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ARTICLE

Creating careful circularities: Community composting in New York City

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Abstract

While matters of food waste and soil have become vital research arenas, compost remains the Cinderella of human geographical enquiry. In response, this paper brings compost to the centre of debates at the intersection of diverse economies and circular economy. In particular, the concept of community composting and the care involved in such practices is used to offset and problematise the techno-scientific bias in circular economy discourses. Extending feminist perspectives on care in soil studies, this paper focuses on the careful circularities that are realised through community composting in New York City. This case study provides not only a material space for examining community composting but also a unique opportunity to consider the colliding worlds of worth that operate in and around urban sustainability transitions to zero waste. Drawing empirical insights from interviews, participant observation, and document analysis, this paper argues for a sensitisation of circular economy policy and research to matters of care and diverse economies as a means to better understand motivations, justifications, and outcomes of efforts to reorient food systems onto more sustainable pathways. We argue that privileging care in this way helps to shift focus away from dominant narratives of "scaling-up" towards sustainability to a more relational perspective that sees transformation in connecting, deepening, and even scaling-down. This means attending to the micro as well as macro transformations needed to enact the required sustainability transitions.

KEYWORDS

care, circular economy, community composting, diverse economies, New York City

1 | INTRODUCTION

Compost is seen as black gold among food producers. However, the process of creating, distributing, and using compost in an urban setting has received limited attention within the social sciences broadly and within geography in particular. This is despite an increasingly robust realm of waste and discard studies within the academy (Davies,

2012; Evans, 2012; Gregson & Crang, 2010; Gregson et al., 2015). Diversified practices of organic waste management, including community, municipal, and commercial composting, are emerging and new spaces, relations, and infrastructures for creating, processing, and utilising urban compost are being constructed. As policy commitments to zero waste and circular economies proliferate, this inattention to compost in urban food systems becomes increasingly untenable.

In response, this paper focuses on the form, function, and practices of New York City's network of community composting initiatives. In doing so it brings together debates at the intersection of circular economy and diverse economies in order to create constructive dialogue. Concentrating on the care involved in community composting, this paper offsets and problematises the technoscientific and capitalocentric bias in many circular economy discourses to date (following Gregson et al., 2015; Hobson, 2016; Hobson & Lynch, 2016). Drawing on empirical insights, this paper argues that a sensitisation of circular economy policy and research to matters of care (Puig de la Bellacasa, 2015), as it is practised through diverse economic, material, and social engagements in community composting, is needed to understand potential pathways to sustainable, regenerative, and circular food systems. Privileging care in this way, we argue, helps to crystallise the kinds of material and affective relationships needed to enact sustainability transformations.

Following an explanation of the context for the research on which this paper is based, we review existing research on composting and on the circular economy, identifying a research gap in the understanding of the social dimensions of sustainability in community composting, and in circular economy narratives more broadly. Drawing on empirical data generated through policy analysis and semi-structured interviews with policy makers and community composters, alongside participant observation in four community composting sites in New York City, this paper engages recent scholarship on care in cities (Power & Williams, 2020) and soil (Puig de la Bellacasa, 2015). We find the more-than-human entanglements of care, affect, and materiality evident in this scholarship also permeate practices of community composting. However, these ethics and qualities are rarely admitted in decision-making about systems of organic waste management.

2 | THE CONTEXT FOR COMMUNITY COMPOSTING IN NEW YORK CITY

Community composting in New York City (NYC), including the four specific sites explored in this paper, is not a new phenomenon. It has an extended history affected by broader changes in food and waste practices. As such, this section provides a brief context for community composting in NYC. Composting predates the circular economy agenda, however the metabolic processes which break down the carbon and nitrogen in food scraps and garden waste, and return these elements to the soil, might be described as the original circular economy. These are the kinds of regenerative metabolic cycles that circular economy innovations aspire to. Composting techniques range from indoor vermiculture (worm-based) and bokashi (bacteria fermented) composting, to small-scale backyard activities and neighbourhood, municipal, or regional-scale composting facilities (Boldrin et al., 2009). These features make composting *in toto* one of the most diverse and accessible set of practices that could contribute to the enactment of a more circular economy. Large centralised (municipal and commercial) facilities provide efficiency and economies of scale for those charged with organic waste management; however, the benefits of these systems can be far removed from residents, even when compost is distributed back to them. Furthermore, these systems depend on existing linear infrastructures for urban waste management, including fleets of trucks, and industrial waste transfer and processing facilitates. This creates socially and spatially unjust environmental burdens for the low income and minority communities who host the majority of waste transfer stations (NYC Environmental Justice Alliance, NRDC, 2018).

Community composting is "the notion that organics [shorthand for organic food waste] are processed as close to the sources where they are generated to capture the benefits of both the process and the finished product for the community" (Clark, 2015, p. 32). Community composting enterprises operate at a variety of operational scales, with complex and simple technologies; non-profit, cooperative, social enterprise, and for-profit business models; and through synergistic partnerships (e.g., with community gardens, urban farms, local businesses, as well as waste haulers and industrial composters). This diversity is exemplified by community composting in New York City. What unites this sector is a socio-material configuration that is designed to maximise community involvement and community benefits, which may include "social inclusion and empowerment, greener neighbourhoods, improved local soils, enhanced food security and

fewer food deserts, less truck traffic hauling garbage, more local jobs, and increased composting know-how and skills within the local workforce that is reinforced in the next generation" (ILSR, 2020).

2.1 | Compost in New York

The New York City Compost Project (NYCCP) was founded by the Department of Sanitation (DSNY) in 1993 with the mission of rebuilding "NYC's soils by providing New Yorkers with the knowledge, skills, and opportunities they need to produce and use compost locally" (DSNY, 2020). As an intermediary organisation, the DSNY Bureau of Recycling and Sustainability, which administers the NYCCP, helps leverage the passion and skill of a growing network of grassroots sustainability innovations in community recycling, including the Lower East Side Ecology Center (since 1986) and Grow NYC (since 1970). Both organisations provide community education around sustainability and have longstanding food scrap collection programmes at farmers markets. The NYCCP complements these and activities at community gardens by providing training and technical assistance. In 2014 alone, 2,470 New Yorkers participated in NYCCP composting workshops (DSNY, 2015). NYCCP is well known for their Master Composter training programme, which has equipped hundreds of New Yorkers with the knowledge and skills to start their own community composting operations in New York and beyond. Between 2014 and 2016, as part of the municipality's growing commitment to zero waste and the OneNYC sustainability goal of providing composting services for every New Yorker, the NYCCP received additional funding from DSNY which resulted in 24 new full-time positions dedicated to compost outreach and education, collecting neighbourhood foods scraps through local organic food waste recovery programmes (LORP), and the up-scaling of seven community composting demonstration and education sites across the five boroughs (DSNY, 2015). Figure 1 provides an overview of the multi-scalar governance arrangements that community composting in NYC is embedded in.

