DISSERTATION

WHERE THE WILD THINGS GROW: AN ANALYSIS OF URBAN AGRICULTURE IN U.S. CITIES

Submitted by

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ABSTRACT

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Industrial agriculture produces approximately 24% of the global greenhouse gas emissions emitted annually[1] and agricultural nonpoint source (NPS) pollution is a primary source of water quality degradation to inland and coastal waters, as well as a significant contributor to ground water pollution (EPA 2017; EPA 2022). In the wake of the COVID-19 pandemic in 2022, supermarket food prices have increased 8.6% in the United States and are expected to swell an additional 3 to 4% over the course of 2022 while producers' profit margins continue to grow, with net income increasing by 500% (USDA 2022). Food benefits distributed through the Federal Supplemental Nutrition Assistance Program (SNAP) were threatened with proposed cuts of $4.2 billion during the Trump administration. While the Trump administration's cuts were eventually blocked by Federal courts and the American Rescue Plan of 2021 invested $12 billion to fight hunger, increasing food prices and stagnant wages place a larger burden on lower economic classes, increasing food justice and food security concerns. It's clear that alternatives to the industrial agricultural system are direly needed, and they are indeed actively being sought, primarily at the local level.

Urban agriculture (UA) presents a potential avenue forward, especially to address the social equity concerns inherent in the industrial agriculture system. However, the extant literature on the subject lacks external validity and a comprehensive index of what

[1] Including forestry and land use

efforts cities are employing to combat hunger, inequity, and environmental issues. This dissertation establishes a catalog that demonstrates the wide array of the means by which

U.S. cities are pursuing, attending to, and integrating UA, particularly within the context of sustainability goals; why cities vary in their approach to UA; and how this compares to our understanding of local level sustainability efforts in the extant sustainability literature. To explore these questions the first chapter of this dissertation provides a comprehensive discussion of the UA and sustainability policy context and literature. The second chapter presents an index of municipal programs and policies to examine cities' activities related to UA, with the goal of painting a detailed portrait of the UA landscape in large U.S. cities. With this additive index, UA initiatives are catalogued and U.S. cities with populations over 200,000 are ranked accordingly. The third chapter employs quantitative methods to examine why cities' approaches to UA vary and what factors help explain this variation. This study pays particular attention to eight independent variables related to political ideology, percentage of Hispanic residents, population size and change, median home value, median household incomes, the presence of land grant universities, and adult diabetes rates. Subsequently, the fourth chapter of this research will turn its attention to examining specific cities, for a more comprehensive and qualitative understanding of what initiatives and programs individual cities are engaging in order to provide a richer, more textural, and meticulous understanding of individual cases. Finally, the fifth chapter concludes this research by highlighting key findings and what they mean for current understandings of sustainability initiatives at the municipal level, in addition to avenues for future research.

This research finds that cities are engaging in a wide variety of innovative urban agriculture programs and policies and a vast majority are doing so in the name of sustainability. Many of the same factors that influence the likelihood of a city's pursuit of traditional sustainability policies, such as larger population size, political ideology, and increased wealth, also influence city engagement with UA. However, percentage of Hispanic residents demonstrates an effect contrary to what we would expect in the context of the sustainability literature. Overall, it's clear population size has a dominant effect on how aggressively a city pursues UA. Additionally, the case studies in Chapter Four highlight the importance of a city's relationship with local food policy groups and how participatory a relationship the city and community share regarding UA matters. This research contributes to our understanding of UA in the context of sustainability by providing insights into city attitudes toward UA, cataloging pertinent programs and policies, and offering preliminary explanations as to why cities vary in their efforts. Future research can build upon the foundations this dissertation presents and explore more specific aspects to further the extant literature.

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This research could not have been completed without the patience of my advisor, Susan Opp, the guidance of my committee, and the support of my partner and pup.

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Introduction to Urban Agriculture in the Context of Sustainability

Sustainability has proven itself an elusive concept, particularly for localities attempting to incorporate it into substantive policies and action plans. From the widely referenced Brundtland Commission definition of "meeting the needs of the present without compromising the ability of future generations to meet their own needs" to the more contemporary "three pillars" framework, which incorporates environmental, economic, and social dimensions; sustainability remains conceptually nebulous (WCED 1987, Campbell 1996). Within this framework it is theorized that for sustainability to be truly realized, all three pillars must be recognized as interrelated and equal in importance (Opp and Saunders 2013). In addition to definitional ambiguity, empirical research devoted to sustainability is interdisciplinary and expansive, yet often struggles to incorporate all three pillars into its analysis. Over the last few years, a significant slice of the body of environmental literature focused on the United States has concentrated on sustainability initiatives at the local level in an effort to understand why municipalities exhibit such wide variation in their approaches to this issue (Jepson 2004, Portney 2003, Saha 2009, Saha and Paterson 2008, Opp and Saunders 2013; Opp, Osgood, and Rugeley 2014; Sansom and Portney 2019; Liao et al 2020; Brandtner and Suarez 2021; Fiack et al 2021).

In these efforts to find evidence of the three pillars in local sustainability initiatives, research has catalogued a myriad of city policies and programs, and categorized them as environmental protection, economic development, and/or social equity (Portney 2003, Jepson 2004, Conroy 2006, Saha and Paterson 2008, Opp and Saunders 2013). Across the

breadth of the extant literature, a few common themes emerge. First, the economic and environmental aspects are often the focal points of both research and praxis (Saha 2009, Opp and Saunders 2013). What follows is that the social equity component of sustainability initiatives is often lacking in both consideration and policy, despite its integral relationship with economic stability and ecological health (Saha 2009, Warner 2002, Lubell, Feiock, and Handy 2009). Within this body of literature, examining sustainability at the city level often assumes the form of indexing individual initiatives in a particular city into their respective "Three E's" categories and comparing across the sample. This is often accompanied by conducting case studies or utilizing large-scale survey data to establish generalizability (Portney 2003, Saha 2009, Opp and Saunders 2013, Conroy 2006, Jepson 2004, Saha and Paterson 2008, Lubell, Feiock, and Handy 2009). The subsequent Sustainable Cities and Urban Agriculture section will discuss the extant sustainability literature and common methods for exploring the subject in more detail.

Secondly, aside from cities constrained by limited budgetary resources and ideological divides regarding when, how, and how much to assist citizens who struggle financially, social equity has also been conceptually hard to pin down, both in academia and in praxis. Without a widely agreed upon definition, attempting to outline social sustainability goals and benchmarks can be challenging, particularly for cities lacking Social Justice or Social Equity departments, and the relevant academic literature has been relatively scant until recent years. Urban social sustainability literature has identified multiple physical and non-physical environmental factors included in the social equity discussion, including education and training; social justice; democratic participation; health, quality of life, and well-being; social inclusion; social capital; community cohesion;

safety; reduction in wealth inequality; social networks; cultural traditions; residential stability; green space accessibility; walkable neighborhoods; sustainable urban design; etc (Dempsey et al 2009; Chan and Lee 2008; Turkington and Sangster 2006; Bramley et al 2009). While this list is not comprehensive, it does serve to illuminate the wide range of elements comprising the conversation surrounding social equity.

Opp (2017) distilled the social sustainability literature down into four broad categories: "equal access and opportunity, environmental justice, community and the value of place, and basic human needs" and provided a working definition from a comprehensive social sustainability literature review. Opp (2017) defines social equity as "all people, regardless of race, ethnicity, gender, or income level must have the ability to enjoy equal access to the fruits of public investment, while also being able to satisfy their basic human needs". This definition will serve as a baseline for understanding social equity within the context of UA throughout the following chapters. Having a baseline working definition from which to move forward is essential, particularly if we are to try to determine the indicators defining *how* a city is dedicating its efforts toward social sustainability.

Third, much of the existing sustainability research examines cities' *aggregate* activities related to sustainability across a broad landscape of policy areas. For example, Portney's seminal *Taking Sustainable Cities Seriously* (2003) identifies 38 indicators of sustainability efforts, ranging from renewable energy use by city governments to bicycle ridership programs. Jepson (2004) recognizes 39; Saha and Paterson (2008) find 36; Opp and Saunders (2013) analyze 84. These substantial contributions seek to answer questions regarding what kinds of activities cities are engaging in to promote sustainability, to what extent these actions are undertaken, understanding impediments to municipal action, and

cities' commitment to all three pillars of sustainability (Portney 2003, Jepson 2004, Saha and Paterson 2008, Opp and Saunders 2013).

Contributions to the Literature

This research builds upon the existing, cumulative sustainability research, with a slight directional pivot. Instead of investigating aggregate city efforts toward sustainability, this dissertation focuses on the "Three E's" within a singular policy arena, urban agriculture, by asking the following questions: How are U.S. cities attending to and integrating UA, particularly within the context of sustainability? Why do U.S. cities vary in their approach to UA? How does this compare to what we know about local level sustainability efforts?

The immediate question, of course, is why focus on urban agriculture? This will be subsequently fleshed out in more detail, but in short, because UA efforts at the municipal level in the U.S. have significant environmental, economic, and social impacts, but have not yet been comprehensively catalogued, creating a significant gap in the literature. These facts, compounded with the notion that cities play a dominant role in policy innovation in the United States, provide a fecund and necessary opportunity for inquiry (De Zeeuw 2011, Portney 2003, Saha and Paterson 2008, Opp and Saunders 2013, Rosan and Pearsall 2017, Slavin 2011). As will be discussed further, the claim that UA is indeed an important avenue of sustainability policy is not solely made by this research. In fact, a clearer argument for integration of UA into the sustainability policy portfolio can be derived from cities' behavior. Of the 116 sampled cities, 86 (74%) draw an explicit connection between UA and sustainability, and 65 (56%) specifically include UA in their climate action plans. Perhaps surprisingly given how often research produces evidence of the equity piece of the

sustainability pie being left behind, 77 (66%) of the sampled cities explicitly associate UA efforts with social equity. All but 35 cities, or 70% of the sample, includes UA in their comprehensive/general plans. It is precisely this association with sustainable development in practice that this research seeks to understand and help explain variances thereof, as UA is wildly understudied in the extant sustainability literature given the attention and resources cities are devoting to it. Seventy-five percent of the largest cities in the United States explicitly associate sustainability efforts with UA, yet the literature lacks a comprehensive study of the specific program and policy mechanisms cities might use to operationalize UA to achieve sustainability goals, why municipal approaches may vary, or how UA compares to the existing body of knowledge regarding local sustainability efforts. It is this research's ambition to lay that groundwork and begin to fill these gaps.

Additionally, in the absence of stringent federal environmental regulations and limited federal funding available for food access, as with many environmental initiatives, cities are the current hotspots of progress in the sustainability arena. Gridlock at the federal level has historically been one of the main generators of academic interest in why cities enact the policies they do and why those policies demonstrate so much variation across the country (Klyza and Sousa 2013, Vig and Kraft 2013, Rinfret and Pautz 2014). In the context of UA, there are many contributing factors to why cities feel pressure to innovate: economic incentives, especially with regard to bolstering local economies; limited food access for lower income residents, particularly to nutritious, healthy food; documented benefits of urban green space; accumulating environmental issues from industrial agriculture; revitalization opportunities within city limits, etc.

In addition to positive social and economic outcomes, UA can provide environmental benefits via use and preservation of open space in densely populated urban areas; retaining stormwater; mitigating water pollution; amelioration of the heat island effect; positive microclimate alteration through humidity control, wind protection, and shade; a reduction of food miles traveled; less packaging and processing; revitalization of brownfield sites; improving air quality; encouraging urban biodiversity; as well as resource recycling and conservation (Lovell 2010; Mendes et al 2008; Mougeot 2006; Rosan and Pearsall 2017; Deelstra and Girardet 2000; Vitiello and Nairn 2009; Vitiello 2008; Lovell and Johnston 2009; Bohn and Viljoen 2005; Goddard 2006; Holmer and Drescher 2005; Midmore and Jansen 2003; Smit et al 1996; APA Food System Planning Committee 2006).

Each of these will be discussed more specifically, but the main takeaway at this juncture is that there are many, many reasons cities enact UA policies, but before we can understand the *why*, we first have to understand the parameters of the *what*, which is why this research devotes its second chapter to cataloging and indexing UA efforts across the large U.S. municipalities; specific case selection parameters will be discussed in greater detail in later sections. The absence of a comprehensive national understanding of what UA tools cities are employing presents a substantial gap in both the UA and broader sustainability bodies of literature. If we lack a clear picture of what is being done, it's quite difficult to hypothesize about why.

This research seeks to supplement the extant literature with a robust evaluation of urban agriculture programs and policies in large U.S. cities. Much research is devoted to other avenues of sustainability policy (e.g., public transportation, energy efficiency, green buildings, storm water, electric vehicles, air pollution reduction measures, etc.), but there is

a significant gap in comprehensive urban agriculture policy studies, despite a majority (74%) of large U.S. cities explicitly drawing connections between sustainability goals and UA efforts. As will be fleshed out, UA can have a significant effect on a city's environment, economy, and measures of social equity. Since UA is a tool that cities are currently using to address pressing problems, particularly those that fall within the sustainability arena, the existing body of research needs expanded upon to increase the academic understanding of how UA functions as a facet of municipal sustainability policy.

Additionally, this sample is not constrained by geographic barriers, increasing the generalizability of the findings. Limited generalizability has constrained previous empirical sustainability research (Saha and Paterson 2008, Conroy 2006, Portney 2003). Small *n* studies provide rich texture and detail with regard to a few cities, but since the resulting conclusions are drawn from a relatively narrow sample, it is precarious to generalize much further. To alleviate this concern, as well as those related to selection bias, this dissertation presents a sample that includes the 116 largest cities across the U.S., and is inclusive of 36 states, plus the District of Columbia. In doing so, a diverse array of U.S. city populations with wide variation in demographics are able to be evaluated. This larger sample provides insight into what cities are doing to further their climate action goals via UA and why these actions and related attitudes vary widely from city to city – a valuable addition to the pertinent extant literature. While single city UA case studies do exist, this research gives external validity to the literature by performing case studies based on a comprehensive index and scoring system, providing an insight not yet realized by previous research. Moreover, many of the social equity questions surrounding UA require a certain level of detail with regard to process and deliberative aspects of program and policy formulation, a

level best realized via case studies, as Chapter Four will demonstrate. Now that the research questions have been introduced and contextualized, the remainder of this chapter will provide a review of the literature related to sustainability and urban agriculture.

Sustainable Cities and Urban Agriculture

If a city's efforts are to be considered truly sustainable, they must recognize the interrelatedness of equity, the economy, and the environment when implementing policies and programs to ensure an equitable distribution of resources, services, and opportunities, as well as the negative externalities of existing society and its development (Campbell 1996, Agyeman 2013, Agyeman et al 2005). There is no one size fits all approach to achieving this goal, making the potential range of solutions markedly more complex and localized. While localized solutions can significantly contribute to long term sustainability efforts, due to their inherently limited nature, they can often require more innovative antidotes (Agyeman et al 2005, Alkon and Agyeman 2011). As Hawkins et al (2016) points out, "The variation in environmental conditions both between and within cities, past growth experiences, potential for future development, and the social issues that have plagued many cities over the last 50 years makes the challenge of reconciling these objectives more pronounced". Since cities are the primary drivers of sustainability efforts in the current U.S. context, it's integral to understand how these mechanisms and pillars are considered and function in practice.

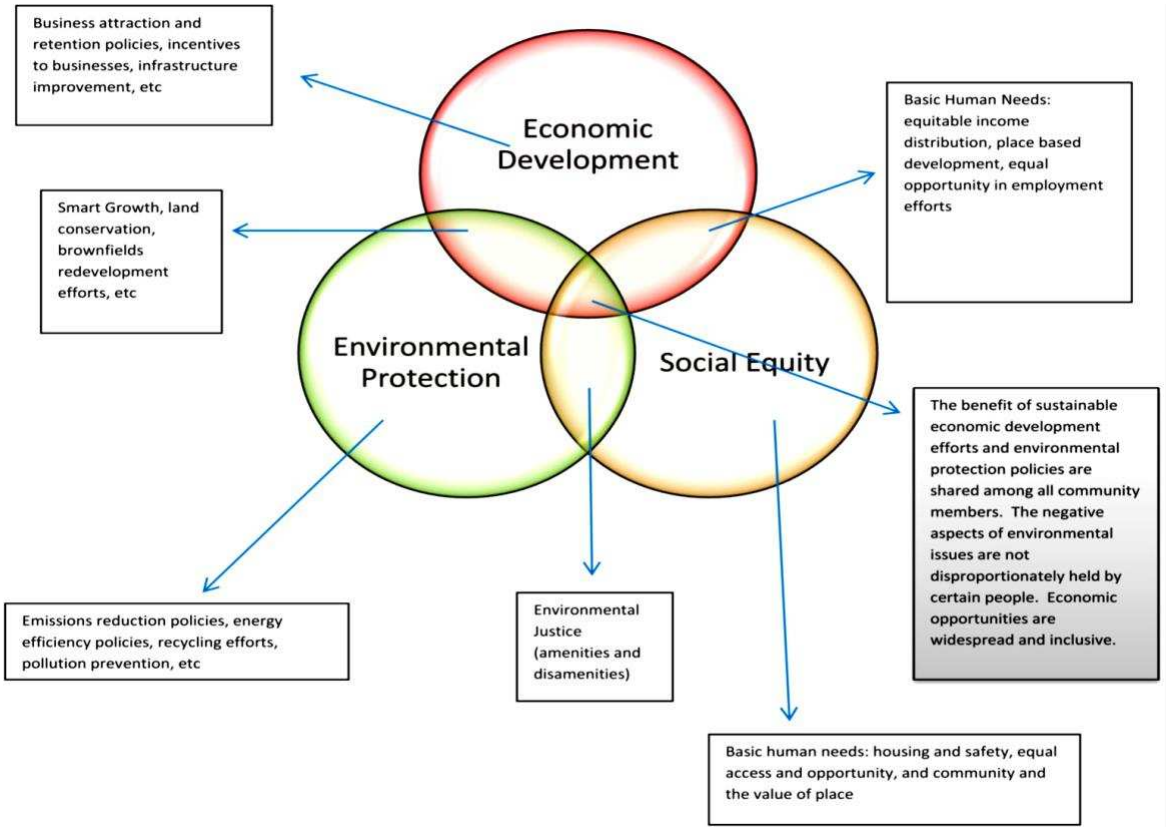


Figure 1: Three Pillars of Sustainability (Opp 2017)

As indicated in Figure 1, the environmental, economic, and social equity spheres can operate independently in many policy areas, but the overlapping segment in the middle is indicative of the types of policies that promote not only environmental protection and economic development, but also social equity (Opp 2017). When evaluating Figure 1, it is evident how complex the creation and implementation of truly sustainable policies can be for city governments, and why attempts to successfully incorporate all three pillars frequently fall short. Assessing aggregate sustainability efforts provides valuable insight into a city's priorities and values, and comparisons across cities even more so. Overwhelmingly, the results of this category of research reinforce the emphasis cities place upon economic and environmental considerations and how often the social equity pillar is

left behind. Sustainability, and evolutions of its academic understandings will be explored first, followed by a review of the UA literature.

Sustainability

Since its inception, the concept of sustainability has garnered increasing attention from academia, practitioners, and environmentalists. On the heels of the 1960s environmental movement in the United States, Meadows et al (1972) published *Limits to Growth*, suggesting via mathematical models that global population, food production, industrialization, pollution, and natural resource consumption were increasing exponentially. They posited, if unchecked, this rate of growth would eventually exhaust the planet, as the ecological systems humans rely on are interlocking and dependent upon one another's health for sustained survival (Meadows et al 1972). Early sustainability research embraced a Malthusian conception of the limits, or carrying capacity, of the Earth, and sought to understand the potentialities of ecological collapse and its ramifications on human existence (Emmett 2006). Central to this body of scholarship is the dichotomy between economic growth and ecological health, predicated upon the concern that unrestrained human activity is depleting natural resources faster than they can replenish, leading to ecological disaster.

Sustainability, then, was initially associated with drastically modifying collective human behavior in the interest of severely limiting economic growth, so as not to exceed the Earth's carrying capacity. As this area of research progressed, more scholars began to see economic growth and environmental protection as not necessarily antithetical to one another (Kidd 1992). This evolution of the larger sustainability discussion was significant, as it introduced the idea that economic development, if managed properly, could also be

environmentally conscientious. The Brundtland Commission codified this idea of developing within the planet's means in their 1987 report *Our Common Future* (WCED 1987). In addition, the Brundtland report (1987) underscored the importance of considering social equity an integral piece of sustainable development and brought these ideas to the forefront of the 1992 Rio de Janiero United Nations Earth Summit. One of the Earth Summit's resolutions, Agenda 21, emphasized the key role of local governments in promoting the principles of sustainable development (Portney 2003).

Despite the foundational international concurrence that future development should integrate sustainability, a precise definition, or standardized measurable benchmarks, were not established (Mazmanian and Kraft 2009, Portney 2003). Despite the persistence of this definitional ambiguity, a majority of scholars agree there are three main components, or pillars, of sustainability: environmental protection, social equity, and sustainable economic development (Adams 2006, Portney 2003, Opp and Saunders 2013, Jepson 2004, Saha 2009, Saha and Paterson 2008). As much of the empirical research has focused on the environmental and economic aspects, many sustainability advocates have drawn attention to the interrelatedness of the three dimensions, particularly emphasizing the importance of social equity as an *equal* pillar of legitimately sustainable communities (Saha 2009, Saha and Patterson 2008, Middleton and O'Keefe 2001, Opp and Saunders 2013, Portney 2003, Campbell 1996). Moreover, scholars posit that sustainability cannot truly exist if equity issues are present because inequality contributes to economic and societal instability (Agyeman 2013; Liao et al 2019; Fiack et al 2021).

The 1992 Earth Summit recognized the essential role local governments must play in fostering truly sustainable development. As roughly 55% of the global population, and

65% of the U.S. population, currently lives in urban areas, cities are the most empirically appropriate unit of analysis to understand sustainability efforts on a broad scale (United Nations 2018, United States Census 2015). In the United States in particular, cities are especially paramount to sustainability efforts. Not only because they are home to a majority of the population, but also because of the legislative gridlock regarding environmental issues at the national level (Klyza and Sousa 2013; Portney 2013). However, the U.S. system of decentralized federalism has allowed states broad innovative discretion in their approaches to sustainability (Klyza and Sousa 2013, Vig and Kraft 2013, Rinfret and Pautz 2014).

In addition to the anti-environmental ideological climate and devolution of environmental responsibilities to the states, the U.S. government has consistently advocated for an increasing globalization of the economy. Globalization has precipitated expansive transformations of local economies, ushering in an era of post-industrialization for many U.S. cities previously dependent upon domestic manufacturing (Portney 2003, Saha 2009). As corporations outsourced their manufacturing operations overseas, and previously influential local businesses were subsumed into divisions of these multinational corporations, their presence in local politics subsided. This shift gave local governments room to experiment with newer, more progressive models of sustainable development (Portney 2003, Feiock and Stream 2001, Rinfret and Pautz 2014). While municipal governments are certainly limited, by a variety of factors, in what policies they can enact and how they can increase revenue, there is some evidence to suggest cities can act as effective mechanisms for achieving sustainability goals (Tiebout 1956, Marvin and Guy 1998, Selman 1996). This is partly attributable to a NIMBY-ism of sorts, the idea citizens

will respond to environmental issues they experience in their daily lives, and also because of city governments' tendency to exhibit higher levels of responsiveness to the concerns of their residents. These factors have resulted in a wide variation of approaches to sustainability across localities, but have simultaneously allowed some cities, such as San Francisco and Portland, to make sweeping strides toward comprehensively integrating the pillars of sustainability into their respective governments and communities.

As briefly mentioned in the introduction to this chapter, notable sustainability scholars have created indices to catalog cities' sustainability efforts. Portney (2003), in *Taking Sustainable Cities Seriously*, identified indicators across multiple categories and ranked 24 cities according to how many of the indicators each engaged with in a public policy context. While there are methodological issues with Portney's (2003), such as limited sample size, selection bias, and lack of attention to social equity, his index and ranking system laid the foundation for other city-focused sustainability research. In 2004, Jepson built off of Portney's (2003) work, but used survey data from mid to large size cities across the U.S. Saha and Paterson (2008) explicitly sought to identify city efforts toward incorporating all three pillars of sustainability, as opposed to strictly environmental protection or sustainable economic development. Opp and Saunders (2013) developed an index in which all three pillars are equal, for a more comprehensive measure of municipal pursuits of sustainability. While this is not the most recent work to date, it does offer a closely aligned launching pad for this dissertation. Sustainability index literature has deepened in complexity and broadened in scope due to increasing accessibility of data over the last few years (Hauer et al 2018; Ovchynnikova 2019; Sansom and Portney 2019; Rodriguez-Plesa et al 2022; etc.) This research builds off of previous sustainable cities

research and seeks to understand if and how equally cities approach the three pillars of sustainability within the specific context of urban agriculture.

Just Sustainability

In recent decades, an avenue of research focusing on just sustainability has emerged. Within the just sustainability framework, four conditions must be met: improvements in quality of life and wellbeing for all; meet the needs of present and future generations; equity and justice with regard to processes, practices, and outcomes; and living within the limits of the planet's ecosystem (Campbell 1996, Schlosberg 1999, Agyeman 2003, Agyeman 2013, Agyeman et al 2005). While this research tends to discuss sustainability in the context of the three pillars or E's, it's important to include the expanded equity elements of the just sustainability framework, particularly because food and nutrition are central tenets of the concerns surrounding inequality in the U.S. The interrelated nature of the principles of sustainability underscores the importance of all elements being present in public sector policies and actions labeled as sustainable. As Agyeman (2013) found,

> "Virtually every contemporary social and environmental problem – violence, obesity, drugs, physical and mental illness, life expectancy, carbon footprint, community life and social relations, long working hours, teen birthrates, educational performance, prison populations, you name it – is more likely to be worse in less equal societies" (Agyeman 2013, 5).

Social equity and inequality issues, then, heavily contribute to, and in many cases actually produce, negative effects on public health, the economy, and the environment. Research suggests nations with a greater commitment to equity, as measured by metrics such as more equal income distribution, well-entrenched and defended civil rights and liberties, and positive educational measurements, are more likely to have better environmental

quality than states exhibiting higher levels of inequality across the same metrics (Campbell 1996, Agyeman et al 2005, Torras and Boyce 1998).

Environmental Justice

In more unequal states, the poor bear the brunt of negative environmental externalities, despite not being a primary source of pollution or environmental harm. The extant literature suggests minority and poverty-stricken populations are less likely to live in environmentally progressive cities, a situation that must be remedied by a locality's engagement with social justice, if any progress that locality makes is to be considered genuinely incorporative of sustainability as it is understood through the context of the three pillars (Saha 2009, Campbell 2006). This unequal distribution of environmental burden and its impacts are two of the main focal points of environmental justice (EJ) as a concept and area of study. Environmental justice shares a similar conceptual struggle with sustainability: there are many conflicting arguments regarding the specifics of its definition. For example, some EJ scholars fall into an ideological camp characterized by restrictive properties, such as who can claim environmental injustice, distinct boundaries between social justice and sustainability, etc.; whereas other researchers such as David Schlosberg advocate for a more inclusive perspective (Dobson 2003, Getches and Pellow 2002, Schlosberg 2007). Schlosberg (2007) calls for an expansion of the definition of EJ to comprise not only individual and human harm, but also injustices perpetuated against communities and the nonhuman world. These crucial debates, and others like them, have laid the theoretical groundwork of the operative definitions and understandings of EJ and allowed for the fashioning of a more practical distillation of the concept that's accessible to public administrators. In *Sustainable Communities and the Challenges of Environmental*

Justice, Agyeman (2005) cites a definition from the Massachusetts "Environmental Justice Policy":

> Environmental justice is based on the principle that all people have a right to be protected from environmental pollution and to live in and enjoy a clean and healthful environment. Environmental Justice is the equal protection and meaningful involvement of all people with respect to the development, implementation and enforcement of environmental laws, regulations and policies and the equitable distribution of environmental benefits (Commonwealth of Massachusetts 2002 in Agyeman 2005).

The particular feature of this definition Agyeman focuses on are the inclusion of aspects of procedural justice, substantive justice, and distributive justice (Agyeman 2005). According to Agyeman by involving all people, incorporating the right to live in a healthy environment, and addressing an equitable distribution of environmental benefits, this definition meets the criteria for EJ by his definition which states "environmental justice should not only be reactive to environmental bads…but that it should also be proactive in the distribution and achievement of environmental goods" (Agyeman 2005, 26).

In a more just society, negative externalities would be more equally distributed or eliminated altogether. In the context of sustainability, unequal conditions render long term stability across all three spheres highly unlikely (Haughton 1999, Agyeman et al 2005). Thus, if the roots of social injustice are not actively being addressed by sustainability efforts, the resulting imbalances will perpetuate economic instability and environmental degradation. Social equity's significant effects on the likelihood of success in achieving sustainability goals are one of the myriad causes for concern that it remains understudied and under-implemented in academia and public administration, respectively.

Urban Agriculture

The United Nations (UN) began researching UA in the 1980s, primarily focusing on the Global South at first due to the significant impacts UA had on increasing food security in

Latin American and African cities (Mougeot 2006). In the Global South, UA directly increases the incomes of a much higher percentage of households than is typical in the Global North, a type of contribution much more easily measured and quantified than the community gardens and community supported agriculture operations more common to Global North UA (Ackerman et al 2014, Mougeot 2005, 2006, Siegner et al 2018). While UA has considerable economic and environmental benefits that will be subsequently discussed, this research is more conceptually interested in the social equity elements, particularly food justice (FJ), food security (FS), and food access (FA), as those are where the most sustainability gains from UA are likely realized in U.S. cities, as well as in the Global South; the nexus between UA and these issues will be examined in depth in the remainder of this chapter. (Mougeot 2006, Rosan and Pearsall 2017).

Urban agriculture encompasses a wide variety of activities, but can generally be defined as "the growing, processing, and distributing of food and other products through intensive plant cultivation and animal husbandry in and around cities". (Brown and Carter 2003). The primary agricultural activities comprising UA are urban farms, rooftop gardens, community gardens (CGs), farmers markets (FMs), farm stands, community supported agriculture ventures (CSAs), vertical gardening, hydroponics, aquaponics, beekeeping, backyard chickens and/or livestock (Rosan and Pearsall 2018; McClintock et al 2012; Voigt 2011; Berg 2014; Grapentine 2015). Regional food systems can significantly contribute to UA efforts but are not included in this research due to the municipal level constraints on the unit of analysis.

While UA is certainly not new, agriculture was largely phased out of U.S. cities in the early 20th century for a constellation of reasons. This period in U.S. history marked massive

rural to urban migration; technological advances, such as improved urban sewage and sanitation, irrigation, refrigeration, large scale national food transportation and processing, and industrial farming; as well as seismic economic shifts, both before and after the Great Depression (Grapentine 2015; Rosan and Pearsall 2017; Mendes et al 2008; Voigt 2011; Brown and Carter 2003; Mougeot 1994, 2006; Pothukuchi and Kaufman 1999, 2000). The combination of these factors resulted in agriculture moving farther and farther away from densely populated urban centers to outlying suburban and rural areas. As agricultural technology industrialized and farming operations grew in size, city planners and residents became concerned with some of the externalities of agricultural practices, such as pesticides, zoonotic disease transmission, sanitation, animal husbandry odors, mechanical noise, public health concerns, etc. (Voigt 2011; Mougeot 2006; Mendes et al 2008; Grapentine 2015).

The advent of Euclidean zoning also represents a causative factor in the historical relationship between urban areas and agricultural activities (Grapentine 2015; Juergensmeyer and Roberts 2013; Salkin 2011). Euclidean zoning essentially serves as a mechanism to avoid activity-focused land use conflicts by classifying property into single use zones. For example, conflicting activities, such as industrial chemical manufacturing and residential properties, are segregated from each other by zone based on activity or use. Additionally, research dating back to the 1880s suggests agriculture in the urban context was perceived as a temporary activity, until a more productive land use could occur. Historically, the temporary municipal acceptance periods of UA correlate strongly with times of economic recession when average consumers could no longer afford mass

produced food. (Grapentine 2015, Rosan and Pearsall 2017; Salkin 2011; Bassett 1979; Lawson 2004, 2005; Bentley 1998; McDowell 1915, 1922, 1924; Kurtz 2001).

Since the initial migration of agricultural activities to suburban and rural areas in the early 20th century, UA has experienced a few more recent resurgences. During WWII, Victory Gardens were common across U.S. households, in support of the war and the pressure it was exerting on the commercial food supply (Salkin 2011; Bassett 1979; Lawson 2004; Grapentine 2015; Juergensmeyer and Roberts 2013). After the war, the U.S. economy boomed and Victory Gardens subsided, as the middle class achieved wide-spread affluence. UA appeared on the agricultural landscape again in the early 1970s, in response to the burgeoning environmental movement, and concerns regarding pesticides and the industrial food system (Lawson 2005; Rosan and Pearsall 2017; Pollan and Roberts 2014; Yellin 2013; Rivera 2013). Slow, but steady, growth has followed the UA push of the 1970s. The movement gained more momentum throughout the 1990s, as concerns regarding chemical use intensified and demand for organic food grew rapidly. In the last few decades, the popularity of UA has increased significantly, partly due to sustainability and localism garnering the attention of consumers, and therefore local governments; but also because of the scholarly push to understand sustainability through the lens of the "Three E's", and the subsequent rising concerns regarding the lack of attention to the social equity pillar (Rosan and Pearsall 2017; McClintock et al 2012). It should be noted that the more modern revival of UA is strongly associated with niche and affluent markets simply due to the consumers who can afford locally produced food without government assistance, as governments subsidizing local food is a relatively new occurrence. Alongside the resurgence of UA in more recent years, an urban homesteading movement has risen, in addition to the maker

movement. The maker movement's primary ideological alignment is with quality of place for sustainable development, with a focus on do-it-yourself entrepreneurs sharing 'makerspaces' at the individual and community levels (Opp 2018). Research suggests local governments could potentially utilize these movements as an instrument for revitalization and to assist with achieving sustainability goals (Opp 2018). As with UA, these avenues for participation in the local economy can allow oft marginalized communities to engage directly in the local economy in ways suited to the skills honed by their community's experience and culture, and thus, engage directly with the solution.

In the current UA climate, the incorporation of agriculture into city planning efforts is occurring across a wide variety of U.S. cities, as a mechanism to address a spectrum of urban challenges in a sustainable manner (Thibert 2012; Florida 2014; Rosan and Pearsall 2017; McClintock et al 2012). Cities are undertaking efforts to increase farmers markets; introduce farm to school programs; create land banks to increase legal protection for community spaces; recognize UA in blight-focused strategic redevelopment plans; incorporate UA into city comprehensive plans and zoning ordinances; and streamline permitting and land disposition processes, among others (Rosan and Pearsall 2017; Delaware Valley Regional Planning Commission 2010; Mendes et al 2012; McClintock et al 2012). Many of these efforts to institutionalize UA into city sustainability plans have experienced success. However, significant constraints on UA frequently remain.

Restrictive zoning ordinances are some of the most common barriers to UA. Many zoning codes may create roadblocks that impede UA development, such as imposing height restrictions on vegetation; barring greenhouses and hoop houses; mandating fencing requirements; banning rooftop gardens; prohibiting animal husbandry or beekeeping; or

disallowing the sale of produce grown on site (Berg 2014; Grapentine 2015; Rosan and Pearsall 2017). Many of these restrictions originate from municipal governments' definitions of permitted uses and public nuisances. Odors, traffic, and aesthetic issues contribute to restrictive zoning, as policymakers can have difficulty managing the conflicts that can arise with neighboring property owners. While smaller scale UA ventures tend to not engender much resistance, the same cannot necessarily be said for commercial-scale gardens and animal husbandry. Cities can curb the amount of potential conflict with a variety of mechanisms, such as restricting the hours within which commercial farms can accept deliveries or conduct sales or limiting the number and type of animals allowed (e.g., allowing chickens, but prohibiting roosters). Some cities may offer conditional use permits or allow community gardens as a permitted use on vacant lots as smaller, more controlled steps toward incorporating UA than outright blanket changes to municipal code (Grapentine 2015; Voigt 2011; Bouvier 2015).

