Jason Park

February 12th, 2020

GEOG 461: Section AB

Assignment #4: Spatial Analyst:

Using Spatial Analyst to Determine Demand of Defibrillators in Pittsburgh, Pennsylvania

Purpose:

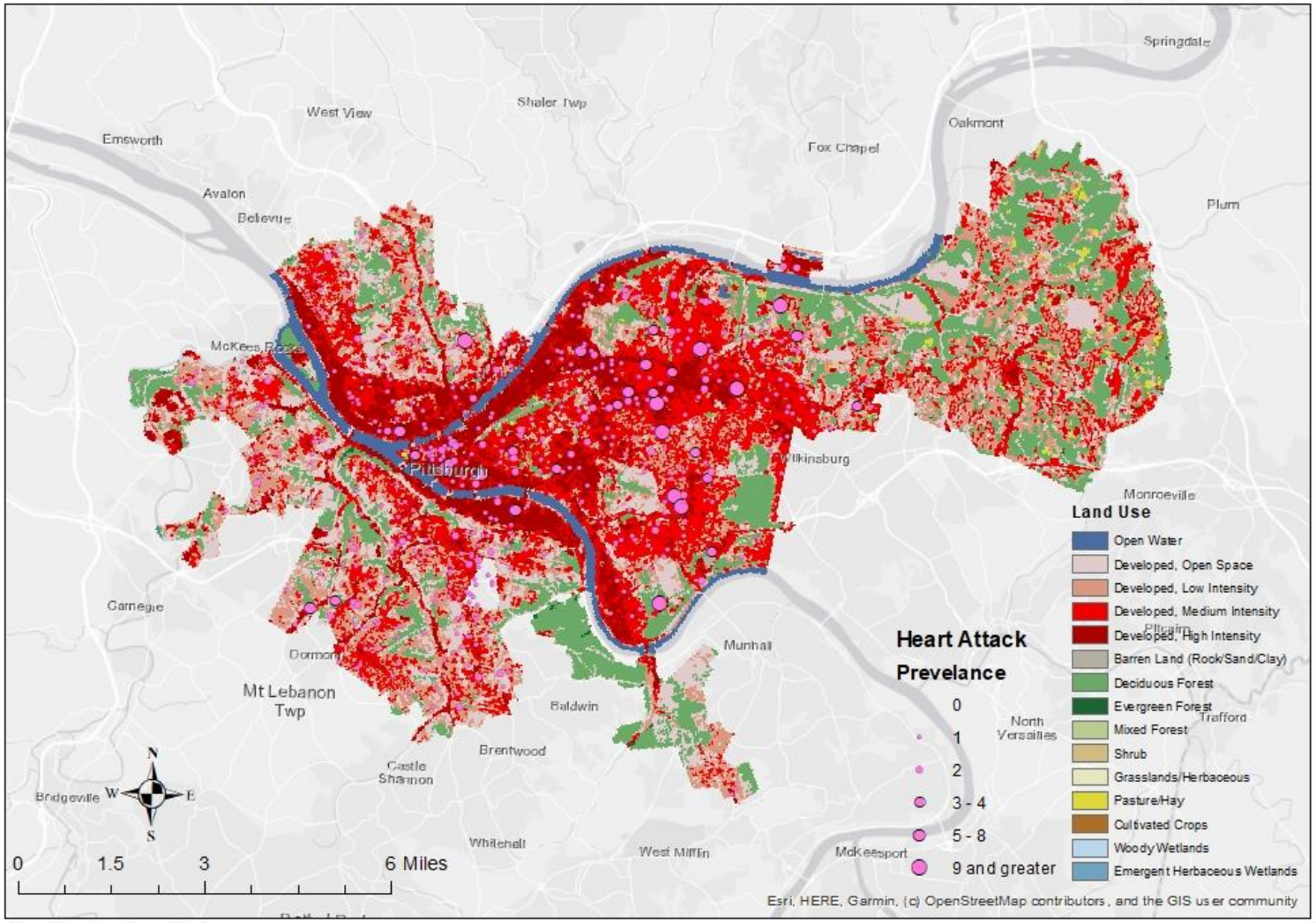
The purpose of this assignment is to create and map an estimate of future demand/need for defibrillators in public places in Pittsburgh, Pennsylvania, and too also understand what land factors contribute to heart attack prevalence in public places. Defibrillators are desired in areas where:

