

# Urbanization effects on the microclimate and vegetation structure of riparian areas along ephemeral streams

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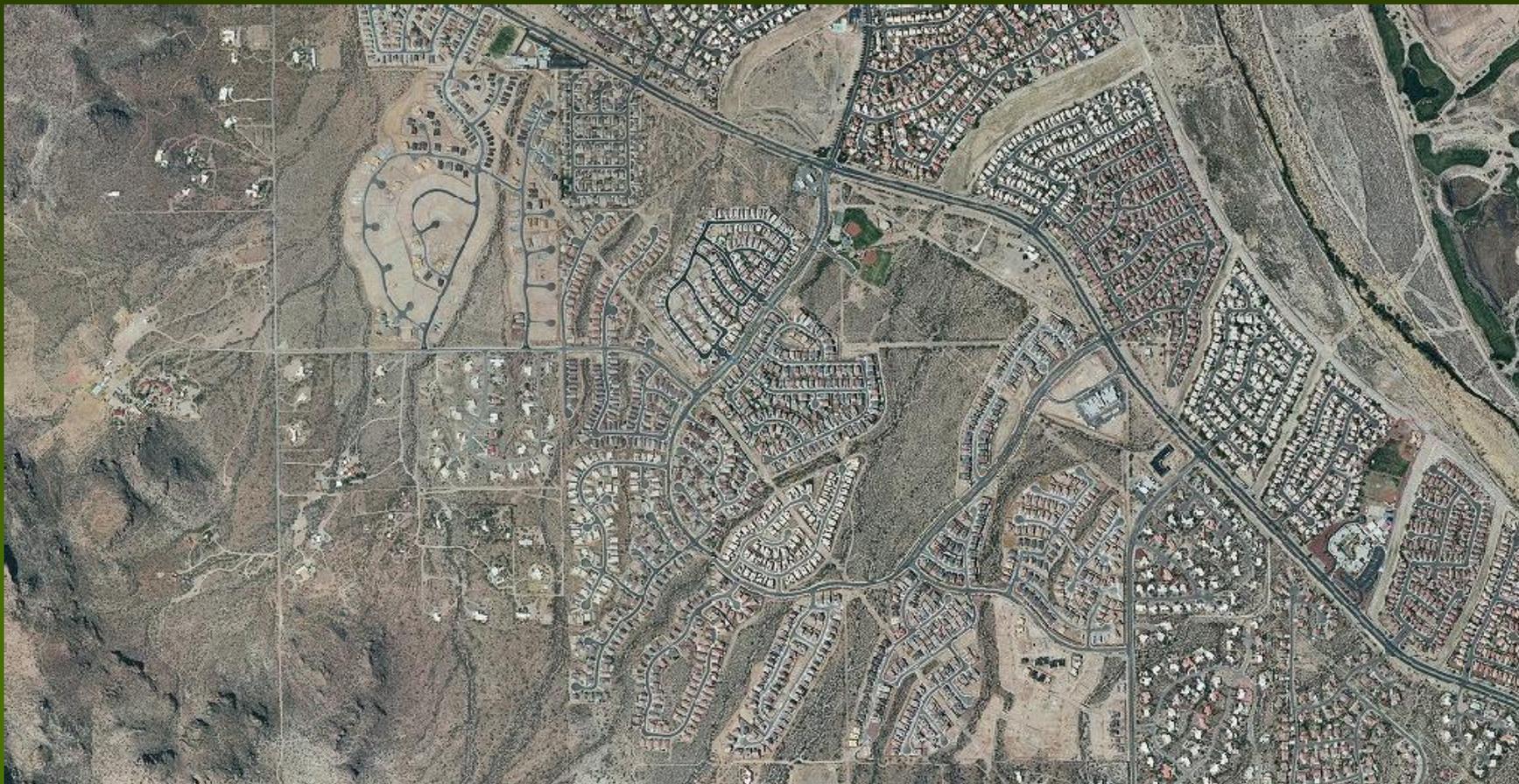
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# Marana, AZ



2000

# Marana, AZ



2006

# Ephemeral Streams & Urbanization

**90% of  
streams in  
Arizona are  
ephemeral**



**2% of  
Arizona is  
'riparian'**

**Ephemeral Stream: Flowing briefly as  
a result of significant precipitation**

**Riparian Area: Ecosystems along  
river/stream banks**

# Ephemeral Streams & Urbanization



# OBJECTIVES



Determine ecological functions of our semi-arid riparian areas along ephemeral streams, how they are affected by urban sprawl, and promote their conservation amidst rapid urbanization

# HYPOTHESIS

Urbanization will . . .

- Increase nighttime temperatures
- Decrease nutrient cycling/plant productivity

# TREATMENT

## Treatment Parameters (Urban Density)

- **High:**  $<14$  and  $>12$  houses/hectare
- **Moderate:**  $<7$  and  $>4$  houses/hectare
- **Low:**  $<1$  house/hectare



