Ain Shams University
Egypt

University of Stuttgart
Germany

Bolstering socio-ecological resilience in Greater Cairo Region's peri-urban agriculture pockets

Strategies for Local Economic Development and Improved Food Security

A Thesis submitted in the Partial Fulfilment for the Requirement of the Degree of Master of Science in Integrated Urbanism and Sustainable Design

By Dorothy H. Estrada

Supervised by:

Prof. Dr. Mohammed Salheen
Professor of Urban Planning
Ain Shams University

Prof. Dr. Antje Stokman
Professor of Landscape Planning and Ecology
University of Stuttgart

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-Dorothy Estrada

Dorothy Estrada
"Bolstering socio-ecological resilience in Greater Cairo Region's peri-urban agriculture pockets"

Abstract

Rapid growth in urban areas worldwide that has created a global alarm about how to make cities more food secure. In the Greater Cairo Region, conditions related to inaccessible affordable housing, lack of governmental proscription, and the unachievable economic gain for small-scale farmers have allowed the massive sprawl of informal settlements in North Africa's largest city to go unchecked. The building development on agricultural fringe land has occurred at such a rapid rate in the last few decades that if no intervention is taken, the extremely fertile lands of the Greater Cairo Region may disappear altogether, bringing the nation on the verge of an extreme food security crisis.

This research focuses on the causes and consequences of encroaching development onto agricultural lands in Cairo's peri-urban fringe in Giza. This development occurs at the cost of food insecurity and gaps in socio-ecological resilience along the city's fringe to prevent further desertification and water shortages in the Nile Valley, among other socio-ecological factors. The main research examines strategies for resilient peri-urban agriculture that can be applied to the Greater Cairo Region. Case study examples of urban fringe agricultural systems from cities in the MENA region and in Europe have been evaluated for 'best practices' in terms of resilient planning and local economic development interventions for urban food systems. In addition, qualitative data collected from formal interviews with city and regional experts, as well as informal interviews in the district of Saft al-Laban (one of the fringe settlements

of Giza) was analyzed to steer policy and design recommendations. The final output of the research are design and policy recommendations on the local, district, and regional level that will act as a suggested integrated plan for peri-urban agriculture systems in the Greater Cairo Region.

Keywords:
Food Security; Local Economic Development; Peri-urban Agriculture; Resilience

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List of Acronyms

FAO	Food and Agriculture Organization of the United Nations
GCR	Greater Cairo Region
LED	Local Economic Development
MENA	Middle East-North Africa
PUA	Peri-urban Agriculture
SES	Socio-Ecological System

Inspiration

Principle 11: Use Edges and Value the Margin

"Within every terrestrial ecosystem, the living soil, which may only be a few centimeters deep, is an edge or interface between non-living mineral earth and the atmosphere. For all terrestrial life, including humanity, this is the most important edge of all...This principle works from the premise that the value and contribution of edges, and the marginal and invisible aspects of any system should not only be recognized and conserved, but that expansion of these aspects can increase system productivity and stability."

-*Permaculture: Principles and Pathways Beyond Sustainability* by David Holmgren

Chapter 1: Introduction

1.1- Research Problem

Currently, there is rapid growth in urban areas world-wide that has created a global alarm about how to make cities more food secure. Peri-urban areas (where agriculture has traditionally taken place) are being pressured for development to suit housing and settlement needs. However, urban development in such areas can have negative environmental impacts and push food production centers more to the periphery. When this occurs, food must travel further, and this transport contributes to the increased amount of CO2 emissions, which inevitably impacts climate change. In addition, other negative consequences include the loss of income for farmers, the loss of soil, biodiversity loss and potential erosion and habitat fragmentation.

Popular now in academic and sustainability discussions is the notion of socio-ecological resilience, loosely defined as "a complex, adaptive system concerning the integrated concept of humans in nature" (Folke, 2005), which is examining the web of dynamics between humans as a species and their interactions with the environment. This includes the management of natural resources, or, in many cases, the current mis-management. Peri-urban agricultural lands are but one example of a precious resources that is being squandered, and as arable land worldwide shrinks, so does our capacity as a species to feed ourselves. In the Greater Cairo Urban Region, this issue is at the utmost extreme, since economic desperation from the working class and farmers, in addition to poor government management of peri-urban agriculture lands has

led to their depletion. This loss has occurred at such a rapid rate in the last few decades, that if no intervention is made, the extremely fertile lands of GCR may disappear altogether, bringing the nation on the verge of an extreme food security crisis.

1.2- Research Objectives and Questions

This thesis touches upon a rich body of knowledge that has begun to developed exploring the importance of peri-urban food production and the socio-economic value of agriculture. Studies published in the last decade indicate that depleting PUA is a major topic of concern, yet little research has been produced to examine regional peri-urban strategies to combat food insecurity and improve local economy in the Greater Cairo Region. This is why the author chooses to focus on this particular geographic location. The academic nature of this text is based on an application-led approach, focusing on qualitative research in combination with design-science. It is necessary to clarify that this research does not immediately concern itself with urban agriculture (i.e., small plots and rooftop farming) but does include references and interlinkages to these concepts and strategies. Several typologies exist when speaking about urban agriculture and its related subtopics, but this scope examines the issue on a larger, regional scale, and linking it with elements in the broader fields of local economic development and food security.

The key research questions to be examined in this text are as follows: 1) *How does peri-urban agriculture support socio-ecological resilience in an urban area? 2) In which ways can peri-urban agriculture activities support local economic development?* These key questions are grounded in the context of the Greater Cairo Region, and contain many sub-questions that have been explored within this research in order to reach a collective understanding of the situation and existing phenomena. Through careful consideration of these questions and in developing a relevant research scope a theoretical framework was developed.

To support this investigation of the key questions, several aims were developed. These aims were then broken down into specific objectives that served as building blocks for the development of the Research Methodology, as illustrated in Figure 1.1. The author is aware that such a research structure will not entirely be able to fully unravel the whole complexity of the key questions identified, but rather, the research will contribute to this larger, developing body of knowledge.

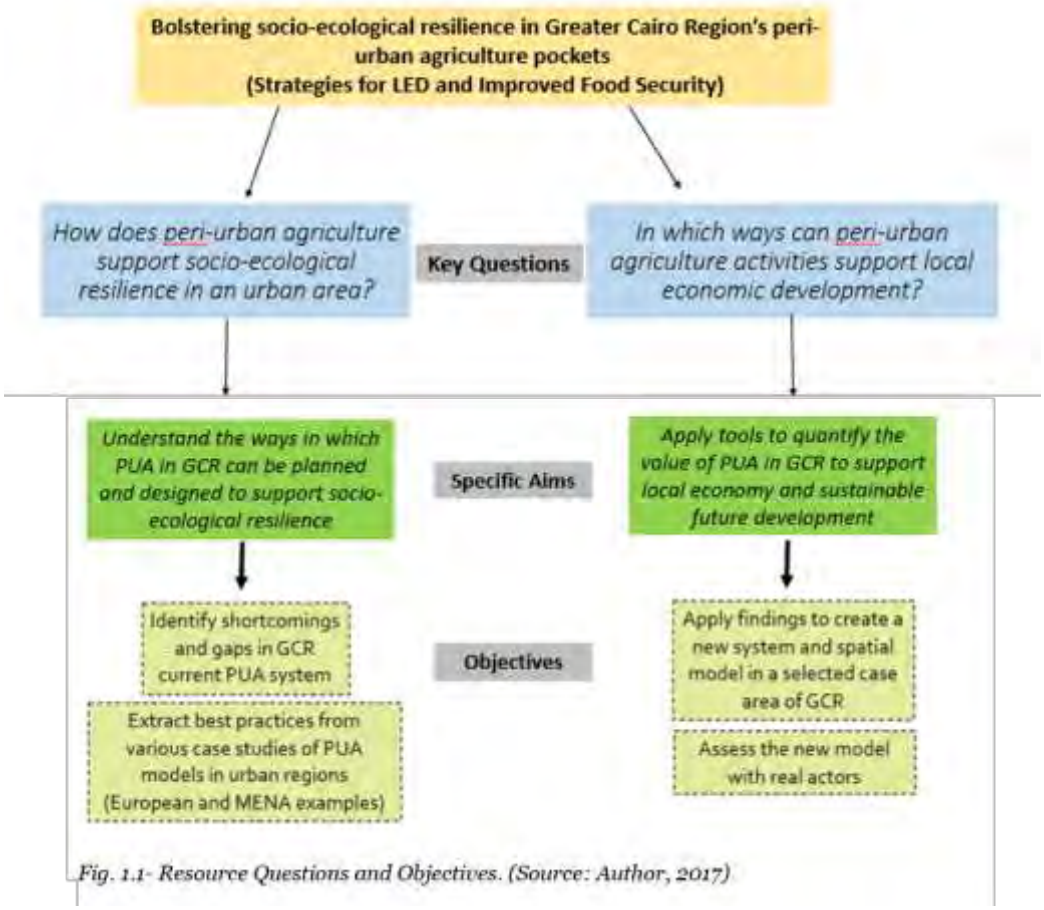


Fig. 1.1- Resource Questions and Objectives. (Source: Author, 2017)

As the quote opening this text suggests, inspiration about this research was partly derived from permaculture design principles, which are not just used in gardening or landscape design, but also can be applied to larger, complex systems as well. The author of this work has a vested interest in this aspect of interfaces,

of how fringes are linked to a larger part of a whole system. She implores the reader to look deeper into this "value and contribution of edges" in urban contexts where they do seem very marginal and invisible. This text aims to explore the deeper questions of how peri-urban agriculture lands affect system productivity and stability.

While working through the first stream of questions presented in this work, the author found that the second stream would require a much broader time period and access to more classified data, which was not possible in this time frame and without external research support, combined with more economic training and expertise. Due to limited time and geodata availability, completing a comprehensive spatial design for the case study area was not achievable, but this body of research attempted to provide design and policy recommendations nevertheless.

1.3- Research Design and Methodology

The research was designed on the basic understanding from previous research that food security (a basic human need, which supports human development), was one of the several pre-cursor foundations for LED to be able to occur. LED, in turn, is one of the stabilizing forces of a sustainable urban region. The researcher aims to better understand these lower-level building blocks, considered to be part of sustainable urban development., and examine both the concepts of food security and LED through a lens of socio-ecological resilience.

a. Development of an Assessment Tool

As mentioned previously, this thesis is a qualitative research based work that has an application-led approach. It is research for design, utilizing place-based information on the spatial elements on the local scale in order to suggest more accurate and appropriate planning and design interventions. To achieve the aims and objectives, a theoretical framework was created, comprised of several elements. First, an Assessment Tool for the selected Cairo site of Saft al Laban

was developed. This Assessment Tool was crafted out of a combinations of other existing assessment tools for resiliency, as well as Best Practices taken from international cases, as discussed in Chapter 3. The purpose of such as tool was to guide the researcher in which possible ways food security and local economic development could be rationalized and operationalized to allow for more resilient urban planning.

b. Research Case Study Selection

Second, after the development of the Assessment Tool, a site selection was made for one of Cairo's peri-urban districts (Saft al Laban) and field work was carried out, as discussed in full in Chapter 6. Selecting a relevant site proved vital in grounding resiliency planning theory into a real-life situation and place to determine its practicality. The results of the data collection for Saft al Laban are also analyzed discussed in Chapter 7, and it was this data that was used to draw design conclusions for the author's proposed interventions. A detailed description of potential limitations of the field work data collection is also discussed in Chapter 6.

The main content of this thesis is laid out in seven chapters, with a discussion to follow in Chapter 8. Chapter 2 delves into the spatial, environmental, social, and economical aspects of resilient peri-urban agriculture and food security, including a discussion on the concepts of socio-ecological resilience and local economic development. Chapter 3 discusses in-depth the chosen theoretical framework to examine resilience and includes three international case studies chosen for their best practices in relation to Cairo's case; Chapter 4 includes an overview of all the historical planning and legal aspects related to peri-urban agriculture in GCR, and Chapter 5 discusses the present-day dynamics of the geographical, social, and governance aspects of agriculture land in Cairo and the plans for future agricultural sustainability. Chapter 6 examines the selected peri-urban site within Cairo, the district of Saft al Laban, and data analysis is discussed in Chapter 7. This serves as the basis for new local level design and policy recommendations proposed in Chapter 8, the concluding chapter.

Chapter 2: Resilient Peri-Urban Agriculture and Its Impact on Food Security

2.1- Regional Planning and Agriculture

a. The Concept of Sprawl and Fringe

As mentioned in the introduction of this work, cities in all regions all around the world, and particularly those within developing nations, are struggling with rapid urbanization. In addition, a phenomena striking perhaps most all of these cities is urban sprawl, defined as low-density residential development over rural land, resulting in the migration of a population from urban centers to the edges (Rinkesh, 2009). Yet, this pattern of urban development can be further analyzed to include an area referred to as the urban fringe. In his book "When City and Country Collide: Managing growth in the Metropolitan Fringe," author Tom Daniels describe the rural urban fringe as "a hybrid region no longer remote and yet with a lower density of population and development than a city or suburb" (1999, pp. 9). He also continues to explain that suburbs and urban fringe cannot be considered the same thing, since suburbs contain different planning schemes and patterns, while "the rural-urban fringe is best thought of as not just a geographic area within a metropolitan region, but also as a step in the development hierarchy between rural areas and a central city" (1999, pp.10).

Fringes may also face special planning challenges, since their residents are often tied economically to a region, but just an urban core, and communities

are resistant to rapid-fire development that would morph their community into a suburb (Daniels, 1999). According to one statistic at the time of Daniel's publication, the rate of the increased size in urbanized land in the North American context was 8 to 12 times higher than that of employment and population growth, (pp. 9) meaning the pressure for expansion on the fringe was immense. In the context of Cairo's informal areas, statistics differ, as will be discussed in Chapters 4 and 5, but the notion of rapid expansion on the fringe holds true (Figure 2.1). Therefore, more strategic, sustainable planning practices are required, in addition to the fact that such areas still contain valuable natural resources, unlike their urban counterparts.

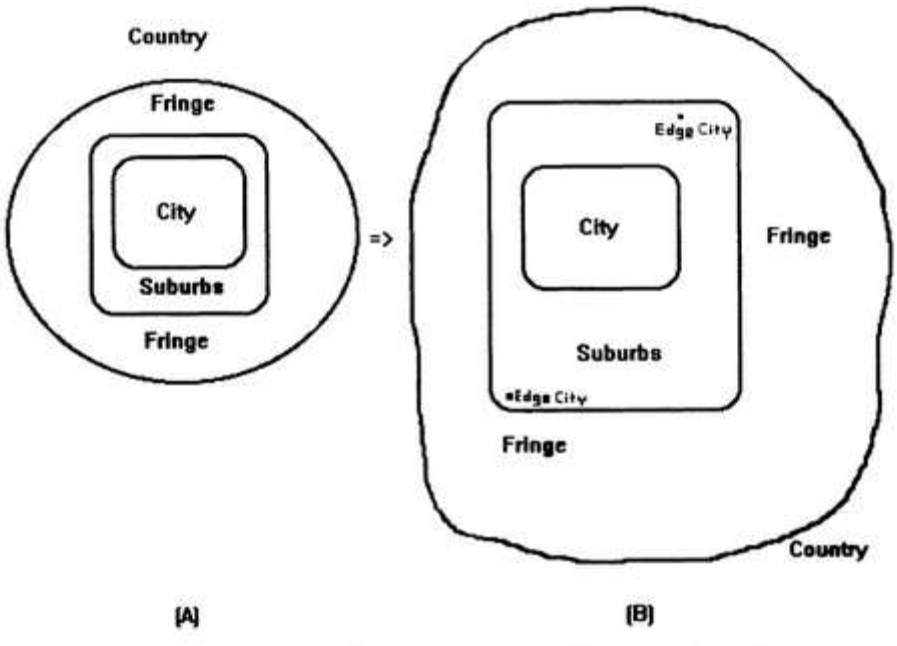


Fig. 2.1- The growth of fringe in a metropolitan setting. (Source: Daniels, 1999)

b. The Concept of Urban Ecology

When considering fringe areas, it is necessary to also discuss them in terms of their natural characteristic and ecological benefits to a city. Such studies are the subject of Urban Ecology, a discipline combining ecology, or "the study of the interactions of organisms with one another and with the environment, and the transformations of matter, energy, and information that are mediated by organisms" with the built urban environment (Pickett, Candenasso, and McGrath, 2013, pp. 8). Urban Ecology is a relatively new academic discipline, not gaining traction as a recognized specialty until the 1950's (pp. 12) and the field has recently undergone a shift in thinking to switch from considering ecology *within* a city (parks, trees, vegetation patches, etc.) to a consideration of ecology *of* a city, taking all natural system analogs (forested parks, vacant lots, green roadway islands) into account (pp. 8).

The concept of holding both Nature and City in design goes back to some revolutionary planners at the advent of the Modernist era. Lewis Mumford, one of the founders of the Regional Planning Association of America, was keen to manage decentralization of urban areas, and admired the work of Ebenezer Howard's Garden Cities proposed a few decades earlier. Mumford believed regional planning was necessary to preserve the natural environment, saying "each region... has a natural balance of population and resources and manufactures, as well as of vegetation and animal life" (Daniels, 1999, pp. 28). These ideas of working with limited landscape capacity and diversity were in contrast to Swiss Architect Le Corbusier's Radiant City plans, which indicated a stark separation between the built environment and nature, focusing on high-rise skyscrapers, multi-lane highways, and carefully planned and separated green spaces (Daniels, 1999). Ultimately, modernist planning with less regard for ecological integration won over most cities.

Yes, urban ecology provides a useful, practical framework that ecological science approaches, principles, and models with those of social and other natural sciences, and emphasizes that cities and their metropolitan regions (including

peri-urban fringe areas) must be considered as complex, integrated systems (Pickett, Candenasso, and McGrath, 2013, pp. 25). Looking at urban planning, and especially urban fringe planning, through this lens begs the questions of what is the carry capacity of such places? How many people can the place support before the quality of life and identify changes? (Daniels, 1999). Some fringe communities in North America and Europe are already asking such questions for themselves and are even actively working to create buffers against suburban sprawl through various political and infrastructural means (pp. 17). The same may not be said for urban expansion in some developing countries like Egypt, where fringe development has gone unchecked and current residents do not have the means or political will to prevent it. Working to understand the value of such fringe areas in terms of environmental services may be key to curbing such development in developing cities.

c. Ecosystem Services

Ecosystem Services are defined as the "the stock of natural ecosystems that yields a flow of valuable ecosystem good or services in the future society" (Richter, 2011, pp. 157). In general, four categories of service are identified (2011):

1. Provisioning (related to production of food and clean water)
2. Regulating (related to the control of climate and disease, mediation of flood and drought)
3. Life supporting (related to the nutrient cycles and providing habitat (suitable living space for plant and animal species)
4. cultural (relating to spiritual, aesthetic, or recreational benefits)

Ecosystems have intrinsic value, but as Niemelä (2010) points out, "only have value, in a utilitarian or economic sense, when there is sufficient natural provision of some quantity and there is someone who wants that quantity. Both the supply of the natural resources and the demand are equally important in determining the value of an ecosystem service" (pp. 197). Urban ecologists are

well-verse about the capacity of ecosystems to clean air and water and offer provisions to sustain life, but are now grappling with the near impossible task of putting a price tag on such features in order to appease others not to develop too quickly without taking such facets into consideration (Pickett, Candenasso, and McGrath, 2013). Currently, ecosystem services are taken for granted and not used sustainably. One report from the Millennium Ecosystem Assessment (MA) found that 60 percent of ecosystem services are being used unsustainably, and that 70 percent of the regulating and cultural services are in decline (Reid et al., 2005). To complicate this, such services are global in their effect, such as the ability of a landscape to sequester carbon to offset climate change (Niemelä, 2010), meaning they should be taken more seriously as existing assets prior to development.

When considering peri-urban agricultural lands in particular, the provided environmental services are vast. For example, agricultural areas can be considered as important subsidence lands for people, as well as recreational areas in developing and developed countries (Richter, 2013). Vegetation, such as large trees or shrubs has been proven to reduce noise levels (Niemelä, 2010), and there have also been studies on the direct health benefits of green areas in the urban environment, with linkages to reduced stress and anxiety, reduced obesity, and lowered rates of childhood asthma (pp. 217). Figure 2.2 from the Millennium Ecosystem Assessment indicates that there are a variety of strong linkages between ecosystem services and aspects of human well-being. High correlation can be seen in the Provision aspects and "basic material", but there is also a strong linkage between Regulating aspects and human healthy and security.

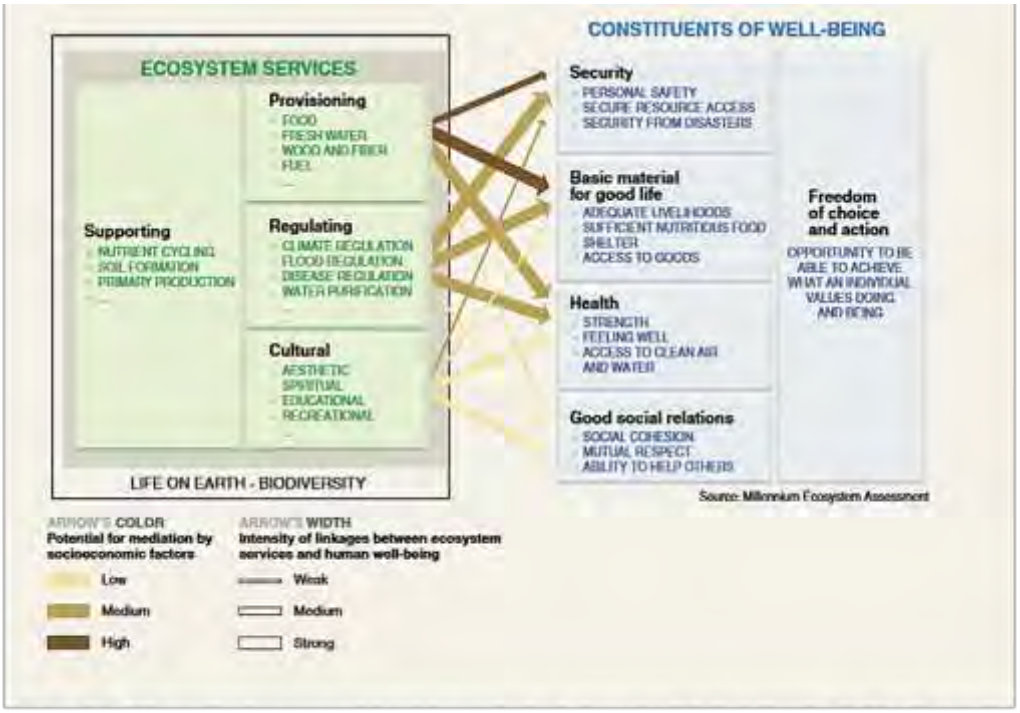


Fig. 2.2- The linkages between ecosystem services and constituents of well-being. (Source: Reid et al., 2005)

Fig. 2.2- The linkages between ecosystem services and constituents of well-being. (Source: Reid et al., 2005)

Perhaps one of the largest issues surrounding environmental services is the high potential to help solve problems in urban areas, but the lack of public realization (Niemelä, 2010). One initiative, the UNESCO URBIS Initiative, aims to "promote interlinkages between the goals of biodiversity conservation, sustainable use, and equitable access" (pp. 217). Through better governance and improved design strategies, ecological services of peri-urban lands can hopefully be more highly regarded as valuable assets for urban regions.

d. Edge Effect

As the conceptual schematic in Figure 2.3 indicates, urban ecology works with both a biological and human ecosystem concept, integrating planning and design for the physical, biological, built, and social systems that exist. It emphasizes cross-boundary interactions, rather than the traditional thinking

only focusing on built-social or physical-biological. When moving out of this abstraction to consider sustainable planning and urban design, two important factors should be taken into consideration. First, landscape functions at nested scales. This means that determining the boundaries of landscapes to be considered in urban ecological design., and that is helpful to always think up one scale (Pickett, Candenasso, and McGrath, 2013; Allen and Hoekstra, 1992). Second, sustainable urban design "should create holistic solutions to existing social and ecological problems while anticipating future challenges and striving to create a better future" (Pickett, Candenasso, and McGrath, 2013, pp. 56). This means that such planning should be place-based and build on aspects that already exist. It involves working with cultural and natural systems in order to guide planning and design decisions (pg. 64).

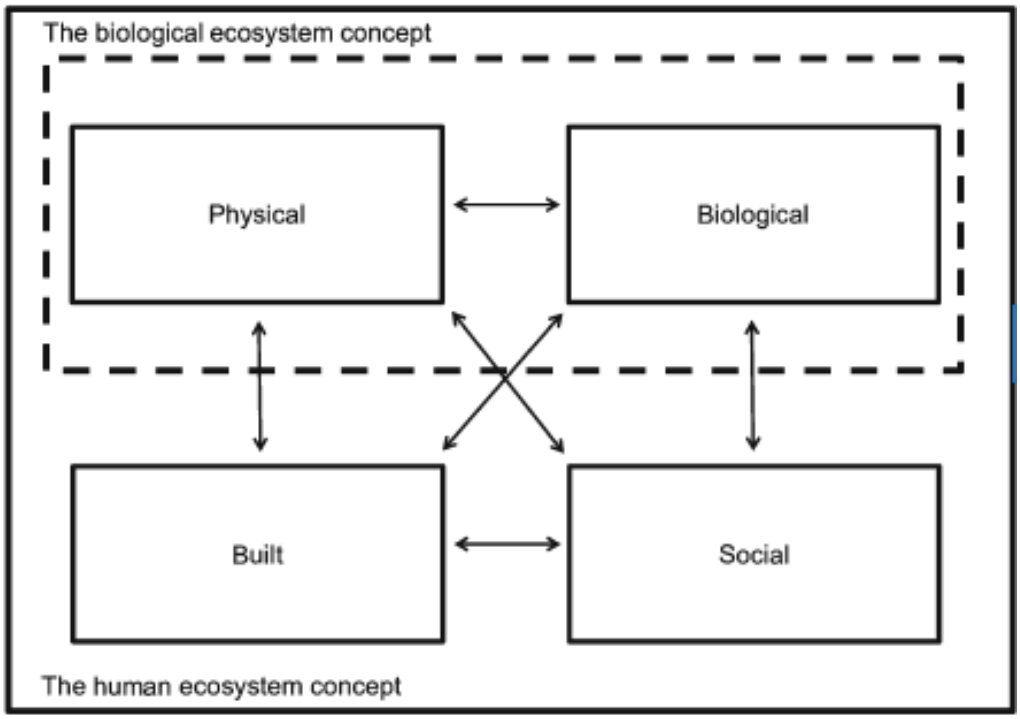


Fig. 2.3- A conceptual schematic of Urban Ecology (Source: Pickett, Candenasso, and McGrath, 2013)

Returning to the value of the fringe in an urban context, it has been studied that the edges of habitats contain different environmental conditions, such as microclimate or high human includes, then their interior (Niemelä, 2010) This is known as the "edge effect," a phenomenon which is largely unstudied in urban areas, despite the fact that urban-fringe landscapes often have very stark differences in their border zones, which can create "very specific environmental conditions (pp. 151). As Niemelä (2010) discusses in his research, the edges between urbanized areas and natural fringe need several layers of planning. He suggests that this could include "green corridors along roads and other routers should link the 'stepping stones' of countryside and urban parks in a range of sizes" (252). Such tactics may be valuable design mechanisms to preserve environmental services, as well as ensue preservation of agricultural land to bolster food security, discussed in the following section.

