

https://dspace.org/

Power protein Closing the justice gap for food system transformation

Isabel Baudish; Kajsa Rasare Sahlin; Christophe Bene; Peter Oosterveer; Heleen Prins ...

IOP PUBLISHING LTD
https://hdl.handle.net/10539/42123
WOS

Downloaded from a DSpace repository. https://dspace.org/

ENVIRONMENTAL RESEARCH
LETTERS

LETTER • OPEN ACCESS

Power & protein—closing the 'justice gap' for food system transformation

To cite this article: Isabel Baudish *et al* 2024 *Environ. Res. Lett.* **19** 084058

View the article online for updates and enhancements.

You may also like

- Food justice: cultivating the field
Charlotte Glennie and Alison Hope Alkon
- The potential to increase food system resilience by replacing feed imports with domestic food system byproducts
Vilma Sandström, Thomas Kastner, Florian Schwarzmueller et al.
- Consumer resistance diminishes environmental gains of dietary change
Clara Payró, Oliver Taherzadeh, Mark van Oorschot et al.

This content was downloaded from IP address 146.141.14.55 on 20/08/2024 at 14:48

ENVIRONMENTAL RESEARCH
LETTERS

LETTER

Power & protein—closing the 'justice gap' for food system transformation

Isabel Baudish[1,2,*], **Kajsa Resare Sahlin**[1], **Christophe Béné**[3,4], **Peter Oosterveer**[5], **Heleen Prins**[5] and **Laura Pereira**[1,6]

[1] Stockholm Resilience Centre, Stockholm University, Stockholm, Sweden
[2] Global Economic Dynamics and the Biosphere, Royal Swedish Academy of Sciences, Stockholm, Sweden
[3] CIAT, Cali, Colombia
[4] Wageningen Economic Research Group, Wageningen University and Research, Wageningen, The Netherlands
[5] Environmental Policy Group, Wageningen University and Research, Wageningen, The Netherlands
[6] Global Change Institute, University of the Witwatersrand, Johannesburg, South Africa
[*] Author to whom any correspondence should be addressed.

E-mail: isabel.baudish@gmail.com

Keywords: protein, transition, meat, food system, justice, transformation, political economy

OPEN ACCESS

RECEIVED
15 November 2023

REVISED
8 March 2024

ACCEPTED FOR PUBLICATION
11 April 2024

PUBLISHED
6 August 2024

Original content from this work may be used under the terms of the Creative Commons Attribution 4.0 licence.

Any further distribution of this work must maintain attribution to the author(s) and the title of the work, journal citation and DOI.

Abstract

The protein shift, or transition, entails a reduction in the production and consumption of animal-source foods, and an increase in plant-based foods and alternative proteins, at a global level. The shift is primarily motivated by the need to minimise the impact of the food system on social-ecological systems. We argue that rather than focusing singularly on transitioning a 'protein gap' in diets, redressing the 'justice gap' is a prerequisite for transformative change in food systems. In this context the justice gap is understood as the gap delineating those who have access to just food systems and those who do not. To substantiate our argument a justice lens is used to analyse the political–economic dimensions of such a transformation and to propose that the future of protein must engage with three core elements to be transformative—disruption, innovation and redistribution. Disruption entails challenging both the food trends that encourage the 'meatification' of diets, and the influence of 'Big Meat' in perpetuating these trends. Innovation emphasises that true novelty is found by designing justice into practices and processes, rather than by firing alternative protein silver bullets within existing food system paradigms. Redistribution stresses that food system redesign is predicated upon establishing fair shares for remaining protein budgets, using approaches anchored in contextual specificity and positionality. Through the application of a justice framework, we expose existing food system injustices related to production and consumption of protein, invite discussion on how such injustices can be addressed and reflect on implications for food system transformations. By reshaping the crux of the protein debate around the more salient concern of the justice gap, food system transformation can take shape.

1. Introduction

Calls to transform the food system urgently resound across academic literature, policy directives, private sector agendas and non-governmental organisation (NGO) advocacy [1–6]. Food systems serve many overlapping functions fundamental to human and planetary health, providing basic human nutritional needs as well as sustaining vital coalitions of livelihoods, ecosystems and cultural practices. However, the global industrial food system that has emerged over the last century is laden with a number of 'aching points' that compromise its ability to deliver these functions equitably, not least to the most vulnerable [7, p 20]. While global efforts to reduce malnutrition and food security have made significant progress, inroads have taken a turn for the worse in recent years [8]. It is ever apparent that the industrial food system serves commercial and trade interests at the expense of human and environmental health [2, 9] and, with the deeply rooted structural fragility of the food system exposed [10],

© 2024 The Author(s). Published by IOP Publishing Ltd

it is imperative that measures for transformation are adopted [3].

One aspect of food system transformation concerns drastically overhauling where dietary protein is sourced—a protein shift, or transition, away from animal-source foods[7] (ASF) and towards plant-based foods and alternative proteins[8] [9, 13–17]. This shift is chiefly driven by the high impact ASF currently imposes on social-ecological systems (box 1). In this paper we focus on terrestrial ASF (TASF)[9] because there is significant commonality in the political–economic dynamics, sustainability challenges and substitutability in consumption. We acknowledge that different TASF also have distinct relations to social, environmental and economic contexts depending on what animal species are prevalent and how they are valued. Blue foods are beyond the scope of this article.

Box 1. Sustainability concerns warranting a shift away from terrestrial animal-source foods.

The environmental impact of terrestrial animal-source food products, in particular meat and dairy, is significantly larger than that of plant-based food products [6, 19–22]. Present food systems are estimated to be responsible for about one-third of global greenhouse gas (GHG) emissions [23, 24] with the livestock sector accounting for 14.5% of these [25]. Meat and dairy are calculated to be responsible for 60% of all agricultural GHG emissions, despite providing only 18% of calories and 37% of proteins globally [26]. On average, producing 100 g of protein from beef emits 25 kg of CO_2, while 100 g of protein from cheese, pork and poultry emit 8.4, 6.5 and 4.3 kg of CO_2 respectively. By comparison, tofu, beans and peas emit only 1.6, 0.7 and 0.4 kg of CO_2 per 100 g protein, respectively [27]. As well as the direct emissions from livestock, emissions are also generated as a consequence of the deforestation and land use change that takes place to graze livestock and cultivate crops for livestock feed [23, 28]. For example, the role that soy cultivation plays in deforestation has been well chronicled, and 77% of soy production is used as animal feed [29]. In addition to climate impacts, other negative impacts from animal production include biodiversity loss stemming from deforestation and land use change [28], and the extensive use of fresh water in meat production [30].

There are also severe human health risks associated with the over-consumption of certain animal-based proteins (highly processed red meats and charcuterie products in particular), such as increased risk of cardiovascular disease and certain cancers [6, 31–34]. Livestock rearing is currently a driver of antimicrobial resistance [35, 36], and future effects of this for human health care systems and animal production are difficult to foresee. But as the COVID-19 pandemic has illustrated, humans and animals are not separate, and the spread of zoonotic diseases is of major personal and societal concern. Human health risks also extend to the impact felt by those working to produce TASF and the associated feedstocks. Many farmers, for example, face increasing economic hardship, loss of livelihoods, and political marginalisation which contribute to mental health issues, including loneliness and increased suicide rates [37–41]. Slaughterhouse workers are found to have a high prevalence of depression and anxiety, and some evidence suggests a correlation between slaughterhouse employment and crime perpetration [42, 43].

Changing modes of consuming and producing protein is challenging, with an ensuite of associated social, economic, ecological and health interconnections. The extent to which these interconnections exist varies with species, scale and region. Livestock play a number of roles [44], generating diverse ecosystem benefits and representing an important socio-cultural heritage [45, 46]. The livestock sector provides for millions of smallholder livelihoods, generating approximately 20%–25% of agricultural gross domestic product (GDP) in low- and middle-income countries [47]. TASF provides a concentrated source of important vitamins, complex amino acids and minerals, with modest increases in consumption offering significant health benefits to the nutritionally vulnerable [48–50]. As climate change will likely reduce the availability of proteins found in wheat and rice—major sources of protein intake for most people around the world—this deficiency will have to be compensated [51].

Oversimplification and imbalance plague the conceptualisation of protein shifts and flattens complexity [52]. Both the arguments supporting *and* critiquing the use of TASF can lack nuance and complete data, omit facts that undermine positions,

[7] ASF refers to dairy products, meat, blue foods (excluding algae and seaweed), and eggs [9, 11, 12]. This definition excludes the lab-grown versions of these products.

[8] Alternative proteins include (but are not limited to) novel plant-based protein substitutes (also known as meat mimics and analogues), lab-grown proteins (also known as cultured and cellular proteins) and processed insect derived products. Traditional plant-based protein preparations (such as tofu and seitan), whole foods emulating meat (such as jackfruit and mushrooms) and traditional insect consumption are excluded from the scope of this term [9].

[9] TASF includes all food products obtained from terrestrial animals at various scales, from mammals, birds and insects alike [18].

and focus on challenging opponent integrity as the primary way to win a debate [53]. Too often is the protein shift couched in binary terms and positionalities, presented as a polarised struggle between dominant and alternative food systems, such as meat-eaters vs. vegans, or intensive corporate farming vs. agroecology [54–56]. Different animals are often reduced to their function as meat, different meats are morphed together and the extent to which meats are processed is often not transparent to consumers. A rather singular concept of protein is the result, setting up a tunnel visioned political and cultural debate [9].

Discourses on protein shifts have also been dominated by a central and misleading narrative of a 'protein gap' that needs to be closed—i.e. there is a global protein deficiency that warrants increased and diversified production [9, 15, 57, 58]. This reductive message is deeply intertwined with the political, economic and cultural role of TASF [59]. The high pedestal that protein is placed on undercuts the relevance of micronutrients and other macronutrients, while the debate on 'the future of protein' often obscures the complex context of broader food system transformations. Echoing the Great Protein Fiasco[10] of the 1930s, hyper-fixation on a 'protein gap' within nutrition agendas can omit the more critical aspects of food access and poverty [60] and ignore the reality that the majority of adults in high- and middle-income economies, in fact, consume substantially more than the daily recommendations for protein intake [61]. 'Exploring other possibilities for framing the problem is an essential first step' in enabling food system transformation [57, p 393] and this paper sets out to do just that.

