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THE DEVELOPMENT AND RESILIENCY OF ORGANIC URBAN AGRICULTURE IN HAVANA, CUBA

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Abstract

This paper examines the existence and development of sustainable agriculture in Cuba and how, following the collapse of the Soviet Union, Cuba began to revolutionize its agriculture system. Dating back prior to Spanish colonization in 1494, the native Cubans, the Taíno Indians, used certain environmentally friendly forms of agriculture, such as crop rotations, organic fertilizers, and regionally dependent planting suited to the island's tropical climate and relatively fertile soils. Colonization subsequently led to a monoculture of sugar cane and the plantations began to destroy soil conditions and the landscape. A few Cuban scientists in the nineteenth century pushed for more environmentally sound approaches to agriculture, but the dominance of environmentally destructive sugar cane production continued well after the Spanish-American War in 1898.

When Fidel Castro took control of the government in 1959, he initially called for environmentally friendly agriculture; however, this did not last once Cuba began trading sugar crops for petroleum with the Soviet Union. By the 1970s, some agriculturists and ecologists in Cuba began research into an "alternative" approach to intensive, chemically dependent agriculture. It was not until the fall of the Soviet Union in 1989 that Cuba was forced to alter their agricultural practices with the subsequent loss of chemical inputs, oil, and food imports Cuba had received from the Soviet Union.

Cuba quickly was able to implement low-input sustainable agriculture into its farms because of two factors: the scientists who had begun studying agroecology in the 1970s, and the traditional knowledge from rural farmers that had not been forgotten during Cuba's input-intensive sugar production. Within one decade, urban agriculture

began to appear in Cuba, particularly in Havana, as a result of the actively passionate citizens who had little experience with gardens, but began to grow food out of necessity following the fall of the Soviet Union.

The question arises as to how did Havana's farmers become successful with agriculture? The answer, as this paper explains, is a rural-science-urban connection that kept alive a vibrant traditional knowledge that was adopted by groups of scientists, who then worked with urban gardener groups to implement the knowledge in areas of Havana. At the same time, the past 20 years has seen successful and growing urban agriculture because of a passion for environment and self-provision of food. Cuba has become almost entirely food secure with very few outside imports, yet the future may hold threats to the resiliency of sustainable, urban agriculture.

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Chapter One

Introduction

1.1: A Nutritional Perspective in Geography

I have this friend who is a bit of a hippie, not in the "peace, love, and hugs" sense, but in the "do your own thing, become your own person" sense. She might not realize it, and I did not until I was well through college, but she is perhaps the biggest influence in my academic decisions because she introduced me to permaculture and living sustainably. It would take a few more years for that idea to sink in and pique my university interests but coming to Penn State, I was certain of one thing: I wanted to study food. I am unsure as to why my initial consideration did not include agriculture, but as it was, I chose to study nutrition. Still, my friend's interests soon became my own.

What has kept me interested in my nutrition major has not been the clinical aspects: working with patients, treating diseases, analyzing blood levels. I have found that I enjoy nutrition application in other fields, usage in jobs outside of becoming a dietitian. I discovered the international agriculture minor at Penn State and consequently, agriculture was where I wanted to be. How do we get the food that is grown in the soils into people's mouths? I broke down nutrition study into its most basic unit: simple food consumption. With international agriculture, I took introductory level classes on agriculture techniques, sustainable agriculture, and more advanced coursework in small-scale food production strategies, and fieldwork in tropical farming. And I loved all the topics; I loved learning about cropping patterns and planting methods that were generations old. One of my favorite memories in college has been climbing to the top of

a plantain farm in Puerto Rico to complete a cross-sectional map of the area, witnessing the beauty of the fields. Nonetheless, with this farm work, I was leaving nutrition behind. The two fields of study were not connecting as I thought they would and knew they should. On my nutrition study abroad to Italy, I was the only student who wanted to visit more farms, actually walk the rows of grapes before we sat down and sampled the wine: every other student just dove for the bottle (not that I was complaining). At Penn State, nutrition does not lend itself easily to agriculture, at least not on an undergraduate level. We are trained to become clinical dietitians, which is a growing and important field to enter. But I wanted to learn more about soils, crops and manure. Yes, I wanted to learn about poop. Not the human kind in nutrition (and trust me, we cover that extensively), but the cow kind.

The summer before my senior year, I decided to sign up for another class. It was not that I needed 18 credits, but I figured why not? When else was I going to have all this knowledge potential at my fingertips? I remembered my sophomore roommate telling me about enjoying her geography classes so I decided to see if I could find a class to fit in my schedule. When I came across Biological Diversity in Agriculture and Global Change, instantly I signed up and waited in anticipation for the fall semester to begin.

I was hooked to geography after one class. Well, maybe not just one: I was nervous about my lack of geography knowledge, my lack of the vocabulary in the field. I found that I already knew a lot because agriculture and nutrition link so well within geography. The field connects that gap between production and consumption. I was finally in a class where it could be routine to discuss soil nutrients and cropping patterns

in one sentence, and then respond with evidence about human consumption and vitamin content in the next.

In class, I became increasingly aware of the connections between agriculture and nutrition, but especially in the week when our readings focused on agrobiodiversity and food security. The Giuliani et al. (2009) work on emmer production in Turkey demonstrated the importance of landraces in creating different economies and the need to preserve seed varieties. In Italy, emmer production has turned into a niche market but in Turkey, it is only the rural, mountainous farmers who are cultivating the crop because of both its success in poor soils and its nutritional value. Emmer is higher in antioxidants and protein than durum wheat, yet its consumption has fallen out of favor in Turkey and is considered the food of the poor (Giuliani et al 2009, 222). Emmer represents "a valuable but as yet unexploited resource for securing the livelihoods of poor rural communities in marginal areas" (Giuliani et al. 2009, 227). After reading about emmer's underproduction relative to its nutritional value, I began reading about other grain varieties, specifically ancient grains that are not as popular or widespread. Some grains, like quinoa, amaranth, teff, and sorghum can be used in diets for people suffering from celiac disease as they do not contain any gluten; however, these grains are not nearly as widely grown in comparison to other crops. There appears to be an emerging market around the world to increase production of landraces for nutritional value.

Through other readings, I learned that loss of agrobiodiversity, while having several significant consequences, can result in nutritional losses in the food supply (Thrupp 2000, 273). Furthermore, traditional food crops represent an important component of an area's culture, defining the people and their histories. Culture, which by

its very essence is ever changing and thus hard to define, is the most significant factor in food consumption and eating patterns as I learned in community nutrition. Changes in the eating patterns and crop availability results in a changed culture, which can have significant adverse effects. I wrote earlier about nutrition's most basic unit being actual food consumption. If consumption patterns change and if biodiversity changes, so does nutrition.

Production of food is a part of culture, part of what makes us who we are. P.J. Atkins (1988) calls for a redefining of agricultural geography to the geography of food. If the focus of agricultural geography were turned to food, then the whole food system would be better understood and the connection between growing food and consuming food would be created in geographical studies. Furthermore, Atkins calls for a rejuvenation of studies in geography of diet and nutrition, in combination with agricultural geography. Studying a whole food system or integrated food system "is incomplete without following its social and economic consequences to their logical conclusion in the lives of the consumers" (Atkins 1988, 282), especially following the nutritional status and food security of the consumers.

My paper looks to analyze not only the development of sustainable, urban agriculture in Cuba, but also the resiliency of such work based on the culture of Cuba. I will argue that because of strong environmental ties in Cubans, growth of sustainable agriculture will continue in the coming years. With such resiliency exists increased food security and increased nutritional status as a result of sustainable food consumption practices on the island.

I hope this introduction provides evidence as to why the following research derived from a nutrition student's mind and the validity of my interests in nutrition, agriculture, and geography.

1.2: Introduction to Urban Agriculture in Havana

Much work has been done on the topic of urban agriculture in Havana, Cuba in the last 20 years. Usage of urban agriculture is seen around the world but Cuba is often considered the gold standard in production because of its ability to feed its population with few resources. While Cuba developed the techniques and successfully implemented the practices in a short period of time, it did not always develop the passion for the environment and its conservation among all the farmers who were forced to grow in a low-input manner, particularly farmers in rural areas. Urban agriculture arose from a necessity to grow food close to where it was needed after Cuba lost its imports from the Soviet Union; however, I will argue that in urban environments, the passion for the environments exists. Havana has made strides to allow all available land to be turned into farms or gardens, provide training and tools to those who want to farm, and ultimately ensure that every Cuban is food secure (Nieto and Delgado 2002, 50). How Havana got to its advanced urban agriculture techniques and sustainable growing knowledge is a process that extends through the centuries.

There is little research that appears to connect the origins of sustainable agriculture research to implementation in urban environments in Cuba. While some of the knowledge in Cuba has been passed down through generations of Cubans, there exist strong ties to passionate scientists who have worked in agroecology. Changes are

occurring in Cuba that may potentially damage the strides Cuba has made to become food secure on its own with sustainable and urban agriculture.

The research for this paper developed into three questions I wanted to answer:

1. How has scientific research influenced the implementation and success of sustainable agriculture in Cuba?
2. How has the rural-to-science-to-urban interaction within Cuba affected the growth and development of urban agriculture?
3. How has the persistence of sustainable agriculture alongside non-sustainable practices influenced the connection between Cubans and the environment?

These three questions allowed me to structure my thesis into three main areas: the past usage and interest in agroecology, the research done by Cuban scientists and farmers to develop alternative techniques, and how the future usage of such techniques will be maintained. But my interest is still with urban agriculture in Cuba as the thesis title suggests. I intend to argue that in Cuba, the persistence of sustainable agriculture techniques throughout years of foreign economic influence is a result of Cubans' instinctive need to connect with the environment. The development of urban agriculture in Havana is a result of this instinctive need.

What makes this paper topic important is the increasing need for countries to achieve food security in a sustainable manner. On March 8, 2011, Olivier de Schutter (2010) of the United Nations released a report that advocated the importance of agroecological farming for the immediate future. Cuba is an example that while not perfect, has seen increases in food production, nutrition, and environmental awareness, all due to its agroecological practices and influx of urban agriculture in the last 20 years.

Furthermore, de Schutter emphasizes the importance of knowledge in terms of agroecology, both from agricultural research and traditional rural knowledge (17, 2010). The interconnectedness between rural, science, and urban knowledge and ideals is pronounced in Cuba and its development of sustainable agriculture. The world's food system can look to Cuba as a successful model of agroecology and the "alternative model" of agriculture. Perhaps this call from the United Nations will help resolve any threats to sustainable, urban agriculture that Cuba may face in the coming years. Some of these threats will be outlined later in this paper.

1.3: Limitations in the Research

There were a few limitations in the research and literature that I encountered while working on this thesis. Most notably was my lack of understanding Spanish. In terms of the research I did access, two main limitations arose:

1. It was difficult to determine who were the rural farmers and scientists in Cuba doing research in alternative agriculture. The literature I was able to access tended to generalize these farmers and scientists, only defining them as "rural" and "alternative." Only a few sources mention specific names of the scientists or specific research in sustainable techniques. In my paper, I discuss the knowledge possessed by rural farmers yet I could not find an answer as to who were the farmers or where were the farmers. In terms of the scientists, the literature defined them as only as alternative scientists, who had an interest and belief in the importance of sustainable techniques for the environment. I believe that the

methodology of much of the literature was flawed because their research did not define the who, what, and where that I found myself continually asking and would make for a stronger argument.

2. Only a handful of my sources mentioned specific scientists (Levins 1993; Stricker 2007; Funes et al. 2002), and it was only a few names. Theses sources discuss the scientists as having a *passion* for the environment that led to their alternative research. In addition to the scientists, both Levins and Stricker discuss the passion of the Cuban people for the environment and ecology. It became difficult in my research and writing to distinguish between facts about Cubans and generalized descriptions of Cubans in terms of their passion for the environment. Much of my evidence into who was conducting and implementing alternative research generalizes the nature and character of the alternative advocates simply because that was the literature I could find. Subsequently in my paper, I sometimes take this romantic, passionate tone. It may be a generalization of Cuban personality but, from my research, I believe that such a passion truly influenced the scientists and citizens of Cuba.