- Bystander help is available
- Land area is commercialized
- There exists a high demand for defibrillators

To map the estimates of demand for defibrillators, we will be utilizing the Spatial Analyst toolkit in ArcMap, and will use the functions within the toolkit to locate areas where defibrillators should be placed. In particular, we will be utilizing the Kernel Density Map function to produce a smoothed mean surface for the number of heart attacks per square foot in Pittsburgh, and use subsequent queries to locate public areas for potential defibrillator employment.

Figure 1

Heart Attack Incidence in Relation to Land Use in Pittsburgh, 2001



Map Creator: Jason Park
Creation Date: February 12th, 2020

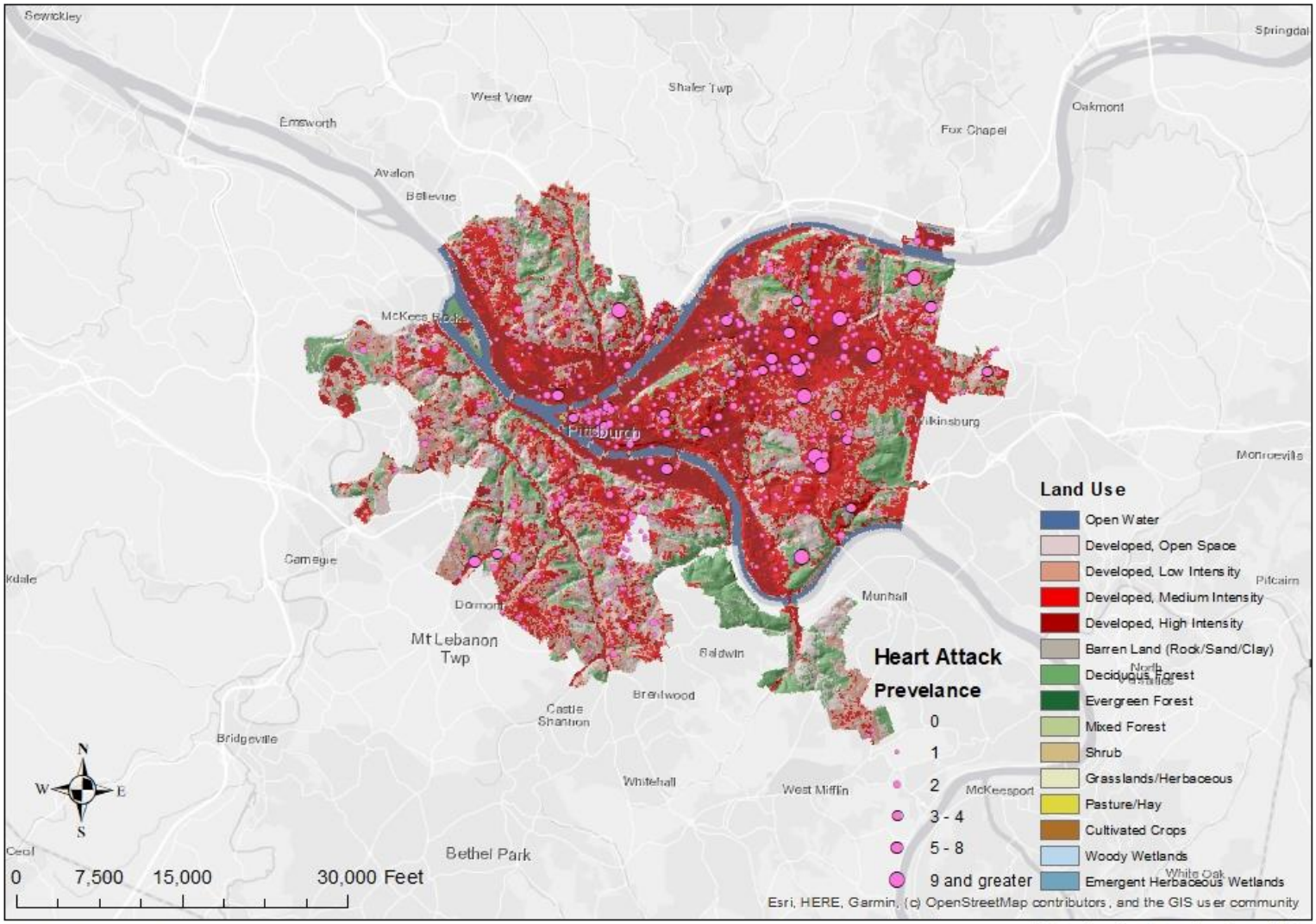
Projection: Lambert Conformal Conic
Data Date:2001
Data Source: US Geological Survey, National Land Cover Data 2001

