

Heat Island Assessment and Mitigation Plan – Borough of Madison

12 May 2019

Assessing Madison Borough for “Hot Spots” Due to the Urban Heat Island (UHI) Effect

Urban heat islands are created when materials in built environments such as asphalt, concrete, and roofing, elevate the temperatures in particular areas. On hot summer days, these “hot spots” in our town can be more harmful for people, who need to work, recreate or travel outdoors. They can also elevate costs of electricity where additional cooling is required to keep indoor temperatures comfortable. While it is true that there are benefits to these warmer areas in winter, with trending upward temperatures, and longer durations of heat waves, the negative effects of peak high temperatures in hot spots, particularly for employees, elderly and children, make simple interventions in our built environment worth considering.

Additionally, the unique situation of our Borough’s ownership of our electric utility puts us in a position to benefit as a community to reduce peak summer loads. The price of our electricity is calculated based on the usage during peak summer days. Conservation during these days will reduce prices overall for the borough and all residents.

This document provides evidence of Madison Borough’s efforts to conduct a heat island assessment, and develop list of recommendations to mitigate heat islands and their impacts on vulnerable populations. We also demonstrate the involvement of relevant stakeholders in the development of our plan.

Key stakeholders are:

- The planning board
- Local public health officials
- The shade tree management board
- Environmental commission
- Commercial facilities located in urban heat islands
- Madison School Board
- Municipal staff, town administrator
- Town council

Evidence of UHI Effect in Madison Borough

Using land surface temperature (LST) maps from LandSat 8 satellite imagery, Sustainable Jersey provides a webmap interface to explore urban heat islands. The following image (Figure 1) was taken from the webmap application¹ to show land surface temperatures across our town. The purple and blue areas indicated cooler temperatures, and the yellow and orange areas indicate substantially warmer temperatures. The color range for the full New Jersey map is about 30 degrees Fahrenheit, ranging from 70 to 100 degrees. The colors transition in two-degree intervals. This particular image was taken June 25, 2016, 3:39pm, when the average air temperature was 83 degrees.²

From Figure 1, there are three main areas of concern. First, downtown Madison, where Stop and Shop and many other businesses are located is the largest and hottest heat island. Second, a parking lot in Giralda Farms, and third Madison High School are also heat islands. Figure 2 shows the tight correlation between tree cover and urban heat islands: by creating an overlay of 2013 Canopy cover from the National Land Use Map, it is clear that the urban heat islands in

¹ Sustainable Jersey. 2019. “New Jersey Heat Island Map.” ArcGIS April 2, Available online:

<http://www.arcgis.com/home/item.html?id=8557b6f11906438f800ab99378394236#overview>

² For residents, one way to interpret this map is to consider an afternoon around 83 degrees, where the parking lot at Shop and Shop or the Madison High School athletics fields feels more like the low 90s.

Madison have fewer trees. Last, Figure 3 characterizes social vulnerability in Madison. Generally speaking, social vulnerability is low in our borough compared to other parts of New Jersey.

