CRISIS OF URBAN AGRICULTURE
CASE STUDIES IN CUBA

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Abstract

This project investigates the extensive system of urban agriculture (UA) in Cuba, a network that arose out of nation-wide food crisis in the 1990s, with the purpose of speculating how elements of this system might be applied to other nations also grappling with food instability born from crisis. The study is primarily spatial in nature; it investigates the common characteristics of UA land in Cuba, the aesthetic impact of the farms on their urban context, and how UA produce travels from farm to consumer. After visiting, analyzing, and interviewing farmers on 21 UA sites (predominantly government-run organopónicos) across the cities of Havana, Cienfuegos, Trinidad, and Santiago de Cuba, successful and replicable elements of the Cuban system emerged. The farms are often in the center of areas of high density, on vestigial construction lots, and have on-site marketplaces, resulting in vibrant community spaces and immediate access to fresh vegetables. The system benefits in a number of ways from the strong, centralized government in Cuba, which is highly motivated to support in-country food production due to previous instability and ongoing insecurity. Organopónico regulations ensure quality and 'organic' methods, prices are lower than other options due to government support and minimized transportation costs, and all land used for these farms is owned and 'leased' to farmers by the government. While some elements of the Cuban system are unique to the country's distinct history and political system, I have identified five significant spatial attributes with the potential for replication.

Figure 1

Greenhouse, INRE 1
Havana, Cuba

Introduction

The Nature of Crises

Today's global food network balances on a precipice. As climate change intensifies, as land, water, and oil reserves are depleted, and as the resulting crises proliferate while populations grow (Clouse 2014), the stability of our industrialized, interdependent food system will begin to crack. These fissures will emerge at different scales: from nations reliant on imports, to cities separated from their productive hinterlands, our interconnected food system faces an uncertain future. Today's system is therefore exposed to many shocks. Anything from earthquakes in Italy to political unrest in Venezuela, typhoons in Indonesia to drought in the U.S., has the potential to unravel the world's chain of food production. If the climate continues to destabilize, the capacity of our cities and nations to respond to crises—crises anywhere in their foodshed—will be essential to survival. From this context, alternative and inventive modes of self-sufficiency demand our attention. (Clouse 2014: 21).

The dramatic truth is that "crises are ultimately productive. They force invention. Breakdowns incubate breakthroughs. Radical destruction gives way to new forms of production" (Wigley 2015). This adaptive potential will be true in our uncertain future, just as it has proved true in our past. Historical adaptations developed from crisis may hold lessons for what lies ahead. To this end, this research project takes Cuba, pre and post 1990s food crisis, as an example of an alternative adaptive system that flirted with self-sufficiency. In the aftermath of this crisis, Cuba developed a robust urban agriculture network that still feeds its people today. This

Figure 2

Streetscape, La Sazon
Havana, Cuba

study evaluates the physical characteristics, urban impact, and reach of Cuba's urban agriculture system to determine if any of its elements can be applied to other nations facing food instability.

History of Urban Agriculture in Cuba

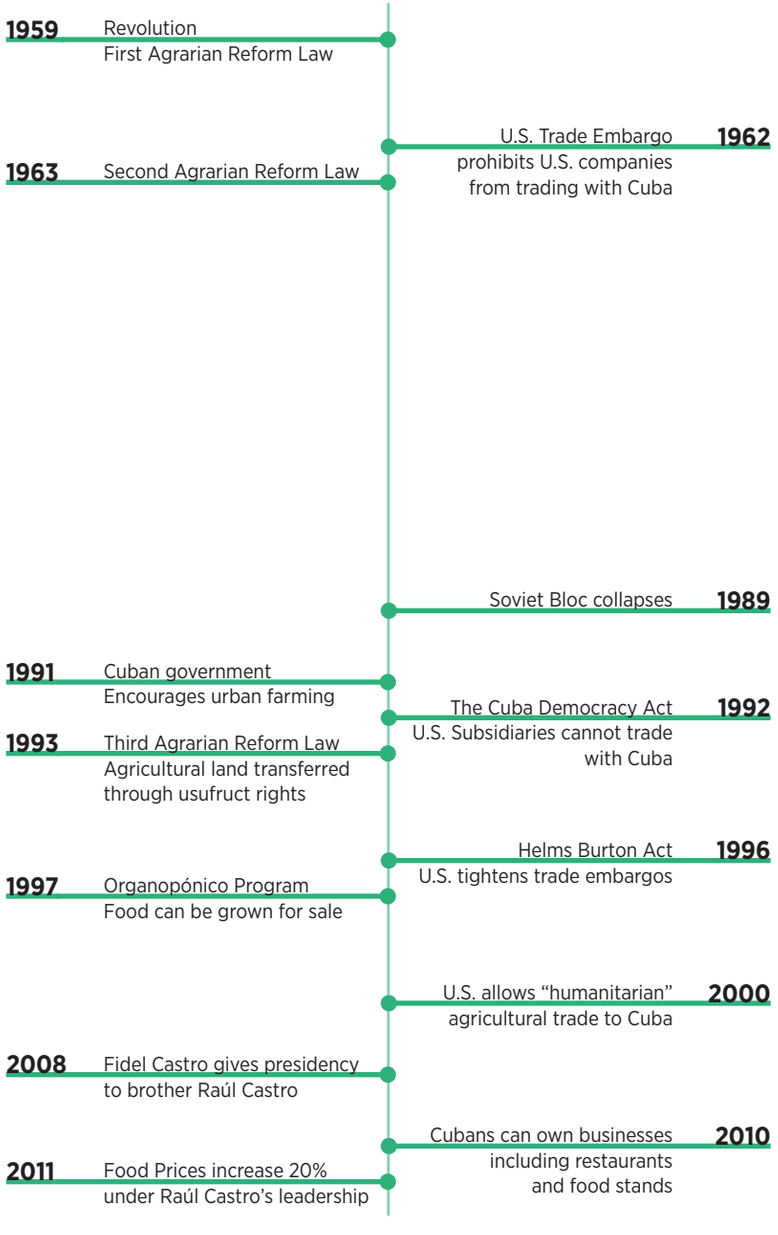
Cuba's history of food production is indelibly tied to the political systems in power both at home and abroad. Cuba's food instability was solidified in 1972, just over a decade after Castro came to power, when the country joined the Council for Mutual Economic Assistance (COMECON). Devoid of a trading partnership with the U.S. due to the 1962 embargo, the nation signed trade deals with the Soviet Union. These agreements limited Cuba's agricultural products to nonessential foods like citrus and sugarcane, and established a dependence on trade relationships for critical goods like cereals and oil. (Clouse 2014: 38). In 1988, Cuba imported 57% of its food supply (Murphy 1999: 1) with staples like cereals, beans, and rice imported at rates of 100%, 90% and 49% respectively. While multiple agrarian reforms in the early stages of the revolution converted Cuba's plantation-style agriculture into state-run farms, the nation's agricultural land stayed highly concentrated and focused on export crops (Figure 3). In 1989, 60% of Cuba's planted land was dedicated to sugarcane production, on some of the country's most fertile soils (Rosset 1994: 17).

