Agriculture and Human Values
https://doi.org/10.1007/s10460-025-10709-0

DISCUSSION PIECE

What does it mean to care in industrial agriculture?

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Accepted: 17 January 2025

Abstract
The paper examines contradictions, limits, and possibilities of agri-care in industrial production. It synthesizes current scholarly debates to identify four pathways for generating caring agriculture: (1) the ethical contagion approach in more-than-human ethics; (2) reciprocal responsibilities and enchantment grounded approaches in Indigenous, religious, and spiritual forms of care; (3) care motivated by aesthetics, values, and ethics in human-centric approaches; and (4) justice driven care grounded in political economy critiques of agrarian capitalism. Drawing on feminist studies, we add a fifth approach centered around the ethics of care and social reproduction to foreground industrial agricultural production in reproductive and care labors. In doing so, our approach highlights the gendered dimension of care and suggests paying closer attention to unequal, historically and geographically situated social relations in care politics. The social reproduction approach underscores the systemic role that care plays in capitalist society by linking caring through industrial intensification with the exploitation of care work in domestic, farm/workplace, and community domains. Central to our reading of the feminist care approach is relational agency, which affords interactivity, mutuality, non-commodified experience, and biospheric egalitarianism in agri-care engagements, raising fundamental questions of whether these qualities can align with the logic of industrial production. From the perspective of social reproduction, even the limited instances of care in industrial agriculture contribute to reinventing and advancing the late capitalist food regime.

Keywords Agri-care · Ethics of care · Industrialization · More-than-human ethics · Labor · Social reproduction

Introduction

Entrepreneurs, technologists, and policymakers frequently argue that new technologies will lead to more sustainable, resilient, and environmentally friendly agriculture. Precision agriculture and vertical farming promise to optimize resource use and reduce pollution, while automation, digitalization, and biotechnological advancements are believed to improve working conditions, lower agriculture's ecological footprint, and alleviate animal suffering (Baur and Iles 2023; Broad et al. 2022; Sparrow and Howard 2021; Werkheiser 2018). The assumption is that these technologies will lead to better care for animals, plants, and communities, thereby addressing interconnected environmental and social crises through industrial intensification.

There have been some instances of successful ecological design that enable environmental care in a factory setting (Geissdoerfer et al. 2017).[1] Yet, practicing caring agriculture has proved to be an ambivalent, contradictory, and "slippery" effort (Arnold et al. 2022; Martin et al. 2015; Mol et al. 2010) even in small gardens tended by conscientious cultivators (Doody et al. 2014; Ginn 2014), let alone in

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[1] One of the most prominent examples of such visions is the circular economy, an industrial systems design approach that aims to create a restorative and regenerative economy (Ellen MacArthur Foundation 2013: p. 2). The circular economy differs from regenerative agriculture, agroecology, or conservation agriculture because it relies on conventional agriculture methods. However, it also differs from the current agro-industrial system defined by the metabolic "interconversions of matter" (Landecker 2013: p. 495; 2019), where, for example, livestock rearing is integrated into the pharmaceutical, cosmetics, and packaging industries, among others (Blanchette 2020: p. 13). Its stated goal is to care for nature through technology.

Published online: 25 March 2025

agro-industrial complexes (Fairbarn 2021; Singleton 2010; Enticott and O'Mahony 2024). Agricultural ecologies are open systems enmeshed in symbiotic relationships with larger ecologies shaped by environmental conditions such as climate, soil properties, water systems, wildlife migration, pathogen reproduction patterns, etc., but also social, cultural, political, and economic factors that determine what crops and livestock are grown, who performs labor, which technologies are accessible, and what is considered as good farming (Beacham 2022; Puig de la Bellacasa 2017). As scholars have argued, even some of the most successful technological solutions and business model innovations still exhibit the characteristics of "weak ecological modernization" (Hobson 2013: p. 90; Lane and Watson 2012) that has failed to create an inclusive green economy or address environmental and social crises it ushered in the first place (Calisto Friant et al. 2020; Hobson 2016; Morrow and Davies 2022).

