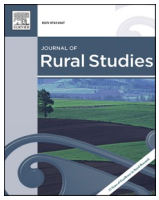
Journal of Rural Studies 119 (2025) 103720

Contents lists available at ScienceDirect

Journal of Rural Studies

journal homepage: www.elsevier.com/locate/jrurstud



# Leverage points to improve resilience in supply chains: civil food resilience and food sovereignty

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ARTICLE INFO

*Keywords:*
Supply chain resilience
Food systems transformation
COVID-19
Climate change
Economic crises
Biodiversity decline

ABSTRACT

Adverse impacts of various interrelated socio-environmental crises reveal food systems as increasingly vulnerable and call for action. To improve food system resilience, we review adaptations of agri-food supply chains and suggest leverage points for change. We distinguish shallow from deep leverage points. Shallow ones merely aim at recovering the established supply chain after a shock, whereas deep leverage lies in changing the design or intent of the system. Findings suggest that responses to COVID-19, which dominate the sample, are biased towards short-term recovery, and neither did justice to calls for "building back better" nor to the long-term impacts of relatively neglected causes of disturbance such as climate change, biodiversity decline, and economic crises. We outline contradictions in resilience discourse between the drive towards short-term system recovery and the need to address long-term stressors caused by an unsustainable food and economic system. Given the need for deep, systemic change, we advocate for civil food resilience and food sovereignty as frameworks for resilience research and food systems transformation.

## 1. Introduction

Crises typically entail calls for action. The COP28 leaders recognised 'that unprecedented adverse climate impacts are increasingly threatening the resilience of agriculture and food systems' and declared their intent for 'scaling-up adaptation and resilience activities and responses in order to reduce the vulnerability […] while conserving, protecting and restoring nature' (Council of the European Union, 2023, pp. 2–3). At the same time, recent farmers' protests across Britain and EU countries suggest that current agricultural policies insufficiently bridge the need for a transition that is both sustainable and just (Finger et al., 2024). In complex ways, the material need for change is juxtaposed and in tension with the inherent drive of a system to uphold itself. After the emergence of COVID-19, the topic of resilience in food supply chains had already seen a remarkable surge, and it had even been on the rise before the pandemic. As with the COP 28 leaders' declaration, public and policy debates during COVID-19, e.g. on "resurging natures" (Searle and Turnbull, 2020) and "building back better", clearly exhibited hope and good intentions (Guilbert et al., 2022; White and Cretney, 2022). However, they did not necessarily draw attention, let alone direct action, to the most effective places to intervene in a system. In this literature review, we focus on agri-food supply chains while taking a perspective of food system resilience (Brock, 2023; Doherty et al., 2019; Ingram et al., 2023; Stone and Rahimifard, 2018; Tendall et al., 2015; Zurek et al., 2022) to suggest leverage points for change.

Resilience can be conceptualised in various ways (Box. 1). In a nutshell, it can be defined as the capacity to 'thrive in a "new" normal' (Bernabei et al., 2022, p. 4). The global socio-environmental crises and challenges humanity faces today do not only alter, but can render impossible, what has previously been "normal". Subsisting on healthy soil that can produce healthy foods and people is one such normality under threat. The impossibility of "crude" productivist maximisation of yields is now not just acknowledged by organic farming practices, but increasingly so by conventional farmers who adopt regenerative practices to try and achieve the 'best of both worlds' – maximum yields despite a low(er) environmental impact and healthy soil (Beacham et al., 2023, p. 8). Rapidly changing climatic conditions and uncertainties in conventional, fossil-fuelled farm inputs suggest that business as usual is

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https://doi.org/10.1016/j.jrurstud.2025.103720
Received 19 November 2024; Received in revised form 23 May 2025; Accepted 28 May 2025
Available online 24 July 2025

rendered increasingly a challenge. While environmental, political, and economic conditions of human reproduction shift, basic human needs do not, and a functional food system that is resilient to shocks and sustainable is a prerequisite for a thriving society. In this review, we examine the ways in which academic studies address disturbances of the food supply. Specifically, whether they encourage "shallow", incremental, or "deep", *systemic* changes that are profound enough to achieve both short-term resilience and long-term sustainability. We review the literature on food supply chain resilience through the lens of four major causes of disturbance: COVID-19, climate change, economic crises, and biodiversity decline.

The geographical focus is on Global North countries with so-called "developed" markets, typically defined by supply chains with a just-in-time system, some of which heavily rely on imports, rather than domestic production, thereby causing environmental impacts in the countries they import from. Whilst supply chains can often revert to "normal" quickly after shocks, as was the case in the context of the recent fruit and vegetable shortage in the UK (Hirth et al., 2023a), this only shows that the system is resilient at present, not how long it will be so. Thus, governments are urged to focus on 'long-term food resilience and environmental issues' (House of Commons, 2023, p. 7). The review highlights foci and gaps discussed in the academic literature on resilience. We find that the majority of studies focuses on COVID-19 and tends to promote "shallow", non-systemic adaptation measures in the face of crises.

The following section elaborates on challenges and the spectrum between shallow and deep leverage points for system transformations. After a third section describing the search strategy of our review, a fourth section on results showcases examples of shallow (4.1) and deep leverage points (4.2 and 4.3) to create system resilience. Section five then discusses the results, in particular the implications of a shallow, short-term focus on system recovery and the neglect of deep, long-term impacts. In the last section, we indicate future research avenues and conclude that deep leverage should be in the focus to ensure long-term resilience and sustainability.

## 2. System resilience and sustainability

### 2.1. Ecological and social sustainability challenges

With six out of nine planetary boundaries transgressed, the contemporary world witnesses global environmental – and as a consequence societal – changes of unprecedented pace and scale (Richardson et al., 2023). Business as usual reactions that refrain from deep structural adaptations ignore the root-causes of, and existential threats emerging from, the four interrelated factual and potential causes of disturbance we focus on.

*Climate change* – could, by the end of the century and under current policies, leave one-third of people outside the niche of a relatively benign climate and expose them, and their food provision systems, to unprecedented heat (mean annual temperature $\geq$29 °C; Lenton et al., 2023, p. 1237).

*Biodiversity decline* – is now at the scale of 'mass extinction'. This means that the current average rate of vertebrate species loss is 100 times higher than the 'background rate', i.e. significantly higher than the rate of extinction before humans intervened in ecosystems (Ceballos et al., 2015, p. 1).

