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Reclaiming and recirculating urban natures: integrated organic waste management in Diadema, Brazil

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Abstract. Although developing world cities are increasingly the focus of urban political ecology perspectives, waste remains an underexplored aspect. This paper helps to fill this thematic gap by using urban political ecology as a lens for analyzing flows of food waste in the Brazilian city of Diadema. The marginal urban poor in Diadema, as in most other cities in Brazil, lack access to affordable fresh fruit and vegetables yet must cope with a disproportionate accumulation of uncollected waste. Integrated organic waste management, consisting of decentralized household-waste collection by organized recycling groups, waste processing, and the utilization of food waste for composting and urban food production, is presented as way of reclaiming and recirculating urban natures for potentially positive socioecological change. However, it is a process characterized by conflict and potential exploitation, while broader structural conditions constrain the ability of the system to offer an alternative to existing waste-management models. The paper concludes with a call for further action-oriented research within urban political ecology to reveal opportunities for new socioecological futures which should occur at multiple scales and emerge from the lived realities of marginalized actors such as *catadores* (recyclers) and urban gardeners.

1 Introduction

In August 2009 the cargo ship *MSC Serena* arrived in the Brazilian port of Santos mysteriously carrying eighty-nine containers (over 1400 tonnes) of toxic medical and household waste from the UK. The Brazilian Institute for the Environment and Renewable Resources, which lodged a formal complaint with the World Trade Organization, later revealed that the waste had been exported as 'recyclable plastic' (Siddique, 2009). Such uneven global flows of waste reflect the ways in which economically and politically marginalized populations bear the cost of the world's burgeoning solid-waste problem. In Brazil marginalized populations—often located at the urban periphery—are not served by any of the 237 (of a total of 5507) municipalities which practice selective waste collection (Mancini et al, 2007). Socially excluded people and spaces bear the burden of the environmental and health hazards of waste dumping, as they lack the social services and legal measures that are required to ensure socioeconomic and environmental equality (Gutberlet, 2006). Attention is increasingly turning to this uneven politics of waste production and distribution, as approaches within the field of urban political ecology continue to draw attention to the limits of prevailing models of waste management and, a fortiori, waste production (Meletis and Campbell, 2009; Pellow, 2006).

Meanwhile, as solid waste accumulates in urban peripheries, the centralized food system in Brazil means that access to fresh fruit and vegetables is both difficult and costly. Diadema is an industrial city where agriculture accounts for 0.04% of the gross domestic product (IBGE, 2007); the majority of food is imported. Financial wealth determines food security, and the urban poor tend to survive on affordable food that is

often low in nutritional value. Within urban political ecology perspectives, attention is also turning to this unequal nature of food distribution. The most nuanced account, however, remains Heynen's USA-focused analysis of the "socionatural contradictions that produce urban hunger" (2006, page 131) and the resulting strategies of a bottom-up politics of resistance (Heynen, 2009). In the Brazilian context, recently there has been focus on the politics of food, particularly regarding the national policies of the Bolsa Família (Family Fund) and the Programa Fome Zero (Zero Hunger Program) (Haddad, 2008; Rocha, 2009). However, a coherent urban political ecology of the flows of food in Brazilian cities remains to be developed.

Despite the proliferating urban political ecologies of waste and Keil's (2005) call for greater attention to food and food security within urban political ecology, there has been a lack of attention to the links between food and food waste. The framework presented by Cofie et al (2006) is an isolated attempt at systematically understanding the flows of food and food waste, but their account lacks a full appreciation of how the political–ecological context can determine the integration of decentralized composting and urban agriculture. This lack of attention to food and food waste within urban political ecology is surprising given the focus of early political ecology perspectives, which explored the "metabolic rift" that caused the "decline in productivity of agricultural land on the one hand, and the problematic accumulation of excrement, sewerage and garbage in the city on the other" (Swyngedouw, 2006, page 23).

In this paper we address the aforementioned gaps in urban political ecology by building on an empirical foundation, so as to avoid the 'empirical emptiness' alluded to by Holifield (2009). We explore integrated organic waste management as a cyclical process which recirculates the value in household organic waste through: (a) the horizontal integration of urban agriculture with solid-waste management; (b) the integration of alternative options for one type of waste; (c) the integration of informative, economic, regulatory, and voluntary mechanisms; and (d) the integration of different political agents (Seadon, 2006; van Kerkhoff, 2005).[1] The process consists of the collection of organic waste by autonomous groups—often associations or cooperatives—of recyclers (known in Brazil as *catadores de materiais reciclaveis*), which is then processed by urban gardeners for application to the soils of local community gardens. Participatory action research was carried out in the Brazilian city of Diadema under the remit of the existing Participatory Sustainable Waste Management (PSWM) project to investigate the sociopolitical conditions for the implementation of integrated organic waste management.[2] In the next section we develop urban political ecology as an analytical framework before turning attention to the implementation of integrated organic waste management and its potential as an alternative system of reclaiming and redistributing food and food waste in the city. The paper concludes with a discussion of the potential for multi-scalar networks of recyclers and urban gardeners to transform urban environmental conditions.