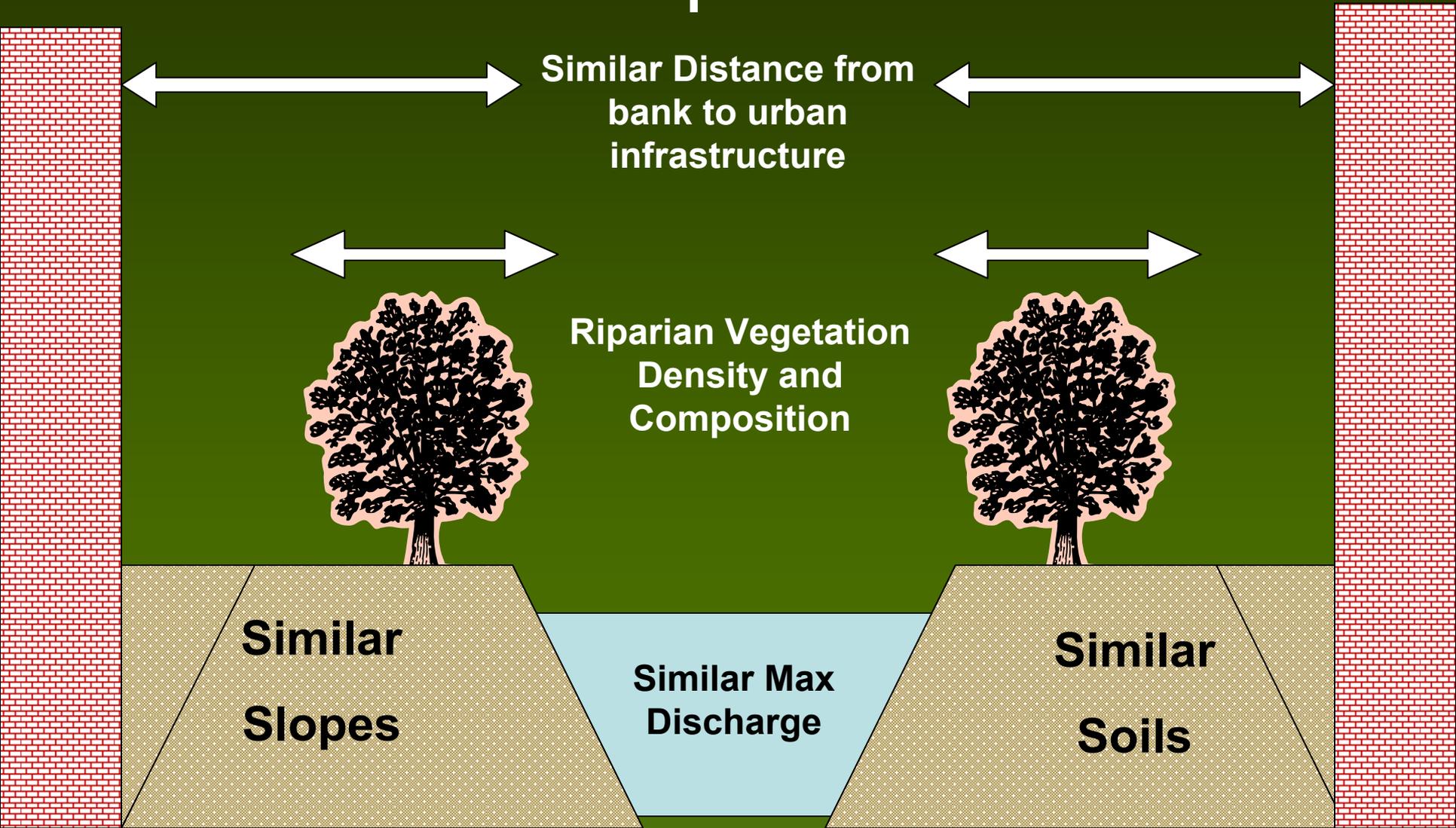
LOCATION

# STUDY LOCATION Site Requirements



Age of  
construction

Flow Direction



Similar Distance from  
bank to urban  
infrastructure

Riparian Vegetation  
Density and  
Composition

Similar  
Slopes

Similar Max  
Discharge

Similar  
Soils

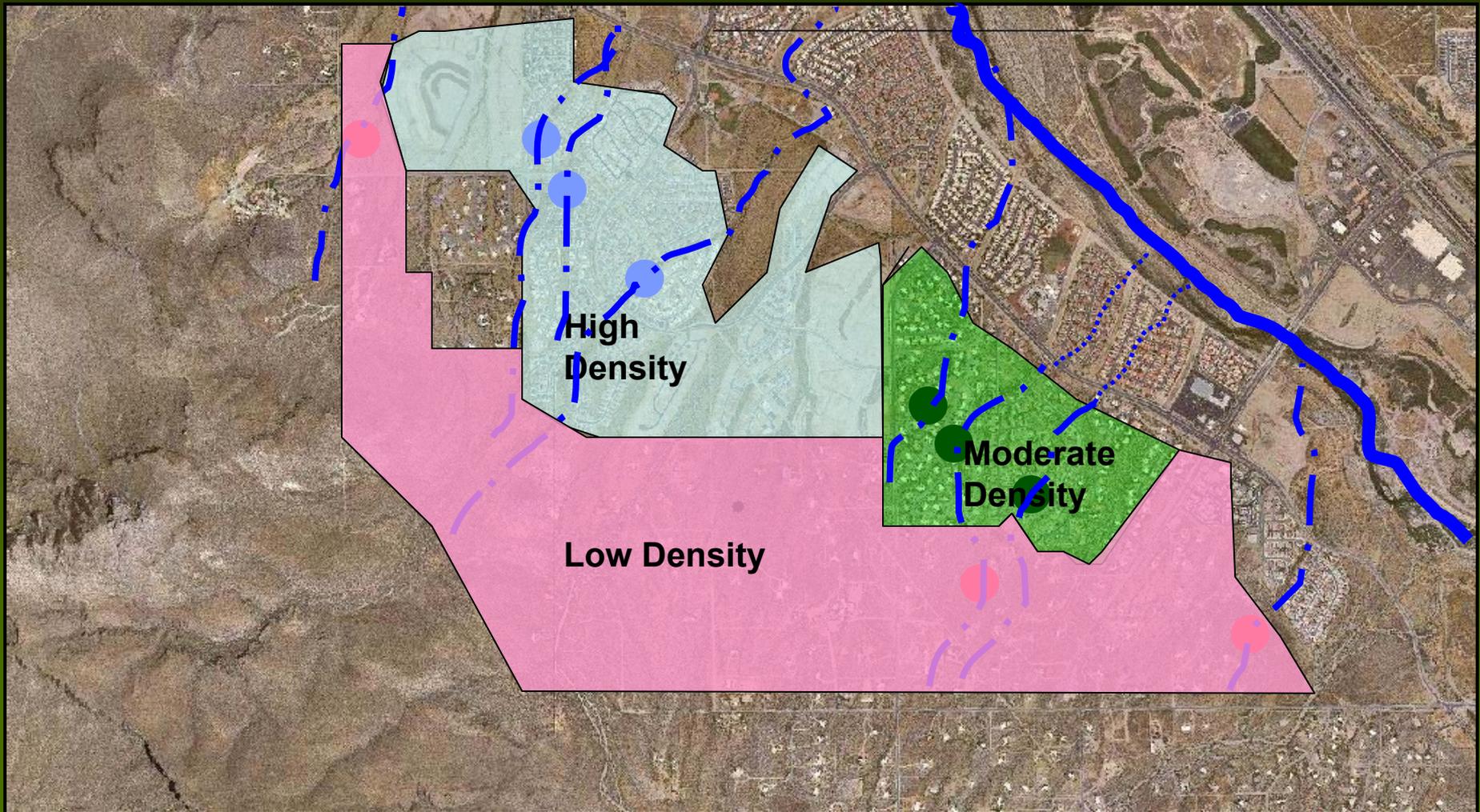
