

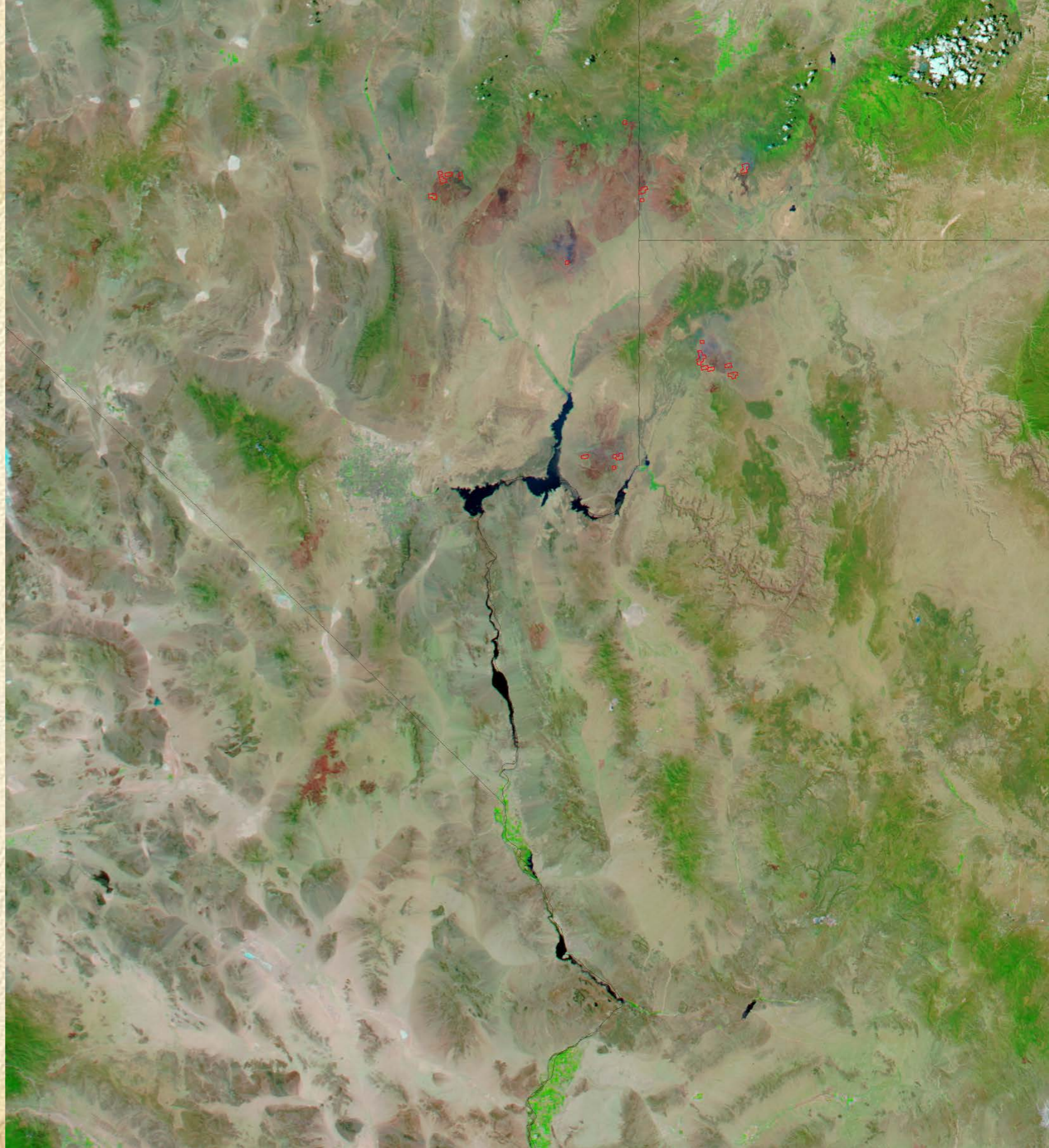
Fire risk and responses of tortoises to burned habitat in the Northeastern Mojave Desert

Kenneth E. Nussear, Todd Esque, Lesley DeFalco, Kristina Drake, Peter Van Linn, Rich Inman

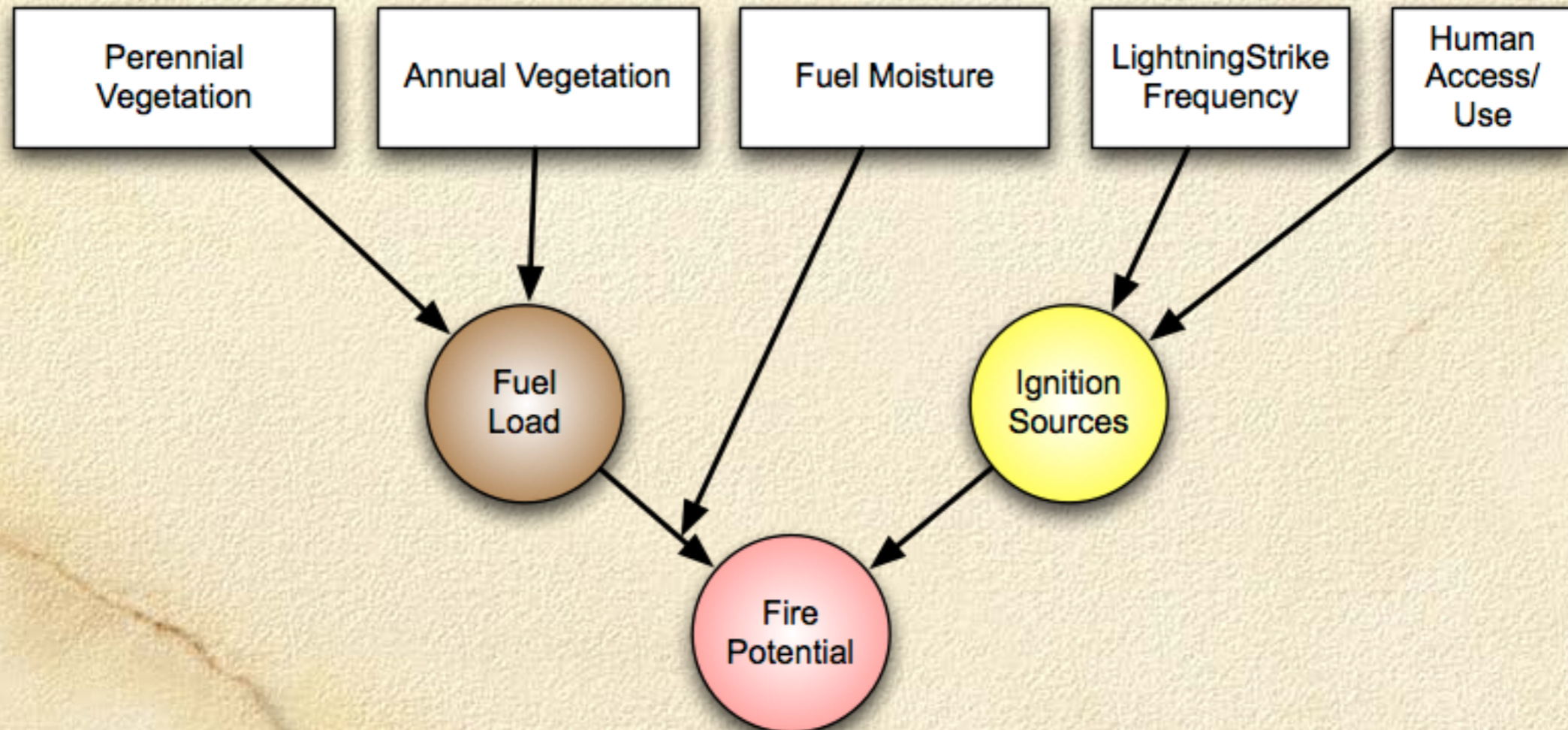
Western Ecological Research
Center, Las Vegas Field Station
U.S. Geological Survey

