



A Farewell to Oil

Low-Carbon Ecology and Social Power in Cuban Urban Agriculture

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Abstract For three decades, food supply in Cuban cities was dependent on oil from the Soviet Union. Then the socialist bloc collapsed, oil supply ceased, and an urban agricultural movement brought vegetable production into the cities. – Today, the need for low-carbon energy transitions is increasingly recognised globally. This thesis examines energy transitions based on the Cuban urban agricultural experience: how is space organised socially and ecologically in and around *organopónicos* to enable production? And what does this imply in relation to the Cuban state's tendency during the period of Soviet dependency to centralise production and political power? Based on fieldwork in Pinar del Río, the spatial organisation of social institutions and flows of organic materials, seeds, water, pest management methods, and other energy sources that enable and regulate production is examined. It is argued that organopónicos cannot be understood as autonomous agroecological production systems as opposed to industrial production systems in either social or ecological terms, as existing literature posits. Rather, urban agriculture in Cuba is simultaneously agroecological and industrial. The thesis instead conceptualises urban agriculture in Cuba and low-carbon energy transitions through a novel theoretical framework of spatial assemblages.

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Preface

‘When you go back to Sweden you can start an organopónico movement over there!’, Antonio said as I headed towards the gate of his urban garden for the last time. We had been talking for some time in the shade of bananas, by a bed of purple aubergines. ‘I’ve just got to write up my thesis first’, I countered while Antonio chuckled under his moustache. Then through the narrow path between a bed of lettuce and another of leek, through the gate, turning left and the organopónicos were out of sight. My fieldwork had come to an end.

I have many times remembered Antonio’s chuckle as I have seen this thesis materialise at my hands. I hope that the thesis can contribute to our understanding of how we may produce food close to where it is eaten. Not tomatoes that ripen through a spray of ethylene gas as they haul across a continent or two; but vegetables that keep most of the production input of energy and carbon within, and not displaced in the Earth’s atmosphere.

Several persons have been invaluable to the process of writing this thesis. No one has been more encouraging, supporting, and patient (usually all three at the same time) than Vanessa Hansen. My supervisor Andrea Nardi and my fellow human ecology students in the CPS-seminar have commented and criticised. So has Richard Langlais who has led the seminar. In particular, I have had great support from Vedra Korobar, Linda Dubec, and Nickolas Panagiotopoulos, whom I have daily rubbed my shoulders next to in the library in Lund throughout the writing process. Oscar Krüger and Corinna Burkhart also invited me to sea-side writing in Lomma.

The fieldwork was realised through the Linnaeus-Palme exchange agreement between KTH Royal Institute of Technology, Stockholm, and the University of Pinar del Río ‘Hermanos Saíz Montes del Oca’ (UPR). Frank Marquez and Leonardo Aguiar Trujillo at UPR have with great generosity and efficiency assisted me with all practical matters in Pinar del Río. Rolando Zanzi at KTH open-handedly enabled me to travel through the exchange programme. In Pinar del Río, the Castillo González family—Luis Guillermo, Marilén, and Mercedes—kindly accommodated and cared for me in the best possible manner. Obviously, this wouldn’t be much of a thesis either without the friendliness of the workers in the organopónicos along the Vial de Colón. I particularly want to thank Ana Reina Diaz Cordero, Antonio Lazo, and Hecton Bentamé Hernandez who administer three of the organopónicos and have offered me plenty of their time.

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Introduction

In the wake of the Cuban Revolution, Cuban urban food supply became maintained by a constant flow of oil from the Soviet Union. This energy flow connected Cuba on an international scale with the Council for Mutual Economic Assistance (CMEA). Imported energy was for the most part funnelled through the Ministry of Sugar, passing provincial bureaucracy, transported to sugar mills and further into sugar fields, tractors, combines, and grinders (Pollitt and Hagelberg 1994). The sugar produce, embodying this latent energy, was then sold back to the CMEA to sustain the flow of oil and, importantly, food imports. Thus, the 8.5 million Cubans living in cities remained fed to the point that the 1980s have been described as ‘the years of the fat cow’ (Wright 2009: 4). However, the structure that this sugar-for-food export-import dialectic held, maintaining the cow’s rumination, was wholly dependent on the international spatial relation of flowing oil.

As the Soviet Union disintegrated in 1990 the hegemonic spatial relation collapsed. Cuba’s sugar fields lay lifeless without petrochemical input; transports stopped without fuel; the 95 percent oil-dependent national electricity system had daily power cuts; and people were left hungry as the metabolism of the cities came to a rusty screeching stop. The ‘Special Period in Peacetime’ that ensued in Cuba after the collapse of the Soviet Union was essentially a spatial crisis. Scholarship on the crisis, such as that referred to throughout this thesis, persistently describes the Special Period foremost as an economic crisis. Yet, the economic crisis, where GDP fell around 40 percent between 1989 and 1993¹, was brought about by the break-down of the energy system’s spatial configuration.

The spatial crisis had exceptionally severe consequences for Cuba’s urban populations. Before the Special Period, the Revolution actively encouraged urbanisation and today’s Cuban cities harbour 75 percent of the domestic population (ONE 2009). City dwellers were entirely dependent on the sugar-for-food dialectic for their food supply and were as a consequence fully in the hands of a working rural sugar production. As the crisis struck, the average daily calorific intake per person decreased from 2,929 kcal in 1985 to 1,863 kcal in 1993. In hospitals mothers and newborn babies began showing lowered nutritive values and in 1992–1993 an epidemic of neuropathy spread across Cuba likely resulting from vitamin B deficiency (Cruz and Sánchez Medina 2003: 4; Rosset and Benjamin 1994: 24).

In response to the crisis, people in the cities began to produce food to feed themselves (Cruz and Sánchez Medina 2003; Wright 2009: ch. 5). They cultivated back gardens, parking lots, roof tops, demolition sites, patios, garbage dumps, and unused urban land with vegetables. Cultivating the city became an act of resistance to the crisis where people engaged in a spatial politics to control food

¹ The exact economic decline is hard to estimate during this period, as Mesa-Lago (1998) discusses at length, and this is my shot from the hip trying to end up somewhere in the middle of the many figures he has collected.

supply. By reorganising the spatial relations of food procurement agricultural production was made possible in the city. In this way, the urban populations transformed the geometries of power to better control food supply themselves.

The spontaneous movement of urban farming was actively met by the state as the introduction of *organopónicos* was made national policy in 1994. The organopónicos were an initiative spearheaded by Raúl Castro's Ministry of the Revolutionary Armed Forces (MINFAR).² The organopónicos principally represent a method of farming where raised beds are filled with organic material that allows farming in areas with low soil quality. The establishment of organopónicos was crucial to the sustained success of other forms of urban agriculture because of their close connection to research centres and relatively high capital supply (Companioni et al. 2002). Interestingly, the organopónicos were a top-down initiative by the Cuban state, known for its centralisation of production and political power, that decentralised urban food supply.

It has repeatedly been pointed out that the transformed agricultural system in Cuba, where urban agriculture stands for a large part of urban vegetable supply, has reduced the amount of energy and carbon input in agricultural production (Rosset and Benjamin 1994; Funes et al. 2002; Machín Sosa et al. 2010). Boillat, Gerber, and Funes-Monzote (2012: 600) even claim that Cuban agroecology is 'today's largest real-life experience of agroecological "degrowth"'.³

AIM

In this thesis, my aim is to contribute to scholarship on the spatial implications of low-carbon energy transitions.⁴ Cuba's historical experience in many ways foreshadows a global future where oil supply is lost. The spatial reconstruction of Cuba's urban food supply system therefore provides an important case to study the transformation of an oil locked-in energy system after the loss of oil input. Bridge et al. (2013) observe that the spatial implications of low-carbon energy transitions still are poorly defined; for instance, how are social and ecological processes spatially related in agricultural systems which are thermodynamically efficient and keep as much as possible of the input carbon inside the produce?

The objective of this thesis is to explain how a new system of social and ecological relations is spatially organised in Cuba to enable urban food production in organopónicos. According

² A more extensive historical background is given in chapter 2.

³ For example, between 1988 and 2007 the use of agrochemicals in Cuba decreased with 85 percent in cultivation of starchy roots [*viandas*], 72 percent in vegetables, 55 percent in beans, and 5 percent in sugar cane. Total production increased over the same period in all cases except cane (Machín Sosa 2010: 13). The number of tractors used in Cuba decreased from 85,000 to 73,000 between 1990 and 1997. Over the same period the number of oxen employed in agriculture increased from 163,000 to 400,000 (Ríos and Ponce 2002: 155).

⁴ A low-carbon energy transition is a reorganisation of an energy system resulting in less carbon dioxide emissions and higher thermodynamic efficiency.

to Bridge et al. (2013: 332), a study like this is highly important as ‘[t]he goal of a low carbon transition [...] is slowly emerging as a question of which geographical futures will be created.’

Previous studies of urban agriculture in Cuba have mainly been carried out in the field of agroecology. This literature has developed hand in hand with Cuban urban agriculture and often describes urban gardening from an aggregated national perspective; it writes the history of urban agriculture emerging in Havana; and it outlines urban agroecological methods that have developed in Cuba.⁵ In contrast, this thesis looks to organopónico production as it takes place at this point in time, when urban agriculture is firmly established in Cuba, through fieldwork in five organopónicos in the western Cuban city of Pinar del Río. I seek to build a detailed empirical case that explains how social and ecological relations are spatially organised to enable urban vegetable production in organopónicos. I here assume that the organisation of space is a political process where different social groups and individuals are enabled and disabled to control the agricultural production process. The thesis also approaches the Special Period from a previously untried perspective. The strength of the spatial perspective is that it brings together ecological and material processes with social change. This makes it possible to approach energy, politics, and economy as linked phenomena, which is crucial if we are to meet the challenge of reconstructing oil locked-in energy systems.

To explore how the new spatial system of urban food supply is constructed I ask three questions. The first two questions look to the institutional and ecological dimensions of urban agricultural space, namely

- (1) How are the organopónicos articulated as *places* in relation to political and commercial institutions that enable and regulate production?
- (2) How are the organopónicos articulated as *places* in relation to material flows and ecological processes that sustain production?

These two questions assume that a place cannot be understood apart from its context, just as a clearing in the woods cannot be understood apart from the forest. The two questions keep the organopónicos as the frame of reference to chart how the world of social practices and ecological processes forms within and around them. Through these relations the organopónicos are articulated as functional, coherent places where low-carbon (or at least less-carbon) vegetable production is possible.

In the conceptual framework that I suggest to guide the analysis the institutions that the first question addresses enrol the ecological and material processes identified in the second question in organopónico production. Organic materials, seeds, water, different pest management methods, and other material inputs in this way get involved in organopónico production through the mediation of these social institutions.

⁵ This literature is reviewed in chapter 2.

With the third question I bring the two first questions together analytically to examine what the new spatial system of socioecological relations implies in Cuba's low-carbon energy transition in relation to state power:

- (3) What does the new spatial system imply, socially and ecologically, in relation to the tendency of the Cuban state during the period of Soviet dependency to strongly centralise production and political power?

In other words, the organopónico workers' capacity to control the articulation of the organopónicos as *places* by enrolling material inputs and ecological practices are put at question. Taken together, these three questions will establish how a new system of social and ecological relations is spatially organised in Cuba to enable urban food production in organopónicos.

OUTLINE OF THE STUDY

To this end, chapter 2 contextualises organopónico production by outlining the emergence of urban agriculture in Cuba and reviewing existing literature on the topic. The five organopónicos in Pinar del Río where the study is based are presented.

Chapter 3 formulates a conceptual framework which makes it possible to analyse the spatial relations that enable organopónico production. Three concepts are introduced—place, metabolism, and scaling—and the system of spatial relations is conceptualised as a 'scaled spatial assemblage of socioecological relations' based on these. From this perspective, the idea of two modes of agricultural metabolism (agroecological vs. industrial agriculture) that the literature on Cuban agroecology suggests characterises agricultural production is discussed.

Chapter 4 discusses methodology and more specifically the fieldwork and process of constructing the empirical material that the thesis builds upon.

Then, in chapter 5, the first research question is addressed. The chapter asks how the organopónicos are articulated as places in relation to other social institutions as their workers interact with these. In this institutional dimension of urban agricultural space, organopónico production and state bureaucracy connect and organisations, projects, and norms regulate employment, planning, and marketing.

Chapter 6 looks to the second research question. The chapter charts the ecological processes and material flows that sustain production and articulate the organopónicos ecologically as places. To go about, I ask what biophysical materials are needed for production and where they come from; what sources of energy are required and which ecological processes are promoted in urban cultivation; and, importantly, how these processes are scaled.

Finally, chapter 7 discusses the scaled spatial assemblages of socioecological relations that enable urban agricultural production. This is done by addressing the third question asking what

the new system of spatial relations implies in Cuba. In this discussion, the findings from the previous chapters are rendered through the theory of two agricultural metabolic modes and it is suggested that this theoretical distinction is too rigid to explain urban agriculture in Cuba.

The emergence of urban agriculture in Cuba: a background

For the Cuban government the prospects of urban farming were not entirely new in the early 1990s. While the Ministry of Agriculture (MINAG) and the Ministry of Sugar (MINAZ) were focused on high-input mechanised monocultures during the 1980s, the Ministry of the Revolutionary Armed Forces (MINFAR) began experimenting with urban polycultures—states rarely seem to be monolithic organisations acting according to one single rationale. The organopónicos were conceived as part of a national defence strategy. The strategists of MINFAR argued that the most likely scenario for an attack against Cuba would be a partial occupation of the main island or a complete blockade. To defend the territory against such an event they devised schemes to make Cuba regionally self-sustaining. Organopónicos would allow people to farm in areas where soils were poor—as in cities. In this way people in non-occupied territory would be able to continue fighting back against counterrevolutionary occupant forces (Levins 2005; Rodríguez Nodals 2006).

‘The economic situation at the beginning of the 1990s’, Mercedes García (2002: 213) notes, ‘differed only slightly from the state of war conceived years earlier by MINFAR.’ Without political and economic allies and with a tightened economic embargo from the USA, Cuba was in practice blockaded. The blockade, however, was not the result of an act of war but of the oil locked-in energy system’s spatial crisis.

During the Fourth Congress of the Cuban Communist Party (PCC) in 1991 the Special Period in Peacetime was proclaimed by Fidel Castro. To produce ‘food in every place with the locally available resources’ became the official Party line (Wong and Carrión Fernández 2006: 2, my translation from Spanish). In an ethnographic study from the time, Mona Rosendahl (1997: 113) describes that ‘A plan called El Programa Alimentario (the Food Program) was introduced by the government with the aim of producing more food locally. Fidel went around the country exhorting and

inspiring people to grow vegetables and root crops and to raise animals wherever they could.’⁶ At this time, MINFAR put its defence plan at work opening the first organopónico in Miramar in Havana.

In 1994, the nationwide introduction of organopónicos was made national policy through a National Urban Agriculture Programme. ‘During 1996’, Altieri et al. (1999: 139) describe, ‘Havana’s urban farms provided the city’s urban population with 8,500 tons of agricultural produce, 4 million dozens of flowers, 7.5 million eggs, and 3,650 tons of meat.’ In 1997, a resolution was passed granting each urban dweller the right to cultivate 0.3 acres of land in urban areas (Wright 2009: 83). Anyone who wished could be granted the right to cultivate land, even when land was privately owned (Altieri et al. 1999: 134). The same year the leadership of the National Urban Agriculture Programme converted into the National Urban Agriculture Group (GNAU). This political leadership works out of the National Institute of Fundamental Research in Tropical Agriculture (INIFAT) in Havana, which is the oldest agricultural research institution in Cuba, and even in Latin America (Murphy 1999: 32–33). INIFAT was central to the development of urban agriculture already since the birth of organopónicos in MINFAR (Koont 2008).

By 1999, urban agriculture contributed to five percent of Cuba’s total domestic production, mainly with vegetables. During this late 1990s period, production quotas were set up for the organopónicos. The aim was to produce 170 grams of fresh vegetables per person per day outside the food rationing system (Wright 2009: 83). According to MINAG, 2.36 million tonnes of vegetables were produced in Cuba’s urban agricultural farms in 2001. This translated to an average of 576 grams per citizen per day (Rodríguez Castillon 2002: 86). In the early 2000s, it was estimated that ‘90 percent of the fresh produce consumed in Havana [... was] produced in and around the city’ (Companioni et al. 2002: 235 note 1). Hence, claims are made that urban agriculture has made Cuban cities close to completely self-sufficient in vegetable production. ‘By the end of the 1990s’, Julia Wright (2009: 91) notes, ‘evidence to the outside world indicated that Cuba was developing a unique and groundbreaking, localized agriculture and food system, at least based on reports of urban agriculture.’

Urban agriculture in Cuba today both involves farming inside the city and periurban or suburban farming. In broad strokes, there are four kinds of urban agricultural farms. The organopónico is the most institutionalised and also the most intensive form of urban vegetable production. Closely related are *huertos intensivos*, ‘intensive orchards’, where the range of produce is the same as in the organopónicos but where cultivation takes place directly in the ground rather than in raised beds. The huerto intensivo is therefore only a viable urban agricultural option in areas with good soil quality. On a smaller, but not less important, scale exist *parcelas* and *patios* where individuals or families cultivate small plots, home gardens, or pots on verandas for subsistence or to sell produce directly on the street. Parcelas and patios may be considered the form of urban farming which remains most true to the

⁶ The Programa Alimentario and its relation to urban agriculture is well explained by Murphy (1999). See also Deere (1993).

spontaneous character of the 1990s urban agricultural movement. Finally, suburban farms (*fincas suburbanas*) exist within a ten kilometre circumference of the city and produce vegetables, roots, and meat products, and often practice agroforestry. Santiago Rodríguez Castillon (2002: 83, my translation from Spanish), a scholar at the University of Havana, distinguishes suburban farming from rural farming in that the suburban farms' 'locations have been determined by urban factors' and that they are part of the urban planning process. In 2001, there existed 3,500 organopónicos; 7,189 huertos intensivos; and 512,014 parcelas and patios in Cuba. Around the then-named province Ciudad de La Habana (corresponding to the capital city) there were more than 2,285 suburban farms (Rodríguez Castillón 2002: 81–83).

PRIOR RESEARCH

The rapid emergence of urban agriculture in Cuba evoked a great deal of academic attention. The existing literature has both developed along with Cuba's urban agriculture and as part of it when scholars have been active in its development. The scholars who have been part of the movement primarily have a strong focus on agroecology. A common trait of this literature is its descriptive character and that it often narrates the emergence of urban agriculture on a nationally aggregated level. A reason for this may be that the scholars many times have been involved with INIFAT and GNAU and other bodies nationally governing urban agricultural space.

The history of urban agriculture and agroecology. In their article *The Greening of the 'Barrios'*, Miguel Altieri et al. (1999) define different types of urban gardens and describe the emergence of urban agriculture in Havana. Scott Chaplowe (1998) does the same with an early account, based on short fieldwork periods in Havana in 1994 and 1995. The most detailed historical account is probably given by Catherine Murphy (1999) in her report *Cultivating Havana*. Murphy's text meritoriously defines institutions that were essential to the establishment of urban agriculture. She describes agricultural extension services that would support farmers; the formation of seed houses in Havana; the role of agricultural research centres such as INIFAT; and the role of domestic and international non-governmental organisations. In comparison, Sinan Koont (1998) gives a brief historical account of how urban agriculture has developed institutionally, piecing together how organisations cooperated for research and education; agricultural inputs; and material and moral incentives for producers, in Cuba's 1990s urban agriculture. In addition, general introductions have been written within Cuba (e.g. Rodríguez Castillón 2002).

Also written by Cuban scholars but published internationally is Cruz and Sánchez Medina's book *Agriculture in the City* (2003). Cruz and Sánchez Medina explore two urban agricultural projects in Havana, starting in a general history of urban agriculture that links over to a discussion of the features and critical aspects of the two projects. This is one of the empirically richest

works in the literature overall and, more critically than what is common in Cuban academia, it approaches the politics of irrigation, land management, and marketing of produce in Havana.

Here, Cruz and Sánchez Medina's work joins with Altieri et al. (1999), Murphy (1999), and Peña Díaz and Harris (2005) to outline challenges to the expansion and firm establishment of urban agriculture in Cuba during the 1990s. The principal dilemmas are marked by these authors as the scarcity of land in central Havana (Centro Habana and Habana Vieja); the poor quality of top soil; unreliable irrigation technologies and competition between irrigation systems and city inhabitants for water; and also that the urban gardens occasionally were subjected to robbery during the Special Period.

Several accounts are anchored in the field of agroecology. For instance, Companioni et al. (2002) provide a case study of urban agriculture in the volume *Sustainable Agriculture and Resistance* (Funes et al. 2002). Urban agriculture is here posed as one important sector in the larger agricultural system in Cuba. The volume describes how the agricultural system at large transformed along agroecological lines during the Special Period. Typical for these accounts of urban agriculture are descriptions of major agroecological characteristics of urban farming systems. For example, Altieri et al. (1999) identify the main crops in Cuba's urban farms and their associated insect pests; they outline major pest management techniques, such as biological means of suppressing caterpillars, nematodes, bacteria, and fungi that threaten crops; as well as different compost methods. Both Companioni et al. and Altieri et al. aggregate empirical detail on a national scale.

In contrast to this literature, the present thesis re-reads the emergence of urban agriculture from a spatial perspective. By bringing agriculture into the cities, urban populations engaged in a spatial politics to reconstruct the scalar relations of food procurement. This previously untried perspective allows new questions to be asked to understand the Special Period, as exemplified by the questions that this thesis addresses. Through these questions the example of Cuban urban agriculture contributes to the larger aim of understanding low-carbon energy transitions. Still, in terms of urban agriculture the thesis decentres the focus from Havana by focusing on Pinar del Río. It also provides a case of urban agriculture on the scale of production rather than through general principles.