2.2- Overview of Food Security in Urban Planning

a. Definition of Food Security

The concerns of rapid urban growth in cities all over the globe has been one of the most pressing issues for large international bodies concerned with its potential negative consequences. With more than half the population of Africa and Asia expected to live in urban areas by 2020 and already two-thirds of the population of Latin America living there now (World Food Programme, 2002), it is vital to understand the impact associated with this flux, and how it influences our urban systems as we know them now.

The urban food crisis is now the main focal point of dozens of international agencies, most notably the United Nations World Food Programme (UNWFP), and the United Nations Food and Agriculture Organization (UNFAO) who deal with strategies and policies to combat hunger and malnutrition in developing nations worldwide. Food security as defined by the UNFAO "exists when all people, at all times, have physical, social and economic access to

sufficient, safe and nutritious food which meets their dietary needs and food preferences for an active and healthy life" (UNFAO, 2017).

As a partner aid organization, the (WFP) focuses on nutrition and food-related issues in all regions, but in the urban context, it works "as appropriate, in urban and peri-urban areas with high concentrations of malnutrition" (World Food Programme, 2002, pp. 4). According to the collective data between the two agencies, the situation of food insecurity in many regions of the world is very dire. Statistics from eight of the world`s most populated nations showed that the proportion of the urban poor had grown over the past twenty years, and that the number of urban poor who were also undernourished has also grown in the same time frame, but "at a rate that outpaces corresponding changes in rural areas" (pp. 5). As indicated in Figure 2.4, this poses several questions when considering how to meet the multi-faceted challenge of urban poverty and hunger.

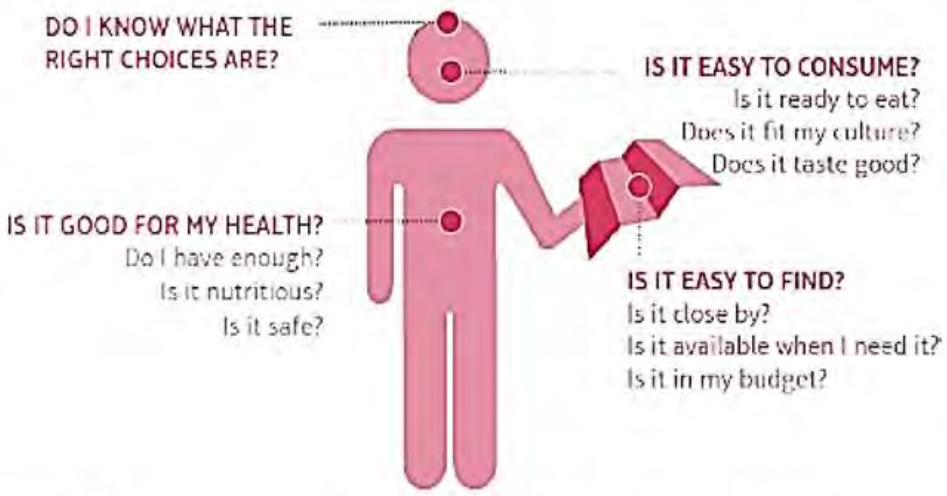


Fig. 2.4- The urban poor face a number of challenges regarding food security. (Source: Patel, et al, 2013)

b. Food Security in Egypt

Annually, the FAO produces a list of Low-Income Food-Deficit Countries (LIFDC) in order to pin-point where to best target their efforts. While Egypt is currently not on this list, and indeed Cairo has served as the location for the Middle East-North Africa (MENA) Regional UNFAO office for several decades,

the criteria for countries on the list is comprised of a per capita gross national income (GNI) below a pre-defined ceiling set by the World Bank as well as the net food trade of a country over the preceding three years (UNFAO, 2016). In Egypt, Greater Cairo region (GCR) has one of the highest population densities globally with 397 persons per ha, and the country is reported to be the world's largest importer of wheat (FAOSTAT, 2015). In 2010, the nation's oil minister stated that Egypt imports 40% of its food, and 60% of its wheat (Weisenthal, 2011).

According to some reports, research suggests that if Egypt is not in a food security crisis now, it may be heading there in the future. According to a 2014 report from the International Food Policy Research Institute, Egypt's food security has been fluctuating greatly in the past few years. Figure 2.5 shows the factors from 2005 to 2012 that may have been affecting food security, such as steady increase of urban poverty, and astoundingly between 2009 and 2011, 15.2 percent of the population (12.2 million people) fell into poverty (Breisinger, et al., 2014, pp. 11-12). The chart also indicates that formal unemployment for younger people is high, with the 15-29 age range at around 27.3% (pp. 11)

The report also notes that food subsidies given by the government are an important safety net for the poor (Breisinger, et al., 2014, pp. 12). The presence of food subsidies is meant to protect the poor from fluctuation of food prices, and the prominent use of the subsidy for baladi bread (sold at 5 piastres, or about US$0.01 per loaf), is evidence that this is vital for many of Egypt's citizens, many of whom view bread as right (pp. 12). Another research, Raymond Bush, points out in his article *Food Security and Food Sovereignty in Egypt* that "it long been one of the greatest ironies that it is the producers of food who are the first to suffer. Smallholder households eek out an existence and are not exempt from the fear and reality of slipping into starvation" (Bush, 2017, pp. 10) The same sentiment was also echoed in an interview with a representative of the UNFAO Regional Cairo office, who stated that food insecurity is worse in Egypt's rural areas, which may overshadow efforts to assist the urban poor on this matter (Yacoub, 2017, pp. 3)

According to the UNFAO Regional Cairo office, food insecurity is an important issue for Egypt, and one that has been partly compounded through over population in some areas, as well as other aspects of food like water and other natural resources needed to produce it (Yacoub, 2017, pp. 1). The strategic crops the FAO considers are those that address food security: Wheat, Maize, and Rice, and as one researcher at the American University in Cairo indicated "food security is planned at the national level" (Moneim, 2017, pp. 4)

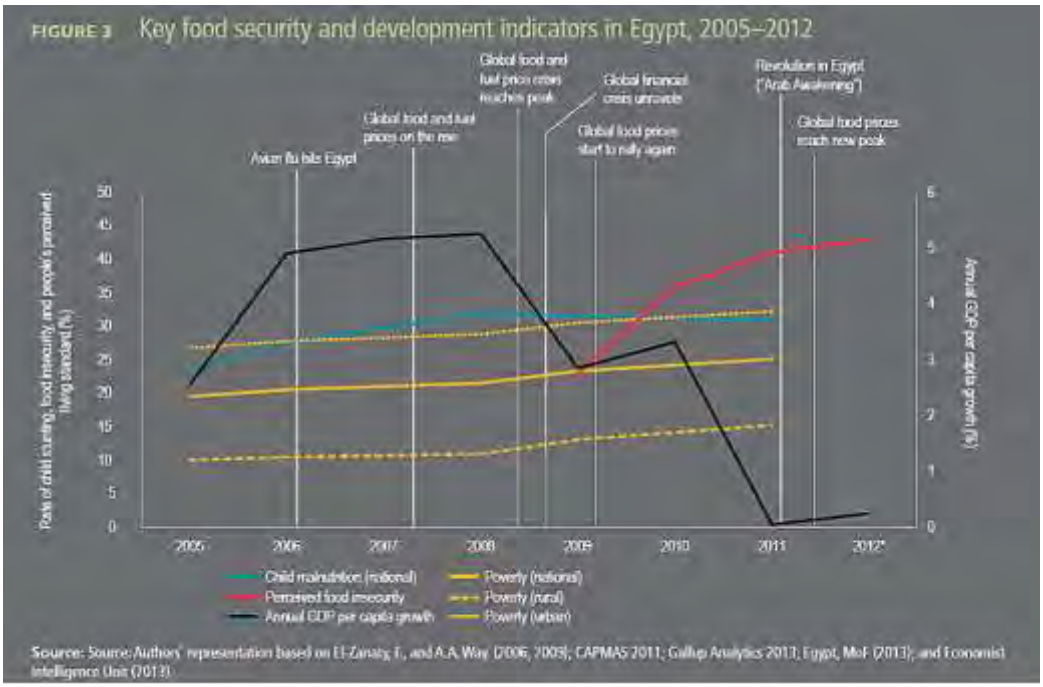


Fig. 2.5- Egypt's food security has been affected by a number of crisis events. (Source: Bush, 2014)

c. How Food Security is Measured

The UNFAO uses a variety of metrics and indicators to measure food security. The organization largely relies on data coming from household surveys completed in countries all around the world in order to make an assessment about food security (UNFAO, 2017). The indicators were revised at a 2011 Committee on World Food Security meeting based on "expert judgment and the availability of data with sufficient coverage to enable comparisons across regions and over time" (2017). The indicators are classified among four dimensions (access, availability, stability, and utilization), and a selected example of some indicators is found below in Figure 2.6.

Type of indicator	Source	Coverage
Availability		
Average dietary energy supply adequacy	FAO	1990-2016
Average value of food production	FAO	1990-2013
Share of dietary energy supply derived from cereals, roots and tubers	FAO	1990-2011
Average protein supply	FAO	1990-2011
Average supply of protein of animal origin	FAO	1990-2011
Access		
Percent of paved roads over total roads	WB	1990-2011
Road density	International Road Federation, World Road Statistics and electronic	1990-2011
Rail lines density	WB	1990-2012
Gross domestic product per capita (in purchasing power equivalent)	WB	1990-2013
Domestic food price index	FAO/ILO/WB	2000-2014
Prevalence of undernourishment	FAO	1990-2016
Share of food expenditure of the poor	FAO	partial
Depth of the food deficit	FAO	1990-2016

Fig. 2.6- The indicators, sources, and coverage dates of the UN's Food Security indicators. (Source: UNFAO, 2017)

While it is true that globally there is a greater number of food-insecure people living in rural areas, the challenges faced by the urban poor are often more complex, and an increasing migration of people from rural to urban areas only means the current 200 million food insecure individuals living in urban informal settlements is expected to grow (Patel et al., 2013). Urban food system indicators such as lack of access, food waste, high prices, or lack of nutrition show that there clearly are problems to be addressed (Patel, et al, 2013). When considering the urban fringe context, transport systems have become a vast network, involving thousands of food miles (leaving a very large carbon footprint). The task of designing for 'food resilient cities' requires a more multi-faceted approach, which can bridge solutions to several food-related issues at once, and ensures that urban food systems are prepared for certain disturbances, and are able to adapt, as discussed in the following section.

2.3- Introduction to Socio-Ecological Resilience

a. Defining Socio-Ecological Resilience

There exists a plethora of definitions to define the word 'resilience' (Meerow et al.,2016). Arguably, the word has become as overused as much as 'sustainability', but according to recent studies, resilience and sustainability differ because:

> "sustainability is not about maintaining a system at its equilibrium state [...] or optimizing a system's performance, but rather sustainability should focus on the system's capacity to create and test opportunities and maintain adaptive capabilities" (Wu, J. and Wu, T., 2013, pp. 219).

With this thought, researchers are now beginning to understand resilience as a key to sustainability in socio-ecological systems (2013).

A recent review by researchers attempted to define urban resilience based on the compiled work of other researchers (Meerow et al., 2016). Their definition states:

> "Urban resilience refers to the ability of an urban system-and all its constituent socio-ecological and socio-technical networks across temporal and spatial scales-to maintain or rapidly return to desired functions in the face of a disturbance, to adapt to change, and to quickly transform systems that limit current or future adaptive capacity" (Pg. 39).

It is the opinion of this author that this definition is well-suited to apply to peri-urban agricultural systems. Fluxes in the peri-urban agricultural systems, such as flood, drought, or extreme weather are likely to affect urban food production areas, and require adaptive or transformational changes (De la Salle & Holland, 2010).

b. Complex Adaptive Systems

As previously mentioned, cities can be thought of as complex ecological systems, in which nature operates as part of a living, active whole system. Scholars now suggest that such complex systems are also adaptive, and that urban landscapes have interactions on lower levels that result "in emergent patters at higher levels that, in turn feedback to influence future lower level interactions." (Niemelä, 2010, pp. 306) Urban ecology has encouraged both scientists and designers alike to consider such feedback loops and self-organization and incorporate urban designs to fit naturally into this. Another term for this is 'panarchy,' or nested hierarchies that continuously influence each other (Wu, J. and Wu, T., 2013). Such considerations encourage a wider, systems-thinking approach, since solving isolated issues does not impact the overall resilience of a wider city region. Ecological resilience emphasizes resistance, change, and unpredictability and can be broken down into the smaller concepts of resistance, adaptation, and transformability (2013).

c. Concepts of Resistance, Adaptation and Transformability

Resilience can be broken down into more digestible components that help us better understand it as a process. The researcher acknowledges that the

concepts may abstract, but are important considerations to understand the nature of socio-ecological systems, such as peri-urban fringe systems and their ecosystem services.

i. Resistance and Regime Shifts

The notion of resistance refers to "the ease or difficulty of changing the system; how "resistant" it is to being changed" (Walker et al., 2004, pp. 2). In some socio-ecological systems, multiple thresholds, or tipping points, exist. When a system goes from one threshold to another, it is called a "regime shift." If the resistance of the system is low, it may enter multiple regimes over the course of time, resulting in various stable states (Wu, J. and Wu, T., 2013, pp. 214)

ii. Adaptation

Adaptation refers the capacity of elements in a system to influence resilience (pp. 3). In some systems that adapt well to a regime shift, changes may be continuous and gradual changes. But, in other systems, adapting to a shift may causes sudden and dramatic changes to the function and structure of a system (Wu, J. and Wu, T., 2013, pp. 215)

iii. Transformability

Finally, transformability is "the capacity to overcome the obstacles of an undesirable regime to create a fundamentally new system" (Walker et al. 2004 ; Folke 2006). This means the system has created a new equilibrium for itself, resulting in new processes and variables to self-regulate (Wu, J. and Wu, T., 2013, pp. 224).

All of these concepts are illustrated in FIGURE 2.7 in the form of a ball reach reaching multiple thresholds and basins of attraction. The figure also provides a comparison between a natural and human ecosystem situation.

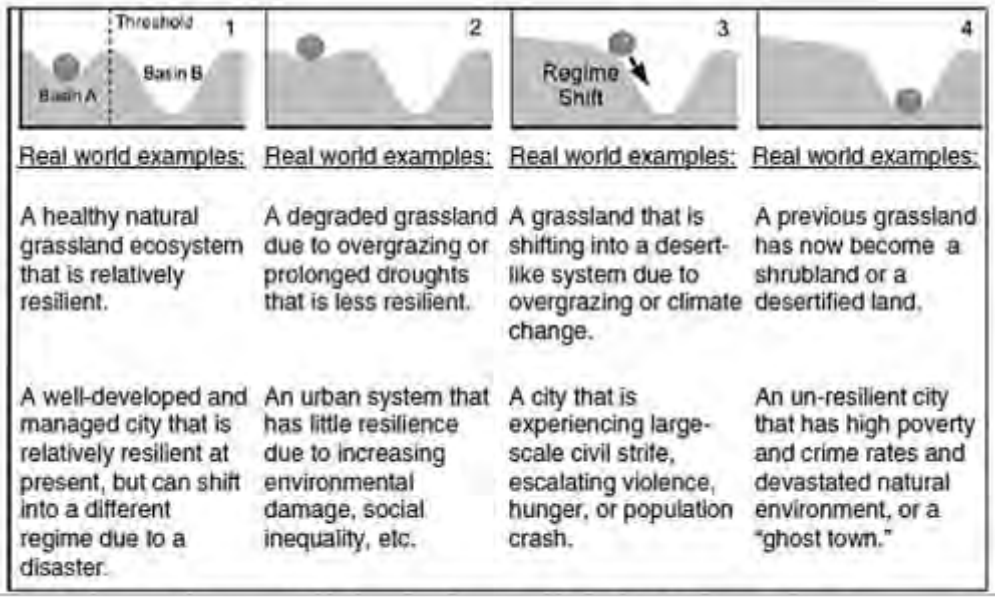


Fig. 2.7- Illustrated key concepts of ecological resilience: multiple stable states, basins of attraction, threshold, and regime shift. The two rows compare human and ecological systems. (Source: Reid et al., 2005. Modified from Folk et al., 2004)

In a socio-ecological system, transformability can also be viewed as a positive thing because it may also refer to creation of an entire new system (ecological, social, economic, or political) that may work for the benefit of the system at large (Folke, et al., 2005,). Looking at the context of peri-urban Cairo, it is therefore pertinent to consider how might one or more changes in the system alter the future outlook for peri-urban farmlands, as well as what the consequences of these changes may be. Resilient ecological design techniques can guide decision making towards changes that have a positive impact the current system existing in peri-urban Cairo.

d. Resilient Ecological Design

Resilient ecological design involves trying to fully grasp the complex nature of a system, and to work with, not against, its natural nested hierarchies and system of change. As Holling (1996) and later Wu and Wu (2013) point out, this has not been an easy task for designers, who misunderstand that changes in

ecosystem function are not always continuous and gradual; that ecosystems are not spatially uniform; that ecosystems have several equilibrium points; and that policies and management practices cannot be considered lineally (pp. 213).

While there is no one-size-fits all ecological design for any system, one such tactic that may be applicable for peri-urban agricultural systems may be designing with patch dynamics, or the spatial changes in urban patches over time. This includes working with heterogeneous spaces, observing the complexity of spatial patterns over time, and noting changes (Pickett, Candenasso, and McGrath, 2013, pp. 100). Such a framework is incredibly useful to plan for the resiliency capacity of peri-urban agriculture land, which has itself, in the case of Cairo been reduced to fragmented patches, as to be discussed.

This chapter has sought to provide an overview of the importance of peri-urban landscapes as areas on the cusp of being overtaken by sprawl, and the importance of their ecological services. It has also discussed the importance of food security in developing urban regions, and in particular, Grater Cairo region, based on current data. Lastly, the chapter covered concepts related to socio-ecological resilience, which is a vital framework needed to consider how to make peri-urban agricultural lands to be more secure. A more detailed framework about how to evaluate resilience and how it may be applied to GCR will be covered in the following chapter.

Chapter 3: Setting a Theoretical Framework

3.1-Assessment tools for Resilience in Peri-Urban Landscape

In order to develop an effective tool for evaluation, several existing models were investigated to see which framework may fit best for the exploration of PUA in Greater Cairo Region. The model selected is a comprehensive tool from The Resilience Alliance, and consists of a five-step process to better understand a socio-ecological system (Figure 3.1). It beings by first describing the problem, and in particular, asking the all-important question of "Resilience of what, to what?" For this particular case, resilience of Cairo region's peri-urban lands to food insecurity and economic development potential. The next step involves looking closer at the system's dynamics, including its existing interactions and governance, and finally, acting on the assessment. The "acting" involves making a conscious effort to bring the knowledge forward into a workable model that includes initiative positive transformations. This in itself is one of the main purposes of this research, and this framework therefore served as the ideal model to work with.

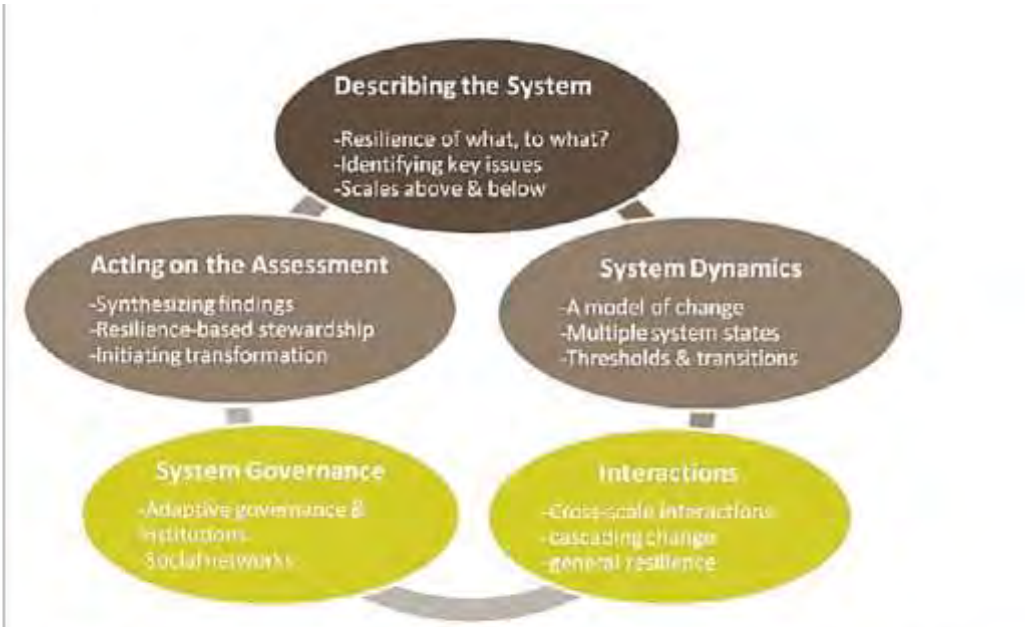


Fig. 3.1- The theoretical framework for resilience assessment. (Source: The Resilience Alliance, 2010)

Before delving into the specific system dynamics of the selected site in Cairo, Saft al Laban, the researcher found it valuable to consider other cases from different regions that may provide insight and offer a selection of best practices to consider when entering the "Acting on the Assessment" step of the framework. Three cases were therefore selected, representing diverse interventions to solve problems related to PUA development.

3.2-Categorization and Application of Selected Best Practices

a. Developing the Evaluation Tool

In order to develop a comprehensive assessment tool, several factors were considered. Since the main interest of the research lies in being able to understand the multiple facets of community resileince, food security, and desirable conditions for local economic devleopment to occur, it as necessary to examine multiple sources. The tool therefore combines the general resilience typologies of as explained by Meerow and Newell in "Urban resilience for whom,

what, when, where, and why?" consisting of the four established typologies of socio-ecological dynamics, urban infrastrcuture and form, networked materials and energy flows, and governance networks (Meerow and Newell, 2016, p. 9). Also taken into consideration was the broad categorization of community resilience criteria put together in the Community Resilience Toolkit, consisting of Equity, Quality, Sustainability, and Ownership (the same dynamics discussed in the ranking exercise of the community workshop held in Saft al Laban, to be further) (Bay Localize, 2009, p. 7).

A third layer of evaluation criteria for food security was integrated with the approriate typology sub-category. Lastly, a layer of evaluation criteria for Local Economic Devleopment was selected from for the "LED Guideing Principles" chart from Treller in order to assess each case's ability to create an enabling environment for Local eocnomic devleopment. The tool, found in Figure 3.2 takes the form of an evlautation matrix. Most of Meerow's developed resilience typoligies remain, but with a few qualitfying changes to reflex the Communiy Resileince critera. The original sources from which the evalutation tool was developed can be found in Appendix 10.

Fig. 3.2- The developed evaluation matrix. (Source: Author, 2017)

3.3-Best Practices for Design of PUA Systems from International Cases

a. Case 1- The Case of Casablanca, Morocco

One example of a spatial innovation for PUA in the MENA region can be seen in the case of Casablanca, Morocco. In 2009, a new master plan for the city took the place of one from 1984, and allocated for possible development of designated urban agriculture areas (Giseke, 2011). As part of a bi-national research project between academics in Berlin and Casablanca, a 5-year program called *The Casablanca Project: Urban Agriculture as Integrative Factor of Climate Optimized Urban Development* was established to explore how urban agricultural could be considered as multifunctional green infrastructure. In particular, "the project addresses how a new green infrastructure can be integrated into an existing and at the same time, dynamically expanding city" and the researchers and student participants sought design solutions to create integrated strategies for the spatial solutions needed (pp. 8).

Designers in this project wanted to prove that urban agriculture could be flexible, and adapt to spatial volatility, which is a main component of resiliency. This was no small task, especially since the student design teams "had to develop tactical strategies that had to engage an underappreciated population of informal urban pioneers, complicated land ownership conditions, and a general skepticism towards small-scale agriculture" (pp. 7). The researchers designated urban agriculture from green open spaces in two ways: it is productive and it is inhabited by people. They advocated that spaces need to be multi-functional, and include residential spaces, provide opportunities for leisure, contribute to ecosystem services, and recycle urban waste (pp. 9). These combined efforts led to a pilot project in an informal area of Casablanca called Ohled Ahmed, a large settlement in the peri-urban area of the city, which lacks a lot of basic infrastructure and has high levels of unemployment.

While the project is still ongoing, some elements of student design proposals have been adopted, including small-scale business models to build

new, local agri-food economic activities. The designers believe that the process of peri-urban agriculture development needs to be a participatory process, and that "urban agriculture is one of the new sustainable types of infrastructure and like wind or solar power, that recognize the reality of finite resources, but then literally generate a return" (pp. 13). Of course, the project contains start-up costs, but it provides a powerful example of the potential for peri-urban agriculture challenges to be met with exciting, pioneering design opportunities. Casablanca's evaluation is shown in Figure 3.3.

Fig. 3.3- Evaluation matrix for Casablanca. (Source: Author, 2017)

b. Case 2- The Case of Accra, Ghana

A second case of interest was the case of Accra, the largest city in Ghana. The case illustrates excellent stakeholder and management aspects in a city with growing peri-urban agriculture needs. In fact, as of a 2007 UNFAO report specifies, the average monthly earnings of a peri-urban farmer in Accra are oftentimes double that of the gross national income per capita, illustrating that farming was indeed very viable in the city region (van Veenhuizen, Danso, 2007, pp. 52). In the Accra region, peri-urban agriculture is small-scale and consists of about 700 ha in the city region alone (de Zeeuw, et al., 2010, pp. 80). In the peri-

urban region, plot sizes can be up to an average size of 20 ha per person, though in the inner city backyard-sized plots are more typical (pp. 81). As in many developing regions, staple crops such as maize, cereals, and vegetable make up the vast majority of produce, and interestingly, many open spaces an operated by public or private institutions (pp.81).

Similar to Cairo's peri-urban areas, the farmers in these regions also struggle with accessing water, which in Accra, comes from a variety of open drains, streams, pipes, and hand-dug wells (de Zeeuw, et al., 2010, pp. 81). Researchers have also noted that despite the high economic value of peri-urban agriculture in Accra, the city is under pressure for changing land use from its current agriculture usage to commercial and economic purposes, just as in Cairo (pp.81). To combat this, starting in 2005 multiple stakeholders related to per-urban agriculture in Accra worked together to advocate for local ownership, commitment, and governance to peri-urban agricultural lands (pp. 81). The result was a more comprehensive understanding of farmer groups though mapping and census activities, to understand their needs and value in contributing to Accra's economy, as well as a large decentralization of peri-urban agriculture land management (pp 82).

In November 2005, 55 stakeholder participants took part in a three-day forum that eventually resulted in the formation of The Accra Working Group on Urban and Peri-urban Agriculture (AWGUPA). The working group is now a major player in influencing city strategies and agenda's involving peri-urban agriculture legislation, and is a strong voice that has improved public awareness and perception about PUA, as well as acting as an extension service to farmers to advocate for better environmental practices (pp 85). All in all, the collective action of stakeholders has been instrumental in preserving peri-urban agricultural lands in Accra, and in creating a better relationship between city and the services they provide. Accra's evaluation matrix is found below in Figure 3.4.

