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Meat matters - making the case for a valuable food in a hostile environment

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ABSTRACT

Contemporary views on meat reflect an ambiguous status of appreciation and rejection, especially in the urbanised West, and tend to come with strong moral overtones. The portrayal of (red) meat as an intrinsically harmful food choice by certain academics, non-governmental organisations, mass media, and public-private partnerships contributes to this tension. Although most of these voices are merely calling for a moderation of the consumption of meat in areas with high intake, others are radical and demand a drastic reduction or even elimination, as will be documented in this article. Some scientists are beginning to articulate their concern about an ongoing trend towards unbalanced communications and anti-meat militancy in both academic and policy circles. The perceived threat is not only that the vilification of meat may add to the ongoing moralisation of dietary choices and societal polarisation, but also that it may further undermine an already precarious situation of public health and a fragile food system, especially (but not only) in the Global South. Minimising livestock may also come with unintended harmful effects on ecosystems and livelihoods. The 'Dublin Declaration of Scientists on the Societal Role of Livestock', issued in October 2022, exemplifies such concern. Together with the body of evidence to which it refers, the Dublin Declaration is to be read as a petition for pragmatism, demanding sufficiently high standards of evidence, and more respect for the principle of caution when it comes to policies that have the intention to severely challenge the role of meat and other animal source foods in future diets.

HIGHLIGHTS

- There is an ongoing trend towards unbalanced communications and anti-meat militancy in media and academic and policy circles
- Minimising livestock beyond a critical threshold may come with unintended harmful effects on nutrient security, ecosystems, and livelihoods
- The 'Dublin Declaration of Scientists on the Societal Role of Livestock' serves as petition for pragmatism, caution, and evidence-based policies

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Introduction

Meat takes up a special place in human diets, not only biologically but also socially (Leroy and Praet 2015). Moreover, it has been argued that meat is a *pharmakon* (Leroy 2019, 2021): it can equally be seen as a cure and a poison, depending on perspective and context, and at times acts as a *pharmakos* or scapegoat, as often is the case with livestock more broadly.

Most traditional and historical populations have prized meat as a nourishing and culturally important

food, conveying rich notions of vitality, generosity, and status. Nonetheless, certain individuals or groups have willingly abstained from meat eating throughout history. As an act of negation, and by inverting meat's symbolic capital, this was in many cases a spiritual or moral statement (Leroy and Hite 2020; Leroy 2021). The latter expresses self-restraint and purity, sometimes also reinforced by feelings of compassion and anxieties over life and death, so that meat eating ends up being portrayed as 'corpse consumption' and as a

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morally deficient, unnecessary perversion (Plumwood 2000). Despite such a Nietzschean *transvaluation of values*, which has become more conspicuous with the rise of proselytic vegetarianism and animal rights activism in the urbanised West (Leroy and Hite 2020), meat continues to be highly valued by most. That being said, securing current consumption levels in a context of a growing global population with increased purchase power, demanding more meat, also comes with challenges on the production side, particularly with respect to environmental impact and animal welfare. For this reason, strategies for a reduction of meat intake are high on the agenda of food systems discussions (Willett et al. 2019).

Few will disagree that it is reasonable to request a substantial degree of transformation of livestock agriculture towards more sustainable performance, even if debate exists on how to achieve this and to which degree this may affect production or consumption levels (Eisler et al. 2014; Leroy et al. 2022a; Leroy et al. 2022b; Beal et al. 2023; Manzano, Pardo et al. 2023). Similarly, it is advisable to evaluate the position of meat in healthy diets based on evolving scientific insights (Lescinsky et al. 2022; Stanton et al. 2022), weighing potential advantages and disadvantages of changes in consumption levels when it comes to the health of specific individuals and populations (Leroy et al. 2022a; Beal et al. 2023). The health consequences of both the consumption and avoidance of meat seem to be contextual, an aspect that requires more dedicated research. The problem, however, is that reductionist and radicalised approaches driven by: (1) insufficient knowledge of the broader context and practical realities of both agriculture and human physiology, (2) various forms of ideology within academia, non-governmental organisations, and policy environments, and (3) the influence of vested interests related to the 'alt meats' market (e.g. lab meat and plant-based imitations), tend to be highly mediatised and take up a larger space in public discourse than petitions for nuanced approaches and more pragmatic and careful interventions (Leroy et al. 2020).