Southern Nevada Fire Complex

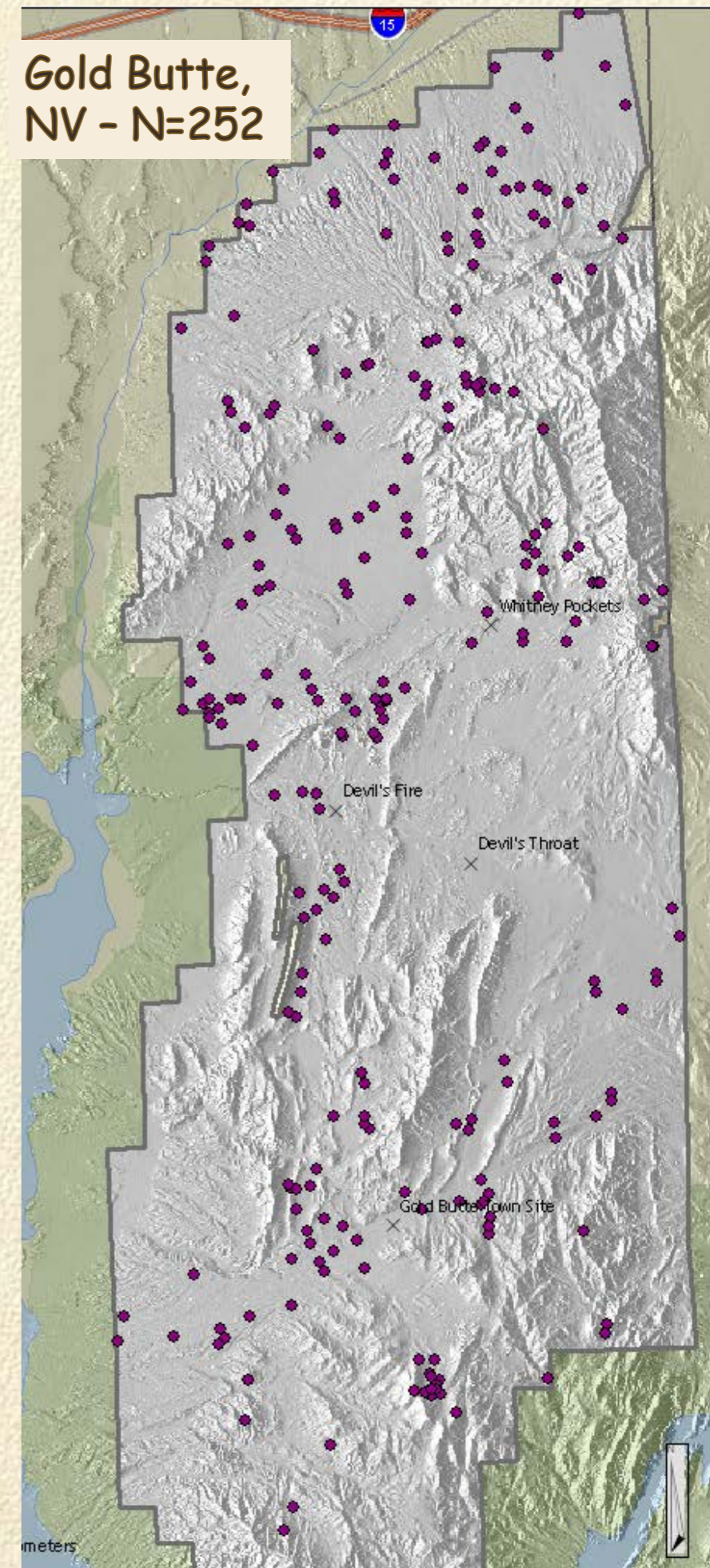
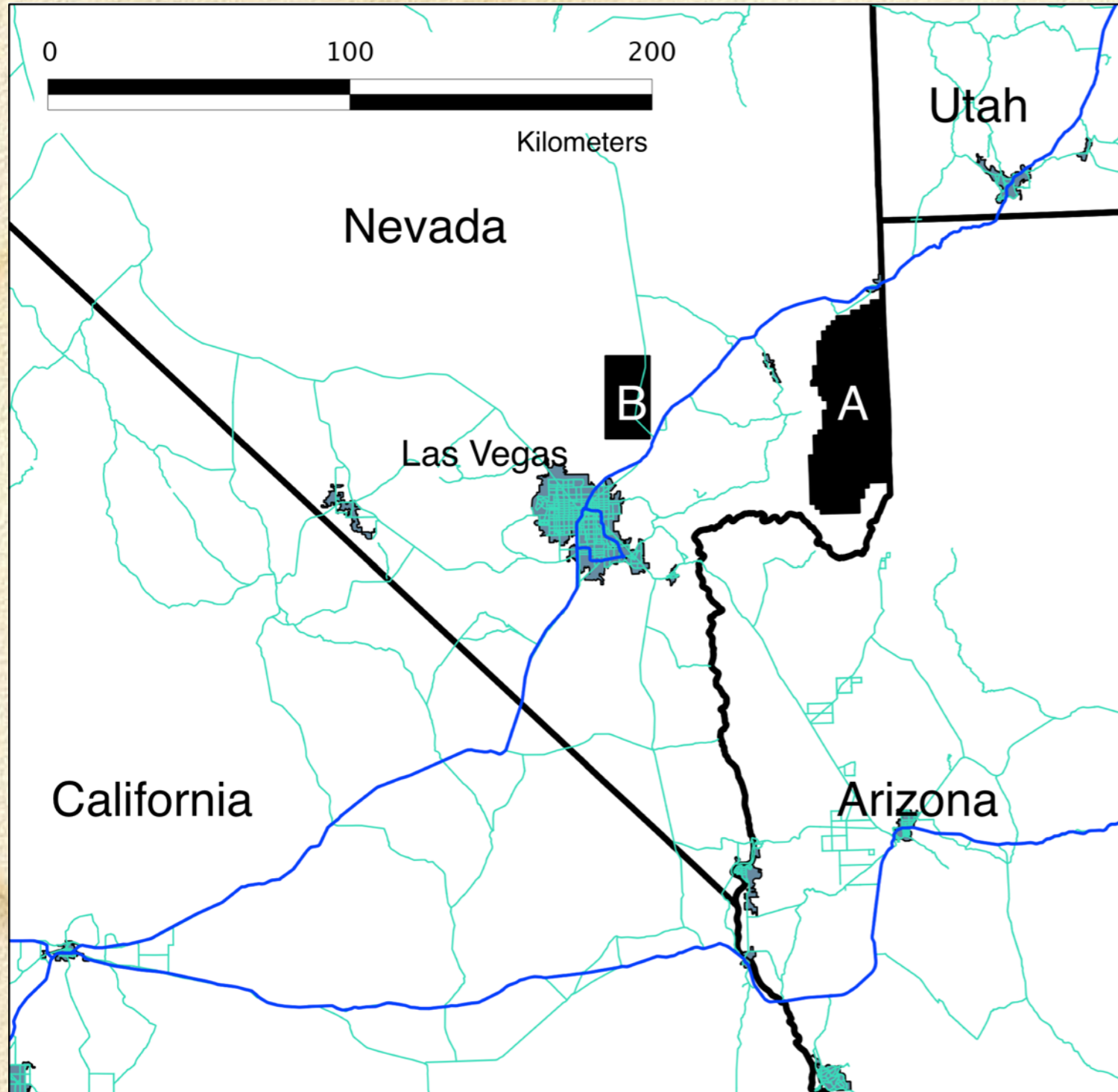
- 739,037 acres
- 403,000 acres
Desert Tortoise
habitat
- 32,000 acres
Critical Habitat



