

LITTER POLLUTION IN DENSELY VERSUS SPARSELY POPULATED AREAS: DOG RIVER WATERSHED

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It is commonly known that when humans populate an area that area is usually subject to some environmental degradation. One of the more common aspects of environmental degradation is litter. This type of degradation is no stranger to the Dog River watershed. For years residents have seen the rivers in this watershed covered in trash, specifically after rain events. The vast majority of the trash is a result of litter from roadsides being carried into the river via drainage pipes. This paper is a comparative study of litter in areas of varying population densities in the Dog River watershed. It seeks to distinguish between the amount of litter found in densely populated areas and sparsely populated areas, and to find out if there is a correlation between population density and litter. I utilize GIS to map population density of the Dog River watershed, and analyze and compare the amounts of litter in areas of sparse and dense populations. The results show that there is no correlation between population density and litter. It also shows that there is no difference in the amounts of litter found in densely and sparsely populated areas.

Keyword: litter, population density, watershed

Introduction

Pollution has long been an issue in the Dog River watershed, in particular litter pollution. The extent of the pollution has not gone unnoticed. There are groups of people and organizations who have taken increased interest in the Dog River watershed with intentions of reducing pollution, including Dog River Clearwater Revival and its numerous volunteers. However, these groups are not capable of completely ridding the area of trash pollution. Human populations have to take an active role.

In every society, there are different settlement patterns that occur. Bodies of water have been known to “act as integrators and centers of organization with the landscape” (Schnaiberg, 2002). Therefore, it is no surprise that the Dog River watershed, also located near the coast, is a populated region. Much of the literature has noted that “human population density conveniently unites a range of human influences on the landscape,

from recreation to construction” (Thompson, 2001). One of the influences or by products of the influences human populations have on the environment is pollution. According to Keep America Beautiful Inc. motorists account for 52 percent of litter pollution and pedestrians account for 23 percent of litter pollution (2006).

“Population density is the measure of the number per unit” (Rosenberg, 2012). In a densely populated area, the measure of the number per unit would be high and in a sparsely populated area, the measure of the number per unit would be low. The measure of the number is not a specific number per unit because dense and sparse in the Dog River watershed is comparative.

While a populated region can account for litter pollution, as where ever there is a human population there is bound to be trash or litter, this research seeks to distinguish between litter pollution in densely populated areas and sparsely populated areas of the Dog River watershed. The research intends to prove if the population density is related to the amount of litter found in an area. This is important as much of the literature today suggests that “a larger population obviously tends to imply more pollution” (Eriksson, 2005). This statement is true when looking at population and settlement on a large scale but it does not take into account the population density of a place or the other factors that may increase litter in that area.

Research Question

Are the amounts of litter pollution greater in densely populated areas of Dog River watershed or sparsely populated areas? Is there a correlation between population density and litter?

Methods

To decide which areas are densely populated or sparsely populated I utilized data provided by the City of Mobile and census data to create a map using GIS. The measure of the number per unit area used is the number of people per block group. The size of each of the block group varied. The density was calculated and the map in Figure 1 was created to show the population density of block groups within the Dog River watershed. Ten locations were chosen to be sample areas. They were the top five densely populated and the five most sparsely populated areas (Fig. 2).

