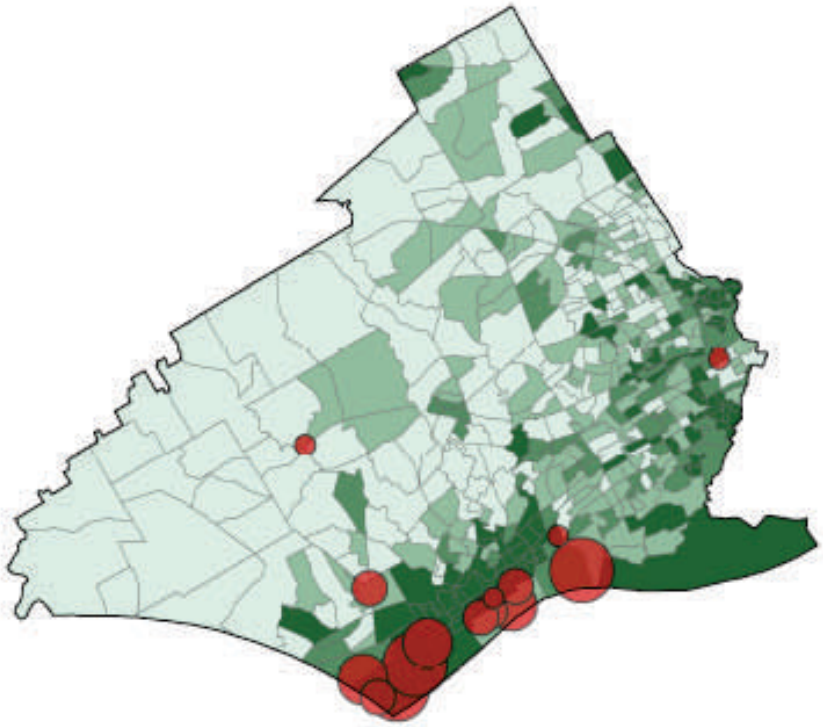
Mapping Environmental Justice

in Delaware County, PA



Environmental Studies Capstone

Swarthmore College, Swarthmore PA

Spring 2006

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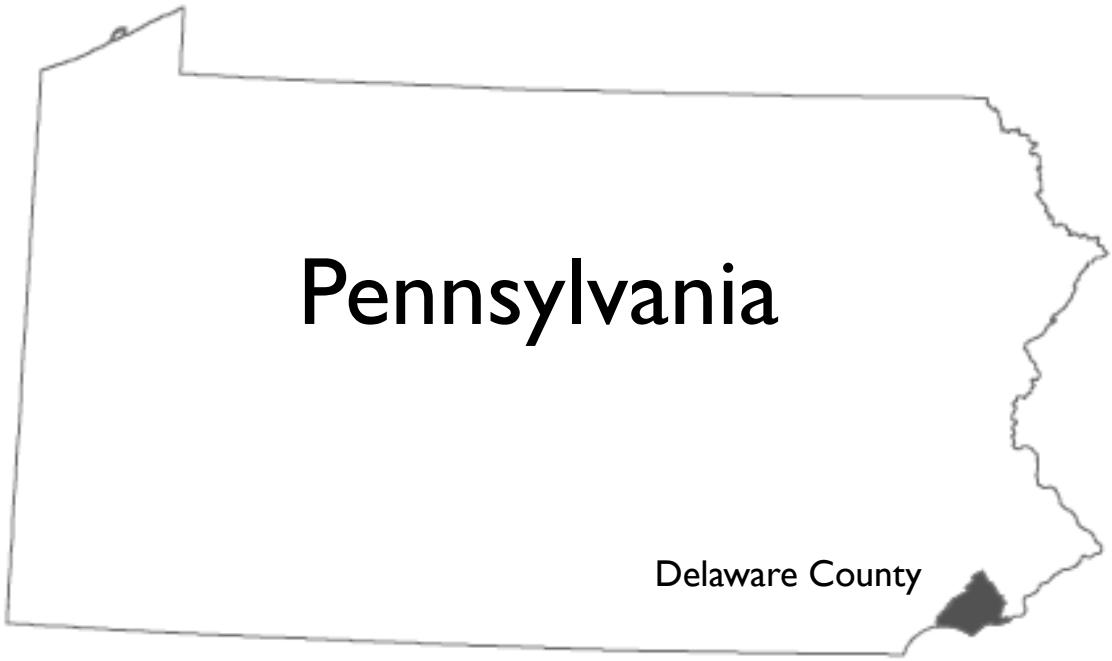

Pennsylvania
Delaware County

Preface:
A Note From the Class

As Environmental Studies minors at Swarthmore College, we have examined the interactions between humans and the natural world. We have looked at a variety of subjects in a multitude of courses, including policy, ecology, sociology, religion, and economics. Now, in our final year, our Capstone has focused on environmental justice, and this booklet has been the culmination of our semesters' efforts. It is the product of our desire to contribute to the communities of Delaware County and is a tool useful for all ages. As injustices result from unequal distribution of environmental harms, we chose to use maps as the centerpiece of our project to help people visualize inequalities present in the places where they live. Environmental justice is not only distributional justice; rather, it is a complex issue, and we have still not come to a consensus about what it means to us. We've asked a lot of questions over the course of this project, and we hope that its product inspires thought and conversation. Environmental justice is a universal issue; *Mapping Environmental Justice in Delaware County, PA* is an attempt to bring attention to its many facets in order to create productive dialogue and action.

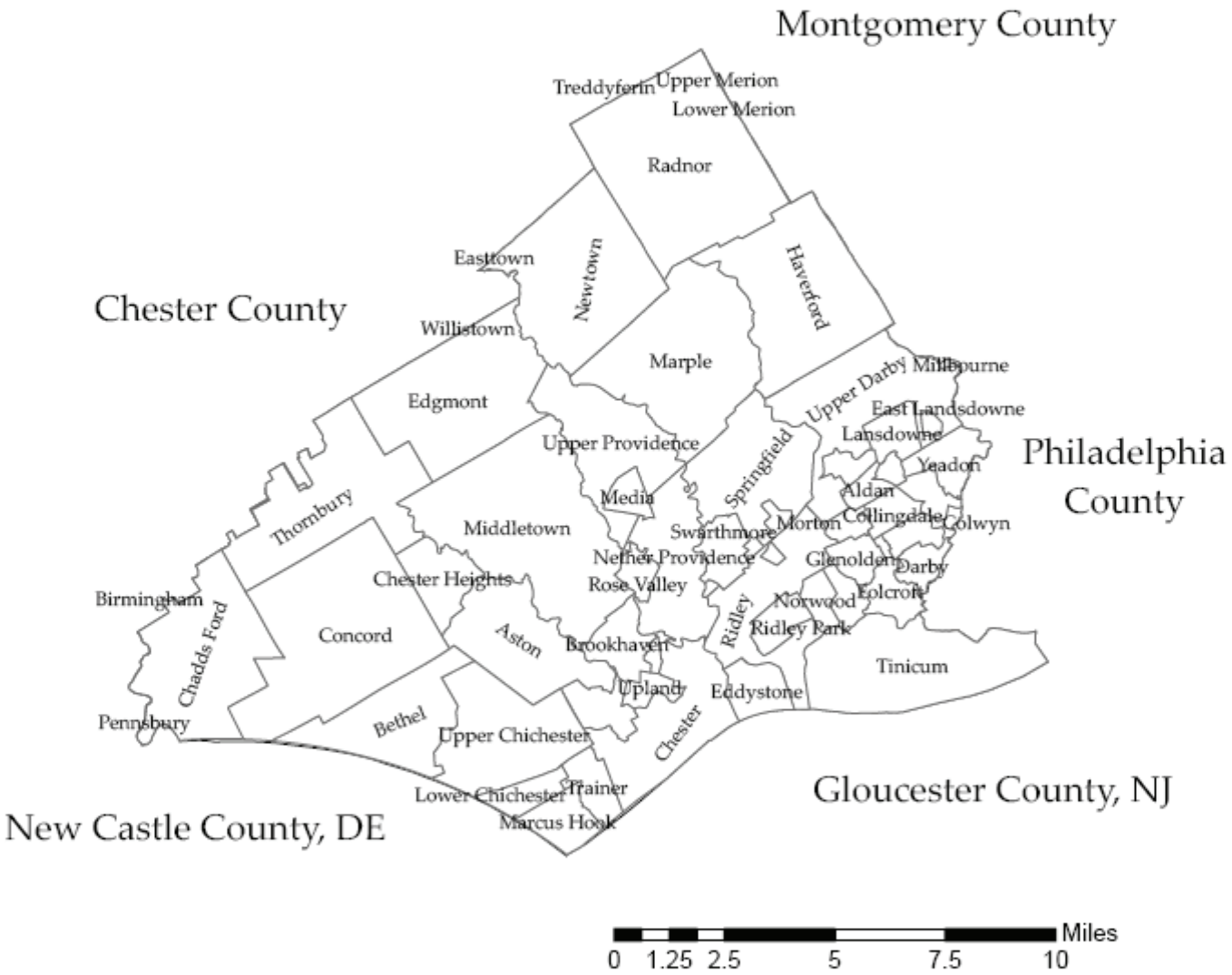
This project would not have been possible without the following people: Diane Anderson, Geoffrey Compton, the organizers of the Delco Concerned Citizens for the Environment Conference, James L. Greer, Carr Everbach, Mike Ewall, Cynthia Jetter, Harris Kornstein, Art McGarity, Hans Oberdiek, Geoff Semenuk, and Doug Willen. We would like to especially thank our professor Carol Nackenoff, who has been a mentor, a voice of reason, and a huge support to all of us throughout the semester.

We are eternally grateful your help.

Sincerely,
The members of the Environmental Studies Capstone, *May 2006*

Eliza Cava
Lauren Fety
Meggy Hudson
Keefe Keeley
Luned Palmer
Carrie Ritter
Emma Schroeder
Emily Wistar

Figure 1. Municipalities



Delaware County, PA
Municipalities

A note about the mapping process

How did we decide on map features? How do I use these maps?

From all of the information we gathered, it was difficult to decide which layers to use. Following days of group discussion, we decided on the maps you see in this booklet. Many of them are common demographic indicators (income, race, and education). We found striking differences between townships in terms of concentrations of income, minority populations, and children, and those differences are the reason we chose to map those particular indicators. In other respects, such as family size, Delaware County is much more homogeneous. The environmental data is more unusual. Why did we decide to map superfund sites with abandoned landfills? *Because both are historical sites, yet pose dangers today*. Why did we map **point sources** of air and water **emissions** together? *Because pollution into the air and water can spread, rather than sinking into the ground.*

None of these decisions were completely objective; we do have a story to tell. However, we provided ways for you to tell your own stories. Each map (and accompanying transparency) has its own set of features. It is up to you to layer these: what do water emissions (Fig. 9) look like on top of streams and green spaces (Fig. 3)? How does the 'Top 15 Polluters' map (Fig. 12) look on top of the 'Unemployment' map (Fig. 6)? There are many different ways to look at this information; we have just provided the tools and information to make it possible.

What data sources did we use? What mapping programs did we use?

There are many available sources for demographic and environmental data. We used many different sites to compile our data. Below is a list of our resources and data. For creating these maps, we used ArcGIS and ArcMap, both software created by ESRI.[1]

Tiger/LINE data. From ESRI.
http://www.esri.com/data/download/census2000_tigerline/index.html
Creeks, municipalities, roads, railroads, census blocks, county outline

National Highway Planning Network
http://www.fhwa.dot.gov/planning/nhpn/
Highways

Pennsylvania Spatial Data Access (PA's digital data repository. These resources come from many different organizations, but they are all available for free and to the public via PASDA.).
http://www.pasda.psu.edu/
Abandoned municipal landfills, air emissions plants, municipal waste operations, residual waste operations, captive hazardous waste operations, superfund sites, water resources, airports

Landview 6. A viewer for the Environmental Protection Agency, U.S. Census Bureau, and U.S. Geological Survey Data and Maps. 2004.
Demographic, social, and economic information

What are our projection coordinates and why?

In creating maps, you must take into account the **coordinate system** you use. Coordinate systems are created from surveying land, with a baseline at the equator. Since every survey may end up with slightly different measurements, it is important to use the same system throughout. There are two widely used coordinate systems today: North American Datum 1983 (NAD-83) and World Geodetic System 1984 (WGS-84). As these are deemed equal unless doing calculations between coordinate systems, it is appropriate for our purposes to map these together.[2]

Not only must your coordinate system be taken into account, but how that system is projected; as the Earth is round, how the sphere is transferred onto a flat sheet of paper matters. There are many different **map projections**. The Universal Transverse Mercator (UTM) projection uses a grid to project small sections of the globe accurately; since we are only working with a small area, this was the best projection for our work.[3]

We used NAD-83 coordinates for our transportation map, and WGS-84 for the other 11. All of the maps were projected with the Universal Transverse Mercator projection in grid 18N, which is the section of the world that Eastern Pennsylvania falls in.

What scale did we choose and why?

