

Nonhuman labor & Food

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Summary

Many (if not all) of the foods humans consume on a daily basis (from kimchi to yogurt and beer) are the result of both human and non-human labor. Non-human labor refers to “work” that is done by non-human actors to produce food and other valuable products. This labor can take many forms, including living, eating, growing, reproducing, and metabolizing nature to meet one’s biophysical needs. While labor is a social and relational process, that cannot be understood outside of human economies – there are merits to extending this concept to non-humans whose labor is often rendered invisible, natural, or instinctual.- Even the ability to digest food is a more-than-human accomplishment, realized in collaboration with gut bacteria. Humans depend on a menagerie of microbes, mycelia, worms, insects, pollinators, farm animals, and other creatures to help grow and process food, but also to digest food and recycle food waste. In food systems human and non-human labors never take place in isolation, they are deeply intertwined – and often mediated by dominant cultural and economic logics of accumulation, efficiency, violence, and extraction. This entry reviews social science research on non-human labor and food and offers an overview of the different food practices and non-human actors that have become sites for empirical and theoretical inquiry in food studies.

Keywords: fermentation, non-human labor, microbes, metabolism, food systems

I. Labor & More-than-human labor

Labor is central to understanding human economies, social relations, power inequalities, bodies and metabolic relations with the more-than-human world. It is also becoming a growing area of concern for food studies scholars as well as activists seeking justice for food workersⁱ. Examining labor across the food system can be a way into “interrogating the exploitative relations and contradictions that underlie the entire food system, from the farm all the way to table”ⁱⁱ.

But what is labor? In public discourses labor is often quite narrowly understood as waged work. Feminist scholars have also done tremendous work to expand the category of labor and place (often unpaid and socially reproductive) foodwork at the center of the table in food studies. Elaine Swan and Maud Perrier take a critical race feminist perspective on foodwork in order to “challenge definitions of what constitutes work, binaries of productive and reproductive work, and to illuminate organisational mechanisms, practices and processes,

and how these produce hierarchies and inequalities.”ⁱⁱⁱ An intersectional lens is a necessary corrective to the race and class biases in feminist food scholarship, and is especially important since foodwork, across the food system, remains highly gendered, classed, and racialized, with some of the most dangerous, highly skilled, yet underpaid labor being done by the most marginalized.

Given the political stakes of labor in food studies, it might seem questionable to expand this category to include non-humans. However, as numerous feminist and decolonial scholars have noted, the ways in which we understand, relate to, and conceive of the more-than-human world has direct implications for the ways in which we reproduce marginalization, oppression, violence, and exploitation in the “human” world, while systematically excluding some people from this very category. Expanding the concept of labor to the non-human is a move to widen the moral and political economies of labor in ways that recognize the novel ways in which nature is enrolled into exploitation and value creation, while also sensitizing humans to their mutual entanglements, vulnerabilities, and (potential) solidarities with more-than-human Others. However, as Sarah Besky and Alex Blanchette caution, scholars describing work-like practices in the natural world should take care not to naturalize this work and the violent and extractive economies it takes place in or simply anthropomorphize non-humans as ‘good’ workers^{iv}. Nature has long been recognized as a vital force in human production and social reproduction, as a provider of energy, nutrients, mobility, oxygen, health, and biodiversity^v. However, too often nature is recognized in terms – such as natural capital or ecosystems services - that legitimize growth and extraction, and serve to naturalize capitalism. For these reasons Alysa Battistoni proposes the term “hybrid labor” in order to “understand the ‘work of nature’ as a collective, distributed undertaking of humans and nonhumans acting to reproduce, regenerate, and renew a common world.”^{vi} This term allows us to see how humans and non-humans both labor to (re)produce commons worlds but never do so alone.

To expand the concept of labor, scholars have reanimated Marx’s concept of metabolism^{vii}. For Marx, labor is central to understanding our metabolic relations with the more-than-human world. Labor includes “the natural forces which belong to the body, arms, legs, head, and hands, in order to appropriate the materials of nature in a form adapted to our own needs. Through this movement we act upon external nature and change it, and in this way simultaneously change our own nature”^{viii}. If we take Marx at his word, then labor is an exclusively human affair, it is the process by which humans mediate, regulate, and control the metabolism of their bodies and nature. Humans labor, and non-humans are merely tools to labor with and labor upon. Marx’s anthropocentrism is especially evident in his comparison of the creative activities of architects and bees, where he writes “what distinguishes the worst

of architects from the best of bees is that the architect builds the cell in his mind before he builds it in wax' ix.