1.4: Definitions

Before embarking on a discovery of sustainable, urban agriculture in Cuba, it is important to have a working knowledge of a few terms:

Cuban Revolution

The Cuban Revolution began on July 26, 1953, when Fidel Castro attacked the

Moncada Fortress in Santiago in the hopes of overthrowing the government controlled by the dictator Fulgencio Batista (Gott 2004, 147). After more attacks, Castro was arrested and sent to prison for two years and upon his release, he traveled to Mexico to gain more supporters and build a army. While in Mexico, he met the Argentinean revolutionary Che Guevara (Gott, 2004, 152) and they both returned to Cuba at the end of 1956 to plot an overthrow and overhaul of the Cuban government. A guerilla army, many of whom were peasant farmers living in the Sierra Maestra Mountains, backed Castro's gain to power. With both his brother Raul and Che Guevara at his side, Fidel's army took control on January 2, 1959 and immediately began changes to the government and infrastructure of Cuba. This paper will later discuss the changes made to the agriculture sector in the beginning years of the Castro government.

Special Period

Officially known as the "Special Period in Time of Peace," the Special Period occurred after the fall of the Soviet Union and dissolution of the Council of Mutual Economic Assistance (CMEA). CMEA consisted of the Eastern Bloc and other communist countries around the world and acted as an economic organization that promoted trade and cooperation among members. The result in Cuba was a drastic change in the economy, imports, and subsequently agriculture on the island. Cuba had few food and oil imports and few export partners to continue trading sugar for nearly everything else.

The country was forced to rely on its own resources and develop the technology to rebuild its industries. A major focus was agriculture and the food system, in order to

feed the Cuban population. While initial years of the Special Period saw a drastic decrease in food availability, such as a 30 percent drop in food availability in 1993 compared to 1989 levels (Nieto and Delgado 2002, 47), the availability of food began to rise as access to food was made easier. Reasons for greater food security included encouragement of self-provisioning of food and urban agriculture (Nieto and Delgado 2002, 56).

Food Security

The most widely accepted definition of food security comes from the World Food Summit of the Food and Agriculture Organization (FAO) in 1996 (FAO 2006, 1): "Food security exists when all people, at all times, have physical and economic access to sufficient, safe and nutritious food that meets their dietary needs and food preferences for an active and healthy life."

Agroecology

A combination of the words agronomy and ecology, agroecology focuses on renewable practices in agriculture, i.e. practices that can be repeated without harming the environment surrounding the farm. Knowledge from agricultural and biological sciences and research, in combination with indigenous practices and community-driven work, create a whole agroecosystem. "Agroecological farming can increase ecological resilience to environmental shocks such as climate change, improve health and nutrition through decreased exposure to pesticides and improved dietary diversity, increase energy efficiency through reduced reliance on fossil fuels, and conserve resources and essential

ecosystem services" (Ishii-Eiteman 2009, 225). There is also an emphasis on the management of farming practices, not only to be environmentally aware, but also to provide production levels that can support the needs of the farmers. Thus economical sustainability, while sometimes forgotten, is an important component of being a true agroecological system (Nelson et al. 2009, 234).

Within this paper, the terms "agroecology" and "sustainable agriculture" will often be used interchangeably. While agroecology includes a greater emphasis on community-driven work, the importance of the environmental impacts and biological inputs is the foundation of sustainable agriculture development in Cuba. The term "alternative model" will also be used to describe agroecology in Cuba, and will be defined further in this section. It should be noted that "organic agriculture" is not synonymous with sustainable agriculture and agroecology. While it can be a component, and is mandated in urban agriculture in Havana, it is not required in sustainable agriculture in the rural areas of the island. Chemical inputs can still be used in moderation (a low-input method), but are done so in combination with techniques, such as intercropping, crop rotation, minimal tillage, etc., to promote production at safe and repeatable levels.

As will be revealed in this paper, Cuban farmers have had the knowledge of agroecological techniques for centuries. The term "agroecology" has not come into common usage until the twenty-first century, but evidence of its existence, to a degree, dates back to the Spanish colonization.

Low-input

Low-input is a term to describe agriculture that is not heavily influenced by external inputs of fertilizers, pesticides, herbicides, insecticides, etc. While not necessarily organic, the focus of low-input agriculture is using less petroleum and chemical-based soil and crop additives, which may in turn lead to biological or organic farming practices. Low-input agriculture became an absolute necessity in Cuba following the fall of the Soviet Union and subsequent loss of Cuba's trading partners. Discussed in the previous definition, low-input combines sustainable techniques that use soil nutrients, cropping patterns, and natural landscape to enhance the productivity of the crops and create a farming system that is environmentally and economically stable in the long run.

Alternative Model

The "alternative model" is an agriculture system that in Cuba, according to Vandermeer et al. (1993, 4), focuses on nine major points:

1. Use of organic fertilizers, also known as biofertilizers to emphasize a biological as opposed to a chemical makeup of the fertilizer.
2. Biological control of pests, which may include trap crops to deter pests from the production crop, strategic fencing and crop coverage, and use of beneficial insects and animals.
3. Changing crops and animal husbandry to fit the local ecology. This involves extensive understanding of the land geography, soil components, root systems, and the best conditions for the crop to grow.

4. Animal traction and other alternative energy sources, which use far less petroleum. The dependence on foreign oil created numerous problems with Cuba's agriculture system and economy. Following the fall of the Soviet Union and subsequent loss of petroleum and machinery trade, Cuba replaced 30,000 Soviet tractors with 300,000 oxen (Gott 2007, 288). While this was initially a difficult adjustment, ultimately, animal traction was a more sustainable option.
5. Crop diversification and intercropping, both of which are important to maintain soil fertility and help prevent soil erosion.
6. Community involvement in areas of both decision-making and local labor usage.
7. Soil conservation and reforestation. Much of the soil and forestlands in Cuba were destroyed due to large plantations that dominated the agriculture industry for hundreds of years. The alternative model, while focused on crop production, also preserves the natural environment of the landscape.
8. Using local knowledge to develop new technologies, a participatory approach that uses indigenous knowledge to further scientific research. This will become vital in the development of sustainable and subsequently urban agriculture in Cuba.
9. Reversal of rural to urban migration to increase Cuban population involved in farming. This part of the alternative model is still in its beginning stages. It will be discussed both in the definition of urban and rural spaces, but also in Chapter Six of this paper.

The "alternative model" is the opposite of the "modern agriculture" model, which is highly mechanized, monoculture-focused and chemical input intensive. Cuban agriculture followed the "modern agriculture" model almost completely from the Cuban Revolution until the "alternative model" became a necessity by 1989. Within the 1950s and 1960s, agriculturists and extension agents were trained in the modern or conventional form of agriculture, dependent on "high response seed varieties, which need heavy doses of synthetic fertilizers, chemical pesticides, heavy machinery, and often heavy irrigation" (García 2002, 90), all components of the Green Revolution.

Following acceptance of the Green Revolution in the 1960s and 1970s around the world, scientists began noticing detrimental effects to the surrounding landscape due to agriculture: chemical runoffs into streams, soil erosion, and decreased crop production (Harwood 1990, 11). Ecologists and agriculturists began to call for an "alternative" to modern agriculture and the Green Revolution. The "alternative model" is a collection of terms (Vandermeer 1995, 201) like "sustainable agriculture," "agroecology," "permaculture," and others, that arose in the 1960s and 1970s and are still in development. In the case of Cuba, the steps outlined above became a necessity from 1989 onward to ensure low-input production and food security (Gersper et al.1993, 16).

Green Revolution

The Green Revolution grew out of agriculture technology developed over decades dating back to the nineteenth century. By the 1960s, the revolution was in place to provide high-yielding varieties of mostly rice and wheat to farmers around the world in order to increase production (Brookfield 2001, 220). Alongside seed distribution was

technological changes, an emphasis on heavy-tilling, chemical fertilizers and pesticides, and the monopoly of large, monoculture farms over small, traditional farmers. In Cuba, there was not direct participation in the Green Revolution (Stricker 2007, 18), but the seeds and tools that were provided by the Soviet Union enhanced Green Revolution technology usage. Agriculturists and extension agents learned how to farm according to the "modern model."

While Green Revolution techniques increased food production, the detriment to rural farmers was pronounced. They struggled to afford Green technology and compete with large agricultural enterprises that dominated the industry following acceptance of the Green Revolution (García 2002, 91). Rural knowledge of farming was considered backwards (Stricker 2007, 21) and in the end, small, rural farmers suffered the most damage from the Green Revolution. Its techniques were environmentally damaging and economically unsustainable, but more than anything, the Green Revolution had dire consequences to those people who had always farmed the fields. "In the rural environment, impaired identity and feeling of belonging were observed, mainly due to the decharacterization of the farm, uprooting the farmer from his land, turning farmers into agricultural workers, degenerating traditional production practices and ancestral knowledge, rural depopulation and emigration to urban areas" (Febles-González et al. 2010, 3).

Rural-Urban Continuum

According to *The Dictionary of Human Geography* (Johnston et al. 2000), the rural-urban continuum was historically defined as "a continuous gradation of ways of life

between the two poles of truly rural community and truly urban society" (721), an emphasis placed on the words community and society to separate the two localities. From the classic definition to separate rural and urban, it was perceived that community, or rural, involves closer relationships among people, tied only to rural spaces, whereas society, industry, and technology are associated with urban spaces. Furthermore, the continuum also invoked the belief that when the population of a space changes, so do the characteristics of its people (870). The concept of the rural-urban continuum as two distinct spaces with separate characteristics was considered demolished after the work by Ray Pahl in 1965. In his view, the separation between community and society was too simplistic. The rural and urban relationship is "a whole series of meshes of different textures superimposed on each other" (721). This spurred the current definition among many geographers; that the rural-urban continuum is becoming increasingly blurred and fragmented (722), apparent with the existence of "urban villages," communities (in the sense of a rural characteristics) in an urban setting.

To attempt to give a definition to urban and rural is nearly impossible because the boundary that exists between two is becoming increasingly unclear. Ceclia Tacoli (1998), in her review of rural and urban literature, concludes that there is little distinction between urban and rural spaces because there is so much overlap with jobs, information, and exchanges of goods. Yet there is one key difference in regards to agriculture in urban and rural spaces: that while urban agriculture is complementary to rural agriculture, urban agriculture is vitally integrated into the local economy, perhaps more so than in rural agriculture, at least according to Mougeot (2000,1). Peri-urban spaces, which exist in places of both city sprawl and rural landscape, create an even greater lack of

distinction between what is in the city spaces and what is outside. However, not all researchers who examine the role of agriculture in urban spaces differentiate between what is urban and if there is peri-urban influence. Urban agriculture may also be an umbrella term of the components intra-urban agriculture and peri-urban agriculture (Mougeot 2000, 4). For the sake of this paper, urban is defined as within historical city-limits, peri-urban is the urban sprawl spaces, and rural is the historical areas of farmlands and small towns not associated directly with a city.

1.5: Methodology

The topic for this paper was developed during fall semester 2010 for GEOG 497C: Biological Diversity in Agriculture and Global Change taught by Dr. Karl Zimmerer. The assignment was to select a global "hotspot" of agrobiodiversity. Instead of a more traditional locality of agrobiodiversity, such as the Peruvian Andes, I decided to research urban agriculture in Cuba. The diversity of the production techniques and sustainability of the system allowed the topic to work well as a center of agrobiodiversity. What resulted was a paper that discussed the reasons for urban agriculture development following the fall of the Soviet Union, the current types of production, and the future threats to continued usage of urban agriculture in Cuba.

Throughout the semester, my paper was discussed and critiqued by the class and the suggestions led me to my current honors thesis: looking into the development of sustainable agriculture in Cuba. I kept wondering where the research for sustainable techniques came from and who were the ecologists and agriculturists providing the information. As I was researching and writing for my thesis, I discovered that urban

agriculture development was not solely a result of scientific research, but of rural knowledge. Indigenous agriculture knowledge has existed on the island for centuries, thus my paper began to take shape as a study into the rural-science-urban interactions with sustainable agriculture.