*COVID-19* – has severely impacted health and economic systems globally and exposed vulnerabilities in global systems of food production and consumption (Borghesi and Morone, 2023; Sperling et al., 2022), in what some have termed 'a perfect storm of coincidental risks' to the global food system (Fan et al., 2021, p. 601). Furthermore, the prevention of future zoonotic disease outbreaks would require action 'to sustainably balance and optimise the health of people, animals, and ecosystems – including [.] the prevention of deforestation' (Sachs et al., 2022, p. 42).

The *economic crisis* – that followed the pandemic, whose genesis was also fuel price rises following Russia's invasion of Ukraine, increased poverty, food prices, reliance on food aid, and exposed food systems as vulnerable (Power et al., 2020).

Leaving these crises poorly addressed is likely to exacerbate them, may lead to cascading risks, and cause civil unrest (Jones et al., 2023)

### 2.2. Systems thinking and the need for "deep" structural change

Faced with a crisis, it can be tempting to prioritise the recovery of the usual functions of the system and bounce back to "normal" (Boons et al., 2020; Hirth et al., 2022). This is understandable considering the moral imperative to ease people's suffering through immediate response. Even if that can and should be done, this superficial form of resilience will not prevent or alleviate future crises if the causes of disturbance are themselves caused by the unsustainable system that is in place. However, changing a system is a difficult undertaking. Systems are inherently inert, held together by actors with vested interests and, thus, reluctant to change.

To conceptualise systemic change, we draw on the works by Donella Meadows who was not only instrumental in establishing sustainability science and policy through the landmark report 'The Limits to Growth' (Meadows et al., 1972), but also conceptualised pathways towards sustainability through systems thinking (Meadows, 1999). The former report problematised the *intent* of the current socio-economic system – economic growth – against the reality of finite resources. In the latter, Meadows identifies shifting a system's underlying paradigms and goals as the most effective places to intervene in a system (Table 1). Drawing on her work, Abson et al. (2017) highlight the importance of addressing the deeper intent and design of a system, not just the mechanistic characteristics apparent on the surface, if the aim is to create system wide changes.

To make lifestyles compatible with the goals of the Paris Agreement, it has been suggested to identify (a) shallow factors, for example, interventions such as specific subsidies, and (b) put particular emphasis on deep factors, such as the sustainability barrier of the economic growth paradigm (Hirth et al., 2023b). While deep leverage points are more effective, 'shallower interventions are favoured in both science and policy' (Abson et al., 2017, p. 33) because deep transformations can only be leveraged with 'changes in existing power relations' (Hirth et al., 2023b, p. 4). While shallow transformations are easier to leverage and more likely to be widely accepted, targets regarding climate, biodiversity, biosafety, and social justice are unlikely to be achieved without deep transformations that overcome, rather than recover, the system that is in place.

Importantly, the deepest leverage points may be hardest to achieve, but this does not make them unattainable. As the current system hosts a range of incumbent structures and processes, deep-level change is just not attainable without resistance from individual and corporate actors in powerful positions – it is attainable, but not *without* a class struggle against an establishment. Meadows conceptualises 'the power to transcend paradigms' as the deepest possible lever and emphasises the ability to stay 'unattached in the arena of paradigms, to stay flexible, to realize that *no* paradigm is "true"' (Meadows, 1999, p. 19). This should not be read as paradigm shifts being arbitrary. Rather, that transcendence comes with 'radical empowerment' to 'choose whatever [paradigm] will help to achieve your purpose' (1999, p. 19). As ecosystems are in decay, along with the social fabric materially enabled by them, the purpose is far from arbitrary. The deeper that society moves into social-ecological crises, the more realistic becomes ensuring wellbeing, and ultimately survival, through systems change, rather than recovering the established system, which is doomed to cause those crises. There is a temporal dimension to how easily attainable deep change is in relation to shallow change, linked to shifting, currently exacerbating, material conditions. Our study aims to outline and discuss viable pathways for deep transformation.

**Table 1**
Shallow and deep leverage points to intervene in a system.

| Increasing effectiveness to intervene in a system | System characteristics (Abson et al., 2017) | Intervention places ordered by effectiveness (Meadows, 1999) | Power relations (Hirth et al., 2023b) |
|---|---|---|---|
| shallow leverage points | *parameters and feedbacks* – relatively mechanistic characteristics and interactions between system elements that drive internal dynamics | 12. Parameters such as subsidies, taxes, standards<br>11. The size of buffers stocks, relative to their flows<br>10. The structure of material stocks and flows<br>9. The length of delays, relative to the rate of system change<br>8. The strength of negative feedback loops<br>7. The gain around driving positive feedback loops | barely challenged |
| deeper leverage points | *design of the system* – social structures and institutions that manage feedbacks and parameters | 6. The structure of information flows<br>5. The rules of the system<br>4. The power to add, change, or self-organise system structure | challenged |
| deepest leverage points | *intent of the system* – underpinning values, goals and world views towards which actors and system are oriented | 3. The goals of the system<br>2. The mindset or paradigm out of which the system arises<br>1. Power to transcend paradigms | deeply challenged |

(Source: developed by authors drawing on Meadows, 1999; Abson et al., 2017; Hirth et al., 2023a)

## 3. Search strategy

The aim of the review was to provide an in-depth account of the aggregated insights of the literature on resilience and adaptations in the context of food supply chains. Between March and June 2023, we searched the Scopus database for peer-reviewed articles and book chapters addressing supply chains with a focus on provision for so-called "developed", i.e. Global North, countries (i.e. this included some case studies on resilience of producers in the Global South provided that the produce was potentially destined for consumption in the North). To cover a clearly laid out range of ecologically and socially impactful causes of disturbance without being eclectic, the search terms (laid out in detail in Fig. 1 following the PRISMA protocol by Moher et al., 2009) included a focus on.

- four major categories of disturbance: COVID-19, climate change, economic crises, and biodiversity decline
- retailers and consumers (while also looking at other supply chain actors, the studies were supposed to address at least one of these two to be selected)
- specific foods: meat, dairy, vegetables, fruit

Applying this search strategy, we identified a list of 513 articles which we subjected to abstract screening and, through the exclusion criteria laid out in Fig. 1, were reduced to a total of 101 relevant studies. We used the reference management software Zotero not only to archive PDF documents of the studies, but also to analyse the data. The first step was to code the material by applying qualitative interpretative methods. Using Zotero, we marked text passages with different colours following a deductive coding scheme.

