Introduction
The spatial distribution of risk factors related to environmental exposure have historically not been distributed evenly across populations. Accordingly, it has been theorized that experiencing a disproportionate burden of environmental risk may contribute to the current disparities in health outcomes for people of color and low-income communities.

In order to further explore this relationship, we construct a raster of composite environmental risk and determine the extent to which it is correlated with income, race, and health outcomes. By modeling the relationship between environmental risk and adverse health outcomes, we might be able to identify one of the mechanisms through which health disparities are reproduced.

Demographics

% Living Below Poverty Line

% People of Color

Correlation Methods
Composite environmental burden was created as a raster and reclassified into 5 categories which were given values of 10, 20, 30, 40, 50, with 10 representing the least environmental risk and 50 representing the greatest. Race, income, and health outcomes were similarly reclassified as 1, 2, 3, 4, 5 escalating in % non-white, % living below the poverty line, and rate of childhood asthma hospitalizations respectively. The raster layers were then added together and the unique numbers ranging from 11—55 where color coded according to the below rubric.

<table>
<thead>
<tr>
<th>Color Code Method</th>
<th>Least</th>
<th>Environmental Risk</th>
<th>Most</th>
</tr>
</thead>
<tbody>
<tr>
<td>Factor: Race, Income, Health</td>
<td>10</td>
<td>20</td>
<td>50</td>
</tr>
<tr>
<td>Least</td>
<td>1</td>
<td>11</td>
<td>12</td>
</tr>
<tr>
<td></td>
<td>2</td>
<td>21</td>
<td>22</td>
</tr>
<tr>
<td></td>
<td>3</td>
<td>31</td>
<td>32</td>
</tr>
<tr>
<td></td>
<td>4</td>
<td>41</td>
<td>42</td>
</tr>
<tr>
<td>Most</td>
<td>5</td>
<td>51</td>
<td>52</td>
</tr>
</tbody>
</table>

Correlation Color Code

Low Env Risk, Low (% POC, Poverty, Childhood Asthma)
Low Env Risk, High (% POC, Poverty, Childhood Asthma)
Intermediate Env Risk and (% POC, Poverty, Childhood Asthma)
High Env Risk, Low (% POC, Poverty, Childhood Asthma)
High Env Risk, High (% POC, Poverty, Childhood Asthma)

Constructing Environmental Risk

Distribution of Environmental Risk and Health Outcomes in the Bay Area, California

Environmental Risk Methods
Composite environmental risk was calculated based on highway proximity, density of highways, and a county-level air quality index from the EPA. The highway proximity layer was created by calculating a Euclidian distance of 5280 feet from major highways and reclassifying into 10 categories. Highway density was reclassified into 10 categories to maintain the specificity. The composite index represents the addition of all three layers evenly weighted.

Health Outcomes

Asthma ER Visits

Childhood Asthma

Results & Limitations
Among the factors correlated with environmental risk, race appears to have the strongest relationship. There is a significant clustering of high environmental burden in majority non-white communities which is most evident in Oakland and the surrounding area in Alameda county. Equally as significant, there is a relatively small number of violet pixels which represent communities of majority people of color which experience a relatively low environmental risk.

Finally, it is also important to note that environmental burden appears to be significantly correlated with rates of childhood asthma. As demonstrated by the clustering of red pixels, rates of hospitalizations for childhood asthma appear to be highest in areas of high environmental risk.

The greatest limiting factor in the extent to which the results of this analysis can be generalized is the validity of the environmental risk index. Although the factors included in the analysis were informed on environmental risk assessment literature, the relative weight of the factors may be different in actuality. Furthermore, as communities are increasingly mobile, it may not be appropriate to estimate environmental risk on geography alone.

Future Considerations
Based on the apparent correlation between environmental risk and rates of childhood asthma hospitalization, it appears that the relationship between environmental risk and health would provide fertile ground for further research so that future people might not be disproportionally burdened by the environment in which they live.

References
Sources: National Air Toxics Assessment, EPA 2011; California Department of Public Health Geospatial Resources, 2012, American Community Survey 2013, 5 year estimate, SF Open Data, Tufts M: Drive.
Class: GIS 101 Intro to GIS
Projection: NAD 1983 State Plane California III (Feet)
Cartography: Thomas F. Cunningham