Here, we argue that to enable a food system *transformation* (over a protein shift or transition), a focus is instead needed on the 'justice gap' in food systems, where there is less emphasis on substituting protein sources, and more focus on the equitable redistribution of food, including protein as a key nutrient. We conceptualise transformation to mean not only changing diets, but also fundamentally contesting the deep-seated form and functions of protein within the global food system [62, 63]. Changing protein is more complicated than a silver bullet approach precariously balanced on techno-optimism, or an expectation that the meat industry will regulate itself [9]. Rather, it involves large-scale structural changes spanning politics, economy and sociocultural norms [64]. By invoking the term 'justice gap' (where the gap refers to delineating those who have access to just food systems and those who do not), we point to the number of injustices that are manifest within food systems—such as malnourishment, human rights abuses, (child) exploitation, marginalisation and, oppression. We propose a vision of a just food system that can provide equitable access to sufficient and healthy food for all, within Earth system boundaries [65]. A just food system also invites safe and equitable participation in the ownership and governance of the means of producing, distributing and consuming food [66]. We position this paper in the understanding that justice is vital both inherently as a process (i.e. justice for justice's sake) and the explicit outcomes a justice approach produces. Food system justice[11] has many intersections with environmental justice, racial justice and human rights approaches, as well as feminist and decolonial scholarship [68–70].

To conduct our analysis, we draw on the three lenses of historical, representational and distributional justice, as proposed in [5] as a framework for examining justice in food system transformation. Historical justice is concerned with how injustices may be carried over and reproduced within transformations [5]. Representational justice is interested in how different perspectives are represented within the transformation, interrogating institutionalised barriers that limit social, economic and political participation, and opening up for citizen input [71]. Distributional justice interrogates how benefits and risks are shared amidst competing needs [72]. Using these three lenses, we propose three core approaches—disruption, innovation and redistribution—needed to close the 'justice gap' and enable a food system transformation encompassing, but not pigeonholed to, protein (figure 1). Our paper discusses system reconfigurations, but recognises the feasibility challenges inherent in confronting systems of power. Justice is also normative, positional and 'malleable' by nature [73, p 2]—these lenses offer up *a* justice perspective, not a definitive one. Our study's subsequent contribution lies in offering conceptual avenues and illustrative examples to refocus the debate on the relationship between protein, justice and food system transformation.

2. Disruption

2.1. The 'meatification' of diets and rise of 'Big Meat'

The growing influence of 'Big Meat' in the global food system is observable throughout several historical food regimes (figure 2 [74, 75]). Within the third and current regime, an integrated 'industrial grain–oilseed–livestock complex' [76, p 65] successfully

[10] The Great Protein Fiasco of the 1930s pinned malnutrition in Africa on the back of protein deficiency, with it only later unfurling that food access and poverty were the more critical issues at hand [60].

[11] Justice in food system transformations is gathering increased attention. The second EAT-*Lancet* commission has an increased focus on food justice [67], and the 2023 Earth Systems boundaries report introduced a justice floor to mirror the planetary boundary ceilings [65].

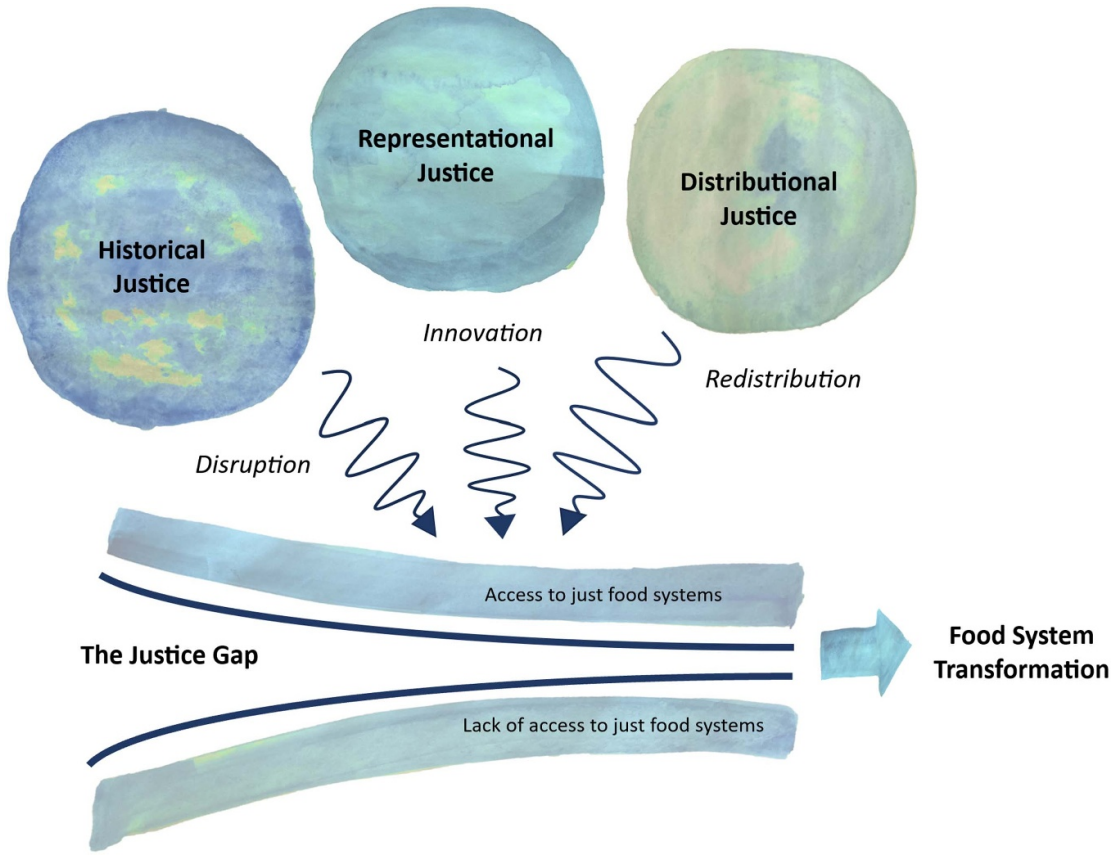


Figure 1. By applying the lenses of historical, representational and distributional justice, can pathways to disruption, innovation and redistribution emerge in and around protein systems. These pathways support the closing of the justice gap, a necessary step on the road to food system transformation.

continues to reinforce the 'meatification' or 'westernisation' of diets [77, p 20]. In 2019 the total global production of meat amounted to over 300 million tonnes (in slaughter weight), a near five-fold increase since 1961 [78], while the population has 'only' increased nearly three-fold in the same period[12]. This dietary shift is still accelerating [80], and spreading to low- and middle-income countries [81] contributing to the triple burden of malnutrition[13] [8, 82].

Industrialised meat production in the current regime is largely driven by the 'imperatives of capital' and not by the ambition to produce nutritious food [92, p 94]. Companies, following shareholder pressure, have focused on encouraging production and sales of highly processed, low-quality food with higher price margins [15, 91]. This has often been underpinned by strategies to de-skill both consumers (slowly eroding food preparation knowledge and encouraging heightening reliance on processed foods), and farmers (increasing dependency on upstream and downstream intermediaries, such as animal geneticists/breeders and meat processors) [94]. Increased demand for meat (particularly pork and poultry) has led to the use of more capital-intensive technologies by farmers, and their vertical integration in agro-food industries that aim for standardised (meat) products [95–97]. As of today, over 50% of the total global TASF production occurs within broiler systems, intermediately or fully industrialised meat systems, in feedlots or in specialised layer systems [98]. Only 15% is produced in 'backyard' or grass-based systems [98]. Even though there is immense diversity of production within categorisations such as 'industrial' and 'grass-based', these numbers highlight the dominance of production systems characterised by market—orientation, rationalisation and economies of scale. Smallholder producers, for example, are often seen as being captured by the agro-food industry where 'technological choices combined with economic choices and cultural evolutions strengthen the dominance of the largest actors' [99, p 19].

Consolidation in the food system is occurring vertically (the acquisition of upstream and downstream businesses), horizontally (merging or acquiring competitors), geographically (entering new regional markets) and concentrically (entering adjacent

[12] In 1960, the global population was around 3 billion people, while it is currently nearly 8: a 2.6 fold increase [79].

[13] The triple burden of malnutrition refers to the concurrent dimensions of undernourishment, micronutrient deficiencies, and over-nutrition [82].

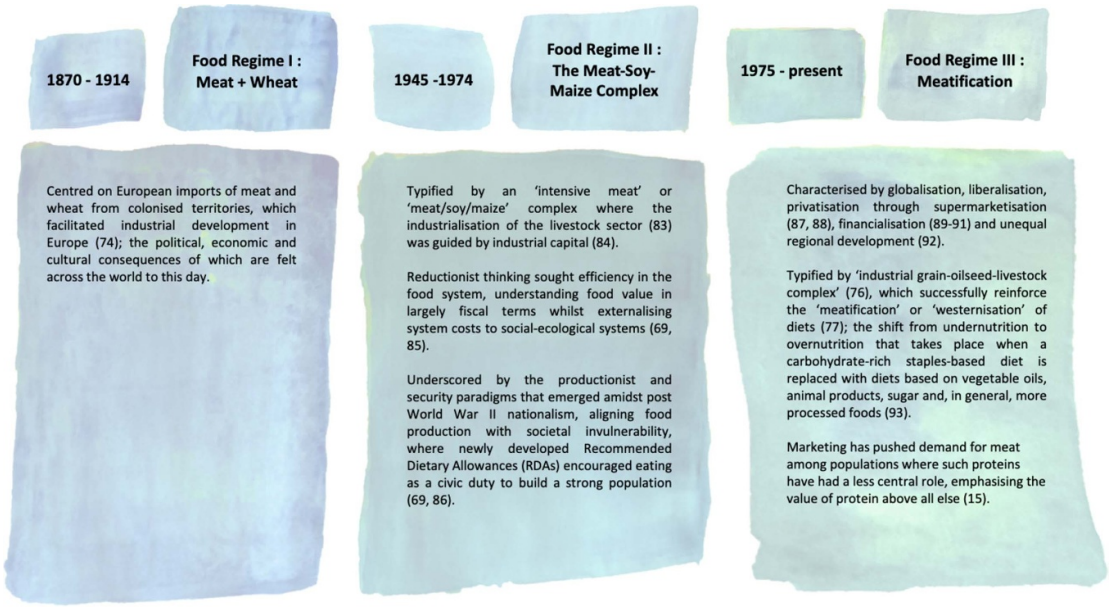


Figure 2. Brief summary of the three food regimes dominating from 1870 to present day (2024), describing the relation of meat to each regime. A food regime lens emphasises the dominant global dynamics between core and periphery powers which shape food system trends. This lens has less focus on local dynamics and South–South relations. We acknowledge that the universalising of the history of the industrial food system is a problem in and of itself as it renders non-industrial actors and processes 'the other', thus devalourising them.

industries) across the supply of seed, agrichemical, fertilisers and machinery [2, 15, 100]. Currently, the global 'protein pie' is a USD 1.5 trillion sector [101] and both capital and control are highly concentrated [102]. The top ten meat processing companies control 75%, 70% and 53% of the slaughter of beef, pork and chicken respectively. Breeding stock is even more tightly controlled, with seven dominant companies [9]. This agglomeration bears witness to the rise of 'Big Meat' at the expense of other small-scale stakeholders across the food system—packagers, breeders, farmers and processors—and also of public, animal and ecosystem health [102]. In the majority of cases, farmers and consumers are excluded from core decision making around farming and diets [103], undermining participation, agency, freedoms—and hence justice [104]. When price increases occur, they are not merely being driven by rising input costs or supply/demand dynamics, but rather 'the result of corporate decisions to take advantage of their market power in an uncompetitive market, to the detriment of consumers, farmers and ranchers, and our economy' [105].

