Analyses of Climate Change Sensitivity for the Reptiles of Joshua Tree National Park

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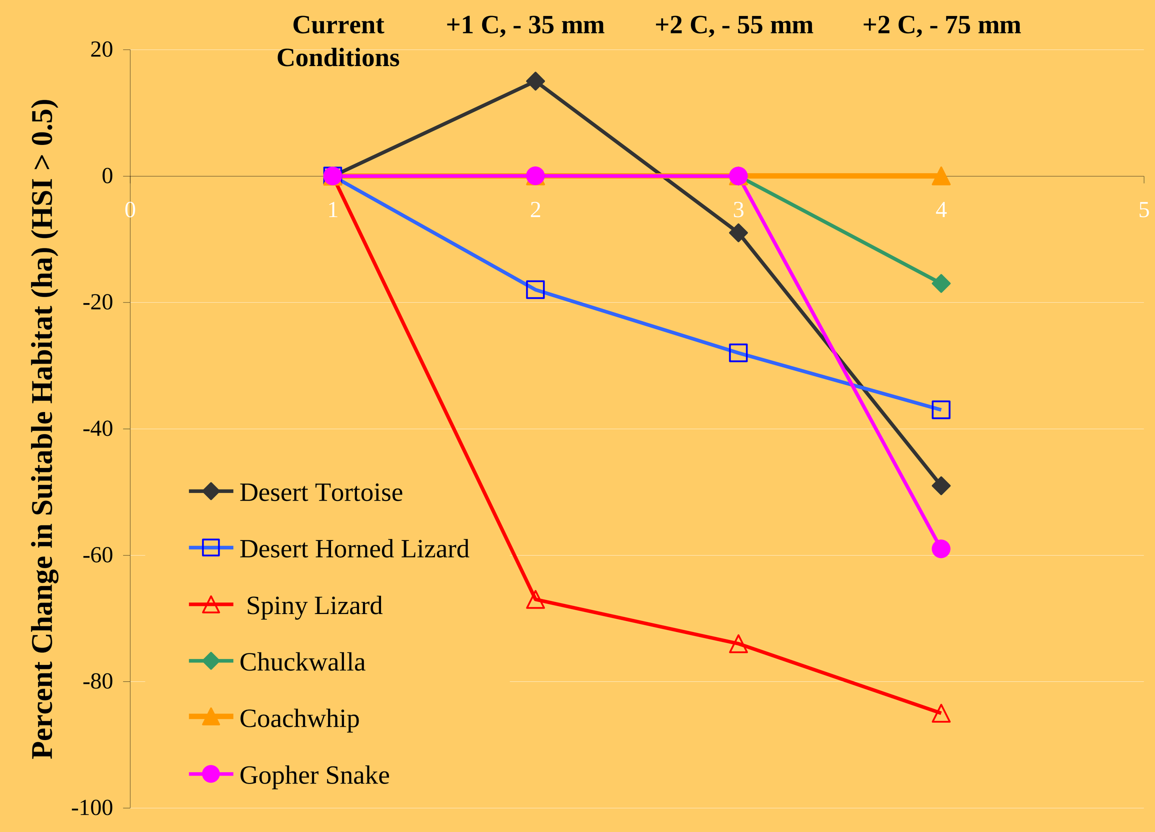
Objectives: To **1**) identify patterns of sensitivity to climate change in desert reptiles; **2**) identify climate change refugia for sensitive species; and **3**) identify critical areas of connectivity between the Park and the surrounding landscape.

Methods: Using the Mahalanobis distance statistic (D^2) (; Rotenberry et al. 2002, 2006) I modeled the distribution of suitable habitat for each of the selected reptile species. The Mahalanobis statistic yields for any location an index of its habitat similarity (HSI) to the multivariate mean of the habitat characteristics at the target species' locations). This statistic has several advantages over other geographic information system (GIS) modeling approaches, the foremost being that only species-presence data are required for the dependent variable. Because only positive occurrence data are required, historic location records from museums and field notes can be used, regardless of survey methodology. This also avoids the uncertain assumption of correct identification of unoccupied habitats (Knick and Rotenberry 1998; Rotenberry et al. 2002).