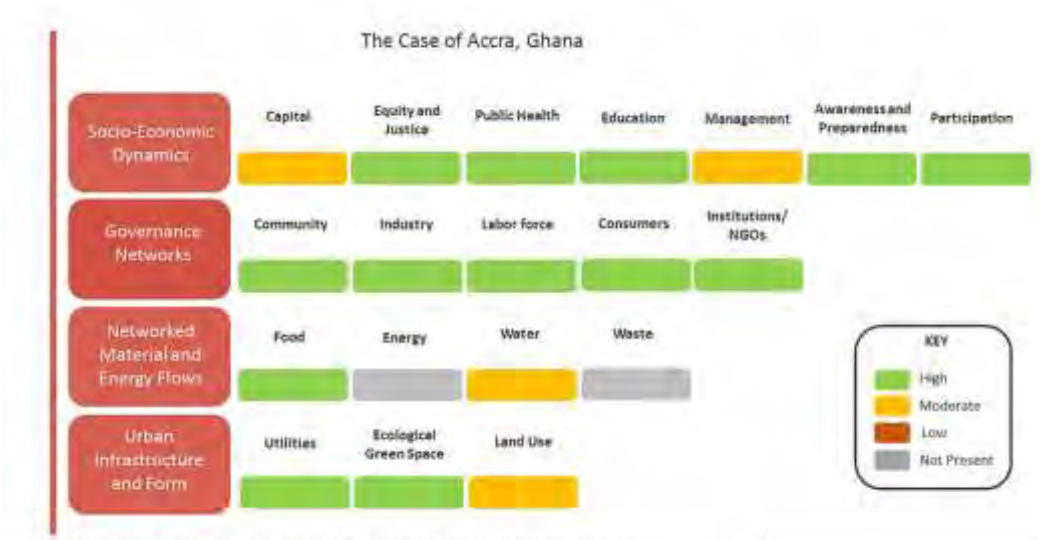


Fig. 3.4- Evaluation matrix for Accra. (Source: Author, 2017)

c. Case 3-The Case of Manziana, Italy

Manziana was once a small agricultural village on the regional outskirts of Rome, but in recent years, the places have changed from an active town that has become more closely linked with Rome's food economy. Traditionally, the town's main economic strengths came from its forestry maintenance, in a system known as the Universita Agraria, or institution that manages the access rights to common land in the village (Polizzano, 2016, pp. 2). The Universita Agraria di Manziana manages over 2000 of woodlands and pastures, which have been very well preserved, but soon realized it was in need of a transition to propel its most value asset into the modern age, and allow it to serve for other social purposes, such as recreation (pp.2)

Also included in the village was an abandoned industrial site called the Solfatara. The site contains an old Sulphur mine, as well as multiple sheds, hangars, and other large buildings (Polizzano, 2016, pp. 4) After a series of workshops run by local ecological transition efforts, it was determined that parts of the woodland preserve and the abandoned industrial site could be converted to new ecological management practices to generate new economic opportunities form the community (pp. 6) Proposals for the development of greenhouses out of the abandoned site and use of forest biomass were being discussed. Most relevant

are the rural-urban linkage to the city of Rome, however, is the local economic development planning that will invest in agro-tourism and link regional economic activities that take place on the site (pp. 6) This was made possible by funneling available EU money into already existing agriculture-focused regional networks (pp. 7).

Among the possibilities for transition planning would also be the implementation of a social-enterprise model, training young and underemployed youth from the region to implement an agri-focused business working with production of local or traditional food and products (pp.7). The Manziana case (Figure 3.5) established the importance of working on a regional scale to utilize more assess for food security planning on the urban level, and highlights the importance of working with regional actors already in existence.

Fig. 3.5- Evaluation matrix for Manziana. (Source: Author, 2017)

d. Evaluation of Case Studies

The prior mentioned three case studies illustrate the multiple approaches in working towards better enabling cities and their relevant stakeholders to manage peri-urban agricultural lands. The case of Casablanca highlights the importance of creating economic linkages and working towards multifunctional in PUA's design and usage. The case of Accra illustrates the power of multi-

stakeholder networks and their management and advocacy potential, and the case of Manziana shows that regional networks for food and transitional planning are also important aspects to consider. Based on these strengths and their varying approaches, cases were ranked in the evaluation matrix describe previously.

As shown in the figures, each case was therefore assessed using the aforementioned criteria and ranked with either a "high" (green box), "medium" (yellow box), "low" (red box) or "Not Applicable" (gray box), given the current information that is available about the given case study. This exercise allowed for the visual representation of what each cases' best practices were, and where gaps in such research remains. Perhaps most prominently, a gap exists in the discussion of energy sources used in maintaining or running activities taking place on PUA lands. It seems most cities do not have much thought to this aspect of resilience yet, or it is not described as part of the holistic process of peri-urban farming. The cases will be revisited in Chapter 7 as part of an analysis to compare with the case of Saft al Laban.

Chapter 4: Historical Background of PUA in Greater Cairo Region

4.1- A Short History of Agriculture in Egypt

Looking from an aerial perspective upon Cairo's urban fabric, one sees a dense patchwork of brown, built-up area hugging the banks of the snaking Nile River, and sprinkled into little clusters that veer into the desert. This is the Cairo of today, a massive metropolis of many different faces, pushing beyond its intended boundaries and constantly expanding on all axes. Zooming into the picture, one phenomenon that can be seen from the east is the development on existing agriculture lands. The majority of these lands in the Giza governorate are found at the fringes of informal settlements. For thousands of years, farming on the flood plain on the banks of the Nile was the lifeblood of Egypt's empire, and in fact, the Ancient Egyptians were one of the first societies to practice agriculture on a large scale (Baines, 2011).

Many scholars of both Ancient Egypt and Modern Egypt believe that undoubtedly, without the Nile there would be no Egypt. Indeed, the Nile has been responsible for Egypt's massive wealth as an ancient empire, and its fertile soil. Oxford Egyptology professor John Baines explains how the yearly cycle of flooding was key to the agricultural bounty:

> The Nile's annual inundation was relatively reliable, and the floodplain and Delta were very fertile, making Egyptian agriculture the most secure and productive in the Near East. When conditions were stable, food could be stored against scarcity.... Crops could be planted after the inundation, which covered the Valley and Delta in August and September; they needed minimal watering and ripened from March to May (2011).

Baines also explains that the expansion of the areas of cultivated land was made possible first through basin irrigation at the time of the Middle Kingdom (1975-1640 BC) in which large sections of the Nile flood plane were divided and irrigated as units. Vegetables in small plots had to be irrigated by hand through carrying water in pots all year round, until around 1500 BC, when a water-lifting device was invented, easing the labor-intensive process. It was this skillful cultivation of the land that allowed the growth in ancient Egypt's population and political stability for so many centuries (Baines, 2011).

Figure 4.1- Image from Thebes of a farmer plowing in Ancient Egypt. (Source: Mark, 2017)

The Nile's annual inundation deposited nutrients onto the soil, so there was little need for heavy plowing, but only light plow with oxen (Figure 4.1). In fact, soil in the region was so fertile, that in a good season, enough food was produced to feed every person in the country, as well as have enough surplus grain to store for future years (Mark, 2017). During the Roman times, Egypt was considered the breadbasket of the Empire. Staple crops of ancient Egypt included emmer (a wheat grain), corn, chickpeas, lentils, papyrus, flax, castor oil plant, onions, garlic, lettuce, and sesame. Animals were raised for meat consumption, but the diet was mostly vegetarian, since meat was expensive and more often reserved for the upper classes or for special occasions (2017). An individual

farmer could make a living in a number of ways, and private landowners profited by growing a number of crops, though they had to pay taxes. Most farmers worked on land owned by nobles or priests, and took a small portion of the produce as profit for their work (2017).

Agriculture remained at the forefront of the Egyptian economy until modern times, and for the most part, the agricultural activities in the peri-urban Cairo region mirrored those taking place in other parts of the Delta. The geology of this region is quite unique, and Cairo's strategic location right before the Delta fans out in the north has resulted in almost 5,000 years of continuous settlement (Sims, 2010, pp. 26). From upper Egypt until Cairo, the Nile valley has high cliffs, with the desert beginning on either side just beyond. In Cairo, however, the valley becomes more flat, with only a gentle slope towards the desert. This formation allows for groundwater from the Nile's hydrology to be extracted more easily for agricultural purposes (2010). The agricultural plain west of the Nile constitutes the peri-urban agriculture fringe of GCR, and extends before the plateau of the Western Desert. It is this geographical location that is now the centerpiece of numerous land development issues that are of great cause for concern.

4.2- Defining the boundary of GCR

a. Defining Peri-Urban Agriculture

In order to give a specific definition of the boundary of what is commonly known as Greater Cairo Region (GCR), and it therefore necessary to specify this geographical boundary. Though there is some discrepancy in how it is defined, UN HABITAT refers to GCR as "a vast agglomeration that comprises the urbanized area of the Governorates of Cairo, Giza, Qalyubiya, Helwan, Sixth October and the eight new urban communities that surround" *(UN HABITAT, 2010).* As of 2006, the population estimate of peri-urban Greater Cairo was 3.9 million inhabitants (Sims, 2010).

The area of focus for the researcher consists of development phenomena taking place mostly in the Giza area, containing the agricultural on the western

edge of the city (seen in Figure 4.2). In fact, the Giza governorates contains some of the most prominent and rapid population growth, consisting of both Cairene residents who have left the urban core (a trend occurring since the mid 1960's due to deteriorating of older housing and the commercialization of downtown) and migrants from rural areas, though this is to a lesser extent (Sims, 2010, pp. 32). Indeed, Sims points out, Egypt's rate of internal migration is relatively low. In a 2008 household survey, it was estimated that only about 18.8% of urban households had changes residences in the last five years, and most were inter-district, with only a faction moving between governorates (2010).

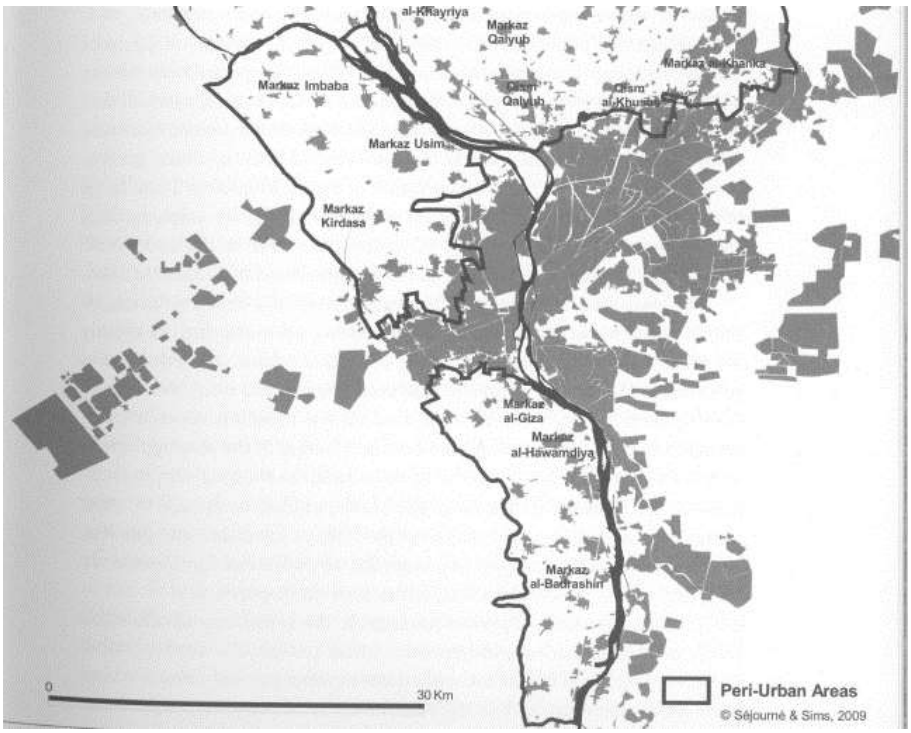


Figure 4.2- Peri-urban settlement areas on the western fringe of Cairo. (Source: Sims, 2010)

This is important to note, since it is a common misconception among many Egyptian officials, even in recent years, to make sweeping generalizations about the rate of rural-to-urban migration, and blame many of the city's problems on it. The numbers speak for themselves to show that a constant flow of rural migration to Cairo is simply not so dramatic, and in fact, most rural migrants come from nearby villages or *marakiz* close to the city region (Sims,

2010, pp. 34). These facts are also the key to understanding why informal settlements have continued to mushroom onto the outskirts of the city. It is now estimated that as much as 44% of Cairo's population lives in such informal areas, which, in the urban fringe of Cairo's peri-urban agricultural plain, is extremely detrimental, as will be later discussed (2010).

4.3- Past Policies of Agricultural Land Reform

a. The 1950's-1960's

Turning to Egypt's more modern history, 1952 marked the year of revolution, in which the monarchy of King Farouk was overthrow, and a republic was established (Hopkins and Saad, 2007). Prior to 1952, agricultural land in the Nile valley and Delta was organized as large blocks of land. A plot of several thousand feddans was quite normal, and owners had their own workers who were paid relatively fair wages and who were able to rent housing on the land from the owner (Moneim, 2017). However, after the new republic was established, one of Nasser's first social programs was to abolish what he considered to be a "feudal system" (though this had already been done so by Mohammed Ali Pasha more than a century earlier) and the state began to seize agricultural land from the owners and redistributed it in smaller, subdivided units to individual farmers (figure 4.3). The result was a very fractured agricultural landscape that was fractured even further as land was once more sub-divided among heirs of the next generation (2017).

The Egyptian Land Reform law established in 1952 was amended again 1958, 1961 and 1969. Each new decree during the Nasser era sought limit land ownership by individuals to 200 feddan, 100 feddan and finally 50 feddan with now only the maximum property of 5 feddan (2.1 hectares) *(*Gouda et al., 2016*).* Simultaneously, in the early 1960's regulations for building housing in rural areas were lacking. Infringements started to multiply at a time where oversight was more focused on industrialization and large-scale building projects in Cairo's city

center (2016). The rural to urban migration to Cairo was also rampant in the 1960's, as farmers sought better work opportunities in the growing city. As crowded city conditions caused a shortage of housing, people soon began to move to the fringes of the city to set up their own makeshift housing, both in the east of Cairo (near the desert), and west, close to Giza (on agriculture land) (Sims, 2010, pp. 50).

The Land Reform laws soon caused problems for farmers, since such limited area did not allow for large-scale mechanized agriculture to take place. Farmer-owners of small plots in rural areas soon began to realize that to build on the land was more economically viable than farming, especially given the population increase at Cairo's fringes (Hopkins and Saad, 2007). Throughout the 1950's and early 60's, formal Cairo was expanding rapidly, in part through state-

Fig. 4.3- A farmer during the Nasser era, when ownership became limited. (Source: Hopkins and Saad, 2007)

sponsored subdivision project and private housing companies. The government's large-scale building projects in places like what is now Mohandiseen-Agouza, west of the Nile, were created out of 800 hectares of agricultural lands, and may have been the driving force for development to continue westward onto the agricultural plain in the coming decades (Sims, 2010).

But when exactly did the first informal settlements on GCR's peri-urban agricultural land appear, and why were they not stopped in the first place, if they violated the law? It seems that from studies of satellite imagery, the first small appearances of informal settlements in multiple locations along Cairo's fringe appeared in the 1960's and 1970's (Sims, 2010, pp. 54). David Sims describes the process and how builders were able to slip through the cracks:

> In most of the earliest cases, subdivision and development began in what had been agricultural lands, frequently being grafted onto existing rural settlements. This helps to explain, at least to some extent, the lack of official reaction. Rural housing was not regulated (building permits were unnecessary outside city limits), so local administration had a plausible excuse for overlooking what was already becoming quite evident. And the logic probably went: If some farmers want to sell of some strips of agricultural land piecemeal, this can hardly be construed as contravening the subdivision laws, which were meant for modern, proper housing areas (pp 62).

As decades of continue inaction have shown, this leniency of the law has been cause for the mushrooming effect that has taken place in the belt of informal settlements stretching around the fringe of the city. In the early days, it perhaps could have never been foreseen to what a massive scale informal development of Greater Cairo Region could reach.

Fig. 4.4- Informal expansion along the north and south axes of the Ring Road. (Source: Gouda, et al., 2016)

b. The 1970's- 1980's

The Land Reform laws in Egypt continued into the 1970's and 1980's, with a dramatic decree bring issued by the government in 1983 that prohibited construction upon arable lands altogether (Law number 116) and spelled out steep fines for doing so (Gouda et. al, 2016*).* During this same time, the Ring Road was being developed, with the intention to stop growth of Greater Cairo. The Ring Road was originally planned to include a greenbelt and a buffer of 500 meters on either side, should roadway expansions be necessary in the future (Piffero, 2010). Neither planning tactic was fully realized, and the informal settlements in the west of Greater Cairo extended right up the Ring Road and beyond, as can be seen in Figures 4.4 and 4.5.

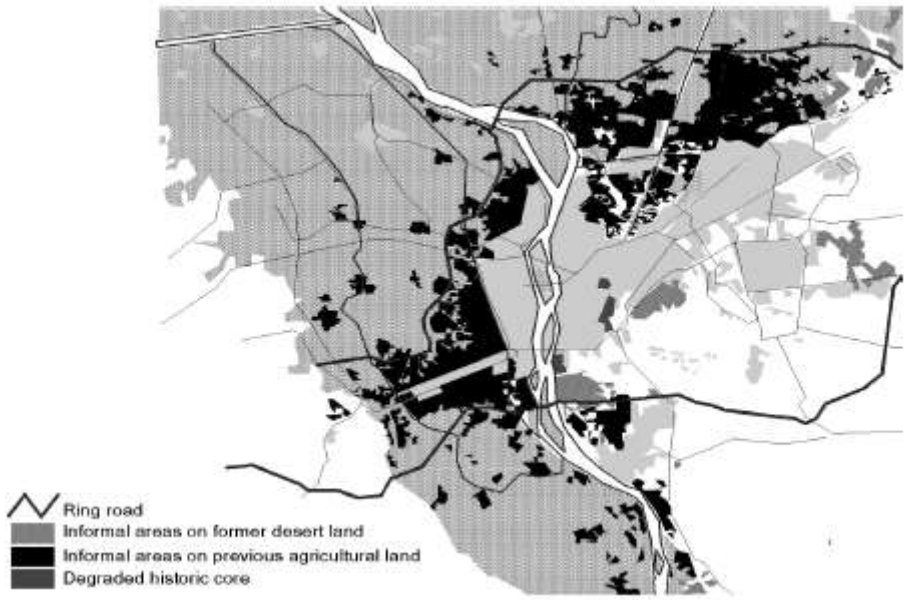


Fig. 4.5- Informal expansion has expanded beyond the Ring Road. (Source: Piffero, 2010)

In fact, the informal building and agricultural land infringements were more present during the decades of the 1970's and 1980's, first in the war years 1967-1975. At this time all formal development in Cairo stopped, but informal Cairo continued to expand to allow for the immigration of over 1 million citizens flowing in from the evacuated Suez Canal zone (Sims, 2010, pp. 64). Aerial footage from 1977 seems to show that fringe plots must have been subdivided and sold during the period, with significant expansion resulting in some of the core villages of Giza, such as Saft-al-Laban, al-Bashtil, Kafr al-Gabal, and even al-Kirdasa (2010).

Table 3.1: Evolution of the population of Greater Cairo and its component parts (1947–2009)

Year	Formal Cairo	Informal Cairo	Peri-urban Cairo (mostly Informal)	Desert Cairo	Total Greater Cairo Region (GCR)	GCR Annual Increase (%)	Percent Informal in Cairo proper	Percent Informal in GCR
1947	2,400,242	0	586,038	0	2,986,280		0.0	10.2
1960	3,905,670	100,000	955,166	0	4,960,836	3.98	2.5	15.6
1976	4,610,326	1,969,000	1,374,317	0	7,953,643	2.99	29.9	38.1
1986	4,650,000	4,248,866	2,063,376	32,615	10,994,857	3.29	47.7	54.5
1996	4,807,632	5,436,477	2,857,468	149,992	13,251,569	1.88	53.1	59.7
2006	5,005,824	6,742,416	3,942,262	601,767	16,292,269	2.09	57.4	62.8
2009*	5,038,763	7,155,106	4,345,567	800,952	17,340,388	2.09	58.7	63.6

Source: Census of Egypt, various years: detailed results, combined with map and satellite image analysis by the author to distinguish informal areas.

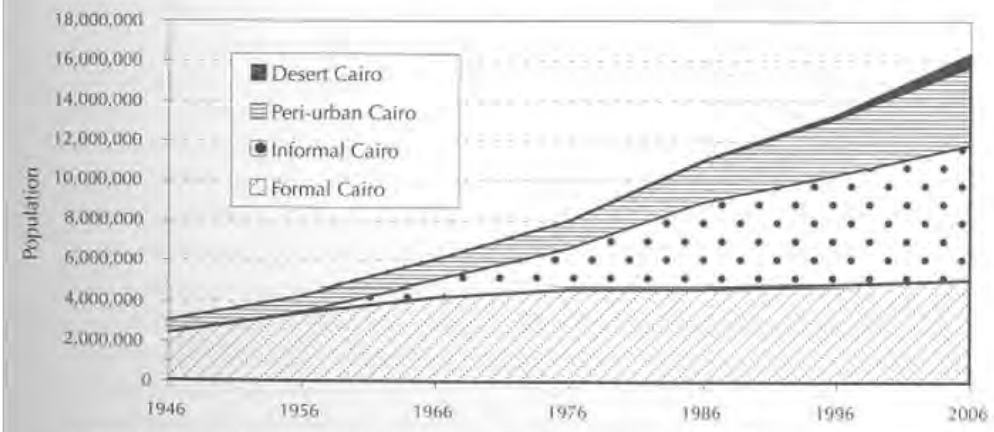


Figure 3.12. Graph showing population growth of component parts of Greater Cairo 1946–2006, based on Table 3.1.

Fig. 4.6- Population has shifted dramatically to Greater Cairo's informal areas. (Source: Sims, 2010)

After the war, Egypt experienced a period of economic growth, and with the oil price hike at the time, neighboring countries were hiring Egyptians to work abroad in various kind of related labor (Sims, 2010, pp. 62). This resulted in a cash boom of expatriate wages flowing back to families in the country, and informal construction reached an all-time high (2010). New buildings and

vertical extensions were added rapidly, since the general choice of investment was in bricks, land, and mortar (2010). Usually, such red-clay bricks were made of topsoil take from local agricultural plots, and is estimated that thousands of feddans were lost to that activity alone (Moneim, 2017). All of this building on the fringe operated in an informal way, with subdivision companies who focused specifically on the parceling out of agricultural land on the fringe areas (Sims, 2010). This piecemeal of arable lands was rampant throughout the 80's, and is estimated in between 1981 and 1988, 340 square kilometer of arable lands were built upon in GCR alone *(Robson et al. 2012).*

Work in agriculture still remained one of the main sectors of Egypt's economy in the 1970's and 80's but as work in rural areas began to dwindle, more migrants from local core villages moved to Cairo's fringe in search of better economic opportunities (Moneim, 2017). However, even greater was the migration from the urban core of Cairo to its fringes. Sims describes this phenomenon as occurring as far back as 1966. A study from 1986-1996 found that all eighteen inner districts of Cairo Governorate has lost over 500,000 Inhabitants, or 20% of their original 1986 population (Sims, 2010), as show in the table and graph in Figure 4.6 and in Figure 4.7 depicting GIS imagery comparing 1986 and 1999. Why? This was due in part the increased commercialization of downtown, where housing costs were rising and older buildings deteriorating. Families sought better accommodation, and new lives in the informal fringe, where prices were better and housing options more varied, all still within reach and connected through transport lines to the city center (2010).

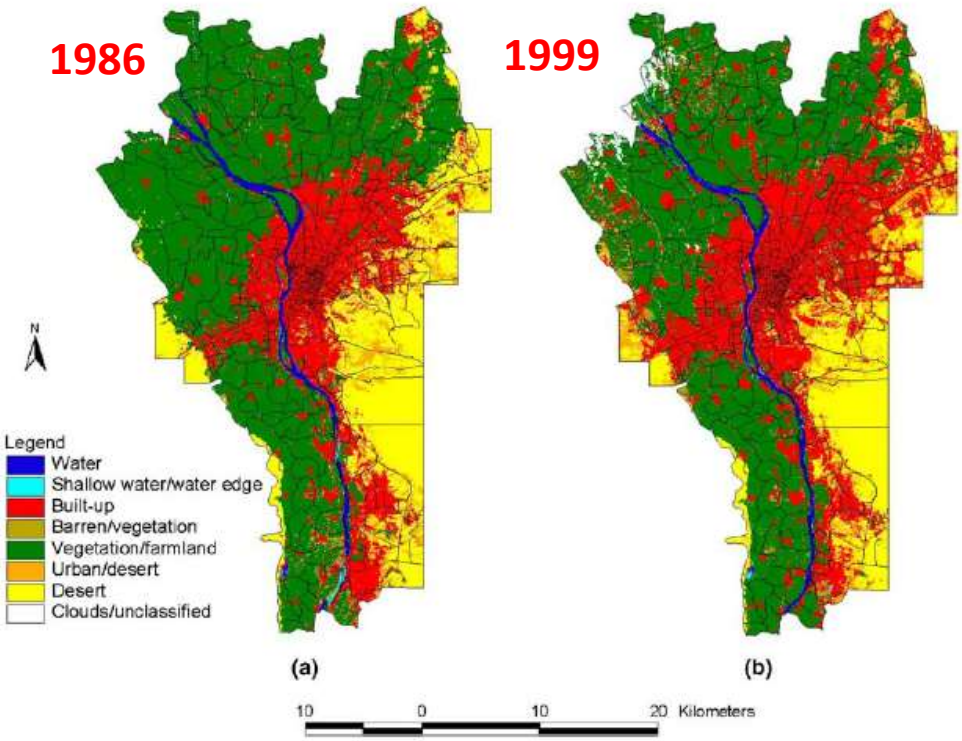


Fig. 4.7- Intensified sprawl on the western fringe over the last few decades. (Source: Yin et al., 2005)

c. The 1990's- 2000's

Since 1990, special focus of Greater Cairo's informal development and subsequent infringement upon peri-urban agricultural land has taken place on the agricultural plain found both to the north and south of Greater Cairo proper, and consists of nine rural administrative *marakiz* of Grater Caro's periphery. In the Qalyubiya Governorate, these include Qalub, al-khanka, Shibin al-Qantir, ad Al-Qanatir al-Khayriya. In this Giza governorate, they are Giza, Imbaba, Usim, Badrashayn, and al-Hawamidiya (Sims, 2010, pp. 70). The things that all these areas have in common that make them attractive for settlement are their flat, irrigated landscape, and relative close range to the city center (a distance of 5km-25km, depending on the district) (2010).

As infractions become more noticeable in the early 90's, the government cracked down once more with two more decrees issued from the Ministry of

Agriculture in 1996. They mandated that any new building on agriculture land would be severely punished through military courts, rather than civil ones, so established landowners and informal "subdivision companies" would not be able to maneuver around the law (Sims, 2010, pp. 72). The result was a halt in new construction for a short time, but an uptick in the amount or bribes an external payment to authorities (2010). Until the new decrees, new tenancies were all but guaranteed for agricultural landowners, but afterward, with the restrictions to build, owners had to hike rental rates for existing tenants, who had to adjust to higher rents or the loss of the land (Hopkins and Saad, 2007).

