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Portland GIS Vulnerability Analysis

Introduction

Disasters are events of widescale destruction, often requiring outside help to respond and recover. However, disasters do not hit everyone equally (Fothergill and Peek 2004). Research has shown that certain communities have more resources than others to survive and recover, and often this has to do with race, ethnicity, income, social class, education, gender, and age (Wisner et al. 2012). This research project was motivated by the question of where these vulnerable populations will go, or receive the resources they need, to survive a disaster.

Portland, OR is situated on the Cascadia subduction zone, which is subject to devastating earthquakes of magnitude 9 on the Richter Scale. Oregon is currently not prepared for this kind of disaster: there will not be enough first responders to get to every community in need, so the Oregon Seismic Safety Policy Advisory Commission (OSSPAC) has recommended that communities begin to formulate their own plans for survival (Oregon Resilience Plan 2013). With this in mind, we brought our own immediate community into the discussion: college campuses. Trusted organizations such as college campuses can play an important role post-disaster in performing critical functions that support the surrounding community such as providing shelter, food, or a meeting space for displaced family members (Eller et al. 2015). Knowing that some people intuitively look to trusted organizations for help, we thought it would be important for the college to know how many people they might need to expect.

Methods

We looked at a list that displayed enrollment numbers of universities in Portland, and chose the top 6, excluding Portland Community College since it had multiple campuses which complicated our analysis. In the future, PCC would be a very important campus to include. First,

using ArcGIS, we created a 0.5 mile buffer zone around each campus. We chose this number because we knew the importance of being able to walk everywhere after a quake because of the probability of damaged roads, debris blocking roads, and glass that could pop tires, so we figured only people in the immediate surroundings would seek help. We didn't include the campus itself in the buffer zone because we wanted the demographics of the surrounding community -- we already have statistics on college student demographics. We used demographic data from the American Community Survey (ACS), which is run by the U.S. Census Bureau, and each chose a different characteristic to map based off of potential vulnerable communities near the campuses we mapped. As a group, we mapped race, income, renters, females, education, and age.

The ACS data was split up into neighborhood polygons, so when we created the half mile buffer, only fractions of some of those polygons were included. To take this into consideration, we multiplied the fractional area by the total population of the polygon to determine roughly how many people were actually included in the polygon fractions. I focused on race, so to map this I added up the percentages of all people of color in my map's attribute table (Black, Asian, Native American, Pacific Islander, Hispanic/Latino), and mapped those percentages. I did this instead of mapping individual race distribution because Portland's 2012 Vulnerability Analysis described communities of color that were over the 27.4% city average were more vulnerable to displacement than others. Since their analysis didn't mention any particular group, I decided to combine them so I could visualize communities of color above 27.4%.

In our next stage, we wanted to determine which parts of the city were most susceptible to hazard in the event of an earthquake. Hazard in this case could mean either landslides, amplification, or liquefaction that causes more damage to buildings and communities in those

areas. This was important to map because if there are vulnerable communities on extremely hazardous ground, then we know that there will probably be more need for relief and supplies. We went through a similar process of creating a buffer, and then using data from the Oregon Department of Geology and Mineral Industries, displayed the relative hazard zones from category A (worst) to D (least). We then had to figure out the area of each respective zone so we could calculate populations of people in those zones.

A portion of this analysis was done on Microsoft Excel. We used the raw data to find the number of individuals in the fractionalized areas of choice in both phases of the project. For certain categories, like age, we took averages instead of sums.