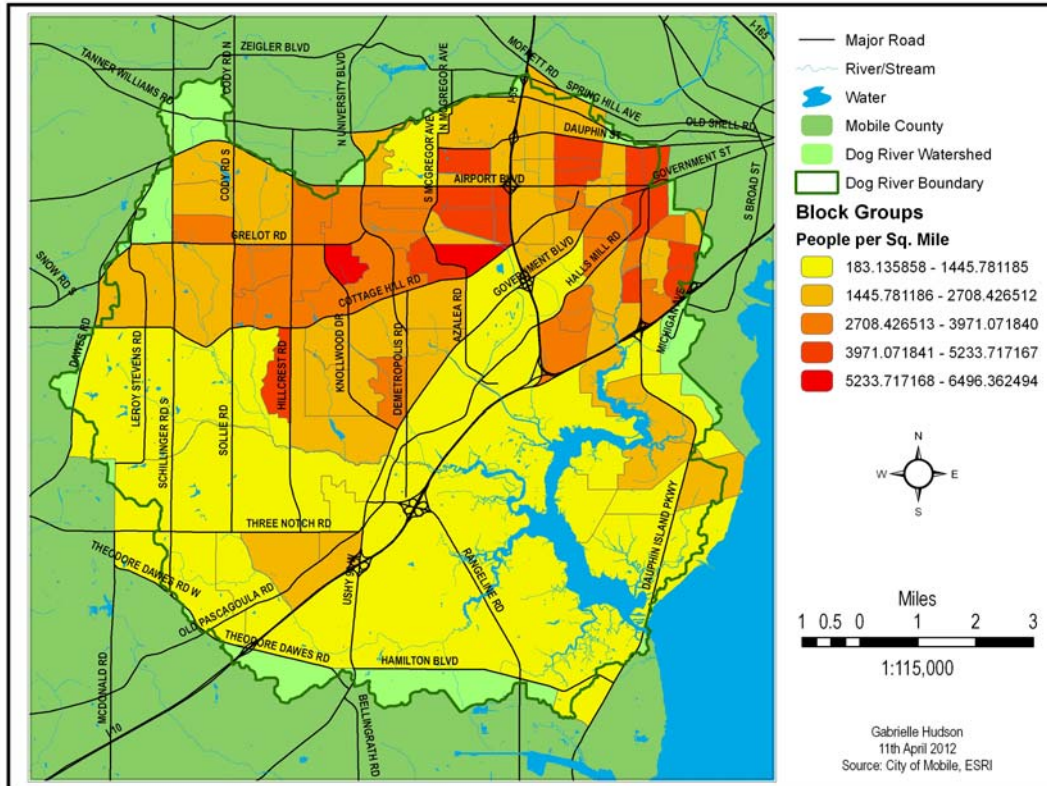


Figure 1. Population density in the Dog River watershed based on block group data

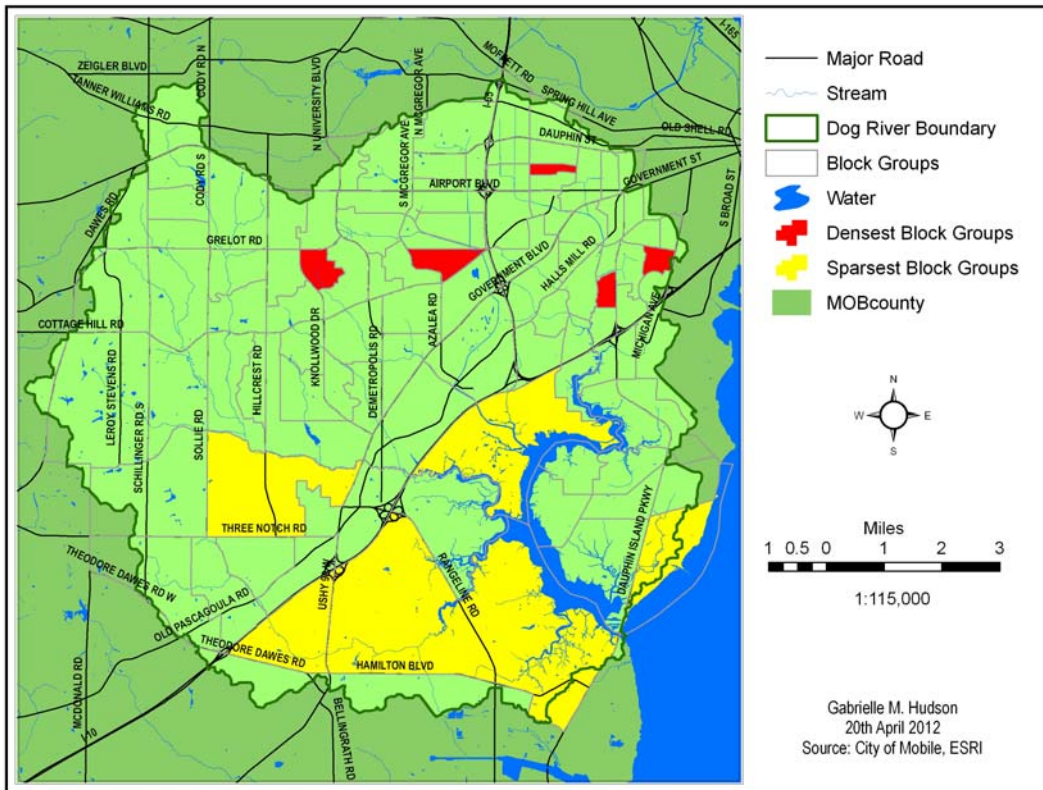


Figure 2. Five most dense and five most sparse blockgroups in the Dog River watershed

Those samples were broken down into descriptive geographic locations. Three roads were chosen, two being residential only and one a mixture between residential and commercial, and surveyed for litter using a specific scale. The scale consisted of three categories including no litter, light litter and moderate to severe litter. No litter indicated that no litter was visible, light litter indicated that upon assessment a small amount of litter was visible, and moderate to severe litter indicated that litter could be seen throughout the area or was extensive (Fig.3). Using the scale created and a map of the samples, I visited those sites to collect data. While at each site documented the amounts of litter based on the scale previously created. Photos were also taken to document what was seen. The data collected was then statistically analyzed using the Chi-square test.



Figure 3. (a) This image is an example of a site that would have no litter. There is no visible litter. (b) This image is an example of a site that would have light litter. There are very small amounts of litter visible and the pieces are very spread out. (c) This image shows a site that has moderate to severe litter. There are quite a number of pieces of trash.

All photos compliments of Gabrielle Hudson.