[1] Drawing on ecological definitions of 'organic matter' based on carbon and nitrogen bonds, 'organic waste' is defined here as food waste suitable for composting (biodegradation).

[2] The PSWM initiative is a University Partnership in Cooperation and Development project, funded by the Canadian International Development Agency (CIDA) (2005–11). Through capacity building, dialogue, and information dissemination, the PSWM project supports recycling cooperatives in the metropolitan region of São Paulo, Brazil, in participating in the design of public policies which increase the effectiveness and safety of the collection, processing, and commercialization of recyclable materials.

2 Towards an action-oriented urban political ecology

There are few accounts that apply an explicit urban political ecology framework to the flows of waste specifically in developing cities. As Njeru (2006, page 1046) points out, "little has been done in this context with respect to urban solid waste problems... research done within the context of urban political ecology... has mainly focused on solid waste problems in the Western World, particularly USA." In seeking to develop an urban political ecology of waste, Njeru (2006) placed the problem of plastic-bag waste accumulation in Nairobi into the broader political economic context and revealed the uneven quality of life that is produced as a result. Similarly, Moore (2008, page 602) addressed the politics of waste in Oaxaca, Mexico, and used the notion of abjection to draw parallels between the exclusion of waste and people through "prohibitions developed to ensure purity". Moore also explored the political strategies employed by marginalized Others in Oaxaca, which revealed the 'public secret' and hazards of waste in order to achieve local development goals. Fahmi (2005) took a similar approach in revealing the exclusionary effects of neoliberal policies for the *Zabaleen* recycling community in Cairo, and Miraftab (2004a; 2004b) explored the political potential for informal waste collectors in Cape Town to open up spaces of resistance to service privatization. More recently, Gill (2010) used two cases to illustrate how political frameworks determine the degree to which waste collectors are able to shape policy in Delhi, India. In the Brazilian context, one of us (Gutberlet, 2008a; 2008b) explored the potential for transforming political frameworks to establish democratic and inclusive waste-management policies in the metropolitan region of São Paulo.

This paper contributes to the growing politics of waste in developing cities by exploring the urban political ecology of waste flows in Diadema. In the form of urban political ecology adopted here, urban socioenvironmental change is conceived as "a series of both enabling and disabling social and environmental conditions" (Heynen et al, 2006, page 12), underpinned by the "circulation, exchange and transformation of material elements" (Swyngedouw, 2006, page 27). Labour is central to this process: it is the agency by which nature is made productive (Marx, 1976), as it shapes, produces, maintains, and transforms the reproduction of urban environments (Swyngedouw, 2006). Thus, cities are not autonomous organic entities but, rather, are determined by the purposeful "organic capacity [of humans] to think differently" (Swyngedouw, 2006, page 24)—what is often referred to as the 'human imaginary'. As a consequence, investigations into urban environments must address the question of "who produces what kind of socio-ecological configurations for whom" (Heynen et al, 2006, page 2).

In this context, the socioecological system of the city is amenable to change according to reconceived human imaginings and the new ways in which such imaginings affect how labour mobilizes the circulation, exchange, and transformation of urban environmental amenities. In this context, we can move beyond "the city as the antithesis of an imagined bucolic ideal" (Gandy, 2006, pages 72–73) to explore how "socio-ecological 'sustainability' can... be achieved by means of a democratically controlled and organized process of socio-environmental (re)-construction" (Heynen et al, 2006, page 13). In this context, it is useful to turn to the proliferating body of work exploring challenges to mainstream political economic processes. Gibson-Graham (2006) drew attention to the economy as a site of ethical praxis and decision making, and to economic processes that are always socially and materially connected through a "commerce of being-together". Such a resocialization of the economy can stimulate local articulations in the form of a community economy, where emphasis lies on place-based strategies of meeting needs, equitable appropriation and distribution of surplus, creating well-being without resorting to export-led development, and replenishing

and sustaining the commons. In the Latin American context, approaches of this kind have been described by the Brazilian economist Celso Furtado as "modernity with solidarity" (Leiva, 2008). For Furtado the challenge is to "give priority to the social and develop our own policies for an autonomous integration into the global economy" (Rocha, 2007, page 132). This focus on *autonomia* (autonomy) is personified in Brazil by the notion of *autogestão* (self-management), which reflects an emphasis on the bottom-up, democratic, and deliberative aspects of the so-called "solidarity economy" (Gaiger, 2004).

