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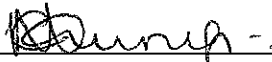
A Lesson from the Urban Garden

Authors	Hamblin, Jamie Y
Citation	Hamblin, Jamie Y. "A Lesson from the Urban Garden." 2011. Georgia State University. https://doi.org/10.57709/2102083 .
DOI	https://doi.org/10.57709/2102083
Download date	2026-04-11 02:36:13
Link to Item	https://hdl.handle.net/20.500.14694/11744

ACCEPTANCE

This thesis, A LESSON FROM THE URBAN GARDEN, by Jamie Young Hamblin was prepared under the direction of the Master's Thesis Advisory Committee. It is accepted by committee members in partial fulfillment of the requirements for the degree Master of Science in the College of Health and Human Sciences, Georgia State University.

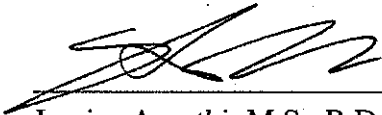
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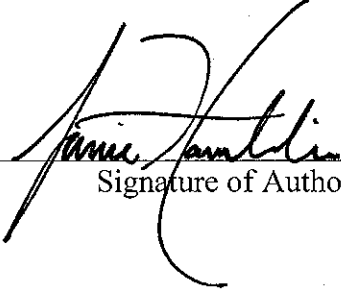
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ABSTRACT

A LESSON FROM THE URBAN GARDEN

By

Jamie Young Hamblin

Purpose: In 2008 the world's urban population surpassed the rural population for the first time in the history of human population growth; furthermore, the United Nations (UN) estimates by 2025 the world's urban population of 3.2 billion will increase by about one billion people. With the increase in mouths to feed, urban food security will continue to be a public health issue in need of attention. Given recent global population shifts towards urban centers, and the interconnectedness between food and health, this review sheds light on the role of urban agriculture in the complex web of factors known as food security. Although urban agriculture takes many forms (community gardens in more developed countries and subsistence agriculture in developing countries), this review addresses urban agriculture specifically as an intervention or project with a goal of increasing food production.

Methods: Using the Sustainable Livelihoods Framework (SLF) as a foundation, an adjusted theoretical framework was developed which accounted for negative implications of urban agriculture interventions as well as sustainability. This adjusted framework was used to evaluate eight urban agricultural projects implemented in varying socioeconomic and geographical locations. Ultimately, the framework generated a food security score, respective of each project. Using this score, statistical tests were conducted to confirm patterns and characteristics of more effective projects. Pearson's correlation coefficients were used to measure correlation between food security score and types of capital (physical, financial, human, natural, social, future) invested in by the project as well as food security score and duration of project (years) and number of other project components. In addition, an ANOVA test compared mean food security score with inclusion of participatory methods.

Results: Statistical analysis indicates food security score has a strong moderate correlation with physical and future capital (0.72 and 0.73 respectively) and a strong correlation with social capital (0.80). In addition, food security score has a moderate correlation with duration of project and a strong correlation with number of project components (0.60 and 0.83). Furthermore, mean food security score of projects which used participatory methods was statistically different than mean food security score of projects which did not use participatory methods ($p=0.01$).

Conclusions: This review cannot conclude that certain types of interventions are the solutions to urban food insecurity. It is evident, that promoting vegetables in home and community gardens can provide some benefits, but simultaneously negative implications can arise such as reduced protein intake or negative social stigma attaches to vegetable gardens. Additionally, in line with current research, participatory methods prove beneficial in incorporating into an agricultural intervention. Ultimately, statistical results affirm that urban food insecurity should be addressed through an integrated strategy which gives consideration to the viability of the project long-term. This can be addressed through the lens of the SLF with the inclusion of future capital. By extension, food security score, developed for the purposes of this review can help with organizing and recognizing patterns and valuable components of interventions; however, this scoring system is fairly subjective with some limitations.

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Jamie Young Hamblin

A Thesis

Presented in Partial Fulfillment of Requirements for the
Degree of
Master of Science
in
Health Sciences
in the
Department of Nutrition
in the
College of Health and Human Sciences
Georgia State University

ACKNOWLEDGEMENTS

Not only would I would like to thank everyone who has been a part of the process of thesis researching and writing, but I would like to thank everyone who has supported me over the past few years of graduate school. This thesis is, in a way, the end product of three years of academic, personal and spiritual growth, and I am very grateful for those of you who walked alongside me during this time.

First, I would like to thank my committee Dr. Ndirangu, Professor McCarroll and Jessica Avasthi for working with me from start to finish; for listening and offering guidance along the way. Also, a warm thank you to my family – my parents and grandparents, Lauren & Chris, Katherine, Daniel and Leigh. Without your support, I would never have begun this journey in the first place, and I have appreciated being able to share it with each of you. Finally, thank you to my community of friends – with special thanks to Cheryl & Eric, Diane & Drew and Catherine. Your unconditional love continues to amaze me.

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ABBREVIATIONS

ART	Antiretroviral Therapy
FAO	Food and Agriculture Organization of the United Nations
HAART	Highly Active Antiretroviral Therapy
HIV/AIDS	Human Immunodeficiency Virus/Acquired Immune Deficiency Syndrome
HKI	Helen Keller International
LDC	Least Developed Country
NAFTA	North American Free Trade Agreement
NGO	Non-governmental Organization
PEM	Protein Energy Malnutrition
PEPFAR	US President's Emergency Plan for AIDS Relief
PLWHA	People Living with HIV/AIDS
SLF	Sustainable Livelihoods Framework
UN	United Nations
UNAIDS	Joint United Nations Program on HIV/AIDS
US	United States
VAD	Vitamin A Deficiency
WHO	World Health Organization

CHAPTER I: INTRODUCTION

“The scope of modern nutrition science should therefore encompass both biomedical nutrition – health issues, and the wider challenges of achieving sustainable food production, greater equity in relation to food and nutrition, and good health prospects for future generations.” Anthony J. McMichael

From the ashes of a past thesis has arisen this paper. What began as an exploration into developing gardens for people living with HIV/AIDS (PLWHA) has turned into a review of urban agriculture and its relationship to food security. Given recent global population shifts towards urban centers, and the interconnectedness between food and health, this review sheds light on the role of urban agriculture in the complex web of factors known as food security. Although urban agriculture is ongoing, especially in developing countries, this review addresses urban agriculture specifically as an *intervention*, and in this case, an intervention designed to increase food production.

Food security, because it is a state which is influenced by many social, physical and economical factors, is particularly difficult to define. During the 1996 World Food Summit, food security was defined as a state in which “all people at all times have access to sufficient, safe, nutritious food to maintain a healthy and active life,” (“Food Security,” 1996). When addressing food security, it is necessary to consider not only access to food, but also what components of a food system exacerbate or diminish that particular state. According to the *Handbook of Agricultural Economics*, food security is further established by four components of a food system: 1) physiological needs 2) complementarities and tradeoffs among food and other basic necessities 3) changes over time and people’s response to change and 4) vulnerability (Barrett, 2002). While food security is a dynamic state, the interrelationship between these four components works to found a particular state of food security. Although there are varying definitions of food

security, for the purposes of this review, the definition set forth by the World Food Summit and the framework outlined by applied economics expert, Christopher Barrett, in *Handbook of Agricultural Economics* will be used.

Additionally, food security can be examined in a variety of different contexts.

Particularly relevant to current shifts in global populations, is the examination of food security within urban settings. In 2008 the world's urban population surpassed the rural population for the first time in the history of human population growth. Furthermore, the United Nations (UN) estimates by 2025 the world's urban population of 3.2 billion will increase by about one billion people (*World urbanization prospects: the 2009 revision*, 2009). Notably, the past increase in urban population in less developed countries like Africa is due to migration of people from rural to urban areas (Satterthwaite, McGranahan, & Tacoli, 2010). In short, the world's cities will be home to one billion more people in only 15 years time. With the increase in mouths to feed, urban food security will continue to be a public health issue in need of attention.

According to the World Bank, agriculture is an integral part of development – whether for enhancing growth or reducing poverty (Webb & Block, 2010), and some researchers argue urban agriculture is a key component of sustainable human development, including therapy, culture and identity (Bon, Parrot, & Moustier, 2009). With the increase in urban population, the role of urban agriculture has been increasingly examined by researchers from a variety of disciplines. While some cities in developed countries are describing urban agriculture as a “resurgence” of agriculture, other cities in less developed countries are finding ways of integrating their traditional methods of subsistence agriculture into their new urban environment. Despite growing academic interest in urban issues, there is

yet to be published any reviews of urban agriculture as a means of alleviating food insecurity.

Therefore, this review seeks to provide a glimpse into global urban agriculture as it relates to food security. Through evaluation of a variety of urban agriculture interventions aimed at food production, it examines the role of these interventions in addressing urban food security. In the evaluation process, the review also highlights the components of those interventions which characterize more effective projects or interventions; ultimately, providing suggestions for future intervention design and evaluation with an emphasis on sustainable approaches.

CHAPTER II: REVIEW OF THE LITERATURE

Urban Food Security

Understanding food insecurity in an urban context is important considering the trajectory of the world's population towards more urbanized settlement (Satterthwaite, et al., 2010). This move toward urban areas, termed urbanization, is defined as simply “the shift in settlement patterns from more dispersed to more densely settled areas along with the expansion of land for urban use,” (Satterthwaite, et al., 2010). Importantly, urbanization is a global trend. It is not just occurring in developed countries, but less developed countries in Africa, Asia and Latin America have all experienced population increases in urban and peri-urban areas (Bon, et al., 2009).

By extension, urban food security is a global issue. Urban food *insecurity* is present in both developed and less developed countries; however, public health research indicates that most of the food-insecure populations (approximately 800 million people) live in middle to low-income countries (McMichael, 2005). The International Food Policy Research Institute carried out a study of 18 less developed countries which examined energy (kilocalories) deficiencies in urban compared with rural areas, and results show that independent of income, energy deficiencies were the same or greater in urban areas compared with rural areas in 12 of 18 examined countries (Ahmed, Hill, Smith, Wiesmann, & Frankenberger, 2007). This means that development, as represented by urbanization, and food security does not necessarily go hand-in-hand.

As distinguished by Daniel Maxwell, international researcher of food and nutrition policy, urban food insecurity is primarily the result of inadequate income to be able to afford food; whereas, food insecurity in a rural setting is more dependent upon

environmental factors such as physical landscape, climate and community hygiene (Maxwell, 1999). Urban food insecurity on a global spectrum has major economical, nutritional and social implications, with these outcomes taking different forms relative to each household. As Maxwell points out, unlike rural food insecurity, which is generally present throughout the community as a whole, urban food insecurity is characterized according to individual household or rather household income (Maxwell, 1999). With income varying from household to household in an urban population, this means varying states of food security as well; making public health interventions in urban settings a challenge.