Cuba's economy was dangerously dependent on the Soviet Union and Soviet Bloc in the late 80's, which together provided 84.6% of Cuba's imports and received 81.7% of its exports. At this time, Cuba's exports were 75% sugar and sugar derivatives, which were purchased by the Soviet Union

at an inflated, favorable price (Rosset and Benjamin 18). Up until 1989, the Cuban agricultural sector was characterized by a dominance of export monocultures, scant at-home crop production, heavy dependence on imported raw materials and food, and a high degree of modernization in farming methods, all buoyed by their agreement with the Soviet Union (Rosset 1994: 18).

Therefore, with the collapse of the Soviet Union in 1989, after three decades of developing a food system built on imports from this one political bloc, Cuba lost its supply of wheat, beans, and oil almost overnight. Cuba had also been importing 90% of its fertilizer and pesticides from the Soviets, so the systems of industrial agriculture that it developed to "emancipate the rural population" became immediately untenable (Wright 2009: 3-4). Tractors were left abandoned in fields, and Cubans were at risk of mass starvation as pesticides, fertilizers, and fossil fuels were ripped from the nation's grasp. Cuba—an island not only physically but also economically severed from its neighbors—was forced to develop a way to feed its population of 10.5 million people, 69% of whom lived in cities, (Rosset 1994: 15) without the imports of staple grains and agricultural technology that its entire food system had come to depend on.

The following decade is defined in Cuba's history as The Special Period in Time of Peace, an austerity program officially mandated in 1991 that today is a stand-in reference for Cuba's extreme isolationism. Food crisis followed this political and economic turmoil, and it has been estimated that the average Cuban's daily caloric and protein intake was reduced by 30% when compared to 1980s levels (Ibid: 22). In the three years after the collapse of the Soviet Union, this food shortage translated into a loss of thirty pounds for the



average Cuban (Clouse 2014: 33).

This period of isolation transformed the country—socially, politically, and spatially. Faced with extreme rations, Cuba's urban population took to the vacant urban land in order to produce their own food. The acute food shortages pushed the government to allow individuals to grow food on government-owned urban land, and in 1993 Castro responded to even more severe U.S. sanctions with the Third Agrarian Reform Law, which allowed 70% of Cuba's agricultural land to be transferred to individuals and cooperatives through usufruct rights (Schultz 2012). The agricultural systems developed during this period were devoid of pesticides and fertilizers by necessity, and therefore Cuba's emerging farming practices were organic by default. The Cuban Special Period represents the largest attempted conversion from conventional to alternative, semi-organic, agriculture in the world's history (Rosset 1994: 34).

In response to the U.S further tightening trade restrictions with the 1996 Helms Burton Act, in 1997 Castro further promoted urban farming by approving a new model for profit sharing—organopónicos. This program allowed urban farmers to augment their base government salary, of around 30 U.S. dollars, with earnings from surplus produce. By 2001, food security was under control in Havana, in large part due to the programs of government supported urban farming (Clouse 2014: 44). From guerrilla growers to the state-run organopónicos, urban agriculture in Havana alone converted 35,000 hectares of land into productive space. From tiny balcony gardens and rooftop farms to collective lots and the multi-hectare fields of Havana's green belt surrounding the city (Clouse 2014), Havana was transformed: severe food shortages were satiated, in part, by output from organic, urban farms. By the early 2000s, Cuban officials

Figure 3
Timeline of
Cuban Food Crisis

estimated, conservatively, that more than 50% of the fruits and vegetables consumed in Havana were produced within the city (Clouse 2014: 35). A country whose food system was previously reliant on imports became self-sufficient through urban, organic agriculture (Diaz 2005).

Despite this legacy of success, the future of UA in Cuba, along with many elements of its present economy, is not clear. The Cuban diet today has improved from its crisis time severity; however, the population is still under 'food stress' due to the challenges Cubans face in securing a balanced diet. High protein animal products like butter, cheese, milk, and meat are still in short supply, as Cuba's cattle population has yet to rebound to 1980s levels due to the difficulty of growing feed in a tropical climate (Clouse 2014: 52). The isolation Cuba saw in the early 90s is also no longer a reality. Today, 25% of Cuba's total food and agriculture imports come from the U.S., including poultry, corn, and wheat. Brazil is Cuba's main source of soy products, and other food imports come from the EU and People's Republic of China. (Ibid: 38-39). While Cuba-U.S. relations had shown further signs of thawing in early 2016, at time of writing the inauguration of President Trump casts doubt on future improvements to trade partnerships between the neighboring countries. Although Cuba today has diversified its imports of food, it is still dependent on Venezuela alone for oil, an all too familiar dynamic. The two countries' 15-year oil agreement is unraveling as Venezuela experiences increasing political and economic turmoil. In 2016, Venezuelan exports of oil to Cuba dropped by 40%, and the Cuban government had to reduce power service daily in state run buildings. (Parraga 2016). Cuba's need for low-input, urban agriculture has not yet evaporated.

Figure 4

Centro Havana
Cuba

Urban Agriculture in Theory

Cuba's historic success feeding its population with urban agriculture lies in stark contrast to widespread, international doubt about the efficiency of UA. Both economists and agronomists alike traditionally question whether the relatively low-yield from organic, urban agriculture can contribute to the world's hurdle of increasing food production by 70% to feed an expected 2050 population of 9.2 billion without increasing the footprint of agricultural land (Connor 2013). Those that question how organic methods can contribute solutions to global food crises presume continued access to oil and chemical fertilizers, and furthermore ignore the presence of political influence over industrial global food production. This is a Global North worldview that disregards the fact that when developing countries use methods of conventional agriculture, they are made vulnerable by a reliance on expensive foreign inputs (Rosset 1994: 30).