Underlying these discussions is the tension surrounding the concept of agri-care itself. Care refers to the attention and nurturing that fosters the "good life" in and of itself, while large-scale industrial agriculture is optimized to extract value and increase commodity production by exploiting reproductive capacities of non-human nature and labor (Graddy-Lovelace 2020; Mahony 2023). If agriculture can indeed be caring, what does such care look like in an industrial setting? The goal of this paper is to examine this question.

We begin with a synthesis of the extant literature on caring agriculture, care in technoscience, and critiques of industrial agriculture to identify four overlapping approaches to agri-care, namely (1) the ethical contagion approach in more-than-human ethics; (2) reciprocal responsibilities and enchantment grounded approaches in Indigenous, religious, and spiritual forms of care; (3) care motivated by aesthetics, values, and ethics in human-centric approaches; and (4) the justice driven care grounded in the political economy critiques of agrarian capitalism. Building on feminist scholars, we outline the fifth approach to care. Such an approach points to the centrality of relations spanning productive, domestic, and public spheres in practicing caring agriculture. It also foregrounds industrial agricultural production in gendered reproductive care labors. Our analysis underscores the situatedness of care in a particular social, historical, and political context. At the core of our reading of the feminist care approach is the notion of relational or distributed agency that is based on interactivity, feedback loops, non-commodified practice, and democratic institutions and principles that extend to non-human nature. This raises critical questions about whether such qualities can be reconciled with the extractive logic of industrial production. Moreover, our approach points to the contradictory nature of care to argue that agri-care holds the potential for both making meaningful changes in industrial systems and reproducing the exploitative and extractive trends in the late capitalist food regime. This means that even the rare instances of care in industrial agriculture enable and help sustain the late capitalist agro-food economy.

To develop these arguments, the remaining part of the paper is organized around four sections. The following section presents an overview of the four approaches. Next, we discuss challenges and possibilities of caring in industrial agriculture. We then develop a fifth mode of care centering on social reproduction and care theory. Our analysis concludes with a discussion of possibilities and limits of practicing agri-care in industrial agriculture.

What drives care in agriculture: four pathways for caring relations

The current understanding of care (care theory) is rooted in the 1980s and early 1990s feminist moral philosophy that questioned dominant ideas of individualism, autonomy, and rationality as underpinning personhood and modern societies. Foundational for care theory is relational ethics that focuses on capacities to respond, engage, cooperate, and recognize the other (Gilligan 1982; Noddings 1984; Held 1993, 1995; Collins 1998). In this context, care is defined as practices, relations, moral commitments, and affective predispositions that "includes everything that we do to maintain, continue, and repair our 'world' so that we can live in it as well as possible. That world includes our bodies, our selves, and our environment, all of which we seek to interweave in a complex, life-sustaining web" (Tronto 1993: p. 103).

Notably, this literature does not equate care with love or even positive experiences. It also does not lead to "assured outcomes" of improved well-being (Haraway 2008; Ginn 2014). As Tronto shows, care can be oppressive, misguided or even detrimental if performed without competence, consent or understanding of the actually existing needs of others (Tronto 1993; Martin et al. 2015). Therefore, care is better understood as a messy interactive process that does not escape power differentials, (self-)exploitation, and violence (Cusworth 2023; Ginn 2014; Law 2010; Singleton 2010; see also Murphy 2015).

Against this background, the growing scholarship on caring agriculture has developed insightful conceptual tools for understanding the practices and values that underpin care (for foundational work in this subfield, see e.g., Curry 2002; Cox et al. 2013). Despite the diversity of approaches, debates revolve around four overlapping yet conceptually distinct approaches to how care is generated and performed.

The most prominent debate on caring agriculture comes from more-than-human ethics and new materialist traditions that move beyond human-centric, instrumentalist approaches to nature to recognize the inherent value, agency, and temporalities of nonhuman nature (Beacham 2018; Seymour and Connelly 2023; Puig de la Bellacasa 2017, 2015; Whatmore 2006). In this approach, care is generated through embodied, sensorial experience and sustained attention to non-human nature (Alarcon et al. 2020; Krzywoszynska 2019; Reisman 2021) practiced in the form of tinkering (Mol et al. 2010) and respectful "living with" microbes, animals, and ecological systems (e.g., Paxson 2012). Such care is usually understood as the capacity to respond to the needs of others, such as vines (Krzywoszynska 2016) or soil (Puig della Bellacasa 2017). It requires developing skills and competencies of care (Krzywoszynska 2016) and following the ethos of cooperation with non-human nature (Alarcon and Marty 2023). In this approach, affect plays an important role in generating care: positive emotions of empathy and companionship are potent drivers of caring relations (Bartkienė et al. 2024). But negative feelings of disgust with, for example animal suffering on industrial farms, can move people to join social movements (Herzog and Golden 2009) or change diets (Buttlar and Walther 2022) as an expression of care. Some philosophers argue that this form of affect constitutes moral disgust, leading to a violation of underlying values.

