Spring 5-18-2021

Exploring Urban Food Desert Polices in the United States Through the Water-Food-Energy Nexus

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A Thesis

Presented to

The Faculty and the Honors Program

Of the University of San Diego

By

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Political Science & Biology

2021

Abstract

Climate change is shifting the distribution and availability of resources around the world. The impacts of climate change are felt significantly within the Water-Food-Energy Nexus, which aims to explore the interconnected impacts on both the natural and human environment. As changes to the climate affect access to resources many societies continue to face the challenge of supporting their human populations while others continue to use resources in excess. Even within industrialized countries like the United States, people face serious resource poverty, clearly seen in food insecurity. Food deserts have arisen in urban areas within the United States and are influenced by a variety of economic, environmental, and social factors. People living in these communities lack the ability to access nutritious, culturally appropriate, and sustainable food options, negatively impacting their health. The ongoing COVID-19 pandemic has only exacerbated the food insecurity felt in urban environments. In this project, I examine case studies of policies that have been implemented on the local level by government and community organizations to combat the growing urban food insecurity. In looking at these local policies through the Water-Food-Energy Nexus I explore the connections between each resource type and the root causes of urban food deserts. Using the Water-Food-Energy Nexus perspective allows for more sustainable approaches to food insecurity, especially as communities begin to experience more significant impacts to natural resources due to climate change and face the unpredictability of resources in their future environment.

Introduction

Food deserts in the United States remain a serious access problem in both urban and rural areas of the country. This problem of food access has been exacerbated by the economic, environmental, and sociological impacts of the COVID-19 pandemic in the United States. The

public health impacts of food deserts can be seen by increased rates of hunger, obesity, and other chronic health conditions. Obesity is a growing public health concern in the United States as the adult population classified as obese by the Body Mass Index (BMI) continues to increase (Koh et. al, 2015.) While obesity is caused by many factors and the uniqueness of each individual body must be recognized, many public health experts agree that increasing access to nutritious food options and limiting the consumption of less nutritious food products is an important intervention in the United States to reduce obesity. Obesity is seen as a public health concern because of the geographic trends that have been found in the United States and altering the food products that are affordable and available in an area does impact the overall weight and nutrition of a community (Cummins, Flint, & Matthews, 2014.) Because of this geographic tie to obesity and other serious chronic health conditions, many public health experts propose eliminating food deserts as an important step in combating these population health challenges (Dubowitz et. al, Nov. 2015.) There is a need for policies to be implemented on all levels of government to eliminate food deserts and increase the access to food for all people.

In examining the problem of food deserts, the research question investigated was: What federal, state, and local policy decisions could offer more accessible food options to individuals living in urban food deserts in the United States? To address this question, a primary and secondary literature analysis was conducted. This method of research allows for a thorough examination of past research and policies. The impacts of the COVID-19 pandemic were examined through literature published during the ongoing pandemic, which allows for a partial understanding of the impacts of the pandemic on food insecurity in the United States. Two specific cases of food deserts were examined; the addition of new supermarkets in the state of Pennsylvania and the creation of urban farming in the city of Detroit, Michigan, in order to

evaluate the causes of food insecurity in each area, previous policy proposals by local officials, and potential policies that were considered. Any policies implemented on all levels of government must consider food deserts in the context of the Water-Food-Energy (WFE) Nexus in order to create a sustainable solution that recognizes the interconnectedness of each of these systems.

The Problem of Food Deserts

There is discrepancy within the literature on a single definition of the term "food desert"; some focus on the quantity and size of food markets available within a specific area while others examine the quality and affordability of the food found in stores that are in close proximity to the community (Walker et. al, 2010.) The term has been defined in federal policy as "areas that, although often served by fast food restaurants and convenience stores, lack easy access to affordable fruits, vegetables, whole grains, low-fat milk, and other foods that make up the full range of a healthy diet" (Holzman, 2010.) This definition suggests that it is more meaningful to consider the affordability and quality of food available to residents and not simply the distance from a supermarket. Research that has considered the distance from a supermarket as the only variable to determine a food desert has found that it does not consider all important factors, and it is likely that income has a much stronger relationship with the nutritious food individuals have access to (Koh et. al, 2015.) It is important to include many factors in the definition of a food desert because it offers more comprehensive policy ideas. Most current research uses a more comprehensive definition of food deserts as an area where residents do not have access to affordable, nutritious, and culturally appropriate food options (Weatherspoon et. al, 2012; LeDoux & Vojnovic, 2013.) It is more meaningful for this research to also consider the affordability and quality of food available to residents, not solely the distance to a supermarket.

In the United States, residents living with limited access to food has been a very concentrated problem centering on people of color and low-income individuals in urban areas. As of 2015 23.5 million people in the United States lived in low-income areas more than a mile from a supermarket (Dubowitz et. al, 2015.) A significant number of residents of the United States remain unable to affordably access food products that will keep them healthy. By being unable to access nutritious food, many people continue to face significant chronic health problems as well as many emotional and social challenges. Researchers explain that long term food insecurity adversely affects already socially and economically disadvantaged communities, contributing to already high incidence rates of obesity and chronic diet-related diseases (LeDoux & Vojnovic, 2013.) Because urban food deserts disproportionately impact residents of color and of low socioeconomic status, the harmful effects of limited access to food fall on already disadvantaged communities.

The Impacts of the COVID-19 Pandemic

The COVID-19 pandemic has caused a serious food insecurity crisis across the globe. Communities in urban areas have felt the challenges of food insecurity even more severely. Many researchers have aimed to identify the extent of the food challenges during the ongoing COVID-19 pandemic through survey research and critical examination of the food supply system. In studying overall world food security, researchers predicted that the number of people facing severe food insecurity worldwide may double from 135 million in January 2020 to 265 million people by the end of 2020 (Lal, 2020.) This dramatic increase in food insecurity can be attributed to many economic, social, medical, and cultural factors from the ongoing pandemic. Urban centers have been especially impacted by the pandemic due to the disruption in the food supply chain, physical and economic barriers to food, and increases in food waste (Lal, 2020.)

