

Correlating Urban Water Demand, Surface Temperature and Vegetation in an Arid Environment: An Update

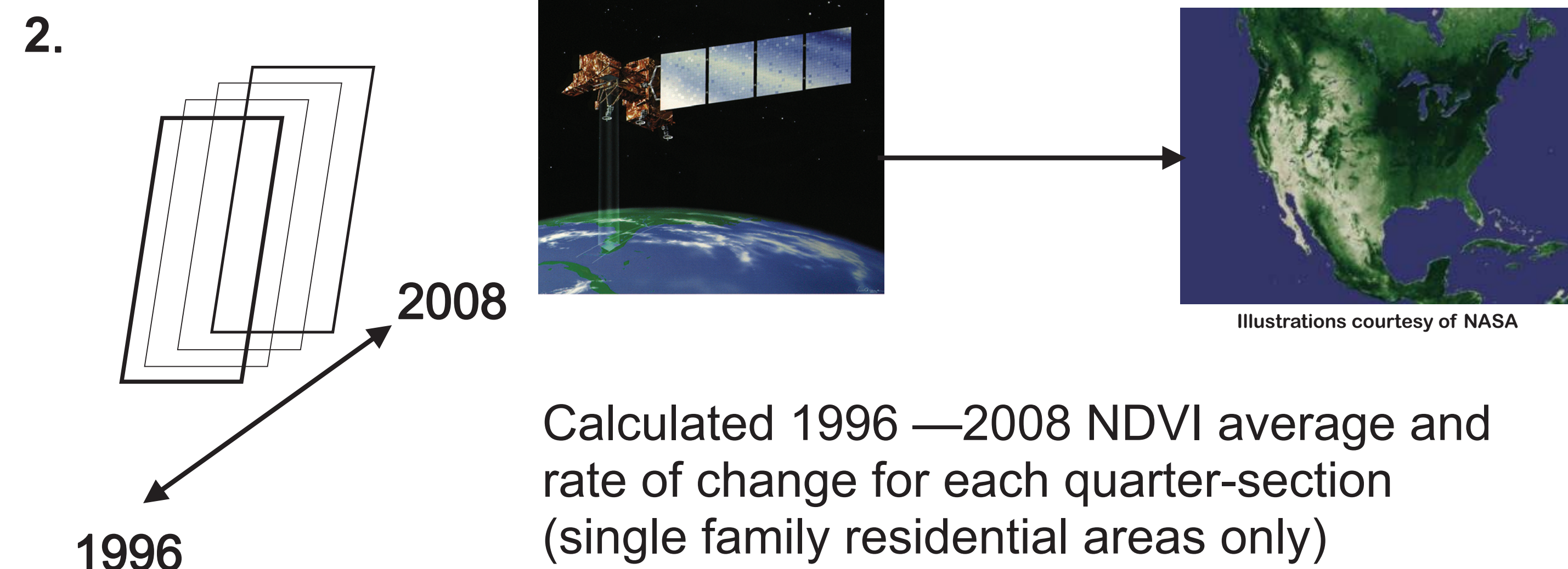
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Research Question: Does outdoor water conservation by single family residences influence the urban heat island effect in semi-arid Tucson, Arizona?