While UA is well-regarded in the planning community for its "ability to enhance urban aesthetics while generating ecosystems and social benefits" (Viljoen, Bohn, and Howe 2005), it faces criticism from economists who see it as a "symptom of poverty and sub-optimal land and labor use" (Davidora 2011) that holds back economic growth. Urban agriculture has been similarly passed over by food scholars who "do not view [it] as a robust section of the food system because of its limited ability to supply food" (Thiebert 2012). While some points made against UA by this multi-disciplinary chorus hold true in the case of Cuba—namely UA as a symptom of a poor economy—assertions that it lacks the ability to efficiently and thoroughly provide food to a foodshed are questioned by the Cuban example. The

backdrop of crisis pertinent to this study calls for another look at the scholarship surrounding UA: both its effectiveness in feeding a population, and its potential to render a nation self-sufficient need to be re-evaluated within the context of 'crisis.'

Research Questions

This study is motivated by the premise that with rising global instability and increasing urban populations, our petroleum-based food system will come under threat. Cuba's food crisis in the 1990s, and the nation's subsequent use of urban agriculture as an adaptation to this crisis, deserve a fresh look as we enter a time of potential world-wide food insecurity. This is a spatial study that investigates the network of urban agriculture in Cuba in order to speculate if and how elements of the Cuban system might be extended to other nations or cities grappling with food instability in the face of crisis. The study asked four questions of urban agriculture in Cuba:

1. What is the path food takes from growth to consumption?
2. What are the common characteristics of urban land used for food production?
3. What are the spatial and aesthetic impacts of urban farms on the surrounding city fabric?
4. Do urban residents depend on this produce as a food source?

Methods

I conducted field research for this study in urban Cuba during July 2016. The cities chosen for in-depth analysis were Havana, Cienfuegos, Trinidad, and Santiago de Cuba, due to both population size and reported significance in previous studies of urban agriculture (Figure 5). While I identified a few sites of UA prior to travel based on information from previous studies, the majority of farms visited were identified while in the field. We used two methods to identify new sites: conversation with residents and farmers about surrounding urban agriculture activity, and remote sensing with satellite imagery. The rows of green beds on a backdrop of brown soil, characteristic of urban farms, were easily visible against the surrounding city fabric in this imagery. We used satellite GPS to both remotely locate new farms to visit and to mark the location of observed sites of UA while biking, driving, and walking through cities.

Upon arriving at a new site of urban agriculture, my research assistant and I employed the following four-part methodology in pursuit of the study's research questions: First, we located the farm on an urban map of the relevant city; second, we informally interviewed the farmer to discern the classification of the farmed land and the reach of the farming practice; third, I drew a plan of the farm and its surrounding context; and fourth, I photographed and drew the farm in order to assess the spatial and aesthetic impact of its presence on the urban fabric.

The informal interviews with farmers included questions to ascertain the following: size of the farm, how the farmer acquired the land, what type of organization governed the site, crops that were planted, the comparative cost of the

food grown, if food was produced for commercial purposes or personal consumption, who consumed the food produced, and what methods of farming were used. We recorded notes from each interview on template interview sheets along with other observed qualitative and quantitative information.

I analyzed and classified the data obtained in the field upon return, and mapped all observed and visited farms into a GIS dataset. Visited farms were classified based on the following variables: relationship to Ministry of Agriculture (MINAG), density of surrounding area, and size of lot (Figure 15). In total, we visited and documented 21 sites of urban agriculture in the 30-day field research period, across the four cities. I identified eight other sites through the methodology described above, shown on the maps in Figures 6 through 10, but did not visit these sites. Information regarding the classification, qualities, and observed significance of these sites of urban agriculture can be found in the following sections.