This article will attempt to answer two main questions that are pertinent to any debate on the future of meat, but have nonetheless only been poorly addressed in scientific literature: (1) how widespread and influential is anti-meat radicalism, and (2) how should the advantages and usefulness of meat (and other animal source foods) be defended in an increasingly polarised, and sometimes even hostile, environment, so that more balanced strategies for food systems transformation can be identified?

Anti-meat radicalism in science and policy environments

Apart from fragmented knowledge and ideologically coloured voices in the public debate on meat consumption, science too can suffer from the same flaws—intentionally or otherwise. On the one hand, sensational scientific findings tend to generate more attention and most easily achieve widespread academic outreach effects. Both university research communication cells and the popular press have a predisposition to picking up sensational, controversial, and therefore newsworthy findings. On the other hand, several industry and societal stakeholders fuel academic research by financial support, thus amplifying the tendency towards presenting a one-sided story. In this section, we shed light on some factors that drive anti-meat radicalism. It is of course equally true that unbalanced and influential pro-meat narratives also exist. However, these are beyond the scope of the current paper and require their own dedicated analysis (cf. Sievert et al. 2021).

Emerging radicalism within the scientific community

Presenting the concept of livestock abolition as a topic that is important enough to warrant a scientific discussion on its potential damaging outcomes, as done by Leroy et al. (2022a), risks being seen by some as a strawman argument within the broader debate on meat reduction. Indeed, pleas for generalised vegetarianism or veganism appear to be only endorsed by a minority of scientists, who are arguing that this should be the general norm for reasons of health (Barnard and Leroy 2020), sustainability (Henning 2011), and/or ethics (Deckers 2013). Such scientific radicalism, however, is usually not a mere intellectual exercise but also serves as a call to action, aiming to affect society at large (Leroy and Hite 2020). Given the scale of their ambition, such proposals often suggest the employment of extreme strategies.

Because the '*enhancement in taste of vegetarian food is not sufficiently motivating*' to cause a transition away from meat (Pohlmann 2021), some scientists have suggested the use of compassion-inducing visual stimuli on product packaging or restaurant décor (Pohlmann 2021), meat-shaming techniques (Kranzbühler and Schifferstein 2023), and disgust-based interventions (Becker and Lawrence 2021), such as the deliberate tainting of meat with blue colourant (Spence 2021), and strategies similar to those used on cigarette packages (Southey 2021). Other suggestions include

the creation of allergic reactions to beef by using ‘meat patches’ that are akin to nicotine patches (Liao 2017), the setting up of public communication campaigns to attack the ‘established association’ between meat consumption and desirable masculine traits (Warlop 2021), or even a generalised legal ban on meat (Deckers 2013; Richardson 2020).

Even though such views are only held by a minority in the academic community, they are sensationalist and tend to receive disproportionate attention. In particular in today’s ‘attention economy’ that is characterised by click-bait dynamics (Leroy et al. 2018) this may lead to a distorted appreciation of such views by the media and the public.

Amplification by scientific institutions

Without authoritative endorsement that adds credibility and exposure to their claims, it would be unlikely that individual scientists could be influential enough to create a persistent and mainstreamed anti-meat narrative. Accumulation of such endorsement is, indeed, what seems to have happened over the last 5–10 years. The University of Oxford, for instance, has published the following two messages on social media (Twitter), thereby referring to input from two of its junior researchers: ‘*What if we all turned vegan by 2050? It’s the way to beat climate change argues Dr Marco Springmann*’ (University of Oxford 2017) and ‘*A vegan diet is probably the single biggest way to reduce your impact on planet Earth, not just greenhouse gases, but global acidification, eutrophication, land use and water use [J.Poore, School of Geography & Environment]*’ (University of Oxford 2019). Building on such arguments, and further contributing to the development of negative attitudes towards meat eating within research institutions, the banning of beef from canteen menus has been considered and sometimes implemented by several universities over the last years (Moyler 2019; Sellgren 2019; Young 2020).

The reason for this evolution towards institutionalised academic hyperbole is unclear, but at least three contributing factors can be identified. Firstly, scientists who are strongly committed to an ideological viewpoint catalyse the accumulation of ‘myside bias’, as well as widespread ‘white-hat bias’ (i.e. the distortion of information in the service of what may be perceived to be righteous ends; Cope and Allison 2010). When such biases start taking hold of academic communities, a culture that favours strong and simple messages over the communication of scientific intricacies may emerge.

