Exploring Connections between Low Albedo, Urban Heat Islands and Social Justice

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LEARNING OBJECTIVES:

- Describe albedo

- Recognize and identify situations and surfaces that have low and high albedo

- Collect and display images from urban settings that have high and low albedo

- Recognize systemic racism by learning about redlining, and observing the application of neighborhood redlining as an act of racism.

- Collect and display GIS data on Heat Severity, Socioeconomic Status Index, and Redlining Data using ArcMap Online

- Interpret and describe data for a neighborhood, and interpret the intersection between the three data sets (Heat Severity, Socioeconomic Status, and Redlining)

- Explore Heat Island Resources and connect with local government on measures and strategies to reduce heat island effects and assistance for residents in urban heat islands during excessive heat events

OVERVIEW:

This assignment is an introduction to the effect of the color of surfaces, and the result of color on how much heat a surface absorbs. Also known as albedo, urban areas have many dark colored surfaces, like roof tops, parking lots and roads, which have low albedo (high heat absorption). Urban areas are to as "heat islands" because they have higher annual average temperatures compared to green spaces, which have high albedo. Heat islands are dangerous and even deadly for urban residents under heat wave conditions. This exercise centers on learning about and applying albedo to urban situations. Other parts of the exercise apply and

interpret GIS data related to application and understanding of social justice issues related to heat island effects. GIS data on heat severity for one city is presented along with the context of historical redlining neighborhoods and current socioeconomic status to examine the financial-based challenges for urban citizens to cope with the combination of these factors. Solutions to heat island effects are explored.

BACKGROUND

Though this exercise centers on the important physical principle of albedo, or the amount of light that is reflected from a surface, we'll apply albedo and examine the effects of albedo on people. We'll examine the possible patterns of **where or place**: where someone lives, the heat severity, and income.

How could albedo affect people differently, when it's a property of a surface, and of circumstances? We'll explore how the answer to that question includes systemic racism as just one part of the explanation, along with other social justice issues like poverty.

Consider an extreme heat event where the temperature is so high that everyone needs their air conditioning on just to not become sick (or worse!) from the heat. During an extreme heat event like this, people living in poverty in an urban heat island must choose between using fans and air conditioners over buying food or other necessities, like medicine and medical care. Furthermore, there is a historical component to the problem, such that neighborhoods that are heat islands were formed by redlining, a form of systemic racism. These redlined neighborhoods lack measures, plans, policies, or funding to mitigate or change the many low albedo surfaces, or as you'll learn the extreme temperatures, that urban citizens are experiencing during extreme heat events.

Part 1: ALBEDO
What is Albedo?

Watch this video on Albedo
https://wpsu.pbslearningmedia.org/resource/buac912-sci-whatalbedo/whatalbedo/

Question1: In your own words, describe what albedo is. How is albedo measured, what is the scale of albedo? Be specific – does a white surface have high or low albedo? What about a dark blue surface? Use examples.

