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Okay, Hi everyone. My name is Caylie Sims, thank you for watching my presentation.

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I am a senior

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graduating in May with a degree in Environmental Science and a GIS certification.

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GIS stands for Geographical Information Systems. And this is my GIS Capstone. For this Capstone, I am examining redlining, tree canopy, and temperature variation, all of which I will define and examine throughout this presentation.

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So, let's get started. For this presentation, I'll have a quick introduction, my methodology, the results and the discussion and conclusion as well.

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So for the introduction, there's three things that you need to understand, the first thing is that there is this problem of extreme heat, as it is caused the most fatalities over the past few decades. And it disproportionately affects communities of limited resources and communities of color. So extreme heat causes death and it can also lead to worsening of certain diseases such as diabetes, or diseases relating to different systems within the body such as the nervous system, cardiovascular system, and can lead to increased cases of heatstroke and other things related to that.

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Moving on from extreme heat to urban heat islands. Urban heat islands are a phenomenon where extreme heat is able to live within urban areas. This occurs because there is an imbalance of manufactured surfaces such as concrete, or pavements to natural landscapes such as parks or green spaces in general. The third thing you need to understand is the concept of redlining, which began in the 1930s. So the Home Owners Loan Corporation, known as the HOLC, began to grade neighborhoods based on

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their ability to get a mortgage, how easy was it - was for these neighborhoods to get mortgages. And this was based on a couple of different factors, such as the quality of the buildings, what was located around or in the neighborhoods, so proximity to schools, businesses, and if they had sewer systems or water systems, but a big component of it was the makeup of

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the residents in terms of race and ethnicity. So let me define redlining really quickly. Redlining is the term to refer to this

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event of grading neighborhoods, but more specifically, it refers to D graded neighborhoods. And these are the worst neighborhoods. So when they were graded, neighborhoods were either given a grade of A which is the best B, C, or D, which is the worst and they were color coded on a map.

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D graded neighborhoods were given

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the color red, so they were given a red line around them, which is where the term redlining come from. So when I refer to a red line neighborhood, I'm talking about D graded neighborhoods and non red lined neighborhoods are A, B, or C neighborhoods.

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All of these pieces of information, so extreme heat, or urban heat islands, and redlining, all to come together in this paper by Jeremy Hoffman and several other authors. It's known as the effects of Historical Housing Policies on Resident Exposure to Intra Urban Heat: A Study of 108 US Urban Areas.

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So redlined neighborhoods have a higher land surface temperature known as LST compared to their non redlined counterparts. Within this study, they examined four regions the Northwest, Midwest, South and West. They found within the Southern and Western cities, there's a greater difference in LST between A graded neighborhoods and D graded neighborhoods.

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However, Midwest cities showed the least difference.

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So this Capstone kind of expands on the findings concerning the four regions so it explores the temperature variation between these four regions. Two cities from each of the four regions were examined in the context of tree cover. So one city had the highest LST difference between A and D neighborhoods.

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The other city had the lowest temperature difference.

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Tree cover

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Other forms of green space typically the lower temperature, so we'll find that

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in most instances, higher tree cover is located in A graded neighborhoods compared to other graded neighborhoods. So examining tree cover will shed some light on to whether the scale of temperature differences between regions are due to tree cover or an alternative reason such as policy.

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So, for this project, I pulled data from two different sources and uploaded them into ArcGIS, which I was then able to work with.

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So the first map or data I pulled from, it's known as Mapping Inequality. It's a website produced by the University of Richmond, in which they contain shapefiles for many different cities across the United States.

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So shapefiles are these little maps. And for each city, you have the entire city as a whole, and the different neighborhoods and their HOLC grade. So I pulled each city

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from the Mapping Inequality website. The other piece of data I used is pulled from the USA National Land Cover Dataset from the tree canopy cover data set in particular. So this is a raster composed of cells. And each cell has a specific category apply to it, which is the percentage of tree cover within that cell.

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So these are all the cities I looked at. You can see on the left, there's the region in the middle, there's the cities and the States, and the temperature difference it has. Portland, Oregon, has a high temperature difference. And then Seattle has a low temperature difference within the region. But as I mentioned before, west and south has the highest temperature difference in average compared to the other two.

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And Midwest has the least compared to the other three.

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So for my methodology, I first had to decide

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what categories of tree cover I looked at. So there are five categories in total, but I didn't want to examine all of them. So I chose to look at the two categories of the highest percentages of tree canopy cover. For almost all of the cities, this category was greater than 75%. But one city only had the category of 50 to 75% and not the greater than 75%.

