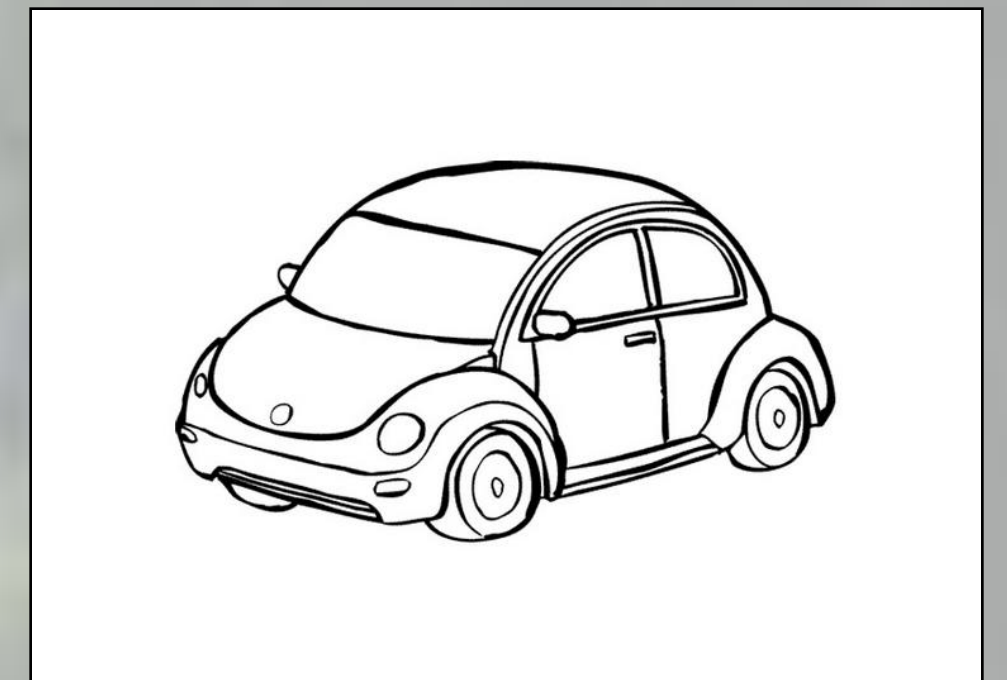


Washington State Regions of High Population Density with Air Pollution from Point & Mobile Sources

With Focus on King & Pierce Counties Schools and Parks



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Kelly Scholting

GIS Certificate Program, University of Washington, Tacoma

Introduction

There are various forms of air pollution with some of the most common caused by human activities. Some types of air pollution are from point sources and from mobile sources. Point sources of air pollution are places that are stationary, usually major industrial facilities that put out a certain amount of pollutants each year. Mobile sources include automobiles such as cars, trucks and buses. Automobiles have been closely linked with increasing levels of air pollution in urban areas (Bhandari, et al. ND). The most common form of traffic pollution is carbon monoxide and nitrogen oxides (Hansen et al 2007).

With increased traffic volume and air pollution can lead to population health problems (Afshar and Delvar, 2007). Specifically, people who live in areas that are exposed to high levels of these pollutants are at risk for increased respiratory related illnesses. For example, nitrogen oxides can prompt an allergic reaction (Batchelder, 2006).

What regions in Washington State have the highest population density and are exposed to high levels of traffic pollution, and point source carbon monoxide and point source nitrogen oxides? For more detailed inquiry for King and Pierce counties where are the high population, high pollution areas and what percentage of these areas have public places where people are there a lot such as schools and parks?