Food insecurity is particularly difficult to measure because it is not necessarily an outcome but rather an informal coping strategy of low-income groups (Maxwell, 1999). This means an individual, a household or a community copes with economic, environmental or social pressures by altering their methods of producing or procuring food resulting in some degree of food insecurity (lack of access to sufficient, safe, nutritious food to maintain a healthy and active life at all times). For some, this may mean buying cheaper, less nutritious food items. For others, this may mean buying quantifiably less food. Interestingly, Maxwell also characterizes urban food insecurity as a “politically invisible problem.” Citing contemporary African cities as examples, Maxwell suggests more visible urban issues such as unemployment and overcrowding often take precedence over the less visible food insecurity (Maxwell, 1999). Given that food insecurity is associated with low-income, these other issues characteristically experienced by low-income groups, such as unemployment and overcrowding, reflect the complicated nature of food security.

While the economic status and agricultural practices vary from city to city, increasingly research features the examination of urbanization and globalization in relationship to alterations in local food systems and subsequent food insecurity. As previously defined, urbanization refers to the change in settlement areas from an area of dispersed settlement to an area of more dense settlement areas as well as the expansion of land for urban purposes (Satterthwaite, et al., 2010). Globalization on the other hand, as defined by Jenkins, is the process of “greater integration within the world economy through movements of goods and services, capital, technology and labor which leads increasingly to economic decisions being influenced by global conditions,” (Jenkins, 2004). Both of these developmental movements will be addressed in relationship to food security.

Regarding urbanization, Jane Dixon, at Australia’s National Centre for Epidemiology and Population Health, suggests seven determinants of urbanization which can alter food security and ultimately nutritional status (Dixon, et al., 2007): 1) decline in food self-sufficiency; 2) displacement of local food retailers, encouraged by marketplace activities of corporate chains; 3) negative impact of global food policy on small food producers, retailers and poorer consumers; 4) food system dynamics that favor processed, high energy foods; 5) loss of livelihood options in local food systems; 6) urban planning and car transport and 7) a variety of sources of advice fueling consumer food anxiety.

Although the issues are multi-faceted, this section briefly addresses the forces at work leading up to and the implications of these seven determinants:

1. **A decline in food self-sufficiency** may have a variety of reasons. In migrating from a rural to urban area, a family may not have access to land to carry on with traditional subsistence agriculture; consequently, their ability to be self-sufficient

in food production decreases. Also, other reasons for a decline in food self-sufficiency are poor soil quality in an urban setting compared with rural or poor government support of urban agriculture.

2. **Displacement of local food retailers** and consequent food insecurity does not necessarily mean a lack of food. As Dixon suggests, urban development heralds the dominance of supermarkets and convenience stores over traditional produce markets, which ultimately may decrease for lower income communities (Dixon, et al., 2007). The establishment of supermarkets and convenience stores, Dixon argues, means an increase in “bulk purchases, lower prices for more processed foods and larger portions,” (Dixon, et al., 2007). This does not mean the quantity of food available in urban areas decreases. In fact, the amount of “food” available can actually increase (depending on the economic state of the city); while simultaneously the quality of food available decreases, thus diminishing food security.
3. **Negative impact of global food policy** is a deeply rooted political issue. One well known example of global food policy, involves the North American Free Trade Agreement (NAFTA) between the US and Mexico. Economists report the liberalization of trade between the two nations may improve the economic state of Mexico in the long-run, but the cost is displacement of local farmers due to the influx of competitive products from the US into Mexican markets (Villarreal, 2010). While the political agenda of governing bodies around the world vastly differ, Patrick Webb argues that their response to national food crises is similar. He writes governments may ignore the problem; pursue trade-based solutions

which include reducing tariffs on food imports or restricting exports; implement consumer protection via subsidies or rationing and input commodity price support (Webb, 2010). Webb further argues, in light of the state of the global economy, governments have begun to question the effectiveness of past approaches (Webb, 2010).

4. **Food system dynamics that favor processed foods.** In an urban setting, food is generally transported from outside the area to the market. This lends itself to treating food items with some amount of preservatives/processing in order to withstand the trip. In addition, because of the added cost of preserving and transporting food to the urban market, more processed (generally less nutritious) foods are cheaper.
5. **Loss of livelihood options in local food systems.** What Dixon is referring to is the decreased capacity for local food enterprises to financially support a household within an urban food system. Because of a variety of barriers such as competitive prices, market access, etc., local food enterprise in an urban setting typically is not the only source of income for households; at least not in the same ways societies built upon traditional agriculture are accustomed to. Interestingly, a trend in urban food systems, both in developed and less developed countries, has been an increase in street food vending (Maxwell, 1999). Enterprises like street food vending fill the gap, so to speak, to supplement household income. This response shows ingenuity on behalf of urban residents. While they may not be able to make a living off their produce alone, they can make some profit from selling chapatti or homemade popsicles. Although Dixon is correct to suggest loss

of livelihood on the local level is a determinant of urban food insecurity, urban residents have shown initiative in responding and coping with changes.

6. **Increased reliance on transportation** facilitates increased reliance on surrounding food environment for those with less access to transportation. If the local food source is nutritious then this is not necessarily a barrier; however, low income urban areas are typically characterized as food deserts (areas that lack access to affordable fruits, vegetables, whole grains, low-fat milk, and other foods that make up the full range of a healthy diet, according to the US Department of Agriculture (USDA) (Ploeg, et al., 2009).
7. **Conflicting advice leading to food anxiety.** Here Dixon refers to a post-industrial urban setting. She explains as local food systems become more globalized, customary diets are replaced with more exotic or more unfamiliar foods leading to confusion and cultural food insecurity, what is termed by Fishler as ontological food insecurity (Dixon, et al., 2007). Specifically, this refers to anxiety about what is nutritious food. In addition to familiar foods being replaced with exotic foods, a good example of this would be food labels. In both developed and less developed countries, food labels may induce shoppers to question whether or not something is healthy. Although Dixon makes a good point, the theoretical nature of this determinant makes it a little more difficult to grasp. However, increasingly, research touches on the health benefits of maintaining traditional culinary practices (Rozin, 2005).

These determinants often fluctuate with one another and are not mutually exclusive; however, it is critical to understand food insecurity, particularly in an urban setting, is part of a complicated web of economic and environmental factors.

Touching on globalization, in a 2010 review Loeweson sites that increased global trade in food products goes hand-in-hand with changes in food availability, accessibility, and price (Loewenson, Nolen, & Wamala, 2010). This directs demand away from traditional or home-produced foods and generates increased reliance on store-bought foods, which are typically more processed, usually resulting in negative dietary impacts (Loewenson, et al., 2010). Although the issue of globalization and the web from farm to table is incredibly and increasingly complex, global food trade, and what we see or do not see in our urban groceries, is reflected in light of global food policy. To be brief, as markets are expanded to include more global as opposed to local food products, agricultural/economic policy stimulates the production of food for export rather than consumption. This means a shift away from traditional or subsistence farming and a movement toward mono-cropping or farming for export and a shift toward reliance, as Loeweson suggests, on store-bought foods.

This shift is evident in Africa, for example. In an article published by the Food and Agriculture Organization of the United Nations (FAO), Kennedy addresses alterations in traditional African food culture as a result of globalization. Kennedy notes that the availability of protein from beans, pulses and groundnuts, which are all part of a traditional African diet, has decreased since 1960 (G. Kennedy, 2002). Like Loeweson, Kennedy suggests this decline is a result of shifting away from traditional diverse agriculture toward growing staple crops such as corn or cacao alone (G. Kennedy, 2002).

The Nutrition Transition

Bridging the gap between urbanization, globalization and health, is what Popkin introduces as the nutrition transition. This term refers to the change in nutrition status as a result of the cumulative effect of changes in food production, distribution and consumption stemming from economic transition from low to a higher income (Popkin, 2001a). Typically, the term nutrition transition applies on a nation-wide scale, yet these changes in food systems examined on a national scale are frequently cited as the same changes that accompany urbanization and globalization and, importantly, demonstrate an association with food insecurity. The following section elaborates on the nutrition transition in the context of health implications of food insecurity. However, it is important to approach food insecurity understanding that it is deeply rooted in local culture and traditions as well as influenced by dynamic global factors.

It is important to note, as Webb and Block argue, “Wealth alone does not predict good nutrition.” A pertinent example of this involves cash crop production schemes in less developed countries. There is significant controversy concerning the promotion of cash cropping over subsistence agriculture as a means of improving nutrition and health. Some studies indicate that a transition to cash cropping can improve childhood health through increased income making expensive yet nutritious foods affordable in addition to increasing access to healthcare services. Other studies show cash cropping has a negative effect on health because cash crops replace food grown for household consumption. A review of cash cropping production in less developed countries indicates that higher income does not always result in improved nutrition or health (E. Kennedy, Bouis, & von Braun, 1992). Specifically, this review examined the effects of cash cropping schemes in

relationship to childhood health. Results indicate that although health (as measured by occurrence and duration of illness) did not improve in children, caloric intake did increase slightly (E. Kennedy, et al., 1992). The authors concluded though small improvement in nutrition was evident, there were no negative health implications associated with transitioning from subsistence agriculture to cash cropping.

Furthermore, Dixon and colleagues describe the nutrition status of an urban population according to three states of development – industrializing, industrial and post-industrial. They note, “Unequal access to calories and diversity [of diet] gives rise to inequities in nutrition status, with under-nutrition being more common among the poor in industrializing cities, whereas in industrial cities the rising middle classes are at greater risk of over-nutrition,” (Dixon, et al., 2007). This suggests unequal access to food, characteristic of an industrializing setting, as well as unequal access to nutritious food, characteristic of an industrial setting, both embody a form of food insecurity and both engender altered nutrition status. On the other hand, in post-industrial cities the food system is characterized by distinct divisions. Dixon describes this systems as “slow-fast,” meaning the wealthier households purchases fresh, local or specialized “slow” foods while the poorer households typically consume a diet of processed, commercialized “fast” food items(Dixon, et al., 2007). This indicates post-industrial higher income households, less affected by economic stress, are more likely to purchase comparatively more nutritious food than lower income households. For the lower income households, over time these habits can lead to increased risk of type II diabetes and heart disease thereby perpetuating Popkin’s nutrition transition.

Health Implications of Food Insecurity

The relationship between food insecurity and health is, at best, complicated. However, scholars have been able to connect economic status of an urban setting with corresponding nutrition and health issues. Following Maxwell's argument that food security is more of a coping strategy than an outcome, health implications of food insecurity may look different for different households. For instance, in an urban setting, one household may cope with economic stress by purchasing less food, in which case the household may be subject to under-nutrition. On the other hand, a household may cope with the same stress by purchasing less expensive, lower quality food, in which case the household may be subject to over-nutrition. Thus, the underweight can live "alongside" the obese in an urban setting depending on income, with both households subject to food insecurity.

Although the resulting health implications of urban food insecurity may look different from household to household, malnutrition is a common thread. With regard to industrializing cities, the United Nations lists insufficient access to food as one of primary contributors to under-nutrition (*Nutrition throughout the lifecycle*, 2000); however, insufficient access to nutritious food and subsequent malnutrition is increasingly common in post-industrial, developed countries like the United States (US), Canada and the United Kingdom (Riches, 1997). According to McMichael, "In modern urban populations malnutrition encompasses new forms of dietary imbalance, especially excesses of certain nutrients...[which] contribute to various non-communicable diseases" like obesity and metabolic disorders (McMichael, 2005). In line with Dixon's perspective, urban food insecurity in a post-industrial urban area, is indeed intertwined

with malnutrition, but here it may take the form of obesity and type II diabetes from purchasing foods higher in fat, sugar and salt but lower in price (Dixon, et al., 2007).