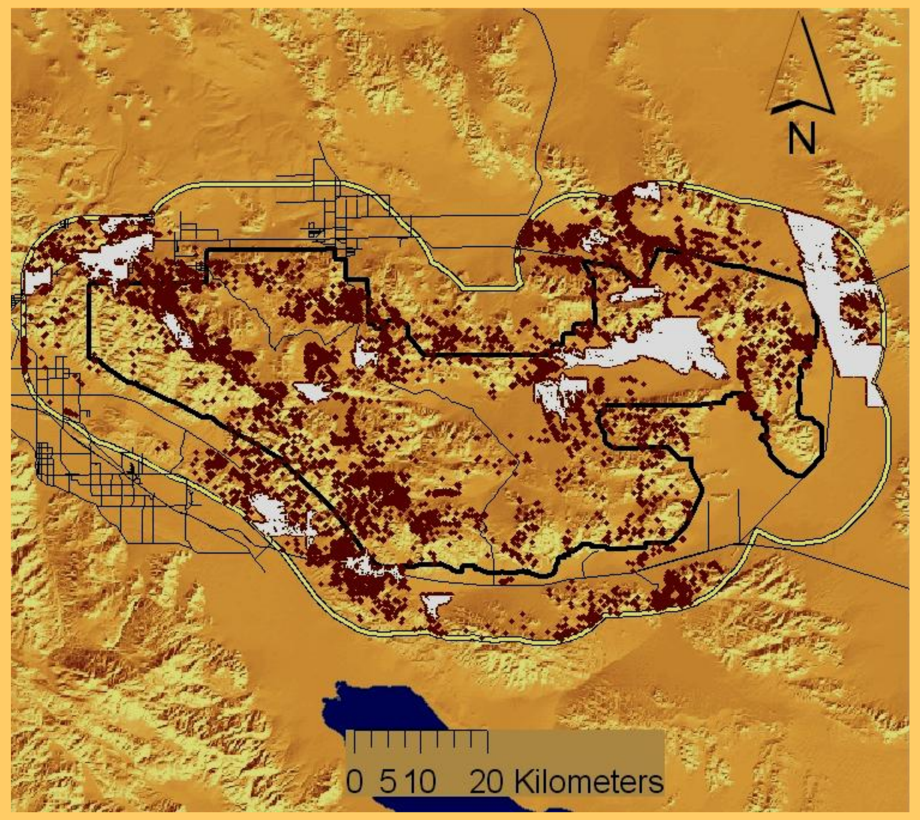
Independent Variable	Desert Tortoise	Desert Horned Lizard	Desert Spiny Lizard	Chuckwalla	Coachwhip	Gopher Snake
Rugged 3XD	X		X	X	X	X
Rugged 20X	X	X	X	X	X	X
Slope	X	X	X	X		
North Slope Aspect	X					X
East Slope Aspect	X					
Minimum Jan Temperature	X				X	
Maximum July Temperature	X	X	X	X	X	X
Mean Precipitation	X	X	X	X	X	X

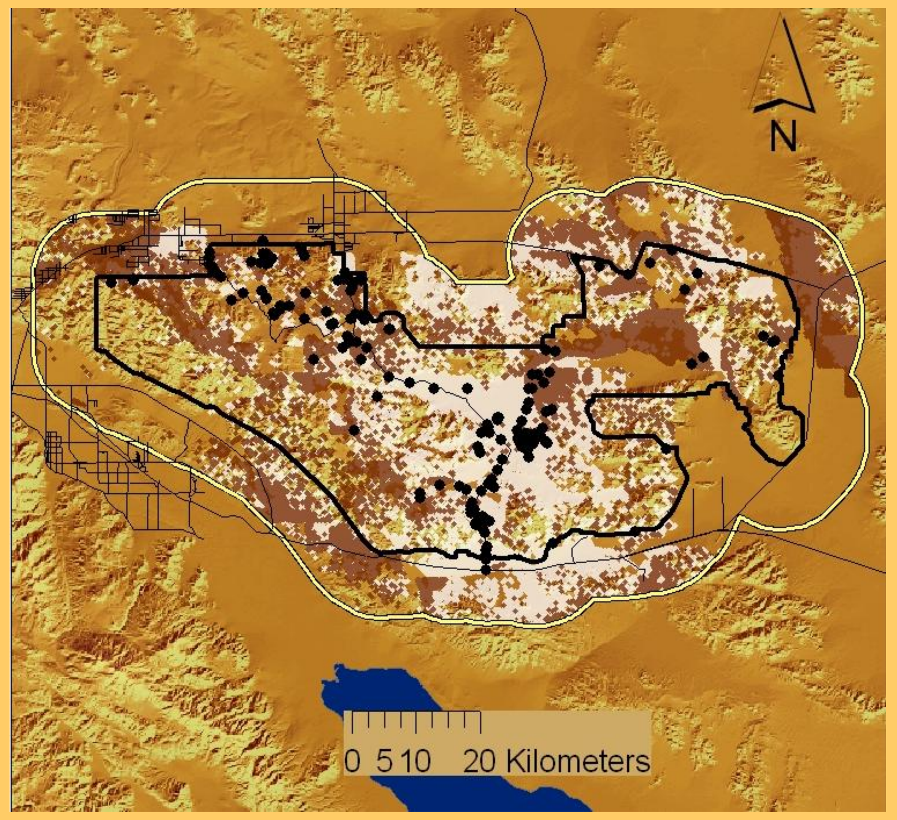
Independent variable combinations used to construct the niche models