From the perspective of more-than-human ethics, care is not a one-way street but involves one's openness and willingness to be affected by others (Van Dooren et al. 2016). It is a dialogical, situated, multispecies, and affect-driven engagement with non-human nature that generates "ethical contagion" (Yusoff 2013: p. 233, building on Haraway 2008). Echoing Bennett's (2010) approach to objects as "affective catalysts," one becomes response- and care-able through sensory interactions so as to "live interconnectedly with animals, plants, and nature in its entirety, and care for it thoughtfully" (Nussbaum 1998: p. 201; for notable critiques of such an approach as "parochial," lacking power considerations, or overlooking violence and suffering, see Cusworth 2023; also Ginn 2014; Law 2010; Yusoff 2013).

While the more-than-human ethics and new materialism are relative newcomers in the debates on agri-care, obligations to care have been enacted in millennia-old Indigenous cosmologies. In this second approach to agri-care, kinship is not only about interdependencies between humans and non-human nature but also, and more importantly, about temporal continuity and collective experiences of change, crises, and adaptations spanning generations of human and non-human collectives, that is "obligations [formed] across the generations, or over time" (Tallbear 2019: p. 25; Whyte and Cuomo 2017). In this view, kinship-centric care practice (Salmón 2000) stems from relational accountability (Reo 2019), inter-species agreements (Watts 2013), and reciprocal responsibilities (Kanngieser and Todd 2020) through inhabiting the same place and time (Langwick 2018).

Echoing the Indigenous approach, the emphasis on the metaphysical as motivating care for nonhuman nature is an extension of the religious practice (Berry 2015; Edwards 2011; Grim and Tucker 2014; Johnson 2014). Some of the organized religions advocate stewardship of living nature, envisioning it as something sacred (for an excellent overview, see Hassink et al. 2020). Interconnectedness of life in Hinduism promotes environmental responsibility (Dwivedi 2006; Singh 2013), while Buddhism stresses the interdependence of beings (Hassink et al. 2020). In various spiritual traditions, the "thing-power" (Bennett 2010) is expressed through sacralization and reverence for nature (Pigott 2021). In this approach, awe and enchantment emerging in spiritual experiences of "fullness, plenitude, and liveliness associated with wonder" translate into environmental responsibility to care for non-human nature (Krøijer and Rubow 2022; Di Giminiani 2022; cf. Caton et al. 2021).

The third and more human-centric approach grounds care in farmer identities, values, and social norms. In this view, being a good farmer means taking care and acting responsibly on their farms (Cusworth 2020; Franklin et al. 2021; Larder 2021). This approach combines ethics with aesthetics: the looks of fields and farms are both a sign of good farming and the material embodiment of norms and values (Nassauer 1997). Scholars have documented how both industrial and smallholder farmers take pride in maintaining "clean" and well-organized" farms (Burton 2004; Burton et al. 2020). This preference for "tidy" aesthetics has significant implications, as farmers may be hesitant to adopt regenerative farming methods, such as using biodegradable plastic that appears "messy" as it disintegrates (Dentzman and Goldberger 2020). Additionally, narratives of good farming vary historically and geopolitically, with different approaches to care coexisting. On a Lithuanian urban farm, for example, two different understanding of care and its purpose stem from a generational divide. Older cultivators view tomatoes as kin to be cared for by maintaining tidy, weed-free gardens with hopes to produce plentiful harvests. In contrast, younger urban farmers are less concerned with plants or harvest than climate change and their wellbeing and thus consider "messy," "organic-looking" farms as more appropriate, even if they are less productive (Mincyte et al. 2020). This suggests that obligations to care can stem not only from immediate sensory encounters with non-human nature but can also be generated by cosmopolitan concerns with global environmental issues (Dobson 2003), on the one hand, and therapeutic self-care (Leck et al. 2014; Hobart and Kneese 2020), on the other.

