The University of Iowa
IOWA INITIATIVE
FOR SUSTAINABLE COMMUNITIES

Brownfields and Social Vulnerability

Using Free & Reduced Lunch as an Indicator in Clinton County, Iowa

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Senior Project Seminar | Geographical & Sustainability Sciences

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Brownfields in Clinton County, Iowa

Introduction

Over the years, environmental issues have received greater attention in the United States. Beginning in the 1980s, concern over hazardous waste grew substantially. There was a national push for greater attention and concern over the location of hazardous waste sites and their proximity to the general public, who can be adversely affected due to exposure to the toxic chemicals released by these sites. This focus includes sites abandoned and those currently in operation. In 1982, hazardous material locations and their proximity to minority neighborhoods gained national attention (Comission For Racial Justice 1987)

Communities like Warren County, North Carolina served as a case study of racial injustice. Warren County was chosen as the location of a polychlorinated biphenyl landfill. The county is a majority-minority community with high rates of poverty (Comission For Racial Justice 1987). In this vein, I focus attention on the connection between high-poverty communities and the location of hazardous sites in Clinton County, Iowa.

Objective

Determining the relationship between high-poverty areas and brownfield locations is complicated by a variety of factors, such as social and economic development, political and cultural relationships, as well as zoning laws and population migration. Despite these difficulties, I attempt to study the relationship using geographic tools.

Household Size	Reduced Price Meals					Free Meals				
	Yearly	Monthly	Twice per Month	Every Two Weeks	Weekly	Yearly	Monthly	Twice per Month	Every Two Weeks	Weekly
1	$21,978	$1,832	$916	$846	$423	$15,444	$1,287	$644	$594	$297
2	$29,637	$2,470	$1,235	$1,140	$570	$20,826	$1,736	$868	$801	$401
3	$37,296	$3,108	$1,554	$1,435	$718	$26,208	$2,184	$1,092	$1,008	$504
4	$44,955	$3,747	$1,874	$1,730	$865	$31,590	$2,633	$1,317	$1,215	$608
5	$52,614	$4,385	$2,193	$2,024	$1,012	$36,972	$3,081	$1,541	$1,422	$711
6	$60,273	$5,023	$2,512	$2,319	$1,160	$42,354	$3,530	$1,765	$1,629	$815
7	$67,951	$5,663	$2,832	$2,614	$1,307	$47,749	$3,980	$1,990	$1,837	$919
8	$75,647	$6,304	$3,152	$2,910	$1,455	$53,157	$4,430	$2,215	$2,045	$1,023
For each additional family member add:	+ $7,696	+ $642	+ $321	+ $296	+ $148	+$5,408	+$451	+$226	+$208	+$104

Table 1

For my project, I look at the relationship between brownfields, public school locations, and the school rates of free and reduced priced lunches. Table 1 shows the income guidelines for students receiving free and reduced priced lunches in the state of Iowa (Iowa Department of Education 2016). I wanted to see if more vulnerable populations were likely to live closer to the brownfield locations in Clinton County, Iowa.

The Iowa Initiative for Sustainable Communities is a campus-wide community with the goal of enhancing Iowa communities' sustainability efforts. (The University of Iowa 2017). The Iowa Initiative for Sustainable Communities partnered with students from The Urban and Regional Planning Department to look more closely at the brownfields in Clinton County, Iowa and specifically focus on their locations relative to residential populations. Basic demographic data was identified. Clinton County has a population of 49,116 with a population density of 70.67 people per square mile. As of 2010, there were 21,733 housing units. The racial makeup of the county was 95.87% White, 1.89% Black or African

American, 1.25% Hispanic or Latino, 0.24% Native American, 0.56% Asian, 0.02% Pacific Islander, 0.34% from other races, and 1.08% from two or more races. The median income for a household in the county was $37,423, and the median income for a family was $46,450. Males had a median income of $35,049 versus $21,333 for females. The per capita income for the county was $17,724. About 7.70% of families and 10.20% of the population were below the poverty line, including 13.70% of those under age 18 and 7.80% over the age of 65 (United States Census Bureau 2015).