All maps are projected at a scale of 1:250,000, which means that one inch on paper equals 250,000 inches in real life. As you can see on each of the maps, that scale translates to one inch on paper equaling 4 miles in real life. Projected at that scale, our maps take up only half a page each, which means we've lost some detail in terms of the street names we could label and how accurately a reader can find his or her house. However, by making the county almost small enough to fit in your hand, we hope to emphasize how small it really is and how while environmental impacts do affect some groups of people more than others, they really affect us all.

Questions to think about:

1) What other features would you like to see mapped? Why? What would they tell you?
2) How do our maps compare to a map you might draw of the county? Of your hometown?
3) Would you include the things and places we mapped?

Introduction:
Environmental Justice

What is Environmental Justice?

When it comes to the environment, geography matters. When we talk about our environment, we are referring to the conditions that surround us every day, including natural attributes such as air and water, and manmade attributes such as buildings and roads. The features of our environment may also include **hazards** that are sources of danger to our collective health and well-being. Environments are different everywhere; some places have more hazards, others more green spaces, and others combinations of these. Location, then, is important in this context. Think about where you spend the hours of each day. How many hours do you spend at home? How many hours do you spend at school? The air we breathe and the water we drink can change depending on where we are and what else is nearby. Environmental policies are implemented and enforced on a local level, and health hazards are almost always the most severe for those who experience the greatest exposure in their homes and workplaces. It is an examination of this inequality that leads to a discussion of environmental justice.

According to the **U. S. Environmental Protection Agency (EPA)**, environmental justice means that all people, regardless of their race, age, job, income, or education level, enjoy the same degree of protection from environmental and health hazards.[1] The notion of environmental justice has been around since the 1980s, but the official definition was first established as a federal mandate in 1994 by President Clinton's Executive Order 12898. This legislation sought to focus federal efforts on ensuring that poor and minority communities were not disproportionately burdened by environmental hazards and that these communities had more say in the legal process that brought environmental hazards in the first place.[2] The federal definition, then, says that the government and the affected communities are both responsible for making sure that any given area has a just distribution of hazards. This project is able to show you how the county looks right now, but not much about the process by which the county came to be this way. As you look through the booklet, think about who is responsible for bringing pollution to a given area, and also who *you* think is responsible for protecting communities. Are environmental hazards distributed equally? Fairly? If not, what can be done to fix this?

How to use the transparencies

- There are 12 transparencies at the back of this book, all of which are also included as printed pages within the book.
- The transparencies are for YOU to layer different maps on top of one another.
- Take a transparency out of the back, and put it on top of either another transparency, or a printed map (e.g., 'Waste' on 'Race,' 'Air and Water' over 'Land Cover').
- If you have access to a projector, these transparencies can be used so many people can see the maps you create.

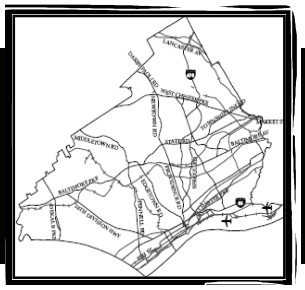
What do you see? What patterns emerge? What different stories can you tell?

Figure 2. Transportation

Transportation

- Highways
- Railroads
- Airports

From Here to There:
Transportation and Industrial History



What is the history of transportation and industrial development in Delaware County?

Delaware County, once a booming industrial center, has experienced industrial flight in the last forty years, mirroring the general trend in the United States. The 'Transportation' map (Fig. 2) shows us that Delaware County's proximity to the Delaware River historically made it a major hub for the import and export markets. Rich in natural resources such as iron ore and abounding in creeks perfect for textile mills, Delaware County required massive infrastructure for transportation to and from the rest of the world. As a result, canals and railroads were established along the river, and early industry took off in riverside locations.[1] While the original mills and factories that existed along the riverfront before World War II are no longer there, new industry often followed the old and set up facilities along the river. Comparing the facing map with the 'Top 15 Polluters' (Fig. 12), for example, you will see that many of the major industries in the county—although no longer tied to the transport system provided by the river—still exist along the waterfront. State permitting laws rarely take into account the concentration of industry in any particular place, and as a result often overlook the unequal distribution of pollution that results.[2] The following major development events in Delaware County history follow the movement of industry in Delaware County. The timeline illustrates the changing role of Delaware County from exporter of agricultural goods, textiles and raw metals to importer of waste. It also points to how development in Delaware County became so unequally distributed, centering along the river in Chester and Marcus Hook.

Timeline of Events

1823 A charter is obtained from Pennsylvania Legislature for the construction of a railroad line from Philadelphia to Columbia (through Delaware County)[3]
1827 Pennsylvania's first railroad opened
1902 Sunoco Inc. is constructed in Marcus Hook
1903 House acts to create the Department of Highways
1929 Interstate 476, "the blue route" is proposed and quickly faced with environmental suits, new legislation and funding issues which keeps it incomplete.
Late 1930s Building begins on Interstate 76[4]
1937 Sunoco constructs world's first large-scale, commercial catalytic cracking plant in Marcus Hook; Interstate 95 (as a link between Delaware Avenue and Center City, Philadelphia) is proposed, due to be completed by 1960
1940 Philadelphia International airport opens
Exits 67- 226 is built on Interstate 76
1950 The Philadelphia extension of I-76 (exit 226 to 326) opens
1960 Exelon generating station in Eddystone is constructed

1965 First two sections of Interstate 95 open
1974 Interstate 95 construction also continues on the section near the Naval Shipyard from Exit 15 to Exit 20
1975 On Interstate 95 the section from Exit 7 to Exit 8 opens to traffic
1981 DELCORA (owned by Delaware County Regional Water Control) is put online in Chester
1987 LCA Corporation (now non-existent) opens a waste transfer station in Chester; Abbonizio Recycling Corporation (demolition debris recycling company) opens; Norquay Technology Inc, Chester, PA is founded
1988 DEP grants a permit to site the Westinghouse trash-to-steam incinerator
1991 Westinghouse "Resource Recovery" (incinerator) opens; Amid protest, the section of Inter state 476 from MacDade Boulevard to the Schuylkill Expressway opens to traffic.
1994 DEP grants a permit for toxic operation in Chester to Soil Remediation
2002 Department of Environmental Protection (DEP) Regional Director Joseph A. Feola announces that DEP has denied Kimberly-Clark Corporation's permit application to burn a tire-derived fuel at its paper manufacturing facility in the City of Chester, Delaware County

What is happening now in Delaware County?

- Alloy Surfaces Company, Inc., a manufacturing firm that had been in Wilmington for 40 years, purchased a 15 acre site and built an 80,000 square foot plant in Chester Township, Delaware County.
- Cintas Corporation purchased a seven acre site and is building a 55,000 square foot facility in the Bridgewater Business Park, Chester Township, where the company will employ over 140 people.
- Hydrol Chemical is expanding its Delaware Valley warehousing and distribution operations to a 6,000 square foot flex building in the Yeadon Industrial Park.
- Excel Automotive, a company that manufactures alternators and starters, relocated and expanded from a 35,000 square foot leased facility and bought a 56,000 square foot industrial facility on Delmar Drive in Folcroft.
- Orlandini Tile Company, a distributor of ceramic tile and associated flooring materials, doubled the size of its Delaware County warehousing operations with the lease of 22,000 square feet of one-story industrial space in Marcus Hook Borough.
- Weeds, Inc., a weed control firm from Yeadon, purchased a two-acre site in the Green Valley Business Park in Aston. The company now owns a total of four acres in the business complex and plans to commence construction of a 20,000 square foot office and industrial structure there.[5]

Questions to Think About:

1) What is the role of transportation in shaping communities and development patterns?
2) Why did industry become established as it is today?
3) What environmental considerations have influenced how industry appeared in Delaware County?

Transportation and Industrial History

For more information about infrastructure and industrial history in Delaware County:

Powering Pennsylvania
(www.legis.state.pa.us/WU01/VC/visitor_info/hello_pennsylvania/powering.htm**)**
A site put together by the commonwealth detailing the transportation, and economic history of Pennsylvania in a positive light.

History of the Delaware River Watershed
(www.phillywater.org/Delaware/Watershed/history_watershed.htm)
A historical description of the colonial settlement, water supply, industrialization and transportation of the Delaware River Watershed.

Pennsylvania Highways: Interstate Highways
(www.pahighways.com/interstates)
Everything you need to know about Pennsylvania's highway system including history, traffic conditions and information on tolls and improvements on the roads.

Experience Pennsylvania's Railways
(www.parailways.com/history/index.html)
A commercial site toting Pennsylvania's railroad system.

Department of Environmental Protection Environmental Heritage Timeline
(www.depweb.state.pa.us/heritage/cwp/)
Presents an environmental history of Pennsylvania from 1644 to the present.

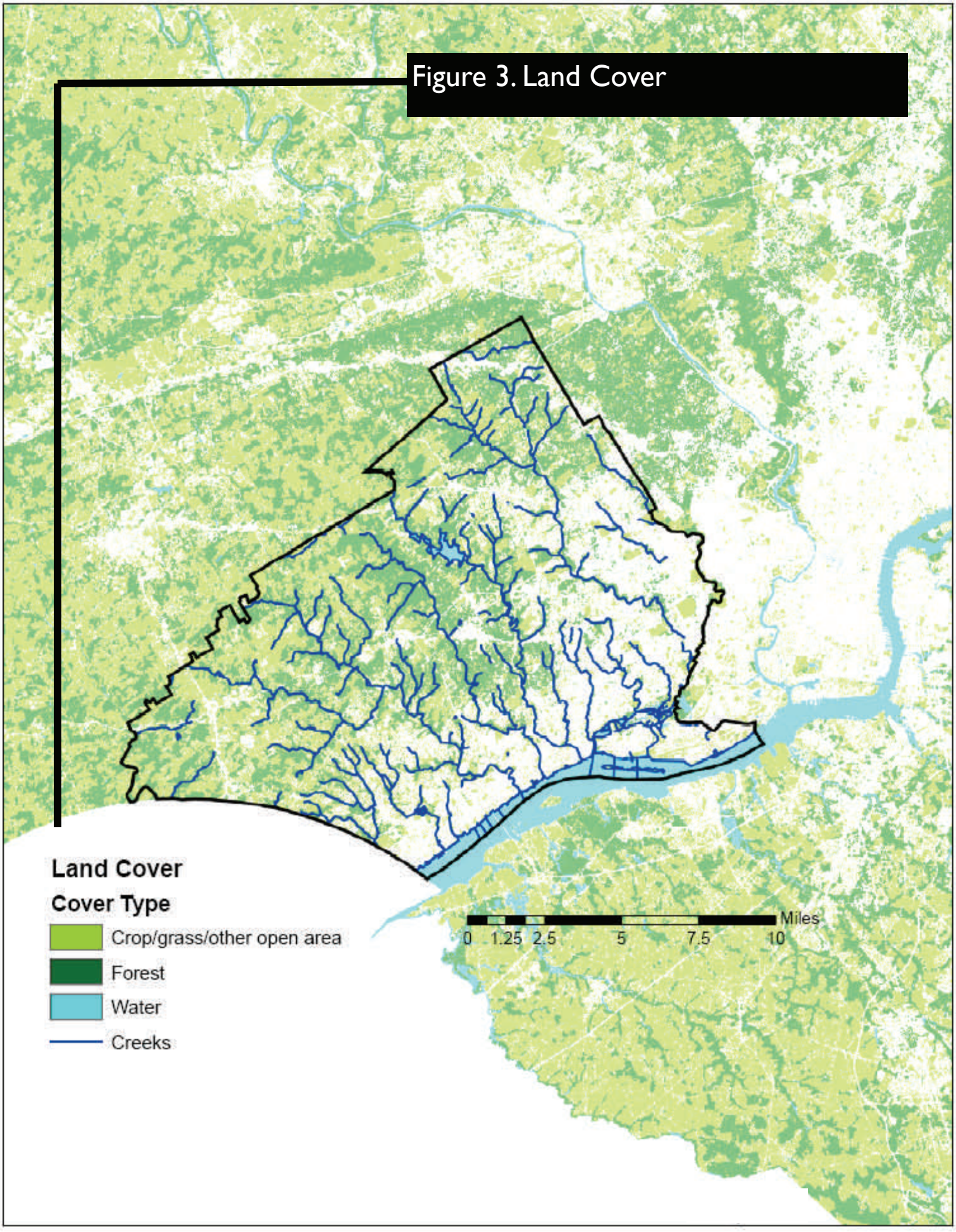
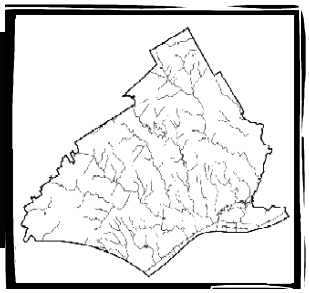


Figure 3. Land Cover
Land Cover
Cover Type
Crop/grass/other open area
Forest
Water
Creeks
0 1.25 2.5 5 7.5 10
Miles

Natural Setting:
Green Spaces and Waterways



What are Green Spaces?