This shift in diet toward purchasing foods higher in fat and sugar typifies what Popkin terms the nutrition transition. Specifically, Popkin notes, “One consequence of the nutrition transition has been a decline in under-nutrition accompanied by a rapid increase in obesity,” which he attributes to the increased consumption of food prepared away from home (Popkin, 2001b). Furthermore, for countries or households undergoing economic transition, as Kennedy points out, as income rises so does consumption of animal foods rich in protein and fat (G. Kennedy, 2002), which has the potential to lead to over-nutrition and metabolic disorders.

While food insecurity is generally not the direct cause of chronic disease, it is associated with risk of disease. For example, medium and low income households in Africa typically spend 75% of their income on food (Dixon, et al., 2007); however, when a member of the household is afflicted by health conditions such as Human Immunodeficiency Virus/Acquired Immune Deficiency Syndrome (HIV/AIDS), the ability of the household to either physically produce food or generate income to afford food is greatly diminished; consequently, the health of the entire family unit can experience slow deterioration of health. Not only are lower income populations very vulnerable to food insecurity with any increase in food price, but the added burden of disease and necessary healthcare puts households financially in a position difficult to recover from.

Generally speaking, as described in the previous section malnutrition takes many forms. The first image that usually comes to mind when considering the term “malnourished” is a wasted and stunted child. There is good reason for it. Specifically in Africa, the number of malnourished children has increased since 1990: over 25% of all African children under 5 years are underweight for their age (Loewenson, et al., 2010). This section briefly highlights the primary health issues targeted by public health programs related to or caused by malnutrition in urban settings including: micronutrient deficiency, HIV/AIDS and obesity.

Micronutrient Deficiency

Nutrient deficiencies are often referenced as indicators of malnutrition. As suggested by Latham, Ghosh and the WHO, vitamin A, iron and iodine deficiency are the major micronutrient deficiencies evident in low-income populations, particularly in less developed countries (Latham, 1990) (Ghosh & Shah, 2004).

Vitamin A

Vitamin A has several important physiological roles, including: regulating growth and development as well as enhancing immune function; thus, vitamin A deficiency (VAD) is associated with poor health, particularly increased risk of illness (Mehta & Fawzi, 2007). Globally, vitamin A deficiency (VAD), is the primary cause of night blindness in children with 250,000 to 500,000 children becoming blind annually ("Micronutrient deficiencies: vitamin A deficiency," n.d.). The World Health Organization (WHO) reports that of those children who develop blindness, 50% are predicted to die within the next year ("Micronutrient deficiencies: vitamin A deficiency," n.d.).

Evidence does indicate that public health programs which use a variety of approaches to correct VAD can be successful. Globally, interventions feature a range of strategies from fortified foods and supplements to gardening and promotion of vitamin A-rich foods. Some particularly successful interventions have occurred in Indonesia and Bangladesh. In Indonesia, national vitamin A capsule distribution was initiated in the 1970s along with a social marketing campaign promoting vitamin A-rich foods. Ultimately, by 1992 the program had reduced night blindness among young children to less than 1% (Pee, Bloem, Kiess, Panagides, & Talukder, 2003). Notably, vitamin A supplementation among children has been shown to significantly reduce mortality by 20% (Beaton, Martorell, Aronson, & Edmonston, 1993). In response to growing awareness of the underlying issues suggested by Latham, according to Helen Keller International (HKI), “there is increasing interest to also increase the production of animal foods in the form of poultry, fish and/or small animal husbandry,” (Pee, et al., 2003) in combination with homestead gardens and vitamin A capsule supplementation.

Iodine

According to the WHO, “iodine is the single most common preventable cause of mental retardation and brain damage. Iodine is necessary for the production of thyroid hormone, which has a variety of physiological functions in addition to brain function (*Childhood and maternal undernutrition*, 2011). Zimmermann explains that iodine deficiency can be the result of multiple environmental changes (Zimmermann, 2010). For instance, iodine is recycled in a sense through the environment; leaching out of the soil into a body of water, and eventually it returns to the soil through rain. Due to flooding or soil erosion

iodine can be replete in soil, which in turn leads to plants and grazing animals being deficient as well (Zimmermann, 2010).

As a result, 2.2 billion people worldwide are vulnerable to iodine deficiency with about half of those people experiencing goiter, a swelling of the thyroid gland due to inadequate iodine. Despite these statistics, universal salt iodization, essentially the addition of iodine to salt has been a successful strategy in preventing iodine deficiency and is currently implemented globally. While salt iodization generally takes credit for correcting the deficiencies, other sources include: supplements, dairy products or the byproducts of fertilization, irrigation and livestock feeds which contain iodine compounds (Zimmermann, 2010). According to a 2007 review, because of iodization of salt the number of countries with iodine deficiency has decreased from 110 in 1993 to 47 in 2007 (Andersson, de Benoist, & Rogers, 2010).

Iron

Iron is an important structural and physiological component of a variety of cells including red blood cells, neurotransmitters and immune cells as well as metabolic functions including DNA, collagen and bile synthesis ("Iron Fact Sheet," n.d.). As is imaginable, a deficiency of iron in the diet has significant health implications. According to the WHO, iron deficiency anemia is the most common and widespread deficiency worldwide with 30% of the population categorized as anemic ("Iron deficiency anaemia," 2011). Interestingly, the WHO comments that the deficiency is prevalent in both developed and less developed countries, which is uncharacteristic of micronutrient deficiencies ("Iron

deficiency anaemia," 2011). Causes of iron deficiency range from inadequate sources of protein and food insufficiency to impaired nutrient utilization.

Zimmermann suggests three interventions aimed at preventing and correcting iron deficiency: 1) education along with diet modification/diversification 2) supplementation 3) fortification (Zimmermann & Hurrell, 2007). One of the major interventions aimed at preventing iron deficiency is cereal fortification. While supplementation and fortification have been successful interventions in some populations, there are some documented negative effects of supplementation such as increased risk of infection for children in tropical regions (Zimmermann & Hurrell, 2007). Because of the relative safety of fortification, food science has developed a greater interest in biofortification.

Biofortification, which involves all of the micronutrients and not just iron alone, features modern breeding techniques to produce new varieties of staple crops higher in micronutrients ("Biofortified crops for improved human nutrition," 2002). Given the sophistication of food science today, biofortification holds a great deal of promise; however, research is not conclusive about its long-term health implications or cost-effectiveness.

Moving from the micronutrients to macronutrients, Latham cites protein energy malnutrition (PEM) as it relates to food insecurity as one of the main contributors to deficiency diseases (Latham, 1990). International research notes the immediate cause of deficiency diseases like night blindness are attributed to PEM; however, the complex underlying issues such as "poverty, inequity, poor food production and distribution, and lack of knowledge" play an integral role in correcting deficiencies (Latham, 1990).

Physiologically speaking, varying forms of vitamin A, retinol from animal sources of

protein or beta-carotene from plant sources, can be converted within the body to provide the necessary components for the eyes to function in dim light. While it is possible for people to experience a micronutrient deficiency in isolation, likely these populations are deprived of other macro and micronutrients from insufficiency of nutritious food. As is imaginable, deficiencies occur mostly in populations that are also food insecure or subject to a variety of social and environmental factors that diminish food security. Specifically, in studies of urban health in India's slums, researchers attribute the following factors as proponents of malnutrition in children: improper infant feeding practices, impaired utilization of nutrients due to infections and parasites, inadequate food and health security, poor living conditions, lack of awareness and knowledge regarding food requirements and absence of parental or adult support (Ghosh & Shah, 2004). Again and again, research points to the complex relationship between health and food security, which is indicative of the need for public health programs to target the factors related to food insecurity not just vitamin deficiencies alone.

HIV/AIDS

Millions of people worldwide die every year from HIV/AIDS and countless more suffer the repercussions of a family or community unit being affected by the virus. According to the 2009 Joint United Nations Program on HIV/AIDS (UNAIDS) Outlook, 33.4 million people are living with HIV worldwide, 2.7 million people were newly infected in 2008 and 3.2 million people died of AIDS related illness in 2008 (Joint United Nations Programme on HIV/AIDS, 2009).

In 1981, the first cases of HIV were reported in the US ("Basic Information about HIV and AIDS," 2010). However, the disease was already spreading rapidly around the world – particularly in Africa. In the mid-eighties Uganda reported the most cases of AIDS on a global scale (Frontline, 2006). In response, international agencies began organizing and mobilizing to prevent the spread of the virus. The first world wide initiative was headed by the World Health Organization in 1986, which was geared at stimulating national governments to act quickly to implement nation-wide intervention programs (Frontline, 2006). Several countries including Uganda and Senegal have seen the success of national campaigns: the rate of HIV infection in pregnant women in Uganda has dropped from 30% to less than 7% since 1990 (Hogle, 2002). On the other hand, countries in Sub-Saharan Africa remain heavily impacted by high rates of HIV infection. UNAIDS estimates that this region represents 67% of global HIV infections in 2008 resulting in a total of 22.4 million people living with HIV (Joint United Nations Programme on HIV/AIDS, 2009). Currently, there are a variety of agencies working to prevent and treat the disease including large international organizations like UNAIDS as well as smaller grass roots non-governmental organizations (NGOs).

While preventing HIV/AIDS transmission and even finding a cure is undoubtedly important, it is also important to keep in mind that 33 million people worldwide are living with HIV/AIDS. In light of Antiretroviral Therapy (ART) and Highly Active Antiretroviral Therapy (HAART), consideration should be given to improving the quality of life for PLWHA. Nutrition plays a critical role in combating HIV/AIDS. Studies show that proper nutrition can decrease the transmission of the virus from mother to child (Mehta & Fawzi, 2007) and that nutrition impacts a person's ability to withstand the virus

(Alyce & Selina, 2006; Fergusson, et al., 2009). According to the American Dietetic Association, “A well-nourished person with HIV who has a controlled viral load is more likely to be able to withstand the effects of HIV infection, supporting immune status and possibly delaying the progression of HIV disease,” (Fields-Gardner, 2010). Naturally, food insecurity and consequent poor nutritional status impairs, rather than promotes, health in any individual, particularly at-risk populations like PLWHA.

It is well-known that the virus compromises the immune system causing greater susceptibility to opportunistic infections. Not only does it cause the slow demise of individual health, but it contributes to the loss of economic productivity of the family unit as a whole. For example, when a family in the Ivory Coast loses an adult to HIV, the family must withstand a 50% decrease in household income (Mukherjee, et al., 2003). Additionally, the increasing time constraints and cost for care of a family member with HIV/AIDS positions women and children of the household more susceptible to detrimental health implications (Loewenson, et al., 2010). Additionally, even in developed countries, food security has been shown to play an integral role in risk of HIV infection. According to Kalichman, who researched food insecurity as it relates to people living with HIV/AIDS (PLWHA) in Atlanta, Georgia, “food insufficiency is independently associated with risks for HIV infection,” (Kalichman, et al., 2010). It is important to note that food insufficiency is a slightly different than food insecurity though it does fall under the umbrella of factors that characterize food insecurity. Specifically, food insufficiency targets the *amount* of food and can be defined as inadequate amount of food intake because of a lack of money or resources that provide access to having *enough* food (Casey, Szeto, Lensing, Bogle, & Weber, 2001).

