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# Dayton, Ohio: A Study

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## Dedication

This thesis is a comprehensive study of the City of Dayton which I have been conducting since my arrival here at the University of Dayton. It includes photography, an audio album "Sounds of Dayton", poetry, prose, and a research study on environmental justice. It is dedicated to the committed Daytonians who have encouraged me to search for more in Dayton, especially Sean Wilkinson, Cindy Currell, and my bicycle, Biancha.

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*AUDIO ALBUM*

Many recordings were made while exploring Dayton. I tried to capture the reality of what was in the atmosphere, what was really there if one were to stop and listen. What I found was that most of what we here in the city is the overbearing sounds of cars, trucks, and buses. Highways, especially, are the chokers and stompers of all other sounds. They bully the tweets of birds and sounds of the wind into a quiet submission. After much recording of the sounds of traffic, I searched for other sounds, the sounds of humans, construction equipment, birds, rain, rakes clearing leaves, grocery stores, and clock towers. I hope that you enjoy this sensory experience of Dayton and allow yourself to become engrossed in the reality of what it is that we are hearing every day, but often forget to notice.

The audio files are available for experiencing by following the links on my website: homepages.udayton.edu/~nicaisen1/Projects.htm. You may also request mp3 digital files by emailing me at nicaisen1@notes.udayton.edu.

Thank you.

*PHOTOGRAPHY*

To help you better visualize the Dayton region, I ventured out via red station wagon and snapped shots of many neighborhoods, attempting to capture the diversity of Dayton's population, especially economic diversity. These may not be dramatic shots of skyscrapers and wildlife, but they depict the realities of where people live, where people go when they leave work. Below are a selection of the photographs. Pay special attention to the conditions of the homes, the roads, and the urban forest.

A street view in the Walnut Hills Neighborhood of Dayton, southeast of downtown, near the corner of Wayne and Watervliet.

This street scene is located in the Belmont Neighborhood in the far southeast reaches of Dayton, near the intersection of Wayne and Smithville.

The above neighborhood is in northeastern Kettering on the east side of Woodman Drive, across from the Delphi Chassis Systems plant.

The northern tip of Centerville, north of Whipp Road, east of Marshall Road exhibits large plots and medium-aged trees.

The above scene is located in Washington Township, near the intersection of Alex-Bell Pike and Mad River Road.

An intersection in a housing district in Moraine, west of Dryden Road and the deceased GM Moraine Facility and east of Interstate-75.

Above is an image of the Westside of Dayton between Danner Avenue and Broadway Street, north of Stewart Street.

*POETRY*

*THE G.M.R.*

I yearn to go back to the years

before the Great War when

my body was free and my children

ran clean and clung tight to my legs

When these people weren't afraid

that I would hurt them or spill

over my bounds and poison their streets,

drown their hopes and limestone basements

Before the walls were built, its hills of soil,

bare barricades on the banks of my

sinuous curves, my sensual power and

fluid folds

Back before I was cast away from the town

when Dayton still respected me

and my gut was teeming with trout

donning scepters of fishing rods

and legs of herons tickling my neck

When the my corset wasn't as tight

and my neighbors knew my name

and the storms didn't make me swell

like an after-dinner belly ache

The summer sun didn't dry me like

an earthworm out of mucus on the

sun-fired sidewalk at ten in the morning

and I was the blood of this region

where I was known as the Great River.

*STORY AS A CASTAWAY MARLBORO*

My feet still glowing amber

as I flip through the air

bouncing trampoline and flutter,

landing roughly rolling on hard pavement

sparks spurting from my ankles

as I spin to a halt.

There I find my resting place among the plastic lids

and asphalt chunkies reclined like drunks

in the corner of the curb, hoping to

someday sneak past the sewer grate

and into its endless pit.

I cool to grey, watching humans tromp past

a rhythm of stomps and shuffles and squeaks,

rolling carts and electric wheelchairs

humming with motion. Yet

nobody stops to pucker

and suck my life back into me,

relight my knees and cough my

exhalation.  Twiddle my torso

in their tar tainted fingertips

and carry me across Jefferson

to that park in the median

where they'll flick my filtered

thoughts to the cool captivity of grass

between the deserted roadways of Dayton.

*DAYTON PROSE*

Thoughts on Dayton

I'm an outsider--not from these parts. I was relocated to this city when I decided to attend the University of Dayton and move my belongings to the cell (called a bedroom) in the close-quartered dormitory of Founders Hall. And overnight, I became one of the elite of Dayton, one of the rich kids toting backpacks of laptops and ipods, sporting LLBean and The North Face apparel. Drinking Odwalla fruit smoothies and working out in the plush Recreational Complex. I was earning a college degree. I was young, white, wealthy, and I had highly educated parents. I was from the suburbs of Kentucky and had no connection to this place. I was fresh. I was an outsider.

But it was during this first year of school that I pledged to gouge a gaping puncture in the bubble of the college campus that divided "town from gown". The bubble was heavily fortified with the lure of everything needed to live being inside of its shield, and everything that could harm me being "out there" on the exterior. Yet, I had an escape. It was my bike, my beloved Bianchi (affectionately named "Biancha") in a glistening mint green, that gave me the speed to lance through the force field of elite students and faculty and dorms and cars and limestone and brick and pillars and Ugg Boots. (Ironically, the tool that gave me the freedom to break from the campus was a symbol of a "rich old man": my racing bike.)

Into the city, I allowed myself to get lost—or, more accurately, encouraged myself to get lost--testing my prided sense of navigation. And, in case of panic, I had a detailed street map of Dayton (quite possibly the most useful tool in learning about a new place). It was just me and Rand McNally, on the roads, in the pursuit of discovering Dayton, for all it's worth or not. Raw wheels and muscle, cracked asphalt, segmented concrete, cobbles, bricks, and railroad grade-crossings. Dayton.

Four years later, I can still recall my first day out in Dayton. My story begins on a humid day in September, I think, warm enough for shorts and T-shirt. Like a young salmon finally finding the ocean, I wandered about knowing nothing of this

place, with no friends with bikes, off alone, green and ignorant. Any direction would have done, but I chose West, and traversed the Stewart Street Bridge over the Great Miami River. The good ol' GMR! (Little did I know of the relationship that I would build with its waters and fishes and tributaries and refuse and wildlife!) Through one traffic light, and I was in the Westside.

It was quite a place, I'll tell you that much. It was...well...dead. Silent. Almost spooky in the ninety-some degree sunny summer air with barely a car on the road. Soon I realized that I was in the midst of a complex of government housing projects, identical buildings, with little architectural thought, red brick, no trees. And then I began to see hints of activity, some people. Black people. Everyone was Black. Some people were standing in the shade, some others over there playing basketball. Everything was slow and lethargic, even the waves of heat rising from the asphalt. This was West Stewart Street, I guess. Small houses, blanched grass, a few cars parked on the side of the road—broad hoods of old Buicks. I pedaled on.

Later, I made it to the east side of the river and up to the top of a hill, catching my breath at the red. As my exhaustion waned, I looked around at a very different scene. Clean lawns of large brick homes, stately trees, pedestrian-friendly sidewalks, and the occasional squirrel. There were people out running and walking dogs. Tennis courts: occupied with the schwaahhp! of racquets and fuzzy yellow balls. The cool, shaded streets were lined with new cars, Benzs and Beamers. Past the large homes I pedaled on, down a tree-medianed boulevard, and then I saw it. Emblazed with the caption "Oakwood Senior High: A National School of Excellence", was the castle. Harry Potter's very own. Dark smoky brick in a Cambridge-wanna-be architecture with walnut-framed windows. Copper gutter spouts climbed up the side of the bricks to the roof, oh! the roof! No tar and sand. No, this roof was none other than slate tiles. Slate, like the old English manors. Slate, like, you know, the stone.

And I could feel it coming, the nausea. The anger, and the upset. I cursed the system that allowed for this, allowed for the money to give slate roofing to a public

school. And the system that allowed others to live in housing projects in concentrated poverty.

Since this early adventure in the 937, I've seen a lot of the City of Dayton and the surrounding areas. I've bicycled the streets, to appointments downtown or at the dentist, to Krogers for groceries, and to fulfill the desire to find myself lost. I've taken the bus, scored rides with friends, walked, and ran the streets. And I've observed, noticed the little things: the cracked pavement, the yellow paint on the curb, the electric lines, the garden beds, the overgrown ivy, the crooked shutters, and the houses for sale. I've been with the cigarette butts and gravel lining the curbs, the railroad tracks and the diesel engines that ride them daily.

I've watched people: troubled people, stumbling or limping. Lawyers and other nicely dressed professionals. Construction workers operating heavy, loud machinery to a rhythm of clinks and clunks. I've seen the skinny old ladies waiting for the RTA. I've talked with the beggars (like Sean) at the interstate highway exit ramps and made friends with an elderly woman at the 2nd Street Public Market. People working, people in government, people just trying to get by. Real Daytonians. People committed to the "here". The region.

People proud to be local. Proud to raise a family and have a home. Proud to be a member of the community. Proud to have always lived here. Some are angry with the way things are. Some are jubilating after a good sermon at Sunday Mass. Some are just too busy and tired to think much about anything. But everywhere I go, I am surprised and satisfied to find so much pride in this city. It's Dayton and its metropolitan area. The typical American town.

Typical, I say. Not that I've lived in many other towns. Not that I've had any more than twenty-two years under my belt. Not that I'm any kind of an expert on America. But I find Dayton typical. It is in the Midwest, with a mostly flat, slightly hilly terrain. It has mild winters, mild summers, and a fair bit of in-between. It is surrounded by suburbs and farmland, corn and corn and corn (maybe a little soy here and there). Dayton is a river city, a standard for most large towns. It was

founded on the banks of the river as a fertile place to grow food, a river that has fueled industry and floods. And like the history of most cities, Dayton was once a booming industrial center: steel, cash registers, car parts, and refrigerators. Paint companies and canneries and grain processers and tires. And with its fellow Rust Belt friends, Dayton has had to say goodbye. Adieu to its vibrant production of goods. Farwell forever (well, maybe not forever, but at least for the near future).

And with the leaving of industry, the city proper has experienced the emigration of residents. The evacuation, rather. In the past forty years, Dayton has seen its population drop from 250,000 to around 160,000. And with the exodus comes vacancy, property devaluation, and a concentration of poverty. In this history and current state, Dayton is typical. Suburbs in the South, North, and East have sprouted like weeds from the once-rural forests and croplands. Schools have become desperate for funds as they try to serve a poor population. (A friend of mine is student teaching this semester and told me that in her Dayton Public School's class, 100 percent of the students are from families under the poverty line!) Downtown is plagued with vacancy and deserted streets, and, just last month, the tallest building in the skyline, Kettering Tower, had to sell due to low rentership of the office spaces. Dayton is not unique in its struggles.