We arrive, then, at an urban political ecology that follows the likes of Heynen (2006) and Moore (2008) in linking theory to praxis through a form of action-oriented research that simultaneously explores and advocates a form of 'modernity with solidarity'. Following Drummond and Themessl-Huber (2007), the aim of our research in Diadema was to affirm the potential of integrated organic waste management and to materialize it as a process. Thus, the goal of urban political ecology is to "understand the socionatural contradictions that produce urban [inequality], and then to act to end these contradictions ... to maintain the importance of the natural foundations of human life" (Heynen, 2006, pages 131 – 132). Such an action-oriented approach helps to uncover the ways in which the same sociopolitical and environmental processes that marginalize can also provide the political leverage necessary to achieve new trajectories of socioenvironmental change (Moore, 2008). This perspective offers a practical solution to finding a bottom-up, democratic politics of socioenvironmental reconstruction. Action-oriented urban political ecology provides a useful framework to assess the extent to which political acts of socioenvironmental reconstruction link together at a variety of scales to change "the very framework that determines how things work" (Žižek, cited in Swyngedouw, 2009, page 615). Thus, we can read integrated organic waste management through urban political ecology to explore its potential for challenging the sociopolitical arrangements which underpin uneven solid-waste accumulation and unequal access to food.

However, we are conscious that an action-oriented urban political ecology based around local struggles must not give undue power to the local, the bottom-up, or isolated incidences of political practice—a criticism that has been levied at Gibson-Graham's approach (Tonkiss, 2008). There is a need to recognize multiple forms of struggle and the fact that not all local or noncapitalist concerns are inherently resistant (Grove, 2009). We must also pay attention to the possibility that the vestiges of a so-called 'solidarity economy' can be reread as "performing a function subordinated to the dynamics of market-oriented capitalism, without treating the root causes of unemployment, and thus contributing to the maintenance of the status quo" (Gutberlet, 2009, page 739). Reading integrated organic waste management through the lens of urban political ecology helps to tease out the extent to which the system is capable of stimulating a transition towards a supposedly more equitable community economy, or whether it merely reproduces uneven environments and exploits a pool of free labour.

3 Food and waste in Diadema

Diadema is an exclusively urban municipality on the periphery of the metropolitan region of São Paulo, and with a population density of 12 830 per km^2 it is the third-densest municipality in Brazil (IBGE, 2010). Approximately a quarter of the municipal area lies within the protected drinking-water catchment of Lake Billings (Gutberlet and Hunter, 2008), and more than a quarter of the city's population live in 207 low-income settlements (*favelas*) across the city (Secretariat of Housing, 2008). In 2003 the incidence of poverty in Diadema was 43.8%, and the Gini coefficient was 0.37

(IBGE, 2003), indicating considerable inequality in wealth distribution. Living conditions in the city are characterized by what Davis (2006, page 206) calls "marginality within marginality", which is "a grim human world largely cut off from the subsistence solidarities of the countryside as well as disconnected from the cultural and political life of the traditional city." Living in this context, more than 7% of households in Diadema do not have access to enough food to sustain their families (Gutberlet and Hunter, 2008). This situation reflects the national paradox of food production in the country:

> "Brazil contains 26% of the world's cultivable land ... it is the second highest exporter of food, behind the United States ... . At the same time, approximately two thirds of its people go hungry, consuming less than FAO established daily minimum caloric needs" (Oths et al, 2003, page 306).

Such a lack of access to food stems from Brazil's centralized food system, which supports large-scale industrial agriculture for the production of export crops (Petras and Veltmeyer, 2005; Roberts and Rocha, 2008). Value added to gross domestic product in Diadema by agriculture is only 348 000 Reais (R$) (approximately US $149 000) per annum, compared with the R$3.5 billion (approximately US $1.5 billion) generated by the tertiary sector and R$3 billion (approximately US $1.2 billion) generated by industry (IBGE, 2007). With little food production in the city, and with income being generated from other sectors, financial wealth determines food security in Diadema.

Despite a lack of access to fresh fruit and vegetables, the urban poor live with a growing quantity of household waste, which is driven by continuous increases in consumption levels. Of the total solid waste collected in the São Paulo region, 37.03% was directed to controlled landfills and 21.95% was disposed of in uncontrolled open landfills or on unprotected land and water bodies (IBGE, 2000). Of the municipal waste in the region, approximately 57.5% consists of biodegradable food waste (IBGE, 2000), and the surveys carried out in Diadema revealed that food waste accounts for 74.5% of household waste in the study area. While the consumption of fertilizer in Brazil more than doubled from 200 million tonnes in 1990 to 450 million tonnes in 2002 (FAO, 2004), a proportion of the nutrients that do reach urban areas as food often end up being combined with hazardous wastes and dumped unproductively into unprotected land and water. This exacerbates the nutrient deficit in Brazilian soils which are on average losing 16.2 kg/ha of nutrients per annum despite the application of nutrients in the form of fertilizer (FAO, 2004).