# STUDY LOCATION

## Site Requirements

**Finally . . .**

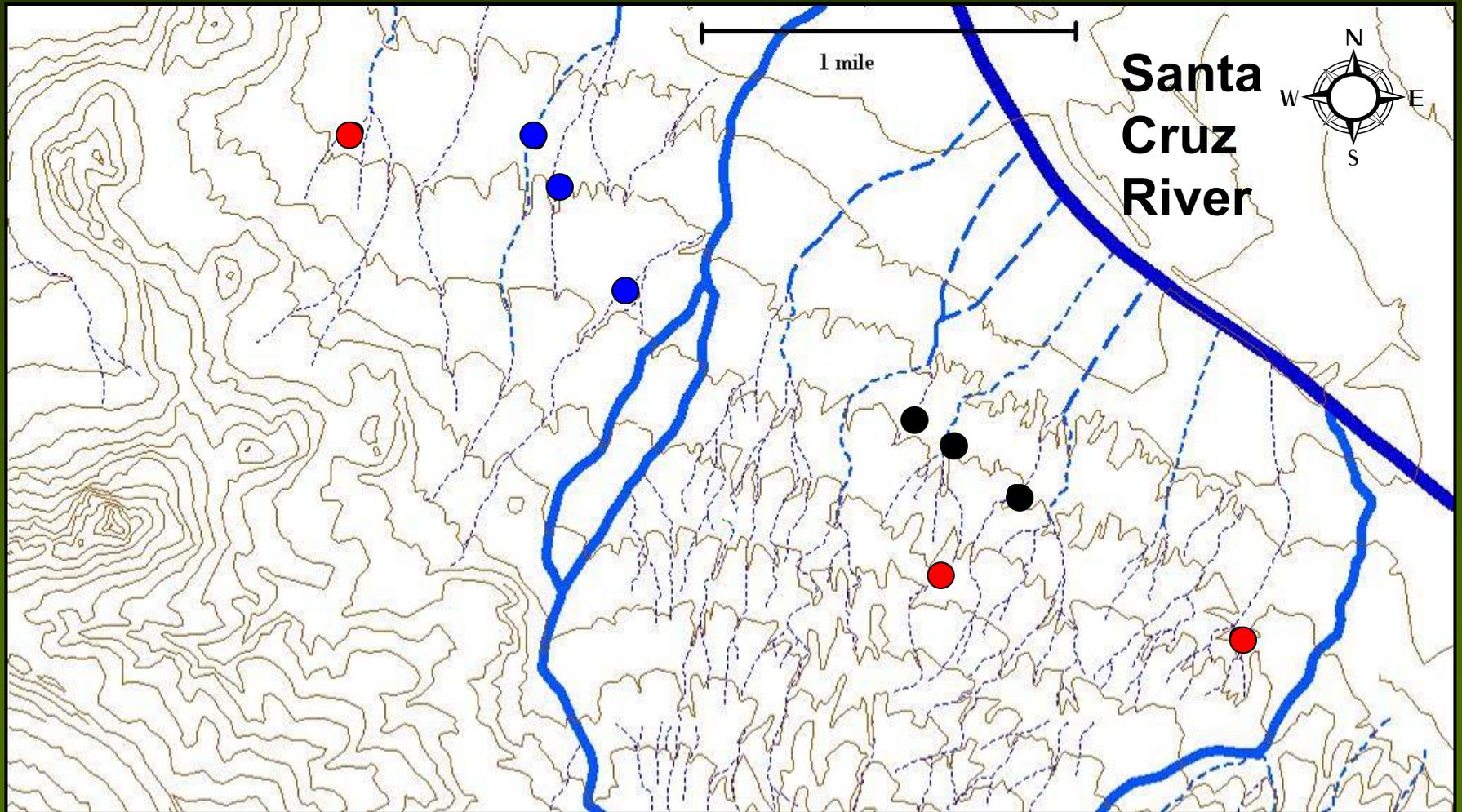
**People needed to let us.**

# STUDY LOCATION



1 km

# STUDY LOCATION



Contour Interval: 20 ft or  
6.096 meters

1 km

# METHODS

# METHODS (Climate)

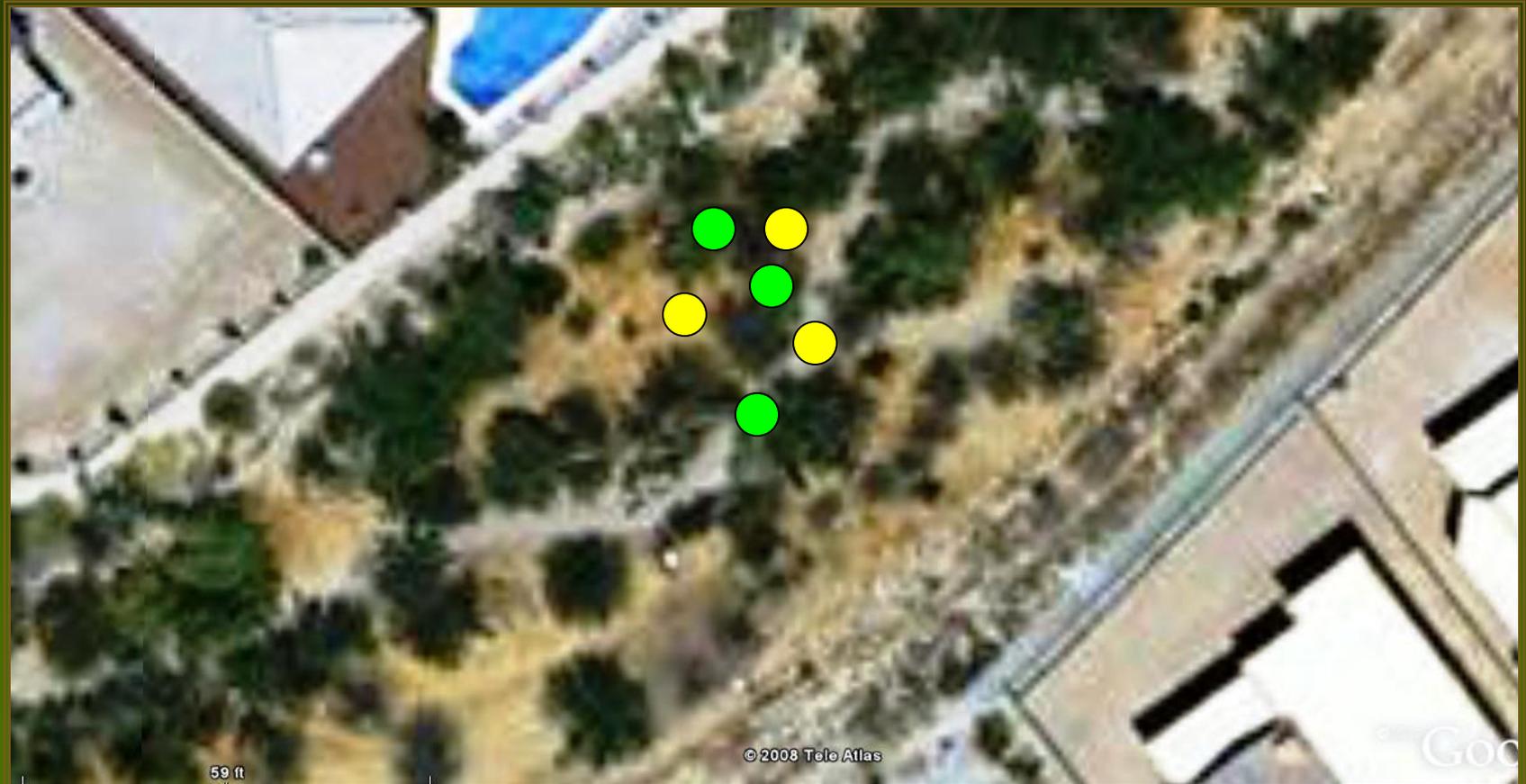
## Microclimate Data

- 6 air temperature sensors
- 2 relative humidity sensors
- 1 rain gauge



- Sensor heights @ 30 cm
- Sampling Intervals @ 30 min

# METHODS (Climate)



● = Canopy Sensor

● = Intercanopy Sensor

# METHODS

## (Riparian Flora)

### Vegetation Data

- 4 Shrub transects (2 x 20 m): includes shrub radii and height
- 40 Herbaceous plots (20 x 50 cm @ every meter within the shrub transects)
- 3 Tree plots (15 m radius): includes tree radii, height, and basal circumference