Secondly, scientists are no longer only evaluated in terms of their scholarly impact (e.g. based on bibliometrics) but often also in terms of their societal impact (Ozanne et al. 2017). One of the parameters to operationalise the latter is societal outreach, or presence with one’s research findings in the popular press (Bornmann 2013). To appeal to broader audiences, and to improve probabilities of having one’s academic findings being picked up by popular media, keeping it ‘bite-sized’ may be seductive, and is often even being encouraged by funding bodies. As stated in Bornmann (2013, p. 2017): ‘*Society can reap the benefits of successful research studies only if [emphasis added] the results are converted into marketable and consumable products*’. As an example, the above-mentioned statement by Dr. Poore from Oxford University that veganism is the ‘single biggest way’ to reduce our environmental impact has rapidly found its way to mass media (Carrington 2018; Pellman Rowland 2018; Petter 2020).

Thirdly, governmental funders are known to affect and steer the content of public-good research within academia (McCrabb et al. 2021). For instance, when governmental health departments are heavily invested in a specific intervention and policy advice, data may be manipulated to fit with political concerns (Watson 2021). Academia may then, in turn, also further radicalise governmental opinion by feeding them with extreme scenarios. The 2019 UK FIRES report, for instance, written by a team from six British universities and funded to assist the UK government in meeting its ‘net-zero’ target by 2050, called for a 50-% reduction of beef and lamb consumption by 2030 and for their full phasing out by 2050 (Allwood et al. 2019). What may make matters even more concerning is that universities and governments are frequently operating within public-private partnerships together with large corporations, investors, and activist philanthropic-capitalists.

Amplification by investors

Bill Gates, a major funder of scientific institutions, is a key investor in alt meat technologies. He has expressed the view that rich countries should transition to the consumption of synthetic beef, either by nudging based on green premium or by using regulation (Temple 2021). Richard Branson, another billionaire and financier of vegan-tech start-ups, has speculated that meat will no longer come from animals by 2050 but will be plant-based or lab-cultured instead (Miley 2017). Both Branson and Gates,

together with KBW Ventures and others, have contributed to (one of) the largest funding moment(s) (\$161 million) in the history of the lab meat industry (Bridge 2020). The founder of KBW Ventures, a vegan Saudi prince and investor, is said to have referred to animal source foods as the 'root of environmental evil' (Halligan 2018). As another example, a think tank that was co-founded by investor James Arbib (the son of fund management tycoon Martyn Arbib) has come up with a prediction that the dairy and cattle industries will collapse by 2030 and will be replaced by precision fermentation (RethinkX 2019).

Farm Animal Investment Risk and Return (FAIRR) has described itself as the '*world's fastest growing investor network focusing on ESG risks in the global food sector*', of which the membership comprises institutional investors managing trillions of dollars in combined assets (FAIRR 2023). It was founded in 2015 by a long-time vegan who wishes to end 'factory farming' (Pointing 2018), with the goal of putting pressure on food companies to serve more alt meats (Robinson 2017). Its 2021 '*Rethinking Protein: Accelerating law and policy in the global food system*' conference to '*concentrate on legal mechanisms to transition the food system*' is illustrative of this effort and involved financial actors, academics, activists, and non-governmental organisations (e.g. the EAT Foundation, see below) (FAIRR 2021).

The scale of the impact of this consortium of wealthy and influential investors is not to be underestimated, especially when combined with a Silicon Valley community of venture capitalists, disruptive start-ups, and social media industries. The widespread popularity of effective altruism, longtermism, and transhumanism within this community seems to further reinforce its inclination to embrace animal rights radicalism (Luneau 2020).

Amplification by mass media

Whether or not all of the above-mentioned amplifiers have a meaningful influence on academic integrity, they certainly contribute to the way radical views on the future of meat unfold in public discourse. Over the last years, alt meats have managed to receive considerable exposure in mass media because of what appears to be a combination of ideological activism, insisting on the harms of livestock farming, and substantial financial backing.

The Guardian, for instance, has received important grants from Open Philanthropy, a main Silicon Valley-linked funder of the vegan-tech industry and leading

animal rights organisations, to publish a series named 'Animals farmed' (Open Philanthropy 2020). Open Philanthropy also sponsored Sentient Media, an activist '*journalism organization dedicated to changing the conversation around animal agriculture*' (Sentient Media 2023). Both typically represent mainstream animal agriculture as extremely harmful and unethical while building on selected scientific arguments. Still in the Guardian, the journalist George Monbiot wrote an article entitled '*Lab-grown food will soon destroy farming—and save the planet*', in which he argued that crops and livestock will be replaced with '*food made from microbes and water*' (Monbiot 2020). Monbiot has also endorsed the Reboot Food initiative of Replanet (2023), in which it is argued that '*Animal farming should be phased out with today's animal products replaced by identical precision fermentation products wherever possible*'.