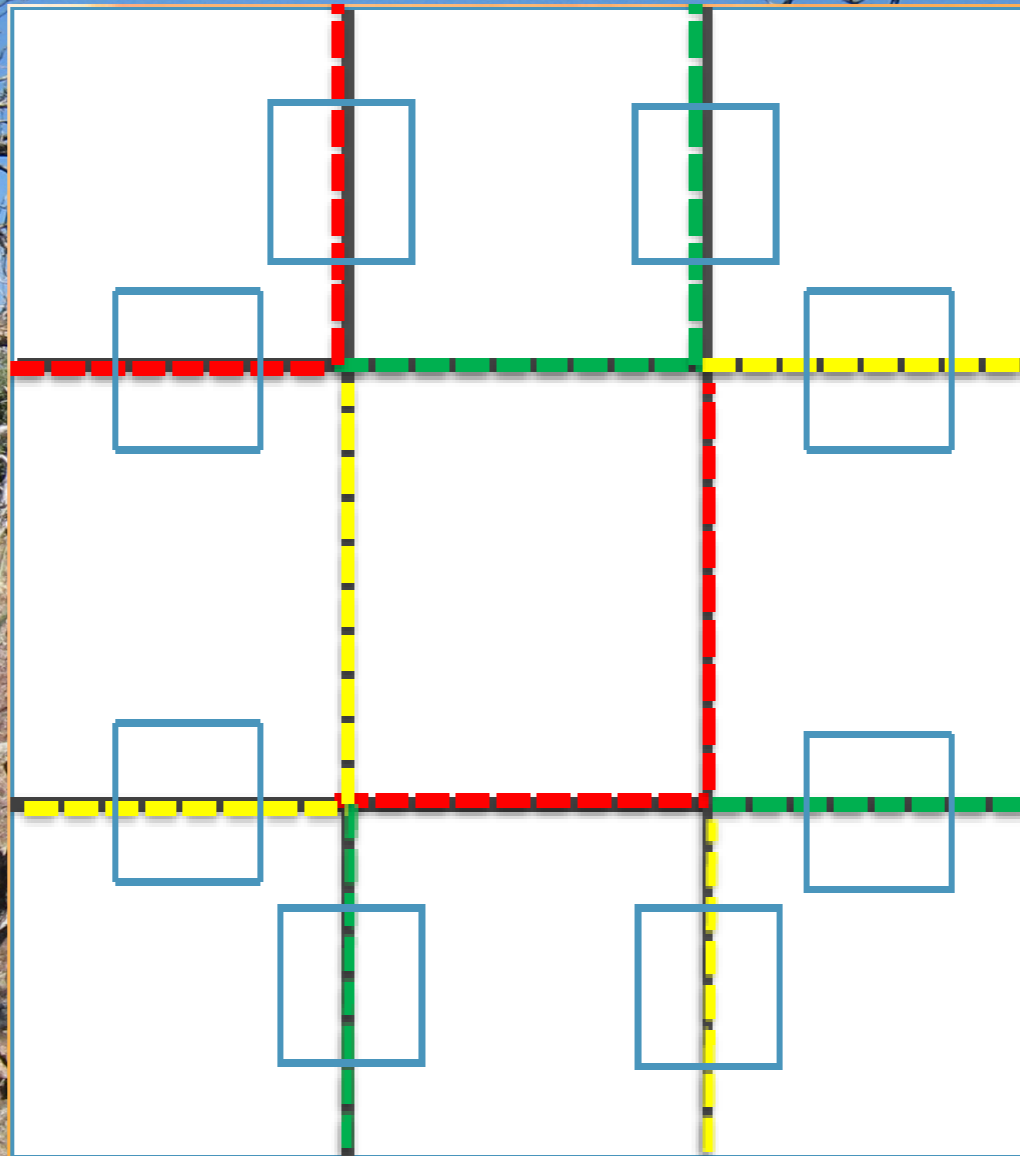
Quantifying Fire Risk



Study Area

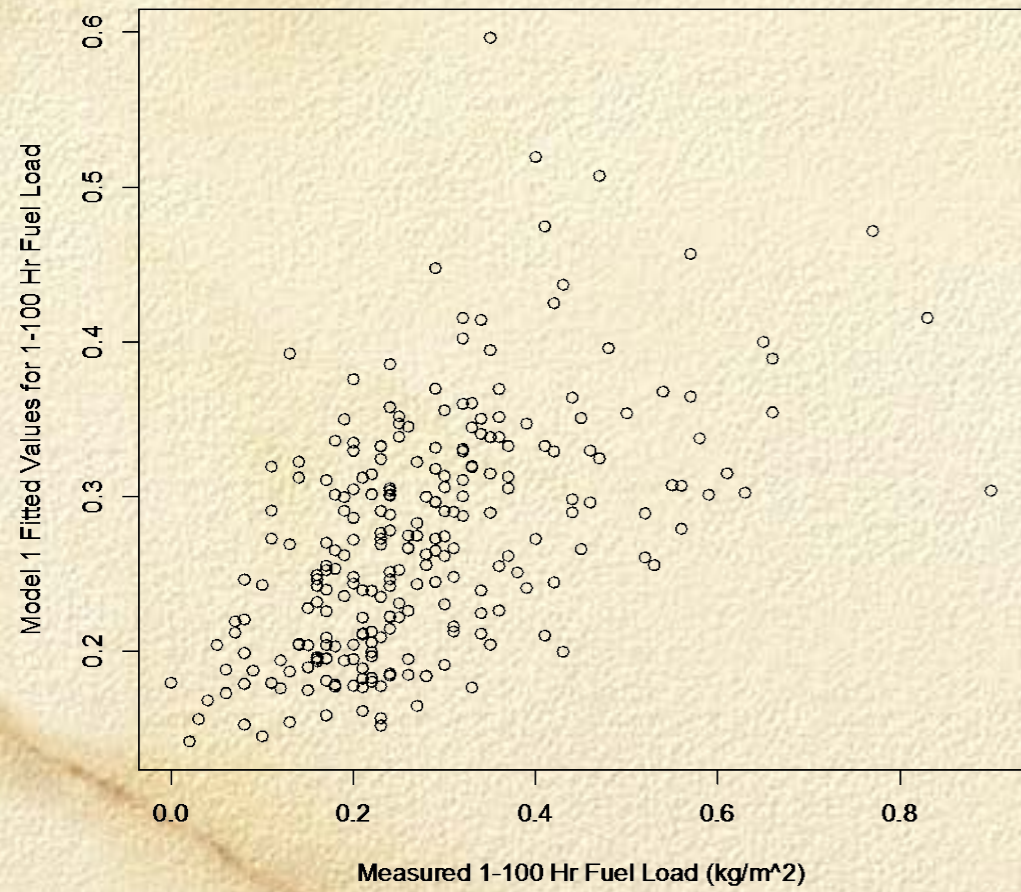


Measuring Fuel Loads

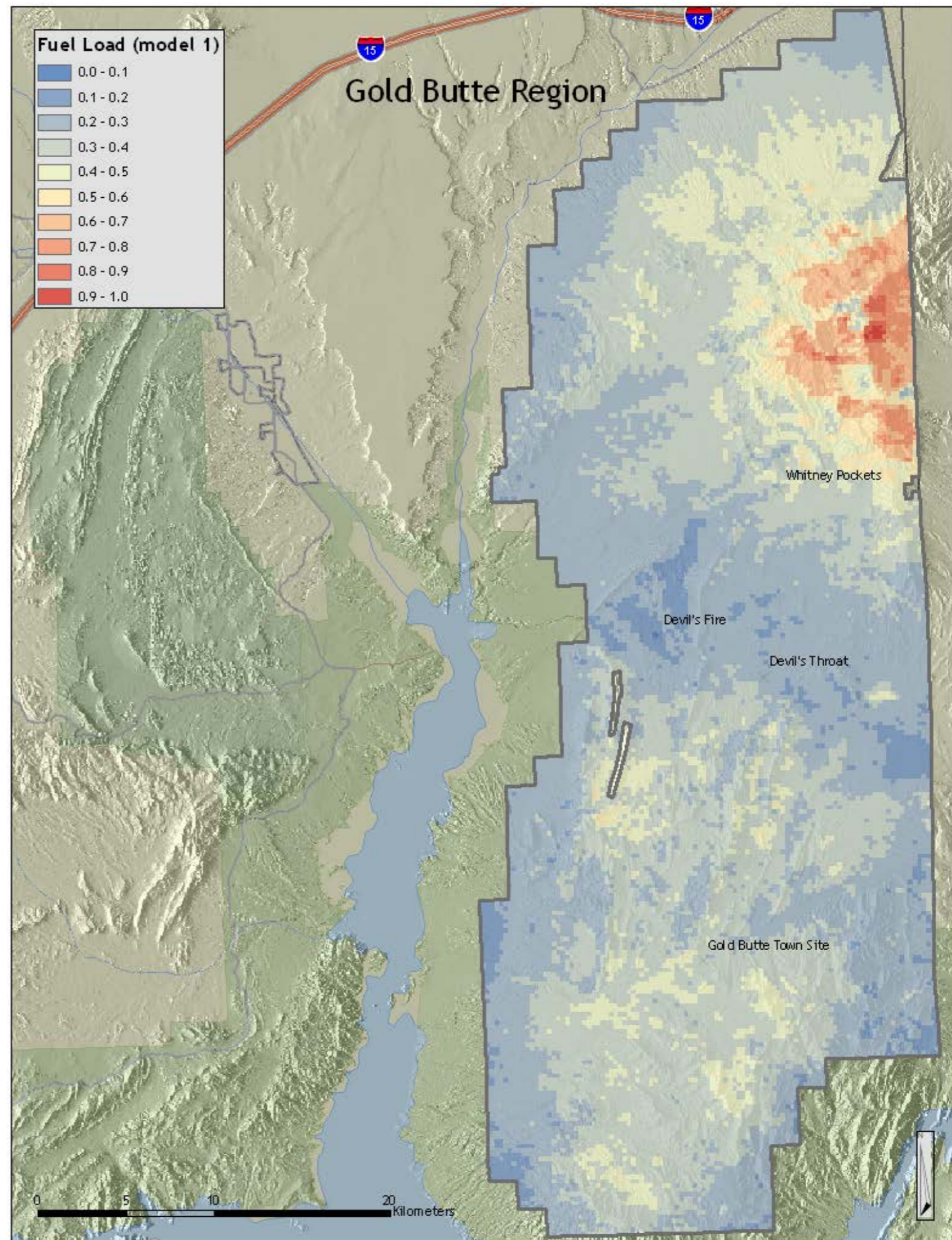


Measured 1, 10, 100, 1000 hr fuel loadings