- Red: Threat to food system/supply chain
- Orange: Specific disruption of food supply chain
- Yellow: Adaptations in response to disruptions or threats
- Green: Specific appeals for action or policy
- Blue: Conceptual aspects of "resilience", e.g. definitions, contextualisation, elements of resilience
- Purple: Retailer adaptations in response to disruptions or threats
- Pink: Consumer adaptations in response to disruptions or threats
- Grey: other relevant aspects

The second step was to export the markings into Excel tables where, ordered by colour code, the material was distilled into more abstract themes to show convergences and divergences in how resilience measures and adaptations in reaction to supply chain disturbances were addressed. The colour code was helpful to distinguish different contexts of resilience, from conceptual aspects (blue) to foci on specific consumer (pink) and retailer (purple) adaptations, threats (red), and policy aspects (green). The main section does not order the findings by colour code, but specific tables reflect that analytic distinction. We categorise the disturbances or adaptation measures found in the literature into shallow, deeper, and deepest leverage – if studies happened to address various forms of leverage, they occur in more than one subsection of the results section.

The analytic process involved two researchers – the first and second author – applying inter-coder reliability. During the sampling process, this involved independent application of exclusion criteria followed by convergent discussion by both researchers. During the coding process, this included a round of trials in which identical studies were marked by both researchers to validate their understanding of the coding scheme.

The articles considered in this review exhibit heterogeneity in that they cover diverse journals from social and environmental sciences, including foci on food security, rural and regional studies, sustainability and systems research, whereas overly technical or non-food related applications of the term "resilience" were excluded. The search terms – focused on COVID-19, climate change, economic crises, and biodiversity decline – limit the scope of the review, excluding an in-depth view on other possible causes of supply chain disturbance. However, a range of other causes of disturbance showed in the sample (Table 2). Factors such as societal conflicts, natural hazards, as well as health, population, and organisational issues may have systemic links to our main categories, but were specific enough to be made explicit, even if they were not necessarily the main foci of the sampled studies.

## 4. Results

Our search explicitly explored the literature on resilience for the themes of COVID-19, climate change, economic crises, and biodiversity decline as causes of food system disturbance and contexts in which adaptation measures are discussed. However, the following subsections containing our findings predominantly address COVID-19 and, to a lesser degree, climate change. Rather than a bias of the authors, this unequal distribution reflects the salience of these topics in the literature.

Specifically, Table 3a shows the dominance of COVID-19, addressed by 68 out of 100 sample studies, compared to only 13 that address biodiversity decline. We also observe in Table 3b that none of the studies is focused on biodiversity decline alone, while that is the case for 21, 6, and 2 studies that specialise on COVID-19, climate change, and

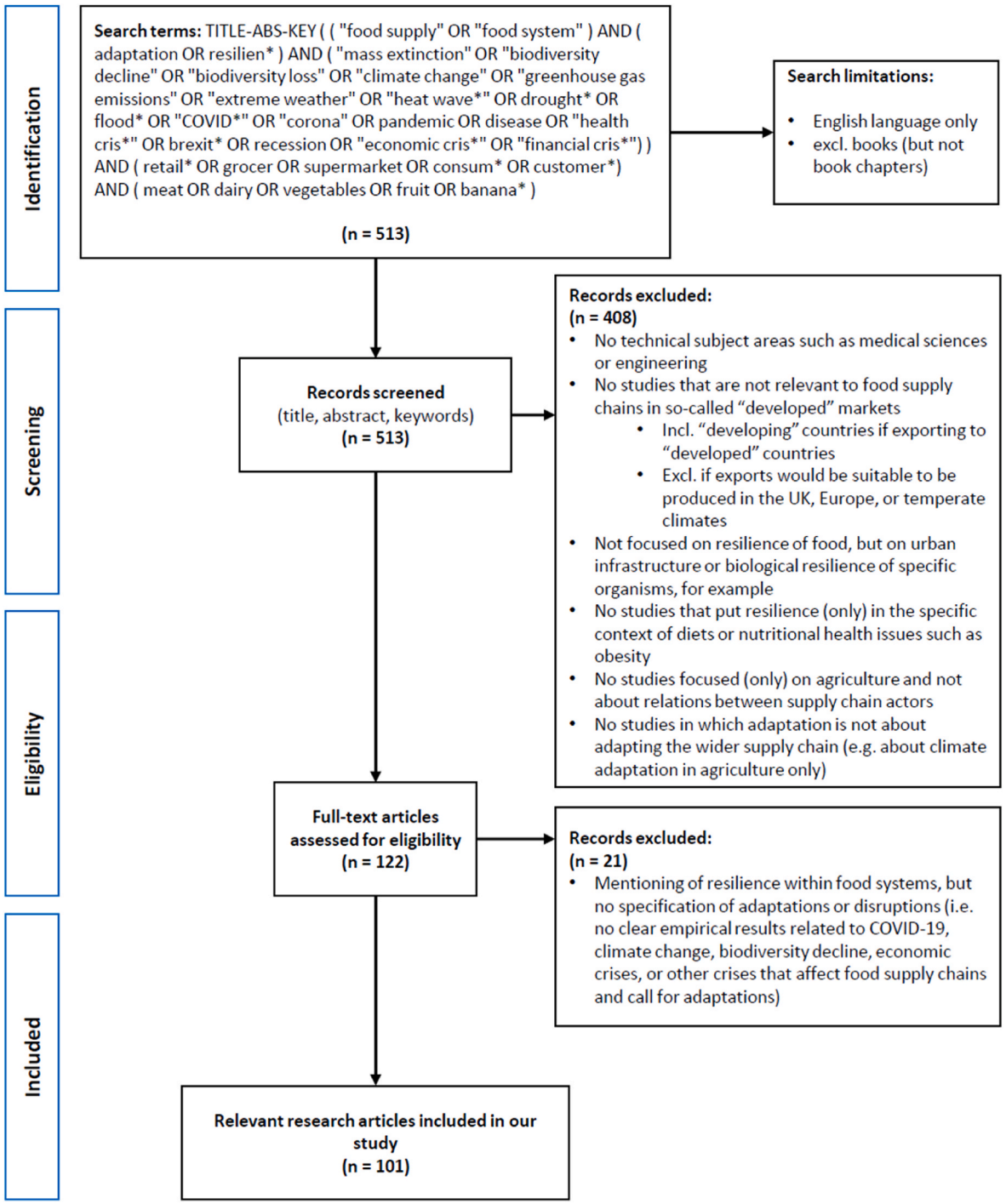


**Fig. 1.** PRISMA chart – overview of the systematic literature search process.

economic crises, respectively. Moreover, Table 4 sketches the way in which biodiversity is a sidelined topic that is mentioned, but not analysed empirically in our sample.

