

Rethinking organic waste streams as metabolic drivers
for improving urban sustainability
and agroecological practices

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Abstract: Restoring the nutrient cycles, and assuming their centrality for sustainable management of agro-environmental resources at local level, are key aspects for amending the metabolic rift that has been historically triggered by the emergence of capitalistic socio-spatial organization, and that is currently reproduced and further deepened under neoliberal urbanization processes. This paper aims to explore how organic waste streams can be reorganized and reconnected with urban and periurban agriculture, enabling the proactive role of farmers and food growers in soil nutrient cycling, and reshaping urban metabolism towards more regenerative and resourceful models. In particular, we look at composting practices as meaningful entry points for inquiring the relations between urban metabolism and agroecological practices. The paper builds on some initial insights offered by the case studies of London and Venice, bringing to light which kind of soil nutrition and land management practices are currently prevailing among food growers in these contexts, which connections are established between food production and food waste, to which extent compost from organic waste is valued (and eventually claimed) as an essential asset for nutrient cycling, how access and control on resources can be facilitated and empowered, and finally how the pattern of urban waste streams can be rethought for enabling place-based metabolic ecologies, considering environmental and social justice issues. Unpacking these aspects allows to understand better how metabolic processes are related to (and embedded into) specific practices of labor located in time and place, and to expand the urban metabolism analytical framework in order to move beyond the 'black box' effects from which suffer many quantitative approaches strictly focused on material flows.

Keywords: organic waste, nutrient cycling, resource management, urban metabolism, urban agroecology

Introduction

In this paper we look at ways in which organic waste management, soil keeping, and food production interplay in nutrient cycles, as an entry point to understand and rethink urban metabolism. The inherent unsustainability of the current resource-intensive, exploitative and disposable socio-economic model requires a structural transformation of the ways we provide our basic (and superfluous) needs. The most urgent imperatives we must face are 1) to disrupt the reliance on fossil fuels, and 2) to dismantle the dominant linear paradigm that has been shaping the economic and spatial organization production systems, together with the related urbanization models and the underpinning metabolic processes in the last two centuries, shifting towards circular and

regenerative models where i) resource depletion, pollution, waste and greenhouse gas emissions are minimized, and ii) more equitable access and control over resources are provided.

We assert that an emancipatory and progressive change, able to bring forward both environmental health and social justice, can only be achieved by coupling circular thinking with a wider agroecological and resourceful perspective. This means that it is necessary not only to seek for innovative organizational or technical solutions in order to create integrated circular economies, but also to problematize resource-management issues that are often depoliticized under the dominance of technical argumentations. We must recognize that ways in which (urban) metabolic processes are organized and reproduced, underpinning and shaping the functioning of the cities, are structured by the existing political ecologies of power (Swyngedouw, 2004). Thus, for understanding the very political nature of the metabolic models, we should reposition our analyses into a broader discourse on power relations, that use to play at two levels: the power of man over nature (which is turned into a deeply social process through its perpetual metabolic transformation), and the uneven power relationships within society (resources access and distribution, degree of democratic participation in decision-making processes).

In this paper we try to address the burning necessity of redesigning the linear metabolic structure ruling the agri-food system: conventionally, foodstuffs and nutrients extracted from the rural and periurban environments flow unidirectionally into the urban areas, with a continuous loss of nutrients that are never returned back to the land, but rather end up in solid waste and sewage that tend to be disposed, instead of recycled. In this scheme, urban waste and sewage unceasing accumulation constitutes a problem to be solved, that generates high economic and social costs (the need of organizing a municipal collecting and dumping service, of building infrastructures, of charging the related fees to citizens, and so on). At the same time, the constant nutrients removal is tackled by employing energy-intensive, industrially-produced synthetic fertilizers and other agro-chemicals, that from one side do not compensate the loss of organic matter, and from the other side are contribute to the soil degradation and erosion, as well as to polluting (directly and indirectly) other vital environmental matrixes, such as water and air. This vicious and wasteful pattern not only increases the dependency from fossil fuel-reliant external inputs, but also deepens the divide between agricultural and environmental processes, depriving the material conditions and the located knowledges for keeping the essential ecologies upon which even social reproduction relies. In this sense, the costs of the current metabolic system are broad, wide-ranged, and not only monetarily computable. Instead, we look at urban organic waste as a possible driver for building regenerative, closing-loops metabolic processes, by transforming it in compost (and/or anaerobic digestate) to be used as a soil conditioner or plant fertilizer, restoring the nutrients cycling, while reducing the use of destructive external inputs. Composting and reusing in agriculture the organic fraction of municipal waste is widely recognized as «a sustainable practice for FW recycling» which could be very beneficial for the soil (Cerda et al., 2017; Sax et al., 2017).

