Examining Disparities in Food Access and Enhancing Food Security in Underserved Populations
MELDI Phase 2

by
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A project submitted
in partial fulfillment of the requirements
for the degree of Master of Science
(Natural Resources and Environment)
at the University of Michigan

May 2015

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Client
MELDI (Multicultural Environmental Leadership Development Initiative)

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ABSTRACT

Urban and school gardens have emerged as a viable resource for community outreach and education. They are an important resource for at-risk communities to learn about healthy foods and healthy lifestyles, while also serving as a food source for communities of limited food access. This study focused on food access within the urban and school gardening context across Michigan and Northwest Ohio. We surveyed garden managers and educators to better understand the role of gardens as resources for underserved and minority communities. Census data was utilized to map demographics and to highlight issues of food access. We found the urban gardens in Toledo can function as both hubs for social justice and examples of diverse growing system, with upwards of 82 crop varieties grown on a single urban garden. We also found that public school gardens are supporting Michigan local food initiatives across the state. In addition we found that garden educators are finding creative ways to align their school garden curricula with state educational standards.

ACKNOWLEDGEMENTS

We would first and foremost like to thank our faculty advisor Dr. Dorceta Taylor for pouring much of her time and energy over the past 15 months into making our masters project a success. Dr. Taylor read and commented on multiple drafts of our proposal, surveys, and our presentation for 2015 Capstone Conference. We would also like to thank our client MELDI for providing funding and a wealth of resources on conducting social research.

The University of Michigan School of Natural Resources and Environment (SNRE) provided us with funding to conduct research and attend conference during the 2014 summer. SNRE also provided us with training and necessary resources in conducting our literature review and for analyzing our data.

The Toledo Botanical Gardens provided us with assistance in distributing our surveys, as well as helping facilitate conversation amongst urban gardeners.

- Justin Burdine

I would like to thank the educators, researchers, nonprofit partners and school garden advocates across Michigan who participated in this study. Their dedication to their work in the educational system, especially in public schools, is inspiring and should not be overlooked. I would also like to thank those individuals who assisted with the spatial and statistical analysis parts of this study. Also, thank you to those who worked with me in the development of my survey instrument and helped in final editing. Lastly, to my family and friends who supported me throughout this process and provided guidance.

- Beatriz Cañas

ACRONYM LIST

CRFS	Center for Regional Food Systems
DPS	Detroit Public Schools
DSGC	Detroit School Garden Collaborative
EBT	Electronic Benefit Transfer
EE	Environmental Education
FTS	Farm to School
K-12	Kindergarten – 12th Grade (high school) Education
MELDI	Multicultural Environmental Leadership Development Initiative
MSU	Michigan State University
NGSS	Next Generation Science Standards
NSLP	National School Lunch Program
SNAP	Supplemental Nutrition Assistance Program
TBG	Toledo Botanical Gardens
WIC	Women, Infants, and Children

INTRODUCTION

Food access represents a major global and national problem. In 2012, approximately 49 million Americans, or 15% of American households, fafoo ced food insecurity. Consumption of unhealthy food is associated with illness, and the national obesity rates are increasing among the poor. Additional national statistics and Michigan-specific statistics below offer additional insight into current food security challenges. Additional studies are needed to examine and improve upon the diverse efforts and processes of food security actors.

In the United States:

- 25% of food insecure households are food insecure
- 23% are occupied by Hispanics
- 33% of those in food insecure households are children
- 35% of the food insecure households are female-headed
- 40% of such households are below the poverty line

In the state of Michigan:

- Michigan was ranked as the 5th most obese state in the nation in 2012, with 31.3% of residents classified as obese. In 2013, it was ranked the 9th most obese state with 28.8% of residents classified as obese.
- 18% of Michigan's households are food insecure
- 25% of children in Michigan live in food insecure households
- Many Michigan residents live in areas where they have limited access to grocery stores selling healthy and affordable foods
- Michigan is the second most agriculturally diverse state

The Initiative

Religious, political, community and academic actors have responded to food access challenges in diverse ways. This Master's Project is organized through the University of Michigan's School of Natural Resource and Environment and nestled under the Multicultural Environmental

Leadership Development Initiative (MELDI)'s "Examining Disparities in Food Access and Enhancing the Food Security of Underserved Populations in Michigan" project, which offers the following vision:

"This project will examine the relationship between demographic characteristics and the distribution of food outlets in 18 small and medium-sized cities. It will also examine the presence or absence of food deserts and oases, effective nutrition and behavioral interventions, and mechanisms for enhancing participation in local food initiatives. We will examine these issues in Sault Ste. Marie, Brimley/ Bay Mills, and St. Ignace - towns in the Upper Peninsula; Holland, Muskegon, Benton Harbor, and Grand Rapids in the west; Flint, Saginaw, Lansing, and Kalamazoo in the central part; and Ypsilanti, Taylor, Southfield, Warren, Pontiac, Inkster, and Dearborn in the southeast. These cities have large populations of one of the following racial and ethnic groups: Blacks, Hispanics, Native Americans, Asians, and Arabs. We chose to focus on one state because policies, such as those related to the use of Electronic Benefit Transfer cards will be uniform. However, we chose cities that vary on dimensions such as the degree of food insecurity, size, poverty rate, demographics, and extent of depopulation."

This Master's Project will reinforce the vision of MELDI by exploring three specific subtopics of food security:

Project 1*: Faith Based Gardens in Toledo (Justin Burdine)*

Project 2*: Michigan School Gardens (Beatriz Cañas)*

Part 1: Faith Based Gardens in Toledo

by: Justin Burdine

INTRODUCTION

Food access is a multifaceted issue influencing livelihoods of individuals and families across the United States. The United States Department of Agriculture defines food insecurity as the inability to obtain food resources on a consistent basis (USDA-ERS 2014). Food security and insecurity are measured on a categorical continuum as follows: (1) high food security, (2) marginal food security, (3) low food security, and (4) very low food security (USDA-ERS 2014). The USDA monitors levels of food insecurity to assess effectiveness of welfare programs (e.g. SNAP). Within the United States 17.5 million households are classified as food insecure, accounting for 14.3% of the population (Coleman-Jensen *et al.* 2014). Children experience some level of food insecurity in 9.9% of households, approximately 3.8 million households, with children (Coleman-Jensen *et al.* 2014).

Food insecurity has been shown to be more common in rural areas and large cities compared with suburban regions surrounding cities, as well as with single parent households (Coleman-Jensen *et al.* 2013; Coleman-Jensen *et al*. 2014). African American and Hispanic households experience a substantially higher rate of food insecurity than the national average (Coleman-Jensen *et al.* 2013; Thompson 2005). Race also plays a role supermarket accessibility, with impoverished African American neighborhoods having less accessibility compared with impoverished White neighborhoods in Detroit (Zenk *et al.* 2005). These disparities can results from systemic issues and the built environment.

Food Insecurity and Health

An aspect to healthy diets is the economic ability to purchase healthier food options. Fruit and veggie consumption is higher among individuals with higher socio-economic and education (Shohaimi *et al.* 2004; Billson *et al*. 1999). Another aspect to healthy diets is the ability to access healthy food markets. A survey of individuals in Philadelphia found that one-third of low-income individuals purchase groceries within a mile of their home (Young, 2011). A study in Minnesota found that markets in low-income neighborhoods had lower availability of fruits and vegetables compared to markets in higher income neighborhoods (Anderson, 2007). Low-income individuals without a selection of healthy foods in their neighborhood must go to the suburbs to find alternative markets. Healthy diets have been associated with decreased risk of chronic disease, such as cancer and coronary artery disease (Shohaimi *et al*. 2004). Recent studies have linked the inaccessibility of healthy food outlets to health-related issues (Zenk *et al.* 2005). Food insecurity can also lead to increased levels of emotional and physiologically distress (Hamelin *et al*. 2002).

Urban Food production

In many US cities, urban gardening emerges as a viable food source during periods of economic stress, such as recessions and periods of War (Cotton 2009). The nation's first municipally-supported gardening project occurred in Detroit in the 1890s, which provided lands for families to grow potatoes during an economic downturn (Cotton 2009). Historically, wars have demanded a large amount of the food supply to be sent to the frontlines, inspiring local gardening movements across the nation to help supplement the national food supply. During World War I, *liberty* and *victory* gardens were promoted as a means to increase local food

production in order to stock the frontlines with a steady food supply (Pack 1919; Hynes 1996). Interest in urban gardening temporarily declined after World War II. The environmental movement of the 1970s led to a resurgence in urban gardening. During the 1980s and 1990s, urban gardens were used to increase urban greenspace and provide recreational opportunities (Otudor, 2014). The recent economic recession has led to a boom in urban gardening initiatives and programs.

Many post-industrial cities (e.g. Detroit and Toledo) have experienced high levels or urban sprawl, leaving previously populous city centers with vacant lots and abandoned buildings. Detroit's declining population freed up 30,000 acres of vacant lots (Cotton, 2009). Detroit's urban sprawl also left Detroit metro as one of the most segregated regions in the United States (Cotton, 2009). Urban sprawl not only moves people from urban regions to suburbs, but it also moves businesses. A food access study found that the majority of supermarkets are located in suburban regions, while the majority of low-income individuals live in urban and rural areas (Anderson, 2007). Anderson also found that supermarkets in urban areas typically face higher operating costs, leading to a 4% increase in consumer prices (2007). With an abundance of vacant lots and a lack of economically advantageous supermarkets, many city governments and residents are looking to urban gardens as an alternative source of local, healthy foods.