Green spaces are spaces within a populated area that are largely undeveloped. These wild areas and parks have aesthetic and ecological functions. They provide people a place to go to escape the stress of urban and suburban areas and significantly reduce noise levels.[1] Green spaces provide habitat for a variety of small animals and can serve as corridors to larger habitat fragments. Because green spaces have a lot of tree cover and thus extensive root systems, they are able to absorb rainwater which prevents soil erosion and contributes to groundwater supplies.[2]

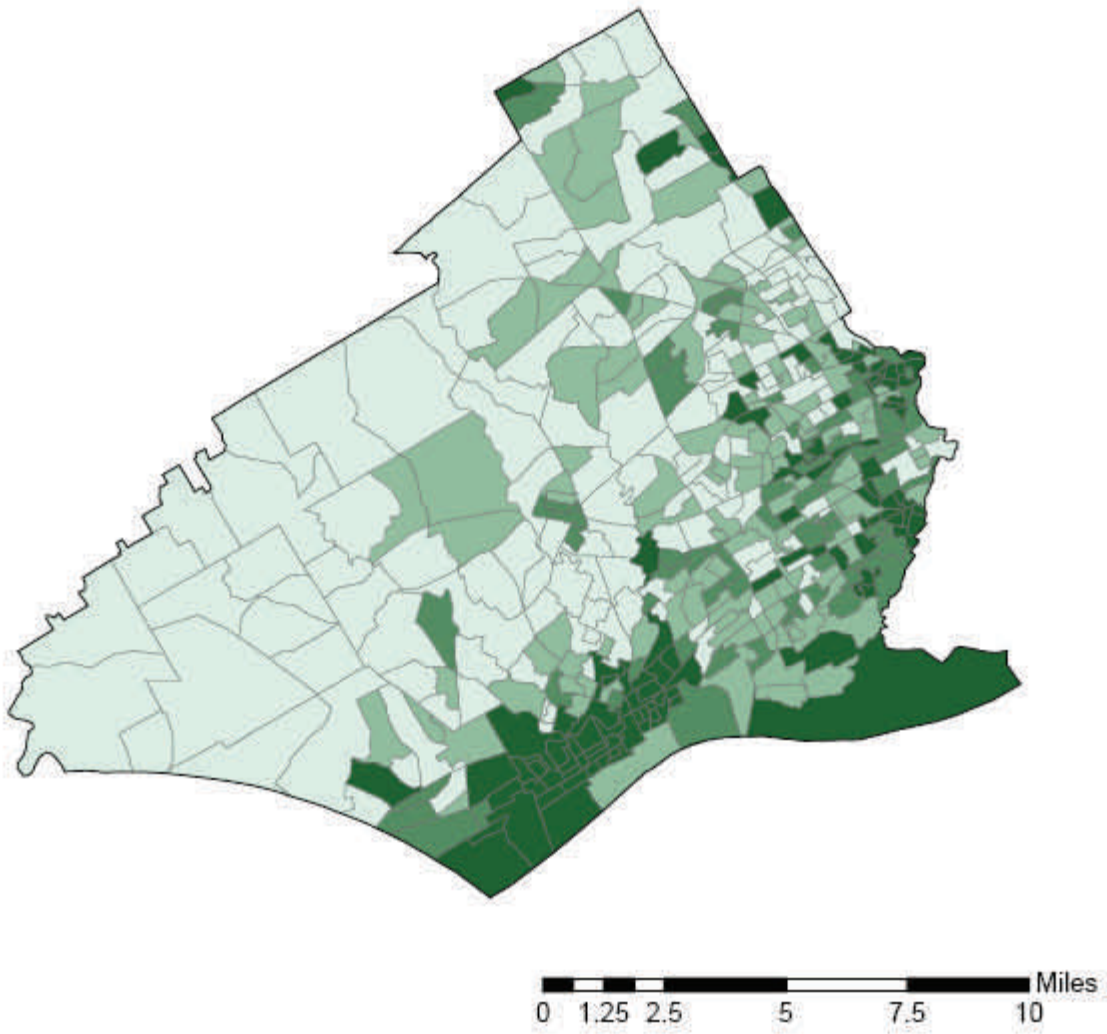
Riparian buffers, which are green spaces directly next to streams, rivers, or lakes, remove excessive nutrients and thus control **non-point source** pollution.[4] Riparian buffers inhibit bank erosion and stream sedimentation. While beneficial to the environment, buffers are also useful to humans. Today, efforts to restore stream health and protect communities from flooding incorporate green space projects, erosion control, and stream route manipulation.

Green spaces in Delaware County are especially important because the county lies in a very wet watershed that drains into the Delaware River. The county has an available surplus of over 20 billion gallons of water a day.[5] There are five major creeks in the county's drainage area: Chester Creek, Ridley Creek, Crum Creek, Darby Creek, and Cobbs Creek. Each of these drains directly into the Delaware River, and they all join the river near the cities of Chester and Eddystone. While the streams flow through protected areas that serve as riparian buffers, such as Ridley Creek State Park and the John Heinz Wildlife Refuge at Tinicum, they also flow past parking lots, roads, and industrial activity.

Questions to Think About:

1) Who uses green spaces? Where are green spaces located?
2) What ecological functions do green spaces provide? How might these functions be enhanced or impaired by human activity?
3) Think about the interaction between industrial processes, green spaces, and streams. How might each piece influence the others?
4) When water picks up pollutants and garbage, where does it go? Where might the pollutants come from?

Figure 4. Income

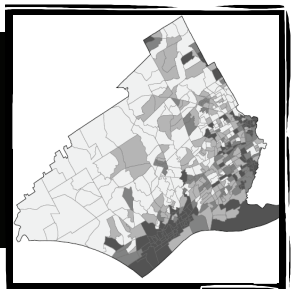


Income

% of households with income less than $15,000

- 0-7%
- 8-13%
- 14-17%
- 18-68%

Demographic Distributions:
Income, Race, Education, Unemployment, and Age



How did we divide our demographic data?

The following population or demographic data were analyzed in units of **block groups (BGs)**, as determined by the U. S. Census Bureau. Each BG is a cluster of smaller census blocks. While census blocks are each the same geographic size, the area of the BGs vary. Regardless of the area of land they take up, each BG has approximately the same number of people living within it; therefore a bigger area on the map has a lower population density. According to the Census Bureau the optimal size for a BG is 1,500 people.[1] The total population of Delaware County in 2000 was 550,864 people divided into 462 BGs.

What is Standard Deviation?

In many of our maps, we used **standard deviations (SDs)** to determine where to divide the data into different groups or colors. Standard deviation is a statistic that tells you how closely all of the block groups are clustered around the average. When the data are tightly bunched together, all the BGs have a similar pattern and the standard deviation is small. When the data are spread apart, there is a large difference between the BGs and the standard deviation is large.

In the following descriptions of the demographic maps, we will tell you when we used standard deviation to determine what color to make each BG. We will also tell you the size of the standard deviation of the data, so you can see whether a particular BG is within 1 standard deviation of the mean by converting from percentages to SDs. If a BG is more than 2 SDs from the mean, it is an outlier, which means it is an unusually large or unusually small value compared to the others. All of the standard deviations are from BG means or averages; for countywide figures, please see Table 1 on page 19.

Correlation or Causation?

In statistical terms, we say that correlation does not imply causation. This means that although the demographic and environmental data align closely with each other in several instances, one does not cause the other. Similarly, the health hazards of many of the **toxicants** that are described are not necessarily indicators of the health of the local population.

Income (Figure 4)

In 1999 the median or middle household income in Delaware County was $50,092, which was approximately $10,000 higher than the statewide figure. However, within the county there is a huge variance among income levels by household. This map shows the block groups where large shares of the population have household incomes under $15,000* a year. The data are broken up by standard deviation from the mean (BG mean = 12.5%, SD = 10.0%).
*In 1999 the federal poverty threshold was $16,700 for a family unit of 4.[2]

Race (Figure 5)

This map illustrates the share of non-white population (including population of Hispanic or Latino origin) in each BG.

Unemployment (Figure 6)

This map displays the BGs with the greatest percentages of adults who are unemployed. The Census Bureau defines unemployment status as adults who had actively sought work in the 90 days prior to answering the census survey. The data are divided by standard deviation from the mean (BG mean = 3.0%, SD = 3.0%).

Education (Figure 7)

This map identifies BGs with the largest percentage of adult population that has not attained an education level higher than a high school diploma. These data are divided by standard deviation from the mean (BG mean = 33.6%, SD = 12.0%).

Age (Figure 8)

This map illustrates where the greatest concentrations of children under the age of 5 live as a percent or share of BG population. The data are divided by standard deviation from the mean (BG mean = 6.4%, SD = 1.8%).

Questions to Think About:

1) What are some of the reasons that affect where an individual or a family chooses to live?
2) Is there a pattern of racial disparity in Delaware County? Is there a pattern of income disparity?
3) During the process of siting a new facility, a company will often promote the facility to the local community by advertising the large number of new jobs it would provide. Which areas of Delaware County have the highest levels of unemployment? Should local unemployment be a factor in determining the location of industrial plants?

How does Delaware County's demographics compare to the rest of the state? To the country?

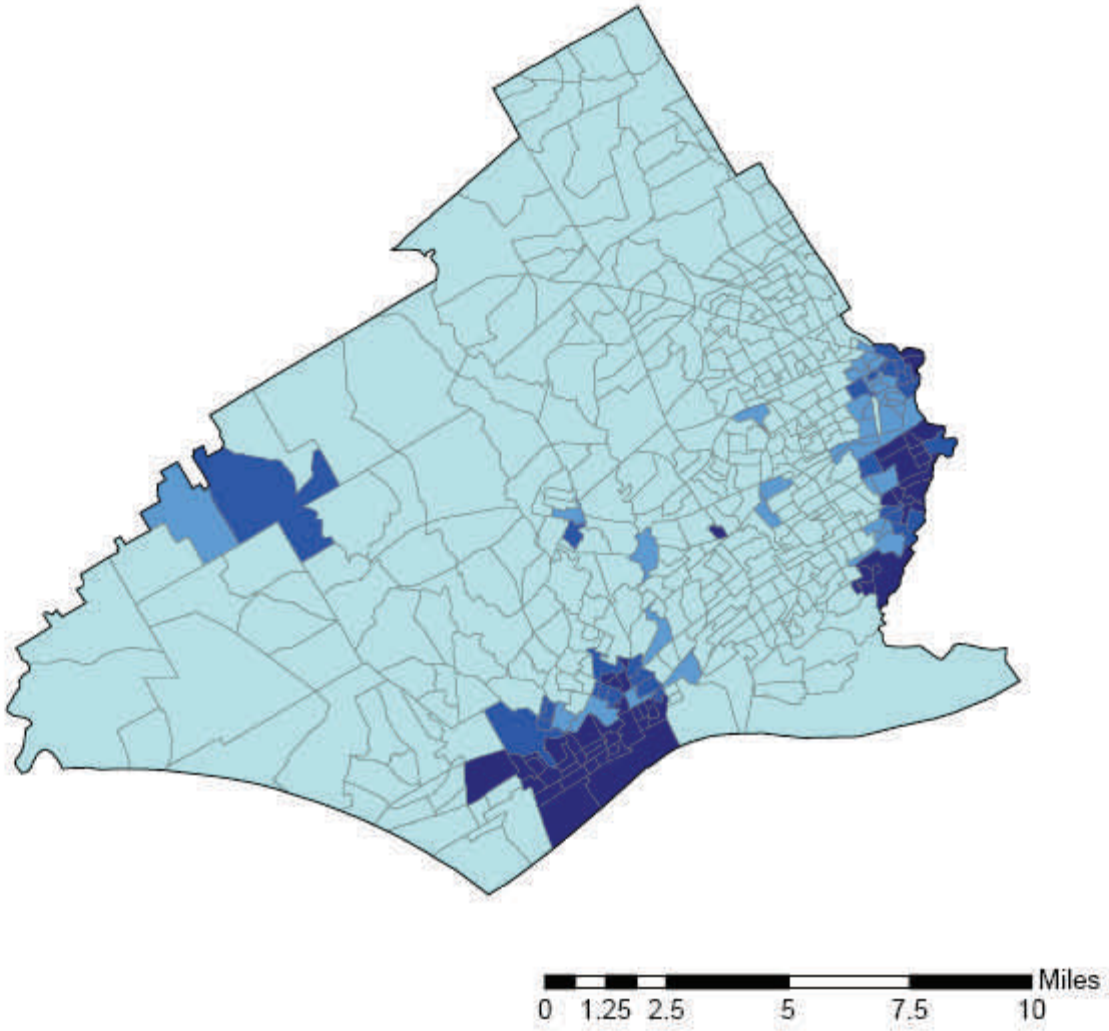
	Delaware County[3]	Pennsylvania[4]	United States[5]
Population, 2000	555,040	12,406,292	281,421,906
Persons under 5 years old, percent, 2000	6.2%	5.9%	6.8%
White persons, not of Hispanic/Latino origin, percent, 2000	**79.6%**	**84.1%**	**69.1%**
Foreign born persons, percent, 2000	6.7%	4.1%	11.1%
High school graduates, percent of persons age 25 and over	**86.5%**	**81.9%**	**80.4%**
Persons per household	2.56	2.48	2.59
Median household income, 1999	$50,092	$40,106	$41,994
Persons below poverty, percent, 1999	8.0%	11.0%	12.4%
Land area (square miles)	184	44,817	3,537,438
Persons per square mile, 2000	2,990.4	274.0	79.6

Table 1. Comparative statistics for Delaware County, PA as compared to state and federal averages.

