Households Located Within the Willamette River Floodplain Area in Lane County, Oregon

Ethan Farina-Henry

ES212 Introduction to GIS and Remote Sensing. Environmental Studies Program
Colby College, Waterville, Maine, 04901

Abstract
Every year the Willamette River, in Oregon rises and sometimes floods. I looked at households in census block groups of Lane County, Oregon that overlapped partially with historically flooded areas of the Willamette River. Using 2010 census data, I used ArcGIS to identify census block groups that intersected with the historical flood plain area. I evaluated whether households based on the race of the household was any indication of a residence being affected by flooding. I did not find a definitive correlation between the race of a household and whether a house may be located within the area of a floodplain. It was found that there was statistically a significant difference between the number of white households inside and outside of the floodplain area, a significant difference between Native American households inside and outside of the flood area, as well as a significant difference for black house owners. However, the statistical test used did not indicate that there was a significant difference in regards to Asian households, within and outside of the flood area.

Introduction
During winter and spring seasons there is a risk of flooding along the Willamette River in Oregon (Oetter et al., 2004). During extreme floods, households and other buildings that are situated within the flood plain are at risk of falling victim to the river. Flooding events within Lane County are typically caused by major winter storms, intense rainfall and snowmelt runoff (Lane County.org, 2013). Since the settlement of Oregon in the 1800s, there have been five major floods. These occurred in 1861, 1890, 1945, 1956, and 1964. The 100-year flood of 1964 caused $71 million in damages (Lane County.org, 2013). There are 40 communities within Lane County that are affected by overbank flooding. Overbank flooding poses a major risk to the infrastructure inside these communities; 7% of buildings are located within the FEMA 100-year flood footprint, and 10% of buildings are within the 500-year flood footprint. 84.7% of Lane County residents are white, 0.9% are black, 1.0% are Native American, 2.3% are Asia and the rest are of another race or of two races (Census 2010). I explored whether there is a correlation between households by race and whether they are situated within a flood zone. For this study I used census block group data from 2010 as well as Oregon flood zone data compiled by the Wetlands Conservancy and FEMA. I examined which census block groups have their footprint within the floodplain area of the major historic floods. Using the Census 2010 data I will attempt to determine whether there is a correlation between census groups within floodplain zones and the race of householders within those census groups.

Methods
Census block group data was gathered from www.sociableexplorer.com and www.census.gov. I downloaded demographic data for household by race of household for the census of 2010. From www.census.gov I downloaded a shape file of the census block groups within Lane County. I downloaded Oregon flood zone data by the Wetlands Conservancy in 2009 (oregonwetlands.net) and contains information merged from the FEMA Q3 National Flood Hazard Layer (NFHL) and the ongoing NFHL updates for modern flood data. I used ArcGIS to create a map that showed Lane County and its census block groups. The flood zone area was also included in the map. To give a broad generalization of the household density within Lane County, I symbolized the joined household census data layer with a dot density with each dot representing 30 households, which is shown in Figure 1. Using the map and the census data I evaluated which census block groups overlapped with the floodplain footprint. The number of households inside and outside of the floodplain were then calculated from the census block groups. Figure 2 shows the household density of census blocks within the floodplain. The darker green block groups have more households. The household densities were then separated by race of the household owner.

Results
Of the 258 census block groups in Lane County, 160 fall within the flood zone area (Fig. 3). A total of 95,971 households fall into the census block groups that overlap with the flood zone area. Of these households, 87,375 are owned by people who are white. Table 1 shows the distribution of households, by the race of the household owner, inside and outside of the floodplain area. The remaining households were either owned by Pacific islanders, an unspecified race or someone of multiple races.

<table>
<thead>
<tr>
<th>Race</th>
<th>Inside Flood</th>
</tr>
</thead>
<tbody>
<tr>
<td>White Owner</td>
<td>87375</td>
</tr>
<tr>
<td>Native American Owner</td>
<td>950</td>
</tr>
<tr>
<td>Black Owner</td>
<td>882</td>
</tr>
<tr>
<td>Asian Owner</td>
<td>1782</td>
</tr>
</tbody>
</table>

Figure 4 shows a map of the Eugene/Springfield area within Lane County. The darker red polygon groups indicate a higher number of households that are owned by a race that is not white. There was a significant difference between white household owners inside and outside the floodplain (p=.028). There was also a significant difference between Native American house owners inside and outside of the floodplain (p=.049), as well as a significant difference between black household owners.

Discussion
Because Lane County is a predominantly White region, it is rather difficult to draw any relationship between race of householders and their location within a flood zone. Based on the Mann-Whitney tests that were used to compare the number of households within and outside of the floodplain area, there was not a clear indication that race of householders is influenced by areas at risk of floods. The resulting p-values for White, Native American, and Black owners indicated that there was a significant difference between the floodplain area and outside of the floodplain. However, the p-values for Asian householders indicated that there was not a significant difference between the number of houses inside and the flood area and outside.

I did not have access to data that showed the exact location of households within Lane County. I had to rely on census block groups that fell inside the footprint of the floodplain. Unfortunately this only gave a rough estimate. According to the Lane County government, there are 3 schools, 13 fire stations, 2 water facilities, and 4 wastewater treatment plants that are within or extremely close to the floodplain boundary. However, they do not include information for the number of residences that are within the boundary. A common mistake when examining floodplain data is to assume that areas outside of the floodplain are not at risk of flooding. Similarly, just because a structure is located within the footprint of a 100-year or 500-year floodplain, does not mean that the structure will be flooded. Some residences and structures have had their first–floors elevated to avoid damage from floods. LaneCounty.org. In order to better understand the risk that Lane County households face from flooding, more detailed census data is needed.

Acknowledgements
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References


Lane County government, 2013. Lane County Flood Hazards.


Census=C2010&ReportId=R10489596

Wetlands Nature Conservancy.

Figure 1. Dot density of household(s) and the floodplain area footprint.

Figure 2. Floodplain boundary of the Willamette River and tributaries with Lane County in green.

Figure 3. Household density of block groups within footprint of floodplain.

Figure 4. Block groups indicating density of non-white householders within floodplain area.