Not only left-wing but also some of the politically centrist media do not shy away from anti-meat hyperbole. Referencing one of its articles, The Economist (2023) tweeted: '*By cooking so many cows, we are cooking ourselves, too. Forgoing steaks may be one of the most efficient ways to reduce our carbon footprint*'.

Amplification by consumers via social media

Via social media, consumers are able to massively spread opinions on the worldwide web. These user-generated communications have been shown to frequently concentrate on dietary choices and affect food preferences (Blundell and Forwood 2021; Hawkins et al. 2021). Recent discourse analysis on user-generated social media posts shows, for example, how content focussing on the indulgence and short-term enjoyment of consuming meat contrasts with the role of plant-based foods in the establishment of long-term values and identities (Davis and Papies 2022), although other online communities are known to strongly rely on meat eating for identity formation (Protogerou et al. 2021). Discursive psychological studies have found that online communication indeed aids in establishing strong food identities (Sneijder and Te Molder 2006).

Both in terms of thought-provoking, user engagement, and consequent behavioural changes, negative claims tend to be particularly influential. Given this negativity bias effect (Rozin and Royzman 2001), through which negative information and experiences weigh relatively more heavily in consumer evaluations and decision-making processes than positive ones, anti-meat messages via social media are expected to

be highly impactful (and the same appears to be the case for anti-vegan messages, further reinforcing polarisation). In attempts to make their posts more authoritative, social media users almost naturally refer to and amplify journalistic and scientific messages that are in support of their own ideas, thus incentivizing mass media and academic institutions to double down on sensationalist reporting.

Amplification by public-private partnerships

Few initiatives have been more influential in politicising the discussions around meat than the so-called Great Food Transformation towards a Planetary Health Diet (Lucas and Horton 2019), as promoted by the EAT Foundation (Leroy and Hite 2020). In 2019, the EAT-Lancet Commission published a report in which it defined red meat as an ‘unhealthy’ food choice together with sugar (cf. ‘key message 5’ in the report), suggesting minimising the consumption of beef, pork, and lamb to a combined 5 kg/p/y (within a window of 0–10 kg/p/y) (Willett et al. 2019). In a proposed semi-vegetarian diet (with a vegan option), the EAT recommendation for *total* meat intake (also including poultry) was set at 16 kg/p/y (within a window of 0–31 kg/p/y) and the suggested caloric contribution by all animal source foods at a mere 14%. To do so, the diet prescribes very small daily rations of beef or pork (each at 7 g) and some poultry (29 g); for comparison the limit for sugar was set at 31 g.

Whether or not the EAT-Lancet approach represents a radical diet, is left to the discretion of the reader, but it certainly is used as a key reference for interventionists strategies that aim at strong reductions in animal source foods. The report itself stipulates that ‘countries and authorities should not restrict themselves to narrow measures or soft interventions’ because ‘the scale of change to the food system is unlikely to be successful if left to the individual or the whim of consumer choice’ (Willett et al. 2019). The suggested hard policy options, which are also listed by EAT’s close partners at the World Resources Institute (WRI; Ranganathan et al. 2016) and World Wide Fund for Nature (WWF; Loken et al. 2020), as well as by the New York University’s CEAP and Guarini Centre (Minelli et al. 2021), refer to legal measures and fiscal and economic incentives, such as a meat tax (see also Springmann et al. 2018), the mandatory use of nutritional warning labels, and the banning of meat from menus and public canteens.

Accordingly, the Food and Land-Use Coalition (FOLU), in which EAT and WRI are central partners, has

stated that it will ‘go deep into the policy, regulatory environment, and businesses of individual countries’, starting with Colombia, Indonesia and Ethiopia, and targeting the Nordic countries, Australia, and Europe next (EAT 2023a). To do so, FOLU has the intention to use the EAT-Lancet approach as a model to transform the global food system by 2050. Australia, for instance, should achieve a 91-% decrease in domestic red meat consumption by 2050, redirecting production at export (Navarro-García et al. 2019).