In our vision, organic waste should be seen not only as a valuable resource to be converted into a re-useful form, but also as a common resource to be mobilized upon the needs, visions and priorities of the local actors directly involved in managing the nutrient cycles. In other words, bringing forward resourcefulness (MacKinnon and Derickson, 2012). Therefore, the reorganization of urban organic waste streams should be consistent with the aspirations and the requirements of farmers and food growers, and should create the conditions for enabling their proactive role in implementing circular metabolism under sustainable and fair conditions. This perspective would also require to decolonize the sphere of urban waste management not only from neoliberal approaches, but also from strictly engineering and technocratic discourses.

Problems and limits in the current soil, nutrients and biowaste management system

There are a number of problematic issues linked to the current linear, industrialized and fossil fuel-dependent management of soil and nutrients: phosphorous peak, soil degradation and erosion, nitrous oxide released from fertilizers. High levels of energy consumption, due to the use of fuels (directly) for powering machineries in the

context of a highly industrialized farming, and (indirectly) for producing the artificially synthesized fertilizers and other agro-chemicals that are largely employed in replacement of agro-ecological internal inputs («industrialized farming consumes 50 times the energy input of traditional agriculture; [...] it has been estimated that 95% of all food products in European countries require the use of oil», Jones et al., 2012); as the crises of 2007-2008 bears witness, this reliance also exposes the whole food system to energy price volatility, further questioning food security. Besides, the massive consumption of energetic sources in agriculture entails a large amount of carbon emissions; the rise in carbon emissions is also connected to the decrease of carbon capture and storage (CCS) linked to the depletion of the organic matter into the soil. According to Montanarella (2002) «the welfare of a population can be linked to fertility and land productivity», and «these health indicators are directly related to the organic matter content of the soils». Not only nutrients, but also organic matter and living organisms are essential components of the soil, from which depends to its health and fertility. The increasing process of soil degradation that is occurring worldwide, and that has been identified as a serious problem to be tackled both at global and European level, depends *inter alia* from the loss of organic matter.

«In the linear food system, a very high proportion of food flows into cities where it is processed or consumed, creating organic waste in the form of discarded food, by-products or sewage. According to Ellen MacArthur Foundation (2019), globally, every year 2,9 billions of tonnes of food are destined for cities, that overall produce 2,8 billions of tonnes of organic waste; only less than 2% of «the valuable nutrients present in these organic resources gets looped back to productive use».

Large-scale, industrialized and centralised systems requires high investments in terms of space, infrastructures, costs of establishment, management and transport (plus associated social hidden costs in terms of environmental externalities). This create a certain rigidity of the system, and a path-dependency. Out-of-town: high waste miles. Besides, even when the recycling processes are highly efficient, they could still be disconnected from the local system, and from ecological processes. Thus, to enable the creation of truly regenerative, virtuous cycles that can maximise social and environmental benefits at local level, circular economy needs to be reframed into a deep metabolic perspective.

Re-cycling organic waste streams: an opportunity for amending the metabolic rift and shifting to regenerative metabolic models

The marginalization of agricultural spaces and practices by neo-liberal urban development (Tornaghi, 2017) is at the base of the reproduction of the metabolic rift occurred with the emergence of the capitalistic economic, social and spatial organization. The metabolic rift has been originally theorized to describe «a rupture in nutrient cycling between town and country», alongside «a rupture in the metabolic relation between humans and nature under capitalism» (Schneider and McMichael, 2012). While acknowledging the wide-ranging and multifaced nature of the ‘rifts’ (Schneider and McMichael, 2010), we believe that restoring the soil nutrient cycles (and recycles) is a crucial and necessary starting point to amend them, and to build new regenerative and resourceful metabolisms.

