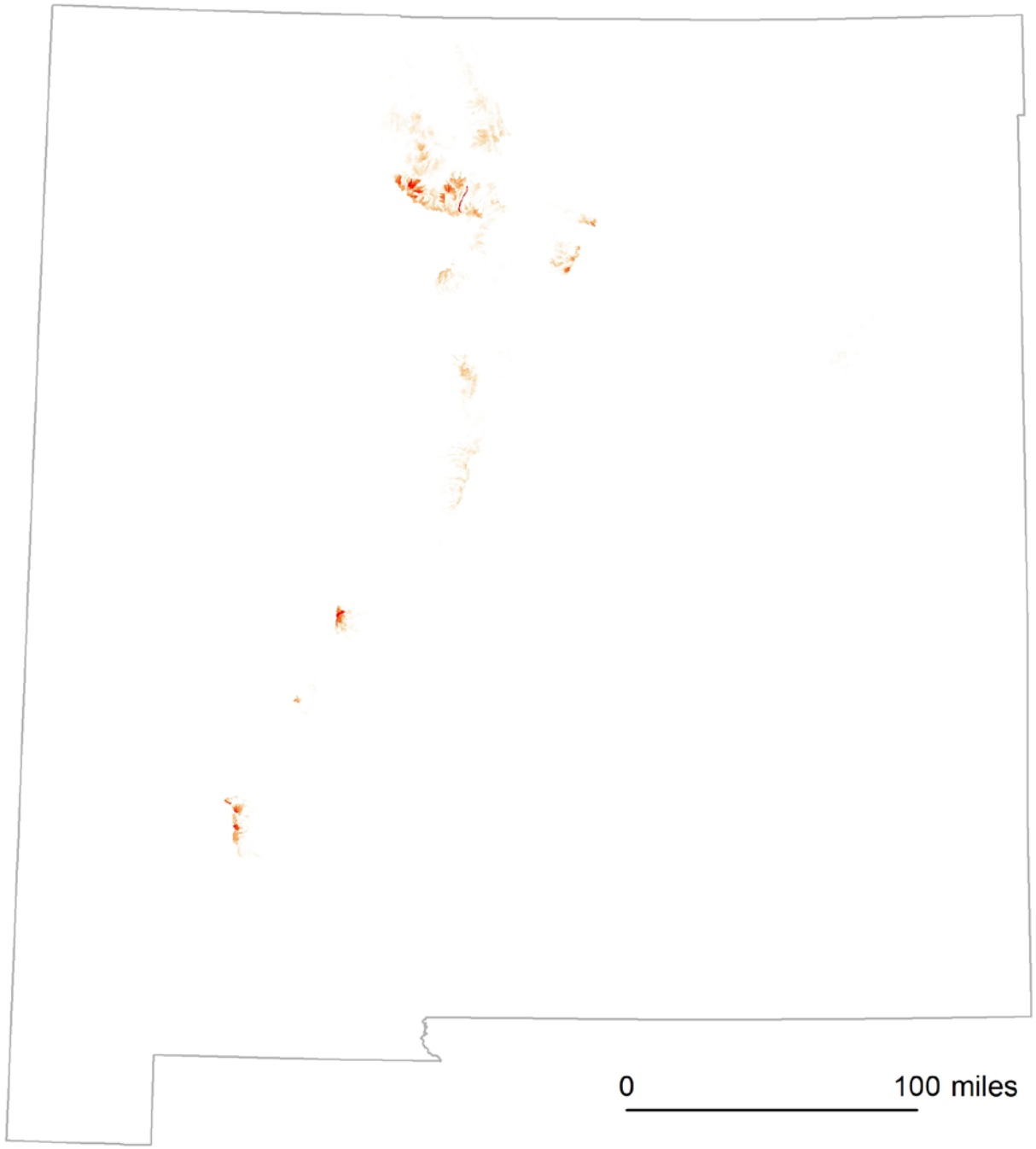


- Where could a debris flow happen and block water deliveries?

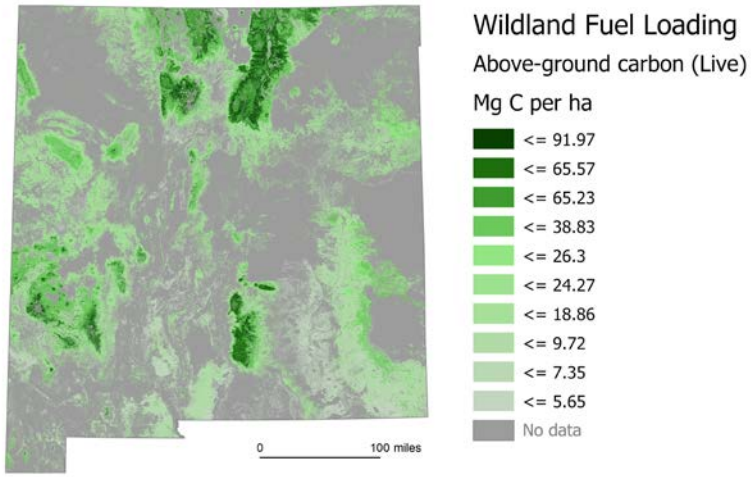


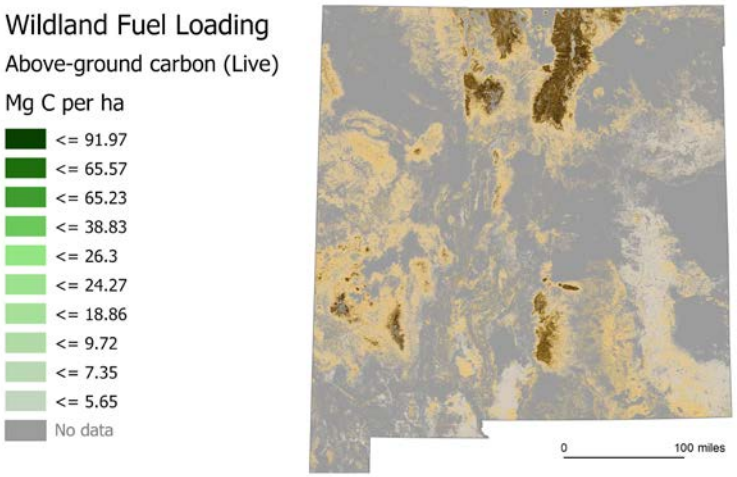
- Where could a debris flow happen and block water deliveries?

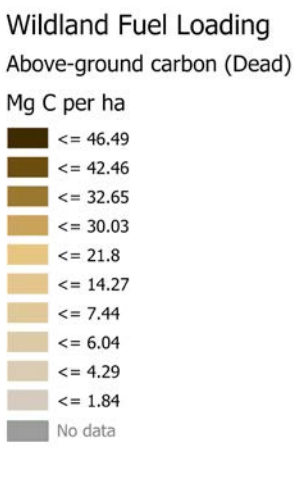
Theme: Carbon Balance: Biomass and Soils

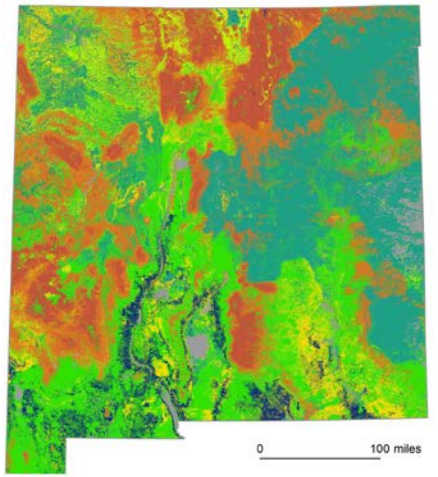
Carbon Balance: Biomass

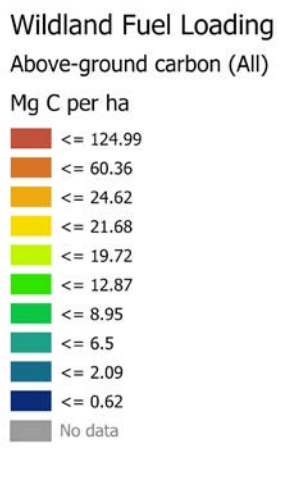
- Above-ground forest carbon stocks (Mg C / ha) were calculated from mean modeled biomass per hectare (Mg / ha) over several strata:
  - Live biomass: Trees, Shrubs, and Herbaceous
  - Dead biomass: Snags, Woody Debris (Coarse and Fine), Duff, and Litter

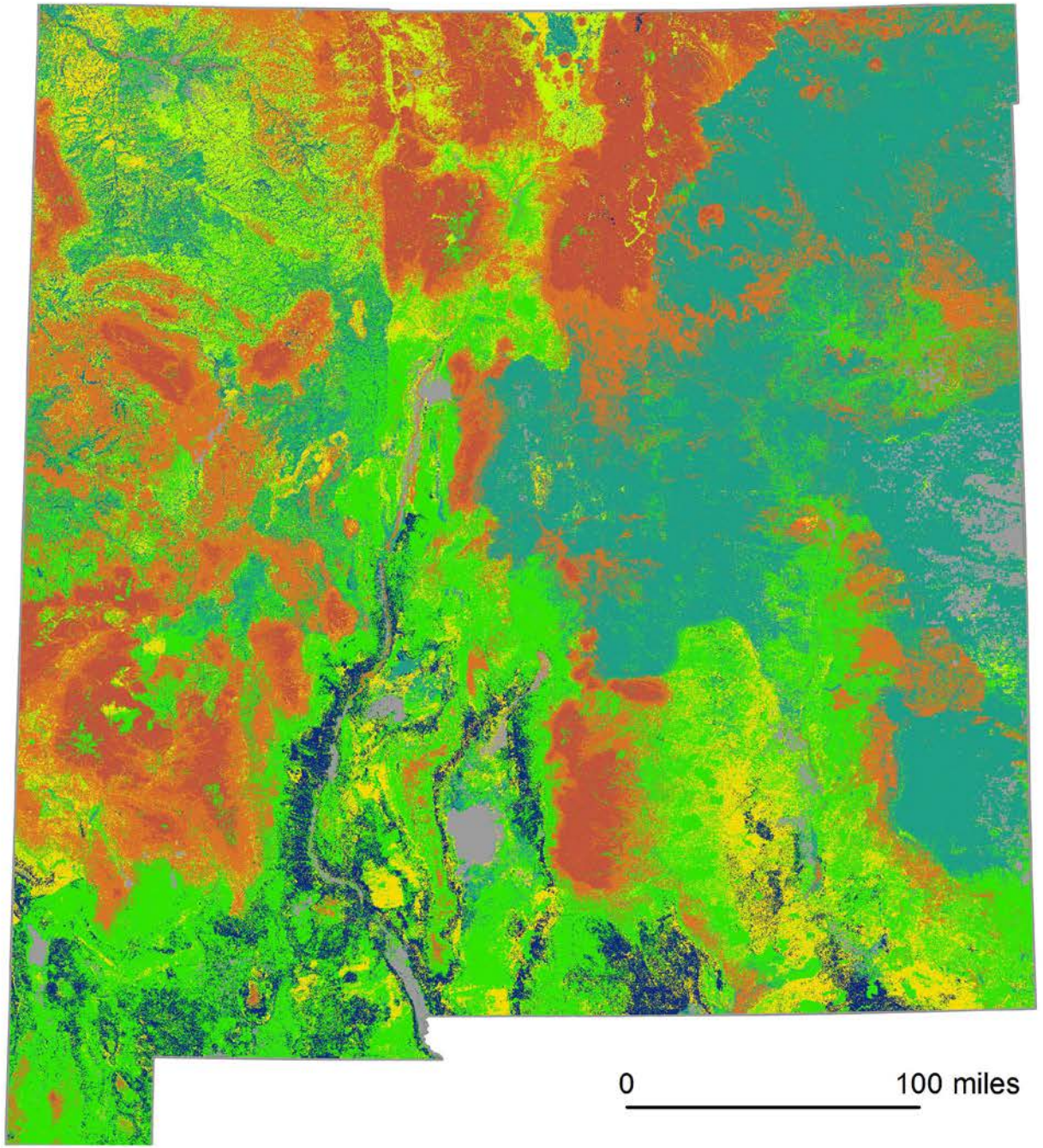










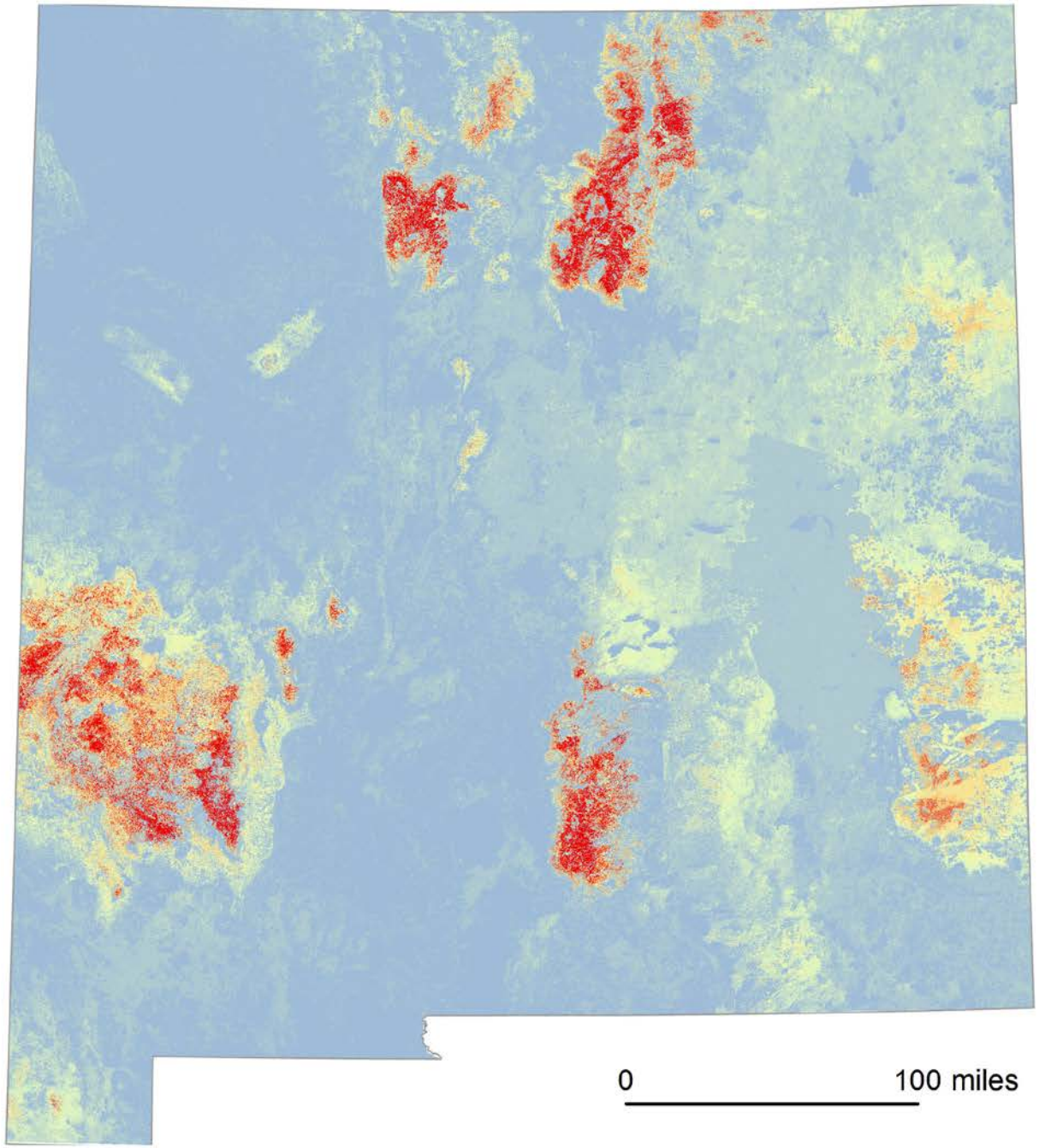


Wildland Fuel Loading

Above-ground carbon (All)

Mg C per ha

- <= 124.99
- <= 60.36
- <= 24.62
- <= 21.68
- <= 19.72
- <= 12.87
- <= 8.95
- <= 6.5
- <= 2.09
- <= 0.62
- No data