# METHODS

## (Litter Decomposition)

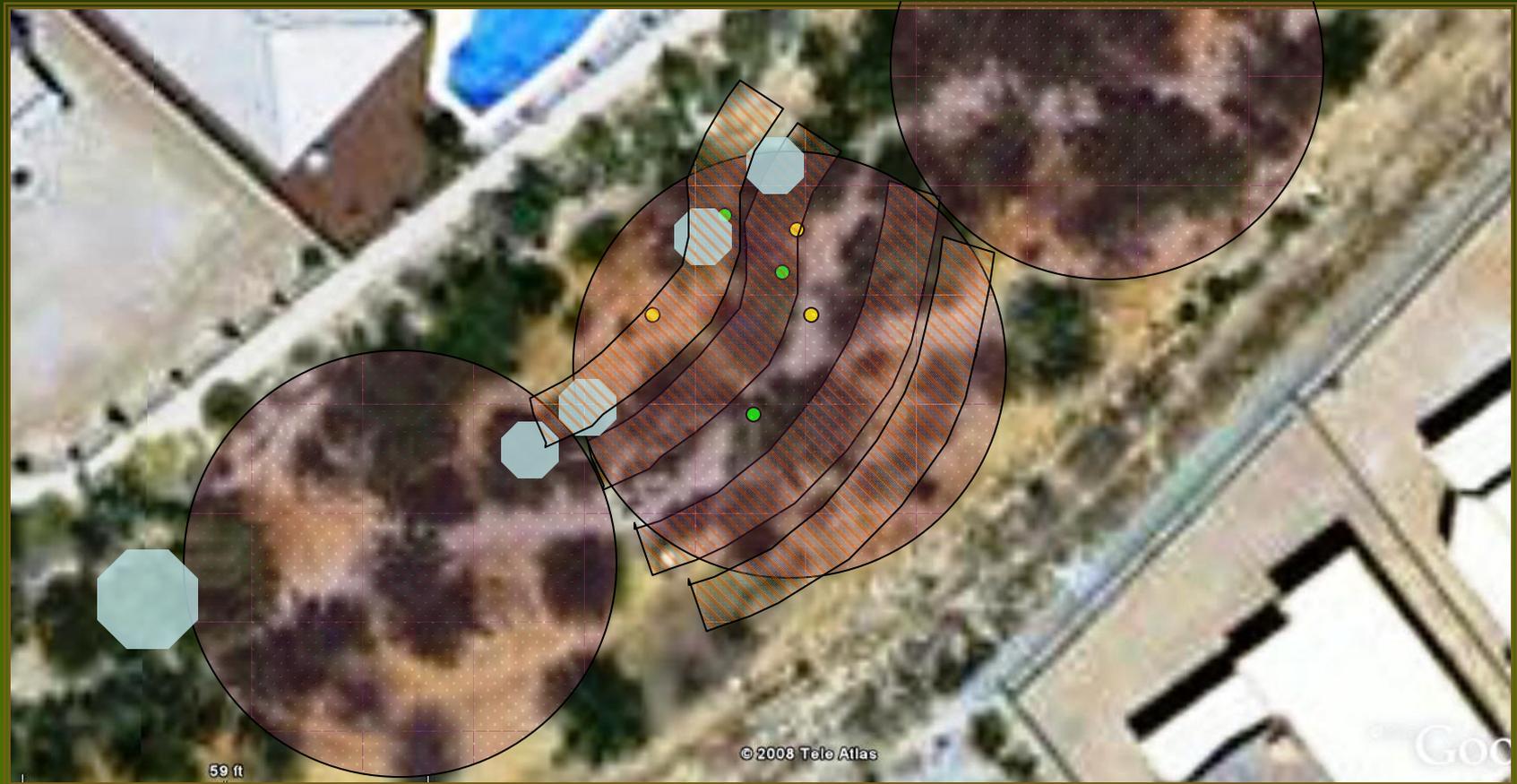
### Leaf Litter Data

- Use dominant species from all nine reaches: *Larrea tridentata*, *Acacia greggii*, and *Parkinsonia microphylla*
- 5 g of leaf and lignin litter
- 2 soil moisture sensors
- 1 soil temperature sensor