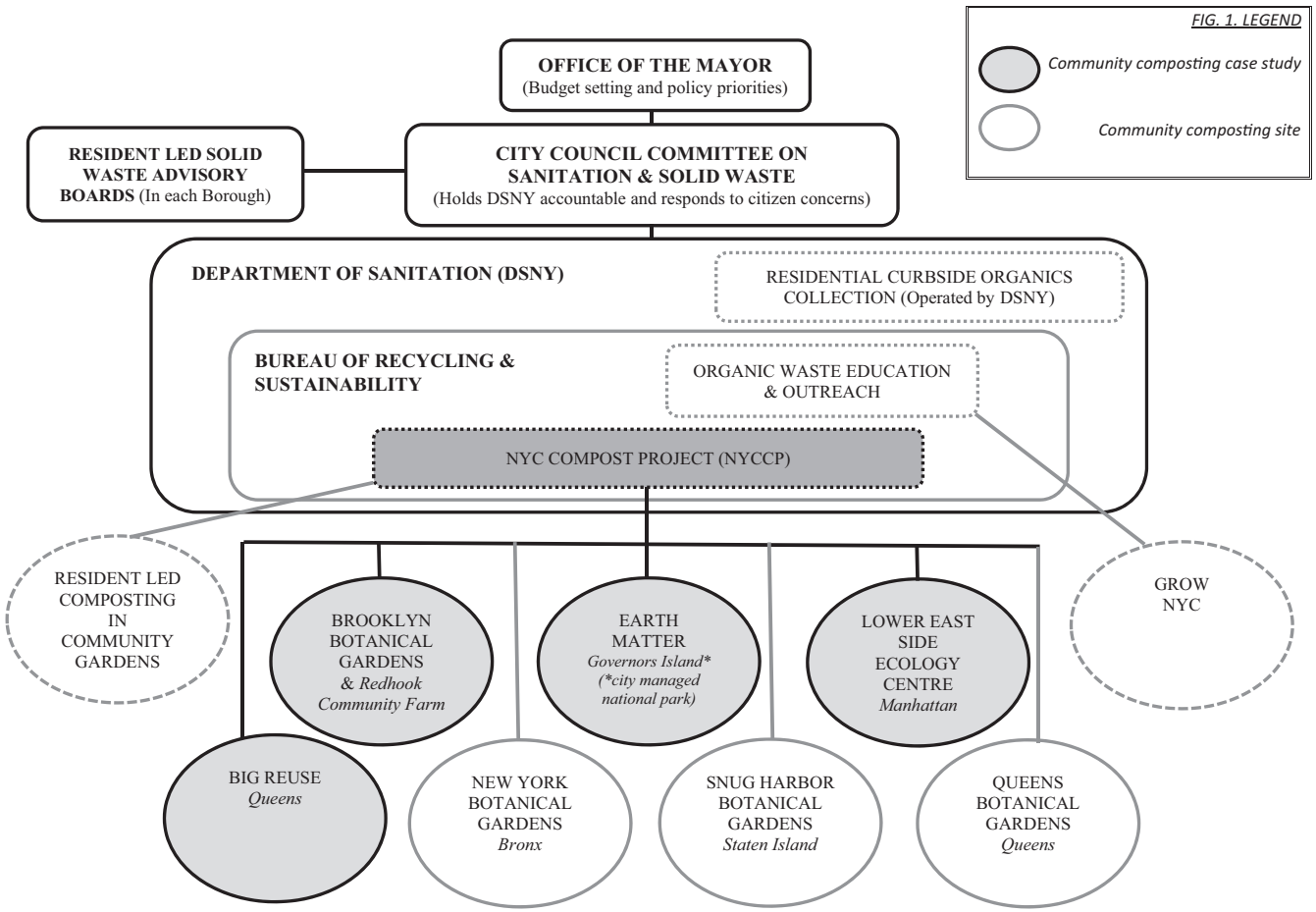

FIGURE 1 Community composting governance arrangement in New York City

This increased investment in community composting through the NYCCP occurred alongside a robust investment in residential kerb-side organic waste collection that began in 2014. It accompanied new waste regulations to help the city become zero waste by 2030, including an organic food waste ban for commercial food businesses (via composting, anaerobic digestion, or donation) (Baptista, 2018; City of New York: NYC Mayors Office of Sustainability, 2016; City of New York, 2014, 2015, 2016; City of New York: NYC Food Policy, 2016; DSNY: Bureau of Waste Prevention, Recycling and Reuse 2001; DSNY, 2006). This has led to an experimental and multi-scalar approach to composting in New York.

Community composters and their allies have driven the transition to municipal composting in New York. Since its inception, the NYCCP, and the multiple grassroots sustainability organisations it funds, have been recognised as critical partners in facilitating the behaviour change, education, and community outreach necessary to make composting accessible to a diversity of New Yorkers (DSNY, 2015). Changing the hearts, minds, and habits of New Yorkers and turning them onto compost was deemed essential for the success of residential kerb-side organic waste collection (Baptista, 2018; Buckel, 2013). These changes took place in what can be described as a "compost friendly" policy environment that began under the Bloomberg administration (the City of New York, 2011) and continued (until recent budget cuts) under the DeBlasio administration (the City of New York, 2014, 2015; 2016). Public investment in composting has been on the decline since 2018, when the phased roll out of kerb-side organics collection (a voluntary and free service for residents) came to a halt. In the proposed 2021 municipal budget, all funding for kerb-side and community composting was cut. These cuts were justified by the COVID-19 emergency and the high cost, US$1,400 per ton, of kerb-side organics collection (Citizens Budget Commission, 2016). This high cost was attributed to low participation rates (Goldenberg & Muoio, 2020). An economic argument for defunding the already frugal community composting programme was never made. In July 2020, thanks to sustained grassroots activism through the #saveourcompost campaign, US$2.86 million was restored to community composting at all seven NYCCP sites (NRDC, 2020). In April 2021, funding for kerb-side collection and GrowNYC was restored, and funding for community composting was expanded – however, the waste equity demands of composters and environmental justice advocates remain unanswered (City of New York, 2021).

Prior to the current crisis, New York's composting economy was thriving. In 2017, there were more than 200 community composting sites at community gardens across the city. A decentralised network of Master Composters, trained by NYCCP, were actively engaged in creating new compost operations, and providing informal training and technical support to their friends and neighbours. Micro-haulers were collecting commercial and residential organic food waste by bike and composting locally when possible. Municipal contracts for organic waste hauling, processing, and composting were awarded to private sector actors, who had an economic incentive to build the composting infrastructure that the metropolitan region needs (DSNY, 2012), as well as grassroots, non-profits, and cooperative enterprises in the social and solidarity economy, who created green jobs and improved their neighbourhoods by composting locally. The compost actors in this field are incredibly diverse in terms of their technologies and methods, their economic and funding models, and the scales at which they operate. Within this diverse economy (Gibson-Graham, 2008; Gibson-Graham & Dombroski, 2020), new material and social relations, that privilege an ethic of care, are being realised.