Obesity

On the opposite end of the spectrum, malnutrition can take on other forms such as obesity and type II diabetes, as suggested by McMichael and Dixon. According to the WHO, in 2008 there were 1.5 billion overweight adults worldwide with one in ten people classified as obese ("Obesity and Overweight," 2011). In 2010 the WHO estimated there were 43 million overweight children under the age of five; however, surprisingly only 8 million of those were from developed countries ("Obesity and Overweight," 2011). The remaining 35 million overweight children are living in less developed countries ("Obesity and Overweight," 2011). These statistics suggests that obesity, on a global scale, may not be just an issue for developed countries. Furthermore, the WHO reports an interesting paradox in the prevalence of global obesity. Accordingly, obesity in low-income countries is more common in women, those of *higher* socioeconomic status and those living in urban communities while in high-income countries, obesity is more common in those of *lower* socioeconomic status. Urban versus rural obesity rates in higher income countries vary from country to country with nations. In the US, for example, rural obesity rates are higher than urban rates; however, in China and India obesity rates are higher in urban compared to rural areas ("Obesity," 2011).

The associations between obesity and type II diabetes are well known; therefore, the increasing prevalence of obesity in less developed countries goes hand-in-hand with increasing prevalence of type II diabetes. While the exact mechanisms behind the development of type II diabetes is not known, it is one of the many health complications that can result from obesity. In short, obesity is a risk factor for non-communicable

diseases like cancer, heart disease and osteoporosis in addition to type II diabetes; consequently, obesity also increases risk of morbidity and mortality ("Obesity," 2011).

Interestingly, in the US, there has been an increase in both obesity and food insecurity in the past decade. However, the reason for this paradoxical association is unclear. A recent review published by the American Dietetic Association investigates the relationship between obesity, food insecurity and food stamps and concludes, like Maxwell, obesity related to food insecurity is a coping strategy for low-income groups in the US (Dinour, Bergen, & Yeh, 2007). Although the cause for obesity may be due to a number of environmental or social factors, according to the authors, "Those households or individuals who are able to positively deal with these coping strategies will likely maintain a non-obese body weight, whereas those who are not able to will likely be overweight or obese," (Dinour, et al., 2007).

In addition to positively coping with fluctuations in the local food system, public health interventions aimed at decreasing and preventing obesity are increasingly being developed and implemented. With recent federal government support, *Let's Move*, an initiative to improve the health of children in the US, provides funding and programming support to a variety of organizations and communities to implement strategies to increase physical activity and promote overall nutrition. Globally, interventions at preventing obesity are on the rise with programs ranging from nutrition education and physical activity curriculums in schools to weight-loss interventions supported by community or faith-based organizations. For the most part, these interventions are being implemented in more developed countries while obesity in less developed countries takes a back-seat to issues related to under-nutrition.

Urban Agriculture

Urban agriculture, as defined by Bailkey and Nasr, is the growing, processing and distribution of food and other products through intensive plant cultivation and animal husbandry in and around cities (Bailkey, et al., 2003). The profiles of urban farmers can be distinguished based on product outlet: home consumption, urban market and export. Specifically, subsistence farmers use their produce only for home consumption; multi-cropping/peri-urban farmers use products for home and urban market; commercial farmers do not necessarily consume but sell to urban markets alone and entrepreneurs use their product for both urban market and export (Bon, et al., 2009).

Furthermore, urban agriculture differs from rural agriculture in that it is not the main source of employment or income for a household; it involves informal land use; it is considered environmentally risky and is in competition with other economic activities (Bon, et al., 2009). The actual produce is purposed for local market or self-consumption alone and not for export, for the most part, and is characterized by high value perishable products (Bon, et al., 2009). Fruits and vegetables are typically the output of urban gardens due to a variety of reasons ranging from lack of produce in local stores or expense of that produce. However, there is increased interest in the importance of livestock as a component of urban agriculture. In 2011, Randolph and others reviewed the role of livestock in nutrition and health for impoverished populations. Despite safety concerns, researchers found livestock, as a development intervention, has many benefits including: producing food, generating income, providing manure, producing power, serving as financial instruments and enhancing social status – all which have the capability of directly or indirectly enhancing household nutrition (Randolph, et al., 2007).

Because urban food security is income dependent, any enterprise, whether animal husbandry or basket weaving, which provides an additional source of income can foster food security in an urban setting.

Globally, millions of urban inhabitants depend on urban agriculture for some, if not all, of their food, and research indicates that urban agriculture has the potential to moderate food and nutrition insecurity in low-income settings (Satterthwaite, et al., 2010). Robin Marsh, agricultural economist with the FAO, reports home gardens, from an international perspective typically provide half of the households supply of fruits and vegetables (Marsh, 1998), and if small scale livestock is involved, this livestock usually meets 10-20% of family members' protein needs. Whether from the actual profitability of produce or savings by not having to purchase produce from the local market, home gardens can account for 20% of total household income (Marsh, 1998).

It is important to distinguish urban agriculture in post-industrial urban areas, for example most cities in the US, from urban agriculture occurring in *industrializing* or transitional urban areas, such as most cities in less developed countries. More recently, the US has seen a resurgence of urban agriculture; however, unlike urban agriculture abroad, US gardens are community gardens rather than individual household gardens with more of a social focus than a survival focus. Gardening for the purpose of providing household food is perhaps more deeply rooted abroad.

However, there are critics of urban agriculture and point to its potentially negative implications. Some argue that urban agriculture is not necessarily environmentally sustainable or safe. Sustainability questions surround agriculture within the confines of

urban space: because of limited land, critics question the overuse of that land. In addition, some critics question the inputs necessary to maintain an urban garden or livestock. Is more fertilizer necessary because of poorer soil quality? Without the help of other inputs from plants, insects and animals, is more pesticide necessary? While sustainability is a major concern, a more immediate concern surrounds food safety, especially considering the high amounts of pollution present in an urban area. While this area has not been highly researched, Kang'ethe and colleagues list several potential concerns surrounding urban agriculture including: disease transmitted through animals; contamination of food, water and environment from pollutants; creation of an environment conducive of disease transmission and physical damage from livestock (Kang'ethe, Grace, & Randolph, 2007).

Despite these concerns, other research presents the potential benefits of urban agriculture equal to, if not greater than, the risks. For example, De Bon points out that food safety risks are higher in an urban area due to a variety of reasons ranging from contamination from irrigation/water sources to limited land availability leading to increased use of chemicals such as fertilizers (Bon, et al., 2009). However, simultaneously, he indicates the "local" nature of urban agriculture allows for better quality control and less need for such products (Bon, et al., 2009).

Others take issue with urban agriculture as a public health intervention or as a means of development in that it is accompanied by "poor project design and management, unrealized expectations and general lack of sustainability," (Marsh, 1998). Issues arise, for the most part, as a result of lack of familiarity and true understanding of the community a program is intended to serve. When programs are developed by governments and NGOs alike from outside the community and implemented by

facilitators who are not community members, project design, management, expectations and sustainability may come into conflict with community vision and values. In addition, Brun argues, “Many programs which are included under the title of agricultural development merely produce greater profits from agriculture for a small minority of national or foreign entrepreneurs and can have a detrimental effect on genuine social development,” (Brun, Geissler, & Kennedy, 1991). Simply put, according to applied anthropologist Cheryl Case, “When someone says the word development, a million things can go wrong.”

Theoretical Framework

Given the nature of this review, it is important to consider how agricultural interventions are evaluated and what sort of framework is an appropriate lens with which to view the intervention as a whole. One framework commonly used in reviewing agricultural interventions is the Sustainable Livelihoods Framework (SLF) created by the Department for International Development (*Sustainable livelihoods guidance sheets*, 1999). The SLF is a framework that operates in partnership with the Sustainable Livelihoods approach. This approach aims to promote the following: improved access to high-quality education, information, technologies and training and better nutrition and health; a more supportive and cohesive social environment; more secure access to, and better management of, natural resources; better access to basic and facilitating infrastructure; more secure access to financial resources; and a policy and institutional environment that supports multiple livelihood strategies and promotes equitable access to competitive markets for all.

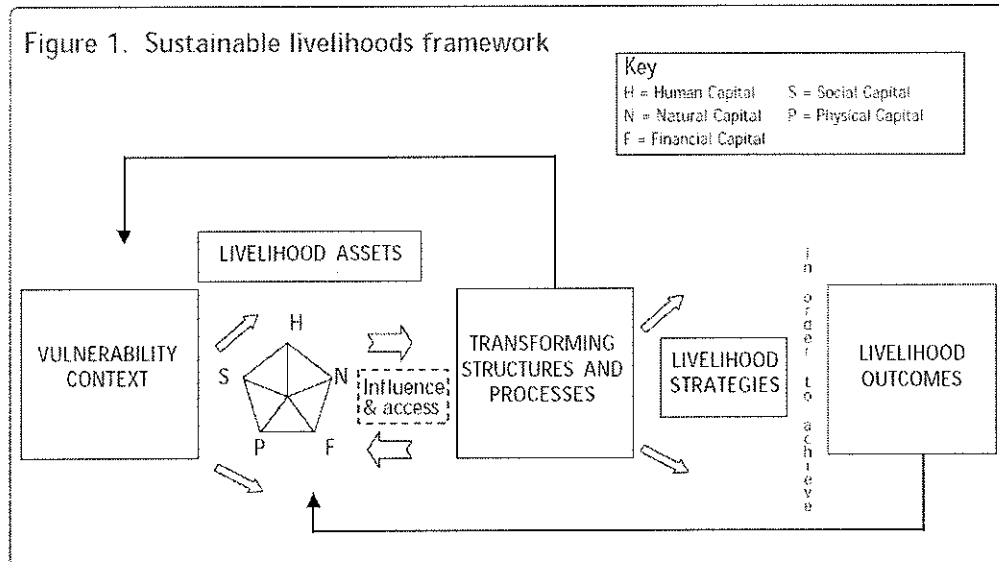


Figure 2.0: adapted from *The Sustainable Livelihoods Guidance Sheets* [54]

While its creators admit the framework is a simplification, so to speak, of the process of improving livelihoods its purpose is to help understand and analyze the livelihoods of the poor, putting the people first (*Sustainable livelihoods guidance sheets*, 1999).

Specifically, this framework examines development via five types of capital involved in an intervention: physical, financial, social, human and natural (*Sustainable livelihoods guidance sheets*, 1999) (see Figure 2.0). Food security is complex; therefore, the application of this framework, which takes into account a variety of factors, is fitting in this review. Although livelihood is not exactly the same as food security, the five types of capital applied to livelihood are equally appropriate to address within the scope of food security. In order for the framework to serve as a fitting evaluation tool for an agricultural intervention, components of food systems were outlined and designated accordingly to corresponding capital (see Table 2.0). These components were outlined using reviews and academic articles which employ the use of this framework and offer example components of this framework that apply to an agricultural setting.