The following subsections divide the adaptation measures that occur in the literature into shallow, deeper, and deepest leverage, suggesting that some responses to disturbances superficially recover the established system while others imply structural changes at deeper systemic levels. The subsections include supply chain adaptations in general, but Tables 5 and 6 elaborate on adaptations specific to consumers and retailers. The responsive adaptations presented do not allow an evaluation of their actual successes, but rather constitute a qualitative overview of measures scholars regard as either having contributed towards resilience or being desirable to achieve it. The unequal distribution of the salience of different causes of disturbance will be picked up in the discussion.

### 4.1. *Shallow leverage*

The disruption caused by the COVID-19 pandemic has activated feedback loops aimed to recover "normal" life. Some researchers note that, overall, supply chains were resilient and recovered well (Bernabei et al., 2022, Dou et al., 2021). However, the recovery from the disruptions often applied to micro- or meso-economic scales, for example, the ability of a company or a sector to return to routines (Ali et al., 2021). The meat sector in particular was impacted, firstly, by enforced closures

**Table 2**
"Other" general or specific, actual and potential, causes of food supply disturbance found in the sample (beyond COVID-19, climate change, economic crises, and biodiversity decline).

| |
|---|
| **Societal hazards and conflicts** |
| food access crises (e.g. economic and food price crisis 2007/08) |
| energy crises (e.g. oil price crisis 1973/74) |
| nuclear accidents |
| wars, violent conflict |
| bioterrorism |
| cyber-attacks |
| industrial strike action |
| racial disparities |
| (post) colonialism |
| ideology |
| **Natural hazards and disaster** |
| volcanoes |
| earthquakes |
| tsunamis |
| natural seasons: the "hungry gap" |
| water shortage (not just due to climate change) |
| nonrenewable water sources |
| **Health and biosafety** |
| excess consumption |
| food-related diseases |
| nutrient deficiency |
| intensive agriculture/monoculture |
| zoonotic diseases (other than COVID): |
| • harming farm animals (e.g. foot-and-mouth disease) |
| • harming humans (e.g. MERS, HIV/AIDS, Ebola) |
| **Population and Environment** |
| population growth |
| urbanisation |
| land abandonment, fragmentation, degradation |
| deterioration in rural public services or changes in well-being |
| population aging (weakens labour availability for sustainable agriculture) |
| cultural change |
| **Organization** |
| bureaucracy |
| ideology |
| food waste |
| food losses |
| import/input dependency |
| externalities (e.g. outsourcing of costs on the environment) |
| animal ethics and rights |

because meat processing facilities had ideal conditions for the transmission of the virus (Paparella et al., 2022), and secondly, by the closure of out-of-home eating (Bernabei et al., 2022; Grunert et al., 2021; Hayes et al., 2021; O'Meara et al., 2022); shifting meat processing from hospitality towards grocery sale had a major impact on day-to-day operations after the emergence of COVID-19. However, the feedback loops in place to make this sector "resilient" can be seen as a shallow leverage aimed at returning to an established system without significantly changing its design or intent. Similarly, the repercussions of COVID-19 increased the necessity of food aid (Bernabei et al., 2022), but offering people free food is ultimately a 'sticking plaster' that does not address the systemic root cause of their food insecurity: poverty (Oncini, 2024). Thus, adaptation through positive and negative feedback loops tends to provide swift relief in times of crisis, but appears less apt to achieve, or may even hinder, long-term change.

Another set of rather shallow levers revolves around technological innovations and solutions typically initiated by capital-rich actors to ensure or improve material stocks and flows. To bring commodity stocks in circulation despite the restrictions of the lockdowns, retailers pushed forward pre-existing trends towards online shopping and home deliveries, which was seen as necessary safety measures to contain the spread of the virus. The growth in online sales put pressures on the availability of appropriate packaging materials (Liu et al., 2021). Technological innovations to improve traceability within packaging did improve delivery efficiency and food safety (Bhat, 2021). However, greater use of single trip materials led to an increase in waste (Liu et al., 2021; cited in Borghesi and Morone, 2023). In the interest of public hygiene, Starbucks temporarily suspended the use of personal re-useable cups, rather than single use paper cups, at its stores around the world (Boyacı-Gündüz et al., 2021). While this was an adaptation in reaction to a threat disrupting regular ways of catering, it suggests that short-term measures can be at odds with long-term resilience and sustainability. Indeed, short-term can have priority over long-term measures if they are aligned with protecting existing or investing new capital.

Similarly, the meat sector had to rapidly change manufacturing processes, in particular towards smaller-sized packaging, to accommodate the shift away from catering, due to restaurant closures, and towards grocery sale. Technological adaptations, as these examples show, were fairly successful in achieving short-term supply chain resilience during the crisis, albeit with trade-offs regarding waste and social isolation. Another adaptation is the acceptance or application of lower production standards, both in the context of COVID-19 (Boyacı-Gündüz et al., 2021) and climate change (Hoffmann and Schöpflin, 2022; Vicario et al., 2023). "Relaxing" food quality standards is, of course, detrimental. Just as in the case of increased digitalisation, however, it can also be seen as ambiguous and justifiable if it is done to maintain food supply in times of crises (Perdana et al., 2022; Vicario et al., 2023).

In the context of buffers of the food system, storage of foods was subject to adaptation measures during the pandemic. Some perishable products were processed into storable and higher value-added products, in the expectation that they would sell later, provided that the production process was flexible enough to enable that adaptation (Coopmans et al., 2021).

Finally, there are some parameters in the context of policy measures that aim at resilience. In the context of climate change, several studies addressed the flooding that occurred in New South Wales and Queensland, Australia, in 2011, and which caused disruptions of the food supply. While scholars emphasised the role of both long and short supply chains in providing food during that crisis (Singh-Peterson and Lawrence, 2015; Smith et al., 2016), governance initiatives were biased towards emphasising and building the role of major grocery retailers, at the expense of smaller and informal sectors (Smith and Lawrence, 2018). Another example for inducing change through parameters such as subsidies are the economic recovery stimuli that governments spent in response to COVID-19. These stimuli resonate with scholars noting the opportunity to "build back better" using systems thinking (Agyemang and Kwofie, 2021; Sperling et al., 2022). The stimuli were intended to create co-benefits for the climate and biodiversity. An assessment of the greenness of these stimuli in G20 countries, however, showed that only one third of the stimuli payments were environmentally relevant and a considerable share led to negative environmental contributions, including bailouts of polluting industries (Vivideconomics, 2021). These examples show that, due to power concentrations within established systems, the general will to create change for the common good in face of crises can result in corporatism. What Reisman (2021) refers to as "disaster capitalism" is based on the observation that technologists use crises to propose and receive substantial funding for innovations that have limited capacity to overcome the crises, let alone the pre-existing and exacerbated structural inequalities. Technocentric solutions are initiated by capital-rich actors who shape the crisis response in line with their vested interests and, as in the case of bailouts, may even profit from disaster. In need to protect their existing investments, this either favours measures to recover from supply chain shocks, or, where necessary, ensures technological over social change.

