Heat islands, backyard landscaping, and the thermal ecology of urban lizards

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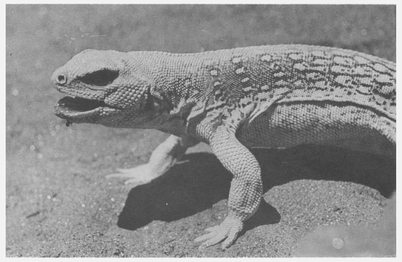


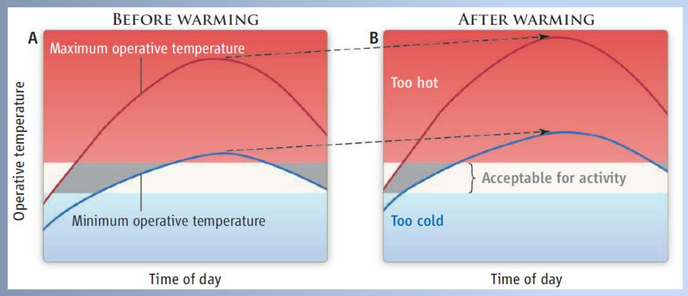
A Desert Iguana showing signs of extreme heat stress.
Thermoregulatory behaviors include open mouth panting and elevating the abdomen. Image: Cowles and Bogert 1944

A cold stressed Horned Lizard is unable to move off the authors finger.
Anthropogenic heat can benefit ectotherms in some circumstances. Image: Author

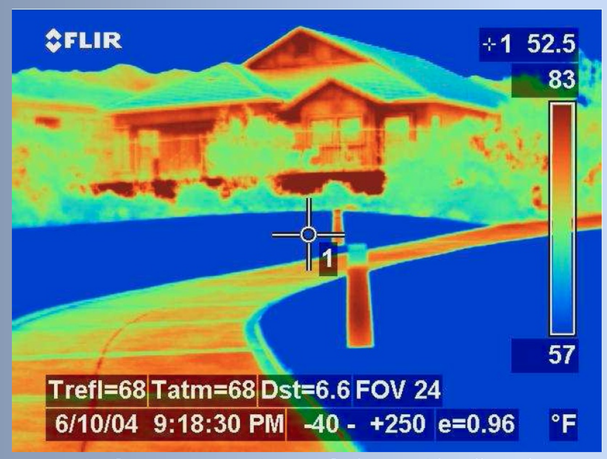
Global warming is predicted to drive almost 40% of lizard populations extinct by 2080 (Sinervo et al. 2010).
In Phoenix, AZ, urban heat island (UHI) "hot spots" greatly exceed global warming predictions.

Research goals:

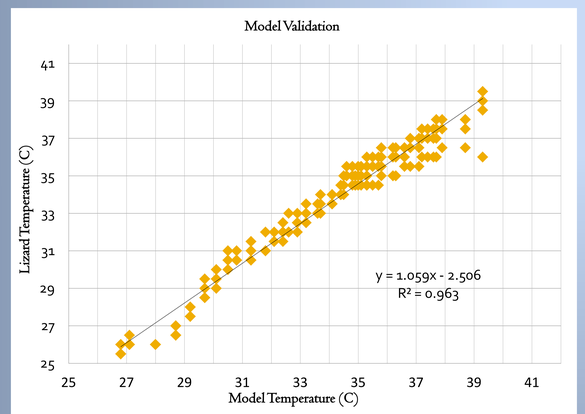
- *Identify how the UHI impacts the daily activity of lizards.*
- *Evaluate mitigation strategies.*



In summer, daily potential activity time (grey shaded area) may be lower at urban sites (after warming) than in rural areas (before warming). Figure: Huey et al. 2010



Surface temperature image of a house, sidewalk, and irrigated grass (blue area).
Figure: CAP LTER