Table 2.0: Sustainable livelihoods type of capital and example components

Type of Capital	Example components of capital (not all inclusive)
Human	<ul style="list-style-type: none"> • Skills (technical and interpersonal) • Knowledge • Ability to do work • Information • Awareness
Physical	<ul style="list-style-type: none"> • Sanitation • Energy or transportation • Access to food • Composting or waste treatment • Tools and equipment
Natural	<ul style="list-style-type: none"> • Land • Water • Wildlife • Biodiversity/environmental resources • Environmental sustainability
Social	<ul style="list-style-type: none"> • Cooperation • Networks • Interconnectedness • Political participation • Access to social services
Financial	<ul style="list-style-type: none"> • Income from productive activity • Available finances/savings • Regular inflows of money • Credit rating or access to credit • Grants or access to grants

In particular, several agricultural evaluations use the SLF; including two of the project evaluations in this review: Karanja's project evaluation in Nakuru Kenya and Wills' article on The Siyakhana Project in South Africa (Karanja, 2010; Wills, Chinemana, & Rudolph, 2010). Examples of academic reviews which employ this framework include Berti's *Review of the effectiveness of agricultural interventions in improving nutrition* as well as Randolph's *Review of the role of livestock in human nutrition and health for poverty reduction in developing countries* (Berti, Krasevec, & FitzGerald, 2004;

Randolph, et al., 2007). To begin with, Berti and colleagues, in combination with an analysis of multiple indicators evaluated whether global agricultural interventions supported or strengthened the five types of capital. They then compared the number of capital inputs, respective to each intervention, with positive and negative effects of the projects including diet, anthropometrics, biochemical indicators and morbidity. Because the framework does not account for negative outcomes of a project, notably Berti incorporated that data outside the framework.

In addition, Randolph and colleagues' review features the SLF in examining the nutritional importance of livestock in less developed countries. In this study, the SLF serves to provide a mapping or as the authors specify "a stylized overview" of how livestock can help reduce poverty in low-income households. Here it provides readers with a visual to grasp of the variety of factors and influences involved in raising livestock and human health (Randolph, et al., 2007). As is the case with Berti's review, the framework does not necessarily account for the negative implications of livestock nor does it provide a quantitative measure of effectiveness.

In becoming more familiar with the framework and its application involving agricultural interventions, two shortcomings of the framework became apparent. First, overall project sustainability was not addressed through the framework. Second, the framework, as it has been used, does not take into account negative implications of projects. Therefore it is necessary to adjust the SLF in order to apply the framework to urban agriculture projects appropriately.

Although it may seem redundant to incorporate sustainability into the *Sustainable Livelihoods Framework*, it is necessary. While environmental sustainability is accounted for within the framework as a component of natural capital, overall project sustainability is not. The SLF operates under the assumption that if investments are made in the five types of capital, given a constant context of vulnerability, a more sustainable livelihood for the target population will be met. Despite investments, this does not necessarily guarantee intended project outcomes will continue once investments conclude. Critics of development projects note the “general lack of sustainability,” as pointed out by Marsh, bringing to the forefront, the at times unreliable sources of funding and the short term nature of technical support. Commendably, projects can be characterized by long term commitment from the managing agency/organization or advanced training for participants which enhances the sustainability of a project. This element of sustainability, which is seemingly lacking at times, can be accounted for by incorporating a new type of capital, future capital, into the framework.

Future capital refers to the sustainability of the project itself; particularly, to the efforts or infrastructure a project facilitates in order for the project outcomes to continue once financial support has ended or when a project is being phased out. Project characteristics which are components of future capital, both positive and negative, contribute to the sustainable livelihood concept by altering the context of vulnerability. The projects which do not incorporate components of sustainability, thereby not investing in future capital, leave project participants within the same context of vulnerability and can even increase vulnerability. The projects which do incorporate components of sustainability, thereby

investing in future capital, alter the context of vulnerability by providing support strategies; ultimately, making project participants less vulnerable to food insecurity.

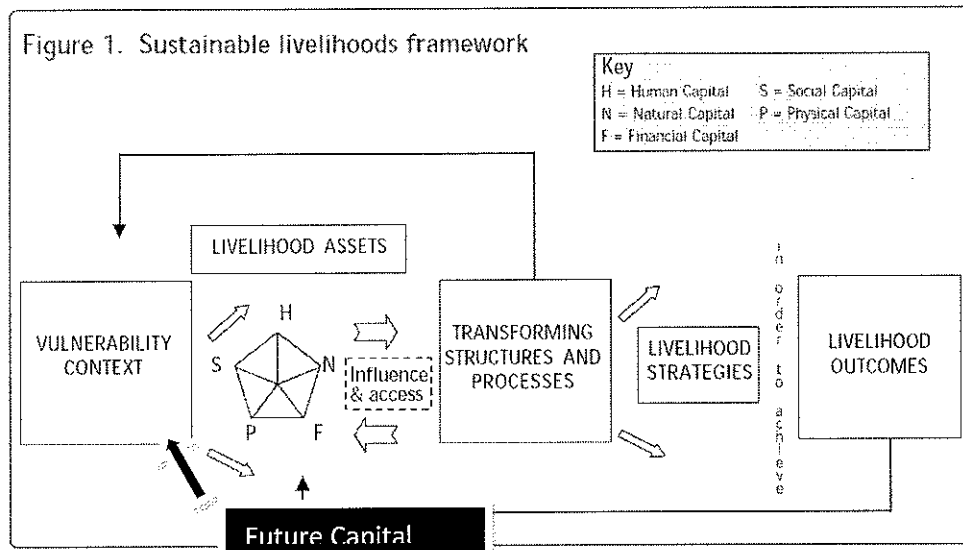


Figure 2.1: adapted from *The Sustainable Livelihoods Guidance Sheets* [54]; modified by the author

Secondly, despite its thorough exploration of positive outcomes of an agricultural intervention, the SLF does not account for the intended or unintended negative outcomes. For instance, Berti provides an example of an intervention that may increase food production, but at the cost of female labor, which in turn makes childcare an issue because of less time at home (Berti, et al., 2004). Or an intervention may increase the amount of vegetables available to the community but simultaneously may reduce the amount of land available for livestock. The framework does not take into account tradeoffs; it only takes into account areas which are being strengthened or improved by an intervention. Consequently this review, in seeking to establish a measure of overall effectiveness, will adjust accordingly for the negative outcomes of an intervention. These adjustments are described in more detail in the methodology section.

CHAPTER III: METHODOLOGY

Research Question

In light of controversy regarding development, this study will assess the effectiveness of urban agriculture in alleviating urban food insecurity and highlight the essential components of an effective intervention, if any. The study intends to assess effectiveness of the interventions based on the Sustainable Livelihoods Framework adjusting for future capital and negative implications. Furthermore, by providing a snapshot of the types of urban agriculture being carried globally, the research intends to examine other environmental or social factors which facilitate or hinder effective urban agriculture and address the application of these components in a variety of socio-economic settings.

It is important to note, this research examines urban agriculture as an intervention; meaning the implementation of agricultural practices as a part of a public health strategy or program. Even though it may be effective, urban agriculture which has been in practice and is not supported by grass roots programming, NGO or governmental agencies will not be addressed in this study. Given the scope of master's level research, this review is intended to provide urban developers, public health workers and policy makers alike with a glimpse of what is being done in the realm of urban agriculture in an effort to improve food insecurity. Most importantly, it seeks to highlight the successful and unsuccessful project components for future replication or avoidance while simultaneously presenting a fuller, more contemporary, picture of urban food insecurity.

Project Criteria

A thorough review of peer-reviewed literature was conducted. In addition a review of gray literature including relevant project reports from government as well as non-

governmental organizations was conducted. The gray literature included in the study was taken from published reports and relevant data available from governmental and non-governmental organizations online between March and May 2011. The peer-reviewed literature was procured from AGRICOLA and PubMed online databases between the months of March and May 2011. Key words included: urban agriculture, urban garden, community garden, food security and nutrition. The intent of the literature and gray literature review was to find pertinent projects to evaluate. For the purposes of this review the term project refers to a project, intervention, program or organization-wide response which involves specific strategies aimed at affecting food production. Projects were included, therefore, if they intended to increase or enhance food production through agricultural methods in a specifically urban context. Projects were excluded if they focused on a rural population, were evaluated more than 20 years ago, evaluated health behavior alone or examined agricultural projects that operate toward social goals as opposed to food production.

Using a variety of sources from peer-reviewed studies to annual reports, a total of eight projects were involved in the review. The information used to review the projects is referenced in Table 3.0. It was necessary to use several different resources in the cases of some projects as not all pertinent data was included in a single document. For the most part, projects included in the review (with the exception of two) targeted low income populations; however, the projects addressed populations with a range of health or nutrition-related issues. Three targeted toward HIV/AIDS; two targeted general food insecurity; one targeted VAD and the remaining two projects addressed multiple health issues, both of which cited over-nutrition as a concern. The exact location of the

individual projects vary, but economically speaking, two projects were located in developed countries (US, Cuba) while three were located in countries designated developing or transitional (South Africa, Philippines, Kenya), and the remaining three projects were located in a less developed country (Ethiopia and Bangladesh), according UN standards. The eight projects with respective locations are as follows:

Table 3.0: Projects included in the review

	Name	Location	Type
1	The Siyakhana Project ¹	Johannesburg, South Africa	Community
2	Worldview International Nutritional Blindness Prevention Program ²	Gaibandah, Bangladesh	Community and Household
3	US President's Emergency Plan for AIDS Relief (PEPFAR) ³	Urban, Ethiopia (Addis Ababa, Bahir Dar, Gondar, Dessie, Adama, Awassa)	Community and Household
4	The PRISM Group project ⁴	Mirzapur, Bangladesh	Community
5	Community health response to national government's Food and Nutrition Plan of 1993 ⁵	Davao City, Philippines	Household
6	Food for All school garden ⁶	San Bernardino, California	Community
7	Urban Harvest ⁷	Nakuru, Kenya	Community and Household
8	Government response to grass-roots urban agriculture movement ⁸	Havana, Cuba	Community and Household

Food Security Scoring

Each project was given a food security score between 0-30 by the primary researcher.

This score corresponds with the Sustainable Livelihoods Framework outlined by the Department for International Development. In addition scores took into account the negative implications of a project based on the second component of Barrett's

¹ (Wills, et al., 2010)

² (Greiner & Mitra, 1995)

³ (*Urban Nutrition Program for HIV/AIDS Affected Children and Women: Biannual Report*, 2008)

⁴ (Skillicorn, Spira, & Journey, 1993)

⁵ (Marsh, 1998; Miura, Kunii, & Wakai, 2003)

⁶ (*Profiles of Participating California Healthy Cities and Communities*, 2002; Twiss, et al., 2003)

⁷ (Karanja, 2010)

⁸ (Altieri, et al., 1999)

framework: complementarities and tradeoffs among food and other basic necessities. The outcomes of each intervention were examined in light of the components which correspond to types of capital including the newly added future capital. See Table A.0 in the appendix for the rubric of the complete scoring method.

Articles and project reports were thoroughly examined for all project investments, components and outcomes. These components were then categorized according to which type of capital investment they represented according to the modified framework. Next, according to the article or report, the newly categorized components were recorded as having either a positive, negative or neutral effect.