Urban agriculture in perspective. In addition to the work reviewed up to this point, several studies have put urban agriculture in a more critical light. In content, Julia Wright (2009) provides an account of urban agriculture in her book *Sustainable Agriculture and Food Security in an Era of Oil Scarcity* that is similar to the studies discussed above. 'Certainly', she argues, 'Cuba's urban agricultural movement encapsulates all the positive forces arising out of the ashes of the crisis' (82). In contrast to the agroecologists, however, Wright criticises the idea that Cuba profoundly 'greened' its revolution through a nationwide implementation of organic farming methods in its entire food supply system. This widespread perception, she argues, is a myth founded on an all too strong focus on urban agriculture in academic and popular accounts of the Special Period. Instead, she asks what was going on in Cuba's rural farming systems while urban agriculture caught the eyes of

enthralled observers: ‘Were these [rural systems] also being run along localized, organic lines, and were they meeting the food needs of the population?’ (91).

The organopónicos and other urban agricultural farms are one important aspect of urban food supply, supplying vegetables. My objective in this thesis is concentrated on the spatial relations that enable vegetable production in organopónicos. It is important, nonetheless, to keep urban agriculture in perspective of the larger food supply system.

The literature on Cuban agriculture and food supply at large is discordant. On one hand, the authors of *Sustainable Agriculture and Resistance* (Funes et al. 2002; also Levins 2005) clearly identify a paradigm shift in Cuban rural agriculture, through examples of animal traction, biological pest control, reduced sizes of farms, and more. On the other hand, Wright (2009) claims that the majority of rural farmers still aspire to a high-input industrialised agriculture. Nelson et al. (2009), in comparison, take a middle ground in their study of eight farms in San José de las Lajas, in present-day Mayabeque province. They argue that while agroecological techniques have been adopted widely by Cuban farmers, output maximisation still holds a higher priority than agroecological principles among them.

In addition to this debate, a rather odd round of pie throwing was recently settled over Cuban food supply (see Altieri and Funes-Monzote 2012). First, Dennis Avery at the Hudson Institute claimed that 84 percent of the Cuban food supply was imported. He then exulted that the agroecological research community’s accounts of Cuban organic triumphs were all communist lies. In response, Altieri and Funes-Monzote charged to the line of defence claiming that this was not at all the case as total imports only add up to 16 percent. In a more nuanced chart with FAO data from 2003, they then show that Cuba imports between 60 and 85 percent of cooking oils, cereals, and pulses, and almost 50 percent of all consumed meat. Of starchy roots, sugar, vegetables, fruits, and eggs, on the other hand, less than 3 percent are imported. With this data in view, it seems likely that the low import ratio of vegetables and fruits correlates with almost vegetable-self-sufficient cities.

Applied research. One more important aspect of previous research is a loosely held-together category of applied research. The literature on agroecology to many parts fit this category; particularly work coming out of Cuban universities and research institutes. The authors associated with the volume *Sustainable Agriculture and Resistance* stand behind numerous articles where results are directly applicable in urban gardens. Some examples of this are found in the magazine *Agricultura Orgánica*, which is published by the Association of Cuban Agricultural and Forestry Technicians (ACTAF) and is disseminated among Cuban urban farmers. This magazine is discussed in the last section of the chapter on fieldwork and method.

In addition to this, the work of María Caridad Cruz (2006; also Cruz and Sánchez Medina 2003), working at the Foundation for Nature and Man Antonio Núñez Jimenez (FANJ) in Havana, has important practical applications. Her text *¿Agricultura sostenible?* challenges the urban-rural dichotomy and opts for a re-conceptualisation of agriculture based on agroecology and

permaculture. In comparison, Castillo González (2010) has a similar approach as Cruz', but from the perspective of landscape architecture. His PhD thesis is a design suggestion for a 'green system' in Pinar del Río that integrates urban and suburban farming in a functional agroecological system.

Peña Díaz and Harris (2005), in turn, look to the relations between urban, periurban, and rural agriculture in Cuba in general and more specifically in Havana. Also in the same anthology as Peña Díaz and Harris, Viljoen and Howe (2005) approach Cuban urban agriculture from the perspective of urban planning and architecture. Through the concept 'continuous productive urban landscapes' they study how organopónicos are architecturally planned in Havana, Cienfuegos, and the small town of Rodas; as well as the institutional support that exists in Cuba to construct productive urban gardens.

PINAR DEL RÍO'S ORGANOPÓNICOS

It is apparent that previous case studies on Cuban urban agriculture predominantly have been centred on Havana. In a sense, this is understandable as the repercussions of the Special Period are likely to have been greater in the largest city where about one fifth of all Cubans live. In this study I want to decentre the focus from Havana as urban agriculture as importantly exists in cities and towns across the Cuban islands.

Pinar del Río is the capital of Cuba's westernmost province and houses around 140,000 people (DPPF 2010). It is located in the Vueltabajo region where the bulk of Cuba's tobacco production takes place. Pinar del Río is both a city, a municipality, and a province, but when I simply refer to 'Pinar del Río' it denotes the city. The province is nationally regarded as progressive in terms of urban agricultural development (María Caridad Cruz, pers. comm. 2013). Pinar del Río consists of a southwestern zone which city planners refer to as the 'historical centre' and a northeastern 'zone of new development'. The two areas are separated by the river Guamá—the *río* in Pinar del Río. (See map 1). There are 39 organopónicos in Pinar del Río; 8 huertos intensivos; and 1,032 parcelas and patios. Geographically urban agriculture is more heavily concentrated in the zone of new development as more 'unused' land remained in this area during the Special Period and until this day (Castillo González 2010: 130).

The study is based in five organopónicos called Ampliación Erea, Erea No. 1, El Vial, UBPC Micro-Brigadas, and La Pesca, which are located along the road Vial de Colón. (See map 2). All five organopónicos were founded during the Special Period in the 1990s. The Vial connects the historical centre with the zone of new development before you are taken en route to Havana. The Vial is reached from the city centre by a 10–15 minute walk on a path that is also served by busses, horse carriages, and bicycle taxis (*bicitaxis*). As you turn north-eastbound onto the Vial, you pass

Ampliación Erea and Erea No. 1 on the right. These organopónicos are both located on the fringe of Consejo Popular Carlos Manuel de Céspedes.

A *consejo popular* is one of five nested tiers of Cuban government, the *Poder Popular* ('People's Power'). The tiers correspond to the national, provincial, and municipal levels with a further subdivision of municipalities, since 1991, into *consejos populares* or 'people's councils' and *consejos populares* into *circunscripciones*. These 'constituencies' geographically map on to housing blocks or small neighbourhoods.

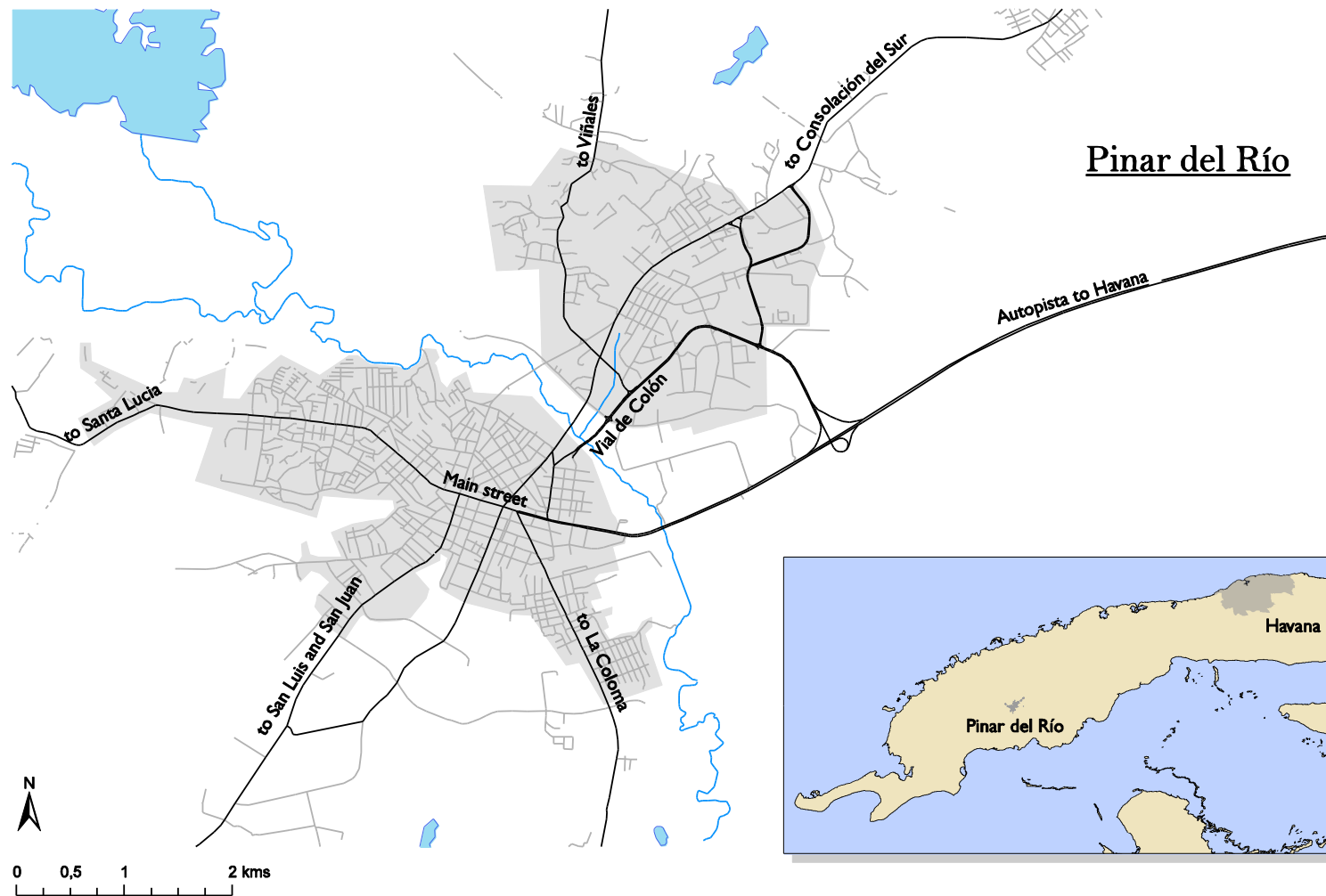
Immediately after Erea No. 1 you cross a bridge over river Guamá into Consejo Popular Hermanos Cruz. On the left hand side, the large organopónico UEB La Mariposa opens up the view with dazzling rows of *canteros*, the raised beds typical for organopónicos, planted with flowers. UEB La Mariposa does not cultivate food but ornamental flowers and is most often referred to simply as the *organopónico de flores*, the flower organopónico. I have interacted with workers at UEB La Mariposa but as it is not directly related to urban food supply it does not figure in this study.

A road intersection delimits the border between UEB La Mariposa and El Vial. El Vial is by far the largest garden in the area with its 1.2 hectares and at its northern end the dense housing area of Hermanos Cruz begins. Across the Vial from the organopónico El Vial is Pinar del Río's *Plaza de la Revolución*; a rather modest revolution square compared to its counterparts in say Havana or Guantánamo.

Consejo Popular Hermanos Cruz is a typical public housing area. It is dominated by five storey apartment blocks mixed with family houses and a number of concrete-slab twelve story apartment buildings whose facades have seen better days and are decorated by revolutionary slogans.⁷ There are also *bodegas* (food ration shops), 'dollar stores', schools, medical facilities, and restaurants in the area. At the onset of the Special Period, Hermanos Cruz was still being constructed when building materials became scarce and construction came to a halt. The area linking Hermanos Cruz with Carlos Manuel de Céspedes thereby remained to be developed according to the city plan. What was then the city garbage dump on the sides of the road Vial de Colón instead transformed into organopónicos.

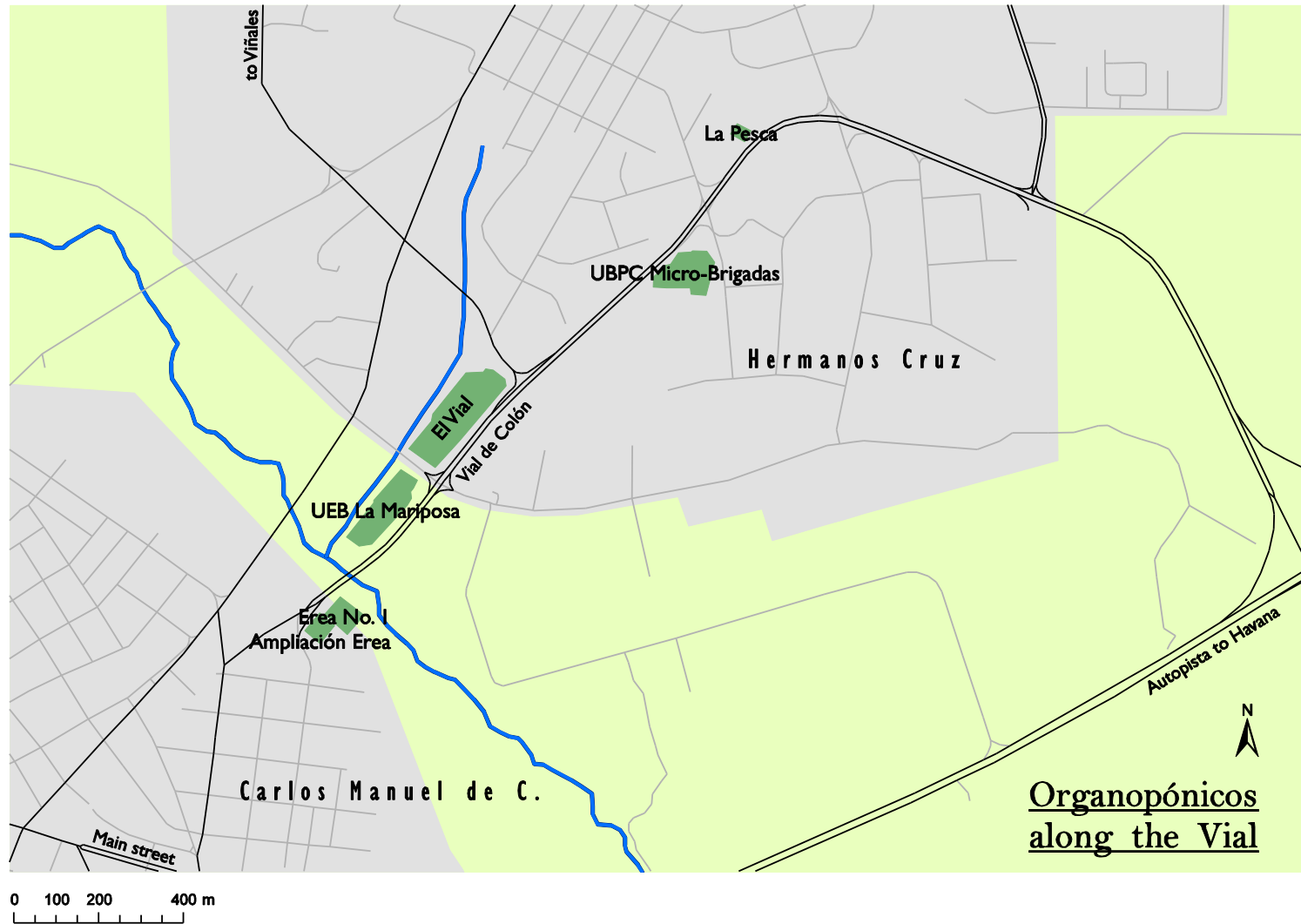
Further along the Vial, among the apartment blocks, is UBPC Micro-Brigadas on the top of a tiny hill on the right. Still further north, just as the Vial bends abruptly to the right, La Pesca is squeezed into an area between two high-rising buildings and a bus stop. Together with other urban agricultural farms in Pinar del Río province, the organopónicos along the Vial produced 183,200 tonnes of vegetables in 2001, which corresponded to 681 grams per *pinareño* per day (Rodríguez Castellón 2002: 86).

⁷ These slogans have been painted by the Committees for the Defence of the Revolution (CDRs) that mobilise most of the people living in the houses. The two most notable murals read 'Defendiendo el Socialismo' (Defending Socialism) and 'Con fidel Revolución' (With Fidel Revolution, capitalising C, D, and R).



Map 1: Pinar del Río. Vial de Colón connects the ‘historical centre’ in the southwest with the ‘zone of new development’ in the northeast.

(Map by the Author, 2013. Source data: OpenStreetMap and Google Earth. Projection: WGS84).



Map 2: The organopónicos along the Vial.

(Map by the Author, 2013. Source data: OpenStreetMap and Google Earth. Projection: WGS84).

Conceptualising urban food supply

Place, metabolism, and scaling

The organopónicos along the Vial are central places in the urban food supply system. To understand how such *places* are articulated, I will in the following define the idea of ‘scaled spatial assemblages of socioecological relations’. These assemblages enable agricultural production through an institutional setup that enrolls material and ecological flows in organopónico production. This concept will then guide the analysis in subsequent chapters. As the organopónico is the place where this study is based, this is also where the theoretical venture will begin. As places of vegetable production and distribution the organopónicos are key to the space of urban food supply.

PLACE

The idea of a spatial crisis, where places can enter into dependency relations with other places that subsequently collapse, demands a relational understanding of place. Anthropologist Eric Wolf ([1982] 2010: 385 citing Lesser 1961) asserts that we must ‘think of human aggregates’, such as an organopónico, ‘as “inextricably involved with other aggregates, near and far, in weblike, netlike connections.”’ Places are not a priori bounded spaces that are internally coherent and have homogenous identities; rather, they are involved with other places, with discourses, and socioecological processes in that place and elsewhere. Geographer Doreen Massey (1991; 1993) calls such an understanding ‘a global sense of place’. This is a conceptualisation of place as open-ended and linked, as progressive and relational, which has been called for both by anthropologists and geographers. The debates on place in anthropology and geography have nonetheless in large parts remained parallel (Escobar 2001).

‘Instead [...] of thinking of places as areas with boundaries around’, Massey (1991: 28) argues,

they can be imagined as articulated moments in networks of social relations and understandings, but where a large proportion of those relations, experiences and understandings are constructed on a far larger scale than what we happen to define for that moment as the place itself.

In other words, we mustn’t stare blindly at the physical enclosure that we perceive as the organopónico to understand it as a place, but widen our view to the relations that sustain it. In turn, such a perspective of a place builds on a relational ontology of space. Relational space, David Harvey

(1973 cited in 2004: 2) argues on a very abstract level, is ‘space regarded in the manner of Leibniz, as being contained in objects in the sense that an object can be said to exist only insofar as it contains and represents within itself relationships to other objects.’ ‘An event or a thing at a point in space’, he continues, ‘cannot be understood by appeal to what exists only at that point’ (4). Therefore, to understand the new spatial system of urban food supply, from the perspective of the organopónicos, the organopónicos must necessarily be related spatially to the processes that enable them.

Here I would like to remain with Massey for a while. In her lucidly argued texts (1991; 1993), Massey identifies relations of capital, race, and gender that determine and differentiate peoples’ senses of place. Ecological, energetic, and geophysical relations, in contrast, remain absent. In her later work (Massey 2005), she acknowledges this and that how we understand a place dominated by a large mountain surely is affected by that geological process. ‘How then to think this notion of place as a temporary constellation, as a time-space event, in relation to this “other” arena, “the natural world”?’ she asks (131). The mountain, she replies, has its own history of folding and eroding and it passes through that place just as a person on a visit, although they do so on very different time scales. Still, the mountain remains apart from the social relations that Massey’s place embodies.

SOCIAL METABOLISM

The idea of social metabolism forces us to transcend the division between ‘our’ social world and that “‘other” arena’. The concept social metabolism holds that all human activities require an exchange of energy with surrounding nature. Social metabolism can be used as a noun, indicating this requirement; as a verb (to metabolise) denoting an energy flow sustaining a social practice; and as an adjective (e.g. a socio-metabolic system) describing a system of energy flows that sustains social practices.

Agriculture depends on a continuous metabolic supply of energy, water, and nutrients that combine into tomatoes and other juicy ‘things’. This food is later enrolled in urban systems of energy, water, and nutrient circulation for the survival of cities. Thereby, the aeroplanes that fly and the foods that fry from all corners of the globe at Massey’s local high street are simultaneously social and ecological. The air travel that enables some to ‘buzz across the ocean’ to do business is inextricably linked with the jet fuel that metabolises the aeroplane’s engines and the social processes that ‘places’ it in the aeroplane’s tanks. In comparison, the organopónico as a place is articulated as a temporary constellation of socioecological relations.

Agroecosystems remain productive through a continuous circulation of nutrients, water, and energy. A continuous removal of plant material from the field takes away nutrients and minerals from the soil. Sustained agricultural production is therefore only possible by regularly shifting farming land or by importing or recycling biomass that has accumulated the nutrients and solar energy on one piece of land to the agricultural field in the form of manures or compost. The fossil fuels that allow the

most intensified agriculture are of course prehistoric biomass which has grown or grazed on land and later decomposed for several million years to concentrate all that energy into mineral fuel. Therefore, photosynthesis aside, land is the crucial factor of production to keep soils fertile, to metabolise agricultural production. As a result, questions of what social institutions organise the space of energy, water, and nutrient flows, for instance how land is managed and distributed, are fundamental to the structures of agroecosystems. Similarly, the technologies that are invented for resource exploitation, energy transformation, and transport fundamentally shape agricultural metabolism.