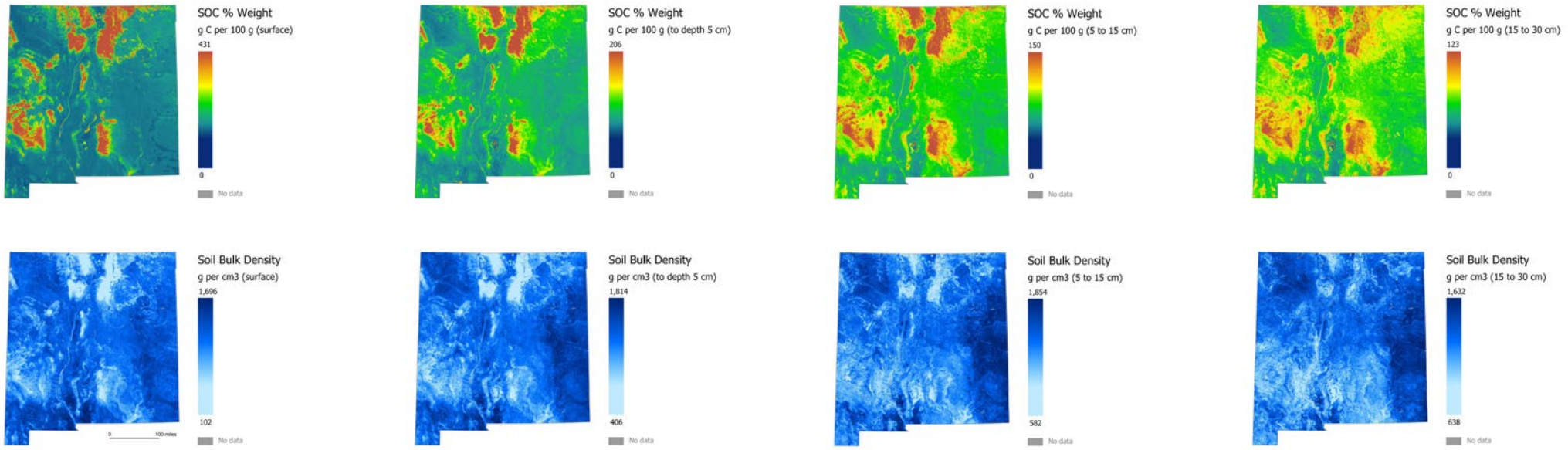
Risk of carbon release by wildfire

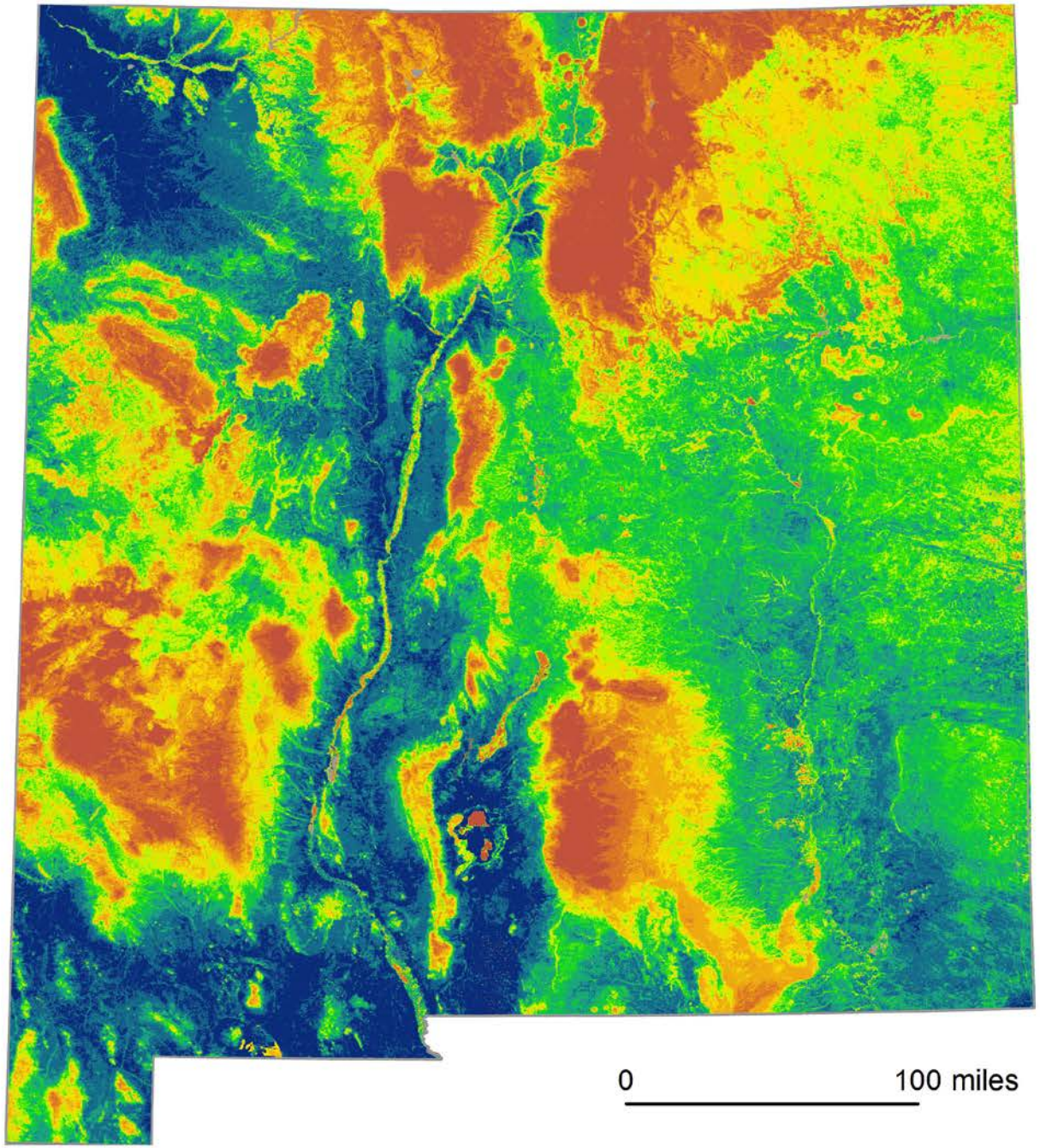
Risk calculated off combined soil and above-ground carbon

- <= 1
- <= 0.125
- <= 0.075
- <= 0.047
- <= 0.031
- <= 0.02
- <= 0.012
- <= 0.008
- <= 0.004
- <= 0

Carbon Balance: Soils

- Using 100-m gridded predictions of Soil Organic Carbon % weight and soil bulk density, SOC (Mg C / ha) was calculated and summed across four standard soil depths (0 – 30 cm).

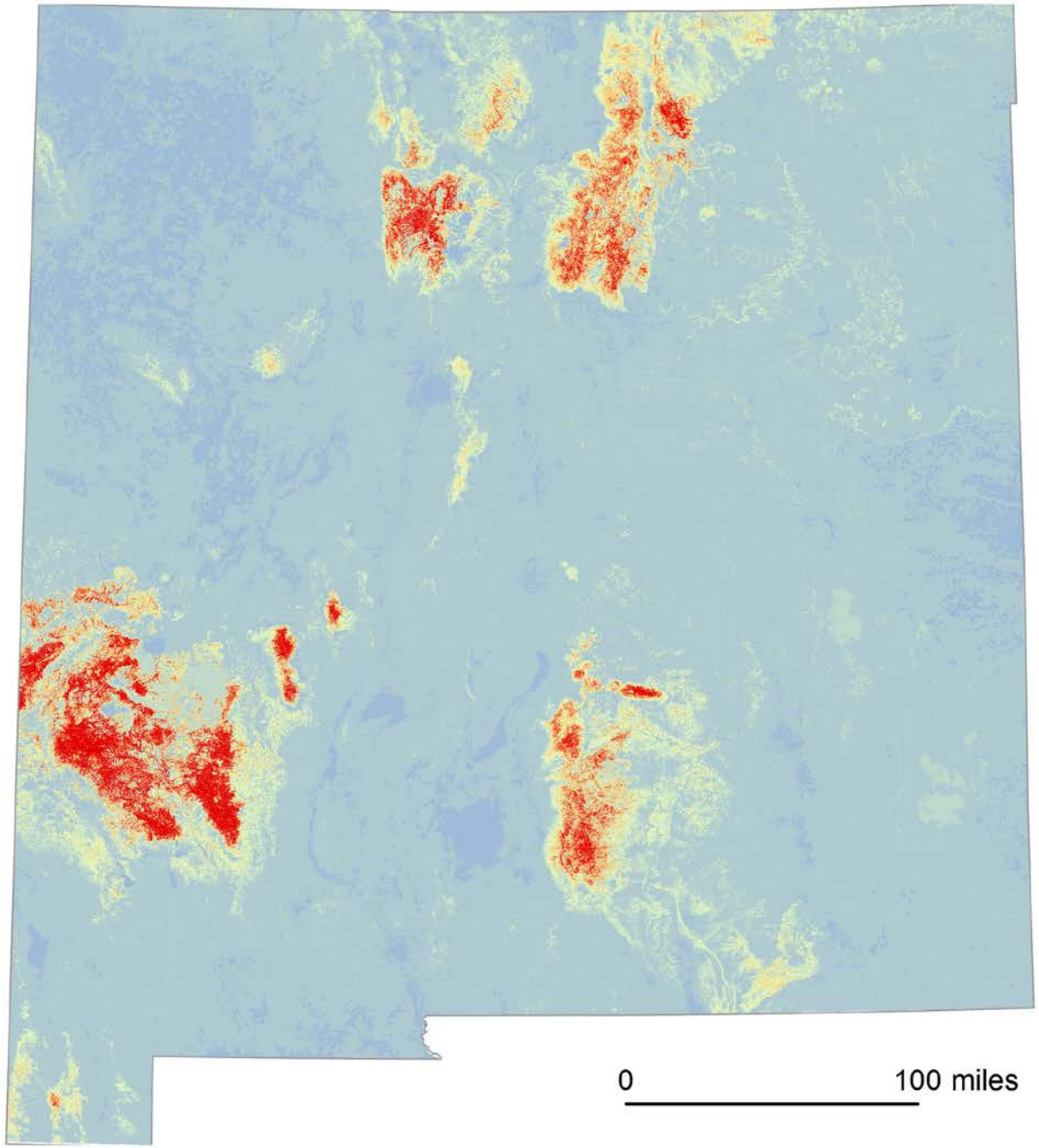




Soil Organic Carbon

Mg C per ha (to depth 30 cm)

- <= 225.26
- <= 129.26
- <= 85.27
- <= 63.27
- <= 53.27
- <= 47.27
- <= 43.27
- <= 39.27
- <= 35.28
- <= 29.28
- No data



Risk of soil carbon release by post-fire erosion

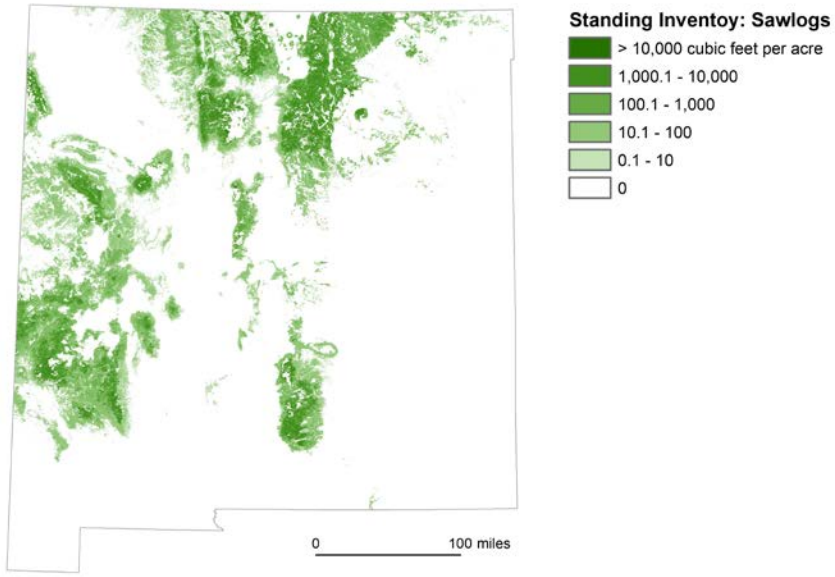
Risk calculated off soil organic carbon

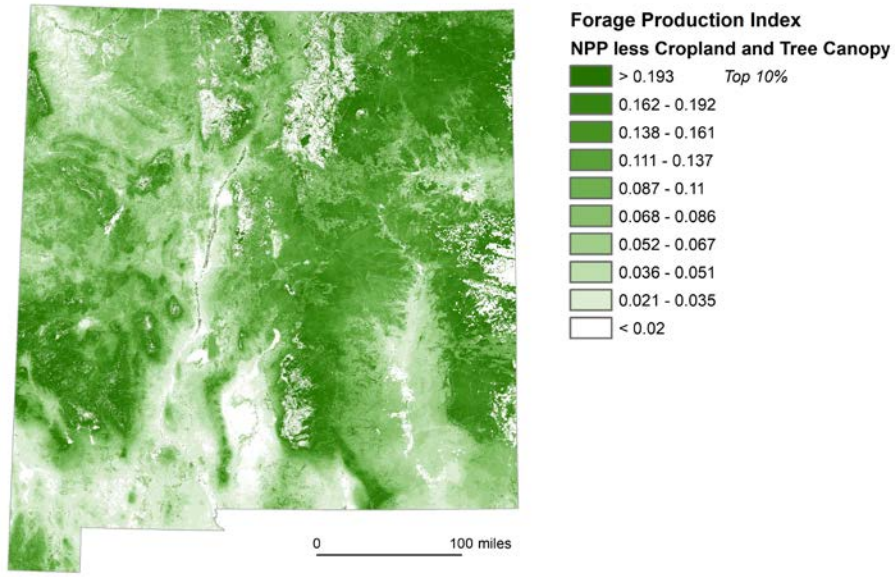
- <= 1
- <= 0.169
- <= 0.102
- <= 0.067
- <= 0.043
- <= 0.027
- <= 0.016
- <= 0.008
- <= 0.004
- <= 0

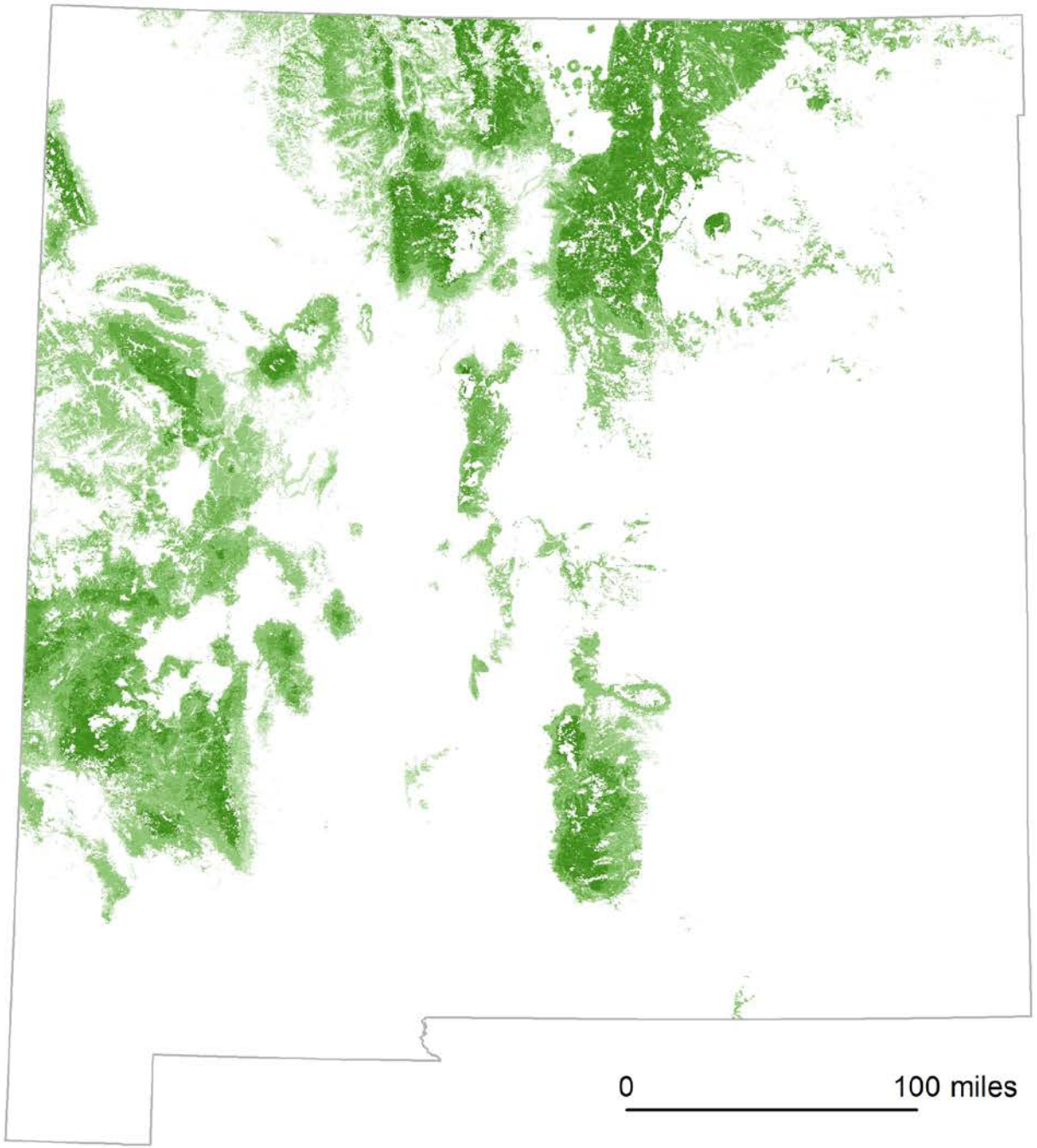
Theme: Timber and Grazing

Timber and Grazing

- Timber value:
  - Standing Inventory of Sawlogs, Small-diameter Logs, and Other Biomass
- Grazing Value:
  - Forage Production on Private Lands and Allotments