Modeling Fuel Load – Remote Sensing



$R^2 = 0.3$



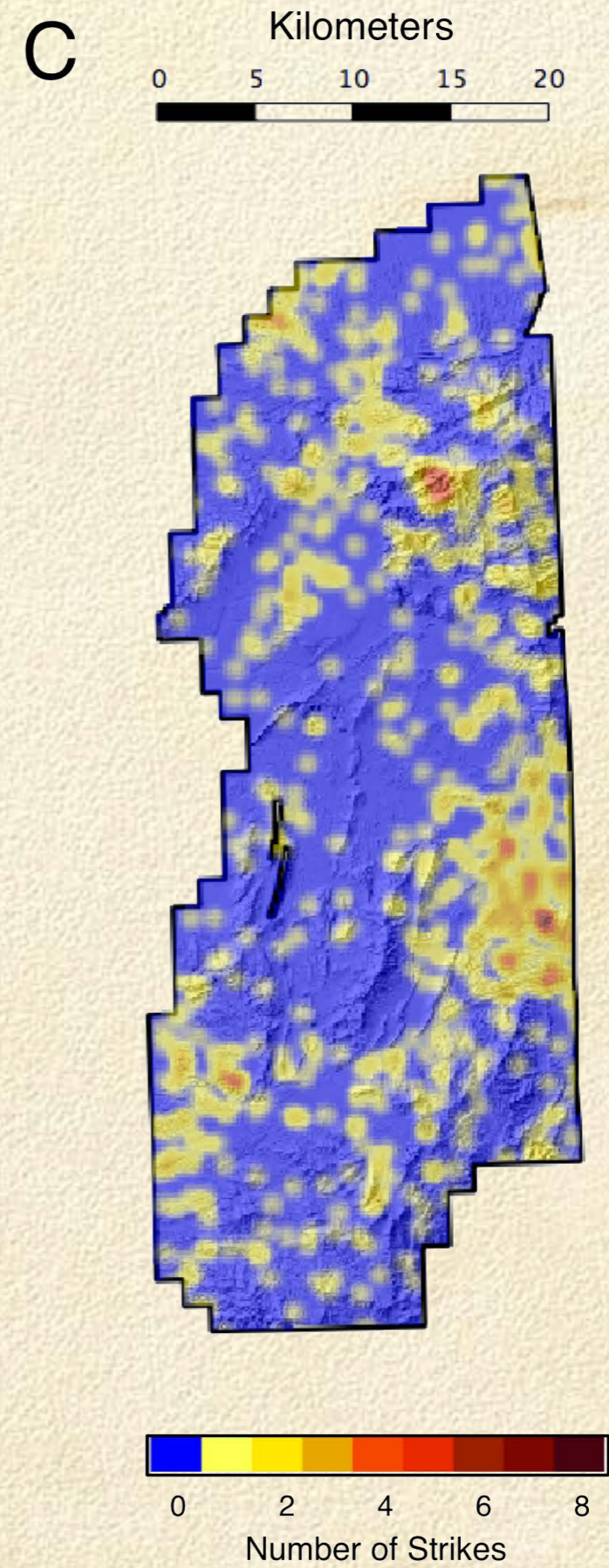
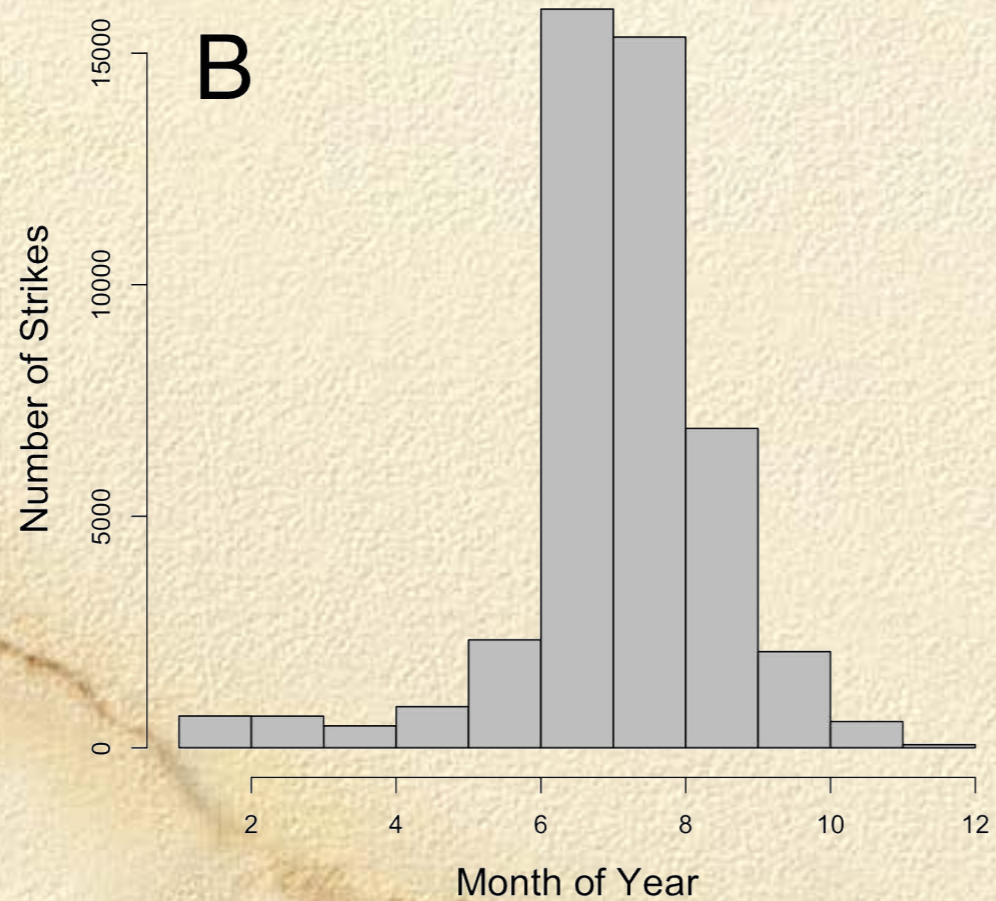
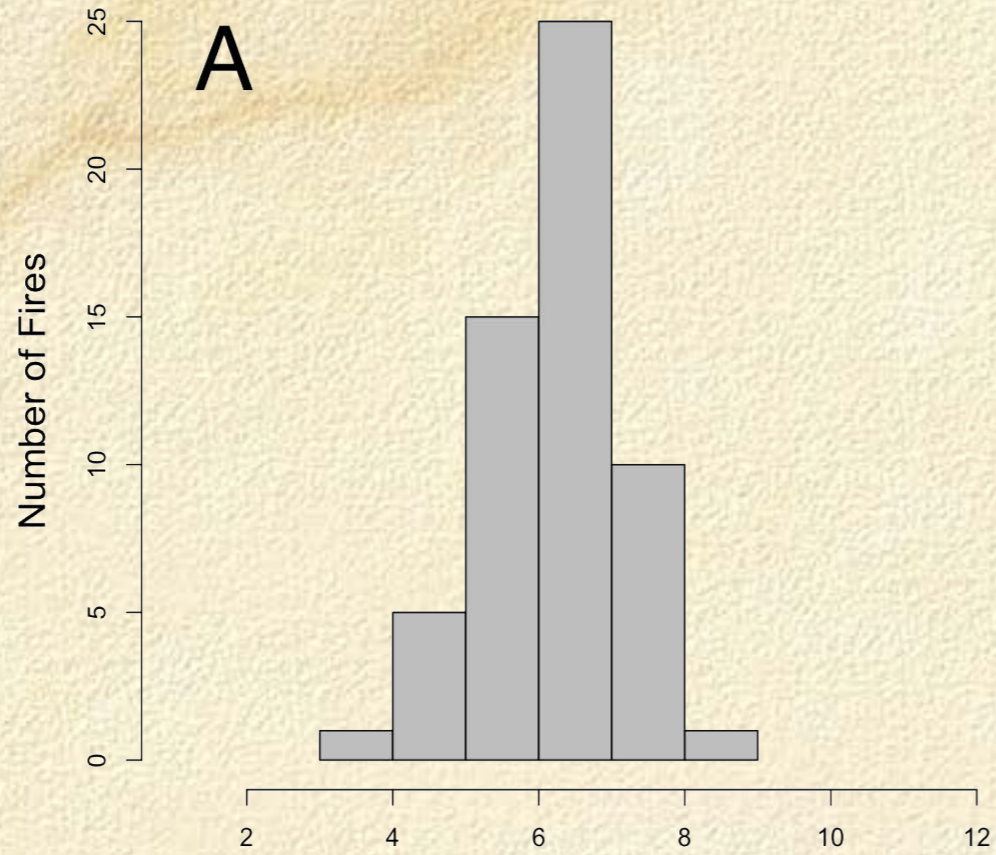
Diverse Vegetation