We should however, be cautious to avoid naturalizing metabolism, even in Marx. As Hannah Landecker warns "Metabolism is not a concept floating above time, influenced by metaphor, and imprinted by context. More than a shift from one theory to another that could be described as a history of metabolism, metabolism is *in* history: the material of the bodies fed by an industrialized agriculture and food-processing system built with knowledge of (industrial) metabolism subtends these conceptual shifts"^x. Scientific and cultural understandings of metabolism have shifted significantly since the 19th century science of *stoffwechsel* that provided Marx with such an apt metaphor for the ways in which (human) labor mediated the exchange of materials and energy in the world. In this time span, the metabolic rift has become a reality, with grave consequences for rural-urban relations, soil health, and human health and nutrition - with (human and non-human) bodily metabolisms significantly altered by diet and environmental risks.

Despite these limitations, scholars have found Marx's concept of metabolism especially helpful for rethinking nature-society relations and further destabilizing the binaries between nature and society. James Palmer summarizes many of the key debates that geographers have had on Marxian conceptions non-human labor, "For Perkins (2007), "nothing in Marx's writings precludes the idea that non-human organisms labor" (1156). As Huber (2017) and others have noted, Marx (1875) himself averred that labor "is only the manifestation of a force of nature"; theoretically, therefore, any force of nature—human or nonhuman—might reasonably be apprehended as a kind of labor in its own right"^{xi}. This body of work points to the value of metabolism to a more-than-human understanding of labor in food and environmental studies, and for making connections between the embodied practice of labor, soil and food ecologies, and more abstract notions of metabolic-rift in agri-food studies ^{xii}.

As I have written elsewhere, "Metabolism unsettles the distinction between human and non-human labor, since it occurs across, between, and within human and non-human species as well as fungi and bacteria. In order to live, all living things from bacteria to bees and beavers must metabolize nature to meet their needs. Marx tells us that we live because we labor and others have labored before us. But we are also alive (and thus able to labor) because microbes live and labor within and around us"^{xiii}. Microbes co-produce the human body and many of the socio-naturesfoods (yogurt, tempeh, tea, kimchi, and medicine) we consume on a daily basis. What if we considered metabolism as a kind of labor, could we took the metabolism in Marx literally? If we defined metabolism as a kind of labor, we might

value a broader range of actors and activities in the food system, ~~and or~~ nurture new interspecies solidarities in the struggle for just labor conditions across the food system ?

~~Understanding Approaching metabolism, and the busy-ness of living as labor, labor as metabolism~~ we can begin to appreciate that non-humans, ~~both wild and domesticated, (some "domesticated" others "wild")~~ labor and produce ~~socio-natures~~ food in cooperation with humans (~~e.g. sheep herding dogs~~), but also with ~~non~~more-than-human others (e.g. earth worms and fungal networks). ~~The socio-natures that are produced by non-humans are sometimes appropriated by humans as food, energy, knowledge, and so on, but these products are also appropriated, distributed, and consumed within non-human communities to meet necessity.~~ Metabolism as a concept for understanding more-than-human labor, also asks us to reconsider what we name *food* in the food system. Everyone eats, but food is a human construct, with varying cultural norms and values determining what particular communities categorize as edible food. As Heather Paxson writes, "Metabolically speaking, plants and other animals are just as much "eaters" as are people and are equally reliant on the metabolic activity of microbes. What can we understand better about eating 'by allowing metabolic relations writ large to decenter human food as the object of inquiry?'"^{xiv}. From a more-than-human perspective, categories of food and edibility would become much more uncertain, we might regard soil, sunlight, compost, dead trees and leaves, rotting food scraps, or nitrogen as food. Sarah Elton, in her essay *Posthumanism Invited to Dinner* explores the potential of a more-than-human perspective in Food Studies, and the implications that recognizing "more-than-human agency" would have for "questions of power, which are so critical to understanding food systems."^{xv}.