Data Sources

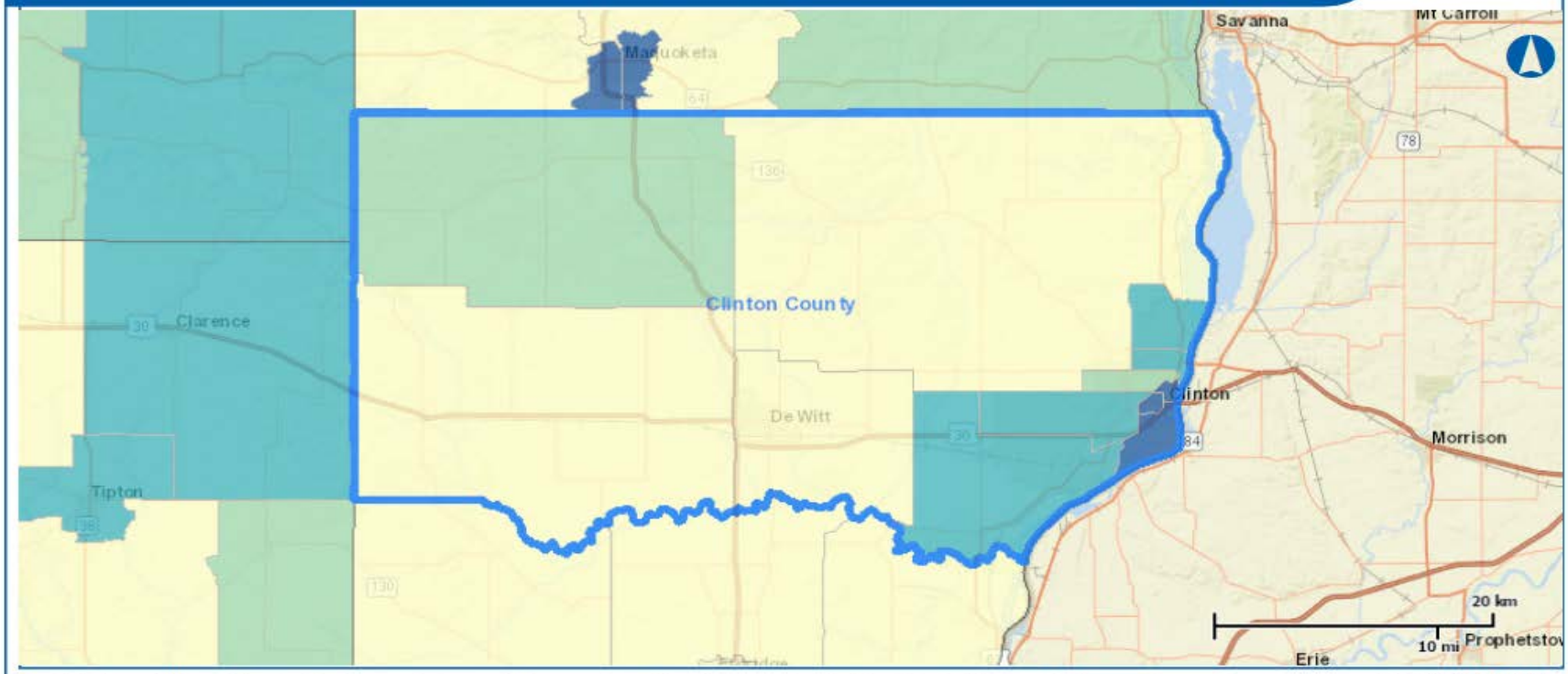
- The Environmental Protection Agency Brownfields location listings
- The Iowa Department of Education data on students receiving free and reduced price lunches
- The US Census Bureau's Clinton County demographic date
- A Social Vulnerability Index calculated from The Agency of Substances and Disease Registry

Methods

First I wanted to look at where the vulnerable communities in Clinton County reside. Social vulnerability is defined as "the resilience of communities when confronted by external stresses on human health, stresses such as natural or human-caused disasters, or disease outbreaks" (The Agency for Toxic Substances & Disease Registry 2013). The Social Vulnerability index uses census data to determine the vulnerability of an area down to the tract level. The index then rates each tract based on fourteen different factors, including poverty, lack of vehicle access, and crowded housing. It then groups the variables into four related themes. Maps of the four themes are shown in the figure below. Each tract receives a separate ranking for each of the four themes, as well as an overall ranking (The Agency for Toxic Substances & Disease Registry 2013). Using Social Vulnerability Indexes, community planners can make more informed decisions on brownfield sites remediation and the impact on human populations.

