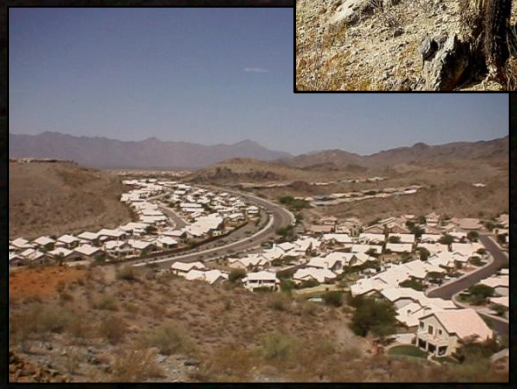
Effects of Desert Tree Shade and Ground Cover Surface Cover on Human Comfort in an Arid City



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Research Objective

Investigate the mitigating roles of tree shade and ground surface cover type on residential undercanopy layer landscape microclimate and human discomfort.

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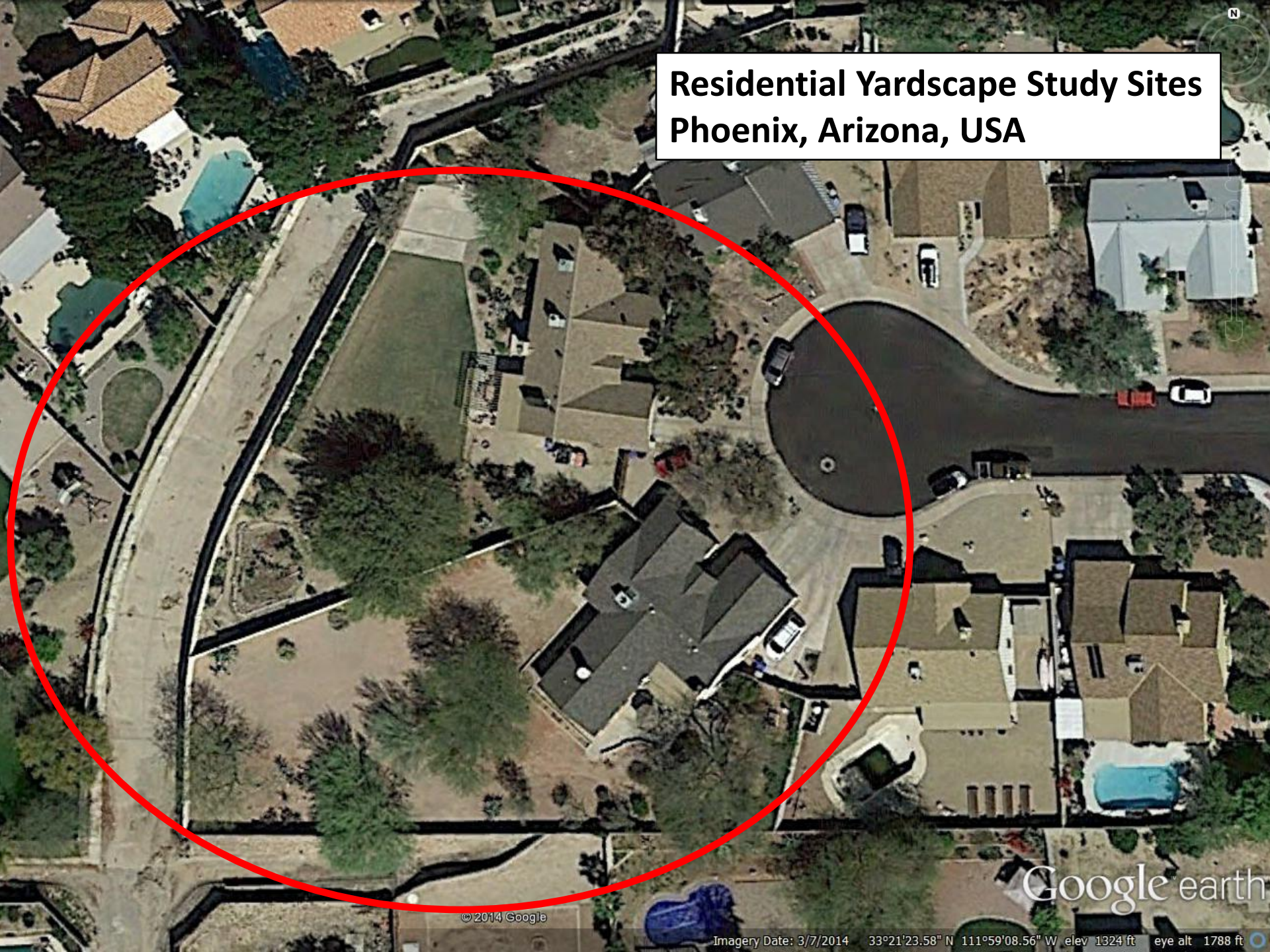