Rooted in the political economy approaches, the fourth mode of care stems from the political economy critiques of capitalism and its attendant alienation and all-encompassing commodification. The idea that exploitation of nature is bound with exploitation of workers has featured prominently in feminist writings, including emancipatory feminist economics, feminist political ecology, and communitarian feminism, among others (Warren 2000; Plumwood 2002; Salleh 1997). In this perspective, the lack of care in capitalism is not accidental but implicit in the existing relations of production that aim at the extraction of surplus labor and externalizing environmental and care work costs (Fraser 2016; Ferguson 2020). This means that caring agriculture is not possible without paying living wages, ensuring healthy and safe work conditions, or meeting basic needs of the workers. Care therefore becomes a political act and a matter of justice (Portocarrero Lacayo 2024; Stock 2021). This kind of justice is relational rather than individualized (Lynch et al. 2021), as it has an explicit communal dimension (Federici 2011; Gibson-Graham et al. 2016). In agriculture, care also has an important spatial dimension, as the transformative change it calls for involves challenging land and property relations (Blumberg et al. 2020; Slocum et al. 2016).

As this approach suggests, the issue of the fracturing of caring relations in industrial agriculture lies in alienation of the worker from the product, process of labor, society, and oneself, but also the depletion and exploitation of land and soil ecologies. John Bellamy Foster (2000) conceptualizes this rupture in terms of "metabolic rift" between humanity and nature. In late capitalism, these processes have been further amplified through the neoliberalization of economies where the regulatory state functions are increasingly serving capital interests, including in agriculture (Di Giminiani 2013). It is not surprising, therefore, that in light of these critiques some scholars have equated a refusal to participate in industrial agriculture as a form of radical care (Arora and Dyck 2021; Salazar et al. 2020). At the same time, the food sovereignty movement, which seeks to challenge global capitalism through the global peasant movement (Sano 2024; Edelman 2014), has increasingly emphasized care and the cultivation of caring practices in smallholder farming and peasant economies as the centerpiece of its political and social agenda (Portocarrero Lacayo 2024).

Taking a long view of the four modes, caring agriculture is made possible through relationships, whether in the form of interspecies encounters, responsibilities rooted in histories of belonging and enchantment with nature, or social norms and relational justice. The next section considers how these forms of generating care map onto industrial agriculture.

Limits and possibilities of care in industrial agriculture

One of the main challenges to practicing care in industrial agriculture is the care-distance-decay problem, stemming from the challenges of generating care across geographic distances (Cusworth 2023; Poppke 2006). If care is generated primarily through direct encounters with non-human nature, then moral contagion is practically impossible due to the spatial distribution of industrial supply chains. From the kinship- and obligation-centered perspective, profit-driven industrialization of rural hinterlands embodies colonial expansionism that has steamrolled diverse local lifeworlds. Similarly, as Max Weber noted over a century ago, industrialization itself is part of the broader modernization project that engenders disenchantment, replacing the metaphysical experiences that may lead to caring for non-human nature in religious and spiritual traditions with rationality and secularization.

Technology further disrupts networks of multispecies care and reciprocal responsibility (Anthony 2012). As breaking machines and glitch-prone software require round-the-clock maintenance (Houston et al. 2019: p. 730), farmers spend more time on technological maintenance and office work rather than focusing on animals, even as tech companies promise the opposite (Baur and Iles 2023). Notably, for workers, new digital technologies superimpose surveillance, undermining workers' agency and sociality that are key for relational justice (Doggett et al. 2024). Compression of time and space on industrial farms and processing facilities results in workers observing and inflicting animal suffering at an industrial scale that has social and moral implications (Blanchette 2020; Pachirat 2011). Automation has also profound consequences for animal care networks. In the case of robotic milking systems, for example, cows are forced to make individual choices about when to be milked, disrupting their herd instincts and potentially affecting the way they bond with each other (Driessen and Heutinck 2015).