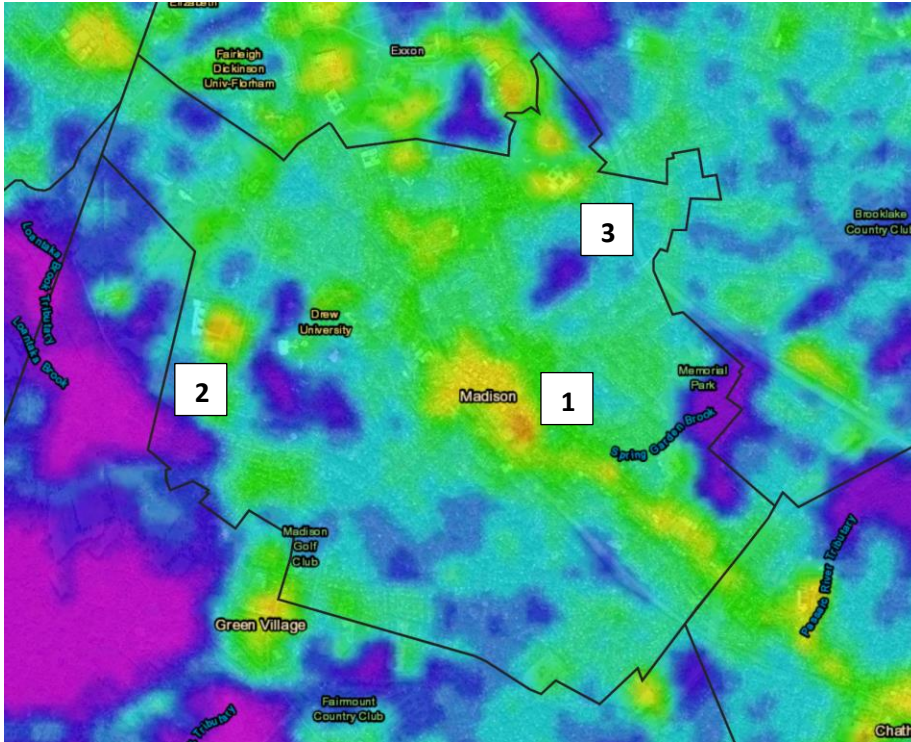


Figure 1. Land Surface Temperatures from LandSat 8: Yellow and Orange Indicates Hotter Areas