For more information on demographics of Delaware County:

The U. S. Census Bureau
(www.census.gov)
The U. S. Census Bureau is in charge of collecting statistics about the nation, its people, and its economy. Every ten years it surveys the entire population of the United States. All of the data that are collected are available online, as well as many other types of maps and graphs that display the information.

Figure 5. Race

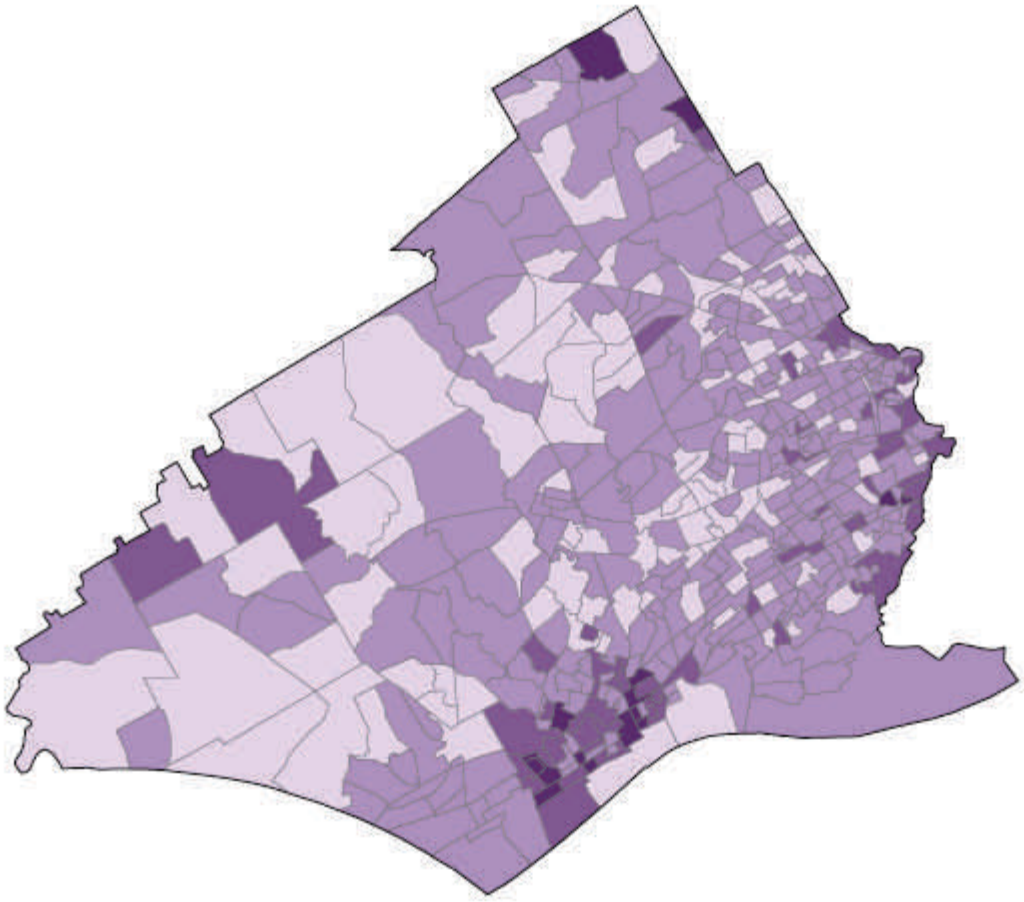


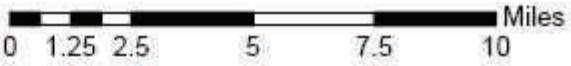
Race

% population that are people of color

- 75-100%
- 50-74%
- 25-49%
- 0-24%

Figure 6. Unemployment



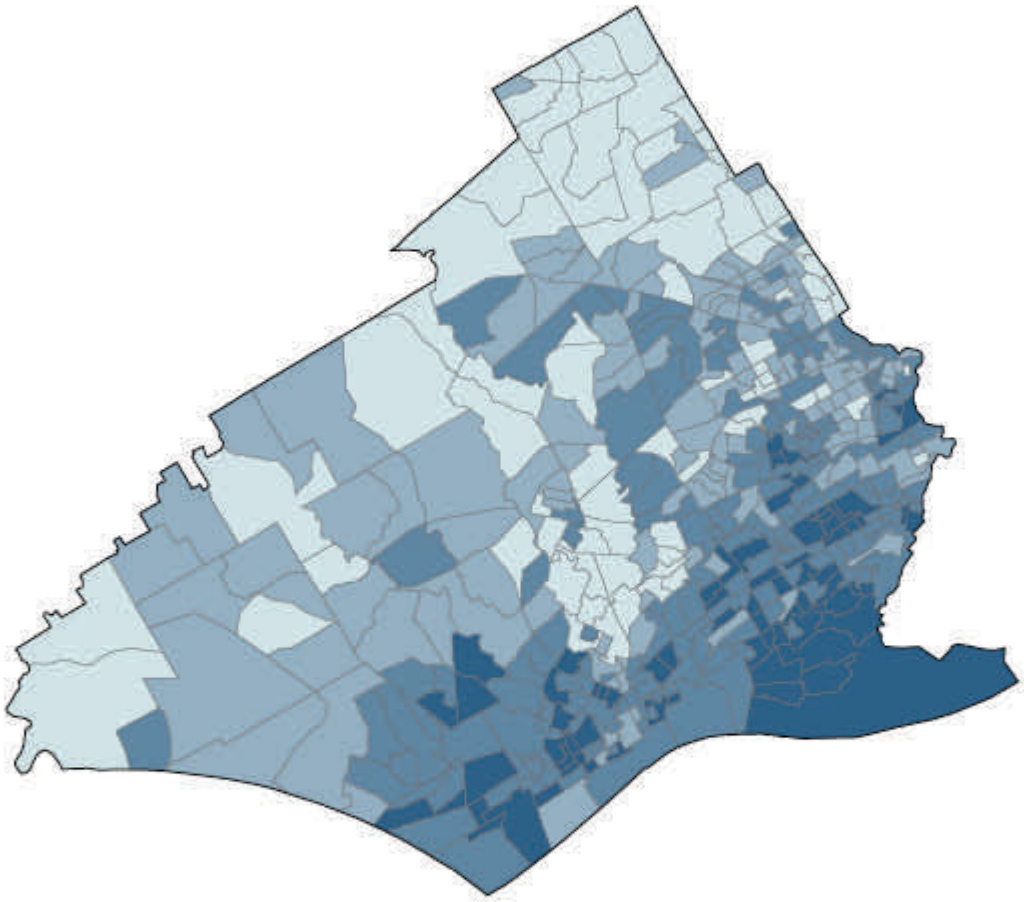


Unemployment

% adults unemployed

- 0-1%
- 2-4%
- 5-8%
- 9% and up

Figure 7. Education



Education

% people with a high school diploma or less

- 0 - 21%
- 22 - 33%
- 34 - 45%
- 46% and up

Figure 8. Age

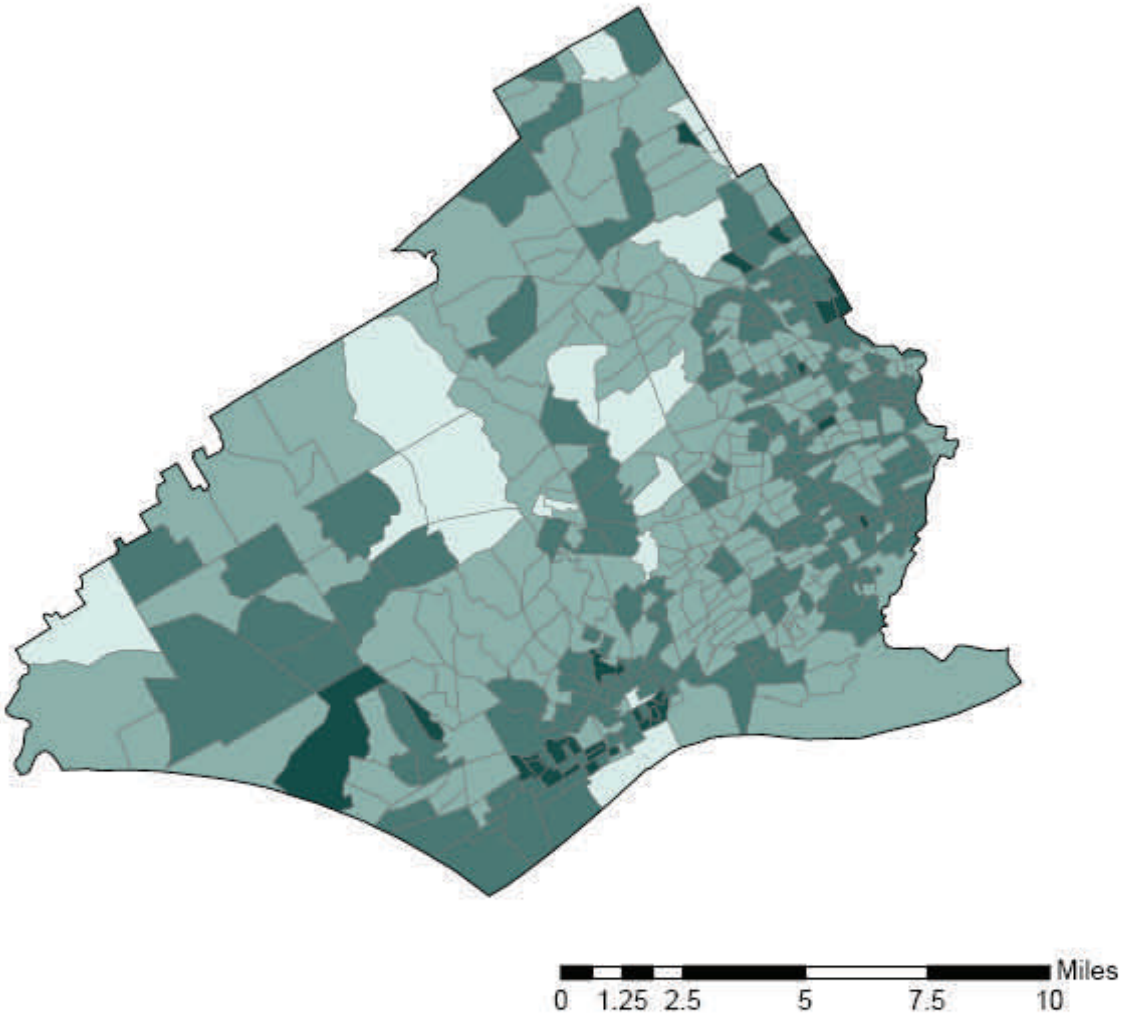
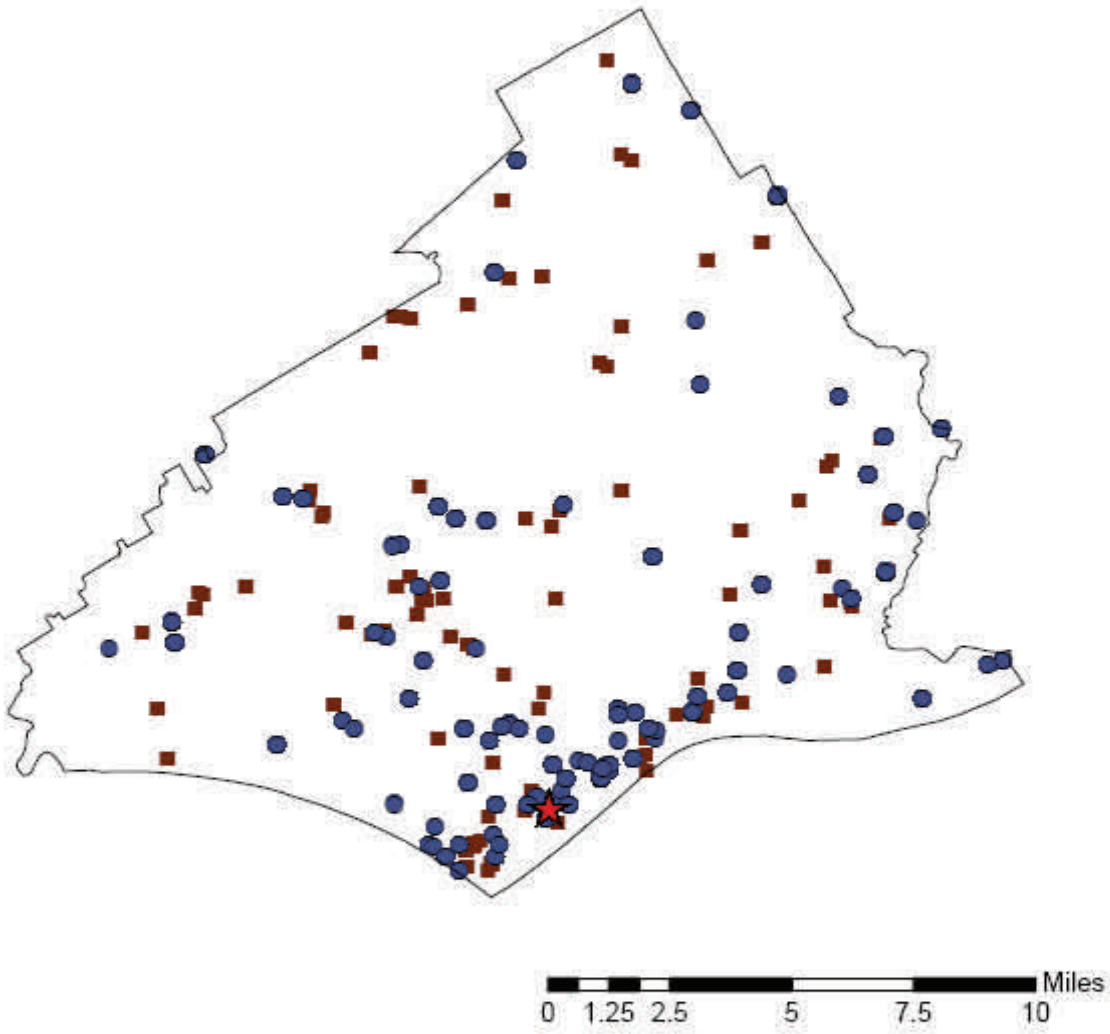

Miles
0 1.25 2.5 5 7.5 10
Age
% of children under 5 years old
0-3%
4-6%
7-9%
10-15%

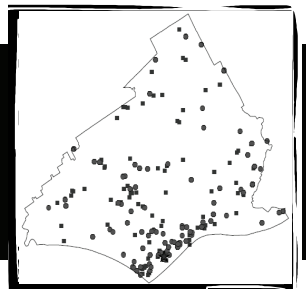
Figure 9. Air and Water



Air and Water Pollution

- Point of air emissions
- Point of water discharge
- DELCORA

Pollution Flow:
Air and Water



Where does my drinking water come from?