As the COVID-19 pandemic continues to impact everyone's daily lives it is hard to predict the overall changes to the food system that will take place, but it is clear that people are facing increasing levels of food insecurity and the access to food is uneven.

The COVID-19 pandemic has exacerbated the existing food security disparities in the United States. In studying different areas in the United States, researchers found that areas that were already food insecure were facing greater levels of food insecurity due to economic and supply chain challenges from the pandemic (Wolfson and Leung, 2020; Clapp and Moseley, 2020; Bakalis et. al, 2020.) Survey research was performed with a sample of Americans who were less than 250% of the federal poverty level from March 19-24, 2020. Researchers found that individuals with very low food security were facing even more financial and food access challenges than before the pandemic (Wolfson and Leung, 2020.) Only 18.8% of respondents who had very low food security were able to comply with the public health guidelines to purchase two weeks of food at a time (Wolfson and Leung, 2020.) People who were very food insecure faced many more resource challenges than respondents who were less food insecure. Living with food insecurity has many long- and short-term health effects which can contribute to more severe COVID-19 infections, including obesity and diabetes.

People who are low-income are at higher risk of both the economic challenges caused by the global recession and of the health complications from the COVID-19 pandemic. Researchers identified that people who were of lower-income were at higher risk of losing their job due to business closures, have less opportunity to work remotely to protect their health, and much less likely to have available sick leave if they contract COVID-19 (Wolfson and Leung, 2020; Clapp and Moseley, 2020.) Even immediately following the first week of shutdowns and COVID-19 social distancing precautions in the United States, low-income adults who were food insecure

were already experiencing increased challenges to access food (Wolfson and Leung, 2020.) This pandemic is exacerbating the significant health disparities that food insecurity creates in the United States. The COVID-19 pandemic is increasing the disparity in access to food in urban parts of the country, showing that current food policies are inadequately addressing the issue of urban food deserts. Additionally, COVID-19 has disproportionately impacted racial and ethnic minority groups in the United States as they face higher rates of infection and more severe complications.

The ongoing pandemic has exposed the weaknesses in the food supply chain. Most food supply chains have a small number of companies dominating each aspect of the supply chain; this creates a problem with resiliency because the supply chain must stop at certain areas if there is a challenge to one of these major corporations (Bakalis et. al, 2020.) COVID-19 has caused significant disruption to the entire globalized food system as many companies at all levels of the supply chain have faced disruptions, causing a breakdown in food supply globally. Urbanization has been increasing the complexities of the food supply chains as companies continue using newer technologies to increase supply to growing cities at lower costs (Bakalis et. al, 2020.) The consequences of this supply chain breakdown in the global food supply due to the COVID-19 pandemic has hit the people already facing food insecurity the hardest. The food systems must be designed to support people who do not have access to safe and nutritious foods and ensure the resiliency for future global challenges.

The disparities in food security in the United States have been further exposed by the food crisis created by the COVID-19 pandemic. Researchers explain that the existing problems of hunger and malnutrition contrasting large amounts of food waste have been exposed by the COVID-19 pandemic (Lal, 2020.) People living in food deserts face many resource challenges

which the pandemic has increased. Researchers found that 41.3% of adults with very low food security reported not having enough food to feed themselves or their family and 49.9% reported not having enough money to pay their bills in March of 2020 (Wolfson and Leung, 2020.) People who are food insecure are more likely to be people of color, low-income, have less secure jobs, and face basic needs insecurities (Wolfson and Leung, 2020.) The high food insecurity of people of color is another way in which the COVID-19 pandemic has disproportionately impacted communities of color.

Factors Influencing Food Deserts

Many factors have been found to contribute to living in a food desert and are based in historical policies concerning the United States' food supply system. In reviewing literature on food deserts in the United States, researchers divided the articles into four main issues within the topic: 1) access to supermarkets, 2) racial/ethnic disparities in food deserts, 3) socioeconomic status in food deserts, and 4) difference in chain versus non-chain stores (Walker et. al, 2010.) Each of these topics are an important aspect of food deserts and provides different opportunities for policy interventions. In examining previous policy solutions, researchers have found that public health initiatives have examined the underlying causes of food deserts separately, but that in order to combat each of these issues, the connections between them must be analyzed and explored (Majowicz et. al, 2016.) This understanding of food deserts provides a useful way to visualize the many drivers for food related public health issues and explains how any intervention in one of these spheres must also consider the others.

Access to Supermarkets

Living over a mile away from a supermarket has been one important variable used to define food deserts. Using this definition, many policy proposals to incentivize supermarkets to

build in the inner-city have been implemented on the local and national level. Previous research has found that the distance from a food store is an important aspect of limited access to nutritious food, but not the only one. In examining the distance living from a food store, food prices in that food store, and obesity rates in an urban setting, researchers found that distance to a store and prices were positively correlated with obesity rates (Ghosh-Dastidar et. al, 2014.) This indicates that people who live further from a grocery store and experience higher food prices in that store did have higher obesity rates than people who live closer. However, researchers found the pricing of healthy foods to have more of an effect on obesity rates than the distance to the stores (Ghosh-Dastidar et. al, 2014.) This indicates that it is not only the distance to a store that impacts access to more nutritious food options, but also the price of nutritious foods at these stores. Because food prices were more closely correlated with obesity rates than distance to food stores, researchers suggest that simply placing supermarkets into low-income neighborhoods is not going to increase the availability of nutritious foods; the food prices and underlying socioeconomic factors must first be considered.