As Smart Growth ideology has become more popular in recent years, Euclidean zoning has given way to a higher prevalence of mixed-use zoning. These broad changes have allowed cities to include UA in their Comprehensive Plans, allowing further integration of UA into urban areas over time. For example, in 2010 when Philadelphia officials were developing the *Philadelphia 2035* Comprehensive Plan, they explicitly incorporated UA in a few key ways: maximize multimodal access to fresh food, establish farmers' market corridors, increase local food production through zoning designations that would permit UA as-of right, and develop transparent standards and guidelines for community gardens to ensure continuity (Rosan and Pearsall 2017; City of Philadelphia 2010). When a city takes explicit measures to codify allowances for UA that are designed

with a focus on the principles of equality as Philadelphia has, it allows UA to flourish and become entrenched in the social and economic fabric of not only the immediate neighborhood, but of the city itself.

In the last few decades, well managed and supported urban agriculture has emerged in U.S. cities as a potential, partial solution to some of cities' most pressing problems. A growing body of recent research supports UA as a potential vehicle for both individual and community health; promoting food security, particularly for disadvantaged communities; economic development; crime prevention; environmental benefits; and increased green space; as well as youth education, development, and employment, primarily in low-income communities, among others (Draper and Freedman 2010; Rosan and Pearsall 2017; Alaimo et al 2008; D'Abundo and Carden 2008; Shinew, Glover, and Parry 2004; Blair 2009; Wachter 2004; Voicu and Been 2008; Armstrong 2000; Firth, Maye, and Pearson 2011; Ferris, Norman, and Sempik 2001; Alkon and Agyeman 2011; Thibert 2012).

As discussed, one of the primary focal points of sustainability research is the interwoven and overlapping nature of the three pillars, and the contention that true sustainability can only occur if all three pillars are present and equally attended to across a city's efforts. With regard to UA, the social equity pillar at first took a backseat to studies more concentrated on environmental and economic benefits. However, in recent years, as the academic and practitioner understandings of sustainability have evolved, social equity has advanced to the forefront of UA, both in the context of associated positive impacts, but also the most critical questions. Given the strong place-based correlations between environmentally conscious localities and the prevalence of white, educated, and wealthy residents, social equity, food justice, food equity, and food access concerns are justified

when the positive environmental and economic benefits of UA are considered (Portney 2003; Rosan and Pearsall 2017).

The extant literature robustly supports the positive effects community gardening can have on individual health. As previously mentioned, many studies report findings indicative of desirable dietary, mental, and physical results obtained from participation in community gardening activities, which can not only improve residents' quality of life, but also reduce long term health care costs, particularly those associated with chronic conditions, such as obesity and type II diabetes (Draper and Freedman 2010; D'Abundo and Carden 2008; Schusler et al 2018; Lawson 2007). Many large *n* studies have shown strong correlations between access to and increases in green space and improved mental health, often with the most dramatic reductions in depression and anxiety for low-income individuals (Beyer et al 2014; Nutsford, Pearson, and Kingham 2013; Cohen-Cline, Turkheimer, and Duncan 2015; Welch, Byrne, and Newell 2014).

It should be noted that a potential side effect of incorporation of UA into a city's landscape can contribute to gentrification in some neighborhoods simply due to its positive consequences and aesthetic value. Gentrification is commonly understood as the process of neighborhoods shifting from low-value to high-value, often catalyzed by public policies and/or real estate development (CDC 2009). Environmental gentrification specifically results from green policies improving the desirability of certain neighborhoods, such as the installation of a new light-rail line or the removal of blight that's replaced with community gardens, parks, and green space, for example. Immergluck and Balan (2017) describe environmental gentrification:

"Large-scale, sustainable urban development projects can transform surrounding neighborhoods. Without precautionary policies, environmental amenities produced by

these projects, such as parks, trails, walkability, and higher-density development, tend to result in higher land and housing costs. This will make it harder for a low- and moderate-income households to live near the projects, and neighborhoods are likely to become increasingly affluent" (Immergluck and Balan 2017, 1).

Environmental gentrification is a relatively frequent occurrence in some areas due to the tendency for governments to focus on economic development and is a primary reason the particular tools cities choose to utilize when deciding to engage in sustainable development are critically important to protecting less affluent residents from inequities. Gentrification is a particularly thorny issue with regard to UA, and sustainability policy in general, because research suggests while cities that link sustainability initiatives with economic development are more aggressively pursuing sustainability, they are primarily focused on sustainability policies that provide the most co-benefits, such as increased revenue (Osgood, Opp, and DeMasters 2016). It is plausible this behavior could also be evident in how cities choose which UA policies to implement. While beyond the scope of this dissertation, future endeavors could create an index similar to that Osgood, Opp, and DeMasters (2016) constructed, designed to focus only on those policies without the potential for co-benefits (6).

While the greening of cities creates an avenue for gentrification, cities have tools at their disposal to protect green space and gardens, which will be discussed in detail in Chapter 2. Furthermore, in addition to individual or community health benefits, UA has been used as a tool to address food insecurity in the urban United States. Blighted communities not only suffer from social, economic, and public safety concerns; they are also affected by public health concerns, such as food deserts. Food deserts are communities in which mainstream grocery stores are either absent or not accessible for low-income shoppers. The USDA considers an urban food desert to be any area in which a grocery store

retailing fresh produce is farther than one mile in any direction (USDA 2015; Treece 2016). Food deserts restrict low-income populations' access to healthy food (Treece 2016; USDA 2013).

For example, the last national-level grocery store chain left the city of Detroit in 2007 and two out of every three residents do not own personal vehicles. The City of Detroit estimates 72% of its population resides in food deserts (City of Detroit 2015, USDA 2018). UA can help increase food supplies in communities with these characteristics by providing a healthy source of food. Cities, such as Detroit, have created land banks and land trusts to allow UA practitioners a sense of security in the land parcels they cultivate, in an effort to provide continuity of these efforts and avoid developers from purchasing the land should neighborhood property values increase. Many commercial UA ventures donate a percentage of the food produced to low-income communities or schools, in an effort to preserve this benefit for disadvantaged communities. Efforts to secure UA land for the community and emphasize the upholding of the social equity pillar vary widely from city to city. Some cities, such as Philadelphia and Portland, have enacted explicit measures to ensure low-income communities receive a vast majority of the UA benefits, including land banks, land trusts, donation requirements, employment requirements, dollar for dollar matching for Supplemental Nutrition Assistance Program (SNAP) benefits at farmers markets, etc. When these types of measures are implemented, UA moves toward fulfilling all three pillars of sustainability in the municipal context.

In addition to an increased consumption of vegetables and resulting health benefits, such as lower adult diabetes rates, individuals interested in the locavore movement often express dissatisfaction and a lack of trust with the industrial food system. Participating in

UA, whether by physically gardening or contributing economically, generally elicits feelings of efficacy and a heightened sense of community (Specht et al 2014; Draper and Freedman 2010; Pollans and Roberts 2014). Across the existing literature, these effects are amplified for disadvantaged urban youth. Multiple studies have reinforced the correlation between youth participation in UA and likelihood of consuming more fruits and vegetables (Draper and Freedman 2010; Raja et al 2008; Hubley 2011). Beyond dietary improvements for youth, UA provides employment opportunities for urban youth to not only earn income, but to develop interpersonal and job-related skills (Krasny and Tidball 2009; Pudup 2008). As Chapter Two will demonstrate, many cities offer UA-related workforce training programs and promote or subsidize living wage jobs in local agriculture.

UA research has also proven successful at building community ties and social capital. Multiple social processes are fostered by participation in UA, including mutual trust and reciprocity. These processes have been found to transcend the UA context and translate into a stronger perception of community (D'Abundo and Carden 2008; Hannah and Oh 2000; Lawson 2007). This can be particularly important when cities use UA as a tool to welcome immigrant or refugee communities, which many of the sampled cities do. Additionally, crime prevention, whether an intentional purpose of the type of UA initiated or an unintended benefit of neighborhood beautification, has been particularly valuable for low-income urban neighborhoods. Residents and participants reported feeling safer after UA was established in their neighborhood and noticed a decrease in petty thefts and vandalizing behaviors (Draper and Freedman 2010; Pudup 2008). As vacant lots are transformed into community gardens and urban farms, the increase in community traffic and activity leaves less opportunity for illicit behaviors. In these ways, UA can provide

avenues of civic and community engagement to which disadvantaged neighborhoods may not otherwise have access.

Food Justice

As it pertains to UA and food access in general, often referred to comprehensively as food justice, social inequities are starkly illustrated. Defining food justice has been a moving target with many parallels to environmental and social justice, mostly due to FJ's analogous roots in economic and racial inequality. This dissertation will borrow its working definition from Gottlieb and Joshi's (2013) seminal book, *Food Justice*:

> "…we characterize food justice as ensuring that the benefits and risks of where, what, and how food is grown and produced, transported, and distributed, and accessed and eaten are shared fairly."

There is considerable evidence to support the argument that each aforementioned element of FJ as defined above is a significant problem in the United States, and one not limited to urban areas. Food security, then, is an important concern that partially comprises the broader FJ arena. For the purposes of this dissertation, FS will be defined as by Mougeot (2006) to mean:

> "…that food is available at all times; that all persons have means of access to it; that it is nutritionally adequate in terms of quantity, quality, and variety; and that it is acceptable within the given culture. Only when all these conditions are in place can a population be considered "food secure."

For clarity, food access is more narrowly understood as the physical ability to procure affordable fresh food (Gottlieb and Joshi 2013). Research has demonstrated that lack of access to nutritious food has many long-term health consequences, including developmental issues in children; increased propensity for chronic issues, such as obesity, type II diabetes, cancer, and heart disease; and shorter life expectancies as a result, in addition to the increased stress associated with living in a food insecure household

(McClintock et al 2011; Widome et al 2009; Meenar and Hoover 2012). Nutritious food is broadly defined as fresh fruits and vegetables, lean proteins, whole grains, and minimally processed foods (Zachary et al 2013; Wolfson et al 2016). There is a growing body of research exploring UA as an opportunity to increase vegetable intake with the specific purpose of reducing diabetes (Armstrong 2000; Alaimo et al 2008; Draper and Freedman 2010; Berg 2014; Sadler et al 2014; O'Hara and Toussaint 2021) Limited food access in urban areas is symptomatic of overlapping social inequities including but not limited to wealth inequality, available time to cook, and a lack of nearby supermarkets.

Even affordably priced nutritious food is often more expensive, thus representing a larger portion of household expenditures for low-income families and individuals, particularly if organic produce is purchased (Wolfson et al 2019). Highly processed foods are designed to be cheaper and shelf stable for long periods of time, making them a convenient choice for low-income households, but these benefits are also often accompanied by higher levels of sodium and calories per serving than fresh foods. Moreover, not only is fresh food more expensive, but it must also be consumed relatively soon after purchasing, which can be challenging for households in which adult members work long hours, multiple jobs, or care for small children (Wolfson et al 2015; Mills et al 2017). In addition to higher costs, shorter shelf life, and increases in time required for preparation, fresh food can also be logistically difficult to access, whether due to a lack of a household vehicle or as a result of no grocery store selling affordable and healthy fresh food in close proximity

Environmental Impacts of Urban Agriculture

Cities recognize the environmental benefits of UA and in many cases, share this information with the public. Of the cities sampled, 65 (56%) specifically mention UA in their climate action plans and 83, or 72% explicitly discuss the environmental benefits of UA. On the most fundamental level, UA can contribute to the use and preservation of open space in densely populated urban areas. For example, Latino community gardens in New York City were identified as the only open spaces available within the neighborhood, thus providing open space for residents for whom it may not accessible otherwise (Draper and Freedman 2010; Saldivar-Tanaka and Krasny 2004). While green space is thought to have a positive effect on human well-being and encourage urban biodiversity, it also improves air and water quality (Treece 2016; Voight 2011; Ackerman et al 2011). The incorporation of managed agricultural land into the urban landscape increases permeable land, thereby decreasing water runoff, which allows more runoff absorption and more effective stormwater management systems, particularly when rooftop gardens are present, as they can absorb between 50 and 100 percent of precipitation (Ackerman et al 2014; Treece 2016; Detroit Food Policy Council 2012; Choo 2011). Evidence suggests green roofs can also improve water runoff quality to an extent. Green roofs are known to capture heavy metals from water runoff, but do not necessarily assist with nutrient removal. In fact, green roofs can actually contribute to the presence of nutrients in runoff, such as nitrogen or phosphorus, when fertilizers are used (Ackerman et al 2014; Czemiel Berndtsson et al 2006; Whittinghill and Rowe 2012). This is one of the least studied areas of the environmental effects of UA.

Increasing urban green space through UA helps mitigate the Urban Heat Island (UHI), or higher urban temperatures than surrounding rural areas, as a result of urban

surfaces absorbing and redistributing solar radiation (Ackerman et al 2014; Memon et al 2010). UHIs impact communities in a few significant ways: by increasing warm weather peak energy demand and increasing cooling costs for residents and businesses, both of which contribute to higher levels of air pollutions and GHG emissions from fossil fuel based electricity generation; increasing heat-related illnesses and deaths, particularly for more vulnerable populations, such as the elderly; and impair water quality by heating stormwater runoff, which consequently raises water temperatures when it drains into natural water systems (Akbari 2005; EPA 2017). UA green spaces ameliorate the UHI by acting as heat sinks and consistently demonstrate lower ambient and surface temperatures than urban areas lacking such vegetation (Akbari 2002; Alexandri and Jones 2008). As many urban localities lack open land for additional green space, the reduction in local temperatures from green rooftops, vertical gardening, and community gardens can assist with cooling urban temperatures and at least partially ameliorating negative externalities of UHIs (Wong et al 2007; Bass et al 2003; Ackerman et al 2013).

In recent years, UA initially emerged as a potential remediation and reuse alternative for blight or contaminated properties in urban areas. Urban blight has been a significant problem for cities in the decades following WWII. As Americans moved to suburban areas and the urban industrial economies declined, particularly in Midwestern post-industrial communities, cities have been confronted with the challenge of managing urban blight (Treece 2016; Leonard 2014). Aside from the social and economic impacts, contaminated properties in urban areas pose a significant threat to public health due to hazardous chemicals, such as lead, in the soil, which can be absorbed by plants, potentially rendering them unsafe for human consumption (Leonard 2016; Rosen 2015). While cities,

such as Detroit, have demonstrated broad successes with the revitalization of blighted and contaminated properties, there are substantial concerns with regard to UA, specifically the safety of farmers and consumers, and the financial burden contaminated sites present for UA practitioners.

One of the most blighted U.S. cities, with around 40,000 blighted parcels of land, Detroit has implemented an ambitious revitalization program and has taken steps to overcome these two primary obstacles. With regard to soil safety, a 2013 ordinance was enacted requiring a site plan review process entailing an evaluation of existing soil conditions and plans to mitigate soil concerns for contaminated sites under consideration for agricultural revitalization (Leonard 2014; Detroit 2013). Contamination mitigation techniques, such as soil washing, installation of geotextiles, phytoremediation, using raised beds, or gardening in containers can assist with remediation, although they vary widely in cost and time required for effectiveness (EPA 2011; EPA 2011b). With the State of Michigan's support, Detroit created the Detroit Brownfield Redevelopment Authority (DBRA) to help secure financing and other state-level backing to incentivize revitalization. State-level policy decisions can help cities address the obstacles to UA as a tool for redevelopment.

Partially due to Detroit's well-documented budgetary troubles, the State of Michigan has made significant statutory progress in easing the financial burden associated with agricultural revitalization of urban brownfields. The Natural Resources and Environmental Protection Act (NREPA) functions as Michigan's modified version of the federal Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA). While CERCLA wields a strict liability standard, NREPA removes retroactive liability for new

owners of land parcels, provided they are not responsible for the contamination in the first place (Leonard 2014; Michigan Department of Environmental Quality (MDEQ) 2011). In addition to assisting potential blighted property purchasers by abolishing retroactive liability for new landowners through NREPA, Michigan also passed a Brownfield Redevelopment Financing Act (BRFA), which gave cities, such as Detroit, the authorization to create their own Brownfield Redevelopment Authorities. This authority allows the DBRA to reimburse individuals for redeveloping blighted properties, as well as to utilize tax increment financing to fund redevelopment projects; both of which incentivize revitalization in such a manner that UA practitioners can participate (Leonard 2014, MDEQ 2013). While there are challenges to UA as a method of contaminated property remediation, cities, such as Detroit, Toledo, Cleveland, and Baltimore, are experiencing successes through innovation (Bedore 2014; Buzby 2014).

UA contributes to sustainability in an environmental context in ways that are more difficult to quantify exact impacts: reduction of food miles traveled, decrease in amount of packaging and processing, and resource recycling and conservation. While some quantitative and measurement aspects of these contributions are currently debated, there is evidence to suggest environmental progress is being made. One of the primary complaints regarding the industrial food system is the dependence upon fossil fuels for production, processing, packaging, transportation, and disposal. For example, Weber and Matthews (2008) found the average food miles traveled from farm to plate and through the supply chain in the U.S. to be approximately 4,200 miles including all variables; shipping alone is thought to average approximately 1,300 miles (Ackerman et al 2014). While there is a dearth of studies quantifying resulting food miles emissions, it is believed to be a

significant amount, particularly for cities far removed from strong regional food chains or productive agricultural land (Bosschaert 2008; Specht et al 2014). It is estimated that in the United States, food production, packaging, retail, consumption, and disposal comprise approximately 21% of CO_2 emissions (Kling and Hough 2010; Treece 2016). UA has the potential to significantly reduce food miles traveled, as well as alleviates the use of petroleum-based plastic packaging and food waste (Peters et al 2009; Ackerman et al 2014).

The final environmental contribution this research will address is resource recycling and conservation. UA, in addition to reductions in fuel consumption due to decreased food miles and UHI mitigating effects, also has the potential to significantly lower building energy consumption and cooling costs, specifically within the contexts of vertical gardening, rooftop gardens, building-integrated hydroponics, and building-integrated greenhouses (Specht et al 2014; Delor 2011; Bask and Baskaran 2001; Wong et al 2003). UA may also improve nutrient cycling via local recycling and re-use of organic and water wastes, which can assist with decreasing the ecological footprint of urban areas (De Zeeuw 2011; De Zeeuw et al 1999; Peters et al 2009). Many rooftop or community gardens rely on locally collected and made compost for fertilizer. Often, local businesses provide food scraps to be used for compost in local UA activities. The Plant in Chicago and the Intercontinental New York Barclay Hotel are excellent examples of how properly managed UA can engender a sustainable system of local business connections with nutrient and organic waste recycling (Ackerman et al 2014; IHR 2013).

Economic Impacts of Urban Agriculture

In addition to the environmental benefits of UA, the potential for economic development opportunities also exists. Eighty of the 116 (69%) cities comprising the sample draw explicit connections between UA and its contributions to local economic development. The sampled cities that connect UA to economic development cite a range of economic motivations supporting UA programs and policies, including revenue from the increased production of locally grown food and its sales, both from the perspective of an increased tax revenue base for local government and the income opportunities and potential for further UA related entrepreneurial innovation created for residents and local business owners. Cities also mention potential revenue from admission and user fees resulting from attracting residents and tourists to publicly owned UA activities such as green roofs, edible gardens/orchards, community garden plot rentals, and gardening workshops organized and owned by the municipality. While some of the aforementioned revenue streams could conceivably be quite small, it's possible there's a larger economic development mechanism at work. Despite the traditional understanding that economic development and sustainability initiatives are at odds with each other, more recent literature suggests sustainability efforts and amenities focused on quality of life tend to attract wealthier, creative class residents and thus, potential for economic development (Florida 2004; Mulligan, Carruthers, and Cahill 2004; Portney 2013; Osgood, Opp, and DeMasters 2017). The "creative class" in this context refers to Richard Florida's categorization of those citizens who "engage in work whose function is to 'create meaningful new forms' (Florida 2004, 2012, 2014; Portney 2013b). Occupations included in this grouping would be science and technology, academia, the financial sector, lawyers, analysts, etc.; anyone professionally creating new and desirable products, workflows, designs, and problem-

solving solutions (Florida 2004, 2012, 2014; Portney 2013b). Portney (2013b, 45) found that:

> "Cities that take sustainability policies and programs the most seriously, particularly if they have relatively large "creative class" populations, tend to be cities that have experienced the greatest growth in personal incomes since 1990. Cities that have done the least to pursue sustainability tend to have experienced the least growth in personal incomes, which is taken as evidence that a new model of local economic growth may well be emerging – a model that emphasizes quality of life as a driver of economic development."

The primary reason for the reversal of conventional understanding regarding the relationship between environmental protection and economic development makes intuitive sense once seen through this causal lens: traditional development policies allow environmental degradation for the sake of economic growth. If left to continue unabated, the increasing levels of environmental pollution will begin to cause a population reduction as residents seek municipalities with better environmental quality and overall quality of life. A declining tax base then severely limits economic growth potential (Portney 2013b, Osgood, Opp, and DeMasters 2017). In contrast, cities that engage seriously with sustainability policies not only retain their original tax base but are likely to attract new residents and businesses as well. This impact is heightened when a significant "creative class" population is already present (Portney 2013b). While the extant literature on this subject has historically drawn connections between cities with more aggressive sustainability policies and negative economic impacts, Portney (2013b) suggests that perhaps this is because cities prioritizing sustainability and environmental protection are willing to sacrifice growth opportunities to do so (Feiock 1994, Portney 2013b). Many forms of UA could be perceived as amenities that improve residents' quality of life. Cities in the sample that cited economic development as a driver of UA reported that farmer's markets, rooftop gardens, and other UA measures tend to attract high value rental

properties and citizens that can afford to rent them, thus it's likely that in some cases, UA is perceived by city officials as an economic development strategy to attract high earners.

Strongly correlated with higher income levels and the creative class, the 'locavore' food movement has drawn significant attention in recent years especially in affluent areas of the country where residents can afford to pay higher premiums for locally grown produce and meat, often motivated by environmental and food quality concerns. UA, in all its forms and geographic locations, serves to shorten the supply chain between farmer and consumer to a local or regional level, as opposed to the national level supply chain distribution common to industrial agricultural production, keeping local dollars invested in the local economy. It is also important to consider the effects UA can have on the local and regional economy. Most fundamentally, UA is grown, sold, and purchased by local entrepreneurs and consumers. This allows local businesses to make profits, instead of national level grocery stores and distributors. Some cities create incentives for local purchasing, as local businesses add character and attract people, whether in the form of agri-tourism or expanding the city's resident tax base. Agri-tourism revenue has increased significantly in recent years. In 2012, U.S. agri-tourism revenue was estimated at approximately $704 million dollars; by 2017 it had jumped to $950 million (USDA 2019)[2]. This revenue can be a key resource for local governments and businesses, in addition to the resulting employment opportunities for the local community.

Additionally, local supply chains require local workers at diverse qualification levels for a variety of tasks associated with food production and distribution, although it should be noted that the job creation potentiality can vary widely from location to location (Specht

[2] After adjusting for inflation

et al 2014; Hui 2011; Graefe et al 2008). Moreover, well-designed and accessible UA programs can positively impact individual households' economic health by reducing the amount of fresh produce a household needs to purchase, thus extending the reach of the household's food budget. These topics, and others related to social equity, will be discussed in more detail in Chapter 2 through an analysis of the UA index indicators.

Besides the additional jobs UA can bring to a city, for many crops grown, UA's high productivity per acre can far exceed the profitability per acre of similar crops grown industrially, except in the cases of cereals, animal feed, or fruit trees, which require too much land to significantly profit from on small acreage (Draper and Freedman 2010; Ellingsen and Despommier 2008). Community and vertical gardens in cities with high population density, such as New York and San Francisco, have demonstrated remarkable returns on investment. For example, an initial investment of $5 to $10 in plants for a community garden plot provided a profit of $500 to $700 worth of vegetables, and the profitability increases with the production of value-added products, a trend the Maker Movement has been able to capitalize on in recent years (Dougherty 2012; Hannah and Oh 2000; Saldivar-Tanaka and Krasny 2004). Moreover, West Philadelphia community gardens produced $1,948,633 worth of fruits and vegetables in a single year (Hannah and Oh 2000). Low initial investments allow often strapped for capital UA ventures to turn a profit in a short amount of time, further increasing local economic growth.

Perhaps the most oft-researched economic development aspect of UA is the opportunity for neighborhood revitalization and economic development, in addition to the potential for gentrification. Many scholars, urban planners, and policymakers understand UA, along with many other sustainability policies as a mechanism to promote long-term

economic development, particularly considering the affluent citizens it tends to attract (Rosan and Pearsall 2017; Lubell, Feiock, and Handy 2009; Voicu and Been 2008; Wachter 2004). As previously mentioned, the use of UA to remediate blighted neighborhoods has become a tool for cities to promote community health and work to initiate economic development. Despite the many positive outcomes associated with UA, there is still substantial debate regarding the economic development aspect. Some argue UA is an excellent lifeline for troubled neighborhoods; others contend UA is better utilized as a temporary use, until neighborhood property values increase, and other larger-scale development is attracted to the area. The latter has tended to be the most high-profile and controversial aspect: cities use UA to increase property values in times of economic downturn and then sell the UA land to the highest-bidding developer, as observed in Philadelphia in the late 1990s and early 2000s, until UA was codified and protected from the temporary use designation (Rosan and Pearsall 2017; van Veehuizen and Danso 2007; Voicu and Been 2008). Until recent years, there was a surprising lack of empirical research on the subject, particularly given cities' recent propensity for tax-increment financing (TIF) to support the provision of parks or open space and the inherent necessity of reliable property value estimates TIF districts require to be successful.

Due to the local nature of research related to community gardens' effect on neighboring property values, much of the empirical research now available is limited to localized case studies, but the findings resonate consistently with one another. Research has found community gardens to have statistically significant positive effects on properties within 1000 feet of the garden, with the most substantial impacts occurring in the poorest neighborhoods, in some cases raising property values by as much as 9.5 percentage points

within five years of the garden's planting (van Veenhuizen and Danso 2007; Voicu and Been 2008). Using a hedonic regression model, in conjunction with the New York City Finance Office, they conclude each garden can increase tax revenues $750,000 over a 20-year time frame (Voicu and Been 2008). Hobden et al (2004) found community gardens and greenways increased values of nearby properties by 6.9%. Ernst and Young (2004) demonstrated values of homes located in the vicinity of parks and gardens were 8 to 30% higher than homes farther away. Moreover, Wachter's (2004) study showed urban greening and the appropriation of vacant land for gardening purposes increased surrounding property values by up to 30%. While empirical results vary greatly across cities, it is evident that UA has a positive impact of neighborhood property values, which contribute significantly to local economic health.

Conclusion

As the extant literature pertaining to urban agriculture in the context of sustainability is lacking a large *n* study and thus, lacks external validity, an assessment of empirical data on city behavior is necessary. As discussed, through inclusion in their climate action and general plans, cities have intertwined UA into the fabric of the social, economic, and environmental pillars of sustainability. In that vein, the subsequent chapter explores city behaviors as they manifest as specific municipal programs and policies being undertaken to promote or support UA activities. Evaluating urban agriculture actions at the local level of government allows for an understanding of a city's priorities and attitudes toward implementation.

Moreover, cataloging municipal behavior with regard to urban agriculture will provide a basis for comparison to known correlations between the demographics of cities

with more aggressive sustainability policies and those that do not demonstrate such an active pursuit of sustainability. Cities in the Western U.S., in addition to California which has a strict environmental quality state rule (California Environmental Quality Act), on those with more affluent residents, higher education levels, citizens that are more likely to vote for liberal candidates, a higher percentage of Hispanic and Caucasian residents, council-manager forms of government, type of metropolitan statistical area (MSA), and those with larger populations are more likely to implement sustainability policies (Portney 2003, Lubell, Feiock, and Handy 2009, Opp and Saunders 2013, and Opp 2017). An MSA is defined by the U.S Census Bureau as "a core area containing a substantial population nucleus, together with adjacent communities having a high degree of economic and social integration with that core". (U.S. Census Bureau, 2021). When these demographic characteristics are present, a city is statistically more likely to engage seriously with sustainability efforts (Lubell, Feiock, and Handy 2009, Opp 2017). Understanding if the same trends apply to urban agriculture will provide a comparative foundation with which to better understand this facet of sustainability programs and policies and why such wide variation between cities exists.

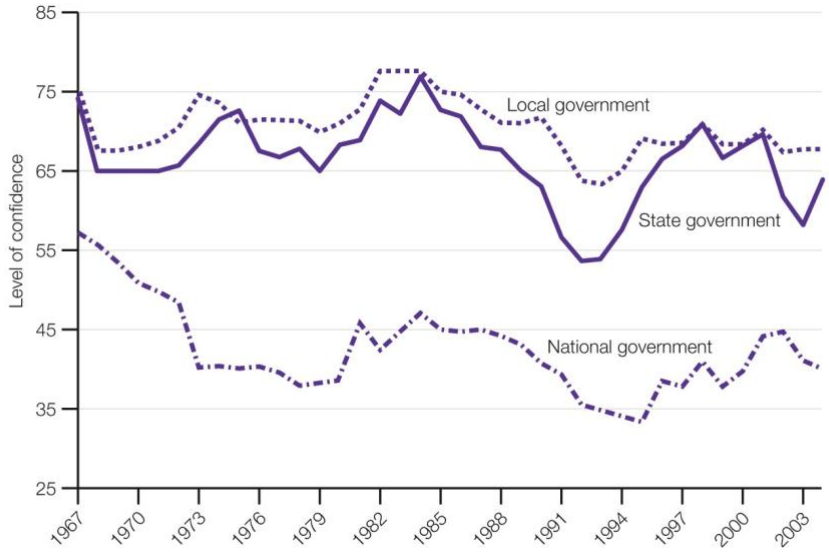
Chapter 2: Urban Agriculture Index and City Rankings

Introduction to the UA Index

Since the early 2000s, UA has become a part of the mainstream conversation concerning the development of more sustainable cities, both for researchers and practitioners. This research explores some of the many unanswered questions regarding municipal pursuit of sustainability within the context of urban agriculture by creating an additive index of municipal programs and policies to examine city activities related to UA. The goal of this index is to paint a picture of the UA program and policy landscape across the United States and thus, the largest 116 U.S. cities were selected to provide a regionally representative sample with broad scope to catalog how localities approach each of the three pillars within the context of UA to provide external validity in the literature. The structuring of this element is similar to the methods used in Portney (2003); Lubell, Feiock, and Handy (2009); Jepson (2004); Conroy (2004); and Opp and Saunders 2013).

This chapter catalogs UA initiatives and ranks all U.S. cities with a population of 200,000 or more (n = 116) based on their composite score, which is calculated according to how many of the indexed programs and policies a city pursues and/or promotes. This population cutoff was selected with the intent to include as wide a range of U.S. cities as possible since no index currently exists, while still remaining within the boundaries of feasibility for this study. As there is no existing comprehensive survey of municipal activities related to UA, this index is the primary focus of this dissertation with the goal of building a dataset as the foundation of future research. As such, the selection of indicators will also include city promotion of certain factors. For example, a city providing

information on how and why to garden organically or how mobile markets can alleviate food insecurity will be considered in the additive index, as education and outreach can be leveraged as successful strategies to increase awareness in the local community. Most fundamentally, how governments of any level frame and discuss issues and potential solutions influence how citizens interpret and understand them. Local governments are consistently the most trusted level of government; how they contextualize decisions, policies, and programs can have a significant impact on public perception (Wolak and Palus 2010, Portney 2013).



Note: Although confidence in all levels of government fluctuate somewhat over the years, this graph shows that especially since 1973, Americans trust their state and local governments far more than the federal government.

Figure 2: Trust in Government by Level; Wolak and Palus 2010

One city presenting UA as an economic opportunity that can revitalize Main Street, and another promoting it as a means to reduce food insecurity, sends two distinct messages to residents with regard to the city's priorities, attitudes, and understanding of UA. At this preliminary stage of exploring how UA functions in the context of sustainability, the decision to promote UA at the local level is worth evaluating and understanding. Another motivation for including the promotion of UA ideas was bred out of consideration

for the variance in resources between the largest and smallest cities within the sample. Chicago and New York City are able to devote substantial resources to entire departments related to food access, but smaller cities, such as Salt Lake City, may not have access to that level of resources and staff. However, if there are demonstrable efforts to educate citizens on the issues, for the purposes of this research, those efforts will be counted toward their index total because this dissertation assumes they provide at least some level of insight into a city's positions and priorities. The sample size represents at least one city from 36 states and includes the District of Columbia. The intention is to include data from a majority of states, and all of the regions of the U.S., as regional and state characteristics play a role in shaping local approaches to UA. Additionally, since State governments sometimes provide assistance and/or funding, it's important to consider as many different states as time and resources will allow to measure whether and to what extent State level support influences municipal priorities and decision-making.

The indexed programs and policies for each city were collected by first examining the city's official government website and municipal code, most of which are available through Municode or American Legal Publishing Code Library. Search terms were applied consistently across the entire sample (n=116); a complete list can be found in Appendix B. Search terms were selected with the primary goal of a systematic review since this is an inaugural UA index. An initial review of each city's website was performed to create a preliminary matrix of potential terms to describe evident activities. Once a pool of terms was finalized, the remaining candidates were cross referenced against each other to avoid conceptual overlap. Population data was gathered from the U.S. Census Bureau and the City Data websites. The index (see Appendices A and B) was created via an exhaustive

evaluation of indicators mentioned throughout the urban agriculture literature and a review of existing city efforts, an examination of various policies adopted by cities, as well as by reviewing index components as they have been compiled by sustainability scholars (Portney 2003, Jepson 2004, Saha and Paterson 2008, Opp and Saunders 2013). As some community gardens are a result of citizen initiatives and may fall outside a city's policy parameters or have no interaction with the local government, such as those tended on church properties or in neighborhoods with Homeowners Associations, indicators of citizen-led urban gardening are not included in this index. Only those currently supported or promoted by the municipal government are compiled and individual indicators have been categorized according to which pillar of sustainability they represent. For the purposes of ranking cities, one point is assigned for each indicator present in a city's programs or policies, and all points will be totaled for a cumulative score. While some sustainability scholars prefer the scaling method for indices, the additive method utilized by this dissertation is in line with previous research. Scaling is the preferable method when the impacts and outcomes of a policy require an understanding of whether a particular policy is "better" or "stronger" than another, but for the purposes of this dissertation, the primary objective is to evaluate if evidence of municipal efforts toward incorporating all three pillars of sustainability exists.

The total index scores for the sample will assist our understanding beyond cumulative score that provide a basis for comparison across and between cities. While it is essential to know which cities are most and least engaged with UA and via which mechanisms, these scores will also function as the dependent variable in the quantitative analysis performed in Chapter Three of this dissertation in which we seek to understand

why wide variation is exhibited across cities in the sample and how UA compares to other types of sustainability efforts. Additionally, the leader, laggard, and median index score of all cities with a population over 500,000 will determine which cities are analyzed in case study form in Chapter Four. By selecting the highest, lowest, and middle ranking cities, we'll be able to infer a snapshot of the categories of and relative dedication to UA activity in cities with ranging levels of demonstrable engagement.

Index Limitations

Before describing the indicators and subsequent city scores derived from the chapter's findings, it may be productive to first elucidate what the index does not do. This chapter was not designed to evaluate the efficacy or comparative strength of any of the policies or indicators discussed or measure the impacts of implemented programs. UA, and particularly its relationship to sustainability efforts, is a recently burgeoning focal area for both cities and academia. Much like Portney's Taking Sustainable Cities Seriously (2003, 2013), this index is primarily intended to survey the landscape of existing policies, programs, and educational communication between city and citizen, and not concern itself with measurements of effectiveness or outcomes. In addition to the nascence of UA programs and policies at the city level, it's also important to consider the wide variation in needs and concerns that each individual city experiences. A broadly inclusive additive index allows for recognition of the various dimensions of UA efforts with which different cities might experiment, without the constraints of certain weighted criteria and standards.

Another advantage to using an additive index is that many of the benefits of UA are difficult to measure. For example, one can easily calculate how many pounds of fruits and vegetables were produced in community gardens in a particular season, or how many

SNAP dollars low-income families spent at farmers' markets, but benefits such as increased social cohesion or connections with nature are less easily, and perhaps less productively, quantifiable. This research prefers the equal inclusivity of all indicators that an additive index provides, without strong ties to strength of outcomes or performance. Since a comprehensive catalog of what UA programs or policies cities are experimenting with doesn't yet exist, filling that gap in the literature claims priority. That is not to say there are not valuable critiques of using an additive index. Indeed, there are because outcomes *are* important. However, we need to know what is being done before we can measure how effective it is and what the aggregate impacts are. Impacts, effectiveness, and their respective generalizability should be considered particularly fertile ground for future UA research.