II. More-than-human food workers – big and small

Having sketched some of the debates around what more-than-human labor is, how this labor is defined and conceptualized, and the implications for recognizing it - I now turn to the various locations of this labor in food systems, and the more-than-human entities that perform it. I have chosen to focus on non-humans that have a biological metabolism, who can live, reproduce, and die and become food for humans and non-humans. This means I have not reviewed the research on the "dead labor" of machines or non-humans like robot who also labor in our food system while reshaping the conditions of human labor (see: ^{xvi}

Animals

Animal studies scholars have been at the forefront of examining non-human metabolic labor ^{xvii}. Their work examines the ways in which non-humans ~~participate contribute to in~~ food production, not ~~as passive resources and commodities, just as medical experiments, companion animals, food sources, and transportation,~~ but also as workers. More-than-human

food workers, ranging from dairy cows, to chickens, pigs, and sheep dogs, have undeniably been domesticated and altered to meet the needs of humans in the food system ^{xviii}. But their labor should not escape critical analysis or be reduced to mere instinct or an extension of human agency. Writing about dairy cows, Porcher and Schmitt argue that domesticated animals labor precisely because humans notice when they stop, “As in the case of human work, animals’ collaboration at work is visible when it is not obtained. Ordinarily their work is invisible” (xxii, pg. 43). Naisargi N Dave captures this dynamic well in her vivid descriptions of animals refusing to cooperate in their slaughter^{xix}. However, human and animal labor are also intertwined, as Les Beldo notes, in the context of the poultry industry, “A great deal of human labor is congealed in the genome and the body of a broiler chicken, for instance, but neither the broiler chicken nor its genetic code is composed entirely of human labor; nor is human labor enough to make the chicken grow” ^{xx}(2017, pg. 110). All of these examples point to the existence of nonhuman labor. They also point to the agency of more-than-human food workers to shape the food system, and their lively capacity to resist exploitation and commodification, by refusing to work by refusing to live, die, grow, and (re)produce As Dave writes, “we know that nature works not because it works, or because of *how* it works, but because it *refuses* to work”. She goes on to argue that animals can teach humans about politics and work, by revealing the conditions of domination and violence by which work is obtained. Drawing from Kathi Weeks’s feminist critique of work she argues that instead of simply extending the concept of labor to animals as a means of recognition, we should instead learn from animals’ constant refusal in order to de-naturalize the moral value and dominance of work. “Instead of taking the position that nature is not mere capital—that it works—the more truly liberatory position might be that nature does not work, it should not work, and neither should we.” (pg. 217) ^{xxi}

As noted above, livestock animals have been one of the most direct ways that scholars have made non-human labor visible in the food system. Without animal labors of metabolism (eating, digesting, growing), and social reproduction (living, reproducing, caring for their young) humans could not eat meat, eggs, or dairy. Animals also labor alongside humans to shape landscapes, harvest crops, improve soil fertility, and move things and other animals around. Most accounts of animal labor are centered on the environmental and moral injustices of the livestock industry, and point to the gruesome ways in which humans and non-humans are exploited in factory farming. Alex Blanchette’s ethnography of the industrial pig farming *Porkopolis* (2020), goes to great lengths to show how human and hog labor are deeply intertwined in all stages of an industrial pig’s life and death, and mediated by the cruel logics of capitalism^{xxii}. Summarizing some of this research Sarah Elton [shows the value of a post-humanist approach to food studies for problematizing livestock industry, recognizing a](#)

the socially reproductive labor of animals, and questioning the economic and moral logics that make some animals writes killable commodities. –“Scholars working in this area problematize the livestock industry that provides dairy products and meats, questioning a system that makes nonhumans “killable” (Haraway 2008^{xxiii}) and renders into commodities living, breathing, sentient beings. Coulter (2016)^{xxiv} approaches animal-human relations through the lens of work and looks at the social reproduction of animals including farm animals, critiquing their exploitation and repression. Wadiwel^{xxv} (2018) too considers the labor of the animals that feed us, specifically chickens, and considers their resistance to capitalism.” Such critiques are founded upon a rejection of the dualism enacted by industrial livestock agriculture that separates humans from nature and that perpetuates the belief that humans are a superior animal to the pigs and chickens reared to kill and to eat. Animals, including livestock, are understood as beings and actors with the capacity to love, work, and even resist—beings who express their agency in many ways.” (2019, 9). Elton’s valuable synthesis of this research shows how deeply intertwined the recognition of animal labor is with broader struggles for animal rights and against human exceptionalism ^{xxvi}.