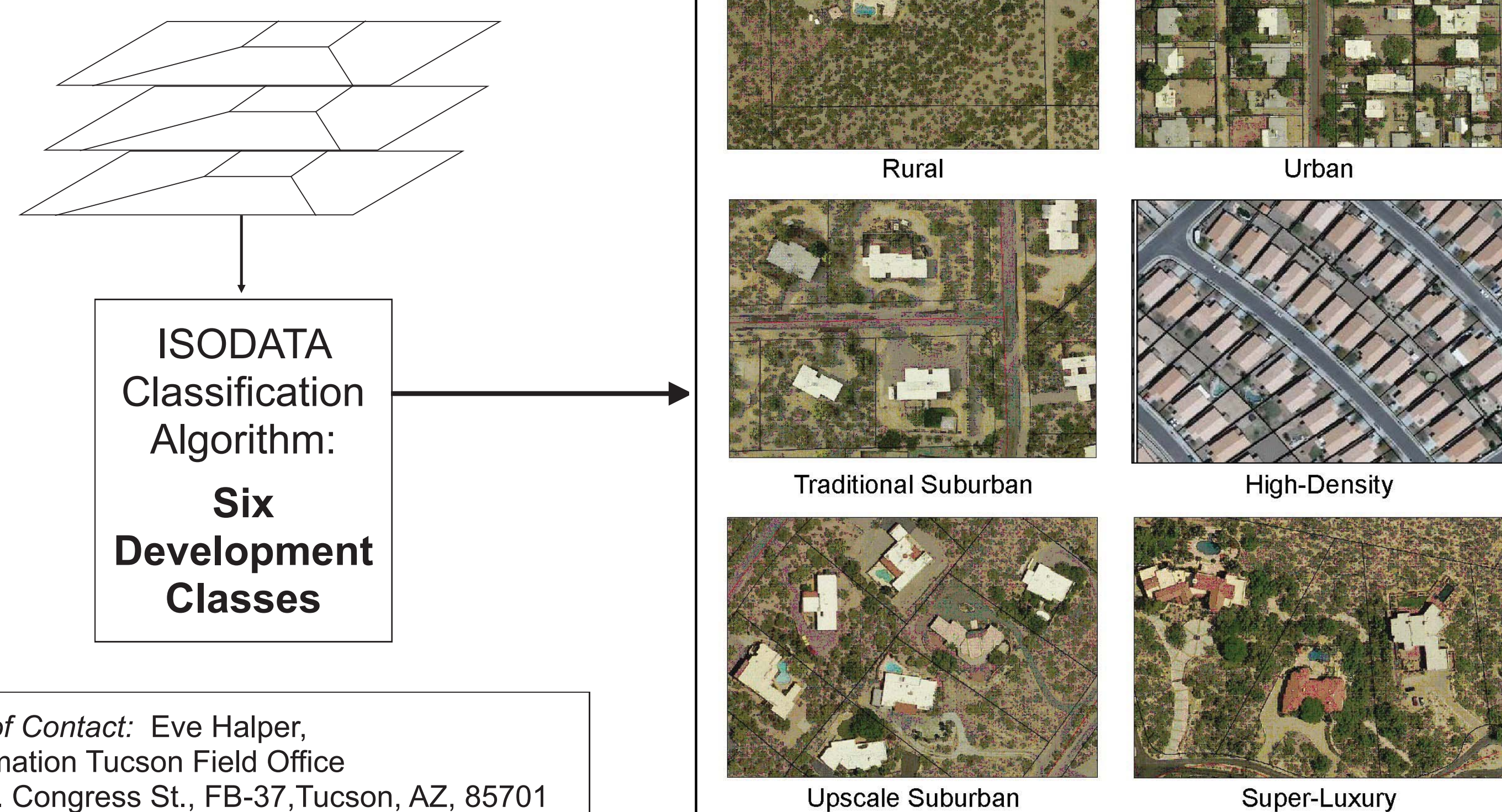
- Data:**
1. Landsat Satellite Images from 1996—2008, dates selected in pre-monsoon months (April, May, June) and less than 300 mm rainfall in preceding 90 days
 2. Monthly single family residential water use data, averaged over the **quarter-section** level (1/2 mile x 1/2 mile area) from 1995—2008 (courtesy of Tucson Water)
 3. GIS data on single family residential parcels, zoning, elevation, winter rainfall (courtesy of Pima County Department of Transportation, Pima County Assessor, USGS)

Data Processing:

1. Calculated Normalized Difference Vegetation Index (NDVI), a measure of green vegetation, and surface temperatures for images.