C40 Cities is yet another major and well-connected initiative, in which EAT and WRI are partners, which is using the Planetary Health Diet as a model for interventionism. Following the signing of the C40 Good Food Cities Declaration, mayors of 184 major cities (including Barcelona, London, Los Angeles, Milan, Paris, Tokyo, and Toronto), have pledged that they will work ‘to achieve a ‘Planetary Health Diet’ for all by 2030’ (C40 Cities 2019a). New York City joined the initiative at a later stage (C40 Cities 2022), its mayor being a self-described vegan who sometimes eats fish and an outspoken proponent of a dietary transition (Rubinstein 2023). In practice, the C40 Cities manifesto implies that both a ‘progressive’ (16 kg of meat and 90 kg of dairy per person per year) and ‘ambitious goal’ (0 kg/p/y for meat and dairy) are set for 2030 (C40 Cities 2019b).

The founder of the EAT Foundation is a 2015 Young Global Leader of the World Economic Forum (WEF) and has presented her organisation as a ‘Davos for food’ (Turow-Paul 2016), which in all probability facilitates influence over policy-making initiatives within global power networks, both nationally and transnationally. The WEF is indeed supportive of the Great Food Transformation, having published an article entitled ‘Why we all need to go on the ‘planetary health diet’ to save the world’ (WEF 2019). Within the larger WEF ecosystem, EAT is allied to the World Business Council for Sustainable Development (WBCSD), in particular via the FReSH initiative through which it gets the support from leading agri-food corporations (WBCSD 2018). Many of the corporate WBCSD/FReSH members have expressed a strong interest in the alt meat market and have developed their product lines accordingly (Wood 2018; Kowitz 2019).

In addition to filling in a potential growth niche in an otherwise stagnating food market, alt meats fit neatly into a decades-old industrial paradigm that is based on ultra-processing. The latter emerged, among other reasons, as a response to the low-fat dictum of the 1980s by food multinationals, which developed

sophisticated ultra-processing techniques as a key expertise within their R&D departments. In this model, the contributions of (animal) fat to texture and mouth-feel, colour, and flavour were replaced and imitated by bulk materials (e.g. starches) and a relatively long list of additives (e.g. colourants, texturizers, aromas, etc.), while promising added value based on speculative health theory. The parallels with the current alt meats market are multiple, including the ultra-processed nature of most products (i.e. concoctions created from protein isolates, oils, salt, and additives), the insertion of such products in a fast-food and snacking culture, and a profit model based on the as yet unsubstantiated promise that the imitation is equal to the original at the level of hedonistic appeal (even with respect to the ‘bleeding’ of meat; Bose 2016; Lamas 2021), but superior on other grounds (e.g. based on claims relating to ‘planetary health’ and even human health).

To reinforce the influence of its corporate network, WEF entered into a strategic partnership with the United Nations (UN) in 2019, with the intention to accelerate the 2030 Agenda for Sustainable Development. This UN-WEF alliance has been lambasted as a ‘*disturbing corporate capture of the UN*’ within a public-private partnership setup in which corporations play a defining role (FIAN 2020). Whether or not facilitated by this alliance, EAT was firmly installed within the influential UN Food Systems Summit in 2021. Meanwhile, however, the role of WEF and WBCSD in the setup of the Summit were met with a lot of suspicion, as discussed below.

Amplification by transnational policy organisations

One of the most remarkable evolutions of the last ten years is how unbalanced views on meat and livestock have been circulating within high-level transnational networks, reaching a historically unmatched level of influence. To substantiate this claim, a series of examples is provided below. This list is merely illustrative and future research should offer a more comprehensive analysis, but, taken together, these examples already do reveal a substantial degree of interconnectivity between some of the key actors.