Tutorial 9-1 Reflection:

In tutorial 9-1, we isolated and classified the different land uses inside the Pittsburgh boundary using the functions found in the Spatial Analyst toolkit. First, we formatted the environment for using the Spatial Analyst tools by setting the Pittsburgh boundary as a mask. This allowed us to clip the Pittsburgh boundary to the original raster map. Next, we extracted land use only within the Pittsburgh boundary by using the "Extract by Mask" function. This function separated cells inside the Pittsburgh boundary from cells outside the Pittsburgh boundary, and symbolized the cells inside the Pittsburgh boundary with their respective land use. This created a new layer displaying land use of areas within the Pittsburgh boundary called "LandusePgh".

Figure 2

Heart Attack Prevelance in Relation to Land Use in Pittsburgh, 2001 (With Hillshade)



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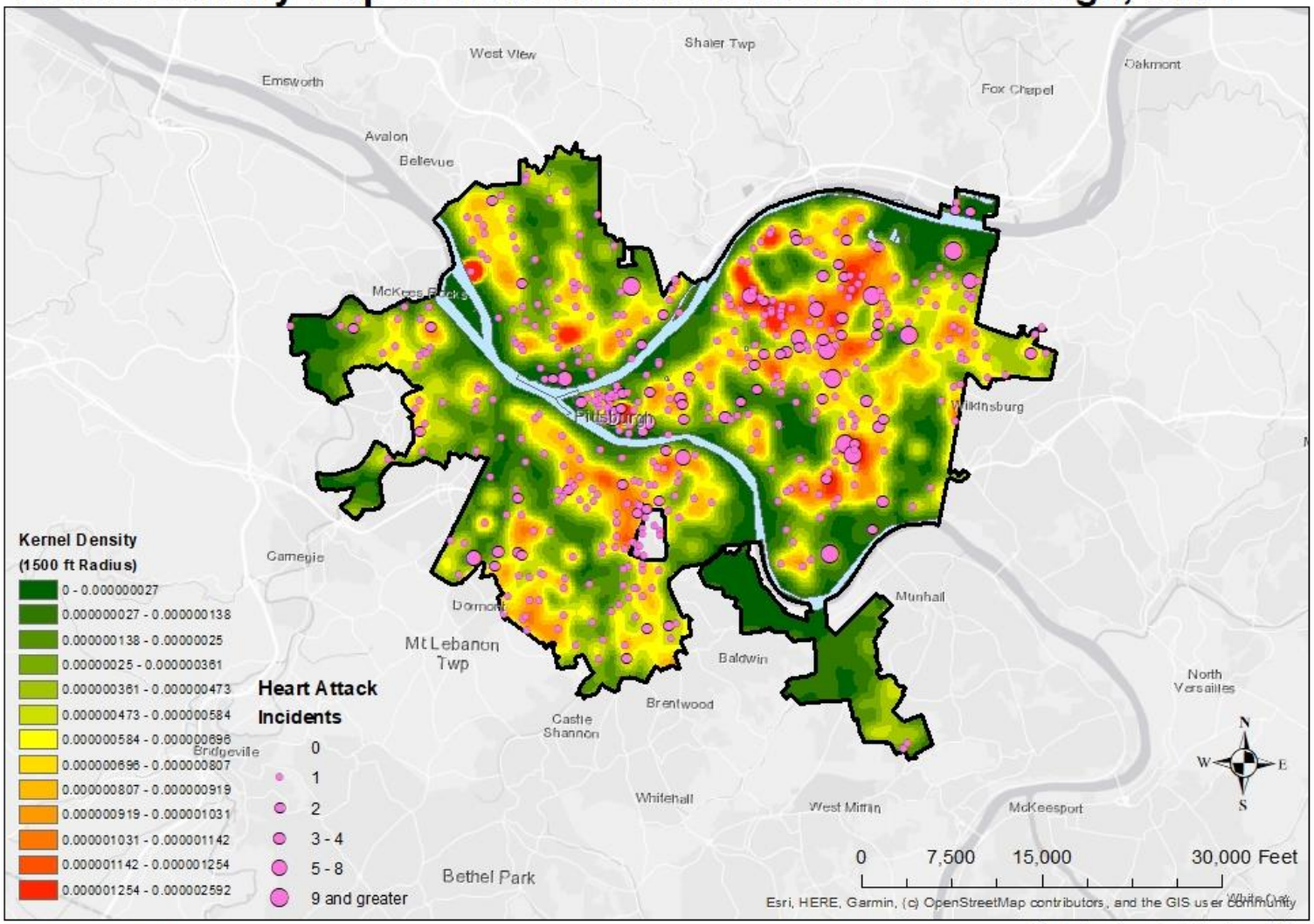
Tutorial 9-2 Reflection:

The purpose of tutorial 9-2 was to gain experience creating a hillshade raster layer, which better represents surface illumination from the real-world sun. Utilizing the Spatial Analyst extension, we used the "Hillshade" function to create a hillshade layer ("HillShadePgh") of the Pittsburgh boundary. We then moved the layer under the land-use layer, and changed the transparency setting of the land-use layer to 35%. By doing so, we were better able to better simulate conditions that are more reflective of a real-world scenario, and provide a map that provides good background for health data.

Figure 3

Kernel Density Map of Heart Attack Incidents in Pittsburgh, 2001



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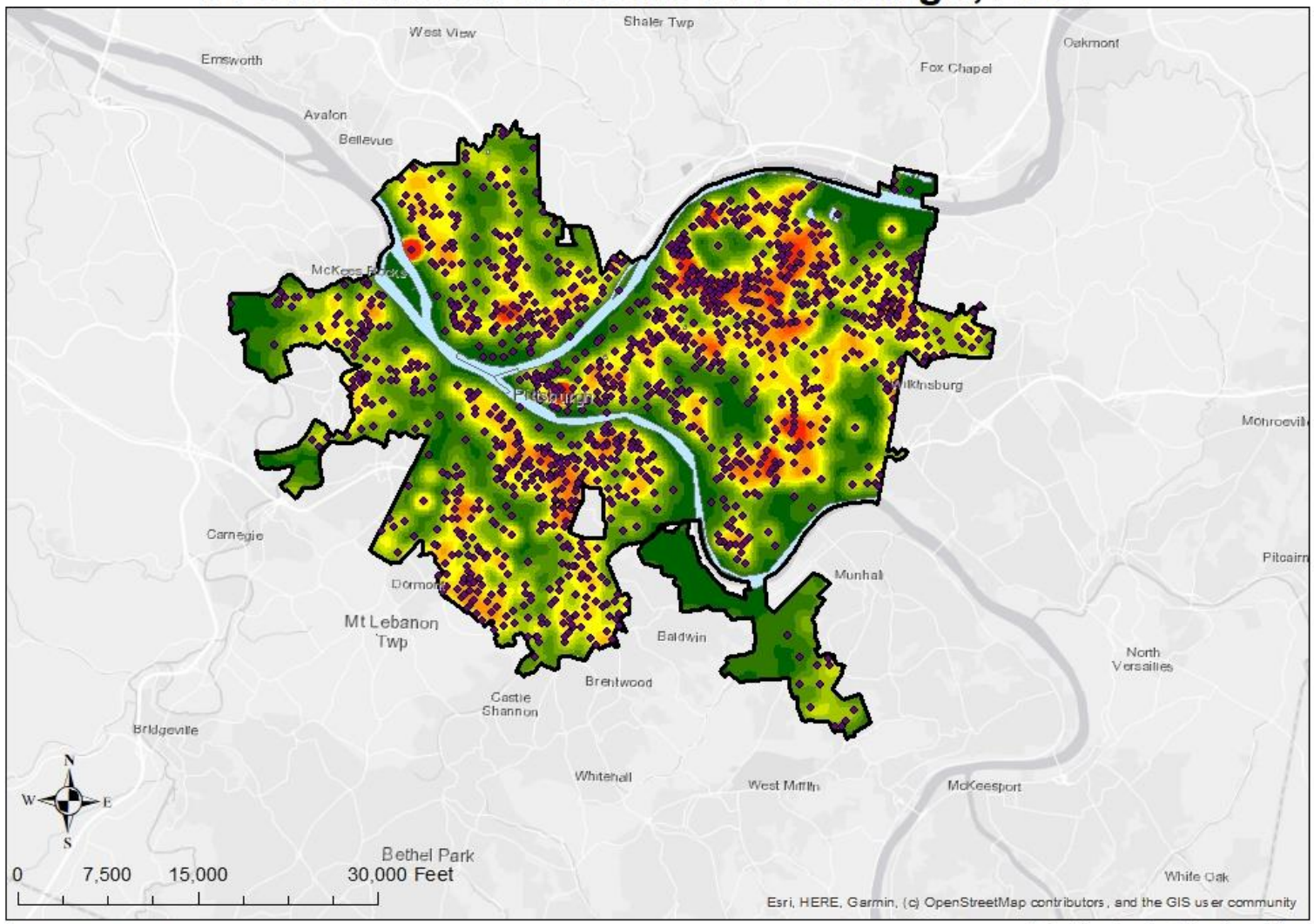
Tutorial 9-3 Reflection:

The purpose of tutorial 9-3 was to estimate and visualize the incidence of heart attacks outside hospitals where bystander help was available, per unit area in Pittsburgh, by creating a kernel density map. Rather than focus on every individual occurrence of heart attack using block centroids and point markers per census block, we use kernel density smoothing to create a mean estimate of the spatial distribution of heart attacks. To do so, we utilized the "Kernel Density" function within the Spatial Analyst toolkit, using a search radius of areas that are 5 blocks by 5 blocks in size (1500 ft.). We then symbolized the kernel density map using a green-yellow-red color ramp. The created layer shows the estimated heart attacks per square foot in relation to where people live.