Social Vulnerability Index (SVI) 2014

Overall Vulnerability | Iowa
[Data Classfied by Iowa Census Tracts]



Social vulnerability refers to the human factors within a community that negatively affect its ability to manage circumstances harmful to health. Communities must prepare for and respond to hazardous events such as environmental disasters, chemical exposures, and disease outbreaks. Preparing for these events prevents or decreases both human suffering and financial loss. The Social Vulnerability Index (SVI)[1] compares and ranks every community in the U.S. at the Census tract level, on many social factors. These factors, including poverty, lack of car access, and crowded housing, are further grouped into four related themes. Each community receives a separate ranking for each of the four, as well as an overall ranking. **To learn more,** please visit SVI home page.

Highest (Top 4th) — **Vulnerability (SVI 2014)** — Lowest (Bottom 4th)

Zero population census tracts

Data sources: [1]ATSDR GRASP. **Projection:** WGS 1984 Web Mercator (Auxiliary Sphere).
Reference: Flanagan, B.E., et al., *A Social Vulnerability Index for Disaster Management*. Journal of Homeland Security and Emergency Management, 2011. 8(1).
Print Date: 4/27/2017.

Agency for Toxic Substances and Disease Registry
Division of Toxicology and Human Health Sciences

GRASP

ATSDR

Map1