Figure 1
Washington State Point Source Locations

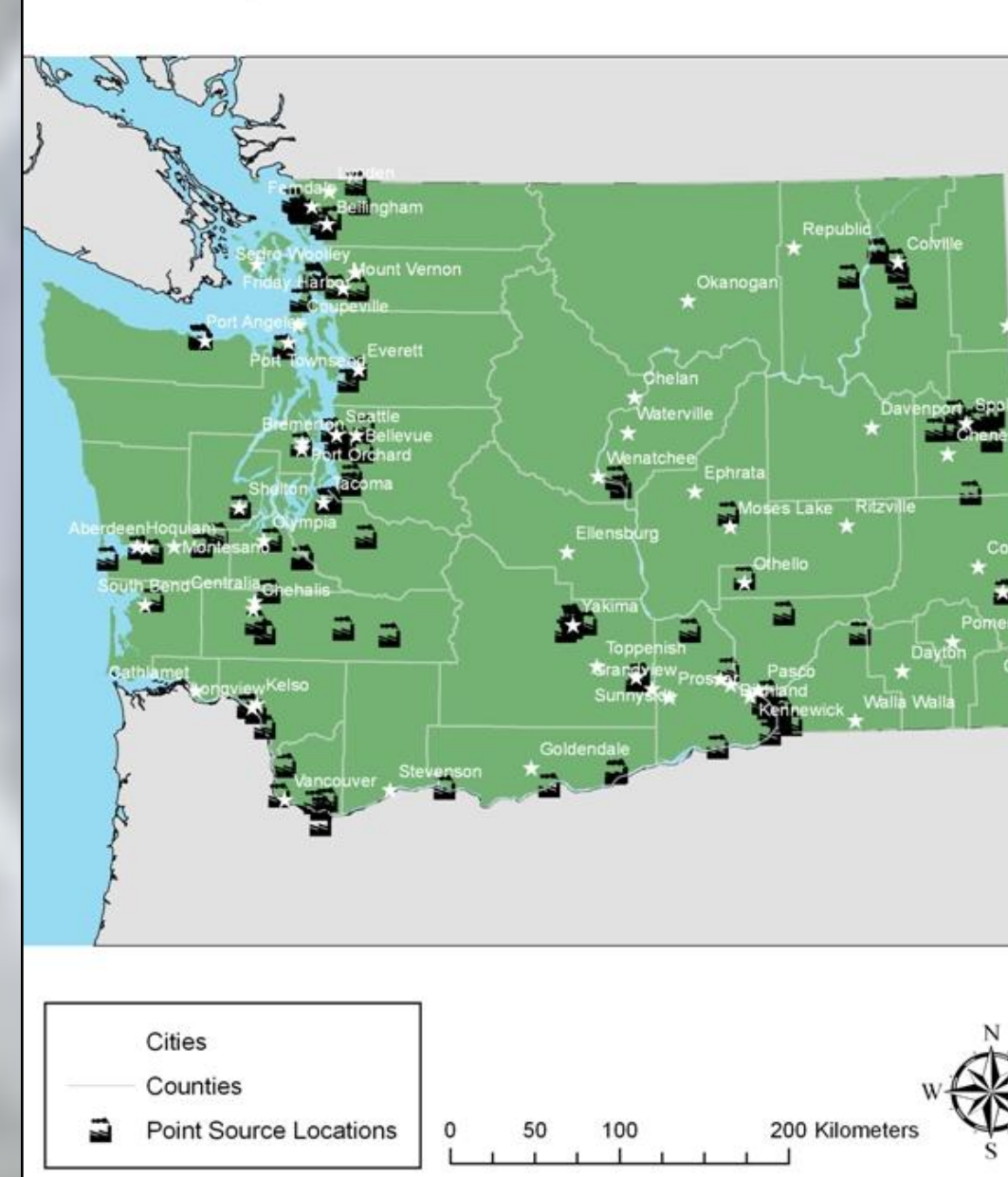


Figure 2
Washington State Major Highways



Methods

All data was projected in NAD 1983 HARN STATEPLANE WASHINGTON SOUTH FIPS 4602 FEET.prj. Table 2 details the sources of all data presented.

Figure 3 is a brief outline of the process the data went through that resulted in four rasters (figure 4). Using raster calculator the four rasters resulted in the master map (figure 7). Traffic line segments (figure 2) have an attribute of average annual daily traffic and this field was used for the IDW process. Locations of factories (figure 1) is what was used for point source pollutants. Each location produced an average annual pollutant amount. For both the population and point source pollution the amount was divided by the area resulting in a population or pollution density. This field was used for the IDW process.

Assumptions for some of the data includes for the traffic line shapefile the pollutant amount was based on the volume of traffic and not an actual pollutant value produced. For the point sources of air pollution a 2 mile buffer was put around each point source and this assumes there is an equal amount of pollutant throughout the entire 2 mile area.