Low Albedo and Heat Islands

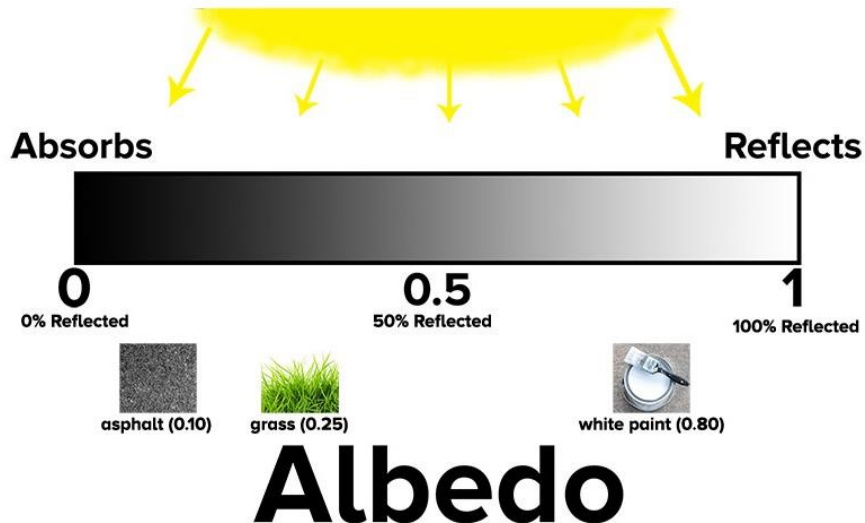**Question 2: Examples of albedo**

A) Present examples of images with high albedo and low albedo. Explain how you know. Use your own pictures, or search for pictures on the internet.

B) Provide at least 2 pictures from an urban or city environment for low albedo and high albedo. Describe the surface and its albedo. Explain why you classified the surfaces as high or low albedo.

C) TESTING OUT ALBEDO - If it is safe to do so. Put on a dark-colored t-shirt, over a white or light-colored t-shirt. Go outside on a sunny day. Record your observations for a few minutes while wearing the black t-shirt. Remove the black t-shirt and then record your experiences while wearing the white t-shirt. What can you conclude about color of clothing and albedo?

[Albedo image from Science Friday (Cooling down your playground)]

Learn About Albedo

Absorbs — Reflects

0 — 0.5 — 1
0% Reflected — 50% Reflected — 100% Reflected

asphalt (0.10) grass (0.25) white paint (0.80)

Albedo

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Part 2: REDLINING:
What is redlining? Redlining is just one form of systemic racism

In the United States we are learning about systemic racism, or racism that is built into the fabric of every-day living, services and events, and this form of racism limits individuals and their free will– our fellow citizens! In this exercise you will develop an awareness of redlining as a form of systemic racism, and the connection between redlining and heat islands.

Watch this video on Redlining

https://youtu.be/O5FBJyqfoLM

Watch this video on Redlining and heat islands

https://www.youtube.com/watch?v=uibxHzqZn-A

Question 3: A) Explain what systemic racism is. B) Explain what redlining is and how it is a form of systemic racism. C) What does "systemic" mean in this context?

Question 4: A) Summarize how redlining has created heat islands. Use the example of Portland Oregon from the "Redlining and Heat Islands" video, if it helps. B) If you live in or near an urban area, do you know of an area that might fit the criteria of a redlined neighborhood? If you are comfortable with sharing, please do so, otherwise no response to part B is required.

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Part 3A: CIRCUMSTANCES OF PLACE OR "WHERE"
Learning the GIS Data

For this part of the exercise you will familiarize yourself with spatial data, or data about people based on where they live. Below are the 3 types of data that you will make observations on individually, and then all together to understand the circumstances of urban heat islands.

<u>Read through the web pages linked to each of the 3 data types to gain an understanding and meaning of each panel below, and how to interpret the data.</u> **(Don't skip this step – it's super important!)**.

Data Type 1: Urban Heat Islands for US Cities
https://pitt.maps.arcgis.com/home/item.html?id=4f6d72903c9741a6a6ee6349f5393572

Knowledge check Data Type 1: Do you understand what the color red means and the color yellow means for this data set? Which color indicates low albedo, or warmer temperatures?

If you're not certain , it's best to re-read….

Data Type 2: Socioeconomic Status (NSES Index) by Census Tract, 2011 – 2015
https://pitt.maps.arcgis.com/home/item.html?id=2a98d90305364e71866443af2c9b5d06

Knowledge check for Data Type 2: Do you understand what the color dark purple means and the color light beige means for this data set? Which has a higher median income, purple or yellow/beige?

If you're not certain, then it's best to re-read….