- In 2018, two leading producers of alt meats (Beyond Meat and Impossible Foods) received the Champions of the Earth award from the UN Environment Programme (UNEP). In support of its decision, UNEP (2018) published an article entitled ‘*Tackling the world’s most urgent problem: Meat*’. The title is not only a sensationalist and scientifically unjustifiable overstatement, but the two recipients of the award also represent a peculiar choice for a prestigious UN prize meant to promote societal benefit. Both companies aim to: (1) generate profit from ultra-processed products that are to be mainstreamed in fast-food culture (e.g. plant-based burgers and sausages, in formal collaboration with the fast-food and snacking sector; Ellis 2021; PepsiCo 2021) and (2) are known to be radicals on a mission to end livestock agriculture. Beyond Meat’s CEO has stated that vegan tech will make traditional protein from animals obsolete (Garcia 2019), while the CEO of Impossible Foods has put it even more graphically (Hadlock 2019): ‘*We plan to take a double-digit portion of the beef market within five years, and then we can push that industry, which is fragile and has low margins, into a death spiral. Then we can point to the pork industry and the chicken industry and say, ‘You’re next!’ and they’ll go bankrupt even faster*’. In another interview, he claimed that ‘*plant-based products are going to completely replace the animal-based products in the food world within the next 15 years. That’s our mission. That transformation is inevitable*’ (Clifford 2020).
- According to Vella (2018), the former United Nations Framework Convention on Climate Change (UNFCCC) Executive Secretary overseeing the Paris Agreement has stated that meat eaters should be treated like smokers and, therefore, be expelled from restaurants. Also in 2018, the WEF published an article on a similar topic, entitled: ‘*A new report says we should tax meat-eaters like smokers*’, thereby referring to a report from FAIRR (Del Bello 2018). In addition, she has been listed as a member of the Board of Directors of both Impossible Foods (Diep 2021) and the WRI (WRI 2021), while her brother is a former CEO of the WEF and an EAT Alumnus (EAT 2023b).
- In 2021, controversy was generated around the UN Food System Summit. The event was judged as a hostile takeover of the food systems debate by the WEF and its partners, while being criticised for the doubtful origins of its funding and the lack of transparency related to the selection of the leaders of the five Action Tracks (Canfield et al. 2021). In Action Track 2 (on ‘sustainable diets’; AT2), an unbalanced setup was established in which anti-livestock perspectives were disproportionately represented. The track was chaired by EAT’s founder (who is, as already stated above, also a WEF Young Global Leader), whereas the WHO functioned as ‘anchoring agency’. Before the Summit, a WHO

director who also acts as an EAT-Lancet Commissioner had already made it clear that, within the food system, *'everything has to be reset [...] we have to have much smaller amounts of meat on our tables. We need to reset, and we need to adjust. We need the policies, the investments, on the supply side and the consumer side. The WHO will be working on the consumer side'* (Grillo 2020). EAT's declared goal was *'to take full advantage of the Summit [and] to force the kind of far-reaching changes that the world now desperately needs'* (EAT 2020). The Youth-Vice chair of AT2 was a leader within the youth climate organisation Zero Hour International, and a known advocate for vegan food choices (Yeager 2019). Moreover, the Good Food Institute (GFI), a well-funded pressure group for the vegan alt meat industry, had *'been invited to lead the innovation pillar of action track 2 for the UN's 2021 Food Systems Summit'*, thus obtaining *'influence on the innovation thinking across all five action tracks'* (GFI 2020). In further support of this, the Civil Society Leader of AT2 was the CEO of 50by40 (<https://50by40.org>), a group that counts WRI, GFI, and various vegetarian advocacy and animal rights organisations among its members (UN 2020). As suggested by its name, the mission of 50by40 is to halve livestock by 2040.

- Ultimately, the 2021 UN Food Systems Summit did not deliver the strong anti-livestock outcomes that many were expecting, partially because of a controversial and tumultuous process. Since then, the various Action Track leaders, among which EAT and the WWF, have regrouped with the above-mentioned C40 Cities initiative and with the Club of Rome in the so-called Food Forward Consortium, as to take the envisaged work further (Club of Rome 2023). This same network also operates within the Global Commons Alliance (GCA; <https://globalcommonsalliance.org>), a large public-private partnership linking the Club of Rome, C40 Cities, EAT, UNEP, WBCSD, WEF, WRI, WWF, and other partners, to large business platforms (e.g. Ceres, Capitals Coalition, and We Mean Business). Similarly, the World Benchmarking Alliance (WBA; <https://www.worldbenchmarkingalliance.org>), which is a member of GCA and which counts EAT, WBCSD, WWF, We Mean Business, and FAIRR among its members, has the intent to play at the highest levels of finance. As such, *'ranking and measuring the companies will [...] create accountability for those who don't change'* [WBA 2023].

- The current composition of the Advisory Board of the EAT Foundation (EAT 2023c) reveals formalised interactions between a group of radical voices (including George Monbiot and Jamie Arbib of RethinkX; see above for a brief description of their claims and ideas), on the one hand, and high-profile representatives of academia and industry, on the other hand (such as the Editor-in-Chief of The Lancet and the president of WBCSD, respectively). Because the aim of the Board is to provide *'strategic advice to EAT's management'*, there is reason to expect that such interactions will eventually materialise in a further evolution of the discourse around meat and livestock at the highest levels.

A hostile environment?