Index Parameters

As previously mentioned, this research examines UA efforts across every city with a population of more than 200,000 in the U.S., including Honolulu and Anchorage, with the goal being to catalog what UA efforts cities are making and rank the cities based on total score. One may wonder if regional climate variations play a role in what UA efforts a city might undertake. Several factors were considered in the decision to construct a more inclusive sample, including growing season, hardiness zone, and range of food that could be grown in each hardiness zone. The information was gathered from a USDA[3] and a National Garden Association[4] website (USDA 2021, National Garden Association 2022). In terms of plant hardiness, this concept represents the average annual minimum winter temperatures

[3] https://planthardiness.ars.usda.gov
[4] https://garden.org/apps/frost-dates/

of specific locations and which plants are likely to grow there (USDA 2021). The coldest cities, Anchorage, Alaska, and Minneapolis, Minnesota, fall within the 4b zone (-25 to -20 °F) and have growing seasons of 182 and 158 days per year respectively (USDA 2021, National Garden Association 2022). For reference, the average growing season for the sample is 247 days per year. Both Anchorage and Minneapolis are below average with regard to growing season, but still score well on the index; Anchorage earned 85 points, Minneapolis 106. The growing season for both cities is April – October and the climates can successfully support vine tomatoes, lettuce, kale, broccoli, asparagus, spinach, strawberries, eggplant, sweet peas, pole beans, winter squash, red and white potatoes (National Garden Association 2022).

It could be suggested that hot, dry climates could negative affect index score. However, a closer inspection reveals that even the warmest and driest U.S. regional climates support a range of fruit and vegetable growth. Phoenix, AZ is in the 9b zone (25 – 30°F) with very limited rainfall, yet is conducive to the outdoor cultivation of broccoli, cauliflower, cabbage, lettuce, spinach, onions, potatoes, tomatoes, peppers, eggplants, watermelon, cucumbers, etc. (USDA 2021, National Garden Association 2022). The same repertoire of produce can also be grown outdoors in Las Vegas, NV. Even cities in the same states with similar climate concerns, such as the Texas cities of El Paso and Lubbock, demonstrate drastically different index score results. In this comparison El Paso ranks 22nd, Lubbock 113th. While what can be grown will vary from region to region and planting seasons will exhibit differences, even the more extreme regions and regional climates can support UA. It's unlikely that regional climate in the U.S. would affect garden or farm growth potential to the extent that it could affect a city's pursuit of UA. It could be argued

that cities in regions of the U.S. with mild temperatures throughout the year, such as the South, may have less incentive to engage in UA since local agriculture is widely accessible and perhaps wouldn't require governmental intervention. Future research could focus on region specific UA to explore this line of inquiry.

For each of the 116 cities examined, 124 indicators are analyzed. Please refer to Appendix A for a complete list. During the data collection stage, as more cities were evaluated, the list of indicators was continuously modified, tweaked, and added to, in order to ensure it was truly comprehensive of a wide range of city efforts. The pages that follow first describe the index rankings and scores and secondly, delineate the reasons for inclusion of each indicator included in the score and offer an explanation of measurement and relative importance to UA efforts broadly. It may be useful to first define what constitutes an indicator. For the purposes of this research, a UA indicator is any policy, program, activity (educational or physical in nature), or other effort intended to further UA goals within the context of sustainability. It should be noted that data on all indicators was collected in binary form, a "1" indicates the presence of a particular element and "0" indicates absence. In the cases of a cumulative point tie between two or more cities, alphabetical order is the secondary sorting method.

As previously mentioned, for the purposes of this index, some indicators simply ask if the city promoted a particular UA idea or method. A city's efforts to promote food-related programs can have significant measurable impacts, even if the city does not necessarily fund or staff the program using municipal resources. For example, city promotion of local farmers markets can raise awareness amongst residents, but not require city dollars or significant staff time. Promotion of a particular activity is measured by information

available via a comprehensive search of the city's website, as city websites are now digital repositories and accessible to any technology connected citizen, either from a personal device or public computer. This research relies upon searches performed using consistent terminology, but also flexibility, in order to capture the wide range of information formats and modalities presented by each of the various sampled cities. This research acknowledges that website quality can vary substantially from city to city and this may impact overall rankings but determined the information that can be gleaned from even the barest bones of websites has adequate value to include.

In terms of findings, Chicago, IL registered the highest score at 118. San Francisco, CA was a close second place at 116. Charlotte, NC; Jacksonville, FL; and Rochester, NY all shared the median score of 68 and Yonkers, NY placed 116th with a score of 24. As Table 1 shows, and the range between scores demonstrates, city efforts with regard to UA vary widely.

Table 1: UA Index Rankings

Rank	Score	City	State	Rank	Score	City	State
1	118	Chicago	IL	59	68	Jacksonville	FL
2	116	San Francisco	CA	60	68	Rochester	NY
3	108	Seattle	WA	61	67	Sacramento	CA
4	107	Austin	TX	62	66	Detroit	MI
5	107	Baltimore	MD	63	65	Durham	NC
6	106	Minneapolis	MN	64	65	Oklahoma City	OK
7	106	Portland	OR	65	64	Chandler	AZ
8	101	Washington	DC	66	64	Lexington	KY
9	100	Denver	CO	67	61	Boise	ID
10	100	Los Angeles	CA	68	61	Fresno	CA
11	100	New York City	NY	69	61	Irving	TX
12	98	Cincinnati	OH	70	60	Orlando	FL
13	97	San Jose	CA	71	59	Aurora	CO
14	96	Milwaukee	WI	72	59	Glendale	CA

15	96	Philadelphia	PA	73	59	North Las Vegas	NV
16	95	Richmond	VA	74	59	Wichita	KS
17	94	San Diego	CA	75	58	Chesapeake	VA
18	93	Louisville	KY	76	58	Scottsdale	AZ
19	92	Madison	WI	77	57	Virginia Beach	VA
20	92	St. Paul	MN	78	56	Baton Rouge	LA
21	91	Honolulu	HI	79	56	Fontana	CA
22	89	El Paso	TX	80	56	Henderson	NV
23	89	Greensboro	NC	81	56	Lincoln	NE
24	89	Tucson	AZ	82	56	Santa Clarita	CA
25	88	St. Petersburg	FL	83	54	Fort Wayne	IN
26	87	Spokane	WA	84	54	Gilbert	AZ
27	86	Indianapolis	IN	85	54	Jersey City	NJ
28	86	St. Louis	MO	86	54	Las Vegas	NV
30	84	Kansas City	MO	87	54	Stockton	CA
29	85	Anchorage	AK	88	53	Omaha	NE
31	84	Pittsburgh	PA	89	53	Oxnard	CA
32	83	Dallas	TX	90	52	Buffalo	NY
33	82	Nashville	TN	91	52	Colorado Springs	CO
34	82	Reno	NV	92	52	Fayetteville	NC
35	82	Tacoma	WA	93	52	Santa Ana	CA
36	80	Atlanta	GA	94	50	Anaheim	CA
37	80	Newark	NJ	95	50	Fremont	CA
38	80	Salt Lake City	UT	96	50	Irvine	CA
39	79	Chula Vista	CA	97	49	Fort Worth	TX
40	79	Winston-Salem	NC	98	49	Glendale	AZ
41	78	Houston	TX	99	48	Memphis	TN
42	78	Long Beach	CA	100	47	Birmingham	AL
43	77	Phoenix	AZ	101	47	Modesto	CA
44	77	San Antonio	TX	102	46	Toledo	OH
45	76	Boston	MA	103	44	San Bernardino	CA
46	76	Laredo	TX	104	44	Tulsa	OK
47	75	Albuquerque	NM	105	43	Corpus Christi	TX
48	75	Columbus	OH	106	43	Norfolk	VA
49	74	Des Moines	IA	107	42	Tampa	FL
50	73	Cleveland	OH	108	41	Moreno Valley	CA
51	73	Mesa	AZ	109	36	Garland	TX
52	73	Oakland	CA	110	33	Aurora	IL
53	72	New Orleans	LA	111	33	Bakersfield	CA

54	72	Riverside	CA	112	33	Huntington Beach	CA
55	71	Arlington	TX	113	32	Lubbock	TX
56	71	Plano	TX	114	30	Miami	FL
57	70	Raleigh	NC	115	29	Hialeah	FL
58	68	Charlotte	NC	116	24	Yonkers	NY

Index Indicators

The following sections discuss each of the indicators in the context of the three pillars of sustainability by categorizing each indicator according to whether it supports the social equity, environmental, or economic pillar. A fourth category, *All – Administrative/Legal – N/A,* includes those indicators that encompass multiple pillars, as well as those that support neither. Some indicators evaluate explicit linkages, while others account for specific programs in place. Since the literature is in the developing stages of understanding municipal conceptions of UA, it is worthwhile to also include indicators that further UA goals independent of sustainability. In sum, the index measures 35 social equity indicators, 27 environmental pillar indicators, and 18 related to the economic pillar of sustainability; the remaining 44 fall in the fourth miscellaneous category described above. Since the index is not weighted, but additive in nature, the intent is not to comparatively account for the variance between numbers of indicators in each category, as that falls beyond the scope of this initial cataloging effort.

All indicators included in the index reflect municipal endeavors. While some of indicators may be programs supported by Federal or State funds or may be delivered by an outside entity, such as a summer meals or SNAP benefit redemption mechanisms, only involvement on the part of the city government, either via promotion, program, or policy,

will be included. The subsequent section comprises the range of index indicators grounded in social equity concerns as listed in Table 2 and provides a description of the role and purpose of each. The articulated questions behind each indicator, for all categories, are listed in Appendix B.

Social Equity

Table 2: Social Equity Index Indicators

Pillar of Sustainability	Indicator	% Cities Engaging
Social Equity		
	Vehicle access restricted areas in city	89.68%
	Facilitate redemption of SNAP benefits at farmers' markets	85.71%
	City supported community gardens open to the public	81.75%
	Food deserts in city	80.95%
	Connect UA and availability of nutritious food	79.37%
	Connect UA and community benefits	76.19%
	Additional funds for SNAP recipients for farmers' markets/CSAs	69.05%
	Connect UA and underserved populations	68.25%
	Community gardens dedicated to growing food for donation	67.46%
	Food related educational programs	61.91%
	Youth nutrition programs	55.56%
	Link UA and community food security	50.00%
	Assistance for low-income citizens to participate in community gardens	48.41%
	Support mobile markets	47.62%
	Community gardens accessible to disabled residents	46.03%
	Link UA and exercise benefits	45.24%
	Link UA with assisting low-income household food expenditures	43.65%
	Community gardens dedicated to veterans/seniors	42.06%
	UA opportunities for workforce development	41.27%
	At risk youth gardening programs	40.48%
	Edible landscapes	39.68%
	Link UA and obesity	39.68%
	Connect UA and cultural understanding/outreach	38.10%
	Facilitation of summer meals program	37.30%
	Food Action/Strategy Plan	36.51%
	Connect UA and civic engagement	35.71%
	Fresh food incentive (for stores in low-income areas)	35.71%
	Link UA and crime prevention	30.85%
	Link UA and benefits to immigrant communities	25.40%

	Facilitate redemption of SNAP benefits with CSAs	24.60%
	Permit growing food in planting strips	19.84%
	UA assistance with felon reintegration	11.91%
	Connect UA and living wage	11.11%
	Support UA as a 'food pharmacy'	7.14%
	Garden or fruit share program	5.56%

Direct Aid City Programs

Garden and fruit share programs are arrangements in which produce is provided by residents from their private gardens or fruit trees/bushes and is donated directly to hungry families or individuals, or in some cases local food banks. As only approximately 6% of cities sampled offer a garden or fruit share program, it's evident that they are not a common tactic employed to address food insecurity. However, since local governments tend to be the driver of innovation, particularly with regard to sustainability, and in the interest of a comprehensive scope, this research considers infrequently occurring programs and efforts such as this worthwhile of inclusion. Edible landscapes also seek to address hunger by using food plants for consumptive, and also often aesthetic, purposes and are available to the public (Celik, 2017). Urban food forests, such as the one recently constructed in the Browns Mill Atlanta area, generally offer public access to a variety of fruits, nuts, vegetables, herbs, and mushrooms. Edible landscapes and edible urban forests are considered as one indicator for the purposes of this research, as in many instances, cities use the terms interchangeably, despite technical differences between the two. These types of programs provide accessible fresh produce to any resident, which can ease the financial burden of nutritiously feeding a family or provide interim meals for the local homeless population at a limited cost to city coffers. City managed edible landscapes/urban forests do require either the use of city-owned land or passive allowance on the city's

behalf to permit planting on vacant lots. Another avenue via which cities can promote micro urban farming is to allow cultivation in city owned planting strips, which are the areas of grass or dirt between the sidewalk and the curb. Additionally, some cities dedicate and manage community gardens from which all food harvested is for direct donation. In approximately 1/3 of sampled cities, a Food Action plan was present to document, coordinate, and strategically plan municipal food security and access efforts such as these. The presence of a Food Action plan, or any plan similarly named and corresponding in intent is captured as an index indicator.

Summer meals programs provide one to two meals a day for children under 18. Cities vary in their requirements: some are intended only for low-income children; others will serve any child who attends. In many cases summer meals funding is augmented by state and Federal sources. A city's promotion of or engagement with the provision of summer meals often refers to local food sourcing for at least part of the meals served. Some cities utilize farm-to-school arrangements to supply a portion of the meals, others use more traditional sources. While the traditionally sourced city programs are only tangentially related to UA, food access programs provide a glimpse into how much attention the city grants to social equity and thus, were included in this index.

Another food access focused social equity indicator is what's referred to as a mobile market. Mobile markets are designed to bring grocery store quality produce to food deserts or vehicle access restricted areas to directly increase accessibility of fresh food to underserved populations. Many are designed to accept SNAP benefits and some offer produce at discounted prices. There is wide variation in how mobile markets source their produce. In many instances, produce is donated or purchased from local community

gardens or urban farms. Other cases source produce from local grocery store chains at negotiated rates. As these types of programs are increasingly in popularity only in recent years, this index does not differentiate between them based on how the produce was sourced. Many mobile market programs are collaborations between multiple actors: private enterprise, food banks, religious institutions, farmers, city departments, etc. In this instance, city promotion presents an acceptable measure, as none of the mobile market programs encountered were solely owned and operated by the city.[5]

This research relies on the USDA definitions of food deserts and vehicle access restricted areas. The USDA considers an urban food desert to be any area in which a grocery store retailing fresh produce is farther than one mile in any direction (USDA 2015). Vehicle access restricted areas are defined as "tracts in which more than 100 households have no access to a vehicle and are more than ½ mile from the nearest supermarket" (USDA, 2019). The presence or absence of these elements was determined using the USDA's Food Access Research Atlas, which uses GIS overlays to identify such areas in each city. Of the cities sampled, 102 have areas considered food deserts and 113 contain sections that are low vehicle access. According to the index, approximately 1/3 of the cities sampled have instituted a fresh food incentive program that provides grants or tax breaks to convenience stores and corner markets in food desert or vehicle access restricted areas.

Finally, the last set of measures included in this subsection of social equity address the city's use and promotion of SNAP benefits. This index measures if the city promotes or

[5] A few cities, such as Baltimore, are experimenting with pilot programs intended to provide discount Lyft rides to grocery stores for citizens who live in food deserts as a mechanism for improving food access, but since these types of trials are still in an embryonic phase of development and implementation, they are not considered in this research.

engages in providing SNAP benefits at farmer's markets, mobile markets, and/or for CSA shares. Promotion is an acceptable threshold for these two indicators, as the USDA and states provide many of the baseline SNAP benefit requirements necessary for purchase at these venues. However, the third indicator in this section inquires if the city offers any additional SNAP benefits, such as dollar for dollar matching or special discounts; this indicator is participation based.

Community Gardens

Indicators in this section pertain specifically to social equity and food justice measures. The first subsection of indicators evaluates what types of community gardens are present in the city and promoted by the city. Since there is no existing national survey of this type of information, it is important to include here, even though it's tangential to city efforts. Additionally, a majority of cities ($103/116n$) promote community gardens on their city websites. In some cases, the various types of community gardens are mentioned. Others simply report garden locations. Since so many cities engage with community gardens, it becomes even more important to understand what exactly is being promoted as it pertains to disadvantaged groups. The types of community gardens evaluated include public community gardens, those dedicated to veterans or the elderly, if there are community gardens or city programs that subsidize plots to increase low-income resident access, if there are gardens designed to accommodate persons with disabilities, and community gardens intended to assist with felon reintegration. In a case study of the San Francisco area, Pudup (2008) found community gardens in prison settings reduced recidivism rates and in public settings provided jobs for ex-offenders and thereby provided an avenue for reintegration (1232). By measuring the frequency with which cities consider

garden access for marginalized groups, this index provides insight into municipal perception and prioritization of social issues.

There's a significant amount of research to suggest that community gardens can have positive social effects on a wide variety of participants. The literature indicates that city-operated community gardens partially managed by local police officers contributed to building community relationships, youth development, and interpersonal skill development social learning for staff and participants, in addition to supplementing community access to nutritious foods (Allen, Alaimo, Elam, and Perry 2008; Krasny and Tidball 2009; Draper and Freedman 2010). Hoffman, Knight, and Wallach (2007) found that community garden participants in Los Angeles demonstrated a reduction in ethnocentrism from the experience of gardening in a diverse group. While much of the literature on this subject is a result of case studies and therefore has limited generalizability, the consistent finding of positive outcomes from municipal UA activities underlines the importance of understanding how local governments are approaching UA from the social equity perspective, both internally and publicly.

City Attitudes and Priorities

Other social equity and food justice indicators included are directly correlated to city efforts. This section explores what equity driven or focused educational programs the city chooses to offer and explicitly made connections between UA and certain community issues or goals. The city offering any at risk youth gardening programs, any UA related workforce training opportunities, youth nutrition programs, food education programs, or encouragement of food pharmacies are all included in the index. Food pharmacies are essentially prescriptions or recommendations for healthy food to accompany or replace

medications (Ren, 2017). Food pharmacies began sprouting up in U.S. hospitals in 2016 in an attempt to combat the root causes of diet-related diseases, such as type II diabetes. As low-income susceptibility to chronic diet related illnesses is well-documented due to the affordability and accessibility of cheap processed food, city promotion of food pharmacies is indicative of a shifting tide in how chronic health issues are addressed, as is if a connection is made between UA and the opportunity for physical exercise.

How an issue is framed by local government affects public perception and is indicative of a city's concerns and objectives (Portney 2013). For example, one of the indicators from this subsection evaluates if a city provided information specifically linking UA to nutritional benefits. Since many of the consequences of poor nutrition are borne by low-income populations, this indicator is included here, as is if a link is established between UA and a reduction in obesity and if community food security is discussed, with food insecurity defined here as reduced quality, variety, or desirability of diet, with and without hunger (USDA, 2019).[6] This allows us insights into the existing ideological orientation towards the government's role in poverty and public health issues. Additional linkages evaluated are did the city link UA to the general benefits it can have for low-income individuals and families, is there an explicit link between UA and cultural benefits, and is a link established between UA and benefits to immigrant populations. Cultural benefits and benefits to immigrants are also important questions in this context. Many cities have community gardens dedicated to immigrants from specific regions of the world,

[6] The USDA definition differentiates between low food security and very low food security (low food security with hunger), but for the purposes of this research, both of these definitions are combined under the umbrella "Community Food Security" indicator.

where they can meet others from their native country and also have access to native foods. As more cities were evaluated, community gardens dedicated to a particular heritage accumulated in the data. Initially, cultural and immigrant benefits were treated as one combined indicator. However, as research progressed, it became clear that there were enough occurrences of cities featuring both types of community gardens that it was worthwhile to separate into two individual categories, as 25% of the cities sampled link UA to immigrant communities and 38% frame UA in the context of cultural outreach and understanding.

A significant number of cities directed the public's attention to efforts framed as strengthening sustainable neighborhoods that are addressed in varying contexts. For example, slightly more than 10% of cities sampled linked UA with the opportunity for living wage jobs in a participatory justice framework for low-income communities, as agricultural work is typically low paying and does not increase employee access to nutritious food (Reynolds and Cohen 2016). Living wage jobs reconsider the role of the laborer and prioritize equitable wages over higher profit margins in contrast to agribusiness (Reynolds and Cohen 2016). Physical safety and security are also considered in the strengthening neighborhoods framework. Index results indicate a third of the sample links UA with reductions in neighborhood crime. This is thought to occur as a result of UA bringing more foot traffic to low-income areas in combination with vacant lots being repurposed for UA endeavors, as vacant lots and abandoned buildings are prime locations that offer cover for engaging in illicit activities.

Additionally, if the city makes an explicit linkage between UA and stronger communities and if a connection is made between UA and civic duty are both included as

index indicators. Research suggests the social capital organization that results from community UA can assist with community development and cohesion, increasing the flow of neighborhood information and performing as a mechanism of community watchfulness (Armstrong 2000; Brown and Jameton 2000, Glover 2004, Draper and Freedman 2010). Democratic participation is key to social equity and approximately 33% of cities across the sample framed UA as a participatory opportunity for citizens to engage with their government and neighbors. In the civic sense, the literature indicates community gardens in particular are an effective mechanism for municipal governments to engage residents by supporting use of public land for the garden and committing to funding (Draper and Freedman 2010; Henderson and Hartsfield 2009). Ohmer, Meadowcroft, Freed, and Lewis (2009) found that citizen engagement with local government through UA is correlated with increased civic motivation and an increased likelihood of participation in additional community events and activities.

These 35 social equity indicators describe a broad range of municipal programs, policies, and promotion of how UA can be utilized to pursue this pillar of sustainability. The possibility that promotion of any of these topics could be a mechanism for greenwashing, which is presenting a policy or program as sustainable when it isn't, must be addressed (Scanlan 2017). This research acknowledges the gravity of this concern. However, the purpose of this index is not to evaluate efficacy or impact, but instead to outline the full spectrum of municipal UA activities and their relationship to sustainability efforts. Future research could explore whether greenwashing is indeed occurring, but this research will remain agnostic on the subject, as this question lies beyond the scope of this dissertation.

Environmental Measures

Table 3: Environmental Index Indicators

Pillar of Sustainability	Indicator	% Cities Engaging
Environmental		
	Promote native plants	85.71%
	Promote UA sustainable irrigation techniques	71.43%
	Discourage pesticide use	69.84%
	Promote low water use/drought resistant plants	69.84%
	Climate Action Plan	69.05%
	Link UA and stormwater pollution reduction	69.05%
	Pollinator benefits promoted	69.05%
	Sustainability/Resilience Department	68.25%
	Link UA and environmental ethic/connection to nature	66.67%
	Link UA and environmental benefits of local food	61.91%
	Promote wildlife friendly gardening	59.52%
	Promote organic gardening	56.35%
	UA in Climate Action Plan	51.59%
	Link UA and minimization of food waste	50.79%
	Municipal composting	50.00%
	Link UA and reduction of heat island effect	46.83%
	Connect UA with habitat restoration	42.06%
	Link UA and preserving biodiversity	42.06%
	Pest resistant plants promoted	40.48%
	Offer information on chemical pesticide alternatives	38.40%
	Promote vermicomposting	36.51%
	Provide contaminated soil gardening information	34.92%
	Link UA and healthier urban environments	32.54%
	Link UA and land stewardship	32.54%
	Link UA and reduction in food miles	28.57%
	Food mapping	21.43%
	Goat landscaping	13.49%

Municipal Programs and Administrative Efforts

Indicators in this section seek to evaluate the contexts in which cities associate UA with environmental protection. In 69% of the cities sampled these connections are made explicit in a Climate Action Plan. To account for this planning effort, the index measures if a city has a Climate Action Plan and if so, if UA is mentioned in it. The presence of an environmentally focused Sustainability or Resilience Department is also captured. Goat

landscaping is included in the list above, as it's an emerging strategy to both save cities money on landscaping costs, but more importantly, to cut down on harmful emissions and inefficient fossil fuel usage of lawn care equipment, such as mowers and leaf blowers. In addition, resident reception of these programs, such as the one instituted in Wheat Ridge, CO, is overwhelmingly positive (Denver Post, 2017). While seemingly tangentially related to UA at best, when cities present information on goat landscaping it's often in the context of supporting local agricultural businesses or urban farms, and thus, is included as an indicator (City of Chicago 2018, City of San Francisco 2018).

Additionally, environmentally focused indicators include if a city compost program exists. Composting has significant environmental benefits. Primarily, composting reduces the amount of organic waste in landfills, thus reducing methane emissions (EPA 2022b). Additionally, compost application can reduce or eliminate the need for synthetic fertilizers and increase crop yields (EPA 2022b). Over time composting can help remediate contaminated or nutrient depleted urban soils and contribute to habitat restoration in doing so, in addition to enhancing water retention and carbon sequestration (EPA 2022b). It should be noted that many of the municipal compost programs are structured as fee for service, creating access issues for low-income residents. This index does not discern if subsidies for service to low-income areas are offered. However, some cities offer rebates and incentives to citizens who provide compost to the city for municipal use. These are considered contributions to the economic pillar and are discussed in the subsequent section. In addition to the carbon reduction benefits of composting, UA vegetation also serves to assist with carbon sequestration and filtration of heavy metals and other pollutants from various urban sources (Vymazal 2005; Lebel et al 2007). Moreover,

research suggests that green roofs decrease carbon emissions from buildings by 9% (Roehr and Laurenz 2008). Because green roof/rooftop garden policies are also implemented to allow access to gardening activities in high-density areas, which in many cases are also low-income, they will be discussed in the *All – Administrative/Legal* section of this chapter.

Local Food

Promotion of purchase and consumption of locally grown and produced food has both economic and environmental benefits. Economic benefits of local food promotion are evaluated as a separate indicator and will be addressed in the following section. The environmental benefits of local food in general terms are referring to moving away from reliance on the industrialized agricultural system and the environmental harm chemical laden and water intensive monocropping inflicts. This is a surprisingly common theme in local government public communications regarding UA. Approximately 62% of cities sampled frame UA as such in the environmental context and 42% explicitly connect local food production with increased biodiversity as a result. Another environmental context presented is the link between UA and a reduction in food miles, or miles travelled from farm to fork. The industrial agricultural system relies on trade across global markets. The carbon emissions from the shipping required to meet international demand are significant (EPA 2022; Ackerman et al 2014). For many varieties of produce food miles could be significantly reduced if grown locally, with some studies approximating a 98% reduction (Peters et al 2009; Ackerman et al 2014). Moreover, less food miles travelled impacts the opportunity for spoilage and waste considerably, particularly when considered on a global scale (Ackerman et al 2012; Ackerman et al 2014). Future research could explore the impacts of UA on municipal food waste more expansively.

Benefits to the Urban Environment

Environmental frames and linkages typically assume one of two forms in local government communication: they're presented as either benefits of UA existing in a city or from the perspective of individual contributions in the residential sphere. Residential garden impacts are discussed in the following section. Indicators measured that speak to the positive environmental impacts due to the presence of UA are if linkages are made between UA and increased habitat for wildlife, pollinator benefits, habitat restoration possibilities, if the city makes an explicit connection between UA and an environmental ethic (or connection to nature), and/or if land stewardship is linked with UA. These linkages all demonstrate a set of conservation principles which were a distinct theme across the representative indicators in the sample.

Some cities chose to highlight more concrete and immediate impacts of UA that contribute to a healthier urban environment. In this context, a healthy urban environment refers to overall positive net benefits as a result of UA. As previously discussed, properly managed UA can alleviate the UHI effect. Research suggests the presence of vegetation can cool the air temperatures by blocking and redistributing light and heat (Akbari 2002; Ackerman et al 2014). These indicators are included in the index because they speak to the city's well documented ability to find innovative solutions to pressing sustainability issues, particularly those affecting residents' immediate quality of life. Additional healthy urban environment approaches, recommendations, and goals include indicators measuring if the city provides linkages between UA and cleaner air, benefits of greenspace, cleaner water, and/or if the benefits of UA on stormwater drainage are explained.

Nature/Gardening Information

City provision of information on any of these elements implies a strong linkage between UA and positive environmental effects, in addition to basic individual-focused cause and effect environmental awareness. However, any environmental factors that do not directly address a gardening "how to" are discussed in a subsequent section. Much of the information discovered for these factors was a result of collaborative work between the city and a university extension program. While some regional effects manifest, such as a higher prevalence of promotion of drought tolerant plants in Western cities, overall, most cities provided some guidelines to sustainable residential gardening ($91/116n$). To be clear, indicators related to codified municipal permitting and UA activities is summarized in a subsequent section, as that type of information focuses more on what the city government allows within city limits than on the linkages between sustainable UA practices and environmental consequences. When evaluating Table 3, it becomes obvious that some indicators, such as native plants and composting, have a higher score than the baseline 'Is organic UA or gardening information present' question. The reason for this is that the benefits of these techniques were sometimes discussed in the context of a city garden installation or at the local botanical gardens, but not necessarily as it pertains to residential UA. They were still included here because external examples such as these remain valuable to UA goals, even when presented in a different context.

While many community gardens and urban farms are large enough to sell produce, or even be considered commercial scale, much UA can be produced residentially as well. This section evaluates if any gardening or UA information is available through municipal channels and if so, what type of message is being communicated. The information

considered can pertain to backyard UA or small community garden UA, as many cities provide information on how to begin small community gardens, many of which do not sell produce, but instead share it among members. Additional factors include information on if organic gardening is promoted, vermicomposting (composting with worms), composting, pest-resistant plant use, native plants, sustainable irrigation techniques, if chemical pesticide or herbicide use is discouraged, if sustainable alternatives to pesticides are provided, and if information on gardening in contaminated soil is present. Some cities offer rebates or incentives for sustainable irrigation system installation or turf removal due to its elevated water requirements. These are considered economic measures and are discussed in the following subsection.

The last indicator in the environmental section is if the city promotes or manages a food mapping program. Food mapping is inclusive of two different types of information. Some cities provide materials on how to design small spaces (balconies, windowsills, small backyards) to maximize home food production and lower household expenditures. Components of this information may include how to reduce the need for chemical inputs through design strategies or how to utilize backyard microclimates. Other types of food maps direct residents to edible landscapes, urban forests, community gardens, and urban farms often in concert with information on the benefits of locally grown food. Since this indicator is limited in participation, both types are counted under one “Food Mapping” umbrella indicator.

Economic Measures

Table 4: Economic Index Indicators

Pillar of Sustainability	Indicator	% Cities Engaging
Economic		
	Sale of crops/animal products permitted on non-commercial property	77.78%
	Link UA and local economy	61.91%
	Link UA and neighborhood revitalization	53.97%
	Foster land trusts	52.38%
	Rain barrel rebate/discount	46.03%
	UA tax incentives/grants	46.03%
	Link between UA and jobs in the community	42.86%
	Offer incentives for local food/vendor purchasing	42.86%
	City owned land disposition process	39.68%
	Link blighted property/UA potential	35.71%
	Aquaculture/aquaponics in municipal code	34.92%
	UA Irrigation rebates/incentives	33.33%
	Link UA and reduction in public health costs	31.75%
	Compost rebates/incentives	28.57%
	Turf removal rebates/incentives	27.78%
	Stormwater pollution reduction rebates/incentives	23.02%
	Foster land banks	21.43%
	Additional/reduced rate water allocation for UA	15.08%

This category of indicators refers to municipal economic measures of assorted scope and size designed to support UA in its various forms. Table 4 provides an economic measures summary. By keeping local dollars local, as opposed to dispersing them to distant corporations at large national level grocery store chains, UA can serve as a driver for local and regional economic revitalization for the small agricultural business sector, which can pay dividends in the long term. Because UA products tend to have a higher price point when compared to conventional industrially raised produce, the onus is on the municipal government to assist local agriculture-based businesses in educating citizens on how their purchasing power is utilized in the local and regional economic system when opting to

purchase local. Studies have found local food has a better rate of return on investment for agricultural entrepreneurs than non-local food, as it's estimated that urban farms that sell to farmer's markets in Philadelphia can profit $68,000 per half acre (Berg 2014). In addition to the profit margin potentials for local agricultural businesses, local food is also thought to have positive effects across the local economy (Draper and Freedman 2010; Rahe 2017; USDA 2018). Rahe (2017, 12) specifically found:

> When determining the multiplier effect, which is the ripple effect of spending money in the economy, local farmers were determined to be 1.74, compared to 1.38 for non-local farmers. This means that local farmers support an additional $0.36 of sales throughout the broader Central Oregon economy for every dollar of local produce sold.

These economic impacts resulting from UA can have significant effects on local economic development and are accordingly included in this index. To determine how local governments approach UA in the economic context, this section pertains to linkages between UA and broader economic benefits of UA, both locally and to the region. Indicators in this section include if an explicit linkage is made between UA and a reduction in blighted properties, if UA is connected with the potential for neighborhood revitalization and increases in property values, and if UA is explicitly linked with increased local jobs. Approximately a third of the sample links UA to reduced nutrition related public health costs, meaning those associated with obesity and type II diabetes.

Financial Incentives

City-driven financial incentives can take various forms. These are separate from city information reporting the large-scale economic factors affected by UA and instead, manifest primarily in the form of grants, rebates, incentives, and other benefits offered for UA related necessities. The rebates included in the section are compost rebates/discounts,

rain barrel rebates/discounts, irrigation system replacement rebate, turf removal rebate, and a stormwater incentive/rebate. These rebates and discounts are important to include in this research as they all either a) directly incentivize behaviors that positively affect residential UA. For example, compost bin rebates or discounted compost for purchase incentivizes residential use, and most were offered with gardening workshops or other types of information dissemination. Irrigation, turf removal, and stormwater rebates encourage residential rejection of quintessential American lawns and landscaping, and instead promote native grass landscapes and UA. These factors were most often associated with the environmental benefits of UA and often presented in the context of individual contributions to solving the climate crisis. Grants as economic index indicators refer to any micro-grants the city may offer, such as community beautification grants, provided they are to be used for a UA purpose, as is the city giving a direct financial contribution (can also be in the form of tools, soil, mulch, etc.) to community gardens. Incentive indicators include an incentive for local food/beverage/UA vendor purchases, which can be internal for the purpose of supplying city operations needs or offered to business partners often at a discounted rate.

Land Security

The next subsection of economic indicators focuses upon UA incentives offered on city land: land trusts, land banks, and a streamlined city land disposition process. As previously mentioned, one of the common struggles for UA operations is the lack of protection from development. Many community gardens are built on city land, some with permission and in other cases, using guerilla gardening tactics. Particularly for those established with city permission, without land banks and land trusts to protect the land,

they operate in constant peril of having the land sold for development purposes. If cities choose to address this problem, they can do so through the use of land banks and land trusts, which protect the land from sale. Ensuring UA endeavors have land security is thought to be one of the most effective ways local governments can engage residents (Draper and Freedman 2010; Rosan and Pearsall 2018). Additionally, cities can offer streamlined land disposition processes, often with special financial arrangements, to give community gardens ownership of the land. The disposition indicator also includes the few circumstances in which cities offer long term land use permits, specifically for UA purposes. While the city disposition indicator demonstrates less aggressive municipal UA support than land banks and land trusts, it does provide insight into the city's attitudes toward small businesses and an openness to UA within city limits.

Small Business Support

Even if a city implements land security measures, there are still more supportive actions some cities are taking to ensure UA entrepreneurial success. Part and parcel of a city's willingness to engage UA from a locally focused economic perspective is the municipal attitude toward small business support structures. This research acknowledges that many localities offer a range of incentives, tax breaks, and small business support programs that are not exclusive to a particular business sector. Those general sort of fiscal supports are not included in the index, as we are most interested in UA specific programs and policies. While this approach admittedly limited the spectrum of policies included, it is my position that limiting inclusion to UA specific policies answers the research questions most efficiently by ensuring a dedicated focus.

There are three local level economic indicators in this UA specific economic support category: an additional/reduced rate water allocation for UA, protection of aquaculture in the municipal code, and permitting the sale of crops and/or animal products on non-commercial property, including residential. It is noted that most municipal code related measures are addressed in the *All – Administrative/Legal – N/A* section. The reasoning behind this categorization is that aquaculture ventures are very rarely, if ever, limited to residential scale and are almost always commercial in nature. Ensuring access to this opportunity is then considered an economic support. Lastly, when municipalities allow less onerous paths for small business growth to develop, they are providing an economic support to the local business community. In the context of UA, producers often rely on farm stands and cottage enterprises to begin to build a customer base and thus, this municipal flexibility is included as an economic indicator. Cottage enterprises encompass certain categories of foods that can be sold without a business license or the requirement to undergo inspections. Expanding where cottage enterprise and other small business products can be made and sold is indicative of a supportive attitude from local government. It should be noted that almost 80% of the cities sampled allow UA sales on non-commercial property.