Moreover, various breeding and genetic selection processes have led not only to the profound loss of bio- and gene-diversity but also to the fragility of animal bodies and agricultural ecosystems (Blanchette 2017; 2019) that, in turn, require new forms of technological intervention. These processes are part of the broader trends towards consolidation (Fairbairn 2021), financialization (Sippel 2023), and automation (Legun and Burch 2021) across all agro-industrial sectors (Fairbairn and Reisman 2024) where complex issues are reduced to (bio)technological solutions (Guthman 2024). Worrisomely, the new digital tools are often repurposed from other sectors without considering specific needs in agriculture, creating new problems with using these technologies on the farms (Guthman and Butler 2023).

As the political economy approach suggests, the negative effects of technological progress on care hinge on the capitalist intensification manifested in optimization, quantification, and enumeration across agro-food systems (Carolan 2023; Hébert and Brock 2017). These processes engender objectification and instrumentalization of non-human nature resulting in "a type of care that can be counted—jobs created, tax revenue generated, pounds of food grown, etc." (Carolan 2023: p. 62). Objectification engenders animal suffering (Bos et al. 2018; Blanchette 2020, 2019), while optimization transforms life-reproducing care with technological acts. Industrial livestock rearing is a case in point where the vital reproductive care function of calf feeding is replaced with inserting the tube in the young calf's esophagus (Enticott and O'Mahony 2024).

Not only does intensification and consolidation of agricultural production undercut caring practices on industrial farms, but they have a negative impact on possibilities to care in the broader agrarian economy. Graddy-Lovelace (2020) shows how new technoscientific pre-breeding techniques aimed at protecting genetic diversity are contributing to the displacement of traditional care practices. She highlights the irony in attempts to replicate the attentive and careful methods that non-industrial farmers have long employed to cultivate biodiversity, yet simultaneously displacing these farmers and repositioning them as marginal, passive consumers of genetic diversity.

Contrary to the political economy critiques of exploitative technoscience and industrial agriculture as undermining care, some counterintuitive examples suggest that the conditions of precarity, insecurity, and exploitation in industrial workplaces can lead workers to care more, not less (cf. Bowen et al. 2019). In these cases, routinized work tasks can offer a reprieve from the demands and uncertainties of the workers' lives outside the workplace, and paradoxically, allow them to reclaim their humanity and value through "good" work. Nevertheless, this underscores the multidimensional and contradictory ways in which industrial workplaces extract care work. While the more-than-ethics, spiritual and Indigenous, and political economy approaches underscore the limits of caring in intensive, technoscience-driven agriculture, the human-centric approach is ambiguous about what it means to care in an industrial setting. This approach revolves around the concept of "good farming," which is anchored in different and often opposing values and moral orders. In this reading, uniform fields of monoculture are just as much a sign of "good" farming and stewardship to some as "overgrown" intercropping efforts on peasant farms are to others. Even the value of productivity becomes contested in this context (Burton 2004). Productivity is commonly critiqued as the primary driver of industrial intensification, which undercuts caring relations. Yet, smallholder farmers and gardeners also aim for higher yields, albeit using different methods that operate as "careful" extractivism (based on Bartkiene et al. 2019). The coexistence of different norms and values related to care means that what constitutes agri-care depends on one's identity, point of view, positionality, and interests. To the extent that this approach echoes relativism, it poses profound normative challenges in distinguishing what constitutes agri-care both within and outside intensive agriculture.

In addition to the ambiguity surrounding human-centric forms of caring in agriculture, there is also a growing interdisciplinary literature pointing to possibilities to care in the industrial and technoscientific contexts. Without trivializing the impact of capitalist intensification and quantification on agriculture, the politics of the possible (Guthman 2007: p. 474; Elwood et al. 2017) recognizes the persistence of diverse economic forms in the late capitalist project (Gibson-Graham et al. 2016), thus opening the potential for systemic change. Various local and global grassroots approaches can also develop pathways for mobilizing networks of care and interdependency (Krzywoszynska 2019). In environmental ethics, cosmopolitan visions of informed, conscious and active ecological citizenship is seen as a blueprint for generating a caring public across national, class, and ethnic/racial boundaries (cf., Bartkiene et al. 2018). Taking a materialist perspective, Cusworth (2023) argues for a metabolic approach that distributes ethical commitments across the food web. This insight resonates with the literature on caring infrastructures where values are embedded in the design of practices, technologies, and spaces to create care-full justice (cf., Asaro 2000; Traill et al. 2024; Williams and Tait 2023).