Delaware County's drinking water is serviced by two separate entities, Aqua Pennsylvania and Chester Water Authority (CWA). Aqua PA, the headquarters of Aqua America[1] (formerly Philadelphia Suburban Water Company), is the larger of the two. It is an investor-owned utility company that provides water to households and businesses in all the suburban counties (820,000 customers).[2] Aqua PA services the eastern half of the county between Philadelphia and Chester, while CWA,[3] a much smaller municipal-run company, services Chester and the county to the west and north of it. Each company tests and monitors its own water quality, with oversight from the **Pennsylvania Department of Environmental Protection (DEP)**.[4] Both companies, according to their self-reporting, meet the DEP's state standards for drinking water.

Where does my wastewater go?

Wastewater for the county is managed by DELCORA, the Delaware County Regional Water Quality Control Authority.[5] They maintain the public sewer system as well as a wastewater treatment plant on 25 acres along the river in Chester (Fig. 9). The organization is a public utility, run by a board of directors appointed by the Delaware County Council. DELCORA collects sewage from local municipalities and transfers it via large-capacity mains to either its own treatment plant in Chester or to a plant in Philadelphia. DELCORA gets most of its revenue from the treatment and transport of waste. Local municipalities usually manage their own sewage and runoff systems that then get connected up with its facilities. Only 20%-40% of the plant's treatment capacity is required to treat all the municipal sewage waste it handles.[6] The remaining capacity is used to treat industrial waste from Chester's heavy industries, such as Kimberly Clark, Sunoco, and BP. Because the treated industrial waste is still so toxic, it cannot legally be released into the Delaware River along with the treated municipal waste, and so is often burned in the plant's incinerator.[7] In 1997 a group of Chester residents, with the help of the Public Interest Law Center, successfully sued DELCORA for $320,000 in penalties for violating federal and state air pollution laws, as well as for "emitting offensive odor and noise from its incinerators" (see pg. 42).[8]

Because of the county's close proximity with Philadelphia, a great deal of regional water planning work is done with the city's Water Department and with the Delaware Valley Regional Planning Commission. The DVRPC serves as a clearinghouse for information and management plans, and administers grants for shoreline maintenance and flood control.[9] Flood control is an issue in Delaware County, as the area regularly suffers from heavy rains combined with low elevation and little to no riparian buffers on its streams (see pg. 15).

What is polluting the air in Delaware County?

The make-up of air is difficult to describe because it is rapidly moving and changing. On 'Air and Water Pollution' (Fig. 9), the blue points represent sources of air pollution. The Clean Air Act established "**criteria pollutants**" that are considered harmful to public health and the environment and are commonly used to measure air quality.[9]

Particle pollution, one type of air emission, is a combination of fine particle and aerosols suspended in the air we breathe. Particle pollution is complicated because there are many different sizes and types of particles. The size of some particles is one-tenth the diameter of a strand of hair; other particles are much smaller. Particles are released into the air during mechanical processes that break up larger molecules. These processes include demolition, construction, mining, crude oil processing, coal burning, and dust storms. Chemical processes also produce particulate pollution by releasing tiny chemicals (such as elemental carbon, heavy metal, sulfur dioxide, nitrogen oxide, and volatile organic compounds or VOCs) into the air. These chemicals then bind to each other to form different compounds. Particle pollution is dangerous because particles can get deep into the lungs and from there can enter the blood stream.[10]

A dangerous product of particle pollution is ozone, which forms when VOCs and nitrogen oxides combine in sunlight. Many non-industrial sources, including motor vehicles, also emit VOCs and nitrogen oxides. Ozone is the principle component of smog.[11]

While these are all possible pollutants, you can not tell from our 'Air and Water' map what is being released at each site; 'Top 15 Polluters' (Fig. 12) gives specific information for certain locations. Not knowing exactly what is happening does not mean that nothing is. Delaware County was one of 22 counties in Pennsylvania that did not attain EPA's health-based standards for fine particle pollution. Delaware County is also one of 37 counties in Pennsylvania that did not attain the EPA's standards for ozone pollution.[12]

Questions to Think About:

1) Find out whether Philadelphia is upriver or downriver from Delaware County on the Delaware River. Where does the runoff go if Philadelphia has a heavy rain, or a sewage spill?
2) What sorts of contaminants make up water pollution? Have you ever seen them? Are they always liquid, or always solid? Can they be both?
3) Have you ever thrown something on the ground? Use our 'Land Cover' map (Fig. 3) to trace which creek is nearest to where you live, and where that piece of trash you threw out might have gone.
4) Does DELCORA treat your sewage? Ask your parents if they know how they are billed for sewage treatment, and how much it costs. Do you think drinking water and sewage companies should charge different amounts depending on where people live in the county?
5) In a particular geographic area, we all breathe the same area, but does air pollution affect all people equally?
6) What could influence the impact of air quality on individuals?
7) Can you think of other things that might influence air quality? How might activities outside of Delaware County influence people living inside Delaware County?

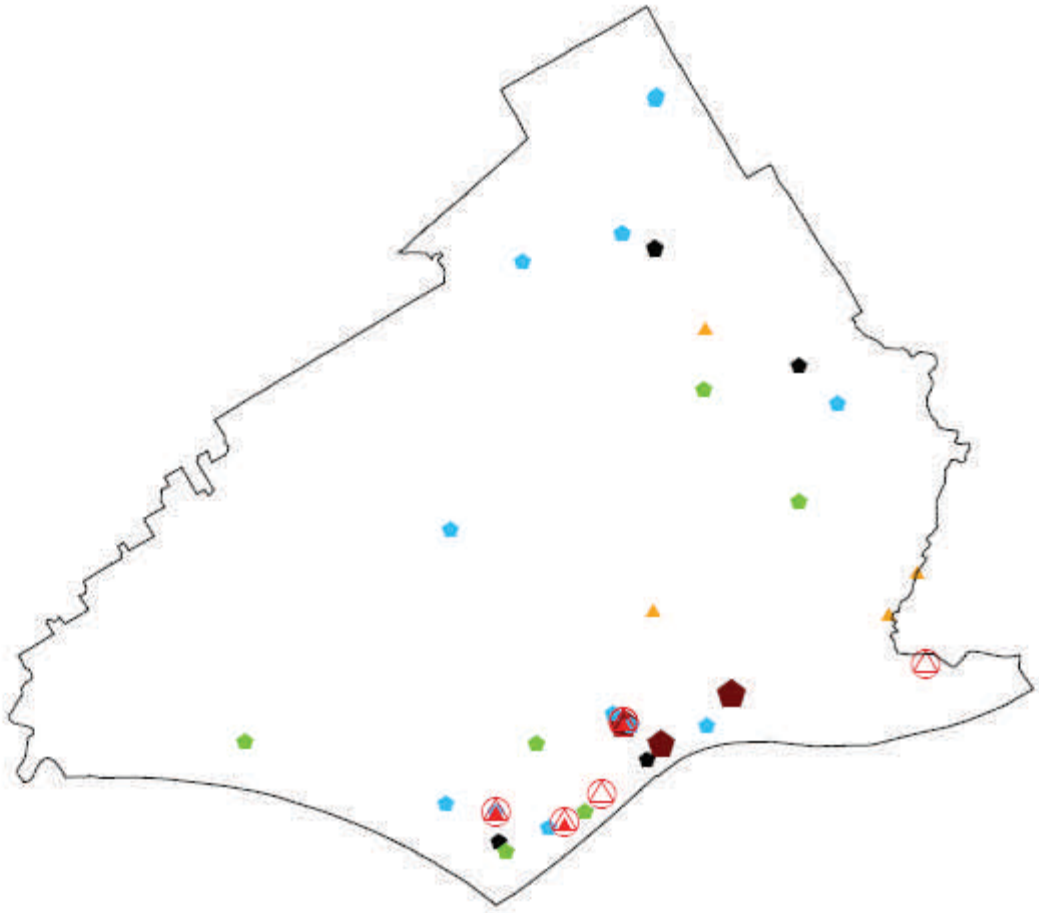
For more information on air and water in Delaware County:

The Pennsylvania Department of Environmental Protection (DEP)
(www.dep.state.pa.us)
The DEP carries out local water quality monitoring, and enforces many of the provisions of the Clean Water Act. You might be surprised at the variety of sites they monitor for discharge quality—even local pizza parlors might make the list! On Figure 9 are all the points monitored for some sort of water discharge in 2006. They are not necessarily major polluters of our water, but they have the potential to be due to the kinds of chemicals they use or the type of industry at each site.

The Clean Water Act (CWA)
(www.epa.gov/r5water/cwa.htm)
The CWA was passed by Congress in 1977 and contains rules and laws specifying the amounts of pollutants that can legally be released into streams, lakes, and oceans, and also sets the national standards for sewage treatment.

The EPAs: The Plain English Guide To The Clean Air Act
(http://www.epa.gov/air/oaqps/peg_caa/pegcaain.html)
A guide to air pollution, its effects, and pertinent legislation.

Figure 10. Waste



Waste

- HAZARDOUS WASTE SITE

Municipal Waste Facilities

- LANDFILL
- PROCESSING FACILITY
- RESOURCE RECOVERY

Residual Waste Facilities

- INCINERATOR
- LANDFILL
- PROCESSING FACILITY

0 1.25 2.5 5 7.5 10 Miles

Current Waste Disposal Sites:
Landfills and Incinerators

What types of waste are produced in the county?

Pennsylvania's Department of Environmental Protection (DEP) defines three distinct types of solid waste that are produced in the state and must be handled by the state's Solid Waste Management Programs.

Residual Waste accounts for 79% of the waste that is produced in the state of Pennsylvania. The DEP defines residual waste as non-hazardous industrial waste. This classification includes any waste material, in any form (solid, liquid or gas), produced by industrial, mining and agricultural enterprises. Some of the kinds of residual waste produced in Pennsylvania include contaminated soil, rubber, textiles, glass, industrial equipment, electronics, fertilizers, pesticides, pharmaceutical waste, oil, residues from the treatment of public water supplies, and paints.[1]

Municipal Waste comprises 19% of Pennsylvania's total waste production. Municipal waste is better know as everyday household trash, from product packaging, grass clippings, furniture, clothing, bottles, food scraps, newspapers, appliances, paint, and batteries.[2]

Hazardous Waste makes up the remaining 2% of waste produced in Pennsylvania. Hazardous waste can come from your house or from industries but is considered hazardous because "in sufficient quantities and concentrations, [hazardous wastes] pose a threat to human life, human health, or the environment when improperly stored, transported, treated or disposed."[3] These materials are explosive, toxic, excessively acidic or basic, or flammable. The list of hazardous wastes in Pennsylvania includes 600 different compounds, and the DEP has specific regulations for hazardous waste and it must be treated before it can be disposed of in the same way that other wastes are.

How does Pennsylvania dispose of its waste?

When waste cannot be recycled, Delaware County municipalities have two options for waste management. The first is to dispose of waste in landfills, and the second is to incinerate waste (although hazardous waste must undergo treatment processes before it can be disposed of by either method). On 'Waste' (Fig. 10), you can see all active landfills in the county in addition to all waste incinerators and processing facilities. All sites pose significant environmental threats.