2.2. Pathways for disruption

Disruption entails challenging both the food trends that encourage the 'meatification' of diets, and the influence of 'Big Meat' in perpetuating these trends. A historical justice lens draws attention to how deep-seated inequalities, experienced over time, replicate in current trajectories, offering insight on where to disrupt such patterns [5]. The economic interests of 'Big Meat' continually act to retain power, visible in the ramped investment in alternative proteins [15, 53], resistance to initiatives that seek to disrupt market grip [77, 106, 107] and, similar to the tobacco and fossil fuel industries, the push back 'against evidence that its product caused harm' [108, p 25]. 'Big Meat' and the privatised food sector have come to wield an undue amount of power from a representational justice perspective. This influence has time and again been correlated with food policy stagnation [108, 109] and should be challenged for its inherent and instrumental impact on widening the justice gap. To create the necessary space for change, industry self-regulation cannot be relied upon [109] and 'politically-inspired regime destabilisation may be necessary' [110, p 37].

Given that power is manifested largely in the form of capital [53, 74, 83, 111], pathways for disruption will likely be a complex and context specific combination of various financial interventions to interrupt profit streams, such as taxation and removal of meat subsidies. Nation states and government subsidies have facilitated the dominant role of private corporations in food systems through, for example, 'direct ownership stakes, payments or tax breaks for production, low-interest funds to finance acquisitions, policies that shift the burden of environmental and community impacts of their operations to taxpayers, and regulatory barriers that disadvantage competing firms' [102, p 32]. Discrepancies in taxation also reflect outdated regulatory environments—for example, at least six EU

states[14] have a higher value-added tax rate for mylks[15] in comparison to dairy [112]. Subsidies also typically favour dominant firms, thereby increasing opportunities for market concentration [102]—seen in the case of feed subsidies benefiting the broiler industry [114] and the Brazilian meat complex [115]. Eliminating harmful subsidies, using mechanisms under the remit of the World Trade Organisation, would target such concentration and offer co-benefits [116, 117]. Pluralist science–policy interfaces for food systems governance, based on the Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services (IPBES), the Intergovernmental Panel on Climate Change (IPCC) or High Level Panel of Experts on Food Security and Nutrition (HLPE-FSN) models, could also be approaches to guard against corporate influence [118].

Additional regulatory interventions are called for, such as restrictions on industry monopolisation, and antitrust and consumer legislation to target anti-competitive behaviours that are driving down wages for workers and prices for farmers, while raising consumer prices [9, 15]. Key meat processors—Hormel, Tyson and JBS—have been historically associated with the latter, with JBS receiving a USD 3.2 billion corruption fine in 2017 [15]. From 2001 to 2018, 52% and 32% respectively of the credit received by the soy and cattle traders active in the Brazilian Amazon came from secrecy jurisdiction or tax havens [119, 120]. As well as this, lobbying activities, including the provision of financial incentives to politicians and the push for pro-meat policies, are well documented within the TASF industry [54, 103, 108, 121–126]. Stronger lobbying regulation is one prospective counter to this, including disclosure and auditing requirements, preventative measures to manage conflict of interest and revolving door practices, and a coherent suite of transparency and integrity mechanisms [127].

Disrupting the centrality of TASF within diets also requires tackling the pervasive nature of protein norms across diverse cultural contexts. Meat, historically, has a social status that has been interwoven with culture, identity and systems of power, including patriarchy and neoliberalism [59]. For example, underscoring mid-20th century Western rationing policies was the perception that women were 'incapable' of handling too much meat, driving an encouragement to go without, and making 'explicit the role meat has played as an enduring symbol of masculinity and racial/national superiority' [59, p 14]. The meat–masculinity connection continues into the 21st century, with the cultural power of meat used in media to emphasise traditional gender roles [128, 129]. Even alternatives to meat can be framed both as a threat to performing manhood [130] or a way to reproduce traditional masculinity [131], indicating that the (patriarchal) gendering of food must be disrupted to pave the way for just dietary cultures that are not grounded in systems of oppression. The links between other forms of cultural power and TASF should also be interrogated. The restrictions on eggs in Indian school lunches (often going against nutritional advice) exemplify the role of religion and politics (and 'caste and class') in influencing food systems, where control is upheld by 'those who have a stake in the system' [132, p 87].

By drawing on a historical justice lens and seeking inspiration in feminist, degrowth and decolonial thinking [66, 133, 134], we can recast the mould of meat norms so that evolving cultural practices are not shaped by 'patriarchal traditions nor by the perverse incentives of industrial food systems' [9, p 48]. Disruption pathways must run deep, for the injustice(s) of hegemonic agri-food systems are ingrained within both the 'imaginaries of how economies and societies should work' and 'the political–economic structures that uphold and reproduce these imaginaries' [133, p 1590]. Disrupting the stranglehold of meat is therefore entangled with disrupting the inner workings of power in food systems. In the wake of disruption there is space for uncertainty to flourish, and for novelty to emerge [135].

3. Innovation

3.1. Fresh meat or more of the same?

There is significant hype around the potential of innovative proteins. The protein gap provides a highly saleable narrative that brings consumers and investors alike to the table. *Product* innovation is emphasised, characterising the protein gap as bridgeable by R&D and investment [57, 136]. Alternative proteins are typically promoted on the basis of health and goodness for humans, non-humans and the planet [17], analogous taste to ASF [137–140] with minimal negative externalities [136]. Markets within both the Global North and the Global South are targeted, the latter by stories of a golden opportunity to leapfrog to an optimised system that does not reproduce the challenges of the western, meatified food system [141, 142].

Established food companies, including 'Big Meat', are raising the scope and scale of their activities across the alternative protein sector [26], driving corporatisation of the sector, aka 'Big Veganism' [143]. Activities include developing alternative proteins, acquisition of alternative protein businesses and investment in start-ups [26]. Nearly all significant meat and dairy manufacturers now have assets in alternative proteins [9], extending their social licence and power within the 'protein' industry. JBS, for example, now owns 100 protein brands globally [102], and the monopolisation entrenches power

[14] As of 2019 these were Greece, Austria, Slovakia, Spain, Germany and Italy [112].

[15] The term 'mylk' refers to plant-based milk analogues, distinct from those made from dairy [113].

asymmetries, as well as hollowing out the original commitments of alternative proteins to sustainability [100]. These investment activities are frequently mired in obfuscation making it difficult for anyone to 'meaningfully assess' the promises and consequences underpinning new products [136, p 1583].

Patterns of corporate concentration are mirrored in the financialisation of food, including the 'innovative' (and lucrative) alternative protein sector which attracts non-food actors such as pension and private equity funds [91, 144, 145]. For example, Vanguard and Blackrock have investments in many of the largest firms in the meat, dairy and animal feed sector, and are now buying into alternative protein product development [9, 146], alongside billionaires like Bill Gates and Richard Branson [17, 147]. R&D ventures in alternative proteins have largely been within the private sector rather than university settings, and often adopting the business models typified by Big Tech and the Silicon Valley [17]. Financialisation undermines sustainable food systems on multiple fronts, squeezing smallholders' income, reducing farmer independence and increasing environmental risks through both intensification of production and expansion into natural landscapes [100].

Novel foods perpetuation of hegemonic norms should not be underestimated. While veganism can sometimes be positioned as political (i.e. a means of resisting capitalist, patriarchal or colonial oppressors [9, 59]), this is not inherently the case. All too often, alternative food system enthusiasts do not 'embrace concepts of social justice or food sovereignty in their discourse and practice' [148, p 199]. Consumers can, for example, be encouraged to care about the planet and health by buying alternative mylk products, but are ultimately only granted agency within the neoliberal bind, remaining 'consumers of commodity food' [113, p 945]. Claims of alternativeness and innovation, within the guise of clever marketing, mask that such green consumer products do not fall far from the capitalist tree [149]. Case in point, many mylks are often purchased in addition to dairy, rather than as a like-for-like substitute [150]. When corporate control of alternative foods prevail, food choices are largely depoliticised, risking foreclosure on 'other potential pathways of food system change' [113, p 958]. As systemic problems are individualised, market mechanisms are pushed as the solution and the 'political economy of industrial agriculture' endures [113, p 945].

Equating the concept of innovation within new products and technology often sees the class, racial and gendered dimensions of food systems neglected [151, 152]. Western vegan food culture is frequently framed as the healthy and moral choice, fuelling the alignment of veganism with affluence and whiteness [152, 153]. This in turn constructs the 'unhealthy other' [154, p 1348, 155] a stigma saddled to the backs of 'the poor, the colonised, and conquered' as 'evidence of their immorality' [66, p 102], used to deny their rights and dignity further [156]. While there is potential for diets which include alternative proteins to facilitate emergent gender norms outside of the meat–masculinity complex [157], vegan narratives online currently have limited space for 'alternative gender performativity' and can reproduce the same patriarchal patterns as TASF [131, p 133]. There remains a proclivity towards vegan 'hyper-masculinities' [130] and the restrictive eating cultures that have long exercised control shaming (particularly) female and larger bodies [158]. When introduced to novel settings, indigenous foods may offer an 'innovation' opportunity with benefits for 'agro-biodiversity, farming system diversity and dietary diversity' [159, p 100]. However, positive outcomes rely on accompanying measures protecting against food system injustice. Traditional protein-rich crops turned 'superfoods,' such as quinoa, flow from Global South to North leaving behind a slew of problems connected to excessive land clearing, reduced domestic food security and boom–bust conditions for farmers [160, 161]. On top of this, traditional insect-reliant diets have been appropriated and commercialised by corporate actors without due acknowledgement or sharing of benefits [162, 163].