Specifically, if a component *strengthened* a type of capital according to the article or report, the component was marked as having a positive effect. If a project component *weakened* a type of capital, it was recorded as having a negative effect. Some studies specifically listed the components which strengthened various types of capital, but overall project evaluations or reports were thoroughly reviewed for indicators, participant responses or documented outcomes which suggested that a specific component had a particular effect. In addition, the negative implications mentioned in these documents were noted and assigned as having a negative effect on the appropriate type of capital. Negative implications, usually unintended, included outcomes that alter participants' normal social fabric or physical environment for the worse. Given the scope of this research, scoring took into consideration up to five components of each type of capital; making for five possible points per type of capital and a maximum of 30 total points overall.

Specifically regarding future capital, 5 points were awarded for the project incorporating components which contributed to overall project sustainability, and no points were awarded if the project did not specify or did not incorporate components which contributed to overall sustainability. A contribution to overall project sustainability was accounted for if a project made particular mention of designing or implementing a project in such a way that the intended project outcomes would be able to be maintained without the presence or funding of the organizing body.

Understandably, reducing an intervention to a numeric score may detract from the finer points of the project; however, for the purposes of reviewing a number of different studies and projects, numerical score will help to determine which interventions are more effective than others. A food security score of 30 does not necessarily indicate a project that eradicates food insecurity, nor does a food security score of 0 indicate a project that does not impact food security. A high score simply indicates a project that facilitates food security while a lower score indicates a project that has less of an impact on food security. The intention of this review is not to prove whether or not urban agriculture is effective at reducing food insecurity but rather to determine the components of more effective interventions and to distinguish components of interventions that may lead to negative outcomes.

Ultimately, food security score was analyzed in comparison with other indicators. Other indicators were collected in order to determine specific characteristics of more successful agricultural projects. These other indicators included: gender focus of project (male, female, both); household income (low or high); health status of target population; type of project (community, household, both); duration of project in years; number of project

segments; foundation of traditional agricultural methods (yes, no); inclusion of participatory methods (yes, no) and economic state of country where the project was implemented (developed, developing, less developed as defined by the World Bank). These other indicators were selected in order to confirm or refute current recommendations for interventions designed to alleviate food insecurity as well as to identify characteristics of more successful projects.

To clarify the terminology, beneficiary refers to the beneficiary or the target population of the project. Number of project segments means the number of parts of the project, which may include nutrition education, mass media campaigns or cooking demonstrations, for example. Participatory methods, which have been increasingly emphasized in public health interventions, specifically refer to relying on the participation or feedback of the target population themselves in the project's planning processes.

Data Analysis

Through the food security scoring method mentioned above in addition to a thorough reading of project evaluations and reports a variety of data was collected and organized into the following table, presented as Table 3.1 (Tables A.1-A.8 found in the appendix indicate the individual food security scores of each project):

Table 3.1: Collective project characteristics

P	F S	Gender	Income	Type	Length	# segments	Health Status	TAG	PM	Ec
1	11	F	Medium	C	3 years	3	HIV	No	No	T
2	15	F	Low	H/C	2 years	5	VAD	Yes	Yes	L D
3	9	F	Low	C/H	2 years	5	HIV OVC/W	Yes	No	L D
4	3	M	Low	C	3 years	1	food insecure	Yes	No	T
5	3	F	Low*	H	7 years	2	VAD/Fe/over	Yes	No	T
6	6	F/M	Low*	C	2 years	2	Heart/over	No	No	D
7	13	F/M	Low	C/H	7 years	5	HIV	Yes	Yes	T
8	20	F/M	Medium	C/H	20+	5+	food insecure	No	Yes	D

Table 3.1: P: project number, FS: food security score, Type: community, household or both, TAG: built upon tradition of agriculture, PM: participatory methods, Ec: economic status of country (least developed, transitioning or developed) *even though World Bank classifies Philippines as medium income and the US as high income, the populations of both of these projects addressed populations that were specified as low income

The projects were analyzed using a variety of statistical methods. Using Microsoft Excel, Pearson's correlation coefficients test was carried out between food security score and the number of components in each type of capital in order to evaluate the correlation between food security score and the types of capital. In addition, the same correlation test was carried out between food security score and those indicators which are considered numerical data: length of project and number of project segments.

A third statistical test, an analysis of variance (ANOVA) test, was carried out between food security score and other indicators. Using ANOVA, mean food security score of projects with each individual indicator was compared to mean food security score of projects without that particular indicator. This statistical test was carried out for all of the

following indicators: gender focus of project; household income; health status of target population; type of project; duration of project in years; number of project segments; foundation of traditional agricultural methods; inclusion of participatory methods and economic state of country where the project was implemented.

In addition to statistical analysis, general patterns and important outcomes were documented upon reviewing these studies. These findings are discussed in detail in the additional findings section of the results.

CHAPTER IV: RESULTS

Statistical Results

Table 4.0: Food security score and type of capital

	<i>FSScore</i>	<i>HUMAN</i>	<i>PHYSICAL</i>	<i>NATURAL</i>	<i>SOCIAL</i>	<i>FINANCIAL</i>	<i>FUTURE</i>
<i>FSScore</i>	1.00						
<i>HUMAN</i>	0.36	1.00					
<i>PHYSICAL</i>	0.72	(0.06)	1.00				
<i>NATURAL</i>	0.59	(0.43)	0.73	1.00			
<i>SOCIAL</i>	0.80	0.03	0.62	0.67	1.00		
<i>FINANCIAL</i>	0.38	0.48	0.30	(0.16)	0.15	1.00	
<i>FUTURE</i>	0.73	0.26	0.28	0.34	0.43	(0.03)	1.00

The types of capital which had the strongest correlation with food security score included physical, social and future capital. Physical and future capital both had strong correlations with food security (0.72 and 0.73 respectively). The type of capital with the strongest correlation with food security score was social capital: 0.80. These statistics indicate that food security score, relative effectiveness of the project, is strongly correlated with the components of physical, social and future capital. This would suggest that projects which are characterized by strengthening these types of capital may exhibit a higher overall score indicative of a project that more effectively addresses food insecurity.

Table 4.1: Food security score and numerical indicators

	<i>FS Score</i>	<i>Duration (years)</i>	<i># components</i>
<i>FSScore</i>	1.00		
<i>Duration (years)</i>	0.60	1.00	
<i># components</i>	0.83	0.33	1.00

Food security score was analyzed with the numerical indicators length of project (in years) and number of segments of the project. Food security score was moderately correlated with length of project (0.60) and was strongly correlated with number of segments of the project (0.83).

ANOVA test and other indicators

Because of the large variance in the data, statistical analysis for all of the other indicators, with the exception of inclusion of participatory methods, did not produced reliable results.

Table 4.2: ANOVA test of participatory methods

ANOVA: Single Factor SUMMARY				
<i>Groups</i>	<i>Count</i>	<i>Sum</i>	<i>Average</i>	<i>Variance</i>
Participatroy Methods	3.00	48.00	16.00	13.00
No Participatory Methods	5.00	32.00	6.40	12.80

ANOVA						
<i>Source of Variation</i>	<i>SS</i>	<i>df</i>	<i>MS</i>	<i>F</i>	<i>P-value</i>	<i>F crit</i>
Between Groups	172.80	1.00	172.80	13.43	0.01	5.99
Within Groups	77.20	6.00	12.87			
Total	250.00	7.00				

The results of the ANOVA test (Table 4.2) indicate the difference between the mean food security score of projects which do not incorporate participatory methods from those that do incorporate participatory methods is statistically significant ($p = 0.01$). Notably, the average score of the projects with participatory methods was 16 while the average score of the projects without participatory methods was 6.4. This suggests that participatory methods do have an effect on overall food security score.

CHAPTER V: DISCUSSION & CONCLUSION

To begin with, food security score demonstrated a strong correlation with physical capital. Given that physical capital includes access to food, this is not surprising.

Furthermore, one of the issues with urban agriculture is lack of physical resources such as lack of access to land.

However, the strong correlation between social capital and food security score was not anticipated. Especially considering participatory methods were accounted for outside the framework in order to assess if participatory methods independently had an effect on food security score. In a similar review of agricultural studies and nutrition, Berti includes participatory methods as a component of social capital. He found that human capital not social capital, namely in the form of nutrition education, was central for improvement in nutrition (Berti, et al., 2004). In this review, however, human capital reflects the weakest correlation with food security score. This can be explained in that the projects included in this review aim to produce food while the projects in Berti's review sought to improve nutrition. It is interesting that projects with similar goals differ in the importance placed on the various types of capital.

Interestingly, future capital demonstrated a strong moderate correlation with food security score. Not only does this suggest the value of projects which are viable beyond the management of the project's organization, but it indicates the need for project sustainability to be considered as a part of the project design and evaluation. This is in line with most criticism of development projects which admonish the general lack of sustainability.

With regard to food security score and duration of project and number of project segments, typically the projects lasting longer durations, with the exception of the community health response in the Philippines, also had higher food security scores. In addition, projects with higher scores also employed more integrated approaches to food insecurity. The PRISM group project, with the lowest food security score, had only one arm or segment of their project, while Cuba, with the highest food security score also had the most segments in their project or response. This is in line with Berti's and others findings which suggest that "investing broadly in the target population – and not just the agriculture intervention – does seem to improve prospects for positively impacting on the health of the people," (Berti, et al., 2004).

In a review of agriculture as a means of improving food security, Robin Marsh, researcher for the FAO's Sustainable Development Department, argues that community development strategies should build upon traditional gardening to improve household food security (Marsh, 1998). Using food security score, an ANOVA test was performed to see if the mean food security score was different between projects which did and did not build upon traditional agricultural methods. Because there was a large variance in the data, this test did not offer valid results. However, the mean score of projects which did build upon traditional methods of agriculture, by relying on methods already in practice by participants, actually had a lower mean food security score than those projects which did not build upon traditional methods. This can be explained in that Cuba had the highest food security score, and its urban agriculture movement did not rely on methods already in practice. In fact the movement initially relied upon self-taught methods or the knowledge of those who had migrated from rural areas into the city. Ultimately, due to

the large variance in the data, no statistically significant conclusions can be made about food security and tradition of agriculture.

Furthermore, statistical analysis confirms the importance of employing participatory methods in urban agricultural projects. Additionally, it is evident from Table 3.1 that the four highest scoring projects used participatory methods while the four lowest scoring projects did not. In fact, Cuba, which received the highest overall score, was unique in that initially its urban agricultural movement was a grassroots effort that was followed up with support and infrastructure from the national government. Although the project, so to speak, did not necessarily employ participatory methods per the definition, the movement was generated entirely by the community. This is evidence in itself that more effective projects, if not initiated by the community the project intendeds to serve, should involve the community during the initial stages of planning and design.

In Bangladesh and Kenya, participatory methods were employed as well. In Bangladesh, women volunteers were recruited from target populations to be representatives. They were responsible for disseminating information by visiting households in the project area. In addition, they put on demonstrations and received training, along with other women, on basic horticulture practices in order to start their own community gardens. In Kenya, baseline research, pretesting, and participant feedback was collected during the period of 2003-2007 prior to project initiation, and during the project itself participant feedback was procured.

