Freeway Capping and the Urban Heat Island Effect: A Study of Boston's Rose Fitzgerald Kennedy Greenway

Urban Heat Islands

"A predominance of dark, impermeable surfaces and concentrated human activity cause urban surface, air, and atmospheric temperatures to be several degrees hotter than those in the suburban or rural surroundings" (Akbari 2005)

Solutions:
Green roofing/ alternative paving
Increased Green spaces
Decreasing exposed pavement

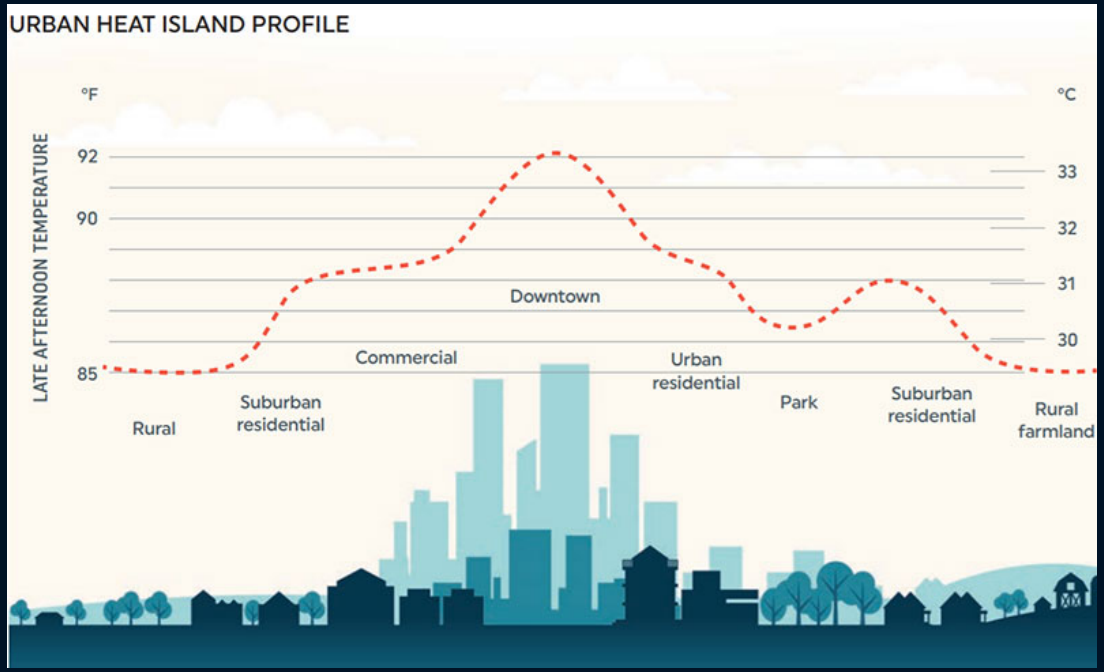


Image link

Akbari. 2005. Energy Saving Potential and Air Quality Benefits of Urban Heat Island Mitigation. Berkeley, CA: Lawrence Berkeley National Laboratory.

Research Question:

Does the Rose Kennedy Greenway reduce the Urban Heat Island effect in Boston?