Since urbanized regions experience a substantially higher level of food insecurity (Coleman-Jensen *et al* 2014), the growing urban agriculture sector may help be a potential solution to ameliorate food insecurity in urban regions. Post-industrial cities across the Midwest (e.g. Detroit, Toledo) are transforming their urban landscape to include urban agriculture as a viable economic market. The urban agriculture sector includes anything from community gardens to urban farms. A report by the city of Toledo has included urban farms and vacant

property remediation on its list of strategic economic steps (Our City in a Garden, 2010**)**. These policy transformations can help provide the governmental backing for urban gardening movements.

Urban gardening is part of the agenda for the Lucas County Land Bank in Toledo, Ohio (2014). The county Land Bank encourages residents to purchase vacant side lots at minimal costs (e.g. $100). Detroit also recently passed an urban agriculture ordinance, making it legal to sell and grow produce grown in the city. A study on vacant lots in Philadelphia looked the greening of vacant lots. The study found that community residents felt significantly safer in areas with more green space (Garvin *et al*. 2012). The psychological benefits of green space is well studied in the literature. A study on urban greenspace found that planting more species leads to an increase in human psychological benefits (Fuller *et al*. 2007). Individuals were attracted to complexity, increasing their enjoyment and utilization of greenspace. Intentionally planting different species in urban greenspace, such as community gardens, may have psychological benefits for community residents.

An important aspect of urban gardens is their environmental and educational benefits. Urban gardens are a source of ecosystem services, such as provisioning and regulating services. Studies have found urban gardens to be a refuge of ecological biodiversity (Cotton, 2009; Uno *et al.* 2010). Uno studied ant diversity in Toledo and Detroit, looking at ant communities within vacant lots and gardens. The study found that quality and complexity of urban greenspace led to increases in ant species and abundance (Uno *et al*. 2010).

Toledo Background and Demographics

A recent USDA study on food insecurity found that Ohio had significantly higher level of food insecurity than the national average in Ohio (Coleman-Jensen *et al.* 2014). Toledo is the fourth largest city in the state of Ohio, located along the Michigan border and the southwest corner of Lake Erie. The median age in the city of 34.2, with a total population of 287,208 (U.S. Census). The 2010 census shows the Toledo metropolitan area to have a population of 651,429. Population demographics can be broken down as follows: 69% White, 26% African American, 6.4% Hispanic, 1.8% Asian, and 0.6% American Indian. Previous studies have shown transportation to be a major area of concern in terms of food security, however, 100% of food pantries in Lucas County are within 1.4 miles of TARTA and 100% of soup kitchens are within 0.25 miles of a bus stop (TAM 2007).

Toledo's urban gardening community is organized and run through Toledo GROWs, an outreach program affiliated with the Toledo Botanical Gardens. Toledo GROWs is partnered with over 150 gardens throughout the metro Toledo region and offers assistance and resources to promote gardening projects in Northwest Ohio. It partners with food banks, food pantries, churches, schools, nonprofits, and businesses throughout Northwest Ohio. Faith-based gardens are linked with the organization Multi-faith GROWs. The Multi-faith GROWs program links churches and religious institutions to foster collaboration and communication for individuals of different religious backgrounds. These gardens are typically found on properties owned by religious institutions or by members of religious institutions.

Research Questions

This study looks at the influence that faith-based gardens in metro Toledo have on the broader issues of food security. I seek to understand whether faith-based gardens approach their target patrons in a different light than community-based gardens and whether faith-based gardens promote government assistance as a means to increasing food access. Sub-research questions that I will be asking are as follows: (1) what crops are most heavily produced, (2) which factors drive the crop planting choices, and (3) whether urban gardens in Toledo act as a hub for social justice. My null hypothesis is that there won't be significant differences between the two garden types or the services, which they provide.

METHODS

Survey Methods:

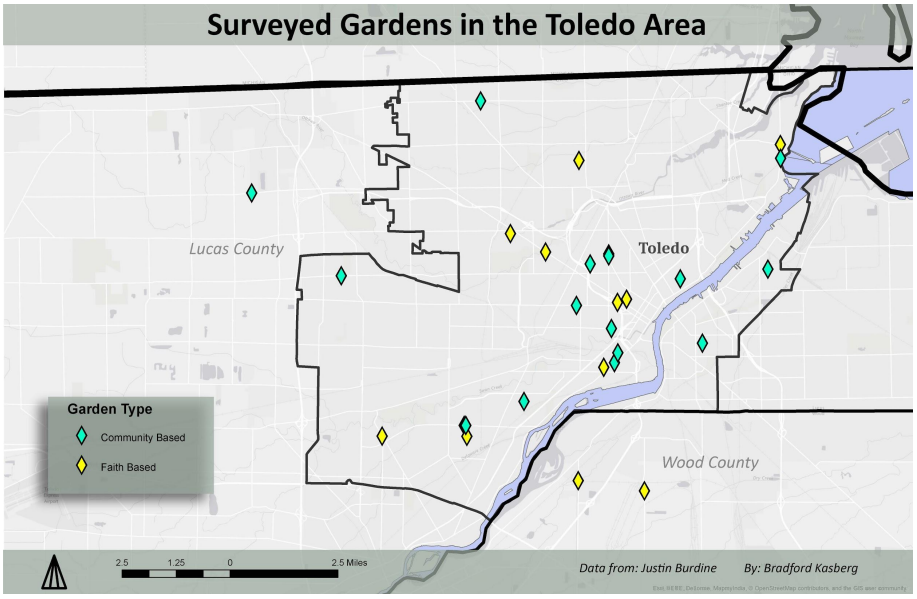
A survey was designed and distributed using the online software program Qualtrics. The survey contained 35 questions which were analyzed to better understand the production methods and culture of urban gardens in the greater Toledo area. The survey was approved by the Institutional Review Board (IRB) at the University of Michigan in early November of 2014. Our research team networked with the Toledo Botanical Gardens to distribute the survey to their listserv of over 150 urban gardeners. The organization Multi-Faith Grows also distributed our survey to a handful of urban gardeners. Social media and email contacts were also used to distribute the survey to a broader range of audiences. The survey was originally sent on November 19th, 2014 and continued to receive responses until February of 2015.

Data Analysis:

Upon completing of the surveying of urban gardeners, our research team began analyzing our data. We used ArcGIS 10.1 to create spatial maps on the distribution of urban gardens in the Toledo area. Census data was downloaded from the 2010 Census to incorporate resident demographics into our spatial analysis (i.e. race, median income). SPSS 22.0 was utilized to compile tables of results and to perform t-tests on the differences between garden types.

RESULTS

The survey received responses from 15 faith-based gardeners and 20 community-based gardeners (n=35). These gardens were distributed evenly throughout the city of Toledo (see Map 1). Our survey receive response from three urban gardens outside of the city of Toledo boundaries: one in the city of Sylvania and two in Perrysburg. These gardens were still used in our analysis because they were within 2 miles of the city of Toledo. The majority of urban gardens were found in downtown Toledo along the Maumee River.

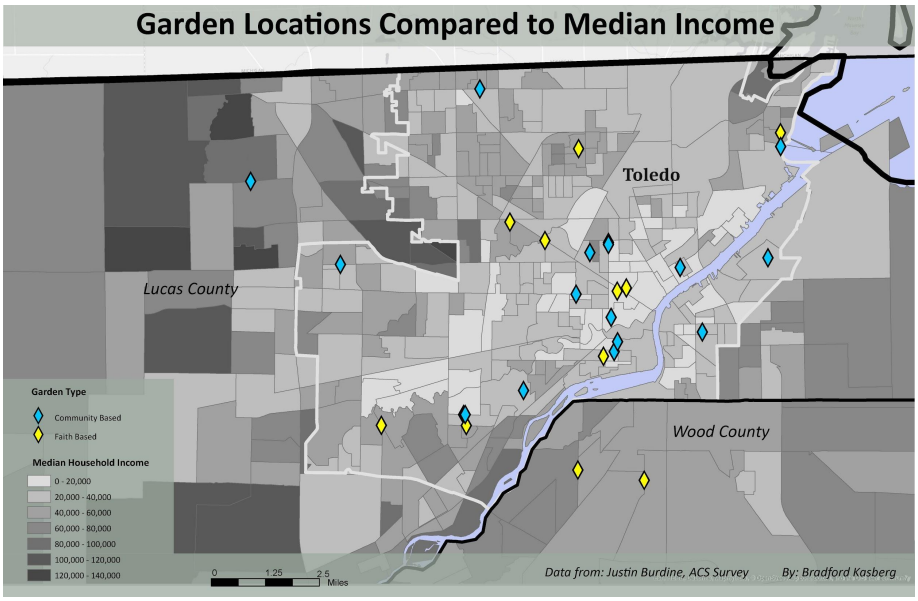


Map 1. Distribution of urban gardens in the greater Toledo region (n=35). The map displays both faith-based gardens (n=15) and community-based gardens (n=20).