Residential Yardscape Study Sites
Phoenix, Arizona, USA
© 2014 Google
Google earth
Imagery Date: 3/7/2014 33°21'23.58" N 111°59'08.56" W elev 1324 ft eye alt 1788 ft

Materials

Micro-meteorological data continuously recorded at 1 min intervals and averaged every 30 min

Methods

- **Summer 2010 [Julian Days 165 to 179 Dry and 216 to 241 Wet]**
- **Dry bulb temperature, vapor pressure, wind speed (1.5-m height)**
- **Global radiation**

- **Apparent temperature (T_{AP}) calculated using equations by Stedman (1984)**

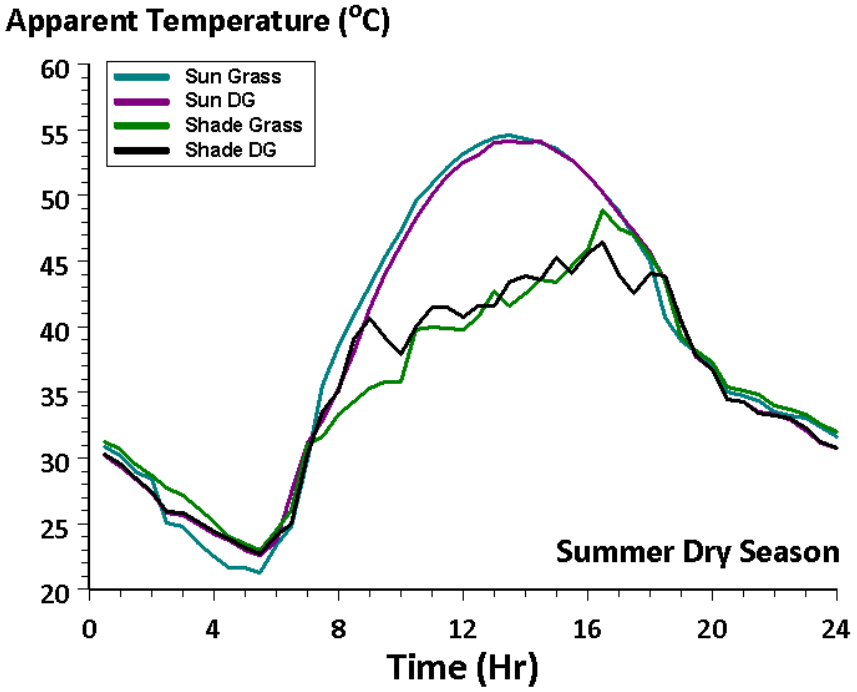
R.G. Stedman. 1984. A Universal Scale of Apparent Temperature. J. Climate and Applied Meteorology 23:1674-1687.