Fig. 4.8- Infringements on agricultural land increased during the 2011 Revolution. (Source: Serag, 2012)

Yet, though these policy actions did succeed in stifling informal building on peri-urban agricultural land for a time, it did not eliminate it altogether. Indeed, this is far from the truth. According to an article published in 2002 analyzing informal settlement development trends from 1991-1998, it was shown that practically no new areas on virgin land had been created, but instead, there was a present infilling of agricultural pockets between informal buildings, and small additions onto existing settlements (Sims, 2010, pp. 70). This remained the case into the 2000's, though the patterns of development

continued to creep onto the agricultural plain in a "critical mass" fashion, describe in the following section.

The next window of opportunity for informal construction to ramp up again would not open until the Egyptian Revolution of 2011. During this time, many decided to make use of the government's occupation with the protests and arable land infringements increased by up to 630 square kilometers in Greater Cairo Region alone (Alnouby 2013) (Figure 4.8). The current spatial, economic, and governance dynamics of present-day PUA lands in Cairo will be discussed in the next section.

Chapter 5- Current Dynamics of Agricultural Land in Egypt

5.1- Spatial Land Loss Aspects

Egypt's agricultural lands are precious, yet being depleted at an alarming rate. In total, only 7.9 million feddans (3.3 percent of Egypt's land area) is arable land (Kruseman & Vullings 2007*).* In general, agricultural land in GCR is generally owned by private individuals in small holdings, with an average of about 2.5 feddans (approximately 1 hectare) each (2007) and in 2005, the average size of a *muklafa*, or agricultural land holding, was only 0.94 feddans (0.4 hectares), with only 11% of plots larger than 3 feddans (Sims, 2010). In Upper Egypt, *muklafa* are even smaller on average and typically more fragmented. In the Delta region, it is not uncommon for a "village" in the rural parts of to be upwards of 100,000 people. Such fracturing of private agricultural land holdings into pockets is due to previous governmental restrictions on ownership, as well as other incentives, as previously discussed.

Of the total area of the Nile Basin and Delta, about 2,268,000 hectares (5.4 million feddan) are old agricultural lands, and the remaining 1,008,000 hectares (2.4 million feddan) are newly reclaimed lands (El-Nahrwy, 2011). The majority of these "old lands" are owned by small farmers, with the reclaimed lands mostly owned by private corporations or the government (2011). Yet, as private ownership has begun to shrink smaller as lands are subdivided, the incentive to farm has become less and less, at the cost of the health of the land, ecosystem, and Egyptian citizens themselves.

According to the UN Food and Agriculture Organization (FAO), 99% of the cultivated lands are in the Nile Valley and Delta region (2011). In particular, Egypt's Delta region has very rich soils and some of the highest yields per unit of land in the world (Hopkins and Saad, 2007). A recent interview with a Ph.D. researcher from Ain Shams University specializing in agriculture land development in the Delta contextualized the problem:

> The soil in the Delta region is very special. Each 1 meter of soil is 1,000 years old, and once it's built on, it is destroyed. It can never be recovered. If you do that, no one can get punished if it's in the urban boundary, and if it's on the fringe, people won't notice (Moneim, 2017).

Such tricky maneuvering around the Ministry of Agriculture's laws is now commonplace in many of the informal settlements of Cairo. Herein lies a tangled mess of land reform laws, economic losses, and insufficient housing that has led to the present situation: Egypt, a once mighty empire build from the fruits of the earth, to now tarnishing it at the expense of relatively short-term gain through informal real estate investment, with no concrete plan for sustainable agriculture development in sight.

5.2- Social Aspects

The previous sections have sought to provide historical context as to why Greater Cairo Region's peri-urban lands are under such threat of diminishing in the present day. It has been stated that a number of land reform laws, some with stiff penalties, have been enacted to prevent informal expansion. So, the question remains, why risk penalties for building at all? And why is this still occurring at such a rapid rate? Figure 5.1 indicates that peri-urban agriculture lands face pressure for development on all sides, but one of the main reasons for the growing sprawl onto peri-urban areas is due to the array of affordable housing

solutions in the mainly informal housing markets in these areas. As Sims describes, "Development is largely out of site, there is less prohibition on building on agricultural land than along the informal fringes of the core agglomeration of Greater Cairo "(pp. 72).

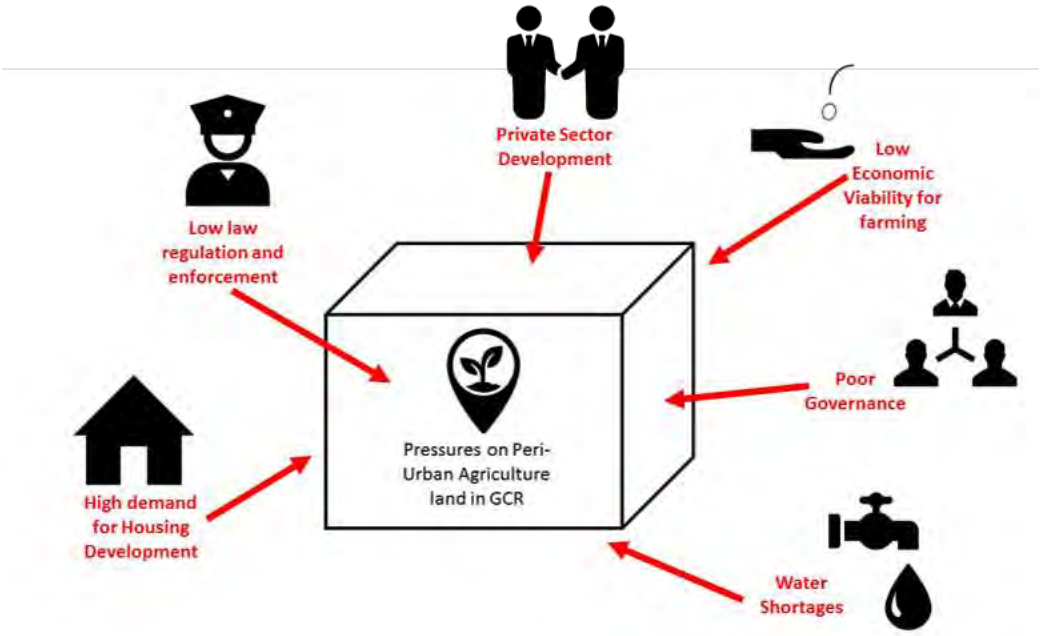


Fig. 5.1- Peri-urban lands face pressures from multiple sides. (Source: Author, 2017)

a. Fragmentation

It is also clear that the driving force behind all this development and subdivision is the historic limiting of private ownership of agricultural land. In 2007, 80% of the landholdings were below 5 feddans and it is estimated that this will continue to shrink further to below 3 feddan by 2025 (Kruseman & Vullings 2007). As indicated in the infographic in Figure 5.2, this diminutive ownership curtails owners from generating any decent income, and the market value of the land multiplies up to eightfold when transformed from agriculture use into building use (Gouda et al, 2016) (Shaalan 2013).

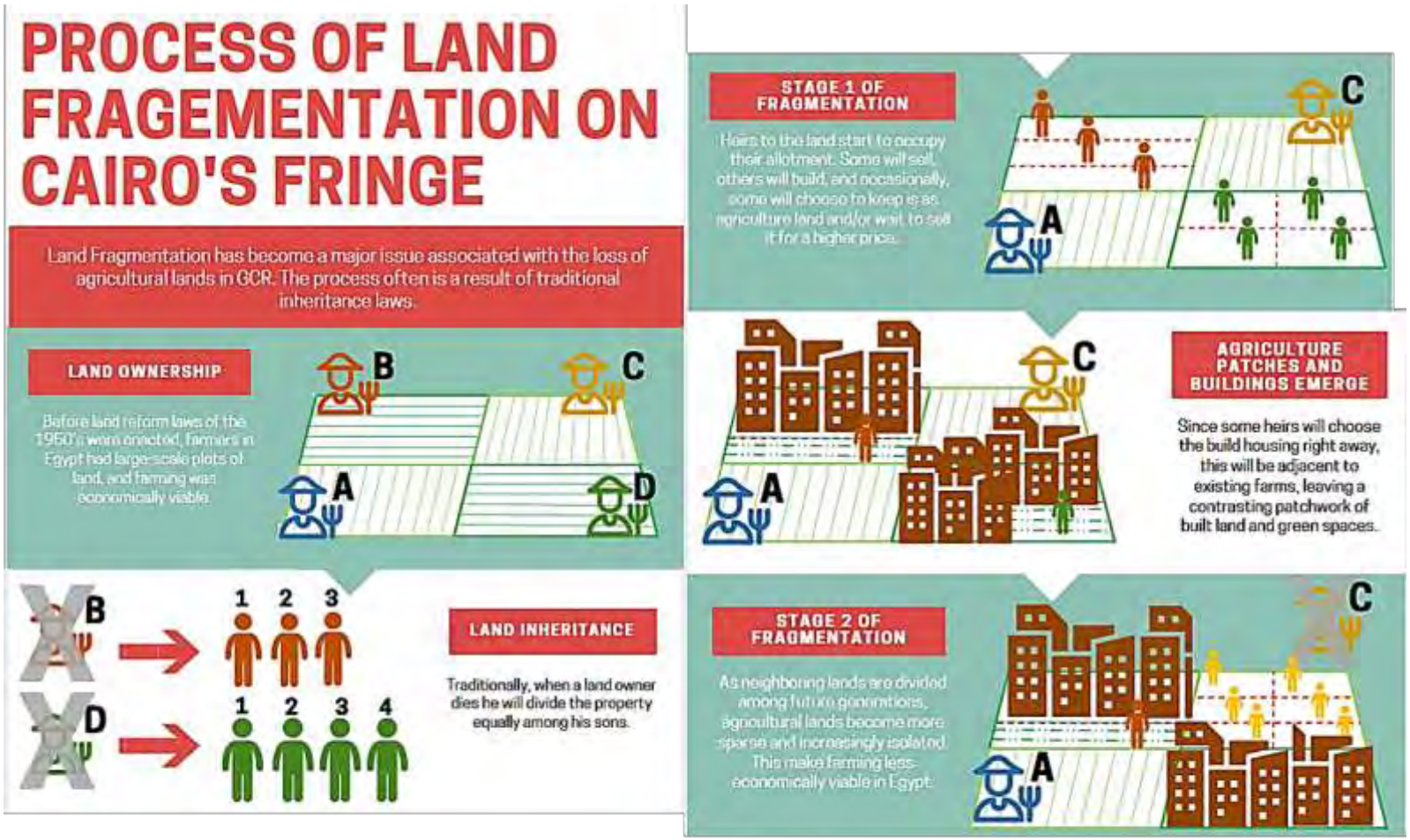


Fig. 5.2- The Process of Land Fragmentation. (Source: Author, 2017)

b. Pioneers and Followers

In the present state of peri-urban agricultural lands in GCR, there have been several noticeable spatial trends tracked over the years to trace and predict how future settlements may spread along the agricultural plain. In general, this is characterized by 'pioneers' and their 'followers' who pop up slowly over time, in areas that are out of site. At first, on a newly purchased agricultural site, housing is built away from main roads and irrigation canals (Moneim, 2017). Several crafty tactics are used, such as building during a week-long holiday or weekends, when government offices are closed, and using that time to start the construction and lay out the foundation (see Figures 5.3 and 5.4) (2017). A secondary step is to construct walls using mud mortar, a cheap alternative minimize losses in case the authorities notice it and mandate it be torn down (Serag, 2012). Once a critical mass of buildings has been established, it is nearly impossible for them to be removed (Abdelhaliem, 2017).

Fig. 5.3- New settlements on agricultural land in GCR follow a 'pioneers and followers' pattern. (Source: Gouda et al., 2016)

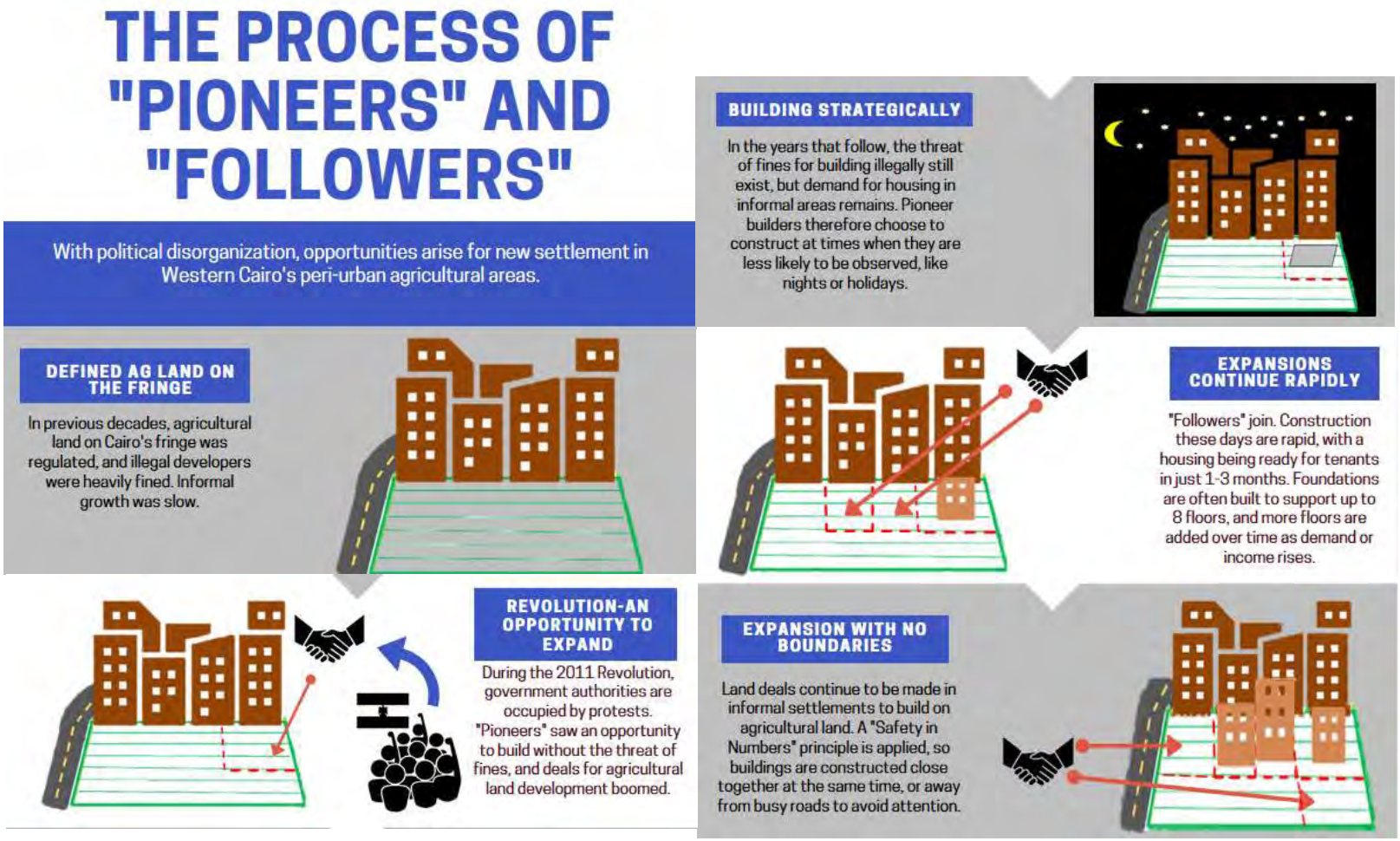


Fig. 5.4- The Process of Pioneers and Followers. (Source: Author, 2017)

Development on the western agricultural plain occurs in a polycentric fashion, with existing towns and villages expanding immensely though informal subdivision into the surround agricultural fields (Sims, 2010). Such patterns of agricultural land are well-suited for development since they contain rectangular plot sizes and existing water sources. In fact, many of the subdivision lines are actually strips of filled-in irrigation channels (Serag, 2012). The lands are so easily convertible; it is little wonder they are such a desirable target for such rapid development. Another issue compounding the problem in some areas of the Delta is the extremely slow bureaucracy of new land use plans and urban boundaries to be approved. According to one researcher interview, in some Delta villages, it has taken almost 10 years from a new urban boundary drawing to be approved. By that time, many residents have already built outside of it already in need of housing, and when it is re-drawn, some agricultural lands automatically get added to have a more uniform shape (Moneim, 2017). This compounded over thirty years' time or more leads to a serious loss.

One tragic occurrence that is also a present pattern concerning such land development are the farmer's intentional neglect of the land. The clay and silt soil of the Delta and Nile Valley are very sensitive, and if cultivation is stopped for a period of 5-6 year continuously, the quality of the soil will deteriorate immensely (El-Nahrawy, 2011) (Abdelhaliem, 2017). In the recent past, doing so would allow for the Ministry of Agriculture to designate a "poor" classification of the once cultivated land, and allow the farmer the opportunity to construct buildings legally. However, in recent years, the Ministry has caught onto this scheme, and can now punish people for intentionally neglecting the agricultural land (2017). One of the only exceptions to this is if the agricultural land enclosed by building spaces, and irrigation cannot be reached (Serag, 2016) (Moneim, 2017). There are even observations of this recent phenomena to suggest that farmers may act as an accomplice with their settlement-building neighbors to intentional cut off the water supply and let building be established and lived-in, so that by the time the Ministry notices, it would be too late (2017).

c. Infilling Pockets

The environmental consequences of such habitat fragmentation are real. As indicated in the infographic in Figure 5.5 there exists such a desperation for lands, that neighbors of a settlement may collaborate to suffocate out any remaining agricultural pockets by building around them. This phenomenon can be described as "infilling" and it results in habitat fragmentation, which results in smaller, more numerous green pockets. While agriculture lands are man-made constructed habitats, it cannot be ignored that they still help support life, and it has been studied that the altered size and edges of the patches "can affect the resource availability and competition of species" (Niemelä, 2010, pp. 151). Richter (2011) notes that urban growth can often times negatively affect connectivity by limiting the movement of organisms and resources and "indirectly by changing the biophysical patterns and processes" (pp. 23).

Perhaps one of the most detrimental environmental effects caused by urbanization and fragmentation is the subsequent surface sealing caused by paving, asphalt, and concrete. Such actions cut of natural soils from performing their exchange of substances between spheres such as water or carbon), and alter natural processes and characteristics, such as contaminant storage and transfer functions (Niemelä, 2010, pp. 31). As mentioned prior, the effects of surface sealing on rich soils such as those found in the Delta are nearly irreversible, so it behooves governing bodies to think more deeply about their value and future sustainability.

Fig. 5.5- The Infilling Strategy. (Source: Author, 2017)

5.3- **Overview of PUA and Cairo's Agri**-Economy

a. Agri-Economics of Egypt

Related to the current discussion of spatial dynamics in Cairo's peri-urban lands is the topic of economic resilient from within its agricultural sector. Egypt has had a dwindling agricultural sector in the past few decades. Despite the vast amount of agriculture land still existing in the region, the job market in the agricultural sector is almost fully saturated. Though it accounts for 29% of Egypt's total labor force, demand for agriculture labor accounted for only 5% of total national demand for labor in the years 2001-2005 (Sims, 2010).

Food in Egypt is distributed in market networks composed of small-scale traders purchase food crops and trade them into the urban areas. There is a plethora of small units, although a few large-scale trading companies operate (Hopkins and Saad, 2007). Overall, the gaps in the distribution chain leave farmers with little to no room for price negotiation for their products (Moneim, 2017). Co-ops among farmers do exist, though their presence has been slow to start and difficult to replicate on a large scale from where it has been more successfully initiated in predominantly tribal communities (2017) (UNFAO, 2017). Overall, the management of food distribution systems in largely monopolized by large industry, adding insult to injury on small farmers and adding to their reasons for continuously illegal subdividing their land on the fringe of Cairo.

The sale of agricultural land parcel is a simple transaction between a farmer-owner and purchaser, and is largely based on community trust. A local *simsar* or real estate broker may be involved, or a local sheik to regulate the process (Sims, 2010). The practice of informal land sales has been previously covered. While it is also possible to buy agricultural land legally in Egypt, the present state of fragmented ownership of plots make it difficult to consolidate a large plot of agricultural land as existed in the past (Moneim, 2017). In addition, the number of urban barriers existing now in the western fringe of Greater Cairo

region make sharing agricultural resources between each plot, such as joint irrigation, nearly impossible (2017).

b. Potential for Local Economic Development

Despite this current situation, it should be stated that the preservation of peri-urban agricultural lands in GCR is a worthwhile endeavor to lead to increased food security and ultimately more local economic development opportunities. Aside from the fact that the lands provide value through the discussed ecosystem service, studies have shown that in other developing parts of the world, and the MENA region, green spaces has the potential to sustain livelihoods, even in small plot sizes. A 2007 report from the UNFAO entitled "Profitability and sustainability of urban and peri-urban agriculture" noted how urban and peri-urban agriculture activities are increasingly being viewed as an integral part of sustainable urban development, and they "must be understood as a permanent and dynamic part of the urban socio-economic and ecological system" (van Veenhuizen, Danso, 2007, pp. 12). Perhaps most importantly, the report provides tangible evidence that urban and peri-urban farmers play an important role in LED, through first-hand production, employment and income generation, and enterprise development.

Most studies about the advantages and economic profitability of urban and peri-urban agriculture refer only to the household level, since that data is usually more obtainable. The FAO report suggest that not only may the activities be profitable from direct sale, but that they also make have a comparative advantage to produce crops that are perishable and in high demand over rural producers, as they are close to market (van Veenhuizen, Danso, 2007). Another study from Nabulo *et al., (*2004) indicated that "improved access to food and additional income positively affects the capacity of the urban poor to work and invest, taking up other jobs or micro-enterprises" (pp. 40). This is indicated in Figure 5.6, showing LED value-chain development, which should be considered as a strategy for PUA in informal areas.

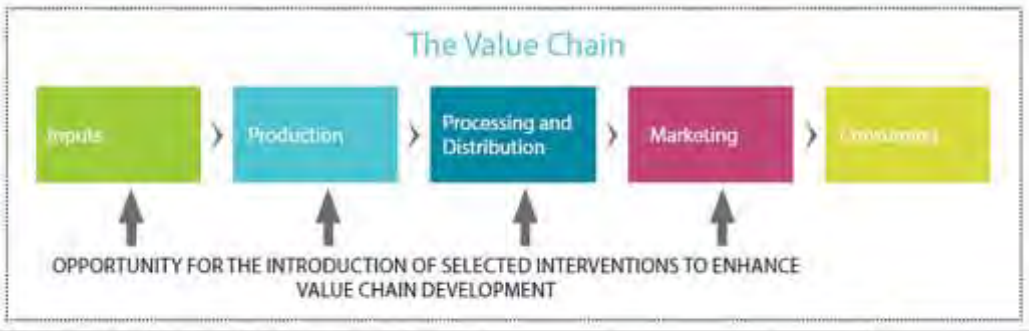


Fig. 5.6- The LED value chain. (Source: Treller, 2014)

Though city-level impact studies are lacking, one research completed in Dar es Salaam, Tanzania in 1994 found that urban and peri-urban agriculture activities were the city's second largest employer (Mougeot, 1999) (van Veenhuizen, Danso, 2007). It was calculated in a later study that urban and peri-urban agriculture enterprises had a value of over $27.4 million annually with a value-added amount of $11.1, (Sawio, 1998). Such numbers can be taken as evidence that PUA lands in Cairo also have untapped economic potential.

5.4. Governance Aspects

In general, the main bodies responsible for all management of agricultural activities in the region are the Ministry of Agriculture and the Ministry of Irrigation. The two often have overlapping programs or services, but do not work with each other (Moneim, 2017). The Ministry of Agriculture is a massive conglomerate of Egypt's extremely centralized government, and while they do spend 528.4 million USD on agricultural research and development each year (as of 2011), and have 50 agencies conducting research on agricultural activities (the second highest in the MENA region after Turkey), over 90% of total agriculture-related spending is allocated to salary-related expenses, leaving limited resources to fund the costs of conducting research and maintaining and upgrading research and development equipment and infrastructure (Stads, 2015). In general, corruption on the Ministry level seems very apparent.

According to discussions with several relevant stakeholders affiliated with the issue of urban development near informal settlements, preservation or action to prevent further loss of agricultural lands in the Greater Cairo Region is not a high priority. One representative from the GIZ (Germany's largest international development agency) indicated that open spaces and parks were part of development plans in informal settlements, but these did not include agricultural lands (Abdelaziz, 2017). Another representative from the UNFAO blatantly stated in one interview that their organization is not allowed to take efforts to prevent the loss of agricultural land, though it is familiar with the problem, since it would act out of its mandate with the Ministry (Yacoub, 2017).

Perhaps most surprisingly, the GOPP (General Organization of Physical Planning), the Ministry responsible for essentially all urban development plan in Egypt, also has no concrete plan of action to address the issue, other than to possibly try to increase the amount of greenspace in Cairo city to a ratio of 20 square meters per person (Moneim, 2017). Yet, this has little to do with the fringe areas and certainly would be used for more aesthetics rather than farming, if such a dream were even possible.

Other related Ministry-level entities include the Egyptian Environmental Affairs Agency (EEAA), yet even with their role of being the centralized body leading the implementation of the UN's Sustainable Development Goals (SDGs), their knowledge and capacity to intervene on the issue of agricultural land encroachment is non-existent. Embedded in the organization is the mission to improve and protect environmental quality in Egypt, but on matters of agriculture, their influence only extends so far. When questioned on the subject of how the conditions of informal settlements in Cairo may be negatively impacting the environment, the interviewee acknowledged the EEAA's involvement in some waste-related projects, but reiterated their role was more to "build capacity," "build institutional frameworks" and "facilitate working groups," with no mention of enforcement (Saleh, 2017, pp. 1-6).

Though the Ministry of Agriculture and Land Reclamation itself is part of a larger conglomeration of ministries and stakeholders who produced Egypt's

Sustainability Plan 2030, the plan does little to offer any plan for curbing the problem at all, other than "integrated policies and programs" and "future scenarios" should be developed, without offering any concrete notion of what those things may be (Salem, 2017). The language of the report has so little binding to it, though it does admit that there is "common agreement that fragmentation of land holdings impedes agricultural development" (pp. 6). Perhaps most shocking is that the report's own mission statement reads: **"**Modernizing Egyptian agriculture based on achieving food security and improving the livelihood of the rural inhabitants, through the efficient use of development resources, utilization of geopolitical and environmental comparative advantages of the different agro-ecological regions" and makes no mention of improving urban livelihoods at all (page 9).

A closer examination of the Ministry of Agriculture and Land Reclamation's Sustainable Agricultural Development Strategy towards 2030 indicates that the problem of land encroachment is acknowledged, but in a "hands off" way. It states:

> Agricultural land in the Delta and the Nile valley regions suffers from two important problems, continued encroachment on agricultural land diverting it from agricultural to non-agricultural uses at an annual rate of 20,000 feddans, and continued degradation of soil fertility in so many agricultural areas. To assess these problems would require undertaking periodical soil surveys as a basis to establish fertilizer rates, continued restoration and maintenance of agricultural drainage systems, as well as for installing new drainage systems where needed (pp. 21).