Figure 5: Cuba

Figure 6: Havana

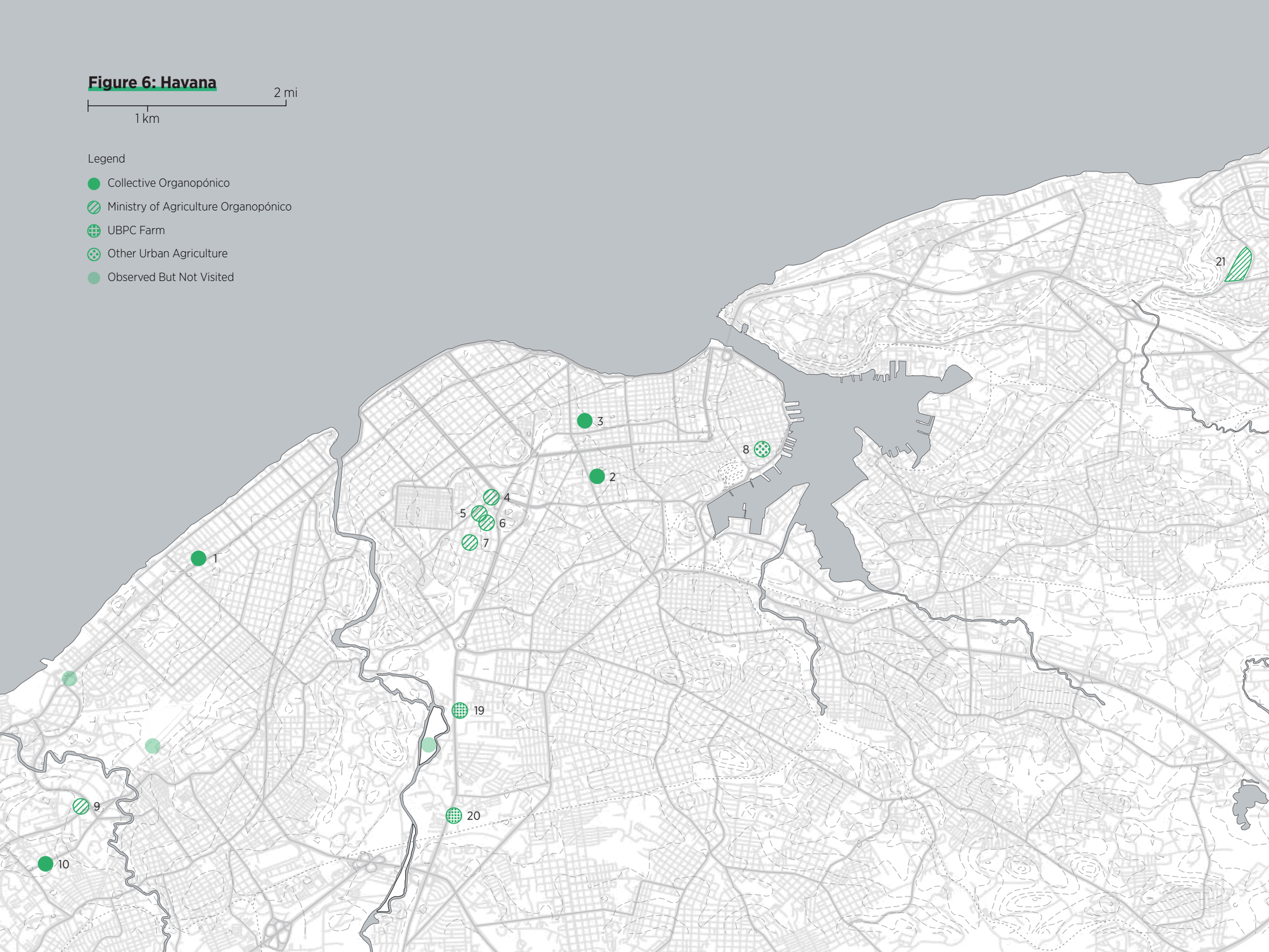


Figure 7: Havana

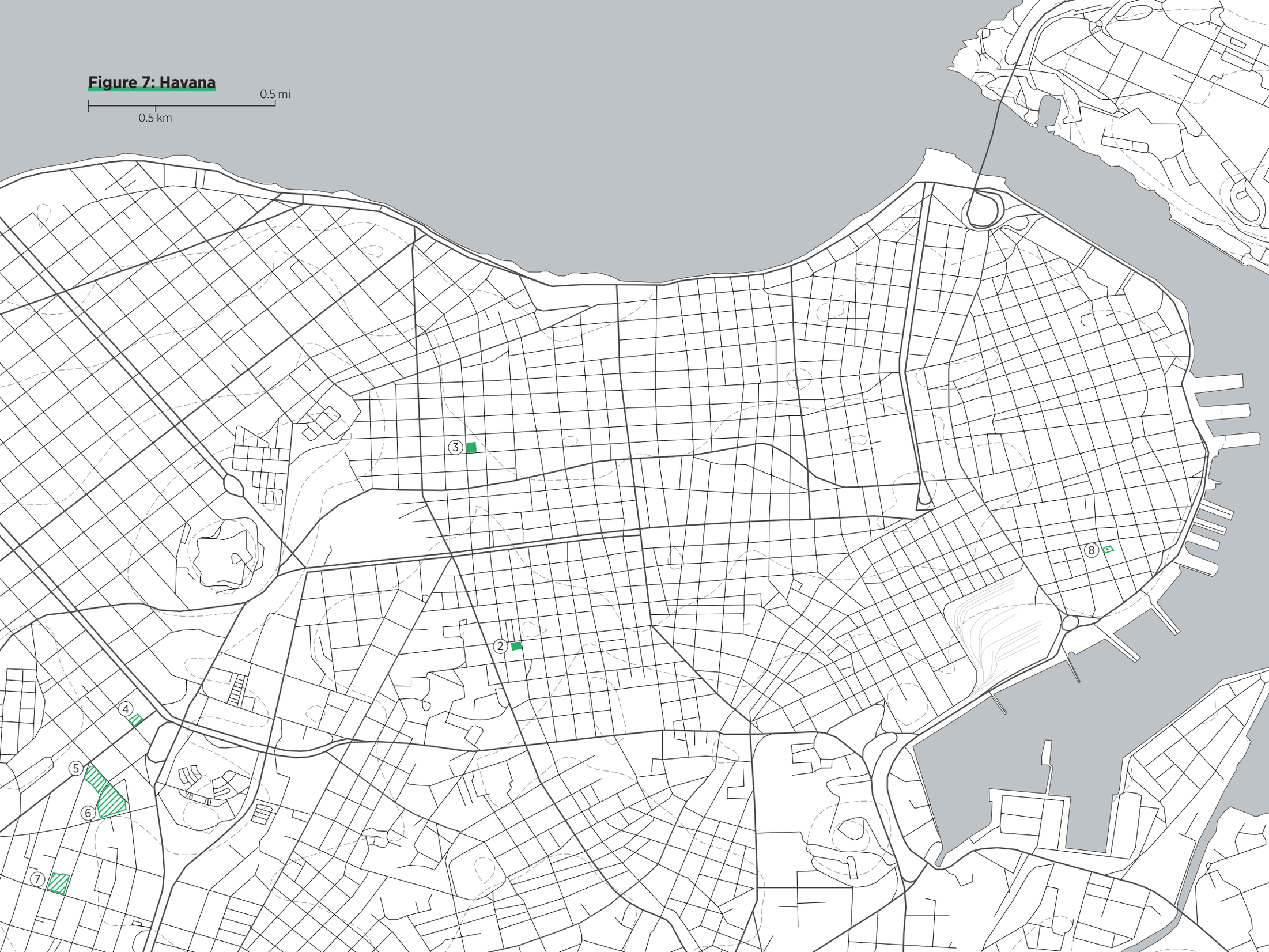


Figure 8: Cienfuegos

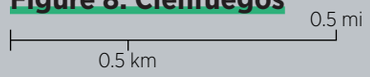


Figure 9: Trinidad

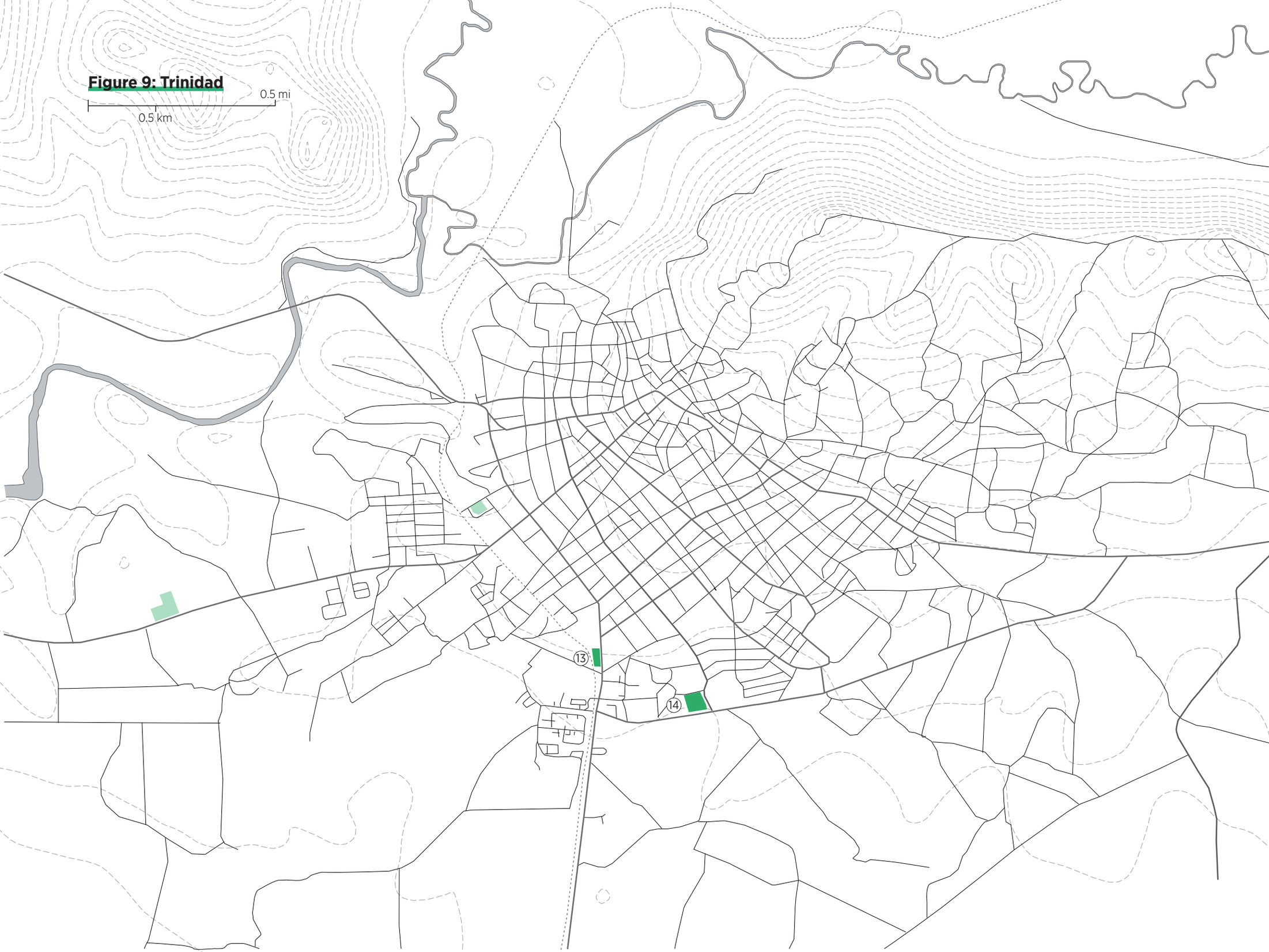


Figure 10: Santiago

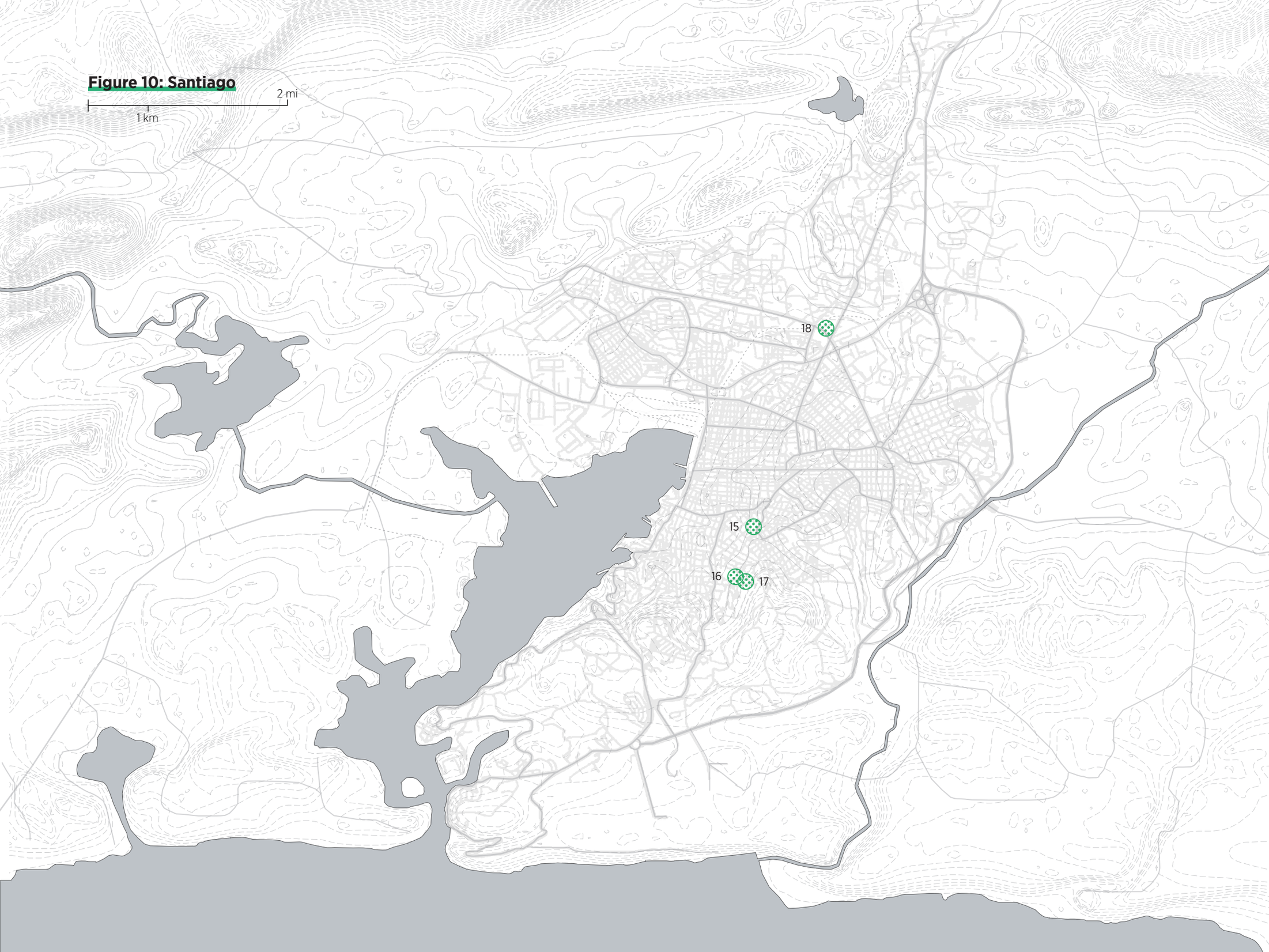


Figure 11
Farmer at INRE 1
Havana, Cuba

Figure 12
Market Stand
Havana, Cuba

Figure 13
La Sazon
Havana, Cuba

Figure 14
INRE 1 Hoops
Havana, Cuba

Figure 15
Market Stall
Havana, Cuba

Results and Analysis

The 21 sites of urban agriculture that I visited in Havana, Cienfuegos, Trinidad, and Santiago de Cuba displayed clear spatial trends and common functional significance. This section explains the results of the research, and then identifies three trends of note across the data collected. Of these 21 sites, 14 were classified as organopónicos: for-profit urban farms run by residents on government land. Of the 14 organopónicos, nine were run by collectives and five by residents working directly for the Ministry of Agriculture. All organopónicos are subject to government regulation, and therefore characteristics such as bed size, vending practices, and types of produce grown are consistent across sites. Two of the 21 sites were larger and run by Basic Units of Cooperative Production (UBPC), four were informal with no point of sale, and one was an old organopónico converted into a medicinal herb garden due to problems with water access (Figure 16). Figures 6-10 were maps of each city, showing the location, relative size, and classification of all sites of urban agriculture, both visited and observed.