### 4.2. *Deeper leverage*

Whilst the previous subsection showcased adaptations at the surface that generated short-term resilience by largely re-establishing pre-crises

**Table 3**
Quantification of sample studies addressing causes of food system disturbance.

a) **Distribution and overlaps**: the number of articles that address causes of disturbance from at least one or two categories (or more)

| | Covid-19 | Climate change | Econ crises | Biodiv decline | Other |
|---|---|---|---|---|---|
| **Covid-19** | 68 | 20 | 17 | 6 | 42 |
| **Climate change** | 20 | 47 | 15 | 12 | 37 |
| **Econ crises** | 17 | 15 | 25 | 7 | 21 |
| **Biodiv decline** | 6 | 12 | 7 | 13 | 12 |
| **Other** | 42 | 37 | 21 | 12 | 64 |

b) **"Specialised articles"**: the number of articles that address causes of disturbance from only one or two categories

| | Covid-19 | Climate change | Econ crises | Biodiv decline | Other |
|---|---|---|---|---|---|
| **Covid-19** | 21 | 2 | 1 | 0 | 19 |
| **Climate change** | 2 | 6 | 0 | 0 | 10 |
| **Econ crises** | 1 | 0 | 2 | 0 | 0 |
| **Biodiv decline** | 0 | 0 | 0 | 0 | 0 |
| **Other** | 19 | 10 | 0 | 0 | 1 |

c) **"Broadest scope articles"**: articles that address causes of disturbance from three or four categories (and possibly "other" in addition; for examples of "other" causes see Tab. 2)

| | Covid-19 | Climate change | Econ crises | Biodiv decline | other |
|---|---|---|---|---|---|
| **Three causes (+other)** | | | | | |
| Abideen et al., 2021 | x | | x | x | x |
| Bhat (2021) | x | x | | x | |
| Godde et al., 2021 | x | x | x | | x |
| Norberg-Hodge (2020) | | x | x | x | x |
| Oh et al., 2021 | x | x | x | | x |
| Reis et al. (2022) | x | x | x | | x |
| Rotz and Fraser (2015) | | x | x | x | x |
| Sanderson Bellamy et al. (2021) | x | x | x | | x |
| Stoll et al. (2021) | x | x | x | | |
| **Four causes (+other)** | | | | | |
| Agyemang and Kwofie (2021) | x | x | x | x | x |
| Fan et al. (2021) | x | x | x | x | x |
| Merchant and Simon (2023) | x | x | x | x | x |
| Sperling et al. (2022) | x | x | x | x | x |

systems, this subsection involves more impactful alterations of system design, such as the power to add, change or self-organise system structure. This intermediate category thus reflects more significant changes that, however, do not overhaul an existing system in its entirety.

Two abstract but pivotal notions linked to the creation of resilience are flexibility and redundancy in the supply chain. In a situation of crisis, supply chains are inevitably confronted with new information, rules, and structures which all require flexible reactions if production and distribution is to be maintained. Redundancy usually connotes the capacity to dispense with a specific supply chain element without that significantly affecting the wider processes and dynamics of food supply, be that in the context of a firm, sector, or the whole supply chain. A climate-resilient food system 'includes increasing absorbing buffer capacities (resources), reactive flexibility, restorative capacity, disturbance exposure, learning capacity, robustness, redundancy, response diversity, autonomy, and independence, being modular (not over-or under-connected), being able to respond quickly to shocks and changes in the system, and being ready to transform if necessary' (Keesstra et al., 2023, p. 5). In the context of COVID-19, some retailers' behaviour and distribution chains were described as rigid or inelastic, whereas other retailers were flexibly drawing on a variety of suppliers; flexibility was seen as an advantage in the challenge to maintain food supply during the pandemic.

A major theme linked to design adaptations of the system are direct sales. Here, conventional supply chains, from producers, via manufacturers and retailers to consumers, are bypassed. Doing so, however, requires the power to add, change or self-organise system structure. Most commonly, farmers set up direct linkages with consumers, e.g. through farm shops, veg box schemes, and home deliveries. The literature identified contrasts between those supply chain actors having strong local relationships and others:

> 'Locally based systems were advantaged in finding new sales channels and end consumers because of strong personal relationships and trust. In contrast, other systems, due to a lack of skills and relationships, failed to develop such relationships and thus lost customers and revenue. Restaurants responded by implementing or strengthening takeaway and home delivery services. Some tried to offer alternative services, such as at-home meal preparation kits. Among alternative channels, thanks to government subsidies, some players deliver products to food banks.' (Bernabei et al., 2022, p. 10)

In other cases, farmers, fishers, manufacturers and distributors turned to direct marketing and selling to consumers (Blay-Palmer et al., 2021; Nichols et al., 2022; Rivera-Ferre et al., 2021; Stoll et al., 2021; Yoshida and Yagi, 2021; Zollet et al., 2021), often via digital technologies (Blay-Palmer et al., 2021; Borghesi and Morone, 2023; Thilmany et al., 2021):

> 'In response to the effects of the pandemic, alternative sales and delivery methods were explored, such as e-commerce and online delivery. The ability to sell food through online platforms helped small producers in shortening the distance to the final consumer. However, not all small businesses were able to take advantage of this opportunity. They were unprepared, with a risk of further losses in the future. Digital platforms were also useful to aggregate a large number of producers and connect them to new customers. (Bernabei et al., 2022, p. 12)

Nemes et al. (2021) observe that, because of the closure of catering and outdoor markets, alternative and local food systems (ALFS) gained new customers and small producers gained new experiences and developed new skills, such as developing online marketing channels. This overcame a common constraint previously seen on the growth potential of ALFS, namely that they had an inability to scale up. Thus, the pandemic led to these niche players becoming more innovative and more widely accepted. At the same time, regime actors, such as retailers also began to engage with the ALFS sector:

> 'In most countries, the conventional retail sector introduced more local food products to supermarkets, even if only to showcase them instead of selling them in larger quantities. These new trends that favour local food may be the first steps in creating a more sustainable food system, involving incremental innovation and gradual change in the regime (Brunori et al., 2011; Nemes et al., 2021, p. 597)

That even conventional retailers stocked more local foods should be acknowledged as a first step in designing the food system towards more sustainability. However, it is a step that does not change the intent of the system (see 4.3), and in the context of shareholder-owned, private corporations, their intent remains profit maximisation. Similarly, the example of direct sales was an opportunity for smaller, alternative suppliers to self-organise within the system, one which ultimately remains dominated by the intent of conventional supply chains.