Racial and Ethnic Disparities

It is important to consider the underlying racial and ethnic discrimination that perpetuates the issue of food deserts if any long-term policy solutions are to be successful. Many researchers have found that members of racial and ethnic minorities are more likely to live in an urban food desert and have chronic health conditions related to poor nutrition (Dubowitz et. al, Apr. 2015.) In analyzing national trends of residents living in urban food deserts, researchers found that white people are four times more likely than African American residents to live in a neighborhood with a supermarket, which related to the higher rate of obesity in African Americans than white people (Dubowitz et. al, Apr. 2015.) By not having access to affordable

nutritious food options, many minority populations continue to face higher rates of chronic health conditions including obesity, diabetes, and hypertension. Many studies emphasize the serious chronic health impacts that limited access to nutritious foods has on minority and low-income neighborhoods (Ghosh-Dastidar et. al, 2014; Dubowitz et. al, Apr. 2015; White, 2011.) These underlying racial and ethnic disparities in food access must be incorporated into any policy proposals because many cities have implemented discriminatory policies in the past that have created the environment for urban food deserts.

Socioeconomic Status

Low socioeconomic status is closely tied to living in an area without access to nutritious and affordable food (Weatherspoon et al., 2012; Walker et al., 2010.) Previous studies have found that low-income regions of cities tend to rely on fast food and convenience stores for affordable, but high calorie food options (Walker et al. 2010.) This limited access to nutritious food has been shown to have serious human health impacts (Walker et al., 2010; Ghosh-Dastidar et al., 2014.) Addressing the broader problem of income inequality would allow for individuals to better afford healthy food options and the demand would incentivize supermarkets to come into food deserts rather than using government intervention to force supermarkets into food deserts where residents would not be able to afford their products.

Other policy proposals to decrease diet-related chronic diseases have focused on an increase in the prices of non-nutritious foods. In reviewing previous literature about the price elasticity of different food products, researchers have categorized the most and least elastic foods. Researchers found the most elastic foods to be eating out at restaurants and soft drinks while the least elastic foods were eggs (Andreyeva et. al, 2011.) The level of elasticity implies how much people will tolerate a price increase in the food item; the elasticity found indicates that

if food prices go up most people will tolerate less price increases in less essential items like restaurants and soft drinks, but will pay for eggs and fruit even when prices increase dramatically. This research helps policy makers understand which foods would be good targets for increasing the price to decrease consumption. Researchers discuss the positive policy impacts of targeting less nutritious foods like soft drinks in increasing the overall health of our society (Andreyeva et. al, 2011.) However, this article does not take into account the harm that increasing the prices of any foods could have on individuals living in food deserts. Many food deserts do not have large supermarkets with more nutritious food options, so people rely on convenience stores and fast food for their food supply. Many foods in these convenience stores would not be considered nutritious and would likely face price increases, making all available food unaffordable for low-income individuals living in food deserts.

Chain versus Non-Chain Stores

As the suburban areas of cities began to develop and people left the inner city, the food supply system in the United States began to change. Many cities across the country saw an increase of larger chain stores moving into the suburbs to develop large supermarkets and service the wealthier suburban population, while smaller grocery stores became unable to compete (Deener, 2017.) The smaller stores went out of business because they could not compete with the low prices of larger chain supermarkets and the larger chains developed sophisticated distribution systems that allowed them to have larger stores to sell even more products (Deener, 2017.) All of this led to low-income urban communities being seen as less desirable customers than the suburban communities, and food stores moved out of the urban area, limiting those communities' access to food. These trends continue today as many smaller grocery stores struggle to compete and larger chain stores continue to develop outside of the city. Policies

supporting local grocery stores in urban areas could have the potential to increase access to the food supply in urban areas.

The Water-Food-Energy Nexus

The WFE Nexus is a conceptual model that allows for the examination of important resource problems in a comprehensive and connected manner. The water, food, and energy systems are each based on finite, physical resources that are dramatically impacted by each other. In developing nexus modeling, researchers suggest not only examining the food, water, and energy systems separately but also the relationships between these systems (Bazilian et. al, 2011; Gragg et. al, 2018.) There are countless social justice implications that come from uneven access to these resources, posing an urgent need to explore the nexus in future policy solutions (Bazilian et. al, 2011.) The ongoing COVID-19 pandemic has further exposed the inequalities in these systems. Future policy proposals must be considered in the context of the WFE Nexus, especially as the physical environment faces increasing resource challenges. Because of the interconnectedness of each of these resource systems and the unique challenges that they face due to climate change, any policy proposals should recognize the impact that the water and energy systems have on food production, distribution, and consumption.

Urbanization and the WFE Nexus

Increasing urbanization around the world is causing significant strain on each of the sectors within the WFE Nexus and is uniquely important when considering urban food deserts. Living in an urban area poses specific challenges with access to food products because of the reliance on the United States national food distribution system. Increasing urbanization is causing strain on the current agricultural system and researchers have proposed the WFE Nexus as a way of conceptualizing the future environmental challenges that agriculture will face (Gragg

et. al, 2018.) Researchers developed a model to view the urbanizing food system in the context of the WFE Nexus, finding that due to the increasing strain on urban environments and resources, many reforms are needed to develop sustainable policy solutions. The authors explain that policies must address the social, economic, and environmental impacts when considering food as the foundation for a healthy community (Gragg et. al, 2018.) This multidimensional model is beneficial because it starts with food as the basis of human settlements and recognizes that it is also deeply connected to the water and energy systems. The authors explain that future policy solutions for agricultural development, urban food system changes, and any alterations to the food, water, or energy systems must be considered through the lens of the WFE Nexus (Gragg et. al, 2018.) This conceptual model provides more perspectives on the social and economic issues related to food access and opens more policy solutions, resources, and stakeholders for the issue of urban food deserts.

In exploring potential policy solutions, it is important to consider the impact that food has on the environment, especially the high amount of water and energy resources that go into food production. A report analyzing energy usage in the United States food system found that over 80% of energy consumption increases from 1997 to 2002 were food related (Cunning, 2010, p. 11.) This shows the increasing use of energy in the food system from the systemic level all the way down to the individual consumer level. By analyzing the energy use in all parts of the food system, researchers identified different energy-intensive steps in the food system that can be targeted for further policy interventions. In examining the greenhouse gas emissions associated with the food system, researchers found that the environmental cost of food production is the major contributor to an individual household's environmental impact (Weber et. al, 2008.) The authors emphasize the individual impact that households have in the greenhouse gases emitted at

all levels of the United States food system, suggesting a need for more individual responsibility in food choices.