Results

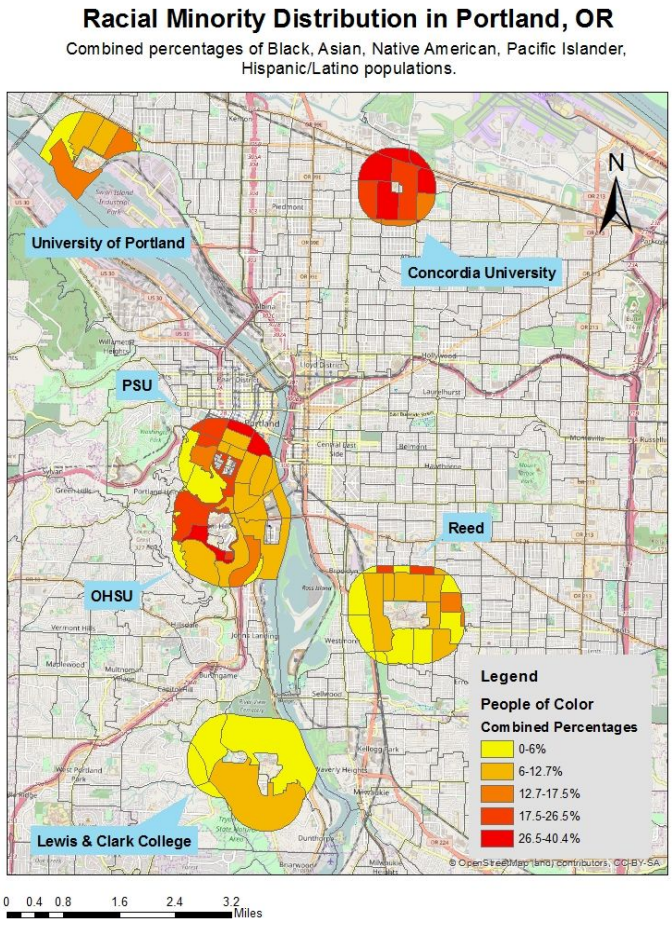

Figure 1: Racial Minority Distribution in Portland, OR

Based off of these findings, it appears as if Concordia, PSU, and OHSU have the highest percentages of communities of color, indicated in the dark orange and red areas.