Landfills are the older form of waste disposal in the country. Before the passage of the 1976 federal Toxic Substances Control Act, just about any type of waste could be dumped in landfills without treatment, including hazardous wastes.[4] There are more than 40 abandoned municipal waste landfills in Delaware County alone that can pose specific environmental harm (see 'Abandoned Waste,' pg. 34). Today, although there is much stricter landfill regulation, active landfills have still been shown to

introduce environmental hazards due to faulty or old leachate collection systems.[5] After 1987, incineration began to be seen as a more effective way of handling waste, although this method poses its own problems.

Incinerators are currently the method of waste control in Delaware County; all of the county's waste is now burned before the remaining ash is put in landfills. Although incinerators reduce the total mass of waste that needs to be disposed of, they have been highly criticized because much of the trash that is burned is converted and released into the air as toxic air emissions. The emissions released from the Covanta Incinerator in Chester (see inset), for example, include volatile organic compounds, dioxins, as well as lead and other heavy metals. Comprehensive studies show that there are significant health risks associated with living near incinerators.[6] Delaware County relies on incineration to burn all of its municipal waste and also most of its residual waste.

Where does Delaware County's waste go?

The trash that each person in Delaware County creates has to go somewhere; while trash-collection day may be the last you see of your banana peels, that doesn't mean they disappear. Rather, the contents of every dumpster end up in the city of Chester, burned in the county's waste-to-energy incinerator.[7] Today, Covanta Holding Corporation owns and operates the incinerator. All 500,000 tons of Delaware County's annual waste is processed there. However, the plant has a large capacity and so also buys waste from private haulers; this results in a total of 1,481,120 tons of waste processed a year, at a rate of 2,688 tons a day. The Resource Recovery Facility therefore processes *3 times* the amount of waste produced in Delaware County every year. All of the ash from the incineration is then disposed of at the Rolling Hills landfill in Bucks County. The incinerator is called a "resource recovery" facility because it also produces a total of 75 megawatts of electricity from the burning of waste, 90% of which is used locally.[8]

Questions to Think About:

1) Think about how much waste is incinerated at a facility like the Covanta incinerator and compare this to the amount of waste produced in Delaware County. Do you think that it is fair that Delaware County is responsible for finding a place for outside garbage? If Covanta doesn't take the trash, where should it go?
2) Which seems like a better method of waste disposal, incineration or disposal in a landfill? Are there other alternatives to these two methods for controlling waste?

For More Information on Waste Disposal:

DEP Bureau of Waste Management
(www.depweb.state.pa.us/landrecwaste/site/default.asp)
Information about programs, regulations, and initiatives in Delaware County to deal with local waste. Also highlights county alternatives to waste treatment and disposal, such as local recycling programs and cleanup efforts.

Environmental Protection Agency Waste Page
(www.epa.gov/epaoswer/osw/index.htm)
Information about nation-wide programs of waste control and more in-depth information about the wide variety of waste produced in this country (industrial, municipal, hazardous, medical, etc). It also has links to other great partner organizations.

Association of Science and Technology Center's Rotten Truth About Garbage Timeline
(http://www.astc.org/exhibitions/rotten/timeline.htm)
A historic timeline about "America's relationship with garbage," highlighting landmarks of both waste production and control.

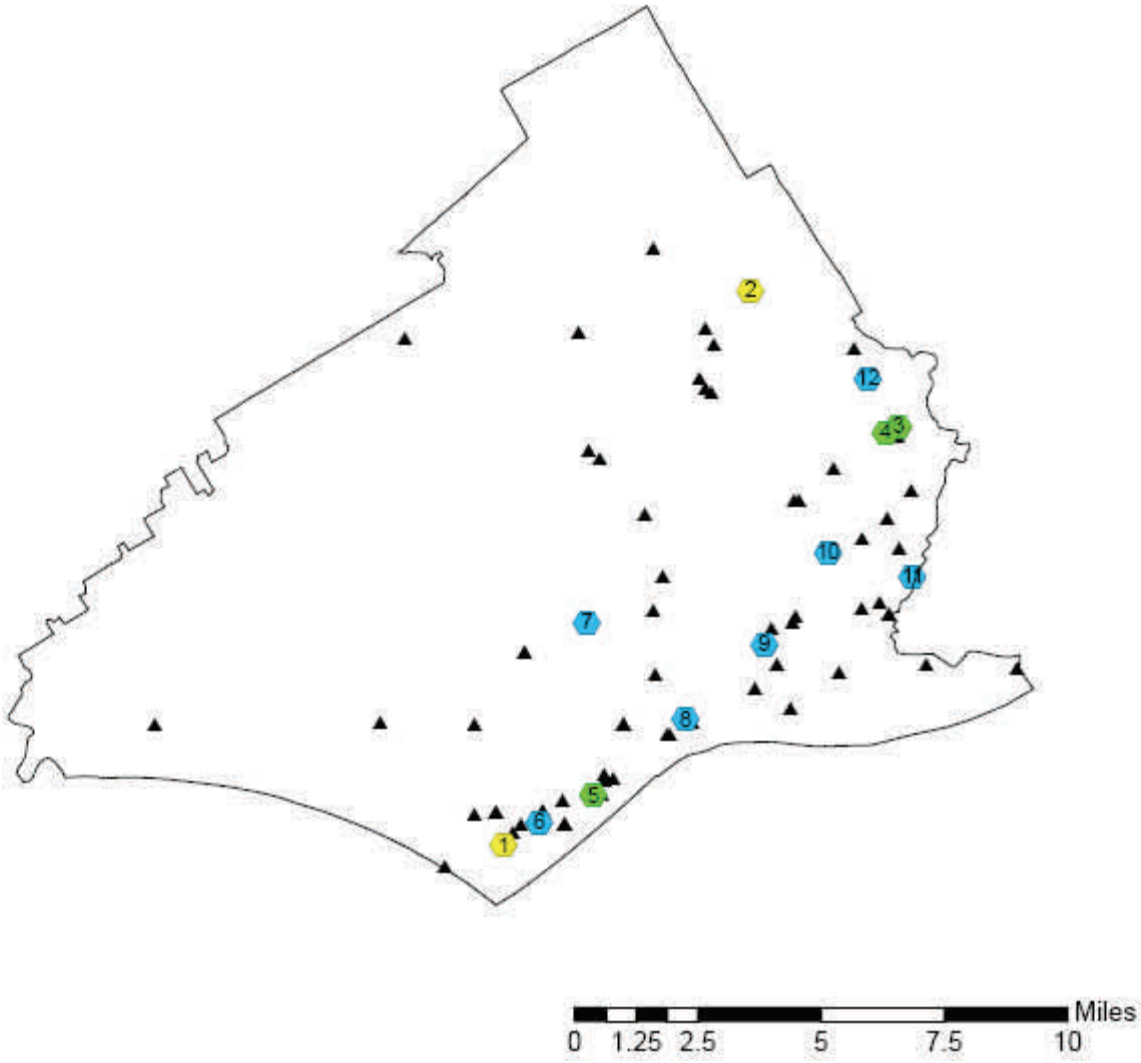
For More Information on the Environmental Dangers of Waste Disposal Systems:

Zero Waste America
(www.zerowasteamerica.org/index.html)
An internet-based Pennsylvania environmental research non-profit organization, this site provides information about reducing waste in the United States as well as specific information about both landfills and incinerators.

Action PA Landfill Page
(www.ejnet.org/landfills/)
Basic questions and answers about landfills and links to other resources and articles on the topic.

Greenpeace Report: "Incineration and Human Health: State of Knowledge of the Impacts of Waste Incinerators on Human Health"
(www.greenpeace.org/raw/content/international/press/reports/incineration-and-human-health.pdf)
Comprehensive overview of the practice of waste incineration and its possible impacts on both workers within waste incinerators and those living nearby.

Figure 11. Abandoned Waste



Abandoned Waste Sites

▲ Abandoned Municipal Landfills

National Priority List Sites ("Superfund")

Type of Listing

- Final
- Deleted
- Proposed

1. East Tenth Street
2. Havertown PCP
3. Austin Avenue Radiation
4. Lansdowne Radiation Site
5. Wade (ABM)
6. Metro Container Corp.
7. Sackville Mills Property
8. Eddystone Ave. Trailer
9. Salt Service
10. Baldwin Defiance
11. Oil Tank Lines, Inc.
12. Hilltop Residential Lab

Abandoned Waste:
Superfund Sites and Inactive Landfills

What is Superfund?

In 1980, Congress passed the Comprehensive Environmental Response, Compensation and Liability Act (CERCLA). The Act established the **Superfund** program, administered by the U.S. Environmental Protection Agency, which is a federal fund (hence the name 'Superfund') that pays for the investigation and cleanup of the largest or most contaminated hazardous waste sites in the country.

What is the National Priorities List?

The National Priorities List (NPL) is a list of hazardous waste sites in the United States that are being investigated and cleaned up under the EPA's Superfund program. Any person or organization can petition the EPA to perform an assessment of a site that they think may constitute a threat to human health or the environment. To determine whether a site should be on the National Priorities List, the EPA uses a **Hazard Ranking System (HRS)** to determine what type of waste is contaminating the site and how big a risk the waste is for the surrounding environment. The public often has opportunities to make comments on the content of the NPL, such as when new sites are added to the list. Sites are deleted from the NPL if the EPA determines that there is no further action necessary to ensure the safety of human health and the environment at the site. Unfortunately, the damage that NPL sites cause to the environment and to human health is oftentimes irreversible.

Are there any sites in Delaware County that are currently on the NPL?

Yes, there are currently two sites that are on the NPL: the East Tenth Street Site and the Havertown PCP Site (Fig. 11).

- The *East Tenth Street Site* is located in the Marcus Hook area of Delaware County and was contaminated by FMC Corporation, a cellophane producer, during the late 1980s. Pollutants found in the soil and water discharge include numerous volatile organic compounds, PCBs, asbestos, and heavy metals, and the site is also contaminated with chloroform, cadmium and mercury.[1] At this site, there has yet to be an emergency removal of contaminants or a remedial assessment.
- At the *Havertown PCP Site*, located in Haverford, PA, implementation of a Superfund cleanup is underway. From 1947 to 1963 the site was owned by National Wood Preservers, Inc., who disposed of all their waste liquids – mainly oil contaminated with pentachlorophenol (PCP) – into a well that then drained into the ground water and eventually contaminated a tributary of Cobbs Creek and the Delaware River.[2] In 1973 the State took legal action against the company to require cleanup of the waste, and it took seven years of litigation after that for the courts to issue a mandate for the cleanup of the site. The cleanup is still underway today, sixteen years later.

What sites in Delaware County have been deleted from the NPL?

The three sites that were at one time on the NPL but have since been deleted are the Austin Avenue Radiation Site, the Lansdowne Radiation Site and Wade (ABM).

- The *Austin Avenue Site*, which in 1996 consisted of 21 properties in five municipalities of Delaware County that were contaminated with radioactive materials, was deleted from the list on April 18, 2002.[3]
- The *Lansdowne Radiation Site* was deleted from the NPL on September 10, 1991. The site was contaminated from 1924 to 1944 by a University of Pennsylvania physics professor who processed enriched radium ore in his basement, contaminating several properties, sidewalks, 243 feet of municipal sewer line, and soils to a depth of 11 feet on eight properties.[4]
- At the *Wade (ABM) Site*, located on the Delaware River in Chester, soil and water had been extremely contaminated by wastes including PCBs, toxics, acids, arsenic, volatile organic compounds, and cyanide salts from an illegal waste storage and disposal facility active in the 1970s.[5] After a multi-staged extensive cleanup, this site was deleted from the list on March 23, 1989.

What sites in Delaware County have been proposed as NPL sites?

There are currently seven sites that have been proposed for addition to the NPL. These are: Baldwin Defiance, Eddystone Avenue Trailer, Hilltop Residential Lab, Metro Container Corporation, Oil Tank Lines, Sackville Mills Property and Salt Service.

What are the dangers of abandoned landfills?

Landfills are places where wastes are stored. Although landfills are designed to securely store waste, problems frequently occur. The four critical elements of a secure landfill design are: a bottom liner, a leachate collection system, a cover, and a proper natural hydrogeologic setting.[8] Unfortunately, pollution can escape each level of protection. The bottom liner, which is typically a clay liner or synthetic membrane, may develop cracks from corrosive household chemicals; the leachate collection system may become clogged and overflow; the cover may break; or the earth and its bedrock may shift. When problems arise in a landfill system, the waste-chemicals inside the landfill have the opportunity to get out!

As landfills age, the waste materials inside react with each other and produce new chemical forms. One product of chemical degradation is landfill gas.[9] Landfill gas is composed mostly of methane and carbon dioxide; these gases are harmful in close proximity and must be carefully regulated. On a more global scale, methane and carbon dioxide are greenhouse gases that influence climate change processes.[10]

The second product of old landfills is leachate. **Leachate** is the concentrated chemical liquid that is formed when water enters a landfill and seeps down. As the water moves, it picks up chemical compounds.[11] Leachate also enters the environment as a landfill ages. With the development of cracks in liners, leachate can seep into the ground and contaminate the groundwater supply for surrounding communities.[12] It is important to realize that even after humans stop contributing to them, landfills continue to affect the environment. Long after dumping ceases, landfills continue to produce chemical products: leachate and landfill gas. These toxic chemicals escape into the environment and adversely affect environmental and human health.

What are brownfields?