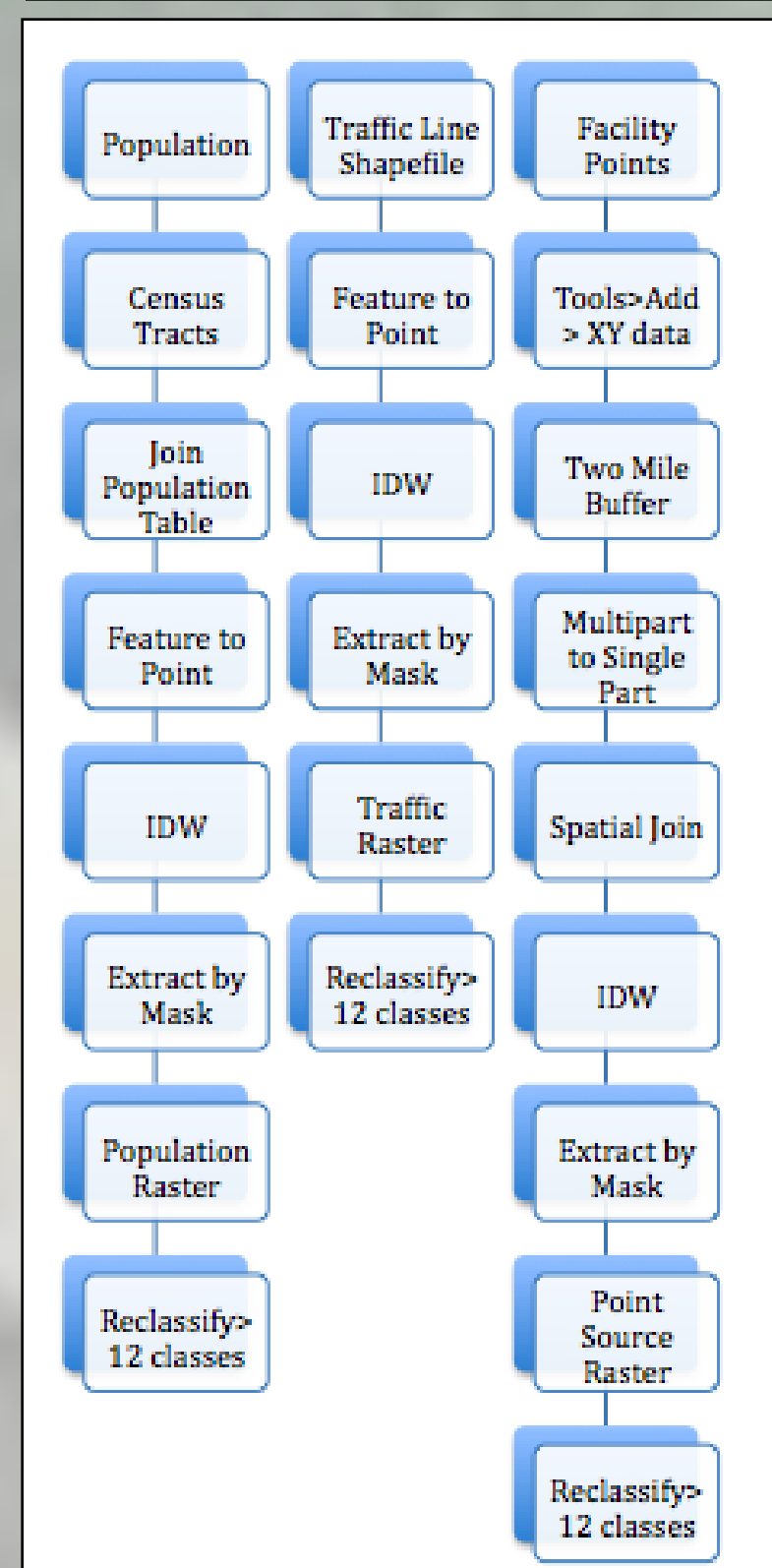


Figure 3: Methods diagram

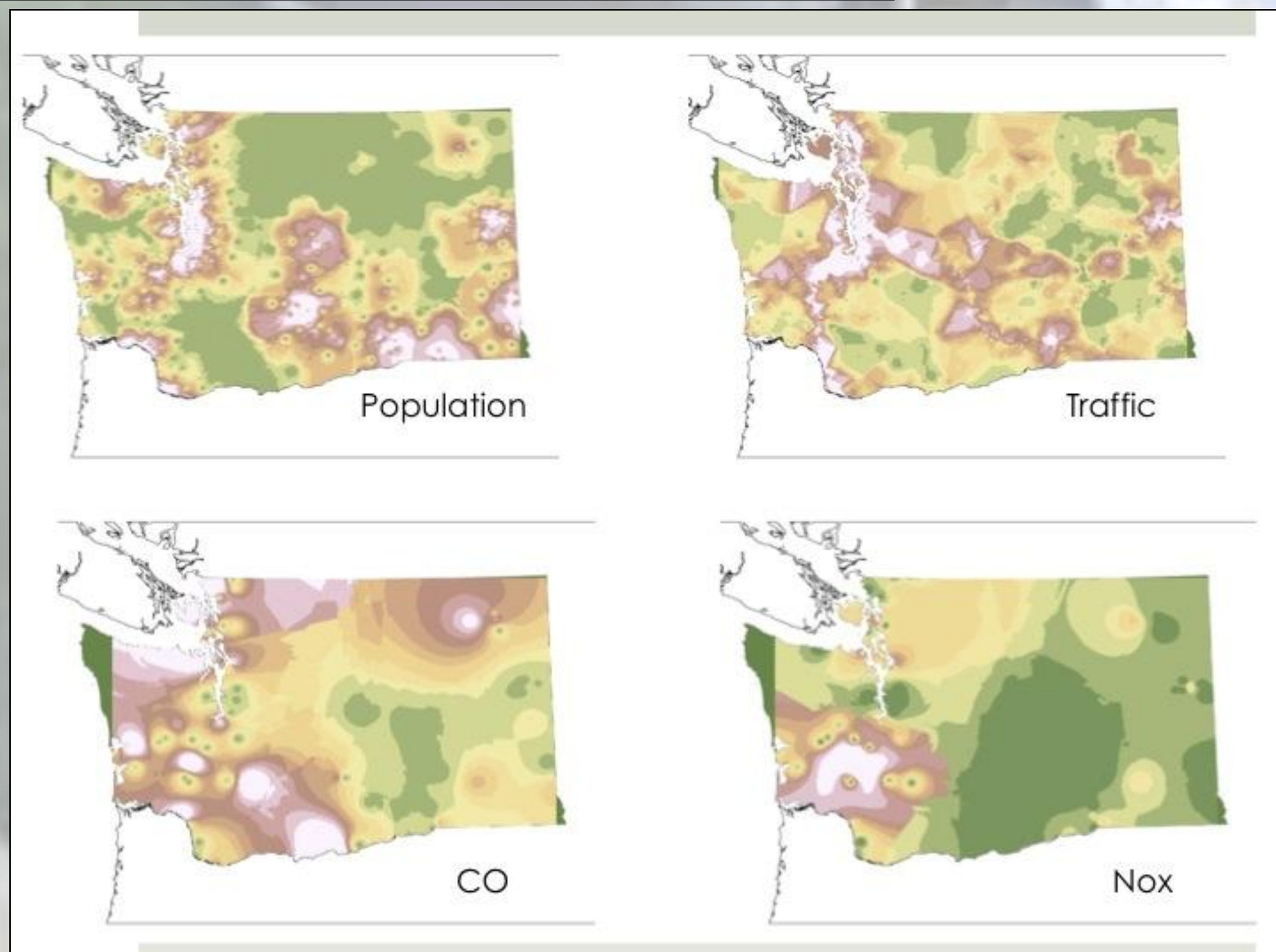


Figure 4: Four rasters from each data set.