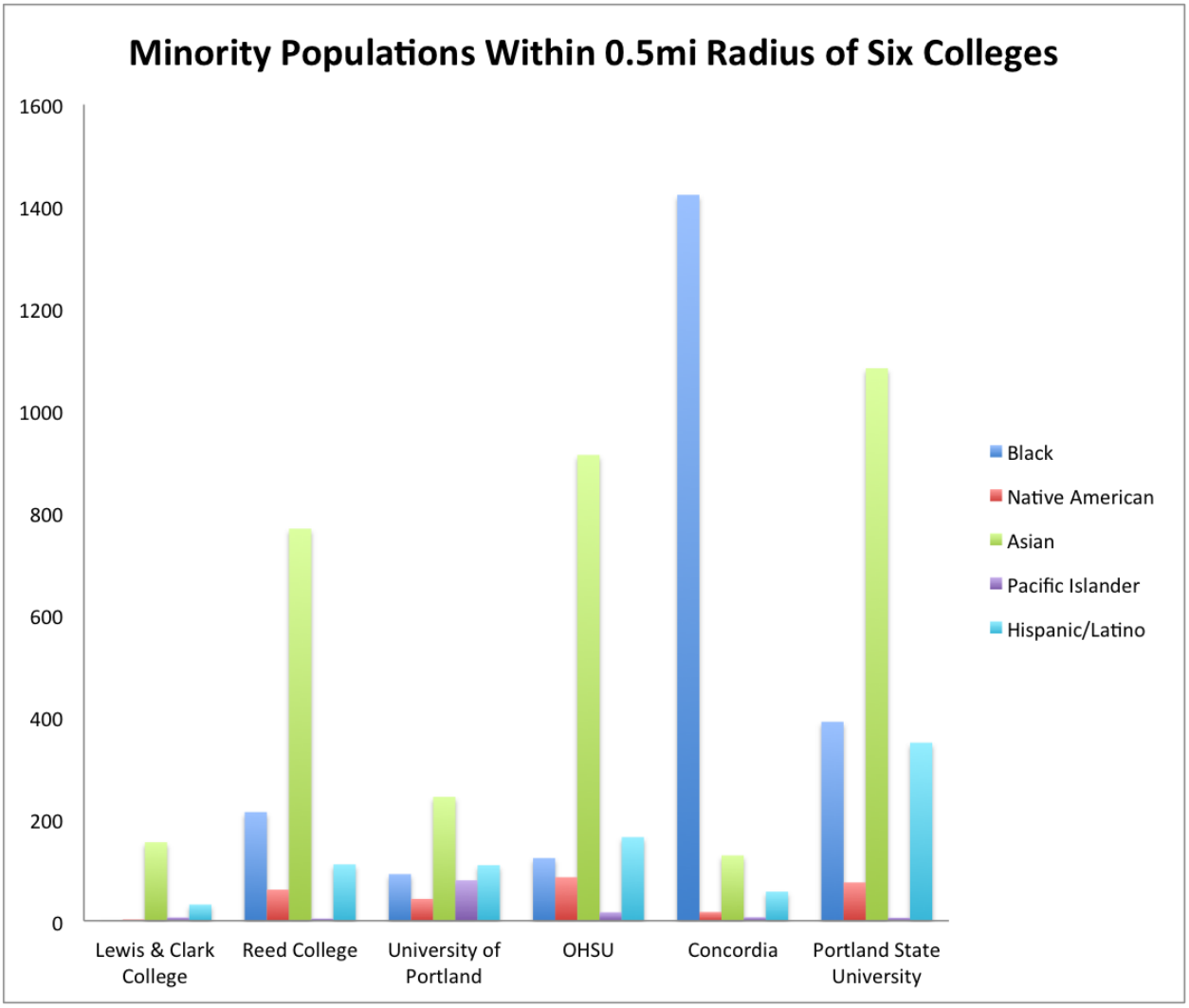

Figure 2: Minority Populations within 0.5mi Radius of Six Colleges

As it turns out, most of the red areas on the map are actually Asian communities, with the exception of Concordia having a predominantly Black population around its campus. In terms of numbers, Concordia has the most people who could be vulnerable to disaster. Next, I created a map that displays the relative hazards in Portland to determine which areas will be most heavily affected.