All – Administrative/Legal – N/A

Table 5: All - Administrative/Legal - N/A Programs and Policies

Pillar of Sustainability	Indicator	% Cities Engaging
All – Administrative/Legal - N/A*		
	Community gardens in special/other misc districts	92.06%
	Community gardens in low density zones	91.27%
	Community gardens in mixed use zones	91.27%
	Beekeeping in special/other misc districts	90.48%
	Community gardens in high density zones	90.48%

	Fowl/rabbits in special/other misc districts	89.68%
	Beekeeping in low density zones	87.30%
	Farmers' markets	85.71%
	Fowl/rabbits in low density zones	85.71%
	Municipal code reference UA	84.13%
	Goats/sheep in special/other misc districts	83.33%
	Rooftop gardens permitted	83.33%
	Community garden information	81.75%
	Beekeeping in mixed use zones	78.57%
	Fowl/rabbits in mixed use zones	75.40%
	Beekeeping in high density zones	72.22%
	Goats/sheep in low density zones	72.22%
	Provide access to UA/gardening information	72.22%
	Promotion of local food (general)	71.43%
	Access to university extension program	69.05%
	Connect UA with sustainability efforts	68.25%
	Fowl/rabbits in high density zones	66.67%
	UA in Comprehensive or General Plan	64.29%
	Pigs in special/other misc districts	60.32%
	Interdepartmental collaboration on UA	57.94%
	Pigs in low density zones	46.03%
	Urban livestock information	46.03%
	Community garden staff	43.65%
	Promotion of school garden	43.65%
	FPC delegate	39.68%
	Promote vertical gardening or hydroponics	37.30%
	Permanent UA staff	36.51%
	Community Supported Agriculture	34.92%
	Goats/sheep in mixed use zones	33.33%
	UA or Food Department	28.57%
	Food hub	27.78%
	Food Policy Council (FPC)	26.19%
	Connect UA with resiliency efforts	25.40%
	Height exemptions for rooftop gardens	19.84%
	Promotion of farm to school	19.05%
	Goats/sheep in high density zones	14.29%
	Pigs in mixed use zones	14.29%
	Goat landscaping initiative	13.49%
	Height exemptions for UA buildings	11.11%
	Pigs in high density zones	11.11%

**All – Administrative/Legal - N/A refers to efforts necessary for comprehensiveness but that don't fall under any one pillar. For example, many cities mention UA in their Comprehensive Plans, but may lack a Climate Action Plan. The Comprehensive Plan would fall under this category. Similarly, a city department devoted to UA or food in general seems sensible information to include in a comprehensive compilation of UA activities but does not fit under any one of the three pillars.*

Measures to assist with implementation and management of UA programs and policies occasionally fall outside the scope of sustainability entirely or conversely, are representative of all three pillars and thus, can't be labeled as one pillar in particular.

Despite a slight pivot from the sustainability context traced so far, these measures can provide significant insight into a city's priorities and attitudes and are worth documenting in this index. To this end, some of the indicators included pertain to allowances for UA in the municipal code, city planning, or other administrative or legal measures. These types of efforts were catalogued because they can have significant impacts on UA. While important, they cannot be considered as solely social equity, environmental, or economic in intent or nature; either they encompass elements of all three categories or one is unable to be clearly identified as present, but they are still related to UA and thus, are included in this index. Efforts in this section entail primarily administrative programs or policies driven by the city government. While there are certain indicators which allow for the inclusion of nonprofit or community work, this section examines efforts the city is directly responsible for, as it provides insight into how the city develops UA and prioritizes funding allocations. The first indicator inquires if the city has a department or program devoted to UA or food in general. In some sampled cases, UA is framed as an avenue for greening the city in a sustainable manner. In others, it's touted as a mechanism for local or regional food security as the primary driver. Since the fundamental questions of this research are focused on UA in the context of sustainability, whether or not a city maintains such a department is a valuable question. Additional indicators in this section also include if the city employs any permanent UA positions, if resources from multiple departments are used to achieve UA goals, and if the city employs community garden or farmer's market staff. Of the 116 cities evaluated, 86 (74%) have a sustainability department, 36 (31%) have a food program, 46 (40%) have permanent UA positions, 73 (63%) use resources from multiple departments, and 55 (47%) employ staff specifically to assist with community gardens. Table 5

demonstrates the percentage of cities in the sample engaging in activities related to each indicator.

Food Policy Councils

As previously discussed, the extant literature suggests food policy councils (FPCs) can exert significant influence over a city and/or county's food policies and initiatives (Scherb et al 2012; Harper et all 2009). FPCs can bring expert knowledge sharing to the table, from all aspects of a local food system. FPCs are routinely comprised of professors from local universities with expertise in food policy or public health, local distributors and producers, city or county officials, local and regional farmers, food industry employees, and/or concerned citizens (Johns Hopkins Center for a Livable Future, 2019). In addition to knowledge sharing addressing food-related issues, FPCs and other similar types of groups and committees have also proven to be a long-term strategy for potential capacity building success (Johns Hopkins Center for a Livable Future, 2019). As a result of the broad food policy capabilities of FPCs, this research includes two factors related to FPCs: if the city fosters one itself or if the city has a delegate on a local FPC. Since FPC structures can adopt many forms, it's important to consider both possibilities, as either form demonstrates food policy development interests on behalf of the city. Of the cities sampled, 33 (29%) drive FPCs and 50 (43%) put forth FPC delegates. Additional research is needed in the future to further clarify the role and impact of FPCs on UA. Chapter Four of this dissertation will evaluate each case's relationship with local FPC if one is present.

Avenues of Sustainable Urban Agriculture

Indicators in this section pertain to various UA mechanisms that have benefits to one or more pillar of sustainability, so are captured in this catch all category. Indicators in

this section include if the city promotes local food in a general sense. As local food in general with regard to sustainability can't easily be ascribed to one particular pillar or another, it's documented in this section of the index. If a city's sole promotion of local food is providing general information on a fair or rodeo type of event, it is not accounted for in this index. As many fairs and rodeos tour on national circuits, it's difficult to discern how much local agricultural business is actually involved and in what ways.

This portion of the index includes if the city promotes farm-to-school or school garden programs. Research suggests there are many benefits to the integration of UA with education, from academic performance improvement in science to better dietary choices and behaviors (Blair 2009; Hermann et al 2006; Klemmer, Waliczek, and Zajicek 2006). These approaches that serve to introduce children to healthy food are integral to childhood health. Childhood obesity rates have risen drastically in recent decades. From 1980 to 2014, childhood obesity rates in the U.S. rose from 5% to over 17% (CDC, 2015; Lyson 2015). Childhood obesity can lead to serious health concerns, such as diabetes and heart disease; social concerns, such as an increase in experiencing bullying or other detrimental effects; as well as contributing to significant health care costs, borne both by the individual, their community, and state health care and/or insurance programs. In an effort to combat this issue, many school districts have initiated farm-to-school and school garden programs to try and bring low-cost nutritious food into their cafeterias. In addition to the nutritional benefits, there are also long-term gains to be made in connecting young students with the sources of their food to develop lifelong healthy eating habits. Nationally speaking, roughly 42% of school districts employ some form of farm-to-school or gardening activities (Lyson,

2015; USDA, 2015). In this sample, 24 (21%) and 55 (47%) of cities promoted or provided support for farm-to-school and school garden programs, respectively.

Another educational avenue cities may opt to pursue to enhance municipal UA efforts is to collaborate with a local university extension office. University extension offices are generally excellent sources of agricultural knowledge and skill building for the community in areas ranging from backyard gardening to financial literacy. Working with extension offices allows city decision makers access to reliable data, as well as boots on the ground to assist with information dissemination. A majority of cities sampled, 87 (75%), collaborated with extension offices to achieve UA goals. In some cases, the extension offices were part of a local university within city limits. In others, cities worked to build relationships with their state's land grant university, occasionally hundreds of miles away. Other local food or access indicators include promotion of or support for community supported agriculture (CSA) operations, farmers markets, community gardens. Each of these sustainable UA food access points offer affordable, locally grown produce, often with financial accommodations, for low-income residents.

A tangential indicator also included in this section is the presence of a food hub. Evaluation of this particular indicator does not measure if the city actively promoted or engaged with a local food hub, but instead reports the presence or absence of one. According to the USDA definition, food hubs are "businesses or organizations that actively manage the aggregation, distribution, and marketing of source identified food products to multiple buyers from multiple producers, primarily local and regional producers, to strengthen the ability of these producers to satisfy local and regional wholesale, retail, and institutional demand" (USDA, 2019). For consistency in accounting, this research relies

solely upon the USDA Food Hub Directory (USDA, 2019). Of the cities sampled, 35 (30%) had USDA recognized food hubs present within city limits.

City Planning

This subsection of indicators evaluates if and how a city incorporates UA into their planning. Long term planning is indicative of directional shifts, motivations, and goals and provides clear insight into the value a city places on the incorporation of UA into its future, as well as overtly demonstrates what UA knowledge and expertise a city holds. Long term planning and eventual codification is essential for UA success in urban environments, where potential post-development property values serve to entice developers and thereby gentrify areas, forcing out previously residing low-income citizens. By evaluating various city plans for elements of UA, we are able to determine if UA plays a role in the city's future and if so, in what context. This section inquires if the city has incorporated any elements of UA into its existing master plan, if UA is explicitly linked to sustainability, and/or if the city links UA efforts with resilience. The benefits of including food action plans are two-fold. Primarily, food action plans are generally indicative of a strong commitment to increasing food access, public health, the environment, and local economic revitalization.

Land Use/Zoning/Permitting Measures

This cluster of indicators comprises the largest piece of the index, as 28 factors were evaluated for this section. All pertain to the city's municipal code. A vast majority of cities store their municipal code in the Municode database or in the American Legal Publishing Code Library. A small number of cities stored the information on their websites, independent of either database, but the relevant information was available online for every city. The basic question we are able to measure by evaluating these factors is how

accommodating the city government is to UA activities. The preliminary and most basic question asked is if UA is present in the city's municipal code. Of the cities sampled, 106 (91%) included UA in their municipal code in some form. The remaining questions all refer to zoning codes for UA buildings and UA poultry, small animals, livestock, and apiaries (beekeeping). Additionally, this section evaluates the zoning requirements for community gardens and urban farms to gain an understanding of how accessible UA is to residents.

As Table 5 demonstrates, each of the animal categories are grouped based on animal/product and evaluated as to whether a city's municipal code permits each type of UA venture in four types of zones: high density, low density, mixed use, special/other misc. The special use category serves as a "catch-all" for miscellaneous zones such as agricultural, rural, historic, etc. For example, fowl and rabbits comprise one category, while sheep and goats another. Initially, these were individual categories. They became grouped together during the data collection stage, as it became clear that city requirements for each element overlapped. Where birds were allowed, rabbit were allowed, and same for sheep and goats. Since each category has an indicator for the four different types of zones, evaluating them separately more heavily skewed the points available in favor of this section of the index. As many more elements are important to consider regarding the nexus between municipal UA policy and the pillars of sustainability, it makes sense for the purposes of this research to group overlapping categories together in order for the entire index to be more proportional to those elements outside of zoning codes. A zone selection process was also necessary, as cities have many types of zones, and it was not feasible to include all here.

It's interesting to note the high prevalence of some of the indicators in this section. Of the cities sampled, 97 (84%) include UA in some form in their municipal code. This can manifest as a wide range of elements, from zoning guidelines for backyard chickens to rooftop garden standards to water allocations for community gardens. Additional indicators include promotion of hydroponics or vertical gardening, inclusion of UA buildings such as hoop houses or greenhouses, and rooftop gardens/green roofs. If height exemptions were allowed for either is also captured as an indicator in this section. Rooftop gardens are permitted in 105 (91%) of cities sampled. Perhaps most notably, community gardens and urban farms (combined because many cities do not differentiate between the two in a codified sense) are permitted in all four zones in 90+% of cities sampled, demonstrating an overall responsiveness to the rising demands for locally grown foods and citizen engagement with UA. Future research could explore the mechanism by which these zoning allowances were granted, as in Memphis for example, advocacy by a food policy group led to less restrictive zoning ordinances as Chapter Four will discuss.

Conclusion

This index has attempted to survey the landscape of municipal level UA programs, policies, and efforts. A wide range of programs exist, and much UA knowledge and information is being provided by city governments to citizens all across the country, representative of all three pillars of sustainability. It's clear that many of the 116 cities sampled consider UA a useful mechanism in their governance toolbox and actively work to remove obstacles and barriers. While this is an excellent foundational start to understanding the nexus between UA and sustainability for cities, there are still questions left unanswered. For example, *why* do cities undertake all of the aforementioned activities?

Why is there such wide variation between cities, particularly those in close geographical proximity to each other, such as some of the sampled cities in California or Texas? Chapter Three will apply the scores from this index as the dependent variable and analyze them across a selection of independent variables in an attempt to tease out answers to these questions.

Chapter 3: A Quantitative Analysis of Urban Agriculture Ordinances

Introduction

The third chapter of this research uses quantitative methods to answer the research question of why cities' approaches to UA vary and what factors help explain this variation. The findings will then be analyzed for consistency with the extant literature with regard to factors that influence municipal-level variation in the pursuit of sustainability. The preceding chapter demonstrates the complexity of the relationship between sustainability and urban agriculture policies at the municipal level. The linkages between UA and other more traditionally researched sustainability programs and policies suggest that some overlap will be exhibited between the demographic characteristics of cities that aggressively pursue sustainability and those that adopt UA. Based on the existing body of literature, it is realistic to consider it likely the reasons for variation are based on political ideology, perhaps levels of educational attainment, socioeconomic conditions, both in the present and over time, population, demographics, etc. Quantitative analysis will assist us in understanding precisely which factors play a role and to what extent they influence development of and support for UA programs and policies in the aggregate. Determining which factors contribute to a city's likelihood of engagement with UA programs and policies serves to help answer one of this dissertation's primary research motivations: explaining variation in approaches to UA in cities across the United States. Identifying UA's similarities and departures from sustainability policies more commonly addressed in the

extant literature is meaningful, particularly in light of the broad scope and span of the UA efforts that were revealed in the UA index discussed in the previous chapter.

Significant precedent for this methodology exists in the extant literature, particularly as related to environmental policies at the municipal level (Portney 2003; Opp, Osgood, and Rugeley, 2014; Jepson, 2004; Liao, Warner, and Homsy, 2019; Portney and Berry, 2010; Portney and Berry 2014; Florida, 2012; Lubell, Feiock, and Handy 2009; O'Connell, 2008; Saha 2009; Krause, 2011 2012; Pitt 2010; Opp and Saunders 2013). As this line of inquiry has unfolded in more depth over the last few decades, many factors have been identified as having correlations with the increased likelihood of sustainability programs and policies. This research evaluates a range of independent variables (IVs) to determine which factors exert influence across the sample of 116 cities (Appendix C). As mentioned, many of the IVs considered to influence the pursuit of sustainability policies are elements of demographic information. City demographic information is integral to sustainability research because it can provide a basis for comparison across cities, as well as a deeper understanding of how demographic circumstances impact a city's approach to sustainability. For example, Devashree Saha (2009) found primarily manufacturing-based economies predict a lower probability of environmentally progressive policy, while Portney and Berry (2014) and Florida (2012) suggest the presence of a large creative class, deriving from a cluster of factors, such as liberal values, high education levels, high personal incomes, and active environmental groups, correlates to increases in likelihood of sustainable policy adoption in addition to whether or not a city is a central, independent, or suburban city. In this context, a central city refers to a densely populated urban core city at the center of a large metropolitan area (U.S. Census Bureau 2010). An independent city is

considered the primary administrative division from the State perspective and is not a part of a territory or county (U.S. Census Bureau 2010). There are 41 independent cities in the United States, 38 of which are found in Virginia (U.S. Census Bureau 2010). Two of the cities included in this research's sample are considered independent: Baltimore, MD, and St. Louis, MO.

Some sustainable cities research also considers state and regional variables. Regional factors are included to account for variations in larger geographic contextual influences observed in previous sustainability research. Western region localities demonstrate an increased likelihood of attitudes and policies favorable to progressive environmental interests (Portney 2003, Saha and Paterson 2008, Slavin 2011). Over the last few decades, California has established itself as a consistent champion and leader of environmental policies, with a strengthening of state laws requiring certain city sustainability initiatives, while others, such as Louisiana, are predominantly at the bottom of the pack (Bettencourt 2002, Rabe 2013). This chapter will explore relationships such as these in a similar fashion regarding how they pertain to UA and sustainability policy by first discussing the dependent variable of the UA index, then the selection of independent variables, the hypothesized relationships, hypotheses tests results, and analyses of the data.

Dependent Variable

The previous chapter illustrated the significant variation in UA policy across large U.S. cities. As described, Chapter Two created an additive index totaling indicator scores from each city. The score each city received is the cumulative total of the policies and program indicators captured in the index and is numerically representative of the

resources and energy each city is willing to allocate to UA. As a proxy for cities' levels of commitment to UA, the index score is the DV this chapter intends to measure the IVs across. Since the extant literature currently lacks a dataset related to UA efforts across a large-*n* sample, the index and resulting rankings provide a preliminary baseline against which we can compare cities.

The range between the highest and lowest scores across the largest cities in the United States compels further inquiry. Repurposing index scores as a dependent variable in an attempt to explain variation closely follows in the methodological footsteps of Portney's pioneering work *Taking Sustainability Seriously* (2003, 2013). While the UA index provides insight into the landscape of *which* UA policies cities are implementing and experimenting, it cannot offer explanations as to *why* some cities are so much more engaged in UA than others. Many of these answers may be city-specific and rooted in social, economic, and demographic circumstances unique to each locale. Chapter Four will examine exactly these types of city-specific conditions, as well as some of the deliberative elements of UA large-*n* analyses may be more limited in the ability to uncover via a leader, laggard, middle-of-the-pack case study approach for the largest cities. First, however, this chapter seeks to tug on the threads of generalizability first, to uncover broader patterns of potential causality.

The sample evaluates at least one city from 36 states and includes the District of Columbia. States lacking cities with populations over 200,000 are not included in the sample. The population cutoff is not to imply that smaller cities do not also meaningfully engage in UA; they do. For example, farmer's markets have become ubiquitous in recent years regardless of city population parameters. However, since population and the inherently related availability of resources has so often played a significant role in a city's

ability to create and implement sustainability policy, selecting a cutoff point for sampling purposes is necessary (Portney 2013, Lubell, Feiock, and Handy 2009). The cutoff of 200,000 was specifically selected because it allowed for the inclusion of 32 additional cases, including cities from states such as Alabama, Idaho, Iowa, and Utah, which would otherwise have lacked representation in the sample. Even if population cutoffs were less impactful, the time and resource constraints on this research preclude a larger sample size. As Chapter Two's UA Index is the first dataset of its kind to have been compiled, the intention was to include data from a majority of states, and all of the regions of the U.S., as regional and state characteristics play a role in shaping local approaches to UA. These effects will be examined qualitatively for each of the three case studies discussed in the following chapter.

Univariate Analysis

This section presents pertinent univariate descriptive statistics related to the Index Score. As mentioned previously, this research has an *n* of 116 as 116 cities across the U.S. were included in the sample. The minimum index score a city could receive is 0 and the maximum index score is 124. The range of the sample is unsurprisingly narrower. Yonkers, NY, scored the lowest at 24 total index points. Charlotte, NC; Jacksonville, FL; and Rochester, NY all shared the median score of 68. Chicago, IL, received the highest score of 118. The standard deviation of index scores is 21.14 which indicates considerable variability across the data set. The distribution of index scores is shown in Figure 3 below. We can see the scores have a symmetric bimodal distribution. In this particular histogram, the bars represent approximately 10% of the cities sampled to demonstrate how index scores change across sample percentiles. As a primary intent of this research is to catalog

and explore the range of UA efforts being undertaken and less concern is given to minute comparisons between cities to determine which is "better", the default organizational method employed when cities receive the same score is alphabetization.

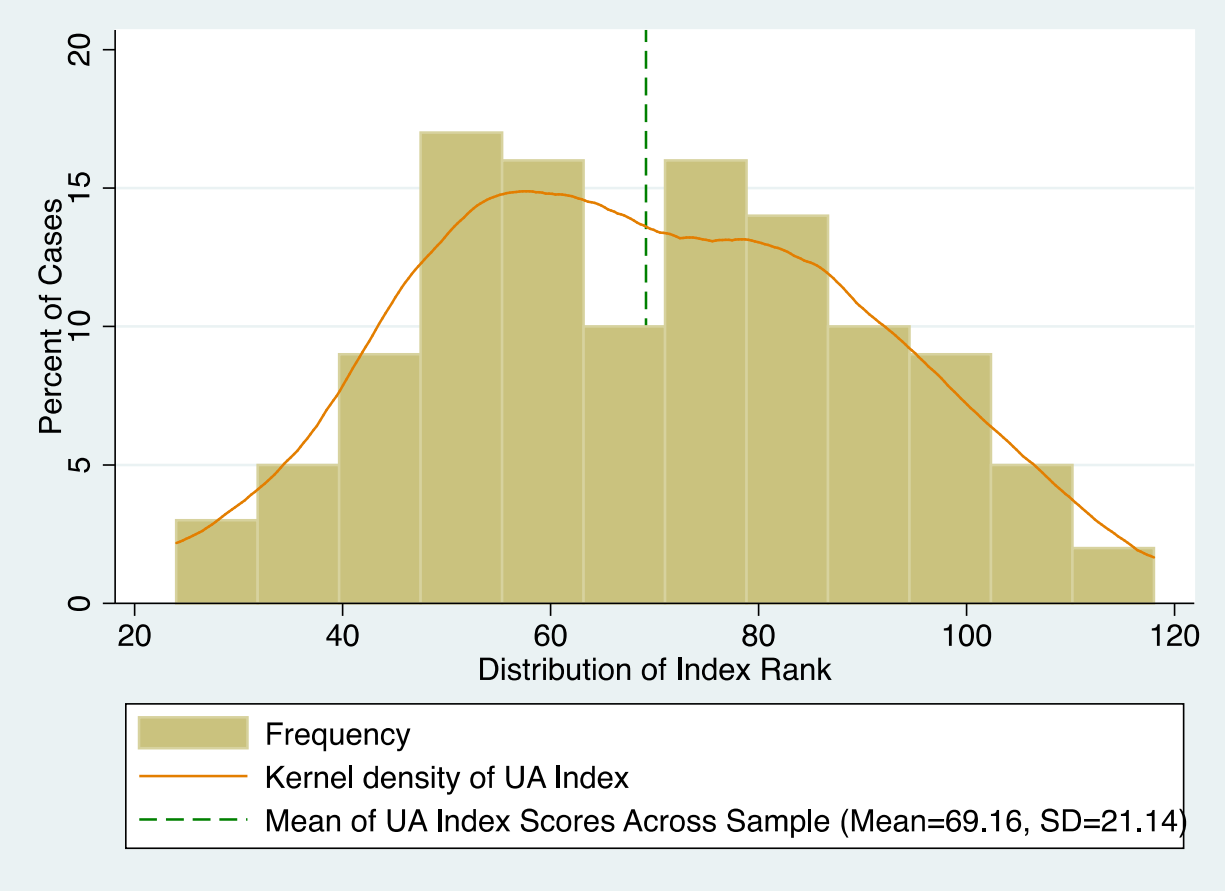


Figure 3: Distribution of Index Scores

Much of the analysis in the remainder of this chapter describes differences in the IVs across various population cutoffs to explore variation in IV behavior dependent upon the size of the city. In both the research and the data, population size dramatically influences policy/program outcome. These cutoffs are needed to be able to examine other possible influences, as there's good reason to think the IVs discussed exert a meaningful influence. When evaluating cities over 500k residents to determine which cities would be included in Chapter Four as case studies, it is apparent the univariate data has significant differences.

In this subsample, the sample range is a minimum of 48 index points and the same maximum of 118. However, the median score of this subset is 86 points as compared to 68 for the entire dataset. Distributions across the population cutoffs utilized in the bivariate and multivariate analysis portions of this chapter are listed below in Table 6. These sample parameters were applied to help explain the variation across the dataset. Since population demonstrates a strong effect on index score, separating subsets at population breakpoints will allow us to examine the effects of variables within those parameters. For these explorations, the full dataset, the sample above and below 500k population, and then a final category that contains four distinct population breakpoints: less than 250k, more than 250k but less than 500k, greater than 500k but less than 750k, and more than 750k. These breakpoints in the data serve to illuminate a few key differences that will be discussed in the bivariate and multivariate sections.

Table 6: Univariate Comparisons Across Population Cutoffs

Sample Parameters	Min.	Max.	Median	St. Dev.	Obs.
Full Dataset	24	118	68	21.14	116
>500k	48	118	86	18.70	35
<500k	24	106	59	18.44	81
<250k	24	95	56	17.53	32
>250k <500k	30	106	65	18.15	49
>500k <750k	48	108	85.5	19.17	18
>750k	49	118	86	18.38	17

Independent Variables

Sustainability scholars have identified many city actions and characteristics, from population size to the state of the local economy, related to the pursuit of sustainability. Opp and Saunders (2013) found correlations between likelihood of a government to engage in sustainability initiatives and multiple factors, including size of population, demographic diversity, and political orientations (690). Lubell, Feiock, and Handy (2009), identify socioeconomic status of the residents and economic health of the city as the most significant indicators of why sustainability initiatives are adopted. Continuations of this line of research suggest the economic health of a city, often discernable through factors such as median home value or household median income, can indicate how well-equipped a particular locality is to fund programs and services, particularly more innovative policies (Opp, Osgood, and Rugeley 2014; Krause 2012).

While the connections between areas with higher median income and home value and more progressive sustainability policy are well established in the literature, there is a growing body of literature arguing that wealth inequality, including resulting environmental justice issues, precludes substantive sustainability policy and directly impedes a localities' collective ability to address environmental issues and implement sustainability-driven policies (Sampson 2016; Ramaswami et al 2016; WHO 2016; Opp 2017; Liao, Warner, and Homsy 2019, Rosan and Pearsall 2017; Homsy and Hart 2019). Other avenues of inquiry demonstrate higher levels of education may also positively influence environmental policy decisions (Jepson 2004; Portney 2008; O'Connell 2008; Opp, Osgood, and Rugeley 2014). It should also be noted that recent research has identified a correlation between higher levels of diversity, particularly with regard to cities with larger Hispanic populations, and increased sustainability scores on sustainability indices

(Opp and Saunders 2013), a finding well worth testing in the context of this dissertation. As the literature currently lacks a large-scale quantitative analysis of this type that focuses specifically on urban agriculture, this chapter aims to fill this gap using univariate, bivariate, and multivariate methods to not only begin to establish explanations as to why UA policies are adopted by some cities and not others, but also to assist understanding if what is known regarding the adoption of city-level environmental policy at large can also be broadly applied to UA.

I focus the bivariate and multivariate sections of this chapter on these eight factors that have been identified as highly correlated with cities that demonstrate a more serious commitment to sustainability: (1) ideological leanings, (2) population, (3) recent changes in city size, (4) fluctuations in median household income, (5) median home value, (6) percentage of Hispanic residents, (7) the presence of a land grant university, and (8) the local adult diabetes rate. After preliminary quantitative exploration to narrow the range of indicators explored,[7] each of these factors were found to have statistically significant relationships with the index score and, in addition to aligning well with UA goals cities pursue, were considered suitable for inclusion in the final model to determine if the relationships hold when evaluated against each other. In the subsequent section, I will outline my hypotheses testing possible explanations for variations in approaches to UA across cities and discuss bivariate findings.

Hypotheses

1. Political Ideology

[7] The full exploratory regression model from which initial significance was determined is available in Appendix E.

The first factor considered for this research is political ideology. Given the influence ideological leanings have been found to exert over sustainability policy, it is reasonable to entertain the explanation that a more liberal political climate may favor support of UA programs and policies over a conservative one.

H1: Cities in counties with more liberal voters will demonstrate higher UA index scores.

This hypothesis is measured by the percentage of voters in the county that voted for a Democratic candidate in the 2016 presidential election. When this data was collected, this was the most recent data available. Data was gathered for each city's county from CityData, an online repository of municipal information.[8] CityData is an informational website that compiles demographic and economic information on U.S. cities from multiple public, private, and government sources. While county data might not be precisely representative of the city voter base, since the population floor for any city in the sample is 200,000 residents, in many cases the city is the majority of the county population. In the instances where cities span multiple counties, the averages of all counties are factored in and weighted according to population percentages.

2. Percentage of Hispanic Residents

To converse with the existing sustainability literature on if the presence of larger Hispanic communities exerts an influence over UA efforts, I evaluate the percentage of Hispanic residents. Research, such as that of Opp and Saunders (2013) and Opp, Osgood, and Rugeley (2014) have found significant correlations between increased city likelihood to

[8] www.CityData.com

engage in sustainability efforts and higher percentages of Hispanic residents, although the drivers behind this have not been confidently identified.[9]

H2: Cities with higher percentages of Hispanic residents will have higher UA Index scores.

The percentage of non-white Hispanic residents for each city was collected from the U.S. Census Bureau's website, and is accurate as of 2018 estimates, when the data was initially gathered. It could be argued that diversity scores may provide added nuance. However, many of the available tools, such as USA Today Diversity Scores, are based on county population. The specificity offered by percentages of Hispanic residents was preferred for the purposes of this research, as several of the larger cities span multiple counties and some of the smaller cities share counties with their suburban areas. The selection of Hispanic in lieu of non-white Hispanic was decided upon due to the U.S. Census Bureau's available data categorizations. Future research could utilize Social Explorer or a similar tool to determine how the differences between these two measures manifest in a quantitative study such as this.

3. Population

The city populations present in the sample range from Salt Lake City at 200,544 residents to 8,622,698 in New York City. When selecting this sample size, it did not go unnoticed that population would need to be controlled for and likely evaluated by several measures; I selected population and change in population between 2000 – 2016, which will be discussed as the fourth hypothesis. Since cities with greater populations tend to have a

[9] Cities with higher percentages of African Americans were also measured but correlations lacked statistical significance, and the means comparisons only were only slightly significant.

more diverse citizenry and a larger tax base from which to draw resources for sustainability efforts, it is expected cities with higher populations will demonstrate higher index scores.

H3: Cities with larger populations will have higher UA Index scores.

City population data was also collected from the U.S. Census Bureau website[10] and is representative of 2017 estimates. This was the most current data available at the time of collection.

4. Recent Changes in City Size

This variable is measured as the change in city population between 2000 – 2016. As it was expected population size would exert a considerable influence on the index score, an additional metric was needed to understand if this was a constant or if fluctuations would impact this relationship and if so, how much. While virtually all cities experience minor population increases and decreases over time, I anticipate cities with higher percentage population gains will have higher index scores.

H4: Cities with greater population increases will have higher UA Index scores.

The Census Bureau's website supplied the change in population information. The range of years between 2000 – 2016 was the most recent dataset accessible at the time the data was gathered. In addition to economic health impacting a city's likelihood to pursue sustainability, UA case studies in the literatures, such as those focusing on Baltimore, Detroit, or Cleveland, emphasize the declining size and economic health as a driver for the creation and implementation UA policies and programs (Buzby 2014; Treece 2016). While

[10] https://www.census.gov

measures such as median income and home value are informative, the data they provide is one snapshot in time unless compared across multiple years, whereas the inclusion of population change as an IV provides insight into of longer-term economic trends and how they affect local UA decision making. To understand if this is generalizable to cities elsewhere will help inform what is known about UA as a sustainability policy.

5. Fluctuations in Median Household Income

Understanding the migration of residents in and out of cities sheds light on a broad trend that is worthwhile of exploration. It could be inferred that significant population losses would have an economic impact as it did across the post-industrial Rust Belt cities, or that rapid population gains would result in increased income levels but without examining economic factors we cannot be certain. The IV measured to determine if these assumptions have validity is changes in median household income between 2000 – 2016.

H5: Cities with higher percentage increases in median household income will have higher index scores.

As with the last few variables, this data reflects Census Bureau information from the years 2000 – 2016. Median income and home value below were selected over average measures of both due to it being more robust and less sensitive to outliers.

6. Median Home Value

Median home value is another valuable tool for evaluating the economic health of a locality and is indispensable for analyzing neighborhood and block-specific data. While this research does not probe down to that level of granularity, it does include overall local median home value to understand the sampled cities' fiscal situations more precisely than

if relying on income measures alone. As affluence is commonly correlated with more sustainability policies, it is plausible to expect that cities with higher median home values will demonstrate higher index scores.

H6: Cities with higher median home values will have higher UA Index scores.

For consistency and accuracy, this data was also gathered from the Census Bureau. The median home values reported are for 2018 which was the most recent data available at the time of collection.

7. Presence of a Land Grant University

In addition to the ideological, demographic, and economic connections described so far, I included the presence of a land grant university as an independent variable. While level of education attained is more frequently evaluated as an IV in research such as this, I elected to include if a land grant university is located within city limits. Land grant universities are examined as a separate variable due to the deep agricultural roots embedded in land grant institutions and their community outreach through agricultural extension programs. Whether a city collaborated with university extension programs for UA purposes was tracked as a component of the UA Index and 87 out of 116 (69%) cities did indeed collaborate with a university extension program in some capacity to further UA goals. The inclusion of this variable in a quantitative context seeks to understand if geographical proximity to a land grant university leads to an increase in UA policies and programs.

H7: Cities with land grant universities present will have higher UA Index scores.

Whether or not a land grant institution is present was determined by reviewing the USDA NIFA's Land Grant University Directory for specific locations (USDA 2018). Land grant

institutions present in nearby cities or suburbs were not included in the index, only those located in the central city being sampled.

8. Local Adult Diabetes Rate

An IV included in Portney's (2013) sustainability index is the need for environmental policy as measured by air quality, the number of days the Pollutant Standards Index (PSI) was above 50, annual high PSI levels, and mean PSI levels (307, 308). While environmental concerns motivate a 65 (56%) of the sampled cities to engage in UA, public health issues were also commonly mentioned as contributing to a city's UA efforts. The UA Index in Chapter Two evaluated multiple city actions, information, and promotional statements connecting UA and public health concerns including youth nutrition programs, food education, obesity, food pharmacies, and public health costs associated with poor nutrition. It is plausible that cities with more of a public health need for nutritious food, as measured in this case by adult diabetes rate, will engage in UA programs and policies amenable to solutions. The adult diabetes rate is included here as a preliminary test to determine if long term public health needs could be driving UA decisions for cities.

H8: Cities with higher adult diabetes rates will have higher UA Index scores.

Data on three public health metrics was collected from CityData.com: obesity rates, adult diabetes rate, and average body mass index. The adult diabetes rate is an oft-used social determinant of health due to the disease's disproportionate effect on racial and ethnic minority and low-income adult populations in the U.S., and the resulting higher risk of diabetes and rates of diabetes complications and mortality (Hill-Briggs et al 2021). Additionally, as described in Chapter One, the existing research demonstrates cities perceive UA as an opportunity to increase fruit and vegetable consumption with the

specific goal of reducing diabetes (Armstrong 2000; Alaimo et al 2008; Draper and Freedman 2010; Berg 2014; Sadler et al 2014; O'Hara and Toussaint 2021). It would be expected that cities experiencing higher public health costs from high adult diabetes rates would be more likely to pursue UA programs and policies. Thus, the adult diabetes rate was selected as an IV for this chapter.

The eight hypotheses outlined in the preceding sections are also summarized in Table 7 below.

Table 7: Hypotheses Summary

Category	Hypotheses
Ideological	
	H1: Cities in counties with more liberal voters will demonstrate higher UA index scores.
Local Characteristics	
	H2: Cities with higher percentages of Hispanic residents will have higher UA Index scores.
	H3: Cities with larger populations will have higher UA Index scores.
	H4: Cities with greater population increases will have higher UA Index scores.
Economic Health	
	H5: Cities with higher percentage increases in median household income will have higher index scores.
	H6: Cities with higher median home values will have higher UA Index scores.
Education	
	H7: Cities with land grant universities present will have higher UA Index scores.
Public Health	
	H8: Cities with higher adult diabetes rates will have higher UA Index scores.

Bivariate Analysis

This section will explore how variation in the dependent variable is explainable by individual independent variables discussed in the hypotheses listed above. Differences in the mean and standard deviation are show in Table 8 below, illustrating the variance in results across population subsamples. A cursory glance reveals that there is a significant

difference in the means when population breakpoints are applied. There is a difference of 22.6 points between cities with greater than 500k residents and cities with less than 500k residents. However, when drilled down further into more specific population categories, the difference increases to 31.19 points between cities with less than 250k and those with more than 750k.