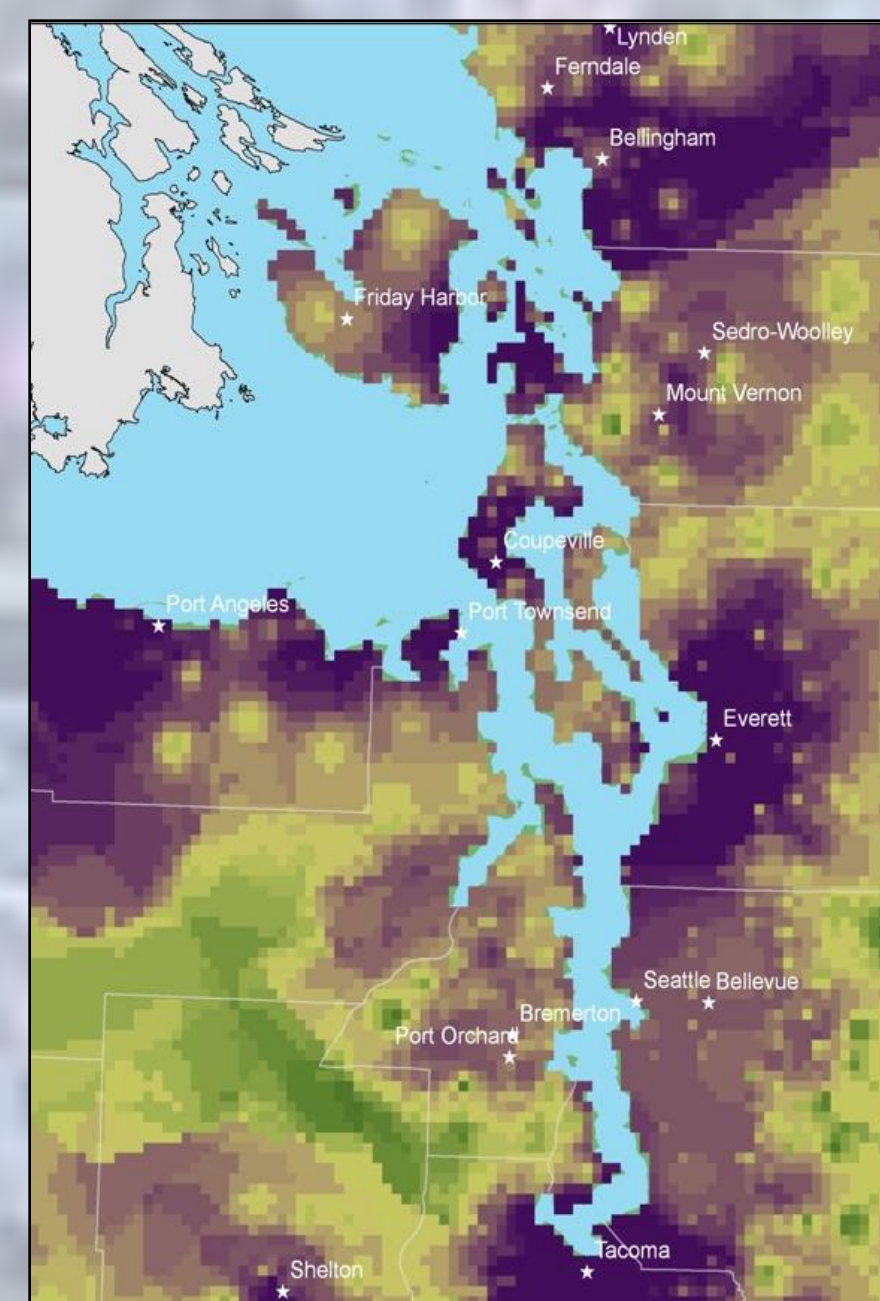


Figure 5: Puget Sound

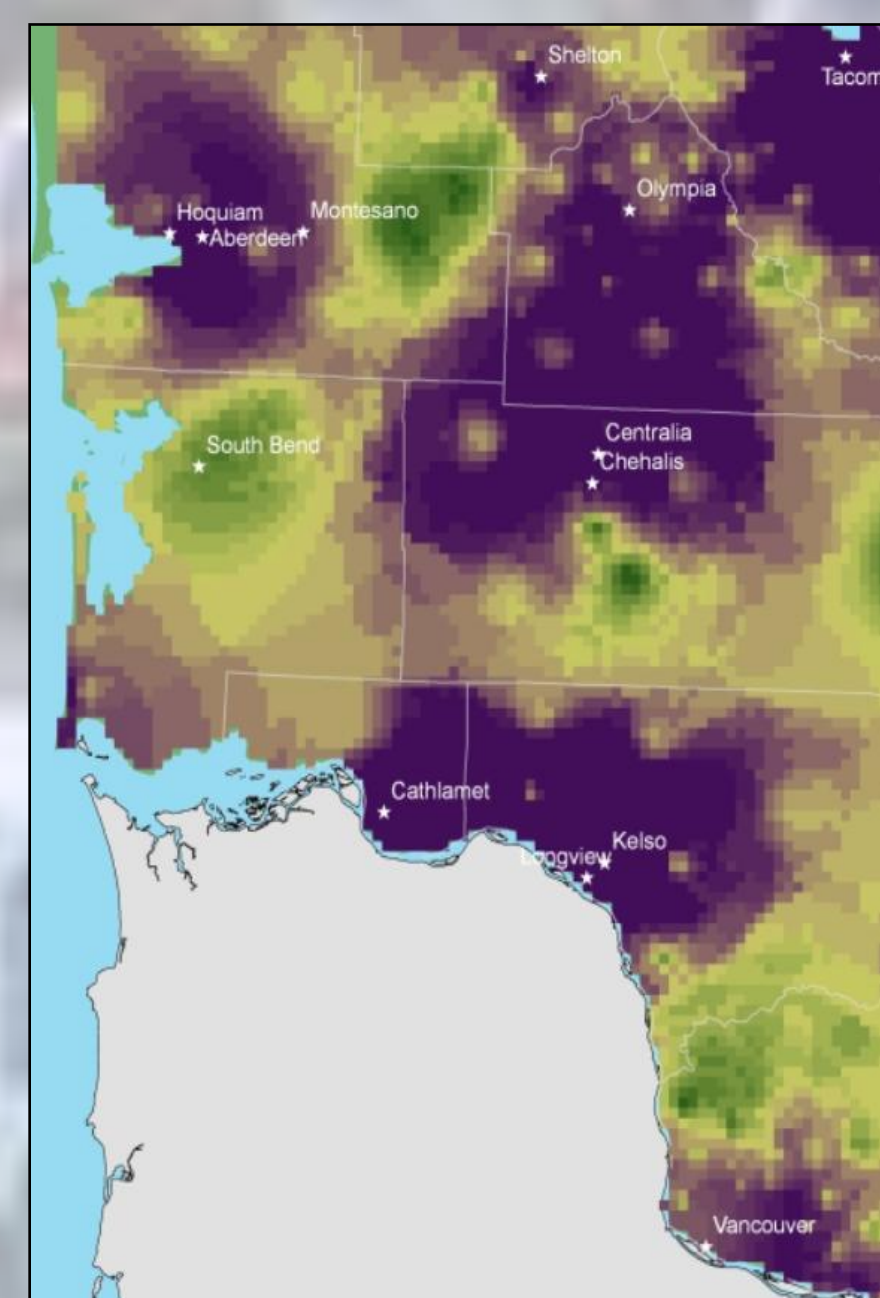


Figure 6: Southwestern WA