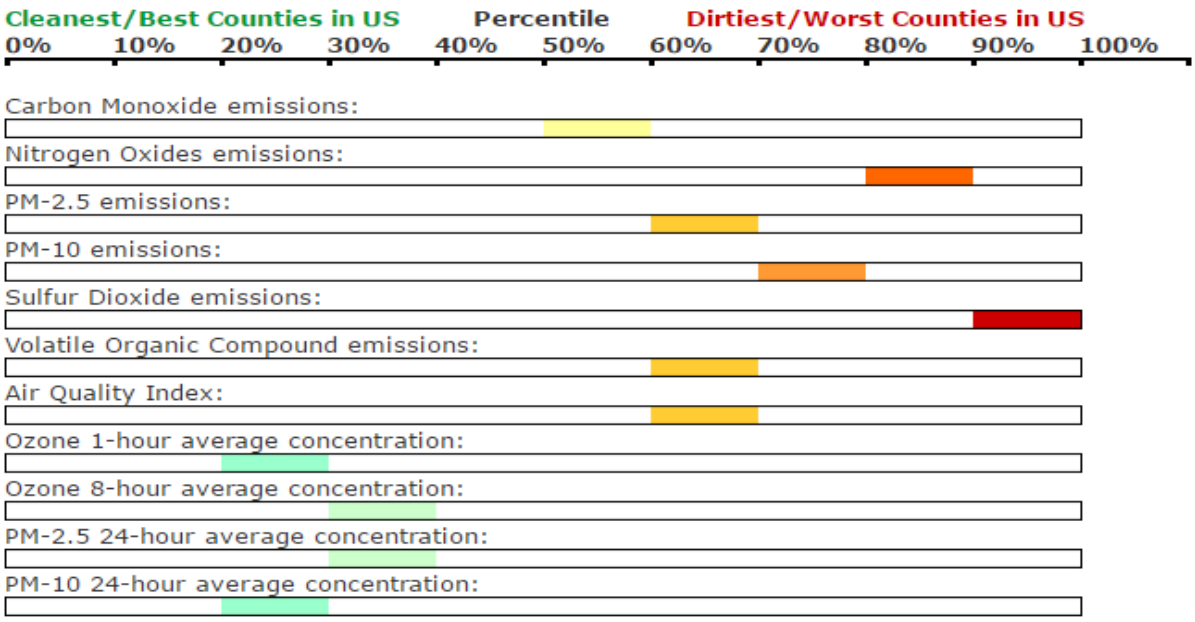


Figure 1

After determining the location of vulnerable communities in Clinton County, I analyzed the location of brownfields and their proximity to public schools within Clinton County. Using shape files of the brownfield locations for Iowa, I queried out all the relevant sites located in Clinton County. I then mapped the locations of public schools in Clinton County from data I received from the Iowa Department of Education. I created shape files of the locations of the schools. Once all the locations were mapped out I put a two and a half mile buffer radius around the contaminated sites. Iowa there is a stronger potential for wind disturbances in the air and it is easier for particulates to get diffused because of this, I wanted to make sure we were looking at an area that was less likely to be disturbed and therefore have a higher concentration of particulates in the air. Figure 1 illustrates Clinton County air pollutants scorecards. Once the buffer was placed I used a spatial join to determine how many public schools were located inside that buffered area. A spatial join uses one of two types of relationships, a

one-to-one or a one-to-many relationship. Spatial joins have to be one-to-one relationships (Esri 2009). Figure 2 is a graphic representation of a join.

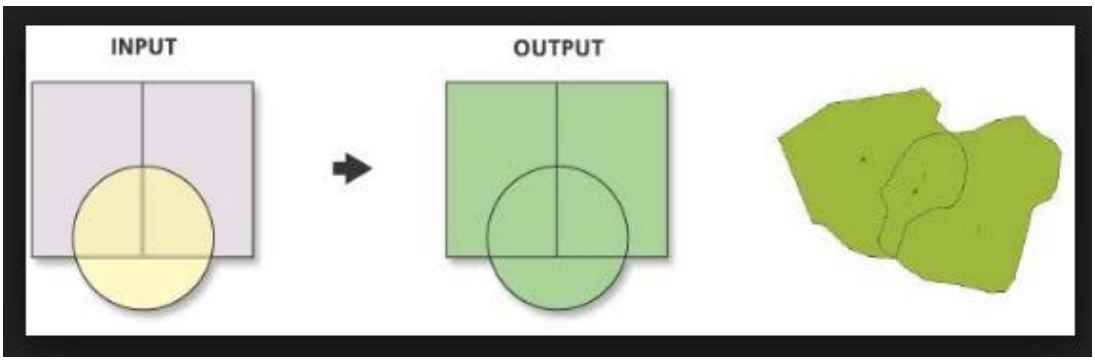
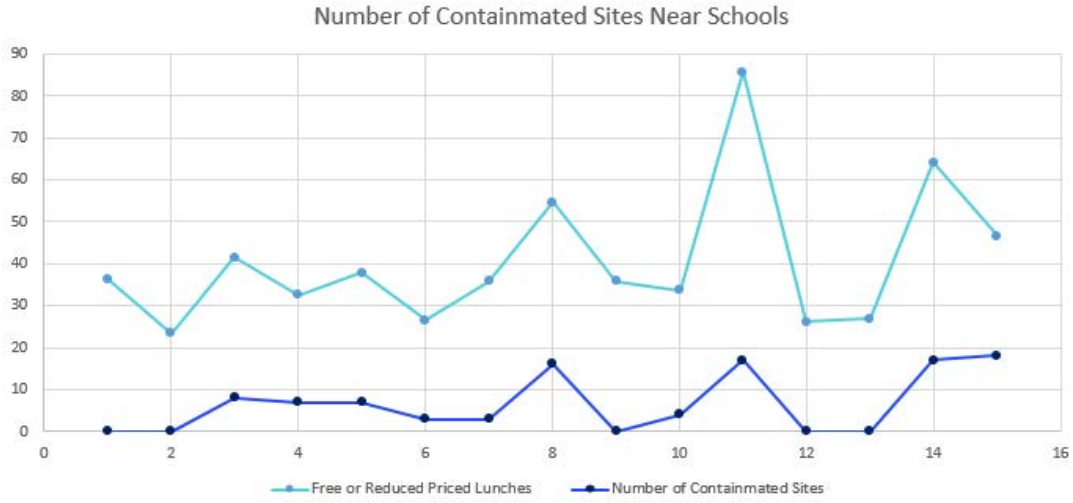