These flows of waste produce a myriad environmental and health hazards—particularly at the margins of metropolitan areas, where social exclusion, waste accumulation, and environmental degradation combine (Gutberlet and Hunter, 2008). A lack of government enforcement of environmental protection legislation compounds this problem, and is particularly evident at the intersection of the municipal boundaries between the cities of São Paulo and Diadema. From 1955 onwards, untreated sewage as well as industrial and household waste has been flowing through the Pinheiros River and secondary drains into Lake Billings, and the "input of toxic industrial contaminants and biological pathogens over decades [has] resulted in a dead water system" (Gutberlet and Hunter, 2008, page 9). Those living in the periphery are now literally surrounded by "garbage piled up at the intersections between squatter settlement and the outside world" (Gutberlet and Hunter, 2008, page 12). Meanwhile, marginalized groups who live and work with the collection and separation of recyclable waste suffer from stigmatization and occupational health hazards (Gutberlet, 2008b; Gutberlet and Baeder, 2008).

Despite—or perhaps because of—inequality in Diadema, attempts to redress the waste and food situations in the city have emerged from the grassroots. A network of informal recyclers (*catadores*) and recycling cooperatives has developed in Diadema. Since 2002 the municipal government of Diadema has been working with the city's *catadores*; in 2004 the local recycling program Vida Limpa (Clean Life) was introduced, and *postos de entrega* (collection depots) were established in parts of the city to aid in *coleta seletiva* (selective collection) according to planned catchment areas Gutberlet, 2008b). In 2008 there were six fully functional postos, with plans in place to establish a further eight. Posto do Centro, which provided the infrastructure and capacity for this research, was established in June 2007 and joined the other five postos under the recyclers' association Pacto Ambiental (Environmental Pact). In June 2004 Diadema became the first municipality in the country to support recyclers' associations with an official policy of remuneration, which was guaranteed in 2005 by the municipal signing of a partnership memorandum with Pacto Ambiental (Gutberlet, 2008a). However, at the time this research was carried out, the recyclers still remained physically and socioeconomically vulnerable, trapped within a monopsonistic market that is generally controlled by intermediaries and characterized by a race to the bottom (Gutberlet, 2008a).

At the same time, a network of *hortas comunitarias* (community gardens) has emerged in the city, supported by the local government department of Abastecimento Público (public provisions). The gardens are usually located on public (municipal) land and are supported by 'soft' government assistance, such as capacity building. The gardens are theoretically open to public involvement, and groups of gardeners manage both the land and distribution of the food produced in them. In 2003 the local government established CONSEAD (the Diadema Council on Food Security) in support of urban agriculture and to encourage the federal government to implement actions towards the national Fome Zero (Zero Hunger) agenda. The council has lent support to *bancos de alimentos* (food banks), *restaurantes populares* (people's restaurants), and a land and citizenship project to help resurrect a culture of agriculture and transform unused urban space into productive agricultural land. In the next section we explore the ways in which the sociopolitical relations of these two cases of grassroots mobilization underpin integrated organic waste management.

4 Towards a new circulation of food waste in Diadema

The pilot implementation of integrated organic waste management in Diadema involved the catadores of posto do Centro, community gardeners and staff at the Fundação Centro de Atendimento Socioeducativo ao Adolescente (CASA),[3] residents in the neighbourhood, and representatives of the local Workers' Party (PT) government.[4] The neighbourhood consisted of 172 residents in 86 households; 45 of the households participated in the research and 41 agreed to provide food waste for the study. To explore the potential for and raise the notion of integrated organic waste management, focus-group discussions were held with catadores and community gardeners, surveys and interviews were conducted with neighbourhood residents, and in-depth interviews carried out with municipal representatives. These research processes were complemented by a poster and flyer campaign to raise awareness, knowledge-building exercises with gardeners and catadores (such as visits to compost-processing plants), and collaborative planning meetings involving catadores, community gardeners, municipal representatives, and PSWM project staff.

[3] Fundação CASA is a 'resocialization centre' for youth who have committed minor criminal offences. The centre is comanaged by the municipality and local community-based organizations, who established a community garden on Fundação CASA land.

[4] The Partido dos Trabalhadores (PT) has been democratically elected in Diadema since 1982.

Following a participatory planning stage, the catadores from Posto do Centro collected food waste from the forty-one households on a twice-weekly basis. The catadores transported the food waste directly to Fundação CASA, where the gardeners received and processed the waste, providing technical expertise as well as the supplementary materials required for aerobic decomposition.

The mean amount of food waste collected during the study was 3.3 kg per household per week, meaning that, with the participation of every household, this part of the neighbourhood is capable of providing 283.8 kg of food waste per week for collection. This quantity of waste can produce 272.7 kg of compost, containing 81.3 kg of carbon and 6.2 kg of nitrogen (at a C : N ratio of 13.1 : 1). At an application rate of 100 tonnes of compost per hectare per year, the community generates enough food waste to provide nutrients for 0.14 ha (1400 m^2) of agricultural land—an area far greater than the existing plot size (approximately 300 m^2) at Fundação CASA. A gardener at Fundação CASA recognized the value of circulating nutrients and helping to replenish the commons: "practically, the organic waste is a clean thing that will provide healthy vegetables and a healthy vegetable garden." Diverting the biodegradable proportion of municipal waste also has an exponential impact in reducing environmental hazards at landfill sites (such as methane emissions), with a potential 37 126.2 kg of food waste per week that could be diverted from landfill within the Centro district of Diadema alone.