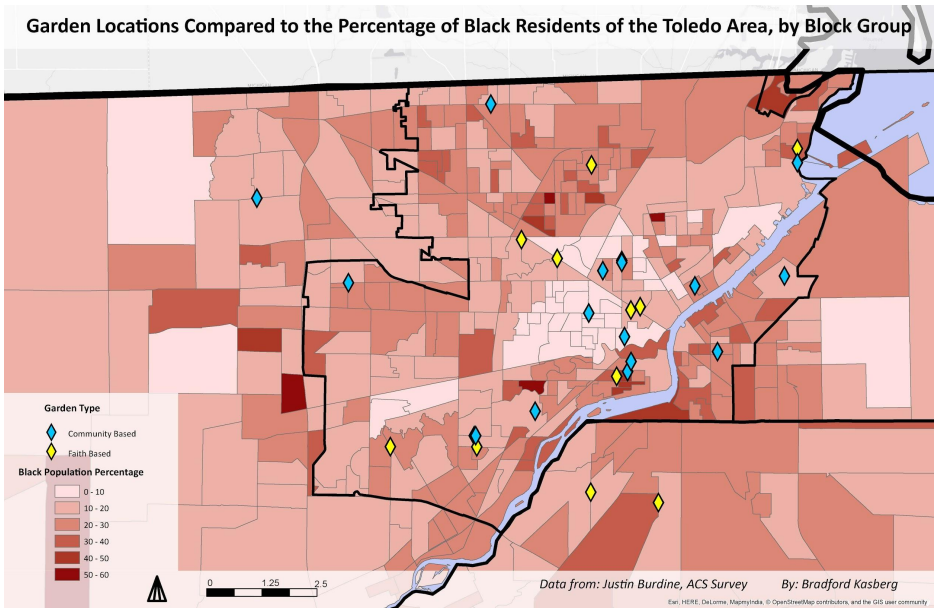
Demographic Results:

Data on median income and race were downloaded from the 2010 Census to understand the demographics of the various communities in close proximity to each urban garden. The

majority of urban gardens in the city of Toledo are found in census blocks with a median income of less than $60,000. Urban gardens located in downtown block groups were more likely to be found in low income areas than urban gardens close to the city limits (see Map 2). Data on race was used to understand whether urban gardens were located in racially diverse neighborhoods. From the 35 sampled urban gardens, only two were located in block groups with less than 10% Black population. The majority of urban gardens were located in block groups with more than 25% Black population, which is consistent with census data.



Map 2. Distribution of urban gardens in the greater Toledo area with census data on median income via block groups. Light shades indicate lower income, while dark shades indicate high income.



Map 3. Distribution of urban gardens in the greater Toledo area with census data on percentage black residents via block groups.

One of this study's research questions was on the demographics and culture of urban gardens. Our research team wanted to understand whether an urban garden captured the true demographics of a community – from staff and volunteers, to the actual patrons of the urban garden. Our results show that both faith-based and community-based urban gardens do an excellent job at capturing the true demographics of the city of Toledo. For certain racial groups, such as the Hispanic population, urban gardens capture their demographic perfectly (see Table 1). This is especially important in the long-term success of urban gardens increasing the food access for minority communities.

Race	Staff	Volunteers	Patrons	Community
Black	13.7%	20.36%	45.75%	26.0%
American Indian	0.5%	0.23%	0.25%	0.6%
Asian	0.05%	0.05%	1.0%	1.8%
Hispanic	5.1%	2.64%	3.5%	3.4%
White	50.85%	51.5%	24.5%	69.0%
Other	28.8%	25.22%	16.0%	

Table 1. Diversity of urban garden staff, volunteers and patrons by race. Percentages in the *community* column show true demographics from Census 2010.

Social Justice Results

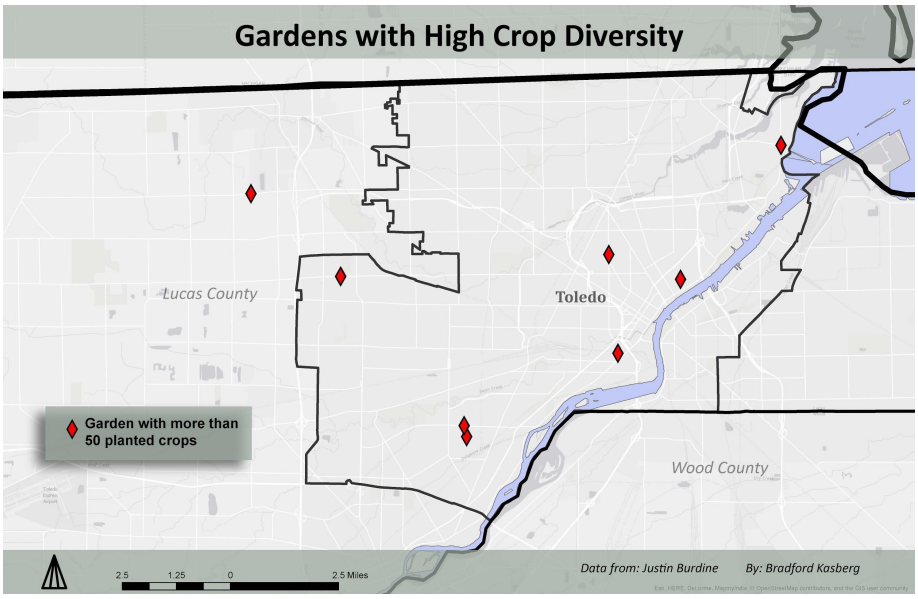
This study also research the role of urban gardens as a hub for social justice in the community. In order to answer this question, data was collected on social programming of urban gardens. Urban gardeners were asked whether they informed their patrons of the following social programs: SNAP, WIC, Elderly Nutrition Program, Energy Assistance, Medicare and Medicaid, and Voter Registration. We found that faith-based gardens never talked with their patrons about social programs, whereas community-based gardens did roughly 20% of the time. The difference between the two garden types was significant (see Table 2, $p<0.05$). However, there seem to be just four community-based gardens actually involved in the social programming. These gardens are located in low-income, downtown neighborhoods.

Social Programs	Faith-Based	%	Community-Based	%
SNAP	0	0%	4	20%
WIC	0	0%	4	20%
Elderly Nutrition Program	0	0%	4	20%
Energy Assistance	0	0%	3	15%
Medicare/Medicaid	0	0%	4	20%
Voter Registration	0	0%	3	15%

Table 2. Number of gardens involved with promoting social programs.

Garden Diversity Results

The final research question was on crop diversity within urban gardens in the Toledo area. Diversity was measured as the total number of crop varieties grown within an urban garden site, rather than the traditional measure of total number of individual species. The distribution of diversity within urban gardens ranged from a minimum of 5 crop varieties to maximum of 82 crop varieties (see table 3). I also calculated the total land area, in acreage, for each garden to understand diversity in terms of land area. I mapped out the gardens with the highest levels of diversity (see map 4). The map shows us that diversity is high both in the downtown area and in the city limits. It also shows us that diversity is not directly related to the area of available land, meaning that the most diverse urban gardens in Toledo are operating on less than 0.5 acres of land.



Map 4. Distribution of urban gardens in the greater Toledo area that have more than 50 different varieties of crops grown within their gardening system (n=8).

Garden Name	Crop Diversity	Acreage
Holy Trinity	82	0.02
Hawkins Schools	59	0.01
Seagate Food Bank	56	*
Messiah Lutheran	54	0.04
First Unitarian	53	0.03
Bowling Green	51	0.11
That Neighborhood	47	0.11
Collingwood Garden	42	0.50
Sylvania Senior Center	38	0.03

Table 3. List of the community gardens with the highest diversity of crop varieties. An asterisk (*) indicates no data was available on acreage.

Crop Name		Frequency	% Occurrence
Tomato		26	87%
Peppers		23	77%
Squash		22	73%
Cucumber		21	70%
Jalapeno		19	63%
Cabbage		19	63%
Eggplant		19	63%
Beans		18	60%
Onion		16	53%
Radish		16	53%
Broccoli		15	50%
Carrot		15	50%

Table 4. List of the most frequently occurring crops in urban gardens in Toledo. Frequency shows the number of occurrences, while the % Occurrence shows the total percentage of urban gardens in which these crop varieties appeared.

DISCUSSION

These results have given us evidence to make some conclusions regarding our understanding of (1) what crops are most heavily produced in urban gardens, (2) which institutional factors drive the crop planting choices, and (3) whether urban gardens in Toledo act as a hub for social justice. Our results indicate that the only significant institutional difference between community-based and faith-based gardens is in their approach to social programs ($p<0.05$). This result is mainly due to the fact that faith-based gardens utilize and promote their own pool of resources rather than directing patrons towards government-sponsored social programs. Many of the faith-based gardens in Toledo have food pantries and a benevolence fund to support their own social programming.

Implications for increasing crop diversity

Findings in our study indicate that urban gardens in Toledo had a much higher level of diversity than we originally expected. The majority of research on urban gardens has focused on their role in solving social issues, such as food access and creating avenues out of poverty. Urban gardens do provide an abundance of services to patrons and community residents, from increasing greenspace to providing local markets for fresh fruits and vegetables. However, the literature on the ecology and complexity of urban gardens is lacking. Our results indicate the urban gardens can grow upwards of 82 varieties of edible crops on a very small amount of land. This type of garden management requires a great deal of complexity in growing techniques in order to manage such a high level of diversity in such a small area. This results does not include flowering plants that have been grown for aesthetic and medicinal purposes, so the total diversity measurement could be higher.

The high levels of crop diversity within urban gardens is facilitated through networks of gardeners and the promotion of individual plots. Each year gardening organizations, such as Toledo GROWS and Multi-Faith GROWS, promote seed swap events. A seed swap is an annual gathering of gardeners and farmers before the growing season begins. They *swap* seeds with one another, which allows each gardener to leave with hundreds of different seed varieties and types. These events promote the sharing of heritage and organic seed varieties, many times banning GMO crop varieties. Seed swaps give urban garden managers the ability to share seeds with community members and volunteers of the garden. Seed swaps provide the necessary resources for individuals with a plot in an urban garden to grow a diversity of crops.