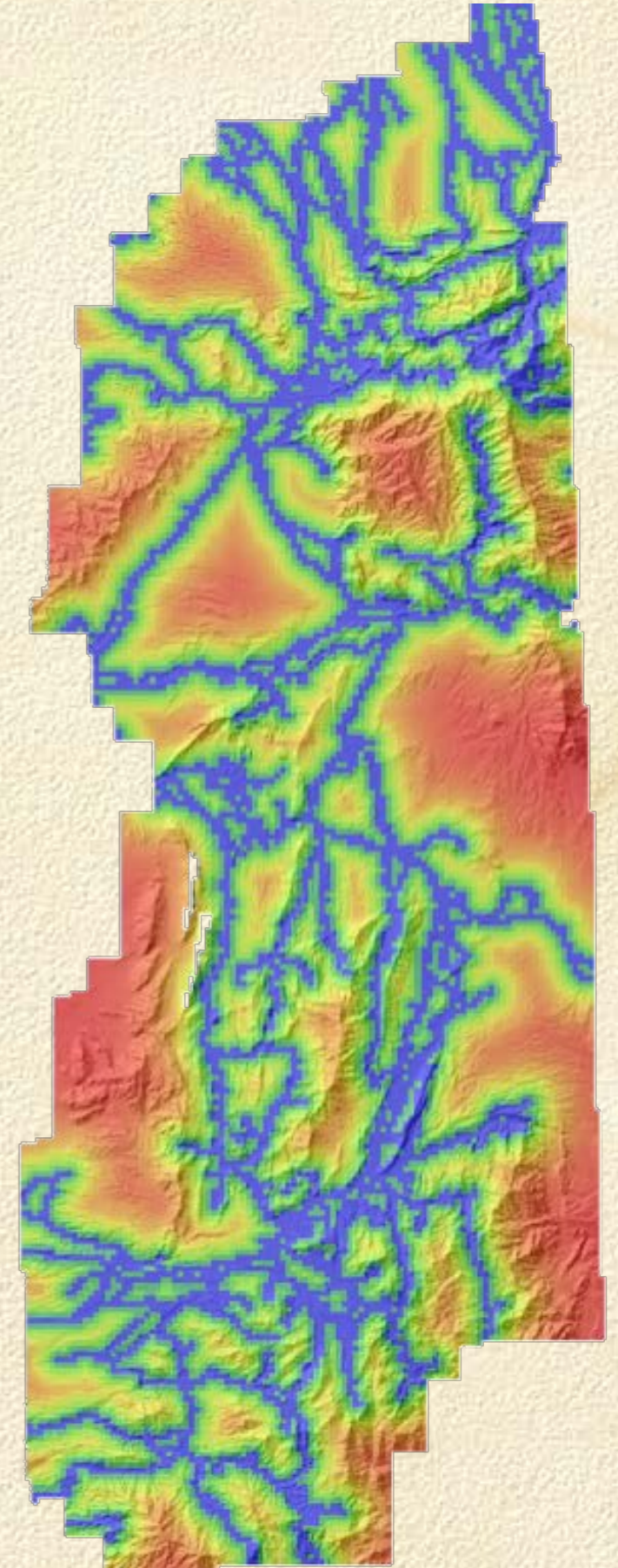
Diverse Vegetation



Ignition Risk - Lightning



Ignition Risk - Roads



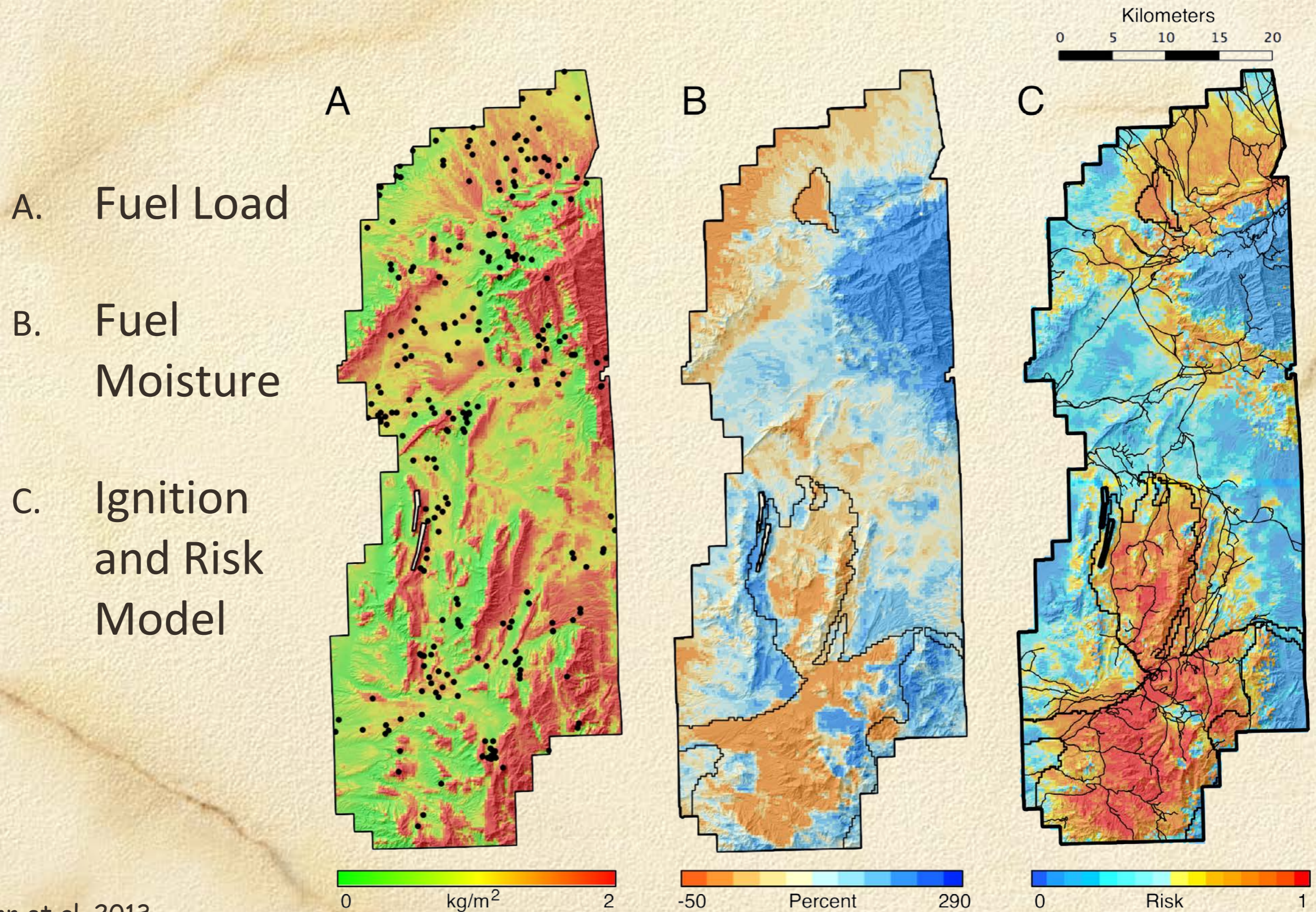
Fire Risk Model Selection

118 Models considered

Table Fire 2. Fire Risk Models – AIC rankings of models of 2005 Fire risk prediction. Average Δ AIC (smaller is better), and model weight is given for 100 model runs, of random data sets of 1000 sampled points. R = Distance to roads, L = Summer lightning density, SM = Fuel Moisture Content at Spring Maximum Temperature, Sm = Fuel Moisture Content at Spring Minimum Temperature, V = Vegetation Type, F = Estimated 1-100hr Fuel Loading, and * indicates term entered as an interaction.

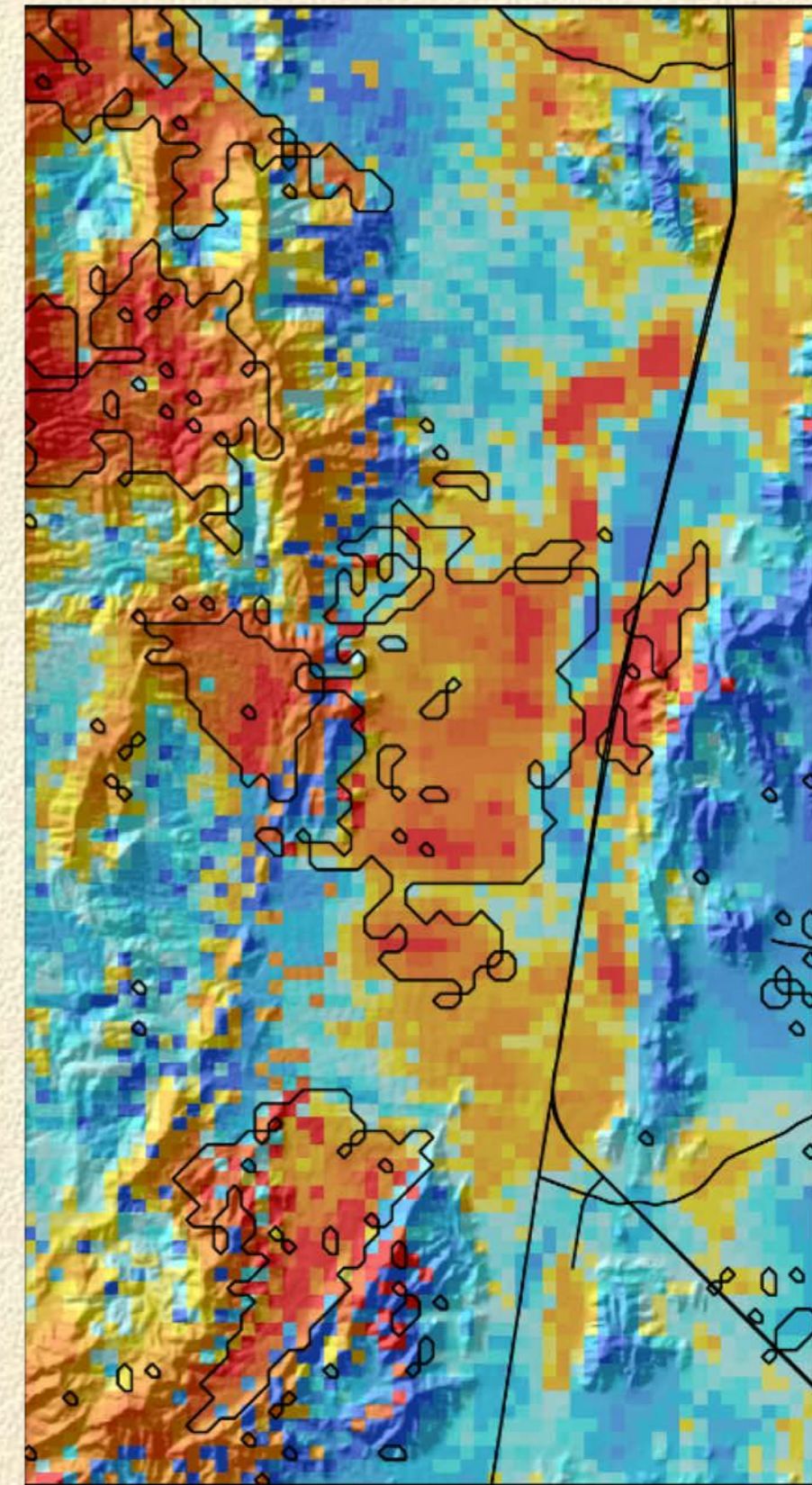
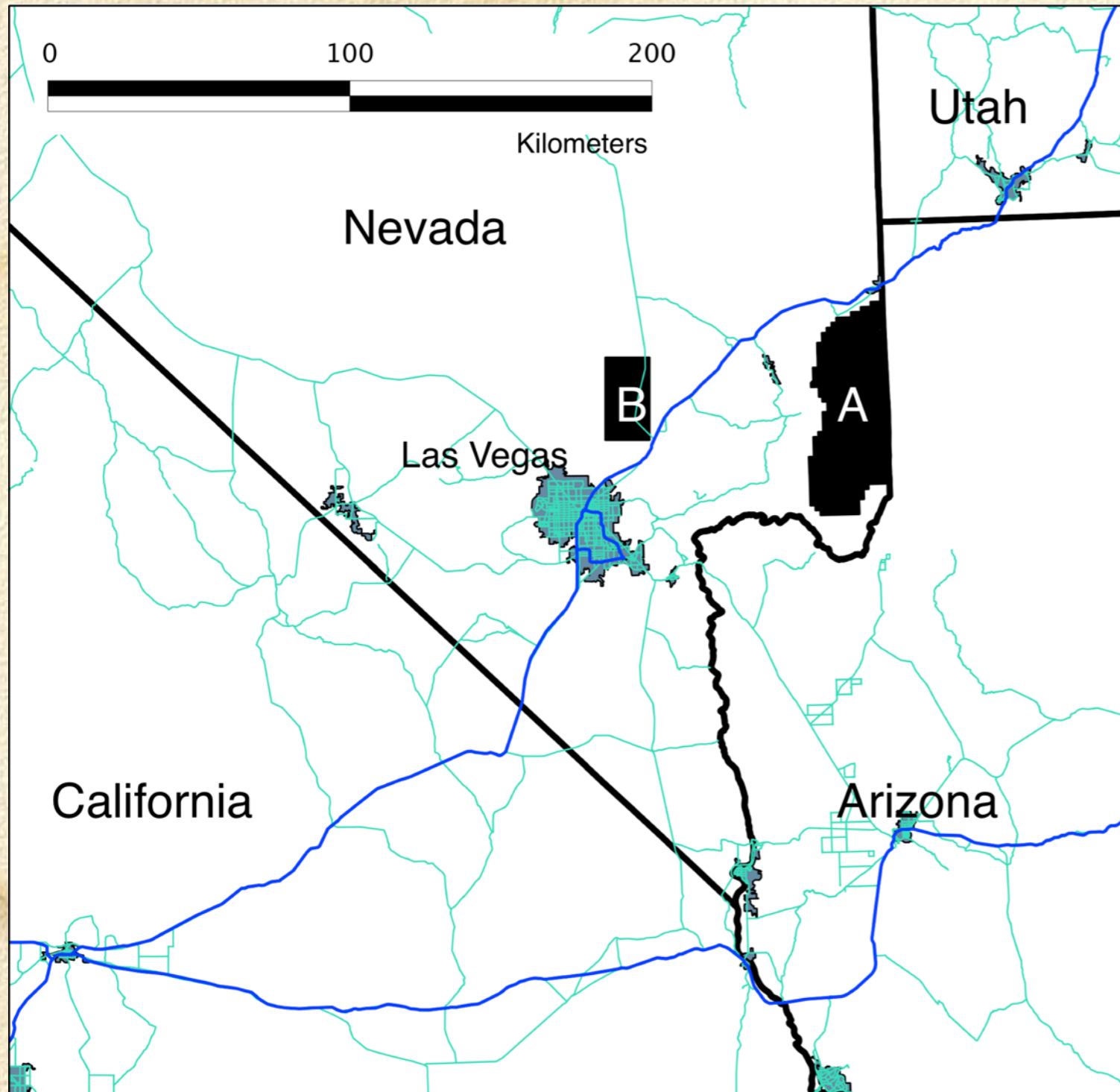
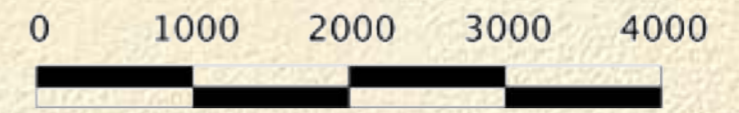
Model	Average Δ AIC	Average Weight
1. R,L,SM,F,V,F*V,SM*F,SM*V	1.33	0.698
2. R,L,SM,F,V,F*V,SM*F,SM*V,L*V	5.49	0.297
3. R,L,SM,F,V,F*V	24.46	0.004
4. R,SM,F,V,F*V,SM*F,SM*V	27.86	< 0.0001
5. L,SM,F,V,F*V,SM*F,SM*V	46.82	< 0.0001
6. R,L,SM,Sm,F,V	50.23	< 0.0001
7. R,L,SM,F,V	59.41	< 0.0001
8. R,L,Sm,F,V	60.08	< 0.0001
9. L,V	326.10	< 0.0001
10. V	353.00	< 0.0001
11. R	400.00	< 0.0001
12. L	429.00	< 0.0001
13. Sm	429.00	< 0.0001
14. SM	429.10	< 0.0001
15. F	458.60	< 0.0001

