Bring on the Heat: How the Percentage of Tree Coverage affects the LST of Public Elementary Schools in Tarrant County

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Introduction

As global temperatures continue to rise, the urban heat island (UHI) effect becomes more severe. These extreme temperatures can negatively impact the health of residents, especially children, living in UHIs. Not only can high temperatures create health risks for children, but they can also interfere with children's education as some schools have reported closing on days with extreme temperatures. While several UHI mitigation strategies exist, one of the most widely accepted ones is green spaces. However, these have mainly been studied in the context of parks. This research aims to discover how green spaces, or more specifically canopy cover (CC) affects the land surface temperature (LST) of elementary schools.

Research Question

How does the percentage of canopy cover at 273 public elementary schools in Tarrant County, TX affect the land surface temperatures of those schools

Data and Methods

We wrote a code that extracted the pixel values of Tarrant County from Google Earth for the summer of 2023. The pixel values were then converted to LSTs using the Sofia Ermida model. I found a parcel file of Tarrant County, a file with the locations of the schools in Tarrant County, and a file with the CC of Tarrant County. I put all these files in ArcGIS Pro. I sorted the school file to only show elementary schools and selected the parcels that had the elementary schools in them. I added a 75ft buffer around the parcels to account for any trees in the nearby vicinity that could be affecting the LST. I clipped the canopy layer to the buffered layer. Then, I turned on the LST layer, found which day was least disrupted by clouds, and found the min, max, and mean LSTs for each elementary school. I exported a file with the percent CC, LST information, and identifying information. I opened this in google sheets and created multiple graphs from the data. I went back to ArcGIS Pro to zoom in on outlying schools.

Results





Parcel + Buffer + clipped CC a)



 Image: School area

 Image: School area

Florence EL (below the trend line) c)





Schools + LST

b)



0.03 0.05 0.1 Miles

Swift EL (above the trend line) d)



Discussion and Conclusions

There is a clear negative trend between percent CC and LST. This implies that elementary schools situated in UHIs should plant more trees in an effort to reduce temperatures on campus. Of course, there are many other factors that affect LST. I was reminded of this when observing outliers on the graph. The figure on the bottom left was well below the trend line while the figure on the bottom left, which had a very similar CC, was above the trend line. The CC around both schools appears to be very similar, and neither school is very close to a body of water. This implies that there were other factors causing some of the LST difference I observed. This information serves to show that simply planting trees isn't the only step that elementary schools should take if they want a cooler campus. While there are many factors that schools must take into account when thinking about how to reduce temperatures, planting trees is certainly a start.



Let's Talk Science High temperatures can create many problems for residents. Children are in a unique position as they are at increased risk for negative health effects due to high temperatures, and extreme heat can interfere with their education. Planting trees has shown to be one method of cooling areas. This study found that the higher the percentage of tree coverage at an elementary school, the lower the temperatures would be at that school. However, it also discovered that there were other factors contributing to the final temperature of the school.