There is a significant amount of waste in the United States food system, both in the form of pollution to the environment and in excess food thrown away. The disparity between the number of American households with excess food waste and the number of households living with hunger is alarming. In a study calculating the nutritional value of the United States daily per capita food waste, researchers found significant nutritional value in the discarded food in United States (Spiker et. al, 2017.) Based on their findings, researchers encourage a deeper examination of the United States food supply system in order to redistribute surplus foods and prevent food waste (Spiker et. al, 2017.) This research provides insight into reevaluating the United States food supply system to provide better access to healthy foods for those living in food deserts while also limiting the significant waste of water and energy that has been dedicated to unevenly distributing food across the country.

Resiliency in the Food System

In considering the environmental impacts of the current United States food system and connections with the water and energy systems, environmentally sustainable reforms should be considered. Resiliency is the ability of social-ecological systems to change and persist through challenges (Stringer et. al, 2018,) and this concept should be a priority when reexamining the current food system. The environment is changing so rapidly that any solution must be sustainable for the social and ecological environment and be built to adapt to the unknown future of the water, food, and energy resources. The WFE Nexus naturally recognizes the importance of resiliency in a complex, interconnected system; it is important to integrate these two concepts to

allow for the examination of challenges facing each individual part of the WFE Nexus while exploring ways for them to adapt and grow in the changing climate.

Case Study: Incentivizing Supermarkets

Putting supermarkets in food deserts has been a recent policy idea in the United States to end food deserts, and there have been many national and local initiatives to incentivize supermarkets to locate in low income and low access areas. The federal government has invested $500 million since 2011 into financial incentives for supermarkets in food deserts (Dubowitz et. al, Apr. 2015.) This policy has been proposed as an important step in increasing access to nutritious food options and has been thought to help decrease the transportation costs that residents face who live far from grocery stores. The state of Pennsylvania started the Pennsylvania Fresh Food Financing Initiative (FFFI) as a public-private partnership to provide loans and financial incentives to increase the number of supermarkets in food deserts (Cummins, Flint, & Matthews, 2014.) This initiative was started in 2004 and lasted for six years when the funds were depleted (Cummins, Flint, & Matthews, 2014.) As a part of this program, many state, local, public and private partners were included in order to get supermarkets to take the risk of moving into urban areas.

The state of Pennsylvania has many urban food deserts, specifically in the urban areas of Philadelphia and Pittsburg. These cities have a long history of discriminatory policies that have led to the disparities in food access between inner-city and suburban residents. In response to this growing problem, the state has provided funding for these cities to implement policies to increase access to food. The policy has been to incentivize supermarkets to build new locations in the inner-city, giving residents easier access to grocery stores. Many researchers have used the introduction of supermarkets into food deserts as an opportunity to study the effectiveness of this

policy, and there remains disagreement in the research. While adding supermarkets to food deserts does decrease the distance residents have to travel to shop for food products, most researchers have found this policy to have limited positive effects on the health of the residents.

The Food Trust is a non-profit organization that worked with the state on this initiative after recognizing the effects of limited access to supermarkets on diet-related disease (Karpyn, 2010.) The cities of Philadelphia and Pittsburg worked with Food Trust to develop local initiatives to identify low-income areas of the city that had high rates of obesity and other diet-related disease, empower those communities to seek change, develop policy recommendations to increase access to food, and then implement these policy changes (Karpyn, 2010.) The Pennsylvania FFFI was aimed at incentivizing food stores to build in food deserts, but this policy may ignore the human factor of food choice and economic accessibility.

Philadelphia, Pennsylvania

The city of Philadelphia, PA has a long history of decreasing access to nutritious food options for low-income and minority neighborhoods. In examining the economic influences of how food deserts came about in Philadelphia, it was found that the four largest grocery chains in the city gradually moved out of the urban areas into suburban areas in the 1950s and recent efforts to reestablish locations in the city have failed (Deener, 2017.) Despite efforts to build new stores in predominantly African American neighborhoods, the four main supermarkets were unable to compete with the suburban supermarket model (Deener, 2017, p. 1286.) The reorganization of the food distribution system due to the growth of suburban communities encouraged chain grocery stores to move out of the inner cities to have larger locations and service the whiter, wealthier population in the suburbs. This reorganization continues to harm minority and low-income residents of Philadelphia because grocery stores have no incentive to

move back to urban neighborhoods and stores face financial challenges if they relocate (Deener, 2017, p. 1304.) The food deserts within Philadelphia disproportionally harm minority and low-income neighborhoods and have been caused by free market policies that do not value food as an essential need of all people.

Due to the large disparities in food access within the city of Philadelphia, the city worked with the state of Pennsylvania to implement the Pennsylvania FFFI. The city targeted areas within the city that were classified as food deserts for incentivizing supermarkets to build locations. Many researchers used this as an opportunity to study the shopping habits of residents of a food desert both before and after the addition of a supermarket in their neighborhood (Chrisinger, 2016; Cummins, Flint, & Matthews, 2014; Karpyn et. al, 2020.) In a randomized study interviewing people living in Philadelphia food deserts, researchers found the perception of the nutritious food available to residents to be the most significant factor in dietary outcomes (Karpyn et. al, 2020.) This analysis of residents living in Philadelphia food deserts before the addition of a supermarket indicates that the distance from a supermarket may not be as important as residents' perception of the nutritious food available to them. This study emphasizes the importance of residents' perceptions of the food available and understanding of food nutrition in changing unhealthy eating habits.