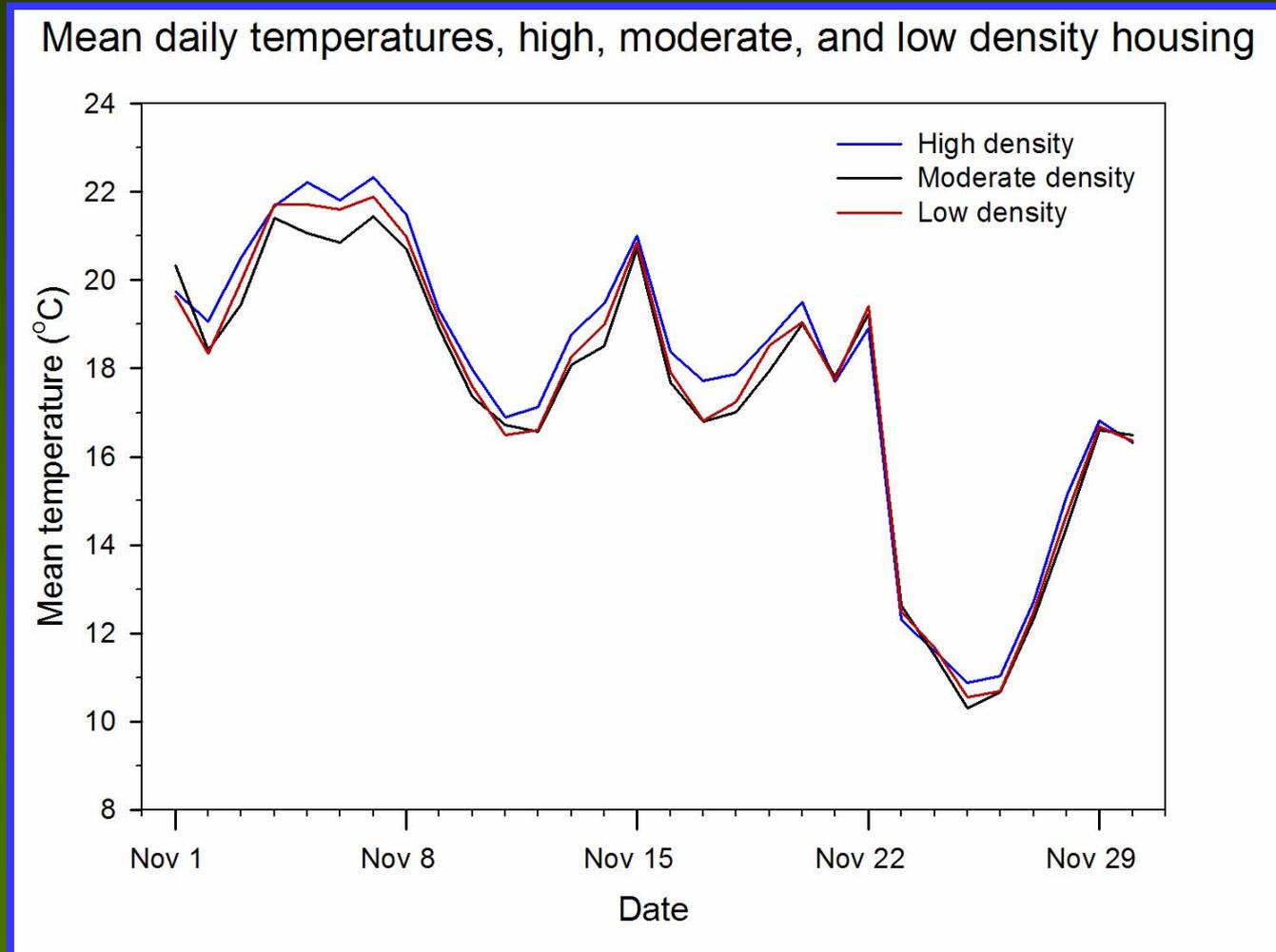
# METHODS

## (Vegetation and Litter)



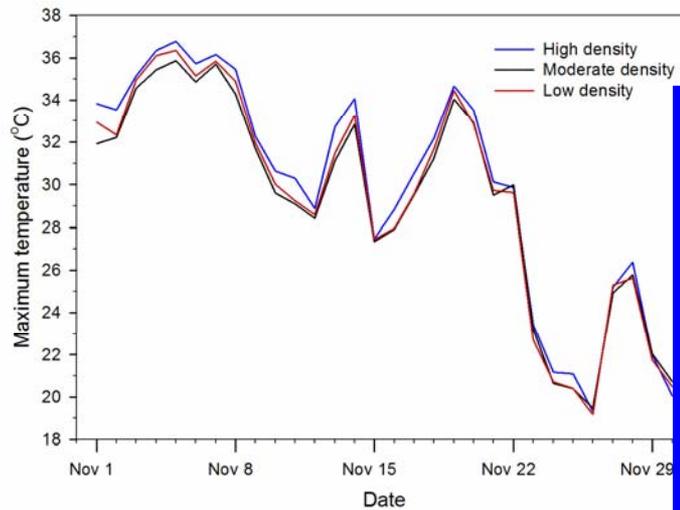
# PRELIMINARY RESULTS

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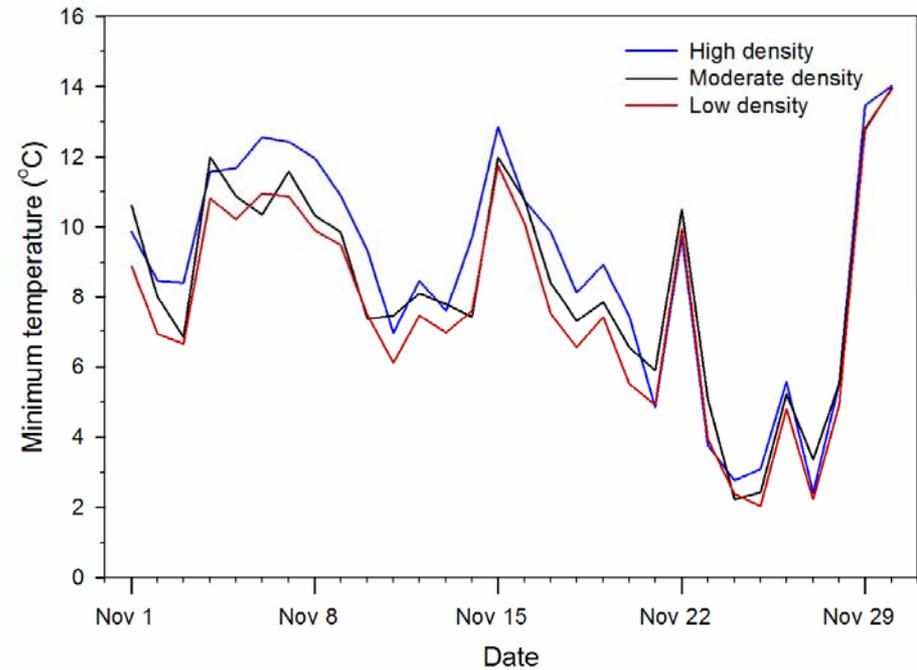