Due to its scale, Havana (Figures 6 and 7) had the most diverse range of UA types, with five Ministry of Agriculture-run organopónicos, five collective organopónicos, and 2 UBPCs. The collective organopónicos are run by worker groups that arrange profit sharing for farmers but are still regulated by, and pay a profit tax to, the Ministry of Agriculture to keep their organopónico status. Generally speaking, these collective farms are newer, less organized, and slightly unkempt when compared to their MINAG counterparts. In both Cienfuegos and Trinidad, I visited two

Summary of Results

	Name	City	Affiliation	Market	Density	Size
1	INRE 1	Havana	Collective Organopónico	Yes	Medium	1.0 ac
2	24 de Febrero	Havana	Collective Organopónico	Yes	High	0.4 ac
3	Raquel Pérez	Havana	Collective Organopónico	Yes	High*	0.4 ac
4	Oro Verde	Havana	MINAG Organopónico	Yes	Low	0.3 ac
5	5to Congresso	Havana	MINAG Organopónico	Yes	Low	1.3 ac
6	Plaza	Havana	MINAG Organopónico	Yes	Low	2.5 ac
7	La Sazon	Havana	MINAG Organopónico	Yes	High*	1.3 ac
8	San Isidro	Havana	Other	Yes	High	0.1 ac
9	Playa	Havana	MINAG Organopónico	Yes	Low	5.4 ac
10	Las Americas	Havana	Collective Organopónico	Yes	Medium	0.5 ac
11	La Calzada	Cienfuegos	Collective Organopónico	Yes	Medium	0.6 ac
12	Grifo Viejo	Cienfuegos	Collective Organopónico	Yes	Medium	0.4 ac
13	Julio Sotolongo	Trinidad	Collective Organopónico	Yes	Medium	0.6 ac
14	Belleza Productiva	Trinidad	Collective Organopónico	Yes	High*	1.9 ac
15	Hospital Garden	Santiago	Other	No	Medium	0.1 ac
16	Chicharrones 1	Santiago	Other	No	High*	0.2 ac
17	Chicharrones 2	Santiago	Other	No	High*	0.6 ac
18	La Finca Privato	Santiago	Other	No	Low	1.6 ac
19	Febrero 24	Havana	UBPC	Yes	Low	5.9 ac