Soil assessment are valuable techniques, but can hardly be considered adequate to prevent illegal construction and subsequent destruction of valuable

agricultural land. The report later goes on to reiterate that "Egypt has applied a law to protect agricultural land during the last 20 years. There is a general agreement that this law should be applied strictly" (Ministry of Agriculture and Land Reclamation, 2009, pp. 42) but defends is off-handed actions by suggestion that incriminating people is not stopping the development from happening. Their solution is therefore to have "comprehensive housing planning for Egyptian villages, and linking the policy for protecting agricultural land with the policy for the distribution of newly reclaimed areas (pp. 42). What this means for people living in informal settlements is open-ended, since neither housing nor reclaimed desert areas to be farm are distributed freely.

Overall, the document is thorough in its presentation of anticipated goals and measures for the next decades. At is time of publication in 2009, much of this progress may have been possible, but with an economic slump following the years post 2011 Revolution and slew of associated political disorganization, it is very probable many such objectives will not be reached by 2030. One of the vows it makes is to protect agricultural land policy by doing "Periodical monitoring of law enforcement, including use of aerial photography" but it seems that in recent years, these efforts may have been abandoned. A quick look on Google earth from any casual observer shows the land are being encroached upon at a rapid rate, and without even a mention of the peri-urban lands around Cairo, their future is most certainly urban.

A separate, interior report produced by a researcher at the Agricultural Research Center (ARC) entitled "Farmland infringement and its impact on food security in Egypt" was published in 2012 did what higher levels of the Ministry would not: unearth the fact that loss of agriculture land has immediate ties to food security, and is result in real loss of commodities that is impacting Egypt negatively in an economic sense. The report elaborates that the intentional construction on agricultural land and land left fallow by its owners both are contributing to extreme loss of arable land in Egypt, which at the time of the report was about 658.7 thousand feddans (Ali, 2012, pp. 16). According to the researchers, this is resulting in an astounding average loss of income from

agriculture of about 17.6 billion EGP per year, with declining yields in essential crops (pp. 16). The report also re-iterated the Ministry's plans to link development of new villages with opportunities to farm on reclaimed land as a measure to deter people from building illegally, and the study itself recommends increasing the violation fine to 200 times the rental price one feddan, but such suggestions seem to have fallen on deaf ears (pp. 16).

a. The Private Sector

In terms of the private sector, the loss of agricultural land has been on little concern. Indeed, from field study investigations, it would appear the Ministry of Agricultural and Land Reclamation is doing as much as possible to entice business owners to focus their efforts away from the Nile Valley and steer them to work on reclamation projects in the desert instead. One such company, East Owainat Agricultural Development, is a collective of companies who was 50,000 feddans (nearly twice the size of the Giza governorate) in southern Egypt, close to the Sudanese border for a cheap price (Mohamed, 2017, pp. 1-5). When asked about knowledge sharing or implementation of sustainable agriculture practices, the interviewee insisted there was no oversight, and all of the water was "sustainable" as an underground aquifer, but they just had to drill for it (Mohamed, 2017, pp. 5). Such business practices, if they are to cause a paradigm shift for a new form of "desert agriculture" in Egypt's future, may not only cause harm to the country's vital water resources, but will continue to drive economic opportunities in agriculture further away from the urbanizing areas where they are most needed, to places where they are unreachable for most residents.

b. Consultants and NGOs

The most prominent stakeholder focusing on food security and related issues in Egypt is most certainly the UN Food and Agriculture Organization (UNFAO). The FAO works hand in hand with the government, and programs are based on priorities and needs that are defined by the government. They work mainly with a CPF (Country Program Framework), considered as a 4-5-year

contract with the government of a country that lists the major priorities and steers how current programs will run. In Egypt, they are currently renewing the program (Yacoub, 2017, pp. 1). While the UNFAO in Egypt's leadership has resulted in what appears to be robust consortium of high-level involved stakeholders discussing solutions for pressing food policy issues (the Ministry of Environment, the Ministry of Irrigation, Agricultural research faculties, Agricultural Cooperatives, and the private sector are all involved), it would seem that CFP grants them little muscle to actually advise on problems, like agricultural land encroachment, that are not considered by the government to be a high-priority issue (Yacoub, 2017, pp. 1). As Dr. Mohamed Yacoub, FAO Assistant Representative in Egypt put it "We are not a donor. We exist to provide technical assistance" (pp. 1).

A secondary but relevant development agency, the GIZ, focuses mainly on participatory development of informal settlements, though its tactics are more holistic in nature and have less influence on the centralized government level. In terms of agriculture land loss, they acknowledge the issue, and one representative commented: "Why the people are still building on agriculture land? It is still more cheap than getting a home … if they are not affording this housing, definitely they will build illegally, even on agricultural land or in the desert" (Abdelaziz, 2017, pp. 10). GIZ does focus on improving the livelihoods of Cairo's most vulnerable fringe population through a variety of programs, capacity training and other means, but this does not involve stepping in for enforcement, nor does it currently feature any work affiliated with bodies such as the Ministry of Agriculture and Land Reclamation. It is, however, starting to put into practice planning for resiliency, but mainly in the area of climate change only, and the program is still in developmental stages. Figure 5.7 reflects some of the interlinkages among primary stakeholders related to PUA issues.

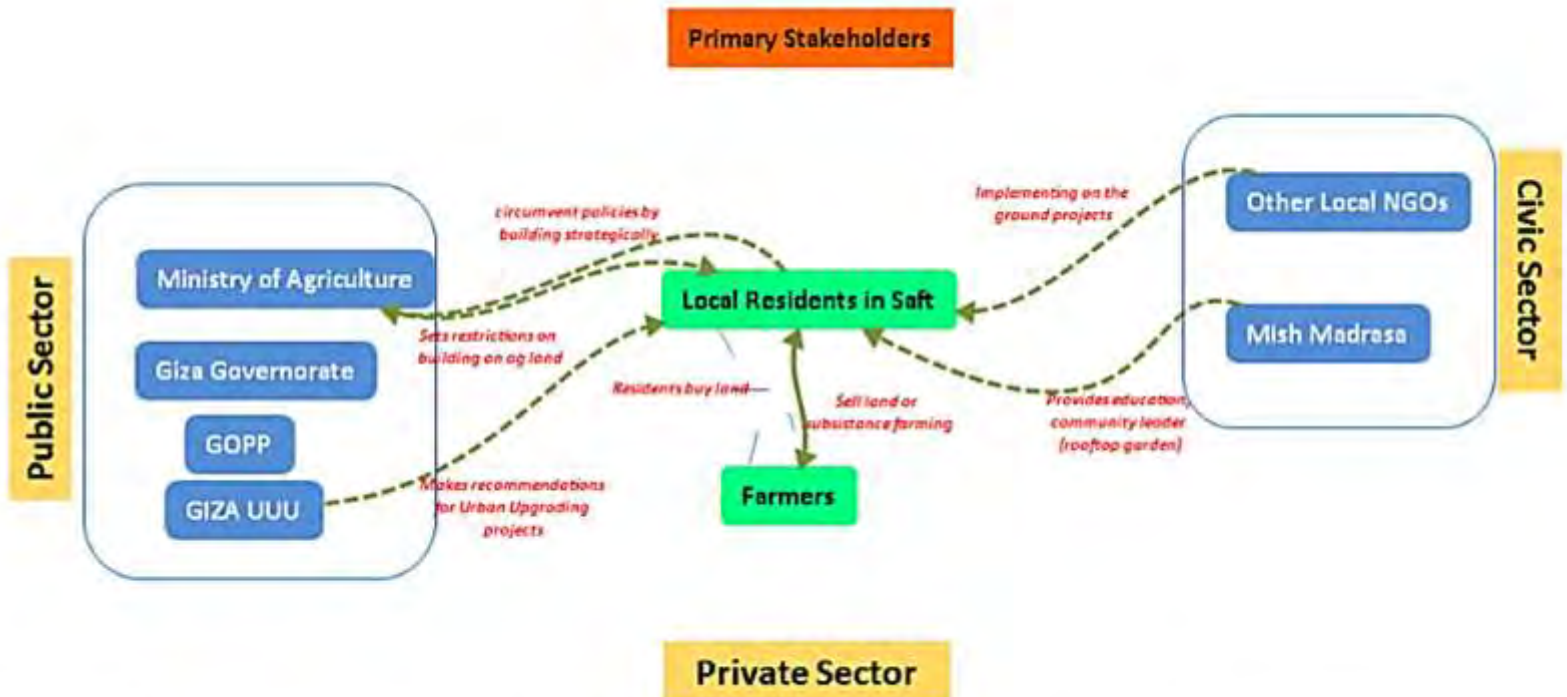


Fig. 5.7- A schematic showing the interlinkages of primary stakeholders. (Source: Author, 2017)

Despite these cool attitudes towards the need for any intervention to curb expansion on agricultural land through planning, other independent researchers are well aware of the threat that the loss of agricultural land poses and are actively working to suggest interventions to the higher levels. One independent researcher, based at AUC, actively is making recommendations for policies for local development in informal areas and encourages changing vague governmental strategies into actions. When interviewed, he voiced the opinion that "the strategic urban plan of the city needs to consider agriculture as one of local economic activities" and that there was a "need to change the planning norms" in Greater Cairo region (Abdelhaliem, 2017, pp. 4). Another PhD researcher based at Ain Shams university describes the situation of easing government policies and continued building activities as a "cat and mouse game" and believes that the government's current relaxed policies are always subject to the will of the citizens. He says "You pass a number of regulation, and we decide whether we have to comply or we have to find a way around it" (Moneim, 2017, pp. 9-15).

Greater Cairo Region's per-urban agriculture lands are controversial, multi-dimensional parts of the urban fabric that have been subject to rapid spatial and social dynamic changes. However, considering an alternate picture of their economic worth, as well as improved governance and management is key in ensuring their survival. In order to ground the discovered spatial, social, economic, and governance aspects into reality, a case study in GCR was selected. The details of this study will be uncovered in the following chapter.

Chapter 6- The Selected Case of Saft al-Laban

6.1-The Context of Saft al-Laban

a. Relative Location of Saft al-Laban

Saft al Laban is a district on the western fringe of Giza, adjacent to the Ring Road on its west, Kafr Tuhurmis to the South, Bolouq ad Dakrour to the east, and Zinayn to the north. Al Dokki in the formal part of Giza can be easily reached by car in about 15 minutes using the Saft al Laban Corridor elevated highway. The relative location can be seen in Figure 6.1. This particular district was chosen due to its interesting development patterns over time. If one looks at a satellite imagery, as seen in Figure 6.2, the green space on the western part of Saft al Laban seems to be shrinking and eaten up by it and the opposite district in the west, Kirdasa. The district of Saft al Laban also matches the area of interest as one of the informal fringe areas where the informal expansion is very dominant. The neighboring Ring Road an extremely close proximity to formal areas of Giza, coupled with the fact that very little research has been done in the areas are also added elements of interest that the researcher felt worthy of further analysis.

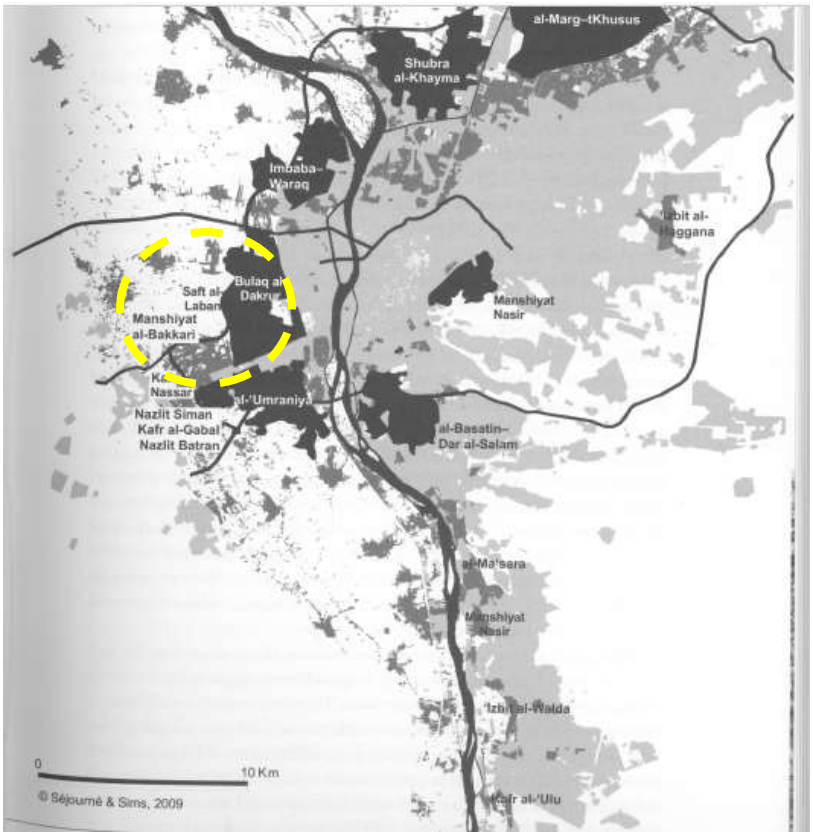


Fig. 6.1- The detailed contextualization of western fringe areas. (Source: Sims, 2010)

Fig. 6.2- The pockets surrounding Saft al Laban. (Source: Google Earth, 2017)

i. Site Selection

Due to the complex nature of resilience and the researcher's unfamiliarity with the fringe areas of Giza, it was vital to select a site among Giza's informal settlements in order to root the phenomena of informal settlement expansion onto agricultural land into a real-world setting. The background and historical overview of Saft al Laban has been described in the previous section, but the justification for choosing the site was due to its proximity to the Ring Road and its juxtaposition to remaining agricultural pockets in the west of Giza. The researcher viewed satellite imagery of Saft al Laban dating back into the 1970's, and due to its rapid rate of change, it matched very well as the expansion phenomena that has been observed as a general regional trend.

After a district-sized site was selected, it was also necessary to select a more zoomed-in neighborhood-scale area to make the asset mapping and informal interview sampling area more feasible. A cross section of Saft al Laban's most western wedge, where it meets the Ring Road and is currently expanding beyond was chosen, since this area represented the true fringe; a stark contrast between open green land a densely urban, surrounded by a major urban infrastructure. It was the opinion of the researcher that surveying residents in this area would yield the most accurate account of the phenomena relating to the loss of agriculture land due to urban expansion since it was happing in their own back yard. Maps of the random sampling areas were printed, though this was more to provide as much detailed imagery of assets in the area rather than to be used as a strict survey route.

b. Historical Overview

With a name that translates from Arabic to mean "Saffron of Milk" its name does invite romantic notions of green pastures and cattle due to its historic agriculture heritage. Yet, little concrete research has been done in the area, which makes finding basic data, such as population of the district, nearly impossible. Estimates range from 180,000 inhabitants according to the 2012 book "Understanding Cairo" (Sims, 2012, pp.129) to 500,000 according to local

residents themselves (Estrada, 2017). Via satellite imagery, it would appear the district is around 180 hectares, but this is also a difficult number to pinpoint, since the fringe of the area is constantly expanding. According to some local residents, Saft al Laban has been steadily urbanizing for about the past 15-25 years, and in the past, was previously only occupied by 7-8 large families (Wafa, 2017) Now, due to high demand for housing and relatively cheap land and rental prices, many outsiders moved into the area, contributing to its rapid urbanization (pp.2)

6.2- Case Study Methodology

As covered in Chapter 1, this research consists of two key questions to be addressed*:* 1) How does peri-urban agriculture support socio-ecological resilience in an urban area?; 2) In which ways can peri-urban agriculture activities support local economic development in GCR? During the data collection period, the selected research methodology was decided upon in order to answer key question 1 and data collected during this process would be used to answer key question 2, since it was determined that knowledge obtained would help inform decisions of strategies for resilient PUA and how it could be applied to the Greater Cairo Region.

a. Field Survey

The main research methodology used to address answering the key research questions about the resilience of PUA and how its associated activities could potentially help support local economic development was devised in a multi-stage field survey that consisted of the following: Informal interviews, informal conversation and first-hand observations, a formal focus group discussion, and formal interviews with stakeholders. The field survey was conducted in a two-week research trip to Cairo in April 2017, and all data was collected first-hand by the researcher.

i. Survey interviews

Informal interviews were conducted in the selected neighborhood site over the course of two consecutive weeks. Prior research indicates that estimates of Saft al Laban's population vary greatly, so it was implausible to achieve a 10% sample size. Therefore, a target sample of a minimum 30 survey participants was set, in order to reach a thorough, qualitative random sample of residents in the target area. In total, 39 residents participated in the survey, and it is the opinion of the researcher that such a number was sufficient to observe patterns in responses and reach a saturation point.

Interview participants were questioned from a standardized 39-question survey that posed questions related to land ownership, economic status, local infrastructure, food security, and relationship to local ecology. The survey was translated into Arabic, and a full version can be found in Appendix 1. Site visits to Saft al Laban to conduct the random sampling took place at various times of day and varying days of the week to try to achieve variety in the people sampled. The researcher always went into the field with a male translator, who was native speaker of the Egyptian Arabic dialect. Working as a pair, the interpreter would read off the list of questions on the survey and the participant responded verbally. The interpreter would then translate the speech into English, and the researcher would mark down the applicable answer to the question, to take additional notes as needed.

ii. Informal Conversations and Observations

On several occurrence during the field survey in Saft al Laban, residents did not want to participate in a full survey, but were eager to engage with the researcher and her interpreter in conversation. When this occurred, the researcher would take notes and answer questions posed by the resident about their interest in the area. Some of these occurrences happened in a larger group of 3-10 people, and in these circumstances, the researcher used the opportunity to ask open-ended questions from the survey to collect some information from the group.

During every visit, the researcher took the opportunity to take notes about the observable activities and behaviors in the neighborhood, in order to compare how they varied at different times of day, as well as to take pictures of the surroundings. Any noteworthy observations that took place at the time of an informal interview were also added to that particular survey.

iii. Focus Group Discussion

On April 9, 2017, a focus group discussion was held with 9 community members at the Mish Madrasa classroom to discuss community assets and resilience, with the purpose of gaining a better understanding about Saft al Laban's socio-ecological resilience status as a community. This event was structured in loose accordance with recommendations made in a 2009 publication entitled the Community Resilience Toolkit (Bay Localize, 2009) which provided examples of structured activities for community groups to extract information useful in resiliency planning. Particular activities from the toolkit were chosen by the facilitator to best fit the information needed in a realistic time frame and capacity for the group from Saft al Laban. The focus group discussion was divided into four parts that consisted of the following: Asset Mapping for local infrastructure and services; Open Discussion about assets and resilience; Evaluation of the community by sector; and a Closing Thoughts dialogue with the opportunity for participants to ask questions. The beginning also included a short introduction to the researcher and the reasons for her interest in the Saft al Laban community. The discussion was held in the Saft al Laban community at the office of Mish Madrasa, a local education-focused NGO, and lasted for a duration of 1.5 hours. Photo documentation for the focus group discussion event can be found in Appendix 4.

During the Asset Mapping activity, the group was split into three smaller group. An asset was loosely defined for the group as "any useful or valuable thing in the community." Each group was given a map of the neighborhood focus area (found Figure in 6.3) and asked to map either 1. Physical Assets (defined as elements of the natural environment such as land and water,

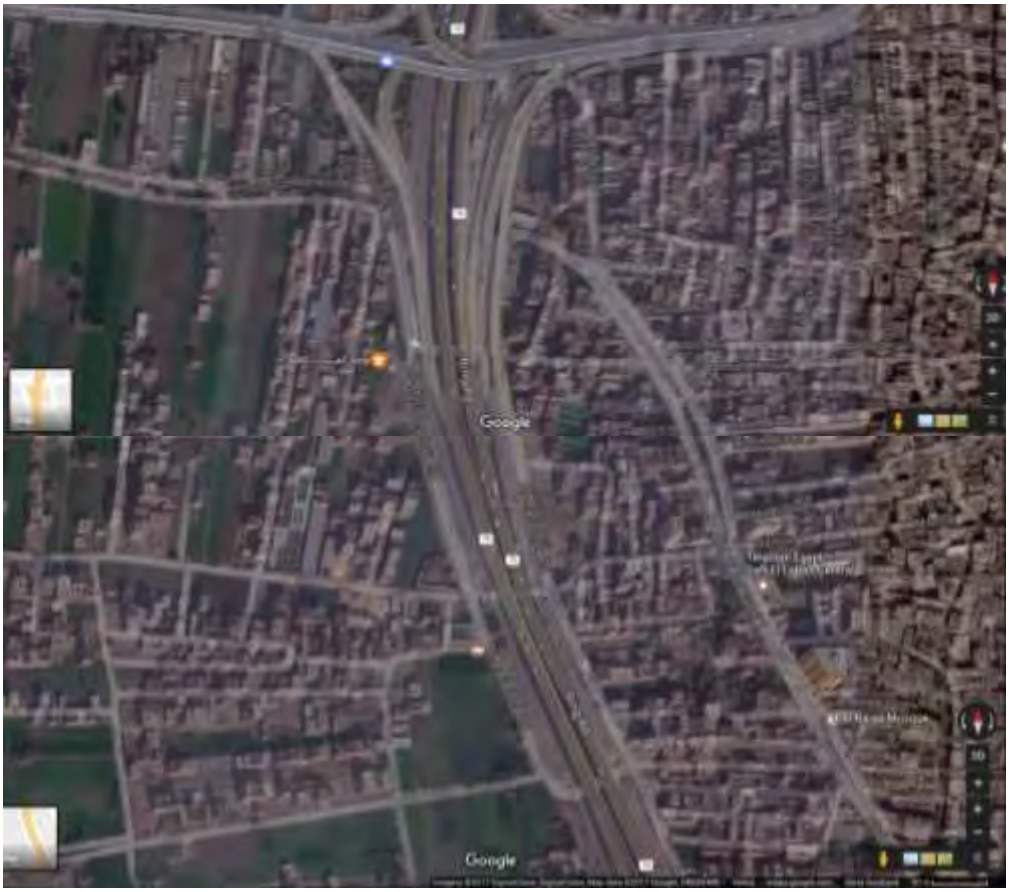


Fig. 6.3- The neighborhood-scale focus area. (Source: Google Earth,

infrastructure such as roads and buildings, and other physical objects) (Bay Localize, 2009, pp. 12); 2. Institutional Assets (defined as organizations or paid groups of people who structurally organized the community, such as local businesses, government agencies, utilities, schools, hospitals, universities, or organized religions) (pp. 11); and 3. Social Assets, which consist of associations, or groups of people working with a common interest, such as volunteers, sports clubs, NGOs or neighborhood associations (pp. 11). Groups were given small pictogram cut outs representing applicable assets for their assigned category (i.e., an icon of a mosque representing a religious institution) and were 30 minutes to collaborate and place the assets on the map for their assigned category.

Afterwards, the maps were shared briefly with the group as a whole. The three Asset Maps can be found in Appendix 2.

The Open Discussion about resilience activity consisted of again breaking the group of 9 into three smaller groups, though this time with different partners. Each group was given markers and paper and one of the following statement to consider: Group 1: a challenging situation one person in your community might face; Group 2: a challenging situation your community might face as a whole; Group 3: a challenging situation your region (Greater Cairo Region) might face as a whole. Participants discussed with one another for a period of 5 minutes before writing down their answers and sharing with the group as a whole. This was then translated to the facilitator from Arabic into English, who wrote down all the answers from each group.

In the Community Resilience Evaluation by Sector activity, participants were asked to rate different aspects of resilience in a variety of sectors. Participants were read a variety of statements dealing with Ownership, Sustainability, Quality, and Equity associated with the following sectors in their community: Social Services and Civic Preparedness, Local Jobs and Economy, Local Food Systems, Local Water Systems, Local Energy Systems, and Local Transportation in housing. An example of a transcript of the read statements can be found in Appendix 3. In the first part of the exercise, participants were asked to rank the current status of their neighborhood on a scale of 0 to 4, specifying how well they felt the Saft al Laban community met the resilience criteria listed. The scale consisted of: 4 = Very well (close to 100% of the time); 3 = Fairly well (most of the time); 2 = Sometimes (about half of the time); 1 = Poorly (only part of the time); and 0 = Hardly ever (almost 0% of the time). Participants were asked to give their best guess based on the information they have now and their own opinion, and were also asked to consider all members of the community when rating, including those of different ethnicities, languages, ages, incomes, physical abilities, and immigration status.

iv. Formal Interviews with Stakeholders

To understand the complexity of the problem being researched required also unravelling its social structures and related governing roles of various actors. To accomplish this, formal interview sessions were conducted with local, organizational, and ministry level officials. Duration for each interviewed varied depending on the interviewee's availability, and all but one interviewee permitted recording of the interview. Interview questions were not standardized, but rather were tailored for the position of the person being interviewed in order to collect more in-depth information about their particular knowledge about the research subject. After the field survey period was ended, recordings of each interview were transcribed. An example of one such interview transcription which can be found in Appendix 11.

b. Potential Limitations

Though the researcher made efforts to organize the data collection with as little error as possible, of course some circumstances occurred that were out of the immediate control of the researcher. These occurred mainly in the informal interview stage and focus group discussion parts of the field survey.

During the informal interviews, all of the data collection was done via interpretation, so it is probable elements were lost in translation. Additionally, respondents of the survey were mainly the people who were openly out on the street or in front of their homes, excluding the people who may tend to stay inside more often. The informal interviews were originally intended to be conducted in the same way, however, it became clear that due to the lack of capacity for the researcher and one interpreter acting solely, it would not be possible to reach the target number of participants. Therefore, the community partner, Mish Madrasa, offered help by distributing blank copies of the survey to its students and have them assist in collecting responses from people they knew in the neighborhood. In total, returned surveys from this group accounted for around 1/3 of the total completed surveys. Due to this difference in the way the survey questions were delivered (in person one-on-one vs. some handed to an individual to fill out themselves) there may be some discrepancies in the responses. Another potential

flaw may have occurred after the first day in the field, when it was determined that there were some grammatical and formatting errors on the Arabic version of the survey that had been given to some people. These corrections were quickly made the next day, and a revised version was printed out for future field visits.

Other potential research flaws may have occurred during the focus group discussion. To begin with, the participants were mostly male, with only one female, who left early to take a telephone call but did not return. Age variation was also an issue, with only three participants from age brackets older than 25, and an additional two participants from this age group also left the discussion early. As with the survey and informal interviews, all statements were being translated to the facilitator from Arabic to English, and it is likely some content was lost in the oversimplification of the participant's statements.

Simultaneously, the selected interpreter was participating in the discussion in addition to being the head of the non-profit, Mish Madrasa. It is very possible his views may have influenced others due to this host status. During the asset mapping portion of the discussion, some maps displayed may have included an area unfamiliar to some of the participants, who therefore may not be able to fully map all applicable assets. Lastly, other flaws affecting quality of data may have occurred since participants were working in close proximity together during smaller group discussions, and overhearing each other may have influenced the way they answered.

6.3- Asset Profile of the Area

a. Agricultural Activities

Combining both the results of the informal interviews and survey, as well as the Asset Mapping activity that took place during the focus group discussion provided a more accurate picture of Saft al Laban's physical Assets as a community. In the survey, an interesting split occurred between people who offered their opinion about farms. While the largest number of respondents remarked "they are good" other commented that they are not useful or do not

exist. Most people also claimed to know a farmer personally and buy their products, but around 31% of respondents said they don't have a personal connection (Figure 6.4).