Despite relatively high food security score, the community garden in South Africa did not incorporate participatory methods. It was designed to serve as a model indirectly having a

positive effect on PLWHA. Project implementers intended by involving leaders of city centers for PLWHA that more community gardens would be implemented at these centers and that more fresh food would be available for PLWHA. Because of the vision and purpose of this garden, participatory methods were not employed; however, some of the issues, such as distance and local community support might have been addressed had participatory methods been used. The other projects in Ethiopia, Davao City, Mirzapur and San Bernardino either did not specify their use of participatory methods or did not include them entirely.

While the development of food security score is not critical in evaluating urban agriculture projects, it is useful in organizing data and using statistical tests to highlight patterns and stratify capital and indicators. Given that this particular review only involved eight projects, these conclusions could probably have been derived from the raw data without statistical analysis; however, the analysis does serve to strengthen the findings. The ability to perform these statistical tests does justify the development of a food security score, despite its limitations. Furthermore, with the development of a food security score, data and conclusions can draw from a number of different statistical tests. This review uses only a few statistical tests to support strong patterns in the data. More conclusive statements could be made if this review collected additional data from more projects.

In combination with statistical data, noted patterns and documented project outcomes give shape to the issue of food security. This section of the results draws on more qualitative data regarding food security and development, which offers support for concluding suggestions for future research involving food security and nutrition.

Beyond statistics, what is evident from this review is that food security or health cannot be examined in isolation. This review began with a focus on food security as it relates to malnourished populations; however, the process of the review reveals that food insecurity is inevitably linked with poor health, in one form or another. Understanding that food security is a multi-faceted issue, gives rise to some limitations with developing and implementing food security score through the SLF, but at the same time demonstrates the value of programs and initiatives that take all of these issues into consideration. For example, in East Africa urban officials are renowned for destroying crops because there are issues with land ownership (Kang'ethe, et al., 2007). An urban garden project could be planned and implemented in East Africa, and it may even receive a high food security score by this review's standards; however, if the project does not address the political issues at hand, that project may be futile.

The Night Blindness prevention project is a strong example of the limitations of addressing micronutrient deficiency alone. This project intended to correct vitamin A deficiency through the promotion of vitamin-A rich vegetables, and it was successful, but only short term. Interestingly, researchers note that twice as many households grew key vegetables and fruits high in carotene at the close of the program, and in 800 children night blindness was resolved, yet night blindness returned to 200 of these 800 children one year later (Greiner & Mitra, 1995). Although this outcome can be attributed to a number of reasons (lack of fat in the diet, lack of animal protein, etc), the point is there must have been external factors or even other food-related issues that the project did not take account of, which allowed for the regression of the target population post-intervention.

Furthermore, the need for projects to address more than just health is evident in considering projects designed for PLWHA. While this review included only three projects geared toward PLWHA, a few patterns emerged. First, these three projects were on the higher end of food security scores, and they each exhibited three or more elements or arms of their respective projects with a focus on technical training for food production. Unlike, the other projects which featured daily seminars or optional workshops, these involved technical training over significant periods of time (in some cases 18 months or more). Generally speaking, these projects emphasize urban agriculture as a means of alleviating food insecurity by equipping participants with the means and the skills to produce their own food in addition to connecting participants with organizations that provide services for PLWHA. While it is possible to quantify food production, it is difficult to give a numerical value to the combined effect of “growing or connecting,” as Wills entitles her article (Wills, et al., 2010). PEPFAR reports the number of women and children who received services from the organizations they fund; however, the bigger question remains, what happens when that support runs out?

Even in the midst of successful interventions that do invest in future capital, the need for sustainable solutions arises. Returning to Bangladesh’s Nutritional Blindness Prevention Program, this program was very effective in reducing night blindness in over 800 children. Furthermore, project planners trained female participants in technical skills with the aim of carrying the project outcomes forward; however, researchers note a year after the project night blindness had returned (Greiner & Mitra, 1995). While most of the projects undeniably make some positive contributions, Cuba’s urban agriculture movement is the only one that suggests long-term progress in alleviating food insecurity.

Despite serving as a model community garden, the Siyakhana Project still in operation in South Africa does not directly address food insecurity for the local community or PLWHA. In addition, the remaining projects (PEPFAR, Urban Harvest, the PRISM Group project, Food For All school garden) with the exception of the community health response in the Philippines all rely on grant funding and have either discontinued support or will discontinue support in the next few years. Again this reiterates the need for sustainable solutions.

Related to the multi-faceted nature of food security are cultural norms and practices which should be taken into consideration. The fragility of social fabric is a common theme in reviewing these projects. For instance, conflicting messages between the government and community health workers had negative social and health implications in the Philippines. Specifically, in 1993 the Philippine government began promoting vitamins, supplements and fortified foods, which are more expensive than food.

Naturally, community health workers began promoting home gardening of vitamin-A rich foods targeting those populations who could not afford pills and fortified foods. In response, a negative stigma was attached with home gardening in comparison to fortified foods and pills. People associated these gardens with poverty, and some claimed they would not have to eat vegetables if they could afford the tablets. Interestingly, project evaluators noted that there was an increase in diversity of diet through the promotion of home gardens; however, there was a simultaneous decrease in consumption of protein-rich foods; therefore, they could not conclude that the work carried out by community health actually benefited participants' diets (Miura, et al., 2003).

This fragility of social fabric can be managed by participatory methods. For example, the Urban Harvest project, through participant's assistance with garden design, altered their strategy from community agriculture to household agriculture when it became evident that participants were forced to choose between traveling to the garden and other livelihoods (Karanja, 2010). This indicates, despite good intentions, what project planners had in mind may not have been the best strategy for the participants themselves. Utilizing participatory methods helps define strategies and components that actually suit the target population. Interestingly, project planners consulted participants about the varieties of vegetables to grown in the gardens and participants, and to the surprise of the planners, participants chose to grow more exotic varieties. Evaluators did not comment on the success or failure of those varieties; however, despite the outcome, the conclusion that can be drawn from this example is that the community or household is choosing for themselves what they think is best. This is evident in the success of urban agriculture in Cuba. The citizens of Havana, even though they did not have a great deal of agricultural knowledge, made decisions about what was best for their households and communities and actively implemented those decisions by starting gardens. Granted it took time, and fortunately this movement received government support unlike some movements in East Africa, for example, where local officials destroy crops because of land ownership issues.

Another theme evident in the review is Popkin's nutrition transition (Popkin, 2001b). In the Philippines, designated a transitioning country, community health workers cited over-nutrition as an issue. In fact, the mean BMI of the participants surveyed was 23.3, and data indicated an increase in obesity since 1998 (Miura, et al., 2003). Moreover, Bangladesh, a least developed country (LDC), saw interesting trends with promoting the

home gardening of vitamin A-rich vegetables. In particular, evaluators noted increased income from increased vegetable production allowed households to purchase more expensive foods like dairy and meat, but some households also purchased more processed snack foods with their increased income although these snack foods were not promoted (Miura, et al., 2003). These two examples, with the increase in obesity and increased consumption of snack foods, demonstrate the nutrition transition in process. In addition, over-nutrition and cardiovascular disease was also reported as a concern for the San Bernardino community, which was also specified as a low-income community (*Profiles of Participating California Healthy Cities and Communities*, 2002). Here, though the nutrition transition is characterized by transitioning or less developed countries, even in developed countries like the US, the same principles apply to low-income populations.

Although the role of livestock in urban agriculture interventions has not been fully explored, in reviewing the literature, much more emphasis is being given to cultivating livestock and its role in food security. Urban Harvest and PEPFAR, two of the higher scoring projects, both employ livestock as a strategy in alleviating food insecurity, yet Cuba, the highest scoring project, surprisingly makes no mention of urban livestock. However, Marsh notes, in relationship to urban gardening in Cuba, that “most gardeners raise small animals,” (Marsh, 1998). The same issues with garden-oriented projects arise with livestock projects; most pertinently, cultural sensitivity and sustainability. With Urban Harvest, the project initially received an exotic breed of chicken but as the project continued exotic chickens were traded for indigenous chickens because they were more economically viable to raise, when funding ran short (Karanja, 2010). Urban Harvest also involved goats as a component of their project; however, technical training was necessary

for participants for growing fodder and raising the goats. One of the project's funders CGIAR developed "improved fodder shrubs," and although the project evaluation was not explicit, questions of this study as a platform for their bioengineered product have arisen. Research does not indicate whether the availability of livestock makes for a more nutritious or healthy community. An interesting study might be to compare nutritional outcomes of those agriculture interventions which included livestock as a component compared with those that focus only on garden produce.

Limitations

Although this study does employ unique methods of organizing and evaluating urban agriculture projects, there were only eight projects included in the study. It would have strengthened the data and the use of the framework used in this review if more projects were included. Although urban agriculture is definitely taking place worldwide, it is not being evaluated or measured; thus, the relative lack of academic articles. While reports from non-academic sources were involved in this review, peer review studies were preferred. In fact, it was difficult to include some projects reports, even from reputable government organizations. These often provided strong quantitative reports of their project outcomes, but narrow anthropological reports. By not mentioning other indicators or project design, some projects could not be included in the review. Additionally, other cultures which have deeper roots in subsistence agriculture are carrying out urban agriculture on their own, which is difficult to report or evaluate.

Another limitation to this review involves the food security score itself. Food security score was more subjective than preferred. First, it was difficult to actually categorize the data into specific types of capital. Also, it was difficult to account for all the outcomes of

a project, especially considering some reports were more forthcoming than others about all of the outcomes, both positive and negative. This was in part because not all of the documents used to evaluate projects were actual evaluations, so it was difficult to get a grasp of the details of the project. Moreover, some of the limitations of the framework in general were discussed in the results section; however, it is important to note that the framework which food security score is based on does not necessarily take into account overarching processes and such as political and economical forces that also influence livelihood.

Last, each project very context based. This makes standardization of evaluation difficult. In combating food insecurity, when one household may benefit from increased income (financial capital) another household may benefit from increased access to land (physical capital) and another from technical skills (human capital). Ultimately, even though two projects may receive the same food security score, one project may be more effective at providing exactly what the household needs thereby being a more effective project. However, the framework of the evaluation does equally weight all the types of capital, which is appropriate given the multi-dimensionality of food insecurity.

Additionally, with respect to the SLF, the adjustments made in this study were helpful in providing a fuller picture of each project than would be accomplished through the original framework. However, in becoming more familiar with the projects, it is evident that what were determined as shortcomings of the framework are actually be attributed to the project's organizers and evaluators rather than the framework itself. Specifically, projects which employed the SLF may or may not have considered this framework in designing their project and rather used the framework to justify its existence instead.

Though not covered in the scope of this review, misuse of the framework has the potential to skew overall results.

Suggestions for future

Ultimately, this review cannot conclude that certain projects are the answers to food insecurity. It is evident that promoting vegetables in home and community gardens can provide some benefits but simultaneously negative implications can arise such as reduced protein intake or negative social stigma attaches to vegetable gardens. Additionally, in line with current research, participatory methods prove beneficial in incorporating into an agricultural intervention. Furthermore, urban food insecurity should be addressed through an integrated strategy which gives consideration to the viability of the project long-term. This can be addressed through the lens of the SLF with the inclusion of future capital. By extension, food security score, developed for the purposes of this review can help with organizing and recognizing patterns and valuable components of interventions; however, this scoring system is fairly subjective with some limitations.