# PRELIMINARY RESULTS

Maximum mean daily temperatures,  
high, moderate, and low density housing

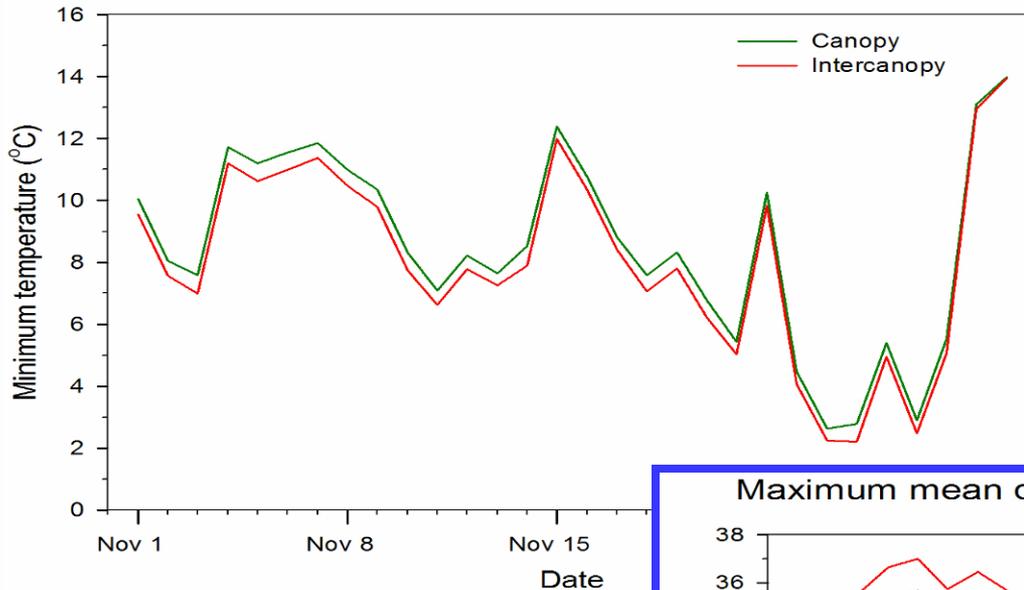


Minimum mean daily temperatures,  
high, moderate, and low density housing



# PRELIMINARY RESULTS

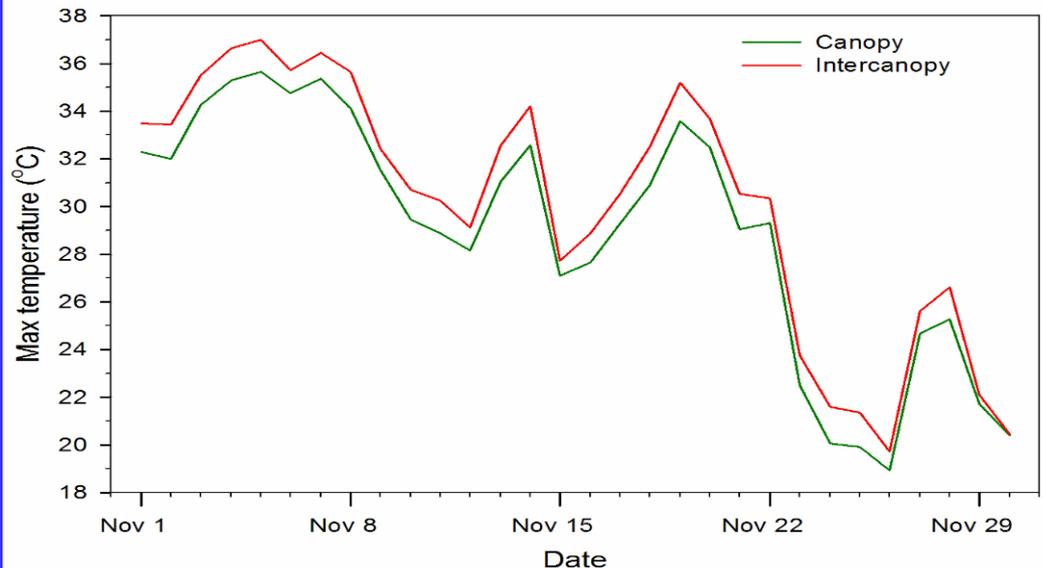
Minimum mean daily canopy and intercanopy temperatures



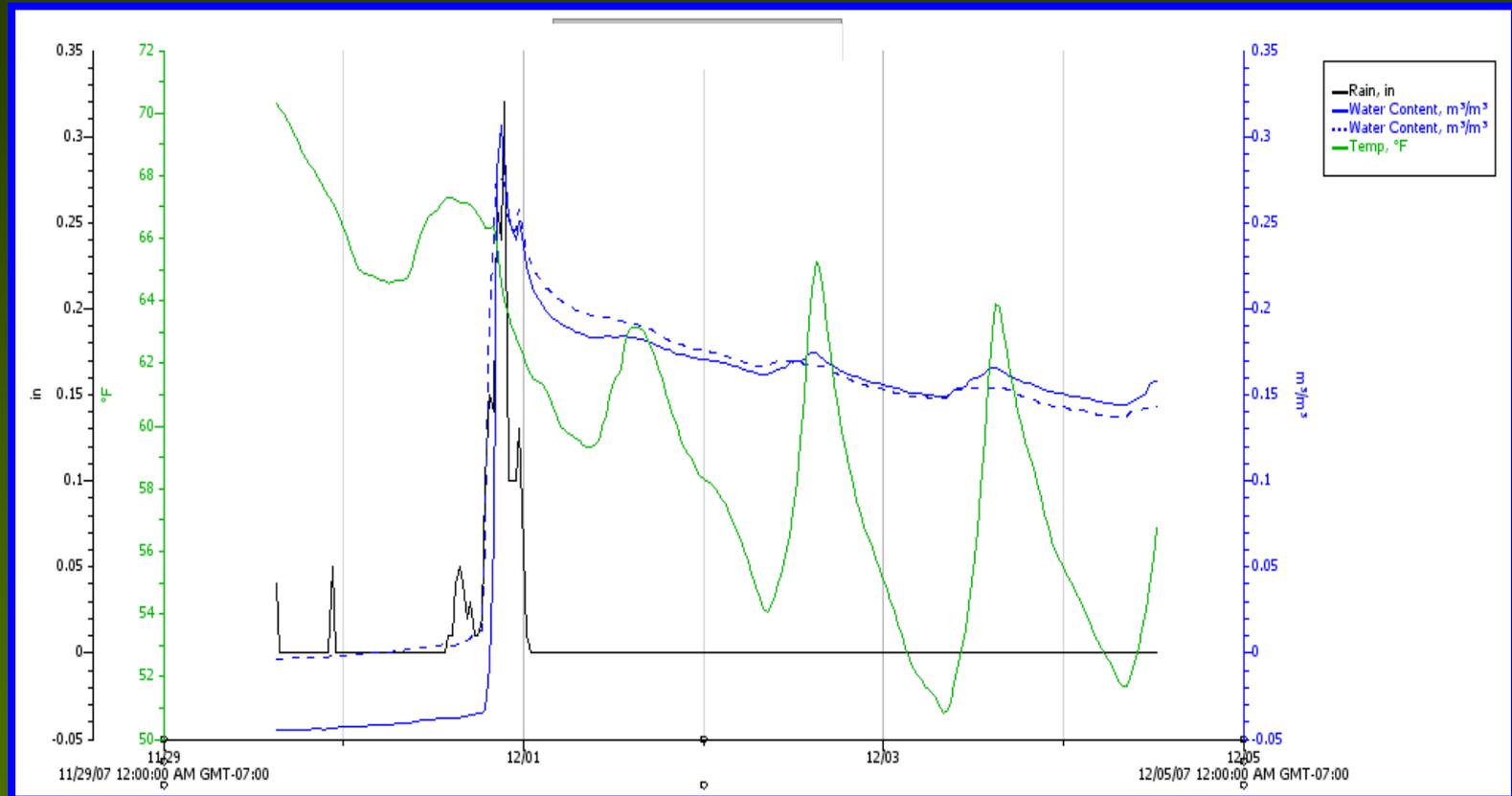
Intercanopy temperatures observed as **LOWER** than Canopy temps during the daytime.