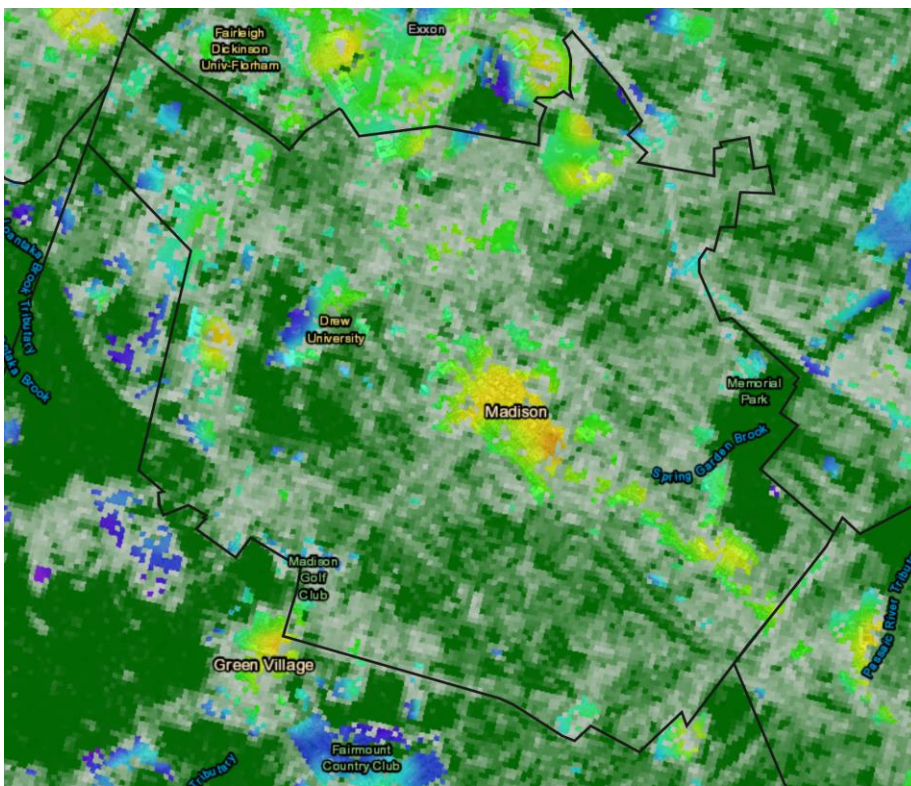
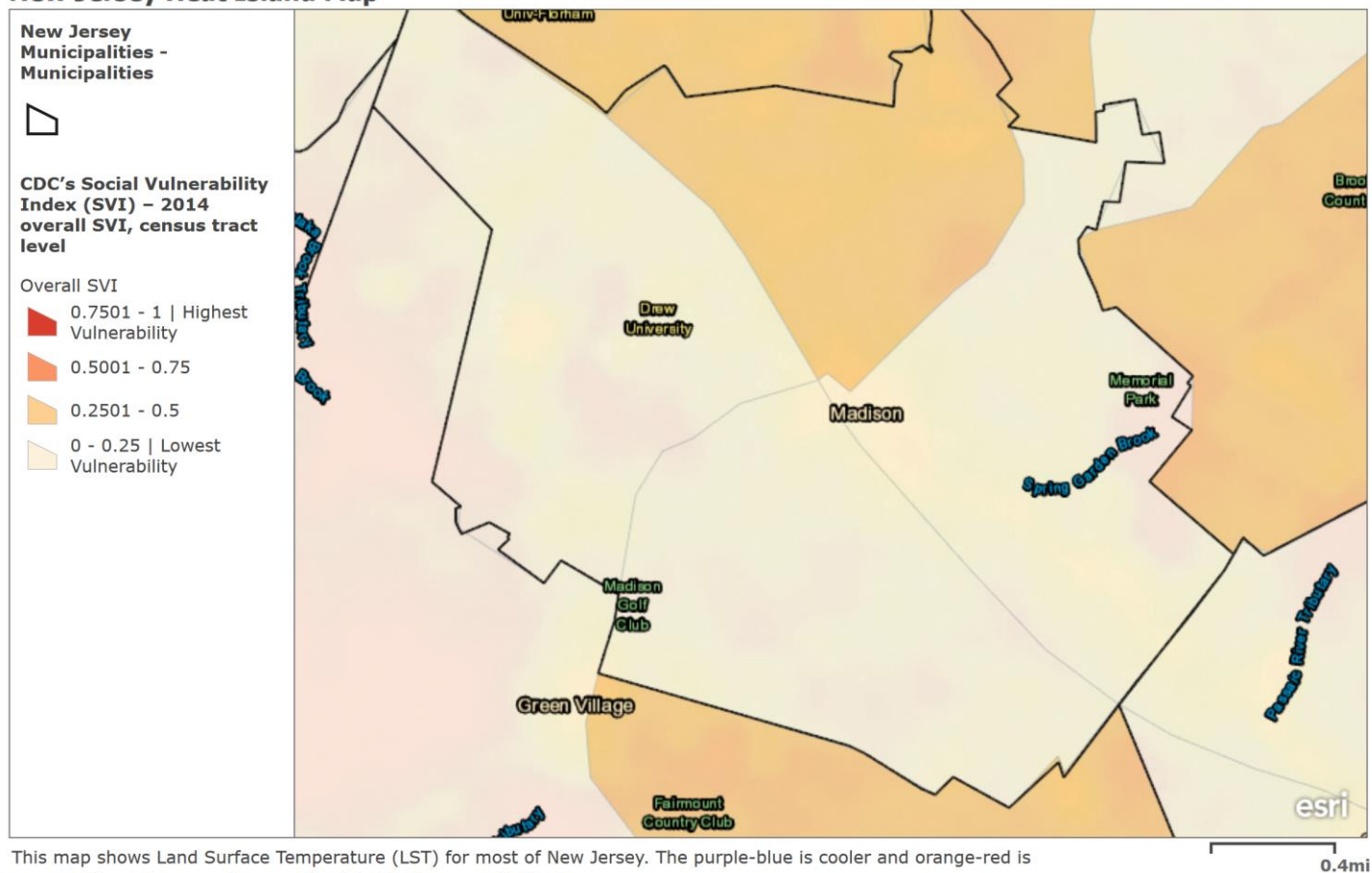


Figure 2. Canopy Cover from the 2013 National Land Cover Map Overlaying Land Surface Temperatures

New Jersey Heat Island Map



USDA FSA | Landsat 8 | CDC/ATSDR/Division of Toxicology and Human Health Sciences/Geospatial Research, Analysis & Services Program | State of New Jersey, Esri, HERE, Garmin | New Jersey Office of Information Technology (NJGIT), Office of Geographic Information Systems

Figure 3. Social Vulnerability Index for Madison, New Jersey

Profile of Hot Spots

Hot Spot #1: Prospect and Main Shopping Area

The first hot spot, located around Main Street, east of Prospect Street, is characterized by several businesses and a large parking lot that supports their customers and workers. The hot spot is an area with fewer trees, but the use of this area may make it difficult for planting new trees. Figure 4 below shows a Google Map of areas within the hot spot. However, it should be noted that most of downtown, along Madison Avenue is much warmer than surrounding areas.