As a nutrition student, I may not appear to be well versed in agriculture and geography. However, as an international agriculture minor, I have studied aspects of farming, especially sustainable agriculture and tropical agriculture. In the spring of 2010, I traveled to Puerto Rico with my international agriculture class to study not only the types of crop production seen in Puerto Rico, but also perform and present a participatory rural appraisal (PRA) of farms in the Adjuntas region. A PRA combines the knowledge of agriculturists, geographers, and social scientists, along with the local farmers and community, to discover problems that may exist in regards to agriculture. It also involves the development and implementation of solutions and the emphasis is on the local community solving these problems. As a class, we were only able to conduct the fieldwork necessary to present the problems. My role was to walk the farms and develop a cross-sectional map of the landscape and planting layout. While walking these farms, I discovered more about agriculture than any classroom had taught me. I was able to see firsthand what a banana tree looks like and experience the damaging erosion due to overproduction of plantains. I saw the heartache of planting a diseased seed that would yield no coffee and enjoyed the succulence of a freshly-harvested pineapple. So I am not a novice to farms and crop production.

What I am a novice to is Spanish. My knowledge and understanding is very limited and probably only includes Spanish and Latin American food. If they spoke

French in Cuba I would be fine, but I am not so lucky. Subsequently, all of my references are in English. I discovered that much original research is in Spanish and I kept hitting roadblocks where I wished I understood the language. Perhaps in the future I can continue research on this topic after learning Spanish.

Chapter Two

Literature Review

2.1: Indigenous Agriculture and Spanish Colonization

A major theme in this paper is the continued practice of sustainable agriculture in one region or area alongside the use of non-sustainable techniques in other regions or areas. Indigenous agriculture is considered more beneficial for the ongoing conservation and evolution of biodiversity of both plant species and the landscape than industrialized production. This conservation is often a result of a natural evolution of crop selection and domestication among indigenous groups, contrary to new crop introduction into foreign soils (Brookfield 2001, 77). One of the earliest known examples of the latter occurred in the Jordan Valley, thousands of years ago. In only a few hundred years, domestication of herd animals appeared, yet for another millennium, the majority of food security came from hunting and gathering, which allowed a coexistence of food sources systems, both domesticated and undomesticated (Brookfield 2001, 63). The domesticated techniques developed at the same time as the indigenous, traditional techniques of food acquisition.

Examining biodiversity conservation in the Americas, there is much evidence of the importance of indigenous agriculture techniques. Native Americans, both in North and South America, transformed the landscape around them long before European colonization. In the southern New England area, maize was grown in constructed ridges or mounds, intercropped with beans, squash, and tobacco, creating a maze of crops that

protected against weed encroachment and soil erosion (Brookfield 2001, 66). What the Indians created was a managed environment that enabled ongoing biodiversity conservation, known as *in situ* conservation (literally "in place" conservation). They controlled the agriculture and transformation of the landscape in such as way as to promote diverse species in the surrounding ecosystem.

Further south, biodiversity was also seen as a product of indigenous techniques. Agricultural biodiversity in the central Andes came from subsistence farming of the peasants under Incan rule, not from surplus farming, mainly maize and potatoes, operated by the Incan state. "Peasant farmers residing in the region both before and after Inca rule carried out the production of agricultural biodiversity and shaped crop evolution" (Zimmerer 1993, 26). The importance of peasant and indigenous techniques in preserving crops is often overlooked, but critical in understanding current *in situ* conservation of agrobiodiversity for the area of the Andes and around the world. However, as is a clear theme, the presence of Europeans changed agricultural lands. After the fall of the Incan empire and subsequent control by Spain, the distinction between areas of surplus farming and subsistence farming in the Andes became increasingly blurred, resulting in decreased food security for rural households and increased market vulnerability (Zimmerer 1993, 28).

Not all indigenous agriculture and traditional techniques are completely environmentally sound. The environment of the Caribbean was not untouched prior to European arrival in 1492. As William Denevan describes in his paper "The Pristine Myth" (1992), there was extensive environmental damage to the Caribbean landscape before colonization due to the large Indian population. The native population did not

always use the natural resources in the most environmentally sound manner and production was not limited to a small area (Denevan 1992, 370). However, by the sixteenth century, with much of the native population killed due to the European colonization, the environmental conditions began to improve (378). Nevertheless, the rapid replacement of Indian agriculture with livestock and sugarcane plantations, prevented any long-lasting recovery of the Caribbean ecology.

Prior to Columbus' arrival, Caribbean agriculture involved two major techniques: slash and burn techniques to clear forested area and created of mounds, *conucos* that incorporated organic plant matter to enrich the soil (Richardson 1992, 23). Crops planted included a mixture of root crops (both manioc and sweet potatoes), peanuts, corn and beans (27), and the agriculture of *conucos* involved both plant diversity and the manipulation of the landscape. However, following the beginnings of sugar cane production in the Caribbean, the destruction of the environment and agrobiodiversity was pronounced, especially once slaves became the main laborers on the islands. Subsistence crop planting was determined by the plantation owners (Richardson 1992, 35) and it was not until the end of slavery on the islands that a return to sustainable and diverse crop and planting techniques were seen throughout Cuba. It is important to note that in slavery did not end until 1886 in Cuba (Gott 2004, 81), due to the intensification of the planting system in the nineteenth century and economic importance of slave-produced exports for Spain.

2.2: Rural-Urban Interactions

A second major theme in this paper is the interaction between rural and urban areas, especially in regards to agriculture and food production. As discussed in the definition section, the relationship between rural and urban areas is believed by geographers today to be increasingly blurred. It is difficult to assign definite geographic perimeters to the areas because of both urban sprawl into traditional rural areas, and more social interactions and exchange of products, jobs, and knowledge. It has been noted that the link between urban and rural is strengthened by agricultural activities (Redwood 2009; WinklerPrins 2002), further blurring the lines of distinction between rural and urban.

Antoinette WinklerPrins discusses this blurring extensively in her work on house-lot gardens in Brazil (2002). She finds that there are four main points that result from rural to urban interactions with gardens. First, "garden products link the rural and the urban" (58). Within families, there may be members in both rural and urban areas, providing direct connections to the two localities and creating permanent exchange networks. Second, "gardens represent a source of food for direct and indirect consumption" (58), enhancing food security particularly in urban areas. Gardens can be a vital part of the urbanization process, not outdated rural traditions that have no place in urban environments. Third, "gardens are important sites for agrobiodiversity" (59). There is a multitude of vegetables, fruit, medicinal plants, and ornamental plants produced. As will be discussed later, urban gardens in Cuba have recharged production of root crops, *viandas*, the staples of the Cuban diet (Deere 1993, 40). Diversity in gardens act as a way to preserve dietary traditions often lost through industrialized food

systems preserving the culture and nutrition of communities. The fourth point is that because gardens represent a transition and connection between urban and rural areas, their visual and social appeal is important (WinklerPrins 2002, 59). Not only do they provide a "green" space for cities filled with pavement, they are areas of activity, gathering, and reconnecting with nature. It can be argued (and it has, as will be discussed later), that gardens and farms in urban environments help make us "human."

To conclude that every human has this innate desire to reconnect with nature is naïve and overly simplistic. Such belief does not define what it is about green spaces that make us human and define "human nature." One could argue that humanity is our connection to nature and the environment and conversely, one could argue that humanity is the modernization of life, in terms of society and technology. This reaches back to the original definition of the rural-urban continuum that separated *community* and *society* as the crucial terms of rural and urban. However, geographers have already acknowledged the blurring of rural and urban, the existence of community in developed societies. The innate need for green spaces in urban settings can be considered a "cultural desire" (Halfacree 2004, 299), a conscious desire, as opposed to a subconscious need.

Whatever the reason for urban gardens and green spaces, there is still the important functionality of agriculture in urban settings: food security. As will be discussed, Havana is currently producing enough vegetables to feed its urban population. This is not true for many staple crops and the transfer of food from rural to urban areas is still necessary in Cuba and around the world. A case study in Naimbia (Frayne 2005, 38) points out the importance of rural-urban food transference as central to maintaining food security in urban areas. Most of the households in the city Windhoek had relatives in

rural areas, perhaps only recently migrated. However, the transfers were also necessary for families without relatives, perhaps gaining food from friends. Surveys indicated that the most important food received in urban areas was spinach, both as a cultural staple and nutrient necessity (Frayne 2005, 39). "Without these food transfers, food insecurity and malnutrition among migrant households would undoubtedly be significantly higher than current levels" (40).

2.3: Scientific Research in Agriculture, Food, and Farmers

A final theme that is significant in this thesis is the development of alternative agriculture research, especially research conducted as a participatory approach with rural farmers. Following the destructive techniques of the Green Revolution, scientists were of two mindsets in what direction research should take (Brookfield 2001, 244): either new technologies that would resolve production problems or a return to sustainable agriculture. The focus of this paper is on the latter production method and will later be discussed in detail in regards to Cuban agriculture.

It is clear that indigenous agriculture was important to agrobiodiversity both prior to and during colonization, and to alternative agriculture research. Conservation of crop diversity is when it includes the maintenance of the agroecosystem (Brookfield 2001, 249), the entirety of the landscape and environment. Agrobiodiverisity can be scaled in different ways, from simple plant seeds, to forests, animals, and insect interaction.

While the rural farmer's knowledge is vital in the maintenance of agrobiodiversity and better ecological management, there is often a gap in understanding between scientists and farmers (Brookfield 2001, 57). Farmers' entire lives may exist around

agriculture and the importance of the land may not be fully understood by observing scientists. Brookfield (2001) emphasis that work between scientists and farmers should be done with caution to insure the correct translation of the questions and answers. Furthermore, the belief that farmers may not understand the science of agroecology is untrue; many farmers use creative methods to adapt to the environment provided by generations of knowledge (Brookfield 2001, 279). Sustainable agriculture production requires a greater foundation of understanding and knowledge of the land. A need for local farmers to react immediately to the knowledge and implement new techniques is necessary for sustainable agriculture to succeed (Roling and Brouwers 1999, 155).

Agrobiodiversity and the resiliency of its practices is a result of small farmers around the world who have continued their agriculture traditions for thousands of years (Brookfield 2001, 270). Brookfield and I both questioned in the context of Cuba why agrobiodiversity coexisted with the degrading practices seen by the Green Revolution and colonization? Better yet, *how* has agrobiodiversity been maintained?

One of the most valuable aspects of small farming techniques is intercropping. While it is one of the most widespread techniques, it was not seriously studied until 1960 by agriculturists (Brookfield 2001, 272). Intercropping incorporates better light, water, and nutrient usage, protects against soil and weed erosion, and helps prevent pest and insect damage. In terms of nutritional value for subsistence farming, intercropping allows for greater food security. Multiple crops have a variety of essential vitamins and minerals and furthermore, if one crop fails because of unsuitable conditions, surrounding crops may survive. The increased food security associated with intercropping is

considered by many writers and researchers in agrobiodiversity to be its most valuable aspect (Brookfield 2001, 273).

This does not imply that small farmers worldwide accept intercropping. Monocropping is often preferable because it takes less time to plant and harvest. Monoculture fields are easier for the farmer to maneuver tools and it is easier to enter the crop into the marketplace (Brookfield 2001, 274). But monocultures undermine the environmental importance of diversity among crops. Diversity will ensure long-term production and economic resiliency, as opposed to the quick fix of the monocultures, which Brookfield warns is "the greatest enemy of diversity" (285).

Science gave us the Green Revolution and its focus on monocultures. Is science able to then incorporate into urban agriculture and organic agriculture? Scientists and farmers can work together on creating and perfecting agricultural techniques, but the emphasis should be placed on the farmers' livelihoods, not scientific research and discovery. Farmers and scientists can work synergistically and we will see that in Havana, the success of urban agriculture came from both its spontaneous, passionate birth following the fall of the Soviet Union, and scientific support from the government.

Chapter Three

From Taíno to Fidel:
Agriculture in Cuba Prior to and Following the Cuban Revolution

Like many lands exploited by European colonizers, Cuba became an ecological nightmare with huge plantations and damaging techniques. For centuries, the economy of Cuba came from large-estates growing mostly sugar for the Spanish crown until 1898, and then for American crop companies. The Cuban Revolution came in 1959 and while initial goals were focused on nature preservation, sugar became the country's livelihood once again. This chapter however, will reveal the importance of subsistence farming for the native people and traditional knowledge in agriculture that has lasted for centuries.

3.1: Spanish Colonization (1494-1898)

In 1494, Christopher Columbus discovered Cuba (see Map 1) as part of the New World, although colonization and production of the land did not occur until around 1511 with the Spanish conquistador Diego Velásquez. Spain recognized the profitability of the island and began to develop the land, first by deforestation for construction materials, then for cattle production (Stricker 2007, 69). It was not until nearly 1600 that Spain began production in what would become the dominant crop on the island: sugarcane. With sugar came increasingly intensive planting with greater yields and thousands of hectares of destroyed and degraded land due to over-production. The Spanish came to the West Indies to find gold and other precious metals, but they stayed because of the profitable land.