And it is this generic nature that makes Dayton such an important place to be. It is this model of a city that places Dayton on the podium of standardness. Dayton is the city to study, the city to be the Guinea Pig, the city to try and fail and try and succeed, the city to be in.

Exert From Essay in Response to "Economic Inequality and Public Policy: The Power of Place" by Todd Swanstrom

These readings, and many other learning experiences, have really tugged on my future. I really want to get out of here, experience some other part of the country while I can. See what northern Wisconsin has to offer. Eastern Virginia and the Chesapeake. Philidelphia, big city. But I feel a calling to Dayton. I feel a need to stay here. To join my new friends in the South Park Community who are building a community garden. To work for the MetroParks (an incredible organization that I highly respect). To pursue mayorhood. This call is social responsibility. I feel a calling to help Dayton. To bring it new energy and ideas. Youth. Education. To not be one of the thousands that flee Dayton each year.

# *RESEARCH PROJECT*

## *ABSTRACT*

The urban forest is an important element of cityscapes today. Urban trees provide a habitat to wildlife populations, create more tolerable city living conditions, and better the lives of residents around them. The urban forest, however, is not distributed equitably to the urban population, and some residents receive more or less of its positive externalities. Montgomery County, Ohio, was chosen as the study site to determine if environmental injustice was present regarding the urban forest. It was found that there was environmental injustice present in Montgomery County, as the density of the urban forest was limited by the educational obtainment and income of the residents. This study's findings are of particular importance at this time as the invasion of the Emerald Ash Borer becomes a reality and governmental organizations prepare for massive tree replanting campaigns.

## *INTRODUCTION*

### *Cities*

We, as humans, have been creating and living in cities for millennia, and we have seen the rise and fall of great cities throughout time. Originally, cities were built for protection from nearby raiders, and they were equipped with armed city walls and city gates that closed at night after farmers returned from their fields. Cities of today no longer have walls to protect its residents from enemies, or at least not the same type of walls.

Cities today are centers of commerce (or recently were centers of commerce) and are often located at the crossroads of trafficked interstate highways and railroads. They house banks and government offices, courts of justice, art museums, symphonic orchestras, restaurants, and music scenes, and they provide necessary utilities such as natural gas and sewer and police and health care. They are often the places of higher learning, i.e. universities and community colleges. Our metropolises offer amenities for a large

population but also provide the intimate conditions of neighborhood communities found in church parishes, neighborhood schools, and community centers.

Most importantly, cities are places of residence and work for millions of Americans. According to the US Census Bureau's 2000 National Census, 79.0 percent of Americans live in an urbanized area or cluster (#1). And the millions of people in cities have transformed them from their original state of forest or marshland, etc. The building of houses and apartments and roads and electric lines and canals and levees and sewers has dramatically altered the landscape. Cities have pushed nature to the fringes and have largely become human environments. However, they are not independent of the broader ecological world with which they interact heavily, for example, by dividing habitats with roads, taming rivers with levees, and the creation of valuable urban ecosystems.

Cities offer complex interactions between and among their component parts. More specifically, cities concentrate different groups of people and their constructs in a relatively small space once dominated by natural processes. Cooperation and conflicts exist in every city between groups of people, their built landscapes, and ecological entities. Such relationships will be explored in this study.

*Urban Ecosystems*

Cities are constructed from elements representative of human society (roads, homes, businesses) that are connected via a complex network of roadways, pipelines, and wires. These social elements are interspersed between parks, lawns, pockets of unmanaged vegetation, water bodies, streams and rivers. The totality of these elements, both ecological and social, is considered the "urban ecosystem." Ecological elements of the urban ecosystem are crucial for ameliorating flood water, for capturing carbon, lowering heat-island effects, and maintaining biodiversity. They provide beauty and a break from the hard surfaces of the cityscape. The importance of managing the ecological elements in urban areas is so prominent that most large cities now employ a division dedicated to "urban forestry" and many municipalities are explicitly dedicating resources to managing the city as a *de facto* urban ecosystem.

While many elements of the urban ecosystem come into being through the natural dispersal techniques of wildlife and plants to vacant urban properties, much of the urban ecosystem is a constructed amenity. It is intentionally built by private residents and businesses: lawns and landscaping, backyard trees and green roofs on offices. Equally, it is intentionally built by governmental bodies: park districts, street trees, school properties, and riverside plantings. Such social production of urban green space has become an important study in the commodification of the urban ecosystem (Heynen, et al., 2006).

The total effect of the urban ecosystem depends on both sectors, private and public, which are far from independent. The net influence of the urban ecosystem cannot be divided. Public street trees reduce sound pollution in similar ways to private backyard trees. Public parks reduce peak runoff water similarly to private lawns and corporate green roofs. Wildlife interacts between the two sectors as do humans. Both sectors have ecological systems that help to bridge more intact systems on the exterior of the urban area. In conclusion, the private and public sectors of the urban ecosystem together build the total urban ecosystem.

*The Urban Ecosystem and, more specifically, the urban forest provide many tangible benefits to the city.* Although urban ecosystems consists of hundreds of elements, e.g. feral cats, water fowl, lawn grasses, green roofs, lakes, and humans, this study will focus on one element of that ecosystem: the urban forest. The urban forest consists of all plants—trees in particular--within the urban area (Pedlowski, et al., 2002). These trees are often rooted in riparian zones along waterways, on property and fence lines, along streets, in yards, and at shopping centers, schools, and offices. The urban forest has been a criterion of particular interest to scholars studying the social formation of urban environments in the United States and abroad (Heynen, et al., 2006). This interest is based on the abundant positive externalities associated with the urban forest that transforms the urban forest into a consumable commodity (Heynen, et al. 2006).

*Positive Externalities of an Urban Forest*

As a long-term entity of the urban landscape, the urban forest provides a myriad of environmental benefits which are utilized--often unintentionally--by the residents of that urban locale. Such environmental benefits include, but are not limited to, supporting wildlife, decreasing the need for summer air-conditioning and winter heating, improving air quality, diminishing sound pollution, mitigating water runoff, and increasing property values.

*Wildlife.* Wildlife in cities is often highly valued by the human residents. Such wildlife includes insects such as butterflies and lightning bugs, birds such as geese and songbirds, and mammals such as deer and possum. The wildlife of a city builds the city as a living and vibrant place, not a desert of concrete and dust. Urban wildlife populations also form bridges between the sometimes more inhabited rural areas surrounding the urbanized region (i.e. the "bioregion") over which animal and plant populations can breed and migrate, forming metapopulations and decreasing the effects of population barriers (e.g. impervious surfaces) that may limit population size and genetic success. The urban forest produces necessary greenspace habitat to conserve biodiversity (McPherson, et al., 2006; Heynen, et al., 2006). Also, because rural areas surrounding cities are largely consumed with economic pursuits, i.e. agriculture, urban habitats make up a valuable portion of the total habitat range of some wildlife. Heynen writes that "the city's urban forest not only provides an important ecological resource for the region but also helps contribute to global biodiversity in the face of rampant global deforestation...these urban stocks of ecological resources will certainly play a crucial role in the future global ecological health" (2003).

*Temperatures***.** An urban forest conserves energy for homeowners and businesses (McPherson, et al., 2006). Shade trees decrease the amount of the sun's radiant energy that interacts with built surfaces such as houses, office buildings, and roadways. Trees convert liquid water to water vapor through a process called evapotranspiration that cools the surrounding air by absorbing solar energy (McPherson, et al., 2006). Such attributes decrease the extremes in microclimates, including the heat island effect that plagues urban centers (Perkins, et al., 2004), an effect caused by the re-radiated of heat by asphalt, concrete, and tarred surfaces, often making cities hotter during sun-lit hours than the

surrounding rural areas. For example, trees can lower temperatures by five degrees (F) compared to outside of the greenspace area (McPherson, et al., 2006). Trees that shade roofs and siding of buildings protect them from the heat of the summer sun and, in turn, decrease the stress on air conditioning units in appropriate climate regions of the US (Dwyer and Miller, 1999). A study in Minneapolis found that three medium trees saved a house 56% of its summer cooling costs. Urban forests further decreases atmospheric heat by reducing demand on heat-spewing power plants that provide energy to the air conditioners. The urban forest provides windbreaks to buildings during the winter months, minimizing the conduction of heat from the interior to the exterior via windows and wall surfaces (McPherson, et al., 2006). A study in Minneapolis found that three medium trees would decrease winter heating costs by three percent.

*Air quality.* In cities, vehicles, industry, and households produce large amounts of air pollution that poses a serious threat to the inhabitants of such cities, symptoms like coughing, headaches, respiratory and heart diseases and cancer (McPherson, et al., 2006). Such health problems can cause economic deficiencies as employees miss work and can cause increased stresses on the medical service industry. The urban forest, however, increases air quality (Heynen, et al., 2006) by absorbing noxious gases and intercepting particulate matter (McPherson, et al., 2006). The urban forest serves as a carbon dioxide sequestration material and serves to deter global warming by decreasing atmospheric carbon dioxide concentrations (McPherson, et al., 2006). Furthermore, as trees decrease energy demands of air conditioners, less carbon dioxide is produced from fossil fuel-based power production facilities.

*Sound pollution.* Urban landscapes are not only described in terms of tall buildings, expanses of housing, and highways and bridges, but by the sounds of the city. Buses, diesel engine trucks, train grade-crossing horns, construction trucks, human voice, and restaurant exhaust fans fill the air with mind numbing noise. McPherson, et al., claims that trucks, trains, and planes (particularly important to Montgomery County, Ohio, with the Wright-Patterson Air Force Base in close proximity) can produce city sounds in excess of 100 decibels, a noise that is twice as powerful as healthy (2006). However, the urban forest plays in important role in reducing urban noise levels (Heynen, et al. 2006). Plants absorb

high frequency noise which is distressing to many people, and they can reduce highway noise by 6 to 15 decibels (McPherson, et al., 2006), creating a more tolerable place to live and work.

*Hydrology*. Urban forests also benefit the hydrological processes that are important to the functioning of cities. As the world's population tips seven billion, water management will most likely become a subject of much concern. When heavy rains are intersected by impervious surfaces, they runoff and are drained with storm sewer systems rapidly to the local stream system. There, the water level peaks quickly with high discharges, washing away soils and nutrients in the aquatic system. Urban forests counter such a trend by intercepting rain, slowing its fall, holding water on leaf and trunk surfaces and releasing it slowly onto the ground or into the soil (McPherson, et al., 2006). This action reduces the runoff and peak discharge of small rainfall events, protecting stream systems from high levels of runoff sediments and flood-level discharges. Also, for cities that have combined sanitary and storm sewer systems, urban forests reduce runoff and, consequently, the stress on the sanitation district facilities, reducing sewer costs for residents.