Figure 4

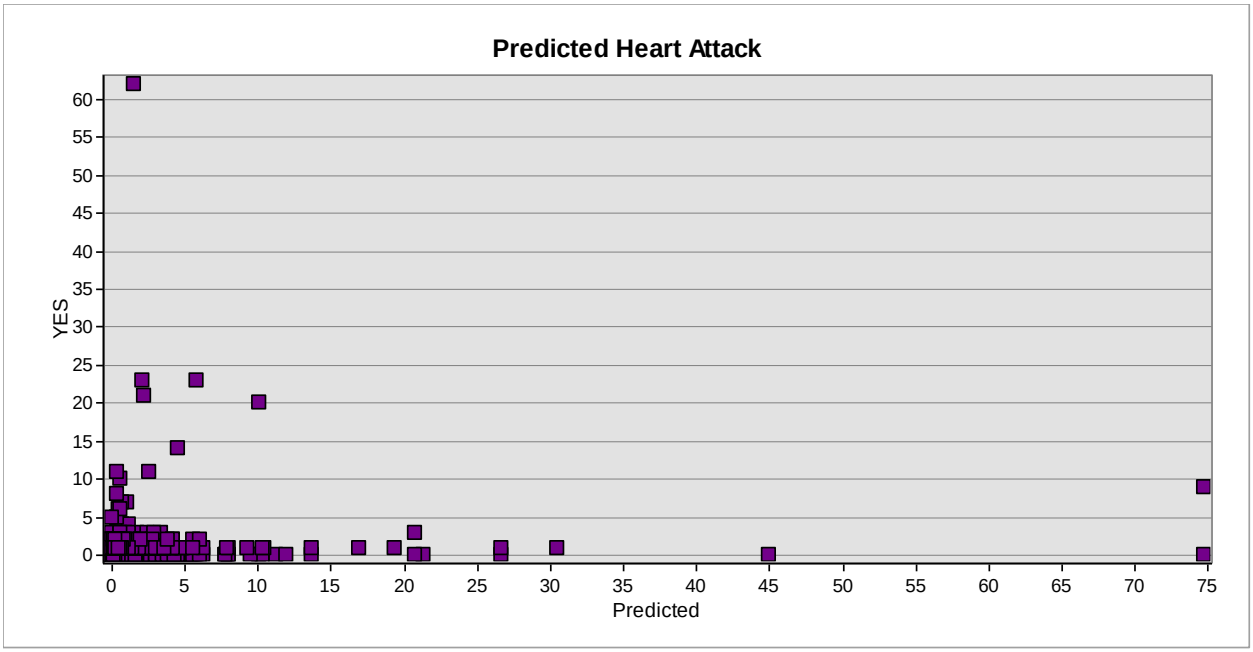
Predicted Heart Attacks in Pittsburgh, 2001



Map Creator: Jason Park
Creation Date: February 12th, 2020

Projection: Lambert Conformal Conic
Data Date:2001
Data Source: US Geological Survey, National Land Cover Data 2001