The native Cubans, the Taíno Indians, were believed by many researchers to have been killed by the Spanish, either with guns or disease. Richard Gott however, in his book *Cuba: A new history*, says that much evidence points to the survival of some Taíno Indians through the centuries in small villages tucked away in the mountains (2004, 22). Whatever its true fate, the indigenous Taíno civilization and culture was, for the most part, destroyed by the Spanish conquistadors. To compensate for the loss of free labor from the native Indians, the Spanish first brought Indians from neighboring islands, and by the end of the eighteenth century, brought African slaves, an estimated 650,000 (Funes 2002, 3), to work the sugarcane fields. The Cuban sugar industry did not flourish until the nineteenth century, after the onset of African slaves. The immediate intensification, due to overproduction and fallen harvest levels in other islands, was pronounced in Cuba: in 1815, 40,000 tons of sugar were produced and by 1894, production was 1,054,214 tons of sugar (Richardson 1992, 60), the greater yields a result of increased crop planting, not increased plant output. Robert T. Hill, an American geologist working around the turn of the twentieth century, researched the West Indies extensively and reported that in Cuba, the entire central plains of the island "farm a continuous field of sugar cane" (Hill 1898, 34).

Overproduction, of both the soil and crop patterns, resulted in yield losses beginning the mid-nineteenth century, attributed to a weakening of the plant, although it was more likely soil degradation (McCook 2002, 22). However, some aspects of farming began to change with the knowledge and skills of the African slaves, along with some of the indigenous agriculture left by the Taíno Indians (Funes 2002, 3). Agricultural techniques that resulted from the combination of knowledge from multiple planters

included crop rotation, organic fertilizers, and plantings dependent on soil condition and regional climate. As discussed in the definitions section of the introduction, these types of techniques are important aspects of agroecology and sustainability. While the scientific significance of agroecology would not be understood for several hundred years, such production formed the foundation for Cuban agriculture.

3.2: Nineteenth Century Agroecology (1850s-1870s)

While Spain still controlled the island almost to the end of the nineteenth century, there were some Cubans who disagreed with the Crown's agricultural pursuits; dissidents who saw the value and importance of nature and the environment. During the nineteenth century, there was an increase in writing about the beauty of nature and the environment in Cuban literature (Roberts 2008, 323), echoing the Romantic Period of literature that was seen worldwide. This sentiment translated to scientists in Cuba, several of whom began to advocate the importance of sustainable farming and land preservation. Alvaro Reynoso, an early Cuban scientist, was considered the foremost expert in sugarcane production in the mid nineteenth century. Using science, he created a cropping system that involved specific tilling techniques, fertilization, and careful spatial plantings (McCook 2002, 23). This system was far too expensive, both in terms of money and labor, and once again, economic preservation won over environmental conservation. In 1886, Francisco de Frías y Jacob, the Count of Pozos Dulces proclaimed, "intercropping and crop rotation in Cuba will reverse the rampant land degradation caused by ignorance and greed" (Funes 2002, 3). His outspoken attack on the Cuban agriculture system was aimed at the plantation-style farms controlled by Spain, farms that grew row after row of

a sole crop, either sugarcane, tobacco, or coffee. These farms may have attempted some sustainable techniques learned by the African slaves or Taíno Indians, but not enough to "reverse the rampant land degradation" (Funes 2002, 3).

Monoculture farms exhibited land degradation in the form of soil losses and nutrient losses, resulting in weakened crops and lowered production levels. Sugarcane production is a prime example of such destructive practices. In an article published in 1853 in the *New York Times*, the process of growing and refining sugar is described in exhaustive detail (Special Correspondence of the N.Y. Daily Times 1853). Sugarcane crops sprout new buds, a process known as *ratooning*, which becomes the next season's crop. Ratooning was known during the eighteenth century to produce less and less yield each successive year, yet the article states that "in the West India plantations the cane is frequently allowed to ratoon for eight successive seasons" (Special Correspondence of the N.Y. Daily Times 1853). In Cuba, it was reported that the sugarcane would be ratooned for seven consecutive years (Hill 1898 76). The cost of replacing the seeds each year was too high, thus the health of the plant was always at risk. Ratooning, although it was probably not known in the mid-nineteenth century, causes the sugarcane plant to be more susceptible to pests (Long and Hensley 1972, 155), which further decreased production yields. Even with an understanding of production problems with ratooning, the Cuban planter's minds were not altered and extensive ratooning use continued. The Renoyso system for planting specified new plantings each season (McCook 2002, 23), most likely to counter the decreased yields seen in the sugar crops and yet these long-term economic solutions could not outweigh the short-term economic costs of agroecological techniques. It would take more than a century for Cuba to adopt

alternative techniques, to realize that it is in Cuba's best interest to look towards methods such as intercropping and crop rotation as solutions to forthcoming ecological problems.

While most of the island's fertile land was in monoculture production for economic gain, it was not the only system of planting found on the island. Small farmers in Cuba were using any pieces of land they could to cultivate food crops for home consumption (Murphy 1999, 5). These small plots, *conucos* as was mentioned in Chapter Two, used sustainable techniques passed down through generations of farming Cubans. While plantation farms characterized the nineteenth century, "something of old Cuba still survived," (Gott 2004, 46) the way of life for rural farmers and subsistence farming that began long before Cuba met Europeans. Such ingenuity and resourcefulness existed well through the Cuban Revolution and continues to play a significant role in the nature of Cuban farmers.

3.3: Twentieth Century and American Farming Standards (1898-1959)

The end of the Spanish-American War in 1898 gave the United States control over Cuba, which they kept for four years until allowing Cuba to become a Republic. However, the U.S. maintained a heavy hand in influencing the island, particularly with agriculture. The Spanish-American War, which officially last from April 25-August 12 1898 (although conflict had been leading up to a war for several years), was known by Cubans as the War of Independence and destroyed the majority of the sugar plantations. The United States made a significant impact in repairing the agricultural lands and sugarcane production by introducing experiment stations throughout the island (McCook 2002, 51). While there was much research going into the crops, American intervention

led to American farming standards and capital flows. What resulted throughout the first-half of the twentieth century was mono-crop *latifundios*, similar to the Spanish colony plantations, except this time, they were run by American companies who brought with them "modern" agriculture (Stricker 2007, 15). When Spain was producing sugar on the island, the Spanish millers would purchase small-farm produced cane. The American milling companies instead ran large-scale plantations that had no need of the small-farmer crops (Murphy 1999, 6). More and more of the Cuban agricultural landscape became large-scale, American-owned *latifundios*, cutting out the livelihoods of Cuban farmers. Sugar continued as the most important economic resource for the country. By 1958, sugar production amounted for more than 25 percent of the total national income and 80 percent of the exports (Stricker 2007, 15). Increasing dissatisfaction with American intervention in both the economy and government of Cuba resulted in an overhaul of the nation.

3.4: The Cuban Revolution and Agrarian Reform (1959-Mid 1980s)

Fidel Castro and his rebel army took control of the government in 1959 in the culminating battle of the Cuban Revolution. Prior to the Republic's defeat, Castro and his revolutionaries lived and planned in the Sierra Maestra Mountains with the peasant farmers. They quickly befriended the rural people in the area and the guerrilla army of the Revolution became a peasant army (Benjamin et al. 1985, 150). Immediately following the successful governmental takeover, Fidel Castro and his new regime began to focus on improving rural farming conditions after experiencing the peasant life during the Revolution. The First Agrarian Reform was established in 1959 and involved state-

ownership of cattle ranches and sugarcane plantations (Rosset, 2000), many of which had been controlled by the United States, and allowances of land-ownership for individual farmers. The government also set up four agricultural goals that focused on rural farmers and "nature-friendly type of agriculture" (Funes 2002, 4): (1) Meet food requirements for sustenance, (2) generate export money, (3) provide raw materials for industry growth and demands, and (4) end poverty and unsanitary conditions in rural areas. An important part of this reform was meeting food requirements, a point echoed by Catherine Murphy (1999, 5) in that food was established as a basic human right. Castro and his government appeared to believe that large-estates could continue sugarcane production for the export economy, while smaller farmers would grow the food needed for the population.

Ideally, this might have been successful, but the communist government met resistance from some of the wealthier farmers, who chose to sell their crops privately to the highest bidder rather than to the state (Benjamin et al. 1985, 158). By 1963, Cuba had decided to enact a second agrarian reform that gave the state even more control of the arable land, and changed the focus in the rural farms from food production to plantation crops for export (Rosset, 2000). Any emphasis on sustainable agriculture and rural development did not last. The focus on "nature-friendly" agriculture and rural reform was forgotten once Cuba decided to compete in the global market the best they could, considering the U.S. trade embargo. Their subsequent trade-relations with the Soviet Union during the Cold War allowed Cuban agriculture to become quickly modernized in line with the Green Revolution. Moreover, modernization allowed Cuba to produce high yields of sugar, which they traded for petroleum from the Soviet Union. Once again, Cuba was focused on monocultures, but this time, they added widespread use of

mechanization, petroleum, imported agrochemicals, and a population that relied on imported food to survive (Rosset, 1997).

There was some food crop production on the island in vegetables. During the 1960s, high-tech production with heavy chemical-input was used on the island leading to the large-scale production of vegetables 1970s and 1980s (Companioni et al. 2002, 221). Any small farmers were pushed out of production by the high yields of the large, state-farms. Cuba had quickly embraced Green Revolution techniques in less than ten years with their industrialized agriculture system courtesy of the Soviet Union trade relations and access to petroleum, mechanization, and chemical inputs.

3.5: Continued Use of Traditional Farming Knowledge (1959-1989)

From 1959 until 1989, Cuban exports were dominated by sugarcane, and imports from the Soviet Union and other communist countries, assured that the population had the inputs to farm, and the food to eat. Small farmers continued to use traditional farming knowledge in order to grow food for consumption on their own, much as they had done in the nineteenth century under Spanish control. While they may have been growing sugar (and some rice and tobacco) intended for export, there was maintenance of crop diversity and integrated practices, including animal traction and many agroecological practices (Funes 2002, 5). Even with the environmentally destructive practices of the export crops, Cuban farmers took the initiative to produce food using more sustainable techniques. The resiliency of these practices and of the rural farmers who continued them even when the Cuban government focused on economic practices would become an important saving grace in food security on the island.

3.6: Discussion and Conclusion

Cuban agriculture was characterized for several centuries by large estates owned by foreign nationals whose sole concern was money. What resulted were detrimental farming practices that for decades destroyed the fertile land of the island. Nonetheless, even with the environmentally harmful growing practices on the plantations, the traditional knowledge of the Cuban people remained. Subsistence farming and methods that evolved from nature and the indigenous people has existed on the island for centuries, long before Westerners arrived. From these practices arose an awareness of the damaging effects of intensive monocultures. The foundation of agriculture on the island is from the indigenous people and the small farmers who understood the land. These are the practices that outlasted the Spanish colonizers and American officials and these are the practices that evolved to revolutionize Cuban agriculture.

Chapter Four

Discovering Sustainability in Cuba:
The Beginnings and Progression of Alternative Agriculture from the 1970s Through the Fall of the Soviet Union

During the 1970s and 1980s, certain scientists in Cuba, mostly at the university level, were working towards an alternative model in farming, but wide-scale implementation would not be achieved without the help of rural farmers and their knowledge. Following the collapse of the Soviet Union, agriculture in urban areas began from ordinary citizens who not only needed food but also wanted to beautify their surroundings, and the connection between scientists and rural farmers would widen to include urban farmers and lead to Cuba's success with low-input, low-technology farming.

4.1: The 1970s Energy Crisis and Environmental Movement

The early 1970s saw a huge struggle for oil and energy around the world. Cuba was no exception. Alongside the energy crisis was an awareness of the problems surrounding the modern agriculture system that grew among ecologists, agriculturists and farmers on the island. It is probably not a coincidence that both the energy crisis and agriculture issues occurred at the same time. And it was not just in Cuba. Robert García Trujillo, former president of Organic Agriculture Association in Cuba was quoted, "We discovered a strong movement – not just ecologists in Cuba – all around the world, an agro-ecological movement…" (Stricker 2007, 35). Thus began the alternative agriculture movement on the island.

