Lesson Plan Three

Heat Sensitivity

Overview

Using ArcGIS Online, students will identify areas prone to urban heat in Cleveland, based upon landscape and vegetation. They will then identify three areas of heat sensitivity and explore the characteristics of those areas.

Estimated Time

60 minutes

Materials

Worksheet 1: Heat Sensitivity In Cleveland

Computers and internet

Learning Objectives

After completing the lesson, students will be able to:

- Identify where urban heat islands occur and the characteristics of urban heat islands
- Use geospatial technology to overlay data
- Recommend ways to reduce the effects of urban heat

Vocabulary

N/A

GIS Tools and Functions

- Overlay map layers
- Change the base map

Additional Resources

ArcGIS Online map: http://arcg.is/1qa0u8

Based on: Juan Declet-Barreto (2016). Heat Sensitivity in Neighborhoods in Urban Areas of Cleveland, OH. Web Mapping Application. http://dsugit.maps.arcgis.com/home/item.html?id=684d4d5569fd4eed9d018dd5cf557fbe

Opening the Lesson

1. Remind students that they have completed two lessons focusing on urban heat islands. In this lesson, they will have an opportunity to apply what they have learned and to explore the impact that varying levels of atmospheric heat have on people's lives.
2. NOTE: Complete A and B before showing the map of Cleveland to students: A) Open the internet browser and go to the link: http://arcg.is/1qa0u8; B) Click on Content in the left-hand column and uncheck the three sensitivity layers.
3. Project the resulting map on a screen. Indicate to students that this is a map of the Cleveland, Ohio area. Point out the City of Cleveland, for reference.

Developing the Lesson

4. Next show the map layer that contains landscape and vegetation. Mention to students that In order to show the map of landscape and vegetation, we need to change the base map. To do this click on "Basemap" and then click on "Imagery with Labels."
5. Distribute a copy of the **Heat Sensitivity in Cleveland** handout to each student. Have students fill in the answers on the handout, as you move through the lesson.
6. Ask students what patterns they observe in the landscape and vegetation map, based on what they already learned in this module, especially about the information contained in the landscape and vegetation map of Marion County, Indiana. Give students some time to write down what they observe about the Cleveland area, in the space following Step I on the worksheet.
7. Point out that whereas in the previous lesson, the focus was on heat vulnerability, this lesson focuses on one measure of heat vulnerability—heat sensitivity. Heat sensitivity measures the sensitivity of the population to heat-related illnesses, such as heat stroke, heat exhaustion, heat cramps, sunburn, and heat rash and to health conditions that are worsened by heat, such as obesity, old age, and diabetes. The higher the sensitivity score, the greater is the potential for heat related health risks.
8. Have students predict which towns and cities are located in three different zones of heat sensitivity—high, medium, and low, based on their answers to Step 1 of the worksheet. They should record their answers in the space provided in Step 2 of the worksheet. Students should also explain their reasoning for making these predictions—based on landscape and vegetation.
9. After students complete Step 2, have some students share their responses with the class. Students might mention that the city of Cleveland has a lot of gray, built up areas (high heat sensitivity). As you get farther from the city there is still gray but with a bit more green space such as in Shaker Heights, Brooklyn Heights, Lakewood, Brook Park, and Maple Heights (medium heat

sensitivity). Then when you get even farther out from the city there is a lot of green and vegetation such as in Westlake, North Olmsted, Seven Hills, Highland Hills, Beachwood and Cleveland Heights (low heat sensitivity),

10. Indicate to students that you are going to see if the students' predictions, for Step 2, were accurate. First, click on the high sensitivity layer, in the left column of the map, so that it can be overlayed on the map. This will show the area that has high sensitivity. Have students fill in the Actual column with cities and towns located in the red area.
11. Next turn on the medium sensitivity layer. Have students fill in the cities and towns in the yellow zone, in the Actual column.
12. Lastly, turn on the low sensitivity layer and have the students fill in the cities and towns located in the blue zone, in the Actual column.
13. Ask some students to share their predictions and how accurate they were, based on the data they collected for Step 2.

Concluding the Lesson

14. Indicate to students that there is more data that just the three areas of sensitivity on the map. Point out that the map is divided into census block groups, which they were introduced to in Lesson 2. Click on a census block group and view the data contained in the pop-up, as a class. Show students that there are five types of data: race/ethnicity, socio-economic status, age and social isolation, impervious surfaces, and unvegetated surfaces Show students that by hovering over each element of the graphs, you can find out what it says.
15. Divide the class into groups of two or three at a computer/laptop/tablet. Have each group go to the link and map showing sensitivity zones. Have the groups select three census block groups in each of the three sensitivity areas and record the data contained in each of the pop-ups in the space provided in Step 3 of the worksheet.
16. Have each group develop a summary of living and environmental conditions in each sensitivity area, based on the data contained in the pop-ups for the three census block groups they chose to examine in each of the three sensitivity areas. Have students record their summaries in the space provided in Step 4 of the worksheet.
17. Ask groups to share their data and summaries with the class.
18. As a class, spend some time brainstorming ways in which the conditions in the red zone could be altered so that people in that zone would be less susceptible to heat related health risks. (For example—providing fans for people without them, bringing in buses with air conditioning and showers, watering stations, having a service to check on older people in extreme heat situations, increase vegetation.)