Realising social and environmental justice in New York's circular economy depends on generating a more holistic understanding of the diverse economies, materialities, and ethics of community composting. These dimensions are absent in circular economy research, which has focused primarily on business-led technological efficiencies and economic growth over social and ecological sustainability (for similar critiques, see Friant et al., 2020; Hobson, 2016). Municipal policy-makers are disciplined by similar logics of economic and administrative efficiency that form part of a neoliberal governing environment (Hird et al., 2014). Within this context, community composting enterprises must justify their existence, and respond to critiques that the sector is not scalable to meet the enormity of New York's organic waste stream, merely offering boutique solutions for a select section of society, and therefore unworthy of public investment. The benefits of community composting are rarely visible to those who are not intimately involved in the practice. As a result, the "added-value" that composting might bring to communities is rarely part of decision matrices. This paper aims to rectify this through a deep reading of community composting in NYC informed by emerging literature on circularity, composting, and care.

3 | COMPOSTING THE CIRCULAR ECONOMY WITH A FEMINIST ETHIC OF CARE

Circular economy scholarship and practice has been repeatedly criticised for a lack of attention to the social dimensions of sustainability (Hobson, 2016; Moreau et al., 2017; Pla-Julián & Guevara, 2019). Closing loops, without attending to

social impacts, equity, justice, ethics, practices, or values, will not spur the just transitions that are so urgently needed (Friant et al., 2020). This is a significant lacuna in research, considering the sustainability goals of circular economy (Ellen MacArthur Foundation, 2012). The roots of asocial circular economy narratives can be traced back to the emergence of political economy as a scientific approach (Cardoso, 2018). Tracing the evolution of the concept, Friant et al. (2020) show how the social, ethical, and ecological concerns that were once at the core of the emerging circular economy discourse in permaculture and ecological design during the 1970s were slowly written out by the technocentric and capitalocentric approach that thrived in the field of industrial ecology and the neoliberal climate of the 1980s and 1990s. In the 21st century, the circular economy agenda has been primarily policy-led rather than academic or activist-driven, with advocacy groups commissioning private sector consultancies to articulate the characteristics of circular economies (Ellen Macarthur Foundation, 2012) that talk the language of power and attend primarily to material flows. The paucity of attention to the social dimensions of circular economy policies and practices is problematic and leads us to take seriously what it means to participate in one eddy of the circular economy, that of community composting.

Advocates of a circular food economy (such as Jurgilevich et al., 2016) have identified the limits of the linear food system, calling for a redesign which reduces waste, reuses food (where safe to do so), makes good use of by-products from food processes and food waste (where it is not possible to design them out), and recycles nutrients. Where it is not possible to reduce or prevent food waste, circular economy models aim to revalorise it, bringing it back into production circuits (SAPEA, 2020). Numerous technical studies exist on large-scale energy recovery (biomethane) or fertiliser distillation from anaerobic digestion (AD) processes (e.gIngrao et al., 2018; Peng & Pivato, 2019), and include life-cycle assessments of these mechanisms (Slorach et al., 2019). To date, research adopting circular economy framings around end-of-life food, particularly in relation to composting (see Stoknes et al., 2018), has been dominated by attention to technical solutions, environmental benchmarks, and economic benefits. Yet, as already identified in critiques of circular economy research and practice more generally (see Hobson, 2016; Hobson & Lynch, 2016), complex matters of social practice and value, and particularly how those practices and values intersect with matters of care in, of, and for communities, are rarely prioritised. This stimulated Fratini et al. (2019) to ask whether the circular economy imaginary can be an opportunity for socially inclusive and environmentally desirable urban transitions. Exploring the case of community composting in New York, as a circular economy innovation that explicitly addresses the social concerns such as labour, health, equity, care, education, participation, and community well-being, begins to fill this critical gap in circular economy scholarship.

3.1 | Socialising compost: Managing food waste

There is growing public and scientific concern in the management of food waste. This includes attention to socio-technical innovations to reduce food waste and loss in the food supply system (Swannell et al., 2019), as well as grass-roots innovations which reduce consumer waste, and extend the useful life of edible food, for example through surplus food redistribution (Davies, 2019). While food waste continues to receive increasing attention from geographers and social scientists (Evans, 2012), with a growing interest in the affective, ethical, and more-than-human engagements with food waste (Mattila et al., 2019; Turner, 2019), social scientific research on composting is in its infancy, even in the dynamic field of discard studies (Hawkins, 2006; Schaffer, 2016). There is a small body of research examining the social practices, embodied and affective encounters, and ethical entanglements related to home composting (Abrahamsson & Betroni, 2014; Ames & Cook, 2020; Kinnunen, 2017), and composting toilets (Dimpfl & Moran, 2014; Hawkins, 2006; Pickering, 2010). But few researchers have examined the social dimensions of composting beyond the household, with the exception of one study on commoning and social innovation in urban composting (Swagemakers et al., 2018).

Meanwhile, in existing research on community composting, we notice the dominant circular economy focus on techno-scientific matters of scale and efficiency. Where the practice has been considered (e.g., Adhikari et al., 2010; Pai et al., 2019; Slater & Aiken, 2015), decentralised or community composting schemes are described as an alternative to the high capital investments and complex logistics required by centralised composting systems. Indeed, while centralised systems offer effective means to divert large volumes of organic material, research in Chicago found that community composting in public parks was a viable means of diverting substantial amounts of food waste, as a complementary intervention to waste diversion programmes (Pai et al., 2019). In a similar vein, Adhikari et al. (2010) found that on-site treatment of urban organic waste using practices such as community composting can lower management costs as well as greenhouse gas emissions by more than one-third in Europe and Canada.

The social dimensions of community composting are taken up explicitly by Slater and Aiken (2015), who in their research on community composting in the UK identified a diverse sector where composting was a complementary activity to help achieve wider environmental or social objectives. These objectives include: increasing awareness and actions relating to recycling and reuse, or supporting people to develop a healthier diet or learn meaningful life and work skills. They found that outputs from community composting were far more expansive than simple metrics relating to the scale of diversion from landfill. These included education events, volunteers, and placements alongside the skills and supports that community composting activities provided to community gardens and kitchens. Slater and Aiken (2015) argue that the standardised measurement and comparison of different community composting operations with existing commercial, large-scale, and highly institutionalised composting processes is not only challenging but also conceptually flawed. In the absence of agreement over measurement processes, they argue it is important to "consider the logic and purposes of the organizations themselves from the 'inside out' ... to assess their work against their objectives" (Slater & Aiken, 2015, p. 1098). Following this approach, we explore in this paper the practices and outcomes of community composting in New York City, focusing particularly on the important role of care involved in such practices as a means to offset and problematise the dominant technoscientific bias in circular economy discourses.