Table 8: Means and Standard Deviations Across Population Cutoffs

Sample Parameters	Mean	St. Dev.	Obs.
Full Dataset	69.16	21.14	116
>500k	84.99	18.70	35
<500k	62.39	18.44	81
<250k	56.47	17.53	32
>250k <500k	66.26	18.15	49
>500k <750k	82.48	19.17	18
>750k	87.66	18.38	17

While geographic region is not evaluated as an independent variable in the subsequent multivariate model, there are interesting trends to note. As demonstrated in Figure 4 below, the South (41) and West (47) regions have significantly more sampled cases than the Midwest (19) and Northeast (9) regions. This disparity is due to population distribution with regard to national large city locations. The South and West regions are particularly affected, as California and Texas cities comprise 42% of the combined South and West region cities. Figure 5 illustrates the median score for each region. While it might be expected that Western regions scores would be skewed upward due to the minimum sustainability standards cities are required to have by California State law, the West region in fact has the lowest median of the four categories.

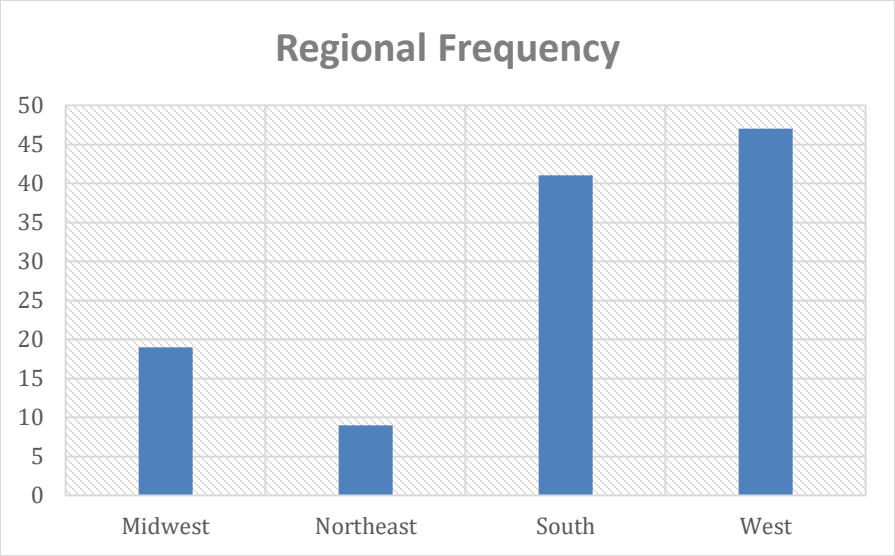


Figure 4: Regional Frequency of Sampled Cities

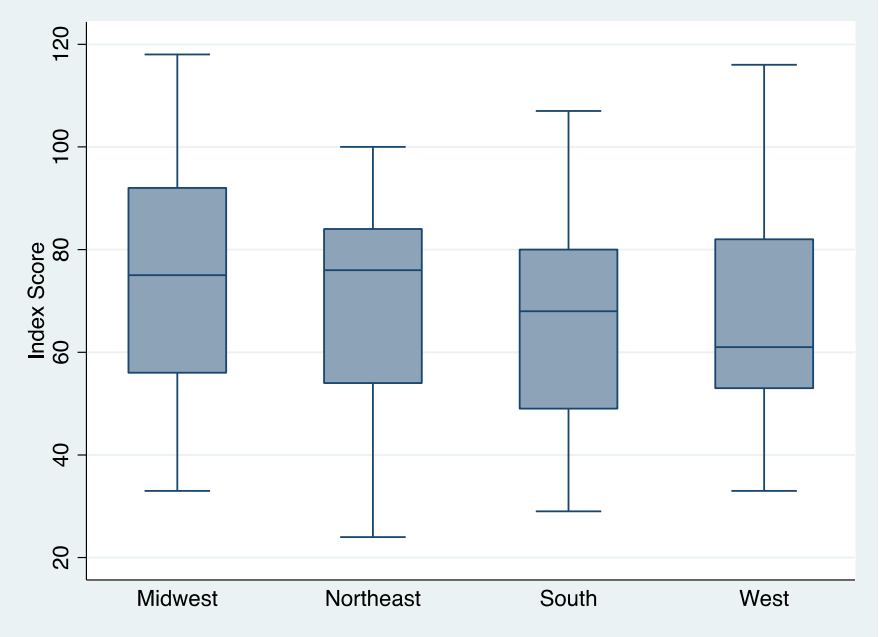


Figure 5: Regional Means Comparison

To further explore connections between the index score and IV's, bivariate means comparisons were evaluated. All of the correlations are Pearson's r and to test statistical significance the Bonferroni correction was applied. The Bonferroni type adjustment is a conservative test that decreases the likelihood of a Type 1 error occurring. Type 1 errors

increase the chance of a false positive result, which would indicate statistical significance when none exists. Table 9 summarizes correlations and means comparisons across political, demographic, economic, local, and educational characteristics.

Table 9: Index Score Correlations and Means Comparisons

Characteristics	Correlation	Mean (SD)
Ideological (2016)		
– Democrat	0.375**	71.59 (22.8)
– Republican	-0.467**	62.15 (15.9)
Population	0.514**	
– >750k (*n*=17)		87.66 (18.4)
– >500,000 <750k (*n*=18)		82.48 (19.2)
– >250k <500k (*n*=49)		66.26 (18.2)
– <250k (*n*=32)		56.47 (17.5)
% Change in Pop 2010-2017	0.036	
– Less than 7.73%		67.94 (22.6)
– More than 7.73%		69.54 (20.1)
% Change in MHI 2000-2016	0.287	
– Less than 39.55%		65.52 (19.0)
– More than 39.55%		71.96 (23.1)
Median Home Value	0.011	
– Less than $228,300		68.50 (18.3)
– More than $228,300		68.98 (24.2)
% Hispanic	-0.281	
– Less than 17.50%		72.83 (19.5)
– More than 17.50%		64.51 (22.5)
Land Grant Institution	0.249	
– Present		81.09 (18.1)
– Absent		66.47 (21.2)
% Adult Diabetes	-0.050	
– Less than 7.95		67.68 (23.0)
– More than 7.95		69.80 (19.7)
Overall Index Mean		69.16 (21.1)

*p < .05 level. **p < .01 level

The difference between the means of ideology and population size are statistically significant, meaning we can reject the null hypotheses for these two variables. Both IVs are performing as hypothesized. The remainder of the IVs do not demonstrate statistical significance here, which may seem initially counterintuitive, but these means comparisons represent the full dataset without applied population cutoffs. The scatterplots below

explore the changes in these relationships across the breakpoints that have been established thus far.

The cluster of scatterplots shown in Figure 6 demonstrate the relationship between index score and the percentage of liberal voters in sampled cities. Each scatterplot is overlaid with a line of best fit to illustrate the direction of the correlation. The plot in the top-left of the figure represents the full city sample; as expected, a strong positive correlation exists between ideology and UA score. However, when compared with the two top-right plots, which are percentage of liberal voters in cities less than 500k on the left and more than 500k on the right, we can determine the positive correlation is much stronger in larger cities. We find similar findings of varying degrees when evaluating the plots in the lower half of the figures, except for in cities with less than 250k population. In this category, the percentage of liberal voters is associated with a slight decrease in index score. This is not necessarily unsurprising as the mean index scores for this population category previously discussed were significantly lower than other population classifications. In fact, three-quarters of the observations in this grouping are below the sample median of 68. Otherwise, throughout the plots we can see all of the cities with index scores above 100 consistently demonstrate higher percentages of liberal voters.

Ideological IV Comparisons Across Population Subsamples

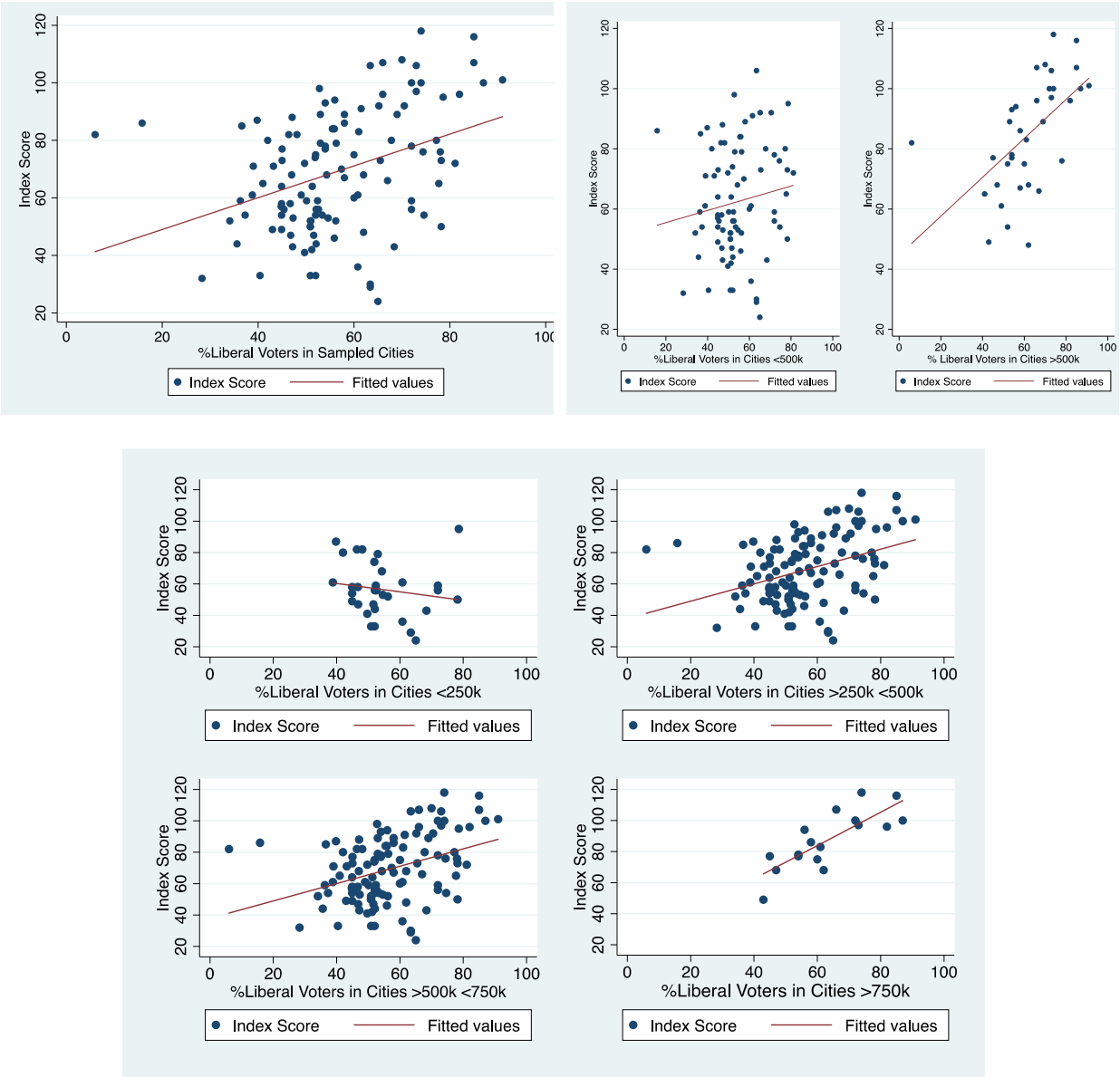


Figure 6: Percentage of Liberal Voters Across Population Breakpoints

Figure 7 depicts the direction of the relationship between the effects of population[11] and index scores. The line of best fit for the whole data sample outlines a positive correlation, and as expected the correlation is strongest for the middle two quartiles of population categories (>250k <500k, >500k <750k). As the largest cities (>750k) are assumed to have the most resources to expend on programs and policies in support of UA, it is logical that the correlation is weaker for that subsample because all included cities have comparatively large populations so population size would exert less of an influence. Conversely, a similar pattern applies to cities with less than 250k and is as expected given the limited size of the tax base in any city less than 250k.

[11] For these models, population is calculated as the log of the city population.

Local Characteristics IV Comparisons Across Population Subsample, Population

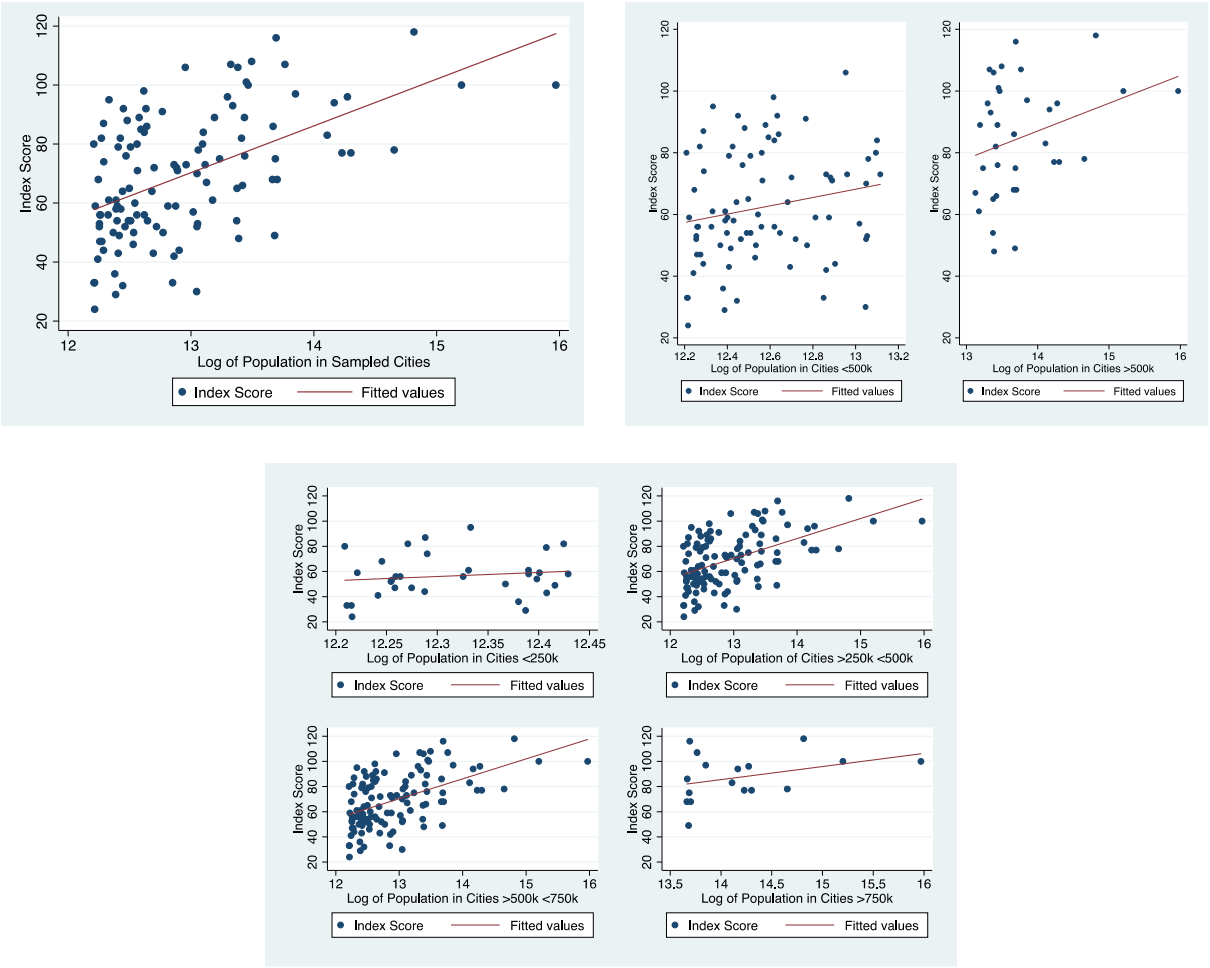


Figure 7: Log of Population Total Across Population Break Points

In the below set of scatterplots the change in population between 2000-2016 and connection with index score is shown. With regard to the full sample, it appears as though there is limited correlation between these two factors. However, when the quartile category scatterplots are taken into consideration, we find that as cities <250k are growing in population, their index scores are also increasing, and for cities >750k as the population change increases, index scores decrease. Perhaps larger cities are allocating resources and staff to more directly developmental efforts to address the population growth and smaller

cities are finding the resources to expand their existing catalog of programs and policies. The cities in the remaining two population quartiles exhibit behavior closer to that evaluated across the full dataset.

Local Characteristics IV Comparisons Across Population Subsample, Population Change

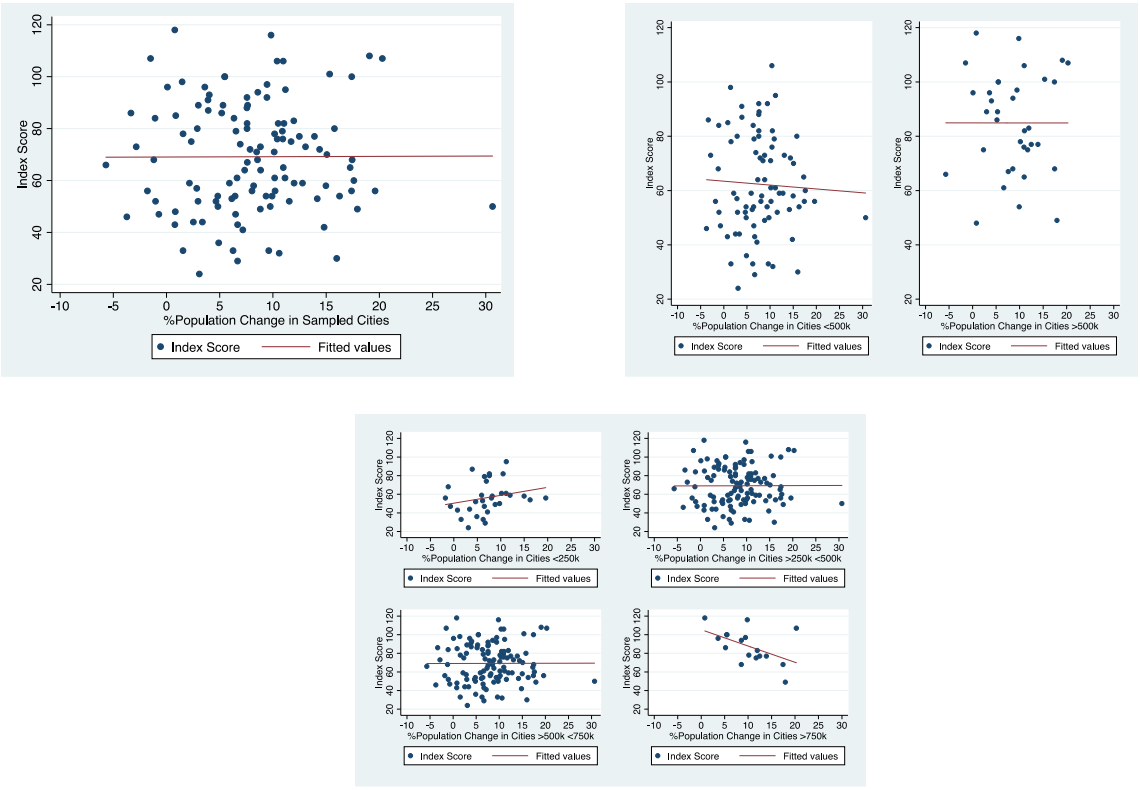


Figure 8: Change in Population Across Population Breakpoints

The economic health demographic indicators will be evaluated in the next two scatterplot evaluations. First, change in median household income is illustrated in Figure 9 below. It appears the pertinent hypothesis (H5) that predicted increases in the change in median household income would result in higher index scores was correct. The deviations between population category are not as extreme for this IV as those discussed above. This is in line with what we expect for cities that pursue sustainability efforts in general.

Economic Health IV Comparisons Across Population Subsample, Change in Median Income

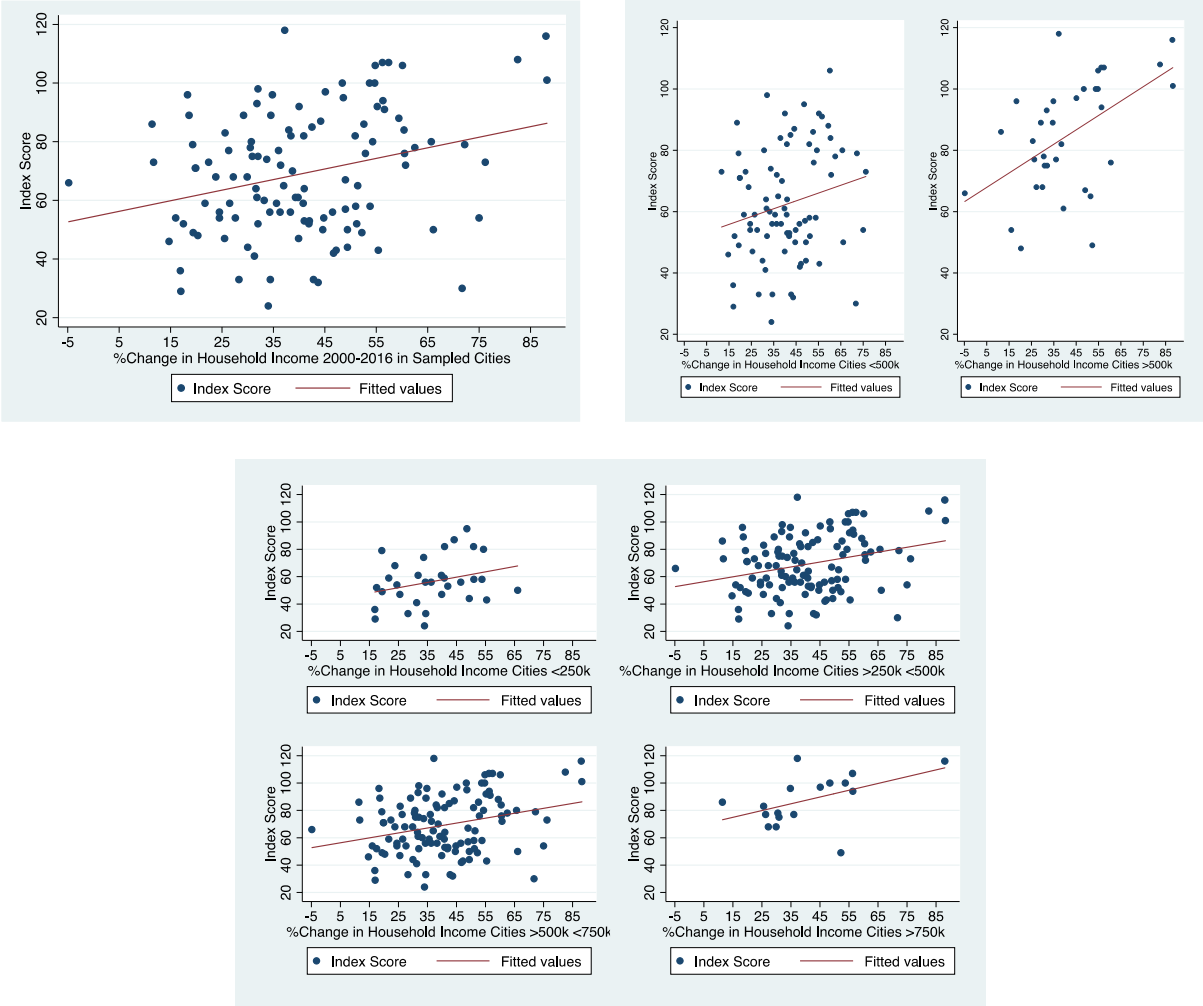


Figure 9: Change in Household Income Across Population Breakpoints

Figure 10 pertains to median homes value and the relationship is as hypothesized: as median home value increases, as does index score. The hypothesis holds across the largest three population subsamples but is strongest in the >750k subset. We can see in cities with less than 250k that increases in median home value exert a negative influence on index score and that this is the only population category within which this occurs. It is also evident that median home value exerts a stronger influence in cities >750k than in the middle two population categories. Generally median home value tends to be higher in

larger cities, but state housing price effects could be exerting an influence on this IV. The point will be discussed further in the analysis section of this chapter.

Economic Health IV Comparisons Across Population Subsample, Median Home Value

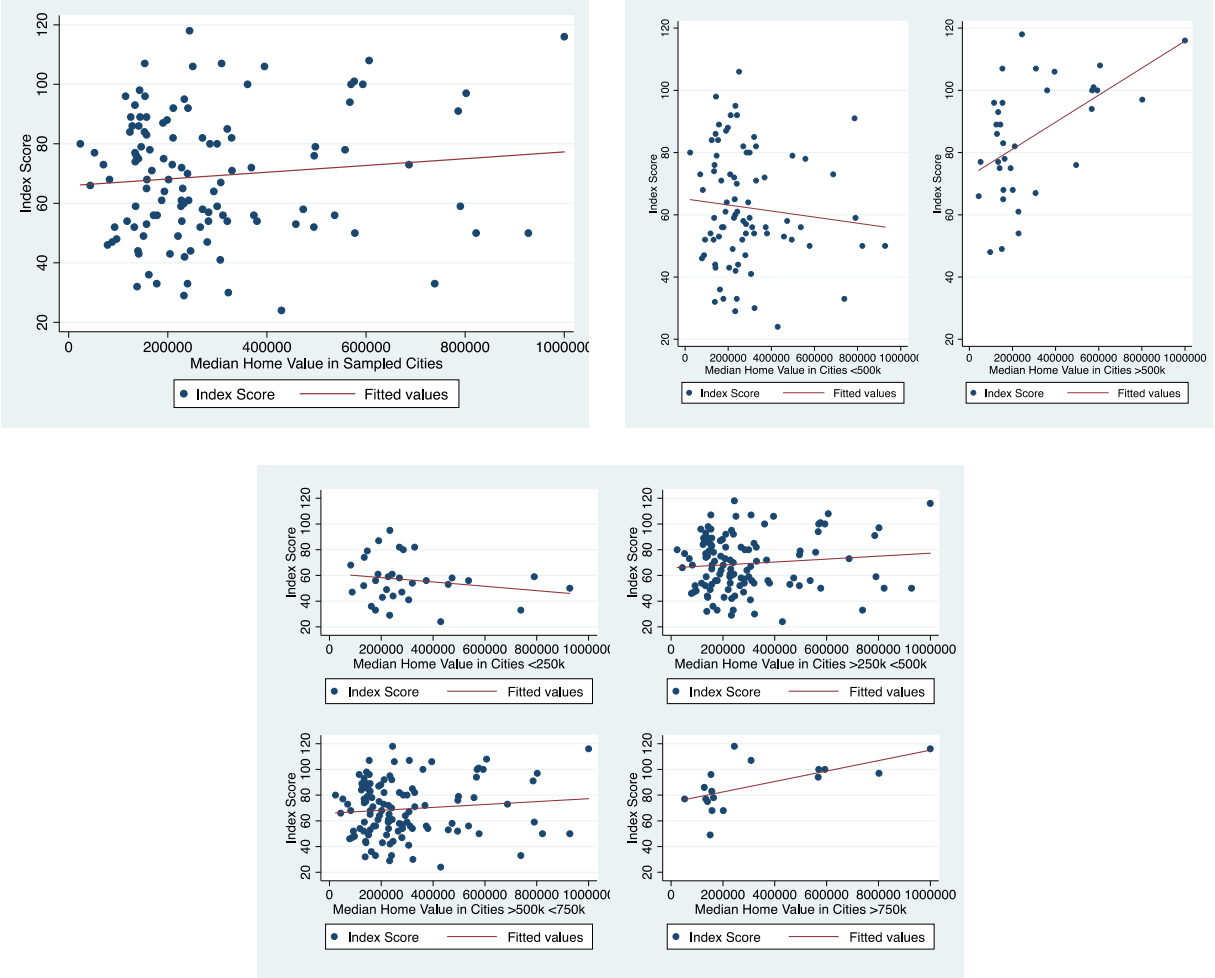


Figure 10: Change in Median Household Income Across Population Breakpoints

The IV measuring the percentage of non-white Hispanic residents, and its relationship to index score is illustrated in the scatterplots below. This bivariate analysis indicates we cannot reject the null hypothesis, meaning that this IV does have an impact on index score. However, that impact is not as expected. The related hypothesis posited above (H2) anticipated an increased percentage of Hispanic residents would improve index score,

but in fact the opposite is true, particularly for cities with populations less than 500k. This is an interesting result as previous sustainability research has found positive correlations between the percentage of Hispanic residents and increased sustainability initiatives (Opp and Saunders 2013; and Opp, Osgood, and Rugeley 2014). It is possible that the relationship is slightly skewed due to the number of cases in the sample from the West and South regions and lower means comparisons found in those regions, in combination with the relatively concentrated dispersion of Hispanic residents across the Western and Southern U.S. The final chapter will discuss this further as an avenue for future research.

Percentage of Hispanic Residents IV Comparisons Across Population Subsample

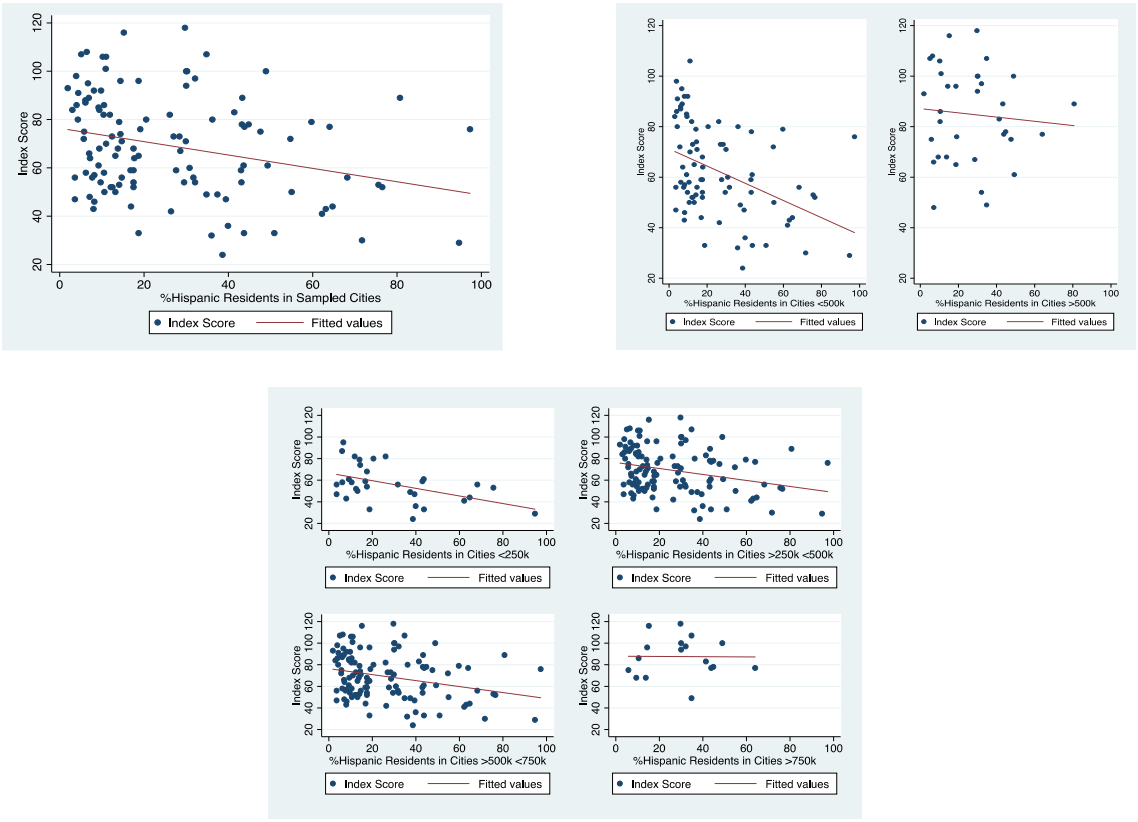


Figure 11: Percentage Hispanic Residents Across Population Breakpoints

As demonstrated in Figure 12 below, land grant universities being present within city limits has a considerable effect on index score means. The mean index score for a city

without a land grant institution is 66.92. Cities where one is located have a mean of 88.33. Across the dataset there are 98 cities without land grant institutions and 18 with. Future research could qualitatively examine the relationships between the 18 cities with a land grant university and their relationship with that university and its Agricultural Extension Office.

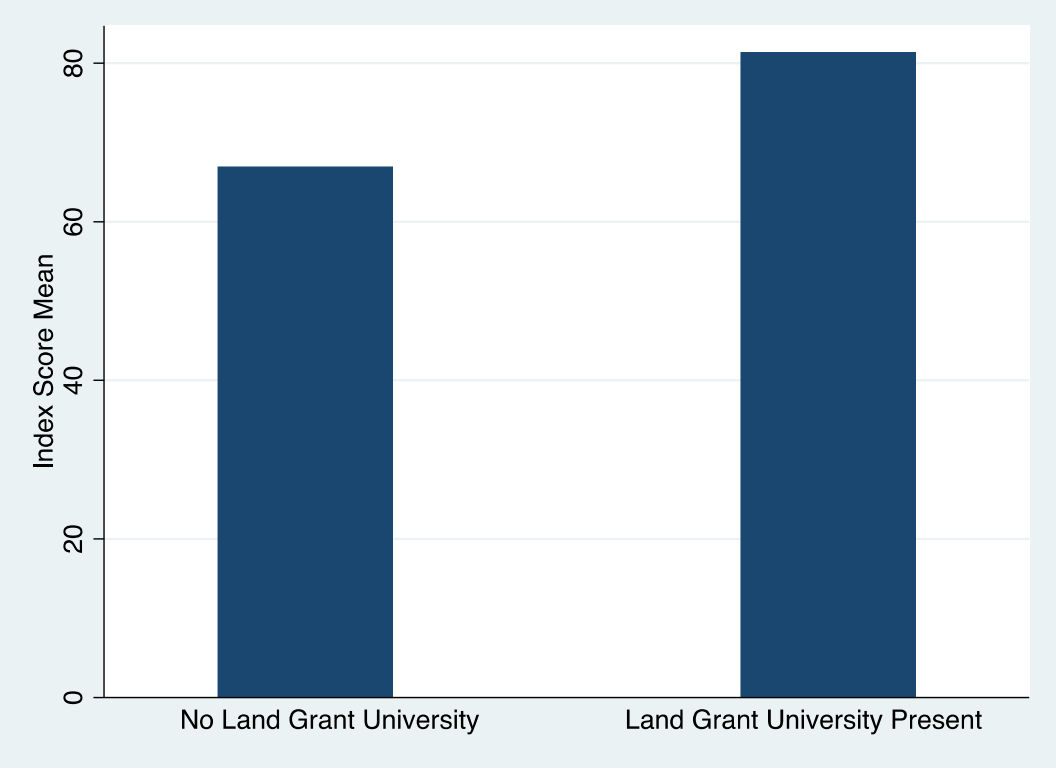


Figure 12: Presence or Absence of a Land Grant University

Lastly, the cluster of scatterplots demonstrating the adult diabetes rate across population breakpoints can be found in Figure 13 below. The related hypothesis (H8) expected higher adult diabetes rates to influence higher index scores; however, it appears the inverse effect is occurring, save for a slight positive correlation in cities <500k, which we can observe is actually only true for cities <250k in the lower group of scatterplots. It could be worthwhile for future research to examine more public health metrics and

relationships to UA, as public health concerns are a recurring theme in city promotion of UA, but it remains unclear if such concerns do indeed drive UA programs and policies.