Results

Based on the outcome of the Chi squared test it is determined that there is no correlation between the population density of an area and the amount of litter found in that area. The raw data gained from the densely populated areas and from the sparsely populated areas were very similar. As seen in Figure 4, in the densely populated areas there were two sites that had no litter, nine sites that had light litter and four sites that had moderate to severe litter. Similarly, in the sparsely populated areas there were three sites that had no litter, eight sites that had light litter and four sites that had moderate to light litter (Fig. 4). The Chi squared test was used to test the null hypothesis, that litter and population density are independent of each other, in hopes to reject the null hypothesis

and accept the alternative hypothesis.

The alternative hypothesis provided was that litter and population density are dependent of each other. In essence I tested to see if litter and population density have no dependence on each other, in hopes that it proved that litter and population density are actually related. The test was done on a level of 99.9% confidence and needed a result of 9.21 to reject the null. The result from the testing however was 0.26 which means I was unable to reject the null.

It is important to note that most of the rules of the test were satisfied. However, the expected frequency was not greater than or equal to five in 75% of the cells, as should be the case when performing the Chi squared test. This requirement was narrowly missed as two of the cells missed the requirement by one.

Conclusion

While the results were not what was expected, the findings were still significant. As previously stated much of the literature today suggests that a denser population is

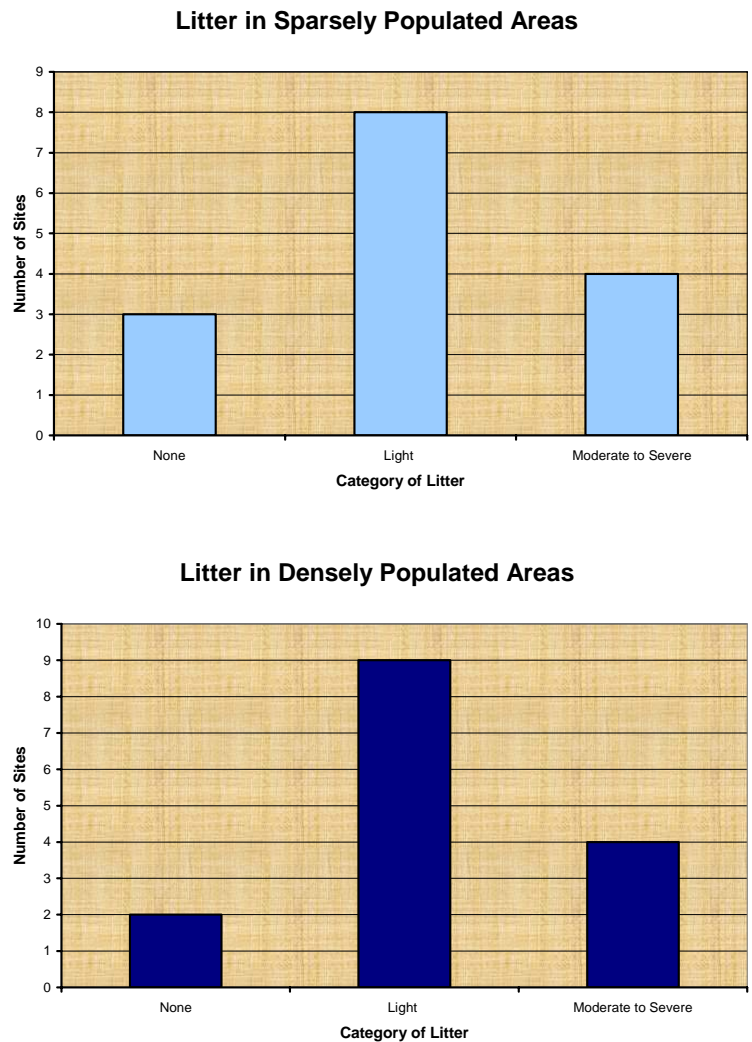


Figure 4. The graphs above show the litter groups and the amount of sites they were found at.

associated with larger amounts of litter. This is especially indicated in areas of a large scale, such as big cities. Based on this research, however, it is now known that in a smaller area, such as the Dog River watershed, this is not necessarily true. There is no correlation between the population density and the amount of litter. This also raises a question for areas that are larger. Is population density really a factor in the amount of litter in larger areas or are there other factors in larger areas that affect the litter amounts instead?

Upon doing my research it is apparent that the concern about pollution in the Dog River watershed is valid. While there were some areas that were very well kept and had no litter, they were of the minority. There was no shortage of litter found and some areas proved to have shocking amounts. Some of the more noticeable reasons litter may be in an area is due to demographics. There was a noteworthy difference in the amounts of litter seen in areas of a higher class or income and areas of a lower class or income. Another significant indicator of litter is traffic patterns. There seemed to be more litter in highly trafficked areas and there also seemed to be more litter at corners of roads. These may be topics suitable for future research.

I did come across some challenges in my research. Due to a limited amount of time and transportation I was unable to get a more significant amount of data. I was also unaware that I would face the issue of having less than 75% of the cells in the Chi squared test equaling less than 5. If duplicated I would suggest using more than ten sites surveying 3 roads each or using ten sites surveying more than 3 roads each.

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