*Biophilic effects of the urban ecosystem*. In addition to the environmental benefits, a functioning urban forest provides positive externalities in the form of psychological and community health. These effects support the theory of biophilia, that is, the idea that humans are happier when surrounded by healthy biota and have the propensity to affiliate with living things (Kahn, 1999). The urban forest has an important role in this theory, as it is the dominant feature of many cities' biota. McPherson, et al., reports many instances of trees' importance to human stress. They state that people show less stress response if they have recently viewed trees and vegetation (McPherson, et al., 2006; Kahn, 1999). Also, scenes of trees and nature provide restorative experiences that mitigate mental fatigue and aid in concentration at home and at the office (McPherson, et al., 2006; Perkins, et al., 2004). Remarkably, one study found that trees outside of the windows of hospital patients increased the speed of recovery and reduced the need for anti-anxiety drugs (Ulrich, 1984). Finally, desk workers who can see nature scenes from their work place experience lower rates of sickness and greater satisfaction with their work (McPherson, et al., 2006; Perkins, et al., 2004).

*Neighborhood/community***.** The urban forest is a member of every neighborhood community and serves to strengthen the neighborhood. McPherson et al. state that research has found treed outdoor spaces to be used significantly more than spaces without trees by residents of public housing (2006). The urban forest creates strong emotional attachments between city residents and their neighborhoods (Perkins, et al., 2004) and provides a sense of connection to nature in residents (Pedlowski, et al., 2002). In addition, Barbosa writes that public green space provides a meeting place that gives a shared focus to communities and neighborhoods (2007).

Clearly, the urban forest is essential to the efficiency of the environment and the happiness of urbanites, and it is one of the largest contributors to improved urban qualities of life (Pedlowski, et al., 2002). The urban forest is important to city residents. However, the idea that the benefits of an urban forest are of a communal value, that is that it has an effect beyond the immediate property line in which it is planted, demands a discussion of urban forestry under the context of social justice.

*Politico-geographic distributions*

Social justice is largely based on the distribution of goods and services, and the urban forest is a good that produces consumable benefits. Now, we must understand how the positive externalities of urban forests (a limited commodity) are distributed among residents of cities. Authors have suggested that the **constructed urban ecosystem is not equally distributed geographically**, and, therefore, the beneficial externalities of such an ecosystem is subject to the scrutiny of the urban political geography (Pedlowski, et al., 2002; Heynen, et al., 2006; Perkins, et al., 2004). Different human social groups within the city have varying levels of power to construct, maintain, and control these ecological features. Social groups manage the ecological features just as they manage other human commodities such as schools, libraries, and automobiles. Perkins et al. remarks that scholars must view the distribution of urban trees as a distribution of commodities, commodities that are constructed via economic investments and political conflicts (2004). They continue in saying that "urban political ecology seeks to uncover the complex

relationships of power that shape urban natural environments...[and] is an ideal framework through which to consider the forces that (re)shape, or impede the (re)shaping of, urban forests" (Perkins, et al., 2004). That is to say that the political environment is a determining factor in where urban forests are dominant in the urban terrain.

Those with power (usually financial power) influence the distribution of urban forest commodities that provide tangible benefits to the immediate and extended locale. This influence is geographic in nature: The heterogeneous mix of social groups across the human landscape has, created a similar heterogeneous and unequal distribution of ecological features. Urban areas with high vegetation cover are usually occupied by the wealthy (Pedlowski, et al., 2002). Likewise, poor urban residents with little financial influence are often incapable of producing private sector urban ecologies and become dependent on public investment in the urban forest through nearby parks and street trees (Heynen, et al., 2006). The urban poor and minorities remain disadvantaged by the public sector investments as such public sector trees represent only a small portion of many cities' urban forests (Heynen, et al., 2006).

The authors are claiming that wealth and urban forests are related in that more money is associated with more forest commodities. Heynen goes so far as to say that "The trees within the urban built environment exude urban power relations as much as any other marker of class" (Heynen, 2003). Such claims ring alarm bells for social justice issues, where the wealthy have more access to a community commodity than do the poor (although the assumption that the positive externalities of an urban forest are in fact a to-be-shared communal resource is up for debate). More than simply a commodity, urban forests influence the quality of life of residents through its external benefits, and an uneven distribution of trees contributes to an uneven quality of life (Perkins, et al., 2004).

*Environmental Justice*

As the urban forest is an environmental entity distributed unevenly to urban residents, a discussion of environmental justice—and injustice—is imperative. Environmental injustice in cities can be defined as segregated urban spaces having unequal

access to environmental services in which poorer areas exhibit worse living conditions (Pedlowski, et al., 2002). Environmental injustice assumes that there is some degree of diversity in race, income, and other discriminatory criteria, and that such diversity is at least, in part, segregated spatially. Pedlowski et al. (2002) say it best as "spatial segregation among social classes in urban space results from a process in which different classes or segments tend to concentrate their presence in different regions or neighborhoods according to wealth" although "wealth" can be substituted for a myriad of criteria that define social groups.

Not only do segments have unequal access to environmental services, but they may be the subject of environmental dissolution. Cities are undergoing impoverishment and environmental degradation, primarily in areas of racial minorities (Pedlowski, et al., 2002). Likewise, the negative impacts of environmental degradation are found most readily in segments occupied by social groups of low wealth and non-Anglo backgrounds (Pedlowski, et al., 2002).

Such statements exemplify the concept of environmental injustice, a reality that can be considered anti-Constitutional. It was our United States Constitution that the Founding Fathers defined the role of any American government as that to establish Justice and promote the general Welfare (Jordan, 2009). President Bill Clinton recognized this counter-Constitutional trend, and in 1994 he wrote the Executive Order 12898 which mandated that every Federal agency must consider the adverse environmental health effects of its projects on impoverished and minority populations.

This action placed environmental justice on the national radar and many studies have been performed since surrounding the topic. For instance, Heynen and Perkins (2006) examined the relationship between urban forest and socioeconomic status in Milwaukee, Wisconsin, where they found a positive correlation between private tree canopy cover and wealth. He concluded that poorer residents remain dependent on public investment for their "collective consumption of urban ecological amenities" (Heynen, et al., 2006). In Central Indiana, Heynen and Lindsey (2003) found that tree canopy cover was positively correlated with the percent of residents with college degrees and the age of the homes but not correlated with population density or median family income. A third study measured

the effectiveness of a Milwaukee urban reforestation project and found that newly planted trees are biased towards owner-occupied homes over rental properties, creating inequity (Perkins, 2004). There have also been similar studies in the UK (Barbosa, 2007) and Brazil (Pedrowski, et al., 2002).

*Study Site*

Although progress has been made in identifying socio-ecological trends, much remains unknown. For instance, are trends found in Milwaukee and Central Indiana characteristic of all regions in the US? Can trends be observed across the matrix of urban and suburban landscapes, not solely the urban center? Perhaps urban ecological elements are correlated with some socioeconomic criteria such as income and property value but are not correlation with others such as race and education level. Are present correlations necessarily evidence of environmental injustice? This study seeks to answer these inquiries using Dayton, Ohio, as the study site.

Dayton, Ohio, provides an excellent opportunity to study the spatial relationships between socioeconomic factors and urban ecological elements. First, Dayton is a medium-sized metropolis and is representative of many other post-industrial, Midwestern city. Second, the Dayton region provides an ideal location to explore the differences in socio-ecological trends between three landscapes (urban, suburban, and rural) as it has clear-cut regions of each type of landscape. Finally, the social variables such as race and income are more distinct in Dayton due to its geographically segregated economic and racial populations. (Please see Dayton Prose in previous section of Thesis.)

*Postulates*

The overarching goal of this project is to assess the spatial arrangement of land-use, greenspace, tree canopy cover and socioeconomic factors in greater urban Dayton. Working within a Global Information System (GIS) framework, I will analyze relationships between these factors to assess the following series of postulates:

*Postulate 1: Urban forest is positively correlated with income.*

I hypothesize that areas with higher family incomes will have higher densities of urban forest. Neighborhoods with higher income have more potential to construct, maintain, and protect the commodity of trees. There is more expendable income in such neighborhoods, income to be spent on beautifying the area, not on housing and food. Also, areas with higher incomes tend to have higher home ownership and lower rentership, which may lead to more investment in the surrounding urban forest. However, while I expect this postulate to hold true in the urban and suburban landscapes, I predict that it could be unsupported newly built "McMansion" neighborhoods where large and expensive homes are built in recently converted farm fields or pastures and, therefore, have few trees.

*Postulate 2: Urban forest is correlated with race.*

I hypothesize that neighborhoods with higher proportions of (self-defined) White residents will have denser urban forests than neighborhoods with higher percentages of (self-defined) Black residents. This trend is proposed because it was supported in a Milwaukee socio-ecological study between White non-Hispanic populations and Hispanic populations (Heynen and Perkins, 2006).

*Postulate 3: Urban forest is positively correlated with education level.*

I hypothesize that those neighborhoods with residents of higher education level will have higher densities of urban forest. This postulate is proposed after a similar study in Central Indiana found that cities with higher proportions of residents with college degrees had denser urban forests (Heynen & Lindsey, 2003). Education level is a symbol of status in our culture. Those with more education are seen as more elite. This postulate supposes that urban forest density is correlated with such elite societal status. Also, those with little education may be unfairly represented by governmental tree-planting campaigns.

*METHODOLOGY*

The first step to analyzing tree canopy cover and its connection to socio-economic criteria was to find scale-appropriate tree canopy cover data. Much investigation took place, searching for fly-over photographs of Montgomery County and computer software to automatically analyze those photographs for tree canopy. This approach proved to be very costly and unnecessary. Another approach that was considered was obtaining a 0.5 meter by 0.5 meter resolution summertime image of Montgomery County and executing a dot test. This test would entail randomly placing 100 dots in each subsection of the map, counting the number of dots out of 100 that overlap tree canopy, and calculating a rough percentage. This approach seemed too rough and left room for operator error. Also, the 0.5m X 0.5m image required over 20 gigabytes of computer memory and was difficult and timely to obtain.

Finally, a simpler and effective method was discovered. The United States Geological Survey operates a website that distributes free data to the American public: seamless.usgs.gov. One of the datum sets is the 30 meter by 30 meter resolution forest canopy cover and is available for Montgomery County, Ohio. It is one of many parts of the National Land Cover Database, produced in 2001 by the Multi-Resolution Land Characteristics Consortium (MRLC) using Multiseason Landsat 5 and Landsat 7 images. This datum set was selected and downloaded from the USGS website and was converted from a raster file to a vector shapefile.

The next step in the analysis was obtaining social and economic data for Montgomery County, Ohio. Polling the public with questionnaires about education and feelings about the outdoors and trees would have been interesting, but was not feasible for a geographic and populous area of the size of Montgomery County. Again, the US government came to the aid, this time with the United States Census Bureau. The Census Bureau collects data on every person and surveys of every neighborhood every ten years. After the data has been collected, organized, and analyzed, it is made available to the American public. This resource was vital to the study's feasibility and success.