The behaviors of the people living in food deserts is just as important as the distance from a supermarket. In order to study this, researchers analyzed the social behaviors of shoppers in a supermarket built under the Pennsylvania FFFI (Chrisinger, 2016.) The study found that easier access to the supermarket did relieve some of the constraints put on shoppers who must take public transportation, have strict budget concerns, or want to shop for more nutritious foods (Chrisinger, 2016.) This indicates that not only does the addition of a supermarket to a food

desert increase the physical access to more nutritious foods, but it may have some positive effects on residents' shopping habits. However, other researchers found that the Pennsylvania FFFI may not have had significantly positive effects on residents' health. Researchers studied two Philadelphia neighborhoods before and after the addition of a supermarket to the community. They found that the opening of the store improved residents' perception of food accessibility but did not lead to any changes in consumption of fruits and vegetables or BMI (Cummins, Flint, & Matthews, 2014.) In interviewing residents, researchers found that few residents adopted the new supermarket as their main food store (Cummins, Flint, & Matthews, 2014.) These results question the efficacy of adding a supermarket to a food desert without other interventions including nutritional education and public health initiatives.

Pittsburg, Pennsylvania

The city of Pittsburg, PA is an area with a large minority population and faces significant challenges in maintaining grocery store chains within the inner-city. Similar to Philadelphia, the city has a long history of large chain stores moving out of the city and into the suburban areas as the white population moved in the 1950s. Pittsburg also participated in the Pennsylvania FFFI in order to encourage supermarkets to come back to the inner-city with the aim of providing more access to nutritious food options. Before the addition of a supermarket to Pittsburg food deserts, researchers studied the food purchasing habits of residents. Researchers conducted a study examining where African American residents of Pittsburg food deserts bought most of their food. This study found that most residents bought their food products from full-service supermarkets despite living far away (Vaughan et. al, 2017.) Researchers also found that most of the non-nutritious foods bought by these residents were at the supermarket (Vaughan et. al, 2017.) These results indicate that despite living far from supermarkets, many residents of Pittsburg food

deserts continue to buy their food at supermarkets at great transportation cost. This indicates that simply adding supermarkets closer to food deserts might not improve the health of residents if their food purchasing behaviors are not altered. A survey study in Pittsburg found that 76% of respondents already do the majority of food shopping at a full-service grocery store (Dubowitz et. al, Apr. 2015,) this information challenges the idea that putting a supermarket into the area is going to help increase access to nutritious food.

After the addition of a supermarket to food deserts in Pittsburg, many researchers used this as a natural experiment to examine the impacts of this policy. In comparing two households in Pittsburg after one had a new supermarket built in the neighborhood, researchers found that the only variable that increased was access to nutritious food and did not see an increase in fruit and vegetable intake, whole grain intake, or decrease in BMI (Dubowitz et. al, Nov. 2015.) Researchers had hypothesized that the addition of a supermarket to the food desert would have increased consumption of nutritious foods, which was the main goal of this policy, but they did not find any difference between the household that received a supermarket and the one that did not (Dubowitz et. al, Nov. 2015.) These results challenge the idea that adding supermarkets to food deserts will increase consumption of nutritious foods and improve the physical health of residents.

In continuing their survey research in Pittsburg, PA, researchers investigated the impacts of the COVID-19 pandemic on residents of two food deserts. Residents of two food deserts in primarily African American neighborhoods in Pittsburg, PA were surveyed from March 23 to May 22, 2020 (Dubowitz et. al, 2021.) Researchers found a dramatic increase in food insecurity from 20.7% in 2018 to 36.9% in 2020 after a steady decline from 2011 (Dubowitz et. al, 2021.) Researchers identified a widening increase in preexisting disparities in access to food for these

residents of color compared to the overall United States population, with a 60% increase in food insecurity in the overall population and an 80% increase in the sample (Dubowitz et. al, 2021.) In this cohort of predominantly African American residents of the Pittsburg, PA urban food deserts, food insecurity is on the rise due to the COVID-19 pandemic. Further policy interventions must be taken to address the emerging economic and health challenges of the pandemic.

Future Policy Implications

The addition of supermarkets to neighborhoods with decreased access to nutritious foods was not found to have a significant impact on residents' purchasing behaviors, consumption of nutritious foods, or physical health. Researchers suggest that placing supermarkets in food deserts is only one aspect of helping people gain access to affordable and nutritious food (Dubowitz et. al, Nov. 2015; Vaughan et. al, 2017; Holzman, 2010.) It is likely that additional policies to address the behavioral, social, cultural, and economic factors impacting food deserts will also be required. There is a need for more evidence-based research into the effectiveness of this policy and local governments should proceed with caution with this policy before the effectiveness of adding supermarkets is better understood. Opening grocery stores in food deserts may be a useful policy but additional evidence-based interventions should be considered as well.

Case Study: Urban Farming

Urban farming has been a proposed policy solution in urban food deserts with large amounts of vacant land. Urban farming has taken many different forms across the country but is mainly defined as growing fruits and vegetables directly in the neighborhoods that have limited access to nutritious food. Many American cities have been developing urban farming programs including Louisville, KY, Chicago, IL, New York, NY, and Detroit, MI (Hashim, 2015.) The urban farming movement has been led by residents of food deserts as they develop vacant land

into community gardens and small farms with the goal of feeding the community. The community-led aspect of this policy conceptualizes urban farming as an effort to ensure food security as a shared community ideal (Hashim, 2015.) Though this initiative is mainly led by the local community, it often requires the support of city governments to use the vacant land and approve the sale and distribution of these food products. Urban farming has the potential to be a very individualized and sustainable policy program because communities can bypass the nationalized food supply system and build self-sufficiency. The city of Detroit, MI has a large urban farming movement in the urban food deserts and residents have developed a large produce market within the community with the support of local government officials.