To go to another place, Erik Swyngedouw (2006: 22) argues that ‘a city is a particular process of environmental production, sustained by particular sets of socio-metabolic processes that shape the urban in distinct, historically contingent ways, a socio-environmental process that is deeply caught up with socio-metabolic processes operating elsewhere’.⁸ As a place, the city depends on a continuous movement of energy, people, water, matter, waste, and information in its metabolic systems. Swyngedouw concludes that ‘[m]odern urbanization or the city can be articulated as a process of geographically arranged socio-environmental metabolisms’ (35). If circulation of energy and matter stops in the agricultural metabolic system producing food, so does the supply of food in the city. This is what happened when the hegemonic spatial relation of Cuba’s food supply system collapsed in the early 1990s. The loss of the crucial energy source, which held an incomparable energy potential as well as lubricated mechanised infrastructure, brought the oil locked-in metabolic system to a standstill and left the urban populations hungry.

The metabolism metaphor is borrowed from biology and biochemistry where it describes the process where cells and organisms are continuously renewed and maintain their internal coherence by a constant throughput of energy (Fischer-Kowalski 1998). The concept has mainly been used by scholars working in the tradition of its Marxian origins. It has been pointed out that the difference between the biological and social-scientific use of the concept is that social metabolism always is mediated by human labour (Swyngedouw 2006; Martinez-Alier 2007; cf. Fischer-Kowalski 1998). Marx argues in *Capital* (1867 cited in Swyngedouw 2006: 26, Swyngedouw’s emphasis) that

Labour is, first of all, a process between man [sic] and nature, a process by which man, through his own actions, mediates, regulates, and controls the *metabolism* between himself and nature. [... Labour is] the ever-lasting nature-imposed condition of human existence, and it is therefore independent of every form of that existence, or rather it is common to all forms of society in which human beings live.

In contrast to this understanding I want to suggest a broader interpretation of how energy and matter is enrolled in social activities. I find that the analytical vision becomes too narrow when metabolism’s mediation is reduced to human labour and that such an interpretation slights other important factors.

⁸ ‘Socio-environmental process’ in this quote can be substituted for ‘socio-metabolic process’ and ‘socio-environmental metabolisms’ in the next quote can be substituted for ‘socio-metabolic systems’ for conceptual stringency.

Both agriculture and cities depend on a constant supply of nutrients, water, and energy and how this is supplied also depends on how social institutions—organisations, agreements, norms, and discourses—produce relational space as they organise energy and material flows.

Labour, as Marx describes it in the above passage, is primarily an act and, as such, I understand it as an immediate human experience. However, the mediation of social metabolism is also dependent on trade agreements and relations between states and companies, as well as cultural/discursive understandings of the relation between society and nature. For example, Alf Hornborg (2009: 242) argues, aptly to the Cuban case, that ‘[a]s many post-Soviet farmers have experienced, when there is no longer any diesel in the tractor, it is just an assemblage of scrap metal. Again, what ultimately keep the machines running are global terms of trade.’⁹ When the trade agreement between Cuba and the CMEA broke, as part of the spatial crisis, Cuban social metabolism halted. Much analytical precision will be lost if such an institution is reduced to the notion of human labour.

Furthermore, from my point of view a conventional understanding holds that cities are supplied with food from the countryside (whether it be the national countryside or a countryside elsewhere, depending on the scaling of the practice). The urban ‘place’ is largely articulated in its relation to the non-urban that metabolises it with food. This to a certain extent defines the urban contra the rural in this modernist discourse. In Cuba this equation took the slightly more intricate form of the sugar-for-food dialectic which was situated in the rural sugar fields and ultimately supplied cities with food via sugar production. It was not until the Special Period crisis that agriculture, out of dire need for survival, moved into Cuban cities. And still, I would argue, it is quite spectacular to come across a half hectare vegetable garden in a high-rising urban area. Chaplowe (1998: 55) suggests that ‘[o]ften, urban agriculture offends the clean, modernist image of a city that authorities want to project.’ Within the modernisation discourse, ‘[u]rban agriculture is often considered a remnant of rural habits, incompatible with the modern division of labour expected in an urban economy.’ Such cultural perceptions undoubtedly play part in the mediation of metabolism.

Sure, if one tries with bolt cutters and chainsaw it might well be possible to squeeze these dimensions into the Marxist conceptualisation of labour. But the question is what the analysis gains from such reductionism and ardent effort. I will rather define metabolism more generally as socially mediated by human labour, organisations, agreements, norms, and discourses, or social institutions for short.

In sum, the idea of spatial crisis demands a relational view of space and places. The spatial relations that articulate places in relation to other places are products of human intervention.

⁹ To be consistent with the terminology outlined in this chapter the tractor can be understood as a place. It is experienced as it is driven and its functioning and internal coherence (i.e. that it can be driven and is not just an assemblage of scrap metal) depends on the intactness of the spatial assemblage of socio-metabolic flows that it embodies as it is driven. As a place, the tractor is most likely scaled within a farm-place and simultaneously contributes to the scaling of the farm.

The organopónico, as a place, is articulated in a system—an assemblage—of social institutions (labour, organisations, etc.) through which certain ecological practices and material flows are enrolled in agricultural metabolic systems. Thus, to enable and sustain agricultural production and city life, spatial assemblages of social institutions that mediate metabolic flows are constructed; or spatial assemblages of socioecological relations for short. If we are to follow Harvey, a place such as an organopónico or an object produced therein, such as a carrot, ‘can be said to exist only insofar as it contains and represents within itself relationships to other objects’. Therefore, the organopónico and the vegetables produced there embody these spatial assemblages of socioecological relations that make them possible as ‘places’ and ‘objects’.

From this relational understanding of farms and cities as ‘places’ and vegetables as ‘objects’ I will next review how previous research has theorised food production systems. I will first make a detour to India and then zoom in on the literature on agroecology that has developed around the Cuban experience.

AGROECOLOGY VS. INDUSTRIAL AGRICULTURE

In their by now classic treatise on India’s ecological history, Madhav Gadgil and Ramachandra Guha ([1992] 2000) assert that Marxist philosophy of history has been inadequately materialistic. The idea of modes of production, they argue, has not taken the ecological contexts of the political economy into sufficient consideration. The relations of production must relate to the governance of nature—such as issues of land distribution and management—and the productive forces must better recount the technologies through which humans interact with nature. To fill the theoretical void, Gadgil and Guha outline a scheme where four ‘modes of resource use’ characterise human history, complementing the orthodox Marxist comprehension of history.¹⁰ Human-nature interaction either takes the form of hunter-gathering and shifting cultivation, nomadic pastoralism, settled agriculture, or industrial agriculture. In these modes metabolic energy sources are differently displaced and scaled and so are the ecological impacts of economic life.¹¹ The difference between the ‘settled’ peasant mode and the

¹⁰ In basic terms, this comprehension entails that history is defined by a number of *modes of production*. These modes are characterised by *relations of production*, which denote the relationship between socioeconomic classes where one class exploits the labour power of another, and *forces of production* (available technology, quality of land, level of knowledge, etc.). The relation between forces and relations of production within a mode is contradictory; when the forces of production continuously develop with time they challenge the static relations of production. This makes the modes inherently unstable and inevitably leads them to collapse into other modes. Orthodox Marxist philosophy of history often posits that a number of modes unavoidably follow each other in history; slavery is succeeded by the feudalism, the feudal mode by capitalism, and capitalism by socialism. (This interpretation is modelled on Graeber’s [2006] explanation).

¹¹ To give an example of this, ‘Japan, the most industrialized Asian country, has the best-preserved forests cover, while the forests of countries like Malaysia and Indonesia—which have large populations dependent on primitive agriculture—are being devastated. But a second look shows that Japan maintains its forest cover, in

‘industrial’ mode can be identified by the relative intensity of energy sources used as well as their relative spatial displacement to maintain the fertility of soils and health of crops. Capitalist and socialist ‘development’ (i.e. U.S. or Soviet modelled agriculture), Gadgil and Guha ([1992] 2000: 14) argue, belong to the same mode in ecological terms:

For instance, there are structural similarities in the scale and direction of natural resource flows, the technologies of resource exploitation, the patterns of energy use, the ideologies of human-nature interactions, the specific resource-management practices, and, ultimately, the cumulative impact of all these on the living environment in capitalist and socialist societies.

As Gadgil and Guha were writing in the early 1990s, they argued that the mode of production ‘framework itself remains very much in favour’ of other frameworks as an analytical tool (11). Simultaneously, the Soviet Union collapsed, Cuba entered the Special Period and the Cuban fat cow was dying from nutrient deficiency. Today Gadgil and Guha’s way of arguing seems a bit antiquated. Against even a mild postmodern scepticism of totalising discourse it seems naïve to divide all-human history into consecutive and discrete metahistorical modes. As David Graeber (2006: 62) argues, ‘the evolutionist model that had dominated official Marxism [...] that saw history everywhere as proceeding, mechanically from slavery to feudalism to capitalism’ had already by the 1950s become too static; anthropologists and historians have since struggled to make the framework more flexible when what they study poorly matches the theoretical categories.¹² It is interesting here, however, to cite Gadgil and Guha’s argument at length as it closely mirrors the logic that the current literature on agroecology is founded on.

In the literature that has developed around the Cuban agroecology experience, Rosset et al. (2011: 162; also e.g. Vandermeer et al. 1993; Rosset and Benjamin 1994; Altieri 1995; Rosset and Altieri 1997; Funes et al. 2002; Cruz 2006; Nelson et al. 2009) argue that the contemporary period is characterised ‘by an historic clash between two modes of farming: peasant agriculture versus agribusiness.’ In peasant agriculture, which is closely linked in this literature to agroecological ideology, the agricultural field is understood as an ecosystem rather than an interface for energy input and agricultural output. Agroecologists and peasant farmers thereby seek to mimic the function of a natural ecosystem in the field through their human intervention. ‘Natural ecosystems’, Miguel Altieri (1995: 57) argues,

reinvest a major proportion of their productivity to maintain the physical and and [sic] biological structure needed to sustain soil fertility and biotic stability. The export of food and harvest limits such reinvestments in agroecosystems, making them highly dependent on external inputs to achieve cycling and population regulation [...].

spite of its enormous per capita consumption of timber, only by shifting the pressure on to Malaysia and Indonesia’ (Gadgil and Guha [1992] 2000: 51).

¹² Graeber’s argument then continues that the anthropologists began to see capitalist forces acting everywhere in history which led them to claim that ancient slavery really just was another form of the capitalist mode of production. Why not instead see capitalism as a form of slavery, Graeber asks.

The agroecological aim is therefore to create and maintain a locally autonomous agroecosystem that to the highest possible degree closes ecological cycles within the farm through recycling and encouragement of predator-prey interactions, succession, commensalism, etc.

Interestingly, the Cuban Ministry of Agriculture (MINAG) circulated a chart to its planning staff in the early 1990s that similarly contrasted a ‘classical model’ of farming with an ‘alternative model’. This chart was reprinted by Vandermeer et al. (1993: 6) and Rosset and Benjamin (1994: 30–31) after a ‘fact-finding mission’ to Cuba during the Special Period. In the classical [industrial] model, the chart tells, agricultural production is dependent on external inputs and aims toward agricultural intensification and mechanisation with ‘cutting edge technology’. Such technology includes imported animal feed, chemical pesticides and fertilisers, modern irrigation systems, and fuel and lubricants. ‘To satisfy ever increasing needs’, the planners are informed, this model ‘has ever more ecological or environmental consequences, such as soil erosion, salinization, waterlogging, *etc.*’ The alternative model, in the opposite column, is characterised by community participation and cooperation, organic fertilisers, biological pest control and animal traction, as well as a ‘diversification of crops and autochthonous production systems based on accumulated knowledge’.¹³

Rosset and Altieri (1997; Rosset et al. 2011) make a further clarification of this scheme arguing that organic farming as it is interpreted in Europe and North America does not represent a shift from industrial to peasant/agroecological farming. Such organic farming is still largely based on monocultures and an input-output model of thought at the scale of the production unit. The only difference from conventional Green Revolution agriculture is that petrochemicals have been substituted for organically certified inputs. Hence, to reduce organic agriculture to pretty much a list of allowed inputs that earns a product an ‘organic’ label does not challenge the current state of affairs. Instead, this ‘technocentric’ interpretation of organic farming privileges ‘the discourse of market choice, consumer sovereignty, and the individual’ (Goodman 2000: 217). In so doing, certified organic farming stands in conflict with agroecological ideology on more than ecological terms. Through a transformation of ecological practice agroecologists also aim toward a larger social transformation that challenges the political economy of agriculture (Funes et al. 2002; also Desmarais 2007).

The political ideals of agroecology are strongly manifested in concept of food sovereignty. This concept has developed in the last decade originating from the international peasant movement La Vía Campesina. Food sovereignty articulates ideals of ‘empowering the local’ to control food supply and of granting people access to food as a basic human right (Patel 2009; Simón Reardon and Alemán Pérez 2010). ‘The emerging concept of food sovereignty’, Miguel Altieri (2009: 104) defines, ‘emphasizes farmers’ access to land, seeds, and water while focusing on local autonomy, local markets, local production-consumption cycles, energy and technological sovereignty, and farmer-to-farmer networks.’ To construct a locally autonomous agroecosystem in ecological terms thereby goes

¹³ Something ‘autochthonous’ originates from the place where it is found.

hand in hand with constructing a politically autonomous institutional assemblage that mediates the metabolism of the agroecosystem.

According to Julia Wright (2009: 199–200), the Cuban interpretation of organic agriculture has been strongly shaped by and conforms to the ‘Latin American agro-ecological school’ which she contrasts to the ‘European certified organic model’. ‘As one [Cuban] rural sector worker put it’, she exemplifies, “‘There is no alternative to sustainable agriculture. Both organic and Green Revolution agriculture are like agribusiness.’”

An essential question that runs through this literature is how to spatially organise energy and material flows to sustain agricultural production. As a fixed point around which theory revolves is the farm, acting much like the north arrow in a map or a clef in a music score. In agroecological agriculture all energy sources and material processes are internalised in the farm which in turn makes it self-sustaining and locally autonomous. This is possible by constructing an equilibrium ecosystem, enclosing ecological and energetic cycles, within the defined limits of the place through social mediation. In industrial agriculture, on the other hand, the energy needed for production enters the farm from the outside in the form of chemical fertilisers, pesticides, insecticides, herbicides, fungicides (all unwanted living things have their technological fix), diesel, lubricant oils, and genetically modified seeds. So, energy sources are external to the farm-place. This supposedly makes the farm more vulnerable as agricultural production depends on the sustenance of the institutions that uphold the displaced spatial relations of energy flows. From the perspective of agroecology

[t]he modern agricultural strategy can be viewed as a reversal of the successional sequence of nature. Modern ecosystems, despite their high yield to humankind, carry with them the disadvantages of all immature ecosystems. In particular, these systems lack the ability to cycle nutrients, conserve soil, and regulate pest populations. [...] The modern systems require large amounts of imported energy to accomplish the work usually done by ecological processes in less disturbed systems. Thus, although less productive on a per-crop basis than modern monocultures, traditional polycultures are generally more stable and more energy efficient [...]. (Altieri 1995: 58)

So, what kind of a place is this ‘fixed point’ farm? And, to directly relate the discussion to the empirical case, what kind of place is an organopónico? For the people working there, people buying vegetables there, and for me doing fieldwork there it is an experience of being somewhere that is inextricably linked with material and social processes. It is linked to oil wells and petro-politics, to agricultural ministries and political ideologies, to predator-prey and crop-weed interactions, and relations between interacting people and nature. The farm is connected to other places and is experienced as a coherent, functioning place when socioecological relations continuously enter from without (such as chemical fertiliser being sprayed on a field) or connect within (such as husk being composted and returned to the field). The answer to the question, in other words, cannot be found in that place only but in its relations to other places.

SCALING

How energy and material flows are spatially organised as they are enrolled in a place is part of what differentiates places from each other—what distinguishes an industrial farm from an organopónico. In both cases the socioecological flows are differently scaled. Scales are not ontologically given but are constructed as spatial fixations of socioecological processes in relational space. Scale distinguishes one place from the other by spatially organising them in relation to each other. ‘The production of geographical scale’, Neil Smith (2004: 196) argues, ‘provides the organizing framework for the production of geographically differentiated spaces and the conceptual means by which sense can be made of spatial differentiation.’

This social process of organising space continuously engages material metabolic processes to sustain social life in places. The popular movement of urban agriculture and organopónicos constructed a new spatial configuration—a new scaled spatial assemblage of socioecological relations—that enables food production in Cuba. This assemblage is differently scaled than the sugar-for-food dialectic and consequently places people differently in the food supply power-geometry. By bringing agricultural production into the city, closer to themselves, people could more easily control the structure of the spatial assemblage. The new scaling of the metabolic system was in no way predetermined but contingent on political, economic, social, ecological, and spatial processes.

A place for Massey and Harvey embodies the relations that meet there. Consequently, when vegetable production ‘takes place’ in an organopónico it embodies the assemblage of scaled socioecological processes that sustains it. Thereby, a farm can also be conceptualised as a place which is scaled within a larger spatial assemblage permitting agricultural production. To borrow the words of Swyngedouw and Heynen (2003: 912),

we must conclude that environments are combined socioecological assemblages that are dynamically produced, spatially and temporally, socially and materially [...]. In other words, socioecological processes give rise to scalar forms of organisation—such as states, local governments, interstate arrangements and the like—and to a nested set of related and interacting socioecological spatial scales.

‘For example’, they add without further detail, ‘the socioecological scalar “nesting” into multiscalar configurations of monocultural cash-cropping agriculture is radically different from the socioecological scales of peasant subsistence farming’ (914).

In this context, it is interesting to note that the agroecology literature often defines the impact of urban agriculture in Cuba in terms of ‘localisation’; as a process where the supply system has become more locally autonomous (or perhaps more sovereign). Wright (2009: 91, my emphasis) sees ‘a unique and groundbreaking, *localized* agriculture and food system.’ Altieri et al. (1999: 135, my emphases), in turn, conclude that ‘[b]ecause the gardens utilize inputs that are produced *locally* and at little cost, the gardeners have a greater degree of *autonomy* and flexibility, allowing the gardens

to flourish even in adverse economic conditions.’ And Scott Chaplowe (1998: 48, my emphasis), to give one more example, claims that Cuba’s popular urban gardens ‘have been greatly influenced by the alternative [agro-ecological] model of sustainable agriculture and reflect the growing *decentralization* in food production throughout Cuba today.’ In these texts, the authors never reflect further on the meaning of ‘localisation’; but, such statements ought to suggest that urban agriculture has produced a system where the spatial relations are scaled close to the urban gardens and where the workers autonomously can control the socioecological articulation of the organopónicos as places.

* * *

The spatial arrangements of agricultural metabolism—whether petro-industrial, organic-industrial, or peasant/agroecological; rural or urban—tie directly into the city’s metabolism with food. The three concepts metabolism, place, and scaling make it possible to ask how a new system of social and ecological relations is spatially organised to enable production in organopónicos. With the aid of this theoretical framework I will approach the three research questions. I will first (question 1) approach the organopónicos along the Vial as *places* that are articulated in relation to political and commercial institutions and examine how that institutional setup is scaled. In this analysis, the organopónicos themselves appear as institutions in the scaled institutional setup. Social processes that are scaled within the setup will be identified that in different ways regulate material flows and ecological processes in the organopónicos; for instance, how policies from the national leadership of urban agriculture are physically expressed in the organopónicos. The analysis will also look to how labour power is enrolled through institutions regulating employment and salaries and to the institutions that supply the city with food. As part of this analysis I will examine the power geometry of these institutions: who controls how different metabolic relations are enrolled in the organopónicos; or, more abstractly put, who controls the articulation of the organopónicos as places?

Subsequently (question 2), I will examine the material flows and ecological processes that articulate the organopónicos as places by metabolising production. The analysis will identify the organic materials, seeds, water, pest management methods, and other energy sources that are enrolled in organopónico production and how the institutional setup mediates their enrolment. The scaling of these ecological will be explored as they enter or exist within the organopónicos.

Then, finally, I will discuss what the new scaled spatial assemblage(s) of socioecological relations implies in Cuba, in relation to the tendency of the Cuban state to strongly centralise production and political power in the period of Soviet dependency (question 3). A spatial assemblage that internalises all socioecological relations in the farm, as agroecological ideology stipulates, would imply a fully localised food production system. In such a system the workers or farmers have full control over the production process. An industrial agricultural system, in comparison, would entail a system with global reach where relations are scaled on a significantly

larger level, to places further away and involving more intense energy sources. In such a system, control over the production process is located on other scales, such as in the international relations of flowing oil.

Fieldwork and method

The study is based on a two month fieldwork period in Pinar del Río that took place from January through March 2013. During this time I was affiliated with the Centre for Sustainable Energy and Technology Studies at the University of Pinar del Río ‘Hermanos Saíz Montes del Oca’. As a student I could work with full institutional support from the Cuban university. Colleagues from the university introduced me in the organopónicos where I worked and I could in this way gain direct access to the gardens and conduct interviews freely with whomever I wanted. The organopónico workers were also open and helpful to work and speak with me in part as I represented the university.

The organopónicos that today align the Vial are of two different kinds: one UBPC and four *organopónicos arrendados*. Including La Mariposa there is also a third kind, the UEB. The differences and similarities among the three kinds will be described in detail later. This diversity allows for a broad study of organopónico production in the area. Still, that these gardens are representative for organopónicos in Pinar del Río at large rests on the assumption that organopónicos in their different varieties function similarly regardless of their location in the city. As will become clear, all organopónicos share the same basic features and although they are independent in their daily work they are closely monitored and politically directed in a central bureaucracy. The differences that exist among the organopónicos along the Vial should therefore be sufficient to draw more general conclusions.

In addition to the three kinds found along the Vial, organopónicos can also take the form of *autoconsumos*. The Food Programme that was launched in the early 1990s planned for schools and workplaces to become self-provisioning through autoconsumos to supply students and workers with lunch (Murphy 1999). Autoconsumos can take any form (organopónico, huerto intensivo, rural farm, etc.) to produce fresh vegetables to the canteens of workplaces. There are currently two organopónicos autoconsumos in Pinar del Río; one serving the Ministry of the Interior (MININT) and one serving MINFAR. I have not been able to interact with workers in the autoconsumos of MININT or MINFAR. Yet, if one loosens up the definition, UBPC Micro-Brigadas could in a sense be called an

autoconsumo as it supplies the canteen of the Granja Urbana with vegetables. El Vial also supplies several canteens with fresh produce.