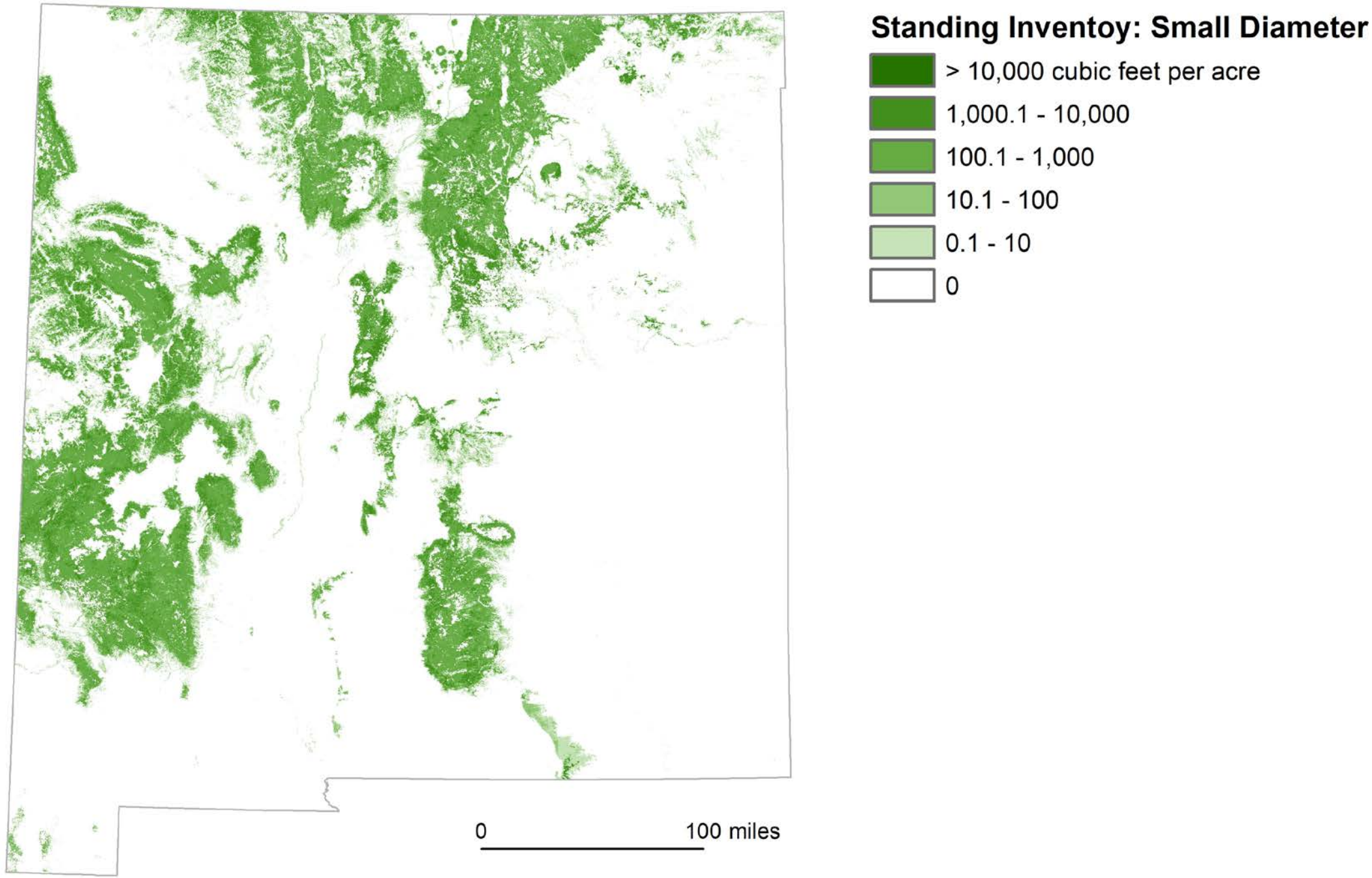


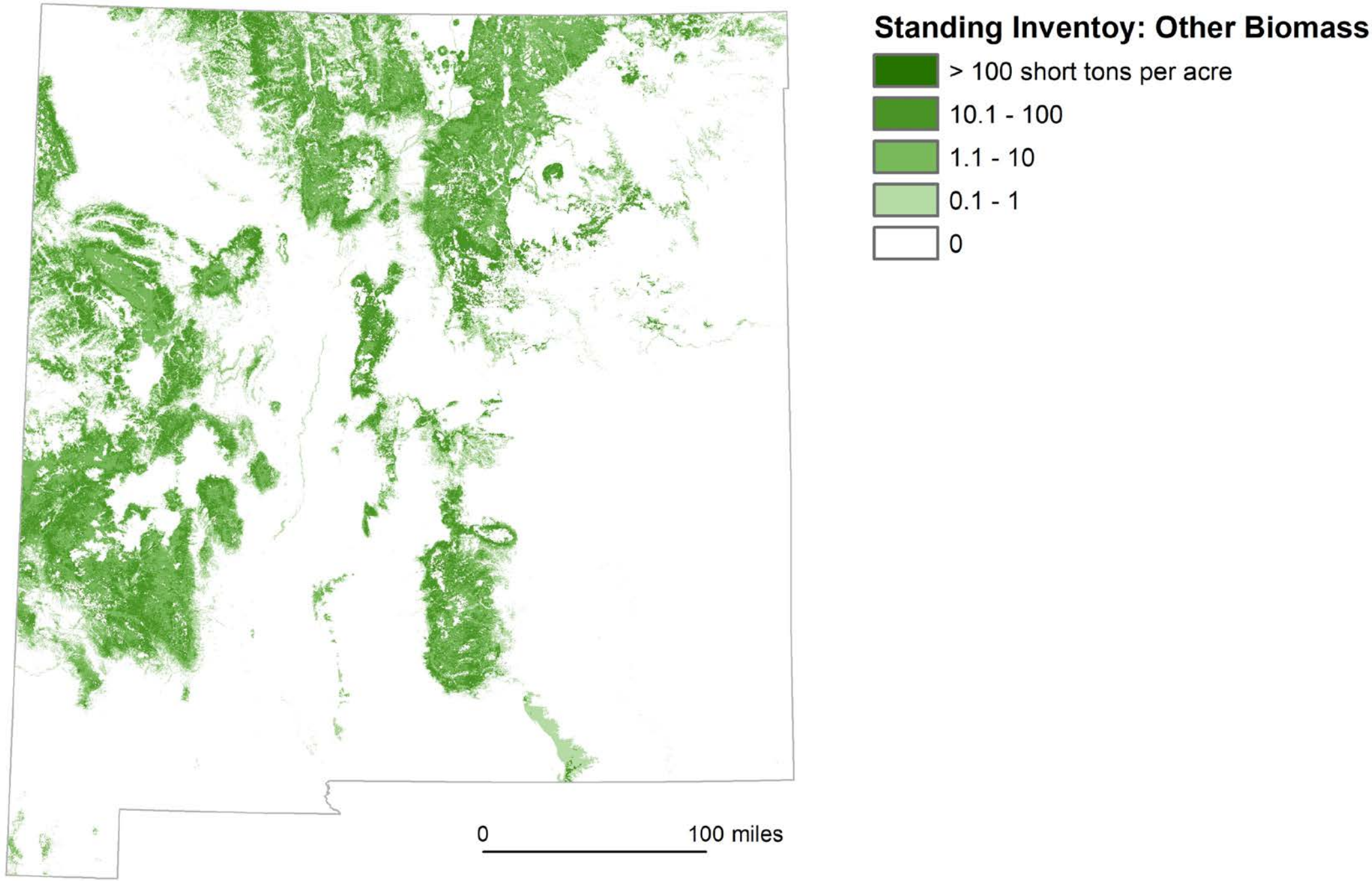


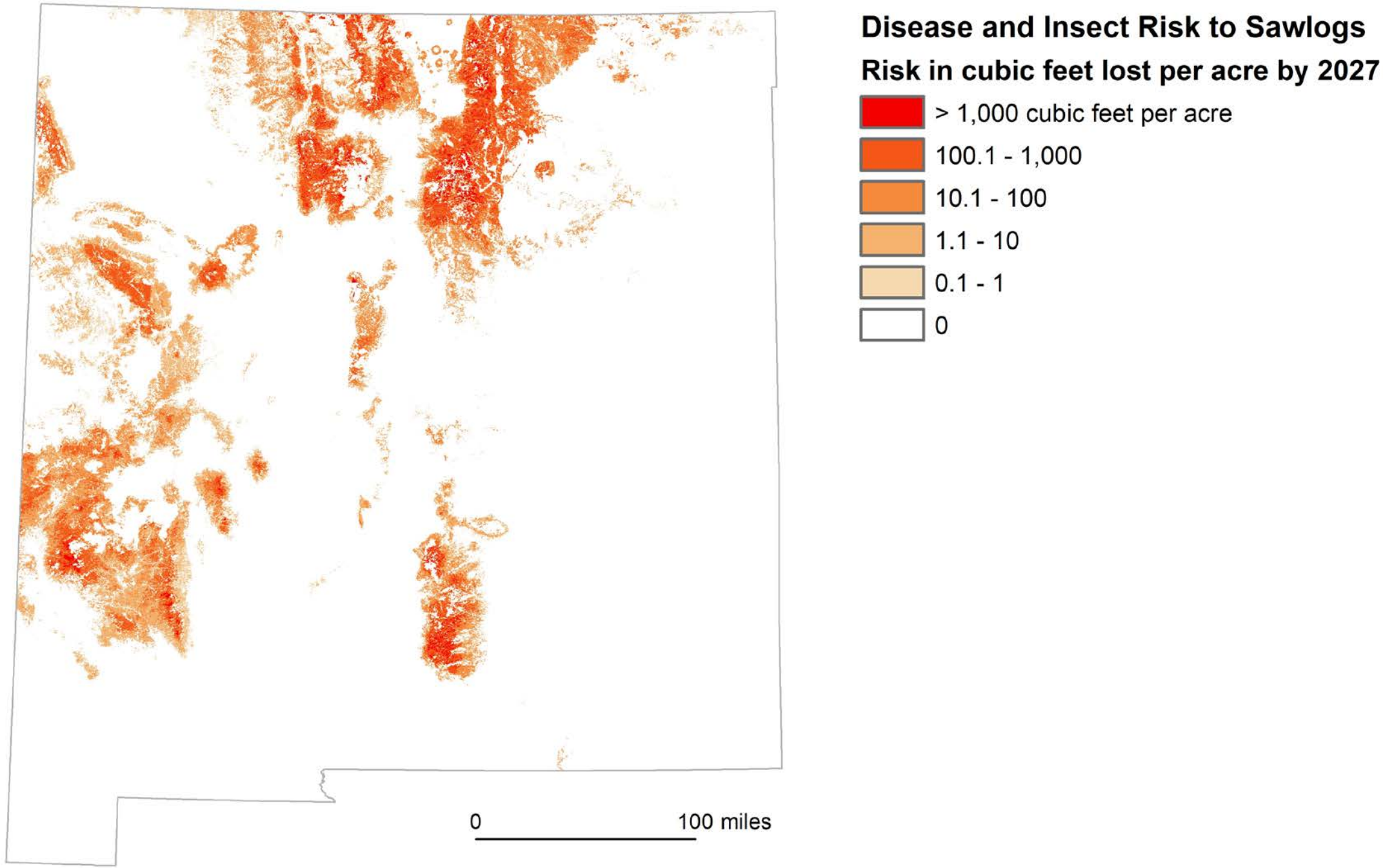


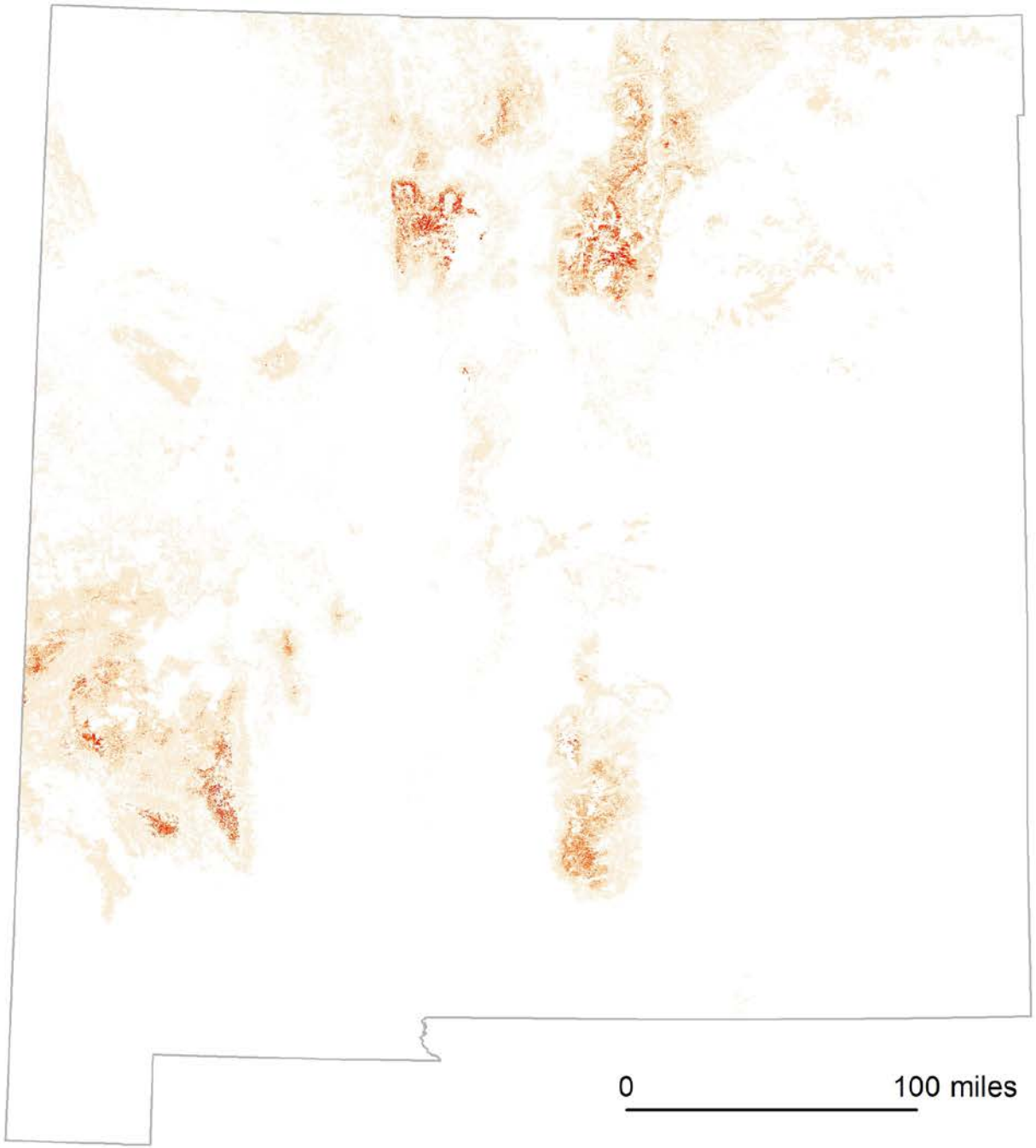
- Standing Inventory is modeled using **Forest Inventory and Analysis (FIA)** Program county-level estimates

- downscaled using maps of forest vegetation type and continuous estimates of basal area


Standing Inventoy: Small Diameter
> 10,000 cubic feet per acre
1,000.1 - 10,000
100.1 - 1,000
10.1 - 100
0.1 - 10
0
0
100 miles


Standing Inventoy: Other Biomass
> 100 short tons per acre
10.1 - 100
1.1 - 10
0.1 - 1
0
0
100 miles