Brownfields are industrial or commercial sites that have been identified as potentially hazardous due to environmental contamination. They are usually abandoned, and redevelopment of these sites is problematical due to the presence of hazardous materials, pollutants or contamination.[6] The EPA's Brownfields Initiative, created in 1995, helps states and communities to work with potential property developers to clean up and reuse brownfields by providing funding, research, education and other necessary services. Delaware County has been selected by the EPA for a Brownfields Pilot program due to the possibilities for economic redevelopment in its distressed communities. Delaware County contains many brownfields sites due to its industry-heavy past. While the numbers and locations of these areas are constantly changing, it is certain that, as the EPA states, "brownfields redevelopment is a key component of returning economic vitality and opportunity to these distressed communities in Delaware County."[7]

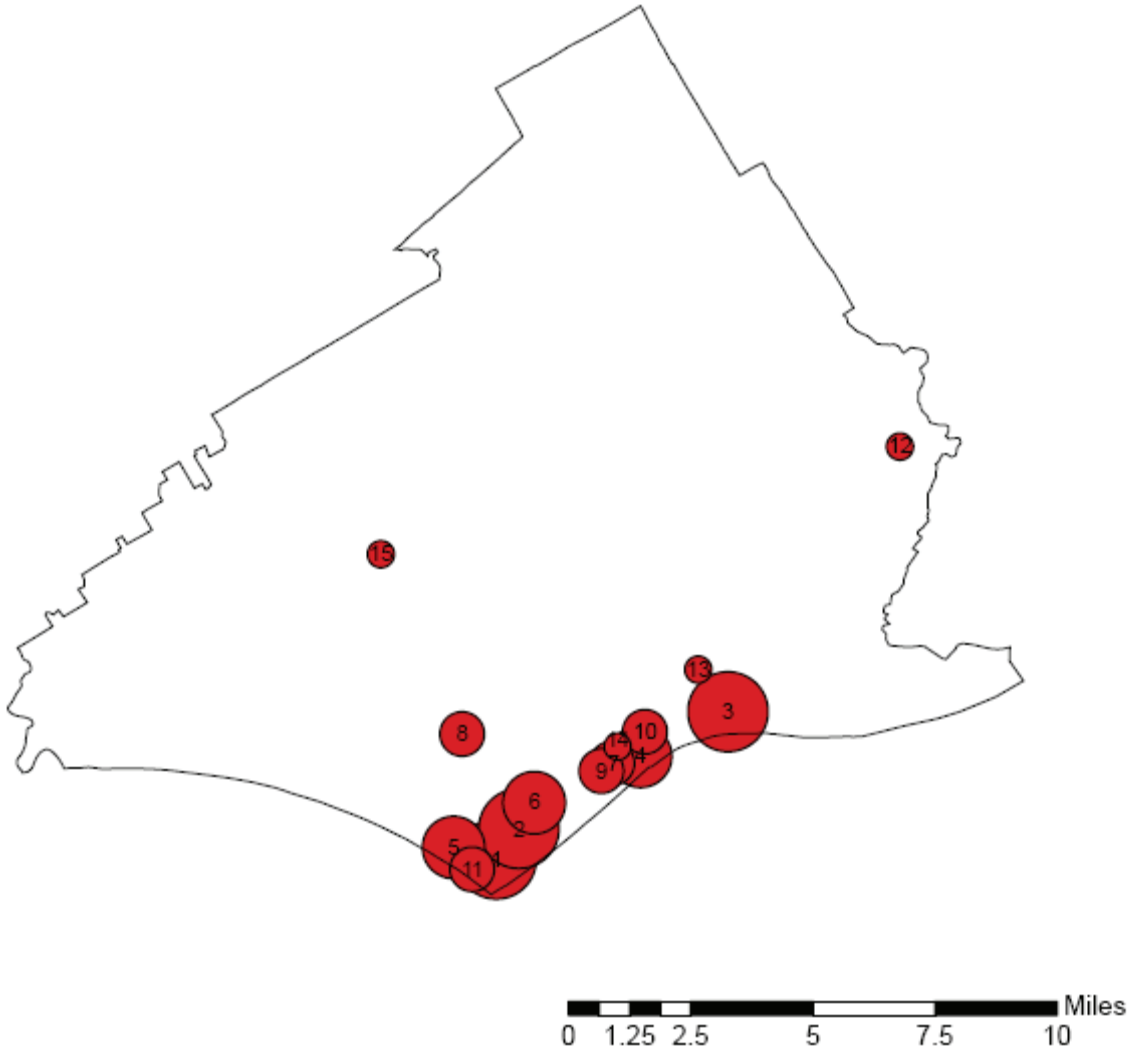
Questions to Think About:

1) Do you think it is a good idea for the public to be able to suggest to the EPA what sites should be on the National Priorities List? Think about the political process involved in creating the NPL.
2) Do you think that the people who live near NPL sites deserve to know?
3) In what ways could brownfield redevelopment help communities in Delaware County?
4) Where are old, abandoned landfills in Delaware County?
5) Where are people, streams, and industry in relation to the landfills? What are the demographics of the people?
6) If leachate were to leak out of the bottom of the landfill, where do you think it would go? Who would be affected? Do you think the leachate should be controlled after escape from the landfill?

For more information about Superfund, the NPL, and abandoned waste sites in Delaware County:

EPA 'Superfund' Site
(http://www.epa.gov/superfund/index.htm)
This site has a wealth of information on the Superfund program, the National Priorities List and will allow you to see maps of the hazardous waste sites all over the country.

Figure 12. Top 15 Polluters



Top 15 Polluters

Pounds of pollution released per year

- 250 - 1000
- 1,001 - 20,000
- 20,001 - 200,000
- 200,001 - 610,000

Hot Spots:
Top 15 Polluters in the County

Who are the top 15 polluters in Delaware County?

The section below is a description of each facility shown in the map 'Top 15 Polluters' (Fig. 12). The rankings are determined by the total pounds of on-site releases of **toxicants** per year, which includes emissions to the air, discharges to bodies of water, disposal to land at the facility, and disposal in underground injection wells. These rankings do not take into account toxicants that are treated at the facility or disposed of off-site, nor do they include releases of chemicals that have not been deemed toxic by EPA. The data on how much of each toxicant is released each year come from the 2004 Facility Report for Delaware County of the **Toxics Release Inventory Program of the EPA**.

While telling you what is released at each site, this list can not tell you the concentrations of releases or exactly what effect these toxicants will have. The occurrence and severity of any negative health effects from exposure to the toxicants discussed below depends on many factors, including the duration of exposure, age and health of the person exposed, other toxicants that may also be present, type of exposure (e.g. inhalation, ingestion, etc.), and the concentration of the toxicant in the environment.

The specific toxicants discussed for each facility may only represent a fraction of the different types of toxicants that are actually released from that facility. *The toxicants are introduced in italics as they are discussed.* The units for each toxicant are given in both pounds and tons; one ton is equal to 2,000 pounds.

#1 Sunoco Marcus Hook Refinery, Delaware Avenue & GR Marcus Hook, PA 19061
Marcus Hook Refinery is owned and operated by the Sunoco Corporation. This facility processes 175,000 barrels of crude oil per day into products such as gasoline, aviation fuel, kerosene, and heating oil. In 1995, the Marcus Hook refinery was cited by the Pennsylvania Department of Environmental Protection for air quality permit violations, including under-reporting emissions and exceeding permit limits for air toxics and volatile organic compounds (VOCs). In response to this and other charges by the US Environmental Protection Agency, Sunoco agreed to pay almost $1 billion for technologies in its refineries that will reduce pollution such as nitrogen oxide and sulfur dioxide emissions at Marcus Hook.

One of the VOCs released into the air is *benzene* (over 24 tons each year). Inhalation of benzene can cause drowsiness, dizziness, and unconsciousness; long-term benzene exposure causes effects on the bone marrow and can cause anemia and leukemia.[1] Emissions from tall stacks limit human exposure because benzene breaks down into relatively harmless molecules within several days. However, the Marcus Hook refinery releases over 70% of this benzene (over 17 tons) near ground level where it could be inhaled by people nearby before it breaks down. This facility also releases over 90 tons of *ammonia* each year. When inhaled, ammonia is a severe respiratory tract irritant.[2]

#2: Trainer Oil Refinery, 104 Post Road, Trainer, PA 19061
Trainer Refinery is owned and operated by the ConocoPhillips Corporation. This facility processes 185,000 barrels of crude oil per day into products such as gasoline, jet fuel, and diesel. As a byproduct of these processes, over 138 tons of *nitrate compounds* are released directly into the Delaware River each year. Delaware Bay has more nitrogen loading than any other major bay in the Northeast or Mid-Atlantic region of the United States.[3] Extreme nitrogen loading causes eutrophication or algal blooms, which lowers the oxygen content in water necessary for the survival of fish and aquatic plants.[4] Infants younger than four months of age are at particular risk from nitrate-rich drinking water, as nitrate toxicity causes methemoglobinemia or "Blue Baby Disease," a potentially lethal decreased ability of the blood to transport oxygen.[5] ConocoPhillips acknowledges their "obligation to conserve and use water wisely" and say that they transact "business in a way that promotes…a healthy environment and vibrant communities, now and in the future." The Trainer Refinery increased nitrate compound releases into the Delaware River by 4% the same year that these statements were released.

This refinery also emits over half a ton of another toxicant called *naphthalene*, but this toxicant goes into the air. Naphthalene is the main component of mothballs and inhalation can cause headache, confusion, excitement, nausea, vomiting and sweating. Severe cases can cause a condition involving the destruction of red blood cells called an acute hemolytic reaction.[6]

#3: Eddystone Station, Industrial Highway & Saville Avenue, Crum Lynne, PA 19022
Eddystone Station is a coal-fired steam-electric generating plant owned by Exelon. It works by burning coal to heat water to produce steam that turns turbines to create electricity. This process requires a continuous supply of water that the facility gets from the Delaware River at Darby Creek. The facility releases nearly a ton of *arsenic* into the air and water each year. Exposure to arsenic has been associated with lung cancer and irritation of the skin and mucous membranes (which can lead to diseases such as dermatitis, conjunctivitis, pharyngitis, and rhinitis).[7 8 9] This facility also releases a ton of *lead* into the air each year. Children are especially susceptible to the negative effects of lead exposure, which include effects on blood and kidneys and on the nervous, immune, and cardiovascular systems.[10 11 12] Ten and a half tons of *nickel* is released into the air each year, and the inhalation of nickel has been associated with asthma, decreased lung function, and bronchitis.[13 14] Eddystone Station releases 162 pounds of *mercury*, ranking it in the top third among all power plants in the United States.[15] Mercury is a bioaccumulating toxicant; its effects are magnified in organisms high on the food chain like fish and humans that eat fish.[16] Mercury is especially harmful to children because it permanently affects the developing brain by harming vision, hearing, motor skill and language aptitude. It lowers IQ and affects attention and memory.[17] Eddystone emits over 200 tons of *sulfuric and hydrochloric acid* each year. Unlike these acids, which can cause acid rain hundreds of miles away from where emitted, arsenic, lead, nickel, and mercury "fall" closer to the facility, causing their respective problems more locally (see inset on acid rain, pg. 40).

#4: Kimberly-Clark PA LLC, Front & Avenue of the States, Chester, PA 19013
Kimberly-Clark PA LLC is owned by Kimberly-Clark Corporation, a company which produces everything from Scott bath tissue to Kleenex tissue to Huggies diapers.[18] The Chester plant releases primarily *hydrochloric and sulfuric acid* (85 tons per year; see inset on acid rain, pg. 40). Every year the facility also releases 16 pounds of *lead* and 126 pounds of *nickel*, both of which have negative affects even in small doses.

#5: Epsilon Products Plant, Post Rd & Blueball Ave., Marcus Hook, PA 19061
The Marcus Hook Plant of the Epsilon Products Company manufactures 380,000 tons of plastics each year. Like the Marcus Hook Refinery, it is owned by Sunoco Corporation. This facility releases over 51 tons of *ethylene* and *propylene* into the air each year. Both of these chemicals are hydrocarbons derived from oil that is refined at Sunoco's Marcus Hook refinery. Each of these toxicants are hazardous to inhale.

#6: Stoney Creek Technologies LLC, 3300 W. 4th St., Trainer, PA 19061
Stoney Creek Technologies LLC produces finishing agents that protect surfaces from corrosion. This process requires methanol as a reactant. This facility releases 22 tons of *methanol* into the air every year, while over 118 tons are recycled onsite. Inhaling or ingesting methanol can lead to dizziness, headaches and nausea.[19]

#7: Norquay Technology, Inc., 800 West Front Street, Chester, PA 19013
Norquay Technology synthesizes custom molecules for high performance use in pharmaceutical, photographic, and electronic industries. This facility emits over 7 tons of *methanol* into the air each year. Inhaling or ingesting methanol can create dizziness, headaches or nausea. It also emits 250 pounds of *toluene* directly into the air each year. Short-term effects of toluene are minor nervous system disorders such as fatigue, nausea, weakness, and confusion. A lifetime of exposure to toluene may cause more pronounced nervous disorders.[20]

#8: Sunoco Twin Oaks Terminal, 4041 Market Street, P.O. Box 2060, Aston, PA 19014
Twin Oaks terminal receives petroleum products from pipelines, stores it, and distributes it in smaller quantities to customers. This facility is also owned by Sunoco Corporation, and most of the gasoline is for Sunoco service stations, though a small amount goes to other customers. It handles both gasoline and heating oil. This facility emits over a ton of *methyl tert-butyl ether (MTBE)*, a flammable liquid that is used as an additive in unleaded gasoline. Breathing MTBE can cause nausea, irritate the nose and throat, and affect the nervous system.[21] As a distribution center, Twin Oaks brings many trucks through the local area. Though it is not a direct emission from this facility, general air pollution from traffic is a major cause of childhood asthma.[22]

What is Acid Rain?