4.2: Scientific Research into Input Substitutions (1970s-1980s)

Cuban scientists first wanted to find alternative inputs to fertilizers and pesticides, biological inputs that might control and help reverse damage that had occurred. The beginnings of the alternative model arose mostly from academics in Cuba (Vandermeer et al. 1993, 4), working on the alternatives in the basements of university buildings and small labs. Many of these researchers were young and fresh-minded, contrary to the modern agriculture proponents who were older and resistant to changes (Stricker 2007, 34). Alternative methods such as intercropping and biological controls of pests take longer and often require more knowledge, something that caused some farmers to resist. Farmers appreciated the ease of tractors and chemical sprays in production. Even so, the alternative advocates kept trying and convincing. Jorge Ramón Cuevas of the Institute of Soils in Fertilizers, who was an extremely important and influential member of the alternative movement, echoed the facts of the early alternative research: a small group of scientists who first began investigating intercropping, crop rotation, and biological control of insects (Stricker 2007, 34). They were concerned with the state of the environment and producing sustainable techniques, but even as the need for such alternatives became apparent, the application was considered too extreme to go into the fields.

One of the probable reasons why this alternative research began when it did arose from "The Ten Million Ton Sugar Harvest" or *La Gran Zafra*. To increase exports and trade with the Soviet Union, Fidel Castro declared that 1970 would be the largest sugar harvest ever on the island. Christmas and New Year's of 1969 were postponed until July

to prepare and complete the harvest (Fraginals and Moreno), which typically lasts for the first six months of the year. *La Gran Zafra* became the obsession of the whole country, with thousands of unskilled workers migrating into the countryside to help harvest sugar. The end result was around 8.5 million tons (Benjamin et al. 1985, 131), the largest harvest Cuba had seen, and a huge increase in their problems with the economy. There was greater dependence on Soviet Union exports to feed the country, more reliance on mechanization and petroleum to farm, all problems associated with modern agriculture. By the end of the harvest in July 1970, even Fidel Castro acknowledged that the overambitious *La Gran Zafra* had "led to a multiplication of our problems" (Benjamin et al. 1985, 131). Because officials began to recognize these difficulties, they began to look at input substitutions (Funes 2002, 5). While research was focused on ways for Cuba to become less financially dependent on Soviet inputs, it would soon lead to research into agroecological methods.

According to Stephen Gliessman in his book *Agroecology: Ecological processes in sustainable agriculture* (2001), change in agriculture to a more agroecological approach is a three-step "Input Substitution Strategy" (304). The first step is for farmers to increase efficiency of their conventional methods. Following the 1970 sugar harvest, Cuba completed this first step and acknowledged the problems with its huge monoculture agricultural system and over-dependence on Soviet imports. However, by the 1980s, Cuba was still dependent on the Soviet Union for 57 percent of its calories (Deere, 1993) because of a greater concern for sugar production than food. Cuba was able to receive 5.4 times the global average sale for sugar from the Soviet Union (Rosset 1997, 292) and was able to trade sugar for petroleum through the 1980s.

Scientists, like Jorge Ramón Cuevas were still working towards alternative methods. The second step of Gliessman's strategy (2001, 304) is substitution of alternative practices into the field. Scientists in the 1980s had moved into this second step, focusing on decreases in fertilizers and pesticides, and increases in intercropping (Funes-Monzote 2010, 223). Some of the first official implements of biological controls occurred around 1985, when research centers in Cuba began conducting studies on alternative technologies, with a focus on entomopathogens (insecticides) and entomophages (insects eating other insects) (Stricker 2007, 34). This focus would lead to the creation of CREEs, or Centers for Production of Entomophages and Entomopathogens, a nation-wide network of research centers, which focus on agroecological solutions. According to Funes-Monzote's work, the first application of alternative agriculture from scientists' studies went to the most economically viable lands. However, "these studies – underpinned by ecological principles – formed the basis for scaling up the application of ecological practices when no alternatives were available" (Funes-Monzote 2010, 223). The final step in Gliessman's input strategy, changing the agroecosystem design, would not be fully realized until after the fall of the Soviet Union, when no inputs were available.

4.3: Who was Conducting Alternative Research?

Much of the literature on the alternative model discusses the important role that scientists in Cuba had in the beginning of sustainable agriculture research, but not much of the literature says who these scientists were. Richard Levins (1993), a Puerto Rican ecologist, wrote an extensive account of the beginnings of the Cuban alternative model

and while he does not name the scientists, he does describe the people he met and worked with in Cuba. They were ambitious people who recognized future problems if production continued in its current fashion. They were ecologists, botanists, zoologists, agriculturists, and citizens concerned with the fate of the environment. Robert García Trujillo, who was mentioned earlier, discussed the goals of alternative model researchers: "…We thought this would be useful for our nations to move forward the new ideas and reduce our pesticides and fertilizers… not just for today and to feed our people, but also for the future" (Stricker 2007, 35). Much of García's work was occurring in the 1970s – both the time of the energy crisis and the time of the environmental movement internationally. According to Levins, in the 1970s, a group of ecologists from the Institute of Botany refused to work with the Forestry Institute in terracing mountainsides for monocultures because they saw it as a pest and erosion problem (Levins 1993, 57). In Levins' opinion, from his extensive work in Cuba and the friendships he formed, Cubans, as part of their nature and personality, have no trouble challenging what they think needs to be changed, a thought process contrary to typical communist states.

According to Levins, Marxist and communist thought demands that scientists actively work to critique and challenge general beliefs, or the "world science." Therein lies Cuban scientists' biggest challenge, "freeing research and development practices from the intellectual domination and excessive deference towards 'world science' and its technological products" (Levins 1993, 57). While Cuba (and the Soviet Union) were communist states that generally rejected Western thoughts (the origins of "world science"), the capitalist ideals of the two nations came first. In order to compete in the global agricultural market and increase the export economy, crop production had to be

continually intensified. During the 1970s and 1980s, market competition meant machinery, petroleum, and chemical inputs to an excessive and deadly degree. It is no wonder then that application of alternative research was not easily accepted by the government run state-farms. The scientists may have viewed it as their duty to provide the knowledge, but the government was afraid to lose high-yield crops and profits.

4.4: The Alternative Model: just in time (1980-1990)

By 1980, the alternative scientists in Cuba had made enough impact on the nation to organize the first national meeting on ecology where the focus was on erosion and deforestation. Many attendees argued against the use of pesticides, but arguments into the safety and profitability of the "modern model" were made. A plant protection staff member "argued that pesticides could not be all bad since the Soviet Union produced them" (Stricker 2007, 33). Alternative scientists continued to advocate for ecological reform and "never doubted their right and obligation to push for ecologically rational policies" (Levins 1993, 58). The research in the 1970s that looked toward alternatives for economic reasons was now beginning to be seen as a necessity for environmental reasons. Finally, by 1986, the Third Party Congress recognized the official need for an alternative model (Stricker 2007, 34), in which Castro asked for greater fuel efficiency and less dependence on Soviet imports. Castro could not predict, however, how important the alternative model would become for his country in only a few years.

The collapse of the Soviet Bloc in 1989 and subsequent disbandment of the Council of Mutual Economic Assistance (CMEA) in 1991 left Cuba with a significant decrease in its imports and economy. In 1990, Cuba received $4.1 billion in imports

from the Soviet Union; however, in the following year, that amount dropped to $1.7 billion and petroleum imports went from 13 million tons in 1989 to 6.1 million tons in 1992 (Stricker 2007, 23). Those same years, fertilizer was reduced from 1.3 million tons to 300,000 tons. In addition, pesticide and animal feed import amounts were significantly reduced (Stricker 2007, 24), and as a result, a change from chemical-dependent agriculture to low-input, low-technology agriculture occurred. Perhaps most significantly, due to the reduction of petroleum, food had to be grown in close proximity to its area of consumption, resulting in an increase in urban agriculture. Luckily, a "widespread interest in ecology [was] already present and familiar when the Special Period made it an urgent necessity overnight" (Levins 1993, 57).

4.5: Rural-Science Interactions with Sustainability

The years following the Soviet collapse were called the "Special Period in Time of Peace," referring to the drastic change in the Cuban economy, imports, and subsequently agriculture. While research into input substitutions began in the 1970s and 1980s and there was a greater awareness of ecology, the government and scientists were nowhere close to being able to farm the island without modern agricultural techniques. The scientists turned to rural farmers for their knowledge and began participatory work in low-input, low-petroleum methods of farming. The Special Period brought about a focus on the recovery of sustainable farming methods that had not been forgotten by the farmers. Rosset discusses in his piece "Cuba: a successful case study in sustainable agriculture" (2000) that the small farmers were descendents of previous generations of small farmers and the knowledge of how to farm with intercropping and manure still

existed. Small farmers also found it much easier to convert to agroecological techniques as opposed to state farms. State farms, which followed a modern agriculture system, did not have workers with extensive knowledge required to farm alternatively. Workers on modern, industrial farms, would understand only one aspect of production, and repeat that process over and over, following an understood recipe of procedures. While this repetition aided in more efficient production, it was not beneficial following the Special Period. As a result, the government and scientists were depending on rural farmers' knowledge to aid in the development of solutions to the farming problems Cuba now faced.

From the scientists' initial work with rural farmers to develop alternative techniques came the process of teaching and implementing the research on the whole island. Robert García worked with NGO Food First to set up a program called the Lighthouse (Stricker 2007, 35). The program consisted of courses and a traveling education center that toured the island to help apply the research into the fields. It was initially believed in Cuba that sustainable methods would be a temporary necessity to their food crisis. This belief probably stemmed from a hope that after losing all its ties to the Soviet Union and falling into a disastrous food crisis, the United States would resume trade and send aid to the island. The opposite was true. In 1992, the Torricelli Bill was passed which not only prevented trade with Cuba by foreign subsidiaries of U.S. companies, but also prevented trade with any new nations formed after the fall of the Soviet Union who were receiving U.S. aid (Murphy 1999, 9). Sustainable agriculture appeared to be staying in Cuba. Thankfully, scientists had advocated to policy makers

that permanent sustainable changes to the food system would be both economically and environmentally beneficial in the long run (Stricker 2007, 40).

A final factor that helped the transition of the rural knowledge and scientific research to be applied in the fields was that the scientists were now politicians. Both Levins and Rosset point out that right before and immediately following the Special Period, these scientists, who had done research and advocated for alternative agriculture, were hired to work as politicians in the Ministry of Agriculture (MINAG) (Levins 1993; Rosset 2000). If the government was advocating use of alternative agriculture, its success and implementation would be far greater with than without governmental support.

4.6: Science-Urban Interactions with Sustainabilty

Of the nearly 11.5 million people on the island of Cuba, 8.6 million live in urban areas (CIA World Factbook 2011). Feeding the large urban population, which did not have ready access to land and crops, would become a daunting yet indispensable task for Cuba. Moreover, the ingenuity of urban Cubans resulted in the development of urban agriculture. With the sudden loss of food "previously provided by the government at very low prices, thousands of urban dwellers began to cultivate it for themselves" (Altieri et al. 1999, 132). Both Funes-Monzote and Murphy discuss that urban gardening in Havana was people-centered, meaning that citizens in Havana began urban gardening under no direction from the government (Funes-Monzote 2002; Murphy 1999). The gardens appeared in vacant lots, backyards, rooftops almost spontaneously following the fall of the Soviet Union. While urban gardens have always existed in Havana, having a

garden prior to the Special Period was "associated with poverty and underdevelopment" (Murphy 1999, 12). The residents may have had little to no farming experience and they used whatever tools and seeds they could find. It was only after gardens began that MINAG took action in the urban sector. While the urban agriculture movement was seen as a necessity to feed the immediate population with limited resources, MINAG also recognized the importance of increasing urban agriculture for continued food security, or the ability to safely, sustainably, and consistently provide food for the citizens.