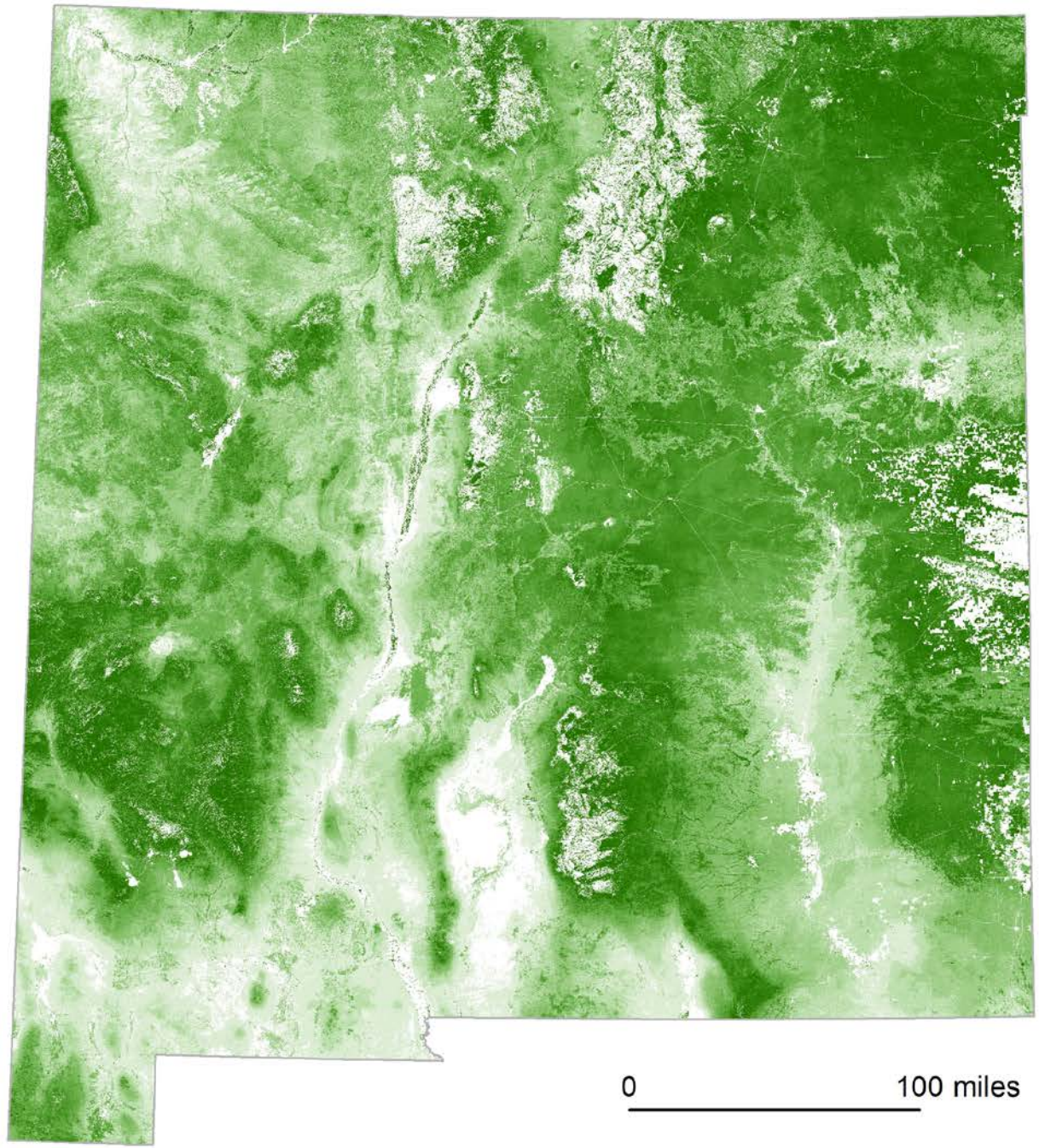

Disease and Insect Risk to Sawlogs
Risk in cubic feet lost per acre by 2027
> 1,000 cubic feet per acre
100.1 - 1,000
10.1 - 100
1.1 - 10
0.1 - 1
0
0
100 miles



Fire Risk to Sawlogs

Annual risk in cubic feet lost per acre

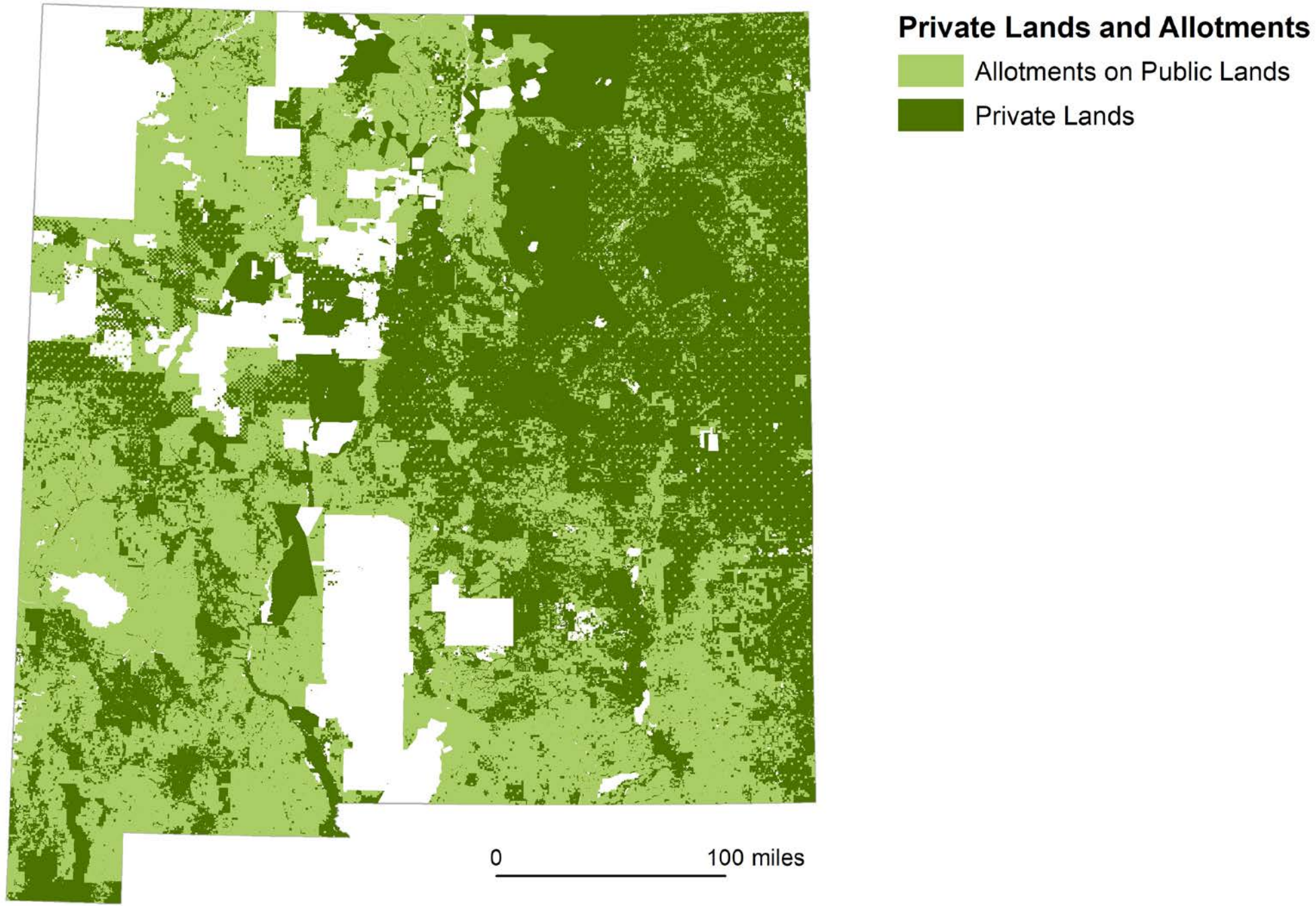
- 60.405 - 1,283.584
- 40.27 - 60.404
- 30.203 - 40.269
- 25.169 - 30.202
- 20.136 - 25.168
- 15.102 - 20.135
- 10.068 - 15.101
- 5.035 - 10.067
- 0.001 - 5.034
- 0

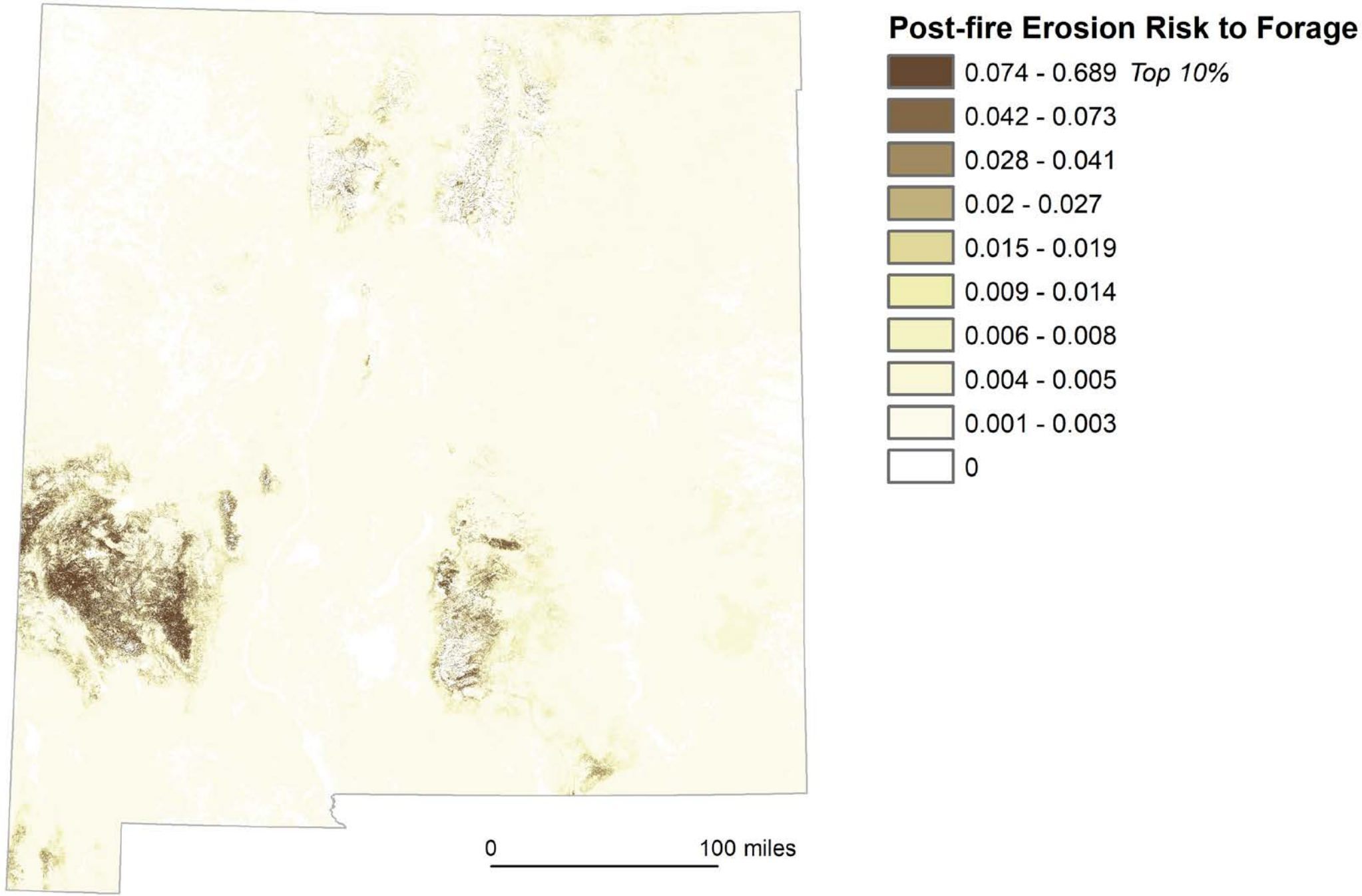


Forage Production Index

NPP less Cropland and Tree Canopy

> 0.193	*Top 10%*
0.162 - 0.192	
0.138 - 0.161	
0.111 - 0.137	
0.087 - 0.11	
0.068 - 0.086	
0.052 - 0.067	
0.036 - 0.051	
0.021 - 0.035	
< 0.02	


Private Lands and Allotments
Allotments on Public Lands
Private Lands
0
100 miles

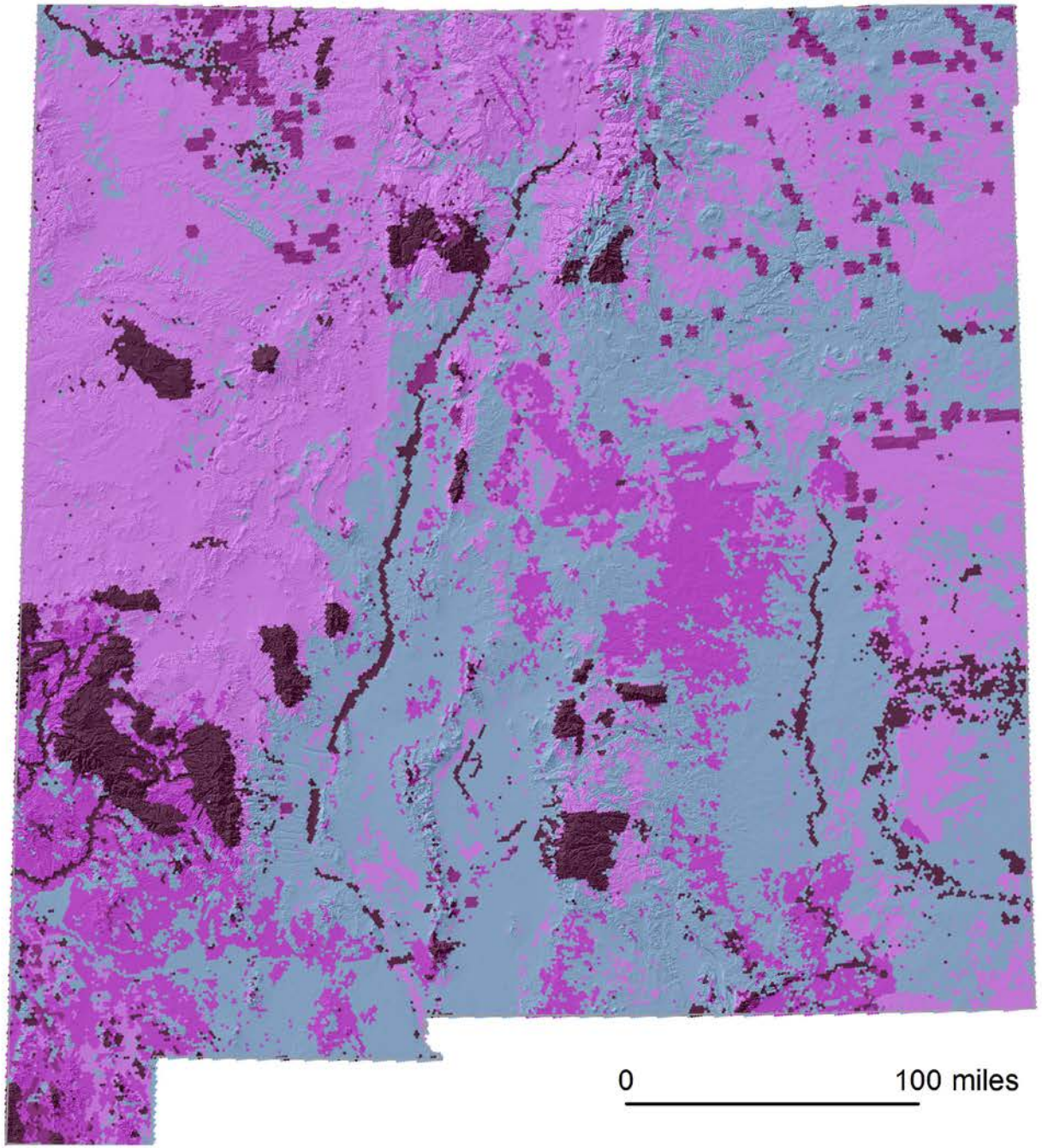

Post-fire Erosion Risk to Forage
0.074 - 0.689 Top 10%
0.042 - 0.073
0.028 - 0.041
0.02 - 0.027
0.015 - 0.019
0.009 - 0.014
0.006 - 0.008
0.004 - 0.005
0.001 - 0.003
0
0
100 miles

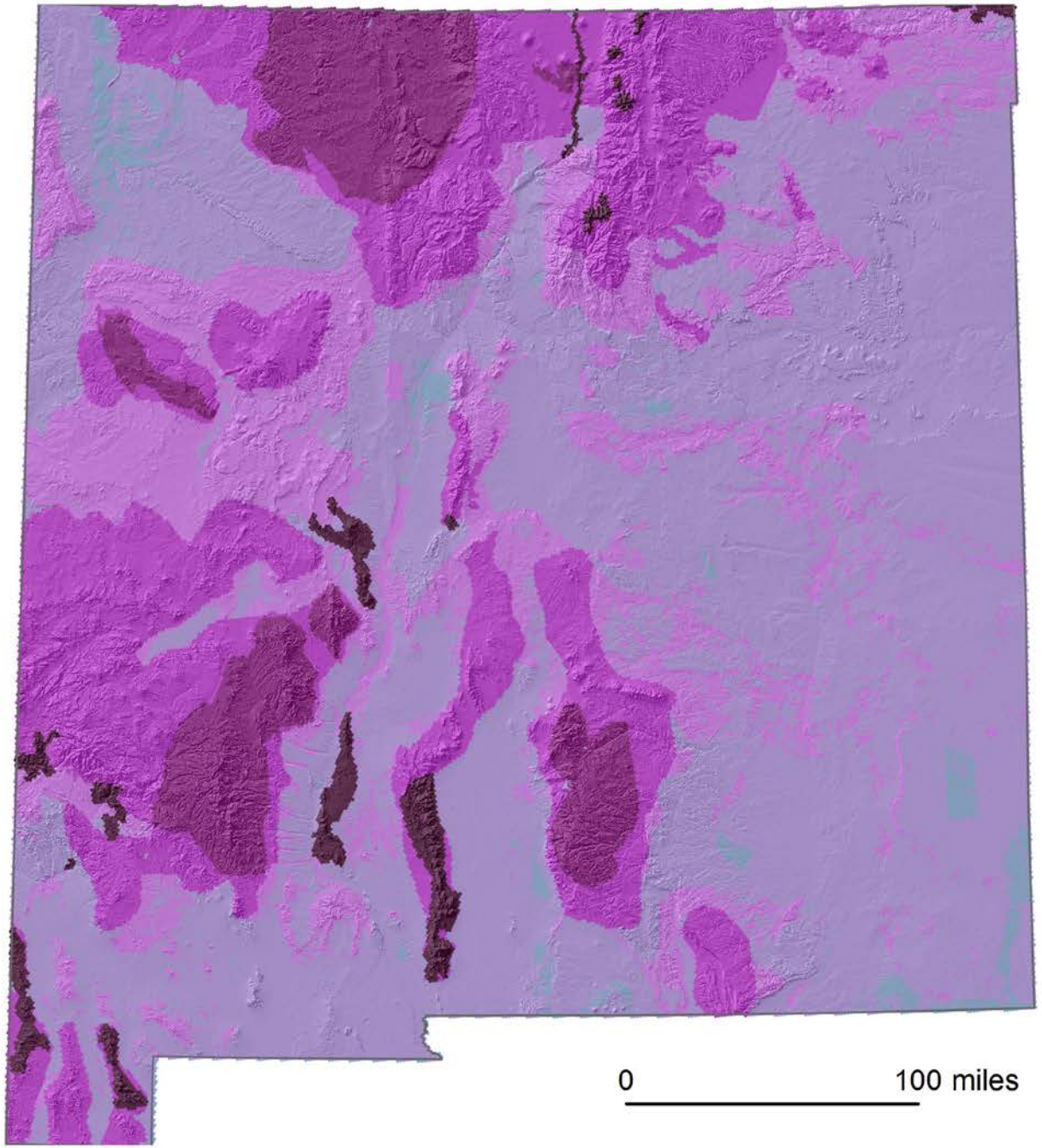
Theme: Biodiversity

Biodiversity: Terrestrial

WAFWA: Crucial Habitat Assessment Tool (CHAT)