Public Health IV Comparisons Across Population Subsample

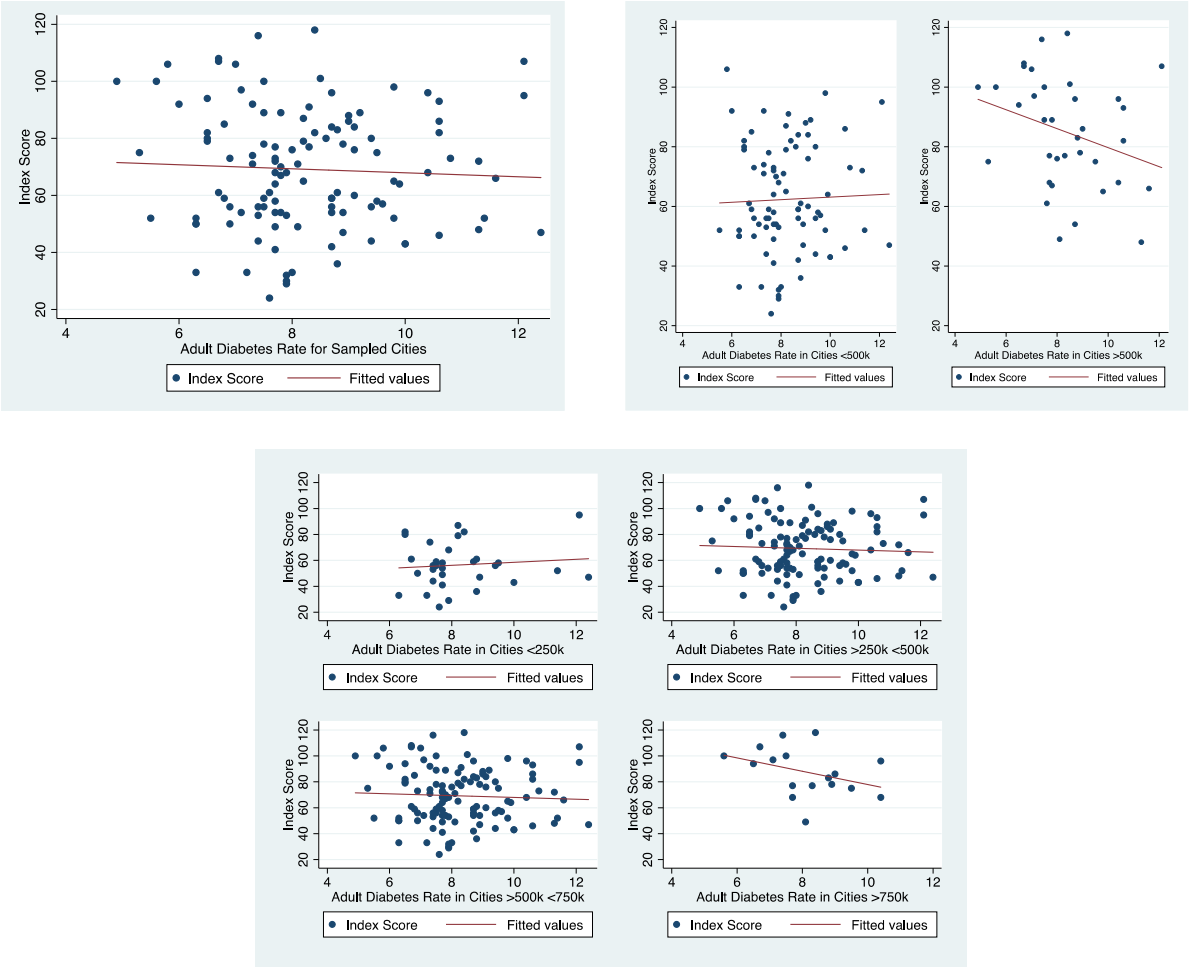


Figure 13: Adult Diabetes Rate Across Population Break Points

Multivariate Analysis

The previous sections preliminarily evaluate the nature and direction of the relationships between the eight hypotheses and the index score. Since there are multiple variables with correlations at various population breakpoints, we must determine if any of these initial explanations are competing and which of the variables exert the strongest influence over a city's index score. I use an OLS multiple regression model, assuming equal

variance, and run three tests for problematic occurrences or distribution of the data. First, I performed a residuals-versus-fitted, or RVF, plot test to make an initial determination if heteroskedasticity or non-linearity are present in the model. The residuals exhibit normal distribution across the graph indicating neither heteroskedasticity nor non-linearity. I then conducted a Breusch-Pagan/Cook-Weisberg formal heteroskedasticity test for both the DV and IV and confirmed that we fail to reject the null hypothesis that homoscedasticity is not present. I then evaluated variance inflation factors (VIF) to test for multicollinearity and was able to establish with low VIFs that multicollinearity was not detected.

Table 10 below provides the results of the regression models. The regression was conducted in multiple iterations, in which one model captured the full sample and additional models were estimated with a less than 250k population break point, a greater than 250k and less than 500k population break point, a greater than 500k and less than 750k cutoff, and a greater than 750 category. As was demonstrated by the scatterplots in the bivariate analysis section, many of the IVs behave differently at varying population levels. To better understand how this affects the strength and importance of the impact of the IVs on index scores, regressions were conducted in a similar manner. All models had statistical significance levels of less than $p = 0.05$ except the model with population cutoffs of greater than 500k but less than 750k, which had a statistical significance level of $p = 0.095$. Three of the models, including the full data set and lower population break points, had statistical significance levels of less than $p = 0.01$, and the full data set was $p = 0.001$.

Table 10: Multiple Regression Model

Independent Variable	**Coefficient**					**Standard Error**					**P-Value**				
Population Subsample	None	<250k	>250k <500k	>500k <750k	>750k	None	<250k	>250k <500k	>500k <750k	>750k	None	<250k	>250k <500k	>500k <750k	>750k
Percent of Liberal Voters	0.391	0.198	0.490	0.410	1.107	0.114	0.321	0.174	0.369	0.370	**0.001****	0.544	**0.008****	0.295	**0.017***
Percent Hispanic Residents	-0.336	-0.340	-0.348	-0.436	0.428	0.072	0.122	0.110	0.268	0.249	**0.001****	**0.01****	**0.003****	0.137	0.123
Population (log)	13.47	-46.08	-1.045	66.84	-19.31	2.174	40.16	10.29	48.88	9.350	**0.001****	0.263	0.920	0.205	0.073
Population Change	-0.418	1.774	-0.997	-1.160	-2.606	0.259	0.649	0.376	1.649	1.083	0.110	**0.012***	**0.011***	0.499	**0.043***
Presence of Land Grant Univ.	9.325	12.96	8.393	27.88	4.051	4.016	10.94	5.876	14.31	8.296	**0.022***	0.248	0.161	0.083	0.638
Percent Adult Diabetes Rate	-2.758	-2.053	-2.704	-7.336	-7.456	1.211	2.466	2.026	3.470	-7.456	**0.025***	0.414	0.189	0.064	0.111
Change in Household Income	0.340	0.512	0.145	0.825	0.251	0.104	0.219	0.170	0.349	0.323	**0.001****	**0.028***	0.398	**0.042***	0.459
Median Home Value	-0.00003	-0.0001	-7.57e-06	-0.0001	-.00003	0.00001	0.00002	-7.57e-06	0.0001	0.00003	**0.014***	**0.009****	0.649	0.177	0.260
n=116															
Adjusted R^2	0.49	0.39	0.31	0.42	0.63										
p	0.001	0.009	0.003	0.095	0.025										

Results and Analysis

The adjusted R-squared values range from 0.31 for the >250 <500k model, to 0.63 for the >750k population break point, with the model evaluating the full data set at 0.49. This spectrum of R-squared values demonstrates that a considerable portion of the variation in index scores attributable to the selection of IVs is explained in some models, while significantly less so in others. Overall, each of the IVs included have a statistically significant relationship with index scores in at least one of the population breakpoint categories.

Ideology

When evaluated in the full model with all sampled cities, ideology, measured as percent of liberal voters in the county in the 2016 Presidential election, is significant with a p value = 0.001 meaning that more liberal ideology results in higher index scores across this particular dataset as hypothesized. However, ideological leanings are not significant in the model examining the <250k subsample indicating there is no relationship between UA programs and policies and whether a city is liberal or conservative. It's possible that UA is a less political issue in smaller cities. As noted in Chapter Two, UA has many applications and there are a variety of motivations to engage with it that exist outside of the sustainability arena. Community gardens, for example, can be supported by the city as a community and neighborhood building activity or to promote exercise, particularly for aging residents. As this research focused on cataloging *all* UA programs and policies and not only those related to sustainability, it's reasonable to entertain the idea that more conservative cities in the sample are supporting UA for purposes other than contributing to meeting sustainability targets. Additionally, the index grants points for less restrictive zoning laws pertaining to

UA. It may be that smaller cities have less restrictive zoning laws simply because they are less densely populated and would be able to make such allowances with less resulting complaints or issues. Thus, unrelated to ideology, these cities could score higher on the index than more liberal, but more densely populated cities that may employ stricter zoning laws due to the potential for conflicts due to the increased population density[12]. However, across the population subgroup with >250k <500k the index scores have a statistically significant relationships with ideology at the p = 0.01 significance level. Ideology does not have a statistical significance in the >500k <750k subsample model but the model's p value is 0.095 so it could have reliability concerns. In the >750k model, ideology demonstrates a statistically significant relationship at the p = 0.05 significance level. As a more liberal ideology is consistently significant across reliable higher population subsamples as hypothesized, further research will be needed to better understand UA drivers and mechanisms in smaller U.S. cities.

H2-H4: Local Characteristics

In the full model, the percentage of Hispanic residents is significant at the p = 0.001 significance level and has a coefficient of -0.336, indicating an opposite direction of relationship than hypothesized as such that increases in the percentage of Hispanic residents lead to lower index scores. In the model evaluating the <250k population subgroup, the percent of Hispanic residents is s significant at the p = 0.01, again with a negative coefficient of -0.034. For the population subgroup describing cities with >250k <500k residents, size of the Hispanic community has a statistically significant relationships

[12] Many cities, particularly those designated as suburban, institute nuisance laws to prevent UA activities from occurring which is why the allowance of various types of UA is included as a set of factors contributing to index scores.

with index scores at the p = 0.05 significance level and a negative coefficient of -0.348, so far, a consistent result across the subsamples organized by population that have been discussed. This IV is not significant in the >500k <750k or >750k model but the former model has p value of 0.095 and may lack reliability. As the drivers behind why higher percentages of Hispanic residents have been found to correlate to higher sustainability index scores are not confidently understood yet it's difficult to speculate at this juncture without a closer examination of community services and economic health of the cities with higher percentages of Hispanic residents out of the cities sampled with <750k (Opp and Saunders 2013; and Opp, Osgood, and Rugeley 2014). The 750k bracket is excluded as that population category does not demonstrate this IV exerting a negative influence on index score. Level of community services would be interesting to explore because as Chapter Four will discuss, UA motivations may originate from a combination of hunger indicators and a city's perception of its responsibility to provide assistance to residents experiencing hunger.

As expected, population size also demonstrates significance at the p = 0.001 significance level without population subsamples included in the model. Population is not significant for the remainder of the models due to the subgroupings limiting the population range in any given subgroup. At the extreme ends of the sample, we see the correlation weaken likely due to outliers having a more significant influence in the middle quartiles. It makes sense that population would have less of an effect as population ranges are narrowed for each subsample.

Change in population is the only IV that is not significant in the full model which runs counter to the hypothesis that increases in population would result in increases in

index score. However, this IV is significant in the <250k subsample at the p = 0.05 significance level. This is in line with what we would expect regarding larger tax revenue bases and more resulting resources to utilize, that index scores will indeed increase as populations grow. For the population subgroup evaluating cities with >250k <500k residents, change in population has a statistically significant relationship with index scores at a p = 0.05, but in this model, change in population has a negative coefficient at -0.997. This result is the opposite direction hypothesized with regard to polarity of relationship with index scores meaning that increases in population result in lower index scores for this subsample. Change in population is not significant in the >500k <750k subsample but as the p value is slightly high at p = 0.095, there could be reliability concerns with the model as discussed. Population change is significant for the >750k subgroup at the p = 0.05 significance level with a coefficient of -2.606 indicating a negative relationship with index scores. It's plausible, as previously suggested, that cities in this and the >250k <500k subsets experiencing the highest percentage increases in population growth are allocating resources elsewhere by necessity to meet the demands of their evolving populous. Accounting for the negative externalities of significant population growth, such an increased homelessness and more residents requiring public resources, leaves less money for many social services and nonessential quality of life type UA policies. This expense is likely be more acutely felt in the larger cities and less so in smaller cities that may be more suburban in nature and experience fewer social issues and to a lesser extent when the concerns are present. The more the city has grown, the more these costs accumulate, so the lower the index score, a particularly strong effect in the >750k subsample that has a mean 18.5 points higher than the mean of the full sample.

H5-H6: Economic Health

In the full model change in median household income is significant at the p value = 0.001 significance level indicating high levels of confidence that change in median household income exerts an influence on index score leading to higher index scores in cities with comparatively higher median incomes. This is consistent with expectations and with what we see across the sustainability literature as increases in median income are generally indicators of a healthy, if not thriving, local economy. This relationship also holds across the <250k subgroup as change in household income is significant at the p = 0.05 significance level. Additionally, at the p = 0.05 significance level, change in median household income is the only significant IV in the >500k <750k subgroup model, but is not significant in the >250k <500k or >750k subsamples. It should be noted the p value for the >500k <750k model is 0.095 indicating potentially outstanding issues with reliability. As larger cities already demonstrate generally higher median incomes and offer more social and quality of life programs than their smaller counterparts, it's plausible that fluctuations in income have less of an effect on public services for the higher population subsets.

Median home value is significant at the p = 0.05 significance level in the full model and at the p = 0.01 level in the <250k population subsample. In both models, median home value has a very slightly negative relationship as demonstrated by a coefficient of -0.0001 indicating that higher median home values result in lower index scores contrary to the hypothesis that higher median home values would lead to higher index scores. When evaluated in the remaining subgroups (>250k <500k, >500k <750k, or >750k), median home value is not significant, noting the aforementioned reliability concerns with the >500k <750k model. The very low coefficients in the models in which median home value

has a statistically significant relationship indicate the effect of the IV is limited and the relationship may not be meaningful.

H7: Education

The presence of a land grant university is significant at the p = 0.05 significance level in the full model as expected, but it is not in any of the other subsample models. In the UA index 69% of cities sampled collaborate with an extension office, which is far more than the eighteen cities have a land grant institution, but perhaps the cities that have one present within city limits are able to collaborate more meaningfully than those doing so from a distance. Future research could explore in greater depth the nature and results of city collaborations with extension offices and land grant institutions.

H8: Public Health

Across the full model the adult diabetes rate is significant at the p = 0.05 significance level; however, the adult diabetes rate coefficient is -2.8 indicating a negative relationship with index scores. This means the relationships being described statistically are the inverse direction of the connections hypothesized as discussed in the scatterplot review above. For the remaining subsample models, the adult diabetes rate is not significant. Interestingly, in the sample, the largest 25 and smallest 25 cities have precisely the same average adult diabetes rate 8.284, but there is a negative relationship between index score and adult diabetes for cities >750k meaning as the adult diabetes rate rises the index score decreases. It's possible this correlation is related to other food access indicators such as hunger percentages and food deserts, as well as how low-income residents experiencing food access issues tend to also experience obesity and diabetes at higher rates than residents with access to healthy food. An alternative hypothesis as to the origins of this negative

relationship follows Sansom and Portney's (2019) theory that cities that more aggressively pursue sustainability tend to demonstrate better public health outcomes than cities with less aggressive sustainability strategies (31). The UA index supports the proposal that cities with higher UA index scores are also cities that more aggressively pursue other types of sustainability policies and thus, we would expect "better public health outcomes", in this context presenting as lower adult diabetes rates. Accordingly, this finding of a negative relationship between higher UA index scores and adult diabetes rate supports Sansom and Portney's (2019) theories describing a positive relationship between aggressive pursuit of sustainability initiatives and public health outcomes (54). A forthcoming research agenda could include exploration of the relationship between a wider array of public health outcomes and implemented UA initiatives. It would also be worthwhile to analyze how cities comparatively fare on UA and general sustainability indices to better understand the degree of the relationship.

Conclusion

This chapter built upon the index created in Chapter Two to measure how certain demographic, political, public health related, and economic variables impacted index score and tested the hypotheses put forth by evaluating the patterns detected via bivariate and multivariate analysis. The main takeaway at this post-analysis juncture is that population has a dominant effect. Once population is categorized into subsets, alternative patterns emerge, suggesting that the effects of the selected independent variables on UA index score are conditional upon population size. In general terms, we can confidently conclude that small, medium, and large cities approach UA programs and policies in response to varying inputs from the local environment.

For all cities sampled, the model has revealed that more liberal ideology, larger city size, the presence of a land grant university, and increases in household income all result in higher index scores. Across the same dataset increases in the percentage of Hispanic residents, increases in the adult diabetes rate, and slight increases in median home value led to lower index scores in contrast to the direction of the relationship predicted. For small cities, increases in change in population and increases in median household income produce higher index scores, whereas increased percentages of Hispanic residents and increased median home values tend to result in lower index scores. Small/medium cities in the sample with more liberal voters have higher index scores, but for this category, increased numbers of Hispanic residents and population changes result in lower index scores. For medium/large cities, increases in household income result in higher index scores, albeit this category may require further inquiry before accurate conclusions can be drawn. Large cities demonstrate more liberal voters increase index scores and increases in population lead to lower index scores.

These findings confirm the nature of relationships discovered via the scatterplots and provide further insight into the nature of these relationships. While this analysis provides a baseline understanding of how these various factors play a role in shaping UA programs and policies, deeper analysis of the changes across population categories is needed. Table 11 below summarizes the results as they pertain to the full data set.

Category	Hypotheses	Result
Ideological		
	H1: Cities in counties with more liberal voters will demonstrate higher UA index scores.	Reject the null*
Local Characteristics		
	H2: Cities with higher percentages of Hispanic residents will have higher UA Index scores.	Reject the null**
	H3: Cities with larger populations will have higher UA Index scores.	Reject the null*
	H4: Cities with greater population increases will have higher UA Index scores.	Fail to reject*
Economic Health		
	H5: Cities with higher percentage increases in median household income will have higher index scores.	Reject the null*
	H6: Cities with higher median home values will have higher UA Index scores.	Reject the null**
Education		
	H7: Cities with land grant universities present will have higher UA Index scores.	Reject the null*
Public Health		
	H8: Cities with higher adult diabetes rates will have higher UA Index scores.	Reject the null**

* Summarizing results from analysis of the full data set.
** Relationship is the inverse of hypothesized.

Table 11: Hypotheses Results Summary

It is clear that UA efforts are impacted by a similar range of factors as more traditionally researched sustainability policies; however, there are a few notable inverse relationships as discussed. Much further research is needed to understand the differences and similarities in these relationships across UA and sustainability policies in general. Specific lines of inquiry to be explored in future projects could pertain to why the percentage of Hispanic residents in the UA context exhibits a negative relationship with index score when the opposite is found for many cities that aggressively pursue sustainability; if public health drivers are interpreted as a need to expand local nutritious food supplies and if so, via what mechanisms; and what is gentrification's role in the development of UA programs and policies at the municipal level? The latter piece could include a time series analysis at the neighborhood level or other means of tackling a difficult and intricate question but is beyond the scope of this dissertation. The following chapter will seek to understand on an individual case basis how UA programs are implemented, if relationships with State or external partners exist to facilitate UA policy development and implementation, and who has a seat at the decision-making table.

Chapter Four: A More Textured Analysis

Introduction

The fourth chapter of this research turns its attention to examining specific cities, for a more comprehensive and qualitative understanding of what initiatives and programs individual cities are engaging in, UA decision making, food policy group influence, and community relations, and implementation approaches. This chapter seeks to qualitatively explore UA efforts across three selected cases, paying particular attention to the presence and level of involvement of regional UA support mechanisms, such as food policy groups (including food policy councils, food partnerships, coalitions, committees, and boards), local food chains, food hubs, and local food non-governmental organizations (NGOs).

While the statistical analysis of cross-case observational data can illuminate trends across a large number of cases and offer a basis for the generalizability of findings, it could also be argued that they are limited in their ability to provide a richer, more textural, and detailed understanding of individual cases (Brady and Collier 2004; Gerring 2011). While large *n* studies can produce broad scope insights into causal effects that prioritize external validity, case studies yield opportunities for a deeper grasp of causal mechanisms, giving precedence to internal validity (Gerring 2011). The complexities of social and political reality give credence to the incorporation of both quantitative and qualitative analysis in this dissertation. Moreover, case studies can allow us to comprehensively explore the details and mechanisms behind the evolution of a city's ideological and practical approach to the integration of UA as a facet of sustainability (Cohen and Ilieva 2015). By examining

cities at various levels of progress, as determined by the UA index in Chapter Two, the range of motivations for the incorporation or restriction of UA can be better understood.

For example, when SNAP benefits underwent the national mandatory shift from paper to electronic format, many low-income consumers were prevented from redeeming their benefits at farmers markets, as farmers markets lacked EBT technology (GrowNYC 2011). The New York City government, in collaboration with GrowNYC (a quasi-governmental organization), implemented numerous policies to assist farmers markets to acquire EBT card readers and launched wide-reaching educational campaigns to inform SNAP recipients (City of New York 2013; Cohen and Ilieva 2015). These efforts raised annual SNAP benefit sales at farmers markets from $26,000 in 2006 to $1,113,893 in 2013, drastically increasingly low-income populations' access to healthy local food (NYC DOHMH 2014). The complex contextual mechanisms of these efforts in New York City would not be discernable from a study solely reliant on a large *n* cross-case statistical analysis. To address these gaps, this chapter will utilize the comparative case study method tools of process tracing and historical evaluation techniques.

Methods

While Chapter Three focused on generalizing findings across the entire sample, this chapter focuses on three comparative case studies to contribute to answering one of the primary research questions of this dissertation, which is 'why do U.S. cities vary in their approach to UA?'. Utilizing a mixed methods approach offers both the benefits of a large *n* descriptive statistical analysis, as well as insights into more subtle causal mechanisms and processes (Brady and Collier 2004; Gerring 2011). Combining qualitative and quantitative methods strengthens the analysis and can allow for more robust conclusions than relying

on either qualitative or quantitative methods alone, by increasing the credibility and validity of the research findings via a more even balancing of breadth and depth of analysis (Creswell 2009; George and Bennett 2005; Gerring 2007, 2011; Riccucci 2010; Yang, Zhang, and Holzer 2008). Moreover, applying a mixed methods approach can serve as practical bridge between the academic theoretical spheres and the public sector in praxis, as policy problems often require flexible, interdisciplinary, and intradisciplinary solutions (Gerring 2007, Mosier 2014, Riccucci 2010). The comparative case study method is particularly useful in this context due to its ability to assess causal linkages and mechanisms in great detail and to help address explanatory, 'why' questions since case studies are better equipped to address causal linkages than a quantitative analysis relying on statistical significance (George and Bennet 2005; Gerring 2007; Yin 2009). For the purposes of this dissertation, the comparative case study method will be able to provide the depth and scope of analysis required to understand variances across individual cities, regions, and states that affect a city's approach to UA. A variety of data sources are examined for each selected city, including historical documents, current program and policy guidance and related information, archived multi-media sources, archived city decision making notes and transcripts, and transcripts from interviews when available. All documents and material were collected digitally.

Additionally, performing comparative case studies present the opportunity to confirm or further elucidate the more generalized findings from the statistical analysis in Chapter Three. The generalized findings provide valuable insight into incident frequency but may not adequately explain the particular circumstances surrounding the decision to adopt, or not adopt, UA policies or programs, or potentially demonstrate that UA is not a

topic that city governments had previously deliberated on or considered, which may be particularly helpful for constructing the laggard city's causal narrative. The comparative case study method also allows for the possibility that variables not included in the index construction or model may be illuminated and examined.

While causal mechanisms may be complex knots, often difficult to disentangle, there are a few techniques in the comparative case study methodological toolbox. This research uses case analysis, process tracing, and historical evaluation, all of which are well suited to identifying and evaluating causal linkages, mechanisms, and processes (George and Bennett, 2005). Process tracing attempts to trace the linkages between potential causes of events and outcomes (George and Bennett 2005). To employ this technique, this dissertation will examine historical sources, archival documents, interview transcripts, or other sources related to the previously discussed outside elements that can affect a city's adoption of UA programs and policies for cities ranked as leaders, middle of the pack, or laggards, as indexed in Chapter Two. Through process tracing, this research hopes to identify any causal mechanisms the statistical models may have overlooked by focusing on sequential processes, and not on correlations across cases. For example, process tracing could illuminate the presence and influence of mechanisms external to city government, such as food policy councils.

The number and nature of many of the variables comprising the UA Index and the hypothesis put forth in Chapter Three underline the need to understand the processes at work and how those practices came to exist in their current roles and contexts. Ideally, process tracing allows us to make evident some of the mechanisms at work in the adoption or lack of adoption of UA policies and programs by considering influences, whether social,

political, or institutional factors, that a statistical analysis would be unable to tease out (George and Bennett 2005, Gerring 2011). Historical evaluation can complement this technique by identifying how these factors came to be and helping to understand the individual food policy climates and nuances of each case.

In an effort to unearth this level of detail and textural richness, this chapter relies on the leader, laggard, middle of the pack model of comparative case studies, and will base its selection on the scoring results from the index. This model allows us to separate and evaluate the tendencies of a city that does well, one that performs in a comparatively average capacity, and one that performs poorly and identify patterns in potential contributing factors and/or influences across the three. From the original 116 cities analyzed, three cities were selected, all of which have populations of over 500,000 to ensure relative consistency of availability of resources: the highest scoring city (118), Chicago, Illinois; the median scoring city (68), Indianapolis, Indiana; and the lowest scoring city (48), Memphis, Tennessee. This chapter examines local factors and determinants that influence the integration of UA policy, especially external partners such as food policy groups, local food chains, and food hubs. Each of these topics will be researched through a comprehensive internet search, document review, and program review to understand these relationships in detail.

In addition to continuing a theme of Chapter Three, the decision to use a population breakpoint of 500k was made for two reasons. Primarily, the extant literature supports the argument that a city's capacity to adopt sustainability policies is in many ways related to the population, with larger cities tending towards having more resources to allocate (Opp and Saunders 2013; Opp, Osgood, and Rugeley 2014). The data presented in Chapter Three

confirms this hypothesis also holds true for this research. As demonstrated in Table 12 below, of the 20 highest scoring cities in the UA index, only five have populations with less than 500,000 residents and only two of those five have populations less than 300,000, offering further support of the conclusion that more resources enable cities to engage with UA and other sustainability programs with increased frequency.

Table 12: Top 25 Index Scores

City	State	Index Rank	Index Score	Population**
Chicago	IL	1	118	2,716,450
San Francisco	CA	2	116	805,235
Seattle	WA	3	108	608,660
Baltimore	MD	4	107	620,961
Austin	TX	7	107	950,715
Minneapolis*	MN	5	106	422,331
Portland	OR	6	106	647,805
Washington	DC	8	101	693,972
Denver	CO	11	100	704,621
Los Angeles	CA	10	100	3,999,759
New York City	NY	9	100	8,622,698
Cincinnati*	OH	12	98	301,301
San Jose	CA	15	97	1,035,317
Milwaukee	WI	14	96	595,351
Philadelphia	PA	13	96	1,580,863
Richmond*	VA	16	95	227,032

San Diego	CA	17	94	1,419,516
Louisville	KY	18	93	621,349
Madison*	WI	19	92	255,214
St. Paul*	MN	20	92	306,621

* >500k population
**Population counts drawn from 2017 estimate from U.S. Census Bureau

As will be discussed in the subsequent section, food policy groups can impact a wide range of both state and local policies (Scherb et al 2012; Harper et al 2009). To explore these effects and this linkage more intimately, as well as how this could affect observations made in this chapter's case studies, the following sections will discuss the purpose and potential influence of the various types of food policy groups: food policy councils, food partnerships, coalitions, committees, and boards, local food chains, food hubs, and local food non-governmental organizations including faith-based organizations if there is synchronization with the city. Additionally, successive sections describe community relations and coordination obstacles cities experience with implementing UA programs and policies. Research regarding the social equity aspect of UA appears to indicate that the communities' municipal governments may be attempting to assist often fail to benefit from their efforts due to misdirected governmental planning and coordination (Reynolds and Cohen 2016; Rosan and Pearsall 2018). Evaluation of the UA programs and policies present in each case will also include an assessment of the community engagement and deliberative process surrounding UA decision making. Following this review, the case studies will be conducted starting with the leader case, and the chapter will conclude with an analysis of qualitative results.

Food Policy Groups

Santo et al from Johns Hopkins (2017) define food policy groups as "groups that assemble stakeholders from across the food system to reform food policies and programs to be healthier and more socially, environmentally, and economically sustainable" (1). The subsections below will more specifically define each type of food policy group and its goals, pertinent stakeholders, linkages to city governments, and potential avenues of impact before examining them in relation to the cases being analyzed in later portions of the chapter.

Food Policy Councils

Food policy groups, particularly food policy councils (FPCs), can exert significant influence over local food system issues and food-policy related goals, but are often regional in scope and external to city government (Scherb et al 2012; Harper et al 2009). FPCs can manifest in a variety of forms and structures; they can be part of the local government, a nonprofit organization, or a council of representatives from various food system sectors. FPCs initial organization occurred to advocate for policies and programs across the food system as they pertain to food related issues such as hunger, food access, malnutrition, public health issues related to diet, local agriculture, and local economic development (Harper et al 2009; Scherb et al 2012). Their main goals are to bring food policy discussions to the table, foster coordination across the local food system, assist with local food needs, food education, and the evaluation and influencing of food policy (Scherb et al 2012). The extant literature indicates FPCs can affect many aspects of urban agriculture, from institutional local food sourcing to underserved communities' access to healthy food (Harper et al 2009; Winne 2008; Clancy et al 2007). Although more research in this area

has emerged in the last few years, a qualitative assessment of the impacts the presence, or absence, of a FPC is best analyzed using case study methodology, and it is these factors and impacts this chapter seeks to explore. Due to the wide variety of potential partners, members, and collaborators in FPCs, and therefore, considerable range in FPC values, approaches, and goals, it is useful to evaluate the participants in each city's local FPC and determine the city's level of involvement, if any occurs.

Local Food Systems

According to the USDA, local food systems (LFSs) can be understood as "place-specific clusters of agricultural producers of all kinds—farmers, ranchers, fishers—along with consumers and institutions engaged in producing, processing, distributing, and selling foods" (2015). While the specific economic impacts associated with regional and local food systems are largely unexamined, due to the decentralized nature of LFSs and the difficulties this presents for economic modeling, the recent surges in demand and supply of local products across the United States imply LFSs require consideration in the context of the effects on UA (Boys and Hughes 2013; Stevenson et al 2011; Matson, Sullins, and Cook 2013). LFSs are thought to contribute to local economic growth in multiple ways (Boys and Hughes 2013; Laforge et al 2016; Rosan and Pearsall 2018). First, for local agricultural producers, research suggests LFSs expand demand for their products across the immediate region. Moreover, any industries or production sectors compatible with or complementary to the food system also experience increased demand (Boys and Hughes 2013). Local food systems rely on local food value chains (LFVCs) to facilitate connections between consumers and producers (Matson and Thayer 2013). Within the context of UA, this can exert significant influence. For larger urban farms, LFVCs can assist with local distribution

and marketing, which are vital to these farms' economic success. While there is much to learn regarding the elements, formation, economic contributions, and impacts of local food systems, a brief analysis of those surrounding Chicago, Indianapolis, and Memphis are included in this chapter to determine if and how each city cooperates or collaborates with their local food network.

Food Hubs

One of the main components of LFVCs are food hubs. The USDA defines a food hub as "a business or organization that actively manages the aggregation, distribution, and marketing of source-identified food products primarily from local and regional producers to strengthen their ability to satisfy wholesale, retail, and institutional demand" (USDA 2013). The prevalence of food hubs has increased rapidly since 2008; there was a 68% increase from 2008 to 2013 (Matson and Thayer 2013). The driver for this is the intersection of the "locavore" trend, or increased demand for local food; the need for local food producers to stay economically afloat; and the difficulty small local producers experience adhering to national food safety requirements or meeting national certification program criteria, such as qualifying for "USDA Organic" certification, which many consumers in urban markets demand. While food hubs are a few steps removed from some of the smaller UA farms, their presence often indicates regionally high demand for local food, which can absolutely impact various facets of UA, such as farmers markets, CSAs, and urban farms. As many of these effects may not be observable as empirical realities, evaluation through the qualitative nature of case studies is most appropriate to understand the processes and impacts on UA.

Community Relations

As discussed in previous chapters social equity concerns are not absent from the UA policy arena. One part of the social equity in UA debate focuses upon wicked problems such as malnutrition, food access, and gentrification and how these issues disproportionately affect low income and minority communities. The other piece of the equity struggle with regard to UA is more in the abstract and revolves around the dominant whiteness of the local food movement primarily driving the rise in current UA efforts. This racial dynamic functions as an exclusionary mechanism, not only for potential minority consumers of alternative food, but also for local Black, Indigenous, and People of Color (BIPOC) food producers in the context of access to resources and decision makers (Alkon and Agyeman 2011; Reynolds and Cohen 2016). As city specific UA programs and policies are reviewed throughout this chapter, particular attention will be paid to municipal approaches to community involvement in UA collaborations and decision making.

Case Studies

Each of the profiled cases below will feature a discussion on city demographics, description of current UA environment and programs, food policy group structure and impacts, and how participatory an environment the city creates for the community with regard to UA.

Chicago

As mentioned above, Chicago scored the highest of cities >500k on the UA Index, accumulating 118 total index points out of a possible 124; 2 more points than San Francisco, the city ranking second. As of 2018, Chicago had an estimated population of

2,716,450 and is the nation's third most populous city (U.S. Census Bureau 2018). By this metric, Chicago's position atop the index is unsurprising. As the extant literature demonstrates and Chapter Three supports, population is a significant factor in the ability of a city to develop, implement, and maintain UA, and historically sustainability, programs beyond the bare operational minimum as a direct result of bringing in decidedly higher tax revenue than smaller cities and is often associated with a more liberal ideological stance. New York City and Los Angeles, the two largest cities in the U.S. also scored quite high on the UA Index, ranking at 9th and 10th respectively. The next clear line of inquiry is to pursue what unique characteristics lead Chicago to surpass these larger cities in provision of and engagement with UA, what can be learned about Memphis and its position at the bottom of the large city ladder with regard to the UA index scores, and which qualities place Indianapolis in the middle of the pack. These questions lie at the heart of this chapter's focus: what distinctive features and municipal circumstances affect a city's ability and willingness to expend resources to engage with UA?

Demographics

Chicago is a midwestern central city with a diverse population and economic portfolio. Approximately 32.6% of residents are white, 29.7% Hispanic, 29.3% black, and 6.3% Asian (U.S. Census Bureau 2018). Chicago's median resident age is 34.4 years old, just slightly below the sample mean of 34.8 years (City Data 2018). The top five employment sectors in descending order are healthcare, professional/scientific/technology, education, hospitality/food service, and finance/insurance; most of which are higher earning

professions[13]. Cook County, where most of Chicago is located, consistently votes approximately 75% liberal, with ~20% voting conservatively, and the remaining ~5% supporting independent candidates (City Data 2018). As of 2018, Chicago's median household income was $53,006 with a median home value of $243,900 (City Data 2018). Chicago is overseen by a mayor-council government structure. Reflective of the city's diversity, the mayor, Lori Lightfoot, is the first LGBTQ black woman to serve in this position for a large U.S. City (NBC 2019). Moreover, of the 50 aldermen representing Chicago's 50 wards and comprising the Chicago City Council, 19 are white, 18 are black, 12 are Latino, and one is of Asian descent (City of Chicago 2022). This breakdown indicates Latino and black communities have significant representation on the Council, but Asian residents do not.

UA Environment and Programs

One of the many notable features of Chicago's food program is that it's housed within their Sustainability program, Sustain Chicago. By creating this inherent structural linkage between environmental affairs and food programs, Chicago has clearly communicated the importance of the role food plays in establishing green policies and designing a more sustainable future. Sustain Chicago is comprised of eight departments: Energy, Waste and Recycling, Water, Transportation, Food + Compost, Economic Development, Green Space and Stewardship, and lastly, Emergency Preparedness. Each of the above listed departments is responsible for the sustainability related elements of each

[13] These categorical distinctions as reported by City Data are derived from the Bureau of Labor Statistics. One of Indiana's top industries is Administrative, Support, and Waste Management. This sector is defined as "the sector comprises establishments performing routine support activities for the day-to-day operations of other organizations". (Bureau of Labor Statistics 2019).

division. For example, the Sustain Chicago Transportation department focuses on bicycle related transportation issues, public transportation options, electric vehicle program administration, etc. (Chicago 2020). Chicago also has an overarching Transportation department that addresses all aspects of transportation; Sustain Chicago is the division that specializes in sustainable transportation (Chicago 2018). The selection of these particular divisions demonstrates Chicago's perceived most important focal points to addressing the climate crisis. The city is explicit in their discussion of the environmental benefits of UA, from energy saving to reductions in the urban heat island effect (City of Chicago 2020). Chicago also considers food justice to be an integral part of this program, surpassing many similarly sized cities with regard to its dedication to sustainability by ostensibly demonstrating its commitment to the equity pillar. Much of the UA information Chicago provides for the economic and environmental benefits of UA is presented through a justice lens. For example, as economic development is discussed, plans to assist the BIPOC communities are included as will be discussed. The same tactic is taken with the environmental benefits of UA: the city explains the climate crisis and how it affects the city as a whole and then elaborates on the benefits UA could bring greater benefits to parts of the city most in need (City of Chicago 2020).