Following this new interest and necessity of urban agriculture, MINAG began providing education and techniques for sustainable production. According to Cruz and Medina in their book *Agriculture in the City*, one of the reasons why urban agriculture became successful in Havana was that the Ministry of Agriculture provided training and tools to city dwellers who wanted to garden (2001, 24). Murphy reinforces this fact in that due to Havana citizen's enthusiasm about gardening, MINAG provided the services needed to continue and develop urban agriculture (1999, 12). By 1994, MINAG had created an Urban Agriculture Department and worked with *Poder Popular* to provide education for urban gardeners (Altieri et al. 1999, 134). *Poder Popular*, or the People's Power, was created in the 1970s and is the elected governing body in Cuba that works within all levels of the government, local, municipal, and national (Benjamin et al. 1985, 217). Both the Urban Agriculture Department and *Poder Popular* worked to ensure any available land in the city would be converted to gardens: even privately-owned vacant land had to be turned into production as mandated by the government of Havana (Murphy 1999, 12). Numerous organizations and NGOs began to be involved with education and training of gardeners and farmers. For instance, *Consejo Ecumenic/DECAP*, the Cuban

Council of Churches, published numerous pamphlets on techniques, and offered educational workshops for urban and rural farmers to help transition to the alternative model in Havana (Murphy 1999, 36). Urban agriculture was quickly moving to become successful and sustainable due to the interest of the gardeners and educators, as well as the techniques that grew out of the rural fields and was spread by the agriculturists.

4.7: Rural-Urban Interactions with Sustainability

While this chapter has discussed rural-science and science-urban interaction, the growth of urban agriculture is a triangle connection that thirdly must link the rural to the urban. Rural to urban distinctions, as discussed in the definitions of this paper, are becoming increasingly blurred. Cuba is no exception. In 1958, one year prior to the Cuban Revolution, 56 percent of the Cuban population was considered rural (Funes 2002, 4). Now, that number is about 20 percent (CIA World Fact Book 2011). Obviously there was significant rural-urban migration in the past 50 years, and there is likely to be continued connections from the urban to rural areas, a role that urban agriculture plays into immensely.

Urban agriculture creates a link between urban and rural spaces, especially in developmental research that tends to focus on either rural or urban spaces (Redwood 2009, 5). Agriculture connects the spaces, or as WinklerPrins discusses, agriculture is a contributing factor to the "blurred lines" (2002) in between rural and urban boundaries. Looking at Cuba, medicinal plants have an important role in the connections between rural and urban relations. So called "green medicine" (García 2002, 214) has been used in Cuba for generations, even moving with people who migrated from rural to urban areas.

Medical crops must be organic because chemical fertilizers or pesticides can affect human health. Research began in 1973, with the Medicinal Plants Experiment Station in Havana (García 2002, 214). Green medicine represents one of the earliest organic productions in a Cuban urban area.

Peri-urban spaces have made a significant contribution to agricultural development in Cuba. The National Food Program, which began in the late 1980s, was started to try to gain more independence from imports, especially vegetables. Over 20,000 hectares of land, mostly just outside of Havana, was converted from sugar to vegetable production (Murphy 1999, 7), in an area known as the "greenbelt" (see Figure 1). This plan, however, did not include sustainable methods and the beginning of the Special Period halted any progress that the National Food Program hoped to achieve in food sufficiency. The greenbelt still represents a geographic delineation between the urban and peri-urban spaces, as can be seen in Figure 1 below with urban Havana in the central half-circle, and peri-urban Havana between the two greenbelts. A project in the 1960s was aimed at increased vegetable production in this area (Hirt and Scarpaci 2007, 288), similar to the National Food Program, both in location and subsequent failure.

Figure 1: Location of the greenbelts surrounding central Havana (Hirt and Scarpaci 2007)

Other connections have existed between rural and urban areas with agriculture in Cuba. In the early 1970s, there were a few programs set up to link the urban with the rural. A successful program sent urban students to the farms in rural areas. On one large farm, 60 percent of the labor was made up of students who worked three hours a day, four days a week (Benjamin et al. 1985, 175). An unsuccessful program was set up with adults in the city (Benjamin et al. 1985, 176). On Sundays, which was their only day off from work, urban dwellers could sign up to go into the countryside and help out on farms for the day. The productivity of the program was low, but the ideology was there to connect Cubans with the land. A similar program has been discussed in the last decade to have urbanites move to the rural farms and help solve the labor constraints (Warwick 2001, 56). Better housing is being built in the countryside, along with more amenities that aim to attract people who may be willing to commit anywhere from two weeks to two years on a farm. Whether this program will be successful in creating connections

between rural and urban spaces remains unknown, but the idealism of the program is encouraging for continued support of sustainable agriculture.

4.8: Discussion and Conclusion

The origins of alternative agriculture research began in the 1970s, possibly from the energy crisis that numerous nations were experiencing, but also from the intensive and destructive agriculture techniques seen with the "modern model." A small group of scientists, who were passionate about the environment, were responsible for beginning to research alternative farming. Once it became economically viable, official research from the government began in the 1980s. Nothing though prepared Cuba to face the economic downfall that occurred from the collapse of the Soviet Union. Food security became the immediate concern and while researchers worked with rural farmers to perfect low-input methods of farming, urbanites were growing food on their own, with little knowledge. Their passion to produce food in any open space led the Ministry of Agriculture to provide training and tools that would lead Havana and other Cuban cities to become the world's gold standard in urban agriculture. At the same time, the link between rural and urban spaces in terms of agriculture was apparent in Cuba prior to and following the Special Period.

Chapter Five

Farming in Havana:
Urban Agriculture in the Last 20 Years

Thus far, this paper has chronicled agriculture in Cuba and the development of alternative techniques that saved Cuba from its food crisis following the collapse of the Soviet Union. Yet perhaps even more important is the persistence of traditional farming knowledge, which the rural farmers taught the alternative scientists, who taught the urban gardeners. Urban gardening has become an indispensable tool in feeding the people of Cuba and this chapter will focus on its specifics, and why Cuba is considered by many to be the gold standard today for urban agriculture.

Map 1. Modern day map of Cuba (CIA World Factbook 2011)

5.1: Urban Agriculture Basics and the Rural-Urban Connectivity in Havana

Before delving into agriculture in Havana, it is important to understand the basics of the Cuban climate. About the size of Pennsylvania, Cuba (see Map 1) is characterized by mostly rolling plains, and a mountainous region in the southeast. The rainy season

lasts from May to October, with annual average rainfall amounting to 1,300 millimeters (Funes 2001, 2), or about 51 inches. The dry season has intermittent rainfall that causes irrigation and water supply problems in Havana. The average temperature per year is 25° C (77° F), with the temperature range plus or minus two degrees. The soil is mostly red ferralitic and is low in organic matter and nutrients (Altieri et. al. 1999, 136). In urban areas, soil composition is further compromised by buildings, pavement, and garbage littering the city. Yet in Havana (see Map 2), advances in urban agriculture have helped the city feed its 2.14 million people (CIA World Factbook 2011).

Map 2: Satellite view of Havana and its surrounding urban sprawl (Google Maps 2011)

There are several types of agriculture seen in urban areas on the island; the three significant and most-studied types are intensive gardens, *organopónicos*, and popular gardens. Intensive gardens are found in areas of higher quality soil and better water supply and drainage; thus, seeds are planted directly into the ground and produce yield of about 12 kg per square meter of soil. *Organopónicos* are more common in urban areas, with about 1,613 in existence in 1996 (Altieri et al. 1999, 132). These types of gardens appear in areas where the soil is poor and subsequently seedlings are grown first in

nurseries and then transplanted into raised beds composed of compost (see Figure 2). The yield in *organopónicos* is about 16 kg per square meter, in part from an increase in organic matter in the soil from raised bed production. The third type of farm, popular gardens, is equivalent to a more common term: community gardens. Community members in urban areas transform dumps and vacant lots into garden plots that range in size from a few square meters up to three hectares. In Havana alone, in 1996, there were 26,604 gardeners in about 5,000 gardens across the city (Altieri et al. 1999, 132). In addition to these more structured examples of gardens, there are also rooftop gardens, window-box gardens, potted plant gardens: gardens that exist in any space within the city that may support plant growth.

Urban gardeners grow mostly fruits and vegetables, the most popular crops are tomatoes, beans, bell peppers, cucumbers, radishes, celery, chard, lettuce, beets, Chinese cabbage, and cabbage (Altieri et al. 1999, 135). Popular gardens have revitalized the production of root crops, *viandas*, including sweet potatoes, potatoes, and cassava. The Cuban National Food Program, which began before the end of CMEA, started to focus on *viandas* production in Havana and its surrounding areas after the fall of the Soviet bloc, particularly because Havana was always dependent on other parts of the country for *viandas* (Deere 1993, 40). Without petroleum imports to ease transportation of goods, the staple crops of the Cuban diet would not be able to reach the city. Planting techniques, like intercropping, are used in the different types of urban gardens throughout Cuba. *Organopónico* farmers utilize different methods of companion planting, such as basil, which is planted the ends of the raised beds and gives off a pungent odor to deter insects. Corn is another crop used, in this instance it is considered a "trap crop." Corn is

not a staple in the Cuban diet, but it is planted in the beds to protect the lower growing crops like green beans from pests. The excess corn that does not go into human consumption is then used as animal feed (Stricker 2007, 40). Urban agriculture also includes animal production and farmers raise bees, fish, cattle, pigs, chicken, rabbit sheep, and goats (Stricker 2007, 41). Problems with urban animal production continue as Cuban farmers must still buy some imported animal feed, which is expensive (Koont 2004, 20). Successes have been seen though in small animal production, including guinea pigs and rabbits (Premat 2009).

Figure 2. Raised beds at an *organopónico* in Havana (Funes et al. 2002)

5.2: Organic Agriculture in the Cities

Chemical fertilizers are prohibited in the city of Havana, and have been since the MINAG formed. The absence of chemicals has created some of the most diverse aspects of urban agriculture in Cuba, specifically integrated pest management and organic soil management. Cuban urban farmers focus on biological inputs to control pest problems, such as the addition of insecticidal plants, fungi, bacteria, and helpful insects to control

pest problems within the plantings. Soil management is also, out of necessity and ecological awareness, carefully maintained through organic inputs. A variety of composting methods are used to produce compost from organic matter such as animal manure, urine, bones, blood, crop residues, weeds, sawdust, coffee pulp, etc. Worm composting, or vermicomposting, is also used, with experimental stations around the country to educate farmers (Gersper et. al. 1993, 20). Cuban soil is rapidly oxidized in the tropical climate, creating low nutrient levels (Altieri et. al. 1999, 136) (see Figure 3). As a result, *organopónicos,* which use different types of compost rich in nutrients for raised beds, are the most common type of urban agriculture space. It should be noted though that Cuban agriculture, as a whole, is not organic. Outside the cities, chemical inputs are still used. For example, potato production, while highly productive with 23 tons/hectare (second only to Argentina in Latin America), still uses some synthetic fertilizer (Koont 2004, 16). Nevertheless, health of the environment and the people is of major concern in urban populations, where land space and soil are limited and the population is highly concentrated.

Figure 3. Intensive vegetable planting where the red ferralitic soil is evident (Funes et al. 2002)

5.3: Nutrition and Food Security in Cuba

People's health has been affected in positive ways in the last 20 years, just as food security has improved. In the first years following the collapse of the Soviet bloc and before urban agriculture strengthened and began to revolutionize the way Cubans gained fresh food, the average protein and caloric intake was 30 percent below levels it had been a decade earlier (Funes et al. 2002, xvi) (See Figure 4). The end of CMEA not only caused a reduction in agricultural imports, but also medicinal imports, particularly from restrictions due to the U.S. Toricelli Bill. In reaction, urban farms began to incorporate medicinal plants into their crops for both home consumption and market sales. Chapter Four referenced the importance of "green medicine" in Cuban agriculture, and its strong connections to urban farming. Vegetable crops too were understood to have health and nutritional value and are vital crops in urban production. For example, *espinaca baracoa* is a spinach-like plant that is high in protein and the amino acid lutein, which has been shown to aid in the prevention of optical degeneration diseases (Stricker 2007, 40). In a study done in Trinidad, a city in south-central Cuba, the most common crop grown in home gardens were banana, papaya, avocado, guava, mango, lime, sweet basil, orange, bell pepper, and custard apple (Buchmann 2009, 712). The researcher, Christine Buchmann, concluded that the Cubans were growing non-staple foods to nutritionally supplement their diet.

