Los Angeles Urban Heat Island: Changing Land Use and Climate

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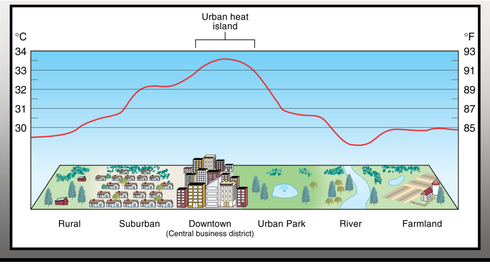
Introduction

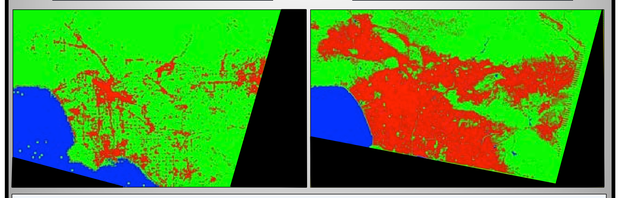
The Los Angeles urban heat island (UHI) is a complex changing entity. This study aims to analyze the UHI as it exists throughout the greater Los Angeles metropolitan area. Major influences on the UHI include population, land use, Pacific Ocean variability, weather, and climate. Downtown average temperatures have increased over the last century with minimum values increasing faster than maximum values, similar to other UHI cities. However the LA UHI is uniquely affected by California's diverse topography and microclimates. The city lacks well defined surrounding rural areas that are characteristic of a traditional UHI as vast areas of suburban sprawl spread out to the foothills of nearby mountains. Satellite imagery and remote sensing provides classification for land use throughout the region. Consequently, specific stations were chosen for analysis of patterns found in daily cooling rates between urban and suburban settings. Diurnal temperature data were aggregated from weather stations located throughout the study area for the past decade, and used to analyze the temperature differences between stations in order to identify the intensity of the UHI throughout the day. Land use change within the city possibly changes the intensity of the UHI. We consider possible mitigation efforts to minimize harmful heat island effects.

Urban Heat Island



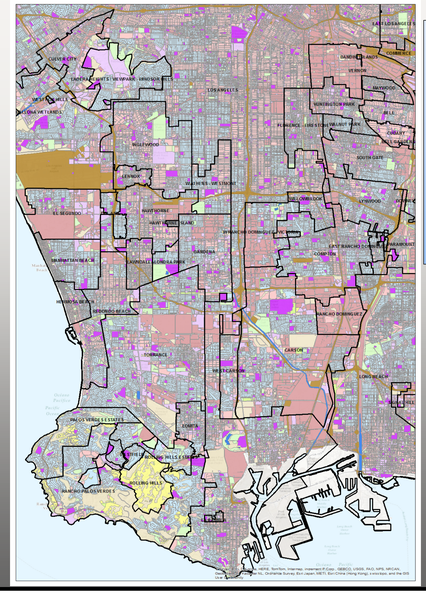
Land Use Classification

1972 | 2010



Urban (red) Non-urban (green)Water (blue) No Data (black)

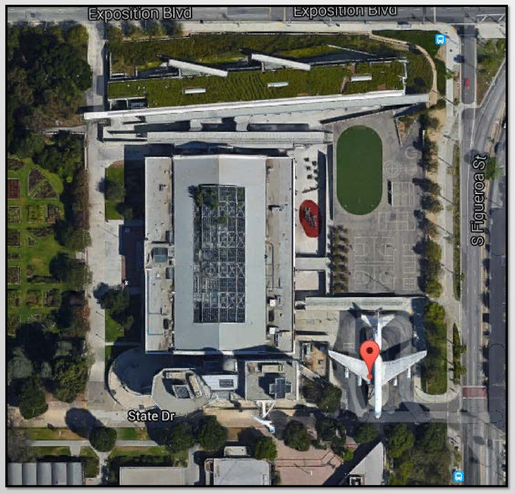
Current Land Use



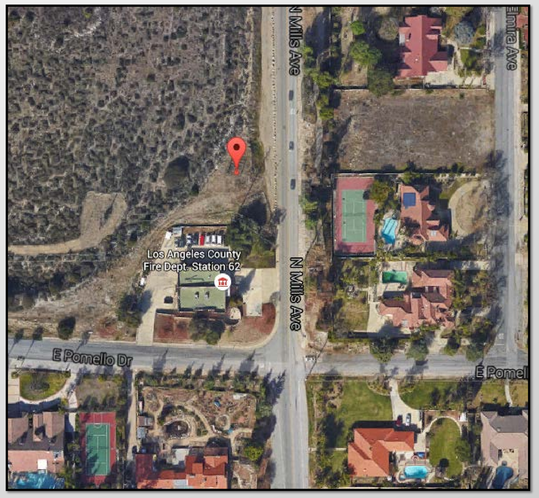
During the period 2000 to 2012, open space and vegetation has decreased 28% in the urban areas.