From the US Census Bureau website—www.census.gov—its query driver, American Factfinder, and some aid from Bureau staff, data sets were downloaded for permanent academic research use. Such data sets include housing characteristics, income characteristics and race and education data. The data sets were compiled for the US Census Block Group scale—defined areas created for population analysis functions, usually containing between 100 and 1000 residents. The data were based on the 2000 Census, as the 2010 had not yet been completed. Although the tree canopy cover data was obtained in 2001 and the demographic data was obtained in 2000, the difference of one year was decided to not have a profound effect on the study.

Now that the canopy cover and demographic data sets had been downloaded, they were to be compared geospatially. This means visually illustrating the data on a spatial platform, such as a map. Such a feat requires a map skeleton on which to place the meaty data. Much of the data had been downloaded according to a US Census Bureau Block Group scale. Luckily, a map framework of the block groups within Montgomery County was available for download at the Montgomery County Real Estate Auditor website. The file was downloaded and accessed using ArcGIS software, a Geographic Information Systems interface produced by ESRI.

Using the ArcGIS software suite, the forest canopy cover data was converted to a shapefile and cut to fit the Montgomery County boundary. This map is shown in Figure R2. The percent tree canopy cover value for the 30m X 30m blocks were then averaged per block group, so that one value for tree cover could be assigned to each block group. This calculation was performed using a function of the ArcGIS software. It is displayed in Figure R3. Later, demographic data tables were imported into the computer program. They were aligned to the Block Group geographic structure using their US Census Bureau STFID numbers which corresponded between the map layer and the data table.

The imported and mapped data was then displayed using a color ramp, where the tint and shade of the color—or the color, itself—represented the gradient of tree canopy cover or demographic information. For example, a block group that is more shaded and closer to a true black exhibits higher percentages of tree canopy cover than does a block group with a tint closer to true white.

After some maps were constructed, it was observed that trends were present between the demographic criteria and canopy cover. However, those trends seemed to disappear or reverse in areas far from population cores. In rural areas—in the western half of Montgomery County—there are large expanses of farmland, with little to no canopy cover, and there are large plots of forest, with nearly 100 percent canopy cover. Also, rural areas, such as Jefferson Township and Germantown, have few Black residents. Finally, families with large tracts of agriculture (and little tree canopy cover) can yield high incomes while, at the same time, other families can have great acreage of forest and no agricultural land (high tree canopy cover) and commute to jobs elsewhere that yield high incomes. In conclusion, the rural block groups added confusion and outliers to the general trends of the urban and suburban populations. It was decided to remove them from the study area.

US Census Bureau data concerning urban status was available and downloaded. This data evaluated homes as urban or not urban based on a complex system of distance to population centers and population density. All Montgomery County block groups in which fewer than 90% of the households were considered "urban" by the US Census Bureau were removed from the study. Twenty-nine of the block groups considered not urban and two block groups non-contiguous with the urban cluster were removed from the study. This reduction in study area limited the research to 384 of the 415 block groups in Montgomery County. The existing maps were reconstructed to contain only the urban block groups.

The data was also imported into a scatter plot, where the correlations between canopy cover and the three demographic criteria were visualized. They were analyzed using regression evaluations but were mainly used as a visual reference. Visual assessments were also made using the maps. For example, the maps displayed quickly and effectively the areas that exhibit high levels of tree canopy cover. They also illustrate areas with high percentages of high school degree obtainment. Quick correlations between tree canopy cover and education can be noticed by any viewer of the maps placed side by side. Some smaller geographic areas of interest were also microassessed.

*RESULTS*

The following maps were produced with the gathered data using ArcGIS software and shaded to display the desired attributes. From Figure R1, we can see that the urbanized area of Montgomery County is concentrated in the eastern half, stretching from the northern to the southern border of the county. Municipalities in the Urban Area include Dayton, and its southern suburbs: Oakwood, Kettering, Moraine, West Carrollton, and Centreville, and its northern suburbs: Englewood, Vandalia, and Huber Heights, as well as neighboring Trotwood and Riverside. Dayton appears twice on Figure R1, once for the city proper, and again to the north at the location of the Dayton International Airport. The airport was not included as part of the urbanized area.

Figure R2 shows the shape of the urbanized zone within Montgomery County, again with municipality boundaries. It also shows areas exhibiting tree canopy cover. We notice a void of canopy cover within the City of Dayton and nearby municipalities. To the North, there are areas of high canopy cover, including Harrison Township, Clayton, Butler Township, and Vandalia. To the South, there are high levels of canopy cover in the western portion of Washington Township. The shape of the tree canopy imitates rivers and parks in the region.

Figure R3 took the value of the pixels from Figure R2 and calculated the mean percent canopy cover value for the entire block group. The map dramatizes the reality of Figure R2 in a way that shows a voided city center encircled by a dark ring. South of Dayton, a dark region (much canopy cover) probes north from Centreville and Washington Township as far as Oakwood, while leaving white areas (little canopy cover) southeast of Dayton in neighborhoods such as South Dayton and Kettering. It is important to remember that the data portrayed in this map are averages for the entire block group range. A block group area could have regions of 40 percent tree canopy cover, and others of zero percent cover, yielding an average of 12 percent for the entire block group.

Figure R4 imitates the trend in Figure R3, except that Figure R4 displays median family income per US Census Block Group. Again, the core of the geographic area (downtown Dayton) is mostly red and orange, meaning a low family income. Areas north

and south central of downtown are greener, representing areas with high median family incomes. This map does not show the maximum and minimum incomes per block group, only the mean value for that block group. Therefore, block groups that have mixed incomes are shown only as an average.

Figure R5 shows a different trend than Figures R3 and R4. Figure R5 shows the percent of residents per block group that consider themselves racially Black according to US Census surveys. Areas that are darker brown have higher percentages of Black residents. Most of the high Black areas are west and northwest of downtown Dayton, whereas many of the high White areas are southeast of downtown Dayton. This figure is dramatic in its illustration of the extreme geographic residential segregation of the Dayton area. Also, an interesting comparison between Figure R4 and Figure R5 can be made when looking at areas of low income. Low income areas occur in both areas of high Black and high White populations. Income does not follow the same boundaries as race in this study area.

Lastly, Figure R6 demonstrates another sociological trend, that of educational obtainment. It shows the percent of residents per block group that have obtained a high school diploma or equivalent (such as a GED) or higher, defined as a post-secondary degree. The education trend is remarkably similar to the income trend, showing areas close to downtown, to its west and northwest, and to its southeast having low incomes and educational obtainment. In addition, areas to the far north and to the south central have high percentages of high school degree obtainment.

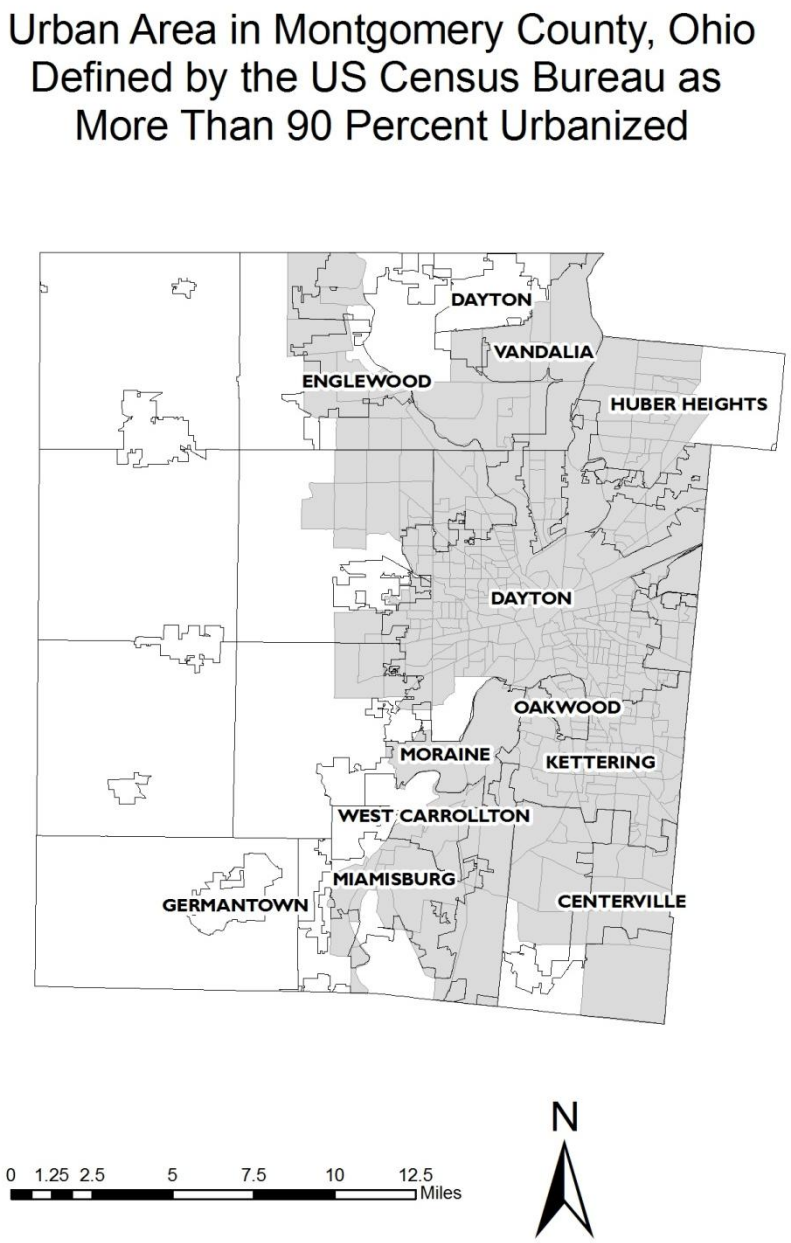



Figure R1: Map showing the boundaries of municipalities and townships within Montgomery County, Ohio. The shaded region represents the area considered at least 90 percent urban by the US Census Bureau. The shaded region is the primary study area.