Risk Model - 2005



Repeatable?

Validate!



AUC for training and testing 0.83

Van Linn et al. 2013

Fire in the Mojave Desert: Understanding Desert Tortoise Use of Burned Habitat

**Kristina Drake, Todd Esque, Kenneth Nussear, Lesley DeFalco,
Andrew Modlin, Sarah Scoles-Sciulla, Philip Medica**

US Geological Survey

Western Ecological Research Center

Henderson, Nevada

The Desert Tortoise...



- Mojave Desert Population
 - Threatened 1990
- Designated Critical Habitat
 - Physical & Biological Needs
- Survival Challenged by
 - Predators
 - Disease
 - Habitat Loss...
 - Wildfire driven by exotic grasses



Impacts From Wildfires in Southern Nevada

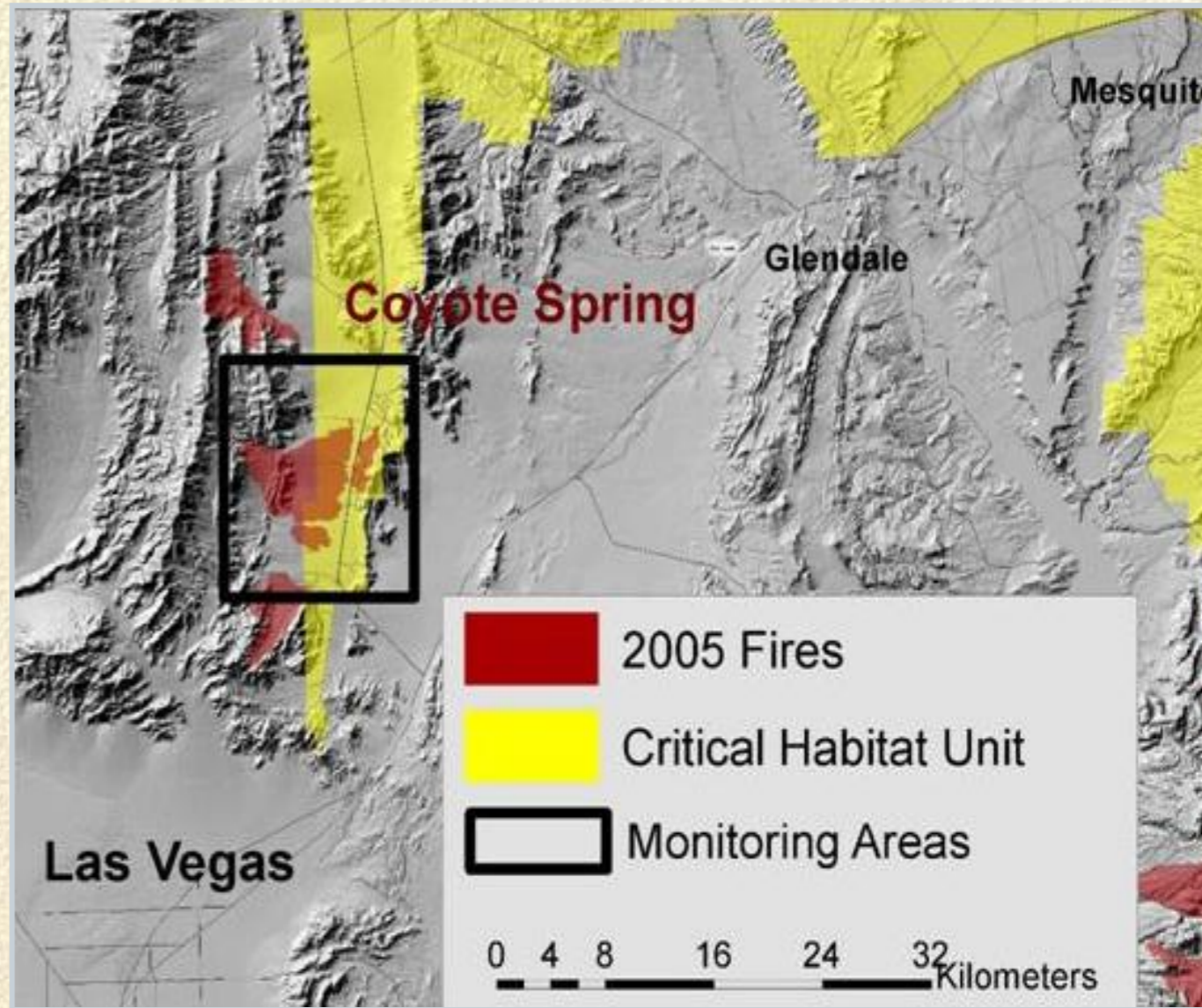


- Loss of perennial plants
- Shifts in vegetation (Native -> Invasive Grasses)
- Death and Emigration of tortoises
- Potential for slower growth and decreased fecundity