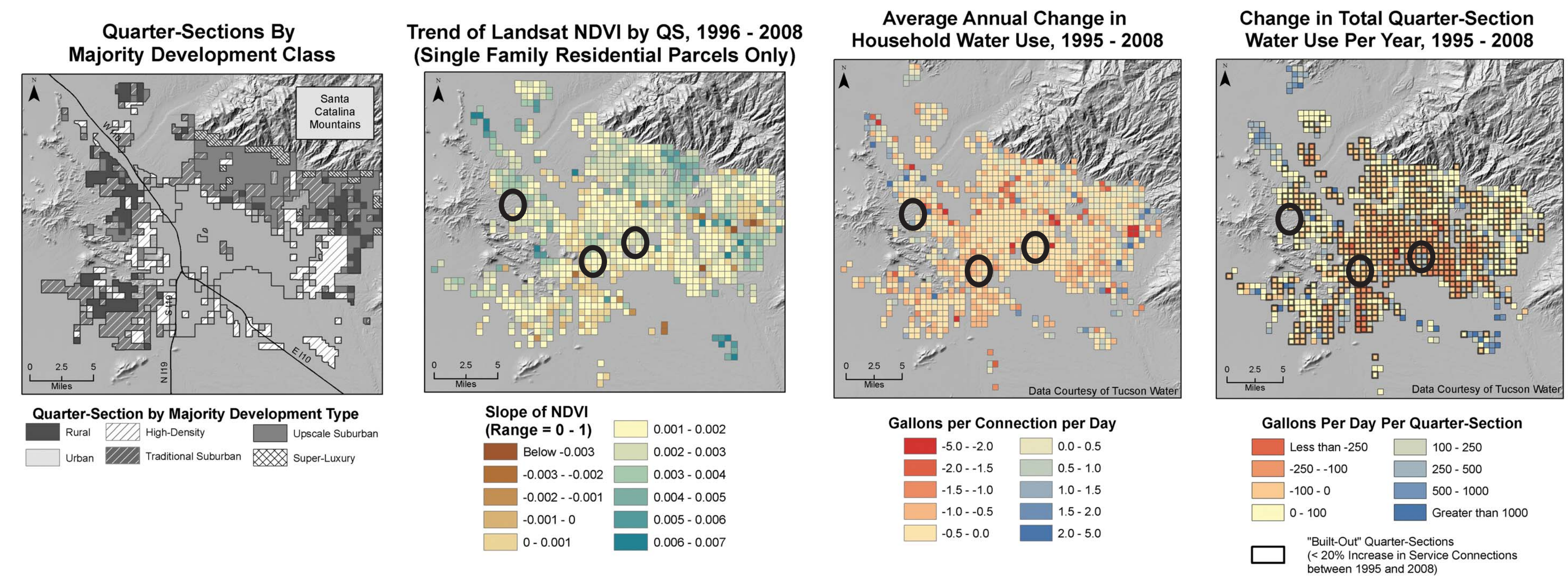


3. 11 GIS Layers of Residential Parcel Information

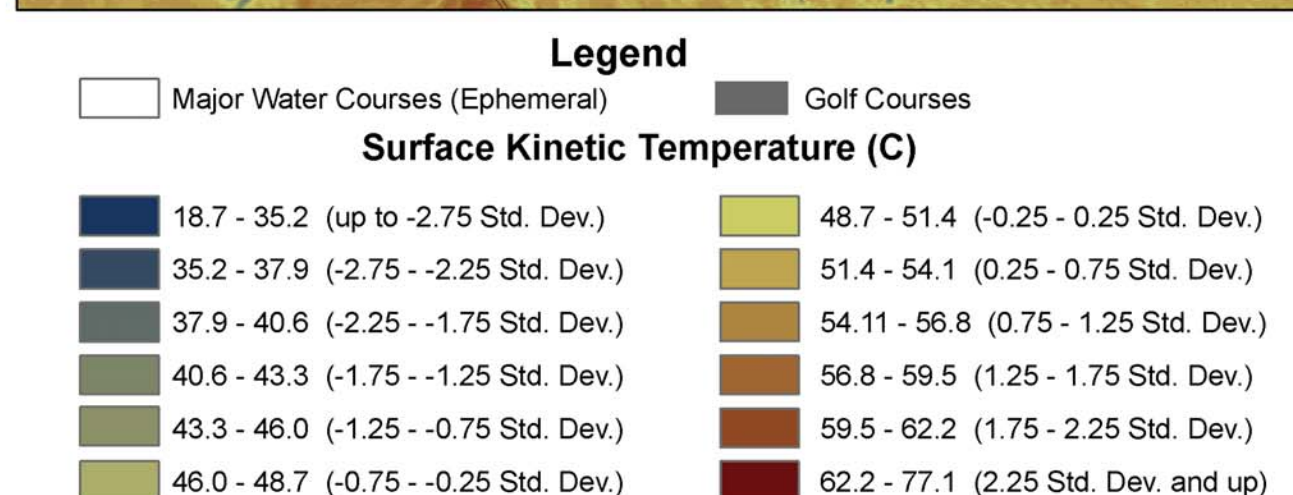
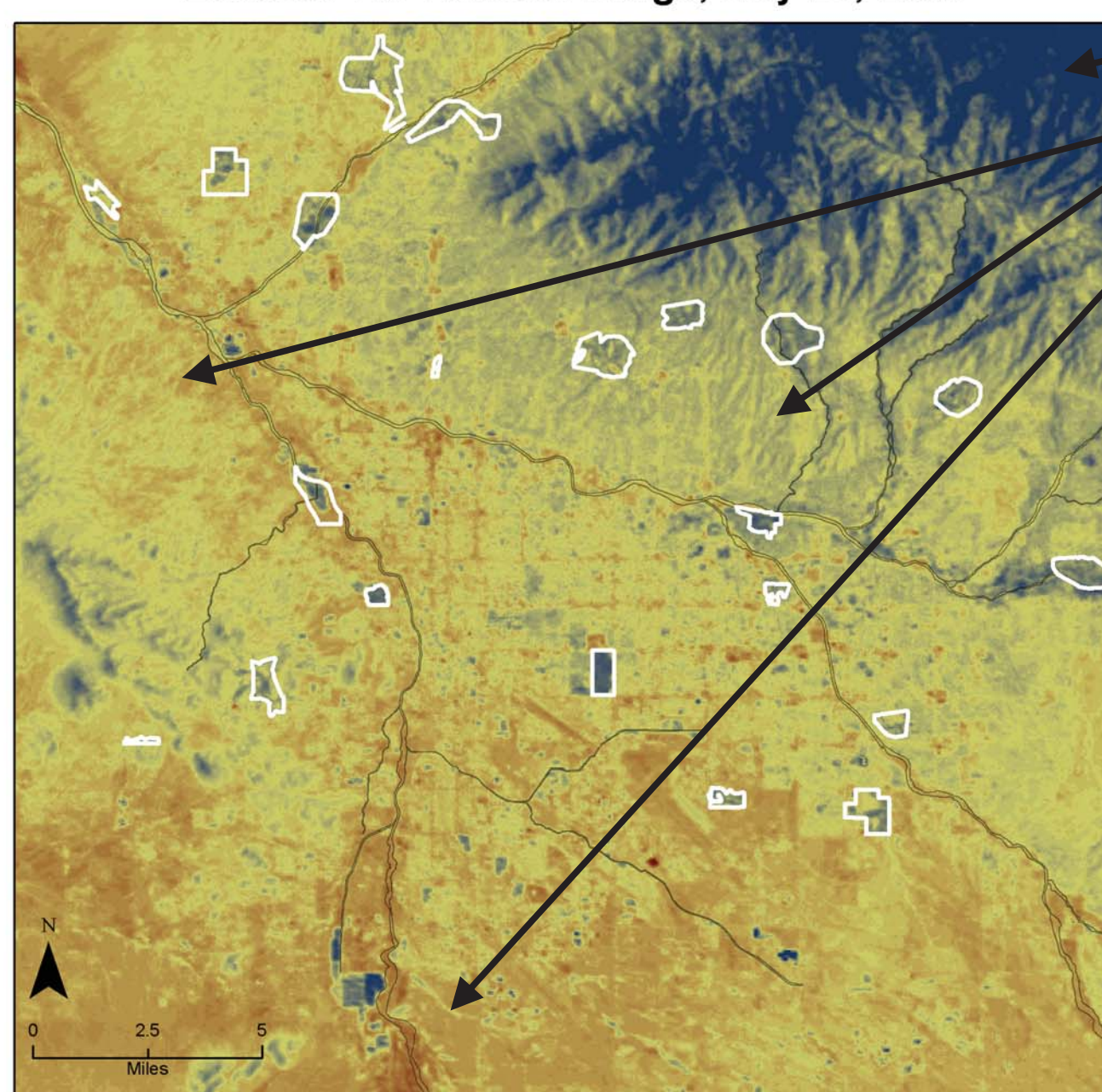


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Results: Many quarter-sections had declines in total water use, but also became greener. Is this due to the presence of established, rain-fed vegetation, especially trees?