However, the question of whether integrated organic waste management can forge alternative socioecological conditions is not one related to practical or biophysical feasibility, since composting has been used for agricultural purposes for centuries. Rather, the question concerns the extent to which sociopolitical relations among local networks of actors and institutions can sustain an integrated system of food-waste recycling.

4.1 The social relations of food-waste circulation

The positive social relations and emergent solidarity between the catadores and gardeners were fundamental aspects which mobilized capacity for the integration of collection and processing. The catadores and gardeners established a mutually supportive reciprocal system, exchanging food waste for food, particularly green leaf and root vegetables and smaller quantities of fruit. The products from the garden are helping to feed the youth in the rehabilitation centre and local residents who provided food waste. Plans are in place to incorporate the local school within the collection round and subsequent food distribution. The community gardeners, who emphasized the communal and qualitative dimensions of the garden, supported a reciprocal model of this kind:

> "the garden will be useful for me and ... many other families and children in need. We don't sell it to anyone. The garden is for our own consumption, for our friends, and a few neighbours ... it has always been like this. I already have the means to get involved with work that will benefit us all."

Gardeners also identified the potential for expanding reciprocal networks to other gardens:

> "I've met people from other vegetable gardens and we could exchange amongst the gardens with no problem: plants, fertilizer, etc. When the fertilizer is ready, we could bring something for them: a little or a big bag. If we could bring it, better! In the same way they could help us, we could help them [too]."

The above reciprocal exchange mechanisms reflect Gibson-Graham's (2006) call for attention to the equitable distribution of surplus and the possibilities for replenishing the commons via economic strategies that are not export oriented. Interviews with

gardeners elsewhere in Diadema revealed that residents commonly form into groups to collectivize their resources and maximize the benefits of selling food on the market, which has brought increased income generation. Although the garden at Fundação CASA has not yet expanded production sufficiently for market exchange, the gardeners are amenable to selling surplus food in order to invest in improved infrastructure. As one gardener explained:

"it is more important to exchange than commercialize it, but if there are a lot of leftovers, we could even find someone to sell it for us and buy shovels maybe, tools, anything else we need ... it would also be an income for me. Any 20, 30 reais would be profit. But it is good for now."

Regardless of the means of distribution, however, the quantity of food waste provided during the study was surprisingly low compared with the initial survey estimates (31.6 kg of food waste per week per household). The reasons for the low quantities include practical constraints such as in-home storage of waste, collection frequency, and transport technologies (ie, the size of collection carts). These aspects have been addressed in the practical waste-management literature; of greater concern here is the effect that relative conceptions of urban environments have on the circulatory processes of integrated organic waste management. Evidence from the household surveys indicated that environmental awareness was strong and that residents were largely aware of the benefits of reusing household food waste (table 1). As one resident explained:

"I would be contributing to everybody's well-being; [a] clean life, [a] healthy life. It is better for everybody if we always try to make good use of resources for our advantage and everything around us, with no waste."

In contrast, however, a proportion of residents perceived food waste to be an environmental hazard, a health risk, or a social contagion, and indicated that waste should simply be removed from the neighbourhood. As a result, the ideals in table 1

Table 1. Socio-environmental conceptions in the neighbourhood.

Issue	Proportion of households (%) ($n = 45$)
Aware of selective collection of recyclables (coleta seletiva)	95.6
Recycling food waste creates more benefits than problems	88.9
Perceive recycling waste as extremely important	88.4
Agreed to separate food waste for the pilot study	84.4
Able to identify material accepted by the coleta seletiva program	80.0
Participate in coleta seletiva	77.8
No perceived difficulties for a food-waste collection system	77.8
Indicated a theoretical willingness to separate food waste	73.3
Perceive local food production as extremely important	70.5
Agreed that knowing their food waste helps to produce local fresh food would cause a significant change in their food-consumption habits	64.4
Agreed that knowing their food waste is recycled would cause a significant change in their recycling habits	53.3
Able to identify the landfill as destination of municipally collected waste	46.7
Indicated a theoretical willingness to participate in a community garden	46.7
Aware that Vida Limpa is the organization responsible for coleta seletiva in their neighbourhood	13.3
Aware of urban agriculture in the neighbourhood	6.7

were not transformed directly into critical action, and participation levels in the project were not as high as had been expected given the survey responses (in any one collection round, participation ranged from 31.7% to 61% of those who had agreed to take part). The extent to which integrated organic waste management can stimulate positive socioenvironmental change and offer a system of meeting needs locally is contingent upon these relative conceptions and the ways in which they are transformed into practice. This case demonstrates the necessity of continuous awareness building and feedback to the community, despite attempts to include community members more actively through participation in the project.