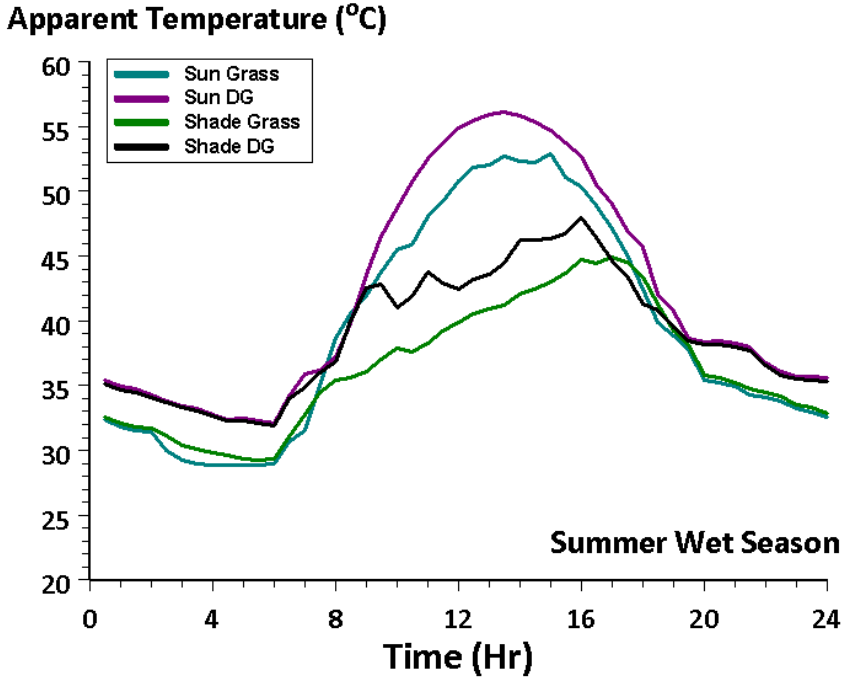
Yardscape	Full sun	Under Mesquite Tree
Mesic – Turf	Sun – Turf	Shade – Turf
Xeric – DG	Sun – DG	Shade – DG

Factorial matrix

Exposure: Full sun or mesquite tree shade

Surface cover: Turf grass lawn or decomposing granite mulch (DG)