Study

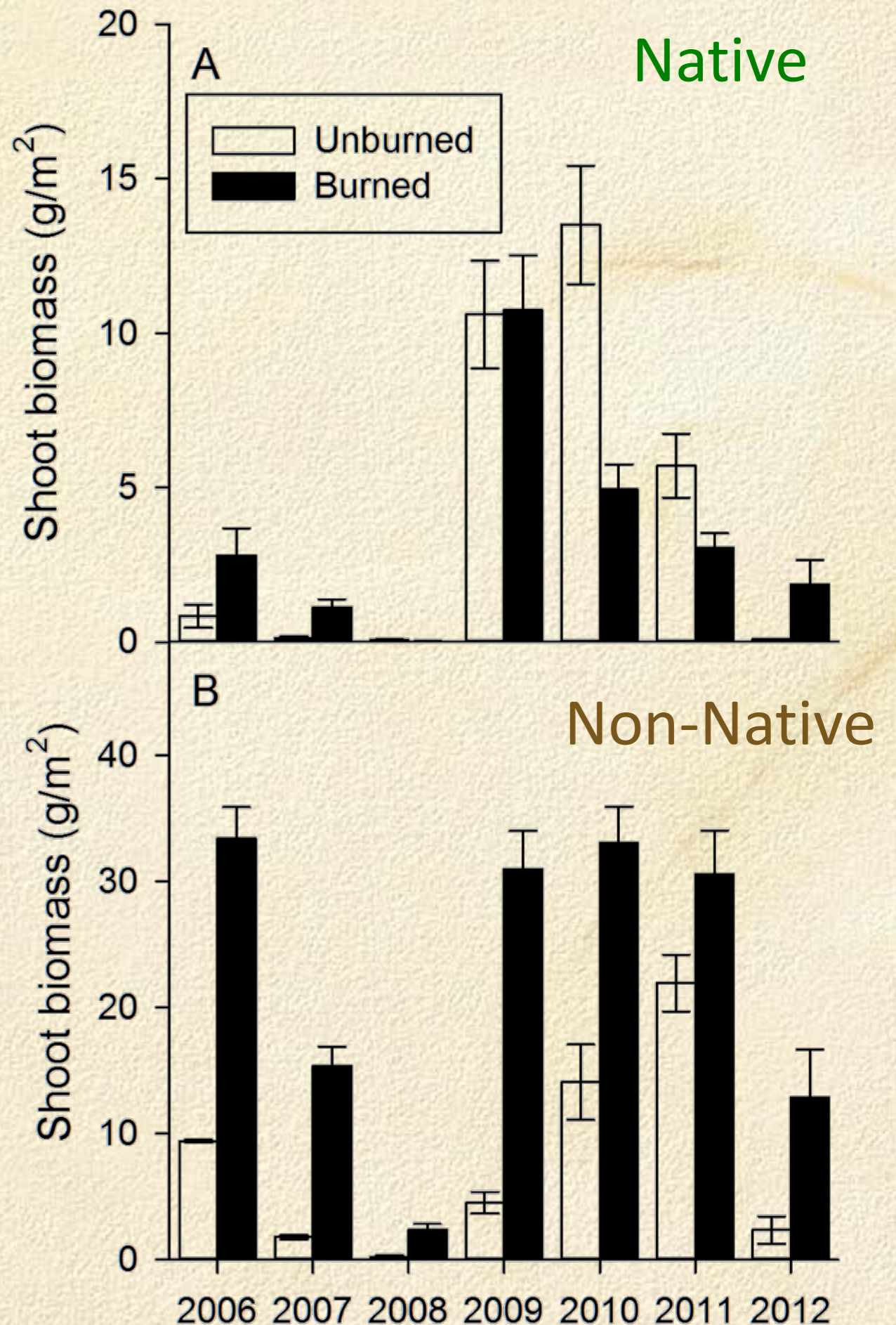
Tortoises responses to wildfire

- **Habitat Characteristics**
 - Vegetation
 - Tortoise Density
- **Possible Differences in**
 - Spatial Habitat Use
 - Movement Patterns
 - Behavior
 - Shelter Selection
- **Study Animals (2006-Present)**
 - 25 Tortoises



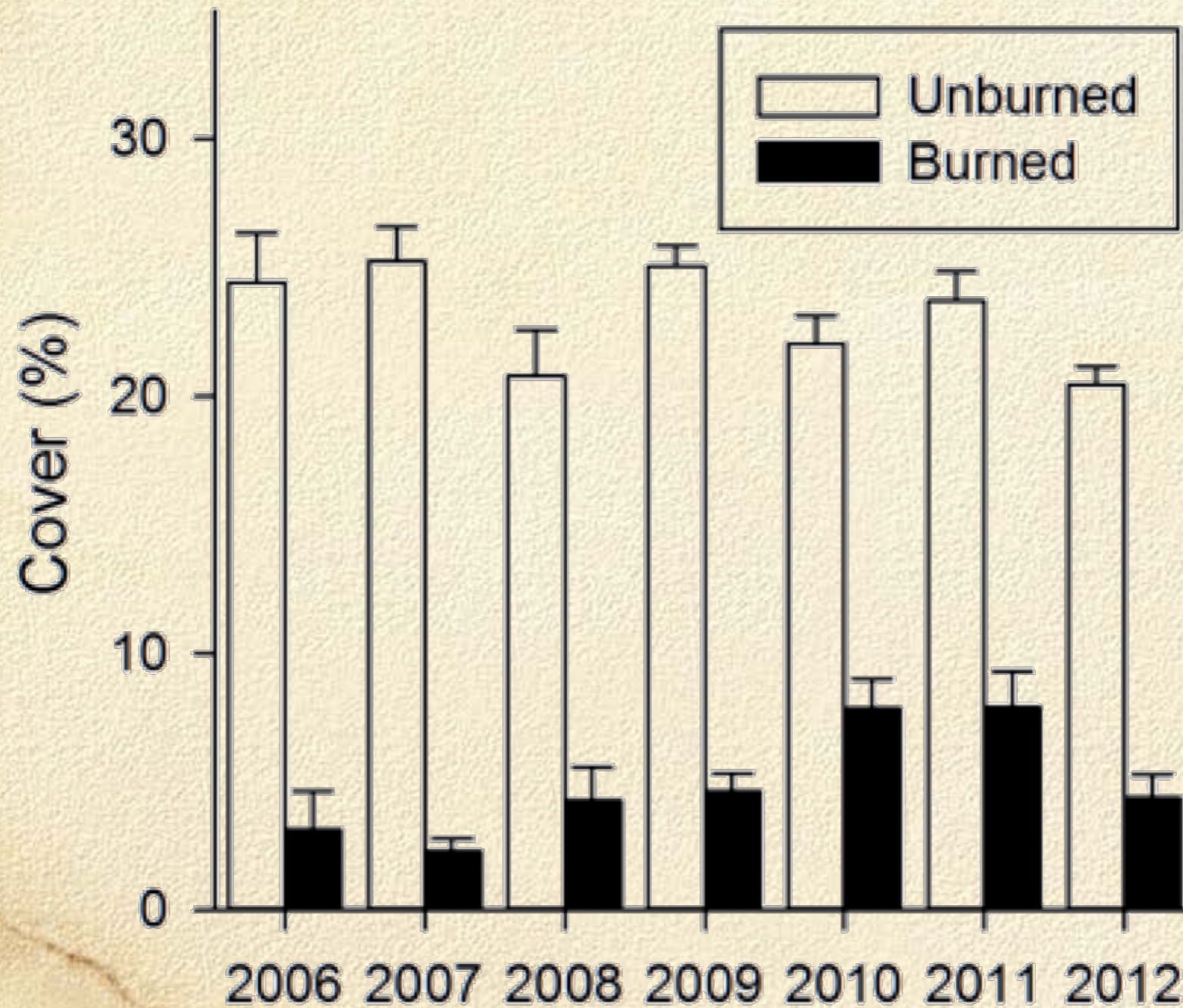
Annual Plant Biomass

- Native species higher in Unburned habitat in years of higher rainfall
- Sustained increases in invasive species biomass immediately following the fire