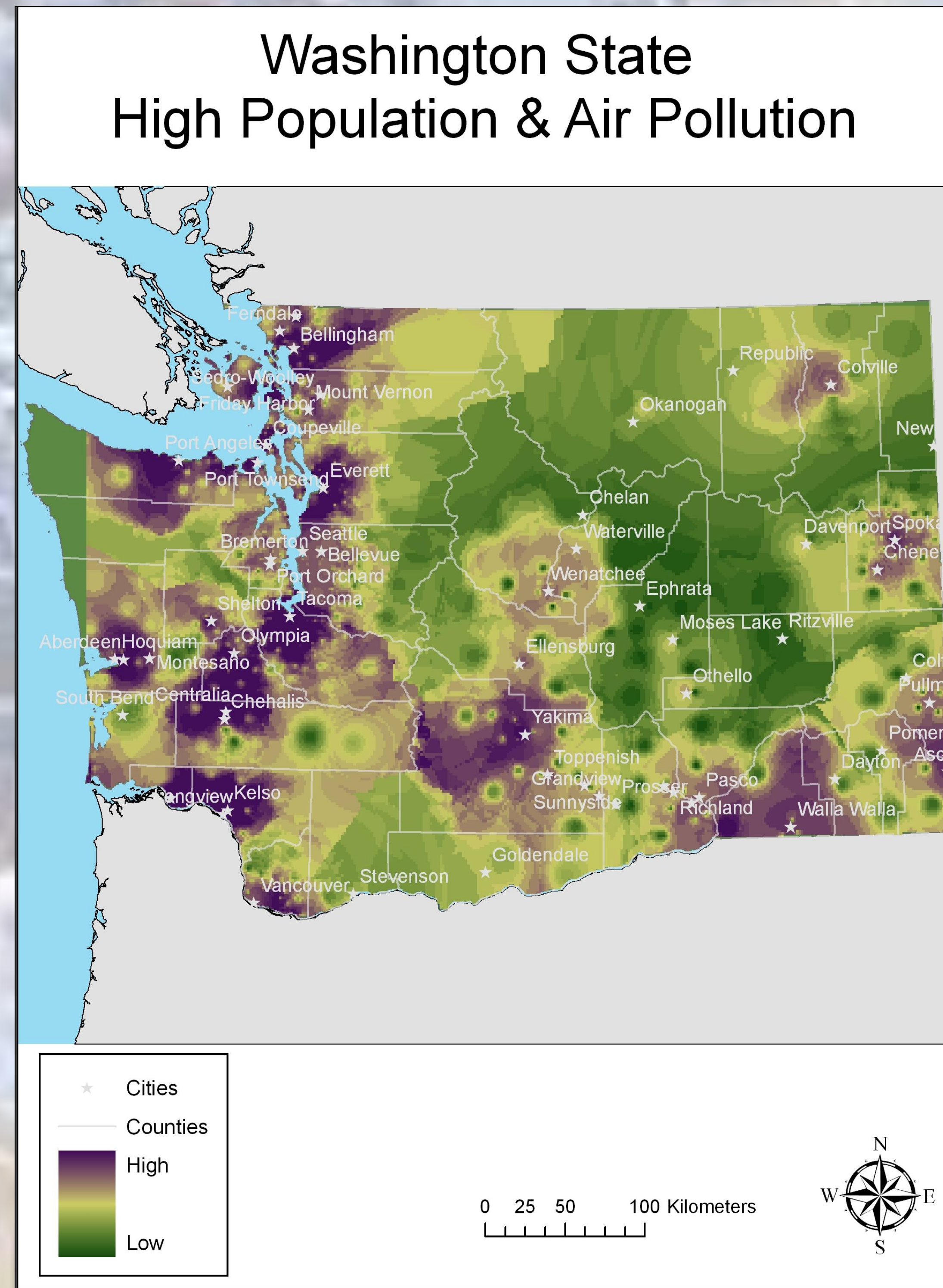


Figure 7: Mastermap of Washington State showing High regions of high population and high pollution.