All Species of Concern (2018)





Biodiversity: Terrestrial

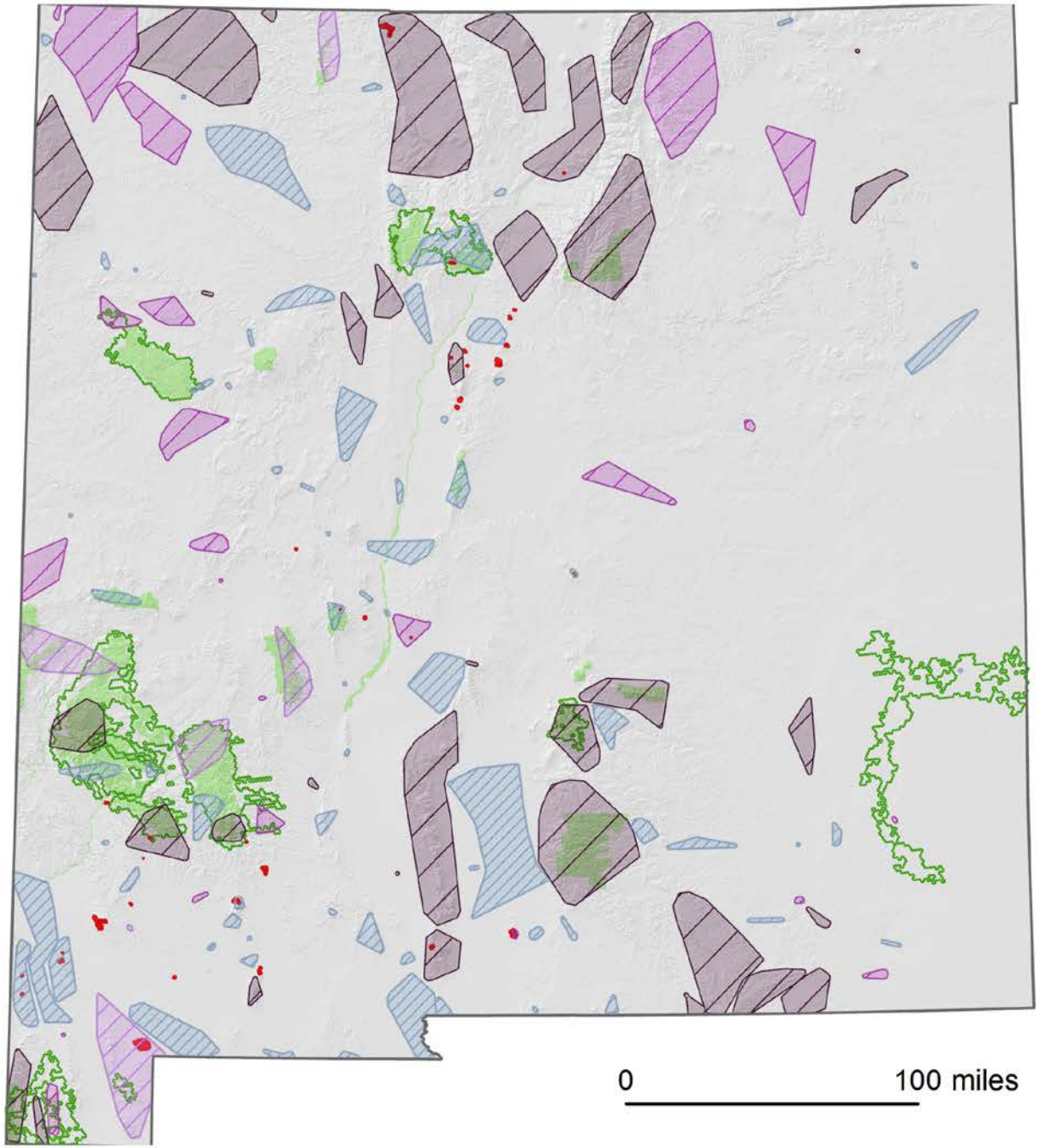
WAFWA: Crucial Habitat Assessment Tool (CHAT)

SERI (Terrestrial)

Rank

High

Low



Biodiversity: Terrestrial

Natural Heritage New Mexico

Significant Bat Use Areas

Important Plant Areas

Rank

High

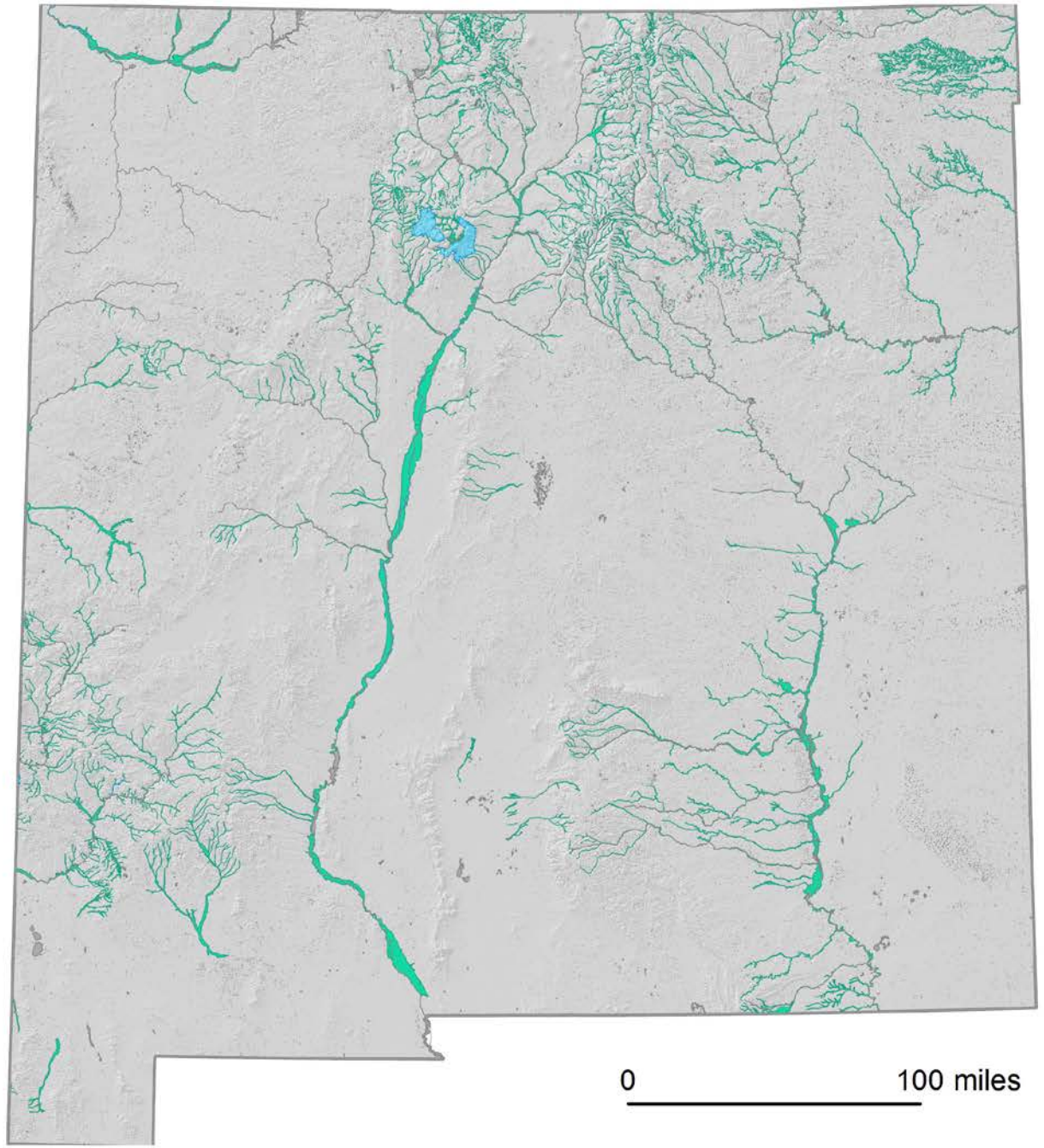
Low

NM Department of Game and Fish

COAs (Montane)

US Fish and Wildlife Service

Critical Habitat



Biodiversity: Aquatic

Rivers and Lakes / Reservoirs

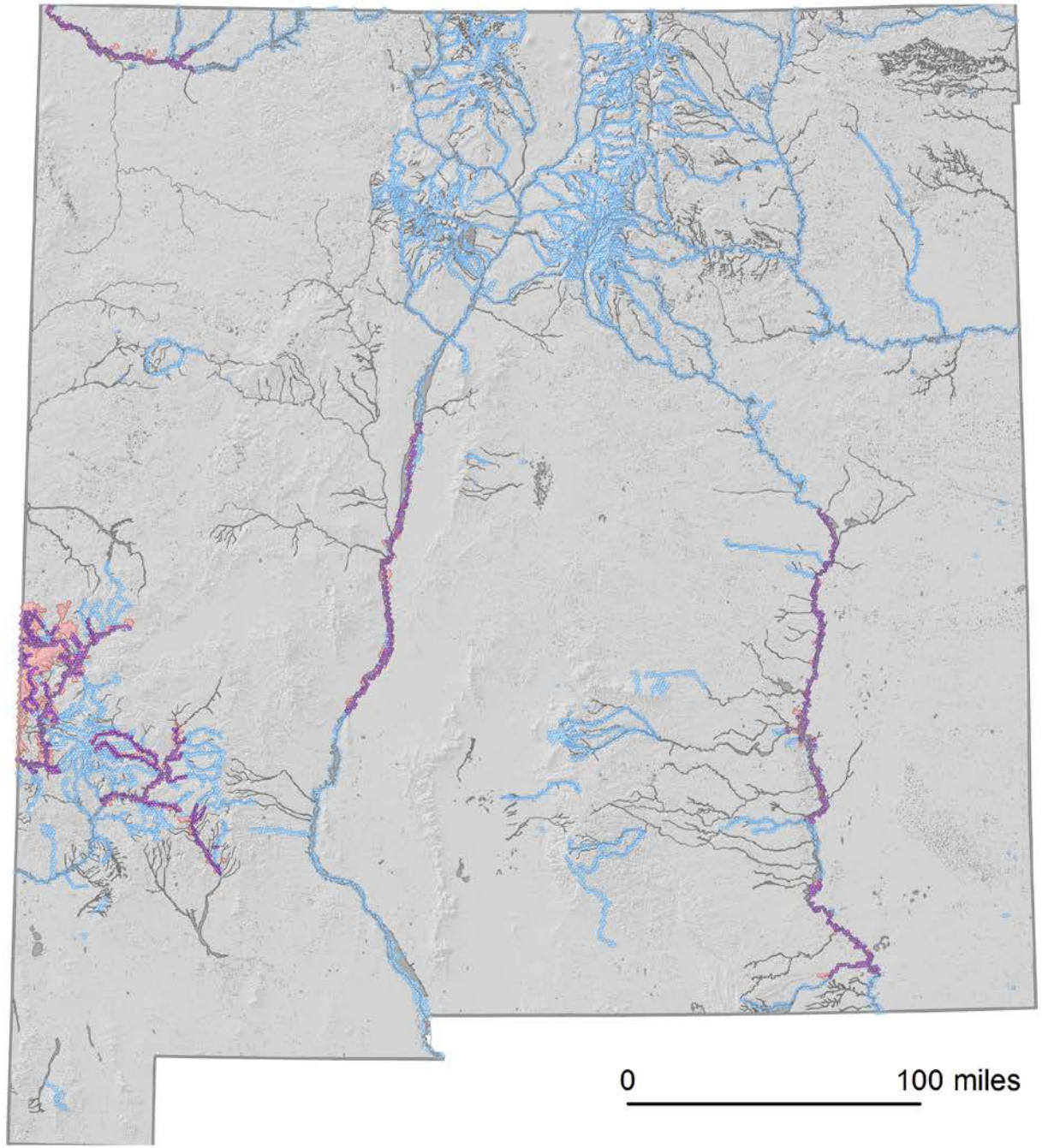
US Fish and Wildlife Service

Critical Habitat

Natural Heritage New Mexico

Riparian Corridors

(Perennial streams/rivers)



Biodiversity: Aquatic

US Fish and Wildlife Service

Critical Habitat

Natural Heritage New Mexico

Riparian Corridors

(Perennial streams/rivers)

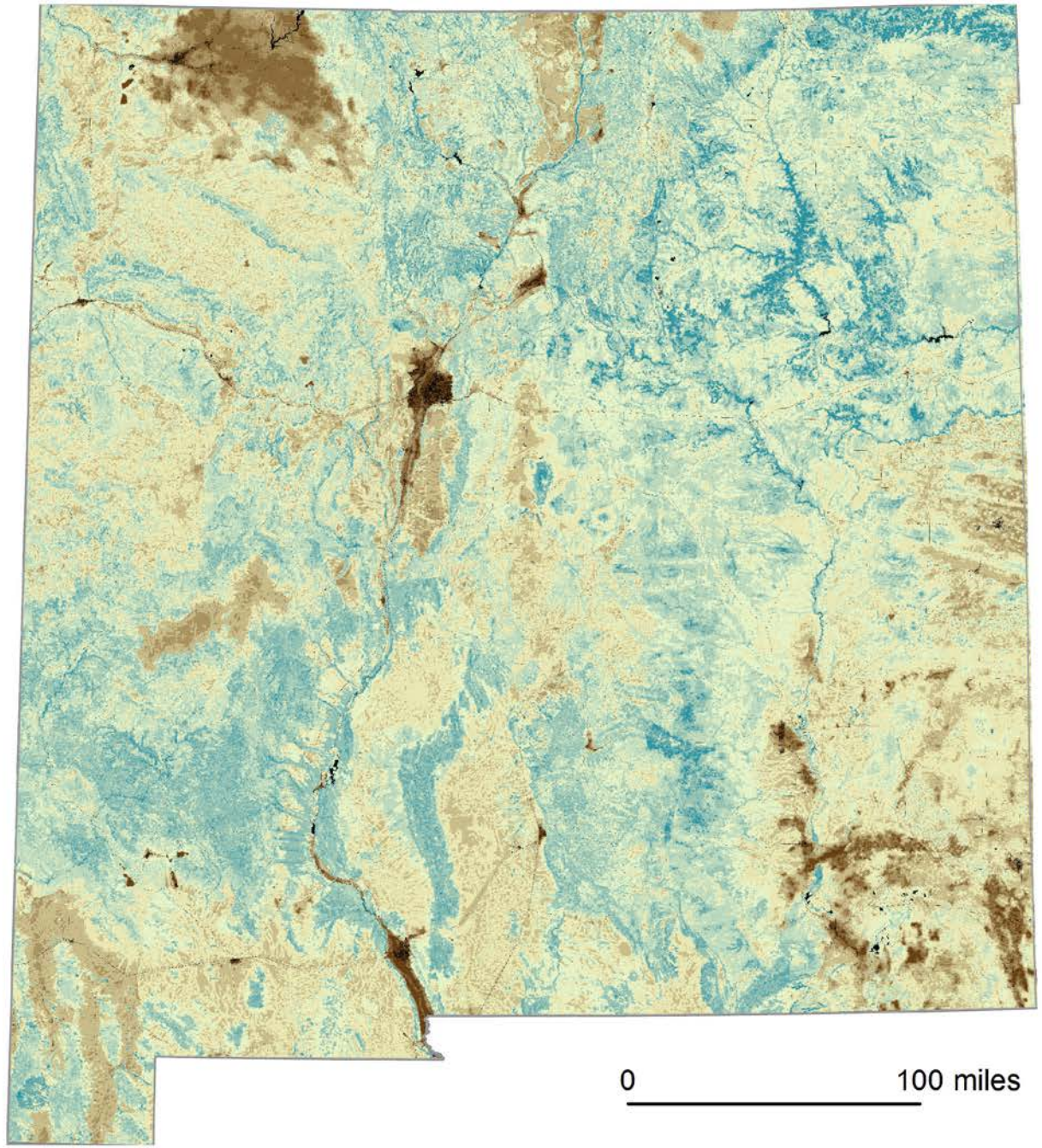
NM Department of Game and Fish

COAs (Riverine)