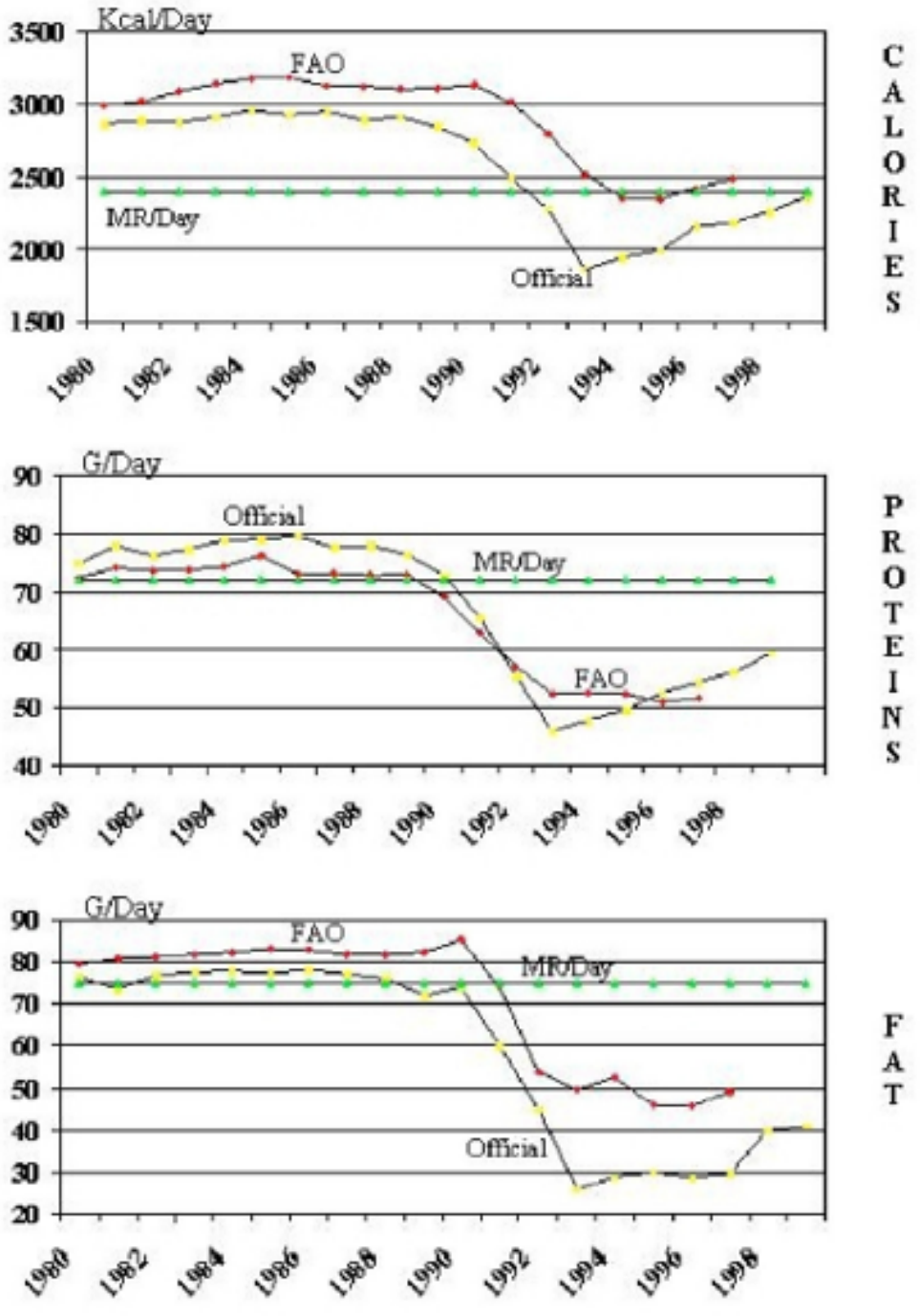

Figure 4. Daily per capita intake of calories, proteins, and fat, and FAO's minimum requirements (MR), 1980-1999 (Alvarez 2004)

Subsistence crop production has increased in the past 20 years, resulting in increased food security in Cuba. When the Soviet bloc was dissolved, food and agriculture imports decreased significantly. In 1989, Cuba had 908,762 pesos worth of agricultural and food imports, but then reached a low of 467,332 pesos by 1994 (Ritter 2004, 113). Unfortunately, production values were not yet high enough to feed the nation. Roots and tubers production in 1994 was only 74.2 percent of what it had been in 1988; vegetables were 47.7 percent. During the time of the economic crisis, however, Havana residents' rates of obesity dropped to 5.4 percent in 1994, a change from 11.9 percent in 1982 and physical activity from 30 percent in 1987 to 70 percent from 1991-1995 (Franco et al. 2007, 1376). As seen in Figure 3, calorie, protein, and fat intake decreased significantly in the years of the Cuban economic crisis, yet the incidence of coronary heart disease and type 2 diabetes mortality decreased by 35 and 51 percent, respectively (Franco et al. 2007, 1378). While food availability and caloric intake was significantly diminished following the fall of the Soviet Union, health status in regards to typical Western dietary diseases decreased, due to a lower incidence in obesity, increased physical activity, and perhaps, increased food production from gardens.

By 2000, agricultural production had increased to 152 percent of 1988 values for roots and tubers, and vegetables were 216.2 percent. Beans went from 73 percent to 402.7 percent (Ritter 2004, 109). While these percentages represent Cuban agriculture in its entirety, urban farming played a significant part in these increases in production. In 1999, the urban sector of agriculture produced more than 800,000 tons of farm products, mostly vegetables (Nieto and Delgado 2002, 45). In Havana alone, vegetable and herb sales reached 943 grams per day per person in March 2003 (Koont 2004, 20); FAO

recommends 300 grams. The last ten years has seen continued success with providing food for the nation. Cuba has continually been viewed as the gold standard in urban agriculture by agroecologists for sustainably providing food for not just urban areas, but the whole nation. With 20 years now in production, what is the future of sustainable agriculture in Cuba going to look like?

5.4: Discussion and Conclusion

Following the loss of imports from the Soviet Union, Cuba did not immediately achieve success from urban agriculture. Over 20 years though, it is apparent that Cuban cities, particularly Havana, have developed a system to improve food security and nutrition among the people. Crops are seen in a variety of areas, from large farms to small window planters, from community plots to rooftops. Nutritional status has increased since urban agriculture began to take hold, providing people with fresh crops and a healthier diet. The most amazing point is that these successes occurred in such a short period of time. What will the future hold for urban agriculture in Cuba?

Chapter Six

Resiliency of Urban Agriculture: What will the future hold?

While the last 20 years have demonstrated the success of Cuban farmers and gardeners in providing food for the nation, the future of urban agriculture is not clear. Challenges are already occurring and changes will need to be made in order to maintain a low-input, sustainable method of being food secure. This chapter will focus on possible problems to the continued importance of urban agriculture, labeled as "What Ifs…" meaning what if this was to occur. In some cases, solutions are already in place and farmers are working towards continued improvement of food production. The final section of this chapter examines the resiliency of urban and sustainable agriculture in Cuba, pointing out the strong connection between the land and the people. This connection will champion the continued use and development of agroecology in Cuba.

6.1: What If… Scenario One: U.S. Trade Market

The first "What if" is one that has been discussed for the past 50 years and is still full of uncertainties: what if the United States lifts the trade embargo with Cuba? The United States is not only a resource-rich country, but is close Cuba, about 90 miles away. Many American farmers would be excited to trade with Cuba. Currently, according to the CIA World Factbook (CIA 2011), the United States provides 6.87 percent of total imports into Cuba, which includes some food. Rice is a popular American import into Cuba, and while typically, Democratic administrations have been more lenient in trade with Cuba, a substantial amount of rice was exported to the island under President

George W. Bush. In 2004, $64 million worth of rice went to Cuba, but when the Treasury Department began to require advance cash payments, the export/import numbers dropped to $24 million in 2007, $7 million in 2008, and $0 in 2009 (Torbati 2010).

President Obama has made a step towards improved U.S.-Cuba relations by easing the travel restrictions and allowing money to be sent (Thompson 2011), but this policy change is a small step. As quoted in a *New York Times* article, Robert Pastor, a professor of international studies at American University, believes that it will take "another 50 years of incremental steps" to change the international relations between the two nations and "even then, we're having trouble taking baby steps, when what we need is a giant leap" (Thompson 2010).

Let us imagine then the giant leap that allows Cuba freer trade with the United States in terms of food imports. What would happen to Cuba's urban agriculture? Perhaps the farmers in the cities would stop gardening, which would be easier. The urban gardening movement arose from a necessity to feed themselves when nearly all food imports stopped after the fall of the Soviet Union, so why would Cubans not go back to the way it was previously if food imports were readily available again? Is there a force that is motivating urbanites to farm, something more than a need for food?

6.2: What If… Scenario Two: Ocean Oil Drilling

In 2005, former President Fidel Castro announced to the Cuban National Assembly that oil had been discovered off the coast of Havana (Stricker 2007, 129). Since the fall of the Soviet Union, Cuba's petroleum imports have been significantly

reduced. As stated in Chapter Four, in 1992, Cuba imported 6.1 million tons, down from 13.1 million tons only three years before. As a result, Cuban farmers were forced to revolutionize the way they farmed: a shift from conventional, petroleum-input heavy farming, to sustainable farming that relied very little on chemical fertilizers, pesticides, and oil.

This year, in 2011, oil companies will begin to drill for oil in Cuban waters of the Florida Strait, which are in some locations only 50 miles from the Florida Keys (Krauss 2010). There is interest from Spanish, Russian, Norwegian, Indian, Vietnamese, Brazilian, and Venezuelan oil companies to drill and/or explore for drilling sites and all of these countries were granted leases by the Cuban government (Kramer 2010). Drilling oil off the coast leads to two major concerns. The first, and perhaps more prominent to American audiences, is the possibility of another oil spill, this time however, it will be closer to the Florida coast, with scientists estimating the spill reaching American beaches in only three days (Kramer 2010). As the Cuban oil industry is in its nascent stage, they have few resources and knowledge to prevent or resolve another oil spill; no underwater robots or spare drilling rigs. While the United States decided to no longer expand its offshore drilling in the Gulf of Mexico and into the Atlantic Ocean, it has no control over Cuban decisions, even if these decisions may ultimately be detrimental to the Florida ecosystem.

The second concern, pronounced by agroecologists and agriculturists in Cuba, is the potential input changes to farming on the island if more oil was made available. The agroecological approach to farming, the low-input, low petroleum methods, begun prior to the Special Period was implemented and "led by research institutions, non-state

organizations and the Cuban government," not by the farmers themselves (Nelson et. al. 2009, 234), meaning that while farmers have made significant contributions to sustainable knowledge, it was the scientists who campaigned for the techniques. As a result, even today, most farmers are only using the agroecological farming techniques because it is a necessity in the current import and economic status of Cuba. Based on evidence provided by some of the literature, it appears that Cuban farmers do not understand or believe in the importance of sustainable agriculture; they are not "ideological" followers of the agroecological movement. Pamela Stricker writes of this lack of ideology in her book *Toward a Culture of Nature* (2007), as does Erin Nelson and her colleagues in their paper entitled "Institutionalizing agroecology: success and challenges in Cuba" (2009). While Cuba includes aspects of agriculture, renewable energy resources, and environmental education as part of their written laws on the environment, "if the population does not comprehend the human impact of the environment, they will not understand nor will they adhere to those laws" (Stricker 2007, 135). Many farmers expressed respect for the ideas of reducing chemical use (often referring to agrochemicals as *veneos*, or poisons), maintaining biodiversity, and minimizing tractor use, all to protect the soil, they still would prefer to use inputs to ease their farming practices.

The preference for chemical inputs and machinery is not the case with urban agriculture. Not only is it policy not to use any chemical inputs on urban-grown food, urban farmers are also committed to sustainable agriculture. Nelson and her colleagues found one urban farmer who, in response to the question of what is the importance of agroecological farming, stated "how beautiful [farming] is when you start loving the

land" (2009, 239). When asked in 2005 what was the one major action that Cuba has done to help the environment, Fidel Castro answered urban agriculture (Koont 2009, 61). Urban farmers and gardeners possess an abundance of knowledge and a passion for sustainable agriculture. The "What If?" then becomes what if urban farmers helped teach rural farmers about the importance of agroecology? It would be a reversal of roles, when in the early stages of urban agriculture, rural farmers were teaching the techniques, now urban farmers will teach the passion. There are similar programs in existence, such as Farmer to Farmer (*campesino-a-campesino*), which involves farmers helping other farmers with policy-making questions, land usage, etc, in a participatory approach. Jack Fairweather, a researcher in Cuban agriculture, believes that what needs to be devised are policies that increase education about the benefits of organic agriculture to ensure that fewer farmers return to conventional agriculture if cheap oil once again becomes reality for Cuba (Nelson et. al. 2009, 239). While there would be some limiting factors in urban farmers aiding rural farmers, such as crop differences and land size differences, what is most important is to share the understanding and passion of sustainability.