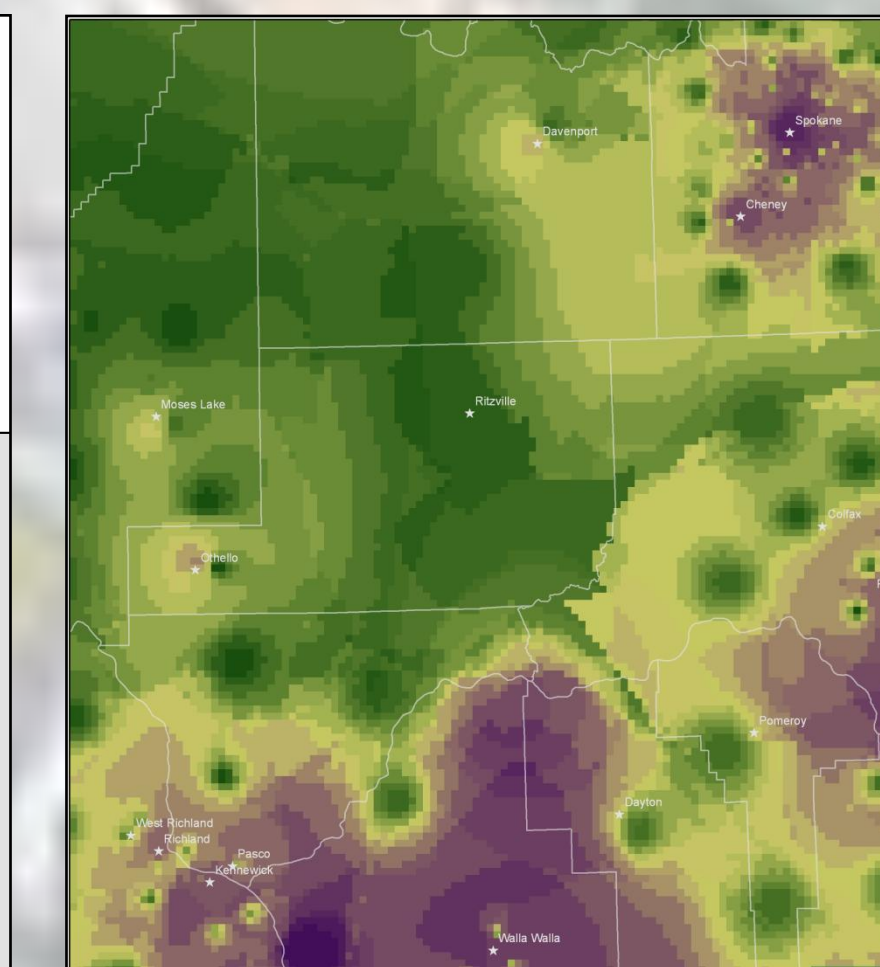


Figure 8: Walla Walla

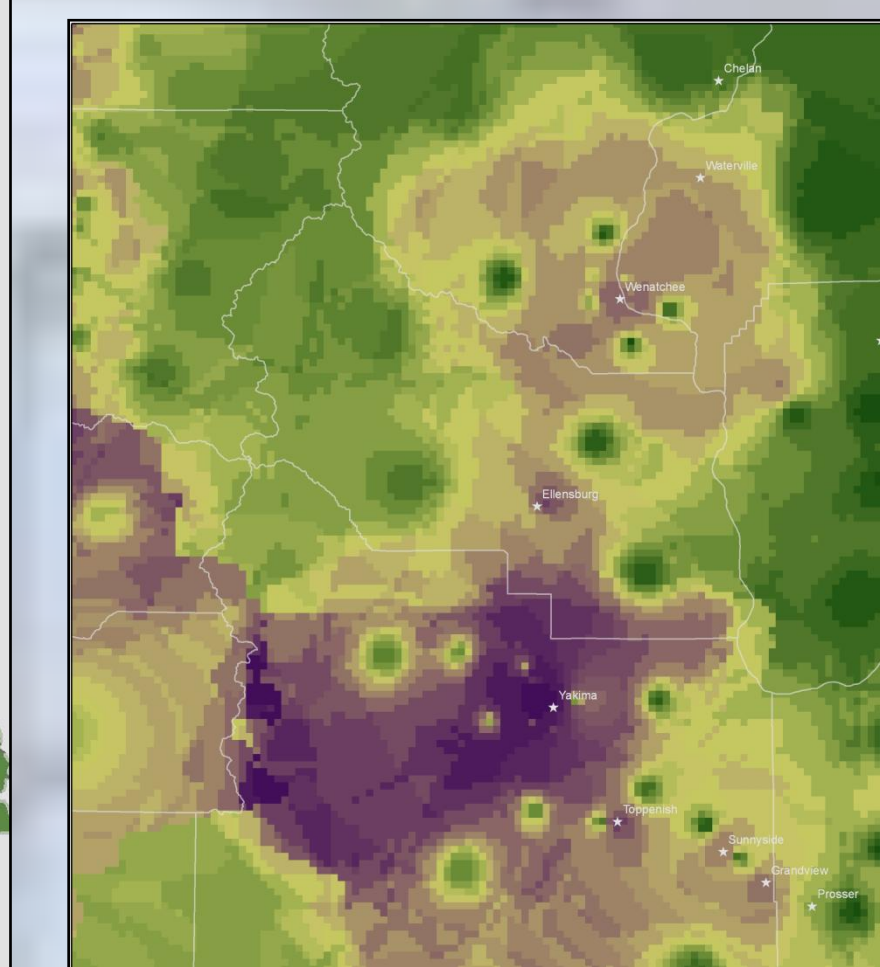


Figure 9: Yakima & Wenatchee

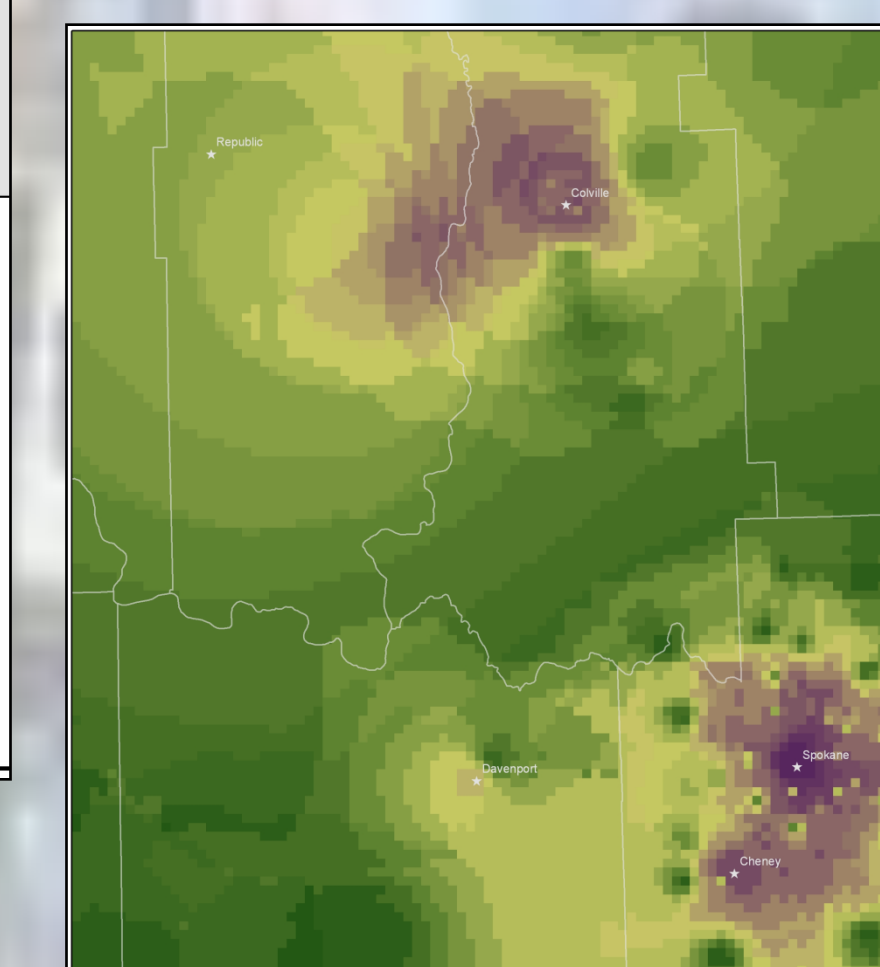


Figure 10: Spokane & Colville

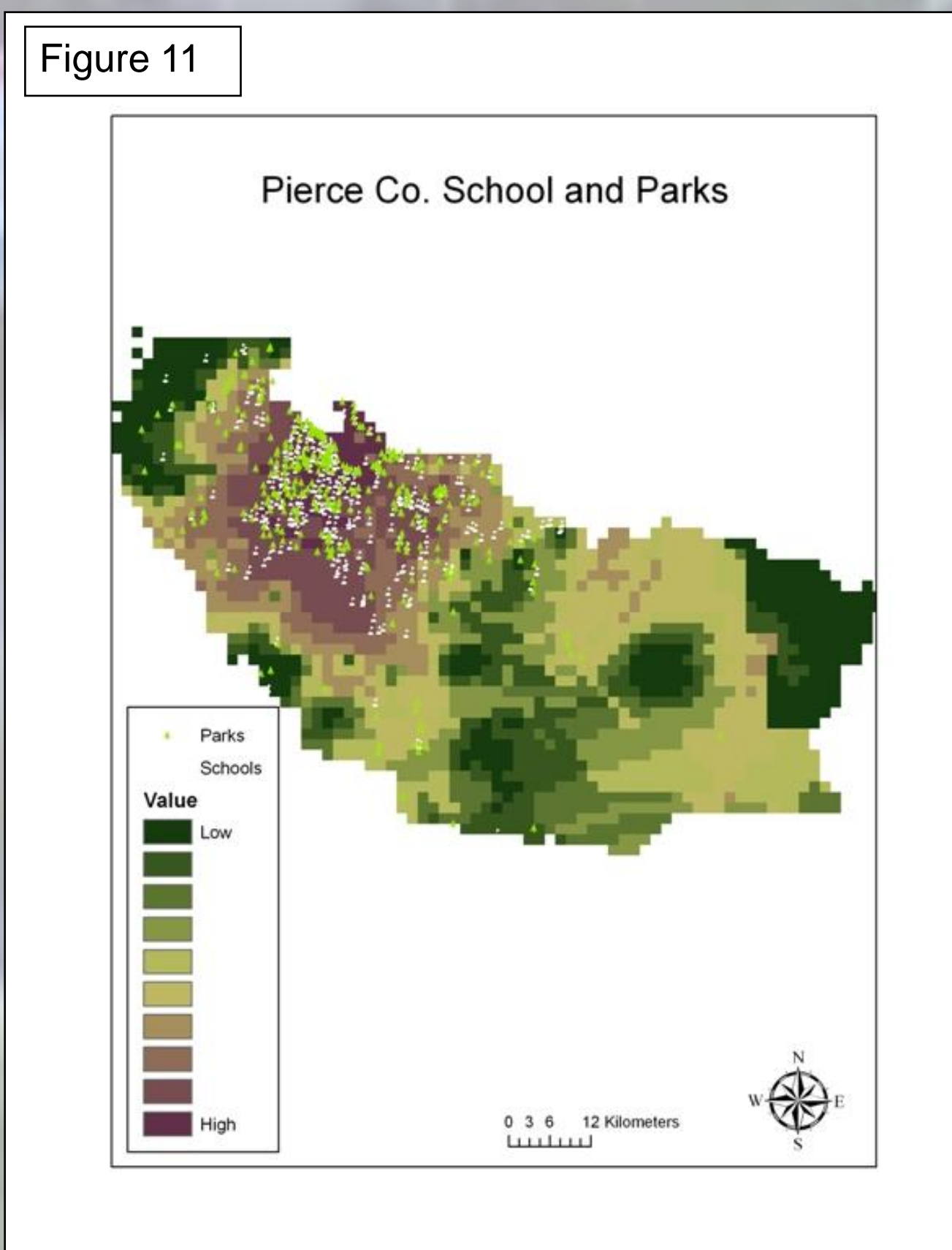


Figure 11

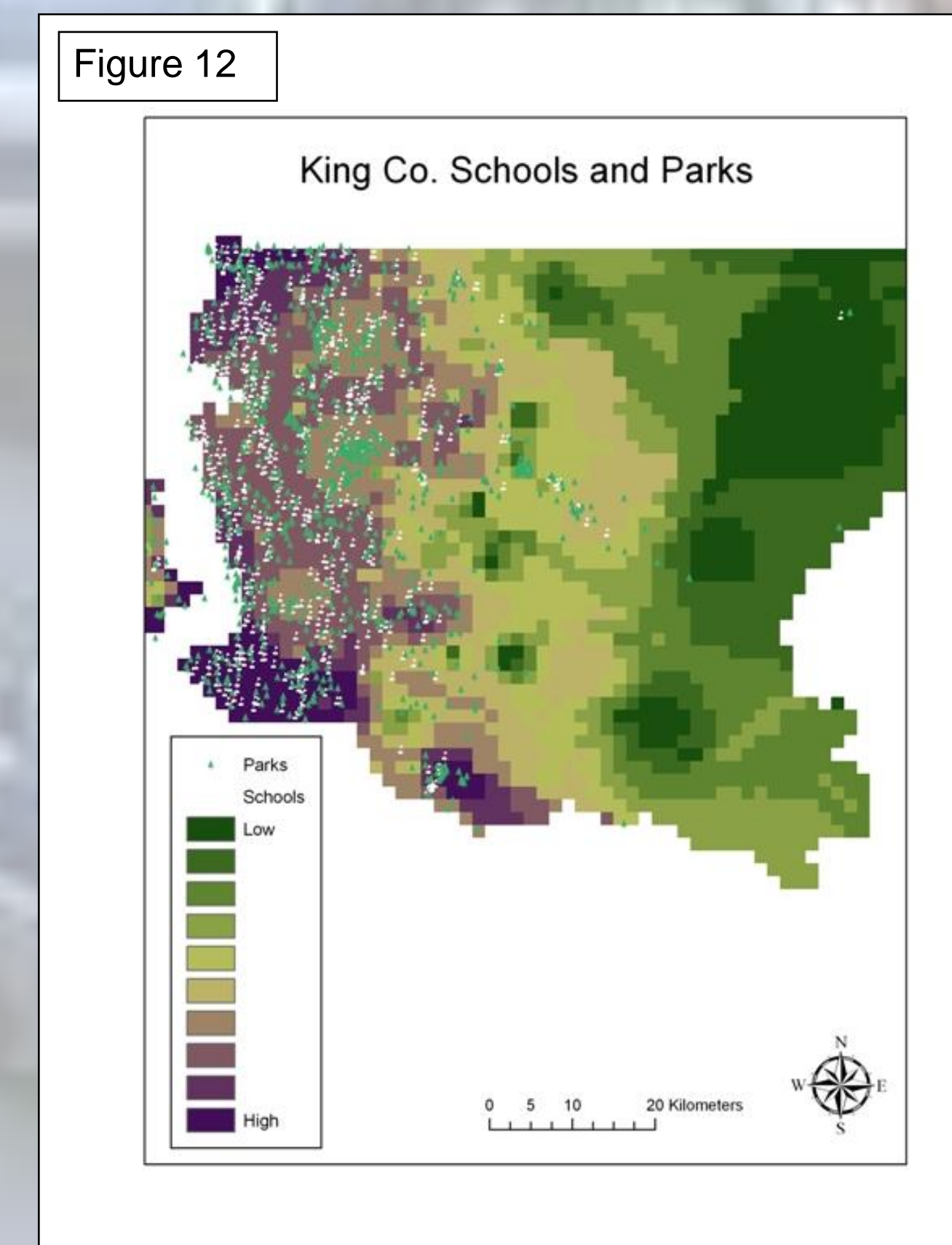


Figure 12

Summary

There does appear to be a strong relationship between areas of high air pollution and areas of high population density. Regions of highest population density, point and mobile source air pollution are along the I-5 corridor (figures 5, 6), Spokane (figure 10) and southeastern Washington State (figures 8,9). Most of the hot spot regions in western Washington are also city ports. This is not unexpected as urban areas usually have high pollution and high populations.

In Pierce County the City of Tacoma (figure 11) has the higher concentration of population density with point and mobile sources of air pollution than Seattle in King County. King County has high hot spot in the north (Everett) and in the south (Tacoma) (figure 12). Most of the medium hot spot regions in King County are along the western boundary (waterfront). A high percentage of schools and parks