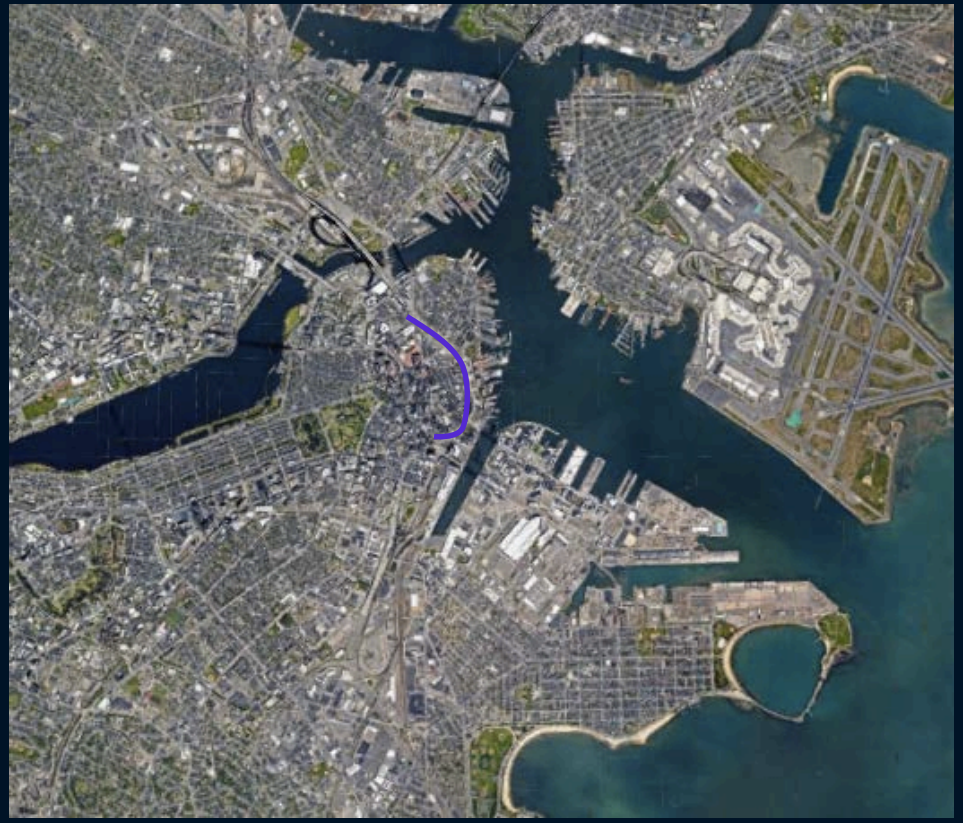
Study Area

Before (1997)

After (2010)

Image Link

Study Area



Satellite imagery from Landsat 8, Google Earth, Image link

Methods

Cropping to Study Area

- Landsat 5 TM

- Band 6 Thermal Imagery

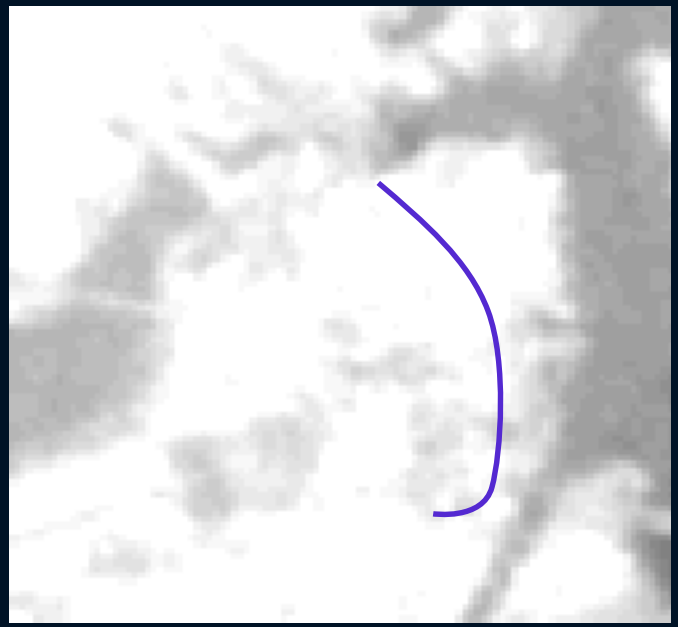
- Swath Cropped to study area around central Boston

Thermal Conversion

- Landsat 5 Thermal Data was converted to Temperature in Celsius

- Formula: $T = K2 / \ln(K1/Ll + 1)$
where:
T = at- satellite brightness temperature in degrees Kelvin
K2 = Band- specific thermal conversion constant from the metadata
K1 = Band- specific thermal conversion constant from the metadata
Ll = product of the Radiance formula