From interviews and surveys, we understand that urban gardeners in Toledo strategically plant crops at different times throughout the entire growing season. This creates a condition in which at least some crops are in bloom each month throughout the growing season. This attracts pollinators and provides continual pollination services for both the urban gardens themselves and for the surrounding community. This leads to the idea that urban gardens provide a great deal of ecosystem services for urban regions. An important policy intervention could be to provide government funding and assistance to support and expand urban gardening initiatives. These would model a payment for ecosystem services. Urban gardens can mitigate storm water runoff, decrease the heat island effect, remediate poor soils, reduce crime, increase access to greenspace, and provide education and recreational resources.

The social justice garden

Findings in our study indicate that a handful of urban gardens in Toledo acted as a hub for social justice. The social justice garden is a garden that (1) promotes social programs, (2)

serves a diversity of patrons, and (3) operates in an underserved neighborhood. Of the 35 urban gardens sampled in our analysis, there are four that meet all of the criteria of a social justice garden. These gardens are all community-based gardens. These social justice gardens are located in census block groups with median incomes of less than $40,000 and with greater than 20% Black population.

There are many examples from across the United States of cities taking steps toward the promotion of urban gardens. The city of Baltimore has incorporated urban gardening into its official climate adaptation agenda, specifically to help manage storm water runoff. By formally adopting urban gardening as a policy goal, Baltimore is providing institutional backing towards these initiatives. Chicago has done a similar task with rooftop gardens, mitigating the heat island effect as well as storm water management. The city of Toledo has begun taking steps toward the promotion of urban gardens, with the support of government officials and community members. However, institutional backing is necessary to ensure that urban gardens can continue operating as the economy recovers and property values increase.

Limitations

The main limitation of this study is its sample size. It would have been beneficial to have received a greater number of complete survey responses. This would have allowed us to run a more robust statistical analysis of our results. Another limitation of this study is the timeframe. Since our study took place during one growing season, it resembles a snapshot in time. It would have been beneficial to have received data from multiple growing seasons to compare and contrast the impact of interventions on growing practices. Finally, site visits and interviews for

each urban garden would have been helpful in better understanding the food landscape of Toledo.

CONCLUSIONS

This research has broader social implications for political, social, and ecological interventions. We found that urban gardens in Toledo can be a great refuge for planned biodiversity, and future studies should look at their impact of urban garden quality on associated biodiversity. We also know that urban gardens are well distributed throughout the city of Toledo, with a majority of gardens being located in the downtown area of the city along the Maumee River. It would beneficial to do a spatial analysis on the quality and complexity of surrounding landscape features to understand the importance of these urban gardens as greenspaces and wildlife habitat. We also found that a handful of urban gardens function as hubs for social justice. Future studies should look at the temporal influence of these social justice gardens on behavioral and community changes.

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Part 2: Michigan School Gardens

by Beatriz Cañas

INTRODUCTION

This paper will give an overview of public school gardens in Michigan. The study is not focused on specific cities but tries to incorporate a range of public schools through Michigan. The study will highlight characteristics of those involved in school garden creation, implementation and maintenance. The research will specifically look at the resources that have allowed educators to be champions in creating a variety of curriculum that incorporates school gardens on a regular basis. Relationships between school garden curriculum and common core standards will also be explored as well as what types of subjects are being taught using the school garden. Lastly school garden educators and partners will be asked to share recommendations or best practices to better address needs or barriers to creating a well-integrated school garden.

These findings will help draw conclusions that can provide more information than what the dominant narrative around public school gardens currently tells us. A literature review will be conducted of the psychological and educational benefits of green space and the value of school gardens on student vegetable consumption. This portion of the study will focus on the history of Environmental Education (EE) as the discipline where school gardens take root. This history of EE will give audiences a backdrop to why implementing school gardens has been a difficult process. In addition the literature review will give a better understanding of the topics that have not been thoroughly researched in relation to school gardens, such as Environmental Justice.

Psychological Benefits of Green Space

Dominant literature on the value humans have placed on green spaced has ranged across disciplines and evidence shows that in the past decade scholars have made strong relationships between access to green space and psychological and physical health benefits. A review of environmental psychology studies show that nature or any green space can have restorative benefits. Outdoor green space contains elements of soft fascination which, captures our attention. "Soft fascination-characteristic of certain natural settings-has a special advantage in terms of providing an opportunity for reflection, which can further enhance the benefits of recovering from directed attention fatigue" (Kaplan 1995). Our days are often filled with over stimulating features that rapidly deplete our directed attention. For this reason nature is the ideal setting to explore and take part in play based activities. Walking and spending time in nature causes electrochemical changes in the brain that can lead people to enter a highly beneficial state of what the Kaplan's refer to as effortless attention. This state of mind can lead to a positive mindset which, "broadens an individual's thought-action repertoire with positive benefits to physical and intellectual activities, and to social and psychological resources" (Dolesh 2013). Thus being in nature can provide a restorative experience that can lead individuals to participate in thoughtful action. This evidence shows that there is a direct link between human health and the structure of our built environment.

Environmental psychology and research on the restorative benefits of nature has guided researchers to focus on building natural environments in urban settings to provide opportunities for exploration. "Natural environments that are easily accessible thus offer an important resource for resting ones directed attention" (Kaplan 1995). By focusing on the health of our

environments, research has shown that we are creating spaces that can positively influence our behavior and state of mind.

History of Environmental Education

Defining Environmental Education is one of the key points of disagreement that researchers and practitioners have discussed since the development of this field. The lack of clear definitions of what Environmental Education is and that it is not synonymous with outdoor education and ecology has made it difficult to implement it as a standard subject in schools. The history of Environmental Education in the United States is complex because of what nature traditionally represents and the elite history of conservation efforts. "The writing and public speaking of John Muir and Enos Mills popularized wild nature as a source of recreation, replenishment, and solace throughout the early 1900s" (Carter and Simmons 2010). This also led to the social construction of nature and subsequent conservation movements left out certain populations from enjoying the restorative benefits of nature. Environmental Education thus has its roots in many movements where participation is limited or selective. A brief summary of the field of Environmental Education shows that its roots intersect with conservation education, ecological education and outdoors education. It incorporates knowledge of environmental science and also serves as the instrument for dissemination of said knowledge with environmental literacy as the end goal (Carter and Simmons 2010). Many practitioners, however, and the general public have had difficulty separating environmental education from advocacy for environmental causes. Distinguishing this difference was problematic for those working towards environmental education as a standard in schools. It's journey as a discipline that has not been established as an essential part of the education system is reflected in educational policy. The 2001 No Child Left Behind Act repeatedly ignored integrating EE into

classrooms while the National Environmental Education Act received little attention (Carter and Simmons 2010). However, since this there have been great achievements in EE that have given it a place in many schools.

Guidelines for Environmental Education

What has allowed the discipline to move forward in many ways was the creation of Environmental Education Guidelines for Excellence established in 1996 by the North American Association for Environmental Education (NAAEE) These guidelines focused on key characteristics of what EE materials should incorporate including emphasis on skill building and action orientation but also ensuring that materials are transferable across topics and focusing on their usability in the classroom (Simmons 2005). This provided a structure for the initial implementation phase of environmental programs. These guidelines, though catered towards environmental educators and formal classroom teachers, also provide background information to those new to the field of Environmental Education. Critical reviews of these guidelines lead to the additional creation of NAAEE Strands in Excellence in Environmental Education: Guidelines for Learning in 2004. These guidelines provided society with not only a framework for Environmental Education but also a basis for evaluation of programs (Simmons 2005). This framework helped narrow definitions of environmental literacy to better fulfill the goal of fostering citizens who have the skills and knowledge that go beyond what is taught in the environmental sciences. This focused particularly on providing a link between "standard based core curriculum and environmental education," highlighting for students an understanding of analysis, systems and processes (Simmons 2005).

Context of School Gardens/School Yards

Shifting to the research drawn on the similarities between community gardens and school gardens, as well as home gardens, we can infer that because these spaces have similar landscapes they not only give people the opportunity to engage directly with nature they provide the space to gain knowledge about basic ecological systems; in addition to aspects about food systems (Litt 2011). Environmental Education literature stresses that there is a relationship between "people's sense of place, how they are connected to where they live, affects how they learn, and the decisions they make about land use and personal consumption" (Winther 2010). By taking into consideration these relationships researchers have been able to better assess the history of the schoolyard that has, in many cases, transformed into a place for the school garden. Early on environmental educators felt it was intuitively right to have students experience the outdoors and interacting with nature; this now is seen as an effective teaching strategy (Brown 2003). Further environmental education research by Dillon suggests that when students participate in fieldwork they remember their outdoor experiences many years after (2006). The history of the school garden can be traced back to times of war but the popularity of school gardens gained momentum in the early 1990s. Over the past 20 years we have seen thousands of school gardens emerge in not only urban but also rural areas. School grounds that have traditionally been covered by blacktops or grass have been transformed into vegetable and native plant school gardens (Williams 2013). "More recently school gardens have become the ideal landscape to promote environmental movements and to continue to appreciate the concept of integrated learning" (Hazzard 2012). School gardens provide the ideal environment for students to engage in exploration and mental restoration.

Generally school gardens are used to enrich academic instruction. School gardens are not only instructional resources but also can be defined as specific teaching tools. They typically are used to teach science related topics. In a study conducted by Graham school principals agreed that curriculum materials designed for school gardens and linked to academic lessons in the classroom would further promote the incorporation of gardens in schools. Principals also thought that if school gardens were paired with nutrition-based curriculum they could further integrate the garden into the classroom instruction. However, Graham did not find that principals felt strongly about the influence school gardens have on school meal programs (2005).