Considering barely the most common and used biowaste recycling methods, among the numerous existing (a systemic review is shown in LOUISE, 2016 and), composting is the only one that permits to mix and transform both the two main kinds of UBW streams (food and green waste), while vermicomposting and biomethanization

(or anaerobic digestion) fits only for food waste, and mulching¹. it is no more a significant Uonly composting fits for recycling jointly, in the same process, food and green waste; vermicomposting, dehydration. Mulching

The recycling methods that maximise environmental benefits are natural composting, vermicomposting, and mulching with chopped green waste (LOUISE, 2016). In terms of treating capacity and scale, natural composting allows to process up to 2.500 kg of bio-waste annually, while (electro-) mechanized composting techniques are more appropriate for more important amounts: from 10.000 to more than 100.000 kg/y.

Exploring the potential of closing the loops between food waste and food growing: initial insights from London, Brussels and Venice

In the city of London, the is very differentiated and fragmented. Most of . Since the market of waste management is clearly liberalised, besides the municipal companies, there is a number of big, medium or small operators that work mainly with the commercial businesses, offering collection services that are wide-ranged in terms of sorting schemes, pricing systems (including ‘per bag’ option), provided bins sizes, collection frequency, contract flexibility.

London’s city farms seem to be self-sufficient, relying on their own organic resources without requiring external inputs. Both the farms we have visited and interviewed (Stepney and Spitalfields) consider compost as an essential asset for improving soil quality and supply use to compost important amounts of manure from the many animal they host, piled into a number of traditional aerated composting bays. In Stepney City Farm has also been installed a compost tumbler for food waste, which is

Discussion

The explored case studies shows that choice of the most appropriated method, scale, logistic and arrangements for developing alternative models of UBW recycling depend from the local specificities, varying on the base of the physical, technical, organizational, socio-economical, and cultural environments. Analysis and design should consider those aspects, and place the nutrient cycling within urban contexts, as well as into specific labour practices, situated in time and place.

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In the case of Brussels, the presence of bridging organizations who are playing a strong advocacy role, and are mutually engaged in a wide action-research process working on many levels (project experimenting, actor

¹ Here we don’t consider manure (a very rich organic resource, much valued in the past centuries), because it does not represent an available UBW stream nowadays, if not in very negligible part, after the building of the modern sanitary sewer system, from the one side, and the ouster of animals from the city, on the other side.

mobilising and policy lobbying), is proving to be essential not only for building alternative, more ecological and socially-driven ways of managing biowaste, but also for strategizing them. At the same time, they seem to meet an apparently open and fertile policy context, with a public administration that is interested in developing new approaches to waste management, also pushed by a changing external regulative framework (the European package for circular economy, and the limitation to landfill). This may suggest that the attitude and the capacity of acting for change locally are conditioned by the context-specific enabling or disabling conditions (spatial organisation, infrastructures, social capital, economic opportunities, etc.), but also by multilevel political, regulative and cultural settings.

The Italian case study reveals that the legislation, both nationally and locally, is more restrictive, and particularly disabling for alternative, decentralized, socially-innovative models of bio-waste management. Changes at normative level, with special regard to biowaste transportation rules, would simplify Moving food waste on long distances before processing it represents a waste of energy, considering that more than 70% of it is water, and that the solid matter gets considerably shrieked during recycling processes. In the case of Venice, it is particularly inconvenient, due to the logistical constrains and to the transportation costs (linked to the high price of the fuel used for ships): hence processing at least part of the UBW on site would be strategic. Besides, for a low-input, closed-loop agriculture.

In order to the amend the ‘knowledge rift’, recovering knowledges and skills is paramount. In this sense, community composting has a great relevance. In both the cases of London and Bruxelles emerged the role that a programme of ‘master composters’ can have in enhancing knowledges and skills.

Conclusion. Reframing organic waste streams management: from to *nutrient sovereignty*?

- taking care of soil health and productivity;
- contribute to food security;
- re-claiming control over nutrients.

In order to reshape infrastructural systems and social practices around urban waste and composting towards a regenerative, circular model enable metabolic agency, also the metanarratives should be renewed. Brenner and Schmid (2015) point out that contemporary debates on (urban sustainability) are dominated by a «city-centric techno-environmentalism», based on neo-naturalist and neo-positives approaches that advocates for engineering solutions, naturalising (and thus depoliticising) socio-spatial organizations and forms, normalizing also territorial control through «sound management» and «market-oriented governance» of urban life and functioning.

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