Overlap

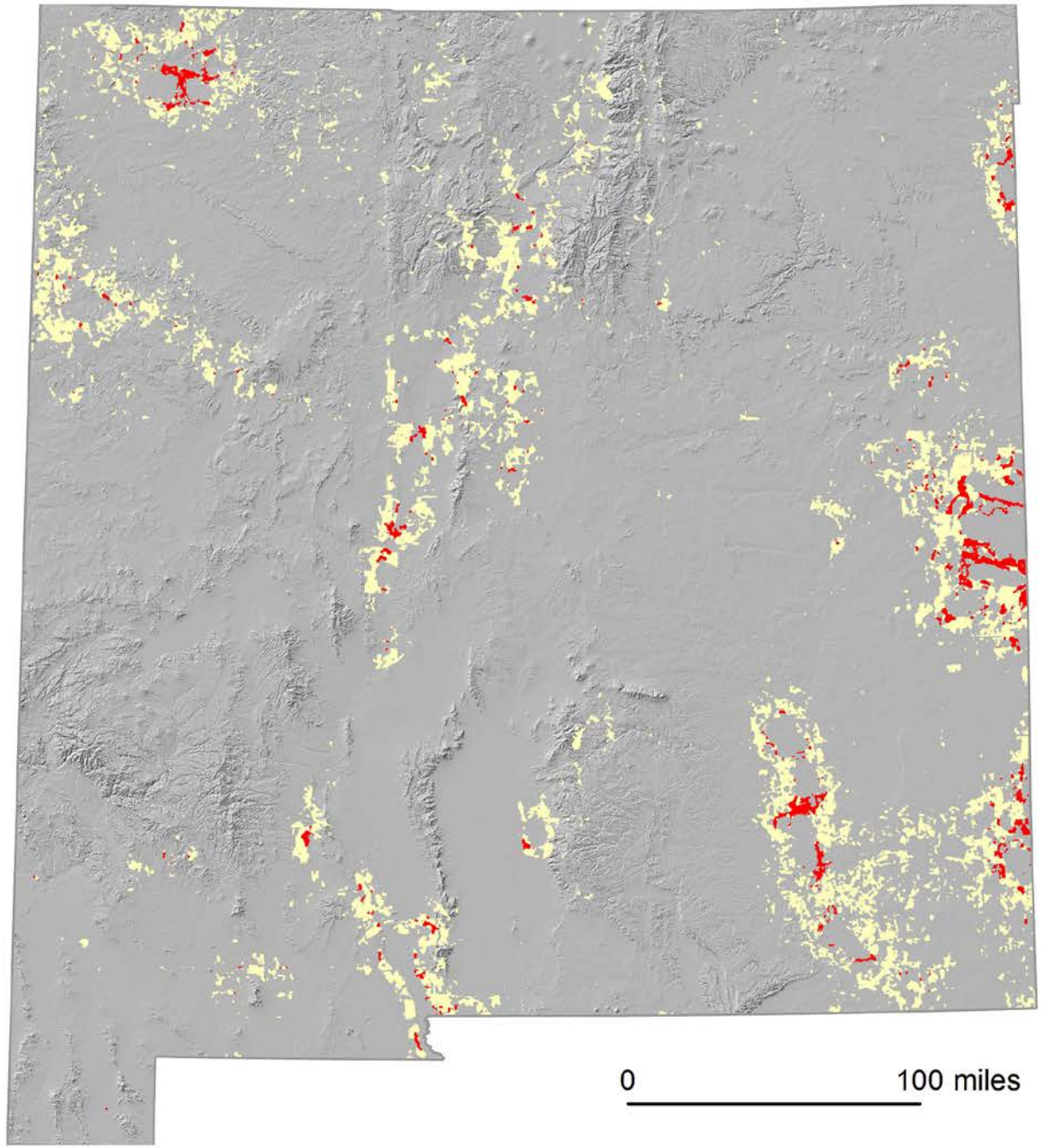
WAFWA: Crucial Habitat Assessment Tool (CHAT)

SERI - Aquatic (High Rank)



Climate Resilience (Terrestrial)

- Most resilient
- High resilience
- Median
- Low resilience
- Least resilient
- Open water / Developed



Omnidirectional connectivity

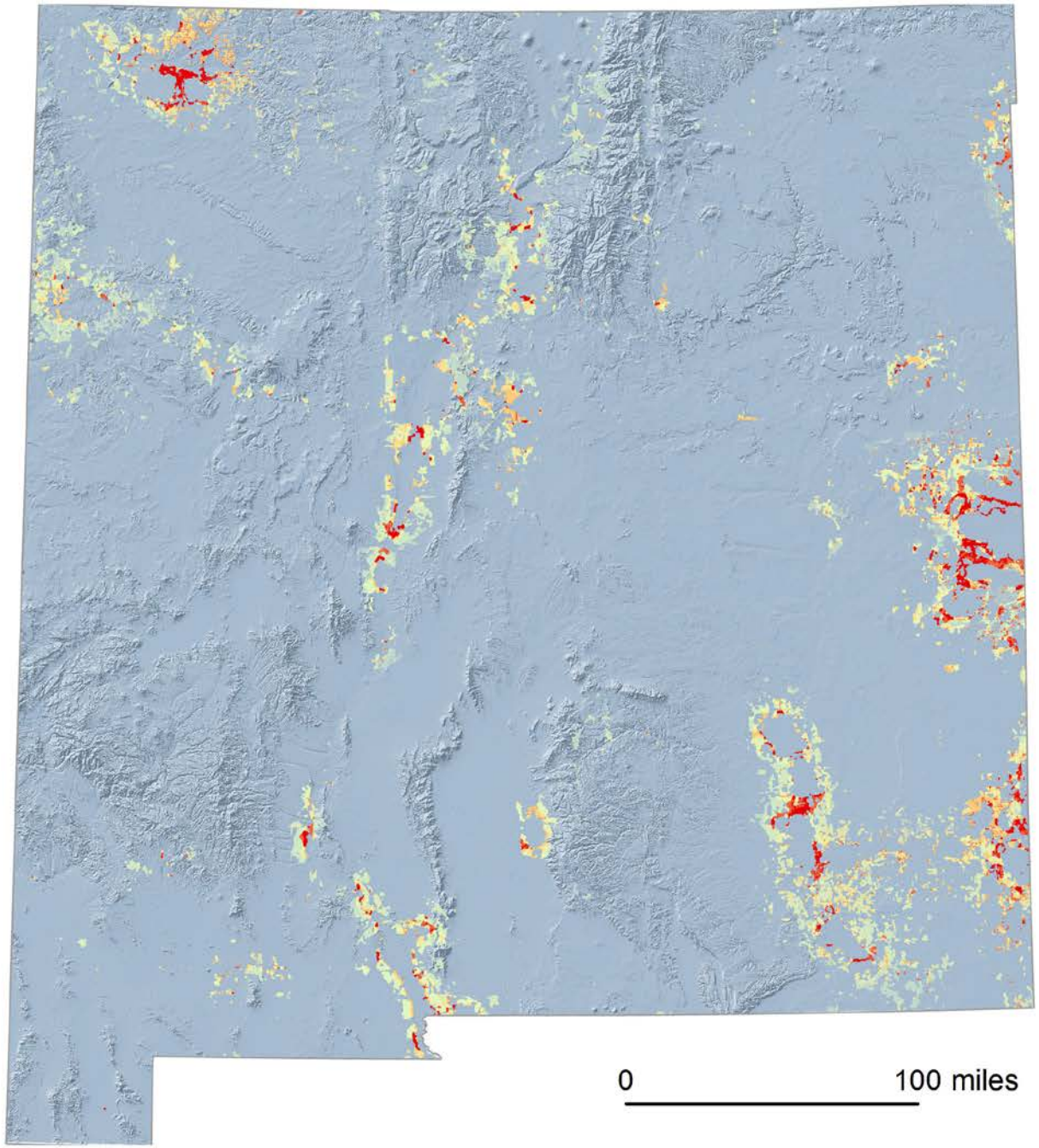
Importance to preserving landscape-scale connectivity

Critical

- Animal movement channelized into a potentially single option
- Connectivity could be severed with the loss of a relatively small amount of dispersal habitat

High

- Reduced options for animal movement
- Important in relation to nearby areas of critical importance

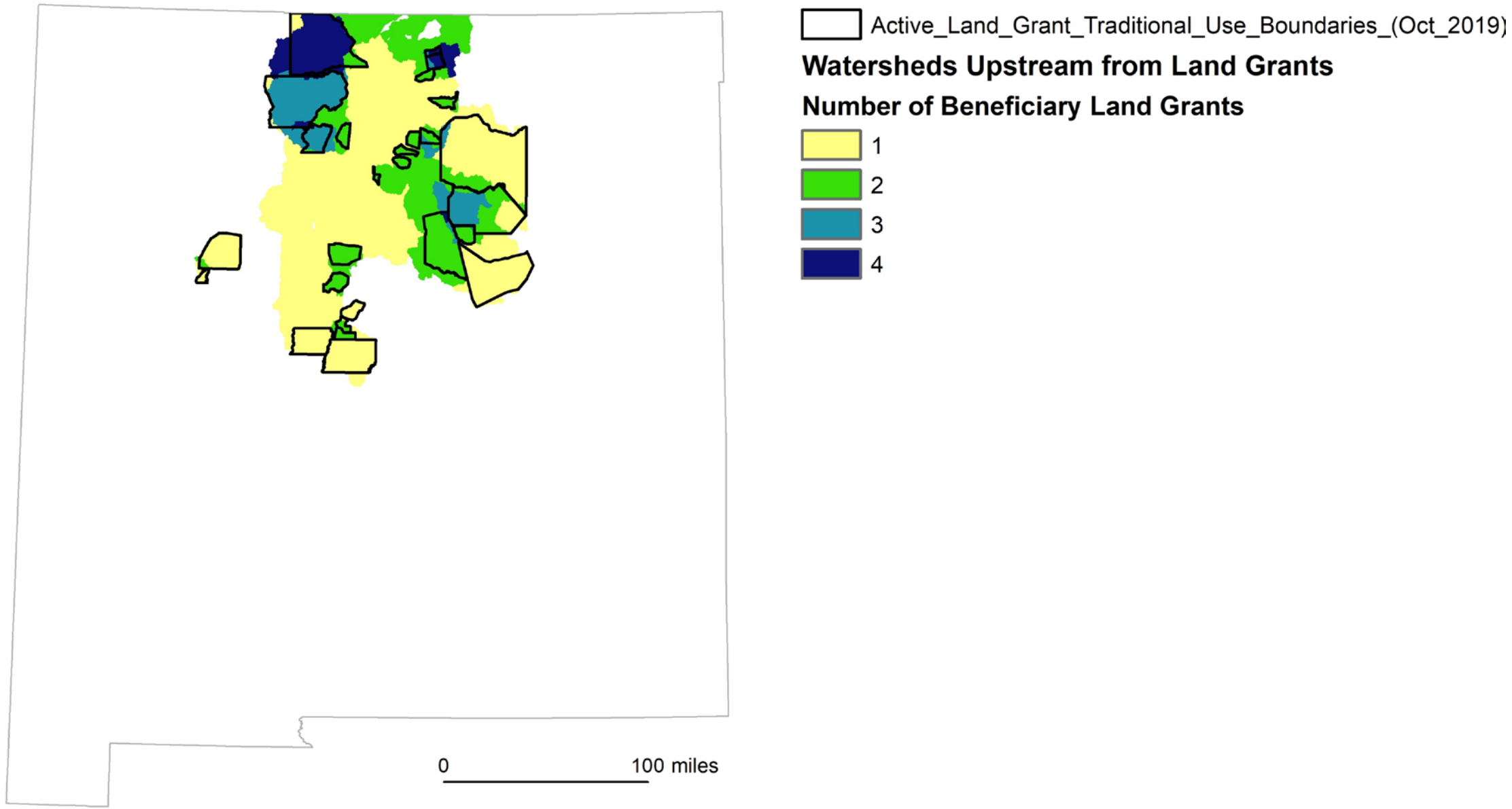


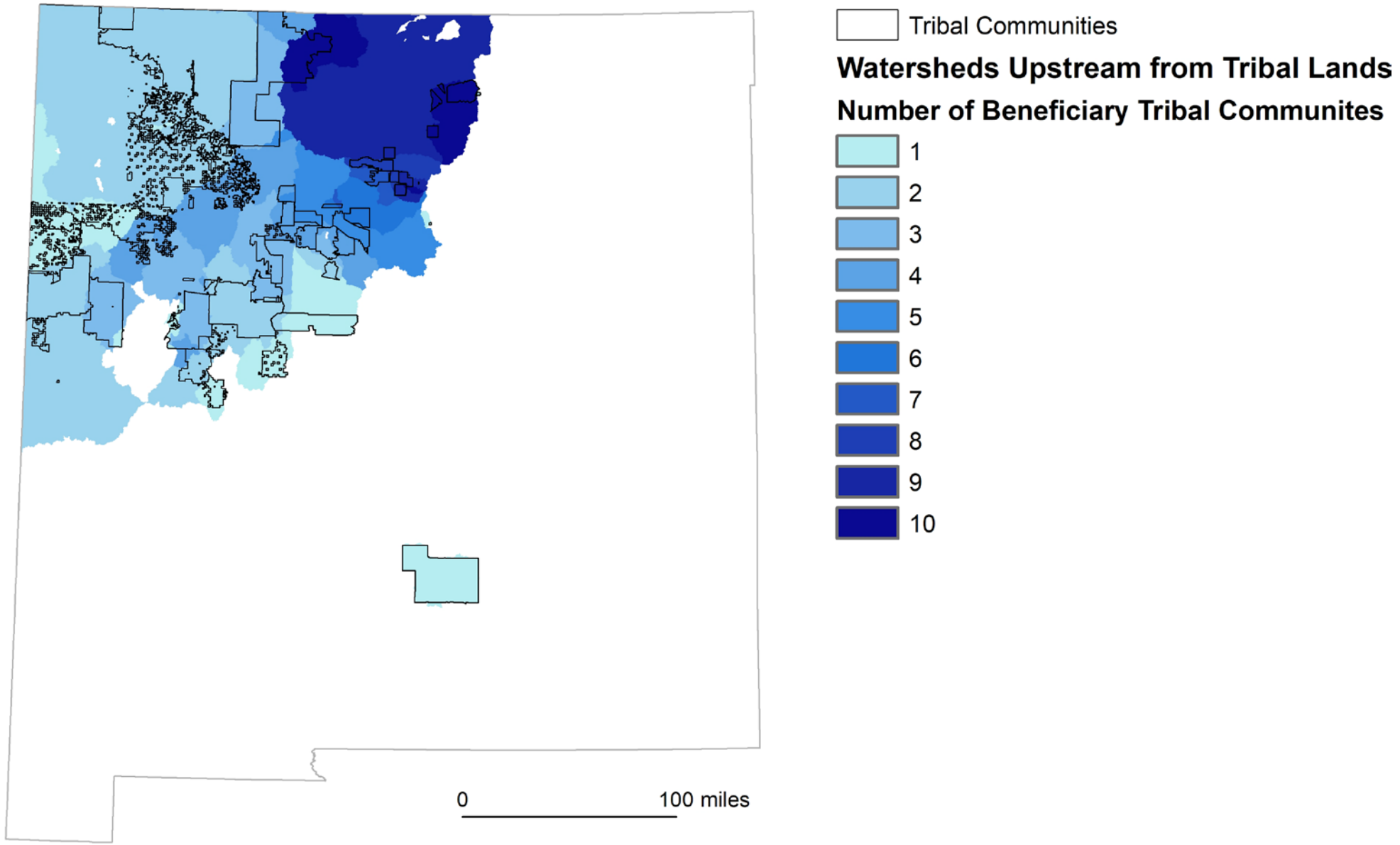
Fragmentation risk to landscape connectivity

Existing human modification used as predictor of more intensive future modification