3.2 | Careful circularities: loving compost

Moving beyond the technocentric preoccupation with scale and efficiency in composting requires a different conceptual framework, one that is able to accommodate sustainability impacts beyond efficiency, and acknowledges and privileges the affective, material, and ethical *doing* of care (Puig de la Bellacasa, 2011). The diverse sustainability benefits of community composting – such as enhancing social cohesion, and individual and environmental wellbeing – remain overlooked because of a capitalocentric framing in circular economy narratives that privileges economic productivity and efficiency, commodity production and exchange, and limitless growth. As countless feminist scholars have noted (Cameron & Gibson-Graham, 2003; FADA, 2020), this framing marginalises and devalues care work, defined here as the paid and unpaid labours of caring for people and planet, "an affective state, a material vital doing, and an ethico-political obligation" (Puig de la Bellacasa, 2011, p. 90). The marginalisation of the ethics and values attached to care work has prompted recurring calls for an ethic of care (Fisher & Tronto, 1990). Making careful circularities visible thus requires a radical rethinking of economy and waste in circular economy research. Adopting a careful circularities lens, we can glimpse what other transformations occur at the level of everyday practices, affect, and emotions, such as cultural and ethical norms around responsibility, care, and repair.

We depart from previous research on circular economy and community composting to emphasise the practice (Macgregor, 2011), ethics (Fisher & Tronto, 1990), and materialities of care (Krzywoszynska, 2019; Puig de la Bellacasa, 2015) as critical to understanding sustainability benefits. We take inspiration from scholars of waste ethics (Hawkins, 2006) and soil ecology (Krzywoszynska, 2019; Puig de la Bellacasa, 2015), who have drawn on feminist ethics of care, science and technology studies, and feminist materialism to examine the careful interdependencies and interrelations that occur within waste, soils, and food systems. These perspectives privilege the role of attentiveness, responsiveness, and mutual vulnerability in the multispecies *doing* of care in science and everyday life. Along these lines, we argue that community composting offers an opportunity for relating to waste differently (Hawkins, 2006), through passionate immersion (Van Dooren et al., 2016) and play (Turner, 2019) that invites alternative ways of loving and living with organic waste, rather than managing it out of existence.

Feminist materialist approaches that attend to vibrant materialism, affect and emotion, and interspecies care are especially well suited to understanding the more-than-human entanglements and ethical engagements of community composting. These approaches have been widely applied to theorise the social, emotional, and ethical dimensions of sustainability transformations related to food and eating (Hayes-Conroy & Hayes-Conroy, 2010), diverse food economies (Beacham, 2018), waste (Hawkins, 2006), food waste (Turner, 2014, 2019), community gardening (Cameron et al., 2011), household composting (Kinnunen, 2017), and soil care (Krzywoszynska, 2019; Puig de la Bellacasa, 2015). Feminist materialist approaches to care emphasise the importance of attending to the transformations that occur at emotional, visceral, affective, and embodied levels – and see these as important ethical and political openings for rethinking our relationship with food and waste. The framework of careful circularity privileges the *doing* of care in circular economy and draws from feminist materialist approaches to embodiment and emotion, to attend to the social, material, and affective relations in community composting which invite new material sensitivities, affective stances, and ethical relations with waste.

Social, embodied, and ethical concerns are nearly absent in the scientific literature on composting and circular economy, which tends to focus much more on feasibility, evaluation, and matters of economic and material efficiency (Adhikari et al., 2010), although they are present in research on food waste and home composting (Ames & Cook, 2020; Kinnunen, 2017; Turner, 2014). These concerns led discard studies scholars to question the moralising calls for "zero waste" and circular economy ambitions to design a world without waste (Hawkins, 2006; Kinnunen, 2017; Song, 2016). What might be equally important is cultivating a different relationship to waste, that rests on an ethic of care, maintenance, and repair (Martínez, 2017) and refuses the "dominant ethos of disposal, distance, and denial" (Hawkins, 2006, p. 122) that has transformed waste from "the unavoidable material surplus of living" (Kinnunen, 2017, p. 67) to abject matter and environmental burden.

Attending to care as a property of community composting permits attention to other social values in circular economy scholarship. There has been far less discussion of the social and ethical implications of circularity, even as food, compost, waste, and soil are increasingly theorised as sites for practising a more-than-human ethics of care and transforming our relations with the material world in both agri-food studies (Beacham, 2018; Morrow, 2021; Puig de la Bellacasa, 2019) and discard studies (Hawkins, 2006). Following Friant et al. (2020) and Pla-Julián and Guevara (2019), we see an urgent need to bring these social dimensions, and care specifically, back into the description and analysis of circular economies. In this paper we apply the perspective of careful circularity to explore the diverse economies, materialities, ethics, and values of community composting in New York, thereby addressing the absence of research on the social dimensions of community composting and circular economy more broadly.

4 | METHODS

The qualitative data that this paper draws on is the result of research with community composting initiatives conducted over three months in the summer of 2017. The research was completed as part of a broader international research project about food sharing in cities (Davies, 2019). The New York City Compost Project (NYCCP) was selected as a case study because of the interaction between diverse actors in the collection, redistribution (i.e., sharing), and governance of compost. There are seven NYCCP sites in total and four of these were visited. These sites were selected for their geographic and operational diversity (see Table 1). They included well-established sites like Red

TABLE 1 New York City Compost Project demonstration sites studied

Host (location)	Composting techniques	Composting tools	Composting capacity
Brooklyn Botanical Gardens @ Red Hook Farm (Brooklyn)	Windrows, aerated static pile	Food scrap containers, shovels, brooms, wheelbarrows, screen, solar- and wind-powered air blower, solar panels, wind turbine	225+ tons[a]
BIG Reuse (Queens)	Aerated static pile, windrows	Food scrap containers, Gore cover, temperature and oxygen probes, blower, skid steer, Jay-Lor mixer, Toter-Tipper, screen, thermometers	650+ tons[b]
Earth Matter Compost Learning Center (Governors Island)	Aerated static pile, windrows, tumblers, in-vessel systems, 3 bin systems, bokashi composting, chicken assisted deep litter, worm bins, and much more	Food scrap containers, skid steer, Jay-Lor mixer, blowers, thermometers, shovels, numerous compost devices	480+ tons[c]
Lower East Side Ecology Center (Manhattan)	In-vessel system, windrows	Food scrap containers, compost containers, skid steer, truck, thermometer	250+ tons[d]