20	1rd Julio	Havana	UBPC	Yes	Low	5.1 ac
21	Vivero Alamar	Havana	Collective Organopónico	Yes	High*	27.2 ac

*High density housing project

Figure 16
Summary of Results

organopónicos each, both run by collectives, but observed a few more in both cities as shown on Figures 8 and 9 respectively.

Santiago de Cuba is the outlier of the four cities. During field-work there, I did not witness any organopónicos, and there were no points of sale at any of the observed sites of UA. While some of the spatial trends to be discussed do hold true for the more informal farming that was observed, UA in Santiago was of a different tenor. Compared to the bustling sites of UA in other cities, in Santiago no residents or farmers were present, and sites had a forgotten, deserted appearance contradicted only by the presence of growing plants (Figure 17). The lots were generally less than half an acre, smaller than the UA lots seen in other cities, which ranged from .5 to 27 acres in size. There are a number of reasons why Santiago might be such an anomaly with respect to the type and quality of UA activities. The climate is considerably hotter and drier than Havana, for example, with average temperatures 3° higher and precipitation 10cm lower than its more eastern counterpart (Climate Data). Additionally, the terrain, as depicted in Figure 10, is steeper and more uneven than the other cities, as much of the urban fabric springs out of severe slopes unsuited to agriculture. While the nature of UA was distinct from other cities, the activity was still present and contributes to the significance of an important spatial trend that will be discussed in the following section.