The above-mentioned examples provide a non-exhaustive overview of power networks and recent narratives in the scientific and policy arenas that can effectively be considered as radical, since they aim at a very strong and unrealistic reduction or even elimination of (red) meat production and consumption, while disproportionately overstating the harms of meat and livestock agriculture. The purpose of this overview is not to argue that the entire food systems discussion is now dominated by anti-meat perspectives, nor to rule out that pro-meat lobbying has become irrelevant, which is far from being the case (Sievert et al. 2021), but to illustrate how the debate on meat and livestock is at risk of becoming dangerously unbalanced and increasingly polarised.

In addition, calls for drastic meat restriction through policy are not new, and go back to the late 19th and early twentieth century at least (Leroy and Hite 2020). In 1917, for instance, the US Food Administration propagated *'meatless Tuesdays'* and *'porkless Saturdays'* for food conservation purposes (Leroy and Hite 2020). In 1969, a Rockefeller report commissioned by Richard Nixon urged for a dietary shift *'away from consumption of animal livestock towards vegetables and synthetic meats'* and *'a closed system of agriculture - food from factories'*, requiring an *'international economic order, capable of dealing with natural resources and environmental conditions on a world scale'*, to be implemented by a body with *'assigned central responsibility'* and serving as a *'lobby for the future'* (Commission on Population Growth and the American Future 1969).

What the overview presented in this paper *does* hope to achieve is to document that the current anti-meat bias and hyperbole, and the networks that are

promoting it, are both radical and significant enough to be taken seriously. This has created a need for a thorough scientific debate on what such ideas could mean for the future of the food system. Adopting a Great Transformation would create an unprecedented systemic change, of which the results are difficult if not impossible to predict and which would require unprecedented levels of interventionism, hard policy measures, and social engineering. Furthermore, this evolution risks making academic fora in the domain of nutritional and agricultural sciences, which should enable a serene exchange of conflicting ideas and function as a laboratory for genuine attempts at theory falsification, intimidating and potentially hostile environments for opposite views and more moderate perspectives.

A telling example of how such hostility may stifle proper scientific interactions is provided by the NutriRECS affair. In 2019, the NutriRECS group published a series of articles in *Annals of Internal Medicine* looking into the relation between red meat intake and mortality or chronic disease. It was praised in the editorial as the most inclusive review of the evidence to date, so that *'those who seek to dispute it will be hard pressed to find appropriate evidence with which to build an argument'* (Carroll and Doherty 2019). The authors made use of the GRADE system, which is applied by over 100 organisations worldwide as a gold-standard method for the inspection of the quality of evidence in the health sciences. The conclusion of the NutriRECS studies was that the claims that red and processed meats are posing a health risk were only supported by low to very-low certainty evidence (Johnston et al. 2019). Those that indeed sought to dispute this claim (e.g. members of the True Health Initiative, including the EAT-Lancet report's lead author, and the animal rights front PCRM, both part of the 50by40 initiative mentioned above) tried to *avert* publication of the studies and to discredit the authors based on alleged conflicts of interests (Dyer 2020; Leroy and Hite 2020; and, especially, Rubin 2020).

How to move forward?

As a counterreaction to the scenarios proposed in the previous section, various experts have cautioned against potential harmful outcomes of overly drastic food system interventions that wish to narrow down the vast heterogeneity within the global dietary spectrum to a centrally designed 'healthy and sustainable diet'. Warnings refer, for instance, to the pitfall of nutritionism in a food policy context (Katz-Rosene

2020; Leroy et al. 2022; Johnston et al. 2023), the overestimation of the potential of alt meats (Wood et al. 2023), and a failure to contextualise the critical role of livestock in food and nutrient security, livelihoods, and gender equality, especially in small-holder agriculture which is responsible for 70% of food production in Africa (Adesogan et al. 2020; Leroy et al. 2023). Some authors have also pointed out that there is insufficient acknowledgement of the budgetary implications of the proposed dietary shift (Hirvonen et al. 2020; Ederer et al. 2023), while ignoring ethical complexities (Croney and Swanson 2023) and socio-cultural practices (Burnett et al. 2020), to the point of being neo-colonialist (Katz-Rosene 2020). With respect to environmental impact, it has been argued that the broader ecological functions of livestock are often overlooked, and their negative outcomes overstated (Manzano, Pardo et al. 2023; Manzano, Rowntree et al. 2023; Thompson et al. 2023), especially in the case of ruminants (Katz-Rosene 2020; Leroy et al. 2022a; Manzano, Pardo et al. 2023). Sustainable land use also must be considered in the effort to feed a growing human population in a manner that protects natural capital and biodiversity. Livestock, as part of a circular food system utilising land not suitable for growing crops and food system by-products, can improve the efficiency of agricultural land to feed a population (Wilkinson and Lee 2018; Lee et al. 2021; Thompson et al. 2023). Moreover, negative ecological trade-offs of system change away from animal agriculture need to be factored in (Leroy et al. 2022a; Thompson et al. 2023), for instance with respect to the impact on water wastage (Vanham et al. 2020).