In technosciences, the politics of possibility further re-envisions technologies as tools for enabling—not displacing—attention and awareness. While most of the research on surveillance technologies critiques their increased capacities to extract value and commodify land and labor by undercutting care (e.g., Aistara 2009), environmental sensors used in citizen science or for other communal purposes can create more livable community spaces (Gabrys 2018). They do so by opening new venues for engagement to "generate transformed ways in which to respond and demonstrate responsibility to these changing worlds, within and beyond the usual registers of sense (cf. Yusoff 2013)." (Gabrys 2018).

Even in highly controlled environments of scientific labs, researchers have found ways to incorporate community concerns and care for the Indigenous knowledge, non-human life, and multispecies collectives as a way of challenging colonialism (Liboiron 2021, cf. Burch et al. 2023). Barad's (2007) approach to science, for example, recognizes the ways in which ethical and justice concerns thread through

every practice (Barad 2012: pp. 55–69), an approach that encompasses tinkering with governance institutions and structures (Fletcher 2020).

Putting such hybrid forms of care into practice (Reisman 2021: p. 403), a handful of studies have already documented how industrial workers perform care for insects (Bear 2021), palm oil seedlings (Chao 2022) or vines (Alacorn et al. 2020) in the backdrop of mounting pressures to be efficient, optimize, and deliver the results to the bottom line of corporations. In each case, relations spanning different company divisions, species, and value systems are central for creating conditions for care to emerge. These studies show that industrial forms of care are possible even in some of the most exploitative and dehumanizing conditions, but also that these forms are exceedingly rare, isolated, and fragmented.

To summarize, care in industrial agriculture faces a challenge of aligning the runaway technological progress fueled by profit-maximization with values, obligations, and goals of communal survival in the context of overlapping environmental, social, economic, and political crises. At the same, there are some potential openings for performing "good," albeit fragmented and incomplete, care even in the highly optimized industrial and technoscientific environments. This can be achieved by reinvisioning infrastructures and metabolic relations, tinkering with institutions, and mobilizing local and trans-local relations.

Industrial agri-care through the lens of ethics, agency, and social reproduction

Even though feminist care theory has been foundational for the developing current understanding of care, few studies in agri-care have directly engaged with this literature (for notable exceptions, see Cox et al. 2013; Curry 2002; Enticott et al. 2022; Hassink et al. 2020; Shisler and Sbicca 2019; Stock 2015, 2021, among others). Combining the ethics of care with social reproduction, the feminist care theory emphasizes relationality in agency within caring relations; underscores the structural role that gender plays in care practices; and situates care in a particular social, political, material, and historical context. These contributions point to fundamental challenges for practicing care in industrial agriculture; they can also explain why and how hybrid care can emerge in the technoscientific and industrial contexts.

Central for care theory is Tronto's (1993; 2013) work on the ethical, practical, and political dimensions of care. Tronto conceptualizes care in terms of stages. The first stage, focusing on attentiveness, involves recognizing needs: "Genuinely to care about someone, some people, or something requires listening to articulated needs, recognizing unspoken needs, distinguishing among and deciding which needs to care about" (Tronto 2001: p. 62). The second stage is responsibility—after recognizing needs, someone must feel and take responsibility for meeting them. The third stage involves the actual caregiving process, which demands competence and skills: "Incompetent care is not only a technical problem, but a moral one" (Tronto 2001: p. 63). The fourth stage, care-receiving, provides feedback from the care recipient to assess whether the care has been good, adequate, sufficient, and effective (Tronto 1993: pp. 105–108). Finally, the fifth stage highlights the importance of collective responsibility, advocating for democratic institutions and processes (Tronto 2013).

A defining feature of Tronto's ethics of care approach is a relational understanding of agency that revolves around feedback loops, mutuality, and responsiveness to others. Pickering (1995) conceptualizes it as the "dance of agency"—a continuous, interactive, and indeterminate process or dialectic engagement among humans and non-humans alike. This approach implies relinquishing human control, which is the antithesis of open-ended, feedback-based care (Law 2010).[2] It also includes (Kopnina 2014) an expansive version of democratic principles that allow non-humans to exercise their agency.