[a]Seehttp://www.added-value.org/compost/

[b]See https://static1.squarespace.com/static/5548ed90e4b0b0a763d0e704/t/5a4ebb27c8302547a5573fb6/1515109160628/Retherford-McCarronPaperv7-26-17.pdf,http://www.bigreuse.org/how-do-we-process-food-scraps-to-make-compost/

[c]Seehttp://www.nycfoodpolicy.org/earth-matter-ny/

[d]Seehttps://www1.nyc.gov/assets/donate/about/partnership/lowereastsideecologycenter.shtml

TABLE 2 Economies of community composting at NYCCP sites

Host	Funding model	Material transactions	Labour	Site ownership
Brooklyn Botanical Gardens @ Red Hook Community Farm (Brooklyn)	City-funded Barter relationship with food cooperative	Donated browns and greens Gifted compost	Waged unionised labour Alternative paid labour from Green City Force Volunteer labour	City property – managed via Greenthumb
BIG Reuse (Queens)	City-funded	Donated browns and greens Gifted compost	Waged labour Volunteer labour	City property – managed via Greenthumb
Earth Matter (Governors Island)	City-funded	Donated browns and greens Gifted compost	Waged labour Volunteer labour	City-managed National Park
Lower East Side Ecology Center (Manhattan)	City-funded Compost sold at farmers' market	Donated browns and greens Gifted compost	Waged labour Volunteer labour	City property – East River Park and Fireboat House, accessed in exchange for horticulture services

Hook Community Farm and the Lower East Side Ecology Center, as well as newer operations like the Earth Matter and BIG Reuse.

Participant observation took place during weekly volunteer shifts at three NYCCP community composting sites in Brooklyn, Queens, and on Governor's Island. This method allowed for extensive user engagements and hands-on experience with compost, eliciting data on the everyday practices, embodied experiences, and materialities of community composting. During this time, Oona worked with composters to hand sort and chop organic waste, build and turn compost piles, and sift, bag, and distribute finished compost to community members. Through these experiences she became attuned to the embodied and visceral dimensions of composting, although visceral methods (Hayes-Conroy, 2010) were not an initial part of our research design. She also attended food scrap donations in Brooklyn and Manhattan. During all of these activities she had informal chats with composters, food scrap donors, and compost users who readily shared the emotions and bodily sensations that composting provoked. It was not possible to volunteer at the NYCCP site in Manhattan; instead, a site visit, composting workshop, and interview were completed. Field notes were recorded as user engagements and served as an important starting point for identifying emergent themes for data analysis. These four NYCCP sites are summarised in Table 1 and discussed below.

Eight semi-structured interviews and more than ten informal chats were conducted with key staff members of the NYCCP, as well as entrepreneurs, policymakers, and city employees working on waste and circular economy in New York. To gain a sense of the broader policy landscape that shapes New York's composting economy, public policy documents, industry reports and websites, and news articles were also examined. The interviews were transcribed and analysed in NVivo through two rounds of coding. First, with predetermined codes including: goals and motivations; food waste; history; policy, rules, and regulation; scale and sustainability. These codes were developed together with an international research team to facilitate cross-case comparisons and summaries. The second round of coding drew on the context-specific themes and concerns identified in field notes, and these focused on economies, material flows and encounters, diverse economies, and embodied experiences of labour and care. Interviewees are quoted anonymously or by name, according to their wishes.

5 | CAREFUL CIRCULARITIES IN COMMUNITY COMPOSTING

In this section we draw out the complex performances of care observed in the creation and distribution of compost. From the perspective of careful circularity, we consider how the diverse economies and materialities of community composting can generate positive economic, environmental, and, particularly, social transformations. In this way we demonstrate empirically what might be gained by expanding theoretical conceptions of a circular economy to include considerations of care – care for oneself, for the wider community and environment, and with more-than-human others. The economic practices and material flows at each community composting site are embedded in circuits of

care that span a number of subjects, sites, and spaces: households carefully sorting their organic waste; care for and with more-than-human composting companions; care for urban trees, soils, and environments; care for the health of neighbours near and far whose bodies carry the unequal environmental burden of our linear waste management system; and care for community.

5.1 | Economies and care in community composting

While there is increasing recognition of the role of cities in the circular economy (Fratini et al., 2019), there is less exploration of the role of cities in redistributing the wealth and resources necessary for a just transition to not just a circular economy but also a circular and regenerative society that is founded on social and environmental justice, resilience, and plenitude (Friant et al., 2020). There is an assumption in circular economy literature that policy-makers should support those circular economy innovations that have an economic rationale, and promise efficiency, profit, and scale (Ellen Macarthur Foundation, 2012). Yet, as Hobson (2016) convincingly argues, this economic rationale risks perpetuating the current business-as-usual approach, particularly when the economy is defined in terms of capital and growth, rather than livelihoods and sufficiency. Worse, it may eclipse the regenerative work that many grassroots sustainability initiatives are engaged in, potentially undervaluing, underfunding, and undermining the transformative potential of these community-based activities. A diverse economies lens (Gibson-Graham, 2008) is therefore useful for appreciating a wider range of economic activity in circular economy, including non-monetary benefits evident in the multispecies care work of community composting, through which organic waste, people, communities, worms, and urban soils become "matters of care" (Puig de la Bellacasa, 2011). Moving beyond a capitalocentric view of the economy within the circular economy allows for greater recognition of the caring and regenerative labours that are invisible to, excluded from, or devalued in relation to capitalism (Holmes, 2018; Moreau et al., 2017).

At the NYCCP compost sites studied, careful circularities are being realised through paid and unpaid labour, non-market exchanges, the donation of materials, and the gifting and sharing of compost. These economic practices are embedded in a broader diverse economy of community composting, in which public funding and property, and community participation play a significant role. All NYCCP compost sites are run by non-profit organisations and, as a condition of public funding, NYCCP compost must remain a public good. Together these make up the diverse economies of community composting (see Table 2).

5.2 | Labour

The labour of composting at NYCCP is conducted collectively, in collaboration with volunteers, staff, youth, and more-than-human compost companions who metabolise organic matter, weave fungal webs, and aerate compost with their movements. These joint labours are educational experiences, through which participants learn to care for compost and its inputs through passionate immersion (Van Dooren et al., 2016) and play (Turner, 2019) with more-than-human compost companions. This echoes Puig de la Bellacasa's (2019) observations of the affective and embodied ways that humans come to know and care for soil. However, Pitt (2018) questions the extent to which such encounters necessarily lead to more caring relations. Food provisioning is often driven by anthropocentric notions of care (Morrow, 2021). This leads Pitt to situate more-than-human encounters on a spectrum from caring to killing, that recognises the ambivalence of killing some non-humans, like slugs (Ginn, 2014), in order to care for others. Similarly, research on household composting has found that encounters with organic waste, smells, and pests can disrupt the labours of household sustainability (Ames & Cook, 2020). Through hands-on experiences and passionate immersion in the compost pile, participants learn to be attentive and responsive to diverse materialities (plastic bags, elastic bands, fruit stickers, maggots) in the waste stream. Importantly, the convivial act of composting-together stimulates curiosity, surprise, and joint reflections on how to be a "good composter." Using finished compost to tend vegetable patches and urban trees is another way of experiencing these benefits. These labours help residents understand and appreciate the benefits of composting, and also what can and cannot be composted (Buckel, 2013).