Food Access in Detroit, Michigan

Detroit, MI has a growing problem with food disparity within the large urban areas. This disparity is especially prevalent in the African American community within the city. Many studies in Detroit have found that lower-income and African American neighborhoods in the city have limited access to more expensive nutritious food options (White, 2011.) The health of minority and lower-income groups in Detroit has been negatively impacted by limited access to affordable food options. Specifically, African American women's health has been impacted as seen by significantly higher rates of obesity, hypertension, and Type 2 diabetes than white women (White, 2011.) The significant difference between white and African American populations' access to affordable and nutritious food is the product of a history of segregation and discriminatory polices within the city. Detroit's food access is a product of the structural racial segregation that has been built into the city's infrastructure (Hashim, 2015.) This combination of structural segregation and de facto segregation from the "white flight" in the 1980s has led to Detroit being socially and economically divided along racial lines (Hashim,

2015.) In order to combat the structural barriers to food access, communities within food deserts in Detroit have turned to urban farming in order to build self-reliance and provide their own source of nutritious food.

The underlying assumption in food deserts is that people who live in disadvantaged communities shop at the few stores located in their food environment, but research identifies a different trend in Detroit. By examining grocery shopping patterns of people located in food deserts, researchers found that people tend to shop outside of their neighborhoods (LeDoux & Vojnovic, 2013.) This study highlights the importance of studying people's shopping behaviors rather than simply the locations of food stores. In studying people's behaviors, more comprehensive policy interventions can be developed that focus on multiple geographical, economic, and social factors that impact the food options available.

An important measure of community health is obesity rates, which have been found to be tied to limited access to nutritious food options. In examining obesity rates in Detroit by census tract, researchers compared obesity rates with the recognized low-income areas and designated food deserts (Koh et. al, 2015.) Researchers found high obesity rates overlapped with 93% of the low-income tracts and 60% of the less nutritious food tracts (Koh et. al, 2015.) The researchers did not observe as much congruency between high obesity prevalence and food desert tracts as they did obesity rates and low-income areas. Researchers propose that this is likely due to the use of supermarket distance as a measure defining food deserts (Koh et. al, 2015.) Because previous research has found that people often leave their own community to shop at the farther away supermarkets, it is likely that the current designations of food deserts in Detroit are not fully representative of food access.

The Goals of Urban Farming

Many urban areas have been considering urban farming as a viable local solution for food access disparities. In Detroit, the community has established urban farming as a local solution to address food deserts and obesity. Many coalitions have formed around urban farming in African American communities in Detroit (Hashim, 2015.) Many urban farming political groups have formed in Detroit over the past decade, focusing on building self-sufficiency and a sense of community. Urban farming coalitions have used many methods to appeal to the state in order to farm the vacant land. In Detroit, groups have used the argument that urban farming will promote community self-sufficiency and stimulate local economic development (Hashim, 2015.)

In interviewing African American women who organize community farming, researchers found that rather than petitioning the government to increase access to food, these women were transforming vacant land themselves to provide for their own community (White, 2011, p. 19.) By taking control of the vacant land and urban farming, these women are taking control of the food resource and no longer relying on policy decisions that have continued to fail them. These women view urban farming as an act of resistance; they are working against the systems that have oppressed them (White, 2011, p. 20.) This community-led approach to food insecurity has allowed for political action and a sense of resistance among the people most impacted by the policies perpetuating food deserts. Urban farming is a type of resistance to capitalism, the corporate influence over the food supply, and the failed city policies that have deprived the African American community in Detroit of access to nutritious foods.

Detroit is a city with very high potential for urban farming because of the large amount of vacant land available. In assessing the food capacity of urban farming in Detroit, researchers found that 31% of seasonal vegetables and 17% of fruits could be supplied on less than 300 acres in the city (Colassanti & Hamm, 2010, p. 41.) Detroit is an example of a deindustrialized city

which has large amounts of vacant land in urban areas because many businesses and residents moved out of the city and into the suburbs in the past decades. In analyzing vacant land in Detroit, researchers conservatively estimate 4,800 vacant, publicly owned acres for potential urban agriculture (Colassanti & Hamm, 2010.) Using less than half of this estimated land, researchers estimate that it could provide two-thirds of fresh vegetables consumed and 40% of fresh fruit consumed (Colassanti & Hamm, 2010.) While there appears to be sufficient land to provide for the city, it remains difficult to estimate and quantify the labor that would need to go into transforming this vacant land into high producing farmland. This high potential for urban farming in the city of Detroit suggests the potential of a successful urban farming policy. There is a lot of potential for city policies to support urban farming by allowing the use of the land, supporting the redevelopment of the land, and funding urban farming efforts.

The D-Town Food Market and the DBCFSN

D-Town in Detroit is a produce market that has emerged to support urban farming and supply the products to residents after the last chain supermarket left the city. This market helps support largely African American urban farmers and provide affordable, local, fresh produce to the disadvantaged urban community (Hashim, 2015.) D-Town began in 2006 as a way of providing food to the local community by African American urban farmers (White, 2010.) It is run by the non-profit Detroit Black Community Food Security Network (DBCFSN) on land that was leased to the group after efforts to lobby the Detroit City Council (White, 2010.) DBCFSN increases the food supply and prevents hunger in their community by using mobilization, education, policy advocacy, and physical improvements to neighborhoods (White, 2011, p. 15-16.) D-Town is an example of how urban farming has greatly provided for the community by taking control of the food supply and building self-reliance rather than relying on large grocery

store chains to provide nutritious food options. This case study demonstrates the ability of urban farming to build a sense of community and activism among people who have been neglected by their local government when it comes to meeting their fundamental needs. This act of resistance to the modern food system allows for a community development of activism and political agency as well as providing fruits and vegetables to a nutritionally deprived community.

Future Policy Implications

Urban farming can build community self-sufficiency in areas that have been neglected by corporations and the food supply system. Detroit is an example of an individualized approach to urban farming and the ability of a local community to take control of their own food supply. This policy has gained popularity recently as climate change threats increase and there is a push for sustainable urbanization (Colassanti & Hamm, 2010, p. 42.) Detroit is just one example of urban farming; this policy has the ability to be implemented on a local level, led by communities to better address the unique concerns of affected areas and the unique environment of each city.