Although school gardens are commonly utilized to teach nutrition and broader science topics (agriculture, natural sciences, sustainability), a study by Skinner further explores the fundamental aspects of the school garden. Skinner described the most essential elements of a school garden by defining the purpose it had in relation to providing a hands-on approach to learning. A school garden not only offers a holistic learning experience but also incorporates project-based, experiential learning, while encouraging cooperative behavior. In addition to intrinsically motivating students to carry out pro environmental behaviors through engaging with their surroundings. Overall the school garden has the potential to fulfill the social and educational needs of students (2011).

Science and environmental educators perceive the school garden as a tool to broaden the scope of the classroom. By participating in hands-on activities and active learning outdoors students are not confined to a building or isolated from the natural world (Winther 2010). Habib and Doherty found that the school garden is not only an instructional tool but also serves as a safe space for students. Research shows that "large numbers of students report 'that they feel, 'calm,' 'safe', 'happy', and 'relaxed' in the school garden" (2007). By measuring these attitudes

towards school gardens, research can infer that students who feel positively towards school gardens can also engage in pro environmental behaviors.

In addition to the school garden being used as an instructional tool we have seen the school garden also used as a form of support to fund more environmental literacy programs in public schools. Within the last decade the public saw increased academic and political support for school gardens when action was taken against the 2001 No Child Left Behind Act through the No Child Left Inside movement. This coalition saw the 2001 act "as narrowly defining curriculum and restricting children." School gardens were used by the movement as opportunities for learning experiences in outdoor environments (Williams 2013).

Teacher's perceptions of barriers in school gardens

One aspect of school gardens that has been explored in environmental education literature are the professional, curricular and financial barriers to implementing school gardens. Graham's study also measured teacher attitudes and perceptions of the difficulties associated with school gardens being incorporated into the school system (2005). Dirks' research also included reports of teacher frustrations with trying to successfully integrate gardening activities into already developed curriculum, which is strongly shaped by state academic standards and requirements. Incorporating gardening lessons to existing curricula would be beneficial for both teachers and students but the education legitimacy of gardening is often questioned (2005). In a study of school gardens in California, teachers agreed that "resources such as teacher training for gardening and its connection to curriculum (51%), curriculum materials linked to academic instruction (50%), and lessons on teaching nutrition in the garden (46%) would assist in the school garden being used for academic instruction" (Graham 2005). These barriers in addition to

busy teaching schedules and strict state school requirements often lead to the end of many school gardens.

Curriculum in School Gardens

When evaluating approaches to integrating school gardens in curriculum research shows that gardens should not viewed as separate from the main curriculum used. Pascoe describes school garden curriculum as an interdisciplinary portal that can connect many subjects, which would further enrich the learning experiences of students (2013). Kaye's research reiterates this point and gives insight into developing green curriculum that addresses environmental education guidelines and also is easily applied to different environmental science topics. Kaye's suggested that educators teach about the environment through an approach where students can learn and apply what they learned about the environment across other subjects and topics they are learning (2012). The process of using school gardens to teach many topics not limited to science or environmental education is seen as part of a movement to "greening curriculum." This process will also provide schoolteachers with "environmental education best practices" and resources used to develop classrooms where students can take part in issue investigation and inquiry based learning. An example of this approach is seen in Dirk's study where the Junior Master Gardner program was integrated into third grade classrooms. The results of the program showed how "horticulture, plant science and gardening can be integrated into every subject area of the elementary school curriculum" (2005).

Educational and Health Benefits of School Gardens

"Researchers assessing the impact of community gardening have concluded that they confer social benefits to neighborhoods, as well as nutritional, physical activity, and general

health, benefits to participating gardeners" (Zick 2012). There is a statistical difference between the vegetable intakes of community gardeners and non-gardeners (Litt 2011). Therefore the general goal of school garden curriculum in recent years has shifted to changing behavior with the goal of influencing food choices that promote healthy living and wellbeing. We define nutrition education and nutrition-related choices or habits as an activity that involves "consumption of specific food group, food references, attitudes toward snack foods, food sanitation or food preparation techniques" (Morris 2000). This is in contrast to solely using school gardens as instructional tools to teach environmental science topics.

Academic research on school gardens is dominated by the effects of nutrition-based curriculum on students; which, is often used in conjunction with school gardens. However, again we see the importance of integrating school gardens into nutrition-based curriculum that is being provided. Parmer's 2009 study concluded that nutrition education when used by itself did not change fruit and vegetable preference or knowledge amongst children, but including a garden component will increase the likelihood of vegetable intake (Parmer 2009). Research shows that having both the nutritional and school garden components as part of a classroom approach is constructive because behavior change takes place when "there are multiple levels of an intervention" especially early on. In Farfan-Ramirez's experience with a school garden based approach, Nutrition Matters!, students benefited from active learning in school gardens that attributed to their willingness to taste vegetables throughout the program (2011). Not only do school gardens improve healthy food preferences and nutrition knowledge of students but also influences the willingness to consume vegetables that students had not previously been exposed to (Morris 2002). Further nutrition based curriculum used as interventions for students can have greater impacts on participants of school gardens if the activities they are involved in are theory

driven and involve individuals from their school, home and community environments (Lytl and Achterberg 2005).

In evaluating the educational benefits of school garden curriculum, Broda's 2007 research "describes the major educational benefits of school gardens in the traditional school settings as:

(1) Providing concrete experiences to clarify abstract concepts

(2) Providing motivation for the reluctant learner

(3) Adding variety to teaching and learning

(4) Helping increase student achievement."

Research has shown how these benefits effect children collectively. These elements that benefit students' learning processes provide the rationale behind the implementation behind implementing school gardens into existing curriculum (Winther 2010). These educational benefits also translate into social benefits for student participants. The collaborative learning that commonly takes place in school gardens creates a social environment where students feel comfortable and encouraged to share what they have learned with others outside of the school setting. "This has the potential for spreading the benefits to a much larger community" (Habib and Doherty 2000). In addition students who participate in gardening have a better sense of self and interpersonal skills compared to non-gardeners, which can transcend beyond childhood into adulthood. By being exposed to gardening children can be exposed to healthy social habits, which will encourage them to garden in the future (Gross and Lane 2007).

Students who participate in school gardens have varied learning outcomes across subjects, however, students who participate in school garden have significantly higher scores on tests that measure science academic achievement. This is compared to students who are taught with traditional classroom approaches (Klemmer 2005). This was also seen on the positive impact

gardening learning had on students' grades and knowledge gained (Williams and Dixon 2013). Hale et al. found that gardening's hands-on approach encourages inquiry and creates an environment where students are interacting by conducting experiments and sharing results together (Bienick 2013). In a garden, students are able to carry out steps of scientific inquiry by observing and creating research questions. Morris and Skinner both used school gardens to build on social cognitive and self-determination theories to better gauge students' perceptions of their competencies, achievement, and engagement in school. Students who utilized school gardens were more intrinsically motivated and had a greater sense of autonomy, which predicted learning outcomes (2002 and 2012). This intrinsic motivation can result in habitual pro environmental behaviors that can benefit not only the student but also communities at large. Students who experience instruction based in the schoolyard develop "positive environmental attitudes" and are more like to change behavior (Winther 2010).

Although this research is not as prominent as the educational benefits of school gardens, they can also help students address multilayered and larger topics about the food system both domestic and internationally. Moira's study on food insecurity in Africa used school gardens to discuss the social implications of food insecurity by providing the space for students to develop skills and interact in the natural world (2012). In relation to this students can also use school gardens to discuss food justice issues such as barriers to accessing healthy foods. In addition to this educators can utilize food gardens to discuss the dimensions of agriculture including big agriculture, small farmers, and local food. They can also incorporate topics such as pesticide use, genetically modified organisms, and greenhouse gas emissions in relation to climate change (Harrison 2008).

Gaps in the Literature

Absence of Environmental Justice Curriculum

Past studies on school gardens focused little on how school garden curriculum is disseminated amongst schoolteachers and environmental educators. If an accessible system of dissemination was present, this may address teachers concerns in incorporating school gardens into the classroom. Few studies addressed the barriers that teachers face in developing curriculum for school gardens. For example, we know that there are barriers in implementing school gardens into excising curriculum but we cannot gauge the difficulties teachers encounter in developing garden-related curriculum. In addition we do not see many studies that report on garden classroom curriculum that meet both educational state standards and environmental education guidelines. Most schools in studies are provided funding by outside sources, which may exclude public schools from these studies. In addition the socioeconomic backgrounds of many of the students in these studies is not mentioned. This characteristic is often absent in environmental education research so there is little academic literature that looks into the effects of school gardens on students from urban or low socioeconomic backgrounds. Overall most research is done on schools on the west coast because of their ability to have longer growing seasons where gardens are utilized throughout the academic school year, studies done in the Midwest, specifically Michigan are limited.

Even though there are significant social benefits to participation in school gardens, literature does not specifically look at the presence of social or environmental justice in school gardens. The presence of formal, non-formal, or informal Environmental Justice school garden curriculum is nonexistent.

This literature gave me an idea of how to structure my research instruments and also provide insight into what past researchers excluded from their studies, so that I could address those topics in my work. The work done in California on teacher's perceptions can inform the ways in which I approach and interact with educators. In addition it will help to determine the best and most appropriate ways in which the research I conduct can benefit the environmental education community. This research can also help to narrow my scope and guide my efforts; past efforts have shown me that a focus on reviewing garden curriculum would further add to the merit of school garden curriculum as a part of existing curriculum. Research has showed that school gardens alone, as opposed to a garden where an educational component is present as well do not drastically change attitudes resulting in behavior change (i.e. more consumption of fruit and vegetables). School gardens, therefore, should be utilized in curriculum in other ways such as to address environmental justice issues.