Accepting Santiago de Cuba as an outlier, the UA I observed in the other three cities had significant commonalities, and through my visual observation and farmer interviews, research question one, *what is the path food takes from grown to consumption*, was immediately answered. The

Figure 17
Chicharrones
Santiago de Cuba

14 organopónicos were highly regulated and organized—they each had an attached market stall to sell produce and were clearly subject to spatial standards. Instead of the hodgepodge of balcony gardens or front-yard farms depicted in the literature on UA in Cuba, I observed a highly regulated and established system of organic farming and food vending. The consistency of market stalls explains how food grown on UA sites reaches consumers, as produce is consistently sold directly from the farm to residents. It is significant to note that none of the farming observed was subsistence farming; all food was produced with the goal of sale for profit at both UBPCs and organopónicos. The difference between these two types of urban farms is organopónico's use of raised beds, and scale, with UBPCs generally covering five times the area of an average one-acre organopónico (Figure 18). Organopónicos, typically in denser areas and on land of uncertain history, must use raised beds filled with soil from the countryside to protect against contamination, while UBPCs can farm directly on the land in their less dense urban context. Vivero Alamar, an organopónico on the east side of Havana, is a notable exception in both scale and type of farming, as it covers 26 acres and grows crops directly in the soil.

Though the focus of this study is not on the organic methods of farming employed by urban agriculture in Cuba, which is widely applauded, there were a few consistent methods worth noting. The majority of farmers interviewed mentioned the use of 'natural pesticides,' which included planting green onions around the edge of raised beds to ward off pests (Figure 19), and the placement of large bushes of oregano at the ends of rows to serve the same purpose. Organopónico INRE 1, the first in Havana, planted cacti around its perimeter fence in order to 'purify' the air coming into the

Figure 18

UBPC 24 de Febrero
Havana, Cuba

Figure 19

Green Onions at Playa
Havana, Cuba

farm off the road, as well as to create an extra deterrent for individuals considering stealing from the farm. This technique was also observed at Organopónicos Playa and Plaza.

Three Trends: Markets, Housing and Water

Research question two, *what are the common characteristics of urban land used for food production,* is best discussed through three spatial trends across the witnessed urban agriculture sites. These three trends are the following: the presence and urban significance of market stalls attached to farms, the confluence of high density housing projects with sites of UA, and the persistent concern of water access for farming activities.

With the exception of Santiago de Cuba, as already noted, all instances of urban farming we observed came with an adjacent market stall, just feet away from the produce production. These markets were consistently within the urban lot of the farm (Figures 12, 15, 20-22). Facing the street and typically labeled with the farm name, these market stalls, staffed by farmers, sell the produce from the farm to residents in the surrounding neighborhood. When these stalls are set back from the sidewalk (Figure 22), as is the case at INRE 1, La Sazon, and Oro Verde, the markets serve as informal community spaces, where residents interact while buying fresh produce for their home, casa guests, or paladar (informal restaurants operated out of residences). In contrast, these market stalls can also be pressed right up against the sidewalk, presenting a welcoming front to the neighborhood. In some cases, like Raquel Perez, 24 de Febrero, and Vivero Alamar, the attached market stall extends the length of the farm, incorporating an entrance and a covered vending

area, almost as if trying to blend into the surrounding urban fabric (Figure 20). In the summer months, the organopónico markets supplement their own produce with vegetables grown in the cooler countryside, an arrangement that maintains their role as bustling hubs of community food access all year round.

The second trend worth noting is the spatial overlap of housing projects and organopónicos. This concurrence was apparent in La Sazon and Raquel Perez in Havana (Figures 13, 22- 23), in Belleza Productiva in Trinidad, and in the farming seen in the Chicharrones neighborhood in Santiago de Cuba (Figure 17). The housing developments at these sites were built in the 1980s Soviet era, the pre-collapse period in which the USSR's influence over Cuba was extreme. The USSR was not only Cuba's main source of imported goods, but also their resource for technology and expertise (Rosset 1994: 30). The time of this construction made these housing projects ripe areas for urban farming in the decade that followed. For example, Organopónico Raquel Perez, founded in the late 1990s, was built on a lot flanked by two 20-story high-rise apartment complexes. This lot was used as a staging area during the 1980s construction of these buildings, so when the economy collapsed a few years after they were built, the central lot had yet to be put into use and was available for urban farming. This appears to be a common history of organopónico lots—the land central to large housing projects built in the 80s was undeveloped when the USSR dissolved and was therefore converted to farms a few years later during the Special Period. This places organopónicos directly amidst areas of high-density residential populations and means that farms and their markets are within walking distance of a large number of city residents.

Figure 20

Market at 24 de Febrero
Havana, Cuba

Figure 21

Market at La Calzada
Cienfuegos, Cuba

Figure 22

Market and Housing at La Sazon
Havana, Cuba

The third trend among UA sites in Cuba is the challenge of water access for farming in an urban environment. This was especially evident in Havana, where the government controls residents' supply of water through a network of crumbling infrastructure (Clouse 2014: 45). In July 2016, a drought had reduced the level of water in the city's aquifers to such a degree that the government restricted water supply to every other day. Because of the inconsistency in water supply caused by restrictions like this, many residents use back-up barrels to store siphoned water pumped when it is available. Water access is therefore a fraught subject in Havana, and farmers at Raquel Perez, INRE 1, Vivero Alamar, and San Isidro confirmed this by mentioning water use as a point of contention between the community and urban farms. Farmers at Raquel Perez, INRE 1, and Alamar boasted their own, on-site well, an essential resource that both ensures consistent irrigation and appeases residents' concern about farmers expending the neighborhood's entire water supply.

Water is the protagonist in the story behind the only urban agriculture site we observed in Havana that was not an organopónico or UBPC. San Isidro is a small urban farm that specializes in medicinal herbs sold out of its market storefront—an apparently booming business in its fifth year. In the 1990s, this sliver lot between two crumbling buildings in Habana Vieja was an organopónico, founded on the site of a collapsed building. The farm did not have a well, and farmers switched the land to medicinal herbs in the early 2000s because of the burden of municipal water use; plants like aloe and peppermint need less water than vegetables. At the time of the visit, there was no water at the farm whatsoever. The farmer explained in our interview how the government broke his water pipe while renovating the street five years

Figure 23
Housing at Raquel Perez
Havana, Cuba

previously, and had yet to repair it. In the meantime, the farmer regularly carried water to the farm from his house to serve his production needs. San Isidro's story is surely an anomaly, however the case demonstrates a fundamental challenge facing agricultural activity in urban areas—access to clean and plentiful water for crop irrigation (Ibid: 54).