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So with this information in mind, I had to geoprocess all the information in order to produce a table with the area of tree cover within each neighborhood. So each city was inputted into the first input, and then the HOLC grade field was inputted into the zone field. The third was the raster, tree canopy cover raster and the category was the canopy cover percentage category. And the processing size was left at the default.

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So after running that tool, for each of the eight cities, it output eight separate tables which contains the area of canopy cover in meters for each of the cities within each neighborhood in ArcGIS.

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So I export this to Excel using the Table to Excel tool. I did this just because it was easier for me to look at and analyze by color coding everything. And I was also able to calculate the mean area of category of canopy cover within each grade for the city. So you can see on the left is the raw data, what are GIS outputs, and on the right is a table with all of the means of the area of canopy cover.

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For this information, a new field was created in each of the cities attribute table known as TC AVR stands for tree canopy cover average, the values were added to each grade to map out the results.

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So for the results, this is the table

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in its entirety. And what I really want to look at is the D minus A values. So this is the difference in tree canopy coverage between D neighborhoods and A neighborhoods. I don't -

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there's two ways to look at these values. First, whether it's positive, or negative, and the intensity or how big the number is. So positive values within this field. mean that there's a higher mean area of

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dense tree canopy cover in D neighborhoods. While negative values indicate that it's a higher mean area of dense tree canopy cover is a neighborhoods. So if you look left to right, there's a pattern of

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negative, positive, negative, positive. And the temperature difference of the cities within a region is high, low, high, low. So we see that pattern. So positive D minus A values and low temperature differences are correlated with one another. Additionally, we can see that the greater

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areas like the regions with the greatest LST difference compared to the other regions, they have higher and bigger numbers. So there's more of a difference between the dense tree canopy cover in A and D neighborhoods. You can see that there's minimal tree coverage in D compared to A in Joliet, Illinois, which is the lowest

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city within the Midwest. But that's also the Midwest as a region has the least amount of difference in LST compared to the other regions.

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So there is a higher amount of tree coverage within D neighborhoods versus a neighborhoods in cities with low temperature difference.

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Within the regions, they have different sorts of differences. And the bigger than number is in difference, the greater the temperature variation is. So minimal difference in tree coverage leads to a lower difference in LST, comparing neighborhoods throughout all the regions. So this occurs in all the neighborhoods and it's beneficial to understand because we do have this issue of varying temperatures between cities within one region. So this means that separate communities such as resource limited communities, and communities of color are dealing with more heat, leading to more health effectsand possibly death. So we also see that trees are assisting in alleviating heat disparities. So this leads to the conclusion that trees are possibly a solution to the issue of urban heat islands and heat disparities.

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So with this idea of tree covers, can be implemented into these neighborhoods with higher temperatures.

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And there are pros and cons to adding tree coverage. So trees can really transform a neighborhood. So they cool down neighborhoods, which then reduces the cost of electricity bills, and also reduces risk of death and health issues.

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It benefits physical health, as it helps helps filter air pollution, and also benefits mental health as it reduces the stress levels of nearby residents. However, the one con is that when you add entry cover, there's a possibility of gentrification being accelerated. This then leads to long term residents being displaced.

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So I know that was a lot of information I just threw at you. And there's actually more information that I could have shared. But, this is a very dense topic. So I've created two separate proce-products, which allows you to explore this more on your own, you can just scan the QR code. But within ArcGIS, there's ArcGIS Online, which allows you to produce separate things, which allows users to interact with them separately. So I made a story map and a web app, and I'll go over those real quick. The story map is really more details. It's something you can take at your own pace. So there's all these different sections and reading, more explanations, basically the same presentation I have here, but it's more detailed, and actually see the maps I created and everything and it includes citations, which you can then examine yourself.

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Now, if we look at the web app, this one's more interactive. But it still holds a lot of detail. Doesn't look like much right now. But if you click on one of these bookmarks, you can zoom in automatically to any of the cities that I analyzed. Now, within each of these cities, you have the different neighborhoods, but if you click on one, you get a pop up which actually shows the original description of why the HOLC greater that the specific way.

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So you can read that those trends of growth in this area. It's underdeveloped on the west and has no sewage city sewer systems or water. You can do this for all neighborhoods within all cities. So if you would like more information, I highly recommend that you check those out.

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So these are all my sources. Again, thank you so much for

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watching my presentation. I really hope you enjoyed it. I really appreciate it and I hope you have a great day.