During my fieldwork I was in contact with all six organopónicos along the Vial but worked more intensely in UBPC Micro-Brigadas, El Vial, and Ampliación Erea. Successful fieldwork does not only depend on the good intentions of the researcher but also on the generosity of the workers whose precious time I have wanted a share of. The timeframe for my fieldwork was rather short and as a result it was a balancing act to on the one hand cover all organopónicos in the area, to get a larger sample, while on the other have sufficient time to gain a deeper and more nuanced understanding. Consequently, I decided to spend more time in UBPC Micro-Brigadas, doing some minor work tasks like weeding and joining for lunch, and less time in, for instance, La Pesca. Gradually I became less of a spectacle in UBPC Micro-Brigadas and as mutual confidence grew I was able to ask and learn things that may not be told immediately and that surface during more informal conversations. It was then possible to ask more directly about these things in other organopónicos and to cut some corners in that way. This also accounts for the fact that I have more recorded interview material from UBPC Micro-Brigadas and that more direct quotations from Micro-Brigadas appear in the text.

The perspective of this thesis is markedly from the point of view of the organopónico—a perspective from the place of urban agricultural production and urban agricultural workers. When this thesis is written, interest in urban farming in my surroundings seems to be increasing by the day as an alternative means to food procurement. Courses on non-industrial agricultural systems and urban farming at my own university and the close-by university of agricultural sciences are brimming with students; documentaries on urban agriculture are regularly screened and Cuba is frequently, and sometimes uncritically, promoted as a forerunner to post-oil energy systems. If you and I are to understand and ourselves advance urban agricultural practice the perspective of the urban farmer is essential.

An important question to ask at this point is on what conditions the organopónicos can be the outlook into urban agriculture space. The idea of a scaled spatial assemblage gives the impression that this is a totality that can be viewed in its entirety, at a distance. However, if urban agricultural space is viewed from the position of MINAG, or from the perspective of a vegetable consumer, or from a place of production such as an organopónico, the scaled relations will look different. Different aspects will be emphasised from different positions in relational space as a situated experience of it ultimately boils down to different people's position in the power-geometry of the food supply system.

A spatial assemblage, as it was defined in the previous chapter, is a more or less stable scalar set up of socioecological processes that enables and serves a certain purpose. When the workers of an organopónico engage in vegetable production they depend on the intactness of this assemblage

or have to transform it. The nominalisation¹⁴ of such relations as ‘an assemblage’, ‘a place’ and ‘scales’ strengthens the effect of making the relations collectively appear as an object that can be studied in full grandeur. However, the view of urban agricultural space from an organopónico is a partial view. The relational ontology that is inherent in the concepts of place, scaling, and metabolism implies that an observer of ‘the spatiality’ also is a participant in ‘it’. The observer is placed within the spatiality and, to paraphrase Donna Haraway, her or his view is not a view from nowhere but from somewhere. It is a view from a place, differentiated by scale, in the spatial assemblage that is meant to be the object of study. The observer or participant is thereby unavoidably part of the object to be observed. Richard Howitt (1998: 55) argues that what changes in an analysis of such a [perceived] geographical totality, as we inescapably study it from different scaled places,

is not the elements themselves (the features on a landscape, the sites involved in a production process, the ecological processes affecting a social formation, the cultural practices performed by people), but the relationships that we perceive between them and the ways in which we might emphasize specific elements for analytical attention. What we emphasize at one scale may not be what we emphasize at another.

Urban agricultural space is, in other words, always experienced and these experiences are situated within its spatial configuration. I will approach the spatial configuration of urban agriculture from the point of view of workers’ experiences from the scaled place that is the organopónico.

Hereby, it is important to acknowledge that my inquiry never can grasp the workers’ experiences directly. I can only produce representations of their experiences filtered through my interpretations and with access to information that they are willing to provide me. It is therefore paramount to be clear about my own standpoint as a researcher.

During my fieldwork I have daily paid more money for rent and food than an average Cuban earns per month. In the eyes of the people I have met I have undoubtedly appeared incredibly rich. Still, to my knowledge this has not opened doors that otherwise would have been locked for me. Nor have I at any time attempted to unlock doors in this way. To my knowledge, the fact that I am identified as a man has similarly not led me to men-exclusive situations. In the organopónico where I have spent most time, however, I have frequently played on the norm that I can be expected to share a ‘male’ interest such as sports together with male workers (all workers in this garden except the administrator, two vendors, and the economic officer are men). I have tried to keep informed about baseball and football news—not least the hype surrounding footballer Zlatan Ibrahimovic, who like I am from Sweden—and used this to initiate discussions with the workers. In my view, this has been an effective icebreaker.

Furthermore, that I am a wealthy, pale skinned man from Europe—thus finding myself at the dominant end of most social relations—has without doubt shaped the questions I have asked,

¹⁴ Nominalisation is a term from linguistics that describes the discursive effect of turning a process into a noun which makes it appear more as a static fact than a process with agency.

and as certainly the questions I have not asked. I have sought to be as consciously aware as possible of the power I potentially can exercise through my social position during interviews and other social interactions. To this end, I have aimed to let the persons I have interviewed influence the questions I have asked. I have encouraged my interlocutors to tell me when I have misunderstood and to explain when I have been wrong. The organopónicos along the Vial are located relatively close to each other and I was able to walk from one to the other almost every day during the fieldwork. In this way I continuously returned to the organopónicos with new and rephrased questions that developed during the fieldwork. In this manner, the study has all the time been corrected and my understanding has been deepened through interactions with my interlocutors.

As I have approached the organopónico workers and other people involved in urban agriculture I have frequently introduced myself as a geographer rather than a human ecologist. Geography is, in comparison to human ecology, a well-known and highly respected discipline in Cuba which is also uncontroversial and directly means something to most people. Many of the workers have then asked why on earth a geographer might have an interest in organopónicos—urban agriculture ought not interest anyone but agronomists. I have then responded that I am primarily interested in understanding what they do in the organopónicos, how they work, and also the relations that exist between the organopónicos and the city, from their point of view.

INTERVIEWS

The empirical material is mainly based on interviews and conversations with workers in the six organopónicos. Each organopónico employs a number of people who are generally referred to as workers (*trabajadores*; which is the term conventionally used for farmers in the state sector) rather than small farmers (*campesinos*; i.e. non-state agriculturalists).¹⁵ One of the workers is appointed as administrator and is ultimately responsible for production, economy, and staff. There is also at least one vendor in each garden and UBPC Micro-Brigadas employs an economic officer.

My main interlocutors have been the administrators. From the organopónico workers' point of view it has been most natural for the administrator to speak with me as she or he is their

¹⁵ A common Marxist rendering of the terms would probably define a worker as someone who does not own the means of production and sells her or his labour for a salary. The workers employed by the Cuban socialist state would, in theory, collectively own the means of production through the proletarian state's appropriation of property. The worker employed by the state would thereby labour in the interest her or himself. A *campesino* (peasant), in contrast, would directly own the means of production but produce on a subsistence scale for her or his own family interest.

As will become clear in the following, the 'workers' in the organopónicos do own several means of production directly themselves. The terminology is therefore rather confused and to be consistent I will, as they usually do themselves, call the organopónico agriculturalists 'workers' or use the more general term 'urban farmers'. (For a historical contextualisation of Cuban agriculture and agrarian reform, see Wright [2009: ch. 4]. Formally, *campesinos* in Cuba are farmers who own less than 5 *caballerías* [67 hectares] of land.)

representative. From my point of view the administrator performs the same work tasks as the other workers, and is thereby highly knowledgeable about farming in the city, as well as having an overhead view. The administrators also represent their organopónicos in the municipal administrative level of urban agriculture, the *Granja Urbana*. As such the administrators are key persons to explain the space in which the organopónicos exist—from the point of view of the organopónicos. In addition, I have conducted some interviews with more regular workers. These have generally been more informal dialogues. I have consistently tried to triangulate information in interviews and conversations with other sources, either as a cross-triangulation with other interviews, with observations, or with printed primary or secondary sources.

Moreover, all organopónicos in one or several consejos populares are represented by a person who inspects, reports, and coordinates work on behalf of the Granja Urbana. I did numerous attempts to meet and interview the area representative for Consejo Popular Hermanos Cruz and Carlos Manuel de Céspedes. However, through her repeated absence from appointments she made clear that she was not interested in speaking to me.

The interviews can best be described as semi-structured, if very open. I have usually interviewed each person several times during the two months in interviews that have lasted between 30 minutes and three hours. All interviews have been conducted in Spanish and have taken place in the organopónicos, either in an office facility or while simultaneously walking in the gardens. In the interviews I have aimed to let the person I have talked to tell her or his story even if I each time have come prepared with a set of questions. Whenever possible I have recorded the interviews and later transcribed them from Spanish to English. Other times I have taken detailed notes during the interviews, extended the notes immediately after the conversation, and finally written them out with as much detail as possible within a few hours. I have tried to write these accounts more in the form of my memories of the interview than as questions and answers. As the wording ultimately is mine in these transcripts it becomes more difficult to approach the material anew at a later stage as is possible with recorded interviews. I have not wanted the style of the transcripts to give the impression that this is possible. In the following, all references to the interviews are made in footnotes and not in the running text to make the text more readable. All direct quotations are my translations from Spanish.

I have been conceiving of the interviews as structured in two phases. In the first phase I interviewed all administrators in the six organopónicos one or several times. After I had interviewed a couple of administrators I could direct my questions better to the others. The questions I posed followed the same themes with all six administrators. In the first phase I sought to learn about the history of the organopónicos—when they were founded, why, why in their specific locations, and what characterises their locations as spaces for agriculture (crops produced and which crops grow well and less well in the gardens; soils, drainage, etc.). I asked about more hard facts such as land areas, the number of workers, production and sowing plans, and financial results. We discussed farming methods and pest management as well as what organic material, seeds, cuttings, water, electricity, and other

inputs they use, where it comes from, and how it gets to the organopónicos. I also sought to understand the relation between the organopónicos, in their different forms, and other institutions such as the Granja Urbana, MINAG and the National Urban Agriculture Group (GNAU), the Empresa Acopio y Beneficio de Tabaco and other companies that the organopónicos depend on or do commerce with.

In the second phase of interviews the format was less consistent. When I picked up an interesting thread in one organopónico, I introduced the topic with other administrators to get more diverse interpretations. These interviews mostly focused on market relations and how the workers negotiate the seeming contradiction of selling on a free market according to supply and demand while at the same time producing according to a central plan. I attempted to get a more profound understanding of the relation between the organopónicos and the Granja Urbana. As I will describe later, the Granja is a dual administrative structure, political and commercial, and in several interviews I tried to understand when the organopónicos respond to which ‘leg’ of the Granja. I did this by discussing the hypothetical process of me—if I were Cuban—opening a new organopónico. How would I get land; who formally employs workers and pays salaries; what is the role of the syndicate (CTC) and the Communist Party (PCC); how are financial contracts made and who makes bank transactions; what happens if there is an economic surplus at the end of the year and what happens if the production plan is not reached?

PARTICIPATORY MAPPING

In UBPC Micro-Brigadas and El Vial, respectively, I made maps together with two workers and the administrator. In these exercises I wanted to surrender command over the pen to allow the organopónico workers to define relationships, categories, and detail. Also, mapping allows a visual transmission of information. In interviews, communication is predominantly verbal and, as I will discuss in the next section, through observations I was able to perceive and personally experience urban agricultural space. By combining interviews and observations with mapping, primary material was constructed through three different ways of knowing: verbal language, perception, and visual/graphic representation.¹⁶

In one map the participants drew all the connections they could think of between their organopónico and the city, the municipality, the province, the nation, and the world. I initiated the exercise by indicating that I know that produce is sold to the community at the organopónico’s vending stall. This then indicated a flow of produce from the organopónico to the city and a flow of money from the city to the organopónico. The workers then expanded the map with connections, for

¹⁶ See Chambers (1997: ch. 7) for an interesting discussion of these aspects of participatory mapping.

instance, to the market, to political institutions such as MINAG and the Party, to peat bogs and seed shops, and to companies from where they purchase vinegar to conserve unmarketable leek and biscuits for the workers' coffee break. In the UBPC they also drew a map indicating all the relations they could think of existing within the organopónico; for example, a worker moving harvest excess to the compost and later compost to the cantero where vegetables are cultivated. These maps can perhaps be understood as the workers' immediate conceptualisations of the socio-ecology that they find themselves in as organopónico workers.

The maps were made in the second half of the fieldwork period so that I would have sufficient knowledge to facilitate the process. As Spanish is not my first, or even second, language (although I speak Cuban Spanish more or less fluently) I found it hard to actively include all participants in the mapping process. The administrators therefore came to have rather dominant roles in the exercises. UBPC Micro-Brigadas and El Vial were chosen so that I would get one set of maps for the UBPC type of organopónico and one set for the organopónico arrendado type.

As the maps were not made in a format that is easy to publish I have not tried to reproduce them here. Rather, I have used them while working with the interview material as a point of reference. The maps have also been a useful source of detail when it comes to locations and names of places, institutions, and companies that the organopónicos are connected to or cooperate with. The conversations held while the maps were drawn were recorded.

OBSERVATIONS

A third important method in the construction of primary material has been to directly observe, and sometimes participate, in organopónico work. I continuously asked my interlocutors to show me the practices, places, and work procedures they described in interviews. Among other things, I witnessed the different methods used to produce organic materials in the organopónicos such as composts and vermicultures. I observed and to a minor degree participated in different work routines such as sowing, weeding, harvesting, husbandry, sales, irrigation, and the installation of an irrigation system. I also took part in workers' meetings and every once in a while inspected storage facilities to see if I found some unmentioned thing of interest. I have recorded observations and things I learnt during more informal conversations together with my own impressions in a field diary. This diary has been kept in Swedish and all quotations from it are my translations to English.

Furthermore, the administrators and the area representatives meet each Monday in the Granja Urbana together with the Granja directorate. These meetings are held at the Granja's campus in Consejo Popular Diez de Octubre, also in the zone of new development, northwest of Hermanos Cruz. On Monday 11 February, I was able to join the meeting together with 26 administrators, five representatives, and five members of the Granja's staff. Sitting in on the meeting was important as it

gave a direct experience of an event that often surfaces in conversations with the administrators. The meeting also gave me a personal experience of how the Granja Urbana works. The Monday meeting was largely dominated by the upcoming inspection visit by the GNAU, which was to follow the week after, and the directorate—sometimes in a heated voice—tried to ensure that all organopónicos were in the best possible shape.

After the meeting I visited the Granja's *Casa de Postura* where the Granja produces cuttings that are later sold to urban farmers. For logistical reasons it was not possible to visit the Granja's seed shop, nor any of Pinar del Río's two Centres for the Reproduction of Entomophages and Entomopathogens (CREEs).

A QUESTIONNAIRE THAT TURNED INTO A STRATEGIC PLAN DOCUMENT

To understand how the organopónicos and urban agriculture are articulated in the urban planning process I approached the Provincial Directorate of Physical Planning (DPPF) in Pinar del Río. I was informed that it was not possible for me as a non-Cuban national, although officially a student at the local university, to access the city plan. Instead I was allowed to prepare a questionnaire to the director of the DPPF asking for 'the data I want to get out'.

The rather challenging process of formulating this questionnaire is unnecessary to discuss at length: the response I received paradoxically came in the form of a strategic planning document and not as answers to my questions (this document is referred to as DPPF 2010). I was informed that most of my questions would be answered by the plan document.

The document is co-authored by Luis Guillermo Castillo González and is closely modelled, both in content and design, on his PhD thesis (Castillo González 2010). By a lucky coincidence I happened to rent an apartment from Castillo González during my fieldwork and could discuss Pinar del Río's urban planning with him related to urban agriculture. Before completing his PhD he worked at the DPPF for 25 years and, according to him, urban agriculture remains unmentioned in the DPPF's master city plan. The strategic plan that he and his colleagues completed, and which the DPPF then sent me, is a plan with low priority in the urban development process due to the omnipresent lack of finance.

ADDITIONAL PRIMARY AND SECONDARY SOURCES

During my fieldwork I also came across three other important sources. In El Vial I was demonstrated a field manual for organopónico production. The manual had no title page and Hecton Bentamé Hernández, the administrator of El Vial, was not sure where it came from. The first eight pages were

also missing. My guess is that the manual originates from INIFAT. The manual describes different organic materials and how to prepare a good soil mix; it describes the characteristics of a large range of cultivars, crop associations, irrigation techniques, pest management methods, when to harvest and post-harvest methods; and it also outlines how to prepare a vermiculture and how to realise a nutritionally balanced diet.

In UBPC Micro-Brigadas, in turn, I was demonstrated several documents. These included the cooperative's budget; production and sowing plans; the methodology for the evaluation made by the GNAU; and a large digitally made map of the organopónico. I recorded these documents, as well as the field manual, by taking photographs of them. I have accurately replicated the GNAU methodology as I frequently refer to it in the text and appended it to the thesis.

Also, I collected two special issues devoted to urban agriculture of the magazine *Agricultura Orgánica*. The magazines present important inside accounts of the history of the urban agricultural movement and of various urban agricultural institutions and sub-programmes. Being special issues to celebrate the 20th and 25th anniversaries of urban agriculture in Cuba the texts are rather self-congratulatory. Most texts, nonetheless, are written by respected scholars in the fields of agroecology and urban agriculture in Cuba. Some of the authors also hold leading positions in the GNAU and at INIFAT. As such they are valuable accounts of how Cuba's urban agriculture is articulated in official discourse.

Organopónicos as institutions

The organopónicos share the same basic features. The gardens consist of a patchwork of *canteros*; 20–30 centimetre-high raised beds that are typical for the organopónico method of farming. Each garden has a vending stall close to the garden gate where produce is sold according to the supply and demand of the urban vegetable market. The vending stall often connects to a storage facility, some form of office, and in some cases a mini-industry. The office can be a small room with a desk as in El Vial or a mere cupboard and a stool inside the vending booth as in La Pesca. Mini-industries (*miniindustrias*) or processing centres (*centros de elaboración*) exist in UBPC Micro-Brigadas, El Vial, and Erea No. 1 and are facilities where produce that has run old or has low quality can be jarred with vinegar to be sold as a pickle. (See figures 1 and 2). A large space in UBPC Micro-Brigadas is covered by grass where four horses graze and the area of Ampliación Erea is equally split between canteros and an

urban banana plantation. Towering over all the organopónicos along the Vial are large water tanks which pressurise irrigation systems. The tank in Ampliación Erea was mounted during my fieldwork period. Ampliación Erea is also partly covered with a black net that gives shade to crops in the canteros beneath. This earns the organopónico the epithet ‘semi-protected’.

The organopónicos look similar at first sight, but looks are deceptive. To work in all five organopónicos would imply negotiating two differently constructed, but closely interrelated, scaled spatial assemblages of socioecological relations. Cucumbers and carrots that are harvested in the organopónicos thereby embody two slightly different assemblages that enable production. The aim of this chapter is to explore the institutional dimensions of these assemblages to address the first research question.



Figure 1: Inside an organopónico. Workers meet at the combined vending booth, mini-industry, and office in UBPC Micro-Brigadas. In the foreground are cultivated *canteros*. (Photograph by the Author, Pinar del Río, 2013).



Figure 2: Business in El Vial. Tomatoes and cachucha peppers for sale on the urban vegetable market. (Photograph by the Author, Pinar del Río, 2013).

THE GRANJA URBANA

It seems almost impossible to distinguish how the organopónicos along the Vial are institutionally articulated as places without first shifting focus to another place in urban agricultural space. The experiences of working in the UBPC and the organopónicos arrendados are in several important ways regulated in their scalar relations with the Granja Urbana.

Agricultural production in Cuba is nationally governed by the Ministry of Agriculture (MINAG). One exception exists to MINAG's authority, which speaks to the historical importance of one species in Cuba's ecology and economy. This is the powerful Ministry of Sugar (MINAZ) which directs the sugar industry. Urban agriculture is presided over within MINAG by the National Urban Agriculture Group (GNAU) through a Programme for Urban and Suburban Agriculture. This

programme is divided into 26 sub-programmes to develop urban agriculture and to guide urban farmers in areas ranging from soil management and conservation to aquaculture (see Companioni et al. 2002: 225). MINAG is subdivided with branch offices in each of Cuba's fifteen provinces. Provincial MINAG is further split into municipal units which in the case of urban agriculture are expressed as the *Granjas Urbanas* or the 'Urban Farms'. In the official narrative, the first Granja Urbana was formed in Havana in 1995 'to give logistical and economical state support to the independent Movement of Urban Agriculture' (Rodríguez Nodals, Companioni Concepción, and Herrería Martínez 2006: 7, my translation from Spanish).