Figure 5

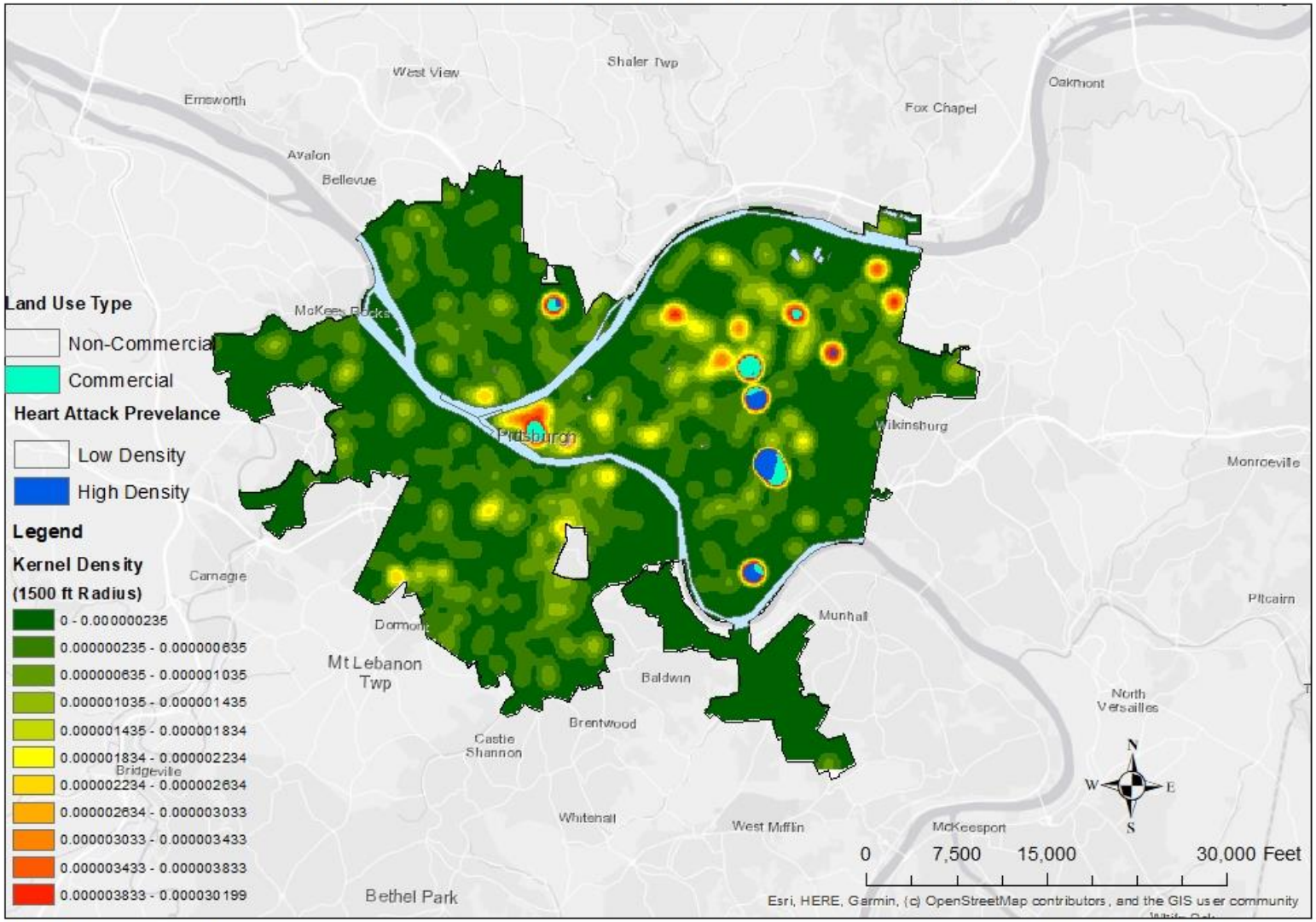


Tutorial 9-4 Reflection:

While the created kernel density map created in Figure 3 displays the estimated heart attacks per square foot, it may not be an entirely accurate depiction of the actual heart attack incidence, as the kernel density shows incidence in relation to where people live rather than in relation to where heart attacks actually occur. Therefore, the purpose of tutorial 9-4 was to determine if there exists a correlation between the estimated number of heart attacks from the kernel density map and the actual occurrence of heart attacks from the OHCA data. We first extracted point estimates from the raster surface for every point in the OHCA layer using the "Extract Values to Points" function to create a new layer ("OHCAPredicted"), and added a field titled "Predicted" in its attribute table. We then populated the "Predicted" field using the equation 5 * [RASTERVALU] * [AREA] to get a 5-year sample of heart attacks from the OHCA data. After exporting the newly created layer, we created a scatterplot of actual vs. predicted heart attacks, and determined that the predicted values correlate poorly with the actual values.

Figure 6

Suitable Defibrillator Sites in Pittsburgh, 2001



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Tutorial 9-5 Reflection:

The purpose of tutorial 9-5 was to create a new kernel density map that more accurately depicts the actual occurrence of heart attacks in Pittsburgh. Doing so brings us back to the goal of our assignment, which was to determine public places in most demand of defibrillator placement. The two qualifications for areas in need of defibrillators are: having a high incidence of heart attacks, and being in a commercial land zone area. To find commercial land areas, we converted the zoning commercial buffer layer to a raster dataset, and differentiated the commercial vs. non-commercial land areas through different color symbolizations. We then used the YES attribute of the OHCA point layer as inputs to create a more accurate kernel density map of heart attacks that showed a stronger correlation between predicted vs. actual heart attacks. To determine areas that qualify for having a defibrillator in place, we reclassified the raster data set to select 25-block areas that have 10 or more heart attacks every 5 years in locations where bystander help is possible. This results in 8 areas on the map that have high heart attack densities. Finally, we queried the 8 areas to select only those found within commercial zone areas, and use the overlapping map layers to determine areas that qualify for defibrillator placement.