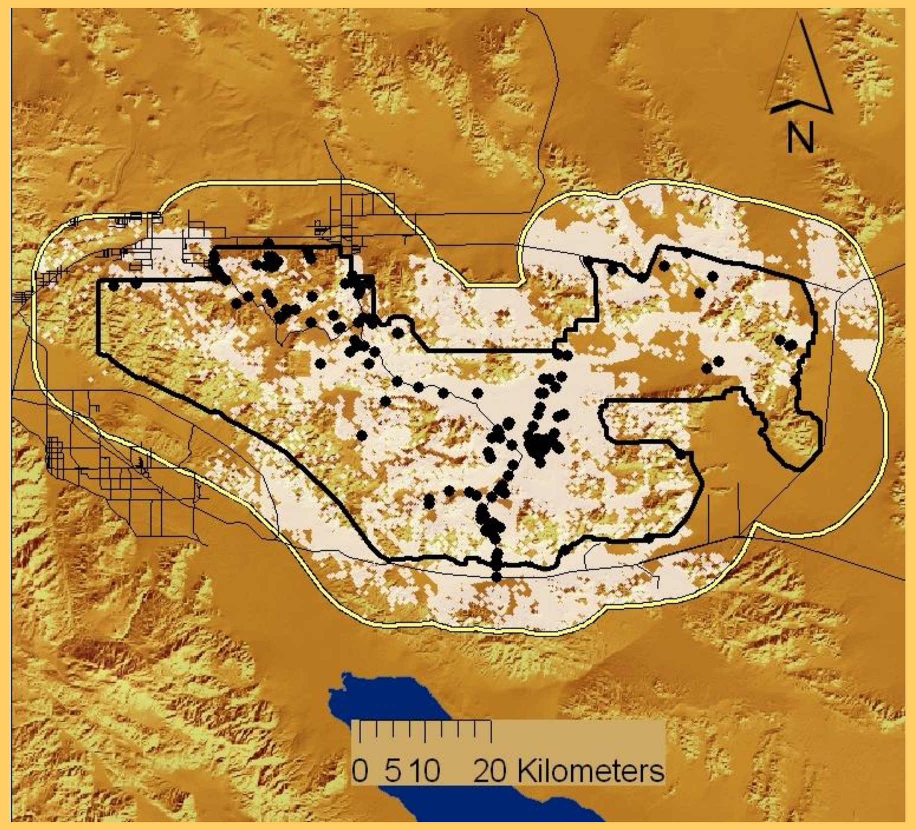
Using the niche model based on current habitat preferences, I then iteratively shifted temperature and precipitation conditions on the underlying map to simulate progressive levels of climate change – and measured the change in area of suitable habitat available to each species.

Modeled suitable habitat with a +2° C , - 75 mm in precipitation highlighting contiguous habitat patches > 500 ha indicating likely refugia from climate change (white polygons)