Stop & Shop is located at 113 Main Street. Other businesses affected include Jaeger Lumber, Slamwich Scratch Kitchen, Weenies, Rose City Repairs & Service, Rose City Transmissions, Investors Bank, Gary's Wine & Marketplace, Enterprise Rent-A-Car, Nail salon, and Bank of America, among others. Figure 5 shows the larger area of downtown Madison affected by higher temperatures. Residents in Madison may find that areas around their homes are often 6-8 cooler than downtown.

Madison Borough: Urban Heat Islands

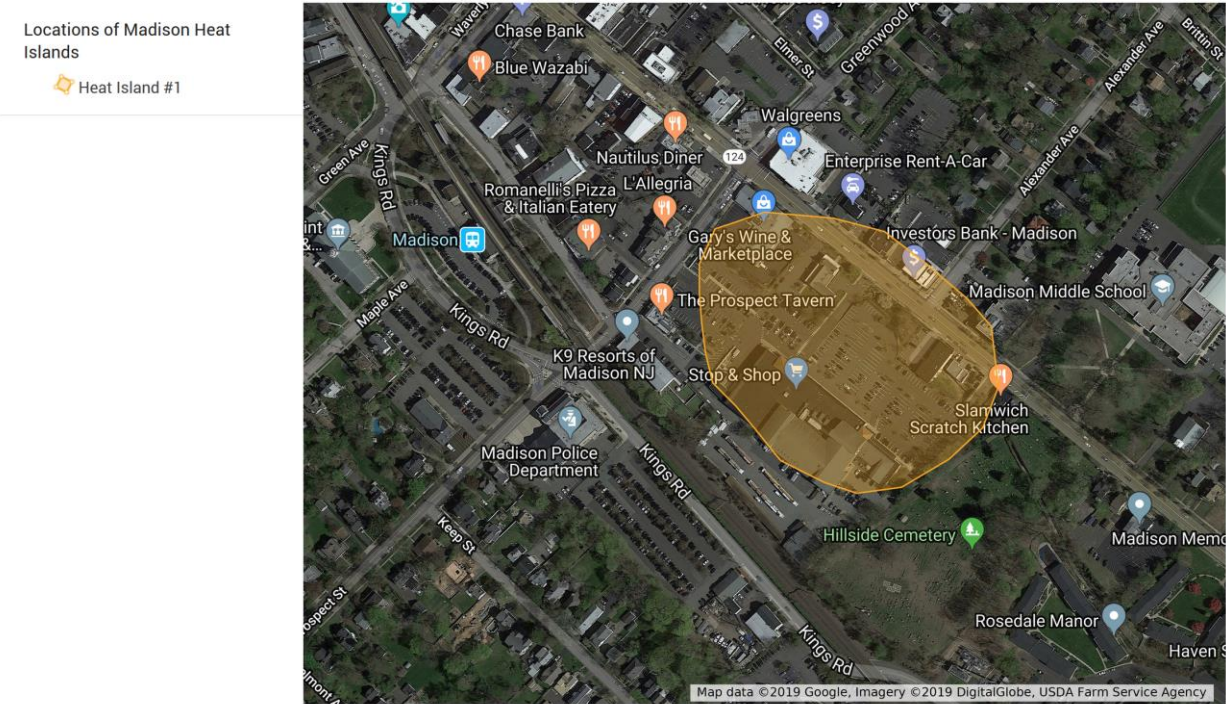


Figure 4. Google Map of Businesses within Warmest Urban Heat Island in Madison, Available [Online](#).