Microbes

To complement this robust body of animal studies research, Nikolai Siimes argues for the importance studying “awkward microbes” in the food system. He observes that that post-humanist research has been largely oriented towards non-humans that are “ ‘big like us’ and ‘animal like us’ (Krzywoszynska, 2012^{xxvii}; Lorimer, 2014^{xxviii}), as evidenced by the growth of animal studies (over say fungal studies). Some non-humans are more charismatic than others, evoking greater interest and affection (Lorimer, 2007^{xxix}). While recent advances in (particularly human) microbiome research has sparked engagement with the less charismatic and more awkward world of yeasts and microbiomes, this remains an undercurrent in agri-food studies (notable exceptions include: ^{xxx}Brice, 2014; Evans & Lorimer, 2021^{xxxi}; Krzywoszynska, 2012, 2020^{xxxii}; Morrow, 2021; Paxson, 2008^{xxxiii}; Tsing, 2015^{xxxiv}).” pp. 76. Siimes’s important synthesis of this research points to the value of studying the smaller and less visible non-humans that live and labor across the food system, from soil to gut.^{xxxv} However, in the fizzy world of fermentation^{xxxvi} and food preservation, microbes are fast becoming charismatic food workers, and drawing the affection of food studies scholars and the general public. During the Covid 19 pandemic, while the world was gripped by the biopolitics of public health and death, and people stayed home in efforts to contain a deadly air born virus, a growing number of home fermenters and food preservationists began inviting microbes into their kitchens and bodies, as they cared for sourdough starters (see

^{xxxvii}) fermented pickles and kimchi, traded kombucha SCOBYs, and consumed fizzy home brewed drinks. The bug of microbial enchantment is easy to catch. Microbes are exciting and unpredictable, they bring potential risk and danger, new sensory experiences, fizz and even explosions, but they are also potential allies who live inside of humans (and other animals) and provide a range of probiotic health benefits.

This post-pasteurian microbe-curious food culture was first described as such by food anthropologist Heather Paxson. Her work on the microbiopolitics of raw milk cheese^{xxxviii} (and the human-microbial labors of reverse engineering *terroir*^{xxxix} has inspired countless scholars in the social sciences and humanities to get to know microbes^{xl} without worrying too much about their lack of training in microbiology. Wading into the shallows of the technical and natural food sciences many food studies scholars have been aided and inspired by Bruno Latour's approach to Science and Technology Studies (STS). This approach emphasizes embodiment, relationality, and more-than-human agency in the collective performance of knowledge and reality^{xli}, and legitimizes social science and humanities scholars trespassing into technoscience.

In this vein Nikolai Siimes's (2023) research on *Brettanomyces* "awkward Brett" a yeast that can disrupt predictable wine - is illustrative, especially when it comes to the methodological challenges of "knowing" really tiny non-humans using qualitative methods. My own work also takes an embodied and ethnographic approach to understanding the non-human labors of *acidophilus bacteria* in a neighborhood yogurt making cooperative, but ultimately relies on what humans, as eaters and food producers, can taste, feel, and hear about the microbes they work with. Maya Hey reflects on the methodological and ontological challenges of knowing microbial labor in her growing oeuvre of fermentation research^{xlii}. Drawing on the performative approach of STS scholar Ann Marie Mol she pays particular attention to the role of narrative in shaping the ways in which humans can know, experience, and sense microbes and - how different worlds are composed and held together (despite their contradictions)^{xliii}. "Due to our limited ability to see microbes, we have had to sense them otherwise—through senses like taste and smell—which have coded memories into our bodies in lasting ways. ~~I argue that delicious/disgusting narratives can serve as a heuristic for how we think about microbial life and, more generally, the relationships that constitute our physical and social beings. . . . = Examining how we relate to and work with microbes is important because our mutual thriving is at stake.~~ The unsettling fact that they [microbes] can live without us—when we cannot live without them—suggests that we urgently need to reconsider the way we conceive difference across species"^{xliiv} pg. 25)