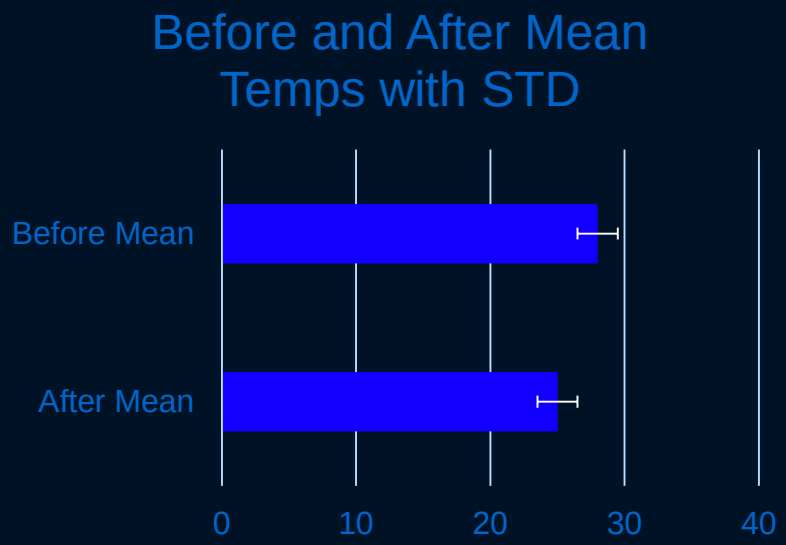
Imagery

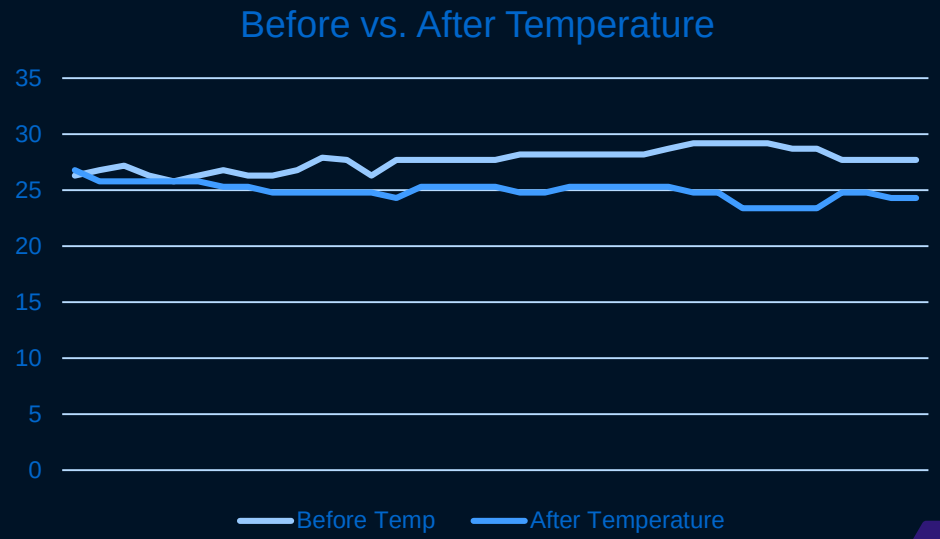


Before (1999)

After (2013)

Analysis


Before and After Mean Temps with STD
Before Mean
After Mean
0
10
20
30
40


Before vs. After Temperature
35
30
25
20
15
10
5
0
Before Temp
After Temperature

Conclusions

Heat Reduction

The Greenway did reduce the ground temperature in the area.

Cost

The Greenway cost $15 billion and took 15 years to complete.

Inequity

Maintenance and expansion benefits the affluent white residents of downtown Boston.

Nanos, Janelle. “The Greenway: In Need of a New Director and a New Direction,” *Boston Magazine*. December 18, 2012.