Under the leadership of David Buckel, the BBG NYCCP site at Red Hook Community Farm has developed a low carbon and labour-intensive approach to composting. This model began through a unique collaboration with Park Slope Food Coop. Members of the Coop volunteer for three hours each month in a variety of coop jobs, including unloading, restocking, childcare, and cleaning. However, there are currently more members than jobs. This allows the Food Coop to

redistribute surplus labour to various community projects. The Coop approached Red Hook Community Farm to donate their organic waste. In exchange for composting services at the farm, Coop members contribute to the collective labour of processing their waste. It is through this exchange and access to abundant voluntary labour that David's slow compost approach took root.

Another important source of composting labour is the Americorp programme Green City Force. This programme recruits young adults living in public housing to the green economy, providing paid hands-on training in green enterprises that benefit the communities in which they live. Participants are regular volunteers at the Brooklyn site, where they create compost for their urban farm at nearby NYCHA public housing. Each week they run a barter market at the farm, where resident can pay for fresh organic vegetables with their time (volunteering on the farm) or with food scraps (to feed the compost). Their participation ensures that composting skills, labour, and materials reach the most disadvantaged New Yorkers. This is an example of a careful circularity, where material and labour flows are designed around principles of social justice and solidarity rather than efficiency and profit. The participation of young people of colour is critical to further diversifying the sustainability movement and ensuring that composting is accessible and accountable to those communities who continue to carry the unequal environmental burden of municipal waste management (New York City Environmental Justice Alliance, 2020).

Community composting is a kind of care work that is socially and environmentally necessary. However, like other forms of care work it is often undervalued. Green jobs in the grassroots sustainability movements like urban agriculture (Reynolds, 2015) and community composting are often done as volunteer work or poorly compensated "labours of love" by people with the socio-economic privilege to do so. This limits the diversity of the sustainability movement, and can lead to blind spots around racial and economic justice. As Guy Schaffer and Sandy Nurse have argued, in relation to the youth-led composting enterprise BK Rot, if composting is valuable environmental work, it must be compensated as such (Schaffer, 2016, 2017). The current manager of the Brooklyn NYCCP site is an alumnus of Green City Force, where he trained with his predecessor David. As an employee of BBG he holds a union contract (and the benefits that have been secured through collective bargaining by the labour union DC 37 Local 374). This is a small step in ensuring that the caring and regenerative labours of the circular economy are accessible, inclusive, and fairly valued.

5.3 | Transactions

The distribution of compost is another way in which social and economic benefits are realised. All NYCCP sites have the mandate to distribute compost to community greening, where compost circulates through wider circuits of environmental care. Recipients include Parks as well as community groups. The Lower East Side Ecology Center works closely with residents who steward the trees in their neighbourhood. And the Big Reuse has an online portal through which community groups can request compost. They have adopted a comparatively loose definition of community group – as any group of more than two people who are doing something for their community. When someone makes a request for compost, they receive a phone call from a NYCCP employee who asks them about their composting needs and knowledge. Through this process they actively foster new community collaborations around local needs.

> And if we know that they are just one person we always like try and "hey, why don't you ask your neighbour if she needs some too and then you can be a community group?" And like giving people the gumption, you know, and kind of like the carrot to talk to their neighbours about compost that's free – because everybody loves free stuff. (Staff, Big Reuse)

The power of compost-sharing to facilitate community was observed during a compost pick up at Big Reuse. Here Oona encountered an energetic white man from Brooklyn, who was the self-appointed neighbourhood tree steward of his block. He waters the trees, cleans garbage out of the beds, and yells at people for using it as a dog toilet. For the first time he is picking up free compost. Having community compost will require him to enrol his neighbours into practices of tree care as well, potentially shifting a policing relationship to a caring one. Making community-based environmental care a condition for accessing community compost has the potential to further incentivise forms of collective care. It also resources the caring activities that many residents already engage in.

In Brooklyn, David was more selective about the community groups he distributed compost to. Community groups must prove they are a non-profit. Recipients included a food pantry that grows fresh vegetables for clients; urban farms at NYCHA public housing run by Green City Force; and the adjacent youth-run Red Hook Community Farm. These

transactions allow the operation to close the loop on its circular food economy in the most local way possible, while distributing compost to places where they believe it achieves the maximum social impact.

The non-market transactions that occur around community composting are about more than simply "closing loops" or keeping resources at their highest economic value for as long as possible. They are about circulating resources where they are most needed, according to the logics of care, social justice, and solidarity. The materials (e.g., compost, food scraps, weeds, wood chips and shavings, leaves, coffee chaff, etc.) that flow so freely through the community composting economy have been stripped of their exchange value, instead they are gifted, bartered, and shared. The resulting compost is a protected public good that cannot be exchanged for money. Transforming waste into a commons facilitates collective forms of care. This logic stands in sharp contrast to the circular economy discourse of revalorising waste as a commodified resource (Ellen Macarthur Foundation, 2012).

Preserving non-market spaces of circular economy is necessary for realising the broader (social, economic, and environmental) sustainability aims of circularity (Moreau et al., 2017; Pla-Julián & Guevara, 2019). Pursuing an economic rationale alone will impede circular economy agendas from addressing socio-economic and environmental justice (Friant et al., 2020). Public funding is essential to resourcing these spaces of possibility, while fairly compensating the care work of community composting, and ensuring that these "caring infrastructures" (Morrow & Parker, 2020) and green jobs are accessible and inclusive to diverse urban residents.

5.4 | Material encounters and care in community composting

The environmental injustice of our current linear waste economy, and the presumed benefits of shifting to a circular economy, can be understood through the lens of materiality. The socio-technical configuration of waste management brings together diverse materialities, such as waste infrastructure (transfer stations, trucks, and bins), the pollutants that fill our air and accumulate in our bodies, causing asthma and other diseases, and the vital materialism of waste itself – as an unstable, diverse, and potentially toxic entity (Hird, 2013). The materialities of waste are felt most acutely around waste transfer stations. Seventy-five percent of the city's waste is trucked into just three neighbourhoods – North Brooklyn, Southeast Queens, and the South Bronx – for processing before travelling to landfill, incineration, recycling, anaerobic digester, or industrial compost (NRDC, 2018). As one interviewee stated:

> It results in a lot of truck traffic and, you know, associated issues. Asthma in particular is really high in North Brooklyn I think and the South Bronx too. I think between the two they're like within the Top 5 most hospitalisations for asthma in the city if not the country. It's pretty intense. (City council staff)

However, one of the unintended consequences of the municipal kerb-side composting programme was increased truck traffic to these same neighbourhoods.