Attitudes Toward Urban Agriculture

Research questions three and four, *what are the spatial and aesthetic impacts of urban farms on the surrounding city fabric*, and *do urban residents depend on this produce as a food source*, were both answered by conversations we had with residents and farmers. These discussions illuminated common sentiments toward urban agriculture that begin to explain the role it has taken in Cuban culture. The three themes of market accessibility, housing density, and water use influence residents' feelings toward organopónicos, with the first two contributing to their popularity. A few residents mentioned to us that they appreciate the greenery that urban farms bring to the neighborhood, a contrast particularly evident in Habana Vieja and Centro Habana, where treeless streets are filled with swirling dust and unrelenting sun (see Figure 4). The farms of San Isidro, Raquel Perez, and 24 de Febrero emerge from this dense crumbling fabric like oases—lush, green openings in a densely packed city-scape.

Many urban residents also spoke of how they love the proximity, assurance of quality and low price of food grown on organopónicos. As a point of comparison, one farmer explained that agromercados, markets that sell produce grown in the countryside, are five times the price of organopónicos, largely due to difference in transportation

costs. Considering this price differential in reference to the average Cuban's $40 monthly salary implies that residents rely on the food from urban farms to maintain a complete and balanced diet. With regard to this question, it is important to highlight the role government support plays in the organopónico program. The farmed land is either government-owned and run or leased to cooperatives for 25-year renewable terms (Schultz 2012), and MINA also provides seeds, in effect shouldering much of the burden of cost.

In summary, within the Cuban system of urban agriculture today, land used for farming is government-owned and often near high-density development. These farms provide aesthetic respite from a dusty, decaying urban fabric. Food is sold from market stalls directly on the farm, and residents rely on this relatively inexpensive source of fresh produce. The challenges and possibilities for reproducing elements of this system are discussed in the following section.

Figure 24
La Sazon
Havana, Cuba

Figure 25
Vivero Alamar
Havana, Cuba

Figure 26
San Isidro
Havana, Cuba

Figure 37
Vivero Alamar
Havana, Cuba

Conclusions

The intention of this study was to consider if elements of the Cuban system of urban agriculture might be applied elsewhere. Conclusions regarding replicability can be drawn based on both the results of this study and an understanding of the conditions that contributed to UA's proliferation in Cuba. It is first important to discuss the unique elements of the Cuban situation, which complicate a discussion of replicability. It is clear that urban agriculture in Cuba was motivated and enabled by the extreme extent of their food crisis, the strength and power of the centralized government, and both vacancy and low land values in urban settings. The severity of the food shortages seen during the Special Period ensured an engaged citizenship behind government-led UA initiatives, and the government was equally supportive of individual farming efforts. The dire necessity of urban farming during this time is largely responsible for the pervasive and entrenched system of UA seen today.

Additionally, the unique strength and reach of the central government in Cuba cannot be separated from the success of the urban agriculture program. All of the sites of urban agriculture observed were on government land. The legal framework of usufruct rights allowed individuals and groups to use government land for farming initiatives over long-term lease periods (Schultz 2012: 117-38). This policy and framework of ownership makes it easy for the government to assign land uses to plots of land, independently from market force. In fact, between 1960 and 2012, there was no real estate market in Cuba—Cubans legally owned their homes but were unable to sell them (Clouse 2014: 56). Therefore, after the food, and economic, crisis of the '90s, urban land had no real

value: state construction had halted and Cubans could not sell or buy property anyway. These unique land-use policies, and the government's ability to control all development, are elements of the Cuban system unlikely to be replicated in other countries.

However, there are other UA practices developed in Cuba that have the potential to be employed elsewhere to improve food security in advance of crisis. The cases explored in this study indicate that government support for urban farming practices is essential for ensuring adequate land access and effective affordability of produce. To this end, governments in other nations could subsidize urban farming practices in the face of food crisis, including providing seeds and public land to support the practice. Additionally, the on-site vending so pervasive in the Cuban system demonstrates an effective method of integrating an urban farm into city fabric. This market strategy also ensures that time, cost, and energy used in the transportation of food to citizen is minimized—an essential feature of the Cuban system that ensures its capacity to function in the face of threats to the nation's food system or economy. Additionally, the model of placing urban farms within dense urban populations, like housing developments, presents a large potential for successful replication. This spatial overlap places the affordable, fresh, produce within range of a large number of people, who are generally of low income and therefore sensitive to food insecurity.

The specific organopónico practices of raised beds and plant-based pesticides would also benefit a replicated system. The policy of importing soil from the countryside in order to form raised beds has an associated upfront cost but eliminates any immediate concerns about soil quality,

enabling a relatively quick start for the farm in question. Plant-based pesticides, like green onions, are an efficient way to manage pests as the vegetable can be eaten or sold as well. The water issues presented in the Cuban system, resolved only by the expensive project of digging an on-site well, is a significant impediment to proliferation of UA in other countries, particularly those in dry climates. Adaptations involving appropriate plant species can mediate some of this challenge, as was seen in San Isidro, however adequate water access is likely a pre-requisite for a successful UA system.

Haiti and Jamaica would be appropriate starting points for a study that sought to apply the lessons learned from the Cuban example to other specific nations. Though their political climates differ from Cuba's, they are also Caribbean island nations that experience food insecurity in the face of crisis. Both are import dependent and geographically isolated; Haiti still reels from the 2010 earthquake and 2016 Hurricane Matthew; and Jamaica confronts an economic crisis made more severe by the rising cost of imported food (Cave 2005). Overall, the Cuban experience with urban agriculture demonstrates a revolutionary use of urban space that mitigated the impact of widespread food crisis. Many discreet elements of this system have the potential to be replicated in other nations, both to prevent a crisis from affecting food supply, and to mitigate the effects of a crisis that is already underway.

Port
Havana, Cuba

Castle
Havana, Cuba

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Acknowledgements

I am grateful to the Hixon Center for Urban Ecology and the Tropical Resources Institute of Yale University for funding this project, as well as to Michelle Addington for advising my studies. I would like to thank Reinaldo Funes Monzote for his generosity, as well as all of my colleagues and friends in Cuba who leant me their stories and experiences. I would also like to thank Frederico Labanti for sharing his immensely helpful research in advance of my field study. A final thank you to Zoe Flavin, my translator and research assistant, for her patience and sense of adventure.