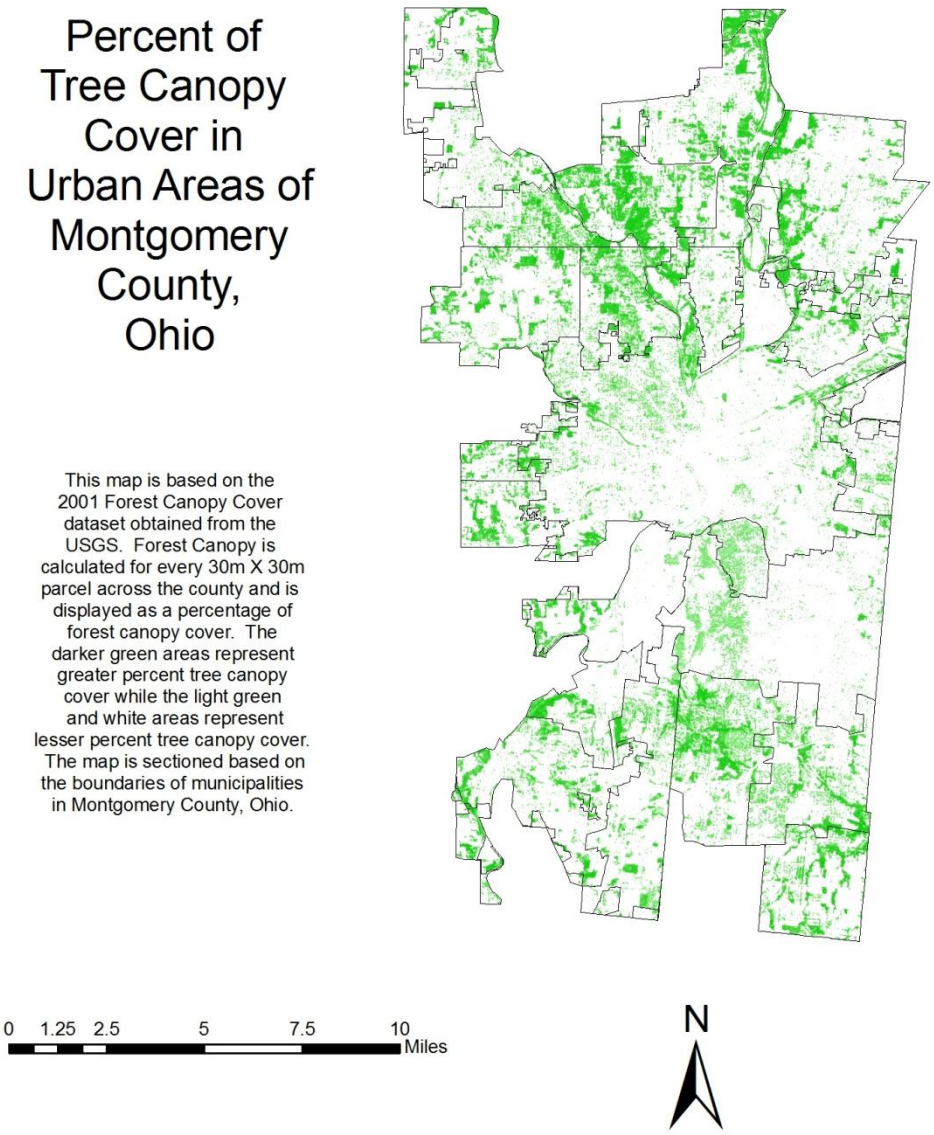



Figure R2: Map displaying the 30m X 30m resolution forest canopy cover. The darker green areas represent 30m X 30m plots with a higher percentage of canopy cover while white areas represent 30m X 30m plots of less than one percent forest canopy cover. The grey lines show the municipal and township boundaries as labeled in Figure R1. The City of Dayton is at center.

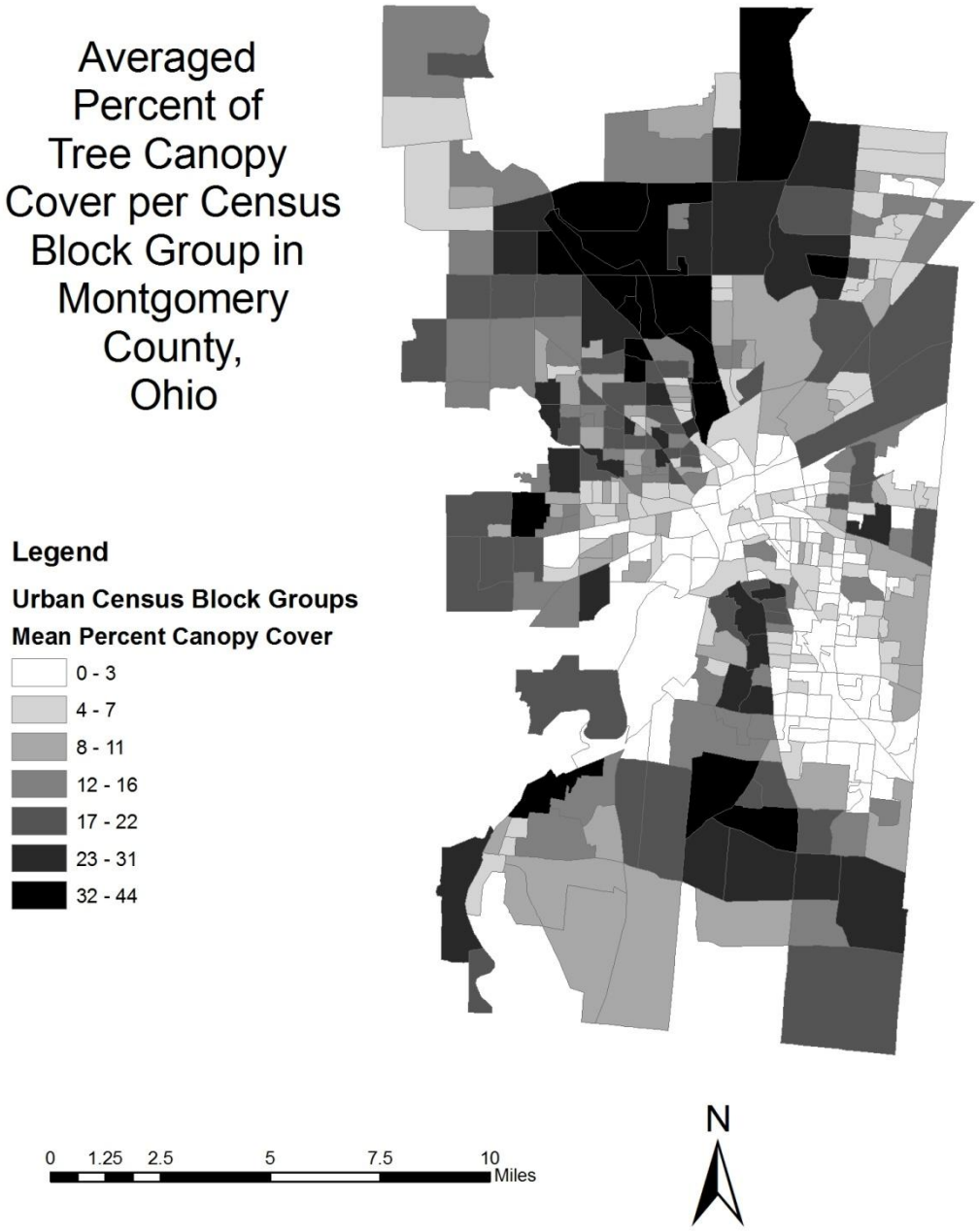



Figure R3: Map illustrating the mean value for tree canopy cover within each US Census Block Group within the urban area of Montgomery County, Ohio. The values for each 30m X 30m plot within each block group were averaged to achieve a mean for the entire block group. Block groups that are shaded in black have a high percent of canopy cover while areas in white have little to no canopy cover.

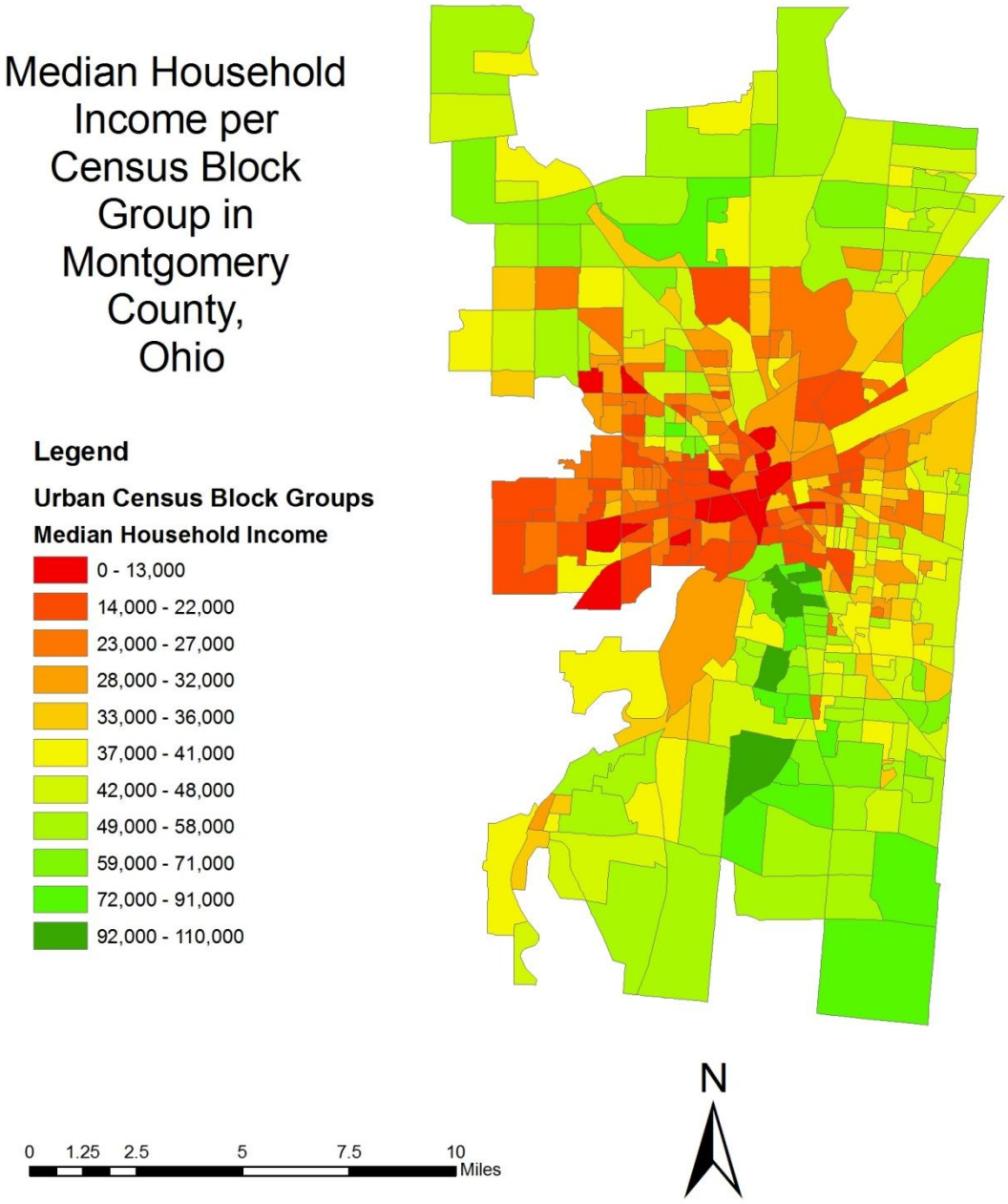



Figure R4: Map showing median household yearly income per Census Block Group in the urban areas of Montgomery County, Ohio. Areas in dark green represent the highest median household yearly income ($112,744) while areas in red represent the areas with the lowest median household yearly income ($7,174).