However, such scientific contextualisation is generally overshadowed by the well-coordinated mainstreaming of negative views on animal farming. In 2022, a group of scientists (among whom the first author of the present publication) organised an international two-day summit in Dublin, entitled 'The Societal Role of Meat - What the Science Says', with the purpose of achieving a comprehensive synopsis of the scientific evidence, which was then formalised in a series of articles (Croney and Swanson 2023; Ederer and Leroy 2023; Ederer et al. 2023; Johnston et al. 2023; Leroy et al. 2023; Manzano, Rowntree et al. 2023; Polkinghorne et al. 2023; Thompson et al. 2023; Wood et al. 2023).

The summit gave birth to the Dublin Declaration (2022), which has the intention *'to give voice to the many scientists around the world who research diligently, honestly and successfully in the various disciplines in order to achieve a balanced view of the future*

of animal agriculture', and has meanwhile been endorsed by more than a thousand scientists. It further makes the point that 'livestock systems must progress on the basis of the highest scientific standards. They are too precious to society to become the victim of simplification, reductionism or zealotry. These systems must continue to be embedded in and have broad approval of society. For that, scientists are asked to provide reliable evidence of their nutrition and health benefits, environmental sustainability, socio-cultural and economic values, as well as for solutions for the many improvements that are needed'. The issue raised by the Declaration, therefore, is epistemological, calling for further scientific discovery and sincere debate.

The improvements required for a successful livestock system transformation are indeed 'many' and will have to lead to increased circularity, improved animal health, higher biodiversity, and more acknowledgement of the local ecological context, all of which has to be achieved within the constraints imposed by the nutritional and social needs at population level (Leroy et al. 2022a; Leroy et al. 2022b; Beal et al. 2023; Ederer and Leroy 2023). A mix of solutions that combine extensive systems and agroecological principles with sustainable intensification will be required (Thompson et al. 2023), rather than a blanket recommendation aiming at a fixed percentage of reduction of herd size (at the production level) or caloric intake (at the consumption level). The need for a robust food system based on a flexible animal production setup is particularly critical to safeguard food and nutrient security in times of crisis, since the latter can erupt unpredictably and quickly compromise global supply chains (e.g. in the case of pandemics and armed conflicts).

All of this obviously brings its own set of major difficulties and challenges (Polkinghorne et al. 2023), but transformation from *within* the current system, building on a productive combination of existing wisdom and scientific innovation, is expected to have a higher chance of success than the alternative of a novel and experimental food system in which bioreactor foods are dominant and animal source foods have been minimised to inconsequential levels. In the former scenario, animals remain part of the solution, rather than being seen as a problem that needs to be minimised (Leroy et al. 2020). Whether or not that also means lower meat production and consumption in the urban West, should be considered as an outcome of the transformation, not an *a priori* goal that sets the agenda. Adjustment of the animal production systems to a higher level of agroecological performance by combining a reasonable interaction between

bottom-up (to stimulate diversity) and top-down approaches (to issue evidence-based guidelines) will eventually lead to its own shift in both production and consumption levels. It is our opinion that, in comparison to a Great Food Transformation scheme, this will come about with a lower chance of upsetting the integrative functions and productivity of a highly complex system.

Disclosure statement

FL is a non-remunerated board member of various academic non-profit organisations including the Belgian Association for Meat Science and Technology (president), the Belgian Society for Food Microbiology (president), and the Belgian Nutrition Society. On a non-remunerated basis, he also serves on the Scientific Board of World Farmers' Organisation (WFO) and FAO/COAG Sub-Committee on Livestock. ML is a non-remunerated President of the European Federation of Animal Science, he chairs the UK Universities Climate Network-Net Zero Universities group, and also serves as a member of the Technical Advisory Board for the FAO/LEAP on integrating circular bioeconomy approaches in the environmental assessment of livestock. The views the authors express in this commentary are theirs alone and not necessarily those of the aforementioned organisations.

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Data availability statement

Data sharing is not applicable to this article as no new data were created or analysed in this study.

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