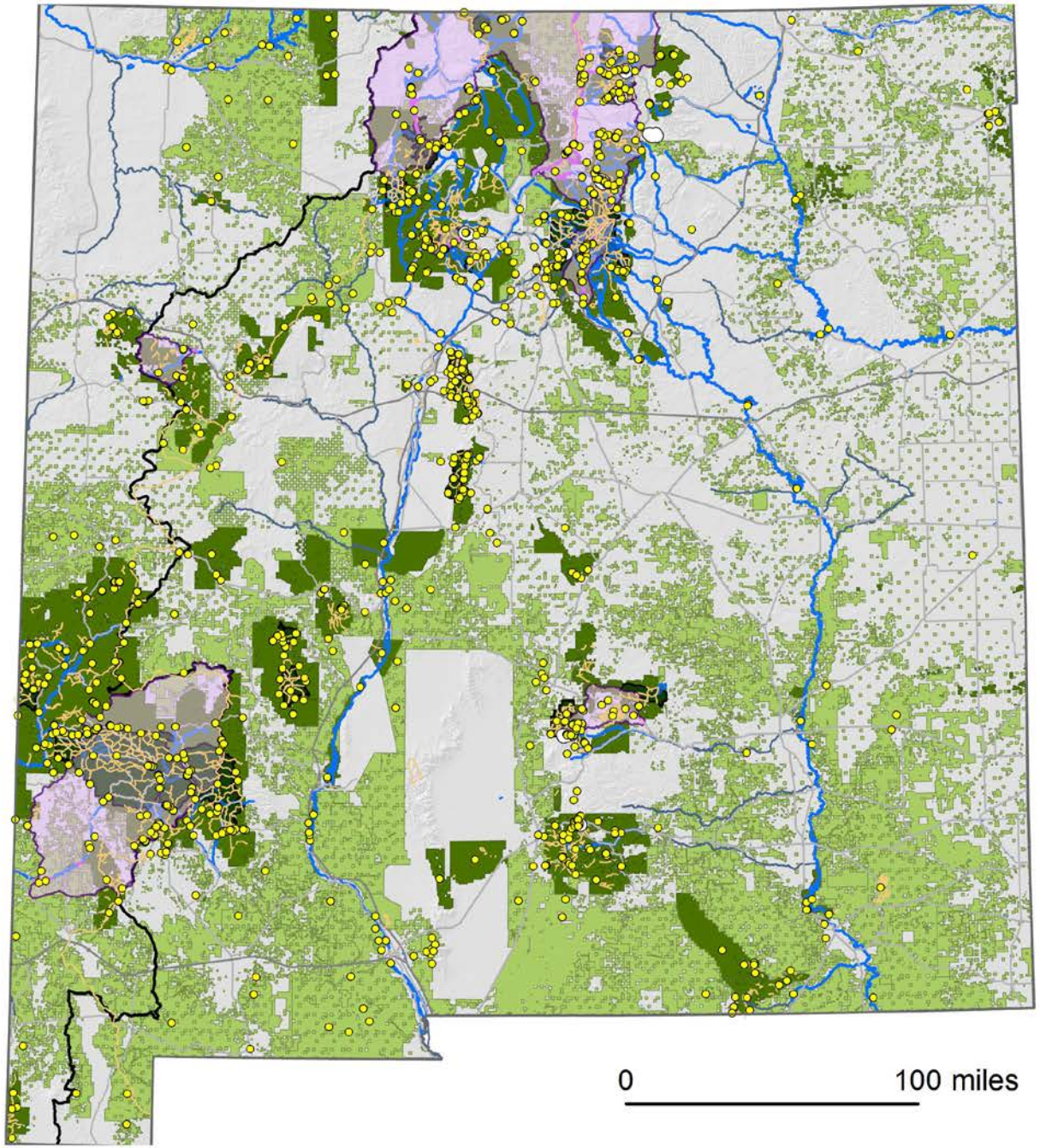
- <= 1
- <= 0.192
- <= 0.047
- <= 0.027
- <= 0.02
- <= 0.016
- <= 0.012
- <= 0.008
- <= 0.004
- <= 0

Theme: Indigenous & Traditional Communities


Active_Land_Grant_Traditional_Use_Boundaries_(Oct_2019)
Watersheds Upstream from Land Grants
Number of Beneficiary Land Grants
1
2
3
4
0
100 miles


Tribal Communities
Watersheds Upstream from Tribal Lands
Number of Beneficiary Tribal Communites
1
2
3
4
5
6
7
8
9
10
0
100 miles

Theme: Recreation and Cultural Use



Recreation and Cultural Use

- Recreational Site (multiple agencies)
- Continental Divide Trail
- Trails (local)
- Ski Area
- Fishing Waters (NMDGF)

Wild and Scenic Rivers (WSR)

- WSR River
- Contributing area (watershed)

Recreation by Land Ownership

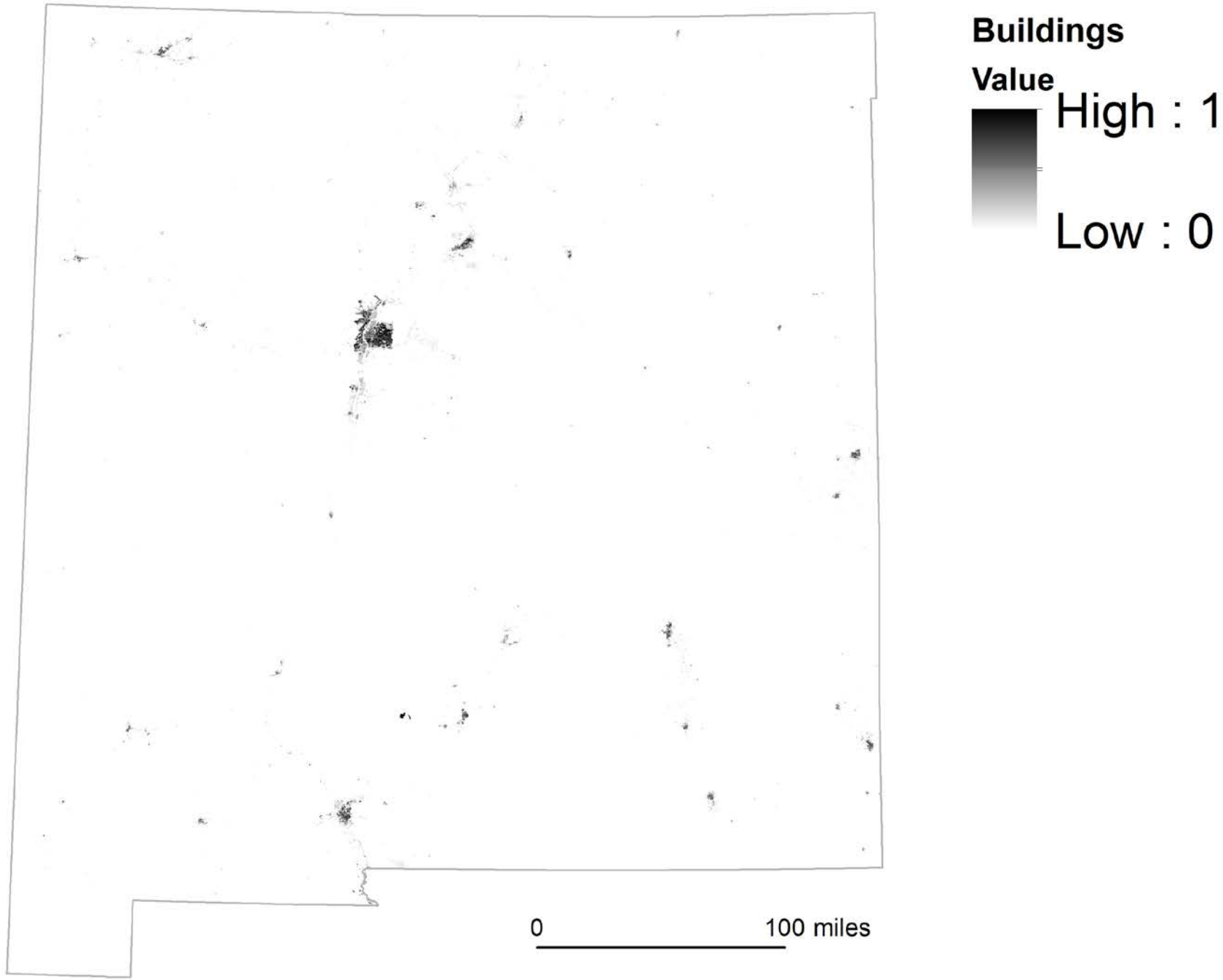
- Managed for Recreation
- Recreation Allowed
- Restricted Access
- Wilderness
- River
- Highway

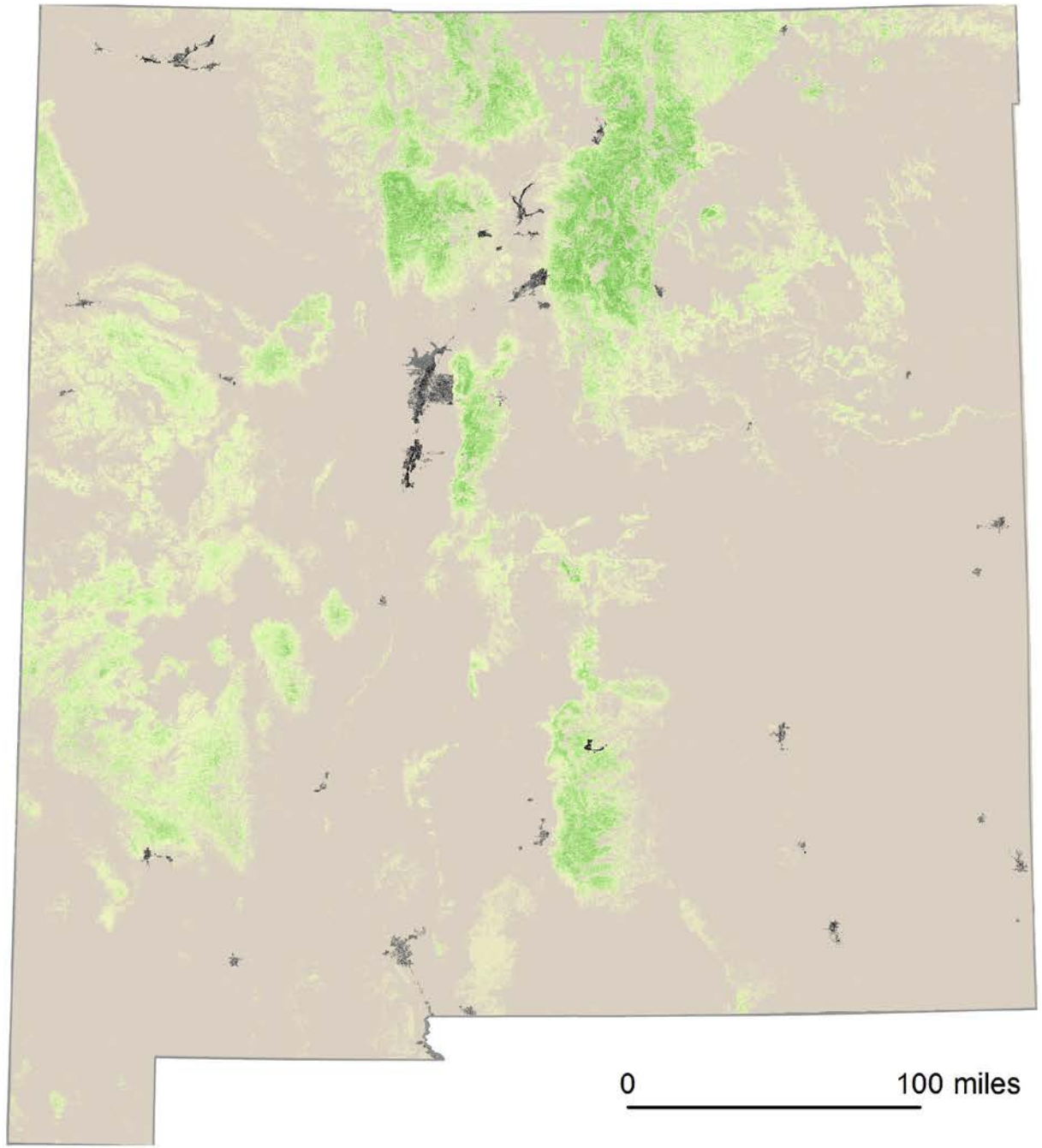
Theme: Urban Forests and Communities

Tree Canopy (Urban areas)

Classification of NAIP 2018 imagery (0.6m)

- Tree
- Tree (~ 95%) or Irrigated Grass (~ 5%)
- Shadow
- Irrigated Grass
- Permeable
- Impervious (incl. Large Buildings)
- Impervious


Buildings
Value
High : 1
Low : 0
0
100 miles



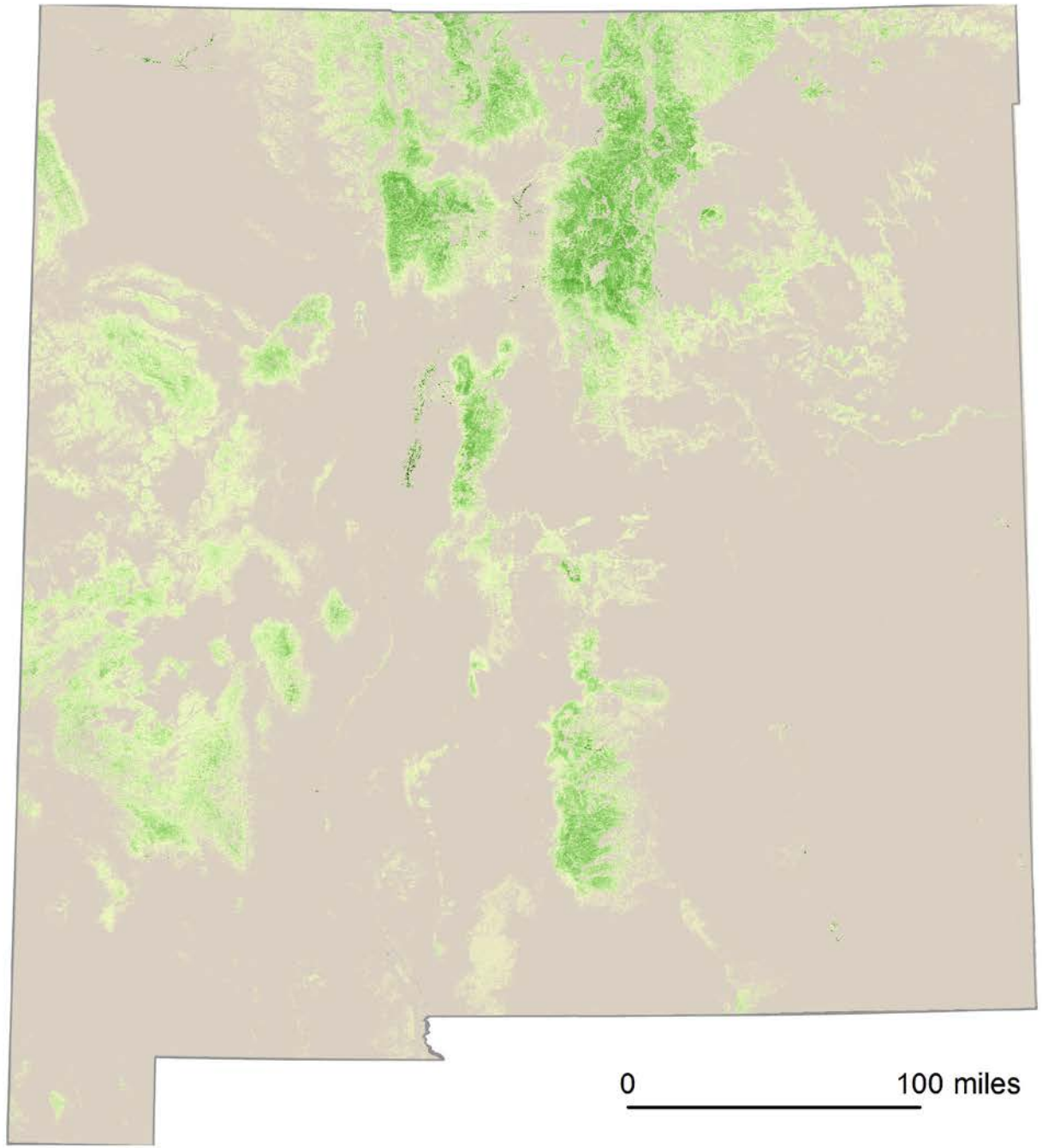
Tree Canopy (Pct cover)

NAIP 2018 imagery (0.6m)

0 100

NLCD 2016 data (30m)