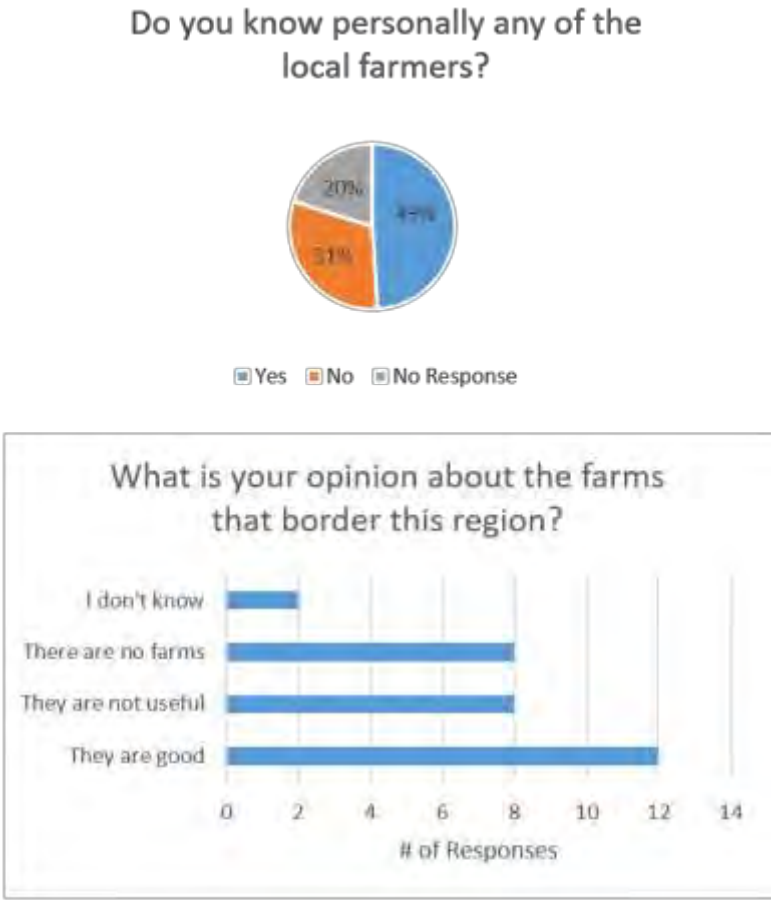


Fig. 6.4- Opinions about local farms in Saft. (Source: Author, 2017)

One striking comment came from one of the workshop participants, who said “I remember that 15 years ago, this place was beautiful...It was green with lots of water and birds. All it was green, there was even a canal, but all of that is gone now" (Wafa, 2017). This comment echoed similar sentiments held by participants surveyed in the community. When asked how they felt about their outdoor environment, a large number of respondents (27%) said they wanted ‘better waste disposal.’ Another 16% commented that they wanted to change ‘the behaviors of other residents’ (Figure 6.5).

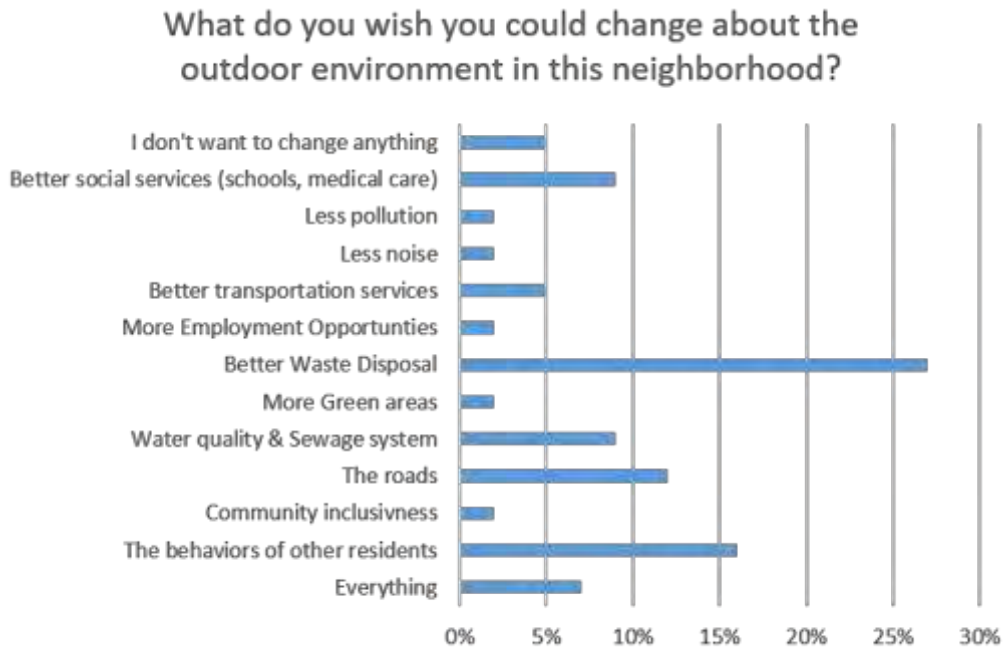


Fig. 6.5- Desired changes in the neighborhood. (Source: Author, 2017)

However, when it comes to agriculture, the opinion is a little more varied. As Figure 6.6 indicates, most survey participants claimed that people working in agriculture work outside of Saft, which was also confirmed by an informal interview with a group of local farmers selling their products on one of the main roads in Saft. The majority of participants did not respond when asked if they felt agriculture was beneficial for the community, but 31% said yes, they believe it would be beneficial.

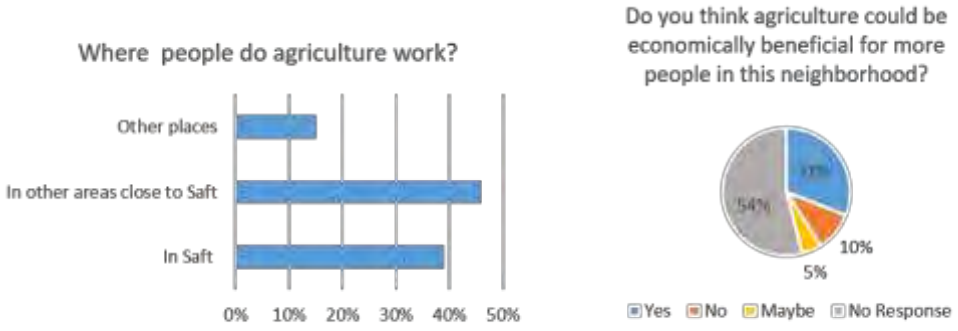


Fig. 6.6- The predicted future of agriculture. (Source: Author, 2017)

The majority of community members surveyed do not participate in agriculture, and the split was an even 50/50 when those who do participate were asked whether they produce for home consumption or for sale. The majority of those farming grow seasonal crops, which consisted of a lot of crops for livestock, such as alfalfa, as witnessed by the researcher during visits to the site. A fewer but still notable number of people are raising poultry or other byproducts such as eggs. The majority of people who participate in agriculture estimate their earnings to be between 500-1000 EGP per month. During the asset mapping activity, farms were identified predominantly by being on the west side of the ring road, as well as some gardens sandwiched between the tangled highway infrastructure on and off ramps in the northern part of the neighborhood. This is also consistent with what the researcher observed during field visits, and the area was also identified as having an important water source. However, the lack of label water sources seemed to indicate this was a sparse physical.

Over 50% of respondents said that they do not feel the streets are safe, and nearly 50% claim that they are lit at night. A large majority of respondents claim that the streets are not maintained by either cleaning or paving. This was also consistent with field observations, since the predominant infrastructure is the Ring Road, which is an elevated highway above the neighborhood, but the roads below remain unpaved and full of potholes. The densified neighbor section of Saft is a crowded network of narrow streets and alleys that are a result of filled

in irrigation canals, but the west side of the Ring Road under the tunnel contains fairly wider (though still unpaved) straight roads. The same sentiment of poor quality local roads was echoed by the focus group participants when naming specific local challenges.

b. Existing Infrastructure

During the focus group discussion, several various kinds of institutional assets were defined in the neighborhood, including streets of local businesses, several mosques, and one ministry office. From the community survey, it was identified that some schools are present in the area, but their proximity to the selected neighborhood scale seems to be out of range. Most people claimed medical clinics are in close proximity, though several respondents commented that they are expensive or have a bad quality of care (Figure 6.7). Most respondents also said that there were no NGOs active in the area, apart from Mish Madrasa, which was mapped during the Focus group discussion. One survey participant remarked that there were more active NGOs in the area before 2011, but after the revolution they disappeared.

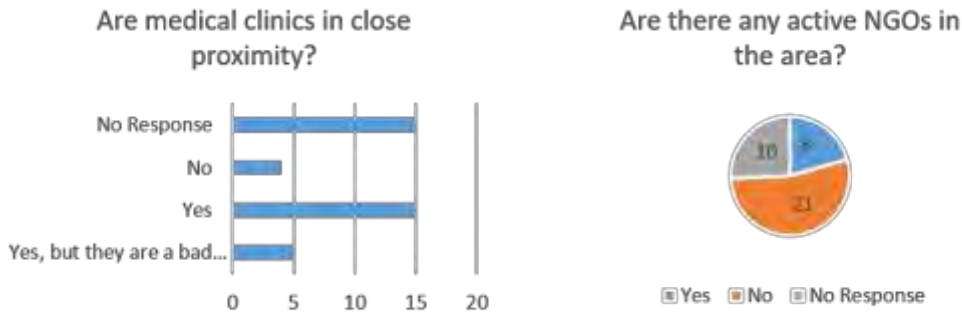


Fig. 6.7- Medical access and NGOs. (Source: Author, 2017)

Local transportation does exist in the form of tuktuks, microbuses, taxis, and some private cars, but focus group participants claimed they are of "low quality" and that access to public transportation was a problem in general. This same sentiment was also given by some survey participants. From observations

in the field, private education centers seemed to be prominent, but according to one interviewee "There are schools in the area but they are not efficient or sufficient.... there are only 3 governmental schools. The schools are so overcrowded that students are sitting on the floor. Student teacher ratio is 1:130" (Wafa, 2017).

From field observations and claims from focus group participants, there is no police station in the area, and disputes are settled by neighbors. But perhaps the most prominently lacking institutional asset is the presence of a waste management service. According to survey participants, waste is managed mostly by dumping it in a tunnel close to the Ring Road, as confirmed by the researcher's site visits. A few times a week, mostly at night, a dump truck from the city comes to pick up the trash to take it elsewhere, but some piles remain. Most people claim that no recycling or composting takes place, which was not observed by the researcher (Figure 6.8).

Fig. 6.8- Waste management tactics in Saft. (Source: Author, 2017)

Some participants commented that they do not feel safe walking through the tunnel due to excessive amount of trash, and feel that that its smell and the presence of livestock herded in the tunnel to eat some of the trash is unhealthy

for the area. According to one interview, this mismanagement has to do with price of waste management services, and after a private company who was servicing the area hiked their prices, people began throwing their trash in the tunnel without a way for anyone to pay to pick it up (Wafa, 2017).

c. Social Assets

The community has a striking pattern in the way many residents describe their own perspective about the place. A common thread in conversation with many interviewees was that they love Saft al Laban for its people; that friends and family were there, so it's where they felt they belong (Figure 6.9). When asked if they expect to have more neighbors in the future, most responded yes, and when asked if they or the neighbors plan to expand their homes, the answer was also yes (Figure 6.10). Therefore, there seems to be a common consensus that Saft al Laban will become increasingly urbanized.

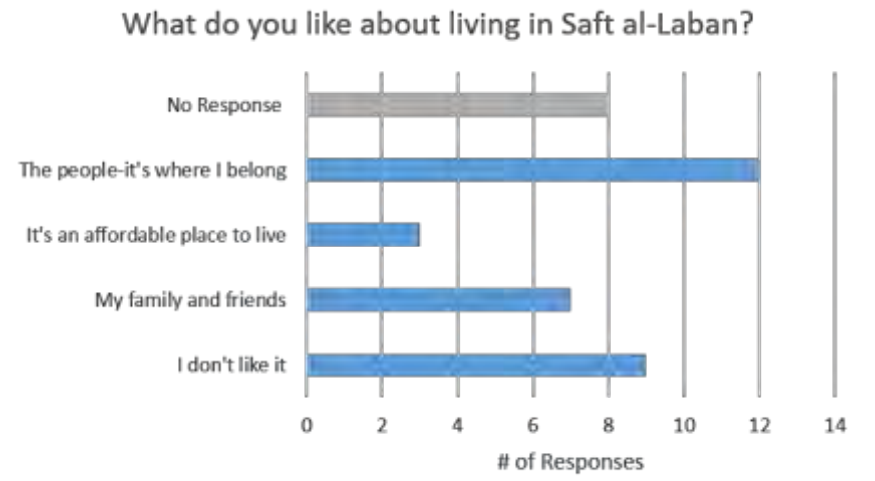


Fig. 6.9- Resident's perspective about their neighborhood in Saft. (Source: Author, 2017)

Fig. 6.10- Future growth in Saft. (Source: Author, 2017)

Interestingly, based on the researcher's field observations, there is a striking difference between the lifestyle of the people living in Saft al Laban on opposite sides of the tunnel under the Ring Road. Those that live on the west, near the farmland, behave in a more communal manner, and are often seen hearing their livestock (oxen, sheep, camels, goats, horses, donkeys and more) into the center of Saft for market, or some of their agricultural products. In general, they consider their farmland an asset, and some interviewees remarked that know they cannot farm it forever, but will hand on to the land as long as possible to wait for the real estate price to increase. People in the main district of Saft tended to be less communal, and less tolerant of the farmer's practices.

A large majority of respondents said they spend eight or more hours outside. This can also be confirmed by the researchers visits to the area and the amount of street activities taking place. The majority of children also play outside in the street, though usually in less trafficked side roads and alleyways. When asked how they felt about the outside environment in their neighborhood, a large number of people said they don't like it Figure 6.11), and listed a number of other local places that were more attractive to visit, such as cafes outside of Saft, an amusement park in Giza called Dream Park, the Giza zoo, and a local pool called Moonlight. Most people claimed that they go to the city twice a week or more, both for business and pleasure.

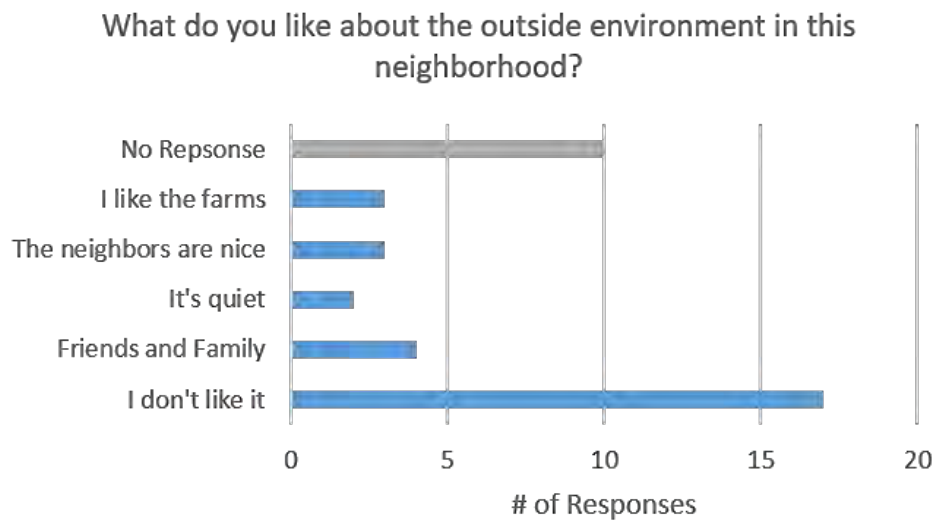


Fig. 6.11- Opinions about the outdoor environment in Saft. (Source: Author, 2017)

Some of the focus group participants also commented that the youth sports fields were expensive to play in, and predominantly used by males. It was mentioned also that the one local youth club that does exist does not have any services and people "hang out there to smoke joints" (Estrada, 2017). Several focus group participants commented that they believe their community has a serious drug problem that they think needs to be addressed.

The various data collection methods were useful in obtaining a more holistic perspective of one of Cairo's peri-urban fringe communities. In the next section, the data will be further analyzed and discussed, in order to dig deeper and extract important revelations about how the situation in Saft al Laban may be applicable to the wider GCR region.

Chapter 7-Data Analysis and Discussion: Saft al Laban as a Window to GCR

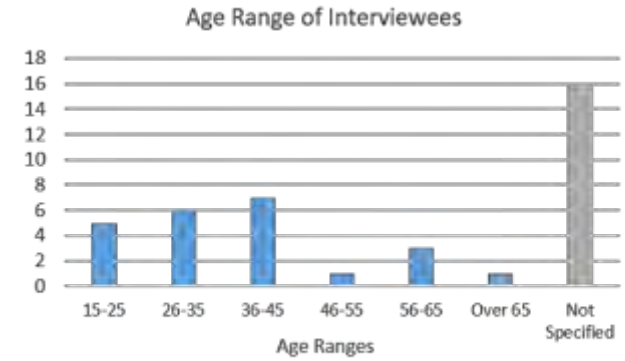
7.1 - Analysis of Findings

The intent of the Cairo-based case study was to give more insight on what the PUA land loss phenome looks like in a real-world context. The following chapter will give more analysis to the case of Saft al Laban, to provide clues as to what design and policy interventions may be appropriate to curb the problem.

a. Neighborhood Scale

i. General Demographics

In the general survey, the majority of identified interviewees were male, and most were between ages 36-45, though with a large number not specified (Figure 7.1). Most of the people interview have lived in Saft al Laban for most of their life, and were therefore able to call up historical perspectives of their place before rapid settlement began.



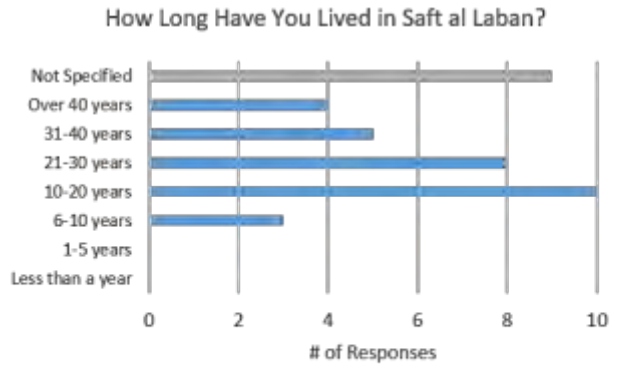


Fig. 7.1- General demographics of survey participants. (Source: Author, 2017)

ii. Land Ownership

The survey found that a vast majority of homes in Saft are owned and constructed from brick. Home ownership is high, but among renters, a majority found out about the property from an "other source," perhaps a family member or friend. There is a fairly even split of whether the broker or the owner made the rental agreement. Average rent hovers around 424 EGP/month for those who submitted info about this expense.

There is a fairly diverse split in how people acquired the property. For a small majority, this was by building it themselves, however, a lot of others answered that their parcel of land was either inherited from a deceased family member of that is was purchased. For people who has to make a purchase ownership agreement for the land, the vast majority answered "other." While it very well may pay this "other" could be family or a friend, some interviews in

person seemed reluctant to discuss about it more. The research believes this could be due to the sensitivity of purchasing farmland illegally, but it cannot be confirmed or denied with the present findings. In terms of cost, price ranges per square meter varied quite considerable, from only 100 EGP or less up to 7,000 EGP or more (Figure 7.2) However, a majority of interviewees claim the cost is now around 5,000 EGP per square meter for a new, unbuilt plot, and several remarked in their interview that this was a sharp increase in the 200 EGP rate they paid for their property 10-15 year prior.

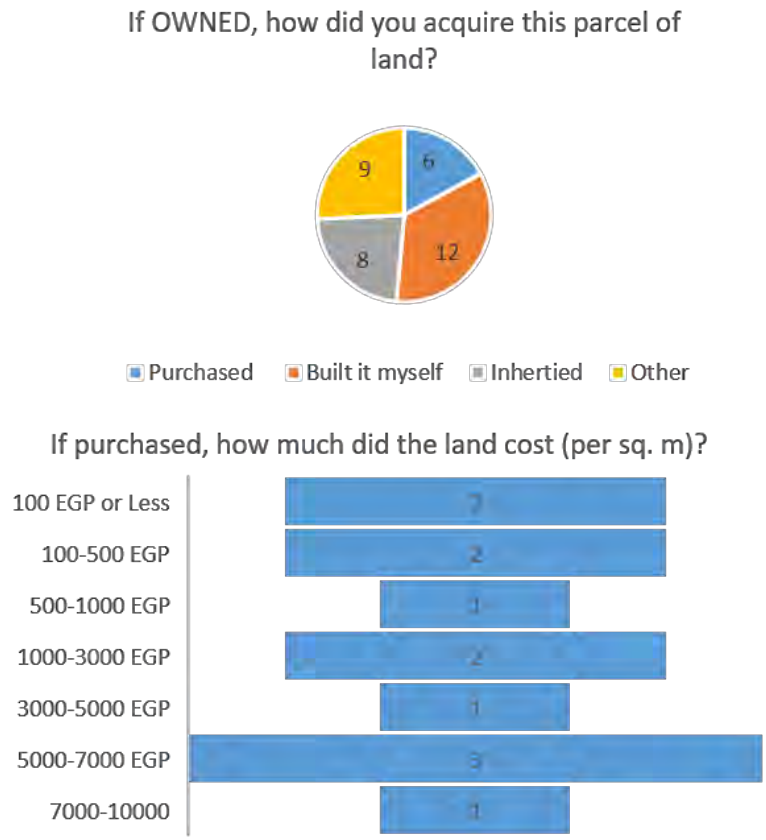


Fig. 7.2- Dynamics of home ownership. (Source: Author, 2017)

A number of people claimed that new homes can be built astoundingly fast, in about 1-3 months. This was also confirmed by focus group participants, and was observed by a researcher during one visit after seeing a bulldozer on the west side of the ring road clearing a patch of farmland at night. A very low

percentage of people choose to use any of that land for agricultural purposes, with it being clear that the only ones doing this are at the very fringe part of the district, and one observed rooftop farm at the Mish Madrasa building (Figure 7.3).

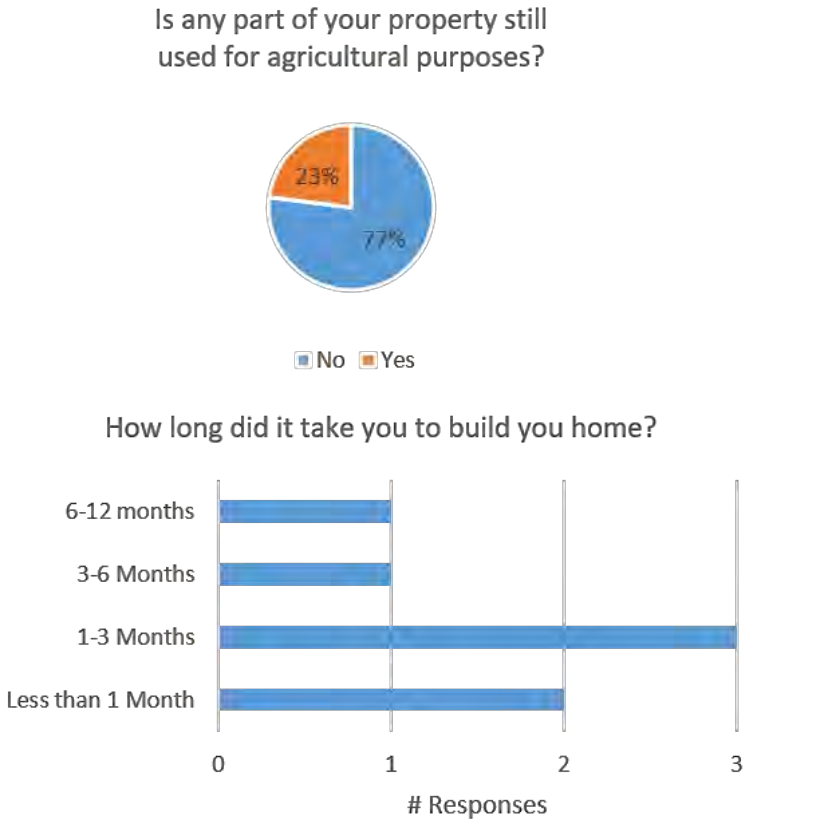


Fig. 7.3- Dynamics of properties. (Source: Author, 2017)

iii. Economic Status

The majority of people surveyed claimed that they were employed, with the most of those employed identifying that they work elsewhere in the city (outside of Saft). Most people did not want to comment on their earnings, but four respondents who did respond said they earn 5000 EGP or more per month. However, this range varies greatly as those survey have varied employment types. Ten respondents (48%) of the 21 who claimed to be employed work full time,

while another 29% work part time, and still another 10% are self-employed (Figure 7.4).

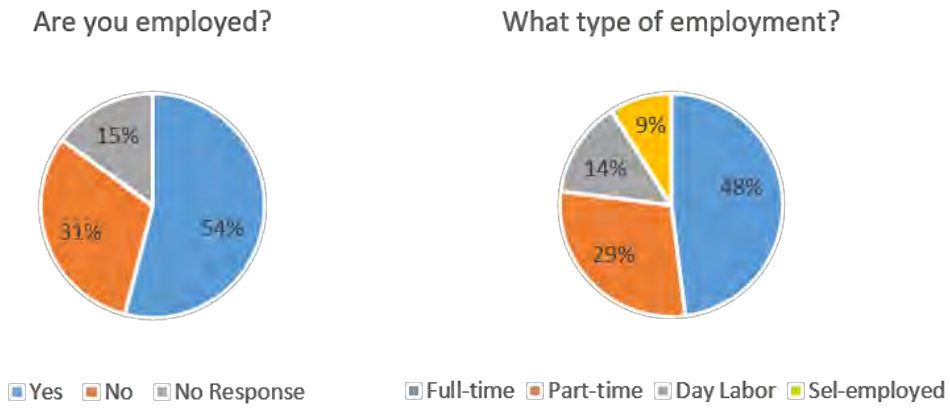


Fig. 7.4- Employment statistics in Saft. (Source: Author, 2017)

Most survey respondents also did not respond to the question about whether monthly earnings were enough to cover their monthly expenses, as indicated in Figure 7.5. There was a fairly even split between those responding 'yes' (28%) and 'no' (26%).

Fig. 7.5- Employment sustainability for residents in Saft. (Source: Author, 2017)

However, participants in the focus group commented directly that they felt the middle and low classes cannot afford their basic needs. The researcher found these employment statistics to be surprising, as it was expected unemployment would be higher, but this also may be due to the fact that most respondents were male, as there was a vocalized cultural stigma in the district that women should not need to work (Estrada, 2017).

In terms of services, there was a fairly consistent response rate of people who have access to landline phones, gas line, sewage and waste disposal hovering around a 15-20% confirmation rate. The most prevalent service was electricity, with 100% of respondents claiming to have access, and the lowest being cars at 13. Interestingly, no survey respondent claimed to lack access to water, but those who confirmed were only 23 out of 39 (Figure 7.6) However, it may be that water is a more controversial service, with some previous research showing illegal tapping from agricultural lands. Cost was much more varied, with the highest cost for services being for a car and electricity.