New Jersey Heat Island Map

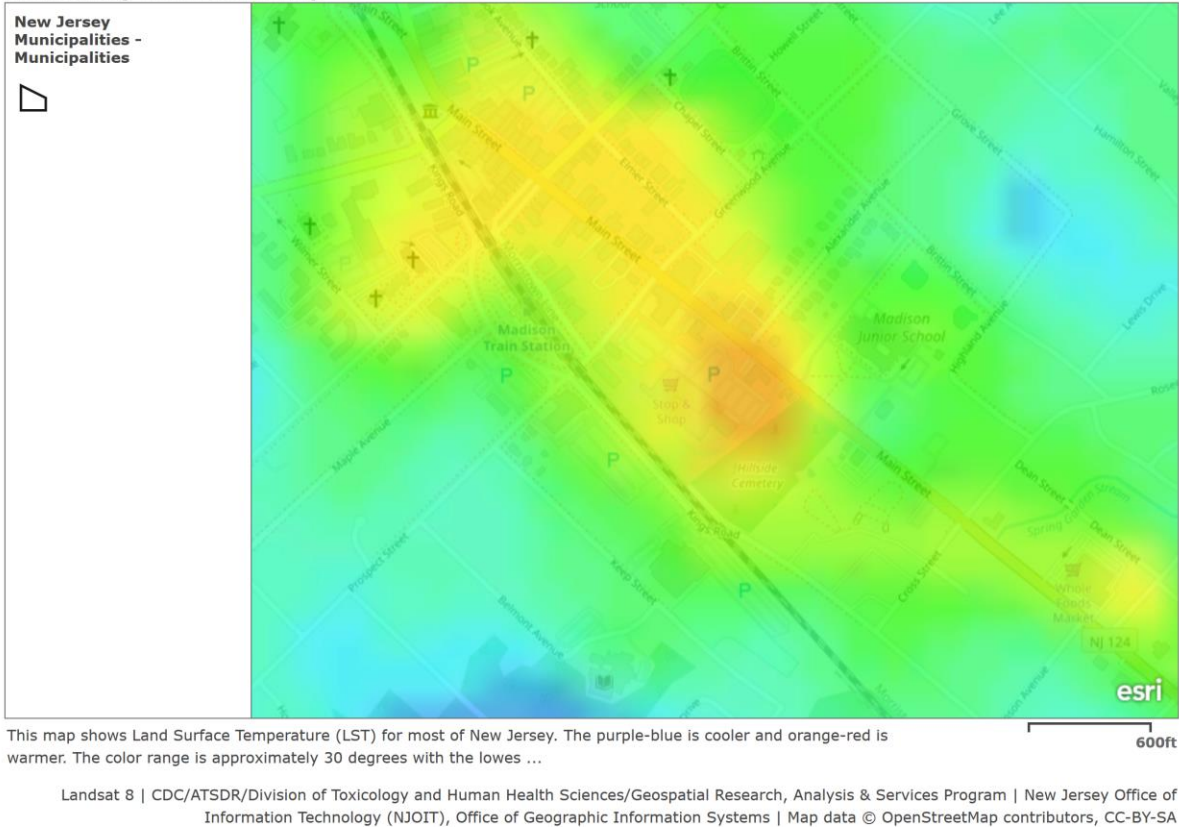


Figure 5. Madison Downtown Heat Effect

Hot Spot #2: Giralda Farms

The Giralda Farms hot spot is unusual in that it is near a parking lot, but is actually comprised of green space (see Figure 6). We learned during a presentation to the Shade Tree Commission that this particular heat sink is an underground parking lot. It is unfortunate that this particular green roof isn't serving to cool the area more. This may be an area worth re-reviewing when updated heat data are available, since it not clear if construction of this parking lot may have taken place on the date of the thermal image.