METHODS

Research Question and Hypotheses

This study had multiple objectives that were intended to highlight the intersection between barriers that educators face in implementing gardens, how school gardens are utilized, and the demographics of the students they serve. The main research question is in what ways are school gardens being implemented in Michigan public schools and are their purpose? What are the percentages of students who are eligible for free or reduced meal programs that also have access to school gardens? The study highlights these questions so recommendations can be made to better serve students and school communities. In addition this study aims to find ways in which educators can best use already existing environmental education resources to further aid them in finding a permanent place for environmental education, and specifically school gardens, in the Michigan public school system. Drawing from the literature and previous studies, I hypothesize that public school gardens in Michigan have singular uses and are mainly used to teach nutritional education topics. I also hypothesize that a main barrier for teachers in public schools is allocation of time to teach certain subjects over others. Further, requirements to teach to common core standards hinder the range of opportunities educators have to teach environmental education through school gardens in public school classrooms.

Study Design Description

This study is based on data that was gathered through an electronic survey and short discussions with key informants in late 2014 October-December and early 2015 January-February. Study recruitment took place through multiple avenues. This included partnerships between University

of Michigan, School of Natural Resources food access projects and directly contacting individuals who work with school gardens and farm to cafeteria programs. Initial contact was made in early January 2014 through the Michigan Farm to Institution Network as part of Michigan State University Center for Regional Food Systems. Number of potential participants is unknown because Michigan Farm to Institution Network does not disclose that information. Members of the Michigan Farm to Institution Network consist of "food service directors and buyers as well as farmers, food suppliers, advocates, supporters and researchers" across the sate of Michigan (foodsystems.msu.edu). The network was initiated to connect these individuals across the sate and support institutional sourcing of local food After initial contact was made with key stakeholders to gauge interest in research project 40 individuals responded that they were interested in participating in the project. Other participants were contacted through a southeast Michigan county public school network. Some individuals could not participate because they did not have a school garden at the time or were from another state. Though these individuals did not complete the survey, they volunteered to share their ideas about barriers to implementing school gardens, which were used to inform recommendations for educators. A 30 question, open and closed ended survey was sent to 50 individuals through online survey tool Qualtrics. From these 50 individuals 24 participants completed the survey in its entirety, which gave the study a 48% response rate. Questions in the survey were directed at school educators or school garden partners; therefore, each participant did not answer every survey question.

Survey questions were developed based of gaps in the Environmental Education and school garden literature. Some questions were also adapted from Food Corps and Michigan State University Extension survey disseminated in early 2014 to look into the dimensions of capacity building in school garden related projects. Researchers and peers at the University of

Michigan reviewed the survey multiple times and the survey was pretested twice before being disseminated to key stakeholders.

Data Analysis

The closed ended questions of the survey were analyzed through SPSS 22.0 software. Statistical tests through SPSS were run and descriptive statistics were calculated; the majority of the study looks at frequencies of responses. The opened ended questions and email responses from key stakeholders were hand coded for major themes and key words that were also identified in the literature review. For these responses the main themes centered on goals for student and community participation in school gardens and ways to implement other school gardens. For the open-ended responses themes were also compared to the Next Generation Science Standards and Environmental Education Guidelines for Excellence. Spatial analysis was completed using ArcGIS 10.22 to spatially display percentage of students eligible for Free or Reduced Meal Programs in Michigan. Data for school meal program eligibility was also collected through Michigan School Data database as a part of the Michigan Department of Education. The database provided 2014 percentages and counts of students, in K-12, eligible for free and reduced lunch in each Michigan school district.

Limitations of the Analysis

This study has several limitations that are due to a variety of factors that do not allow it to be an accurate representation of the current state of school gardens in Michigan. Though the survey had a response rate of 48%, the potential sample size was relatively small. The survey was disseminated to 50 individuals and these 50 individuals do not represent all the stakeholders

who work on school garden programs in any capacity. Initial contact to participate in the study through the Farm to Institution Network could have also limited the pool of participants. Not all advocates of farm to school programs are members of this network. It is also not exclusively for school garden programs so it is difficult to gauge the actual number of members that work specifically on school garden issues. School gardens are not centralized through another network but instead belong to multiple networks that work with different aspects of the food system and I was unsuccessful at locating all these networks. In addition to these limitations, it is important to note that some participants worked in the same school garden. Even though people may have different perceptions and opinions about the work that is done in the same school garden this does not accurately capture the work being done across the sate in different school districts. Time required to complete the survey was taken into consideration when designing the survey instrument but could have still been a major barrier. Most participants were educators who do not have time throughout the school day to check and respond to emails because of teaching during class periods and supervising of students. In general educators may have difficulty completing activities outside of normal school hours because of other commitments and limited free time throughout the school day. There was also a delay of two weeks between initial contact and when survey was first disseminated. This could have limited responses to the survey because it was not something that those who had shown initial interest were reminded of in a timely manner. Most participants also were very successful with implementing their school gardens at their respective schools. This may imply that Michigan Public Schools are implementing successful strategies from the start or that schools that are struggling in this area not connected to formal networks.

Public and Charter Schools

A part of the study that brought to light some questions of concern was the definition of a traditional Public School and the difference between these institutions and Charter Schools. The latter in the simplest way are defined as public schools that have been created outside of local school boards and can be independently owned and operated (Peters 2015). Some survey respondents identified their school as a public institution; however, through the spatial analysis they were defined as Charter Schools. This resulted in a point of confusion and perhaps as another limitation of the study. These institutions were difficult to categorize because technically they are public schools but Charter Schools at times are not considered as part of a Public School district. This limits the study because the main focus was to survey individuals who work in schools that are funded by the state, as these schools often serve marginalized communities. This may lead to an inaccurate picture of Michigan public school gardens because Michigan Charter schools compete for state funds. Charter schools are allowed to receive both private and public dollars (Peters 2015). It may be that the schools surveyed were able to be successful in their school garden efforts because they had more flexibility and funding within their school to implement programs. However, charter schools may not be the answer to educational reform and implementation of school gardens. Current debates emphasize that charter school legislation, and Michigan is an example, "creates educational environments that become racially and economically segregated" (Peters 2015).

Detroit School Garden Collaborative

I would like to note that this research project does not intend to overshadow or overlook the current successful grassroots school garden movements that are taking place in cities in

Michigan that were not part of the study. This includes programs such as the Detroit School Garden Collaborative (DSGC). It is important to note that this collaborative has created over 45 school gardens in Detroit Public Schools since 2012. This collaboration began with policy reform and implementation through the Healthy, Hunger Free Kids Act 2010 that has supported not only healthy food but local food as well because it is a farm to school initiative (farmtoschool.org). "This revolutionary project makes DPS one of the few in which food services, site management, and curriculum are working collaboratively to ensure that students are able to learn academic content in a real world context related to gardens" (detroitk12.org). In many ways Detroit is a champion in school garden creation and implementation. This program has also showed that partnerships are crucial in the development of school gardens, through partnerships there is room to build capacity and that partnerships foster community. Partners include: "The Greening of Detroit, which will provide technical assistance and training and will facilitate the Garden Resource Program; Eastern Market Corporation, which will provide community outreach, grant identification, sponsorship identification and help create a new DPS (Detroit Public Schools) Farmer's Market; the United Way of Southeast Michigan, which will provide community outreach and sponsorship identification; and The Detroit Medical Center, which will offer community outreach, Health and Wellness education and sponsorship identification" (detroitk12.org). Including the narrative of these types of movements in research is crucial in capturing what people are doing that is successful related to environmental education and specifically school gardens to better target and resolve issues or barriers to school garden implementation.

Free and Reduced Meal Programs

The analysis on school gardens and how accessible they are to students eligible for free and reduced lunch programs was not fully addressed in this study (Appendix A, Figure 1). Preliminary research was conducted using a spatial analysis; however, a more thorough statistical analysis of the data looking at cross tabulations was not completed. Though percentages of students who are eligible for free school meal programs are an indicator of household income it does not accurately present who is actually participating in the these programs (Appendix A, Figure2). A research method approach that included in person interviews could have highlighted more of the culture around school gardens and food insecurity. Also participation of students in this study could have also provided more information on the socioeconomic factors that contribute to eligibility for free and reduced lunch; however, receiving parental consent to work with children was outside the time frame of this project.

Results and Discussion

Demographics

Survey participants identified as serving multiple roles within and outside of the school systems. The majority of individuals, 52%, stated that they had Garden Educator or Coordinator roles in the school garden they worked with. A small percentage, 21.7% identified as being public school teachers. When asked what type of institution they worked in, 76.2% of respondents identified as working within a public school, this includes elementary, middle and high schools. Therefore the population that the survey results represent not only includes public schools but also people who work in garden education as a profession. Years of involvement in the school garden varied from 29.2% of respondents who have been working in their school garden for 10 or more years and 41% of total respondents that have worked with their institution for 1-3 years.

The majority of school gardens 85.7%, were less than a quarter of an acre and size. This is understandable due to the size of most public schools and available green space in urban areas. Out of the participants surveyed they reported that their school garden had been in place for multiple years: with 37.5% 1-3 years, 29.2% 4-6 years and 20.8% 10 years or more. Garden amenities varied and were numerous; most common amenities were raised (70.8%), tool sheds (70.8%), and compost (66.7%). Overall the school gardens surveyed had well-planned structures that allowed for implementation of amenities and frequent utilization. Incorporating student use 52% of respondents used the school garden at least 3 times a week and 91.3% of respondents agreed that the students in their school were highly interested in working in the school garden. This can imply that the garden was widely accepted in their school community and perhaps provided an adequate amount of support to sustain the garden. Another key finding differing from the literature highlights that school gardens were categorized as having more that use.