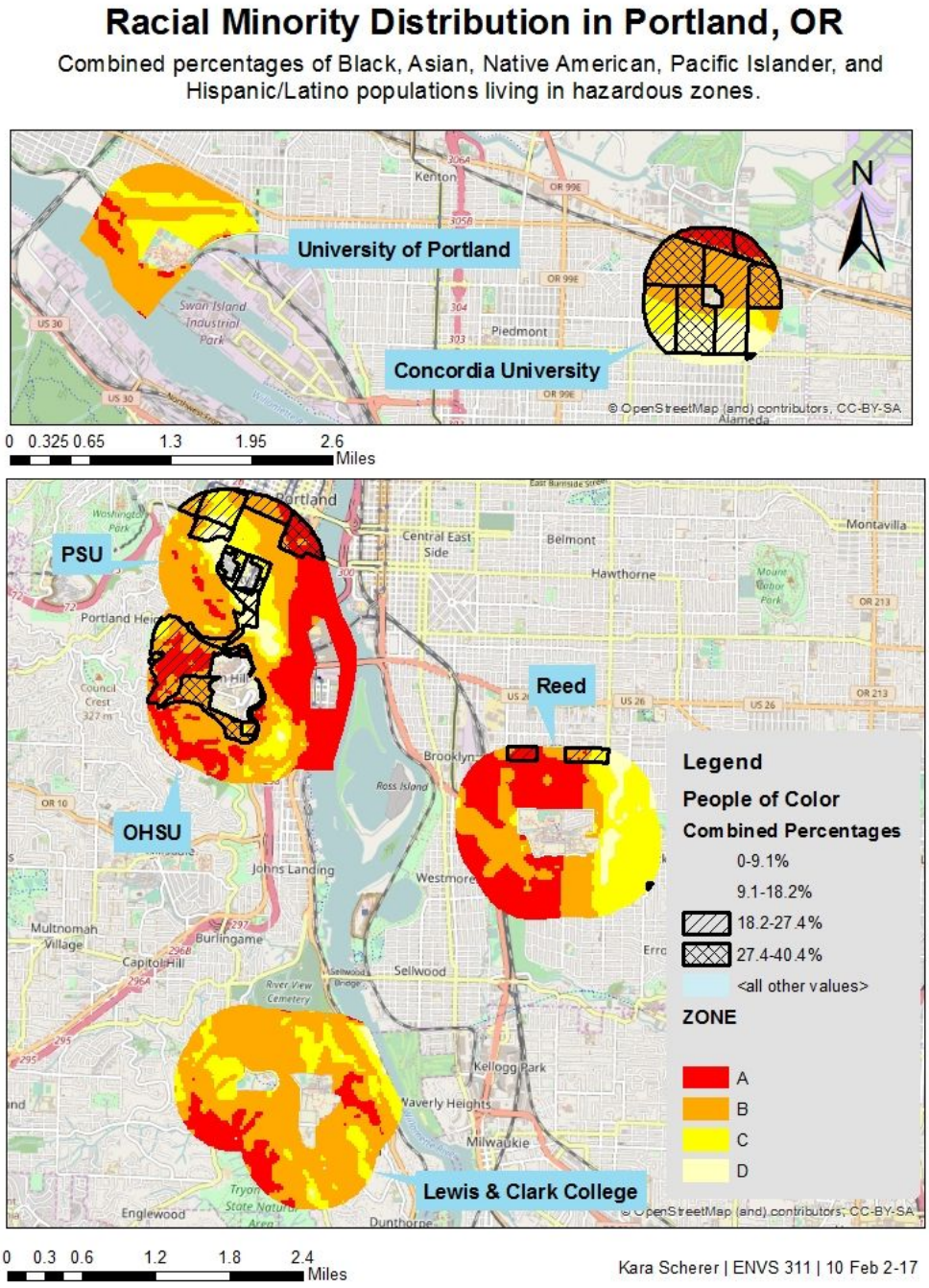

Figure 3: Racial Minority Distribution in Portland, OR Living in Relative Hazard Zones.

This map indicates that in terms of having populations of 27.4% or more people of color living in a Zone A area (areas with double cross-hatch on top of a red area), Concordia, Reed,

and PSU are most at risk. All have relatively small Zone A areas that intersect with communities of color, but the number of people would depend on the population density of the area.