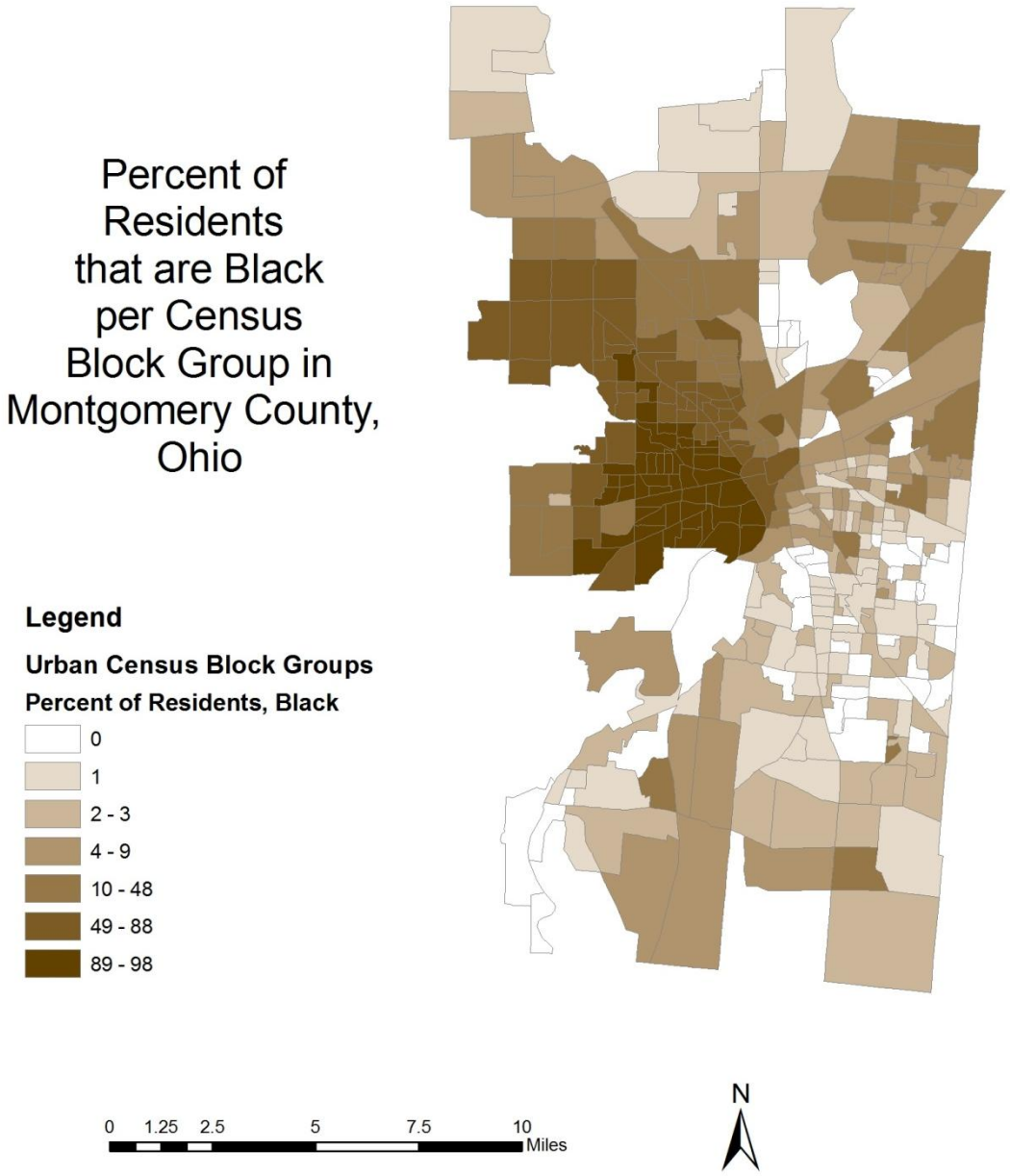



Figure R5: Map showing the percentage of residents in each block group that consider themselves racially Black, within the urbanized area of Montgomery County, Ohio. White areas represent block groups with low percentages of Black residents (0%), and dark brown areas represent block groups with high percentages of Black residents (89-98%). Notice the line of segregation near the center of the map following the Great Miami River, separating East and West Dayton.

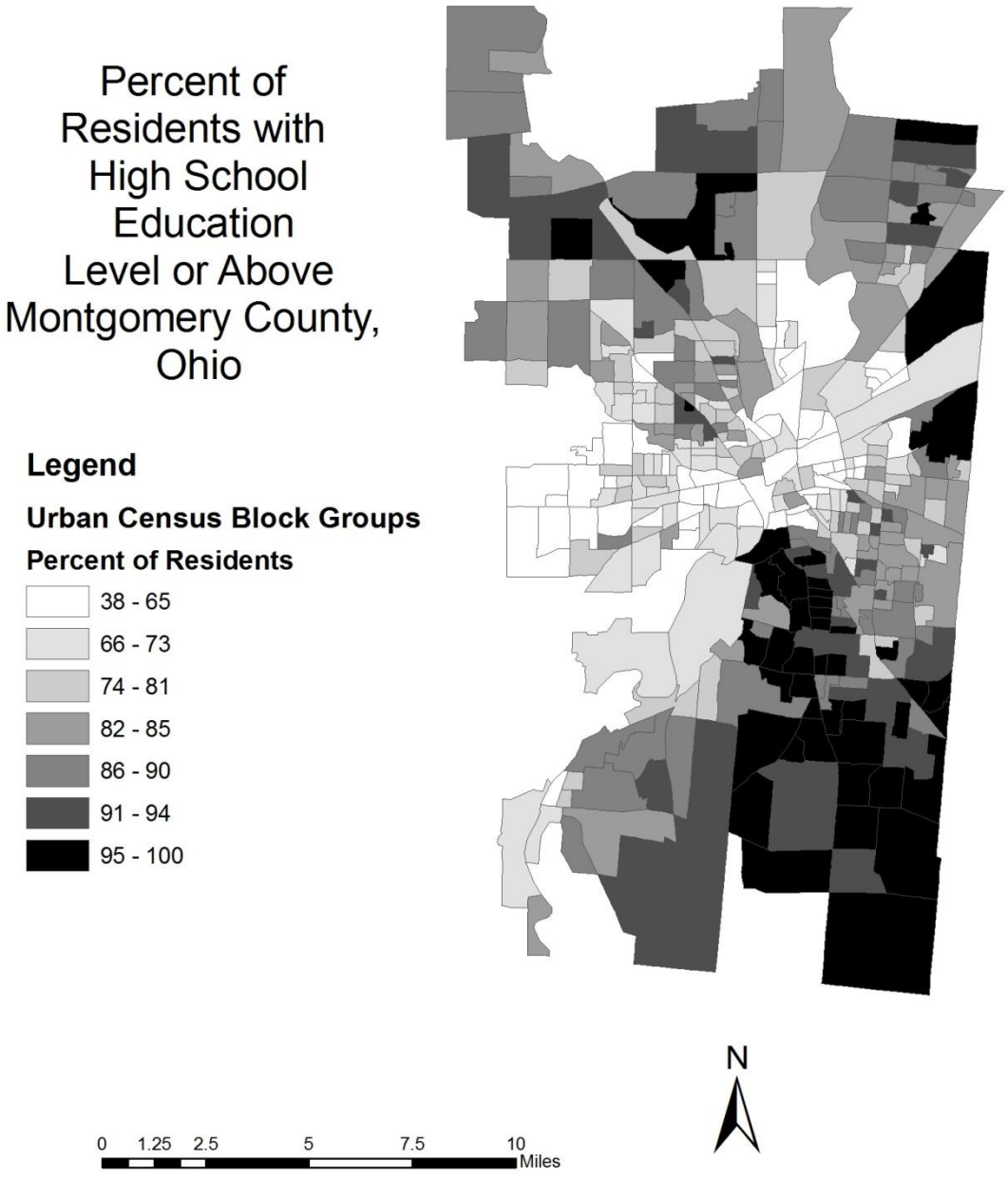
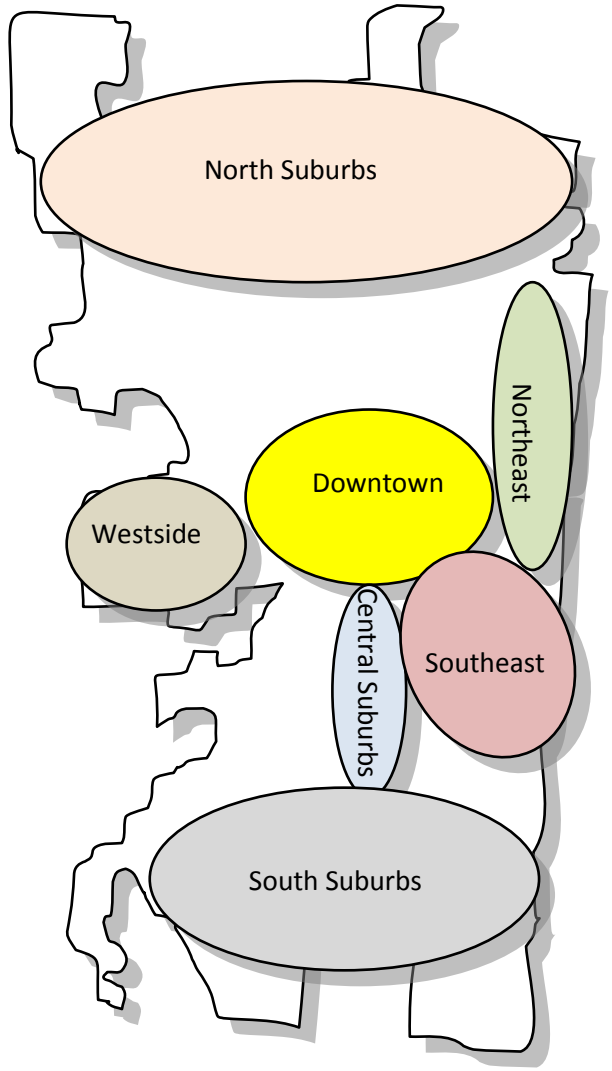



Figure R6: Map displaying the percent of residents (aged 25 years and older) that have a high school degree, GED, or higher, per block group in the urbanized area of Montgomery County, Ohio. Areas in black represent block groups with higher percentages (95-100%) of residents with a high school degree or higher and areas in white represent block groups with lower percentages (38-65%) of residents with a high school degree or higher.