≤100
≤90
≤80
≤70
≤60
≤50
≤40
≤30
≤20
≤10

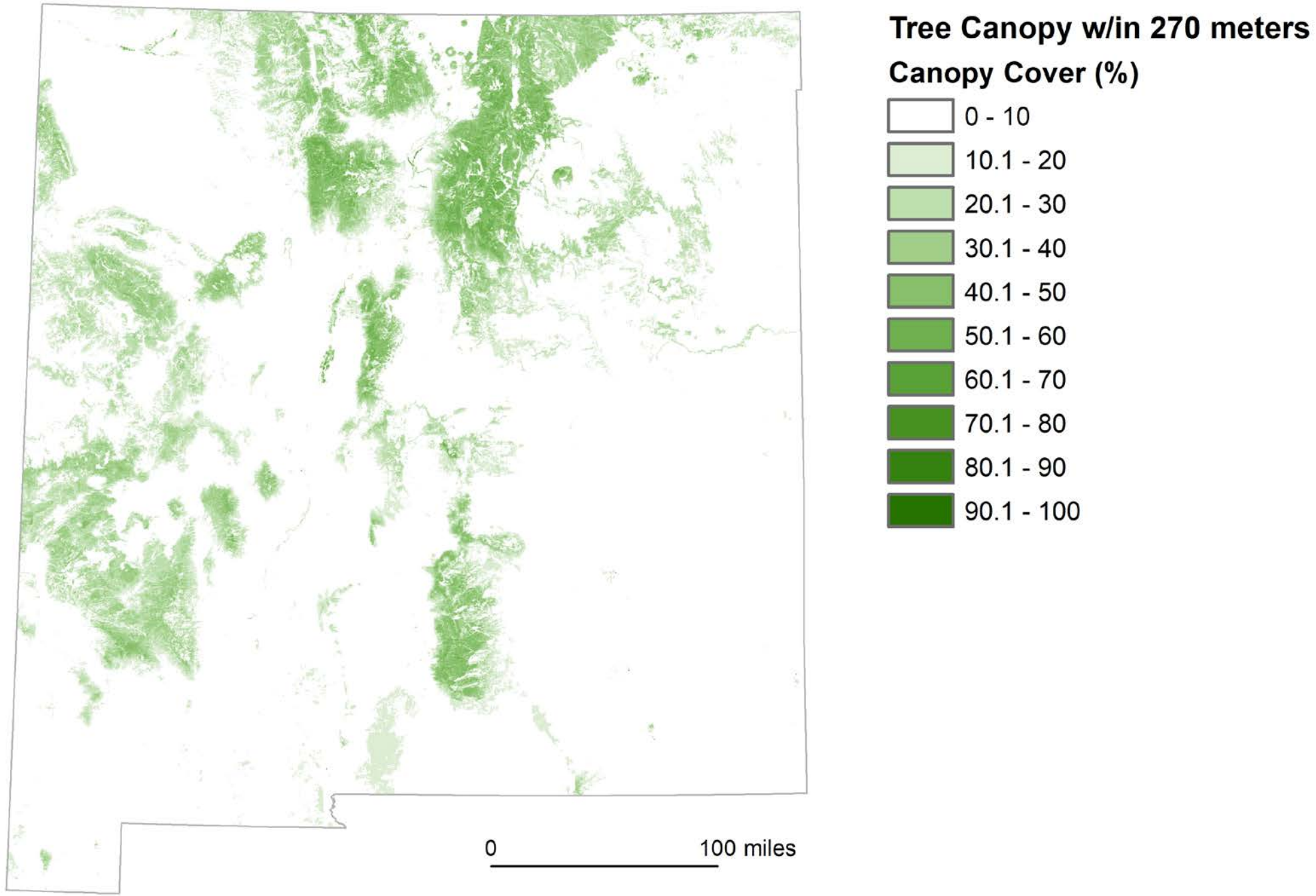


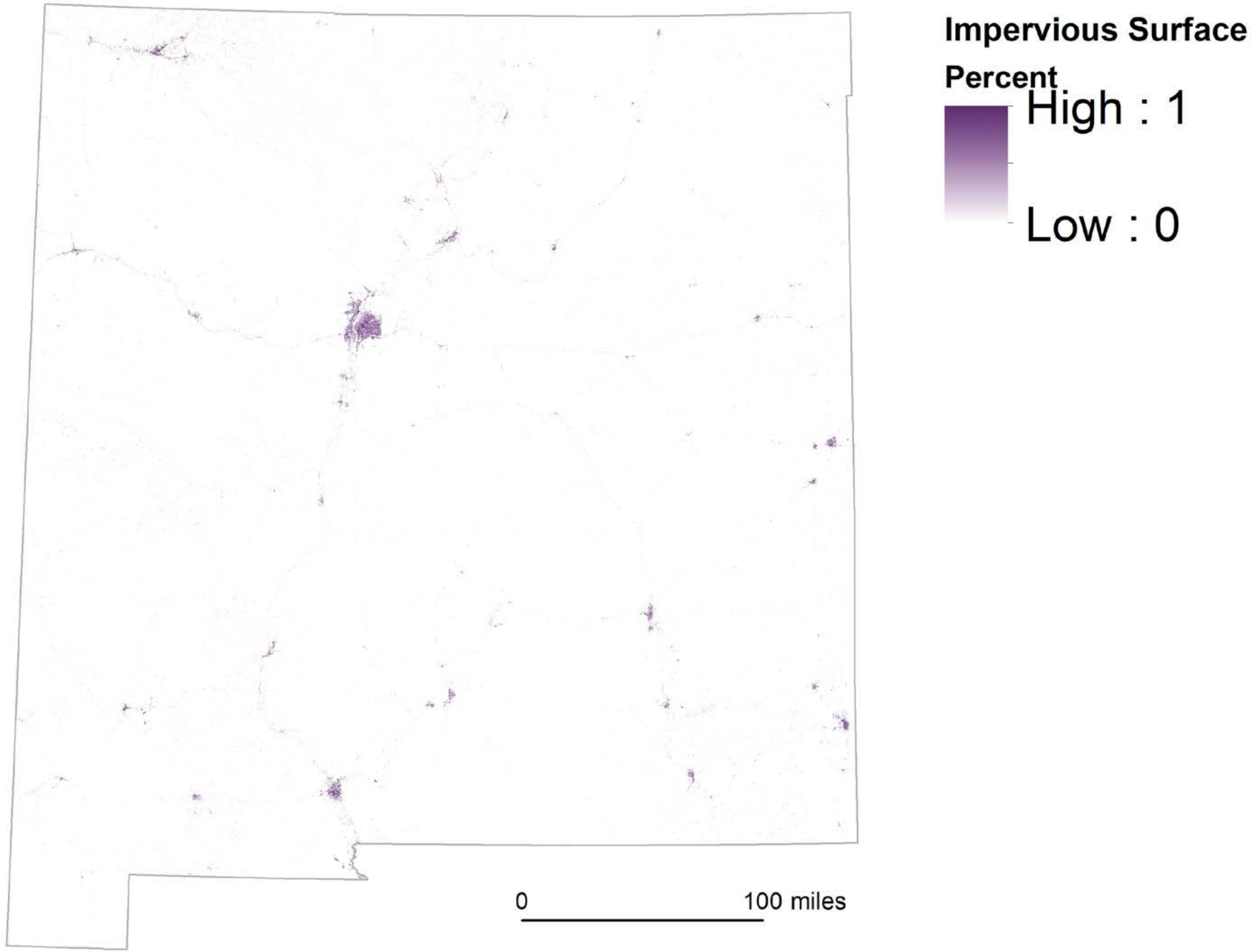
Tree Canopy (Composite)

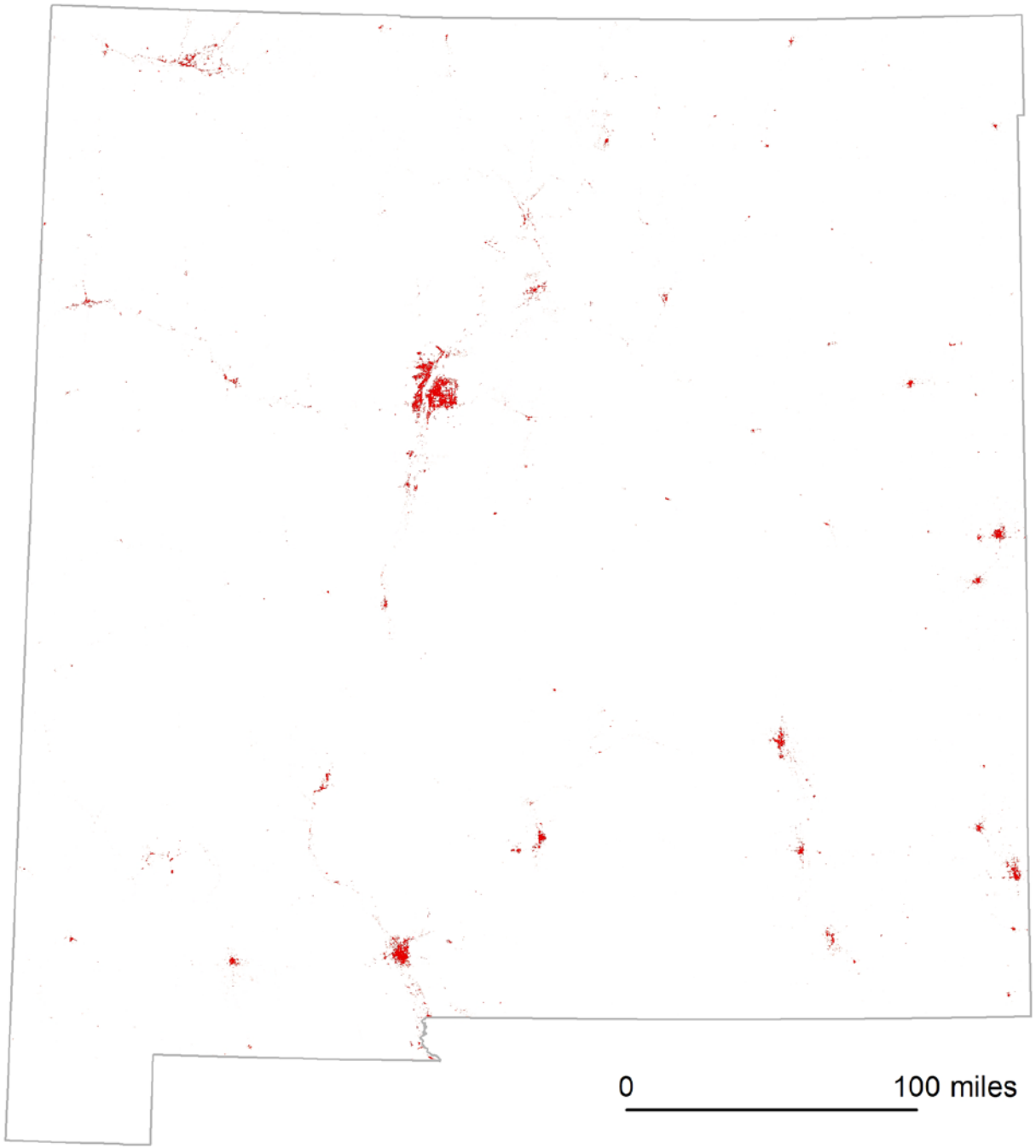
NAIP 2018 and NLCD 2016

Percent coverage

- ≤100
- ≤90
- ≤80
- ≤70
- ≤60
- ≤50
- ≤40
- ≤30
- ≤20
- ≤10


Tree Canopy w/in 270 meters
Canopy Cover (%)
0 - 10
10.1 - 20
20.1 - 30
30.1 - 40
40.1 - 50
50.1 - 60
60.1 - 70
70.1 - 80
80.1 - 90
90.1 - 100
0
100 miles


Impervious Surface
Percent
High : 1
Low : 0
0
100 miles

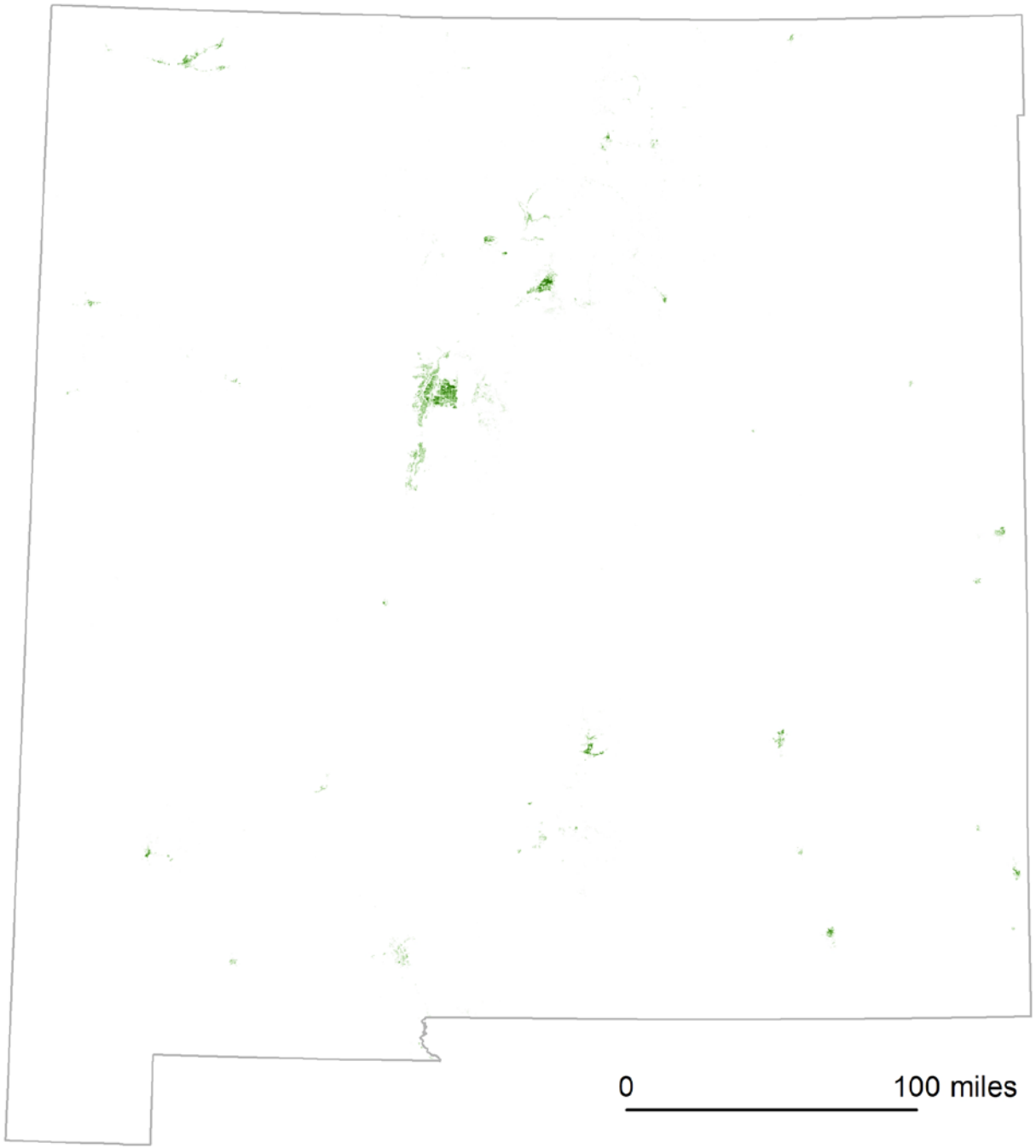


Tree Planting Need Model

Missing Tree Index

High : -0

Low : -0.580827

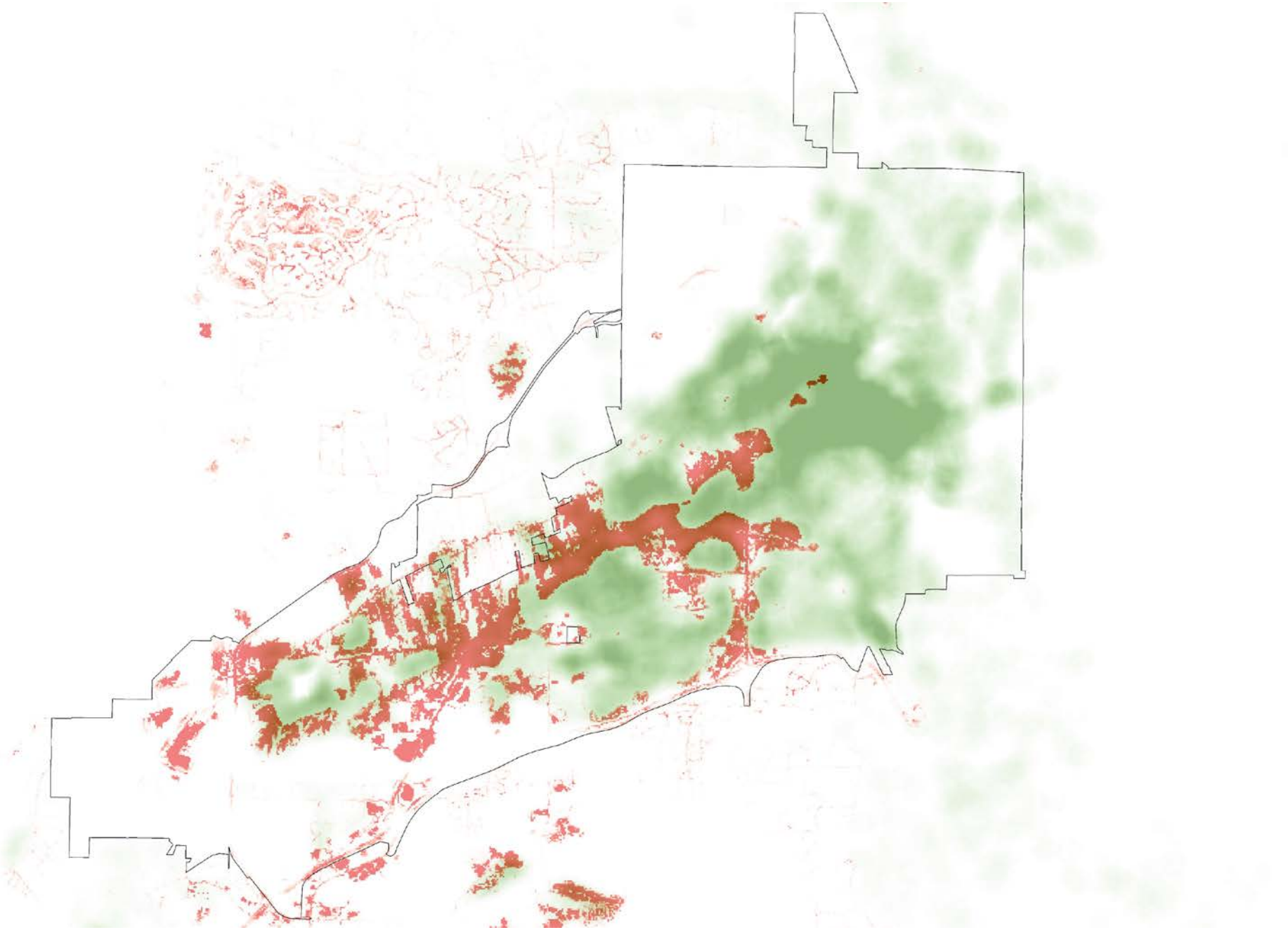


Tree Maintainence Need Model

Existing Tree Value Index

High : 0.129463

Low : 0



Thank You