The hierarchical structure of MINAG follows the principles of democratic centralism which permeates Cuban society. The idea, as originally outlined by Lenin for a revolutionary government, is that democratic representation goes up the pyramid while decision making and political direction goes down. The same structure exists in the Poder Popular, which was briefly outlined in chapter 2, as well as in the Cuban mass organisations, such as the CDRs, trade unions, women's, student, and youth federations. Along the chain of command, linking MINAG through the Granjas Urbanas to the organopónicos, Cuban urban agriculture is governed. The Granja Urbana in Pinar del Río consists of all the municipality's organopónico administrators, the organopónicos' area representatives, and the Granja's directorate. This directorate is made up of a director and a sub-director, economists, an information officer, heads of transport and storage, and heads of the Granja's seed shop (*Tienda de Semilla*) and cuttings greenhouse (*Casa de Postura*).¹⁷

The Grupo Nacional de Agricultura Urbana. GNAU works out of Havana closely connected to INIFAT. From the perspective of the organopónico workers, GNAU holds four main functions. First, GNAU sets a national production plan (*plan de producción*) stating that each organopónico should produce 20 kilograms of vegetables per square metre cantero per year. The plan must be approved by the workers' syndicate, CTC.¹⁸ This plan is then adjusted by the Granja Urbana according to the individual circumstances of each organopónico. For example, UBPC Micro-Brigadas has a production plan of 16 kilograms per square metre per year. 'Since we are a dry organopónico that does not have water', Ana Reina Diaz Cordero who is the administrator of the UBPC explains with reference to their problems with irrigation, 'our plan is 16 kilograms per square metre. We have 2,180 square metres, through 16, and you have the production plan. If we would have normal water the production plan would be 20 kilograms per square metre, this is the normal.' El Vial, in comparison, has a production plan of 15 kilograms per square metre per year, and with 10,330 square metres of canteros their plan amounts to just about 155 tonnes of vegetables per year.¹⁹

¹⁷ Dagmar Omar Luis Diaz (DO), 25 January.

¹⁸ Ana Reina Diaz Cordero (AR), 20 February.

¹⁹ AR, 20 February; Hecton Bentamé Hernandez (HBH), 23 January; Field notes (FN), 24 January.

Second, GNAU has centrally defined a set of crops that must be cultivated in at least one cantero in each organopónico across Cuba.²⁰ These are chard (*acelga*)²¹, water cress (*berro*), strawberries (*fresa*), moringa (*moringa*), and Cuban oregano (*orégano francés*). Ana Reina describes that the compulsory crops all have exceptionally high mineral and vitamin content and that the introduction of several of these, such as moringa, has been accompanied by propaganda campaigns to generate consumer interest.²²

Third, GNAU administers projects which involve the organopónicos. Many of the compulsory crops have been introduced to the urban agricultural ecosystems through Proyecto Anémia.²³ This project aims to prevent anaemia by supplying the population with iron-rich vegetables. The projects are always funded through international development aid or donations and projects is the only real possibility for the organopónicos to acquire new tools or technologies.²⁴ The organopónicos find themselves in a stern financial situation which means that most incomes are reserved for salaries. Ana Reina explains that most of the tools they need, be it shovels, wheelbarrows, sprinklers, or workwear, are sold in *pesos convertibles* (CUC\$) whereas all incomes are generated in *pesos cubanos* (CUP). The fixed exchange rate between the two currencies that work in parallel in Cuba is set to 1:25 and it is therefore almost impossible to purchase necessary capital supplies for the organopónicos.²⁵

The organopónicos along the Vial were involved in four different projects during my fieldwork. Beside Proyecto Anémia, there was PROAGRU which was funded by the European Union to help organopónicos recuperate after hurricanes Gustav, Ike, and Paloma. Through the project the organopónicos were among other things supplied with materials to rebuild destroyed structures such as roofs and with bicycles that can be used to transport produce. Proyecto Palma involved the organopónicos to promote cultivation of the national tree, the Royal palm, and to disseminate information about the tree. A fourth project, PHL, aimed to improve city sanitation. Consequently, the projects connect the organopónicos to broader political projects and social processes. The projects emanate as national policy initiatives from the GNAU and are administered through the scaled relations with the organopónicos.

One of the most significant things that the organopónico workers rely on receiving from projects is irrigation systems. For instance, the irrigation system in La Pesca comes from a Brazilian funded project while El Vial and Erea No. 1 have received their systems through Proyecto Anémia. The decisions of who will be involved in each project and who will receive what things are made in the Granja Urbana.²⁶

²⁰ FN, 8 February.

²¹ Chard is also known in English as mangold.

²² AR, 7 February.

²³ AR, 20 February.

²⁴ AR, 25 January.

²⁵ AR, 22 January; 7 February.

²⁶ FN, 24 January, interview with the administrator of La Pesca; HBH, 23 January; FN 18 February, interview with El Neno.

Fourth, the GNAU visits the organopónicos three to four times a year to do an evaluation. Such an evaluation was done in Pinar del Río in late February 2013. It was done according to a methodology that the organopónico workers had knowledge of before the inspection. Each organopónico could be awarded a maximum of 100 points split over thirteen evaluation categories. These categories referred to soil quality and content and that the canteros are continuously cultivated; pest management and intercropping; irrigation and drainage; knowledge and involvement of the workers; sales and relations to the population; as well as garden aesthetics and that there are ‘facilities for women’.²⁷

Based on the evaluation the organopónicos are awarded a diploma. When I ask Hecton Bentamé Hernández, administrator of El Vial, if ‘you get something or [if there are] any subsidies’ when you ascend a level he responds matter-of-factly that ‘no, it’s a moral stimulus’.²⁸ Through the diplomas the GNAU encourages the organopónico workers to transform their organopónicos physically, ecologically, and socially in accordance with the evaluation categories. In general, the evaluation seems to be taken very seriously by the workers. One of the first things I was shown by the administrator of La Pesca was the diploma he had been awarded in September 2012 indicating that his garden was a ‘Referencia Nacional’. When I politely responded that that was a great achievement, he smirked at me saying that, yes, he was proud but that it wasn’t good enough.²⁹ Similarly, Hecton Bentamé Hernández describes that to attain and later maintain the ‘Referencia Nacional’ status ‘is very big, very difficult’ for El Vial as a large organopónico.³⁰ Between different evaluations the organopónicos can both earn and lose diploma levels.

The award scale is currently divided in ten steps.³¹ After the February evaluation Erea No. 1 and Ampliación Erea remained on the second to highest level, ‘Doble Excelencia’; La Pesca and El Vial both rose to the seventh level, ‘Candidato Excelencia’; while UBPC Micro-Brigadas remained at level five, ‘Referencia Nacional’. Based on a random selection of organopónicos in the municipality the Granja Urbana is then given an average grade which can be used to compare Granjas across the country. The grades are Bad, Regular, and Good and the Granja in Pinar del Río was graded Regular. As a result, the directorate of the Granja struggles hard to keep all organopónicos in best possible shape to be seen as a progressive municipality. My field diary account from the Granja Monday meeting I attended describes that

The director seemed to be highly knowledgeable [about the individual organopónicos] and posed questions. Particularly, it seemed important to be informed about the compulsory crops and extra

²⁷ A reprint of the methodology, as received from UBPC Micro-Brigadas, is found in the Appendix.

²⁸ HBH, 23 January; FN, 24 January.

²⁹ FN, 24 January, interview with administrator of La Pesca.

³⁰ HBH, 23 January.

³¹ The scale is: 1. Candidato Referencia Municipal, 2. Referencia Municipal, 3. Candidato Referencia Provincial, 4. Referencia Provincial, 5. Candidato Referencia Nacional, 6. Referencia Nacional, 7. Candidato Excelencia, 8. Excelencia, 9. Doble Excelencia (also known as Doble Corona), 10. Triple Excelencia (also known as Triple Corona).

time was given to discuss moringa that many seemed to have troubles with. Among the most important [things] prior to the GNAU visit is to have all canteros cultivated (at least 48 hours before arrival). The municipality receives fewer points for each empty cantero, the director informed. Until next Saturday [the GNAU would arrive the following Sunday] he wanted to know how many cantero-metres each compulsory crop has [in each organopónico].³²

For at least one of the administrators who attended the meeting, the inspection was a source of anxiety. UBPC Micro-Brigadas was one of the municipality's sampled gardens and Ana Reina Diaz Cordero was not happy about the current state of her organopónico. Again from my field notes, after a conversation with Ana Reina that took place immediately after the meeting in the Granja:

She made a self-evaluation and realised that she probably cannot get more than 50% of the points. And worst is that her organopónico contributes to the result of the entire municipality. The plant barriers are too sparse, the vermiculture is dried out, there are irrigation problems, the soil around the moringa is terribly bad, there is no toilet specifically intended for women, and all workers don't have the knowledge needed to get full points under '*capacitación*' [...].³³

In my interpretation of Ana Reina's comments, the moral stimulus of the diplomas is not only something that the workers can strive for, but also an institution that stimulates a form of peer pressure in the urban agricultural community. This peer pressure exists both on the municipal scale, where Granjas will compare results among each other, and on the scale of production where organopónicos compare results. No one wants to be the administrator whose organopónico has contributed to a lower municipal result. This social mechanism, in turn, is directly related to promoting the material processes that the evaluation categories correspond to, such as the physical outlay of the organopónicos and certain ecological processes working in the gardens. The scalar relations articulating the organopónicos as places that extend from the GNAU via the Granja Urbana in this way socially organises certain metabolic processes in the organopónicos.

In sum, the Granja Urbana, as an operational unit of the GNAU, is the interface between state policy and the organopónicos. Through the nested administrative hierarchy of MINAG, rules and norms are set that the organopónico workers must or are encouraged to follow. The most central of these directives are the production plan, which identifies the quantity of production; the range of compulsory crops, which to a certain extent defines the nutritive quality of production; the linking of urban agriculture to other social goals and processes, through projects; and the encouragement of certain ecological practices, the physical outlay of the gardens, and the capacity and ecological knowledge of the workers, through continuous evaluations of the organopónicos.

Empresa Acopio y Beneficio de Tabaco. At the same time as the Granja Urbana is a political body it is also a commercial institution. The Granja itself is a *Unidad Empresarial de Base* (UEB) or a 'Basic Company Unit'. A UEB is a local centre of production within a state company. For

³² FN, 11 February, my translation from Swedish.

³³ FN, 11 February, my translation from Swedish.

example, an electric power plant can be a UEB within the state utility or a state-owned restaurant can be a UEB within a national restaurant chain. The Granja Urbana in Pinar del Río is a UEB within the state agricultural company Empresa Acopio y Beneficio de Tabaco ('Tobacco Gathering and Benefit Company'). The organopónico workers usually refer to this company simply as the 'Empresa Tabaco' or 'Tabaco' (I will in the following refer to it as Emp. Tabaco). There is nothing particular about Emp. Tabaco that makes it better suited than other companies to deal with urban horticulture beside its normal agricultural focus. Antonio Lazo, who administrates Ampliación Erea, explains that Emp. Tabaco has been the commercial trustee for the Granja during the three previous years. Before that the company Cultivos Varios held the same function, and before that the company Citrico. According to Antonio, this depends on which company has resources to manage and support urban agriculture in the municipality.³⁴ How the company is selected is unclear and out of reach for the organopónico workers. However, and this potentially makes the dual structure of the Granja Urbana confusing, the agricultural companies that facilitate urban agriculture, for instance Emp. Tabaco, Cultivos Varios, and Citrico, fall under the aegis of the Ministry of Agriculture. Therefore, at the top of the urban agricultural institutional hierarchy we find MINAG. The structure then divides into two legs that further down the nested scalar configuration rejoin in the Granja Urbana: one political leg that reaches from the GNAU via provincial subdivisions, and one commercial leg that in the case of Pinar del Río municipality reaches through Emp. Tabaco.

As a UEB of Emp. Tabaco, the Granja Urbana can act as a commercial legal entity. All contracts that the Granja makes, for example with production centres of organic materials or state enterprises that want to buy urban agricultural produce, are made in the name of Emp. Tabaco. Similarly the Granja can keep bank accounts, do bank transactions and write cheques in the name of Emp. Tabaco.³⁵

Annually, the organopónicos submit a sowing plan (*plan de siembra*) to Emp. Tabaco via the Granja Urbana. The sowing plan is a break-down of the production plan set by GNAU into individual crops which is then divided into monthly production targets. This plan is made in square metres rather than weight. It is then only after the harvest that the quantity of each crop is measured in kilograms to refer back to the production plan. The sowing plan as well as production results must be reported to and be approved by Emp. Tabaco and in extension MINAG. As an example from an approved sowing plan with results, there were 133 square metres planted with radish (*rábano*) in UBPC Micro-Brigadas at the beginning of November 2012. 10 more square metres were sown according to the plan and 15 square metres were harvested during November, leaving 128 square metres for the beginning of December. The harvest added up to 65 pounds (*libras*) of radish of which 55 pounds were sold, and 10 pounds were given as gratuities. This generated an income of 110

³⁴ FN, 18 February, interview with Antonio Lazo.

³⁵ FN, 8 February, interview with Ana Reina Diaz Cordero.

pesos.³⁶ The weight as registered in the marketing unit pounds was then converted into kilograms (circa 29.5) to, together with all other crops at the end of the year, ideally sum up to the production target.³⁷

THE ORGANOPÓNICOS ARRENDADOS AND THE UBPC

The two forms of organopónicos that produce food along the Vial are to a large part distinguished by their different scalar relations to the Granja Urbana and subsequently to the GNAU and Emp. Tabaco. Common for both kinds is that the sale of produce is the only source of income. In all cases this money accrues to the organopónico and its workers. The organopónicos arrendados ('leased organopónicos')—Erea No. 1, Ampliación Erea, El Vial, and La Pesca—have the closest bonds to the Granja Urbana. The organopónico arrendado workers pay a monthly rent (*arrendamiento*) to the Granja of 1 peso per square metre cantero to use their land. In contrast, the UBPC, along the Vial exemplified by Micro-Brigadas, is a *Unidad Básica de Producción Cooperativa* or a 'Basic Unit of Cooperative Production'. This form of cooperative was defined in law as the Special Period held Cuba in its firmest grip in 1993.³⁸ The political idea was to link people to the land (*la vinculación del hombre al área*) and through the law many former large state farms were broken up into UBPCooperatives (Alvarez 2004; Wright 2009: 138–142). The UBPC is primarily a cooperative form for rural production that has also been used for urban agriculture. The UBPC is an autonomous association of farmers who according to law can use the land they have been assigned '*en usufructo*'. This means that the state formally owns the land but that the cooperative has the right to use it indefinitely as long as it is productive. There exists no market for urban land in Cuba so the workers cannot purchase the land they use.³⁹ To use their 8,229 square metres of land in Hermanos Cruz, UBPC Micro-Brigadas pays 10 centavos per square metre as a monthly tax to ONAT, the National Tax Administration Office.⁴⁰ While the organopónicos arrendados only pay for the area covered with canteros the UBPC pays for the entire garden area (only 2,705 square metres out of the 8,229 are canteros in UBPC Micro-Brigadas). The amount, however, is negligible compared to the sum paid by the organopónicos arrendados.

Both organopónicos arrendados and UBPCs opened in areas planned for other purposes as capital to realise the plans vanished during the Special Period. The organopónicos therefore exist on

³⁶ All following references to 'pesos' refer to CUP, also known as 'pesos cubanos' or 'moneda nacional'. There are 100 centavos to 1 peso. 'Pesos convertibles' will be referred to as CUC\$.

³⁷ Photograph of 'Plan de siembra y producción-Granja Urbana Mcpio Pinar del Río. UBPC Micro-Brigadas, November 2012.' The original plan document, dated 28 November 2012, was demonstrated to me by Ana Reina Díaz Cordero.

³⁸ This is *Decreto Ley 142* from 20 September 1993.

³⁹ In theory, they of course collectively own the land through the socialist state.

⁴⁰ Map from participatory mapping exercise in UBPC Micro-Brigadas, 8 February; FN, 8 February.

urban land that is planned for a different purpose. María Caridad Cruz at FANJ explains that according to Havana's city plan urban agriculture is temporary while suburban agriculture is permanent.⁴¹ Luis Guillermo Castillo González says that the same is true in Pinar del Río's city plan.⁴² The provincial government can at any time decide to realise the plans for the areas where the organopónicos are located. If this is the case, the organopónicos arrendados can simply be closed. The UBPC, in contrast, must be offered a replacement location and receive financial compensation for the move.⁴³ Nonetheless, Ana Reina and Omar, the administrator and a worker at UBPC Micro-Brigadas, are certain that the government would take the organopónico's social impact in the area into close consideration before this would happen and make an advisory survey among the residents.⁴⁴

With their incomes, furthermore, both organopónicos arrendados and UBPCs pay for all necessary inputs, such as organic materials, seeds, tools, lunch, etc. that they cannot produce within the organopónico or obtain in other ways (for instance through projects). The means of production is in this way owned by the organopónico workers collectively. In the case of organopónicos arrendados, however, payment for these products does not go directly to the peat bogs, seed shops, and canteens where they are acquired but to the Granja Urbana. As organopónicos arrendados they have no legal position to write contracts or keep bank accounts. Instead all commercial transactions, apart from sales of produce, are mediated by the Granja Urbana as a UEB of Emp. Tabaco. The Granja Urbana decides from where inputs are bought and arranges transports. Transports are similarly paid for by the organopónicos arrendados to the Granja Urbana. Usually, transports are arranged through Emp. Tabaco on provincial level which provides lorries, drivers, and fuel. In this way the organopónicos reach one scalar level above the UEB Granja to acquire the services of the trustee company Emp. Tabaco.

In comparison, the UBPC is an economically and legally independent entity. The UBPC makes its own annual budget and is fully connected with the bank. The UBPC has its own economic accounts and can directly do bank transactions without the mediation of the Granja. This also means that the UBPC members decide which companies they wish to buy inputs from and to which organisations they wish to sell produce (beside sales at the garden gate). However, in many cases they still contract services through the Granja Urbana out of convenience; for example, when it comes to purchasing certain organic materials. Emp. Tabaco can then also facilitate transports.⁴⁵

Workers and administrators. Labour power is enrolled in the organopónicos through institutions that regulate employment. The organopónicos arrendados employ workers themselves and salaries are directly paid from monthly incomes. Salary levels fluctuate depending on the particular

⁴¹ FN, 16 January, conversation with María Caridad Cruz.

⁴² FN, 21 January, conversation with Luis Guillermo Castillo González.

⁴³ HBH, 23 January; FN, 24 January, interview with Ana Reina Díaz Cordero; DO 25 January.

⁴⁴ DO, 25 January. Omar speculates in the interview that this probably would be done through the consejo popular or the CDRs.

⁴⁵ Map from participatory mapping exercise in UBPC Micro-Brigadas, 8 February.

month's sales. Antonio Lazo in Ampliación Erea tells that the salaries usually diminish during the rainy season as production generally is bad during this period. The same often happens when it is unusually dry. 'If there is a surplus after the rent, salaries, and inputs have been paid the salaries increase and then the rest is deposited in an account that the Granja Urbana help the organopónicos keep. The money can be used as a security if something happens.'⁴⁶ The administrators, on the contrary, are appointed by the Granja Urbana. Typically the Granja tries to find workers who seem able to take on responsibility for the running of an organopónico and employ that person. The Granja can even employ the same person to administer two organopónicos.⁴⁷ The Granja can also dismiss an administrator of an organopónico arrendado if she or he mismanages the garden or if they have difficulties cooperating.⁴⁸

The cooperative workers in a UBPC, on the contrary, elect their administrator. That the leadership should be elected collectively is stipulated in the UBPC law (Alvarez 2004: 2). Consequently, the UBPC administrator cannot be sacked by anyone but the cooperative members. Furthermore, when it comes to salaries the UBPC is in a different position compared to the organopónicos arrendados. The organopónicos arrendados have their monthly incomes (sales) and expenditures (rent, inputs, salaries) and the salaries fluctuate according to that equation. In UBPC Micro-Brigadas, in contrast, the salaries are annually budgeted and therefore have a maximum cap. Salaries could currently be paid up to 6,000 pesos. In one interview, I ask Ana Reina Diaz Cordero why there is only a max cap and no minimum. She then explains plainly that 'if there isn't money, there isn't.'

Me: In my country the union has a very strong opinion that there should be a set minimum level; but what says the Cuban union?

Ana Reina: That you must pay, you always have to pay the worker. [... That is the case] if you are a paid worker in a state company [*una unidad básica de*]; but in our case where it is incomes minus expenses, if there isn't [money], there isn't. If you didn't earn, you have to cut. But what happens is that a UBPC generally has a resource base, a reserve of money in the bank. But there are UBPCs that don't have this; they sell on a daily basis. If I don't sell, I don't have.⁴⁹

In the case that production and sales go unexpectedly well, on the reverse, and the cooperative has generated more revenues than expected this is split in equal shares and is handed out as a bonus to the workers at the end of the year.⁵⁰

Planning and results. The workers of the organopónicos arrendados collectively decide on the sowing plan. The administrator then presents the plan to the Granja Urbana during a Monday meeting where it is ratified by the Granja before it is passed along to Emp. Tabaco. The planning

⁴⁶ FN, 18 February, interview with Antonio Lazo, my translation from Swedish.

⁴⁷ FN, 18 February, interview with El Neno; HBH, 4 February.

⁴⁸ AR, 20 February.

⁴⁹ AR, 20 February.

⁵⁰ AR, 22 January; 25 January.

process can be summarised as the production plan (20 kilograms per square metre per year) is being passed down from GNAU at the top of the scalar hierarchy of the Granja's political leg. The sowing plan, which is made at the lowest level, the level of production, travels back up the hierarchy along the commercial leg. At the end of the year the harvest as registered in the commercial leg should correspond to the plan emanating from the political leg.

Similarly, the administrator of a UBPC must submit a sowing plan and report production results to the Granja Urbana to have them sanctioned, even though the UBPC is independent. 'If you make a plan', I ask Ana Reina, 'and you hand it over to the Granja and explain it, and the Granja says that you should produce 10 kilograms more cress, will you change the plan?'

Ana Reina: Before, the Granja had to say this and this and this, but now they can't decide for me; they can give an opinion—not the Granja, but *Tabaco* and in *Agricultura* [MINAG]. When they review the plan, they can say that you are spending much money on this, you should put it on other things—that—but these are suggestions. I receive them and we discuss them, the workers.

Me: But you don't have to change nothing?

Ana Reina: Nothing.

In other words, the UBPC works out the sowing plan independently, 'but is it preferable to change [it] if *Agricultura* says so?', I continue to ask:

Ana Reina: If they convince you that in reality you are mistaken and that this is wise. Because the plan is yours. I am the one who knows my soil; I am the one who knows my sales. From there, *Agricultura* can't give me a plan. I discuss my plan, and if I find reason and they convince me [I change it]. But in reality it is I who make the plan.