6.3: What If… Scenario Three: "Model" Gardens

The third "What If" is actually in the beginning stages of development. In a report entitled "State Power, Private Plots and the Greening of Havana's Urban Agriculture Movement" (2009), Adriana Premat examines the usage of officially-recognized and endorsed (by the government) "model" gardens in the capital city. It is clear that urban agriculture came from the people and "food production was spontaneously and independently undertaken by average citizens trying to provide for

themselves and their families" (Premat 2009, 34). Therefore government influence grew out of the environmental passion of its citizens. In the late 1990s, the Ministry of Agriculture began to see a problem with this method of uncontrolled farming and gardening. Many of the home gardens, the *patios* and *parcelas,* were overgrown or not being planted to their fullest potential. For a city that was relying on its urban gardens and farms to provide almost all of the produce consumed within the city limits, Havana was doing a poor job in monitoring those who were growing and the production was not nearly as efficient as it could be. Thus, in late 1999, the Ministry began to use "representatives" to conduct a census and determine how many home gardens were being used in Havana. The census information helped form the *Moviemiento de Patios y Parcelas* in early 2000, which helped to certify certain gardens throughout the city as "model" gardens. These sites were using "greener" farming practices and became models for other gardeners who wanted to become more productive. In 2001, there were 70,000 *patios* and *parcelas* in Havana, 159 of which were deemed "models" (36). Soon, other farmers began working harder to achieve model status as a sort of competition. One farmer that Adriana Premat interviewed in her work was Manolo (40). He began with rabbit-production, not growing any of his own crops for feed. After taking a course on crop production, Manolo began to cultivate his own feed and began to raise guinea pigs and chickens too (see Figure 5). Guinea pigs, an animal that could be easily cultivated in cities, were brought from Peru in an attempt to add more protein to the Cuban diet. It turned out to be a very popular addition. Manolo began to experiment with adding animal excrement to feeds or using it to make compost and vermiculture.

Nothing was wasted on Manolo's rooftop garden. Because of his successes, the government officially declared his garden a model garden.

What makes this movement and subsequent competition for "model" status so interesting is that it was completely voluntary. No government officials dictated that every farmer or gardener must join, which raises the question posed at the end of the What If…Scenario One: why are urbanites farming and more specifically, why are they farming sustainably? It was first because of necessity: there was nowhere near enough food available to sustenance health. Something changed the Cubans' minds in regards to what is important about gardening and farming. It is not just food access. It seems to be about pride in the work and a love for environment, based on interviews reported by Premat. One of the "model" gardeners from Premat's paper, Rafael, included in his crop rows signs to teach visiting farmers about the importance of sustainable growing (Premat 2009, 38). He has prepared signs that said "Organic agriculture: a sustainable way of life" or "A healthy environment guarantees your health." Rafael is a man who should be going out to the rural areas and teaching the farmers about the importance of sustainable farming.

Figure 5. Manolo's rooftop garden and production of rabbits, guinea pigs, and chickens (Premat 2009, 41)

6.4: What If… Scenario Four: Privatization of Jobs

This final "What If" is another change that is already occurring in Cuba and focuses on the economic importance agriculture on the whole island. As reported in the *New York Times* in September 2010, Cuba intends to lay off more than 500,000 people from public, government sector jobs in order to create more private sector jobs (Malkin 2010). Privatization of jobs is a drastic change in the communist economy, a change that should reduce monetary stress on the nation. Historically, agriculture has been a small private sector in Cuba (the only private sector), yet because of an increased need for food, the new Cuban government under Raul Castro's rule has encouraged more privately-owned, as opposed to state-owned, farms (Voss 2008). In 2006 when Raul Castro took office, he began making agricultural reforms, including transferring state lands to private, and opening privately-owned agriculture supply stores. According to a BBC News report by Michael Voss (2008), these changes in Cuban agriculture are vital in aiding the current failing economy and made lead to increased self-employment and small businesses in the cities. As the Cuban economist Juan Triana stated, "the changes in agriculture are very important because agriculture is a test for future changes in the Cuban economy" (Voss 2008). Sustainable agriculture shaped Cuba 20 years ago and agriculture may be the key to revitalize and sustain the Cuban economy in the next 20 years.

6.5 Resiliency of Urban and Sustainable Agriculture

Urban agriculture has the ability to link various systems in the Cuban state, including the economy, society, environment, and education (Cruz and Medina 2001,

169). Urban agriculture can create jobs, provide money through trade, sales and even tourism, increase environmental awareness and education, and increase health within the community. Threats to the development of urban agriculture may be detrimental to Cuba but there is evidence that a resiliency exists. Cuba has a historical interest in agroecology that has not only saved it from a food collapse in the last 20 years but will ensure agroecological support in the coming years. Discussed in previous chapters, sustainable agriculture has existed on the island for centuries, before Spanish colonizers arrived. Even more important is the continued use of sustainable agriculture and knowledge of the techniques alongside non-sustainable practices, both during periods of colonization and after the Cuban Revolution. It appears that Cubans have a great ability to understand earth and the importance of environmental awareness.

The nature of Cuban minds appears to link the rural to the urban, furthering scientific progress into the importance of urban farms. According to Richard Levins, city planners in Cuba view urban agriculture as both a way to provide food and a way to "ruralize" or "humanize" the cities (1993, 52). There is almost no stronger evidence than this connection between farming and humanity to exemplify the importance and resiliency of urban agriculture. Farms represent humans' work within nature, the connection to earth that links humans to the surrounding environment. Agroecology works to create a symbiotic relationship between the people and the land, to better both and ensure the longevity of the relationship. Levins' details such a connection in combination with an increasing dissatisfaction to Soviet ideals experienced in the 1980s. In 1987, a committee was set up to rebuild the uniform housing construction that had been copied from the Eastern Bloc. One of the planners, Mario Coyula, promoted the

change by stating "the relationship to the earth is essential to the people" (53). Environmental awareness was beginning to take hold prior to the Special Period, yet it appears to have been a part of the Cuban ideal for many years.

The popularity of ecological figures in Cuba also created the strength of environmental awareness on the island. Antonio Núñez Jiménez was a captain under Che Guevara during the Revolution. Afterwards, he became a leader in the agrarian reform and finally was the first president of the National Academy of Sciences. In 1980, Núñez Jiménez began a campaign entitled "Towards a Culture of Nature" that promoted environmental awareness and respect of nature amongst regular Cubans (Stricker 2007, 115). Hugely influential within the government, he is considered to be the key figure in getting the government to recognize the importance of environmental policy and research, with his belief that "neither philosophy nor ecology is possible, without a scientific point of view, to deal with nature and the environment of Cuba" (Stricker 116).

Another influential figure of ecology was Jorge Ramón Cuevas, who had a popular television show from 1988 until his death in 2000 called *Entorno*. He aimed to bring nature and environmental education to all Cubans (Stricker 100). What he viewed most important was creating a dialogue about the beauty of nature and the need to protect the environment. While Cubans innately understood the importance of the relationship between humans and land, they needed to be made aware of how much they could do to protect their land. In Cuevas' words, "if you give people a solution, then it goes right through them. But if you leave the questions open, then they will think and talk about it and find a solution" (Stricker 100). The resiliency of urban agriculture exists because of the people. Farming grew out of a need for food, but also a passion to solve the problems

and will continue to thrive because of its ability to "humanize" urban spaces. What needs to be seen in the coming years is a similar passion in rural farming, a passion for the environment and continued development of agroecological techniques.

6.6: Discussion and Conclusion

While Cuba has proved its ability to successfully provide food in a low-input, low-technology situation, the long-term sustainability of the Cuban agriculture system needs to be addressed. Changes are occurring that may disrupt the methods of sustainable farming: the possible modification or nullification of the trade embargo between the United States and Cuba would make a huge impact on agriculture for the island. Oil drilling may revert sustainable farms to conventional farms, as some farmers see it being easier. Nevertheless, with urban farmers, there is a strong ideological belief that sustainable farming is the way to farm for both the health of the environment and the health of the people. Cuba must begin to use the knowledge and passion of these urban farmers, and share the importance of agroecology with the rest of the nation. Similar passion was seen prior to the Special Period with the beginnings of ecological campaigns among passionate Cuban scientists. Richard Levins remarked that his friends, the environmentally aware researchers in Cuba, viewed it their responsibility to share the importance of ecology with the island (1993, 53). Hopefully, in order to ensure the resiliency of sustainable agriculture, other Cubans will fulfill their responsibility as Cubans, and as humans tending to earth.

Chapter Seven

Discussion and Conclusion

I started this project because I was drawn to the ingenuity of Cuban urban agriculture. There is something beautiful and indescribable about soil and crops nurtured into life among stark concrete and asphalt. I believed urban agriculture in Cuba to be an anomaly, its growth and success so removed from the rest of the world that it represented some sort of perfect example for urban agriculture. Yet nothing is perfect or without its faults. The initial years following the fall of the Soviet Union were not immediately food productive and the gardens have not been efficiently maintained. The basis for urban agriculture arose from the absolute necessity of food production. Nevertheless, without a solid understanding of sustainable techniques, Cuba should not have been nearly as successful, so quickly, in feeding its people following the loss of imports. So where did sustainability come from? I began this project by asking where the science of agroecology originated in Cuba.

From my research, it soon became apparent that it was not just the scientists in Cuba, the agriculturists, ecologists, and environmentalists who had a passion for the environment. The Cuban people inherited an abundance of knowledge, traditional knowledge that was passed down through the centuries focused on sustainable growing. Even with agricultural foreign influence from Spanish colonization, American companies, and Soviet Union imports, sustainable techniques persisted and ultimately help to develop agriculture. The foundation of agriculture in Cuba is from the indigenous people and the small-farmers who understood the land.

Without the rural farmers in Cuba, the alternative agriculture scientists would not have been able to successfully implement widespread sustainable agriculture systems on the island prior to and following the fall of the Soviet Union. While there was research being conducted in the 1970s and 1980s at universities by a handful of scientists, it was the participatory work among rural farmers and scientists that made the transition from industrialized agriculture to low input, low technology agriculture possible.

What I wanted to answer in my thesis was where did urban agriculture come from? I have tried to put together the pieces of the puzzle of literature. Urban agriculture is a direct result of a need for food security. The spontaneous development of urban agriculture is from the Cubans instinctive need to connect to the environment. Cubans appear to be innately connected to nature, the green spaces that make them "human" as Richard Levins wrote. Perhaps I can even argue that the urban citizens who began to farm out of nothing were in fact maintaining sustainable methods in the non-sustainable environment of the cities. That while there was a necessity to grow food for consumption, there was also a necessity to grow food for its connections to the environment. Urban farmers appear to be the most passionate in Cuba about continued sustainable agriculture, for both food security reasons, but also for the beauty that is provided by soils and crops lovingly grown. The "model" gardens in Havana are an example of work being done by urban farmers who not only want to produce food, but also are doing so in innovative, sustainable ways that, according to Adriana Premat, are beautifying the environment.

I discussed in my literature review about work the work done by Antoinette Winklerprins in Brazil (2002). She concludes that urban gardens represent the transition

from rural to urban spaces. Urban gardens are a way to not only provide food but also a way to "green" the surrounding environment and connect urban citizens back to the land. Havana has become successful with low input technology from a food security standpoint, as well as an ecological, greening standpoint. The persistence and success of urban agriculture came from the ability of gardens to reconnect Cubans to nature. Antonio Núñez Jiménez, the government official and ecology advocate wanted this reconnection made with his campaign "Towards a Culture of Nature." I think that the urban citizens involved in agriculture have worked to achieve this culture of nature.

It is almost impossible to prove scientifically that urban Cubans have altered their culture to become more environmentally sound because culture is almost impossible to define and measure. I believe that it was not an altering of the culture but the culture of nature has existed in Cuba for centuries. This culture of nature is what has maintained sustainable agriculture techniques amidst foreign influence and resulted in a handful of scientists to conduct alternative research. Urban agriculture developed because of the Cuban culture of nature and it will be maintained because of Cuba's instinctive need to connect with the environment.

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