The “pandemic-fueled sourdough frenzy” ^{xlv}has also resulted in a number of ethnographic engagements with sourdough starter - the goopy mix of yeast, flour and water that kicks off the fermentation process in sourdough bread. Laura Siragusa’s autoethnography ^{xlvi} of making kin and community while caring for sourdough starter during the pandemic is also illustrative of the socially reproductive role microbes can play in making human and more-than-human relationality possible. Along these lines Molly McConnell’s essay on caring for sourdough starter and place making, invites ethical exploration into the collaborative more-than-human labors of place-making and bread baking and offers an in depth review of the latest scholarship on more-than-human approaches to care, conviviality, and attentiveness. The ethical questions that arise from McConnell’s critical analysis of sourdough making are important and relevant for any research on non-human labor in food. She asks, “who is benefiting from this relationship, and how can I claim to know best for the microbes when I don’t understand what they’re saying to me. How do we communicate with the more-than-human, and how do we avoid exploiting them for our own gain? ~~As Maya Hey asks, “Who are we and, perhaps more importantly, who are we to consume (microbial) others? (2019, 455),...~~’ How do we make sure to decenter ourselves while also not necessarily centering the more-than-human? How can sourdough provide us with a methodology of doing life with the more-than-human, and how can it be an example of how to share a place when we are not the only ones making that place? ~~The embodied nature of working with a sourdough starter does not mean it generates or encourages ethical relations with the more than human, or that it even acknowledges the role of the more than human. But it can.~~” ^{xlvii} 532). McConnell’s reflections echo those of other qualitative food researchers (e.g. ^{xlviii}) who advocate for a sensuous, embodied, and playful immersion with the non-human – not only as a means of “knowing” this labor, but to create opportunities for ethical encounters, and swerves that result from being viscerally affected by the life force of more-than-human others.

Plants, Fungi, & Soils

Settling down to earth from the “lively” activities of animal and microbes, I now turn to the less perceptive, but still very much alive, non-human labors of plants, trees, soils, and fungi. As Mindi Schneider and Phillip McMichael write “An acre of living topsoil contains approximately 900 pounds of earthworms, 2,400 pounds of fungi, 1,500 pounds of bacteria, 133 pounds of protozoa, 890 pounds of arthropods and algae, and even small mammals in some cases (Sullivan 2004). These soil organisms feed on soil organic matter (once-living residues in various stages of decomposition), and each other, releasing inorganic nutrients, especially nitrogen, phosphorus, and sulphur, in the process. ~~Soil organisms interact in myriad and complex ways, moving material and energy through the soil (Bird et al. 1998),....~~

The 'natural' fertility of a soil, and the availability of plant nutrients, is therefore based on a complex soil food web and metabolic reactions between living and non-living soil components." (xlix pg 469). While humans have been the central protagonists in the debates about soil fertility and exhaustion, the labors of making and regenerating soil are undeniably a more-than-human undertaking. This labor is slowly being recognized in farms, gardens and forests. It is critical to our food systems, ecosystem, and the human ability to breathe oxygen, survive extreme heat, and live on earth. However, compared to more "charismatic" non-humans this labor is often challenging for non-experts to apprehend. Sometimes this labor is hidden underground (fungal networks), or it is such a taken for granted part of our surroundings (trees and plants) that it goes unseen.