*ANALYSIS & DISCUSSION*

The maps will be visually compared to detect correlations between the canopy cover and the social criteria. By placing the maps side-by-side, such connections may be inferred. The percent tree canopy cover map will always be displayed on the left hand side. The maps will be described according to the following zones:



*Postulate 1.*

Grouping Figures R3 and R4 compares tree canopy cover to median household income per block group. It should be noted that white areas and black areas represent low and high canopy cover and that red areas and green areas represent low and high median incomes, respectively. Beginning at downtown Dayton, the white low canopy cover areas correspond nicely with the red low income areas. In fact, the brightest white and red block groups are both found in the center of the maps, at downtown. Also, the canopy cover "protrusion" of the Central Suburbs corresponds well with the high income "protrusion" in the same location. Similarly, the North Suburbs and the South Suburbs both exhibit high canopy cover and relative incomes.

However, the entire urbanized area of Montgomery County does not follow such a trend. The Westside is an area of very low income, but it has areas of both very low and very high tree canopy cover. Also, the Southeast has moderate incomes but is plagued with extremely low canopy cover. Finally, there is a large appendage of high canopy cover driving southward towards downtown from Englewood. This area of high canopy cover does not correspond with high income levels, and may be attributed to large tracts of forested area, including Five River Metropark's Wezergyn Garden, a large wooded parcel off of Frederick Pike, land abutting the Stillwater Wilderness Area, and the thick riparian buffer of the Stillwater River.

Overall, tree canopy cover and income are correlated, with some discrepancies in the Southeast and the Westside.

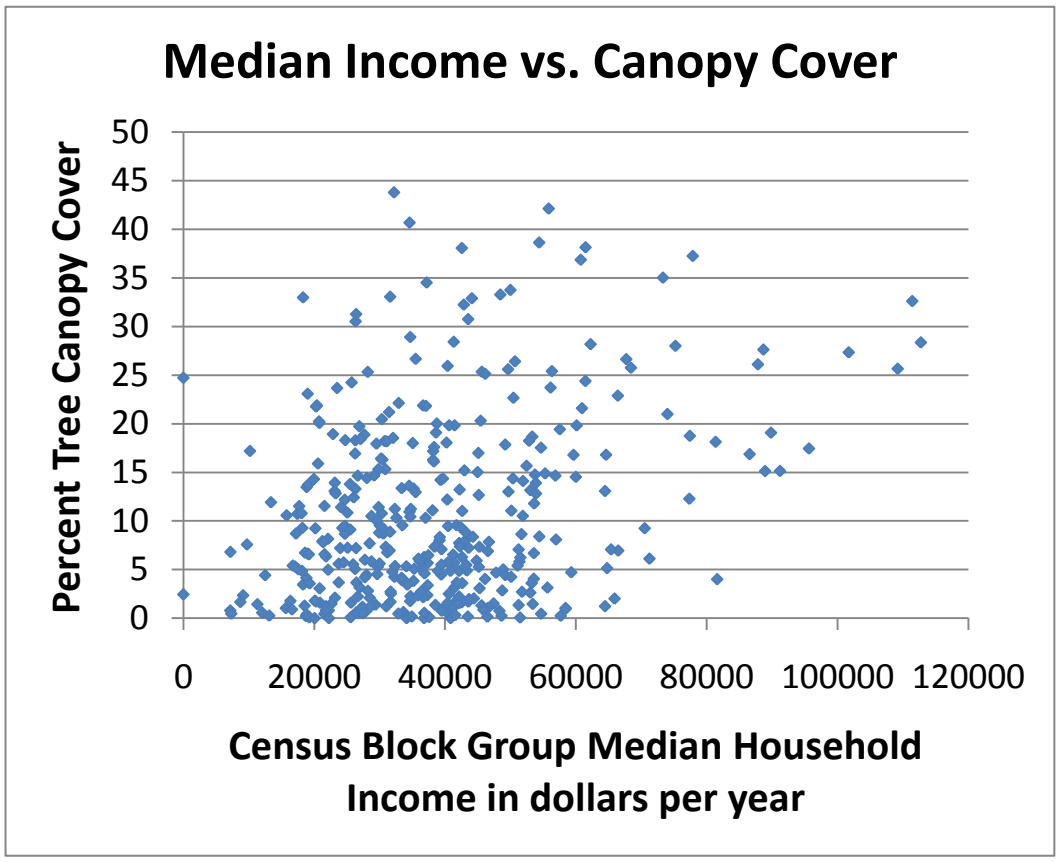



Figure A1, above, illustrates Postulate 1. It compares median household income with tree canopy cover. Each point on the scatter plot represents one Census block group. There does seem to be some correlation between the two variables, although weak. Most striking is the exclusion correlation, where areas of low income CANNOT have high canopy cover and where areas of high income CANNOT have low canopy cover. The middle income ranges have much flexibility in terms of canopy cover, and the trend appears only slightly correlated.

*Postulate 2.*

To test Postulate 2, we again compare two maps: that of tree canopy cover (Figure R3) and that of percent of residents who are Black (Figure R5). Firstly, it is

important to remember the extreme scale of the color gradient in Figure R5 map. It ranges from zero to ninety-eight percent Black, where only the two darkest shades of brown represent a Black majority of the population. Simplistically, we can say that significant Black populations are limited to the Westside and areas northwest of downtown. All other areas exhibit only marginal populations of Black residents.

When comparing the two maps, we quickly note that significant correlations do not exist. While the Westside and areas north of the Westside consist primarily of Black residents, the tree canopy cover varies from very low to moderately high. All other urbanized areas of Montgomery County are dominated by White residents, areas that have a variety of tree canopy situations. For example, the Southeast is inhabited primarily by White residents and has abysmal tree canopy conditions whereas the City of Vandalia (in the North Suburbs) consists almost exclusively of White residents but illustrates remarkably high tree canopy cover. In conclusion, little to no correlation exists between percent tree canopy cover and percent of residents that are Black in Montgomery County, Ohio.

Please note that other minority races were not included in this study as the combined population of White and Black residents represents more than 97 percent of the study population. Therefore, areas that have low percentages of Black residents can be interpreted to have high percentages of White residents.

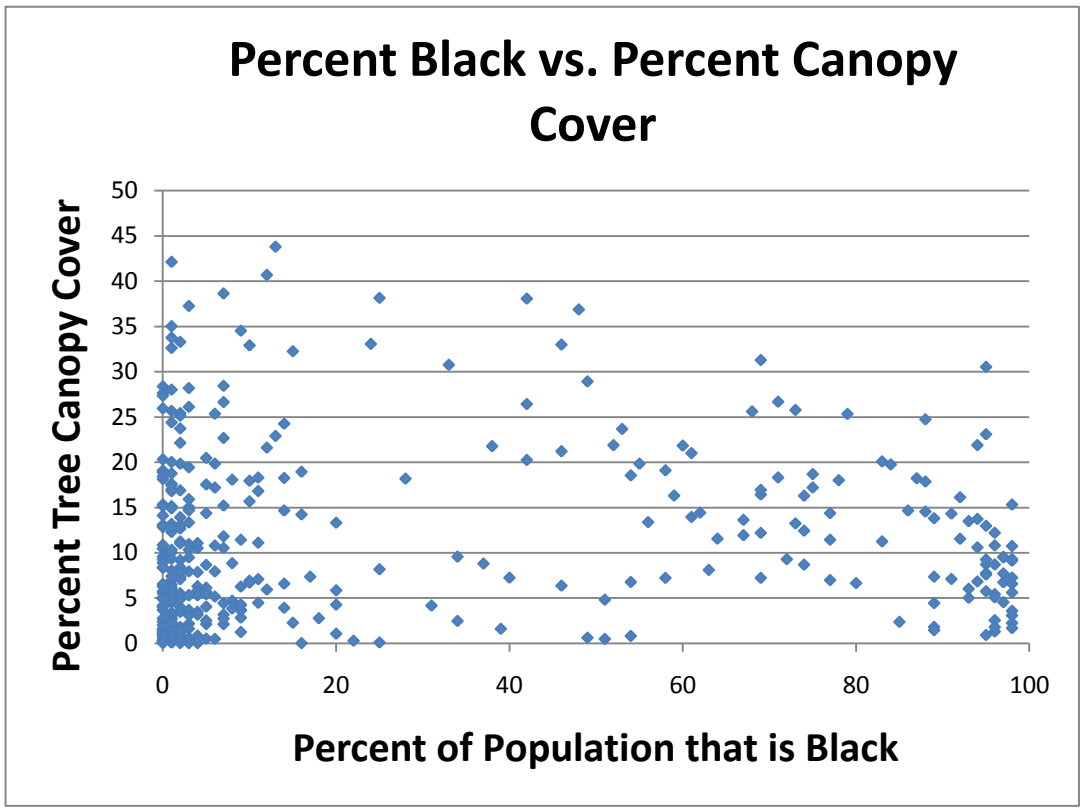



Figure A2, above, illustrates Postulate 2. Each point represents one Census Block Group. It effectively shows the segregation of the Dayton region but does not show great correlation between race and tree canopy. There is an exclusion correlation in that strong White areas have the potential to have high percentages of canopy cover (many block groups avove the 20 percent canopy cover mark) while strong Black areas do not have that potential (few block groups are above the 20 percent canopy cover mark).

*Postulate 3.*

To test postulate three, the percent tree canopy cover (Figure 3) is compared to the percent of residents over the age of 25 with a high school degree or equivalent or above (Figure R6). These maps are used to assume a comparison between environmental quality and educational success. A quick glance at the map makes it clear that educational obtainment in urbanized Montgomery County is

concentrated in the South Suburbs and Central Suburbs. Specifically, block groups in Washington Township, Centreville, western Kettering, Oakwood, and Riverside show the highest levels of high school graduates. Quite remarkably, Downtown and areas north of downtown exhibit very low educational obtainment. Similarly, the Westside appears to be a desert of education. However, and quite surprisingly, the Southeast has moderate education levels. The North Suburbs illustrate moderate to high education levels.

The two maps are quite similar. Firstly, the blanched downtown is a hallmark of the figure comparison. Secondly, both feature a "pinnacle" of high canopy cover and high education protruding from the South Suburbs up through the Central Suburbs. Finally, the North Suburbs is an area of both tree canopy and education.

While the maps do resemble one another, there are a few geographic regions where discrepancies are present. Foremost is the Westside. On Figure R3, the tree canopy cover in the Westside is fairly moderate, ranging from low on the eastern edge of the Westside to quite high on the western and northwestern regions of the Westside. However, the trend does not follow suit on the education map (Figure R6). There is a blatant educational void that blankets the Westside, with most block groups averaging a miniscule 38 to 65 percent of residents with a high school degree. Now, attending to the Southeast, there appears another significant discrepancy between the two maps. The educational obtainment in the Southeast seems to be relatively average, ranging from 82 to 90 percent of residents holding a high school degree or higher. On the contrary, the Southeast represents a large geographic region of very low canopy cover, marking a contrast between the correlation of canopy cover and high school degrees. In conclusion, tree canopy cover and education correspond to the same geographic areas with exceptions in the Westside and the Southeast.