3.2. Pathways for innovation

To close the justice gap, technological innovation must avoid being co-opted by incumbent actors and giving incumbent companies the opportunity to steer the debate and governance arena. Setting clearly defined regulatory parameters, for example, would help evaluate new protein technologies and whether or not they align with a public good [9]. Reflexive protocols should be attentive to contextual specificity; not all alternatives are created equal nor are they all necessarily sustainable or more ethical [136, 164–166]. Elevating actors that are truly attentive to sustainability across value chains is paramount as such social innovations challenge key routines, institutions and beliefs and are key for broader systemic change [15, 167–169]. For novel foods, this could entail increased transparency [170] and the open sourcing of intellectual property [136]. For TASF, innovation could be reducing the emission intensity of rearing livestock [171–173], or looking to tradition for the future, such as re-coupling animal rearing and landscapes, contributing to the un-making of the industrial meat regime [174, 175]. Justice can also be embedded relationally in food systems via the 'cultivation and celebration of meaningful food' [148, p 199]. Box 2 suggests different ways of relating to food with the intent of stretching 'understanding of what it means to grow and eat food justly' [148, p 199].

Box 2. Rebuilding meaningful food.

Meaningful food is one possible avenue for understanding what innovative approaches to food could look like, moving beyond food as a commodity and instead aiming to foster, build and strengthen relational food [148]. Innovation founded in justice becomes less about matching problems with singular solutions, and instead expanding ideas of food practices and relations. During the 2022 event 'Healing Our Connection with Food in the Fake Food Era', food sovereignty advocate Vandana Shiva captured this sentiment forthwith:

> *'Our movement has to be founded on the awareness that eating is an ecological act, and join hands with the Earth, and with the farmer as one unity. Therefore, the pattern of big farms with big money, and big investors wanting to extract more from the Earth, needs to be reverted in favour of a return to a culture of care that provides dignity to farmers who produce real food to feed the world'* [176].

A few existing illustrative examples centred around meaningful food are:

- The Slow Food movement with its view of consumers as co-producers, heralding 'good, clean and fair' food alongside convivial relations throughout the food system [177].
- The Via Campesina, a small-scale farmer led, grassroot movement 'aiming for family farming to promote social justice and dignity' [168, p 3].
- The recognition of agroecology as not only a science, but also a 'movement and a practice', with the latter being closely intertwined with equity struggles for example in Latin America [178, p 503].
- Pastoralism, through its tightly woven human–livestock interactions within biocultural landscapes, reflects where meaningful and innovative approaches to TASFs may be sought in tradition. Painting all livestock production with the same brush as 'the problem' has the potential further to marginalise some livestock farmers, especially pastoralists, who are contributing to the wellbeing of people and nature [179–182].

Beyond product innovation, there is a crucial need for innovation of *process* and food system governance to enhance diversity and combat power concentration [1, 100]. Given the number of different trade-offs and actor heterogeneity this will be no mean feat, with any framework that diminishes food system complexity either 'hopelessly naive or radically incomplete' [183, p 443]. As a foundational point of departure though, representational justice highlights who speaks for whom, power dynamics, systems of control and collective decision making [184, 185]. Often those most affected by the food system injustice given 'little influence in decision-making processes' [73]. Pluralistic inclusion is often, explicitly and implicitly, absent as an objective within major protocols for food system transformation [186]. Such absence must be corrected in a manner that steps beyond limited consultation [187] or only a seat at the table. Co-production processes that reproduce unequal power relations may do 'more harm than good' [188, p 1095] and risk pinning transformation of food systems on the 'backs of the rural poor' [186, p 729]. Instead, inclusion demands actual engagement (being heard at the table) with a balanced range of human and non-human perspectives [5, 9, 118, 189]. Deliberative democracy models such as citizen assemblies are potential vehicles to empower citizens and diverse food system actors—consumers, processors, retailers, vendors, transporters, producers alike—to formulate decisions along common interests [183].

As of now, deeply rooted issues of political economy prevent the formulation of pluralist visions for food system transformation [190]. Adopting processes that foreground relationality [69] and operate intersectionally can help to consider by who, and for whom, protein transformations are being imagined and what 'senses of justice' are included [191]. Food sovereignty frameworks by design support inclusion and 'autonomous struggles for the exercise of entitlements to land and community-based decision making, along with democratic and participatory control over our local natural assets' [148, p 216]. By first unpacking the 'matrix of oppressions'—patriarchy, capitalism and colonialism—just alternatives to the corporate industrial food system can emerge that resist the allure of silver bullet solutions [192, p 1029]. Therein lies the true novelty of novel foods.

4. Redistribution

4.1. Unfair portions of the multi-layered protein pie

Applied to food systems, distributional justice is concerned with the fair allocation of risks, impacts, opportunities and benefits within the food system—all of which are presently unevenly shared across nations and various subpopulations [5]. It is now apparent that a universal dietary 'protein gap' is a misnomer. In 2020, the total global supply of protein was equal to ∼85 g per capita per day [193] (far outweighing the average person's daily need

(∼50–60 g) [6, 194]). Simultaneously consumption is highly unevenly distributed and significant protein deficiencies do still persist in specific populations because of poverty[16] and lack of access. Consumers in high-income countries eat nearly twice as much protein in total compared to consumers in low-income countries (104 compared to 58 g of protein per capita per day) and their meat share of dietary protein is five times higher (30% compared to 6%) [194]. These inequities are visible throughout modern history. In 1961, the supply of protein in the EU was ∼87 g per capita per day, while in those countries classified as 'Least Developed', the supply was ∼49 g [195].

The social-ecological impacts of TASF are often externalised and unequally distributed. Global markets birthed out of colonial legacies contribute to 'pastureland exploitation in one country (creating TASF that are) used and consumed in another' [196, p 2]. Developing countries have historically contributed very little to the demand driving greenhouse gas emissions associated with meat production, yet they are expected to bear heavier burdens in terms of impacts of climate change and land use change. For example, the EU, the USA, China and Japan (home to ∼30% of the global population), are responsible for over 50% of the exploitation of the world's grazing lands [196]. Eighteen of the 30 supply chains encompassing this land use are cattle related, which 'confirm[s] the exacerbation of global inequality due to livestock consumption' [196, p 6]. The disproportionate distribution of benefits and costs between groups and regions are also observable when considering differing labour conditions, resource ownership, livelihoods and capacity to participate in decision-making processes [73].

The politics of protein distribution are intersectional. Communities of colour and the poor are often denied access to participating in the 'diet advocated by the food movement' across the various activities of the food system [197, p 5]. Gender is moreover one of the 'strongest and most consistent predictors' for beef intake [198, p 8], with the result 'unsurprisingly always the same: men eat more meat than women do' [199, p 2809]. A recent USA based study found half of all beef consumed could be attributed to 12% of individuals, with female, older and African-Americans typically falling within the lower consumption bracket [198]. Women face heightened nutritional deficiencies and food insecurity, particularly during pregnancy and breastfeeding [200]. This gender disparity is also seen in ownership and labour patterns concerning TASF, particularly in the Global South [201]. Women are the backbone of the food systems' triad of production, distribution and consumption [85], and two thirds of the world's 600 million poor livestock keepers are female [202]. However, this involvement 'does not correlate with their control over use of products or decision making regarding management or sale' [203, p 266]. For example, women may have the right to sell cattle milk on paper, but not have rights to its associated earnings [204] or decision-making powers concerning the herd and household [205]. For justice to prevail the full rights of vulnerable groups must be being protected for justice to prevail.

[16] Poverty can be understood here as a number of compounding and interlinked dimensions, including but not limited to monetary poverty (where certain foods are rendered unaffordable for lower income groups) and time poverty (where the burdens of unpaid work may limit the time available to prepare and consume certain foods).

4.2. Pathways to redistribution

A key dimension of closing the justice gap lies in redistribution within food systems, including protein as a key nutrient. Distributional justice has strong intersections with human rights and basic needs—every individual should have access to food that is safe, healthy, culturally appropriate, produced under fair labour conditions, avoids environmental harms and is sufficient to meet their dietary requirements [72, 206]. The rights of one person cannot be allowed to jeopardise the needs of others. There is an inherent boundary when needs satisfaction becomes luxury, and this applies to the 'need' for meat/protein [129, 130].

There are clearly many philosophical and pragmatic questions that are associated with establishing fair sharing of risks and burdens in food systems—what is the environmental budget for food production, what is the minimum fair share, and what measures could be implemented to tangibly protect this? Consumption corridors are one mechanism that could be used to seek to equitably distribute TASFs across groups. A consumption corridor refers to the optimal space between a maximum (ceiling) (such as the planetary boundaries [207] or livestock sustainability limits [208–210]) and minimum (floor) consumption levels (based on justice thresholds [65]). The optimal space should allow 'everybody to satisfy their needs without compromising others' ability to meet their own' [211, p 1]. Consumption corridors are typically negotiated using deliberative democracy processes [211, 212]. They offer potential as strong governance tools that can place caps on consumption that can 'bring about absolute reductions in the negative impacts of consumption in a just manner' [212, p 619]. Establishing regional fair shares within the remaining corridor could in turn be based on different methods: grandfathering (proportional to contribution to environmental impact), ability to pay (proportional to GDP per capita), or per capita (proportional to population) [213]. These methods echo the United Nations Framework Convention on Climate Change (UNFCCC) Paris Agreement's central tenet of 'common but differentiated responsibility' [214],

where high consuming groups must make drastic reductions to make room for others.

This unequal allocation of risk and benefits associated with protein is increasingly recognised at a high level but must be strengthened [34, 215]. There remains strong reluctance to implement policy tools to steer diets, let alone cap current overconsumption of protein and meat [216]. Demand for meat is expected to increase across the board, even in high-income regions [173, 217, 218]. The effectiveness of multilateral measures to reduce this demand still have much to prove—*The Global Methane Pledge*[17] for example, is limited by its reliance on voluntary measures and its scope does not encompass consumption. Pathways to transformation cannot exist before existing distributional injustices are duly recognised and acted upon by regulators, investors and big business. Attention should be paid to the diverse range of social inequalities experienced by marginalised groups propping up the current food system [5]. Too often the very 'subjects of justice'[18] are not specifically identified within conceptualisations of transformation [73, p 14] and rendered invisible in policy documents [220].