In this way, the UBPC is still independent, but the planning process is closely monitored and filtered through the bureaucracy of MINAG. If the UBPC does not achieve the production results that the plan stipulates the administrator has to answer to the ministry. Ana Reina describes the procedure:

You have to explain [...] to *Agricultura*; you have to go there when you don't fulfil the plan of production and sales; in other words you have to... one month, two, three months you can fail the plan and it goes four five months with overproduction, this compensates. You don't fulfil today, but tomorrow yes, and at the end it adds up. The year is what counts. But, ok, when you go four five six months accumulating loss it's an alarm.

Me: And what do they ask? What happens?

Ana Reina: Well, I imagine—I haven't been there—I imagine that they ask you why you haven't fulfilled the production plan to know the reason.⁵¹

⁵¹ AR, 20 February.

Consequently, the organopónicos arrendados answer to the Granja Urbana while the UBPC answers to MINAG.

SUPPLYING THE CITY WITH FOOD

When tomatoes, cauliflowers, strawberries, broccolis and other crops are harvested in the organopónicos one of five things happens to them. Either they are sold to a state institution deemed socially important (a *centro esencial*) or on the urban vegetable market. They can also end up pickled and sold in a bottle (which is done on a very small scale) or be gifted ‘to workers or to the Granja or to an agricultural event, or whatever’ resulting as gratuities (*gratuidades*). They can also be counted as a loss as they did not sell (a *merma*) or ‘since things didn’t go as planned, you had a pest or something’ (a *pérdida*). The aggregated weight of these five vegetable destinies refers back to central plan.⁵²

The organopónicos have two major options to market their produce. All organopónicos arrendados must partly sell to centros esenciales; for example, El Vial delivers vegetables to a hospital, a home for the elderly, two day-care centres, a cantonment of MINFAR, and to workplaces of the Ministry of the Interior (MININT). Hecton Bentamé Hernandez describes that

We deliver that [the vegetables] directly and it is billed for a bank transaction. A company will write a check to me directly or to the Granja Urbana. The Granja Urbana can deposit it directly in the account of Emp. Tabaco; but the economist in the Granja has to reconcile the transfers.⁵³

All the organopónicos arrendados deliver vegetables to at least one day-care centre and these contracts are set by the Granja Urbana.⁵⁴ The organopónicos arrendados can also sell produce to other companies and organisations; for instance, El Vial sells produce to the canteens of more than eight companies.⁵⁵ The UBPCs, in contrast, are free to sell to whomever they want. Antonio Lazo in Ampliación Erea explains that sales to the centros esenciales ‘have a cap, capped prices.’ There is ‘an agreement between the company and the organopónicos that regulates the price. Usually the prices to these institutions are lower than on the market [*en la calle*].’⁵⁶

The other option is to sell on the urban vegetable market. All organopónicos have their own vending stall adjacent to the gardens. UBPC Micro-Brigadas also has two fixed vending stalls in agricultural markets (*Las Placitas*); one in La Conchita and one in the area known as El Pedagógico. Besides this they have a mobile outlet and set up vending stalls during city festivals (for example, at

⁵² AR, 20 February.

⁵³ HBH, 4 February.

⁵⁴ FN, 11 February, notes from Monday meeting in the Granja Urbana.

⁵⁵ Map from participatory mapping exercise in El Vial, 22 February.

⁵⁶ AL, 29 January.

the annual agricultural festival that takes place on the Plaza de la Revolución).⁵⁷ El Vial, in comparison, has five outlets displaced from the organopónico; three in *Las Placitas* and two ambulating vendors. These are all located in the historical centre of Pinar del Río.⁵⁸

The prices are set by the supply and demand of the market. Antonio Lazo continues:

[I]t's a free [price] formation. That which we produce...that which goes to *centros esenciales* has its agreed prices. But in the street we can put the price we want. Of course you have to put...you must see the prices [shift] to sell; for example the lettuce [*lechuga*] in December sells for 5 pesos per pound but now it's down to 3. Or 2.50 or 2, because it doesn't sell. It's the principle. The first principle is that it sells good. [...] Prices have to go down if we don't sell because we can't lose a *cantero*. [...] If I have many *canteros* with lettuce the price goes down; if I have one it can be higher.⁵⁹

Ana Reina Diaz Cordero in UBPC Micro-Brigadas adds detail to this picture, describing that prices rarely rise above 5 pesos per pound. In theory the price formation is free, but the Granja Urbana advises that prices should remain relatively low so that the population can afford the vegetables.

Ana Reina: [B]ecause we understand that we have to get fresh condiments to the population for viable prices, [they] control us for high prices, the Granja says no.

Me: So it is not completely free, the prices?

Ana Reina: They are free, because I can earn if I want to, whatever the Granja says, but with problems of consciousness, of... look if it should reach the population it mustn't be that way. But it *can* be that way. They don't oblige us, but they control us.

In other words, if the prices must rise above 5 pesos per pound, they can, as Ana Reina clarifies when I ask what happens 'if the Granja says sell for 5 but you must sell for 7 to pay the expenses'. However, if the administrator works strategically incomes can often be generated without this happening:

Ana Reina: For that there must be alternatives administratively in a UBPC. This is completely a decision for the UBPC. I must; for example, the lettuce is 5 pesos and I must strategically sell, because else I will not fulfil the plan. I don't raise [the price for] the lettuce, I raise the price for other things that are selling. [...] These are administrative things you have to think about strategically as administrator. You must know the market; if you don't it won't work.⁶⁰

The organopónicos must generate income from the market as they monthly have to pay rents and inputs. For this reason, it is not possible for the workers to produce 20 kilograms of heavy-weight beetroots per square metre per year to easily fulfil the production plan instead of producing a

⁵⁷ Map from participatory mapping exercise in UBPC Micro-Brigadas, 8 February.

⁵⁸ Map from participatory mapping exercise in El Vial, 22 February.

⁵⁹ AL, 29 January.

⁶⁰ AR, 20 February.

variety of up to thirty crops. If the market demands a variety of products (in addition to the compulsory crops determined by GNAU) the organopónico workers must supply a variety of crops. ‘Because you have to sell it’, Antonio Lazo explains. ‘Because we are obliged to pay our rent. And we must make the money.’⁶¹

The sowing plan is the instrument that the organopónico workers have to reflect the demand of the market in the planning process. The sowing plan is set annually but can be revised monthly. However, a question I have continuously returned to during my fieldwork, and later, is how market forces can work when supply ultimately is regulated through a central plan. If the plan leads to overproduction, the surplus can be registered as losses or gratuities and still contribute to reaching the production target. This, notwithstanding, is undesirable for the workers as it does not generate income and consumes valuable inputs. I ask Ana Reina ‘What happens if the plan says produce 100 kilograms of carrots [*zanahoria*] but only 50 kilograms sell?’ If only 50 kilograms sell because of a crop failure, the failed carrots must quickly be substituted with another crop:

You lost in carrots but have to compensate by sowing another crop. You have to substitute the carrots. The kind of crop doesn’t matter; you produce the plan in quantity. The carrot plan was not reached, why? Because the field refused [*el terreno no quiso*], the climate did not permit sowing carrots; in other words, you sowed but it didn’t grow. Quickly you have to get an alternative; sow some other thing to get the kilograms; substituting the carrots.

Here, for example, when it is really dry, as it is now, lettuce is almost impossible to grow. Lettuce needs lots of water, same for cabbage [*col*], look. When this happens you have to replace it with something else, for example okra [*quimbombó*], chives [*cebollino*]...string beans [*habichuela*]. They need much water in the beginning but can then stay drier. You have to sow crops that are dry.⁶²

Antonio Lazo’s description is also in agreement with Ana Reina’s, as my notes from a conversation read:

If a vegetable does not sell as much as planned it can be compensated by growing another that sells better. In this way the plan is not the law, but if it is followed the economics will add up at the end of the year, with rents, salaries, inputs, etc.⁶³

If only 50 kilograms sell because demand from the community is low on the other hand appears as a hypothetical case: ‘The people will consume...’, Ana Reina states bluntly. In the hypothetical case, however, the workers must find alternative markets not to fail economically:

We have other alternatives, to sell...to sell to hotels, to day-care centres, to boarding schools, to work centres, and more.

⁶¹ AL, 29 January. A second reason for why the organopónico workers must keep diverse ecosystems is ecological, to keep pests away without using chemical pesticides. This is discussed in the next chapter.

⁶² AR, 20 February.

⁶³ FN, 18 February, interview with Antonio Lazo, my translation from Swedish.

Me: There is always a market?

Ana Reina: Yes. But here in the city centre there are organopónicos, but there are places where they don't exist. So we have the alternative to sell in the agro-markets there, in *Las Placitas*, that exist in every area where people live, and we can take it [the produce] there also. We don't have only one market, we have several. The sales are slow, because there are many ambulating vendors right now, now when you can get private vending permits. But to our benefit they sell very expensive and we sell cheap.⁶⁴

To sum this up, the contradiction between plan and market has two premises. The central plan demands that the organopónicos produce a certain amount of vegetables. For this to happen they must generate incomes to afford inputs and pay rents. This is the first premise. In the current situation, prices rarely rise above 5 pesos per pound both as the Granja advises this and as the consumers would not afford vegetables at higher prices. Any other situation is seen as hypothetical, although it is possible to sell produce to state enterprises (which would give even lower prices) if the community would not consume. This is the second premise. Therefore, the contradiction between central plan and market forces seems to keep a catch built into the system where the organopónico workers cannot generate profits on any significant level without continuously finding new markets. However, as the second premise gives, the community will consume when prices are below 5 pesos and this is how the administrators understand that the system should work. This makes it hard for the organopónico workers to acquire fixed capital, for example by investing in irrigation systems. The workers must also continuously negotiate the contradiction between central planning and market forces to keep their salaries balanced.

Even so, both Ana Reina and Antonio Lazo, with whom I discuss this more deeply, see the contradiction as rational. Ana Reina explains the plan as setting a social contract between organopónico workers and the community that the organopónicos serves:

[The plan] is for work discipline. If I'd be free, I wouldn't have to respond to you; with a plan you say that you should sell, that this is the production.

The plan is also an instrument for the workers to know that they are fulfilling this social contract, she continues:

Or if there is a loss the workers know that there was a loss. You evaluate.

She then explicitly states that the plan keeps some from making overtly large profits, as she tries to motivate the need for the plan:

⁶⁴ AR, 20 February.

On the contrary, I don't sow anything—I have money, there is nothing to sell [...] Or I sow, I don't know, I should sow a vegetable but I sow grapefruit [*toronja*] that will give me more money than a vegetable and I sow only to earn, you understand?⁶⁵

Antonio Lazo, more clearly uses tropes from socialist discourse to explain why they do not strive for larger profits. He calls the institutions through which they supply the city with food 'a capitalist system...that of course isn't capitalist':

Capitalism is to think in your personal fortune, your family and that; we have another way, we think of the country, the common good [*el conjunto*], in the people; because we are part of the people. Therefore, well, we don't do that, we don't work with a capitalist mentality. So we do it more or less in capitalist style, but not with this, how to say, this capitalist thing. I tell you, we don't throw away [*no botamos*] because of the market because we can't keep the prices, we think that we should sell to the people. [...]

I'm telling you, a market is opening up, which isn't capitalism, it is according to the laws of capitalism, but it is not with this idea, this idea that some people should become rich. [...] I tell you, if we don't sell at 5 pesos we sell at 4, we sell at 3, at 2, at 1. If we sell at 1 we sell at 1, but we don't close. We wait for the prices to rise.⁶⁶

The two administrators in this way legitimise the contradiction and explain it as an institution where organopónico production, although largely performed by independent workers, primarily serves the community. In doing this, they must continuously negotiate the contradiction to keep salaries balanced and break even economically. This, in turn, is crucial to enrol material inputs and ecological processes in production. 'So can you say that the plan is to fulfil the social role [of the organopónico]?', I end by asking Ana Reina:

Yes, no, not so much as the social role; in reality it obliges you, it disciplines you, it stimulates you. It stimulates you to always do better; to sow better things; the final result is that the population receives a product which arrives with quality and a fair price. But if there is no production plan, there is no control, there is nothing, to say, after which you are working.⁶⁷

SCALING THE ORGANOPÓNICO INSTITUTIONALLY

So in sum, how are the organopónicos articulated as places in relation to political and commercial institutions? The organopónicos exist in relation to institutions that appear as nested scales: what goes on in the organopónicos is wound up in decisions and processes that take place on scales that represent the Cuban 'nation', 'provinces', and 'municipalities' as spatial units. Thus, organopónico production is affected by processes that take place on a significantly larger scale than what we understand as the

⁶⁵ AR, 20 February.

⁶⁶ AL, 29 January.

⁶⁷ AR, 20 February.

organopónico itself. Urban agricultural production in the organopónicos along the Vial is regulated through this scalar setup which spatially differentiates the Cuban urban food supply system—from the nation to the municipality's consejos populares to the organopónicos and places therein, such as the canteros. In this institutional scalar assemblage, the organopónicos are either UBPCs or organopónicos arrendados: a UBPC is independent in relation to the institutional hierarchy when it comes to contracts and payments and in regulating the labour power that is enrolled in the garden (employment, electing the leadership, budgeting salaries). An organopónico arrendado, in contrast, is bound to the municipal body that governs urban agriculture, the Granja Urbana, where business and leadership is administered. The regulation of labour power, still, is in the hands of the organopónico arrendado workers. Production in organopónicos arrendados basically follows the equation of incomes minus rent minus inputs minus salaries, after which the workers are free to share a potential economic surplus or to reinvest it in production. UBPC production, in comparison, is stricter where all operations are annually budgeted. It is the organopónicos' responsibility to break even economically without institutional economic support. While the workers of a UBPC have an independent legal status they have a greater administrative task than organopónico arrendado workers.

The organopónicos are strongly connected to the state, politically and commercially, in the institutional scalar assemblage of urban agriculture. The Granja Urbana is the institution spatially closest to the organopónicos. The administrators are themselves active in decision making and in communicating with the Granja. Organopónico production is impossible to understand without focusing on the structural relation between the organopónicos and the Granja Urbana.

The Granja Urbana is an operational unit of the Ministry of Agriculture. Through a political leg, spanning from the National Urban Agriculture Group through provincial bureaucracies to the Granjas, the frames for production are set through a central plan. The workers continuously have to negotiate the complex of fulfilling the plan, which regulates supply, while marketing their harvest according to the supply and demand of the urban market. Negotiating the contradiction, it is up to the organopónico workers to find markets for their produce which is crucial to generate incomes. At the same time, they are obliged, through the central plan, to produce 20 kilograms of vegetables per square metre per year. As they find markets, they must set prices according to the demand of the market while producing according to the set supply. This potentially places the workers in a vulnerable situation as there is no institutional economic support when sales are bad and production must continue. As Ana Reina Diaz Cordero explains, the administrators must have different price-setting strategies to negotiate the contradiction. They do this, however, with an understanding of organopónico production as primarily aiming to supply the community with vegetables, rather than to make a profit.

Furthermore, the political leg encourages certain ecological processes in the organopónicos including an array of compulsory crops. A specific physical outlay of the gardens is promoted through the GNAU's evaluation criteria. Through the political leg the organopónicos also

connect to other societal initiatives through projects. Via a commercial leg, in turn, spanning from MINAG through their ownership of Emp. Tabaco to the Granja, the central planning process is monitored and approved. Ultimately, it is through this structure that the organopónico workers are able to acquire necessary inputs for the metabolism of the organopónicos. The intactness of this institutional scalar assemblage that regulates and mediates socioecological flows is therefore crucial to fulfil the central plan and to metabolise the city with food.

Next I turn to the biophysical materials, energy sources, and ecological processes that are enrolled in production. How are the organopónicos articulated as places in relation to the material flows and ecological processes that sustain production? Together with the institutional setup that has been explored in this chapter, and that mediates the metabolism of the organopónicos, these material flows construct the scaled spatial assemblages of socioecological relations that enable organopónico production.

The metabolism of the organopónicos

ORGANIC MATERIAL

The organopónico method of farming was invented to permit agriculture in areas where soils are infertile and hard to work. In the organopónicos canteros are filled with a mix (*la mezcla*) of organic materials that provides nutrition for the crops. The same soil mix is used for all crops, although some cultigens such as radish need softer soil for their roots to develop.⁶⁸ The same ingredients are used in all organopónicos along the Vial. The quantities of each material may be different, however, in different organopónicos.

Compost. All gardens have active composts (*compós*) where byproducts from production, such as haulms and husk, are deposited for decomposition. The resulting compost is then used as an organic material in the canteros. The amount of compost that is possible to produce in each organopónico varies. In Ampliación Erea where a large area is devoted to banana cultivation, the administrator explains that banana residues provide lots of potassium rich compost.⁶⁹ Ampliación Erea

⁶⁸ AR, 25 January.

⁶⁹ AL, 29 January.

therefore has more biomass to compost in comparison to La Pesca where all space is dedicated to canteros. Consequently, La Pesca is more dependent on other sources of organic material.

Earthworm humus. According to GNAU guidelines, all organopónicos must have a vermiculture (*lombricultura*) that supplies earthworm humus (*humus de lombriz*) in ‘a nearby area’.⁷⁰ La Pesca and El Vial have their own vermicultures whereas Ampliación Erea and Erea No. 1 share the vermiculture located in Erea No. 1. In time for the GNAU inspection in late February, the workers in Ampliación Erea were activating a vermiculture within their organopónico to increase their evaluation result. The UBPC, in turn, was experiencing problems with their vermiculture which was completely dried out and the workers were working to reactivate it with new worms. The vermiculture is usually fed in the organopónicos with harvest byproducts or livestock manure.⁷¹

Chicken manure. One of the most important sources of soil fertility is chicken manure (*gallinaza*). This is bought from chicken runs outside the city. As large quantities are used, it is acquired from several chicken farmers who are located both within the municipality of Pinar del Río and in neighbouring municipalities.⁷² Chicken manure is brought in lorries to the organopónicos through the mediation of Emp. Tabaco. Ana Reina Diaz Cordero in UBPC Micro-Brigadas explains that chicken manure must be mixed with compost in the organopónico to ensure that it is not too strong and will burn plant roots.⁷³

Peat. When the amount of compost is insufficient, peat (*turba*) is purchased from a peat bog in neighbouring municipality San Luis. Peat is also transported to the city in lorries running on diesel or petrol.⁷⁴ Environmental historian Alfred Crosby (2006: 61) calls peat ‘the adolescent fossil fuel’; biomass that has decomposed without the presence of oxygen over several thousand years. It is a relatively carbon intense source of organic material which is available close to the organopónicos. The long period of peat formation must make it considered a non-renewable energy source.

Livestock manures. Livestock manure (*estiércol vacuno*) is either used to feed vermicultures or is mixed with compost and put directly in the canteros. UBPC Micro-Brigadas has the most diversified use of manures. As they are a UBPC they are permitted to sell products and services other than vegetables, which is not the case for organopónicos arrendados.⁷⁵ For this they have recently started to breed rabbits and pigs which will be sold for slaughter as alternative protein food sources. At the end of my fieldwork the UBPC had seven rabbits with seven rabbit babies and three pigs. The income, the worker in charge of husbandry explains, will at first be reinvested in production to breed more rabbits and pigs.⁷⁶ In the meantime all faeces are collected and used as

⁷⁰ See Appendix.

⁷¹ AR, 25 January; HBH, 4 February.

⁷² AL, 29 January; HBH, 4 February; FN, 18 February, interview with El Neno.

⁷³ AR, 25 January.

⁷⁴ AR, 25 January; AL, 29 January; HBH, 4 January; FN, 18 February, interview with El Neno.

⁷⁵ AR, 20 February; AL 29 January.

⁷⁶ AR, 25 January, note of conversation with worker.

manure. The UBPC also has four horses that they use for traction and transport with two-wheeled wagons and whose dung is used as manure. These animals all feed on organopónico produce.⁷⁷

El Vial, in turn, has four cows and a horse that graze in an open area outside the organopónico enclosure. Their dung is used to feed the vermiculture. Erea No. 1 and Ampliación Erea buy cow manure from farmers outside the city.⁷⁸

Sawdust. Sawdust (*asserín*) can be added to the soil mix to make it more porous and increase drainage. The organopónicos along the Vial rarely purchase sawdust but Ana Reina Diaz Cordero explains that sawdust often accompanies the chicken manure they buy. As chicken farmers swipe the floors to collect manure other materials such as sawdust come along.⁷⁹ El Neno, the administrator of Erea No. 1, tells that they earlier used to cover the paths between the canteros with sawdust to reduce the growth of weeds. This sawdust could then, although it was only rarely done, be added to the soil mix after it had begun to decompose in the foot paths.⁸⁰

Limestone. Hecton Bentamé Hernandez in El Vial explains that they sometimes buy limestone (*cal*) from a lime quarry in Santa Lucia in neighbouring municipality Minas de Matahambre.⁸¹ El Vial is the only of the five organopónicos to do this. When I ask El Neno in Erea No. 1 about limestone he explains that chicken manure serves the same purpose as it is rich in calcium content.⁸²

Cachaza. Cachaza is a filter cake mud consisting of small fibres that have been filtered apart from sugar cane juice. It is one of the most extensively utilised organic fertilisers in Cuba, in part as the sugar industry has kept it available in large quantities. Four percent of the sugar harvest results in cachaza (Treto et al. 2002: 167). As a biofertiliser, cachaza is widely used in Cuba's urban farms (Companiononi et al. 2002: 232) but it is not used in any of the organopónicos along the Vial. When we discuss the topic, Hecton Bentamé Hernandez in El Vial explains that 'No, it's too far off; cachaza is in San Cristóbal, in Bahía Honda, very far. It's good but it's too far off [to get]. Now it's practically out of the province.'⁸³ The other administrators give the same responses: the sugar centrals are too far away to make it practical or economically sound to acquire cachaza. However, if it were accessible they would happily use it.⁸⁴

The absence of cachaza in Pinar del Río's urban agriculture is as interesting to note as the actual use of other organic materials. All organic material that is used is either produced within the organopónicos (compost, vermiculture, livestock manures) or is purchased from places located in

⁷⁷ AR, 25 January.