Figure 2

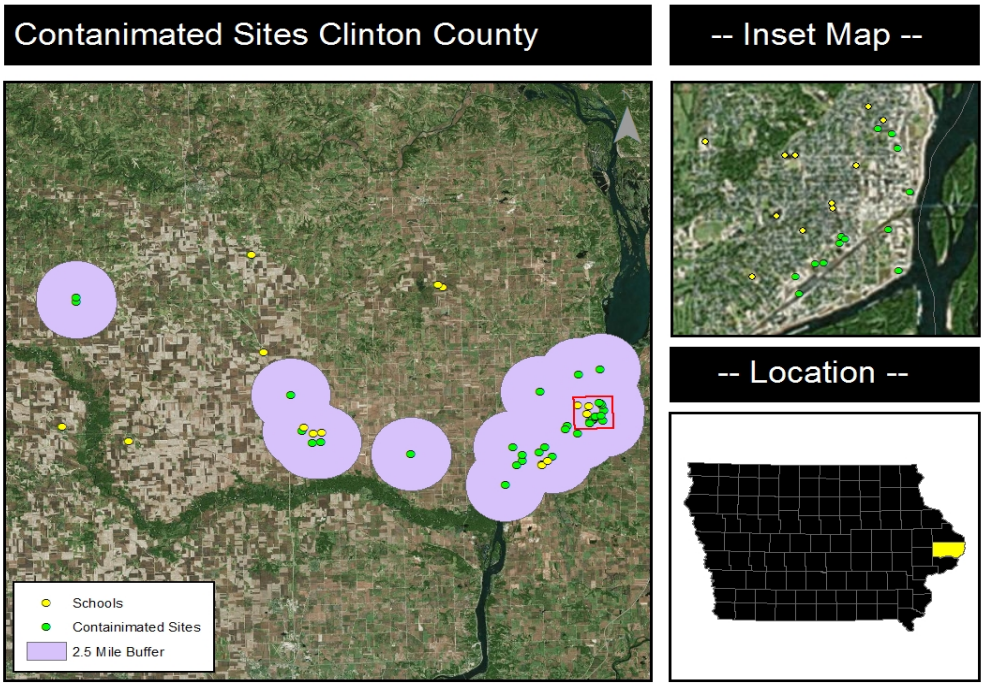
Once the items were joined, I was able to get a count of how many public schools were in 2.5 mile radius of each site. This allowed me to study the school individually and identify which students receive free or reduced priced lunches at each school. Those figures are shown in graph one. In the graph the school with the highest number of students receiving free or reduced priced lunches was Jefferson Elementary with 86% they also had eighteen contaminated sites within a two and a half mile radius.

Conclusion

Graph 1 demonstrates a significantly higher proportion of students who receive free of reduced priced lunches relative to higher numbers of contaminated sites in the community.



Graph 1



Map 2

Map 2 shows the locations of the sites, schools and the buffer of the sites. If you compare the clustering of the sites to map one there is a clear correlation to the location of sites and vulnerable communities. While this finding is admittedly not groundbreaking, this paper gave me the opportunity and experience to apply geographic software tools to real-world problems. If given the opportunity for future research, I would be interested in studying the community health implications of living in such close proximity to the contaminated sites. Is there a higher prevalence of asthma or cancer in these communities? I would also like to study the causal direction of the subject. Do high-poverty communities attract development which ultimately leads to brownfields or does lower socio-economic status lead to settlement in areas with a higher percentage of brownfields? Perhaps the two move together or both are influenced by other unidentified factors?

Understanding of these relationships may lead to even more research in this area. Will environmental remediation lead to more gentrification? Will socially vulnerable populations relocate as property values rise in communities where current residents can no longer afford to live in an area where land is more desirable and less hazardous? Answers to these questions are beyond the scope of this project but better understanding of this data and awareness of socially vulnerable populations therefore can help communities can make even better and more informed public policy decisions.

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