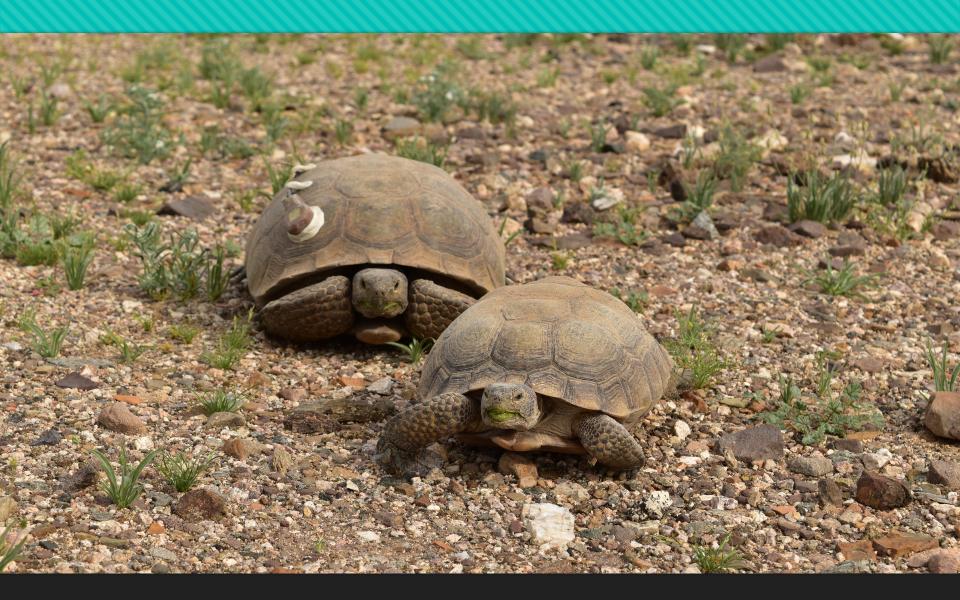
How long can Desert Tortoises, *Gopherus agassizii*, hide in their burrows from climate change?





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# HOURS OF ACTIVITY VS HOURS OF RESTRICTION

- Ectotherm survival depends on a *delicate* balance between hours available for activity and hours of restriction
  - Hours of restriction surface temperatures above operative temperatures
    - Critical Thermal Maximums (CTM) = 41.3 °C
- Reduction in hours of activity may leave tortoises unable to meet all of their crucial biological needs
  - Past a tipping point for survival.

### CLIMATE CHANGE

- Southwestern United States disproportionally subjected to trends in rising temperatures and increased aridity
- Global Circulation Models (GCM)
  - Projected temperature increase of 3.5–4°C within the next 60–90 years
- Predicted to affect distribution . and survival of desert tortoise

IMPACTS OF CLIMATE CHANGE ON DESERT TORTOISE

- Thermal constraints on activity and microhabitat utilization
  - Spend up to >98% of their annual activity cycle <u>below ground</u> due to harsh desert conditions and <2% of time <u>active at the surface</u>.
- Environmental Sex Determination
  - Limit production of male hatchlings

## **POSSIBLE RESPONSES?**

#### \*None

#### \*Extirpation/extinction

#### \*Evolution

-wider threshold temperature for sex determination

#### \*Adaptation

- shift elevation range upward
- shift geographic range
- shift nesting season
- change nest depth/location



## IMPORTANCE

- Desert species already struggling to survive in the harsh desert conditions where climate change is predicted to have its most severe impact
- Respond quickly enough to a rapidly warming climate?
  - evolution would have to occur at a rate that is >10,000 faster
- Habitat fragmentation limits ability to track climatic niches.

### DATA COLLECTION

- Study site located in the the southernmost boundary of Joshua Tree National Park in the Sonoran Desert of California.
- Data loggers designed to mimic thermal dynamics of desert tortoises
  - Collected air temps every 15 minutes under current conditions
- Data loggers placed in various tortoise microhabitats; in and under bushes, trees and under rock shelters and burrows



### **PERCENT OF OBSERVATIONS ABOVE CTM**

CLIMATE	MINIMUM	MAXIMUM	MEAN
CURRENT CONDITIONS (2016-2017)	0%	9.1401%	2.576%
FUTURE CONDITIONS (+4 °C)	0%	13.3041%	6.449%

## CONCLUSION

Future climatic conditions that further restrict hours available to tortoises for above ground activity will have a potentially major impact on their surface activity and possibly their survival rates

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