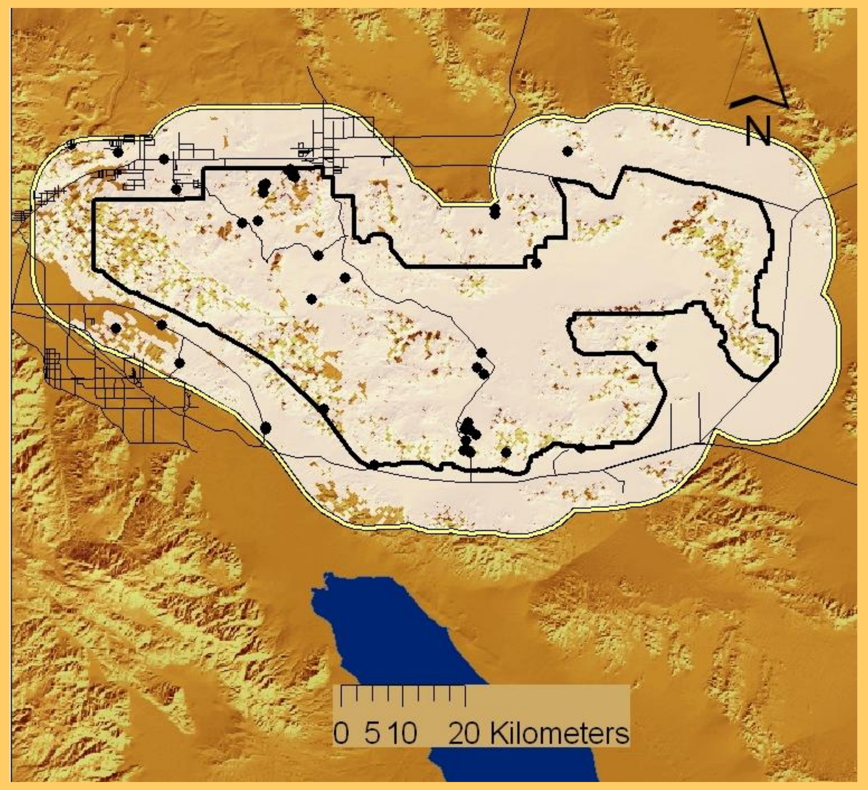




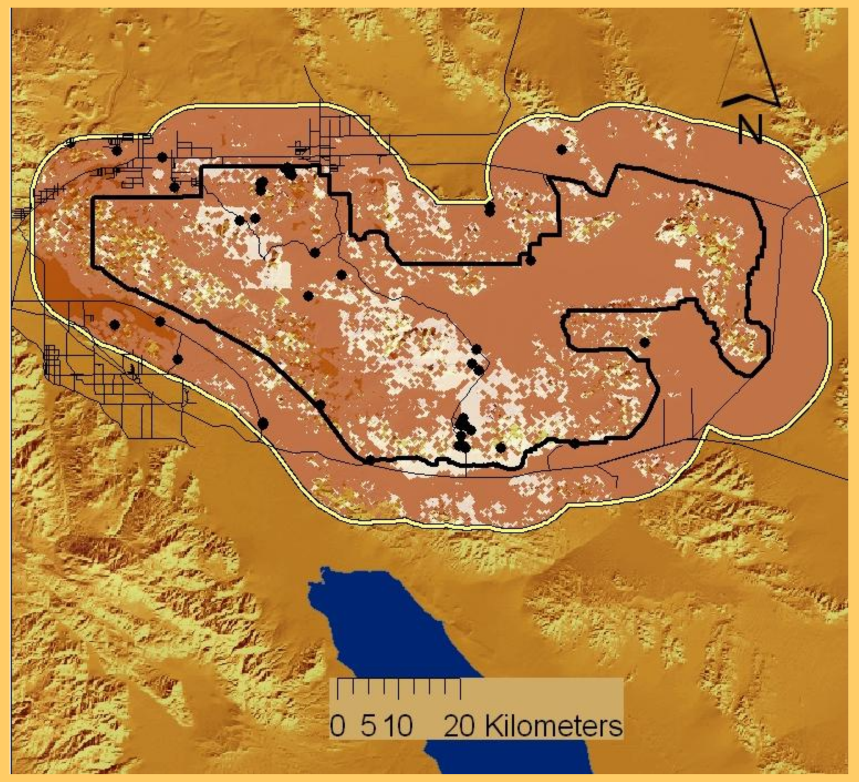
Modeled suitable habitat with a shift of +2° C , - 75 mm in precipitation (brown)



Modeled Suitable Habitat Current Conditions (white)



Modeled Suitable Habitat **Current** Conditions (white)



Modeled suitable habitat with a shift of +2° C , - 75 mm in precipitation (brown)

Conclusions

The topography of Joshua Tree National Park is sufficiently diverse to provide refugia from expected climate change for all of the species modeled. However two species that were not modeled due to insufficient location data, the western fence lizard and Blainville's (coast) horned lizard, will likely be extirpated from the Park. This modeling was able to identify likely refugia where the Park managers can focus efforts to sustain populations, as well as identify critical points of connectivity between the Park and surrounding areas where species will find suitable habitat/ climate envelopes.

Literature Cited
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