The COVID-19 pandemic has emphasized the importance of developing localized food supply systems, especially for urban areas. Urban agriculture currently supplies 15-20% of the world's food supply (Lal, 2020.) It remains important to systematically develop more urban agriculture to provide a portion of the food system. The large international food supply system relies on huge energy and transportation costs and is especially vulnerable to global disruptions like COVID-19 (Lal, 2020.) Urban farming improves access to nutritious foods, community knowledge about gardening, provides jobs and economic opportunities, and improves the local ecosystem (Lal, 2020.) Urban farming has been a popular policy in the United States and in 2013, 42 million American households were utilizing home gardens or community gardens for a portion of their food supply (Lal, 2020.)

Urban farming has taken many different forms in cities across the United States, from rooftop gardens to small farms developed on vacant land. Many of these initiatives have been community led, with only requests for land use made of the city governments; this increases the community buy-in to the policy and has the potential to be individualized across the country. Urban farming builds community and political activism in food deserts, as in Detroit where African American women have taken a leading role in developing urban farming and the local food market D-Town. This not only provides the physical need of supplying nutritious food options to the residents of the food desert, but also increases awareness and activism in the community about their lack of access to food and the neglect they have experienced by their political leaders.

Policy Proposals

In examining two popular policy proposals it is clear that the issue of food deserts requires a comprehensive solution that addresses the many factors that have led to food access disparities. Many researchers agree that food deserts require a significant government intervention on all levels of government, but there remains disagreement in which policies would be the most effective. It is important to consider the local communities that live in food deserts and the unique challenges that they face if any policies are to be effective. Additionally, the long-term environmental sustainability is important to consider because of the significant resource challenges that climate change poses for the future.

Historical housing, farming, and zoning policies have led to urban food deserts in many communities, but each city has a unique history. These policies continue to significantly impact minority and low-income areas of cities, preventing them from accessing affordable, nutritious, and culturally appropriate food. Researchers found that urban areas in the United States have a

paradoxical epidemic of obesity and food insecurity, and policymakers must engage in ways to address both complex issues (Hashim, 2015.) Previous policies on the local and national level must be reevaluated in addition to creating new policies to alter the structures in place that have created this huge food disparity.

Local Policy Solutions

Local policy solutions have the most direct impact on food deserts because they can include significant community input. In evaluating two popular policies of increasing supermarkets and urban farming in food deserts, both were found to be local policies with mixed impacts. The Pennsylvania policy of incentivizing supermarkets to come back to urban areas was moderately effective at increasing food access in the area. Some researchers found an increase in residents using the supermarket for their food shopping but no overall changes in resident health or food preferences. This policy also does not address the broader problem of the United States food supply system's negative impacts on people and the environment; it only perpetuates the system by increasing the number of large chain supermarket locations. The Detroit policy of urban farming did see an increase in consumption of more nutritious foods, but there is limited research on the health effects of this policy. This policy also built a sense of community activism around the issue of food access in Detroit as people began taking responsibility for providing nutritious food to the community rather than relying on government policy solutions. Urban farming does have the potential for more long-term sustainability if residents focus on growing environmentally appropriate crops; however, some climates will have more potential for growing better crops with larger yields than others. By bypassing the national food system to provide the crops directly to the consumer at a more affordable price, urban farming offers the potential of

self-sufficiency. Both of these policies help residents in food deserts gain access to more food options, but neither are a comprehensive solution alone.

Potential Long-Term Impacts of the COVID-19 Pandemic

The COVID-19 pandemic is furthering the existing disparities in access to food as it disproportionately effects people of low socioeconomic status and communities of color who are already food insecure. Though the pandemic is ongoing, researchers have already seen levels of food insecurity increase past levels seen during the Great Recession (Wolfson and Leung, 2020.) When comparing the African American cohort to national levels of food insecurity, the gap between the two groups had been narrowing since 2011, but in the 2020 sample, researchers saw an increase in the disparity between the sample and the United States levels of food insecurity (Dubowitz et. al, 2021.) This indicates that the disparities in food security are being impacted by COVID-19 and communities of color are facing many more challenges to food access than most of the country. Food insecurity is associated with higher risk of mental health conditions and physical chronic conditions; it is a large long term health cost to have such a large population of people in the United States facing food insecurity (Wolfson and Leung, 2020.) As COVID-19 increases these food disparities and increases the overall health costs of people with chronic conditions, it is important for policymakers to address food and other resource poverty.

The current food supply system is based on many international components that are vulnerable to large disruptions to the global economy, like the COVID-19 pandemic. There is a need to build resilient food systems, reduce food waste, and investigate local food production to address the weaknesses of the current system (Lal, 2020.) Food system resilience is the ability of a food system to provide appropriate access to food despite unforeseen disturbances (Bakalis et. al, 2020.) The strain on the food system was clearly seen during the start of the COVID-19

pandemic where almost all food demand landed on supermarkets. These companies reported significant strain on all levels of their supply system and an inability to cope with this increased demand. Before the pandemic, about 50% of food demand was on supermarkets and 50% was on food services, but due to restaurant and delivery closures early in the pandemic, 100% of demand was on supermarkets (Bakalis et. al, 2020.) There has been a focus in the food system for stability. To put off any significant changes to the system despite signs of greater changes in the future, the focus must now be on resilience, which aims to accommodate these large changes (Worstell, 2020.) Climate change has been impacting the food system and its impact will continue to grow. We must reconceptualize a food system that can adapt to the changing physical world. COVID-19 has created a huge disturbance in the food system that has exposed the decades of putting off a reorganization of the harmful and ineffective food system.

Resiliency in the food system has not been a priority in the past, but there is an opportunity to reorganize this system to be more adaptive to future challenges. Shortening food supply chains has the potential to help build resiliency in the food system. This can be done in multiple ways including helping small-scale farmers market their produce directly and focusing on locally sourced food for large urban areas (Bakalis et. al, 2020; Clapp and Moseley, 2020.) By having shorter supply chains, there is less potential for supply breakdown when a significant event disrupts the entire global economy, like a pandemic. The COVID-19 pandemic has disrupted the global food system; as a result we have seen many new innovations. This reorganization of the food system in response to COVID-19 has the potential to lead to more resilient strategies of food production, distribution, and consumption (Worstell, 2020.) Many areas of the United States have seen a shortening of the food supply chain as the problems with a large nationalized system have come to light. In urban areas, where transmission of COVID-19 is

very high and where many transportation services have been reduced, the challenge of accessing nutritious foods has only increased (Worstell, 2020.) There must be initiatives to increase urban food production and more direct sourcing of food to urban areas. This pandemic offers an opportunity to redesign the United States food system to be better prepared for future disruptions to the economic and environmental systems.