### *4.3. Deepest leverage*

The deepest leverage lies in changing the intent of the system – its underlying goals, mindsets or paradigms. The power to transcend those paradigms thus means to impact a system at its deepest roots. Resilience debates touch a range of topics that include alternative paradigms. To be clear, the following examples should not be interpreted as creating a

**Table 4**
Patterns and framings of biodiversity decline.

Biodiversity decline presents itself in the sample as a topic that is sidelined, mentioned typically in combination with other causes of disturbance, if at all, and not analysed empirically. None of the retailer or consumer adaptations in response to disruptions or threats had explicitly to do with biodiversity decline. By contrast, retailer and consumer adaptations were in response to COVID-19, climate change, and economic crises (see Tables 5 and 6). Some references do not address the ways in which biodiversity decline is a threat to resilience, but rather just state that certain adversities lead to biodiversity decline. Other statements, however, do address how biodiversity decline itself leads to adversities and thus negatively impacts resilience.

| Pattern & Framing | Examples |
|---|---|
| ***Adversities → Biodiversity decline*** | |
| Listed along with other causes of disturbance | "Most human activities related to food systems such as consumption, production, processing, and retail will impact the environment through food waste, misuse of agrochemicals, deforestation, soil degradation, depletion of freshwater, **reduction in biodiversity**, and greenhouse gas emissions." (Keesstra et al., 2023, p. 5) |
| Emphasis on how adverse effects of the food system lead to biodiversity decline | 'The loss of biodiversity is real, vast, continuing, and irreversible and the main driver of **the loss of biodiversity** is food systems' (Westling et al., 2019, p. 1162). 'Industrialized forms of protein food production have delinked food production from natural ecological cycles and ecosystems, damaging the climate and **hampering biodiversity**.' (Katz-Rosene et al., 2023, p. 10) |
| Emphasis on how a lack of governance leads to biodiversity decline | 'Poor governance creates market failures, especially for common pool resources such as environmental resources, leaving global issues such as GHG emissions and **loss of biodiversity** to be ineffectively managed.' (Fan et al., 2021, p. 608) |
| Intensive agri-business leads to decrease in ecological diversity | '[…] processes of corporate concentration, farm-scale intensification, mechanization, and the "cost-price squeeze" have led to a **decrease in ecological** and economic **diversity**' (Rotz and Fraser, 2015, p. 459). |
| ***Biodiversity decline → Adversities*** | |
| Intensive agri-business leads to agriculture's vulnerability and lack of resilience | 'When oligopolistic markets and actors exist along the production and supply chain, the chain itself becomes highly vulnerable to perturbation: whether it is weather, price, producer mismanagement, or pestilence. For example, large, tightly packed **monocrop systems** […] are ideal conditions for pest and disease populations to develop.' (Rotz and Fraser, 2015, p. 466) 'Roughly half of US cropland is used for genetically uniform monocultures of corn and soybeans […]. **Biodiversity loss** among domesticated species used in agriculture, and in the general ecosystem, impairs agriculture's resilience and adaptability to climate change and other shocks' (Shannon et al., 2015, p. 154). |
| Intensive agri-business leads to a lack of crop biodiversity and low genetic variety | '[…] the 7000 species of plants used as food crops in the past have been reduced to 150 commercially important crops, with rice, wheat, and maize accounting for 60 % of the global food supply […] approximately 75 % of the world's **agricultural diversity** was **lost** […] **Without** the **genetic variety** that creates resilience, the food system is vulnerable to catastrophic losses from disease and the disruptions of a changing climate' (Norberg-Hodge, 2020, p. 405). 'Current industrial agricultural practices, climate change, and **the decline of ecosystem services** impact agriculture production. In the global agricultural system, genetic diversity is decreasing' (Merchant and Simon, 2023, p. 645). |
| Biodiversity decline leads to soil and land degradation | 'The continued degradation of agricultural land is driven in large part by the scale and practices of industrial agriculture, which **impair the essential ecosystem services** associated with soil (e.g., water and nutrient retention) and undermine farmers' long-term capacity to produce food' (Shannon et al., 2015, p. 154). 'Even with the existing agricultural land, more than 25 % is **severely degraded** due to erosion, soil fertility loss, salinization, and other processes, constituting a grave risk to food security.' (Fan et al., 2021, p. 603 f.) |
| Biodiversity decline leads to vulnerable agriculture and nutrient depletion | 'The **loss of biodiversity** further adds to these impacts by increasing agriculture's vulnerability to pests and local weather extremes and decreasing soil capability to support global food systems. Different species and varieties are also important to ensure a large spectrum of nutrients found in foods, as varieties and species contain different nutrient compositions of essential macro and micronutrients.' (Fan et al., 2021, p. 606) |
| Biodiversity decline impairs ecosystem services: pollination | '**Wild species** that are vital to food and agriculture, including pollinators, soil organisms, and natural enemies of pests, are **rapidly disappearing**' (Fan et al., 2021, p. 604). 'Large-scale land clearing, irrigation, fertilizer, and pesticide application is a **threat to** many **ecosystem services** (e.g., pollination, pest control, and regulation of disease vectors) and a contributor to climate change.' (Merchant and Simon, 2023, p. 646) |

situation in which the food system is currently at the cusp of being overhauled. The intent of the system may be the most effective intervention place, but it is also very difficult to create deep leverage. Thus, the examples given here challenge the system by inclination only, they have an alternative intent, but to change or replace the system, they would have to be upscaled from their current existence as niches.