Intercanopy temperatures observed as **HIGHER** than Canopy temps during the daytime.

Maximum mean daily canopy and intercanopy temperatures



# PRELIMINARY RESULTS

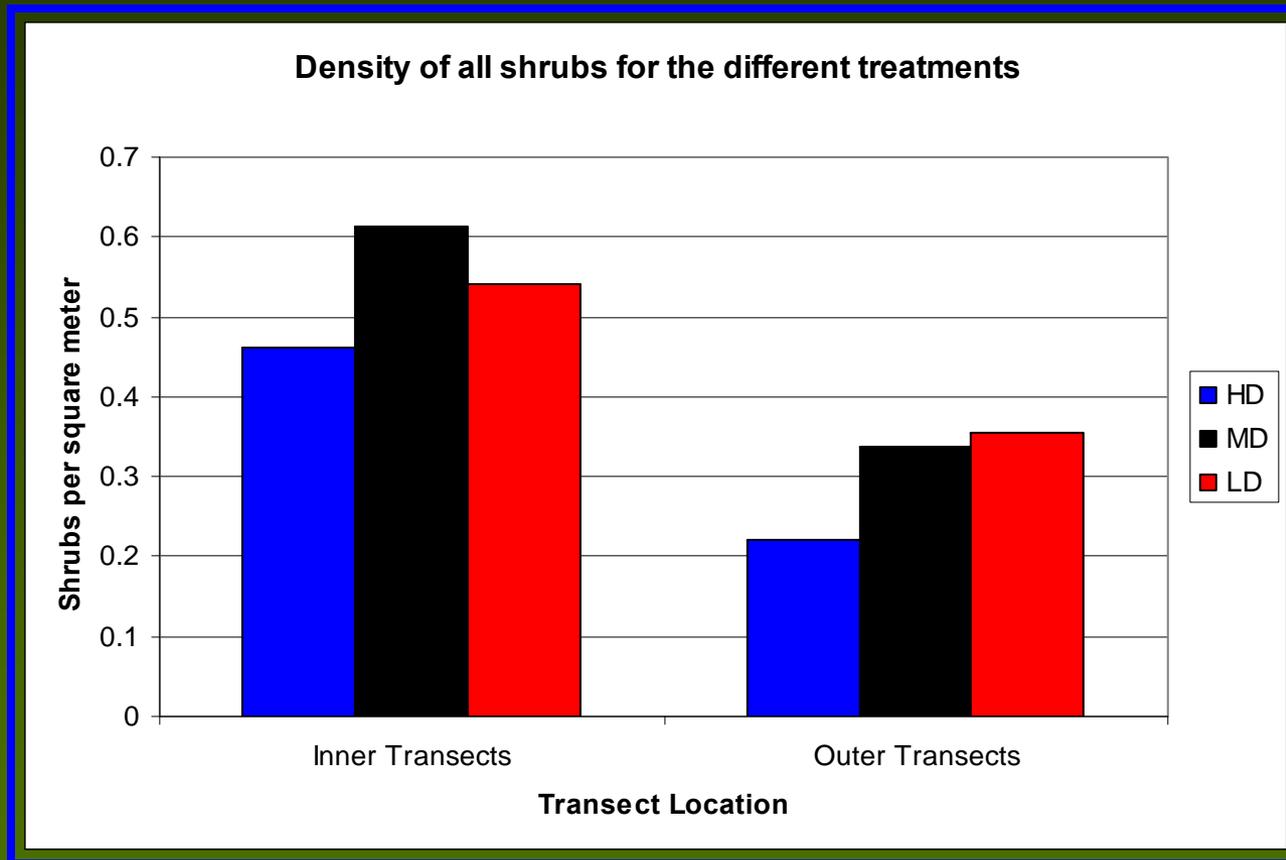


Early December rain at the study sites:

Black = Precip; Blue = Soil Moisture; Green = Soil Temp



# PRELIMINARY RESULTS



Tree plots are complete, and the December Herbaceous plots were also conducted but consistently showed 'bare soil' and 'litter'. Currently thousands of unknown annuals are popping up and I'm terrified of the next survey.

# SUMMARY

1. November 2007: no statistical difference in mean, max, or min temperatures between the treatments.
2. We expect to see greater differences come late spring and early summer (hotter and drier), especially in the nighttime temperatures.
3. Opportunities for studying the ecological functions of ephemeral streams and the impacts of urbanization on our semiarid ecosystems are limitless and important for informing land managers and developers on the impacts of our urban sprawl.

# CONTACT

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