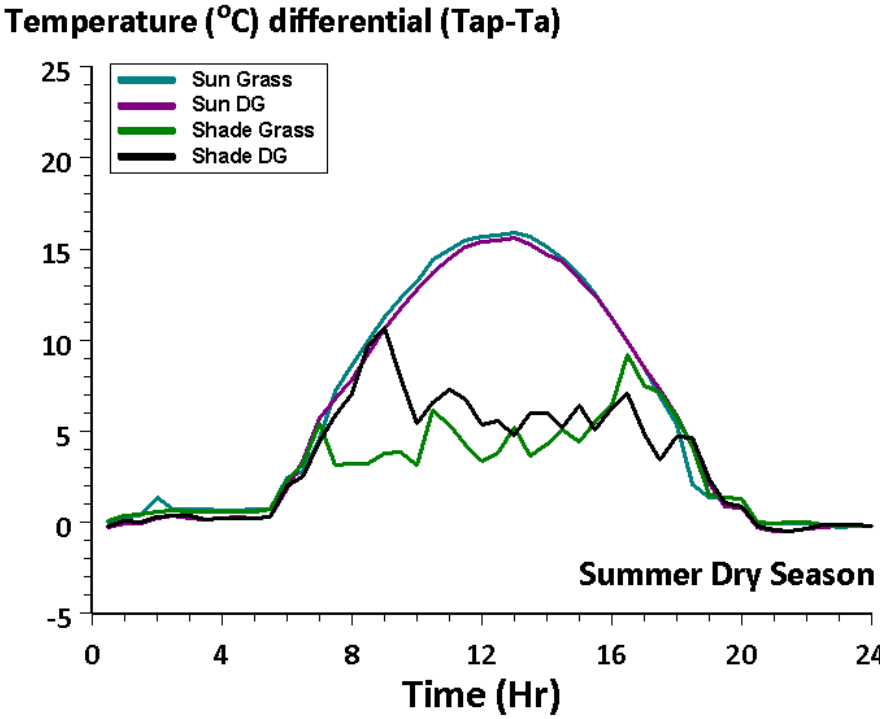


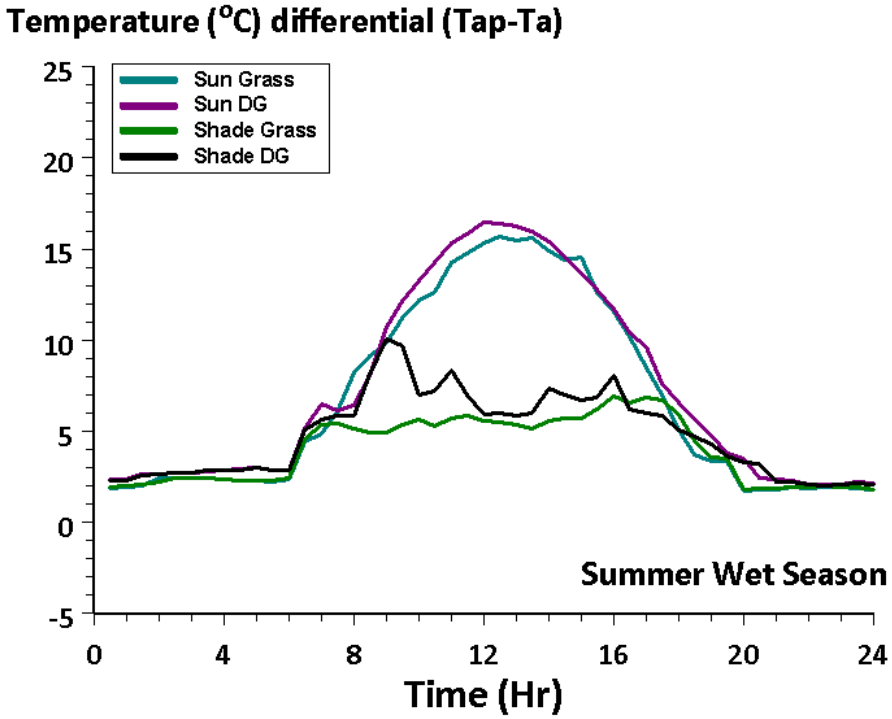
Mean diel summer calculated apparent air temperature (°C) profiles at 2-m height

Factorial matrix

Exposure: Full sun or mesquite tree shade

Surface cover: Turf grass lawn or decomposing granite mulch (DG)



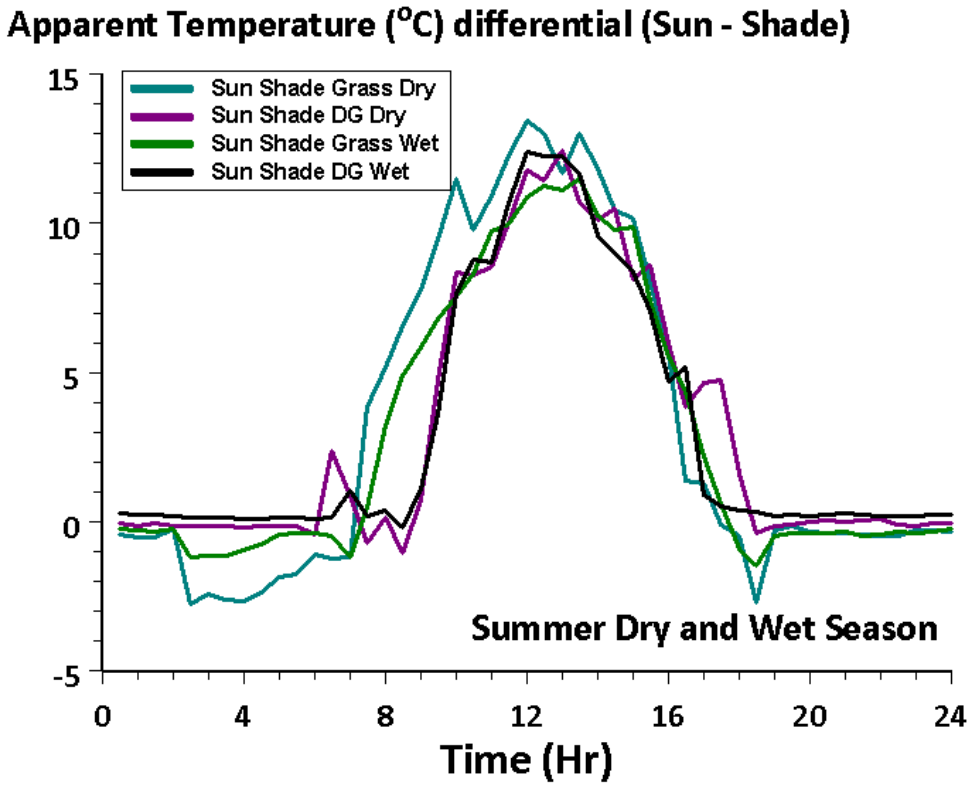


Mean summer temperature (°C) differential profiles at 2-m height between apparent and ambient air temperature (Tap-Ta)