First, the 'just in time' paradigm was challenged during the pandemic as actors in the supply chain sought to become more flexible with alternative supply sources and distribution networks (Carolan, 2022; Paparella et al., 2022). The alternative paradigm, 'just in case' production, is about anticipating risks and threats, but also behaviour of supply chain actors, creating buffers and safety measures to be prepared for disturbances (Carolan, 2022). However, the increased flexibility and diversity of 'just in case' production comes at a cost to monetary efficiency (Coopmans et al., 2021). It is costly to maintain the ability to vary farming practices, processing methods, and packaging materials to enable supply to be switched quickly across retail, restaurant, and wholesale trade channels (Bernabei et al., 2022; Markandya et al., 2021) and to farmers' markets (Luoni, 2021). Diversification, of markets, customers, and trade channels can require investment that may not be recouped, but diversification towards locally produced inputs can be effective in dealing with transportation and import disruptions; hence, finding the right balance between flexibility and cost will be a future challenge (Bernabei et al., 2022). Moreover, it is noted that at times of crisis, a supply chain comprising only a few large firms, and one that is vertically integrated, can be subject to failure at critical points causing disruptions throughout the system whereas a chain (Thilmany et al., 2021) comprising many small, dispersed firms serving local markets can be more robust (Bernabei et al., 2022; Blay-Palmer et al., 2021; Reis et al., 2022). Decentralisation, supported by digitisation, is a way of increasing resilience (Reisman, 2021; Thilmany et al., 2021). A system which focuses on reliable supply rather than efficiency for profit maximisation clearly has a different intent.

Second, another paradigm shift lies further up the supply chain in agricultural practices. Agro-ecological methods, for example, organically certified (Boyacı-Gündüz et al., 2021), carbon-neutral (Borghesi and Morone, 2023) or regenerative farming practices (Fan et al., 2021) and nature-based solutions (Keesstra et al., 2023) are amongst the recommendations. The avoidance of synthetic fertilisers, pesticides, and other fossil-fuel based inputs reflect a qualitative shift away from the focus on mere quantities. That is, the quality of the soil, harvest, and nutrition overshadows the usual aim of maximising commodity outputs.

**Table 5**
Consumer adaptations in response to disruptions or threats.

| Cause of disruption | Impact of disruptions: drivers of consumer behaviour change | Adaptations and behaviour changes during disruptions | Medium- and long-term possible considerations |
|---|---|---|---|
| COVID as the disruptor | Huge scale impact on millions of consumers globally in the short term, leading to:<br>• Uncertainty and fear<br>• Reduced number of places to buy and consume food<br>• Enforced change to work and school patterns<br>• Price increases for some foods in some areas and at some times<br>• Desire to support local community | • Taking control in the face of uncertainty and fear including 'panic' buying, hoarding, practising physical distancing, reducing number of shopping trips<br>• Increased food consumption in the home<br>• Increased use of online food ordering<br>• Increased use of local shops, local suppliers and farm shops<br>• Increased use of foodbanks, charities, government food schemes and community food sharing | Little evidence (yet) of long-term consumer behavioural changes resulting from the short-term adaptions except perhaps an increased capability to use digital methods of ordering and payment |
| Climate change as the disruptor | Researchers identify the need to change food demand patterns and diets, especially from high meat diets to fruits, vegetables, nuts and seeds, in order to<br>• reduce the agricultural impact per person<br>• provide healthier diets<br>• switch to foods with longer shelf lives<br>However, researchers' views differ if this is yet changing within mainstream consumer consciousness or social norms | • Localised price increases during extreme weather events lead to food insecurity especially for lower-income households<br>• In times of limited food supply, people make trade-offs between avoiding disease and not forgoing calories<br>• There may be a reduction in the variety of foods available, yet consumers have confidence that climate adaptation issues (e.g. lack of availability of certain fruit and vegetables from overseas) would be likely to be overcome by technical solutions, such as heated greenhouses in the UK, for example | Dietary change is key to reducing GHG emissions ( Batlle-Bayer et al., 2021). Most scholars make the need to switch to less animal-based foods an issue of free consumer choice, rather than one that could be engineered from the supply side. Similarly, framings of resilience in the food supply chain mirror stereotypes of market-led supply and consumer-led demand, rather than consider food supply relations outside of market relations and commercialised settings, as well as outside of perspectives that challenge poverty and inequality as social sources of food insecurity that are unsustainable and to be considered in "resilient approaches" |
| Other: Disaster Risk Management approaches in the context of external events | Local food shortages | • Build relationships with farmers<br>• Seek other options for accessing food locally | |
| Other: Economic crisis | Lack of access to organic fresh products at fair prices | • A direct sales organisation set up to link local farmers to local consumers | A particular project in Greece involved a weekly box–basket distribution scheme with fresh, seasonal and often organic fruits and vegetables. |

The economic intent of the system, then, is to meet essential needs at the consumer end rather than serving the financial goals of the rest of the supply chain.

Third, a food system oriented towards future planning in the context of a changing climate should encourage self-sufficiency (Chiffoleau and Dourian, 2020). This can include the use of traditional or indigenous and seasonal foods (O'Keefe et al., 2016), including foraged wild foods (Merchant and Simon, 2023), as an alternative to conventional food provision through globalised market relations. Also linked to self-sufficiency, is prosumption, the abolition of the separation between producers and consumers when people grow their own food. Particularly the COVID-19 crisis has increased public interest in growing food

**Table 6**
Retailers and alternative food supply.

| Form of food provision | Impact of disruptions | Adaptations and actions taken | Positives | Negatives |
|---|---|---|---|---|
| Conventional retail | • Shortages of staple foods<br>• Exposes the rigidities of a 'just in time' supply chain<br>• Higher prices<br>• Storage cost and capacity challenges at higher temperatures | • Reduced choice of foods on shelf<br>• Increased digitisation<br>• Increased direct deliveries<br>• Increased flexibility and range of suppliers, including some more local suppliers<br>• 'just in case' rather than 'just in time'<br>• Acceptance of lower standards<br>• Increased use of single trip packaging | For retailers:<br>• Sales and profit increased due to more at home eating and their being favoured as 'essential' by governments | For retailers:<br>• Supply variability and price increases<br>• Difficulty in getting increase labour for deliveries<br>• Costs of changes to packaging<br>For consumers:<br>• Lower food standards<br>• More packaging waste<br>• Increased demand for food aid |
| Alternative retail e.g. direct to consumer, 'grow your own', community activities | • Increased direct sales from farmers, fishers etc to households and caterers<br>• Expansion of local supply<br>• Increased food supply from other local sources e.g. urban cooperatives, community agriculture, 'grow your own', foraging for traditional foods | • Increased digitisation and customer deliveries<br>• Increased collaboration, knowledge sharing and networking e.g. community gardens<br>• Centralised coordination of supply for best governance, food aid organisation | For the sector:<br>• Shorter supply routes to consumer to reduce environmental impact<br>• Expansion of local supply<br>• Fresher and potentially healthier food<br>• Improvement in conditions for small producers | • Increased workload for farmers and growers |
| Public procurement for food provision | • New initiatives needed to increase this route to feed people | • Increased amounts of food produced for this route | • Wide positive impact on diets<br>• Supports sustainable suppliers | • Little evidence of scale |

(Sanderson Bellamy et al., 2021). Indigenous and traditional foods from all continents are under-recognised, at best valued at local level, but they do not figure in global supply chains. This is not to say that they should be shipped across the globe, but to acknowledge their potential role in achieving more food security, food sovereignty, and thus a 'civil' (Lang et al., 2025) form of resilience.