School Garden Type	Frequency	%
Classroom Garden	22	91.7
Nutritional Garden	14	58.3
Recreational Garden	8	33.3
Visual Garden	9	37.5
History Garden	3	12.5
Cultural/heritage garden	4	16.7
Other	3	12.5

Table 1. Categorization of School Garden

Table 1 shows that the majority of school gardens were used as classroom gardens, which shows that school gardens were used to teach subjects directly related to what is taught during school hours. This may also explain further findings explaining why teachers are able to use the garden in the classroom. Educators are aligning curriculum with major science standards that have given them opportunities to use the school garden during school hours and still comply with curriculum mandates. Educators (50%) identified Science as one of the main subjects taught in the school garden along with Environmental Sciences (41.7%) and Math (37.5%). Drawing from what is mentioned in the literature this may also reflect the interdisciplinary roots of environmental education and how it incorporates many subjects.

Common Core and Next Generation Science Standards

Contrary to the literature educators are finding ways to pair their school garden with common core curriculum. Educators are taking initial steps in helping their school gardens become a school standard, 65.2% of teachers have or are in the process of pairing their school garden with a classroom curriculum. This is also represented in the list of curricular resources that teachers identified that they have ben working with in order to provide their students with educational experiences in their school garden. Though core curriculum is still identified as a difficulty for teachers it is not as large of concern. Only 12.5% identified aligning their school garden with core curriculum as a main barrier when working with school gardens.

In addition teachers are also beginning to cater curriculum to the Next Generation Science Standards (NGSS) and finding ways in which their lesson plans can connect to the NGSS student performance expectations. Unlike common core, which emphasize, Math and Reading and Science Literacy, NGSS encourages through different ways of teaching how students can pursue science in college and science related careers (nextgenscience.org). The standards have not been officially adopted by the Michigan Department of Education and are currently in review. However, NGSS has gained support through collaboration with scientists, researchers and educators in the development process. This is appealing to many educators and survey respondents identified dimensions of the NGSS framework that they have used as a base to teach subjects in the garden. One respondent highlighted that in their school garden students were learning Science and Engineering Practices, a main component of NGSS.

Farm to School Programs in Michigan

One of the major results of the study is that all of the produce sourced from the school garden was used and none of it went to waste. Figure 1 shows that most produce was given to the school community, which includes students, teachers and neighborhood members. This points to the literature in that school gardens serve as a basis to build and foster community. Practices such as giving fresh produce to the school community can encourage relationships and encourage more active use of the school garden. Figure 1 also illustrates that 37.5% of respondents reported that produce sourced from the school garden is used in farm to cafeteria programs. This is possible in Michigan because the state does not have any regulations prohibiting the use of produce grown on school sites in school cafeterias. A Farm to School Procurement Act, encouraged the Michigan Departments of Agriculture and Education to work directly with FTS programs. Michigan is also part of the National Farm to School Network and through MSU, the CRFS has created a Farm to Institution Network. These efforts in addition to the 2014 Michigan Good Food Charter have steered Michigan into adopting goals such as "Michigan institutions will source 20% of their food products from Michigan growers, producers and processors" (Michiganfood.org). Schools play a major role in the Michigan Good Food charter and supporters hope to see that "Michigan schools will incorporate food and agriculture into the pre-K through 12th grade curriculum for all Michigan students and youth will have access to food and agriculture entrepreneurial opportunities"(Michigangoodfood.org). In Figure B1 the main goal that teachers identified for their students is that they have opportunities to connect to local food. Educators surveyed not only want to increase healthy food consumption among their students but also have their students learn the importance of eating local. From the schools surveyed it is evident garden educators are supporting local food initiatives on a smaller

scale through their school gardens and providing fresh produce not only to students but also to the broader school community.

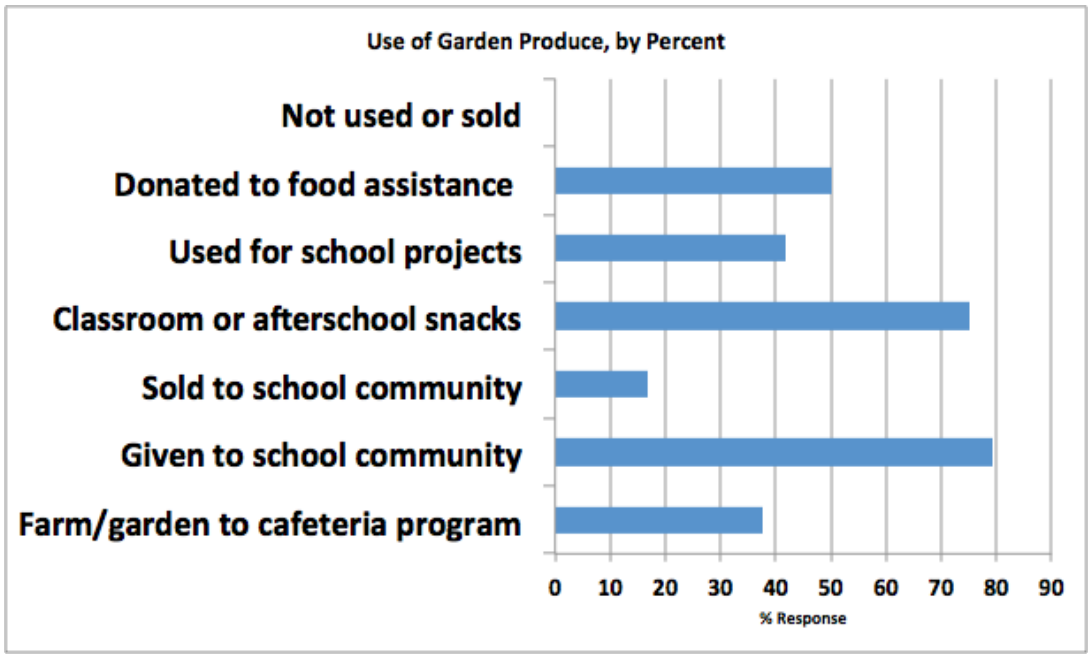

Figure 1. Use of Garden Produce (Fruits and Vegetables)

Importance of Evaluation in Environmental Education

Another important idea to capture from the survey results was that educators were not completing evaluation of their school garden programs. When asked if they were measuring student outcomes to see if they were meeting goals responses were mixed but most educators were not quantitatively measuring outcomes and outputs. Evaluation of Environmental Education programs has often been overlooked especially because of the multiple roles and tasks teachers have to fulfill throughout the school day. However, Zint 2011 discusses that soon only educators who can prove that their programs are successful through formative evaluations will have opportunities to secure resources to sustain their programs. Another barrier identified that has been previously mentioned related to evaluation is the lack of time educators have in the

school day to complete formative evaluations of their programs. Taking into consideration these obstacles it is important to be consistent with evaluation from the beginning. Like environmental education, evaluation according to Simmons does not need to be considered an add-on or just something else to find time for in a school day that is already filled to capacity (2005). Evaluation of school gardens should be part of the framework and plan that is constructed before building and implementation of the school garden. In this way educators will be prepared to track long term pro environmental behaviors as an outcome of participation in school gardens (Zint 2012).

CONCLUSION

Changing the Framing of School Gardens

A major shift in the framing of school gardens in the public education system is needed in order to best cater to educator and student needs. School gardens are portrayed as having one-dimensional purposes. Since school gardens are traditionally seen as recreational or solely for nutritional purposes they are treated as add-ons and not integral to learning (Simmons 2005). However, because school gardens are part of EE curriculum they are a place where students can explore issue investigation, experiential and place based learning. School gardens as a part of EE encourages students to think about their actions in relation to their environment in the broader context. They then are allowed to forge connections within their own school communities (Carter and Simmons 2010). In order to have this shift in discussing the framework around school gardens, school garden usage should be encouraged beyond nutritional education. These activities then can be aligned with education and curricular standards. To accomplish this a centralized school garden network needs to be established that provides curricular and funding

resources for school garden educators. According to Simmons "educators need good-quality environmental education materials but with literally thousands of products to select from, deciding which materials best meet their needs can be overwhelming'" (2005). The issue is not a lack of resources but allocation of these resources and time spent gathering these resources. A system that helps filter resources and can provide evaluation resources as well in order to provide educators with a plan that is unique to their school environment. The room for evaluation also needs to be a fixed component of school gardens. The centralized school network would allow access to logic theories and behavior models that provide various ways for educators to conduct needs assessments, post and pre tests (Zint 2012). These evaluation methods are crucial in developing an understanding of student backgrounds and to address misconceptions. In Figure B2 a model outlines recommendations from educators and practitioners surveyed. The Michigan School Garden Network would connect school garden champions and those who are new to implementing environmental education. Educators have years of experience in their fields and ultimately they already have many of the solutions to barriers, they but lack a mechanism to communicate and share their knowledge. A network would provide them the opportunity to connect and continue to foster environmental stewardship through school gardens.