Factorial matrix

Exposure: Full sun or mesquite tree shade

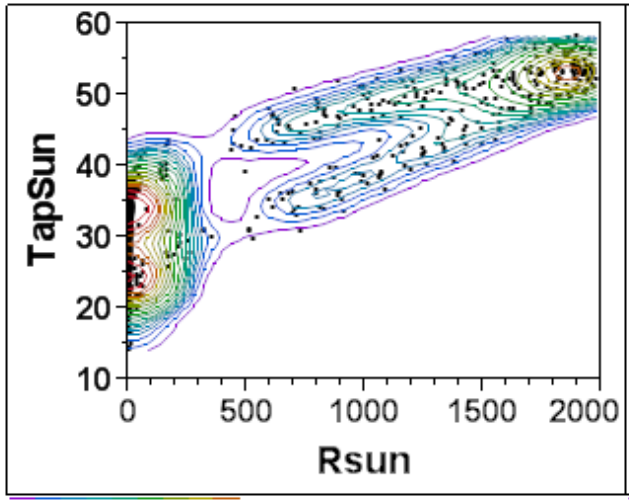
Surface cover: Turf grass lawn or decomposing granite mulch (DG)

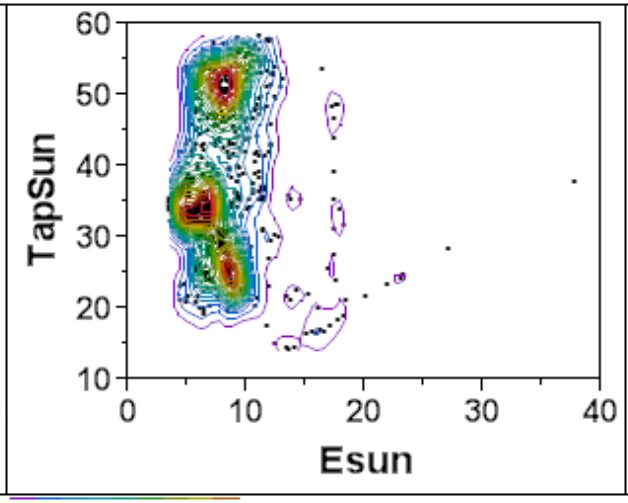


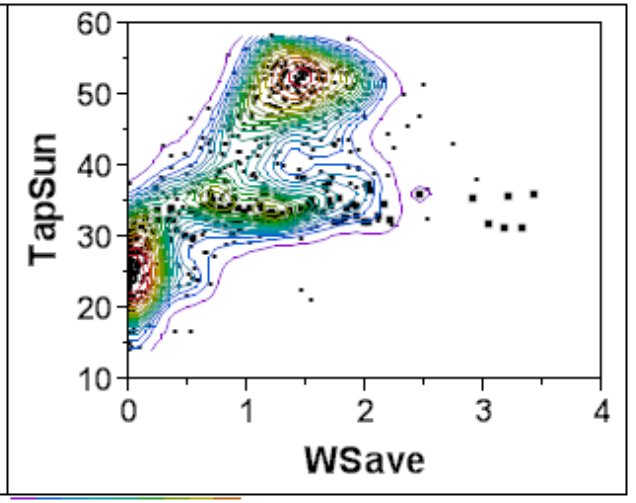
Mean summer temperature (°C) differential profiles at 2-m height between apparent temperatures in sun and shade

Bivariate plots of Apparent Temperature (Tap) against Global Radiation (R), Vapor Pressure (E), and Wind Speed (WS) during Summer Dry