However, anyone who has taken care of plants on a regular basis knows that they labor. Building on the post-humanist approach to Marx and labor that I introduced at the start of this entry, James Palmer (2021) contends, "that plant metabolism (in the form of photosynthesis, growth, and carbon sequestration) might usefully be conceptualized as a distinct form of nonhuman—in this case, vegetal—labor in its own right" (pg. 142)ⁱ. Writing in the postcapitalist tradition of diverse economies, Elizabeth Barron and Jaqueline Hess introduce the labor of Fungi, as vital to ecosystems while arguing for a less instrumental and human centered understanding of fungal labor. "~~Fungi are spore-producing organisms such as mould, yeast, mushrooms, morels, truffles and toadstools that feed on living or dead organic matter.~~ Fungi do a lot of work – they cycle nutrients in the environment, provide food for other organisms (including people), and decompose dead matter." Fungal labor intersects with a diverse more-than-capitalist human economy of mushroom foraging, harvesting, selling, and self-provisioning. Taking a more-than-human perspective, the authors ask "But what does this look like from the fungus's perspective? What work has the fungus done to provide this edible product for humans? Are there insights we can learn from how other organisms labour, expend energy, produce outputs and interact with others via forms of exchange?"ⁱⁱ.

Of course plant and fungal labor cannot take place in isolation, this labor always happen in relation to other forms of life and matter – most notably soil. Maria Puig de la Bellacasa and Anna Krzywoszynska have both drawn attention to the more-than-human labors of soil care and restoration. Writing about the soil restoration and improvement, Krzywoszynska notes that the "liveliness of soils is producing hopes and hopes centered on the possibilities of remaking agriculture through new configurations of soil labor." However her findings show that "practices of enrolling soil biota as laborers are likely to reproduce and may reinforce the existing dynamics of domination and exploitation of environments."ⁱⁱⁱ In other words, it is possible to recognize non-humans as food workers, without significantly changing our

material, cultural, or economic relations with the more-than-human world. This contrasts with feminist and vibrant materialist accounts of soil, that invite humans to become enchanted by and vulnerable to the liveliness of the more-than-human world, and nurture relations of collaboration rather than exploitation and domination.^{liii} Taking an ethical stance on what labor is and ought to be, has also prompted these scholars to adopt the lens of care and social reproduction to attend to the ways in which labor (by humans and non-humans) is first and foremost oriented towards sustaining life rather than capital. This feminist reading of labor is closer to Battistoni's take on hybrid labor, as the collective human and non-human labor necessary for reproducing our commons world. The lens of care and attentiveness is also evident in a growing body of research on the collective and more-than-human labors of compost. As I have reflected on elsewhere, "The labour of composting ...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 de la Bellacasa's observations of the affective and embodied ways that humans come to know and care for soil~~" (^{liv}, pg. 537)

As numerous scholars have observed (see: Iv, Ixiii), laboring with non-humans can (but does not guarantee) ethical openings for appreciating non-human labor, recognizing our radical interdependence and mutual vulnerability, and reconfiguring out relations with the more-than-human world to nurture less exploitative, violent, and extractive relationalities. In my own work on community composting and community fermentation, I have observed that such ethical openings are possible – when human labor is dignified, safe, and equitably compensated (not always with money, but also with food, pleasure, companionship) – and the pace and tempo of this labor is in harmony with the metabolic cycles of human and non-human workers. This requires humans to have autonomy over their working conditions, the ~~freedom to ability to slow down~~adjust the pace of production to the life rhythms of their non-human ~~ee-workers~~, and and the food and economic security to do so, ~~eede control to (some)~~ ~~more than humans without dire risks.~~

Insects

While insects and their larvae are increasingly recognized as a sustainable food source for humans and other animals ^{lv}, and their metabolic activities are enrolled into agriculture in direct and deliberate ways – from pollination to food and feed production. They are predominantly encountered as pests, to be managed, killed (with chemical pesticides or

hungry ladybugs), or simply swatted away. Even though, “insects exist at the foundation of the food chain, provide plant pollination services crucial for our own food production, and provide ecosystem services including nutrient cycling and waste disposal”^{lvi}, their labor has received scant attention in food studies. This might be attributed to a eurocentric “yuck factor”^{lvii}. To recognize insects as laboring, would require humans to recognize their value, their ability to suffer, and the multitude of other ways that food cultures relate to insects all over the world. It would mean extending the moral economy of labor to tiny monsters. Symbolic or material proximity to insects has long been a strategy for Othering, legitimizing violence and genocide. Recognizing insects as laboring is necessary, not only for challenging the supremacy of humans over nature, but also for destabilizing the dominance of minority world cultural and food norms over others.