Worksheet 1:

Heat Sensitivity in Cleveland

Step 1: Analyze and interpret the map of Cleveland.

Step 2: Fill in the answers.

	Predictions	**Actual**
Which cities and towns would have high heat sensitivity? How do you know this?		
Which cities and towns would have medium heat sensitivity? How do you know this?		
Which cities and towns would have low heat sensitivity? How do you know this?		

Step 3: Fill in the answers.

Census Block Group: _____

Total Population: _____

Sensitivity Rating: _____

Race/Ethnicity: % African American = _____ %Hispanic = _____ %White = _____

%Native American = _____ %Asian = _____ %Other = _____

Socio-Economic Status: %No A/C = _____ %Poverty = _____

%No HS Diploma = _____ %Not White = _____

Age and Social Isolation: % Living Alone = % Elderly =

% Elderly and Living Alone = _____

Percent of Impervious Surfaces: _____

Unvegetated Surfaces: _____

Census Block Group: ___________________
Total Population: ________________________
Sensitivity Rating: _______________________
Race/Ethnicity: % African American = _______ %Hispanic = _______ %White = _______
%Native American = _______ %Asian = _______ %Other = _______
Socio-Economic Status: %No A/C = _______ %Poverty = _______
%No HS Diploma = _______ %Not White = _______
Age and Social Isolation: % Living Alone = % Elderly =
% Elderly and Living Alone = _______
Percent of Impervious Surfaces: __________
Unvegetated Surfaces: ___________________

Census Block Group: ___________________
Total Population: ________________________
Sensitivity Rating: _______________________
Race/Ethnicity: % African American = _______ %Hispanic = _______ %White = _______
%Native American = _______ %Asian = _______ %Other = _______
Socio-Economic Status: %No A/C = _______ %Poverty = _______
%No HS Diploma = _______ %Not White = _______
Age and Social Isolation: % Living Alone = % Elderly =
% Elderly and Living Alone = _______
Percent of Impervious Surfaces: __________
Unvegetated Surfaces: ___________________

Census Block Group: ___________________
Total Population: ________________________
Sensitivity Rating: _______________________
Race/Ethnicity: % African American = _______ %Hispanic = _______ %White = _______
%Native American = _______ %Asian = _______ %Other = _______
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Age and Social Isolation: % Living Alone = % Elderly =
% Elderly and Living Alone = _______
Percent of Impervious Surfaces: __________
Unvegetated Surfaces: ___________________

Census Block Group: ________________

Total Population: ____________________

Sensitivity Rating: ___________________

Race/Ethnicity: % African American = ______ %Hispanic = ______ %White = ______

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% Elderly and Living Alone = ______

Percent of Impervious Surfaces: _________

Unvegetated Surfaces: ________________

Census Block Group: ________________

Total Population: ____________________

Sensitivity Rating: ___________________

Race/Ethnicity: % African American = ______ %Hispanic = ______ %White = ______

%Native American = ______ %Asian = ______ %Other = ______

Socio-Economic Status: %No A/C = ______ %Poverty = ______

%No HS Diploma = ______ %Not White = ______

Age and Social Isolation: % Living Alone = % Elderly =

% Elderly and Living Alone = ______

Percent of Impervious Surfaces: _________

Unvegetated Surfaces: ________________

Census Block Group: ________________

Total Population: ____________________

Sensitivity Rating: ___________________

Race/Ethnicity: % African American = ______ %Hispanic = ______ %White = ______

%Native American = ______ %Asian = ______ %Other = ______

Socio-Economic Status: %No A/C = ______ %Poverty = ______

%No HS Diploma = ______ %Not White = ______

Age and Social Isolation: % Living Alone = % Elderly =

% Elderly and Living Alone = ______

Percent of Impervious Surfaces: _________

Unvegetated Surfaces: ________________

Census Block Group: _____

Total Population: _____

Sensitivity Rating: _____

Race/Ethnicity: % African American = _____ %Hispanic = _____ %White = _____

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%No HS Diploma = _____ %Not White = _____

Age and Social Isolation: % Living Alone = % Elderly =

% Elderly and Living Alone = _____

Percent of Impervious Surfaces: _____

Unvegetated Surfaces: _____

Step 4: Write a brief summary of the living and environmental conditions in each sensitivity area, based on the data contained in the pop-ups.