

Atlanta Case Study

Part 1: Using Thermal Images to Examine Urban Heat Islands

Atlanta has become a "heat island", soaking up radiant energy during the day and holding onto it at night. Data indicates that heavily developed parts of the Atlanta downtown area remain warmer than the surrounding areas, effectively trapping heat like a sponge holds water.

Look at the **Atlanta Case Study: Thermal Data Images** that were collected on May 11 and 12, 1997. The **top image on the left** is a **thermal image** of downtown Atlanta. The **top image on the right** shows the Atlanta area suburbs. Notice the **color differences** between the two images. **The color key is below the images.**

Observations:

1(a). What is the **primary (most prominent) color** on the "Downtown Atlanta Day Temperature" image? Red

(b). What temperature range does this correspond to? 85-100 degrees

(c). What features do you think produced this color? Roads, parking lots, and building surfaces

2(a). What are the **secondary (other) colors** on the "Downtown Atlanta Day Temperature" image?

Orange and yellow

(b). What temperature range does this correspond to? 65-75 degrees

(c). What features do you think produced these colors? Trees, grass areas, and shaded buildings

3(a). What are the **primary primary (most prominent) colors** on the "Atlanta Suburban Day Temperature" image?

Green and yellow

(b). What temperature range does this correspond to? 55-65 degrees

(c). What features do you think produced these color? Forested areas, established neighborhoods with large trees, park areas with grass fields

4. Where do you think "downtown Atlanta" is located on the "Atlanta Suburban Day Temperature" image?

Upper, right corner of the image

What evidence supports your claim?

This area is red in color, indicating a high heated area.

Look at the **bottom set** of thermal images. The **image on the left** is a **thermal image** of downtown Atlanta during the **day**. The **image on the right** is a **thermal image** of downtown Atlanta during the **night**. The **bottom image** is a **zoom-in thermal image** of downtown Atlanta during the **night**. Notice the **color differences** between the three images. **The color key is above the images.**

5. What features can you identify in the “**Downtown Atlanta Night Temperature**” images?

Clusters of the downtown buildings, sidewalks and roads are indicated by the orange color. Other roads outside of the central business district are yellow. The roads appear a prominent yellow color in the green-colored residential areas outside of the downtown area.

6. Which image allows you to make more precise identifications of land uses? Answers will vary. Students may select the “day image” since some of the downtown buildings are white, indicating the highest heat on the temperature scale. The major highways outside of the downtown area appear red next to surrounding areas of yellow and green. Some students may state the night image since the roads appear a prominent yellow color in the green-colored residential areas outside of the downtown area.

7. Why do temperatures of roads remain warm at night and therefore very noticeable on the **night** images?

The asphalt materials of the roads absorb and retain heat much more than their surrounding materials.

Interesting fact: While daytime air temperatures on that date were only about 80 degrees (F), surface temperatures downtown reached as much as 118 (F). Nighttime air temperatures hovered between 50 and 55. But due to the “heat sink”, downtown surface temperatures hung on as high as 75 degrees.

Part 2: Using Land Use Maps to Examine Sprawl

Sprawl is a process in which the spread of development across the landscape far outpaces population growth. Sprawl is a significant environmental, social, and economic issue for many regions around the United States. Let’s examine sprawl in the Atlanta area.

Here is some population data for the downtown city limits of Atlanta:

1980 – 425,000 people
 1990 – 394,017 people
 2000 – 416,474 people
 2007 – 498,109 people

Here is some population data for the metropolitan Atlanta area:

1980 – 2,138,000 people
 1990 – 2,959,950 people
 2000 – 4,112,198 people
 2007 – 5,314,283 people

1. Between 1980 and 2007, how has the population within the **downtown city limits of Atlanta** changed?

It decreased between 1980 and 1990, and then gradually increased beyond the 1980 population level.

2. Between 1980 and 2007, how has the population for the metropolitan Atlanta area changed?

It has rapidly increased. It has more than doubled in population.

3. If a city area grows by more than 2 million people in a 20 year period, how do you think the land uses

of that area might change?

Land uses are significantly altered. Forested and agricultural areas are developed into commercial and residential areas.

Examine the **Atlanta Case Study: Land Use Classification Maps**. These maps show the land use for the metropolitan Atlanta area for the years 1973, 1983, 1992, and 1997. Look at the key. Forested areas are green, farmland areas are yellow and water is blue. Red and orange points indicate areas of population densities.


4. What has happened to the forest areas between 1973 and 1997? *It has decreased.*
5. What has happened to the cropland areas between 1973 and 1997? *It has decreased.*
6. What has happened to dense and sparse urban areas between 1973 and 1997? *They have increased.*
7. How is land use development related to forested areas?

As land use development for urban and suburban areas increases, forested areas decrease.

The changes you have viewed in these land use classification maps showing changes in Atlanta resulting from urban expansion due to **sprawl**. More people moving into the greater metropolitan area means that trees were removed to make way for new houses, roads, parking lots, office buildings, and shopping centers. Croplands (farms) are also converted into residential neighborhoods. This process of sprawl is clearly revealed on the maps.

Open the **Atlanta Area.kml** file in Google Earth. This is the metropolitan Atlanta area. Click the check box to turn on the **Road** layer. Explore the land features.

Identify the locations of the interstate highways in and around the city. (Interstates 285, 20, 85, 75, and 575).

Use the Ruler tool  on the top tool bar to measure the distances of these roads around the metropolitan Atlanta area. **Hint:** Click "**Path**" on the Ruler toolbox to measure I-285.

8. Describe the locations of these interstate highways.

The major highways come from outlying areas and converge to form a "belt" around the greater Atlanta area.

9. What do you observe about the land use near these highways?

Much of the land near the highways contains residential and commercial areas.

Interesting fact: NASA scientists are studying temperatures in Atlanta, Georgia, because many trees were cut as the city grew. Tree removal contributes to forming urban heat islands. Scientists estimate that Atlanta's vegetation and tree cover decreased by 65 percent between 1973 and 1993. The area of tree loss equals 153,781 hectares (380,000 acres).