4.2 The politics of integrated organic waste management

The socioecological relations outlined above served to create what Smith and Ruiters (2006) call 'new socio-ecological space'. By affirming the potential of organic waste collection, catadores and community gardeners reconceived the value of food waste and proactively pursued positive circulatory change. Local residents also recognized the potential for an alternative, democratic, urban metabolism, stating that "if each one of us helps a little, we are collaborating for a better city", and that "it is important to give another ending to these materials." The transformation of integrated organic waste management from concept into material practice stands as a political statement advocating a different socioenvironmental future, a statement which has the potential to effect change in local government. Interviews with municipal representatives revealed their willingness to pursue a formal policy of remuneration, similar to that already in place for nonbiodegradable recyclable material. A remuneration agreement for organic waste would channel financial resources usually reserved for the disposal of solid waste in landfill directly to the catadores, thereby helping to prevent their exploitation.

However, there are broader sociopolitical tensions involved in affirming positive circulatory change. The results in table 1 reflect the surveys that were carried out with just 52.3% of the 86 households in the neighbourhood. This sample size was dictated by a politics of selective waste collection already in play, as the surveys and informal interviews were carried out with residents who are sympathetic to the catadores and their cause. Although only 13.3% of respondents could identify Vida Limpa as the organization of catadores, 77.8% said that they participate in coleta seletiva. Many of the residents who elected not to participate in any of the research processes were identified by the catadores as households who are either hostile to the recyclers or ambivalent to selective collection; the remaining households are likely to be generally uninformed concerning selective waste collection. Some residents indicated that they were not willing to provide food waste because their recyclable material is not collected by the catadores consistently, which reflects the nature of Vida Limpa's trap line. The catadores only visit familiar residences and actively avoid households who have been hostile or consistently ambivalent. Some residents even cited a dislike of the catadores as a reason for nonparticipation, preferring not to contribute positively to their cause. Such hostility was on display during the research, when the catadores received verbal abuse from residents who reinforced a culture of exclusion by securing themselves behind their locked property gates. This tension is evocative of Caldeira's (2000) depiction of São Paulo as a city of walls which segregates the urban poor and reinforces indifference towards the marginalized. It also supports Heynen et al's (2006) recognition that the contradictory process of socio-environmental change inevitably results in conflict. As table 2 illustrates, community gardens in Diadema are also contested socio-ecological spaces, which conjures debates about security of tenure.

Interviews with municipal representatives and staff at Fundação CASA revealed that no concrete tenure agreements exist:

"the city hall is not going to give possession of these areas to the people. They are merely for title of use with urban agriculture."

Table 2. Spaces of urban agriculture in Diadema.

Location	Absolute (material)	Relative	Relational
Fundação CASA	Topographically accessible space available for composting; propinquity to an established Vida Limpa collection route and Posto do Centro; physically enclosed; moderate production levels; experimentation with composting.	Established for educational purposes; gardeners claimed ownership for personal production; good production quality; value of composting recognized; lack of awareness by surrounding residents of its existence; selective access with formal identification required.	Reciprocal benefits for gardeners and catadores; access determined by networks; land tenure subject to support within Fundação CASA; ambivalence from youth within the institution.
Jardim Santa Elizabeth	Large, open, flat space; open physical access; approximately 2 km from Villa Nogueira recycling depot; composting in place; nutrient-deficient soil; contaminated water runoff from local settlements.	Municipally cleared and decontaminated; municipally added compost heaps; underutilized soil; poor production quality; lack of interest from surrounding communities; local residents favour settlement expansion.	Violent conflict with local residents; use of garden for educational purposes in the local school; lack of collective organization amongst gardeners; insecure land tenure.
Jardim Inamar	Large space; steep gradient; enclosed by walls and buildings; difficult physical access; far from recycling depot; high production levels; ad hoc composting.	Established by local residents for self-production; access via unlocked school side gates; good production quality; interest from surrounding residents.	Three organized farmers' groups; collective commercialization direct to market; municipal support through capacity-building initiatives; no formal educational role within the school; insecure land tenure.
Posto Nova Conquista	Small space within the confines of Posto Nova Conquista; no space for composting; low production quantity.	Established and used by associates of the Posto; local residents unaware of existence of urban agriculture; no interest in composting.	Poor waste separation in the community, leading to accumulated food waste, but no space to process; coordination between the few garden groups and the recyclers at the depot; insecure land tenure.