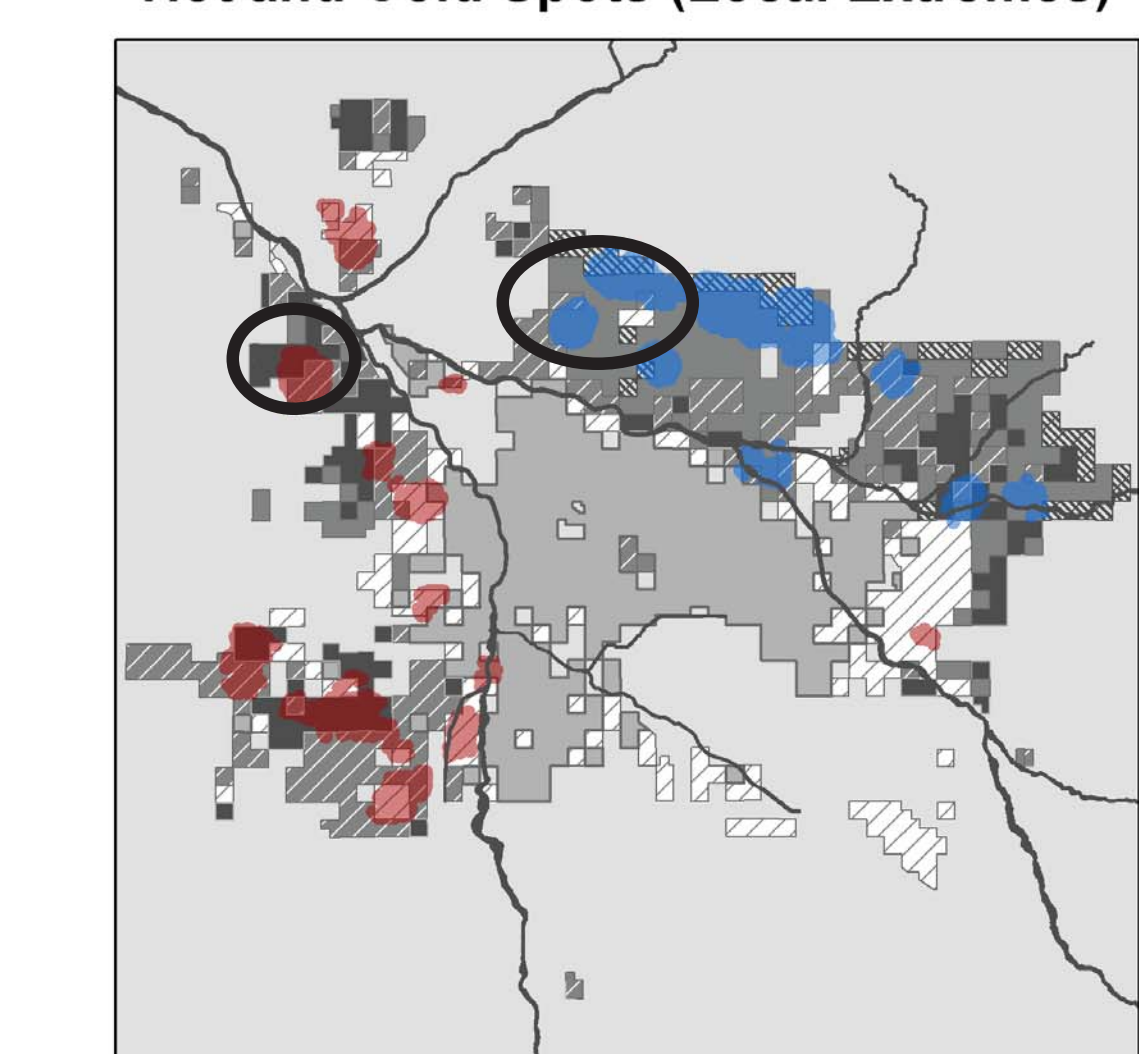
Landsat TM Thermal Image, May 28, 2008



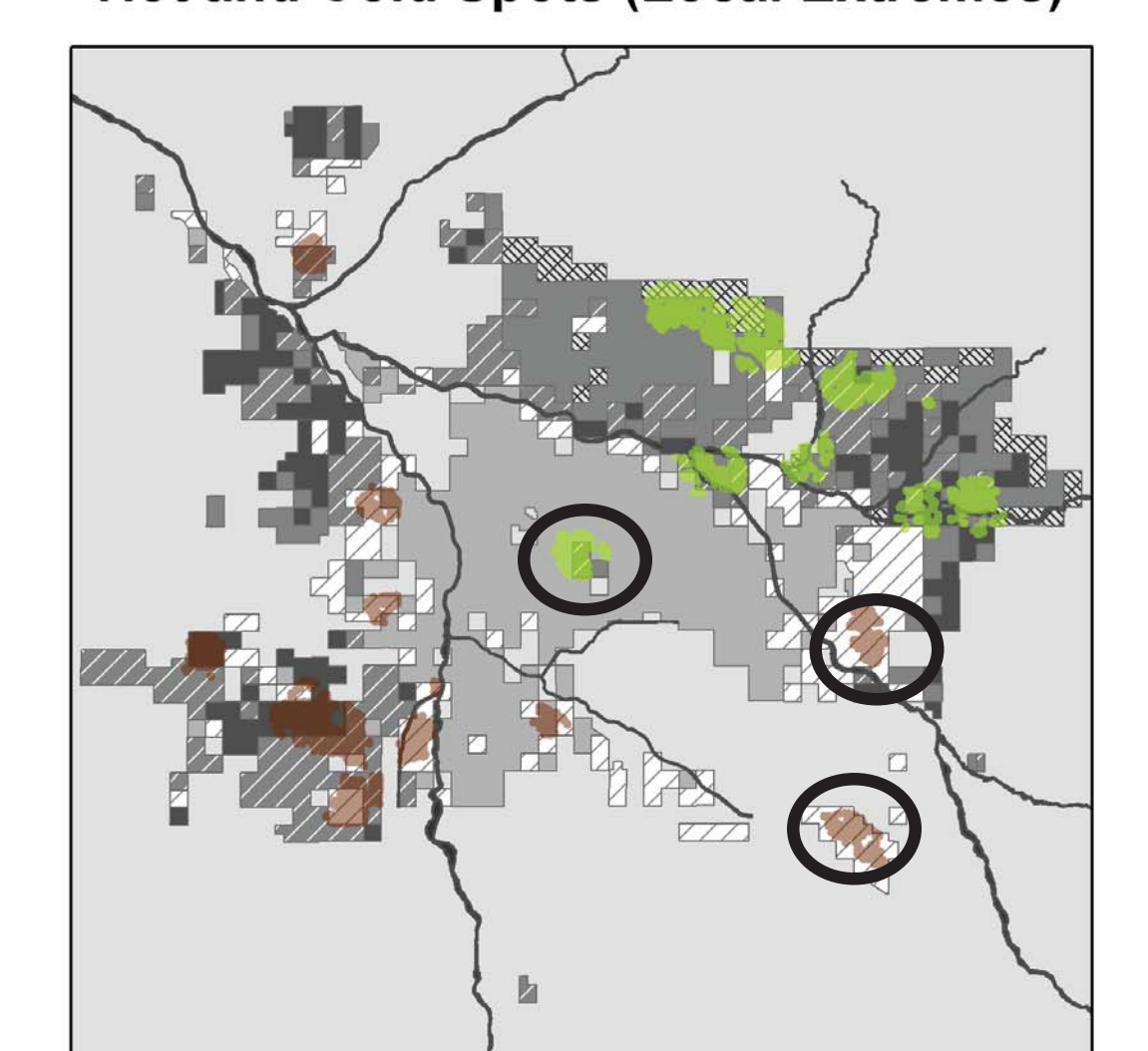
Where are the hot and cold spots in the Tucson Metropolitan Area?

Cool—Mountains, riparian areas, golf courses and parks.
 Residential areas may be hotter or cooler than undeveloped areas.
 Hot—Street intersections, airports, landfills, dry river beds

May 28, 2008 Surface Temperature Hot and Cold Spots (Local Extremes)



May 28, 2008 NDVI Hot and Cold Spots (Local Extremes)



Temperature and NDVI hot-spots sometimes, but not always overlap. Why?
 Cooling effects from mountains at the outskirts of the city
 Urban heat island effect inside the city