Where insect labor has received the most attention, is, unsurprisingly, among honey bees and the humans who keep them. The activities of bees have long captured the imagination of labor thinkers, including of course Marx. As Renisa Mawani writes “ Bees have acquired a reputation as “model ‘modern’ industrial workers.” They are industrious, cooperative, attentive to the hive’s division of labor, and acquiescent of their place within it.”^(lviii)pg. 119). Bees (and other less charismatic pollinators, like wasps) are keystone species in our food system, they pollinate crops, flowers, and trees. Humans have invested considerable resources in harnessing and appropriating the labor of bees for agriculture^{lix}, as well as military uses.

As Lisa Jean Moore and Mary Kosut write, “Even though almonds, broccoli, onions, blueberries, and many other dietary staples would not exist without the work of bees, this labor is rendered invisible.....Bees produce much of the food we consume whether through pollination or honey production. The embodied labor of bees constitutes us physically as a species”^{lx} (528-9). The vulnerability of honey bees, and by extension our food system, to threats like colony collapse disorder has mobilized a diverse range of human actors to preserve, manage, care for, and efficiently exploit the honey bee. Honey bee labor is intertwined with highly commercial and industrial labors in California’s almond orchards (Kosek 2019), as well as artisanal and playful labor of small scale honey producers and hobby beekeepers (Ellis 2022). While honeybee labor cannot be understood apart from human labor, it is often eclipsed by human labor. For example, “bees are responsible for the pollination of crops, but it is the farmer who actually plants and harvests. ... Likewise, bees manufacture honey, but it is humans who harvest the honey, making the product of the bees’ labor real and useful to us.”^{lxxii} (pg. 528)

However, the ability of bees to labor and the livelihoods of the beekeepers who exploit their labor are increasingly threatened by human-induced changes to bee metabolisms. As Jake Kosek writes

“monocrops, pesticides, changing landscapes, the use of high-fructose corn syrup, and new protein supplements in the bee’s gut—a multispecies environment—have impaired the presence and vitality of the microbes, which in turn have transformed the bee’s metabolism, digestion, and immunity” (lxi pg 161). This suggests greater attention is needed to metabolism, not simply as a metaphor for human labor, but as a precarious multispecies labor – carried out by microbes and fungi, insects and soil creatures, human and non-human animals whose diet and health, are interwoven by shared landscapes, pollutants, and diseases.

III. Discussion & Conclusion

Hopefully this entry has offered a taste for the diverse ways in which food studies scholars have begun to attend to non-human labor in the food system. Across this very diverse body of work there are some common red threads, that circle all the way back to Marx and metabolism, but also take some interesting feminist and post-humanist turns. What is evident, is that human and non-human labors are deeply intertwined, at a social, economic, cultural, environmental, and biological level. Shifting from metabolism as a metaphor to metabolism as a biophysical and multispecies labor, that is lived and embodied in highly interdependent yet unequal ways can help us to better understand the radical and non-reciprocal vulnerability at stake in caring for, killing, feeding, and being fed by non-humans. While humans bear responsibility for the conditions of non-human labor, and have engineered and domesticated non-human foodworkers big and small, they are never fully in control of their labor – even in the most highly controlled factory farm or laboratory settings. Non-human labor continues to captures our attention in its failures and refusals, revealing the absurdity, domination, and violence that is necessary for making humans and nature “work” for capitalism^{lxii}. Shifting focus from the production of food as a commodity to the collective multispecies reproduction, regeneration, and renewal of a common world^{lxiii} in a food commons could reveal quite different labor arrangements.

Industrial capitalist food systems are exploitative of both human and non-human labor. However, other food systems are possible. Humans have depended on and collaborated with non-humans for a very long time to make their food provisioning safer, more secure, and more resilient to shocks. However, we have clearly reached a tipping point, with the intensified exploitation of non-humans generating greater harms than goods, and exposing human and more-than-human food workers, eaters, and the ecosystems to unacceptable risks and dangers. My hope is that by attending to non-human labor we might begin to cultivate a different ethics towards the more-than-human world, that shifts our habit of control, domination, and extraction to an ethic of care, collaboration, and interdependence.

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