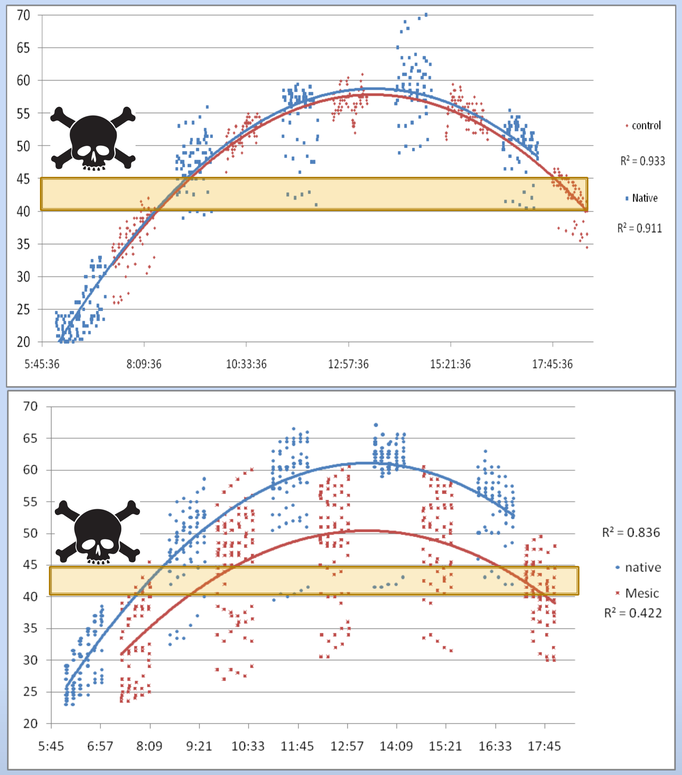
Copper lizard models closely match a live lizard's body temperature over a wide range of conditions.

Methods

Place lifelike copper lizard models with temperature data loggers in different habitats, and predict potential activity times.

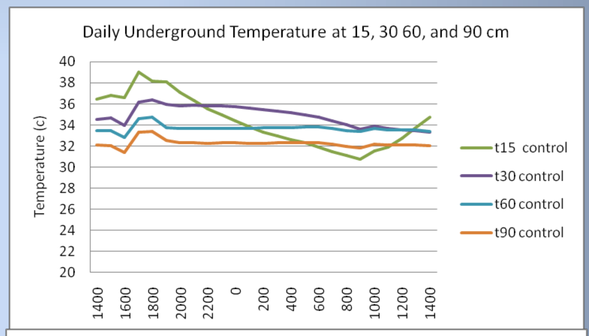
CAP LTER's North Desert Village experiment at ASU's east campus has a variety of experimental landscaping plots:
Mesic (heavily irrigated grass and shade tress), Xeric (lightly irrigated desert plants),
Oasis (mix of mesic and xeric), Native (unirrigated local plants), and a barren control plot.

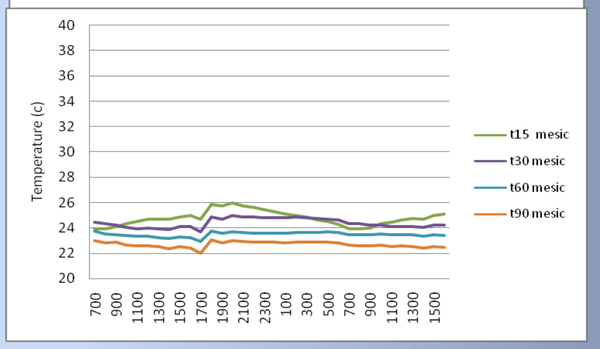
Summer Lizard Body Temperatures VS Time of Day



Can landscaping increase potential lizard activity?

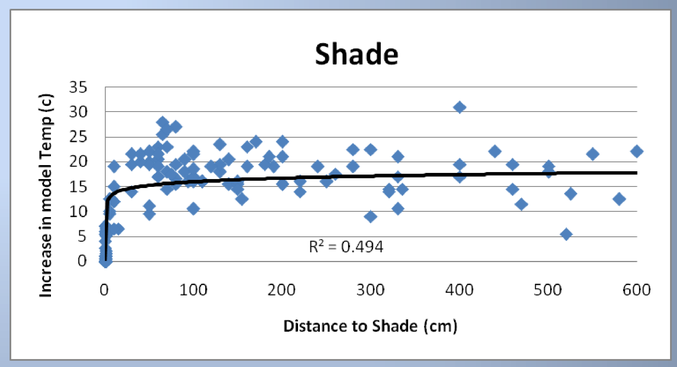
Lizards prefer 25-40 °C; 45 °C is lethal.
Xeric landscaping slightly increased temperature variability but did not change average temperature.
Mesic landscaping resulted in large increase in variability and lowered average temperatures by as much as 10 °C.





Can lizards survive a temperature increase by aestivating during summer?

Small lizards are unlikely to survive much more than a week underground in xeric habitats before running out of energy or water.
Cooler underground temperatures in mesic habitats are ideal for longer aestivation periods, but are actually too cold for proper egg development (> 27 °C).



What is the most important microhabitat characteristic for mitigation strategies?

]Distance to shade explained much more temperature variation than vegetation, substrate, height, humidity, and sky view %.

Literature cited

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Huey, R. B., J. B. Losos, and C. Moritz. 2010. Are lizards toast? Science **328**:832-833.
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