In conclusion, urban food security, a state in which “all people at all times have access to sufficient, safe, nutritious food to maintain a healthy and active life,” (“Food Security,” 1996) may seem more and more elusive as the world becomes more urbanized with issues of politics, economics and health becoming increasingly interrelated and increasingly complex. More and more, the process of examining food security reveals that urban food insecurity and its consequent health issues are as Popkin describes a “burden being born by the poor,” (Popkin, 2001b). With increasing rates of obesity and chronic disease in less developed countries, and low-income urban populations being

characterized as food insecure, the collection of these projects subtly indicates the deep undercurrent of sociopolitical and economical issues that plague urban poverty and exacerbate barriers to good food and good health. This is precisely where this review steps in to encourage the consideration of *sustainable* and viable urban agriculture drawing on the history and traditions of participants themselves. Although the incorporation of these factors does not necessarily guarantee food security, they are characteristics of more successful interventions.

On a global scale, households and communities may not be able to afford the food they need or the necessary drugs or services to ameliorate their health issues; however, they can be equipped to grow their own food. A household garden may not solve all the problems, and it may not always be the answer, but over an extended period of time, the effect of having access to nutritious food does have the power to enhance quality of life. Thus, whether generated by nutritionists or public health specialists, implementing an effective urban agriculture intervention is a step toward modern nutrition science, as McMichael envisions it, “encompassing both biomedical nutrition – health issues and the wider challenges of achieving sustainable food production, greater equity in relation to food and nutrition, and good health prospects for future generations.”

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APPENDICES

Table A.0: Sample rubric for food security scoring

Type of Capital	Effect	Example components of capital (not all inclusive)
Human	Positive (+): 1 Negative (-): -1 Both (±): 0 Points out 5 total	<ul style="list-style-type: none"> • Skills (technical and interpersonal) • Knowledge • Ability to do work • Information • Awareness
Physical	Points out 5 total	<ul style="list-style-type: none"> • Sanitation • Energy or transportation • Access to food • Composting or waste treatment • Tools and equipment
Natural	Points out 5 total	<ul style="list-style-type: none"> • Land • Water • Wildlife • Biodiversity/environmental resources • Environmental sustainability
Social	Points out 5 total	<ul style="list-style-type: none"> • Cooperation • Networks • Interconnectedness • Political participation • Access to social services
Financial	Points out 5 total	<ul style="list-style-type: none"> • Income from productive activity • Available finances/savings • Regular inflows of money • Credit rating or access to credit • Grants or access to grants
Future (sustainability)	+ (5 points) no effect (0 points) Points out of 5 total	Infrastructure, financial commitment or technical support for community or participants to maintain project independently
Total Score	Score out of 30 maximum points	

Table A.1: Food security score of The Siyakhana Project, Johannesburg, South Africa

Capital	Effect	
Human	+ + + Points: 3	<ul style="list-style-type: none"> • Permaculture skills (18 months training) • Knowledge of herbs for medicinal use • Nutrition and food preparation skills
Physical	+ + Points: 2	<ul style="list-style-type: none"> • Composting • Access to fresh vegetables for beneficiaries and trickle down to PLWHA
Natural	+ + - Points: 1	<ul style="list-style-type: none"> • Reclaimed urban land in city park • Promotion of permaculture • Location of garden required some participants to drive from 20km away
Social	+ + + - Points: 2	<ul style="list-style-type: none"> • Cooperation of local NGOs • Built social networks of NGOs and ECDC • Built social networks of university and local community in selling produce • Garden beneficiaries and volunteers not from surrounding community
Financial	+ + + Points: 3	<ul style="list-style-type: none"> • Small funds for WV • Potential financial gain from consuming and/or selling own produce • Potential financial gain from selling medicinal creams
Future	none Points: 0	<ul style="list-style-type: none"> • Without university/donor funding this project would not continue – in part not integrated with local community, and no long term commitment from local partner agencies
Score	11	

Table A.2: Worldview International Foundation Nutritional Blindness Prevention Program, Gaibandah, Bangladesh

Capital	Effect	
Human	+ + + + + Points: 5	<ul style="list-style-type: none"> • Training for headmaster and 1 teacher • One day training seminars for women's group gardens • One day awareness seminars offered three times year to village leaders • Education through WV house visits and demonstrations • Increased awareness of health-related information through traditional folk performances and mass media messages
Physical	+ ± + Points: 2	<ul style="list-style-type: none"> • Seeds for highly motivated students (15) to start own gardens or if families found to be night blind • Increased income increased access to more expensive foods like meat and dairy, but also increased purchasing of less nutritious snack foods • Access to fresh vegetables through various community gardens
Natural	Points: 0	
Social	+ Points: 1	<ul style="list-style-type: none"> • Built social networks of WV groups (4 landholding and 5 landless) to create community garden
Financial	+ + + - Points: 2	<ul style="list-style-type: none"> • School received funds for inputs to grow A rich produce • WV volunteers received some money for community work • Potential financial gain from consuming and/or selling own produce • Subsidies stopped half way through project (60% of gardens disappeared)
Future	+ Points: 5	<ul style="list-style-type: none"> • Training for WVs with demonstrations to enhance project sustainability after phase out
Score	15	

Table A.3: US President's Emergency Plan for AIDS Relief (PEPFAR), Ethiopia

Capital	Effect	
Human	+ + Points: 2	<ul style="list-style-type: none"> • Training extension officers – in turn lead gardeners , and in turn follower gardeners • Additional training in HIV-related capacity building
Physical	+ + Points: 2	<ul style="list-style-type: none"> • Access to fresh vegetables from community and home gardens • Access to poultry
Natural	Points: 0	
Social	+ + Points: 2	<ul style="list-style-type: none"> • Built social networks of NGOs and municipalities via Vegetable Days • Participating in garden programs links PLWHA to other services like PMTCT
Financial	+ + + Points: 3	<ul style="list-style-type: none"> • Potential financial gain from consuming own produce and selling • Potential gain from poultry (50% eaten, 50% sold) • Income not only leads to more access to food but services and schooling as well
Future	none Points: 0	<ul style="list-style-type: none"> • PEPFAR dedicated to continuing with aid through 2013, but no indication of infrastructure in place for long term sustainability
Score	9	

Table A.4: The PRISM Group project, Mirzapur, Bangladesh

Capital	Effect	
Human	- Points: -1	<ul style="list-style-type: none"> Requires high level of knowledge and technical skill to maintain crop beyond traditional aquaculture
Physical	+ + Points: 2	<ul style="list-style-type: none"> Carp production Dried duckweed meal provides an excellent substitute soy and fish meals in poultry feeds
Natural	+ + Points: 2	<ul style="list-style-type: none"> Effective removal of toxins from wastewater Reclamation of marginal urban land
Social	Points: 0	<ul style="list-style-type: none"> No indication that social networks were built or destroyed
Financial	+ - Points: 0	<ul style="list-style-type: none"> Buffers the costs of inputs by not having to purchase feed Requires higher start-up cost than analysts believe local fisherman could afford
Future	none Points: 0	<ul style="list-style-type: none"> Project funds not allocated to water treatment plant ultimately
Score	3	

Table A.5: Community health response to government Food and Nutrition Plan of 1993, Davao City, Philippines

Capital	Effect	
Human	+ + - Points: 2	<ul style="list-style-type: none"> Increased information from community health workers about buying cheap yet nutritious foods Knowledge/encouragement to plant fruit trees and grow vegetables in yard Households began to view gardens as a sign of poverty – believed if they could afford vitamins and tablets and fortified foods promoted by government, they would not be forced to eat vegetables
Physical	± Points: 0	<ul style="list-style-type: none"> Increased diversity of diet through increased diversity of vegetables grown at home and replacement of rice with vegetables, but also decreased intake of protein rich foods
Natural	Points: 0	
Social	Points: 0	
Financial	+ Points: 1	<ul style="list-style-type: none"> Potential financial gain from less expenditure on produce
Future	none Points: 0	
Score	3	

Table A.6: For for All school garden, San Bernardino, California

Capital	Effect	
Human	+ + + Points: 3	<ul style="list-style-type: none"> • Training for school staff through 2 workshops • Nutrition education for community at large • After school kids exposed to garden/nutrition activities
Physical	+ Points: 1	<ul style="list-style-type: none"> • Access to fresh vegetables through 3 school gardens
Natural	Points: 0	
Social	+ + Points: 2	<ul style="list-style-type: none"> • Established city's food policy • Networking between school and local community with garden and nutrition activities
Financial	Points: 0	<ul style="list-style-type: none"> • Grant funded, but no financial gain specified
Future	no Points: 0	<ul style="list-style-type: none"> • When grant money runs out, no mention of future of gardens
Score	6	

Table A.7: Urban Harvest, Nakuru, Kenya

Capital	Effect	
Human	+ + + Points: 3	<ul style="list-style-type: none"> • Technical training goat care • Training vegetable production, utilization and marketing • Nutrition education
Physical	+ + + Points: 3	<ul style="list-style-type: none"> • Increased access to livestock (goats) • Increased access to poultry • Access to fresh produce through community and home gardens
Natural	+ + + Points: 3	<ul style="list-style-type: none"> • Establishment of waste management (via re-use) • Increased access to land • Establishment of fodder banks for goats
Social	+ + + - Points: 2	<ul style="list-style-type: none"> • Built partnerships with municipalities, university, faith-based organizations and community based HIV/AIDS organizations • Enhanced existing networks between local organizations • Increased access to health facilities through networking • Collective farming difficult because of distance for some participants; therefore, participants traded other livelihood activities for going to the farm
Financial	+ + Points: 2	<ul style="list-style-type: none"> • Increased access to savings • Potential financial gain from regular supply of fresh vegetables from community and home gardens
Future	none Points: 0	<ul style="list-style-type: none"> • Funds discontinued 2010
Others of note		<ul style="list-style-type: none"> • Participatory methods: participants chose to grow more exotic varieties of vegetables
Score	13	

Table A.8: Government response to urban agriculture movement, Havana, Cuba

Capital	Effect	
Human	+ Points: 1	<ul style="list-style-type: none"> • Environmental and agricultural awareness
Physical	+ + + Points: 3	<ul style="list-style-type: none"> • Transformation of unsightly or abandoned lots • Decreased reliance on transported or imported food • Access to fresh produce through community and home gardens
Natural	+ + + + + Points: 5	<ul style="list-style-type: none"> • Urban access to land • Revitalized interest in traditional crops • Composting • Organic soil management • Integrated pest management
Social	+ + + + + Points: 5	<ul style="list-style-type: none"> • Build trust with rural migrants with more knowledge of agricultural practices • Established national sense of community through government support of grass roots movement • Local community through “popular” gardens or community gardens • Government established Urban Agriculture Department offering support from extension agents, which now total over 70 agents • Creation of horticulture clubs to share information, tools, resources
Financial	+ Points: 1	<ul style="list-style-type: none"> • Potential financial gain from consuming and/or selling produce
Future	+ Points: 5	<ul style="list-style-type: none"> • Analyst predicted phase out of urban gardens, but overtime they have increased in number, size and quality, and government continues to support
Score	20	