5. Conclusion

Food system transformation predicated on justice is a crucial step towards articulating the systemic changes needed around protein consumption and production. When considering how to set the table for change, we must disrupt the existing set up, not only rethinking the plate but also considering who serves and who dines at the table, who benefits from the arrangement, who is left out, and who goes hungry. By using the proposed framework in combination with other justice-centred approaches, the protein discourse can be realigned. This creates space to develop context-specific strategies correcting injustices and for the justice gap in food systems to close.

Data availability statement

No new data were created or analysed in this study.

Acknowledgments

This article used the work of L B, C B, P O and H P in the unpublished report *Protein Transitions Beyond the Political Economy: the Case of the Netherlands* as a starting point. Thank you also to colleagues in the protein, grazing and transformation discussion groups at the Stockholm Resilience Centre, and the Justice working group of the EAT-*Lancet* 2.0 Commission for enriching our shared thinking around protein, transformation and justice.

Funding

I B and L P acknowledge the IKEA Foundation Grant No. G-1910-01412, 'A visionary agenda for transforming the food system'. K R S acknowledges the support of the Swedish Research Council for Environment, Agricultural Sciences and Spatial Planning Grant No. 2019-00403. L B, C B, P O and H P acknowledge the support of the Policy Institution and Market small grant on 'Food system transformation—Beyond the political economy of protein transition' allotted to the CIAT International Center for Tropical Agriculture under the program CGIAR Research Program: Policies, Institutions, and Markets, led by IFPRI. C B acknowledges the spport of the Sustainable and Healthy Diet through Food System Transformation (SHiFT) initiative funded under CGIAR. Any opinion expressed here belong to the authors.

Conflict of interest

The authors declare no conflicts of interest.

ORCID iD

Isabel Baudish https://orcid.org/0000-0001-7441-3041

References

[1] Béné C 2022 Why the great food transformation may not happen—a deep-dive into our food systems' political economy, controversies and politics of evidence *World Dev.* **154** 105881
[2] Clapp J 2022 Concentration and crises: exploring the deep roots of vulnerability in the global industrial food system *J. Peasant Stud.* **50** 2437–56
[3] Ingram J and Thornton P 2022 What does transforming food systems actually mean? *Nat. Food* **3** 881–2
[4] Webb P, Benton T G, Beddington J, Flynn D, Kelly N M and Thomas S M 2020 The urgency of food system transformation is now irrefutable *Nat. Food* **1** 584–5
[5] Whitfield S *et al* 2021 A framework for examining justice in food system transformations research *Nat. Food* **2** 383–5
[6] Willett W *et al* 2019 Food in the Anthropocene: the EAT–Lancet Commission on healthy diets from sustainable food systems *Lancet* **393** 447–92
[7] Wood A, Queiroz C, Deutsch L, González-Mon B, Jonell M, Pereira L, Sinare H, Svedin U and Wassénius E 2023 Reframing the local–global food systems debate through a resilience lens *Nat. Food* **4** 22–29
[8] FAO; IFAD; UNICEF; WFP and WHO 2022 Repurposing food and agricultural policies to make healthy diets more affordable *The State of Food Security and Nutrition in the World* (FAO)
[9] IPES-Food Panel 2022 The politics of protein: examining claims about livestock, fish, 'alternative proteins' and sustainability (available at: www.ipes-food.org)

[17] The Global Methane Pledge is the existing international governance framework for methane emission reductions, and highly associated with TASF production [219].

[18] [73] proposes that the key 'subjects of justice' to consider are 'those with a particular role in the food system including producers and consumers, people who are marginalised, Indigenous communities, those with experiences of negative consequences of the food system, future generations, and nonhumans'.

[10] Béné C, Bakker D, Rodriguez M C, Even B, Melo J and Sonneveld A 2021 *Impacts of COVID-19 on people's food security: Foundations for a more resilient food system: Executive summary* CGIAR COVID-19 Hub (https://doi.org/10.2499/p15738coll2.134298)
[11] Adesogan A T, Havelaar A H, McKune S L, Eilittä M and Dahl G E 2020 Animal source foods: sustainability problem or malnutrition and sustainability solution? Perspective matters *Glob. Food Secur.* **25** 100325
[12] Blue Food Assessment 2021 *Building Blue Food Futures for People and the Planet. The Report of the Blue Food Assessment* (Blue Food Assessment) (https://doi.org/10.25740/rd224xj7484)
[13] Aiking H and de Boer J 2020 The next protein transition *Trends Food Sci. Technol.* **105** 515–22
[14] Garnett T 2015 *Gut feelings and possible tomorrows: (where) does animal farming fit?* (Food Climate Research Network Oxford Martin Programme on the Future of Food Environmental Change Institute University of Oxford)
[15] Howard P H, Ajena F, Yamaoka M and Clarke A 2021 "Protein" industry convergence and its implications for resilient and equitable food systems *Front. Sustain. Food Syst.* **5** 684181
[16] Katz-Rosene R, Heffernan A and Arora A 2023 Protein pluralism and food systems transition: a review of sustainable protein meta-narratives *World Dev.* **161** 106121
[17] Sexton A E, Garnett T and Lorimer J 2019 Framing the future of food: the contested promises of alternative proteins *Environ. Plan. E: Nat. Space* **2** 47–72
[18] FAO 2023 *Contribution of Terrestrial Animal Source Food to Healthy Diets for Improved Nutrition and Health Outcomes – An Evidence and Policy Overview on the State of Knowledge and Gaps* (FAO) (https://doi.org/10.4060/cc3912en)
[19] Hilborn R, Banobi J, Hall S J, Pucylowski T and Walsworth T E 2018 The environmental cost of animal source foods *Front. Ecol. Environ.* **16** 329–35
[20] Notarnicola B, Tassielli G, Renzulli P A, Castellani V and Sala S 2017 Environmental impacts of food consumption in Europe *J. Clean. Prod.* **140** 753–65
[21] Springmann M *et al* 2018 Options for keeping the food system within environmental limits *Nature* **562** 519–25
[22] Stehfest E, Bouwman L, Van Vuuren D P, Den Elzen M G J, Eickhout B and Kabat P 2009 Climate benefits of changing diet *Clim. Change* **95** 83–102
[23] Crippa M, Solazzo E, Guizzardi D, Monforti-Ferrario F, Tubiello F N and Leip A 2021 Food systems are responsible for a third of global anthropogenic GHG emissions *Nat. Food* **2** 198–209
[24] Moberg E, Säll S, Hansson P A and Röös E 2021 Taxing food consumption to reduce environmental impacts—identification of synergies and goal conflicts *Food Policy* **101** 102090
[25] Hedenus F, Wirsenius S and Johansson D J A 2014 The importance of reduced meat and dairy consumption for meeting stringent climate change targets *Clim. Change* **124** 79–91.
[26] Money A and Cottee J 2021 Bull Market? Corporate venturing and alternative proteins (Oxford Smith School of Enterprise and the Environment) Smith School Working Paper 21-03
[27] Poore J and Nemecek T 2018 Reducing food's environmental impacts through producers and consumers *Science* **360** 987–92
[28] Reid R S, Belelian C, Said M Y, Kruska R L, Mauricio R M and Castel V 2010 Global livestock impacts on biodiversity *Livestock in a Changing Landscape: Drivers, Consequences, and Responses* (Island Press) pp 111–37
[29] Ritchie H and Roser M 2021 Forests and deforestation (Our World in Data) (available at: https://ourworldindata.org/forests-and-deforestation) (Accessed 10 March 2023)
[30] Hoekstra A Y and Chapagain A K 2006 Water footprints of nations: water use by people as a function of their consumption pattern *Water Resour. Manage.* **21** 35–48
[31] Afshin A *et al* 2019 Health effects of dietary risks in 195 countries, 1990–2017: a systematic analysis for the Global Burden of Disease Study 2017 *Lancet* **393** 1958–72
[32] Godfray H C J *et al* 2018 Meat consumption, health, and the environment *Science* **361** eaam5324
[33] Ranganathan J *et al* 2016 *Shifting Diets for a Sustainable Food Future* (World Resources Institute) (https://doi.org/10.13140/RG.2.1.3808.2961)
[34] World Health Organization 2023 *Red and processed meat in the context of health and the environment: many shades of red and green information brief* (World Health Organization)
[35] Van Boeckel T P, Brower C, Gilbert M, Grenfell B T, Levin S A, Robinson T P, Teillant A and Laxminarayan R 2015 Global trends in antimicrobial use in food animals *Proc. Natl Acad. Sci.* **112** 5649–54
[36] Van Boeckel T P, Glennon E E, Chen D, Gilbert M, Robinson T P, Grenfell B T, Levin S A, Bonhoeffer S and Laxminarayan R 2017 Reducing antimicrobial use in food animals *Science* **357** 1350–2
[37] Bossard C, Santin G and Guseva Canu I 2016 Suicide among farmers in France: occupational factors and recent trends *J. Agromed.* **21** 310–5
[38] Herrero M, Thornton P K, Gerber P and Reid R S 2009 Livestock, livelihoods and the environment: understanding the trade-offs *Curr. Opin. Environ. Sustain.* **1** 111–20
[39] Thomas G and De Tavernier J 2017 Farmer-suicide in India: debating the role of biotechnology *Life Sci. Soc. Policy* **13** 8
[40] Van Der Ploeg J D *et al* 2019 The economic potential of agroecology: empirical evidence from Europe *J. Rural Stud.* **71** 46–61
[41] Wheeler R, Lobley M, McCann J and Phillimore A 2023 'It's a lonely old world': developing a multidimensional understanding of loneliness in farming *Sociol. Rural* **63** 11–36
[42] Percival R 2022 *The Meat Paradox: Eating, Empathy, and the Future of Meat* (Pegasus Books)
[43] Slade J and Alleyne E 2023 The psychological impact of slaughterhouse employment: a systematic literature review *Trauma Violence Abuse* **24** 429–40
[44] Herrero M, Grace D, Njuki J, Johnson N, Enahoro D, Silvestri S and Rufino M C 2013 The roles of livestock in developing countries *Animal* **7** 3–18
[45] Eriksson O 2022 Coproduction of food, cultural heritage and biodiversity by livestock grazing in Swedish semi-natural grasslands *Front. Sustain. Food Syst.* **6** 801327
[46] Rivera-Ferre M G *et al* A food system summit brief prepared by science partners of the scientific group for the food systems summit
[47] Salmon G 2016 *Livestock and Economy. Does the Livestock Sector Make up 40% of Total Agricultural GDP Globally?* (Supporting Evidence Based Interventions Project)
[48] Godfray H C J, Beddington J R, Crute I R, Haddad L, Lawrence D, Muir J F, Pretty J, Robinson S, Thomas S M and Toulmin C 2010 Food security: the challenge of feeding 9 billion people *Science* **327** 812–8
[49] HLPE 2017 *Nutrition and food systems. A report by the High Level Panel of Experts on Food Security and Nutrition of the Committee on World Food Security*
[50] Neumann C G, Demment M W, Maretzki A, Drorbaugh N and Galvin K A 2010 The livestock revolution and animal source food consumption: benefits, risks, and challenges in urban and rural settings of developing countries *Livestock in a Changing Landscape* (Island Press) pp 241–8
[51] Medek D E, Schwartz J and Myers S S 2017 Estimated effects of future atmospheric CO_2 concentrations on protein intake and the risk of protein deficiency by country and region *Environ. Health Perspect.* **125**
[52] Herzon I *et al* 2023 A rebalanced discussion of the roles of livestock in society *Nat. Food* 4 926–7
[53] Béné C and Lundy M 2023 Political economy of protein transition: battles of power, framings and narratives around a false wicked problem *Front. Sustain.* **4** 1098011