⁷⁸ AL, 29 January; FN, 18 February, interview with El Neno.

⁷⁹ AR, 25 January.

⁸⁰ FN, 18 February, interview with El Neno.

⁸¹ HBH, 4 February.

⁸² FN, 18 February, interview with El Neno.

⁸³ HBH, 4 February. As of 1 January 2011, the municipalities San Cristóbal and Bahía Honda belong to the province Artemisa. The former province La Habana was then split into western Artemisa and eastern Mayabeque where Artemisa also retained three eastern municipalities of Pinar del Río province.

⁸⁴ AL, 29 January; FN, 18 February, interview with El Neno.

other municipalities of Pinar del Río province (chicken manure, peat, cow manure). In the latter case, organic material is transported by Emp. Tabaco to the organopónicos in lorries metabolised with diesel or petrol which is supplied through internationally scaled trade relations. Cachaza, on the other hand, is not used as the scaling of this practice would displace the source of organic material too far off from the organopónicos. In terms of organic material and soil fertility, the organopónicos along the Vial are thereby provincially self-reliant. Consequently, their production of vegetables in this sense maintains a relatively localised food supply system. Still, the scaling of the socioecological relations that enable urban agricultural production extends out of the city.

The fate of impoverished soil. From the array of organic material inputs listed above, it is clear that unless a mix that has been used a few times is not removed the canteros would overflow with soil. In all the organopónicos the same soil mix is reused for several rotations with different crops. In El Vial, when the soil is finally impoverished, it is disposed of in an area outside the organopónico, on the garden's western side where a canal runs from river Guamá.⁸⁵ In UBPC Micro-Brigadas, equally, Ana Reina describes that '[a]fter some time or for larger crops like moringa, the soil is exhausted and we have to throw it away. It is put in a place away from the organopónico.'⁸⁶ When I ask El Neno in Erea No. 1 what they do with impoverished soil, in contrast, my interview notes read that

he seemed somewhat uncomprehending [to my question] and explained that they put it [the used soil] in the large heap of 'Materia orgánica' that is right by the [garden] gate and mix it with chicken manure, compost, and peat to make it fully usable again. But at some point the heap must become too large, I asked, but then it is just a matter of selling the good soil to a *finca* or a cooperative somewhere.⁸⁷

The methods of soil management differ slightly among the organopónicos along the Vial, but the spatial flows of organic material have the same direction in all of them. New fertile matter must enter the gardens as surplus or impoverished soils exit.

SEEDS, WATER, AND ELECTRICITY

Next to organic material, urban agricultural production depends on the organopónicos' metabolism with seeds and water. The metabolism of the irrigation systems that are used in the organopónicos, in turn, enrolls electrical energy to propel water pumps. This connects the organopónicos and the canteros therein to socio-metabolic systems where electricity is generated and distributed.

⁸⁵ FN, 21 February, interview with Hecton Bentamé Hernandez.

⁸⁶ AR, 7 February.

⁸⁷ FN, 23 February, interview with El Neno.

Seeds. The organopónico workers produce some seeds on their own within the gardens. Lettuce, string beans, chard, and radish can generally be produced within the organopónicos. Tomato (*tomate*) seeds are also produced in El Vial.⁸⁸ In one occasion Antonio Lazo in Ampliación Erea showed me their seed production and explained the reason behind it primarily as a matter of quality:

Look, here we are making some seeds. Chard, lettuce—so we don't have to buy it—in this way we know what we are planting. It's good quality lettuce. And if I get a lot I put in a jar and keep in the refrigerator and I will have fresh lettuce seeds.

Me: And for what else than chard and lettuce do you produce seeds?

Antonio: String beans, chard, we can make pepper [*pimiento*]*—in all its varieties—*aubergine [*berejena*]. [...] Also spinach [*espinaca*] we can reproduce.

I also asked if he sometimes sells seeds to others, but

I haven't made it a habit; if some people come and look for some seed I usually give it to them. But I sell cuttings to other organopónicos, to *parceleros*, private growers and the like.⁸⁹

However, the bulk of seeds used in the organopónicos is bought from the Granja Urbana's seed shop, the Tienda de Semilla, or in the case of the UBPC sometimes from a contractor in Consolación del Sur municipality. Cuttings are also acquired from the Granja's cuttings greenhouse, the Casa de Postura. 'Generally it is much easier to buy seeds (which is cheap) as they are produced in places designed for the purpose', my notes from an interview with El Neno in Erea No. 1 read. According to El Neno, all seeds they can buy are produced nationally.⁹⁰

Therefore, depending on species and local circumstances, the metabolism of the organopónicos with seeds looks different. In some cases the seed supply process is internalised in the unit of production. In other cases the organopónicos depend on relations which are scaled far off from the gardens but still make the Cuban island territorially self-supplying.

Water and electricity. For a continuous supply of water to the crops the organopónico workers must rely on other sources than rainfall. Rains are heavy during the hurricane season that approximately spans from June through October with a peak at the turn of the month August/September. During this period, rains can be so plentiful as to make cultivation difficult. The rest of the year the organopónico workers depend on irrigation technologies. The mode and state of irrigation varies among the organopónicos and irrigation is in some cases the most difficult obstacle to production. None of the organopónicos have financial resources to buy an irrigation system and Ana

⁸⁸ FN, 24 January, interview with Hecton Bentamé Hernández; 18 February, interview with El Neno; AL, 29 January.

⁸⁹ AL, 29 January.

⁹⁰ FN, 18 February, interview with El Neno, my translation from Swedish.

Reina Diaz Cordero explains that one sprinkler would cost more than CUC\$25, i.e. over 625 pesos. The only way to obtain one is thereby through an internationally funded project.⁹¹

La Pesca is the only organopónico where the workers were fully satisfied with their irrigation system. They had recently received a system with eight sprinklers through a project.⁹² The irrigation system in the large organopónico El Vial was also intact but as will be described later the administrator was not fully satisfied with the design of the irrigation system to be able to intercrop plants. UBPC Micro-Brigadas truly suffered from problems with the irrigation system. Their irrigation system used to cover the entire garden but it broke several years ago and now only covered the organopónico's northern half. The hoses that the workers could use to manually irrigate canteros, in turn, were too short to cover the area left without irrigation which made cultivation in a large part of the garden extremely difficult.⁹³ Erea No. 1 and Ampliación Erea had until my fieldwork period irrigated their entire gardens manually with hoses. I could nevertheless witness the installation of a large water tank, water pipes, and sprinklers in Ampliación Erea.⁹⁴ Both organopónicos were now receiving irrigation systems. Tamara, a worker in Ampliación Erea, explains that the irrigation system will save many hours of work for her as she now only will have to press a button to irrigate the whole garden instead of moving a hose from cantero to cantero.⁹⁵ As my fieldwork came to an end only a water pump was missing for the irrigation system to be up and running.

Whereas the organopónicos are dependent on internationally scaled relations for acquiring the irrigation infrastructure there are two sources for obtaining the actual water. La Pesca and UBPC Micro-Brigadas have their own wells while El Vial shares a well with UEB La Mariposa. In this way the organopónicos are continuously metabolised with water stored in the ground through access points scaled within the gardens. The irrigation systems being constructed in Erea No. 1 and Ampliación Erea, in contrast, would be connected to the city aqueduct.⁹⁶ Water in this centralised supply system is propelled by pumps that run on electricity from the National Electricity System (SEN). The water pumps that propel the individual irrigation systems in the organopónicos all also run on electricity from the SEN.⁹⁷ According to a half yearly report, January to June 2010, from the Cuban National Statistics Office (ONE 2010), 58 percent of all electricity in the SEN was generated in thermoelectric plants, which are fuelled by domestic and imported crude oil; 13 percent came from combined oil and natural gas generation; and 21 percent from distributed generators fuelled by diesel and fuel oil. For the metabolism of the irrigation systems, the organopónicos are thereby hooked up in

⁹¹ AR, 7 February.

⁹² FN, 24 January, interview with administrator of La Pesca.

⁹³ AR, 7 February.

⁹⁴ FN, 18 February.

⁹⁵ FN, 30 January, interview with Tamara.

⁹⁶ AL, 29 January.

⁹⁷ AR, 22 January; HBH, 23 January; LP, 23 January; AL, 29 January; FN, 18 February, interview with El Neno.

larger scaled industrial systems of carbon-intense energy flows. This is true regarding both water and electricity supply.

INTEGRATED PEST MANAGEMENT AND THE USE OF BIOCIDES

A most critical aspect of the organopónico farming process is to keep the gardens shielded from pests and insects that feed on crops. All the organopónicos around the Vial use five major methods for pest management. During the GNAU's inspections these methods are reviewed and the organopónicos receive high points for well developed systems of integrated pest management. Out of 100 evaluation points 35 points are related to pest management.⁹⁸

Repellent plants, traps, and barriers. The organopónicos are physically divided by plants and traps that set up certain physical as well as ecological spatial relations within the gardens to hinder pest migration. This is done in three ways. First, at the ends of each cantero, a set of plants are grown to fend off threatening insects. These are marigold (*marigol* or *flor de muerte*); two kinds of basil (*albahaca blanca* and *albahaca negra*); and the succulent herb *orégano francés*, which is variously known in English by names such as country borage, French thyme, and Cuban oregano. (See figure 3). There are also neem trees (*nim*) planted in the gardens. Neem leaves and fruits are ground into a powder which produces an effective bio-insecticide when suspended in water.⁹⁹ According to the field manual I was provided in El Vial, neem extract works as a repellent, stops digestion, is sterilising, and regulates growth of 160 different species of insect pests.¹⁰⁰

Second, along with the repellent plants are insect traps. These are made from plastic bottles placed horizontally on a wooden frame where the sides of the bottles have been cut open and the bottles filled with molasses to attract and capture insects.

Third, the organopónicos are physically divided into compartments and are enclosed by hedges of banana (*plátano*), maize (*maíz*), millet (*mijo*), and guava (*guayaba*). These tall-growing plants act as barriers between sections of canteros and to the outside of the garden to thwart pest and insect migration.

Burning the soil. Caution is taken as soon as organic material is moved both into and within the organopónicos. Ana Reina Diaz Cordero describes that they always leave chicken manure and peat in the compost after it has been brought to the organopónico before it is used.¹⁰¹ In this way fungi and nematodes have a harder time to survive from the heat generated from decomposition. In

⁹⁸ These are substrate quality (10 points), 50 percent or more canteros intercropped (5 points), control of pests and diseases (10 points), and the existence of barriers and repellent plants (10 points). See Appendix.

⁹⁹ AL, 29 January.

¹⁰⁰ Photograph of untitled field manual, page 52. The manual was demonstrated to me by Hecton Bentamé Hernandez.

¹⁰¹ AR, 25 January.

Erea No. 1, the first thing you see as you enter the garden is a large heap of organic material where the soil mix is prepared before it is put in the canteros for the same reason.

After the harvest, when canteros are again prepared for cultivation, the soil is formed into a V-shape inside the cantero to expose it to as much sunlight as possible. It is then left for a day so that the sun will burn remaining pests.¹⁰² These spatial-ecological interactions within the organopónico between compost, cantero, organic material, and the sun act to minimise disease risks.

Polycropping and crop rotation. The organopónicos are polycultures in several dimensions. On an aggregate level, at least ten crops are grown at any one time in the organopónicos (for instance in La Pesca) but this can add up to thirty crops. Different crops are usually cultivated in adjacent canteros (ex. chard, beetroot, lettuce, spinach, lettuce, strawberries, etc.)¹⁰³ or with one crop in a cluster of canteros adjacent to another cluster or several single-crop canteros (ex. cress, lettuce, lettuce, lettuce, lettuce, carrots, chives). One cantero can be divided into adjoining sections with two or more cultigens in the same bed (ex. beetroot, lettuce, and carrots); and, canteros are often intercropped (*intercalados*) meaning that one or more cultigens are sown between the rows of the dominant crop (ex. lettuce intercropped with chives). (See figure 4). According to the guidelines from GNAU, 50 percent of all canteros must be intercropped. In some organopónicos this was a task that took a lot of effort in preparation for the GNAU visit in late February.¹⁰⁴ One difficulty with intercropping, Hecton Bentamé Hernandez in El Vial explains, is irrigation. The irrigation system they currently used had sprinklers placed between the canteros which showered the crops from a distance. This meant that the tomatoes they wanted to keep intercropped with other vegetables would take most of the water with their deep roots and leave the plants with shallower roots dry:

If we had a MicroJet irrigation system it would be possible to intercrop cucumber [*pepino*], radish underneath; lettuce again. It would be possible to intercrop.

Me: Why isn't it possible right now?

Hecton: Because it's very difficult with the irrigation system that we have. It is dry; if we sow radish it won't grow because it will be dry. We put some water with a hose but that goes into the centre [... of the cantero in which the soil is concavely shaped with the tomatoes in the middle]. And the edge where we should be able to sow radish is higher and the moisture doesn't get there. Because the tomatoes take the water with the deeper roots.¹⁰⁵

Polycropping also takes place in the temporal dimension through crop rotation. 'The most important thing to keep in mind here is that you constantly have to keep sowing. As soon as a cantero is empty you have to cultivate it', describes Antonio Lazo in Ampliación Erea.¹⁰⁶ When crops

¹⁰² AR, 25 January.

¹⁰³ This and the following examples are from Erea No. 1 on 18 February 2013.

¹⁰⁴ FN, 5 February.

¹⁰⁵ HBH, 4 February.

¹⁰⁶ AL, 29 January.

are rotated, as well as intercropped, they utilise different nutrients in the soil and because they have differently shaped root systems they also take up nutrients at different soil levels. The organic material in one cantero can therefore be used during several rotations without being impoverished. Crops with growth cycles of varying length generally follow each other (ex. radish following string beans) and Ana Reina Diaz Cordero explains that one should try not to plant two crops that belong to the same family in sequence.¹⁰⁷ This is because the genetic similarity makes the crops more vulnerable to disease. There are also certain crop associations that the workers try to take advantage of. For instance, cabbage should be grown after carrots as carrots minimise cabbage disease risk.¹⁰⁸

The agroecological logic behind this is that ‘diversity is the enemy of epidemics. [...] Any agricultural practice that increases diversity over time and space, such as crop rotation or mixed cropping on a farm or in a region, acts as a barrier to the spread of epidemics’ (Scott 1998: 269). If a farm consists of one single species, on the other hand, where all individuals incidentally also are genetically identical, an insect can happily see the entire farm as its dinner table. A diverse farm is more resilient to pest outbreaks as different crops act as barriers for pathogens to spread and thereby spatially limit their habitats. Some crops may also be more resistant to drought while others can manage in overtly wet conditions, which makes the diverse farm more resilient to climatic stress.

In sum, the use of repellent plants, plant barriers, grease traps, burning of the soil, and the practice of polycropping and crop rotation are activities where the organopónico workers mediate certain ecological processes. As these practices take place they are scaled within the organopónico as a spatial unit (and consequently act to constitute the organopónico as a scaled place). Repellent plants and traps constitute predator-prey interactions that work as physical barriers along with banana and maize hedges. Ecological interaction between organic material and sunlight in various places inside the organopónico reduces the risk for surviving pests. Polycropping sets up specific ecological relations between the canteros (different adjacent crops); within the canteros (adjoining crop sections); and even between sown rows (intercropping). Crop rotation similarly encourages certain ecological relations temporally.

Biocides. In addition, two methods of pest control are used where the organopónicos are scaled in relations that extend outside the gardens’ perceived boundaries. Early during the Special Period over 200 biotechnology production centres called Centres for the Reproduction of Entomophages and Entomopathogens (CREEs) were established across Cuba (see Funes 2002: 16–17). These centres produce organisms that feed on insects (entomophages) or cause diseases in insects (entomopathogens).¹⁰⁹ Cuban farmers, in all agricultural sectors, can buy these fungi, plants, and insects and use them to control attacks by inserting a natural predator to prey on insects or

¹⁰⁷ AR, 25 January.

¹⁰⁸ HBH, 23 January.

¹⁰⁹ I am thankful for the help of Nickolas Panagiotopoulos in making these words comprehensible to me by translating them from their Greek origin.

microorganisms threatening the crops. In this way the interactions of a natural ecosystem are mimicked in the agroecosystem.

There are two CREEs in Pinar del Río, one north of town in La Conchita and one south of town on the road to La Coloma. All the organopónicos arrendados purchase products from the CREEs through the Granja Urbana; in other words, Emp. Tabaco is the formal customer. UBPC Micro-Brigadas only uses one product from the CREEs (Trichoderma) and Ana Reina Diaz Cordero explains that this is something they buy from the Granja.¹¹⁰ As is the case with seeds, it is more convenient for the UBPC to write this contract through the Granja rather than to arrange transports, etc. independently with the CREE.

The most commonly used product is Trichoderma. This is used in all organopónicos along the Vial. Trichoderma is an antagonist fungus that attacks soil-borne pathogens and it is produced on rice husk (see Pérez and Vázquez 2002: 116). Other products that are used in El Vial, Ampliación Erea, and Erea No. 1 are different strains of *Bacillus thuringiensis* (Bt) and *Beauveria bassiana*. The Cepa-66 is a strain of Bt which ‘kills in the soil, the parasites’, in the words of Antonio Lazo, and *B. bassiana* is an entomopathogenic fungus that parasitises on arthropods.¹¹¹ A fourth product is Tabaquina which is made from byproducts from tobacco production in the province and often is mixed with neem extract.¹¹²

Finally, two products are used against snails, at least in El Vial, called Caracolé and Bavotró.¹¹³ These are brought by Emp. Tabaco who according to Hecton Bentamé Hernandez has the products in storage.¹¹⁴

Chemical pesticides and Sanidad Vegetal. In the event that a severe disease invades an organopónico and spreads in a crop, the use of chemical countermeasures can be authorised by a branch of the Granja Urbana called Sanidad Vegetal (literally ‘Plant Health’). ‘Sanidad Vegetal is part of the GU [Granja Urbana] with its own technicians who come to help if you have problems’, my notes from an interview with Ana Reina Diaz Cordero reads.

The inspector (who also authorises the use of chemical pesticides) works in Sanidad Vegetal but comes from the outside, from MINAG on provincial level. The inspector participates in the GU but has no formal position in it.¹¹⁵

Towards the end of my fieldwork, the tomatoes in El Vial had attracted such a severe disease. Hecton Bentamé Hernandez then brought the issue to a Monday meeting in the Granja to be authorised to apply a chemical pesticide.¹¹⁶ I have not been able to find out where chemical pesticides

¹¹⁰ AR, 25 January.

¹¹¹ AL, 29 January.

¹¹² AL, 29 January; HBH, 4 February.

¹¹³ I am uncertain of the spelling of these brand names.

¹¹⁴ HBH, 4 February.

¹¹⁵ AR, 7 February.

¹¹⁶ HBH, 4 February; FN, 5 February, interview with Hecton Bentamé Hernandez.

come from, but their chemical content unavoidably make them dependent on petro-industrial metabolic systems.



Figure 3: Pest management with repellent plants in El Vial. Basil and marigold averting pests at the ends of *canteros*. (Photograph by the Author, Pinar del Río, 2013).



Figure 4: Polycropping in Ampliación Erea. Adjacent *canteros*, left to right: leek, beetroots, lettuce with chives adjoining; lettuce with chard and chives intercropped; lettuce; leek. (Photograph by the Author, Pinar del Río, 2013).

LABOUR POWER

As was discussed in chapter 3, human labour is an important aspect in the organopónicos' metabolism; for example, it is through human labour that organic material, seeds, irrigation, and pest management are actively enrolled in agricultural production. Scholars who have worked with the metabolism concept strictly in the Marxist tradition even see labour at *the* process where humans mediate the metabolism between themselves and the rest of nature. However, the work done by human labour power, in the sense of the words that can be expressed in terms of watts or joules per second and that a physicist might ascribe them, is also a crucial energy source in the metabolism of the organopónicos.

In the participatory mapping exercise in UBPC Micro-Brigadas, the workers indicated a connection between 'the population' and the organopónico as a relation of 'work' in one direction and of 'employment' in the other. This connection is regulated through the institutions of employment, salary payment, and leadership election, which was described in the previous chapter. UBPC Micro-Brigadas employs 10 people, El Vial 34, La Pesca 4, Ampliación Erea 5, and Erea No. 1 10. This means that there are on average 262.5 square metres of cantero per worker and that each worker annually produces slightly more than half a tonne of vegetables if the 20 kilograms production plan is

kept.¹¹⁷ James Scott (1998: 418 note 48) argues, in a discussion contrasting industrial agriculture with peasant/agroecological farming, that peasant farming often is seen as economically inefficient in comparison to industrial agriculture due to its labour intensity.

Organic farmers have occasionally opted for mixed cropping as a way of avoiding the heavy use of fertilizers and insecticides. The most common obstacle to certain (not all) forms of polyculture is that they are too labor intensive in a context where labor is the scarce factor of production. It is hard to know how much of this labor intensiveness is the result of the fact that virtually all machine implements have been designed with monoculture exclusively in mind.

In contrast, it has many times been pointed out in the debate on Cuban urban agriculture that the labour intensive polycultures were an important source of employment during the Special Period. Richard Levins (2005: 22), who explicitly writes from a pro-Cuban policy standpoint, argues that urban agriculture in fact is socially efficient:

It provides employment for some 300,000 people at a time when capital is not available to invest in more industrial employment. This comes to about ten people per hectare, a very labor-intensive system that would be regarded as highly inefficient in the United States, though each worker is producing ample vegetables to feed 36 people. In the context of the unemployment that appeared with the Special Period, it is socially efficient.