> [DSNY] just did a bunch of new contracts with private waste transfer stations for organics [organic food waste] processing as part of increasing the programme ... eight out of ten of them went to facilities in those three districts. So they're just increasing what's going there every day. (City council staff)

Even the most high-tech innovations for processing organic waste, such as anaerobic digesters, depend on existing waste infrastructure (e.g., trucks) to move waste "someplace else" and thus reinforce unjust waste mobilities (Davies, 2012) and geographic inequalities. Certainly, "simply 'adding compost' to an unsustainable and environmentally unjust waste management systems does not lead to sustainable or just urban transformations" (Morrow, in press). Examining the flows, relationalities, and geographies that develop around the materiality of organic waste offers a way into thinking about the possibility of more just transitions in socio-technical configurations such as community composting, and the broader waste management systems these practices are embedded in.

> Most folks agree that the more decentralised and local organics [organic food waste] recovery [is] the better, because less is going on trucks, material's not going as far away, it's just better for the environment. And from a community-building standpoint more of the resources that are in the community stay there instead of going somewhere else. (David, NYCCP, Brooklyn)

Community composting brings people into contact with a diverse set of materialities, including soil, worms, microbes, chickens, goats, sweaty bodies, food scraps, bins, bicycles and tricycles, shovels and pitchforks, trucks, blowers, tarps, thermometers, and the mix of ingredients called browns (dry, carbon) and greens (wet, nitrogen) that make up compost. Keeping these organic materials local, by redistributing the benefits of compost to urban food growing, trees, and soils, offers a way of "closing the loop" or at least ensuring that the benefits and responsibilities for such resources are shared locally and not transformed into burdens elsewhere.

Public organic food waste collection for community composting also stages new encounters that bring residents into contact with the diverse materialities that make up their organic waste stream. Rather than hiding organic waste at the bottom of the bin, community composting celebrates food scraps and the people who donate them. At farmers markets and compost drop-offs across the city, people can be found hanging out, talking trash, depositing their frozen food scrap sculptures, and critically reflecting on the consumption habits that led to them standing there red-handed with a bag full of mouldy strawberries from halfway around the world.

> And then you have folks that are like giving us like whole frozen strawberries because they just like think it's bad. It would normally go in their garbage but they're putting it in there and they're like, "I feel so much better about that." And then it allows a time for reflection because it's almost like when you go like for confession. It's like you "come to the toter [bin]" and you see what you're putting in there, and if we're there we get to engage with you – "Hey, thanks, what's this? Oh, wow. Okay." (NYCCP staff, Queens)

Food scrap donation can be a moment for confessing our food waste sins, providing a sense of relief (Ames & Cook, 2020). But it is also a chance for exchange, education, and reflection. Participants might take home a neglected plant or even food that looks OK, or trade advice on how to use up ingredients and food scraps in the kitchen.

One of the critical roles of community composting, especially in the eyes of the city, is community education and engagement. One of the primary modes of engagement is volunteering. Volunteers come to compost sites to be with the waste, compost, and soil and get their hands dirty, creating visceral contexts for engagement with food and the materialities of food becoming compost (Ames & Cook, 2020). Rather than disappearing our waste through kerb-side collections which ultimately ends up, out of sight and mind, in a landfill, incinerator or anaerobic digester, community composting allows people to participate in the diverse economy of composting. In Brooklyn, the process starts with dumping out a bin of food scraps, onto a base of browns (wood chips, leaves). Volunteers wear rubberised gloves and sort through the colourful and putrid collection by hand to remove plastic bags and elastics, and break up large objects, like watermelon rinds, using a spade. Stomping, squishing, smashing and generally mucking around in decay seems to satisfy a desire for play for those involved. Playing with food waste (Turner, 2019) is a form of sensuous and passionate immersion (Van Dooren et al., 2016), through which participants come to love rather than fear the vitality of compost. The windrow pile is then built up and up, with layers of browns and finished compost to seal it off from the ever-present threat of rats and seagulls. The materialities of living with organic waste in a densely populated city create new encounters with urban nature, some desirable, others less so.

At the Brooklyn site, more than 2000 volunteers are involved in composting each year. Many are drawn to the site through the online platform NYCares – out of curiosity and a desire to act against climate change. Others come for the pleasure and conviviality of composting with others. Hand-turning compost is fast spreading as the best free work out in Brooklyn. Care for community and planet is certainly one motivation for volunteering, but for many it is not the main reason for showing up, at least not initially. It is *through* the embodied labours of composting that volunteers come to come care about compost, soil, waste management systems, food waste, worms, and their more-than-human composting companions. Numerous composters described this as a process of "falling in love" with compost. When compost services were cut by the mayor, composters expressed pain and "heartbreak" when they thought of their food scraps going to landfill.

The "slow compost" approach, where annually 225+ tons of compost are processed entirely by hand, is a deliberate nod to the sensuous visceral encounters that slow food stages, as sites for realising new relations to our local food system through the body (Buckel, 2013; Hayes-Conroy & Hayes-Conroy, 2010). Visceral encounters with the materiality of organic waste can also be transformative. These encounters offer opportunities for what Hawkins and Potter describe as "a kind of intimacy and enchantment with the sensuousness and vitality of rubbish" (2006, p. 111). When such encounters occur at the community compost sites, volunteers are described as "jazzed" and overcoming revulsion and disgust to make space for curiosity and wonder, as David recalls, "oh, this isn't yucky. Oh, this is wonderful." The affective swerve from yuck to wonderful we observed in community composting contrasts with Ames and Cook (2020), who find that

households involved in composting are debilitated by their visceral reactions of disgust towards the presence of decay in their otherwise clean and sanitary homes. This points to the importance that a public and convivial setting may play in stimulating play, experimentation, and curiosity around social norms of engagement with food waste. As suggested by Rankin (2019), it is possible to feel mixed emotions in our visceral engagements with compost; emotions can ebb and flow over time and across different spaces. Acknowledging this complexity would mean designing compost opportunities that invite a diversity of bodies, emotions, and affective states.

To make time for these visceral encounters, inefficiency is deliberately cultivated. David refused to adopt labour-saving technologies (such as skid steers) that many of his colleagues around the city have brought into their operations. He viewed such technologies as an unnecessary use of fossil fuels, requiring too much maintenance and safety training, and creating barriers to community engagement. David was also very passionate about the sustainability lessons we can learn from the labour of community composting and the physicality of care.