Urban & Suburban Weather Stations

Current Downtown Los Angeles (USC)



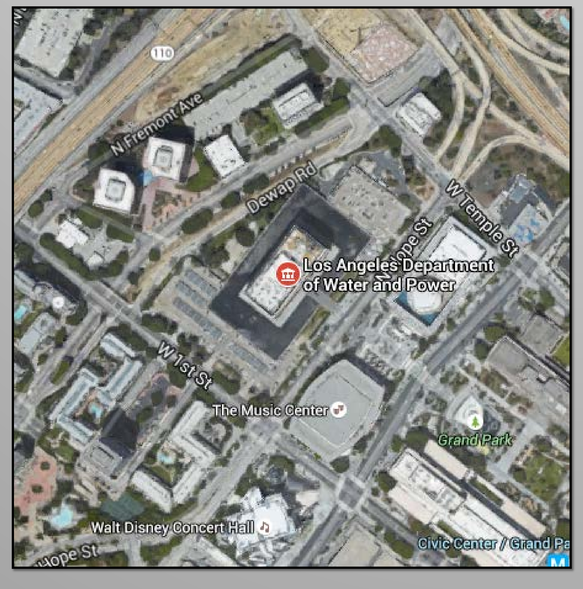
Claremont (CMT)



Average Temperature Difference [°F] (USC-CMT) June 2010

1am	7.6	1pm	-2.4
2am	8.2	2pm	-4.0
3am	8.7	3pm	-5.2
4am	8.9	4pm	-7.1
5am	8.8	5pm	-6.7
6am	9.4	6pm	-5.5
7am	5.7	7pm	-3.6
8am	1.3	8pm	-0.2
9am	-0.9	9pm	2.2
10am	-2.0	10pm	4.8
11am	-1.9	11pm	6.6
12pm	-1.6	12am	7.1

Previous Downtown Los Angeles



WILL THE REAL LOS ANGELES STAND UP: IMPACTS OF A WEATHER STATION'S RELOCATION ON CLIMATIC RECORDS (AND RECORD WEATHER)

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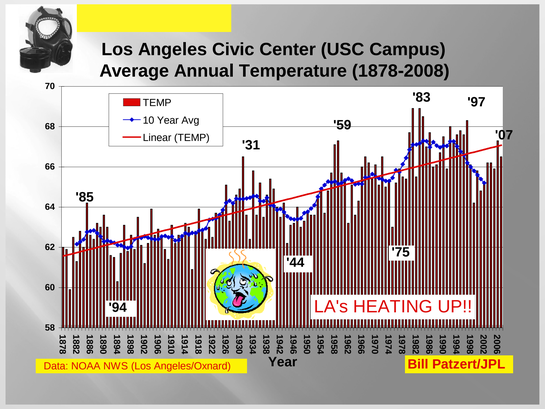
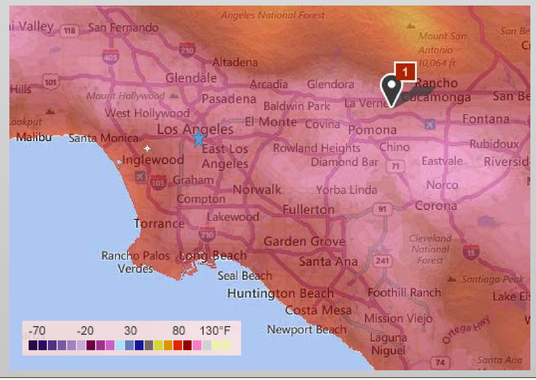
Aerial photos show the land use differences between the two sites. The USC site resembles a park, with tall shade trees just west of the instrument shelter. The shelter is also above a grass area. The DWP site is located on the roof of a 2-story downtown parking structure, with no immediate vegetation or obstructions. The DWP location is also closer to where one would expect the urban heat island peak.

By shifting the official downtown Civic Center station to a park-like environment about 6 km closer to the beach, there appears to be a discontinuity in the records. Maximum and mean temperatures are cooler, especially Tmax. Minimum temperatures are similar for the two sites.

Long Term TemperatureTrend



Southern California Temperatures 2pm 9/10/2015



Analysis

•Downtown Los Angeles' annual average temperature as well as Los Angeles county population trends are gradually increasing.
• The heat island effect is especially noticeable between the urban and suburban settings throughout the night.
•The urban station experienced a smaller temperature range than the suburban location.
•The heat island effect is not observed during the warmest parts of the day between the two selected stations .
•The change in location of the urban station possibly masks the reality of the temperature difference between stations during the day.

Future Research

•Compare results from the current downtown stations with data from previous years and the previous station.
•Analyze trends and changes in the minimum temperatures for the urban and suburban locations.
•Compare land use changes with warming trends over the LA basin.
•Recommend strategies to mitigate the impact of the UHI, particularly in hotspot areas.
•Incorporate wind data and analyzing the effects of onshore/offshore flows.
•Analyze how global warming impacts LA UHI.

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