A portion of the programs and policies are designed as general city benefits, but Chicago's UA program devotes considerable attention to social equity. Specifically, the city has published the Chicago Food Equity Agenda, a plan designed to ensure "that every Chicagoan has access to healthy and affordable food and that food becomes and engine for community wealth building" (City of Chicago 2020). The Chicago Food Equity Agenda has five measurable goals:

- Eliminate barriers to food pantry expansion;
- Market and maximize nutrition programs and benefits;
- Leverage City and institutional procurement to support local BIPOC growers, producers, and food businesses;
- Eliminate barriers to urban farming; and
- Support BIPOC food businesses and entrepreneurs, especially with access to capital (City of Chicago 2020).

These goals focus on many of the existing equity concerns voiced in UA research. Further analysis of the deliberative practices employed to create the Food Equity Agenda in its current form will occur in the Community Relations subsection below.

In addition, the recent Chicago Recovery Plan allocated $10 million in funding to "capital investments in urban agriculture, the creation of a food incubator, and the development of a Chicago Good Food Fund" (City of Chicago 2022b). Food incubators are shared facilities that offer commercial kitchen and other food production equipment that is often cost prohibitive for small businesses at affordable rental rates (Colpaart 2020). These spaces provide a supportive infrastructure for local food-based businesses and are key to community economic development and creating vibrant food hubs. The Chicago Good Food Fund directs and supports city agency and schools in purchasing to prioritize healthy, local food purchases produced in safe working conditions with fair wages that are environmentally friendly (City of Chicago 2022b).

The primary connection between the implementation of UA to address environmental concerns revolves around the green roof system for which the city is known. Chicago's Climate Action Plan discusses the city's intent to require 6,000 rooftop gardens by 2020 (City of Chicago 2018) due to the building cooling, environmental, and energy saving effects, in addition to a source of food and increased property values via beautification for both residential and commercial sectors (City of Chicago 2018). The

robust nature of the plans and policies the City of Chicago has developed, along with the outlining of specific and measurable short and long-term environmental, economic, and social goals in the context of UA, are indicative of the city's level of commitment to every pillar of sustainability.

Food Policy Group Involvement

Chicago is home to a vast majority of food policy groups in their various forms. Evaluating a selection of these in greater detail is a ripe topic for future research as the numbers far exceed the capacity of this dissertation. To narrow the scope of groups to discuss, this section will limit discussion to the four organizations (six individuals) listed as primary collaborators with the City of Chicago to draft the Chicago Food Equity Agenda. These individuals also comprise the inaugural Chicago Food Equity Council. Since the Food Equity Agenda was published in 2022 it is well-suited as a benchmark of the City's current motivations and vision as they pertain to UA.

Erika Allen, founder of the 501(c)(3) Urban Growers Collective, is one of the four food policy group authors and inaugural Food Equity Council members listed. The Urban Growers Collective operates eight urban farms where they offer educational and professional programs to create economic opportunities for BIPOC and develop community level food production systems (Urban Growers Collective 2022). Allen is well-known in the UA community for her work to empower BIPOC through UA and to unite growers in creation of a just and sustainable community-based food system (Urban Growers Collective 2022). Interestingly, Allen is also the equity representative for Chicago's Eat Local Live Healthy UA Plan from 2006. This plan will be discussed further in the Community Relations subsection below.

Also on the council and listed as an author is the Executive Director of the Chicago Food Policy Action Council (CFPAC), Rodger Cooley. CFPAC is a non-profit food justice advocacy group formed in 2002 (CFPAC 2022). The Board is comprised of six members: Erika Allen, Urban Growers Collective; Daniel Block, Director of the Fred Blum Neighborhood Assistance Center and Professor at Chicago State University; Jose Olivia, Co-Director of the Food Chain Workers Alliance; L. Anton Seals, Jr., Lead Steward of Grow Greater Englewood who will be discussed momentarily; and Kim Wasserman, Executive Director of Little Village Environmental Justice Organization (CFPAC 2022).

Returning to L. Anton Seals, the Lead Steward for Grow Greater Englewood (GGE), a 501(c)(3) self-described "social enterprise" (GGE 2022). Grow Greater Englewood is a community organization dedicated to growing local food economies and land sovereignty for BIPOC. It should be noted that Dr. Angela Odoms-Young is the non-profit's Secretary (GGE 2022). Dr. Odoms-Young is also one of the authors of the Food Equity Agenda and a member of the Food Equity Council. She was a professor of nutrition at the University of Illinois studying the social, cultural, and environmental determinants of diet and is now a member of the Cornell Human Ecology department (Cornell University 2022). Additionally, Erika Allen, is a GGE Board member (GGE 2022).

The fourth and final food policy group with representation on the Food Equity Council and that is a primary contributor to the Food Equity Agenda is the Greater Chicago Food Depository (GCFD). The organization has three members on the council, one of which was also one of the four co-chairs of the inaugural food policy working group (City of Chicago 2022). The members are Amy Laboy, Vice President of Programs and Community Partnerships; Sophie Milam, Vice President of Policy, Advocacy, and Engagement; and

Nicole Robinson, Vice President of Community Impact; the latter of which was the member that was part of the work group (GCFD 2022). The GCFD is a food bank hub with over 700 partnerships and distribution methods, including mobile markets (GCFD 2022). There do not appear to be linkages with other Food Equity Council members through additional channels as was present with the other organizations discussed. As will be fleshed out momentarily, the City of Chicago's inclusion of a range of community-based food leaders, as opposed to government officials with policy expertise, in addition to voices active in research and academia is perhaps demonstrative of Chicago's organizational inclination to collaboration and learning. This point could be explored further in future research to better understand the mechanisms and participation more robustly in Chicago as well as other large U.S. cities. It is also notable that the leaders of community organizations involved are leaders of organizations with different goals. For instance, the Food Chain Workers Alliance, as their name suggests, focuses on fair labor practices for those employed in local agricultural and food related supply chain positions and their families, whereas Grow Greater Englewood was created to build sustainable local food economies (Food Chain Workers Alliance 2022; Grow Greater Englewood 2022). While the missions of these two organizations certainly overlap and actionable goals likely intertwine, both voices are individually important to Chicago's Food Equity Agenda discussions. Further exploration of these nuances could also be explored.

Community Relations

The importance of Chicago's creation of a Food Equity Agenda to furthering social equity via UA cannot be overstated and is perhaps a significant contributing factor to how Chicago earned the overall highest index score the city received. Within the UA literature,

there are significant concerns regarding the deliberative process to construct programs like Chicago's Food Equity Agenda, many of which revolve around a limited set of participants in the initial formation and subsequent review process (Alkon and Agyeman 2011; Reynolds and Cohen 2016). However, the list of stakeholders Chicago invited to the decision-making table includes representatives from a wide range of groups. In addition to various city departments, there are delegates from multiple types of food policy groups (food policy council, and food-based social resilience enterprises), local producers, food banks, schools and universities, community building non-profits, community development focused organizations and mission-based lending (City of Chicago 2018). This group, its status as the inaugural Chicago Food Equity Council, and its associated goals as previously discussed indicate a municipal commitment to beginning to address the root causes of inequity through community participation instead of focusing on alleviating the symptoms with a top-down approach.

In addition, in February of 2022, Chicago formally established a permanent Food Equity Council to centralize the city's approach to achieving the goals laid out in the Food Equity Agenda and work to strengthen relationships with BIPOC communities to address food system inequities (City of Chicago 2022). A community-focused deliberative approach to developing and implementing UA programs is a significant shift from the Eat Local Live Healthy UA plan released only 16 years ago in 2006 (City of Chicago 2022). Eat Local Live Healthy focused primarily on the economic development, environmental, nutrition, and community food security facets of UA. None of the categories refer specifically to BIPOC or even minority communities being disproportionately affected by these concerns. In fact, the word "equity" is not used throughout the document. The section of the plan that

addresses community food security is found in a section titled "Increase Food Production and Composting in Chicago Neighborhoods" (Chicago 2022). A sidebar presenting statistics on Chicago and Illinois food security and child obesity as shown below in Figure 14. Three subsections are featured that list three subgoals: increasing the number of residents trained to grow food in the city, teach more residents how to compost, and improving children's gardening skills. All of these topics are discussed throughout the plan in a general wellness context with no reference to race, income levels, or inequalities.

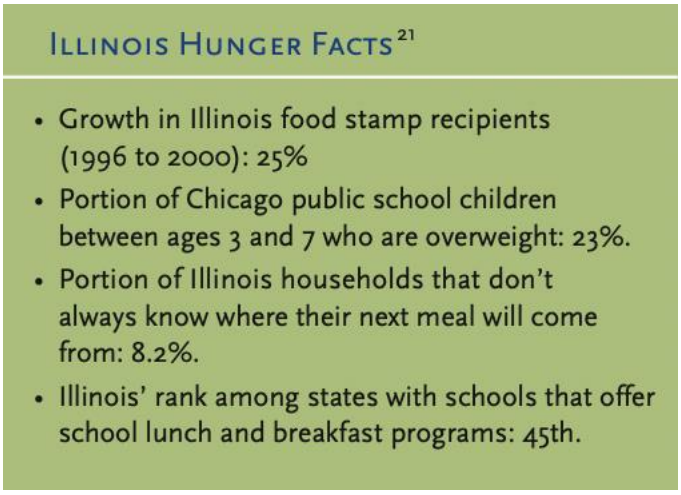


Figure 14: Illinois Hunger Facts from Chicago's Eat Local Live Healthy Plan (Chicago 2022)

The lack of a modicum of attention to equity provides a striking comparison between the Chicago food plan from 2006 and the current version. While the plans were formed in the same manner, in which a work group was formed to discuss topical areas of concern and provide a working draft and then finalization by a larger cohort of experts, the circle of those included at the decision-making table is considerably smaller in contrast to the Food Equity Agenda selection of collaborators. The primary authors of the Eat Local Live Healthy Plan are City Departments: Planning and Development, the Mayor's Office, Department of Environment, Department of Public Health, and Department of Aging. The

document concludes with a list thanking a variety of people for their time. Of those listed, a wider range of organizations and sectors are represented, including CSA's the Chicago Botanic Gardens, a Midwestern-focused legacy community revitalization nonprofit, organic standards, Heifer International, gardening promotion and education groups, the USDA, University of Illinois Extension program, humane animal treatment, recycling, healthy schools, etc. (Chicago 2022). Out of the 56 organizations or individuals (names without listed affiliations), only one is social equity focused in nature. These shifts in the city's approach to UA could plausibly be reflective of institutional learning, the potential drivers of which the conclusion of this chapter will speculatively consider. After Indianapolis and Memphis are discussed, the remainder of the chapter will provide a comparative analysis to attempt to identify preliminary hypotheses for future research's consideration.

Indianapolis

Indianapolis, Capital city of Indiana, is the median scoring city out of those in the sample with populations greater than 500k with a total of 86 point on the UA Index. Indianapolis ranked 18th in the subsample of cities >500k, but placed 27th for the full sample, demonstrating in concrete terms the differences in mean index scores when compared across population size as discussed more thoroughly in Chapter Three. As Indianapolis is home to 863,002 and is the 16th largest city in the U.S., a higher index score in the full sample is expected due to the population size effects. The remainder of this section will continue the explorative trajectory of Chicago's evaluation and compare Indianapolis' demographics; UA attitudes, programs, and policies; local food policy group involvement, and community participation in UA decision making.

Demographics

Like Chicago, Indianapolis is a central city in the midwestern United States. Indianapolis is considerably less racially diverse than Chicago with approximately 55% of the population white, 10.5% Hispanic, 28% black, and 3% Asian (US Census Bureau 2018). Median resident age is 34.1 years, slightly lower than Chicago and the mean of the sample (34.8 years) (City Data 2018b). As of 2019, the five leading employment sectors are healthcare; accommodations and food service; education; professional, scientific, and technology; administrative, support, and waste management (City Data 2018b). Indianapolis is located in Marion County, Indiana. In the 2016 Presidential election, Marion County voted 36% Republican, 58% Democrat, and 6% Independent. The median household income in Indianapolis in 2018 was $44,615 and median home value was $128,200 (City Data 2018b). Indianapolis has a mayor-council form of government, as 12 of the 20 largest U.S. cities and each case city in this do. Joe Hoggsett, the Mayor is white (City of Indianapolis 2018). The City Council has 19 white members and 6 black, which is 24% of the council. The black population in Indianapolis is relatively well represented when compared to percentage of the population (27.7%), but as there were no Hispanic members of the Council in 2018, the Hispanic community appears to lack representation in Indianapolis government.

UA Environment and Programs

Indianapolis houses UA programs and policies within the Office of Sustainability (City of Indianapolis 2018). While the city does have a food plan in place, it is part of Thrive Indianapolis, the city's climate action plan (City of Indianapolis 2018). Indianapolis' Food and Urban Agriculture Plan consists of two primary goals and seven total subgoals as

shown in Table 13 below. The first thing one might notice is a lack of an environmental element to the food plan, despite being contained within the city's Climate Action Plan. In fact, after a comprehensive search of the city website, the only connections made between UA and climate are two mentions of UA and a reduction in GHGs. UA and urban environmental and habitat improvements, including pollinator protection and stormwater runoff benefits, are mentioned, so environmental linkages are present, but associations with climate change beyond the link to GHG reductions are not present (City of Indianapolis 2018).

Table 13: City of Indianapolis Food Plan (City of Indianapolis 2018)

Food &Urban Agriculture
Food insecurity in Indianapolis is reduced by 20% by 2025, compared to the 2017 baseline.
Subsidize the cost of EBT equipment, removing a barrier for markets and grocers to accept Supplemental Nutrition Assistance Program (SNAP) vouchers.
Advocate to increase access to SNAP benefits, including removing the asset limit from SNAP qualifications.
Assess available incentives and maintain City's current related grants focused on community-driven food solutions like co-ops and community supported agriculture programs (CSAs) in food deserts by 2021.
Increase purchasing of Indiana-grown food by 2025.
Support local Healthy Food Financing Initiatives, providing seed funding for the development of new healthy food access projects in underserved communities.
Identify funding to support the expansion of farmers markets and reduce barriers that currently prevent markets from offering extended hours and operating year-round. Encourage the diversification of urban agricultural growing methods (e.g., hydroponic, aquaponic, greenhouse) by 2022.
Establish a Farmland Bank through a public-private partnership to acquire agricultural land to lease, with consideration of racial inequities.

The goals and subgoals listed above indicate intention to support food access for low-income and minority communities, but the plan fails to identify project benchmarks or specific project deliverables. The only performance metrics discussed are reducing BIPOC food insecurity by 2.25% by 2025 and reduce community food insecurity by 6% by 2025 (City of Indianapolis 2018). As there is limited additional UA information available for UA program goals having been met in the past, it would be illuminating to reevaluate progress on these objectives in five years. In addition to the aforementioned UA goals, Marion County and Indianapolis cooperatively manage two community gardens. Plots in each garden are open to the public and a wealth of gardening, potential donation, and health benefit information is available (City of Indianapolis 2019). The city is progressive in UA and urban livestock zoning which tracks logically with the predominantly food access and economic focus demonstrated in the city's Food Plan, particularly with regard to the diversification of growing methods. While Indianapolis does engage with UA policies and programs, the nature of participation and promotion is more limited and narrower in scope than Chicago's approach to UA in which specific and measurable progress is being made, reported, and evaluated publicly by the city government and its partners. The goals outlined for both Indianapolis and Chicago overlap in intent, Chicago demonstrates significant progress towards implementation, ostensibly through work groups involving the community, the delineation of short- and long-term goals, and detailed plans to achieve each goal, including pilot programs.

Food Policy Group Involvement

A majority of the primary authors of the Indianapolis Food and Urban Agriculture Plan are city departments, specifically the Office of Sustainability, the Department of Public

Works, the Department of Metropolitan Development, the Department of Business and Neighborhood Services, the City of Indianapolis Department of Homeland Security and Indy Parks, the city's parks and recreation management section. The Marion County Public Health Department and a local hospital, Eskenazi Health, are both also included as primary authors, as is the McKinney Green Initiatives Fund, a philanthropic foundation that focuses on renewable energy job creation, sustainable local food systems, and capacity building and leadership development in the green non-profit sector (McKinney Family Foundation 2019). Two task forces are noted for their contributions, the Municipal Task Force and the Community Task Force (City of Indianapolis 2019). As the title suggests, the Municipal Task Force is entirely comprised of City and County departments and partners. The Community Task Force includes a wide range of members from a diverse group of sectors, with the exception of community UA leaders. A few of the organizations represented on the Community Task Force are an Indianapolis tourism bureau, software developers, the Indiana Latino Institute, The Center for Urban Health, the McKinney Family Foundation's Executive Director, the Indiana House of Representatives, realty firms, the Sierra Club, employment and development consultants, and the City-County Council, represented by the President of the Indianapolis City Council.

Only one organization involved in the creation of the city's climate action plan, Thrive Indianapolis, is connected to UA. Groundwork Indy, represented by Phyllis Boyd. She was the Executive Director of Groundwork Indy until joining the City of Indianapolis as the Parks and Recreation Director in 2021 (City of Indianapolis 2022). Groundwork Indy was formed when the City of Indianapolis submitted a letter of interest on behalf of a local steering committee to establish a Groundwork trust (Groundwork Indy 2022c).

Groundwork USA, the organization that the letter was submitted to is a "a national organization that partners with the National Park Service and Environmental Protection Agency, assists a network of 20 nonprofits known as Groundwork Trusts. Trusts are formed in communities struggling with environmental, economic, and social decline and work to transform brownfields and underutilized land into parks, trails, community gardens and other public green spaces" (U.S. National Park Service 2022). Groundwork Indy's focal areas are Youth Development, Greenways & Parks, Brownfields & Vacant Land, and Healthy Communities (Groundwork Indy 2022c). The Youth Development program provides opportunities for local teenagers that involves local food and nutrition education (Groundwork Indy 2022d). The Brownfield & Vacant Land division focuses on remediating and revitalizing vacant and contaminated lots using UA as a partial solution to increase food access, while the Healthy Communities area assists with the establishment of community gardens to promote healthier diets and active living (Groundwork Indy 2022, 2022b).

Indianapolis has a food policy council, Indy Food Policy, that was created by the Indianapolis Community Food Access Coalition (ICFAC) and was recently joined in support by the newly established Indianapolis Division of Community Nutrition and Food Policy (Indy Food Policy 2022).[14] Oversight for ICFAC is provided by the Indianapolis Community Food Access Coalition (IndyFAC), also established in 2021 (Indy Food Policy 2022). ICFAC is managed by a team of seven, six of which are employed by the City of Indianapolis the non-governmental member is from AmeriCorps VISTA program (Indy Food Policy 2022).

[14] The new Division will not be discussed further as it was only established in 2021, two years after the data for the index, demographic data, and a majority of this chapter was gathered and index scores were established.

ICFAC has three primary objectives: increase access to fresh produce to all of Indianapolis, address food insecurity in low-income areas, and a farm to store program connecting urban farms to stores and consumers (Indy Food Policy 2022).

Community Relations

While there is now a community representative on IndyFAC as of 2021, there has not historically been opportunities for community participation in the city's UA policies and programs. Without community input, it could be difficult to both discern what the root causes of the food issues are and understand if meaningful progress is being made at the neighborhood level. The city co-manages two community gardens as mentioned previously but they are promoted as healthy activity and resident relationship building programs and not community assistance or food access oriented. Additionally, there are metrics available measuring the indicators associated with the three ICFAC objectives listed above, but they only offer information on program output and are not descriptive of community impact. For example, the fresh food in local grocery store food access for Indianapolis ICFAC program only provide information on which stores have been partnered with and not pounds of produce sold or other health measures associated with increases in fresh food. The low-income focused ICFAC program states that 301,139 pounds of fresh produce were delivered, 13,093 healthy food boxes distributed, and 937 recipe books donated. Information on what healthy food boxes contain or to whom the fresh produce or recipe books were delivered is not available. Lacking impact measures with regard to the objectives, it is difficult to ascertain how successful these programs are.

Memphis

With a population of 652,236 as of 2018, Memphis is the laggard case study due to it receiving the lowest score of 48 index points across the subsample for cities with more than 500k residents. The lowest score received for the full dataset was Yonkers, NY, with 24 index points. There are 35 cities in this subset and Memphis placed 35th. In the full sample, Memphis placed 99th out of 116 despite having the 25th largest population size which as we've established exerts a strong influence on the full dataset. The subsequent portions of this subsection will address Memphis' demographics; UA attitudes, programs, and policies; local food policy group involvement, and community participation in UA decision making.

Demographics

Memphis is a Southern region central city in Shelby County, TN. Memphis is 25.4% white, 7.1% Hispanic, 64.4% black, and 1.6% Asian, with a median resident age of 33.8 years, the youngest city in the sample and a full year below the national mean (U.S. Census Bureau 2019). To reiterate for clarity, Hispanic was selected in lieu of non-white Hispanic to maintain consistency with selection decisions made in previous chapters of this dissertation. The top five employment sectors in descending order are healthcare; education; accommodation and food services; administration, support, and waste management; and transportation (City Data 2018c). Sixty-two percent of Shelby County voted Democrat in 2016, 35% Republican, and 3% independent (City Data 2018c). Memphis' median household income is the lowest in the sample at $38,826 annually as of 2018 (City Data 2018c). Median home value also lags behind Indianapolis and Chicago at $96,800 in 2018 (City Data 2018c). As with the other two cases, Memphis also operates

with a mayor-council form of government and the Mayor, Jim Strickland, is white. The Memphis City Council has 13 members, one for each of its Districts. Of the 13 members, 8 (62%) are black and the remaining 5 (48%) are white. As found in Indianapolis, the Memphis Hispanic community lacks representation in city government. Black residents are well represented, and white residents are overrepresented due to the lack of Hispanic or Asian members.

UA Environment and Programs

Perhaps unsurprising given its low UA Index score, but Memphis does not maintain a Sustainability or Food department, but they do have a joint Climate Action Plan with Shelby County. UA is discussed in the Plan, but only in the context of helping to reduce food waste. Memphis offers less restrictive zoning than similar sized cities, which contributes to its index score of 48 points. Overall, Memphis lacks linkages between UA and sustainability, likely due to the limited nature of the city's engagement with sustainability in general. This is surprising in the context of the liberal ideological leanings and the size of the city. However, Memphis ranks 105th for median household income across the full dataset and 108th for median home value. It's plausible the economic challenges exert a chilling influence on UA and sustainability efforts, which would also be in line with expectations given the associations in the sustainability literature between increases in wealth metrics and correlated increases in sustainability index scores (Portney 2003, Opp and Saunders 2013).

Food Policy Group Involvement

The Food Advisory Council of Memphis and Shelby County (FACMSC) is a subsidiary program of Grow Memphis, which was established in 2007 as a community garden

resource hub that has since evolved into a network of community gardens located in low-income neighborhoods (Grow Memphis 2019). While there are city government representatives on the FACMSC, all meetings and activities are organized by the Grow Memphis, an extra-governmental nonprofit (Grow Memphis 2019). It appears that Grow Memphis serves in a UA support role that city governments are typically responsible for in other cities. For example, Grow Memphis started a dollar-for-dollar match program called Double Green$ for SNAP/EBT recipients at farmers markets in the Memphis area (Grow Memphis 2019) an investment typically made by municipal governments. It should be noted that while these food policy group activities are documented, both the council and Grow Memphis lack a strong internet or social media presence, suggesting that perhaps both are limited in staff and resources.

Community Relations

FACMSC conducted an evaluation of the Memphis area and concluded that the region is experiencing a major knowledge gap with regard to UA and recommended significant public education on UA and sustainable food systems in general (Institute for Sustainable Communities 2019). As of 2019, there's no evidence of the city engaging in education programs for these topics. It appears most of the UA education, information, and support in Memphis is provided by Grow Memphis and the organization's partnerships. The city participates on the FACMSC but not in a decision-making, managerial, or fiscal capacity.

While the Memphis city government has not demonstrated significant engagement with urban agriculture, there are several highly active food focused organizations that also seek to address neighborhood resilience issues which could potentially explain why the

Memphis government has elected to take a less participatory role. This research will discuss two of these entities, Urban Farms Memphis (UFM) and Kingsbury Community Farmers Market (KCFM), but a more robust examination, particularly for laggard large cities identified in the UA index such as Jacksonville, FL (59) and Fort Worth, TX (97) both of which are the 12th and 15th largest cities in the sample, respectively, but have UA Index Scores below the median as indicated by the numbers in parentheses after each city shown above. These organizations were selected due to the availability of existing academic research due to the reliability of peer reviewed findings versus the evaluative capacity of this dissertation.

The Kingsbury Community Farmers Market was "established as a community-based food solution to the lack of food access and affordability as well as empower youth to take action in the future of the food system" (Jacobo et al 2019). KCFM is a collaborative endeavor based upon key strategic partnerships between KCFM, the University of Tennessee Extension, the Shelby County Farm to Table program, Big Green, and Tennessee Coordinated School Health (Jacobo et al 2019; Big Green 2022). KCFM was designed to work toward its goals by reciprocally increasing organizational capacity via utilization of neighborhood school gardens (Jacobo et al 2019; Big Green 2022). While the KCFM is expanding but is somewhat limited in scope due to it being limited to a high school endeavor, it's important to note that part of the program from a student's perspective entails an entrepreneurial education curriculum (High Ground News 2018). Support for this element of the program is provided by Big Green, a Colorado based non-profit. While exploring food groups outside the local area is beyond the scope of this research, it would

be productive for future research to explore the impact that national scale non-profit organizations have on urban agriculture across U.S. cities and regions.

UFM launched its Urban Farms Market in 2011 with the intent of utilizing it to operate as a distribution mechanism for UFM in addition to participating local farmers (Thompson 2011). Unfortunately, UFM is an example of how gentrification creates instability in locally owned burgeoning food economies. UFM's Market, the lynchpin of its functional existence, was only able to remain in operation for three summers before succumbing to financial woes (Polzin 2016). While high operating costs were a contributing factor, the main obstacle to continuity was the lack of willingness on the part of the landowners to sell UFM the land they farmed on due to higher bids from interested developers, leading to Urban Farms Memphis' discontinuation of operations (Polzin 2016; Urban Farms Memphis 2017). As will be discussed in the concluding chapter of this dissertation, much further examination is needed into the impact of gentrification, not only on the initial creation of food deserts and food access challenged neighborhoods, but also on community owned urban agriculture operations in general.

Analysis

In addition to having populations of >500k, the cities comprising the cases studied in this chapter are geographically located within 535 miles of each other. While this could be considered a weakness in the sample, it could also be interpreted as more robust grounds for comparison by controlling for regional differences within a shared foodshed. To qualitatively explore city government and UA relationships four areas of interest were evaluated for each case: demographic attributes; UA attitudes, programs, and policies; local food policy group involvement, and community participation in UA decision making.

Demographically speaking, the cities rank in the expected order with Chicago having the highest index score and largest population; Indianapolis has a larger population than Memphis and a higher index score. Ideological comparisons yielded surprising results with regard to Memphis, as higher percentages of liberal voters tend to result in higher index scores, but Memphis had a higher percentage of liberal voters and a lower index score than Indianapolis. Additionally, as discussed above income inequality issues leading to gentrification could have a larger impact in Memphis, a preliminary conclusion ripe for much further exploration. Chicago, as the most liberal, has a higher index score as expected. As previously discussed, it is likely that Memphis' struggling economy plays a role in their lack of engagement with UA and subsequent lower index score. It appears Chicago has higher percentages of white collar and professional workers than Indianapolis or Memphis, which could shape attitudes toward UA and sustainability, but future research into the role dominant job sectors play in UA engagement is needed to understand if a relationship exists. This chapter found economic indicators to abide by the expectations laid out in Chapter Three, as the cities' index scores correlate in rank to their respective incomes with higher earning, higher property value cases demonstrating higher index scores. Community representation in government data in this chapter seems to suggest that better index scores result when more communities are represented as they are across the Chicago population and City Council, but further research would be required to confirm.

As expected, Chicago had the most expansive UA program and policy network with detailed linkages to each pillar of sustainability. Indianapolis echoed many of the UA sustainability themes put forward by Chicago, but significantly less connections to environmental impacts were present, in addition to a lack of benchmarks and precise

metrics to evaluate impact. Exploring Memphis did not yield evidence that UA is actively being engaged with other than less restrictive zoning requirements, for which Grow Memphis actively advocated (Grow Memphis 2019). The expanded role of Grow Memphis, a non-profit, in advancing UA goals and priorities is notable. Future research is needed to compare the impacts of city led UA programs versus when a non-profit has a primary role.

Chicago invited the widest range of subject matter experts and community representatives to the UA decision-making table and leveraged their collective expertise to help craft long- and short-term goals, plans to address the problems identified, equity agendas and councils, and implementation tactics. The result is a more comprehensive and detailed food action strategy to address the city's most pressing food related concerns. Indianapolis' food plan could likely have been created in such a manner as to be better suited to community level problem solving, but it was drafted almost entirely by governmental and quasi-governmental contributors. Conversely, the City of Memphis was a stakeholder invited to participate in a non-profit's programs and policies instead of playing a driving role as the other two cases do.

As a result of this, Memphis lacks community engagement with regard to UA as the city does not pursue many UA programs or policies. Indianapolis previously allowed the community to play a very limited role but in more recent city documents, it appears community representatives have been added to food related work groups and decision-making bodies. Chicago's relationship with the community demonstrates coordination between an entrenched UA network of experts across a range of social and food justice groups. There is documentation of support provided from member to member in varying capacities and in some cases across multiple organizations. These connected organizations

frequently coordinate and serve in an assortment of roles for the city government to provide expertise and resources related to UA.

The evolution of Chicago's food equity and UA orientations as outlined in chronological iterations of the city's food plan is revealing. The Eat Local Live Healthy plan from 2006 focused on the local economy, hunger, and nutrition but failed to address how BIPOC communities experience poor nutrition, food access, food security, and a lack of opportunities to meaningfully participate in the local agricultural economy. However, the more recent Food Equity Agenda provides concrete steps, measurable outputs and impacts, and goals for a more equitable sustainable food system. The less developed Thrive Indianapolis plan also focuses on hunger but does not identify the burden borne by BIPOC communities. Memphis has a plan to address hunger but as there are no links to UA, it falls outside of the scope of this discussion.

It is reasonable to consider that UA motivations may originate from a combination of hunger/nutrition indicators, availability of the resources to address the issues identified, and a city's perception of its responsibility to provide assistance to residents experiencing hunger/nutritional deficits. Hunger/nutrition indicators in this context include number of food stamp recipients, growth in number of food stamp recipients, obese/overweight schoolchildren, percent of households experiencing food insecurity, nutritional quality of school lunch and breakfast programs, percent of the city considered a food desert, etc. Metrics describing these indicators are collected by State and Federal agencies and function as barometers against which cities are measured. It's speculative, but I suspect UA programs have grown and developed out of cities responding to hunger/nutrition indicators with innovative solutions, as they have to environmental issues such as poor air

quality in the absence of State or Federal action. Utilizing a survey methodology with a smaller sample of cities would be highly valuable in exploring internal municipal processes. Cities with more resources tend to be the most aggressive innovators with regard to sustainability policy and it's plausible to think UA is approached similarly and why we see overlapping trends emerging. This could likely also offer an explanation as to why the correlation between increased liberal voters and higher index score exists, as those who subscribe to liberal ideology are more likely to believe it is the government's responsibility to address social ills, including those that pertain to hunger and nutrition.

Based on levels of community engagement respective to each of the cases featured in this chapter, it seems a connection between increased community participation and meaningful contributions to UA program and policy planning and higher index scores exists. As Chicago exemplifies, reliable networks of information sharing with experts and leaders in the community result in UA decision-making more in tune with specific community needs and a broader network of programs and support mechanisms in place. As discussed, there were many Chicago experts and community leaders that played multiple roles throughout the deliberative and strategizing processes, Erika Allen, L. Anton Seals, or Dr. Angela Odoms-Young for example. It could be argued that a broader coalition with a wider selection of experts and community leaders would bring more diverse ideas to the table. As Indianapolis' UA efforts were highly government-centric and demonstrated less reach and innovation than Chicago's, it could be tentatively inferred that there may plausibly be a linkage with community participation and UA policy outcomes. Further analysis of food programs and the panels of experts and community representatives across food programs in large cities perhaps could provide additional insights.

Community groups in the Memphis analysis present an interesting quandary to consider in future endeavors: it's apparent that for Memphis community groups, such as Urban Farms Memphis, have a large impact on UA. However, as evidenced by the dissolution of Urban Farms Memphis, even local organizations with significant impact cannot guarantee organizational stability. The supposition of this research is that this is largely related to the lack of available funding, particularly in cities with low municipal engagement as Memphis demonstrated. It would be valuable for UA scholars to explore the trajectories and stability of food communities on a regional or national scale to determine what potential impacts this may have.

Conclusion

This chapter examined the leader, laggard, and middle of the pack cases from the subsample of cities with populations greater than 500k. From this preliminary and limited analysis, we can infer that there is a potential linkage between how involved a city is with local food policy groups and how participatory a relationship the city and community enjoy with regard to UA. These cases suggest that cities with available resources to do so are able to create a system that allows for inclusive deliberation with community leaders and experts within the local food community and that this participatory deliberative approach leads to programs and objectives designed with more specific indicators, metrics, and impacts. If there is a form of institutional learning occurring, deeper analysis will be required to understand the mechanisms at work.

With regard to UA and sustainability, it seems possible that UA motivations rise out of hunger/nutrition indicators, resource availability, and perception of responsibility to address the issues identified. This is in line with what we would expect with regard to sustainability policies and the cities that more aggressively pursue them. As this research is

a preliminary cataloging and analysis of existing UA programs and policies, future research could comparatively explore opportunities for city governments to engage the community in decision-making processes across UA and other types of sustainability policies. Chapter One discussed how in both academia and practice social equity is the pillar of sustainability most often insufficiently addressed. It would seem that this issue is less prevalent with regard to UA, as social equity concerns appear to be a driver for many of the cities sampled. This should be a primary focus of future research exploring the relationship between UA and sustainability from a municipal perspective.

Chapter 5: Conclusions and Future Research

Introduction

Pivoting from an investigation of aggregate city efforts toward sustainability, this dissertation focuses on the "Three E's" within a singular policy arena, urban agriculture, by asking the following questions: How are U.S. cities attending to and integrating UA, particularly within the context of sustainability? Why do U.S. cities vary in their approach to UA? How does this compare to what we know about local level sustainability efforts? Seventy-five percent of the nation's largest cities explicitly associate sustainability efforts with UA, yet the extant literature lacks a comprehensive study of the specific program and policy mechanisms cities might employ to achieve sustainability goals, why municipal approaches may vary, or how UA compares to the existing body of knowledge regarding local sustainability efforts. It was this research's intent to begin to fill these gaps. This final chapter will conclude by highlighting key findings, discussing how they either align with or run counter to current empirical understandings of sustainability initiatives at the city level, as well as addressing the limitations of this research and providing suggestions for avenues of future research.

To address these primary questions, I first created an Urban Agriculture Index cataloging 124 UA programs and policies across the 116 largest U.S. cities. Once UA efforts were cataloged, an additive index scoring system was applied in order to allow us a mechanism by which to compare engagement levels across cities. The scores derived from the index were then analyzed as the DV via quantitative analysis using univariate, bivariate, and multivariate methods. To consider the questions qualitatively, Chapter Four provided comparative case studies of the leader, laggard, and median cities from a subset of those

with populations greater than 500k. The subsections of this chapter summarize and contextualize the findings with regard to the research questions posed.