The formal political apparatus of local government also coproduces local urban metabolic processes. Elsewhere, we have identified three broad factors which restrict the establishment of an enabling political environment (Yates and Gutberlet, 2011). First, sectoral and hierarchical forms of government organization construct a barrier to a proactive politics of socioenvironmental reconstruction. This echoes Darbas's (2008) concern that the broader shift from government to governance has prompted an

overemphasis on the logic of political mandates and administrative concerns. Second, the maintenance of uneven sociopolitical relations through personalized and continuous relationships has maintained hierarchy and patronage. Third, symbolic rather than substantive participation in decision making was underpinned by inaction and a lack of policy enforcement; the conflict that emerged during the everyday politics of deliberation did little to transform such relations. This supports Swyngedouw's (2009) argument that formal politics has become determined by popular gestures, a process that Darbas (2008) refers to as "deliberative truncation". Deliberative truncation emerges from a routine politics that consists of "mutually reinforcing and institutionally hardened constellations of beliefs and practices that constitute fronts of resistance to novel ideas" (page 1467). The current political institutions in Diadema are "not neutral vehicles for democratic deliberation, and administrative apparatus are not unproblematic conduits for goals arising out of such deliberations" (page 1466).

Swyngedouw (2009) was right, then, to draw attention to the ways in which debate within politics has been replaced by governing technologies which attempt to draw local environmental struggles into a 'postpolitical consensus'. The deliberative struggles of Vida Limpa representatives have done little to change hierarchical political structures and patronage, and may have been subsumed within what Swyngedouw (2009, page 615) calls the "placebo-politicalness" of formal politics. Catadores voiced frustration at frequently attending meetings with municipal representatives which would result in verbal agreements but no concrete action. According to the catadores, their time would be better spent working at the posto to improve their operations on the ground; for them, more can be achieved through actions than through empty discussions with local government. One representative in particular was disillusioned by interactions with local government, but in 2009 returned to the fold at Vida Limpa with renewed vigour to tackle the issues that catadores face in their everyday working lives.

4.3 Emancipation or exploitation of the catadores?

The political struggles outlined above reflect the concern that supposedly informal economic and political activities are not inherently liberating or empowering. Some authors have presented recyclers and community gardeners as entrepreneurial in their attempts to gain a foothold in a new resource-based informal economy of the city (eg, Medina, 2005; Mougeot, 2005). The vast majority of the urban poor, however, cannot be labeled 'entrepreneurs', but remain bound by the structural and institutional sources of their original oppression (Karnani, 2009). Recent global economic events revealed the vulnerable position of catadores in the São Paulo region; the price obtainable for many recyclable materials dropped to a half, or for some materials a third, of the previous value, which forced many catadores to abandon their activities at the beginning of 2009. Rather than instilling a social remit within the market economy, community gardening and door-to-door recycling are particular articulations of a 'solidarity economy' which may reflect the proliferation of an underremunerated and exploited sector within the increasingly neoliberalized capitalist economy. Despite their attempts to recirculate the value inherent in organic waste equitably, community gardeners and catadores may be literally doing the dirty work of capitalism in providing an underremunerated 'ecological fix' to the threat of waste accumulation (Bakker, 2009). The process of integrated organic waste management relies, in part, on existing modes of production and consumption, thereby limiting its impact to what is simply a radical tension *within* existing waste-management models. The fact that integrated organic waste management does not directly tackle the *production* of urban waste under capitalism means that the commodity relation still "hides the multiple socioecological

processes of domination/subordination and exploitation/repression" (Swyngedouw and Heynen, 2003, page 900).

For Swyngedouw (2009) political activity is not simply about voicing demands in formal politics—an avenue that the catadores have pursued—but is about the right to a collective process of emancipation. Such emancipation is supposedly achieved through a politics which disrupts the consensual order of unequal urban environments by inserting the impossible into the realm of politics and democracy. Paradoxically, however, once political disruption has resulted in the recognition of marginalized groups within formal politics, they become subsumed within the postpolitical constitution—by successfully enacting the political they are at once subsumed (as the 'other') within a prevailing condition of "postpolitical postdemocracy" (Swyngedouw, 2009). Thus, for Swyngedouw the impossible must be inserted into the political while avoiding elite capture and postpolitical consensus within formal politics. This approach, however, is in danger of concealing the progress that is being made on the ground in the realm of political action rather than political discourse. While catadores and urban gardeners struggle with formal political negotiations, they are actively reconceiving urban environments: through their everyday practices of reclaiming and recirculating the value inherent in food waste, they are contributing to a more even distribution of environmental amenities and the resulting benefits. It is from these lived realities that socioecological reconfigurations must emerge and penetrate into the political: by creating a tension within existing models of food distribution and waste management, catadores and community gardeners are reconceiving the possible through their material actions, rather than through an ideological discourse of impossible versus possible.