Perennial Vegetation Cover

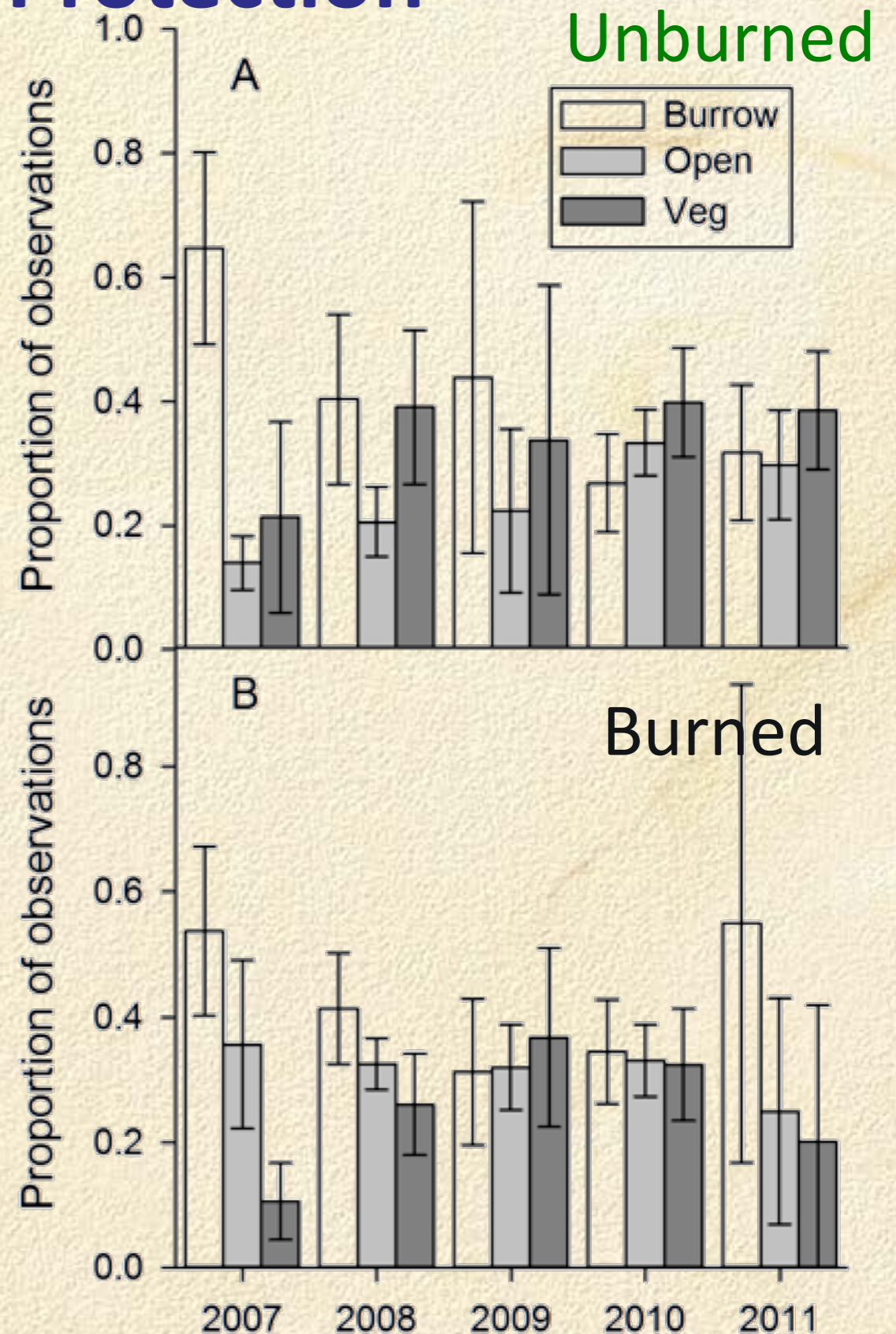
Shelter/Thermal Protection



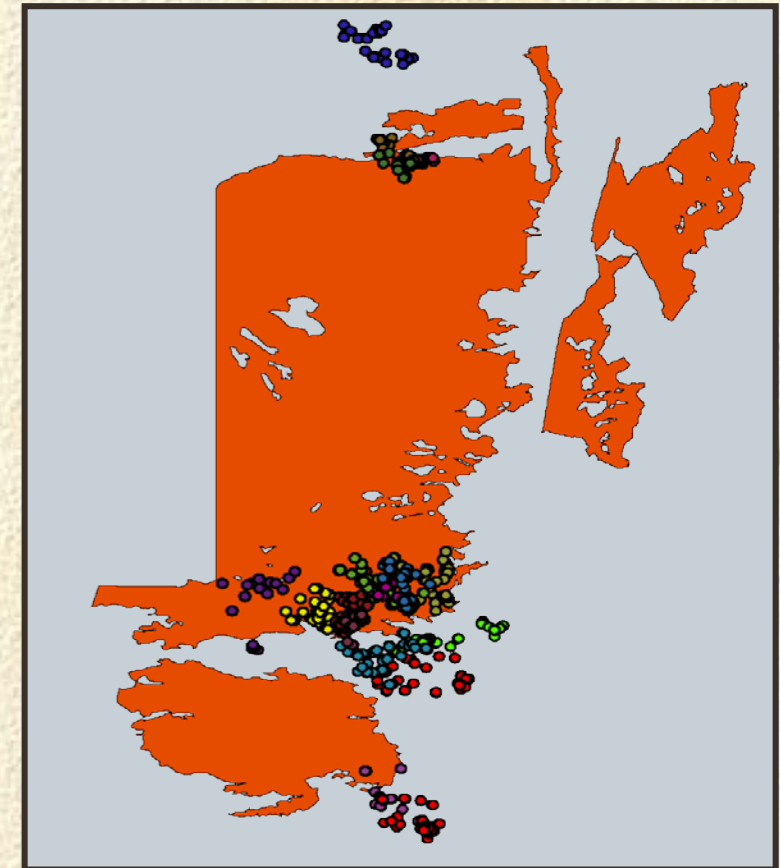
Perennial Vegetation Cover

Shelter/Thermal Protection

- Lower use of Vegetation in Burned habitat as expected
- Recent dissertation found no differences in temperature (Snyder 2014)

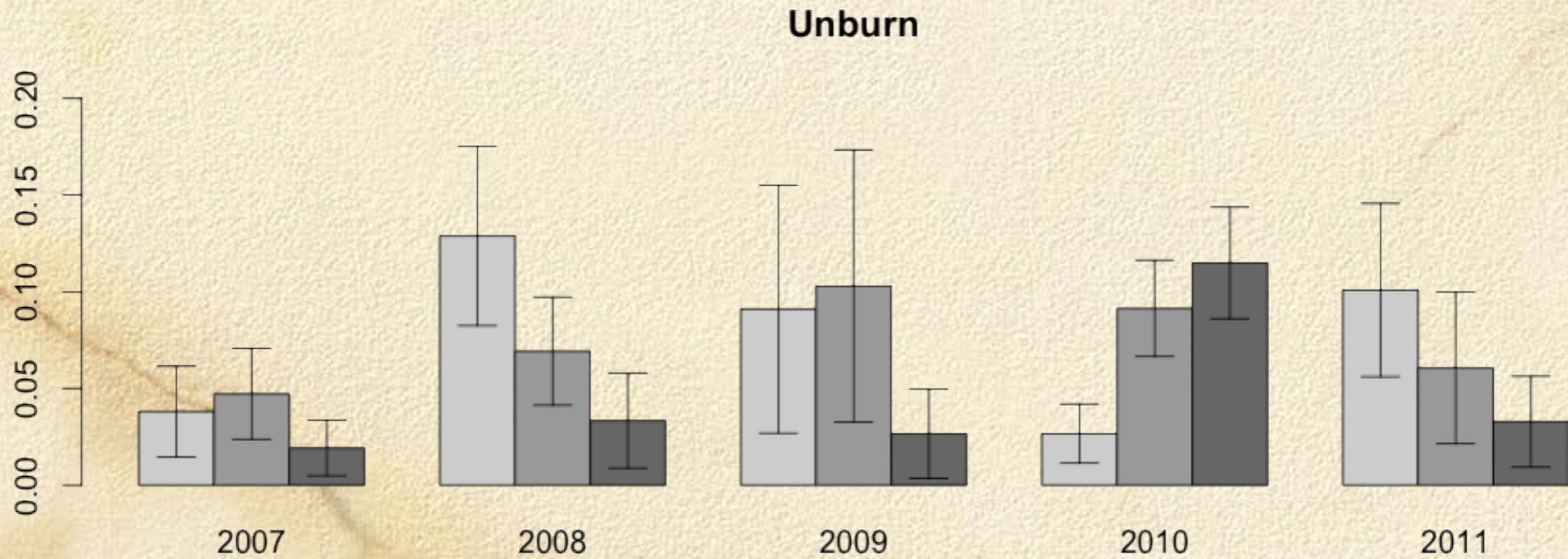
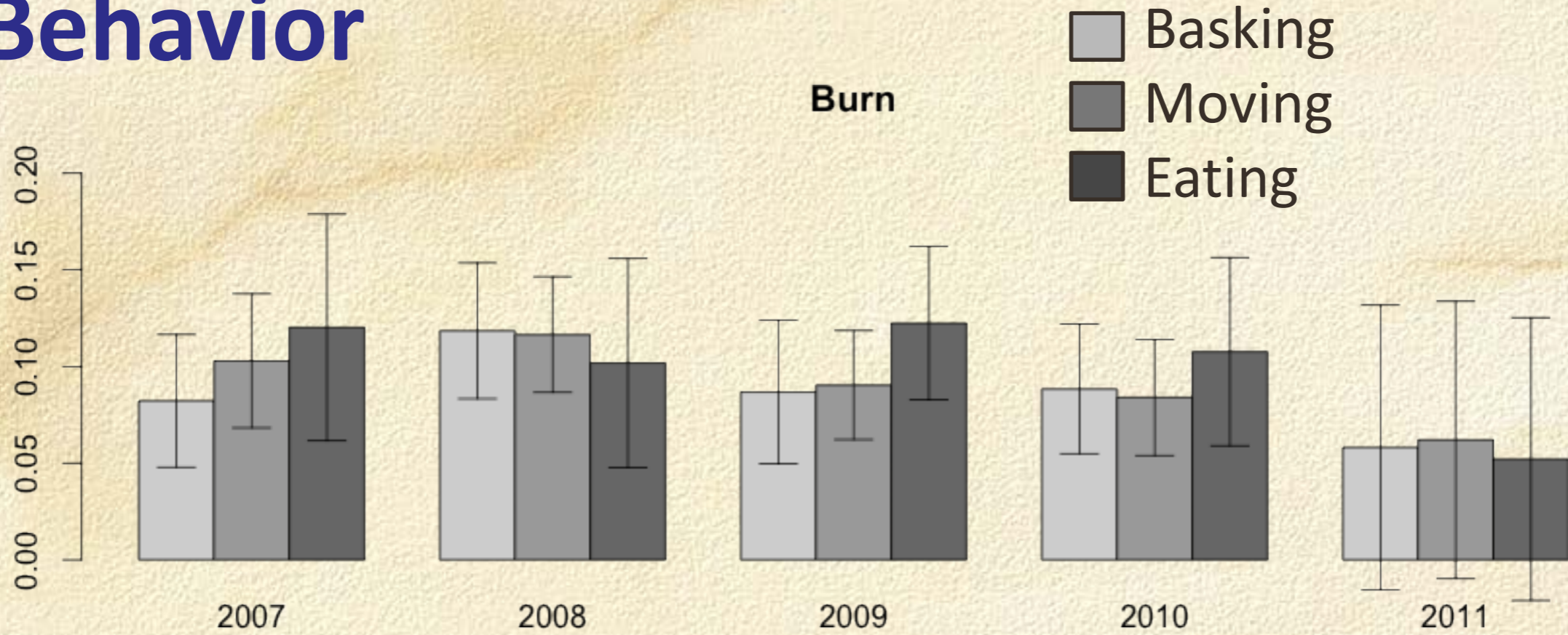


Habitat Use



	<u>Obs.</u>	<u>Burn</u>	<u>Unburn</u>
2006	122	20%	80%
2007	2,647	43%	57%
2008	3,888	57%	43%
2009	1,669	60%	40%
2010	3,081	39%	61%
Total	11,407	49%	51%

Behavior







Summary: What We Learned Post-Fire ...

1. Substantial vegetation changes occurred

Shifts in vegetation (Native Shrubs -> Alien Grasses)

Potentially altering shelter sites and dietary composition

2. At least 5 years post-fire, tortoises are still using burned critical habitat.

- Out of ~11,000 observations, ~52% were in burned habitat

- Post-fire estimations indicate that ~45% of tortoise home-ranges had been burned during the 2005 fire.

3. Tortoises moved further into the burn each year until temporary shade resources were reduced (Loss of *Sphaeralcea*)

4. Tortoise behavioral and microhabitat selection differences were noted between habitat types.



Acknowledgments

Funding Contributors:

- Bureau of Land Management
- Alicia Styles-Nevada Bureau of Land Management, Las Vegas and Ely District
- US Fish and Wildlife Service, Desert Tortoise Recovery Office
- Nevada Department of Wildlife
- Tortoise Crews
- USGS vegetation crews
- SCA Resource Interns
- BLM Emergency Stabilization and Rehabilitation Program
- Coyote Springs Investment Properties
- USGS Western Ecological Research Center
- USGS Priority Ecosystem Science Program