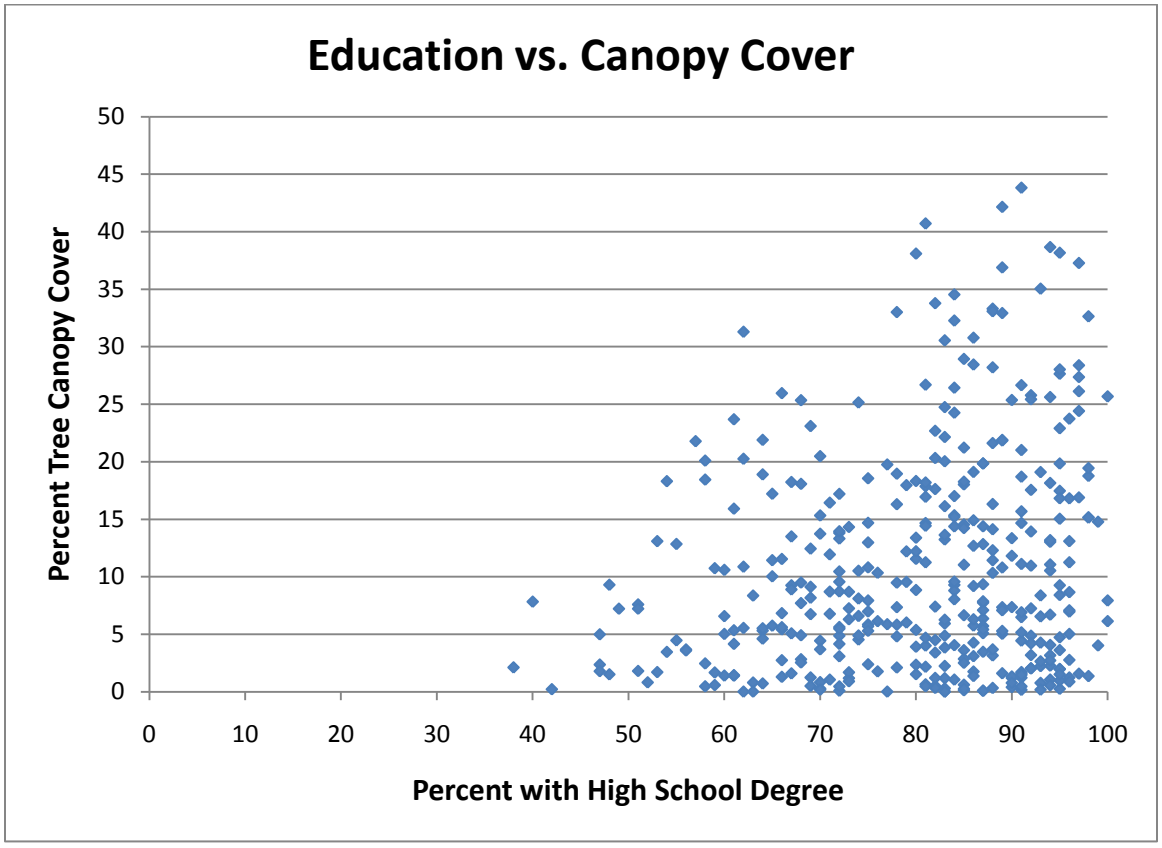


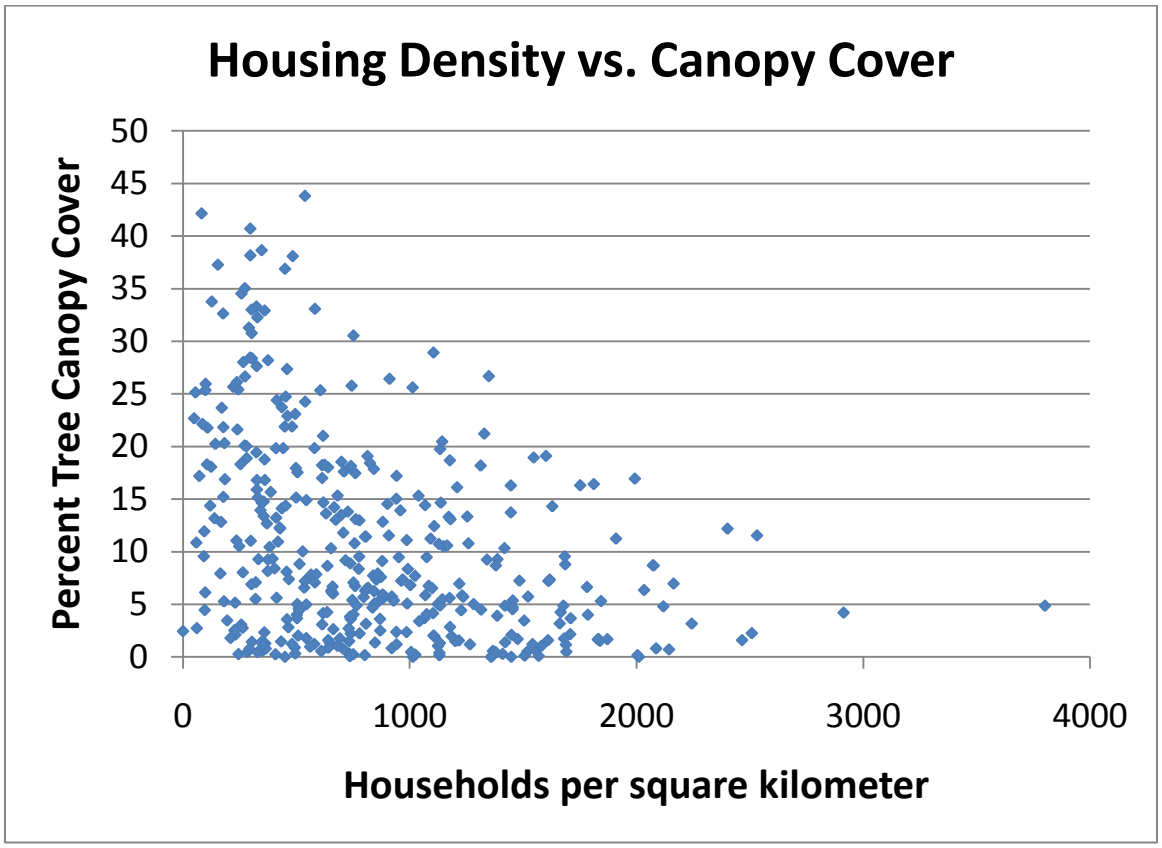

Figure A3, above, illustrates Postulate 3. It compares the percent of canopy cover on the y-axis with the percent of residents over the age of 25 who have obtained a high school degree or equivalent or higher. Each point represents one Census block group. This chart shows little correlation, but it does demonstrate an interesting trend. The points on the scatter plot form a triangle, where those areas with high levels of high school education obtainment have both high and low canopy cover, while areas with low high school education obtainment can only have low canopy cover. Again, we have an exclusion correlation, where the negative area is the most enlightening, showing that education is merely a limiting factor for canopy cover, not a guaranteed access to improved canopy cover.

*Discussion*

There are many factors that contribute to the uneven distribution of the urban forest across the urban areas of Montgomery County, Ohio. While education and income do show some correlation to canopy cover, there are many more factors that must be explored before writing a "law" to predict canopy cover in other areas. Such criteria may include housing tenure, or the age of the home and the length of stay for the current residents. As homes age, the trees around them age as well, increasing their canopies. As long as the trees are maintained, and fallen trees are replaced, areas of older homes may express higher canopy covers. Housing tenure should be explored in future studies.

Another criterion that my serve useful is past land use policy. Was the former land use agricultural, industrial, forested, or refuse? Areas that were recently agricultural and have been converted to residential zones may have few trees, as there were no trees existing before. All trees planted will take years to achieve maximum canopy. However, in areas with similar housing tenure, built on former forest may exhibit high canopy cover as many of the margins between homes may retain formerly-forest trees. Perhaps the Southeast was formerly farmland, while the northern stretches of the Westside may have been former forest, although this suggestion is merely speculation.

Finally, housing density may affect canopy cover. Below is a scatter plot that supports this claim.




This figure does not guarantee that areas with less dense housing have higher canopy cover, but it does illustrate the pattern that in order to have a high canopy cover, the area must have low housing density. Areas with high housing density cannot have high canopy cover. It is another exclusion trend, where housing density is a limiting factor for canopy cover.

To generalize the results of this study, one could say that while race is minutely related to canopy cover, income and education are both limiting factors for the maintenance of an urban forest. Briefly, areas with strong urban forests were areas with high levels of high school education obtainment. In other language, areas with low education obtainment were not areas with dense urban forests. Those with low education were excluded from the possibility of a dense urban forest. Also, areas of high income expressed dense urban forests while areas of low income expressed sparse urban forests, and areas of medium income were home to urban

forests of varying density. Residents with very low incomes were excluded from the possibility of dense urban forests. These generalizations are not universal across the study area, but are common trends.

This generalization, an exclusion trend, does resemble environmental injustice, at least on a localized scale. While it is not always the case that wealthy residents necessarily have denser urban forests (and more of the beneficial externalities associated with urban forests), there are wealthy regions that do have denser urban forests. However, poor residents (those under $20,000/year household incomes) do not have the opportunity for dense urban forests and express dense urban forests nowhere in the study site. The very low income residents are experiencing an environmental injustice.

Likewise, although highly educated residential areas do not always exhibit high canopy cover, lowly educated residential areas almost never exhibit high canopy cover. This observation is a clue to the existence of an environmental injustice against those with low educational obtainment.

*Dissemination of Results/Importance of Research*

This study is of particular importance at this time. It is the job of every level of government to establish justice and promote the welfare of the people. Perkins, et al., suggest that the positive externalities of urban trees should be evenly distributed to the extent possible through urban environments (Perkins, et al., 2004). The distribution can take place via government action (setting up new parks, new street trees), non-profit organizations (with tree campaigns), or through private motivation. Another point was made by Barbosa, et al., (2007) stating that policy-makers want to know "whether those who enjoy the greatest access [to the urban forest's benefits] include those who are most in need." Policy-makers in Dayton, nearby municipalities, and Montgomery County will be better able to

understand the distribution and the factors affecting such distribution, thanks to this study.

In the next three to five years, millions of ash trees in Montgomery County will be decimated by the Emerald Ash Borer, a pest whose larva feeds on the vascular tissues of ash trees. Many ash trees are found along streets as street trees and in lawns at residential properties, offices, schools, and other urban places. Already, Five Rivers Metroparks is preparing for the decimation of ash trees on their properties and are drafting plans for replanting. The information in this study will assist Five Rivers Metroparks and other governmental organizations to better address the ideals of justice when spending tax dollars to replant the urban forest. As Heynen (2003) says, "most low-income areas provide ample space for future tree-planting resulting in a more equitable and just distribution of urban trees." Montgomery County can produce a more just distribution of trees, and the massive replantings that will occur after the wake of the Emerald Ash Borer will provide the perfect opportunity to create such an equitable urban forest.

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