Given current trends towards industrial intensification, it is hard to imagine how such relational agency can be implemented in the context of highly structured and extractive industrial production. From the care ethics perspective, the logic of industrial agriculture, centered on control and optimization, makes it nearly impossible to perform care through relational agency. According to Tronto, this is not only because it fails to recognize and attend to non-human agency, but also because it violates the ethical and moral foundations that bind societies through shared values and a sense of responsibility. In addition to Tronto's ethics of care, the feminist social reproduction approach introduces another key issue in agri-care: a structural understanding of gendered labor relations. While often overlooked, gender has had a profound impact on who cares for whom and in what capacity (Gustavsson and Farstad 2022; Lesley et al. 2019; Hansen and Stræte 2020; Azima and Mundler 2022). In patriarchy, care is rooted in gender roles, social identities, and notions of justice (Gilligan 1982) that designate care as a feminine quality. This explains why women are disproportionately involved in sustainable, non-productivist farming as owners, workers, and volunteers (Costa 2010;

[2] Windsor (2024) makes a similar argument in his analysis of the looming end of industrial Camembert cheese production due to genetic overselection. For cheesemaking to continue, microbes must be treated as "our coworkers, not our servants" (Windsor 2024). This means granting them the agency to evolve more freely into more diverse and resilient, even if unpredictable, cultures.

Jarosz 2011; Sachs et al. 2016; Mincyte and Bartkiene 2019; Mincyte and Dobernig 2016; Pilgeram and Amos 2015; Trauger 2004). Similarly, in industrial farms, they are typically assigned "maternal" tasks requiring time and attention, yet these are considered secondary to production (Sumner and Llewelyn 2011; Unay-Gailhard and Bojnec 2021). Studies like Enticott et al. (2022) show that while women are assigned to care for animals and plants during the most vulnerable stage in their lives, both caregivers and animals are marginalized in the production process.

Meanwhile, men are expected to be emotionally detached from suffering (Blanchette 2019; Rutt and Tjørring 2024) and focus on machinery (Brandth 1995), with farm equipment becoming objects of male care. Such a move displaces attention from nature to technology. Moreover, technologies themselves can be "coded as either masculine or feminine" (Brandth 1995: p. 124), further reinforcing normative roles and gendered labor organization. The patriarchal order can also assign men morally stigmatized jobs like slaughtering livestock, which lead to social isolation despite higher pay and power (Pachirat 2011). These complex gender dynamics suggest that care in industrial agriculture is defined by inequality not only in terms of class, race, and ability, but especially in terms of gendered body positionality.

Furthermore, the social reproduction perspective conceptualizes gendered care labor as foundational for the current agro-food economy (Mincyte 2024). Social reproduction refers to care work that maintains foundational life-sustaining functions spanning biological, social, and cultural domains (Bakker 2007). This reproductive labor is just as important for industrial capitalism as productive labor, as it reproduces workers by meeting their vital physical needs, teaching skills, and providing cultural, social, and ethical competencies (Federici 2004). From this perspective, industrial agriculture relies on not only on the steady supply of low-wage labor, but it is also subsidized by the unpaid care work in workers' homes (McNally and Ferguson 2016).

From the social reproduction perspective, the popular idea that automation will resolve labor issues is problematic because it obscures the broader social costs of technological intensification (Mincyte 2024: p. 30). Job losses, increased isolation, and heightened precarity in local economies are byproducts of financialization, digitalization, and automation in the industrial sector. Neoliberal deregulation, along with the weakening of welfare state functions, has shifted financial risks and basic care responsibilities from the private sector and state institutions to households (Bakker 2007; Fraser 2016). This suggests that industrial intensification, even when aiming at developing caring practices on farms, adds burdens in the form of feminized care labor at home and in communities.

Against this background, care in industrial agriculture needs to account for external costs, namely the reproductive and care labors of humans and non-humans (Blanchette 2019, 2017). In practical terms, industrial agriculture and the social and environmental problems stemming from it emerge as integral components of rural place-making (Elwood et al. 2017; Lawson 2018).