New Jersey Heat Island Map

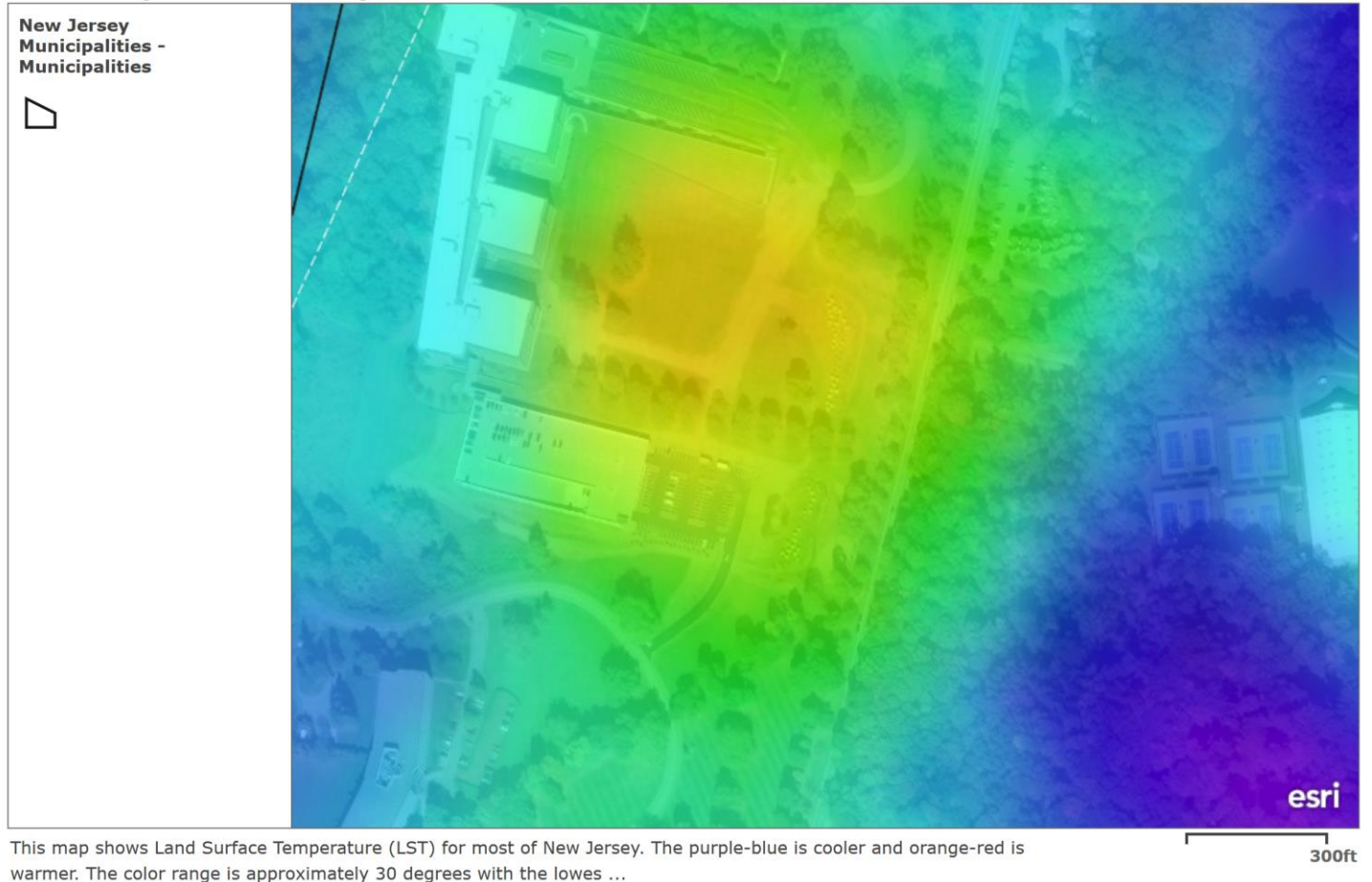


Figure 6. Geralda Farms Hot Spot Profile

Hot Spot #3: Madison High School

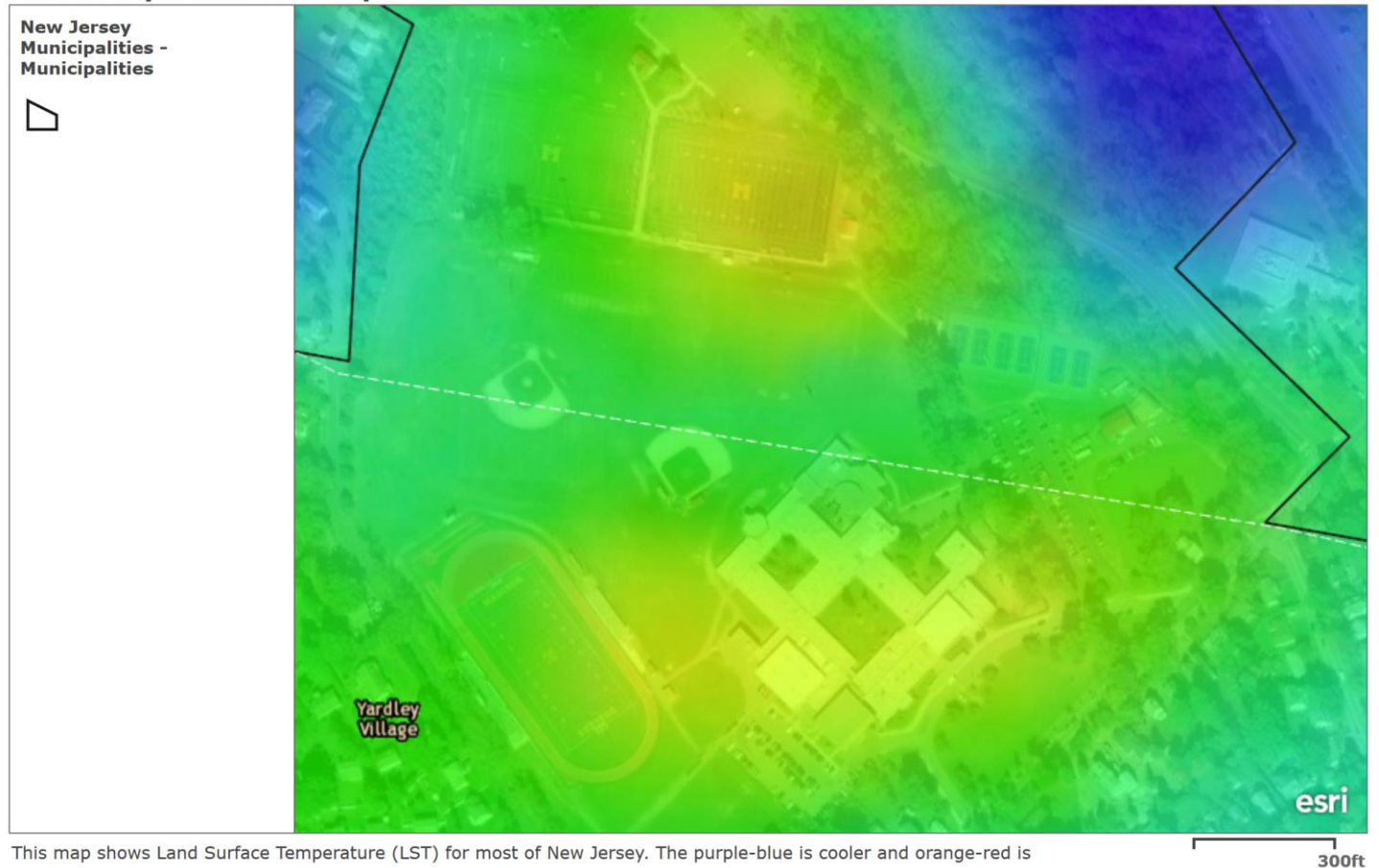
The last area of concern is Madison High School: particularly the athletic fields (see Figure 7). As stated previously, there are benefits to the heat sinks in winter, but the majority of health concerns related to temperature for student athletes focus on heat exhaustion in the summer. Both the football and track field are warmer than other areas of the campus by 4-6 degrees. While significant portions of campus are consumed by playing fields, there are areas that are currently grass, which may be suitable for new tree plantings. Synthetic turf fields absorb considerable solar energy, even reaching temperatures up to 160 degrees Fahrenheit.³ Adding heat island effects to the list of concerns about artificial turf may be useful to public health officials when advising among the many different health considerations that turf