[54] Cusworth G, Lorimer J, Brice J and Garnett T 2022 Green rebranding: regenerative agriculture, future-pasts, and the naturalisation of livestock *Trans. Inst. Br. Geogr.* **47** 1009–27
[55] Garcia D, Galaz V and Daume S 2019 EATLancet vs yes2meat: the digital backlash to the planetary health diet *Lancet* **394** 2153–4
[56] Gregson R, Piazza J and Boyd R L 2022 'Against the cult of veganism': unpacking the social psychology and ideology of anti-vegans *Appetite* **178** 106143
[57] Guthman J, Butler M, Martin S J, Mather C and Biltekoff C 2022 In the name of protein *Nat. Food* **3** 391–3
[58] Duluins O and Baret P V 2024 A systematic review of the definitions, narratives and paths forwards for a protein transition in high-income countries *Nat. Food* **5** 28–36
[59] Chiles R M and Fitzgerald A J 2018 Why is meat so important in Western history and culture? A genealogical critique of biophysical and political-economic explanations *Agric. Hum. Values* **35** 1–17
[60] Mclaren D S 1974 The Great Protein Fiasco *Lancet* **304** 93–96
[61] Mittendorfer B, Klein S and Fontana L 2020 A word of caution against excessive protein intake *Nat. Rev. Endocrinol.* **16** 59–66
[62] Olsson P, Galaz V and Boonstra W J 2014 Sustainability transformations: a resilience perspective *Ecol. Soc.* **19**
[63] Pereira L M, Drimie S, Maciejewski K, Tonissen P B and Biggs R 2020 Food system transformation: integrating a political–economy and social–ecological approach to regime shifts *Int. J. Environ. Res. Public Health* **17** 1313
[64] Scoones I *et al* 2020 Transformations to sustainability: combining structural, systemic and enabling approaches *Curr. Opin. Environ. Sustain.* **42** 65–75
[65] Gupta J *et al* 2023 Earth system justice needed to identify and live within Earth system boundaries *Nat. Sustain.* **6** 630–8
[66] Bradley K and Herrera H 2015 Decolonizing food justice: naming, resisting, and researching colonizing forces in the movement *Antipode* **48** 97–114
[67] EAT. EAT Forum 2024 About EAT-Lancet 2.0. (available at: https://eatforum.org/eat-lancet-commission/eat-lancet-commission-2-0/about-eat-lancet-commission-2-0/) (Accessed 20 February 2024)
[68] Alkon A H and Agyeman J 2011 Conclusion: cultivating the Fertile Field of Food Justice *Cultivating Food Justice: Race, Class, and Sustainability* (*Food, Health, and the Environment*) ed A Ah and J Agyeman (The MIT Press) pp 331–48
[69] Gilson E C 2015 Vulnerability, relationality, and dependency: feminist conceptual resources for food justice *Int. J. Fem. Approaches Bioeth.* **8** 10–46
[70] Morales A 2011 Growing food and justice: dismantling racism through sustainable food systems *Cultivating Food Justice: Race, Class, and Sustainability* (*Food, Health, and the Environment*) ed A H Alkon and J Agyeman ed (The MIT Press) pp 149–76
[71] Hicks C C *et al* 2022 Rights and representation support justice across aquatic food systems *Nat. Food* **3** 851–61
[72] Kaufman A 2012 Theories of distributive justice *Encyclopedia of Applied Ethics* (Academic) pp 842–50
[73] De Bruin A, De Boer I J M, Faber N R, De Jong G, Termeer K J A M and De Olde E M 2023 Easier said than defined? Conceptualising justice in food system transitions. *Agric. Hum. Values* **41** 345–62
[74] Friedmann H and McMichael P 1989 Agriculture and the state system: the rise and decline of national agricultures, 1870 to the present *Sociol. Rural* **29** 93–117
[75] McMichael P 2009 A food regime genealogy *J. Peasant Stud.* **36** 139–69
[76] Weis T 2013 The meat of the global food crisis *J. Peasant Stud.* **40** 65–85
[77] Weis T 2016 The meatification of diets *The Routledge Handbook on Food and Nutrition Security* (Routledge)
[78] FAOSTAT 2023 Food Balance (New Methodology, 2010 and Onwards) Rome (available at: www.fao.org/faostat/en/#data) (Accessed 19 July 2023)
[79] The World Bank 2018 A changing world population (available at: https://datatopics.worldbank.org/world-development-indicators/stories/a-changing-world-population.html) (Accessed 14 November 2023)
[80] Kearney J 2010 Food consumption trends and drivers *Phil. Trans. R. Soc.* B **365** 2793–807
[81] Reardon T and Timmer C P 2014 Five inter-linked transformations in the Asian agrifood economy: food security implications *Glob. Food Secur.* **3** 108–17
[82] Gómez M I, Barrett C B, Raney T, Pinstrup-Andersen P, Meerman J, Croppenstedt A, Carisma B and Thompson B 2013 Post-green revolution food systems and the triple burden of malnutrition *Food Policy* **42** 129–38
[83] Bernstein H 2016 Agrarian political economy and modern world capitalism: the contributions of food regime analysis *J. Peasant Stud.* **43** 611–47
[84] Bonanno A, Busch L, Friedland W, Gouveia L and Mingione E (eds) 1994 *From Columbus to ConAgra: The Globalization of Agriculture and Food* and (University Press of Kansas)
[85] Vansteenkiste J 2022 Gender in the world food economy: inequitable transformation of Haiti's food economy *Front. Commun.* **7** 755994
[86] Lang T and Barling D 2012 Food security and food sustainability: reformulating the debate *Geogr. J.* **178** 313–26
[87] Clapp J 2017 The trade-ification of the food sustainability agenda *J. Peasant Stud.* **44** 335–53
[88] Reardon T and Hopkins R 2006 The supermarket revolution in developing countries: policies to address emerging tensions among supermarkets, suppliers and traditional retailers *Eur. J. Dev. Res.* **18** 522–45
[89] Clapp J 2012 *Food* (Polity Press)
[90] Clapp J 2014 Financialization, distance and global food politics *J. Peasant Stud.* **41** 797–814
[91] Clapp J and Isakson S R 2018 *Speculative Harvests: Financialization, Food, and Agriculture Practical Action Publishing* (Fernwood Publishing)
[92] Jakobsen J and Hansen A 2020 Geographies of meatification: an emerging Asian meat complex *Globalizations* **17** 93–109
[93] Pingali P 2007 Westernization of Asian diets and the transformation of food systems: implications for research and policy *Food Policy* **32** 281–98
[94] Jaffe J and Gertler M 2006 Victual vicissitudes: consumer deskilling and the (gendered) transformation of food systems *Agric. Hum. Values* **23** 143–62
[95] Khan A A and Bidabadi F S 2004 Livestock revolution in India: its impact and policy response *South Asia Res.* **24** 99–122
[96] Lundström M 2019 The political economy of meat *J. Agric. Environ. Ethics* **32** 95–104
[97] Millar J and Photakoun V 2008 Livestock development and poverty alleviation: revolution or evolution for upland livelihoods in Lao PDR? *Int. J. Agric. Sustain.* **6** 89–102
[98] FAO GLEAM v3.0 dashboard 2022 (available at: https://foodandagricultureorganization.shinyapps.io/GLEAMV3_Public/) (Accessed 10 September 2023)
[99] De Schutter O 2019 The political economy approach to food systems reform *IDS Bull.* **50** 13–26
[100] IPES-Food 2017 Too big to feed: exploring the impacts of mega-mergers, consolidation and concentration of power in the agri-food sector
[101] FAIRR 2022 Coller FAIRR Protein Producer Index (available at: www.fairr.org/index/) (Accessed 14 February 2023)
[102] Howard P H 2019 Corporate concentration in global meat processing: the role of feed and finance subsidies *Global Meat: Social and Environmental Consequences of the*