The emphasis on rural place-making and its situatedness in a specific context is one of the key contributions of feminist studies to understanding care in industrial agriculture. For care to be effective, it must respond to the needs of particular animals, plants, ecological systems, and people. Care is always placed in specific contexts, shaped by social positionalities, culture, economic structures, political geographies, and material realities. This contextualization explains why care can still occur even under exploitative and oppressive work circumstances. It arises from a convergence of situated factors that may include one's particular lived experiences, gender roles, workspaces as well as interactions with coworkers, plants, animals, insects, etc. The situatedness of these alignments means they are accidental, making them impossible to automate or scale up in an industrial context.

Concluding reflections

This paper aimed to synthesize the emerging debates on caring agriculture to consider what it means to care in agriculture in general, and industrial agriculture in particular. Our contribution to this body of literature is an emphasis on relational agency, gender, and social reproduction as key for understanding agri-care.

We show that a more sustained focus on ethics, gender, and labor as sites of generating care can bring a grounded understanding of the limits and possibilities of caring in the industrial setting. The social reproduction perspective highlights the gendered dimension of care and suggests paying closer attention to unequal social relations in care politics. Central to this approach is a relational notion of agency that requires an open dialogue, interaction, and response-ability. Although scholarship on care in technosciences has identified possibilities for practicing hybrid and imperfect forms of care in industrial settings, they largely depend on the accidental alignment of local factors: care is always situated in a specific social, historical, geopolitical, and material context, making it impossible to scale up.

Such an approach has two broader implications. First, it underscores the need to have a serious discussion about the current agrarian economy: who and what will be included and excluded from it. Existing policies and financial support mechanisms have subsidized industrial agriculture,

implicitly and explicitly marginalizing low-tech, care-centered agriculture such as smallholder farms, peasant households, and other non-productivist farming operations (Graddy-Lovelace 2020). Tronto's foundational work on care (1993) advances this critique by expanding the moral boundaries of "domestic" care into the public domain. Tronto's ethics of care makes caring practices in rural homes, smallholder farms, and industrial agricultural fields and corporate offices part of caring networks. After all, washing workers' clothes at home or covering for a sick colleague in the office of a large agro-industrial enterprise are also part of caring networks contributing to agri-care. Such a conceptual approach moves beyond the conventional registers of recognition and redistribution (e.g., in the form of acknowledging cultural identities and providing higher wages to workers) to a more systematic rural place-making that includes poverty, everyday obligations, and interspecies encounters (Fraser 2009; Lawson 2018; Mincyte 2024) into the calculus of agri-care.

More broadly, the social reproduction approach points to the underlying contradiction and messiness of social reproduction labor that underpins agri-care. Care labor serves as the source for nourishment, fulfillment, and thriving, yet simultaneously reproduces the exploitative and alienating economic order (Habers 2010; Katz 2001). There are no easy ways to disentangle the "good" care from its contradictory effects, as it is part of the fundamental "dialectical struggle between the humane and the technological" (Mahony 2023: p. 614; building on Graddy-Lovelace 2020). Industrial agri-care contains the potential for both opening alternative pathways in industrial systems and the continuation of exploitative, dehumanizing, and suffering-inducing trends in agricultural intensification. From the perspective of social reproduction, even the limited instances of care in industrial agriculture contribute to reinventing the late capitalist food regime.

Acknowledgments We gratefully acknowledge the feedback received during presentations of this paper in the speaker series at the European Union Center at Indiana University Bloomington and the Science and Technology Studies Food and Agriculture Network (STSFAN) workshop. Special thanks to Guntra Aistara, Elizabeth C. Dunn, and Karen Hébert for their insightful and generative comments on earlier versions of this project.

Funding This research received support from the Baltic Research Programme Project No. EEA-RESEARCH-24 "Promoting collaboration for sustainable and circular use of bioresources across agriculture, forestry, and aquaculture, CIRCLE" under the EEA Grant of Iceland, Liechtenstein and Norway (No. EEZ/BPP/VIAA/2021/9).
Diana Mincytė acknowledges support of the Professional Staff Congress of the City University of New York (PSC CUNY) and the National Endowment of the Humanities. Any views, findings, conclusions, or recommendations expressed in this article do not necessarily reflect those of PSC CUNY or the National Endowment for the Humanities.

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