> One of the challenges for developing sustainable practices, whether it's recovering organic material for the purposes of making compost or whether it's more generally making sure that the negative impact you have on other human beings and the Earth is more minimal. Talking about it is so easy. (David)

To reflect this priority, everything in Brooklyn is done carefully by hand, creating intentionally slow, artisanal, and physically demanding systems. Year round, 10–30 volunteers turn up Saturdays to turn, move, and sift tons of compost, with pitchfork, wheelbarrow, shovel, and screens. Where other compost operations use a machine sifter, this operation has a screen frame that hangs over wheelbarrows. Finished compost is used on the farm or bagged and delivered to community greening projects. During sifting, people of all ages and backgrounds stand shoulder to shoulder, listening to hip hop, and gently pushing finished compost through the screen. During this process we pick out fruit stickers and elastics which failed to decompose and hand rescue the worms. The worms are returned to live in a new pile. This slow time was a much-needed opportunity for us to escape the heat of the day, pause, and reflect on our lives together and share anxieties about what was coming "next" – whether it was climate change, the end of school or work, or an apartment lease.

Through slow composting, the physical and bodily burden of "taking care" of one's own community's waste is experienced. The weight of this waste is literally on our shoulders, backs, and knees, and carrying it forces our bodies to slow down and make time for composting, a necessary labour of soil care (Puig de la Bellacasa, 2015), by cultivating attentiveness (Krzywoszynska, 2019) toward composting processes and waste itself.

5.5 | Visibility, values, and the precarious benefits of community composting for a circular economy

The previous sub-sections have illustrated how community composting, in its diverse organisational forms, works by engendering a suite of material interactions with food waste, compost, soil, and technologies. By doing so, NYCCP provides far more than a service for the collection and management of food waste. In direct contrast to the commercial and municipal kerb-side collection of organic waste and the mega-facility composting infrastructures which are exacerbating socio-environmental injustices, community composting ensures the value of end-of-life food remains within the territorial communities that create it. Community composting provides material sustenance for soils in community gardens and other spaces that embody a circular and regenerative approach to food production and consumption (Davies, 2020). It also facilitates the re-enchantment of waste through multisensory engagements with more-than-human others in the vital and valuable processes of organic decomposition. Essentially, the diverse economies of community composting and the material interactions it fosters combine to generate positive economic, environmental, and, particularly, social transformations within the sites of community composting and their environs which exceed conventional waste management across multiple dimensions.

However, this reading of the multivalent benefits and values of community composting only counts if it is part of evaluative mechanisms. It is widely documented that municipal waste management, including food waste, has elevated material and economic efficiency as the main metrics of evaluation (Davies & O'Callaghan-Platt, 2008). While circular economy narratives potentially offer the opportunity to look beyond these arenas of value, to date interpretations have tended to focus on how circularising economies can support the extraction of even more economic value from existing systems (Gregson et al., 2015). Political commitments on the part of governments (when viewed as a

singular institutional organism) remain wedded to the primacy of the market, even within recent conceptions of a green new deal (Galvin & Healy, 2020). Yet, as this paper has shown, it is possible to do things differently at a more cellular level within the organism of government and for diverse economies of composting to co-exist. Nonetheless this is a precarious co-existence, as illustrated by the 2020 budget cuts. Yet, as Gregson et al. (2015) note, the diversity of interpretations of circular economies means that there are inevitably collisions of morality, materiality, and market logics that create political contestation.

At the time of fieldwork, community composting in NYC was a site of diverse economic practice and material transformation, transforming waste and decay into life. It illustrated diverse economic models that help redistribute the benefits and burdens of these transformations in more just and sustainable ways. Importantly, community composting creates sites for social transformations, from the affective, emotional, and visceral engagements with waste becoming compost that makes participants feel enlivened, to the personal and ethical reflections on the daily practices, habits, and wider systems of provisioning that generate waste. The simple act of "sorting" food waste, prior to composting it, can be a starting place for reflection. At the neighbourhood level, community composting is enrolled in all kinds of transformations, from growing food, to taking care of trees, to bringing people together to negotiate collective responsibility for their compost. Community composting is also a place where, unsurprisingly, people build community. Making the "compost connection" as many interviewees referred to the process of closing the loop between waste, resources, and food, is about much more than returning nutrients to the soil. It is about connecting by doing this work together. The collective action of caring for compost together, or the sense of accomplishment one feels after turning 300 pounds of food waste by hand, can generate discussions of enacting wider changes together.

Holding space for these practices, keeping them funded, and drafting policies that protect and incentivise them are the result of decades of collective action by citizens groups such as SWAB and the citizens committee for New York, environmental justice and waste advocacy groups, composters, gardeners, and their city council representatives. Collective action that, in light of the COVID-19 pandemic, is needed more than ever if the processes are to survive austerity measures in NYC.

6 | CONCLUSION

This paper has illustrated how community composting in the NYCCP creates connections through diverse economic practices and new socio-material interactions between people and organic food waste. To understand these interactions and address a scientific gap concerning the social dimensions of circular economy we have developed the perspective of careful circularity. This approach privileges the multispecies *doing* of care, and can help researchers attend to social, material, and affective relations and transformations in circular economy projects. Community composting creates time and space for cultivating an ethics of care toward organic waste, human and more-than-human others, shifting subjectivities, as well as everyday waste practices.

However, these transformations currently fly below the radar of a regime seeking economic growth and efficiency. Having identified the type of benefits that community composting generates, we believe it is important to examine more closely what it would mean to develop a system of governance that is able to build these benefits into evaluations of policy and practice. In particular, the practicalities of implementing a care ethics approach, and the multispecies alliances and sensitivities it will demand, should be articulated in greater detail in future work. Given the nature of benefits around care and circularity, this will need to be more than a technical matter of methodologies and must involve wider consideration of value and judgement. Such value judgements are not absent from existing systems, but they are rarely explicit. However, we agree with Hinrichs (2014) that explicit examination of power, politics, and governance, which collectively shape the allocation of value, is necessary to get to the bottom of injustice in food systems. Foundational questions regarding values and ethics must accompany questions about who gets to shape and operationalise governing systems and interpretations of sustainability (Smith & Stirling, 2010; Thompson, 2010).

Supporting transitions towards more careful circularities means grappling with messy, complex, and contested criteria that are not easily identified or captured by existing rationalities and technologies of food waste governance. Community composting, as practised in NYC and articulated in this paper, provides an actually existing demonstration of the kinds of positive effects and affects that can be generated. However, without changes in wider systems of food and waste governance and environmental ethics, these impacts will go unnoticed and uncounted. We sense the stirrings of these changes in the compost pile, and welcome further research on the numerous ways in which

multispecies care, play, and attentiveness are opening up pathways for more joyful, responsive, and environmentally just approaches to sustainability.

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DATA AVAILABILITY STATEMENT

The data that support the findings of this study are available on request from the corresponding author, OM. The data are not publicly available due to restrictions, e.g., their containing information that could compromise the privacy of research participants.

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