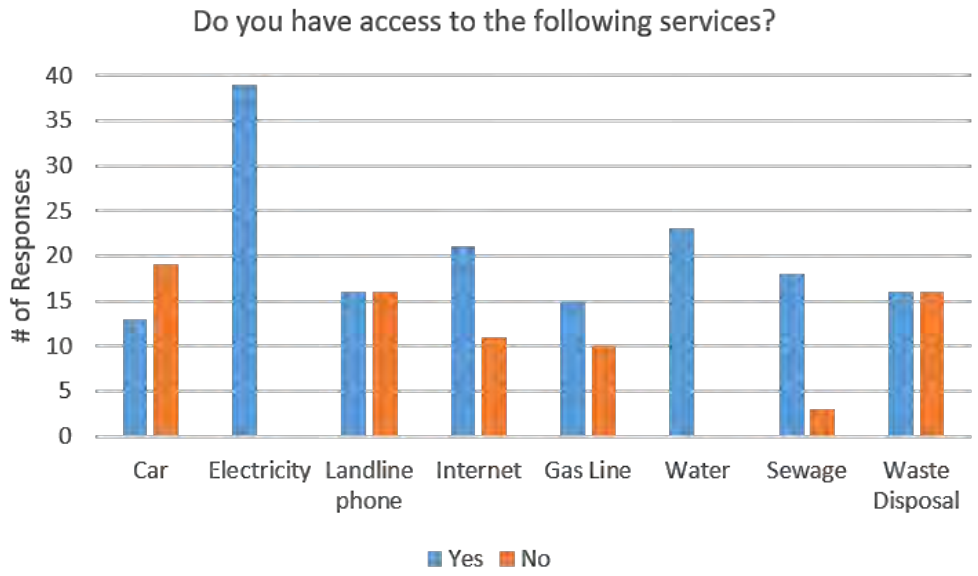


Fig. 7.6- Access to basic services in Saft. (Source: Author, 2017)

iv. Food Security

Turning now to the topic of food security, almost every single interviewee claimed they buy food from a local market, and that there were no issues in accessing these places, but the question of food quality is where there is dissent. A majority claimed the food they buy is "good quality" but fewer said "it's good" or "it's excellent" (Figure 7.7).

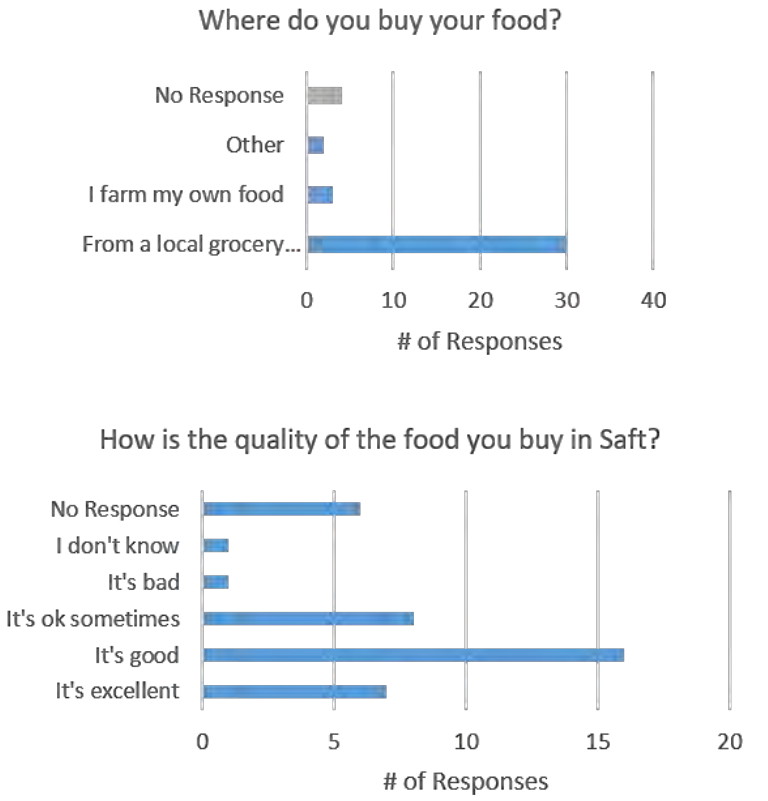


Fig. 7.7- Food availability and quality in Saft. (Source: Author, 2017)

Yet this was quite in contrast to the number of people who said felt the food was not safe to eat; almost 48%. Perhaps this is the placement of the question, but the issue of food safety was not extensively elaborated on by any of the participants. Most respondents claim that if they had options to buy more from local famers, they would (Figure 7.8). Food prices ranged from 500 EGP or less to 4,000-5,000 EGP, with the majority stating the cost is between 2000-

3000 EGP per month for their family. Of course, consumption depends on family size (average in Saft is 4-5 people).

Fig. 7.8- Food safety and potential purchase change in Saft. (Source: Author, 2017)

Most of the respondents did not respond about the quality of product coming from local farmers, but 13 out of 39 did say they believe the produce was good quality and affordable. Eight responded that they believe the quality is bad and wouldn't buy anything from them (Figure 7.9). These responses seem to indicate that local residents of Saft feel food secure, but generally believe that quality of their food could be improved.

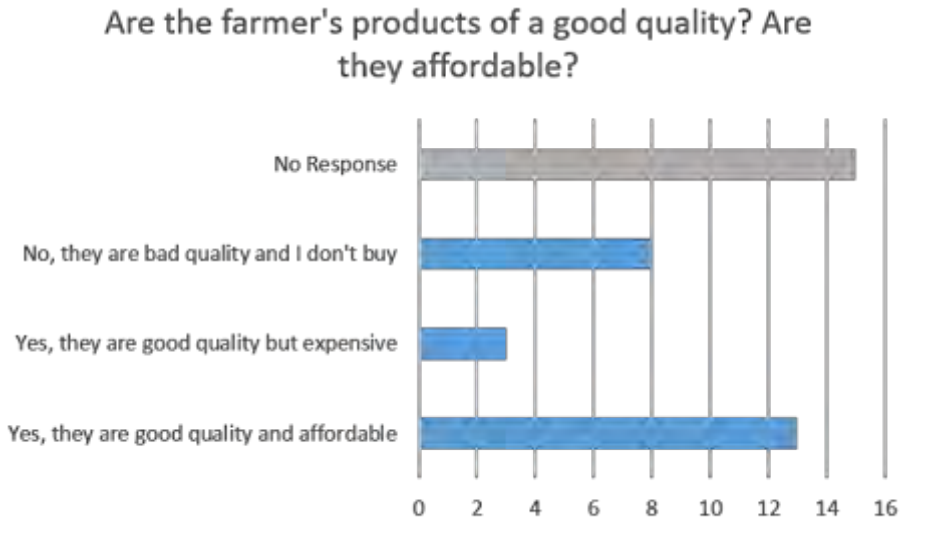


Fig. 7.9- Opinions about quality of farm produce in Saft. (Source: Author, 2017)

b. Focus Group Discussion Analysis

An average was taken from the 9 participant ratings, and the results from this first exercise indicated that no participant felt Saft al Laban was doing "Very Well" in any of the sectors. However, was the criteria of 'Equity' in the sectors of 'Social Service and Civic Preparedness' and 'Local Jobs and Economy,' which the participants feel their community is doing 'Fairly Well.' Equity in these two sectors means all members of the community are able to meet their basic needs when it comes to things like neighbors assisting each other in times of need or residents having enough income to sustain their household. When considering the lowest ranking criteria, it was clear that "Ownership" was absent across many sectors, with the exception of 'Local Energy Systems' and 'Local Transportation and Housing' which still ranked very low. This means that participants believe the community lacks rights to essential resources, particularly in the sectors of Social Services, Local Jobs and Economy, Local Food Systems, and Local Water Systems. An entire absence of Quality for Social Services and Civic Preparedness was also noted, in addition to an absence of Sustainability in the Sector of Local Transportation and Housing. Results can be seen in Figure 7.10.

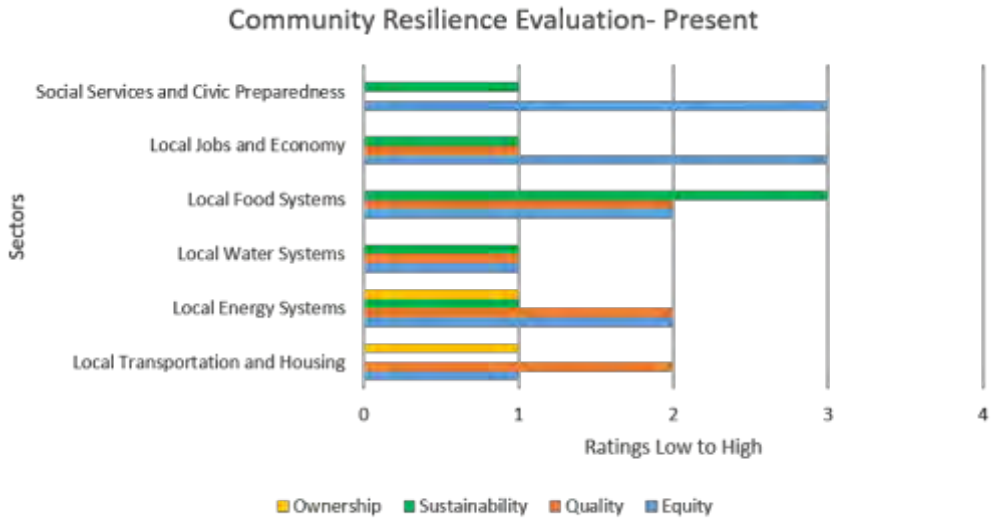


Fig. 7.10- Community resilience assessment across multiple sectors. (Source: Author, 2017)

In the second part of the focus group discussion, participants were asked to do the same type of ranking, but consider their community 10 years into the future. Overall, the results showed an optimistic outlook of the future form the participants, with improvements in virtually every sectors. 'Ownership' was still missing from Social Services and Civic Preparedness' as well as from 'Local Water Systems', but other areas show big jumps in improvement. The highest ranked criteria were 'Equity' in the Local Energy System sector, with participants raking the capacity of residents to meet their own energy needs to be accomplished "Very Well."

Other observations from the focus group discussion participants included vocal comments about the community's social resilience. One participant commented: "we applied resilience during the 2011 revolution. It was not just in Saft, but in all the neighboring communities, we helped each other" (Estrada, 2017). Indeed, others chimed in during the ranking exercise to comment that "People need to confront the garbage problem," and "some people only have access to water a few hours a day, in the evening," triangulating what the research had been told by some survey participants in the field, and explaining the non-existent criteria of "Ownership" in the Local Water Systems sector (Figure 7.11).

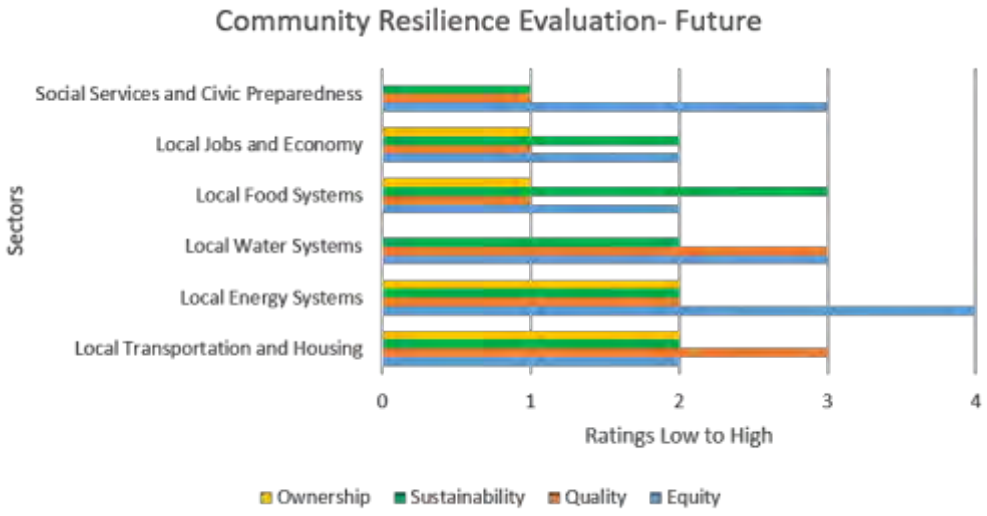


Fig. 7.11- Future community resilience assessment. (Source: Author, 2017)

Using all the available data collected about Saft al Laban, a second evaluation was made using the Resilience Assessment Tool that had also been utilized to evaluate Case Studies, with the results shown in Figure 7.12. In general, the community has many assets, but there is a noticeable lack of management and sense of ownership about many of these assets. In terms of Socio-Economic Dynamics, the community scores very low in utilizing capital to support better income and employment, having existing local economic activities support gender equality (most women do not work), and overall management awareness, and participation for local economic development activities.

However, in terms of public health, education and access to food, the community does relatively well, indicating food security is stable. In terms of Urban Infrastructure and Form, utilities such as water are not community-owned, and some residents lack access. Land use violations are high, and multi-functionality of existing green spaces is not utilized. However, ecological green space still present in this area contains high potential.

Fig. 7.12- Evaluation matrix for Saft al Laban. (Source: Author, 2017)

For Networked Materials and Energy Flows, the community also scores low on aspects related to water, energy, and waste, since these aspects are of low quality and not managed in a sustainable way. However, in terms of food quality and quantity, the community received a moderate ranking, since it is very accessible, plentiful, and relatively safe for most residents to consume. And finally, in terms of Governance, low scores were also present for Industry (due to a lack of organization or economic activities taking place that meet existing business needs), Labor Force (unemployment and underemployment are relatively high), and Institutions and NGOs, since they are almost entirely absent within the area, and no formal partnerships appear to exist. Despite this, the community score high in terms of Consumers, since local markets in formal areas, and potential to formalize a new market in Saft are very high.

c. Summary and Resilience Evaluation

A full summary matrix was created to compare the four cases, found in Figure 7.13. This matrix reveals that Saft al Laban has many gaps in its resilience in terms of food security and local economic development. In order to make accurate, appropriate recommendations, linkages can be drawn between the previously discussed case studies who scored high and apply similar techniques

or strategies to supplement the areas where Saft al Laban scored low (Figure 7.14).

Fig. 7.13: Summary evaluation matrix for all four cases. (Source: Author, 2017)

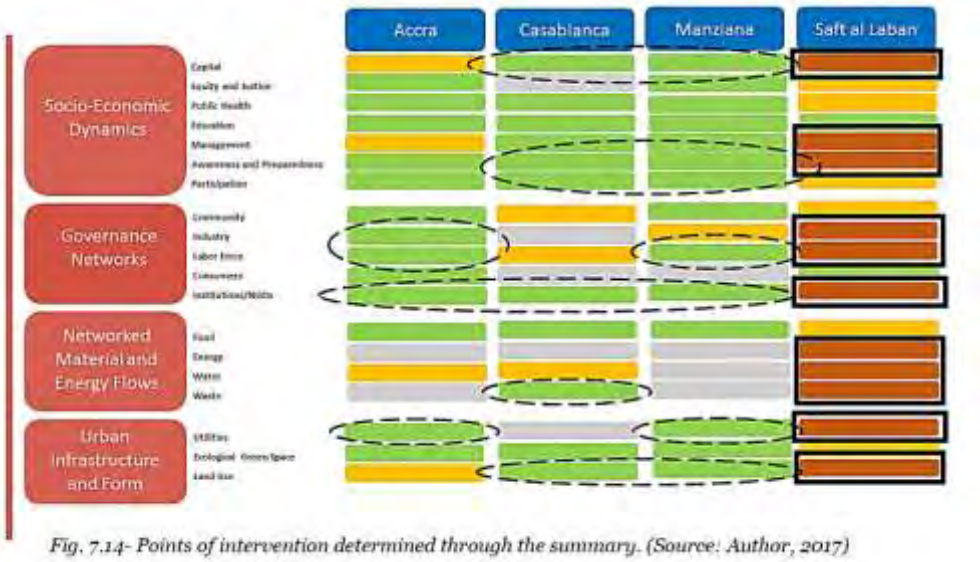


Fig. 7.14- Points of intervention determined through the summary. (Source: Author, 2017)

The case of Saft al Laban may be considered as a mirror to the wider GCR, and patterns of its behaviors and assets as a community as discussed provide a solid foundation upon which to consider strategies that may be needed in other fringe settlements to prevent the further loss of agriculture lands. After giving real-world context to the key research questions, it appears there may be linkages between peri-urban agriculture lands and the capacity for some new LED opportunities for fringe-area communities. These ideas will be further flushed out as recommendations in the next concluding section.

Chapter 8- Recommendations for Resilient Peri-Urban Agriculture in GCR and Conclusions

8.1-Local Level Design and Policy Recommendations

Building on the discussion in the previous section, recommendations were made for design and policy interventions in Saft al Laban. Areas where Saft al Laban scored the lowest were the focus of recommendations in Economic, Environmental, and Social facets, as well as multiple governance scales. Recommendations for these low-scoring areas were also derived from three additional main sources: 1) From the three case studies in Casablanca, Accra, and Manziana that offered best practices; 2) From the community residents of Saft al Laban who participated in the focus group discussion; and 3) From outside literature offering design solutions for areas with similar problems as Saft al Laban.

a. Sustainable Design

i. Economical

While it has previously been discussed that calculating the valuation of ecosystem services provided by Greater Cairo region's agricultural lands is a difficult determination due to the multi-faceted nature of ecosystem services, the research made an attempt to provide examples of which services may be

applicable to the residents of Saft al Laban, based on data collected in their community. This, in turn, could be used as a foundation to consider economic evaluation in other nearby informal settlements also located on the fringe.

By first examining the four categories of ecosystem service types (provisioning, life-supporting, regulating, and cultural) a chart was created based on Colding (2011) where the functions were paired with their aspect contributed by PUA land. Applicable aspects are given an estimated value in Egyptian pounds based on the information provided by the field survey. The chart finds that most Provisioning, Life-Supporting, and Regulating aspects of the land were nearly impossible to assign a value to, since doing so would require more technical data that goes beyond the scope of this research. However, assigning values to the aspects of food provision (since this was specifically asked about in the field survey) as well as cultural aspects was possible. The calculations in Figure 8.1 resulted in an average 121 EGP per person per month, with an annual cost savings of 1452 EGP per year.

Taking a very conservative estimate of 150,000 residents in Saft al Laban (since, as discussed earlier, a census has not been completed) means a cost savings of 72,600,00 EGP per year from the only potential cultural and social services of the surrounding agricultural fringe land. This is also without taking into consideration the possible human health benefits, such as stress and anxiety reduction, which were also difficult to make estimates on based on lack of data. However, a study from the green spaces in the city of Philadelphia, Pennsylvania found that a cost savings due to the environmental services such as storm water mitigation, air pollution mitigation, reduced social problems and reduced medical costs was over 1 billion USD (Niemelä, 2010, pp. 311).

	Ecosystem Service Function	PUA Land Aspect	Estimated Monthly Cost Savings (per person)	*Justification**	*** Based on average estimates per person in Saft al Laban from Field Survey results
Provisioning	Food: Crops	urban food production	54 EGP	Avg. grocery bill per month per person (-) 15% of bill [357 EGP - 15% = 303 EGP]	Avg. 15% estimated savings from direct product sale from farmers. Avg. bill is 1,500 EGP/month for avg. household size of 4.2 people
	Wild plant and animal food sources	Harvesting of wild fruit and plants	Undetermined	—	
Life-supporting	Soil formation	Renewal of soil nutrients	Undetermined	—	
	Nutrient Cycling	Maintained with harvesting	Undetermined	—	
	Water	Purification and storage	Undetermined	—	
Regulating	Air Quality	Reduces heat island effect, removes some pollutants, absorbs CO_2	Undetermined	—	
	Erosion Regulation	Good ground cover reduces erosion risk; hummus holds moisture; prevents desertification	Undetermined	—	
	Pest regulation	Opportunities for natural enemies to provide pest control	Undetermined	—	
	Pollination	Possibility of reducing decline in pollinators	Undetermined	—	
Cultural	spiritual or religious values	Possibility of maintaining sacred places	Undetermined	—	
	Aesthetic values	Attractive places for public interaction	40 EGP	Avg. cost of travel to city center per month per person [4 visits per month X 10 EGP per visit]	Avg. travel to city per month is 4 and average cost is 10 EGP (to and from)
	Human health benefits	Mental and physical benefits (ex. Stress and anxiety reduction)	Undetermined		
	social relations	Group recreational activities	12 EGP	Avg. cost of recreation club entry in Saft al Laban per month per person [4 visits per month X 3 EGP per visit)	Avg. use is 4 times per month and avg. cost is 3 EGP for 1 recreational center
	Cultural Heritage	Agricultural plots and gardens as part of local heritage	Undetermined		
	Recreation	Passive recreation (ex. Walking paths or picnic areas)	15 EGP	Avg. cost of travel and entry to Al Azar park per month per person (1 visit per month x 5 EGP per visit + 10 EGP per travel)	Average visits are 1 visits per month. Park entrance costs 5 EGP and avg. travel cost is 10 EGP (to and from)
		TOTAL=	121 EGP		

Fig. 8.1- Environmental services Cost Savings chart for Saft al Laban. (Source: Author, 2017. Inspired by Colding, 2011)

While this exercise is by no means an end determinant on the value of the fringe agricultural land in Cairo, it may help shed light on the unseen value of these lands. Economic pressure for development is intense, and garnering revenue from crops on these pockets is not enough to guarantee their future. Therefore, by showing a cost-savings, this could be also taken into consideration by the governing authorities and serve as a catalyst for them to act on the issue. In a city the size of Cairo with majority of residents living in or near informal fringe areas, the potential for such a massive cost-savings is astonishing, and peri-urban agriculture lands should be taken into serious consideration as tangible assets.

Other economic strategies include better management and use of capital. For example, the establishment of agriculture-based co-ops could be instrumental in putting the pricing power back into the hands of small farmers, rather than large corporations. Other interventions, such as planting more high-commodity crops, establishing a market in the formal area outside Saft, and establishing connections between existing business needs and local production potential would be monumental in helping to increase value chain development of agricultural crops and by-products produces in Cairo's fringe region.

ii. Environmental

As discussed in Chapter 6, communities like Saft al Laban have many physical assets, but are weak in their capacity to link them together. In Saft the particular problematic aspects of waste, water and land use exist. Of particular concern in Saft is the Ring Road, which has divided the community but not halted continued settlement. The road makes local farmland less accessible and cuts off the people from the green space many of them would benefit from. As Richter (2010) puts it, one of the weaknesses of urban development planning is that it is too much "based on population projection and then built infrastructure" but is "unable to meet the challenges and needs of ecological and sustainable urban development, and is certainly unable to meet the goal of ecological civilization," (pp. 168).

Environmental resilience and landscape planning at the local scale mean taking into consideration small-scale ecological infrastructure, which is designed in a way that "allows ecosystem services to enter the urban fabric" (Richter, 2011, pp. 165). Therefore, Saft should work to make its greenspace more accessible to residents, and implement multi-functional spaces that add recreational capacity near existing farmland, especially for youth. Streets could include mini-green corridors that lead residents through tunnels to the wider greenspaces on the other side, and become more attractive places for commerce. For the two other issues, water and waste, it is recommended that water be managed in a community collective between farmers and residents, so disputes can be avoided and resources be conserved for farming to continue. Members of the focus group

themselves recommended that a citizen clean-up initiative be established to handle waste, which would include a paid training program for workers hosted in the district and include a recycling/composting program that would work closely with local farmers who could utilize the compost as fertilizer.

iii. Social

In the Resilience Evaluation, some of Saft al Laban's weakest social issues stemmed from lacking management, awareness and preparedness, and participation. As aforementioned, better spatial linkages in the neighborhood on either side of the Ring Road would go a long way to improve social relations, but it was also noted by residents themselves that there need to be changes to improve social behaviors. The lack of NGO's in the area means residents must take it upon themselves to organize, which was made possible in the Accra case study by the establishment of PUA advocacy networks in community. These groups would represent farmers and land owners, and if they were to be persistent in asking for resources to help them (such as a partnership with the neighboring Agricultural Research Center in Giza), the possibilities for further LED opportunities in the community related to agriculture would be immense. This would no doubt also have an impact on social dynamics, helping people to better understand and appreciate their neighboring green plots.

In order to strengthen social ties, it was also suggested from locals that there be better cooperation between influential local leaders in Saft and the local government to express their needs and resolve issues. With no police force, neighbors in Saft are used to an unspoken neighbor-helping-neighbor policy, but it requires a better relationship with formal authorities to solve bigger problems, like land disputes. Workshop participants also recommended that their community provide a better safety net for people who feel financially insecure, since they believe these circumstances are what lead people in their community to negative behaviors (Estrada, 2017). This could be interpreted as more established NGOs or charitable works in the area.

b. Policy

Policy interventions can be considered on multiple levels. Given the current situation in Saft, it is clear to see that fringe communities are mostly isolated in their attempts to self-improve, particularly when it comes to PUA. It is vital to boost interlinkages between the local level, organizational level, and institutional level and to provide stronger feedback loops among the levels to improve resiliency (Weiter, 2016) (Figure 8.2).

i. Local Level

On the local level, several design-focused interventions are proposed, but greater participation among local residents is needed if these are to be ever carried out. Communities like Saft al Laban represent similar patterns and dynamics felt in fringe areas in other parts of Giza and Qalyubia, and collectively their changes in the way they manage PUA land now and into the future has a huge effect. Green space areas in these localities should absolutely continue to be tied to agriculture, but must provide other services as well, if there is to be buy-in and utilization from local residents. Multi-functional uses such as recreational spaces or cultural places is necessary in order to promote their preservation importance.

ii. Organizational Level

The local level also requires more capacity building from upper-level actors. Farmers, students, families, and local leaders lack know-how in PUA and resiliency management, and are pleading for interventions to help improve their local economic development. Organizational actors include business, NGOs, and governmental organizations who supply management services and know-how in complex systems. In the context of fringe settlements, it is recommended more investment be provided private enterprises related to agricultural development, as well as more food-security focused NGOs establishing a presence in the region. As aforementioned, governmental actors like the ARC should consider it a

priority to be working in these areas, and could even consider local residents their partners in establishing new research fields as well as test crops and products.

iii. Institutional Level

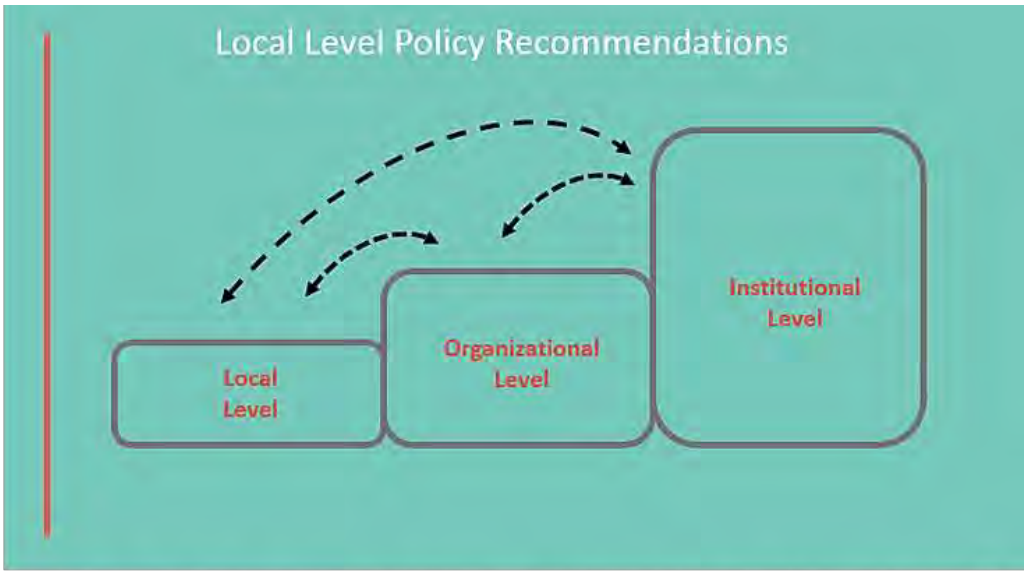


Fig. 8.2- Boosting policy interlinkages on multiple levels. (Source: Author, 2017)

At the top, the institutional level is obliged to play a more active role in debating and discerning the legal aspects of land management of PUA lands. History has shown that policies are powerful tools to limit sprawl. Upper-level actors must take the issue of unsustainable sprawl in GCR more seriously, and communicate more with the organizational level to offer provision of better infrastructure and services to needed to make interventions possible at the local level. In a centralized governmental system like Egypt, this is far from an easy task, but is absolutely vital if Egypt is to achieve its sustainable development goals and allow Cairo to grow into the resilient, sustainable, and food-secure city of the future that it has the capacity to be.