What is 'efficient' in terms of labour power input may here also be a contradiction in terms of economic efficiency contra ecological-thermodynamic efficiency. The technologies that are available to work monocultures, which Scott points to, all depend on socioecological-spatial assemblages that are globally scaled and consume fossil fuels. The human labour power that does work (again in the physics sense) in the organopónicos in Pinar del Río is considerably more localised and consumes less energy to do work. The labour is therefore thermodynamically more efficient but economically inefficient in light of currently available technology to do the same amount of work.

Some of the workers in the organopónicos along the Vial live in Hermanos Cruz, the community that the gardens serve with vegetables. Others commute from other parts of Pinar del Río or even from out of town.¹¹⁸ Agroecologists often argue that farming should be a community undertaking meaning that labour power should be supplied as close as possible to the farm (e.g. Morgan, Murphy, and Quinn 2006). In the organopónicos in Pinar del Río, labour supply enters the organopónicos on a larger scale than the nearest community.

Furthermore, the workers themselves tie into the urban food supply system to be able to work. The workers constitute a form of subsystem where they must eat to be able to produce food

¹¹⁷ Cantero areas: UBPC Micro-Brigadas 2,705 m²; El Vial 10,330 m²; La Pesca 600 m²; Ampliación Erea 900 m² (this garden is nevertheless almost 0.5 ha in size with a large banana plantation that has not been included in the equation); and Erea No. 1 2,000 m². (AR, 22 January; HBH 23 January; La Pesca (LP), 23 January; AL 29 January; FN, 30 January, interview with Antonio Lazo; FN 18 February, interview with El Neno.)

¹¹⁸ AR, 22 January; HBH, 23 January; AL, 29 January.

within the same socio-metabolic structure. In the UBPC, the cooperative is allowed to collectively purchase foodstuffs with state subsidies for consumption in the organopónico. Vegetables are supplied from the canteros while rice, beans, and other protein sources are acquired in state shops.¹¹⁹ For the organopónicos arrendados, on the other hand, the situation is different as they cannot set contracts themselves:

Hecton Bentamé Hernandez: Lunch we usually buy in some other canteen. We interchange products with some of the organisations that we sell to, but lunch we have to get elsewhere.

Me: And why isn't it possible to prepare it here [in El Vial]?

Hecton: It is very difficult... we don't have an assignation. We have to buy for high prices. Rice, beans—fundamental things, eggs. When we are at the Granja Urbana we can eat there because they also have a canteen. These are things that UBPCs can solve, they have an assignation of rice and beans and eggs.¹²⁰

Energy to metabolise the labour power of workers is thereby essentially external to the organopónicos.

SCALING THE ORGANOPÓNICO ECOLOGICALLY

Organic materials, seeds, water, electricity, pest management, and labour power all contribute to the metabolism of the organopónicos. These material flows and ecological processes articulate the organopónicos as places as they are enrolled in production. In the metabolic process, several of these relations are internalised in the organopónico complying with agroecological ideals of organising a locally autonomous farm. Compost, earthworm humus, some seed production, as well as pest management through the use of repellent plants, grease traps and barriers, burning of the soil, and polycropping and crop rotation set up spatial relations within the organopónico which enable and sustain production internally. Other relations act on an urban scale where labour power, biocides from the CREEs, and water is supplied from within the city.¹²¹ Other relations are scaled out of the city where the organopónicos rely on places in neighbouring municipalities to metabolise production with chicken manure, peat, livestock manure, sawdust, and limestone. All of these municipalities belong to Pinar del Río province and the case of cachaza shows that reliance on spatial relations extending out of the province are avoided by the organopónico workers.

Up to this point it can be concluded that urban vegetable production depends on material flows that are scaled within Pinar del Río province. The organopónico workers' major reason for not relying on relations that extend outside the province, such as using cachaza, is that the

¹¹⁹ AR, 25 January.

¹²⁰ HBH, 23 January.

¹²¹ It is of course questionable whether water is supplied from within the city only because wells are located there.

relations' sustenance depends on transports that consume diesel and petrol. These fuels are imported through international scalar relations. However, although this is the case for cachaza, certain metabolic relations adhere to what the scholars cited in chapter 3 would term an industrial agricultural system. Electricity depends on international oil trade; chemical pesticides are in some cases used in the organopónicos; and tools and capital goods are supplied through internationally funded projects. These relations are all mediated on a national scale through the Cuban state.

This suggests that food supply in Cuban cities is dependent on distinct and diverse socioecological scalar assemblages: the organopónicos are linked with industrial, petro-dependent processes, close and far off, while they at the same time have a narrower spatial reach of resource use in a more localised environment. In view of the latter, they reduce energy throughput and diminish the cycling of carbon in vegetable production and urban metabolism compared to the system feeding the fat cow of the 1980s.

Scaling the organopónicos through spatial assemblages

At this point it can be concluded that organopónico production is enabled by two distinct but closely interrelated scaled spatial assemblages of socioecological relations. One assemblage is embodied by the UBPC and one is embodied by the organopónicos arrendados. These assemblages consist of a scalar setup of institutions that the organopónicos exist in relation to; and through the mediation of these institutions material inputs and ecological processes are enrolled in production. The two previous chapters have outlined the institutional and ecological dimensions of these scaled spatial assemblages. In the following I will bring the two dimensions together to see what the new assemblages imply in Cuba as they represent a low-carbon energy system (or at least less-carbon compared with the system under Soviet dependency—urban agriculture in Cuba still relies on some carbon-intense fossil fuels). To do this I address the third research question examining what the new spatial system implies, socially and ecologically, in relation to the tendency of the Cuban state during the period of Soviet dependency to strongly centralise production and political power.

The organopónicos are controlled by the state through the institutional setup governed by MINAG. In the institutional dimension of the scalar assemblages, the national scale, the scale that centralisation aims towards, holds a certain primacy. The central plan and the directives of the GNAU

draw all organopónicos across Cuba towards a common aim. The GNAU also standardises what organopónico production entails ecologically and socially through its evaluations. Urban vegetable production in organopónicos, where vegetable production takes place close to the consumers, is thereby controlled by the state on a national scale. In an article to celebrate the 25th anniversary of urban agriculture in Cuba, Companioni Concepción, Rodríguez Nodals, and Sardiñas Ruíz (2012: 9, my translation from Spanish) who hold leading positions in GNAU and INIFAT, also state that the Cuban Programme for Urban and Suburban Agriculture ‘ascertains the self-supply of the [Cuban] territory. The Programme maintains a productive extensionist movement [of urban farmers] and encourages agro-ecological practices that optimise local resources.’ Fundamentally, they see urban and suburban agriculture as a project to self-sustain Cuban cities with vegetables on a national scale. A large part of the production process is as a consequence regulated in larger scaled relations, external to the organopónicos, where production and political power remains nationally centralised.

However, the organopónico workers directly retain control over the production process to significant extents. What distinguishes UBPCs from organopónicos arrendados is the degree of autonomy that the different character of the scalar relation to the Granja Urbana gives. The UBPC workers have more control over the economic and ecological processes that enable production and articulate the organopónicos as places than the organopónico arrendado workers. The UBPC is controlled by MINAG in the planning and reporting process, but retains final decision power over the production process. The UBPC workers must produce according to the central plan but have the ability to set contracts, make bank transactions, and keep accounts independently. The organopónicos arrendados, in contrast, are closely involved with the Granja Urbana and depend on state bureaucracy to acquire production inputs. Still, in terms of employment, marketing of produce, and generation of incomes the workers of both kinds of organopónicos control the articulation of the organopónico as a place. Therefore, in the new spatial system, power over the production process has to a larger degree been placed directly among the producers, although the state overlooks production. This, notwithstanding, potentially places the workers in a vulnerable position when they must negotiate the contradiction between central planning and market forces. While the central plan posits strong demands on the workers, there is no institutional economic support when sales are bad and production must remain.

In conclusion, urban agriculture as it takes place in organopónicos produces a system of spatial relations characterised by a tension between the ‘centralising’ national scale and the locally empowered scale of production. Compared to the system feeding the Cuban fat cow during the 1980s, institutional control over the vegetable supply system is now maintained within the confines of the Cuban ‘nation’. This control, nevertheless, is upheld in a contradictory relation between the national aim of centrally ensuring urban food supply and the capacity of the organopónico workers to control the production process. The tensions that arise from this relationship forces the workers to

continuously negotiate the contradiction between central planning and market forces and potentially leaves the workers vulnerable.

Furthermore, compared to the system under Soviet dependency, the material flows and ecological processes that the institutional assemblages enrol in organopónico production produce a more localised, autonomous food production system. These material flows and ecological processes also diminish carbon input, emit less carbon dioxide, and are thermodynamically more efficient in comparison with the system wholly founded on oil imports. In the scaled spatial assemblages of socioecological relations that enable production, Pinar del Río's organopónicos draw most inputs from sources scaled within Pinar del Río province. This system is not self-sustaining, however, in strict accordance with agroecological ideology. The agroecological aim is to create and maintain a locally autonomous agroecosystem that to the highest possible degree closes ecological cycles within the farm. In other words, all socio-metabolic flows should be scaled within the organopónico. The organopónicos along the Vial, in contrast, depend on external inputs to maintain the canteros' fertility and the agroecosystems' biotic stability. They do not maintain productivity through closed ecological cycles as would be the case in an autonomous agroecological system.

Certainly, production to some extent relies on agroecological processes that are internalised in the organopónicos, for example through different methods of pest management and composting. However, production is simultaneously hooked up in industrial systems with global reach, for instance as the canteros are irrigated. Organopónico production is therefore possible through processes of scaling that articulate the organopónicos as places both within and without that spatial unit. According to agroecological ideology a well managed agroecosystem should be in ecological equilibrium and thus maintain itself within the spatial unit of production. The stability and furtherance of the agroecosystems in Pinar del Río's organopónicos, in contrast, depend on scaled spatial assemblages that link the organopónicos to multiple places outside the organopónicos. One could of course increase the frame of reference geographically and argue that Pinar del Río province constitutes a functional agroecological system. However, the organopónicos do not return biomass or energy to the places that metabolise them. For instance, peat is a non-renewable energy source and the chickens who supply manure do not feed on organopónico produce. To keep continuously productive, supplying food and income, the organopónicos therefore maintain non-equilibrium ecosystems that keep their internal coherence through social mediation as energy, nutrients, and seeds are supplied in the canteros.

As an allegory, turning to a phenomenon well-known to Cuba, a hurricane only exists as long as it is continuously fed with energy from a warm ocean. As soon as it passes over land and loses its metabolic source the hurricane also loses its internal coherence and productive strength to the point that it finally dissipates. Such a system, known in physical chemistry as a dissipative structure, is nonetheless as natural and functional as a structure that tends towards thermodynamic equilibrium (Prigogine [1977]1993; Kondepudi and Prigogine 1998). The same logic that structures a hurricane

seems to structure production in Pinar del Río's organopónicos; yet, instead of an Atlantic ocean and a Caribbean sea to metabolise the system, Cuban urban agriculture is metabolised by energy and nutrients through human mediation in an assemblage of socioecological relations.¹²² From the analysis of institutions above it is clear that the producers of vegetables, and in extension the urban population, have a greater capacity to control the mediation of metabolic flows in the post-1990s system than in the sugar-for-food dialectic.

To explain the multiplicity of socio-metabolic relations that sustain the organopónicos, the theoretical distinction between two separate modes of agricultural production—agroecological and industrial—seems too coarse. Urban agricultural space in Cuba neither fits the agroecological model, although some aspects of production undoubtedly are agroecological, nor the industrial model. Instead urban agriculture embodies traits from both schemes; organopónico production is simultaneously agroecological (e.g. through intercropping), organic-industrial (e.g. using biocides), and petro-industrial (e.g. through irrigation). Also, in the political aspect of agroecological ideology, aiming for local food sovereignty, urban agriculture in Cuba sits across categories. The organopónico workers retain certain control over the socio-metabolic process through the new institutional assemblages. Still, the state maintains strong control over the articulation of the organopónicos as places through central planning and political directives. The local autonomy and 'autochthonous production systems' that agroecology stands for, and the centralist governance that has been distinctive of industrial agriculture in Cuba and elsewhere, thereby both exist in a contradictory relationship in Cuba's urban agriculture. In comparison, the idea of 'modes of resource use' that Gadgil and Guha championed, suffered in the earlier discussion from being too squarely shaped as it outlined four all-encompassing and discrete modes to characterise history. Equally, the dichotomy agroecology vs. industrial agriculture to characterise agricultural metabolism needs nuance. Urban agriculture in Pinar del Río is both agroecological and industrial.

It is fundamental to Cuban urban agriculture in the context of the spatial crisis that agroecological practices are internalised in the organopónicos. However, just as in fully industrialised systems, the Cuban urban agroecosystems in part function due to diesel, machines, and centralised systems of water and electricity distribution. The organopónicos are not self-contained places of production in terms of ecosystem functioning. Instead the organopónico workers rely on fossil fuel inputs which are supplied in the gardens through institutions that the workers do not fully control.

That a theory of agricultural metabolism must be more flexible than to outline two distinct modes is not necessarily bad, however. To relate back to the aim of this thesis—to the spatial implications of low-carbon energy transitions—the question is how to construct scaled spatial assemblages of socioecological relations that allow food production that is thermodynamically efficient and keep as much as possible of the input carbon inside the consumed vegetables (without

¹²² Alf Hornborg (2001) has used Ilya Prigogine's Nobel Prize winning conceptualisation of dissipative structures in a similar way to understand the functioning of machines.

displacing additional environmental costs). Relative to the Cuban system of food procurement under Soviet dependency, this has to a large extent been achieved by enabling vegetable production in the cities. A further adaptation of agroecological methods only seems to make the case stronger. A further devolution of power to extend the workers' control over the articulation of the organopónicos as places, however, is a controversial political question. The state-socialist ideal of equal access through central planning on a national scale here stands against ideals of local autonomy. Currently, this dilemma is solved by forcing the workers to continuously negotiate the contradiction between central planning and market forces. To explore this process of constructing a low-carbon agricultural system the idea of scaled spatial assemblages of socioecological relations seems effective. This concept effectively moulds around the empirical case in contrast to the discrete modes of resource use.

Conclusion

The collapse of the hegemonic scalar relation of flowing oil from the Soviet Union caused a spatial crisis in Cuba's energy systems. With infertile former sugar fields, sterile after centuries of monoculture and decades of heavy chemical input, together with ceased food imports, the Cuban urban populations were left hungry. In response, people engaged in a spatial politics to enable food production in the cities to control food supply themselves. The Cuban government responded actively to this spontaneous movement of urban farming by introducing organopónicos across the country. The result of this transformation has been that cities, such as Havana, now are claimed to be 90 percent self-sufficient in vegetable supply.

The aim of this thesis is set in relation to the loss of oil in Cuba's energy systems, to contribute to scholarship on the spatial implications of low-carbon energy transitions. The Cuban experience provides an important empirical case to study how a low-carbon energy system can be spatially constructed to reduce our dependence on oil. Hereby, my objective has been to explain how a new system of social and ecological relations is spatially organised in Cuba to enable urban food production in organopónicos.

To this end, three questions have been explored. First, chapter 5 examined how the organopónicos are articulated as *places* in relation to political and commercial institutions that enable and regulate production. There are two different kinds of organopónicos producing food along the Vial in Pinar del Río, the UPBC and organopónicos arrendados. These are largely distinguished in their

scalar relations with the Granja Urbana. The Granja Urbana is an operational unit of a dual bureaucracy where political directives are passed along a political leg from the Ministry of Agriculture's National Urban Agriculture Group and commercial trusteeship is given by the state-owned company Empresa Acopio y Beneficio de Tabaco through a commercial leg. The social mechanisms that make up this nested institutional assemblage regulate the metabolism of the organopónicos; these are directives, rules, and norms, for instance controlling and enabling processes of employment, planning, and marketing.

Second, chapter 6 explored how the organopónicos are articulated as *places* in relation to material flows and ecological processes that sustain production. The organopónicos depend on material flows of organic matter, seeds, and water to keep canteros fertile, and on ecological relations that exist within the gardens to keep crops healthy. Most of these relations are all scaled within Pinar del Río province; nevertheless, the organopónicos also depend on scaled socio-metabolic relations that enrol energy-intensive fossil fuels and industrial practices in production. For instance, the organopónicos depend on electricity generated from oil, and petrol and diesel fuel transports, which make production reliant on spatial relations far displaced from the organopónicos.

Third, chapter 7 discussed what this new spatial system implies, socially and ecologically, in relation to the tendency of the Cuban state during the period of Soviet dependency to strongly centralise production and political power. Through the case built in chapters 5 and 6 and by bringing the institutional and ecological dimensions of the spatial assemblages together, three major conclusions arrive from this discussion. *First*, control over the organopónico production process and the articulation of the organopónico as a place is contradictory. Organopónico production takes place in a spatial system characterised by a tension between the 'centralising' national scale and the 'localised' scale of production. This tension is manifested in the organopónico workers' need to continuously negotiate the contradiction between central plan and the supply and demand of the urban vegetable market. In comparison to the oil dependent system under Soviet dependency, power over the production process has to several degrees been decentralised in the new system. The organopónicos are institutionally articulated as places through processes that are strongly controlled by the national state bureaucracy, headed by MINAG. The organopónico workers, at the same time, have the ability to control the production process in several respects. The dilemma of this relation is that it potentially places the organopónico workers in a vulnerable position as they must negotiate the central planning-market contradiction.

Second, the metabolism of the organopónicos is both agroecological and industrial. Prior research on Cuban urban agriculture has described it in terms of 'localisation' and 'autonomy' and with reference to an agroecological mode of resource use. However, the organopónicos can neither be conceived of as locally contained production units based on agroecological practice nor as industrial farms with global reach. Rather, organopónico production is simultaneously agroecological and industrial. Production internalises certain practices and ecological processes in the organopónicos

that are fundamental to agroecological ideology; at the same time, production is hooked up in larger scaled socio-metabolic systems that fundamentally rely on fossil fuel input and industrial practices.

Third, the theoretical distinction between an agroecological and an industrial mode of agricultural production is too rigid to explain urban agriculture in Cuba. As different aspects of the production process is centralised and localised at the same instant, the organopónicos are controlled both as the agroecological and the industrial mode would postulate. As production simultaneously incorporates agroecological and industrial methods and socio-metabolic relations, the organopónicos analytically sit across the two modes. Instead the idea of ‘scaled spatial assemblages of socioecological relations’ that the thesis tries to approach energy transitions is effective to fulfil the objective of this thesis: to explain how a new system of social and ecological relations is spatially organised in Cuba to enable urban food production in organopónicos.

The idea of ‘scaled spatial assemblages of socioecological relations’ brings together three concepts; place, metabolism, and scaling. It is based on an understanding of organopónicos as places that are constructed through their relations to the social practices and ecological processes that sustain them. These relations, which are embodied in organopónico production, relate urban gardens to other places through processes of scaling. The thesis reinforces this spatial perspective of place and scaling with the concept of social metabolism; it suggests that places are constructed coevally through social and ecological processes. In this way, organopónico production is enabled through scaled spatial assemblages of socioecological relations, which take different shapes depending on how institutions are constructed to mediate metabolism.

The Cuban experience of transforming an oil locked-in energy system is an important case to understand the spatial implications of low-carbon energy transitions. The new spatial system of urban food supply in Cuba has significantly reduced energy and carbon input in vegetable production. Even so, it is important to note that Cuban urban agriculture still depends on fossil fuel input, not least to metabolise the transports that maintain many of the material flows that sustain organopónico production.

When the socialist bloc crumbled and the Cuban government launched its National Food Programme in the early 1990s, Fidel Castro (1991 cited in Mesa-Lago 1993 cited in Chaplowe 1998: 49) avowed that ‘the food program goals are based on its own resources and make allowances for major reduction in oil imports... We are going to demonstrate what real socialist agriculture is[!]’ The urban agricultural system that has developed in Cuba, and the spatial reconfiguration of agricultural metabolism, is an important empirical example to how a different system of food procurement can be constructed in contrast to the current oil-guzzling state of business.

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Appendix

On the following page is an exact reproduction of the methodology used by the National Urban Agriculture Group (GNAU) for their evaluations of organopónicos. The reproduction has been made after a photograph, taken by the author, of the methodology as demonstrated by Ana Reina Diaz Cordero in UBPC Micro-Brigadas on 11 February 2013.

The title translates into English as ‘Evaluation methodology for Organopónicos contained in page 65 of the Guidelines of Urban and Suburban Agriculture for the Year 2013’.

Metodología de evaluación para Organopónicos contenida en la página 65 de los
Lineamientos de la Agricultura Urbana y Suburbana para el año 2013

<i>Indicaciones</i>	<i>Valor</i>	<i>Observaciones</i>
Tener todos los canteros Sembrados	15 Puntos	Solo se admite canteros vacíos cosechados 48 horas antes
El sustrato de calidad	10 Puntos	Por apreciación y examen y sus propiedades físicas.
50 % o más de intercalamiento	5 Puntos	Rabanito, Acelga China, y lechuga. Como ciclos cortos.
Buen control de plagas y enfermedades	10 Puntos	Por apreciación.
Existen las barreras orientadas y plantas repelentes	10 Puntos	Visualización practica.
Capacitación	5 Puntos	Por intercambio con productores.
Vinculación de la fuerza	10 Puntos	Por comprobación documental e
Comercialización	5 Puntos	Comprobar que no existen pérdidas de productos y se cumplen los destinos.
Riego y Drenaje	5 Puntos	No existen emisores tupidos, drenaje resuelto y filtro limpio.
Correcto escalonamiento	10 Puntos	Se comprueba un nivel aceptable de cosechas en la visita.
Población	5 Puntos	Comprobación practica
Lumbricultura	5 Puntos	Existe la producción en un área cercana
Integridad, estética, facilidades para la mujer	5 Puntos	Por apreciación.
Total	100 Puntos	