Acid rain is a process in which acidic particles fall out of the atmosphere. The main chemicals responsible for this pollution are *sulfur dioxide* and *nitrogen oxides*; these interact with water and oxygen to form acidic compounds which are then precipitated back to the Earth's surface. As the air is constantly moving and because this reaction occurs in the atmosphere, pollution from one source may cause acid rain hundreds of miles away. Eventually, acid rain results in increasing acidity and decreasing fertility of terrestrial and aquatic ecosystems. Acid also directly affects the physiology of organisms such as trees and fish that are not capable of dealing with rising acidity. Therefore acid rain's effects are not immediately obvious but with continual acid addition, ecosystem degradation is inevitable.[30]

#9: Degussa Corporation, 1200 West Front Street, Chester, PA 19013
Degussa Corporation is a multinational company that is involved in the specialty chemistry business. This plant is a performance silica production site. It releases over a ton of **sulfuric acid** into the air each year (see inset on acid rain, pg. 40).

#10: Community Light and Sound, 33 E. Fifth St, Chester, PA 19013
Community Light and Sound produces household audio and video equipment. This production process requires the use of *styrene*. The facility releases 1,100 pounds of styrene into the air at ground level. Another 2,000 pounds of styrene are transferred to the Covanta waste-to-energy incinerator (see 'Where does Delaware County's Waste go?' pg. 30). Long term exposure to styrene can result in eye- and skin-irritation, gastrointestinal problems, and deterioration of the central nervous system.[23]

#11: Rhodia Inc., 2nd St and Bluebell Ave, Marcus Hook, PA 19061
Rhodia Inc. produces surfactants, chemicals used in soaps, cosmetics, and other consumer products.[24] This facility emits *glycol ethers* and *ethylene oxide*. While they release 640 pounds of glycols ethers 384 pounds of ethylene oxide on site at ground level each year, they send the majority of these toxicants off-site to be treated. Exposure to ethylene oxide may result in respiratory problems; chronic exposure has been linked to cancer.[25]

#12: Hydrol Chemical Co., 520 Commerce Dr., Yeadon, PA 19050
Hydrol Chemical provides funeral supplies for funeral homes in the mid-Atlantic region.[26] This facility releases approximately 600 pounds of *formaldehyde* into the air each year. Formaldehyde can cause throat and eye irritation, and is listed as a probable human carcinogen by the EPA.[27]

#13: Foamex LP, 1500 E. Second St, Eddystone, PA 19022
Foamex LP produces plastics and foam products; this requires the use of *2,4-toluene diisocyanate*. They emit 660 pounds of toluene diisocyanate on-site each year. Like Rhodia Inc., the majority of their toxic byproduct is treated off-site: over six tons are taken off-site to Montgomery County, PA,

and Ohio for incineration. Short-term inhalation of 2,4-toluene diisocyanate may result in eye irritation, nausea, and central nervous system problems while long-term exposure may result in a lung condition similar to asthma.[28]

#14: Crown Foundry Co. West Philadelphia Bronze, Concord Ave and Patterson St, Chester, PA 19013
Crown Foundry Co. is a bronze company that uses copper and tin in their production process. It deals with 1650 pounds of *copper* onsite each year, emitting 250 pounds into the air at ground level and putting over seven tons into off-site recycling at facilities not authorized to deal with hazardous materials. Copper release can cause heavy-metal levels in drinking water. While people need copper to survive, too much may cause gastrointestinal and liver problems.[29]

#15: Wawa Dairy Warehouse and Distribution Center, 1393 West Baltimore Pike, Media, PA 19063
Ammonia is imported and used in processing fluid milk at the Wawa Dairy. Small amounts are released at ground level.

Questions to Think About:

1) Which facilities provide services for people nearby the facility? Which facilities also provide services for people far away?
2) How are the facilities distributed about the county? Why do you think they are distributed the way that they are? What are consequences of the way facilities are distributed?
3) What toxicants are released from the facilities that could have direct health effects on the areas nearby the facility? What toxicants could cause problems further away?

For more information on toxicant releases:

Toxics Release Inventory Program of the EPA
(http://www.epa.gov/tri/)
For a comprehensive record of which toxicants are released and how they are released from each facility, check out this website. You can search for location, chemical, or facility releasing pollution to discover more about what is happening near you.

Scorecard: The Pollution Information Site
(www.scorecard.org)
Just type in your zip code and you will receive a full "report card" on your community's pollution standing. This site also shows you how the level of pollution compares to other places in the country.

A closer look at environmental justice activism in the county: Chester Residents Concerned for Quality Living and the first environmental justice lawsuit

The city of Chester is home to many industrial polluting sites, including the DELCORA Sewage Treatment Plant, the Covanta Waste-to-Steam Incinerator, and the now defunct Thermal Pure Medical Incinerator. It is also just next-door to coal plants, refineries and chemical companies in the nearby township of Marcus Hook.[1] In 1992, a group of citizens in the city came together over concerns about the noise, air, water, and soil pollution that they suspected was linked to complaints of poor health and decreasing property value and standard of living in the area. Together they formed the Chester Citizens Concerned for Quality of Life (CRCQL). What started as a small group of citizens staging protests outside of the incinerator grew into a much larger movement. The group's concerns gained national attention in 1994, when the EPA decided to conduct a six-month **cumulative risk assessment** investigating the elevated health risks that Chester residents faced. The attention from the EPA was just the first of many victories of a small group of citizens determined to fight for their right to a clean and healthy neighborhood. When Soil Remediation Systems (SRS), a company whose business was treating petroleum-contaminated soil by burning it at high temperatures, tried to locate in Chester, CRCQL turned to the legal system to keep SRS out. The case was seen as the first environmental racism lawsuit in the entire country. Although the Supreme Court ultimately chose not to argue the case, the fact that a neighborhood battle entered the national spotlight showed the power of local grassroots action. In addition to the lawsuit, CRCQL had many other successful campaigns for environmental justice in Chester. They successfully pressured the Department of Environmental Protection from granting a **siting permit** to another polluting company, Cherokee Biotechnology, from locating in Chester. Finally, they were able to pressure the local city council to pass a resolution that no company could locate in Chester without proving that they were not going to contribute to overall pollution levels in the area. Finally, a successful lawsuit against the DELCORA sewage treatment plant yielded a $200,000 settlement to the city of Chester to establish a children's lead poisoning prevention program.[2]

Conclusion:
What does this mean for Delaware County?

Our decision to create a mapping project of Delaware County was sparked by our interest in further investigating claims of environmental injustice in Delaware County, where our college is located. We wanted to see for ourselves where environmental degradation is happening. While we cannot tell the whole story, *Mapping Environmental Justice in Delaware County* does provide snapshots of the current situation.

As the maps show, the major sources of pollution are disproportionately located in areas with higher populations of people who are minorities, economically marginalized, and have lower levels of education than do others in the county. Layering the transparencies shows that when you consider the cumulative effects of the sources of pollution, the problem is magnified. When you look at one map, you can see one specific pollution problem, such as sources of abandoned waste. But when you layer the maps, it becomes clear that in order to understand the impact of one type of pollution, you must also consider the others.

While the maps show what the situation is, they do not show why it is that way. There are many distinct sources of environmental injustice and determining the part each plays in creating the problem is often challenging. These sources range from political and economic to historical and geographical. However, identifying these sources does not justify the inequality that exists. Many people who have recognized this injustice have and continue to devote themselves to bringing environmental justice to Delaware County. One glowing example is the citizens of the city of Chester, who became so incensed about the environmental injustice in their neighborhoods that they took their grievances to the legal system and ended up with a case that wound its way all the way to the United States Supreme Court (see facing inset). We have also included a list of organizations in Delaware County that are currently working on issues of environmental degradation and injustice (Appendix 2).

This project points to the enormous problem of environmental injustice in the county. This predicament is deeply entrenched and there are many political and social forces perpetuating inequalities and environmental degradation. We believe that despite this, change is possible. Injustice in Delaware County need not persist.

"Never doubt that a small group of thoughtful, committed citizens can change the world. Indeed, it is the only thing that ever has." Margaret Mead

Appendix 1:
Glossary

Block Groups (BGs): A cluster of approximately 1,500 people determined by the U. S. Census Bureau to make it easier to examine population trends. The area or size of a block group can vary considerably, depending on the population density.

Brownfields: Industrial or commercial sites, usually abandoned or underused, that have been identified as potentially hazardous due to environmental contamination.

Coordinate system: A way of dividing up the globe as a standardized reference tool, so that each point in the world has a unique location. Most use the Equator and the Prime Meridian as reference points, with latitude and longitude as units of measure.

Criteria pollutants: Substances harmful to public health and the environment that are commonly used to measure air quality. These criteria pollutants nitrogen dioxide, sulfur dioxide, carbon monoxide, lead, particulate matter, and ground-level ozone.

Cumulative risk assessment: Risk assessments provide a qualitative or quantitative evaluation of the risk posed to human health and the environment by the actual or potential presence of pollutants. In the case of a cumulative risk assessment, the EPA will take into account all sources of pollution in a given area in its assessment.

Emission: The release or discharge of pollutants into the environment, usually referring to air discharges.

Hazard: A source of potential harm or damage, or a situation with potential for harm or damage.

Hazard Ranking System (HRS): This is the tool used by the EPA to determine the extent of the environmental and human health risks posed by uncontrolled hazardous waste sites that have been proposed as additions to the National Priorities List (NPL). While the HRS is not a complete risk assessment tool, it does allow the EPA to gauge the overall danger of a site relative to other potentially dangerous areas. For example, an HRS might identify the types of toxicity of waste at a site or determine what people or environments are affected by the site.

Leachate: This is the concentrated chemical liquid that forms when water enters a landfill and seeps down. As the water moves, it picks up chemical compounds. When a landfill ages, leachate problems are aggravated. Cracks in liners can allow leachate to seep into the ground and contaminate the groundwater supply of surrounding communities.

Map projection: Process by which the globe is transferred onto a flat piece of paper. Imagine trying to lay an orange peel out perfectly flat on your desk—it wouldn't come out in a perfect rectangle, would it? All projections are distorted in different ways in order to get them to come out looking flat and square, so we can read them.

Particle pollution: Small particles such as dust, smoke and other solid material that move around in the air.

Appendix 1

Pennsylvania Department of Environmental Protection (DEP): The state agency responsible for implementing environmental laws and regulation regarding the air, water, and land. Find out more about their activities at http://www.depweb.state.pa.us/dep/site/default.asp.

Point source: A direct pollutant discharge from a fixed and stationary location, such as a pipe, channel, smoke stack, factory or ditch.

Non-point source: Pollutants that do not have a single point or origin, but rather come from diffuse sources. Examples are lawn chemicals, agricultural pesticides, or oil residues on streets and parking lots that rainwater washes away, thus polluting rivers and streams

Riparian buffer: A strip of land left as green space along the borders of a body of water to help control runoff and erosion.

Siting permit: There are many specific types of permits granted to industry by government departments, but in general companies must obtain permits granted by the host states' Department of Environmental Protection to build and conduct their business in a given area, especially if the building or operation process involves significant environmental impact. For more information on Pennsylvania's permit regulations, see the DEP's list of permitted sites at www.dep.state.pa.us/efacts.

Standard Deviation (SD): A statistical measure of the dispersion of a frequency distribution.

Superfund: A federal program, administered by the U.S. Environmental Protection Agency, that handles the cleanup and rehabilitation of hazardous waste sites that threaten the health or welfare of the surrounding environment or population.

Toxics Release Inventory Program of the EPA: A publicly available EPA database that contains information on toxic chemical releases and other waste management activities reported annually by certain covered industry groups as well as federal facilities. This inventory was established under the Emergency Planning and Community Right-to-Know Act of 1986 (EPCRA) and expanded by the Pollution Prevention Act of 1990. For more information go to http://www.epa.gov/tri or call the TRI User Support Service at (202) 566-0250.

Toxicant: Any substance that could produce a harmful effect on an organism that inhales or ingests it.

U.S. Environmental Protection Agency (EPA): The EPA is a federal agency that regulates and enforces environmental laws. It also provides information and guidance to policy makers. Visit the EPA's website at www.epa.gov to learn more about the Agency's role in environmental protection.

Wastewater: Consists of human waste (sewage) from toilets and showers, rain water that runs into pipe drains. Industrial wastewater might have been used to wash or cool machinery, as a solvent in a chemical process, to flush materials through a filter or down a drain, and often contain by-products such as paint thinners, heavy metals, and fuel residues.

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