Data Type 3: Home Owner's Loan Corporation (HOLC) Neighborhood Redlining Grade
https://pitt.maps.arcgis.com/home/item.html?id=ef0f926eb1b146d082c38cc35b53c947

Knowledge check for Data Type 3: Do you understand what the color red means and the color yellow means for this data set? What color indicator is used for "hazardous" neighborhoods? What color is used for "declining" neighborhoods?
If you're not certain, it's best to re-read….
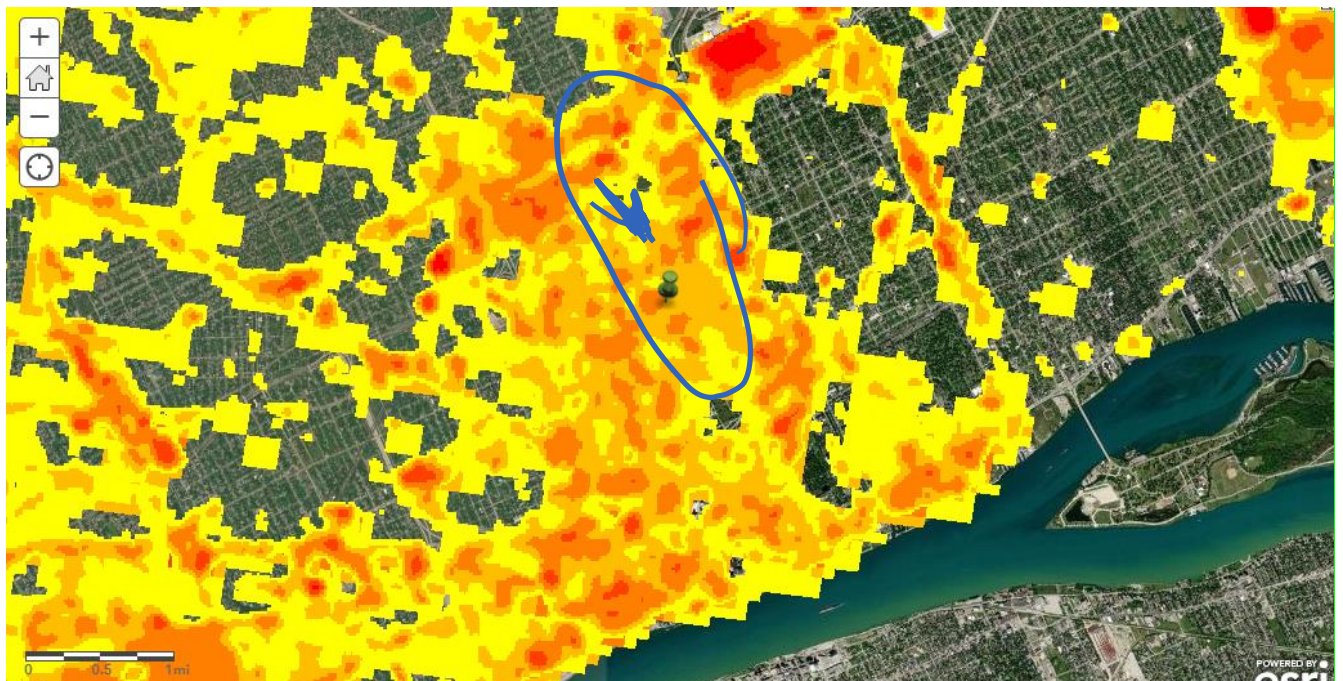
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CONGRATULATIONS! You've now completed your background training on these data types and how to interpret the data. You're ready to compare the 3 panels that are from a map of the south-east side of Detroit MI. This map can also be viewed and explored at this shared link