The COVID-19 food crisis is unique compared to past crises because it was an abrupt change in the food system due to many factors. Lockdown measures disrupted the movement of food products through the global supply chain. The global recession has led to massive job losses and loss of income resulting in food insecurity, and uneven food prices in different geographic areas have contributed to high levels of food insecurity in certain areas (Clapp and Moseley, 2020.) The COVID-19 pandemic has induced a food crisis which has been impacted by past food policies that created these vulnerabilities (Clapp and Moseley, 2020.) There has already been a shift towards local food production during the pandemic as the global supply system breaks down. This is an opportunity for smaller actors in the food system to help reshape this system based on the goal of resilience (Clapp and Moseley, 2020.) Urban centers continue to grow in the United States and around the globe with most of the population predicted to be living in urban areas within the next decade (Lal, 2020.) It is urban areas that face significant resource challenges when a large food supply chain system breaks down as they are unable to locally support such large populations. Previous food policies over the past 70 years have led to the industrialized, globalized, and specialized agricultural practices that dominate the food supply system (Clapp and Moseley, 2020.) COVID-19 has shown the fundamental flaws in this system and the need for resiliency in the food system. COVID-19 is a disruption to the food system that provides an opportunity to reorganize the entire system based on resiliency (Worstell, 2020.)

There will be more disruptions in the future and this pandemic has exposed how inadequate the United States food system is at adapting to change.

Broader WFE Nexus Policies

Any policy solutions must be viewed under the WFE Nexus because the food system is impacted by the water and energy systems. A WFE Nexus approach is one in which the connections between all three sectors can be examined and accounted for in the production, distribution, and consumption levels of the food system. As the physical environment continues to face even more strain due to climate change, the long-term impacts of the water, food, and energy resources must be considered. Researchers analyzed the future sustainability of the Food Supply and Distribution System in urban areas in order to discover important factors within the system and how local urban areas can work to sustainably meet the growing food demands of urbanized areas (Armendáriz et. al, 2016.) As urbanization increases, many areas struggle to ensure food security for all its residents and any policy solutions proposed to alter the food system must first be considered with a systems approach (Armendáriz et. al, 2016.) The food system in cities is closely connected to the available resources and environment in the region, but it is also affected by countless other factors including the larger economy, environmental changes, population dynamics, and the different levels of regulation. It is important to consider the interconnectedness of the human population, the natural environment, and the food system in making any policy proposals.

The food system in the United States has been largely based on the free market, preventing people with lower incomes from accessing food and preventing businesses from servicing these people. Previous United States federal government initiatives to end food deserts have used a supply-oriented mindset, assuming that encouraging large supermarkets to move into

urban areas will lead to people buying more nutritious food (Donald, 2013.) However, this approach does not take into account the demand-oriented perspective which focuses on what consumers in the urban area want, need and can afford. The framing of the food desert problem as one of limited access to supermarkets only perpetuates simplistic ideas for policy solutions and encourages the idea that outside actors know what is best for individual communities (Donald, 2013.) The economic drivers of food access must be reexamined in the context of the systemic challenges that are present in modern urban food deserts in the United States. Policies that ignore the impacts of socioeconomic and racial segregation, the structural barriers in the food supply system, and the finite resources of food, water, and energy will not be successful.

In the United States, water and energy are valued as essential services where private and public institutions work to provide access to all people. However, food has never been treated in the same way by government or by private industry. Food must be reconceptualized not only as a human right but an essential service that must be supported by governmental policies in the United States. The food system in the United States has a history of different levels of state intervention in production, distribution, and consumption (Deener, 2017, p. 1287,) but overall the government has never treated food as a human necessity that should be provided to all. Water and energy are regulated by the government and private companies, with very few people in the developed world having limited access to them, but food has not been treated as a public necessity in the same way (Deener, 2017.) The government regulates and subsidizes water and energy but has allowed the free market to monitor the expansion of the food industry, resulting in private companies at all levels of the food industry making decisions based on what consumers can pay, not what consumers need. This leads to limited access to quality food for low-income and minority communities as they are seen as less desirable consumers. By understanding the

food system as part of the WFE Nexus and creating policies recognizing the relationships between the water, food, and energy systems, more can be done to ensure that all residents in the United States are accessing each of these essential needs appropriately.

Conclusion

Food deserts remain a serious public health concern and human rights violation as millions of people in urban areas of the United States do not have access to affordable, nutritious, and culturally appropriate food. The causes of specific urban food deserts are complex and unique to areas across the country, but there is extensive research on potential policies to help alleviate some of this food access disparity. Any policy solutions must be local and individualized to the impacted community, and work to empower the people who have been overlooked by the food supply system. Incentivizing supermarkets to come back to food deserts has been shown to have some effect, but it perpetuates the environmentally harmful food supply system. Urban farming provides an option for self-sufficiency in the local community as well as supplying nutritious foods directly to residents of food deserts. The United States is facing severe inequality in its food system, with increasing food waste contrasted with a growing number of people living without access to nutritious foods. The severe increase in food insecurity due to the COVID-19 pandemic has exposed the problems within the large, nationalized food system. New innovations in the food supply system must be developed to localize production and distribution to build a more resilient system that can provide for vulnerable communities. The food supply system across the country must be reconceptualized to view food as a fundamental human right, and access to nutritious food should be supported by all levels of government in ways similar to access to water and energy. Without these changes, the inequities in food access will continue and health outcomes will continue to worsen.

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