Toxic Release Facilities Analysis in the Southern Puget Sound Region

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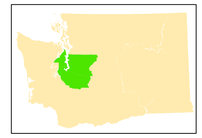


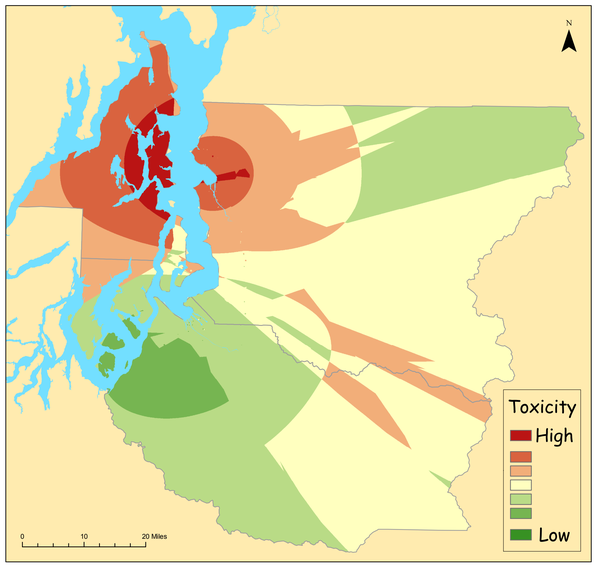
Introduction:

Through energy consumptions, recycling, and different kinds of operations, numerous facilities are disposing and releasing a significant amount of chemicals every day. Within all those chemicals, some could be functioned as fertilizers while most are toxic, threatening both the environment and people's health. The purpose of this project is to find out the areas with relatively serious toxic concentration in the south part of the Puget Sound region (Pierce, King, and Kitsap County), as well as who are the most affected people in those areas. The general public who are interested in environmental issues might get the idea of the toxicity around this area. Besides, city planners might use this as a reference of whether new regulations about releasing toxic would be necessary.

Data Sources:

From U.S. Environmental Protection Agency (EPA):
A table of Toxic Release Inventory (TRI) including all the addresses of facilities and chemicals released in the year of 2009 in Washington.
From U.S. Census Beureau:
2010 Raod shapefiles for Pierce, King, and Kitsap County,
Tabular data of median income in 2005-2009 in the 3 counties by census tracts,
Tabular data of race in 2005-2009 in in the 3 counties by census tracts.

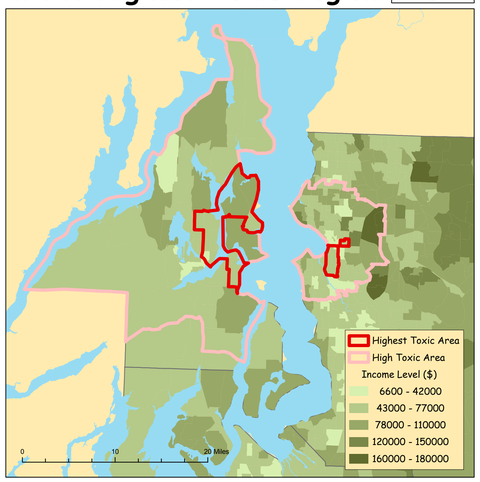
Toxic Concentration in Pierce, King, & Kitsap County



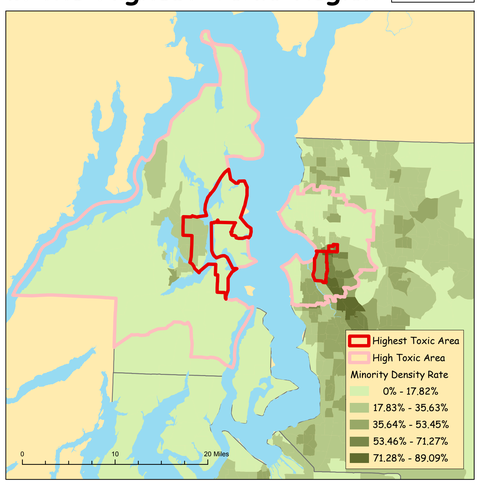
Methods:

By using the road shapefiles, the addresses of the 3 counties in the TRI were geo-coded. After reviewing the chemical data that the facilities in the 3 counties released, facilities that released persistent bioaccumulative toxic (PBT), including benzo(G,H,I) perylene, lead and lead compounds, mercury and mercury compounds, and polycyclic aromatic compounds, as well as dioxin and dioxon-like compounds, were decided to be used for this study. Five point layers were then exported according to the toxic chemicals. Then, Kriging was used in order to interpolate the raster surfaces from the points, which created continuous surfaces that represent concentrations of the chemicals at any given location in the 3 counties. Next, the Reclassify tool was used for classifying based on the severity of the contamination of those toxic. Later, Raster Calculator was then used to conduct an overlay analysis of the reclassified raster layers. Joining the race and income tabular data into the census tracts, a new raster dataset with the mean toxicity was calculated by using the Zonal Statistics tool. In order to interact with the toxic data using vector tools, the Conversion tool was used to convert raster to points. Afterwards, by using Spatial Join, a polygon layer with both the census data and the toxic data was obtained.

Median Income Level in the Highest Toxic Region



Minority Race Density in the Highest Toxic Region



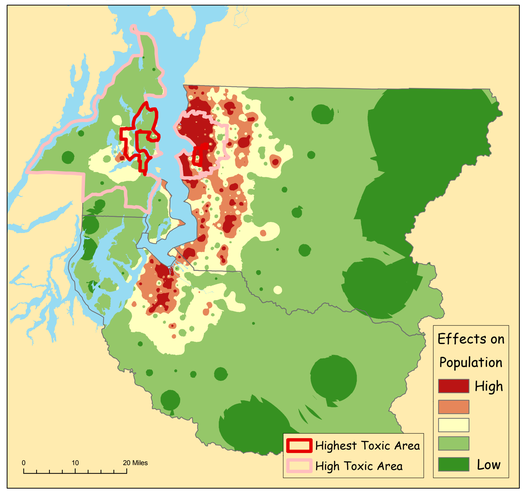
Results:

The Toxic Concentration map above used a red to green color ramp to show the toxicity level of Pierce, King, and Kitsap County from high to low. We could easily tell from the map that Pierce County is relatively pure compared to the two other counties. Zooming into the highest contaminated areas, the 2 maps on the left were created.

In the first map on the left, a color ramp of light green to dark green was used to symbolize the amount of median household income from low to high. From the Toxic Concentration map, the highest 2 classes of toxicity were outlined here. Within the high toxic area, all levels of median income could be found. However, in the areas with highest toxicity, only relatively low levels of household median household income could be found. Therefore, we could tell that the areas with higher level of median household income are mainly not affected by the highest contaminated area that are caused by the toxic release facilities, the areas with lower level of median household income are the ones that are mostly affected instead.

The second map on the left shows the density rate of the minority races in the highly contaminated areas. Minority here refers to people who are African American, Asian, Alaska Native, Native Hawaiian, or any other races that is not White. Again, a color ramp of light green to dark green was used to show the percentages of the minority density rates from low to high. Within the area with high toxicity, all rates of minority density could be found, while only a very small area obtains the highest rates of minority density. Furthermore, in the areas with highest toxicity, only areas with relatively low minority density rates could be found. As the highest contaminated areas do not contain areas with the higher rate of minority density, we could tell that the people who are affected by the toxic release facilities most are not necessary to be any one of the minority races.

Contaminated Regions in regards to Population Density



This map on the left was produced by overlaying the Toxic Concentration raster layer with a raster layer which was created according to the population density. Same to the Toxic Concentration map, a red to green color ramp was used to show the population density level from high to low. This map shows that the coastal areas in King County has a relatively high effects on the population while the highest contaminated areas are mainly in Kitsap County. As Kitsap County has a relatively low population density than King County and Pierce County, although the toxicity levels in Kitsap County is higher than the other 2 counties, less people are actually affected in those areas. While the coastal areas in King County have fairly high level of toxicity and high level population density, more concerns might be needed on those areas instead of the areas with the highest level of toxic concentration, which is Kitsap County.

Literature Sources:

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