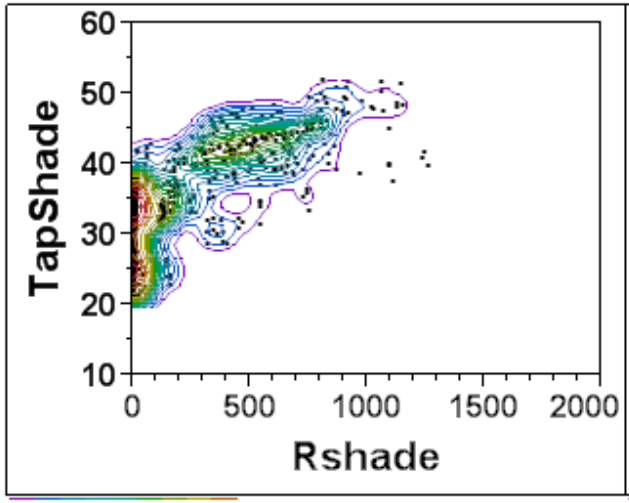
Sun

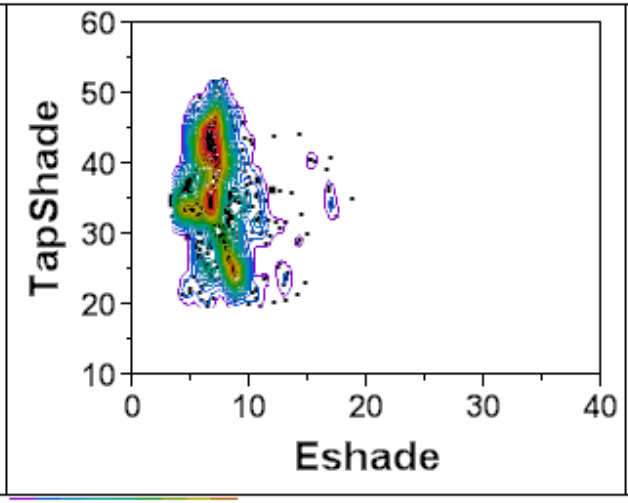


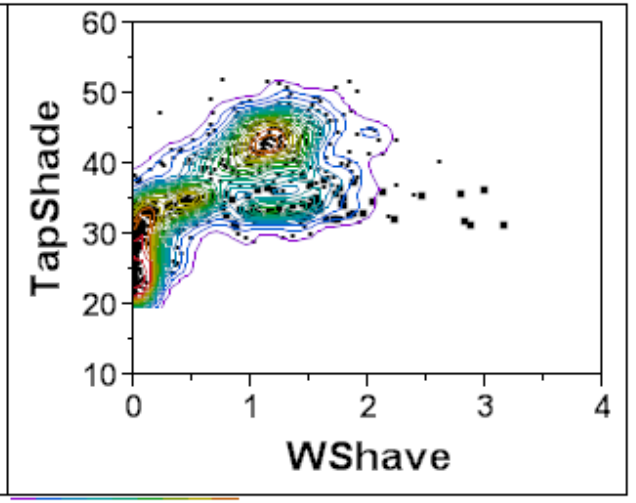




Shade

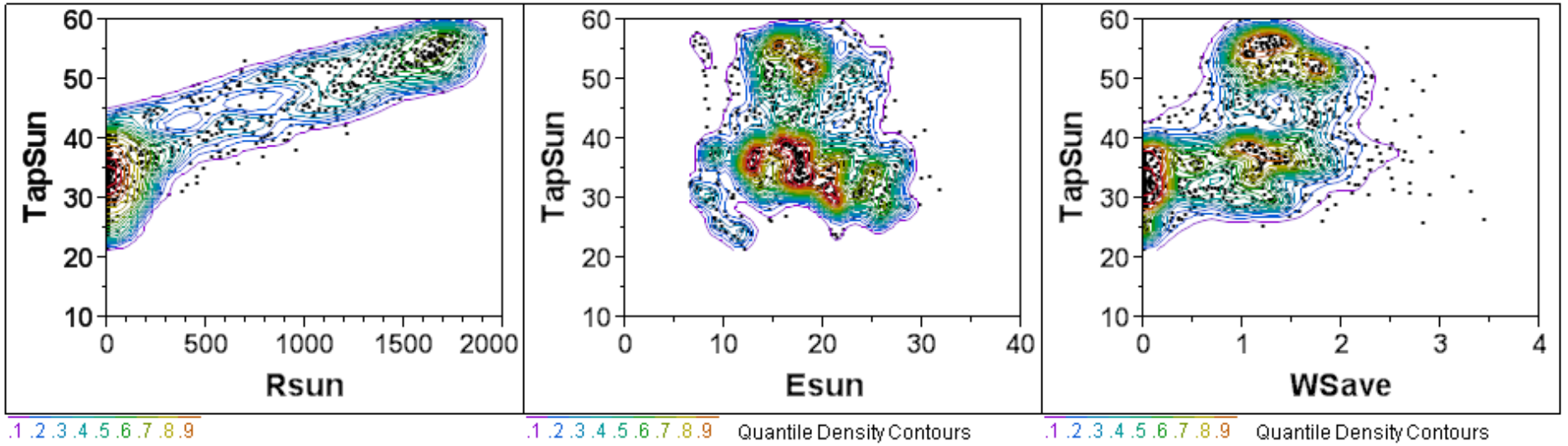




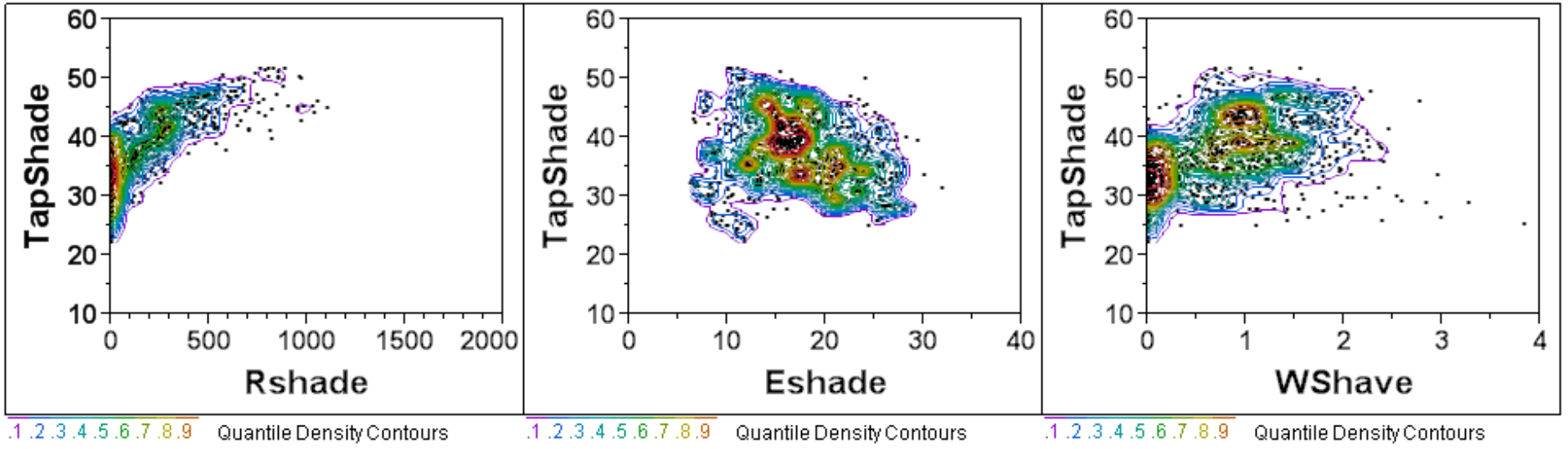


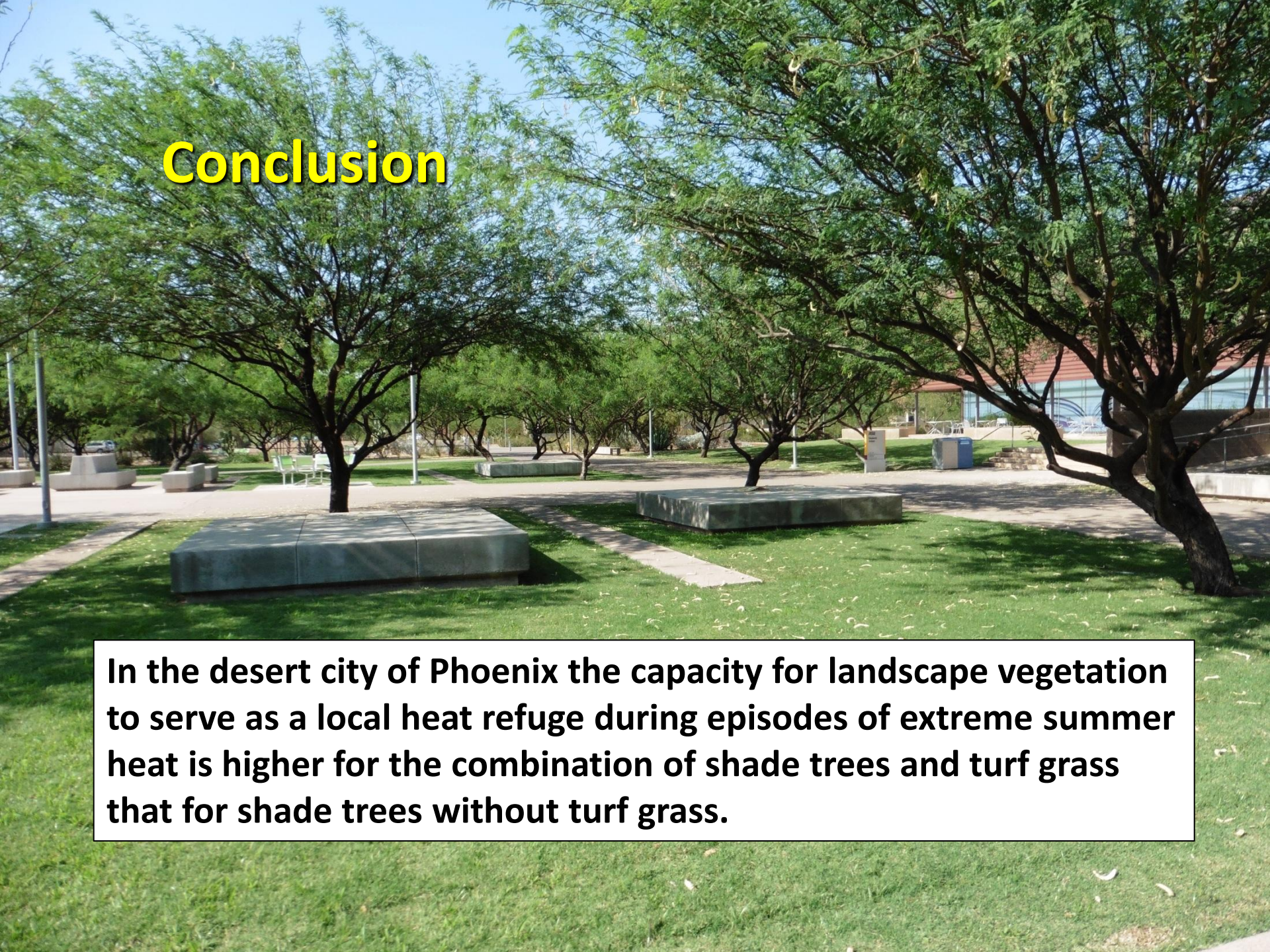
Bivariate plots of Apparent Temperature (Tap) against Global Radiation (R), Vapor Pressure (E), and Wind Speed (WS) during Summer Wet

Sun



Shade





Conclusion

In the desert city of Phoenix the capacity for landscape vegetation to serve as a local heat refuge during episodes of extreme summer heat is higher for the combination of shade trees and turf grass that for shade trees without turf grass.

Conclusion

Sometimes ecosystem services are appear contradictory. Balancing heat mitigation with water conservation in an arid city means the targeted use of turf grass.

Acknowledgements

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