Expanding Meat Industry ed B Winders and E Ransom (The MIT Press)
[103] Hendrickson M K, Howard P H and Constance D H 2017 Power, food and agriculture: implications for farmers, consumers and communities *SSRN* (https://doi.org/10.2139/ssrn.3066005)
[104] Clapp J, Noyes I and Grant Z 2021 The food systems summit's failure to address corporate power *Dev. Basingstoke* **64** 192–8
[105] Deese B, Fazili S and Ramamurt B (The White House) 2021 Recent data show dominant meat processing companies are taking advantage of market power to raise prices and grow profit margins (available at: www.whitehouse.gov/briefing-room/blog/2021/12/10/recent-data-show-dominant-meat-processing-companies-are-taking-advantage-of-market-power-to-raise-prices-and-grow-profit-margins/) (Accessed 10 November 2023)
[106] De Schutter O 2017 The political economy of food systems reform *Eur. Rev. Agric. Econ.* **44** 705–31
[107] Morach B *et al* (BCG) 2021 Food for thought: the protein transformation (available at: www.bcg.com/publications/2021/the-benefits-of-plant-based-meats) (Accessed 3 February 2023)
[108] Morris V and Jacquet J 2024 The animal agriculture industry, US universities, and the obstruction of climate understanding and policy *Clim. Change* **177** 41
[109] Swinburn B A, Kraak V I, Allender S, Atkins V J, Baker P I, Bogard J R and Dietz W H 2019 The global syndemic of obesity, undernutrition, and climate change: the Lancet commission report *Lancet* **393** 791–846
[110] Geels F W 2014 Regime resistance against low-carbon transitions: introducing politics and power into the multi-level perspective *Theory Cult. Soc.* **31** 21–40
[111] Friedmann H 1993 The political economy of food: a global crisis *FEMS Microbiol. Lett.* **110** 77–83
[112] ProVeg e.V. 2019 *Plant Milk Report* (ProVeg e.V.)
[113] Clay N, Sexton A E, Garnett T and Lorimer J 2020 Palatable disruption: the politics of plant milk *Agric. Hum. Values* **37** 945–62
[114] Starmer E, Witteman A and Wise T A 2006 Feeding the factory farm: implicit subsidies to the Broiler Chicken Industry (Tufts University) Global Development and Environment Institute Working Paper No. 06-03
[115] Pigatto G and Santini Pigatto G A 2016 The strategy for internationalization of Brazilian meat industries and the role of the Development Bank. *Inf. GEPEC* **19** 126–46
[116] Sumaila U R, Ebrahim N, Schuhbauer A, Skerritt D, Li Y, Kim H S, Mallory T G, Lam V W L and Pauly D 2019 Updated estimates and analysis of global fisheries subsidies *Mar Policy* **109** 103695
[117] Sumaila U R *et al* 2021 WTO must ban harmful fisheries subsidies *Science* **374** 544
[118] Turnhout E, Metze T, Wyborn C, Klenk N and Louder E 2020 The politics of co-production: participation, power, and transformation *Curr. Opin. Environ. Sustain.* **42** 15–21
[119] Dauriach A 2022 Financial institutions, companies, and the biosphere *Licentiate Thesis* Stockholm University (available at: https://urn.kb.se/resolve?urn=urn:nbn:se:su:diva-211304)
[120] Galaz V, Crona B, Dauriach A, Jouffray J B, Österblom H and Fichtner J 2018 Tax havens and global environmental degradation *Nat. Ecol. Evol.* **2** 1352–7
[121] Neslen A 2023 'The anti-livestock people are a pest': how UN food body played down role of farming in climate change *The Guardian* (available at: www.theguardian.com/environment/2023/oct/20/the-anti-livestock-people-are-a-pest-how-un-fao-played-down-role-of-farming-in-climate-change) (Accessed 10 November 2023)
[122] Abnett K R 2020 EU lawmakers vote for 'veggie burgers,' take hard line on dairy labels (available at: www.reuters.com/article/eu-food-vegetarian-idUSL4N2HE27I) (Accessed 30 January 2023)
[123] Clapp J and Fuchs D 2009 *Corporate Power in Global Agrifood Governance* (MIT Press)
[124] Lazarus O, McDermid S and Jacquet J 2021 The climate responsibilities of industrial meat and dairy producers *Clim. Change* **165** 1–21
[125] Mialon M, Swinburn B and Sacks G 2015 A proposed approach to systematically identify and monitor the corporate political activity of the food industry with respect to public health using publicly available information: food industry political activity *Obesity Rev.* **16** 519–30
[126] Thielman S (The Guardian) 2015 US-appointed egg lobby paid food blogs and targeted chef to crush vegan startup (available at: www.theguardian.com/business/2015/sep/06/usda-american-egg-board-paid-bloggers-hampton-creek) (Accessed 30 January 2023)
[127] OECD 2013 Transparency and integrity in lobbying (available at: www.oecd.org/corruption/ethics/Lobbying-Brochure.pdf)
[128] Parry J 2010 Gender and slaughter in popular gastronomy *Fem. Psychol.* **20** 381–96
[129] Rogers R A 2008 Beasts, burgers, and hummers: meat and the crisis of masculinity in contemporary television advertisements *Environ. Commun.* **2** 281–301
[130] Oliver C 2023 Mock meat, masculinity, and redemption narratives: vegan men's negotiations and performances of gender and eating *Soc. Mov. Stud.* **22** 62–79
[131] Hart D 2018 Faux-meat and masculinity: the gendering of food on three vegan blogs *Can. Food Stud.* **5** 133–55
[132] Dreze J 2017 School meals *Sense and Solidarity* (Oxford University Press)
[133] Guerrero Lara L, Van Oers L, Smessaert J, Spanier J, Raj G and Feola G 2023 Degrowth and agri-food systems: a research agenda for the critical social sciences *Sustain. Sci.* **18** 1579–94
[134] Spanier J, Guerrero Lara L and Feola G 2023 A one-sided love affair? On the potential for a coalition between degrowth and community-supported agriculture in Germany *Agric. Hum. Values* **41** 25–45
[135] Holling C S and Gunderson L H 2002 Resilience and adaptive cycles *Panarchy: Understanding Transformations in Human and Natural Systems* (Island Press) pp 25–62
[136] Guthman J and Biltekoff C 2020 Magical disruption? Alternative protein and the promise of de-materialization *Environ. Plan. E: Nat. Space* **4** 1031–54
[137] Bhat Z F, Kumar S and Fayaz H 2015 In vitro meat production: challenges and benefits over conventional meat production *J. Integr. Agric.* **14** 241–8
[138] Hocquette A, Lambert C, Sinquin C, Peterolff L, Wagner Z, Bonny S P F, Lebert A and Hocquette J-F 2015 Educated consumers don't believe artificial meat is the solution to the problems with the meat industry *J. Integr. Agric.* **14** 273–84
[139] Siddiqui S A, Bahmid N A, Karim I, Mehany T, Gvozdenko A A, Blinov A V, Nagdalian A A, Arsyad M and Lorenzo J M 2022 Cultured meat: processing, packaging, shelf life, and consumer acceptance *LWT* **172** 114192
[140] Verbeke W, Sans P and Van Loo E J 2015 Challenges and prospects for consumer acceptance of cultured meat *J. Integr. Agric.* **14** 285–94
[141] Good Food Institute India 2022 Creating a climate-resilient, robust smart protein supply chain (available at: https://gfi-india.org/our-work/) (Accessed 14 November 2023)
[142] Deshpande V (Good Food Institute) 2018 Why India is a priority for plant-based and clean meat innovation (available at: https://gfi.org/blog/indian-markets-food-innovation/) (Accessed 14 November 2023)
[143] Sexton A E, Garnett T and Lorimer J 2022 Vegan food geographies and the rise of Big Veganism *Prog. Human Geogr.* **46** 605–28