8.2 - Scaling-up, Critical Evaluation, and Suggestions for Further Research

How might these recommendations look like scaled-up? In an ideal scenario at the local level, fringe communities like Saft al Laban would contain more multi-functional green spaces that have strong integrate food production and side enterprises as important parts of their local economy. Regionally, across other fringe communities in Giza and Qalyubia this could result in strong cross-district linkages that share natural resources (ex. water or fertilizer), knowledge (ex. best practices), and economic strategies (ex. regional crop-specific co-ops). In the Greater Cairo region as a whole, such strong interlinkages could result in "food nodes" that act as a backbone to supply food for the city, regulate prices, and protect peri-urban lands from unnecessary development. A conceptual schematic is showing multifunctional, connected green space at the local level and possible regional nodes is shown in Figure 8.3.

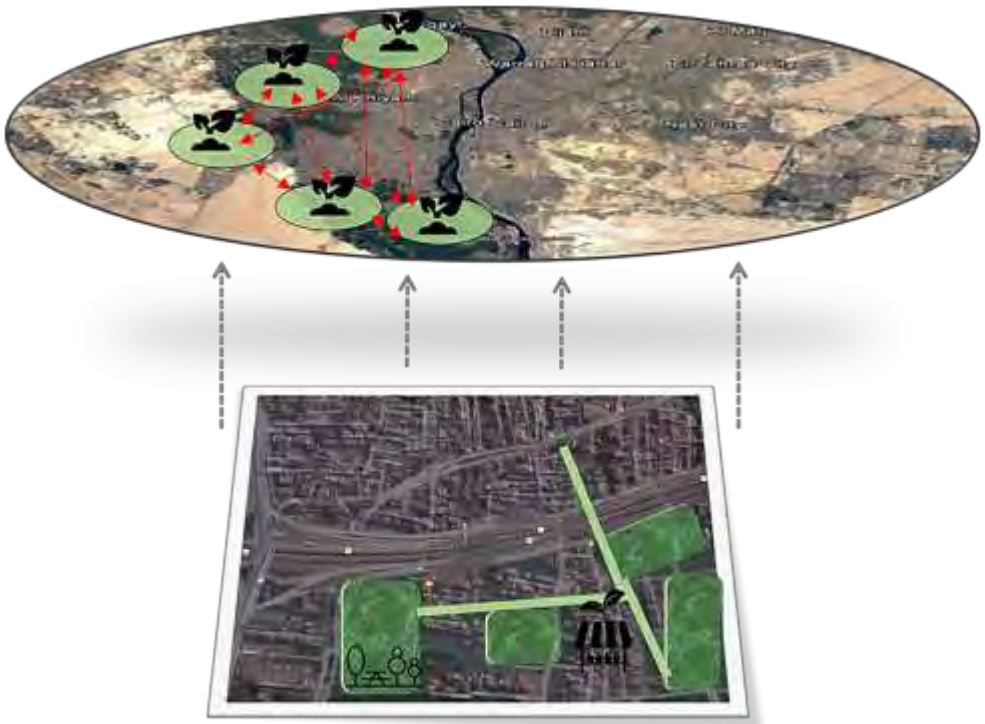


Fig. 8.3- Scaling up the recommendations in GCR. (Source: Author, 2017)

This scenario of the Resilience Food City it not a utopia; it is s a real plan other cities around the world, including those in the developing world, are making to ensure their own future security and ability to sustain their people. While the researcher is aware that this body of work had many limitations and must be examined critically, the created Resilience Evaluation and attempted valuation of ecosystem services are based on some of the best attempts in academia right now to make sense of what it means for a socio-ecological system to be resilient. Aforementioned policy and design recommendations should be improved from a critical review of planning and landscape design experts based in the region, relevant stakeholders, and of course, residents themselves. Such an activity was originally planned for this work, but was not realized due to time constraints and lacking contacts. This step would be critical to carry the recommendations forward to see light in real-world discussion and planning circles.

The research explored important questions related to tangible strategies to improve resilience, but had to do so from the lens of but one local settlement and make several assumptions in the process. It would be extremely valuable if future studies focused on more than one settlement and obtained data that can be used to make a more compressive assessment on regional-level dynamics. Further recommendations for research include looking more deeply into the 1) The economic profitability aspects of peri-urban food security and LED in urban areas and -more vitally 2) The linkage between LED in peri-urban areas and sustaining an urban region. In other words, it is of interest for cities to understand what it costs to be food insecure.

8.3-Concluding Remarks

This body of research explored the history, dynamics, and best-practices related to resilient PUA lands management in the context of GCR. The text built upon the key research questions and strove to uncover the ways in which peri-urban agriculture supports socio-ecological resilience in an urban area, as well as

how it can impact local economic development. While the objectives of the first aim were realized by identifying shortcomings and gaps in the PUA system and extracting best practices for managing PUA in Case studies, research findings indicate that an economic value of PUA cannot be simply calculated because there are too many facets.

After building a comprehensive understanding of the importance of regional agriculture planning, the urgent problem of food security for urban areas and the value of using socio-ecological resiliency concepts to draw linkages among the issues, a theoretical framework was established. This utilized three international case studies that unveiled best practices. A deep analysis of GCR's history and current spatial, environmental, social, and economical aspects of the way PUA lands are managed revealed that a series of drastic land reformation laws, lack of government proscription, housing demand, and low economic incentive for farming were to blame for the overdevelopment phenomena.

The days of Egypt's empire harnessing agriculture as its main source of wealth and power may be ancient history, but as analysis from the Saft al Laban case study and ecosystem services valuation indicated, vital natural assets exist and the potential for wealth remains. Findings showed that residents do envision a more resilient, inclusive future for themselves, and with proper interventions across multiple scales, the land can sustain livelihoods for generations to come.

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Appendices

Appendix 1- Samples of Field Survey- English Version.

Supported by:

Saft al Laban Community Survey-April 2017

1. How long have you been living here?

2. How would you describe your home?

a. Brick house
b. Stone house
c. wooden house
d. Caravan/mobile
e. Tent
f. Bungalow
g. Flat

3. Is your house owned or rented?

4. If RENTED, how much do you spend on rent (EGP/Month)?

4A. With whom did you make your rental agreement?
A. Broker
b. Owner
C. Other

4B. How did you find out about rent?
a. Word of mouth
b. Advertisement
c. Broker
d. Owner
e. Other

4C. Who was the previous owner?
a. Family member
b. Local farmer
c. Family friend
d. Other

5. If OWNED, how did you acquire this parcel of land?
A. Purchased
b. Built it myself
c. Inherited
d. other

6B. If built, how long did that take?

5A. With whom did you make your ownership agreement?
A. Broker
b. Owner
C. Other

5B. How much did the land cost? (EGP/sq meter)

5C. Who was the previous owner?
a. Family member
b. Local farmer
c. Family friend
d. Other

7. Is any part of your parcel still used for agricultural purposes? (Y/N)

8. How many of your neighbors acquired land in the same way as you?

9. What do you like about living in Saft al-Laban?

10. How many neighbors do you have? (# of families)

10A. Do you expect to have more neighbors in the future? (Y/N)

11. Do you or your neighbors plan to expand your homes in the future? (Y/N)

12. Where do you buy your food?

13. Is this place easy to access? (Y/N)

14. How is the quality of the food?

15. Does all of the food you buy seem safe to eat? (Y/N)

16. If you had options to buy food from local farms, would this change anything about where you shop? (Y/N)

17. Are there any subsidized food outlets here? (Y/N)

17A. Approx. how many people in this neighborhood use this subsidy?

18. What is your approx. expenditures on food (EGP/month)?

19. What is your opinion about the farms that border this region?

20. Do you know personally any local farmers? (Y/N)

21. Do any of the farmers sell their products here? (Y/N)
21A. Do you buy their products? (Y/N)

22. Are the products of a good quality? (Y/N)
22A. Are they affordable? (Y/N)

23. Do you participate in agriculture? (Y/N)
23A. If so, for what purpose?
A. Sale for money
b. home consumption
c. exchange for other products

Appendix 1- Sample of Field Survey- Arabic Version.

Supported by:

Saft al Laban Community Survey-April 2017

1. منذ متى تعيش هنا؟

2. كيف تصف منزلك؟
a. بيت من القرميد
b. بيت من الحجر
c. بيت خشبي
d. بيت متحرك e. خيمة f.بيت من القش g.شقة

3. هل انت مستأجر أم مالك المنزل؟
4. إن كنت مستأجراً فكم يكلف الأجار (جنيه/شهر)

4A. مع من وقعت عقد الأجار؟
A. سمسار
b. المالك
C. غير ذلك

4B. كيف اكتشفت المنزل للأجار
A. عن طريق الكلام
b. إعلان
c. سمسار
d. مالك
e. غير ذلك

4C. من هو المستأجر السابق؟
a. عضو الأسرة
b. مزارع
c. صديق
d. غير ذلك

5. إن كنت مالكاً: فكيف حصلت علة المنزل؟:
a. اشتريته
b. أنا بنيت عليه
c. ورثته
d. غير ذلك

5A. مع مين وقعت عقد الملكية؟
A. سمسار
b. مالك
C. غير ذلك

5B. كم هي كلفة الأرض؟[لكل متر مربع]

5C. من هو المالك السابق؟
a. عضو الأسرة
b. مزارع
c. صديق
d. غير ذلك

7. هل هناك قطعة من الأرض خاصتك تستعملها للزراعة؟ [نعم/ لا]

8. كم هو عدد جيرانك الذين حصلوا على الأرض بنفس طريقتك؟

9. لماذا تفضل العيش هنا "صافت اللبن"

10. كم هو عدد جيرانك؟[عدد العائلات]

10A. هل تتوقع أن يزيد عدد جيرانك في المستقبل؟نعم/ لا

11. هل تخطط انت (أو جيرانك) لتوسيع منازلكم في المستقبل [نعم/ لا]

12. من أين تشتري طعامك؟

13. هل مكان لشراء الطعام قريب من هنا؟[نعم/ لا]

14. ماهي جودة الطعام؟

15. هل كل الأطعمة التي تشتريها تبدو أمنة للأكل؟ [نعم/ لا]

16. إن كان لديك الخيار لشراء الطعام من مزرعة محلية فهل هذا سيغير أي شيء بخصوص المكان المعتاد للتبضع؟[نعم/ لا]

17. هل يوجد هنا طعام مدعم؟ (مثل فرن عيش)

17A. بشكل تقريبي كم هو عدد الناس الذين يحصلون على الدعم؟

18. كم هو مصروفك الشهري على الطعام (جنيه/شهر)

19. ما رأيك بالمزارع في محيط هذه المنطقة؟

20. هل تعرف شخصياً أياً من المزارعين المحليين؟[نعم/ لا]

21. هل هناك من فلاحين ممن يبيع منتجاته هنا؟[نعم/ لا]
21A. هل تشتري بضائعهم؟[نعم/ لا]

22. هل منتوجاتهم على مستوى جيد من الجودة؟[نعم/ لا]
22A. هل سعرها مناسب؟ نعم/ لا]

23. هل تشارك في الزراعة؟ [نعم/ لا]
23A. إذا كنت كذلك فلماذا؟
A. لبيع المحصول للحصول على المال

Appendix 2- Asset Maps from workshop in Saft al Laban- Institutional Assets.

Appendix 2- Asset Maps from workshop in Saft al Laban- Physical Assets.

Appendix 2- Asset Maps from workshop in Saft al Laban- Social Assets.

Appendix 3- A sample of statements read for the Resiliency Ranking exercise in the workshop.

Saft al Laban Focus Group-April 2017

Local Food Systems

Rate Your Community's Resilience

Rate the resilience of your community for access to food on a scale of 0-4, now and 10 years in the future.

	Resilience Evaluation Questions	Now 0 - 4	Future 0 - 4
	1. Residents in our community have enough to eat.		
	2. Fresh, healthy, organic food is convenient and affordable.		
	3. Food is grown locally or regionally in a sustainable manner		
	4. Our community has a public strategy to ensure a secure food supply, even in emergencies.		
	Food subtotal (16 points possible)		

ADDITIONAL COMMENTS:

Appendix 4- Selected photos from the workshop in Saft al Laban. (Photos by Author)

Appendix 5- Images of Saft al Laban's commercial streets adjacent to the Ring Road. (Photos by Author)

Appendix 6- More views of the commercial streets and Ring Road overpass. (Photos by Author)

Appendix 7- Shrubs and trees sold at roadside nurseries. Some livestock are kept in pens while others are herded in the streets. (Photos by Author)

Appendix 8- On the west side of the Ring Road, new housing projects are adjacent to agricultural lands. (Photos by Author)

Appendix 9- A small underpass allows residents to cross sides of the settlement and provides stairs up to the Ring Road. This area often had livestock herded through it and is the main dumping site for the community's solid waste. (Photos by Author)

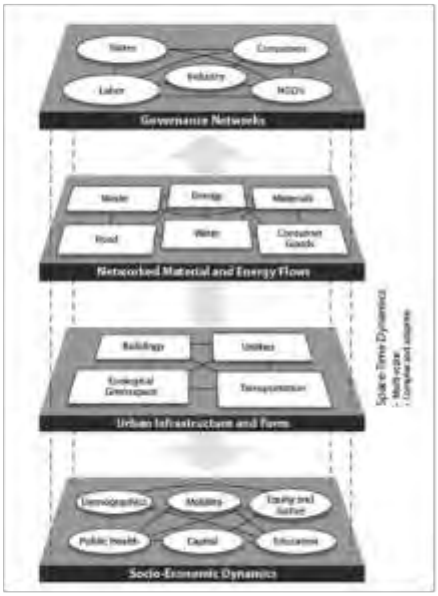
Appendix 10- Some of the existing resilience criteria examined when creating the Resilience Evaluation Tool.

Community Resilience Criteria
(Bay Localize, 2009, p. 7)

Aspects of Food Security
(Patel, et al., 2013, p. 6)

LED Guiding Principles
(Treller, 2014, p. 9)

Resilience Factors in Urban Systems
(Meerow and Newell, 2016, p. 9)



Appendix 11- A sample transcript from one of the conducted formal interviews. A total of six formal interviews were conducted by the researcher.

START TIME: 1:15 pm
END TIME: 1:30 pm
LOCATION: East Owainat for Agricultural Development Office, Giza
NAME: Ahmed Sobeeh Mohamed
TITLE: Hosting Manager

GENERAL OBSERVATIONS:
-Indirect Quote from one of the staff: "Research is pretty much non-existent here in Egypt, because looking at the numbers would be a catastrophe"
-Office is in a very undisclosed location... there is no sign on the door, no one picked up the phone when I called before, and none of the other office tenants in the building seem to know they are there

FULL TRANSCRIPTION:

D: Yeah, so my first question is just if you could give me an overview about what East Owainat.. am I pronouncing that right, East Owainat...

A: Yes

D: Agricultural Development is doing?

A: We... uh we plant crops that is most needed here in Egypt. Then... we try to fill the gap between what Egypt needs from, uh, to cover all the food needs in Egypt. Uhh, like wheat, corn, potato... uh, those are the main ones we plant. Uh, also we have not in Sudan, not near Sudan but in Alex-Cairo desert road we have some locations. We plant there grapes, uh a lot of kinds of grapes, like superior grapes, flames, a lot of kinds of, types of grapes. But this is in our farms that are located in Cairo-Alex Desert road. But near Sudan we only uh, uh, plant crops that is mostly needed in our country, like wheat corn or potato. We use, uh, I don't know how to pronounce it... Bivids.

D: Bivids?

A: That's uh, it, uh gives water to plants from uh, from above.

D: Ok

A: I don't know how to say it in English

D: Like a spray irrigation?

A: Yes yes. From sprinklers or something like this. Because it's a desert area it's all sand, it has no water inside of it. It can't maintain water around it. We import these bivalves, I don't know how to pronounce it, from America, from Reinke. I think it's very famous. Its slogan is "Better than Rain". Uh, we uh, we dig wells, deep to 200 meters, in the sand to reach the water. We call it a sea of good water. It's located in Libya, Egypt and Sudan. We uh, it's uh, I don't know how to say it... it's never, uh run out, it's renewable source of water underground.... because of a lot of rains in Assubia, Uganda, and these countries in Africa, it, the water is preserved underground and comes to Egypt-

D: It's an aquifer?

A: Underground. So satellites discovered the huge amount of water, and the government decided to use it to enhance the farming in this areas and planting in this area. Uh, weather is so difficult there. It's too hot, but it's also an advantage that we can grow up some crops earlier than here in Greater Cairo or around in Delta area. I don't know what to say more..

D: Uh, well some other questions along with that. How large are these, um, these projects that are in the Delta area and in this area by Sudan?

A: By Sudan we have 50,000 feddan... do you know what feddan is?

D: Yes, it's close to an acre

A: AH, good, yeah, you know what feddan is, nearly, as a size of Giza governorate, or twice the size of Giza governorate. It's huge.

D: And uh, this is a for profit company, right?

A: Yes

D: Does--do you have any relationship with the Ministry of Agriculture?

A: Yes, we sign contracts with them, so that they can take our wheat and corn to be in their warehouses to use it around the year to the Egyptian people.

D: But you don't share data as far as best practices for growing or anything like that?

A: Any data is mainly a secret for each company. We just share the price that we exchange the crop with the Ministry, nothing else.

D: Ok. Um, and um, so along with this, are there any scientific organizations to help with agriculture research and development? Like, do you work with any universities?

A: No, no, we have our engineers that plant the crops. They already have the knowledge and the know-how to plant it well.

D: So, are there any other partnerships besides? No relationship with the Ministry, no relationship with the universities, any company partners that work along with you?

A: No, just the local market and the Ministry. We plant and we sell it, whatever is available.

D: And how many people work for you?

A: Around 200. Agriculture is a machine-based industry, if we can see it. It's mainly concerned with machines, tractors, and other agriculture machinery.

D: mm. And um, so, uh, is it that right now most of the farming in Egypt is still done in the Delta, correct? In term of production, like what is produced?

A: It's all around the River Nile.

D: Yeah, the Nile delta.

A: The Nile starts from Luxor and Aswan in the south and goes north coming to the south part of the Mediterranean Sea. It's all focused around the River Nile. But in our site, near Sudan, it's nothing about the River Nile, it's underground water.

D: Uh, ---

(Man enters office)

A: One minute, please.

D: Sure, no problem.

(pause)

A: Sorry

D: No problem. So, uh, given the difficult conditions to farm in the area you were describing in the south close to Sudan, um why is the company focusing more on that vs. lands in the Nile Valley?

A: Yeah, the lands here are very expensive to buy. So the lands will cost a lot, around the Nile. There, the Ministry was giving us some good prices to buy the land, and uh, we saw it's a potential for us to go there and to start planting.

D: And, um regarding the farming situation in the Nile Delta in Egypt, do you think it's feasible that---so, what I know is that farms are very small, farmers are limited to how much land they can own here

A: Yes, around the River Nile

D: -- do you think that this prevents large-scale agriculture from taking place?

A: Around the river Nile, it will not happen. Near Sudan and in the desert, Cairo-Alex desert road, there is massive areas, vast areas that can be planted, that can use uh, it will produce a lot of plants. But around the river Nile it will never happen, it's because its already divided between a lot of people with small areas.

D: If I can ask, how much revenue--- well, first of all, how long is the company been operating, and around how much revenue do you produce in crops per year.

A: Ok, about 20 years, and uh, we can say about 30 million EGP. 25 to 30 million not using out full--full space of land, still need a lot of room for infrastructures. But if we reached that, if we used all of our areas full in planting, we can reach more than 50 million, I think.

D: And has that, have the two sites near Sudan and the one in the delta also been around 20 years, or is that kind of a newer project?

A: Here is a group of companies, all working in agriculture. Some of them are up to 20 years, and others are 10 or 15 year. In Cairo-Alex Desert road, it's about 10-15 years and in East Owainat it's about 21. Before 2005 we were not that big. We had the land, but we didn't have enough money to invest in all of it with our fixed assets and machinery and stuff like that. After 2005 we started the big move for us.

D: And uh, last question I guess is what do you see as the future for this kind of, um, work. Do you think that by 2050 most of the--well, do you think Egypt will be able to produce most of the food it needs? And do you think most of that will be produced in former desert land?

A: That's--- (laughs)

D: It's a loaded question, I know

A: It comes to politics I think. We need more planning on what to plant and where to plant. We need something to look at the picture as a whole, not for each and every grower to choose for himself what we want to grow. I think somebody needs to guide the industry, the agriculture industry in Egypt as we do in other things. Because it lacks proper management and planning. But I think if we do that, we will have our food, we will not import any of these massive amounts of food.

D: Do you think the Ministry should take that role?

A: Yeah, it's their role. But I think we have the land, we have the water, we have the know-how of what to grow, we just need somebody to put a tool in place. With a strategy.

D: And um, to what extent, um, sorry I know I said that was the last question, just 1 more, um to what extent does the company or the companies here focus on aspects of sustainable agriculture, um like efficient water use or things like this?

A: Um, I actually don't get what you are asking. What?

D: How much emphasis is there on sustainable agriculture practices like water efficiency, for example?

A: It's ok, our water is, as I told you before sustainable. We have no um, yani, it's ok. We don't do much efforts for it, it's already there to just use, you just need the pumps to get it out of the land, but nothing else. Just to plant and sell.

D: I think that's everything. Thank you so so much.

[END RECORDING]

اسم الطالب: دوروثي إسترادا

تعزيز المرونة الاجتماعية والبيئية في الجيوب الزراعية في المناطق الشبه حضارية بالقاهرة الكبرى: استراتيجيات للتنمية الاقتصادية المحلية وتحسين الأمن الغذائي

ملخص البحث

إن النمو السريع في المناطق الحضرية في جميع أنحاء العالم خلق إنذاراً عالمياً حول كيفية زيادة الأمن الغذائي للمدن، وقد سمحت الظروف في منطقة القاهرة الكبرى والتي لها علاقة بصعوبة الحصول على سكن ميسور وعدم وجود قوانين حكومية وعدم قابلية صغار المزارعين لتحقيق المكاسب الاقتصادية بالامتداد الواسع النطاق للعشوائيات في أكبر مدن شمال أفريقيا. وقد توسعت الأراضي المبنية على حساب الأراضي الزراعية على نحو سريع في العقود القليلة الماضية، وإن لم يتم القيام بأي تدخل فقد تختفي تماماً الأراضي الخصبة في منطقة القاهرة الكبرى مما يلحق الضرر بالبلاد من أزمه غذائية.

ويركز هذا البحث على أسباب وعواقب التعدي على الأراضي الزراعية في الضواحي المحيطة بالقاهرة في الجيزة. ويحدث هذا التطور على حساب انعدام الأمن الغذائي والثغرات في المرونة الاجتماعية-الأيكولوجية على طول محيط المدينة وحدوث المزيد من التصحر ونقص المياه في وادي النيل كأحد العديد من العوامل الإيكولوجية الأخرى. ويدرس البحث الر ئيسي استراتيجيات الزراعة التي تتسم بالمرونة في المناطق المحيطة بالمدن و التي يمكن تطبيقها على منطقة القاهرة الكبرى. وقد تم تقييم أمثلة لحالات الدراسية عن النظم الزراعية الحضرية لمحيط المدن من منطقة الشرق الأوسط وشمال أسيا وأوروبا من أجل استخراج "أفضل الممارسات" من حيث التخطيط المرن وتدخلات التنميةالاالتصادية المحلية للنظم الغذائية الحضرية. بالإضافة إلى ذلك تم تحليل بيانات نوعية من المقابلات الرسمية مع خبراء في المدن والأقاليم فضلاً عن المقابلات غير الرسمية التي أجريت في منطقة صافت اللبن (إحدى المستوطنات المحيطة في الجيز.). إن الناتج النهائي من البحث هو تصميم موقع جديد ونموذج عملية لمنطقة صافت اللبن حيث تكون بمثابة خطة متكاملة للنظم الزراعية المحيطة بالمدن في منطقة القاهرة الكبرى.

كلمات مفتاحية:

الزراعة الحضرية المحيطية، المرونة، التنميةالاالتصادية المحلية، الأمن الغذائي.

إقرار

هذه الرسالة مقدمة في جامعة عين شمس وجامعة شوتجارت للحصول على درجة العمران المتكامل والتصميم المستدام .إن العمل الذي تحويه هذه الرسالة قد تم إنجازه بمعرفة الباحث سنة 2017

هذا ويقر الباحث أن العمل المقدم هو خلاصة بحثه الشخصي وأنه قد اتبع الإسلوب العلمي والليم في الإشارة إلى المواد المؤخوذه من المراجع العلمية كلٌ في مكانه في مختلف أجزاء الرسالة..

وهذا إقرار مني بذلك،،،

التوقيع:

الباحث: دوروثي إسترادا

التاريخ :

تعزيز المرونة الالاتماعية والبيئية في الجيوب الزراعية في المناطق الشبه حضارية بالقاهرة الكبرى: استراتيجيات للتنمية الاقتصادية المحلية وتحسين الأمن الغذائي

مقدمة للحصول على درجة الماجستير في العمران المتكامل والتصميم المستدام
إعداد :دوروثي إسترادا

لجنة الإشراف

أ.أ .دنتيا شتوكمان
أستاذ تنسيقية المواقع والبيئة
جامعة شتوتجارت

أ.د. محمد صالحين
أستاذ التخطيط والتصميم العمراني المتكامل
جامعة عين شمس

التوقيع

لجنة الحكم
أ.د.....الممتحن الخارجي
أستاذ.....
جامعة .....

أ.د.....
أستاذ.....
جامعة .....

أ.د.....
أستاذ.....
جامعة .....

تاريخ المناقشة:.....

الدراسات العليا

ختم الإجازة
موافقة مجلس الكلية .../.../...

أجيزت الرسالة بتاريخ:.....
موافقة مجلس الجامعة .../.../...

جامعة عين شمس

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تعزيز المرونة الاجتماعية والبيئية في الجيوب الزراعية في المناطق الشبه حضارية بالقاهرة الكبرى :استراتيجيات للتنمية الاقتصادية المحلية وتحسين الامن الألألأيـ

إعداد: دوروثي إستلأادا

المستدام والتصميم المتكامل العمران في الماجستير درجة على للحصول مقدمة رسالة

المشرفون

أ.د .أنتيا شتوكمان
أستاذ تنسيق المواقع والبيئة
جامعة شتوت

أ.د. محمد صالحين
أستاذ التخطيط والتصميم العمراني المتكامل
جامعة عين شمس

يلي و2017