Part 3B: CIRCUMSTANCES OF PLACE OR "WHERE"
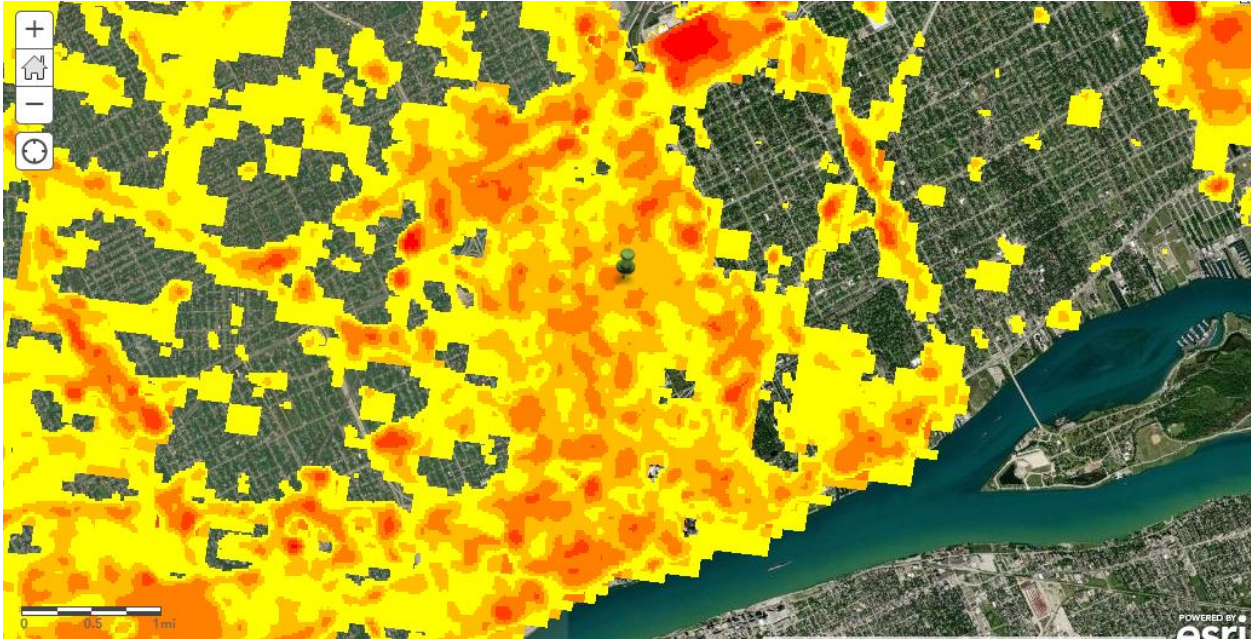## Interpreting the GIS Data

Start by making basic observations for the area near the green push pin near the center of each map panel. You may need to re-read the Data Type 1, 2, and 3 background pages if you are struggling.

This is an example of Panel 1 – for Data Type 1 to show you the location of the area you are observing for this exercise. (The actual map guide of the colors is in Panel 1 (below), this is just showing "where" in the blue circle at the point of the blue arrow). Now that you know where to look on each panel…proceed!

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Panel 1: Detroit MI: Urban Heat Island – Heat Severity

Search for and find the green push pin (see example on previous page), and make observations

Urban heat islands for U.S. cities

- 1
- 2
- 3
- 4
- 5

..

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Panel 2: Detroit MI: Socioeconomic Status (NSES Index) by Census Tract 2011-2015

Search for and find the green push pin (see example on previous page), and make observations. In this case, the information for the indicating color of the land tract (beige) is provided in the box below this map panel

(2 of 3)