³ Sustainable Jersey. 2017. Heat Island Assessment and Mitigation – Technical Guide. December 20. Available online: http://www.sustainablejersey.com/fileadmin/media/Actions_and_Certification/Actions/Heat_Island_Assessment_and_Mitigation/HIAMPAction_Dec20_2017B_Appendix.pdf

brings. Reviewers of this assessment shared that they used a heat gun to document temperatures of 140 degrees Fahrenheit on the field.

Madison High School is located at 170 Ridgedale Ave. Madison, New Jersey 07940.

New Jersey Heat Island Map



This map shows Land Surface Temperature (LST) for most of New Jersey. The purple-blue is cooler and orange-red is warmer. The color range is approximately 30 degrees with the lowes ...

Figure 7. Madison High School Hot Spot Profile

Moving Toward a Heat Island Mitigation Plan

Recommendations and Action List:

Hot Spot #1: Prospect and Main Shopping Area

Step #1: Information and Awareness:

Share information with stakeholders about the effects and concerns surrounding urban heat islands. Each business in the area should understand site specific and local options for mitigating excess heat, due to built-up environments.

Step #2: Recommendations

Painting roofs, greening roofs, and planting trees are recommended to help reduce very high surface temperatures. These solutions provide benefits in terms of reducing energy consumption in the summer, paying back the costs of heat remedies.

Hot Spot #2: Giralda Farms

Step #1: Information and Awareness:

Share information with stakeholders about the effects and concerns surrounding urban heat islands.

Step #2: Recommendations

Since this particular hot spot is currently a green roof, it is recommended that additional native trees and vegetation on the periphery may be planted to absorb excess heat of this specific site.

Hot Spot #3: Madison High School

Step #1: Information and Awareness:

Share information with stakeholders about the effects and concerns surrounding urban heat islands.

Step #2: Recommendations

Painting roofs, greening roofs, and planting trees are recommended to help reduce very high surface temperatures. These solutions provide benefits in terms of reducing energy consumption in the summer, paying back the costs of heat remedies. The health benefits for young athletes are of particular concern, so the heat island effect should enter into borough discussions of use of artificial turf on athletics fields.

Monitoring

Both bringing and keeping urban heat islands into the conversation about other development changes in the town or on the school campuses is important. The effect of urban heat islands elevates the importance of tree canopy, and raises concerns about recent canopy losses due to development. UHI also amplifies the importance of areas like the Madison Recreation Complex, where greenspace provides essential cooling to high school athletes.

Items to Monitor:

Canopy cover in heat islands: Shade Tree Commission, in collaboration with the Green Team
Number of Green Roofs and/or Painted Roofs in Effected Areas: Green Team

Adoption

Copies of these recommendations and communications will be forwarded to the town council, the environmental commission, and the Green Team for review and feedback.

Meetings with Stakeholders:

Tuesday, 14 May 2019, Green Team Meeting, 1:00-3:00pm, HDM Committee Room

Thursday, 16 May 2019, Shade Tree Management Board Meeting, 8:00-10:00am, HDM Committee Room

Thursday, 23 May, 2019, Madison Environmental Commission Meeting, 7:30-10:00pm, HDM Committee Room

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Additional meetings after June 2 submission deadline:

Tuesday, 4 June 2019, Planning Board Meeting, HDM Borough Council Chambers

Tuesday, 11 June, 2019, Board of Education, Public Meeting; 7:30 pm

Tuesday, 18 June 2019, Board of Health Meeting, 7:30, Madison Civic Center

The heat island assessment document will be amended, based on recommendations from stakeholders, and communications in meeting minutes will be posted on rosenet.org.