These tensions—between empowerment and exploitation, emancipation and consensus—are not unique to the local case in Diadema. For example, informal recyclers have organized at the national scale in Brazil under the National Movement of Recyclers (Movimento Nacional dos Catadores de Materiais Recicláveis), which emerged in 2001 through the participation of more than 1700 recyclers in the 1st National Recyclers' Congress in Brasilia (Gutberlet, 2010). Social mobilization soon followed more broadly through the first Latin American Congress of recyclers, and the two meetings have produced manifestos at the national and regional levels (the Brasilia document and the Caxias document, respectively). Most recently, the World Conference of Informal Recyclers (Waste Pickers Without Frontiers)—held in Bogotá, Colombia—stimulated the emergence of a global social movement of recyclers (Gutberlet, 2010). This social movement struggles for a better quality of life and improved working conditions for recyclers; in the São Paulo region, this struggle has taken shape through organization into cooperatives and associations. This movement operates within and across multiple scales to stimulate a form of social justice that is supposedly brought about by what Chilean philosopher Luis Razeto calls "factor C": cooperation, coresponsibility, communication, and community (Allard and Matthaei, 2008). Transnational flows and exchanges of knowledge on urban agriculture (often emerging from Cuba) present a similar case of cooperation and communication at multiple scales and across borders. These examples may be characterized as forms of multiscalar social organization that produce a collective imagining of different trajectories of urban environmental change. However, the elements of factor C may be exposed to the same critiques levelled above at the 'solidarity economy'. In the case of the recyclers' movement, it remains to be seen whether the construction of a multiscalar community based on cooperation, coresponsibility, and communication across scales can overcome the limits of a 'solidarity economy' that is inherently tied to and functions within a broader market economy. For urban gardeners the question remains

as to whether liberal notions such as knowledge exchange and capacity building 'as they go' (as one municipal representative described it) are capable of sustaining urban agriculture as a livelihood option and a means of local food production, let alone as a way of reconfiguring socionatural urban environments. In a country where agrarian movements have been engaging in effective struggles against the conditions which perpetuate hunger, can integrated organic waste management stimulate a positive "ecological imaginary" (Gandy, 2006)? This imaginary could prompt a macropolitical agrarian reform program that would provide secure land tenure for a more long-term vision of urban socioecological change. However, at this point, the more pressing issues identified by recyclers and gardeners include access to space and structural support, which are required before broader and more ambitious structural reforms can have an effective impact.

5 Conclusions

Investigating integrated organic waste management through the lens of urban political ecology brought us, in Braun's (2006, page 206) words, "face-to-face not with the essence of things, but with questions of power ... and politics." The findings helped reveal the unequal flows of food and food waste in Diadema, and opened up the processes of subordination and exploitation to challenge and contestation. In the face of unequal socionatural conditions, catadores and urban gardeners are enacting a form of local environmental micropolitics to stimulate elements of positive socio-ecological change. As Miraftab (2004a, page 254) points out, these groups operate in the multitude of cracks which emerge from the contradictory processes of capitalism, and in those cracks they find "the litter of the system itself, which perhaps prompts their long-term processes of ... emancipation ... . The grassroots movements emerge *despite* the ... rhetoric of the neoliberal programs" (original emphasis). Thus, the 'political moment' capable of reconstructing urban socionatures is inherently bottom-up: it is action from below that begins the "distribution of [environmental] functions and spaces on the basis of the principle of equality" (Swyngedouw, 2009, page 608).

This political – ecological process is, however, mediated by the contradictory relations that determine socio-environmental change in urban settings. The research reported here revealed the ways in which relations between residents, catadores, gardeners, and local political actors can be both facilitative of change and the cause of conflict, thereby producing integrated organic waste management as a contested terrain of socioecological change. The recognition of such contestation can illuminate the otherwise shrouded realities of marginalized groups, so that these realities can point towards more equal urban socionatural relations. This process should not, however, be considered inherently empowering or liberating, as it remains dependent upon existing models of waste management and can only produce a radical tension *within* them. While at the local level the organized process of integrated organic waste management may enhance equality incrementally (through reciprocal exchange relations, for example), it remains locked into an unequal system of commodity production and distribution. The findings, therefore, question the extent to which more 'inclusive' waste-management models are capable of escaping processes of subordination and exploitation, which force marginalized social actors to continue defending their own environments in a context of power struggles at multiple scales.

There is a need, then, to address the broader implications of the findings in Diadema, which present more than just another isolated case where the city is presented as a supposedly given scale of investigation. The place-based reconfigurations of uneven urban environments, such as those in Diadema, are being connected at

multiple scales as marginalized urban actors are collectively steering the ways in which inclusive resource recovery will affect the increasingly complex global flows of waste. This fact was illustrated in March 2010, when the federal government approved amendments to the National Policy on Solid Waste (*Lei 203/91 Política Nacional de Resíduos Sólidos*). The law now integrates the technological, economic, cultural, social, and environmental variables of waste management into a coherent policy framework that will facilitate the national implementation of strategies which have been successful in Diadema, such as inclusive selective waste collection and recycling. The recyclers and community at large also successfully derailed recent attempts to implement 'waste to energy' incineration. There is a need now for urban political ecologists to bring together the multitude of place-based reconfigurations into a coherent theoretical framework capable of understanding their implications beyond local impacts. In the case of integrated organic waste management, the multiscalar recyclers' movement, transnational knowledge exchange among urban gardeners, and broader agrarian reform movements offer useful places to begin addressing the potential for networked socioecological reconfigurations.

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