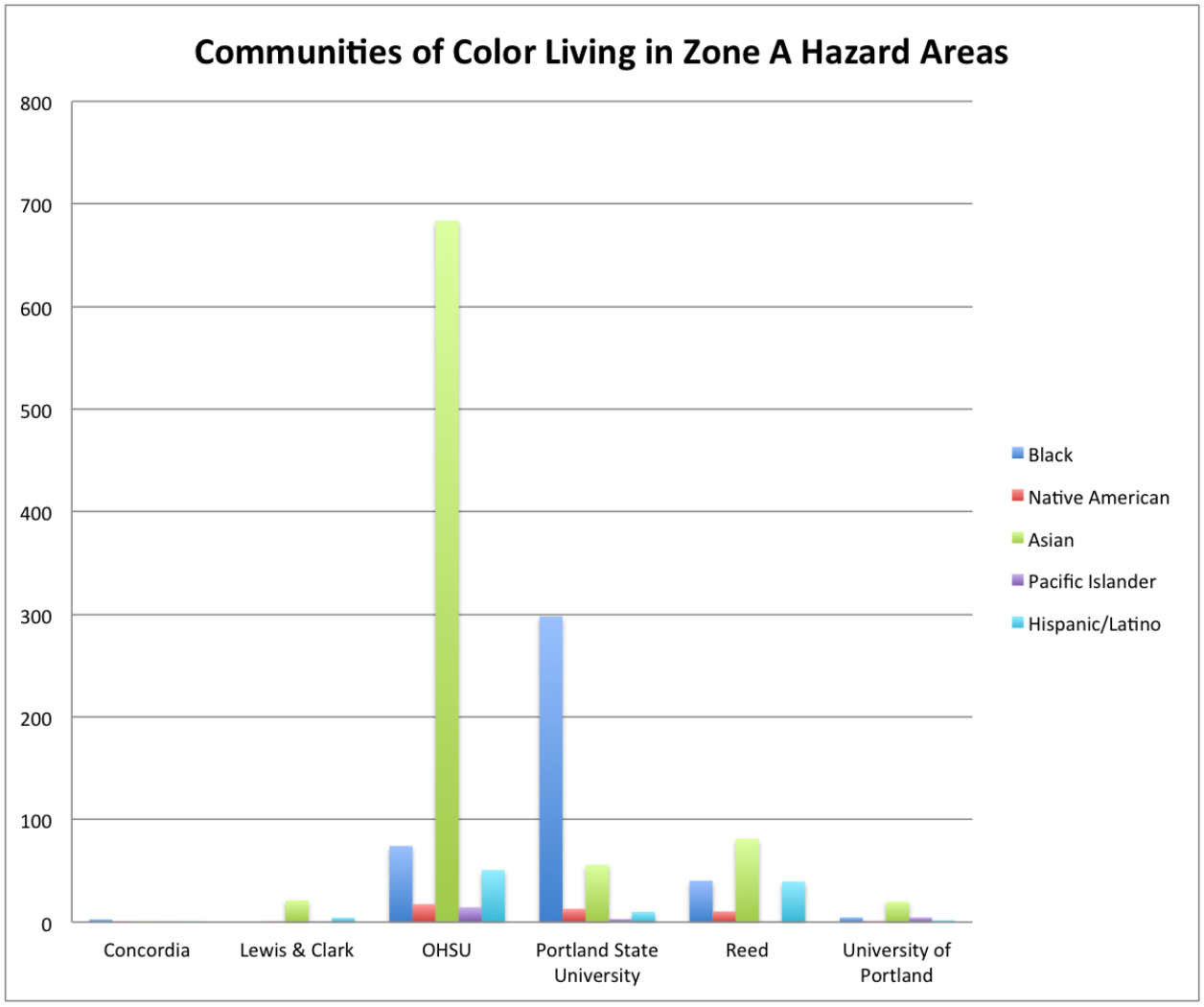

Figure 4: Communities of Color Living in Zone A Hazard Areas

As displayed in the chart above, although Concordia, Reed, and PSU seem to seem to be most at risk, PSU and OHSU actually have the most people at risk, pointing to a higher population density in that area. Upon viewing the map, OHSU doesn't seem to have that many Zone A areas overlapping with communities of color, but the area around OHSU does have a high rises and apartment buildings that could house a lot of people in a small geographic area.

To supplement my findings, I examined the results of my (Un)Natural disaster colleagues who were researching different vulnerability characteristics. AnaCapri Mauro researched education levels, and found that Reed, PSU, Concordia, and UP had significant areas with 50-74.7% of people with no bachelor's degrees. There was a somewhat similar pattern, but the biggest difference was that most people around OHSU had bachelor's degrees, which suggests that although it has a large population of minorities, it may not be especially vulnerable.

Discussion

Ultimately**,** it seems as if population density may play one of the biggest roles in creating a vulnerable population because there will be such a large volume of people seeking help. In terms of race, OHSU and PSU have the most people of color who are living in Zone A areas, so those campuses may want to consider storing some resources for these people. There are a few other areas that could be of concern, but they have under 100 people of color living in Zone A areas around their respective campuses, so although they may need help they would be more likely to get that help from their less-affected neighbors.

In hindsight, we shouldn't have excluded the college campuses themselves from our Zone analysis. Inferring from the surrounding areas, it seems like most campuses fall in Zone B or C, but the majority of Reed could potentially be in Zone A. This is important to consider — perhaps Reed is not a good location to store or plan to supply post-disaster resources because it most likely will be just as devastated as the surrounding community. In this instance, it could be important to identify another trusted organization farther east that is out of the red zone that could be a refuge for the community. On the other hand, Concordia could potentially be in a good position to support their neighbors because although the campus is in a Zone B area, half the community will not be as heavily affected, allowing resources to go more towards neighbors in the north who are in the red zone.

Some factors that could affect the capability of our analysis to predict vulnerable populations who might need help include buffer size, obstructions, other local trusted organizations, and proficiency of community. The buffer size may or may not be accurate after an earthquake. People might walk less or more depending on how much they need help. Obstructions like highways or large parks or hills could deter people from seeking assistance from these campuses. There could be other trusted organizations in the area such as churches, high schools, or other non-profits that may be more prepared to offer help, which could decrease reliance on colleges. If the community is already prepared on a neighborhood level, they may be more able to rely on each other instead of other external help. If we were to continue this project, I would identify other trusted organizations in the neighborhood that may be in less affected zones, and recommend that they accrue resources from the surrounding community to support neighbors in the event of a disaster.

It's important to locate vulnerabilities before disaster strikes because they could affect both pre- and post-disaster disaster stages. By determining where vulnerable populations are, we now have the power to plan and reach out to those communities to help them plan as well. College campuses could be a great resource post-disaster, but they are already incredibly rich information centers that could empower Portland's vulnerable populations to take some actions of their own.

References

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