Census Tract 5175, Wayne County, Michigan

This tract's Socioeconomic Status Index has a value of **34.9.** The Index is on a scale from 0 to 100 with 50 being the national average.
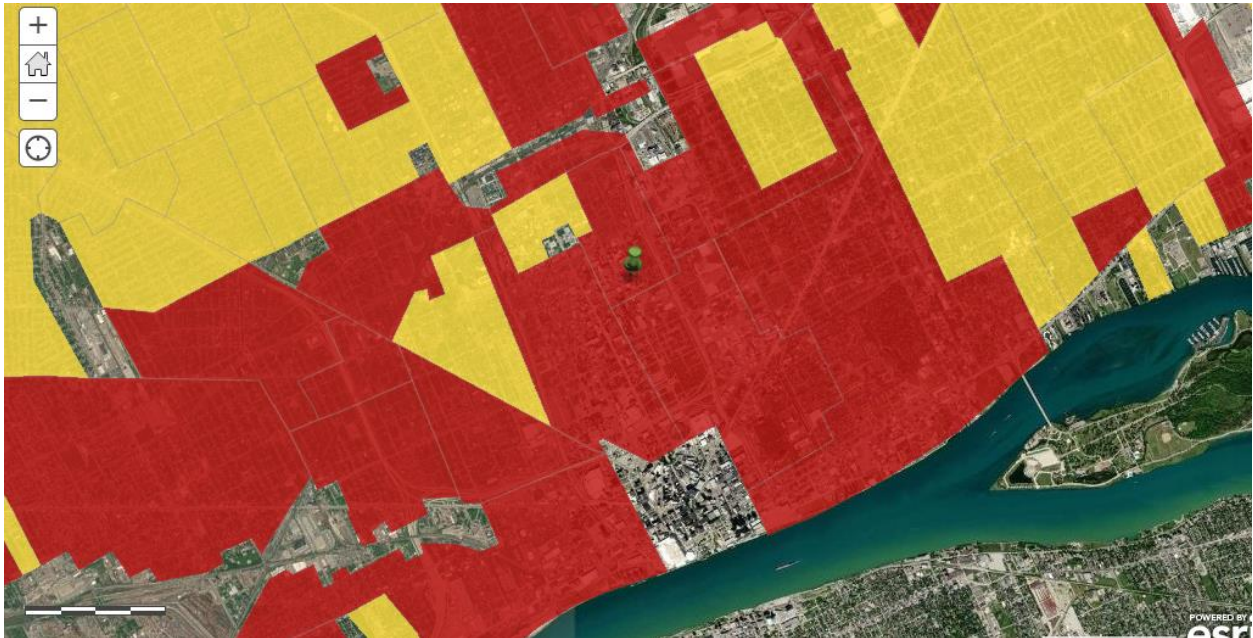
The Socioeconomic Status Index incorporates the following:

- *median household income*, which in this tract was $13,438.0
- percent of households with income *below the Federal Poverty Line*, which in this tract was 48.6%
- the *educational attainment of adults* (age

Zoom to   Get Directions

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Panel 3: Detroit MI: Home Owner's Loan Corporation (HOLC) Neighborhood Redlining Grade

Search for and find the green push pin (see example on previous page), and make observations. In this case, the information for the indicating color of the land tract (red) is provided in the box below this map panel

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Based on the three panels showing data on Detroit MI, please respond to these questions.

Question 5: Using the descriptors that you practiced with for each of the Data Types, what observations can you make about the location of the area of interest (neighborhood with the green push pin), in each of the 3 panels (Data Types):

a.) Data Type 1: Urban Heat Island – heat severity level for people who live in the neighborhood that the pin is marking

b) Data Type 2: Socioeconomic data for people who live in the neighborhood that the pin is marking

c) Data Type 3: HOLC neighborhood redlining grade for the neighborhood that the pin is marking

Question 6: Based on the observations that you made about the individual layers, how could you summarize your observations when considering all three data sets for the pin location? What conclusions can you draw in your summary about the circumstances of heat islands? (3 – 4 sentences)

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Part 4: Heat Island Resources and Solutions

Heat islands effects can be lessened, changed and avoided. <u>Visit this site on heat islands. Select and read up on one publication, resource, tool, or newsletter</u>.

Question 7: Provide the citation for the "Heat Island Resource" that you read and referenced to learn about heat island effects and solutions

Question 8: What is the most impactful solution or idea that you explored? Provide other links and data to any suggested additional information

Question 9: Write a summary of 3 to 4 sentences that you could post on social media platform that would inform your family and friends about the connections between low albedo, urban heat islands and social justice. (Don't forget to provide credit to your source in your posting!!)

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