Appendix A
Spatial Analysis

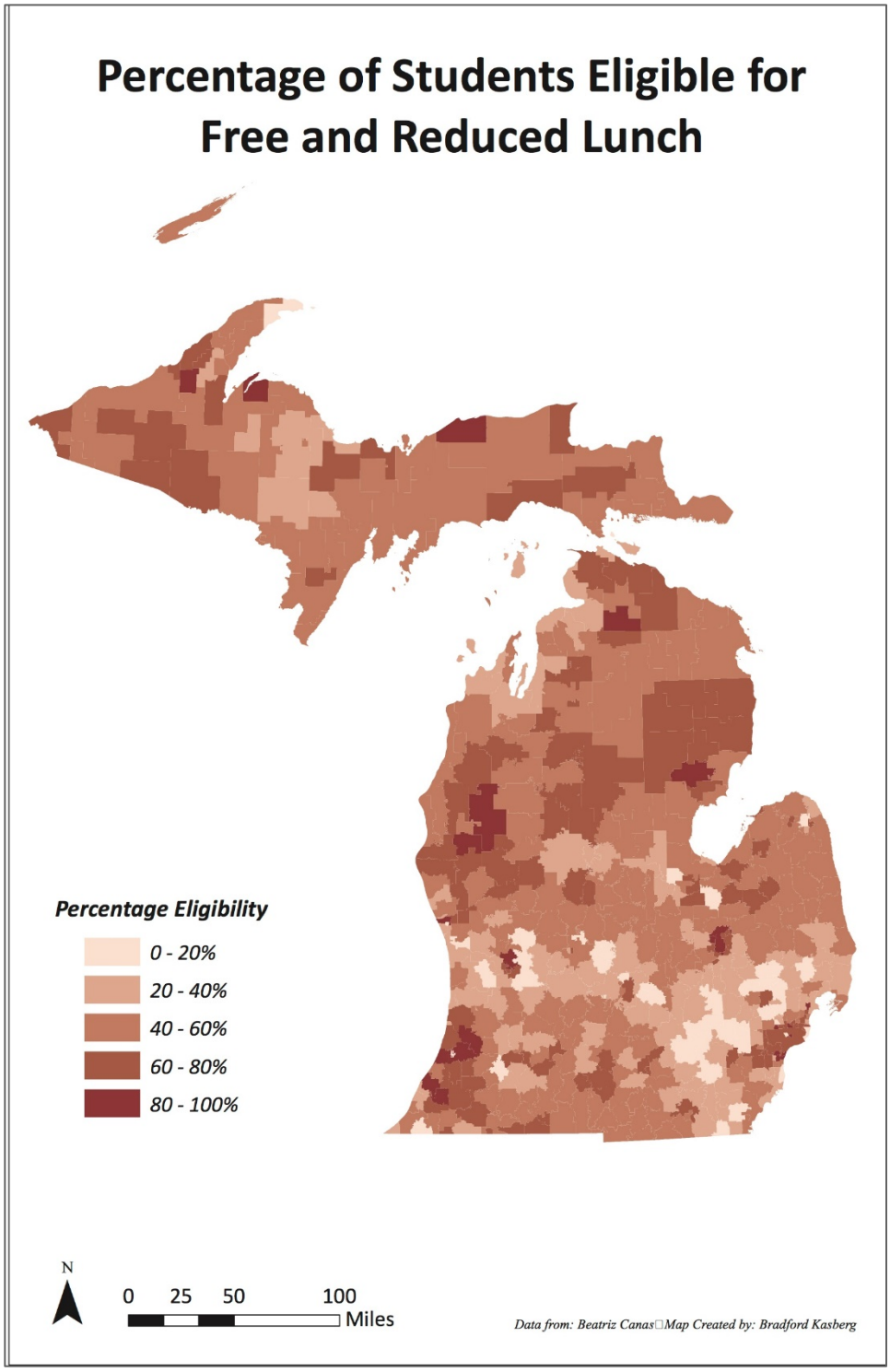

Figure A1. Percentage of Students Eligible for Federal Free and Reduced Lunch Programs in Michigan by County

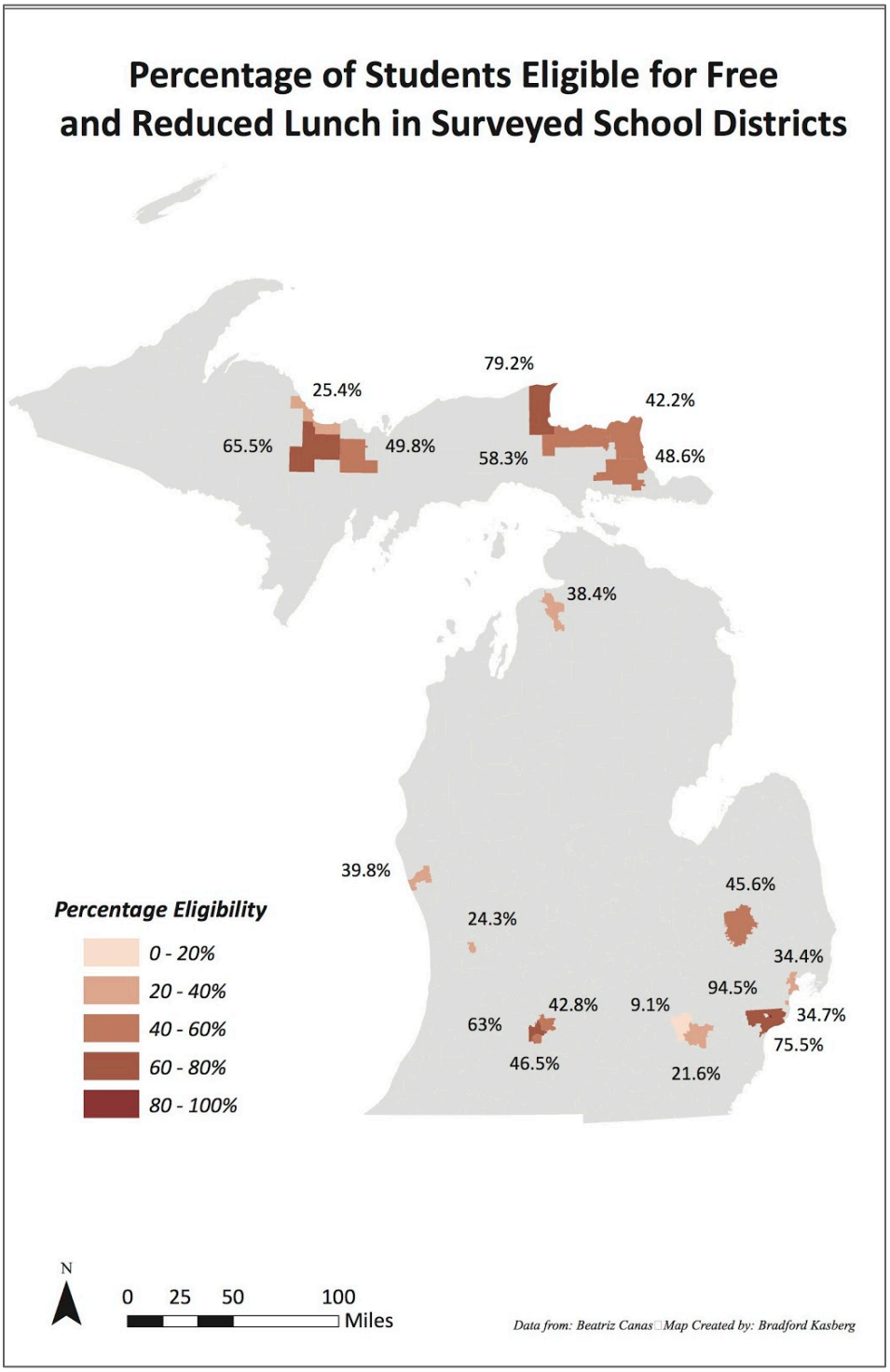

Figure A2. Percentage of Students Eligible for Federal Free and Reduced Lunch Programs in Michigan by County, School Gardens Surveyed

Appendix B
Educational Models

Figure B1. Goals for Student Involvement

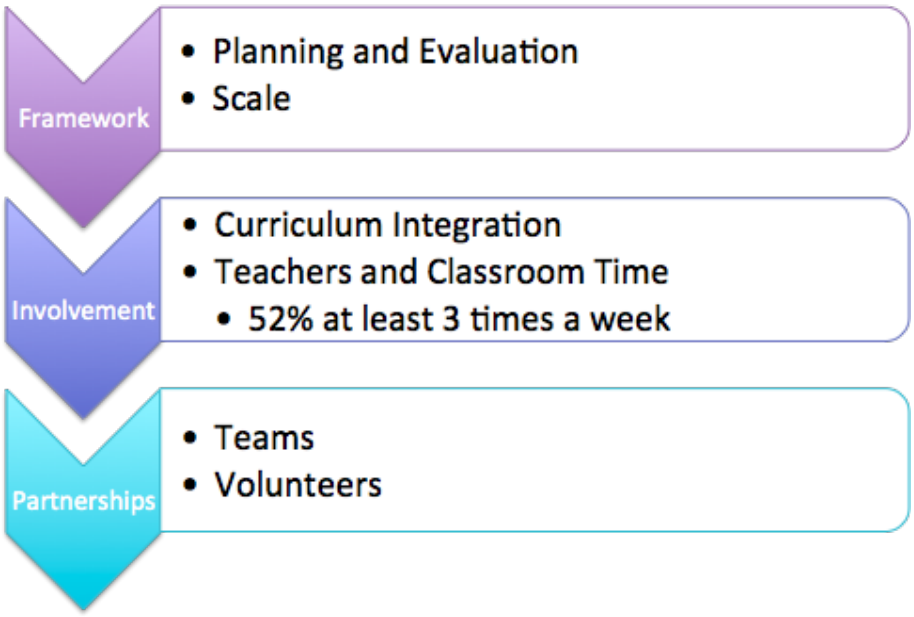

Figure B2. Educational and Logistical Recommendations from Practitioners

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