in Pierce and King County are located in areas that have high population and medium air pollution from mobile and point sources. Pierce county has more schools and parks located in high pollution regions than King County. There were very few schools and parks located in the low pollution regions (Table 1).

Pollution	Pierce Co. Schools	Pierce Co. Parks	King Co. Schools	King Co. Parks
Low	9%	12%	5%	6%
Medium	58%	54%	76%	80%
High	34%	35%	19%	14%

Table 1: Percent of schools & parks in each county in high population and pollution regions.

Future Work

There are several more parameters that can be included in this project to make a more accurate assessment of population exposure to air pollution. First, meteorological data, such as wind patterns may have an affect on the amount of pollutant suspended in air and distributed. Second, to consider different demographics of the population instead of encompassing the entire population. Also, more specific or defined study area and or data perhaps would provide a more informative or useful analysis.

Data Set	Source
2000 WA census tracts shapefile	www.census.gov
2000 WA population table	www.census.gov
2005 traffic lines shapefile	Personal contact WSDOT.
2002 facility location and pollutant output table	www.epa.gov
Washington State basemap	www.ecy.wa.gov
Pierce and King Co. Parks and Schools shapefile	www.wagda.lib.washington.edu
Washington State cities and counties shapefile	www.wsdot.wa.gov

Table 2: Sources of datasets used in this project

Literature Cited

Afshar, H., Delavar, M. 2007. A GIS-based Air Pollution Modeling in Tehran. Environmental Informatics Archives: (5) 557-566
 Batchelder, Tim. 2006. Remote Sensing, Information systems and allergies. Online article
 Bhandari, K. Rao, P. Shukla, A. ND. GIS applications in air pollution modelling. Online article. GIS development.
 Hansen, C., Jensen, S., Baelum, J., Sherson, D., Skadhauge, L., Siersted, H.C., Hertel, O., Omland, Ø., Thomsen, G., Sigsgaard, T. 2008. Individual traffic-related air pollution and new onset adult asthma: A GIS-based pilot study. National Environmental Research Institute, University of Aarhus, Denmark. 23 pp - NERI Technical Report No.665. <http://www.dmu.dk/Pub/FR665.pdf>.
 Background picture: www.publicorgtheorg.org.

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For further information:

Please contact kelly06@u.washington.edu