[144] FAIRR 2020 An industry infected animal agriculture in a post-COVID world (available at: www.fairr.org/article/industry-infected/) (Accessed 14 February 2023)
[145] McKeon N 2021 Global food governance *Development* **64** 48–55
[146] Clapp J 2019 The rise of financial investment and common ownership in global agrifood firms *Rev. Int. Polit. Econ.* **26** 604–29
[147] Temple J (MIT Technology Review) 2021 Bill Gates: rich nations should shift entirely to synthetic beef (available at: www.technologyreview.com/2021/02/14/1018296/bill-gates-climate-change-beef-trees-microsoft/) (Accessed 9 February 2023)
[148] Mares T M and Peña D G 2011 Environmental and Food Justice: Toward Local, Slow, and Deep Food Systems *Cultivating Food Justice: Race, Class, and Sustainability* (*Food, Health, and the Environment*) ed A H Alkon and J Agyeman (The MIT Press) pp 197–220
[149] Ledin P and Machin D 2020 Replacing actual political activism with ethical shopping: the case of Oatly *Discourse Context Media* **34** 100344
[150] Trewern J, Chenoweth J, Christie I and Halevy S 2022 Does promoting plant-based products in Veganuary lead to increased sales, and a reduction in meat sales? A natural experiment in a supermarket setting *Public Health Nutr.* **25** 3204–14
[151] Alkon A H and Agyeman J (eds) 2011 *Cultivating Food Justice: Race, Class, and Sustainability* (*Food, Health, and The Environment*) (The MIT Press) p 389
[152] Slocum R 2007 Whiteness, space and alternative food practice *Geoforum* **38** 520–33
[153] Guthman J 2011 'If they only knew': the unbearable whiteness of alternative food *Cultivating Food Justice: Race, Class and Sustainability* ed A H Alkon and J Agyeman (*Food, Health, and the Environment*) (MIT Press)
[154] Crawford R 1994 The boundaries of the self and the unhealthy other: reflections on health, culture and AIDS *Soc. Sci. Med.* **38** 1347–65
[155] Friedman M and Meerai S 2022 'Our bodies are more than our bodies': expanding social work understandings of race and fat *Intersectionalities* **10** 69–83
[156] Farrell A E 2011 *Fat Shame: Stigma and the Fat Body in American Culture* (New York University Press)
[157] Greenebaum J and Dexter B 2018 Vegan men and hybrid masculinity *J. Gend. Stud.* **27** 637–48
[158] Rose Spratt T J 2023 Understanding 'fat shaming' in a neoliberal era: performativity, healthism and the UK's 'obesity epidemic' *Fem Theory* **24** 86–101
[159] Pereira L M 2017 Cassava bread in Nigeria: the potential of 'orphan crop' innovation for building more resilient food systems *Int J. Technol. Glob.* **8** 97
[160] Gamboa C, Bojacá C R, Schrevens E and Maertens M 2020 Sustainability of smallholder quinoa production in the Peruvian Andes *J. Clean Prod.* **264** 121657
[161] Magrach A and Sanz M J 2020 Environmental and social consequences of the increase in the demand for 'superfoods' world-wide *People Nat.* **2** 267–78
[162] Evans J and Karvonen A 2014 'Give me a laboratory and i will lower your carbon footprint!'—urban laboratories and the governance of low-carbon futures *Int. J. Urban Reg. Stud.* **38** 413–30
[163] Milbank C *et al* (The Global-Hub on Indigenous Peoples' Food Systems) 2021 Rethinking hierarchies of evidence for sustainable food systems. *Nat. Food* **2** 843–5.
[164] Van Der Weele C, Feindt P, Jan Van Der Goot A, Van Mierlo B and Van Boekel M 2019 Meat alternatives: an integrative comparison *Trends Food Sci. Technol.* **88** 505–12
[165] Tuomisto H L and Teixeira De Mattos M J 2011 Environmental impacts of cultured meat production *Environ. Sci. Technol.* **45** 6117–23
[166] Bunge A C, Wood A, Halloran A and Gordon L J 2022 A systematic scoping review of the sustainability of vertical farming, plant-based alternatives, food delivery services and blockchain in food systems *Nat. Food* **3** 933–41
[167] Moore M L, Riddell D and Vocisano D 2015 Scaling out, scaling up, scaling deep: strategies of non-profits in advancing systemic social innovation *J. Corp. Citizenship* **2015** 67–84
[168] Pel B, Haxeltine A, Avelino F, Dumitru A, Kemp R, Bauler T, Kunze I, Dorland J, Wittmayer J and Jørgensen M S 2020 Towards a theory of transformative social innovation: a relational framework and 12 propositions. *Res. Policy* **49** 104080
[169] Westley F and Antadze N 2010 Strategies for scaling social innovation for greater impact *Innov. J. Public Sect. Innov. J.* **15**
[170] Broad G M 2020 Making meat, better: the metaphors of plant-based and cell-based meat innovation *Environ. Commun.* **14** 919–32
[171] Korir D, Eckard R, Goopy J, Arndt C, Merbold L and Marquardt S 2022 Effects of replacing Brachiaria hay with either Desmodium intortum or dairy concentrate on animal performance and enteric methane emissions of low-yielding dairy cows *Front. Anim. Sci.* **3** 963323
[172] Ndung'u P W, Takahashi T, Du Toit C J L, Robertson-Dean M, Butterbach-Bahl K, McAuliffe G A, Merbold L and Goopy J P 2022 Farm-level emission intensities of smallholder cattle (Bos indicus; B. indicus–B. taurus crosses) production systems in highlands and semi-arid regions *Animal* **16** 100445
[173] Gerber P J, Steinfield H, Henderson B, Mottet A, Opio C, Dijkman J, Falcucci A and Tempio G 2013 *Tackling Climate Change through Livestock: A Global Assessment of Emissions and Mitigation Opportunities* (Food and Agriculture Organization of the United Nations)
[174] Mottet A, Teillard F, Boettcher P, De' Besi G and Besbes B 2018 Review: domestic herbivores and food security: current contribution, trends and challenges for a sustainable development *Animal* **12** s188–98
[175] Rudel T K *et al* Agricultural intensification and changes in cultivated areas, 1970–2005 2009 *Proc. Natl Acad. Sci.* **106** 20675–80
[176] Navdanya International 2022 The age of fake food: a conversation with Satish Kumar and Vandana Shiva (available at: https://navdanyainternational.org/the-age-of-fake-food-a-conversation-with-satish-kumar-and-vandana-shiva/) (Accessed 14 November 2023)
[177] Slow Food 2023 Good, clean and fair: the slow food manifesto for quality (available at: www.slowfood.com/wp-content/uploads/2023/11/Slow_Food_Manifesto_Quality_ENG.pdf) (Accessed 14 November 2023)
[178] Wezel A, Bellon S, Doré T, Francis C, Vallod D and David C 2009 Agroecology as a science, a movement and a practice. A review *Agron. Sustain. Dev.* **29** 503–15
[179] Surová D, Ravera F, Guiomar N, Sastre R M and Pinto-Correia T 2018 Contributions of Iberian Silvo-pastoral landscapes to the well-being of contemporary society *Rangel. Ecol. Manage.* **71** 560–70
[180] Zinsstag J *et al* 2016 A vision for the future of pastoralism *Rev. Sci. Tech.* **35** 693–716
[181] Notenbaert A M, Davies J, De Leeuw J, Said M, Herrero M, Manzano P, Waithaka M, Aboud A and Omondi S 2012 Policies in support of pastoralism and biodiversity in the heterogeneous drylands of East Africa *Pastor. Res. Policy Pract.* **2** 14
[182] Fernandez-Gimenez M E, Oteros-Rozas E and Ravera F 2021 Spanish women pastoralists' pathways into livestock management: motivations, challenges and learning *J. Rural Stud.* **87** 1–11
[183] Thompson M S, Cochrane A and Hopma J 2020 Democratising food: the case for a deliberative approach *Rev. Int. Stud.* **46** 435–55

[184] Young I M 2002 *Inclusion and Democracy* (Oxford University Press) (https://doi.org/10.1093/0198297556.001.0001)
[185] Walker G 2012 *Environmental Justice: Concepts, Evidence and Politics* (Routledge)
[186] Davis B, Lipper L and Winters P 2022 Do not transform food systems on the backs of the rural poor *Food Secur.* **14** 729–40
[187] Reddel T and Woolcock G 2004 From consultation to participatory governance? A critical review of citizen engagement strategies in Queensland *Aust. J. Public Adm.* **63** 75–87
[188] Turnhout E, Duncan J, Candel J, Maas T Y, Roodhof A M, DeClerck F and Watson R T 2021 Do we need a new science-policy interface for food systems? *Science* **373** 1093–5
[189] Tengö M, Brondizio E S, Elmqvist T, Malmer P and Spierenburg M 2014 Connecting diverse knowledge systems for enhanced ecosystem governance: the multiple evidence base approach *AMBIO* **43** 579–91
[190] Candel J J L and Pereira L 2017 Towards integrated food policy: main challenges and steps ahead *Environ. Sci. Policy* **73** 89–92
[191] Svarstad H and Benjaminsen T A 2020 Reading radical environmental justice through a political ecology lens *Geoforum* **108** 1–11
[192] Trevilla Espinal D L, Soto Pinto M L, Morales H and Estrada-Lugo E I J 2021 Feminist agroecology: analyzing power relationships in food systems *Agroecol. Sustain. Food Syst.* **45** 1029–49
[193] FAOSTAT 2023 *Food Balance (New Methodology, 2010 and Onwards)*
[194] Sans P and Combris P 2015 World meat consumption patterns: an overview of the last fifty years (1961–2011) *Meat Sci.* **109** 106–11
[195] FAOSTAT 2023 Food Balance (Old Methodology, up to 2013)
[196] Li C, Wu X, Chen K and Chen G 2022 Global pastureland use as reflected in inter-regional supply chain *J. Environ. Manage* **322** 116016
[197] Alkon A H and Agyeman J 2011 Introduction: the food movement as polyculture *Cultivating Food Justice: Race, Class, and Sustainability* (*Food, Health, and the Environment*) ed A H Alkon and J Agyeman (The MIT Press) pp 1–20
[198] Willits-Smith A, Odinga H, O'Malley K and Rose D 2023 Demographic and socioeconomic correlates of disproportionate beef consumption among US adults in an age of global warming *Nutrients* **15** 3795
[199] Ritzel C and Mann S 2021 The old man and the meat: on gender differences in meat consumption across stages of human life *Foods* **10** 2809
[200] Andreae G, Scott S, Nguyen G, Bell Z, Mehmood H, Sermin-Reed L and Heslehurst N 2022 Food insecurity among pregnant women living in high-income countries: a systematic review *Lancet* **400**
[201] Asian Development Bank 2013 *Gender Equality and Food Security* (Asian Development Bank)
[202] Thornton P K, Kruska R L, Henninger N, Kristjanson P M, Reid R S and Robinson T P 2003 Locating poor livestock keepers at the global level for research and development targeting *Land Use Policy* **20** 311–22
[203] Kristjanson P, Waters-Bayer A, Johnson N, Tipilda A, Njuki J, Baltenweck I and MacMillan S 2014 Livestock and Women's Livelihoods *Gender in Agriculture—Closing the Knowledge Gap* (The Food and Agriculture Organization of the United Nations)
[204] Valdivia C *Gender, Livestock Assets, Resource Management, and Food Security: Lessons from the SR-CRSP* (Resource Management)
[205] McPeak J G and Doss C R 2006 Are household production decisions cooperative? Evidence on pastoral migration and milk sales from Northern Kenya *Am. J. Agric. Econ.* **88** 525–41
[206] Gottlieb R and Joshi A 2013 *Food Justice* (MIT Press)
[207] Richardson K *et al* 2023 Earth beyond six of nine planetary boundaries *Sci. Adv.* **9** eadh2458
[208] Clark M A, Domingo N G G, Colgan K, Thakrar S K, Tilman D, Lynch J, Azevedo I L and Hill J D 2020 Global food system emissions could preclude achieving the 1.5° and 2 °C climate change targets *Science* **6** 705–8
[209] Van Zanten H H E, Herrero M, Van Hal O, Röös E, Muller A, Garnett T, Gerber P J, Schader C and De Boer I J M 2018 Defining a land boundary for sustainable livestock consumption *Glob. Change Biol.* **24** 4185–94
[210] Buckwell A and Nadeu E 2018 *What is the Safe Operating Space for EU Livestock?* (RISE Foundation)
[211] Cué Rio M, Bovenkerk B, Castella J C, Fischer D, Fuchs R, Kanerva M, Rounsevell MD, Salliou N, Verger EO and Röös E 2022 The elephant in the room is really a cow: using consumption corridors to define sustainable meat consumption in the European Union *Sustain. Sci.* 1–19
[212] Kanerva M 2022 Consumption corridors and the case of meat *J. Consum. Policy* **45** 619–53
[213] Lucas P L, Wilting H C, Hof A F and Van Vuuren D P 2020 Allocating planetary boundaries to large economies: distributional consequences of alternative perspectives on distributive fairness *Glob. Environ. Change* **60** 102017
[214] United Nations 1992 *United Nations Framework Convention on Climate Change*
[215] FAO and WHO 2019 *Sustainable Healthy Diets—Guiding Principles* (Food and Agriculture Organization of the United Nations: World Health Organization)
[216] Röös E, Larsson J, Sahlin K R, Jonell M, Lindahl T, André E and Persson M 2021 *Policy Options for Sustainable Food Consumption – Review and Recommendations for Sweden* (Mistra Sustainable Consumption report 1:10. Chalmers University of Technology)
[217] Thornton P K 2010 Livestock production: recent trends, future prospects *Phil. Trans. R. Soc.* B **365** 2853–67
[218] OECD 2021 *Making Better Policies for Food Systems* (https://doi.org/10.1787/ddfba4de-en)
[219] The Global Methane Pledge The Global Methane Pledge. Fast action on methane to keep a 1.5 °C future within reach (available at: www.globalmethanepledge.org/) (Accessed 14 November 2023)
[220] Puupponen A, Huttunen S, Kortetmäki T, Lähteenmäki-Uutela A and Kaljonen M 2023 Justice in Finnish Food Policies *Food Ethics* **8** 6