Urban Agriculture Efforts and Engagement: UA Index

The process of determining how U.S. cities are attending to and integrating UA, particularly within the context of sustainability, revealed a range of municipal programs and policies, some of which are commonly employed and others markedly less so. We discovered by reviewing Comprehensive, Climate Action, and Food Plans that a vast majority of cities do associate UA with sustainability and portray UA efforts as an available tool to mitigate climate change, promote economic growth, and address food related social concerns, such as food security, hunger, and poor nutrition. Much valuable information was gleaned from how UA is discussed in the city plans in which it is referenced, but additional inquiry is needed to answer the many questions raised by compiling the index. A comparative analysis of how cities present UA in each type of plan is a fecund avenue for future research intending to increase understanding of city motivations for UA engagement. To this point, a large *n* study utilizing survey data could also help advance the literature by providing insight from the perspective of local UA actors. It may be necessary to create an additional index specific to programs and policies that are currently operating or being implemented and exclude UA related educational materials cities may promote, as those were included in this initial broad-brush evaluation of UA.

Index Limitations

One critique that could be potentially offered is that the index attempts to evaluate with too broad of a brush. Perhaps the sample size is larger than some would prefer or covers too expansive of a scope with regard to policies. Additionally, including UA

promotions and information provided on UA topics could potentially make it difficult to discern which cities are engaging in impactful programs and thus, taking UA more seriously. These are all valid critiques; however, it was the intent of this dissertation to provide a baseline springboard for further research with regard to measuring efficacy. Since no catalog of city attitudes or actions with regard to UA, a more comprehensive approach was preferred.

As stated in Chapter Two, the index was not designed to evaluate the efficacy or comparative strength of any of the policies or indicators discussed or measure the impacts of implemented programs. The second chapter focused solely on cataloging the scope of what efforts are being undertaken and what information is being conveyed with regard to UA. Since *all* efforts were included in the resulting index scores and not only those pertinent to sustainability, the calculated index scores better describe aggregate UA efforts than those specific to sustainability. For sustainability scholars, this could be considered a weakness since this research awards points for UA efforts unrelated to sustainability.

Additional inquiry could seek to conduct multivariate analyses on only the UA programs and policies specifically related to the pillars of sustainability. If indexed, an endeavor such as this would provide focused comparisons to those indices already established in the sustainability literature (Portney 2003, 2013; Opp and Saunders 2013, Lubell, Feiock, and Handy 2009). However, for the purposes of this research it was necessary to establish the parameters of the extent of what is being done before measures of effectiveness and aggregate impacts are sought. Now that a baseline index has been created, impacts and effectiveness should be considered particularly fertile ground for future UA research.

Variation Across Cities

Differences in municipal approaches to and attitudes toward UA have been explored both quantitatively and qualitatively in an effort to provide as robust an analysis as possible in this preliminary examination of UA, both in general efforts and in the context of sustainability. This section will address multivariate and case study findings, including how they relate to the sustainability literature.

Multivariate Analysis

Cataloging municipal UA efforts and analyzing for relationships with various demographic and descriptive inputs provided a basis for comparison to previously identified correlations between cities with more aggressive sustainability policies and those that do not engage in such an active pursuit. Eight IVs were included in the quantitative analysis, all selected from a larger collection of data points as a result of demonstrating statistically significant relationships to index score. The IVs were (1) ideological leanings, (2) population, (3) recent changes in city size, (4) fluctuations in median household income, (5) median home value, (6) percentage of Hispanic residents, (7) the presence of a land grant university, and (8) the local adult diabetes rate. The primary discovery is that population has a dominant effect. Once population is divided into subsamples, alternative patterns emerge, suggesting that the effects of the IVs on index score are conditional upon population size. Overall, we can conclude that small, small-medium, medium-large, and large cities approach UA programs and policies rather differently. A comprehensive comparison of how other sustainability indices in the

literature behave with similar population parameters would help elucidate these relationships with more granularity.

For all cities sampled, the analyses suggests that more liberal ideology, larger city size, the presence of a land grant university, and increases in household income all contribute to higher index scores. These results are in line with what was expected and serve to support similar findings across the sustainability literature (Portney 2003, Lubell, Feiock, and Handy 2009, Opp and Saunders 2013, and Opp 2017). With regard to land grant institutions, across the dataset there are 98 cities that lack one and 18 with one present. The means of cities with land grant institutions are 21.14 points higher than those without. Future research could examine similar indicators across the 18 cities with a land grant university and compare city relationships with local land grant universities and corresponding Agricultural Extension Offices within each population subset.

The full dataset also demonstrated that increases in the percentage of Hispanic residents, increases in the adult diabetes rate, and slight increases in median home value led to lower index scores, opposite of the direction predicted. These findings run contrary to what we might expect in the sustainability literature and further research could seek to examine why the effect is the inverse of what has been found to date, particularly with regard to Hispanic populations and increased sustainability index scores (Opp and Saunders 2013; Opp, Osgood, and Rugeley 2014). While this data could be skewed due to regional distribution of cities with high percentages of Hispanic residents as previously discussed, comparatively exploring the level of community services provided would be interesting to understand the nuances of this relationship with more granularity within

population subsets. Future research could focus on region specific UA to explore this line of inquiry, as well as determine if regional factors affect municipal UA engagement.

For small cities, increases in change in population and increases in median household income produced higher index scores, whereas increased percentages of Hispanic restaurants and increased median home values tended to result in lower index scores. Future research focused specifically upon how UA is characterized in smaller more conservative cities could help unravel why index scores seem unaffected by ideology in cities with less than 250k while the opposite is true for the larger population subsamples. As a more liberal ideology is consistently significant across reliable higher population subsamples, additional inquiry will be needed to better understand UA drivers and mechanisms in smaller U.S. cities. Small-medium cities in the sample with more liberal voters have higher index scores, but for this category, increased Hispanic populations and population changes result in lower index scores. As small and small-medium cities demonstrate that increases in number of Hispanic residents result in lower index scores, specific lines of inquiry to be explored in future projects could pertain to why this IV in the UA context exhibits a negative relationship with index score, particularly for cities of this size, when the opposite is found for many cities that aggressively pursue sustainability. Large cities demonstrate more liberal voters increase index scores and increases in population lead to lower index scores. None of the remaining IVs had statistically significant relationships with index score in this subsample. Perhaps a negative relationship between increases in population growth and decreasing index scores exists because larger cities are allocating resources more directly to developmental efforts or

social programs to address the relatively rapid and comparatively heightened population growth and smaller cities are finding the resources to expand UA programs and policies.

While beyond the scope of this dissertation, future endeavors could create an index similar to that Osgood, Opp, and DeMasters (2016) constructed, designed to focus only on those policies without the potential for co-benefits (6). This approach could serve to tease out "true" UA motivations and drivers. In the public health arena, finding a negative relationship between higher UA index scores and adult diabetes rate supports Sansom and Portney's (2019) theories describing a positive relationship between aggressive pursuit of sustainability initiatives and public health outcomes (54). A future research agenda could include exploration of the relationship between a wider array of public health outcomes and implemented UA initiatives.

Model Limitations

This dissertation sought to provide a preliminary analysis of why cities vary in their approach to UA. While significant linkages were identified, alterations in sample, subsets, model, and independent variable selection could also yield useful results to further this line of inquiry. Future research could analyze the cities with the highest index scores and with populations less than 500k (Minneapolis, MN; Cincinnati, OH; Richmond, VA; Madison, WI; St. Paul, MN; Honolulu, HI; and Greensboro, NC for example) to seek to identify the causal mechanisms and processes behind robust UA programs in smaller cities. Moreover, the sample of cities only includes larger municipalities which could overlook nuances of the factors driving the behavior of smaller cities. A more robust model could include indicators related to hunger and food insecurity beyond the food desert and vehicle access restricted metrics included in this research. Including these variables could increase granularity of

the analysis and provide further insights into the causal mechanisms driving municipal approaches to UA.

Additionally, the data gathered is limited in that it only describes UA activities and efforts occurring at the time of collection. An analysis of the evolution of how UA is presented and discussed in various city plan formats over time could deepen our preliminary understandings of how governmental learning is occurring with regard to UA. If we're to understand municipal causal mechanisms with regard to UA, significant additional research is needed to examine change in UA policies over time to discern when the most policy change is occurring and begin to hypothesize about why it might be at that particular moment. Negative externalities must also be appropriately studied. Research focused on the economic impacts of UA, particularly gentrification, might seek to answer questions related to gentrification's role in the development of UA programs and policies at the municipal level. This course of investigation could include a time series analysis at the neighborhood level or other means of tackling a difficult and intricate question but is beyond the scope of this dissertation.

Three Case Studies

The fourth chapter of this dissertation provided comparative case studies, using the leader, laggard, middle of the pack model case selection. Of the 116 cities sampled across the full dataset, three cities with populations greater than 500k were selected: the highest scoring city (118), Chicago, Illinois; the median scoring city (68), Indianapolis, Indiana; and the lowest scoring city (48), Memphis, Tennessee. For each case, demographic characteristics, UA attitudes, programs, and policies; local food policy group involvement, and community participation in UA decision making were evaluated.

Demographics

It appears Chicago has higher percentages of white collar and professional workers than Indianapolis or Memphis, which could shape attitudes toward UA and sustainability, but future research into the role dominant job sectors play in UA engagement is needed to understand if a relationship exists. Relationships between employment sectors and sustainability policy likelihood have found correlations between more creative class jobs and increased index scores and between manufacturing-based economies and lower probabilities of municipal pursuit of sustainability (Portney 2003, Saha 2009, Florida 2012). Across this small sample, increased levels of diversity across the city and appropriate minority community representation led to higher index scores. Each of the case studies operated under mayor-council forms of government. While research has found council-manager forms of government are more likely to engage in sustainability policy, the preliminary quantitative analysis did not find a significant relationship with form of government across the sample (Portney 2003, Opp and Saunders 2013).

UA Environment

For many of the cities sampled, limited additional UA information is available regarding if UA program goals having been met in the past. Indianapolis is an appropriate example of this, as there is no earlier version of their food plan to reference, only a few metrics are communicated in the current version, and benchmarks were not specified. It would be illuminating to reevaluate progress on these objectives in five years by comparing hunger and access data over the same time span. The UA environment and network of programs and policies a city is able to offer seems to become more intricate as population sizes grow even within the >750k subsample. A qualitative comparison of the UA

departments and policy networks across the five or so largest and highest scoring cities would offer additional insight into variations in deliberation, decision-making, and implementation.

Local Food Policy Group Involvement

Chapter Four has shown that food policy groups play an important role. The case studies appear to suggest that more entrenched collaborative networks of food policy organizations can result in more robust and effective food policy efforts. Of the cities sampled, 33 (29%) drive FPCs and 50 (43%) put forth FPC delegates. Additional research is needed in the future to further clarify the role and impact of specifically FPCs on UA, but also to explore other social support non-profits. Chicago and other large cities are home to myriad food policy groups in their various forms. Evaluating a selection of these in greater detail is a ripe topic for future research. Comparing food policy group networks across cities could provide information on variations in effectiveness and measurable impacts. Lastly, the expanded role of Grow Memphis, a non-profit, in advancing UA goals and priorities is notable. Future research is needed to compare the impacts of city led UA programs versus when a non-profit has a primary role.

Community Relations

A more thorough understanding of program policy development through the lens of inclusivity, deliberation, participation is necessary to further understand this important element of just UA policy and program creation. As discussed, there were many Chicago experts and community leaders that played multiple roles in the drafting of Chicago's Food Equity Agenda. While it could be argued that a broader coalition of experts and community leaders would bring more diverse ideas to the table, but comparison across large city

programs would be required. Further analysis of food programs and the panels of experts and community representatives across food programs in large cities perhaps could provide additional insights. Additionally, the community representation in government data collected seems to suggest that better index scores result when more communities are represented as they are across the Chicago population and City Council as compared to Indianapolis or Memphis, but further research would be required to confirm.

Exploring variation across index scores using these methods suggests that larger, more liberal, and wealthier cities with available resources to do so are able to create a system that allows for participatory deliberation with community leaders and experts within the local food community, noting that important changes in these characteristics occur across population subsets. This inclusive decision-making approach tends to lead to programs and objectives designed with more specific indicators, metrics, and impacts, particularly in the context of social equity. If there is a form of institutional learning occurring, deeper analysis will be required to understand the mechanisms at work.

Conclusion

Much further research is needed to understand the differences and similarities in these relationships across UA and sustainability policies in general. It may be useful to perform comparative case studies for each population subset to understand the municipal relationships with UA qualitatively as well. Selecting small cities with high index scores or large cities with low index scores could serve as a starting point for comparative evaluations within subsamples. It's speculative, but I suspect UA programs have grown and developed out of cities responding to hunger/nutrition indicators with innovative solutions, as they have to environmental issues such as poor air quality in the absence of

State or Federal action. As previously mentioned, utilizing a survey methodology with a smaller sample of cities would be highly valuable in exploring internal municipal processes.

Most importantly, this dissertation has shown that a diverse array of UA programs, policies, and education is occurring in a vast majority of the country's largest cities. Not only are cities engaging with UA, but a significant percentage consider UA to be a facet of sustainability, albeit one of the least understood tools in the municipal sustainability toolkit. In some ways, UA efforts correlate with many of the same city characteristics more traditionally researched sustainability activities do, but there are deviations that must be explored. There is overlap between the motivations behind a why a city might aggressively pursue UA and sustainability, but population is a significant factor with regard to capacity to do so and will require further inquiry to understand motivations and drivers more accurately within narrower population subsets. Additional research is needed, most primarily to provide an estimation of the effectiveness and impacts of UA efforts, but also to seek a deeper understanding of the community-focused deliberative and participatory patterns that have emerged. As the climate crises worsens, industrial agricultural systems experience friction, and the dynamics of our current food system change, alternatives will be necessary and there is no scarcity of avenues for further UA exploration.

This dissertation provides a comprehensive UA Index that describes a wide range of existing UA programs and policies with which every U.S. city with a population of 200,000 or larger is engaging. By constructing such an index, this dissertation provides a platform from which many avenues of future UA research can launch. The previous lack of an urban agriculture policy index created a significant gap in the literature. To address this discrepancy, this research laid preliminary foundations upon which much interdisciplinary

study can be conducted. Urban agriculture is inherently interdisciplinary, and the groundwork laid in the preceding pages supports future development of the intersections between each interested area of study.

Moreover, the preliminary quantitative analysis performed in Chapter Three teases out multiple threads that more intricate analyses could expand upon. As previously mentioned, application of a quantile regression model, perhaps with an examination of varying population break points could reveal nuances not uncovered by this analysis. Additionally, future research would be well advised to examine relationships between gentrification and urban agriculture municipal activities. Gentrification focused quantitative analysis was beyond the scope of this dissertation but could reveal important linkages and connections in a UA issue area that is as of yet relatively unexplored quantitatively. Lastly, myriad case study alternatives exist as a result of the information gleaned from the UA Index, in conjunction with the findings of this dissertation's three case studies. It is this research's sincere hope that its efforts prove useful.

Appendix A

Index of UA Indicators

Pillar of Sustainability	Indicator	% Cities Engaging
Social Equity		
	Vehicle access restricted areas in city	89.68%
	Facilitate redemption of SNAP benefits at farmers' markets	85.71%
	City supported community gardens open to the public	81.75%
	Food deserts in city	80.95%
	Connect UA and availability of nutritious food	79.37%
	Connect UA and community benefits	76.19%
	Additional funds for SNAP recipients for farmers' markets/CSAs	69.05%
	Connect UA and underserved populations	68.25%
	Community gardens dedicated to growing food for donation	67.46%
	Food related educational programs	61.91%
	Youth nutrition programs	55.56%
	Link UA and community food security	50.00%
	Assistance for low-income citizens to participate in community gardens	48.41%
	Support mobile markets	47.62%
	Community gardens accessible to disabled residents	46.03%
	Link UA and exercise benefits	45.24%
	Link UA with assisting low-income household food expenditures	43.65%
	Community gardens dedicated to veterans/seniors	42.06%
	UA opportunities for workforce development	41.27%
	At risk youth gardening programs	40.48%
	Edible landscapes	39.68%
	Link UA and obesity	39.68%
	Connect UA and cultural understanding/outreach	38.10%
	Facilitation of summer meals program	37.30%
	Food Action/Strategy Plan	36.51%
	Connect UA and civic engagement	35.71%
	Fresh food incentive (for stores in low-income areas)	35.71%
	Link UA and crime prevention	30.85%
	Link UA and benefits to immigrant communities	25.40%
	Facilitate redemption of SNAP benefits with CSAs	24.60%
	Permit growing food in planting strips	19.84%
	UA assistance with felon reintegration	11.91%
	Connect UA and living wage	11.11%
	Support UA as a 'food pharmacy'	7.14%
	Garden or fruit share program	5.56%
Environmental		
	Promote native plants	85.71%
	Promote UA sustainable irrigation techniques	71.43%
	Discourage pesticide use	69.84%

	Promote low water use/drought resistant plants	69.84%
	Climate Action Plan	69.05%
	Link UA and stormwater pollution reduction	69.05%
	Pollinator benefits promoted	69.05%
	Sustainability/Resilience Department	68.25%
	Link UA and environmental ethic/connection to nature	66.67%
	Link UA and environmental benefits of local food	61.91%
	Promote wildlife friendly gardening	59.52%
	Promote organic gardening	56.35%
	UA in Climate Action Plan	51.59%
	Link UA and minimization of food waste	50.79%
	Municipal composting	50.00%
	Link UA and reduction of heat island effect	46.83%
	Connect UA with habitat restoration	42.06%
	Link UA and preserving biodiversity	42.06%
	Pest resistant plants promoted	40.48%
	Offer information on chemical pesticide alternatives	38.40%
	Promote vermicomposting	36.51%
	Provide contaminated soil gardening information	34.92%
	Link UA and healthier urban environments	32.54%
	Link UA and land stewardship	32.54%
	Link UA and reduction in food miles	28.57%
	Food mapping	21.43%
Economic		
	Sale of crops/animal products permitted on non-commercial property	77.78%
	Link UA and local economy	61.91%
	Link UA and neighborhood revitalization	53.97%
	Foster land trusts	52.38%
	Rain barrel rebate/discount	46.03%
	UA tax incentives/grants	46.03%
	Link between UA and jobs in the community	42.86%
	Offer incentives for local food/vendor purchasing	42.86%
	City owned land disposition process	39.68%
	Link blighted property/UA potential	35.71%
	Aquaculture/aquaponics in municipal code	34.92%
	UA Irrigation rebates/incentives	33.33%
	Link UA and reduction in public health costs	31.75%
	Compost rebates/incentives	28.57%
	Turf removal rebates/incentives	27.78%
	Stormwater pollution reduction rebates/incentives	23.02%
	Foster land banks	21.43%
	Additional/reduced rate water allocation for UA	15.08%
All – Administrative/Legal - N/A*		
	Community gardens in special/other misc districts	92.06%

	Community gardens in low density zones	91.27%
	Community gardens in mixed use zones	91.27%
	Beekeeping in special/other misc districts	90.48%
	Community gardens in high density zones	90.48%
	Fowl/rabbits in special/other misc districts	89.68%
	Beekeeping in low density zones	87.30%
	Farmers' markets	85.71%
	Fowl/rabbits in low density zones	85.71%
	Municipal code reference UA	84.13%
	Goats/sheep in special/other misc districts	83.33%
	Rooftop gardens permitted	83.33%
	Community garden information	81.75%
	Beekeeping in mixed use zones	78.57%
	Fowl/rabbits in mixed use zones	75.40%
	Beekeeping in high density zones	72.22%
	Goats/sheep in low density zones	72.22%
	Provide access to UA/gardening information	72.22%
	Promotion of local food (general)	71.43%
	Access to university extension program	69.05%
	Connect UA with sustainability efforts	68.25%
	Fowl/rabbits in high density zones	66.67%
	UA in Comprehensive or General Plan	64.29%
	Pigs in special/other misc districts	60.32%
	Interdepartmental collaboration on UA	57.94%
	Pigs in low density zones	46.03%
	Urban livestock information	46.03%
	Community garden staff	43.65%
	Promotion of school garden	43.65%
	FPC delegate	39.68%
	Promote vertical gardening or hydroponics	37.30%
	Permanent UA staff	36.51%
	Community Supported Agriculture	34.92%
	Goats/sheep in mixed use zones	33.33%
	UA or Food Department	28.57%
	Food hub	27.78%
	Food Policy Council (FPC)	26.19%
	Connect UA with resiliency efforts	25.40%
	Height exemptions for rooftop gardens	19.84%
	Promotion of farm to school	19.05%
	Goats/sheep in high density zones	14.29%
	Pigs in mixed use zones	14.29%
	Goat landscaping initiative	13.49%
	Height exemptions for UA buildings	11.11%
	Pigs in high density zones	11.11%

All – Administrative/Legal - N/A refers to efforts necessary for comprehensiveness but that don't fall under any one pillar. For example, many cities mention UA in their Comprehensive Plans, but may lack a Climate Action Plan. The Comprehensive Plan would fall under this category. Similarly, a city department devoted to UA or food in general seems sensible information to include in a comprehensive compilation of UA activities but does not fit under any one of the three pillars.

Appendix B
List of Expanded Indicator Questions

City Engagement with UA

Social Justice and Equity UA Measures in Urban Environment

1. Does the city offer/support a garden or fruit share program?
2. Does the city offer or promote edible landscapes?
3. Does the city have a plan related to food strategy (i.e. a Food Action Plan for combatting food deserts, incorporating local food, increasing low income communities access to nutritious food, etc)?
4. Does the city facilitate a summer meals program?
5. Does the city facilitate/promote mobile markets?
6. Does the city allow residents to grow food in planting strips?
7. Are any community gardens open to the public?
8. Does the city offer financial assistance or resources for low-income individuals/communities to participate in community gardens?
9. Are any community gardens dedicated to veterans/seniors?
10. Are any community gardens dedicated to growing food for donation?
11. Are any community gardens accessible to disabled residents?
12. Do any community gardens offer avenues to assist with felon reintegration?
13. Does the city offer any at risk youth gardening programs?
14. Does the city offer UA opportunities for workforce development?
15. Does the city offer any youth nutrition programs?
16. Does the city offer any food related educational programs for residents?
17. Are any portions of the city considered food deserts?
18. Are any portions of the city considered vehicle access restricted?
19. Does the city make explicit a linkage between UA and community benefits (strengthen community bonds and trust)?
20. Does the city make explicit a linkage between UA and civic engagement?
21. Does the city make explicit a linkage between UA and increasing availability of nutritious food?
22. Does the city make explicit a linkage between UA and underserved or low-income families?
23. Does the city make explicit a linkage between UA and cultural understanding/cultural outreach through food?
24. Does the city make the linkage between UA and exercise benefits?
25. Does the city make explicit a linkage between UA and benefits to immigrant communities?
26. Does the city make an explicit linkage between UA and obesity control/reduction?
27. Does the city make explicit a linkage between UA and earning a living wage?
28. Does the city make an explicit linkage between UA and a crime reduction/prevention?

29. Does the city make an explicit linkage between UA and a "food pharmacy"?
30. Does the city offer stores a fresh food incentive?
31. Does the city promote redemption of SNAP benefits at farmers markets?
32. Does the city promote redemption of SNAP benefits for CSAs?
33. Does the city offer additional funds for SNAP recipients, such as a dollar-for-dollar matching program at farmers markets?
34. Does the city link UA with community food security?
35. Does the city make explicit a linkage between UA and assists with low-income food expenditures link?

Environmental Protection Measures

36. Does the city have a department devoted to sustainability/resilience?
37. Does the city offer/support a compost program?
38. Does the city have a climate action plan?
39. Has UA been incorporated into the climate action plan?
40. Is organic gardening promoted?
41. Is vermicomposting promoted?
42. Are pest resistant plants promoted?
43. Are low water use/drought tolerant plants promoted?
44. Is wildlife-friendly gardening promoted?
45. Is the use of native plants promoted?
46. Are pollinator benefits promoted?
47. Is the UA potential to assist with habitat restoration promoted?
48. If the city provides UA/gardening information, does the available information promote sustainable irrigation techniques?
49. Does the city engage in food mapping? (can be for private property or community wide)
50. Does the city discourage chemical pesticide use?
51. Does the offer chemical pesticide alternatives?
52. Is information regarding gardening in contaminated soil available?
53. Does the city make explicit a linkage between UA and environmental ethic or connection to nature link?
54. Does the city make explicit a linkage between UA and environmental benefits of local food link?
55. Does the city make explicit a linkage between UA and preserving biodiversity/heirloom seeds link?
56. Does the city make explicit a linkage between UA and healthier urban environment link?
57. Does the city make explicit a linkage between UA and reduction of heat island effect link?
58. Does the city make explicit a linkage between UA and stormwater pollution reduction?
59. Does the city employ a goat landscaping initiative?

60. Does the city make explicit a linkage between UA and land stewardship link?
61. Does the city provide information regarding UA and reduction in food miles?
62. Does the city provide information regarding UA and minimization of food waste?

Economic Measures

63. Does the city offer compost rebates/incentives?
64. Does the city offer any grants or tax incentives for UA?
65. Does the city foster any land trusts?
66. Does the city foster any land banks?
67. Does the city have a streamlined city-owned land disposition process?
68. Does the city make an explicit link between blighted properties and UA potential?
69. Does the city allow an additional or reduced rate water allocation for UA purposes?
70. Does the city offer a rain barrel rebate or discount?
71. Does the city municipal code reference aquaculture or aquaponics?
72. Are UA irrigation rebates/incentives available?
73. Are turf removal rebates/incentives available?
74. Does the city offer stormwater pollution reduction rebates or incentives?
75. Does the city make explicit a linkage between UA and the local economy?
76. Does the city offer incentives for local food/vendor purchasing?
77. Does the city make explicit a linkage between UA and neighborhood revitalization link?
78. Are sales of crops or animal products permitted on non-commercial property?
79. Does the city make explicit a linkage between UA and increase jobs in the community link?
80. Does the city make explicit a linkage between UA and reduction public health costs?

All - Administrative/Legal – N/A

81. Does the city have a UA or food related department/program?
82. Does the city employ any type of permanent position related to UA policies/programs?
83. Does the city provide resources from multiple departments to achieve UA goals?
84. Does the city have a food policy council (FPC)?
85. Does a city delegate participate on a FPC?
86. City promotion of local food?
87. Does the city foster/promote any local farm to school programs?
88. Does the city foster/promote any school garden programs?
89. City collaboration with a university extension program for UA purposes?
90. Does the city government participate in/promote CSAs?
91. Does the city government participate in/promote farmers markets?
92. Is the city considered a food hub (USDA Food Hub Directory)?
93. Does the city provide access to UA/gardening information?
94. Does the city promote vertical gardening or hydroponics?
95. Is information regarding raising urban livestock available?

96. Does the city participate in/promote community gardens?
97. Does the city provide staff for community gardens?
98. Has UA been incorporated into the city's long-term plan?
99. Does the city link UA with sustainability efforts?
100. Does the city link UA with resiliency efforts?
101. Does the municipal code reference UA?
102. Are height exemptions granted for UA buildings?
103. Are rooftop gardens permitted?
104. Are height exemptions granted for rooftop gardening?
105. Does the city permit fowl/rabbits in high density residential zones?
106. Does the city permit fowl/rabbits in low density residential zones?
107. Does the city permit fowl/rabbits in mixed use zones?
108. Does the city permit fowl/rabbits in special/other misc districts?
109. Does the city permit goats/sheep in high density residential zones?
110. Does the city permit goats/sheep in low density residential zones?
111. Does the city permit goats/sheep in mixed use zones?
112. Does the city permit goats/sheep in special/other misc zones?
113. Does the city permit pigs in high density residential zones?
114. Does the city permit pigs in low density residential zones?
115. Does the city permit pigs in mixed use zones?
116. Does the city permit pigs in special/other misc zones?
117. Does the city permit beekeeping in high density residential zones?
118. Does the city permit beekeeping in low density residential zones?
119. Does the city permit beekeeping in mixed use zones?
120. Does the city permit beekeeping in special/other misc zones?
121. Does the city permit community gardens in high density residential zones?
122. Does the city permit community gardens in low density residential zones?
123. Does the city permit community gardens in mixed use zones?
124. Does the city permit community gardens in special/other misc zones?

Appendix C
Index Search Terms

Additive Index

1. Urban agriculture
2. Garden share
3. Fruit share
4. Edible landscape
5. Food Action Plan
6. Food Strategy Plan
7. Summer meals
8. Mobile Markets
9. Planting strips
10. Community garden
11. Veteran garden
12. Donation garden
13. Felon agriculture
14. At risk youth garden
15. Workforce development agriculture
16. Nutrition
17. Food education
18. Food desert
19. Vehicle access restricted areas
20. Food pharmacy
21. Fresh food incentive
22. Farmers' markets
    a. SNAP
23. Community supported agriculture
    a. SNAP
24. Food security
25. City departments
    a. Sustainability
    b. Resilience
26. Compost
27. Climate action plan
    a. UA
28. Gardening
    a. Organic
29. Vermicomposting
30. Pest resistant
31. Drought resistant
32. Pollinator
33. Food mapping
34. Pesticide
35. Contaminated soil
36. Local food
37. Biodiversity

38. Urban heat island effect
39. Food miles
40. Food waste
41. Land trust
42. Land bank
43. Land disposition
44. Blight
45. Reduced water rate
46. Turf removal
47. Stormwater pollution
48. Local vendors
49. Food Department
50. Food policy council
51. Farm to school
52. School garden
53. University extension
54. Goat landscaping
55. Food hub
56. Hydroponics
57. Vertical gardening
58. Urban livestock
59. Comprehensive plan
60. General plan
61.

Municipal Code

1. Urban agriculture
2. Planting strips
3. Median planting
4. Height exemption
5. Rooftop garden
6. Green roof
7. Fowl
8. Rabbits
9. Goats
10. Sheep
11. Pigs
12. Bees
13. Beekeeping
14. Apiary
15. Community garden
16. Urban farm

Appendix D
Independent Variables for Chapter 3

1. Index rank
2. Index score
3. Region
4. Division
5. Population 2010
6. Population estimate 2017
7. Percent population change since last census
8. Type of government: council manager
9. Type of government: non-council manager
10. MSA type: Central
11. MSA type: Suburb
12. Median resident age
13. Percentage of county Republican 2012
14. Percentage of county Democrat 2012
15. Percentage of county Other 2012
16. Percentage of county Republican 2016
17. Percentage of county Democrat 2016
18. Percentage of county Other 2016
19. Per capita income
20. Median household income
21. Percentage change in household income 2000-2016
22. Percentage of households <10k/yr
23. Percentage of households 10-20k/yr
24. Percentage of households 20-30k/yr
25. Percentage of households 30-40k/yr
26. Percentage of households 40-50k/yr
27. Percentage of households 50-60k/yr
28. Percentage of households 60-75k/yr
29. Percentage of households 75-100k/yr
30. Percentage of households 100-125k/yr
31. Percentage of households 125-150k/yr
32. Percentage of households 150-200k/yr
33. Percentage of households >200k/yr
34. Percentage change in per capita income 2000-2016
35. Median home value
36. Median gross rent (2016)
37. Percentage of renters
38. Housing density
39. Cost of living index
40. Median property taxes paid (2016)
41. Population density
42. Four-year university present
43. Land grant university present

44. Percentage of the population with a high school diploma
45. Percentage of the population with a bachelor's degree
46. Percentage of the population with a graduate degree
47. Crime rate
48. Unemployment percentage
49. Percent of city workers living within city limits
50. Percentage below poverty line
51. Percentage white residents below poverty line
52. Percentage Hispanic residents below poverty line
53. Percentage black residents below poverty line
54. Percentage American Indian residents below poverty line
55. Percentage Hawaiian Pacific Islander residents below poverty line
56. Percentage Other residents below poverty line
57. Percentage 2+ races below poverty line
58. Average household size
59. Percentage of residents below 50% of poverty line
60. Percentage of white residents
61. Percentage of Hispanic residents
62. Percentage of black residents
63. Percentage of Asian residents
64. Percentage of other residents
65. Percentage of foreign born residents
66. Air quality index score
67. EduGINI index
68. Number of grocery stores/10,000 residents
69. Adult diabetes rate
70. Adult obesity rate
71. Low income preschool obesity rate
72. Average BMI
73. Percentage of population employed in health care sector
74. Percentage of population employed in professional/scientific sector
75. Percentage of population employed in education sector
76. Percentage of population employed in accommodations sector
77. Percentage of population employed in finance/insurance sector
78. Percentage of population employed in construction sector
79. Percentage of population employed in admin support/waste management sector
80. Percentage of population employed in public administration sector
81. Percentage of population employed in transportation sector
82. Percentage of population employed in arts/entertainment/recreation sector
83. Percentage of population employed in real estate sector
84. Percentage of population employed in social assistance sector
85. Percentage of population employed in manufacturing sector
86. Percentage of population employed in religious/grants/civic organizations
87. Percentage employed in a city specific specialized industry
88. Days in growing season
89. Inequality ratio

90. Percentage change in inequality ratio (2010-2016)
91. Lead count

Appendix E

Comparison of Means and SDs for Larger Model in Chapter 3

Characteristics (with %s)	Correlation	Mean (SD)
Region	-0.129	
– Midwest (16.4%)		76.04 (22.4)
– Northeast (7.8%)		70.69 (24.1)
– South (35.3%)		65.98 (21.0)
– West (40.5%)		67.83 (20.7)
Form of Government	-0.326	
– Council Manager (49.14%)		61.69 (17.1)
– Non council manager (50.86%)		75.55 (22.9)
2016 Presidential Vote		
– Democrat	0.375**	71.59 (22.8)
– Republican	-0.467**	62.15 (15.9)
MSA type		
– Central (75.86%)	0.335	72.46 (20.9)
– Suburb (18.97%)	-0.377	52.46 (13.5)
– Independent (5.17%)		73.91 (25.8)
Population	0.514**	
– >500,000		84.67 (18.9)
– 250-499,999		65.81 (18.3)
– <250,000		55.80 (17.6)
% Change in Pop 2010-2017	0.036	
– Less than 7.73%		67.94 (22.6)
– More than 7.73%		69.54 (20.1)
Median Household Income	-0.065	
– Less than $55,565		70.11 (20.7)
– More than $55,565		67.37 (22.1)
% Change in MHI 2000-2016	0.151*	
– Less than 39.55%		65.52 (19.0)
– More than 39.55%		71.96 (23.1)
% Below Poverty Line	0.145	
– Less than 16.65%		65.66 (20.3)
– More than 16.65%		71.82 (22.1)
% Unemployment	0.110	
– Less than 4.0%		66.44 (21.0)
– More than 4.0%		71.12 (21.6)
Median Home Value	0.011	
– Less than $228,300		68.50 (18.3)
– More than $228,300		68.98 (24.2)
% Renters	0.223	

– Less than 50%		64.32 (18.3)
– More than 50%		73.82 (23.5)
% Workers Live in City	0.294	
– Less than 60.85%		62.49 (19.4)
– More than 60.85%		74.99 (21.6)
% White	0.084	
– Less than 42.45%		66.97 (22.7)
– More than 42.45%		70.52 (19.9)
% Hispanic	-0.196	
– Less than 17.50%		72.83 (19.5)
– More than 17.50%		64.51 (22.5)
% Black	0.067	
– Less than 14.30%		67.32 (21.6)
– More than 14.30%		70.17 (21.1)
% Asian/Other	0.015	
– Less than 9.1%		68.44 (20.6)
– More than 9.1%		69.05 (22.3)
% Bachelor's Degrees	0.343	
– Less than 32.15%		61.46 (20.0)
– More than 32.15%		76.02 (20.3)
% Graduate Degrees	0.296	
– Less than 12.0%		62.66 (19.1)
– More than 12.0%		75.26 (21.9)
4 Year University	0.323	
– Present		71.48 (21.0)
– Absent		51.60 (14.5)
Land Grant Institution	0.249*	
– Present		81.09 (18.1)
– Absent		66.47 (21.2)
Lead >5	-0.048	
– Less than 1.195		69.55 (21.2)
– More than 1.195		67.51 (21.9)
Air Quality Index	0.094	
– Less than 89.95		66.75 (20.4)
– More than 89.95		70.73 (22.2)
Grocery Stores	0.187	
– Less than 1.81		64.76 (19.9)
– More than 1.81		72.72 (22.1)
Resident Age	-0.058	
– Less than 34.4		69.88 (19.8)
– More than 34.4		67.43 (23.1)
% Adult Diabetes	0.050	
– Less than 7.95		67.68 (23.0)

– More than 7.95		69.80 (19.7)
% Adult Obesity	-0.094	
– Less than 25.45		70.75 (23.2)
– More than 25.45		66.74 (19.3)
Average BMI	-0.114	
– Less than 28.50		71.05 (21.5)
– More than 28.50		66.18 (21.0)
Overall Index Mean		68.74 (21.3)
*p < .05 level. **p < .01 level		

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