Fourth, another form of food distribution are institutions that require forms of public engagement and procurement. Policy recommendations in the literature suggest promoting food, agricultural and nutritional education primarily in schools, but also more widely among citizens. Additionally, prioritising local and sustainably produced food in public procurement is advised (schools, hospitals, and other institutions; Zollet et al., 2021). The introduction of low-carbon meals to Barcelona schools is one example (Batlle-Bayer et al., 2021). This approach involves reducing meat consumption from the supply end, rather than solely being a matter of consumer choice (the dominant position how to achieve dietary change; see Table 5). Generally, public procurement is seen as a powerful lever for resilience due to the potential of procuring large amounts of food from sustainable suppliers and having a wider impact on diets through canteens. Food provided through public funds changes the system by excluding the conventional intent of capital accumulation.

## 5. Discussion

This section first discusses how the focus on COVID-19 in the sample reflects a tendency towards shallow supply chain recovery and how that sidelines deep, systemic prevention of long-term threats. A second subsection then outlines how research and policy on resilience could be enriched by drawing on food sovereignty perspectives that shed light on deeply rooted oppression and inequality in the capitalist trade and food regime.

### 5.1. Contradictions of contemporary resilience discourse

COVID-19 has received, by far, the greatest attention in debates on resilience. It should be acknowledged that the pandemic has indeed leveraged important debates on the resilience of food systems. However, this also brings to the fore disparities regarding the salience of COVID-19 compared to the relatively neglected theme of climate change and the entirely marginal mention of biodiversity decline and economic crises, all of which are having severe socio-environmental impacts, particularly on the long run.

We have linked the showcased examples where adaptation measures in response to COVID-19 and the lockdowns predominantly resulted in the recovery of the established supply chain (e.g. through technological innovation and minor adaptations) to the notion of *shallow* leverage towards resilient food systems. From a temporal perspective, a significant volume of the literature reflects emergency mode reactions with a focus on the short term. It is in this context – the ability to absorb shocks – that supply chains have been evaluated as largely resilient. However, the focus on quick responses is shallow in its lack of systemic improvements.

Calls to "build back better" imply resilience through improvement rather than mere recovery. They were an expression of hopes to address root-causes of our multiple and interlinked crises. While present, they were barely touched upon in the adaptation measures discussed. To prevent future pandemics and enhance biosafety on the long run, virologists and epidemiologists, including the Lancet Commission on COVID-19, emphasise that mitigating spillover risks of zoonotic diseases requires humanity to confine, end, or even reverse deforestation, habitat destruction, and the risks from intensive livestock rearing (Bernstein et al., 2022; Sachs et al., 2022; and this was pointed out long before COVID-19, e.g. Aguirre and Tabor, 2008; Fornace et al., 2013; Jones et al., 2013). These preventative forms of resilience would require deep social and economic transformations and are typically out of scope in the literature on supply chains.

Our results match the findings of a recent audit committee on environmental change and food security which was appointed by the House of Commons (2023) in the UK. While the experts acknowledged the functionality of the food resilience industry forum established by the government during COVID-19 to tackle 'immediate issues', they also decried the lack of co-ordination regarding 'long-term food resilience'.

These omissions in governance regarding the need for preventative measures and long-term coordination in response to crises are symptoms of a general lack of systems thinking, or at best watered-down forms thereof (e.g. Doherty et al., 2022 on unambitious government strategies against existing policy advice). The literature in this sample, too, is biased towards shorter-term supply chain recovery and lacks consideration of the depth and pace of changes needed, with some papers being exclusively concerned with the recovery of the meat supply chain during COVID-19, not whether that same recovery may be a barrier to long-term resilience and sustainability due to emissions and zoonotic disease risk from livestock. Evidence for high rates of production of animal-sourced foods being a barrier is strong (FAO, 2006; Willett et al., 2019), but vested interests and misinformation campaigns aim to prevent reductions (Bristow and Fitzgerald, 2011; Morris and Jacquet, 2024).

We observed biodiversity decline to be sidelined, a passing mention, named as one point in long lists of disruptive factors, and nowhere in the sample is it in the centre of the empirical analysis. A possible limitation of our finding would be that perhaps biodiversity decline's adverse effects are being analysed in other strands of literature – in agronomy, biology, and environmental sciences, for example – without being described in contexts of "resilience" or "supply chains". How well ecosystems render services to us may be perceived as too far upstream the supply chain to contextualise behaviour of manufacturers, wholesalers, retailers, and consumers. However, it is exactly the systemic economic and social mechanisms, such as the chase of profit margins and growth for capital accumulation, on one side, and lowest possible food prices (Hirth et al., 2025b) to maximise consumption of non-essential goods, on the other, that grant monocultural intensive agriculture with synthetic fertilisers and pesticides its dominant position. This compromises biodiversity and the ecological preconditions for food production, depleting soils and stunting immune systems (in the sense of concepts such as the OneHealth approach, e.g. Bawa et al., 2021; and planetary boundaries, e.g. Richardson et al., 2023).

Furthermore, shorter supply chains turned out to be a popular adaptation measure among the academics in the sample. Evidence that direct sales from farmers to consumers saw a rise during the COVID-19 lockdowns seems to support that. The adaptations proved smaller producers' general capacity to self-organise and shape the system to some degree, but also raises the question how significant that shift could have been had it been concerted and backed by policy intervention, rather than just emerging from the unfortunate circumstances of the pandemic. Farm shops or fruit and veg boxes may enable those consumers to procure healthier and more sustainable food who can afford the premium price. In this system, however, low-income households cannot access good food as foodbanks lack fresh produce while economic crises raise the cost of living.

Against that background of rising poverty, the popularity of "free" food is all the more plausible. Some scholars promote self-sufficiency through local, seasonal, traditional, and indigenous foods, including non-monetary or non-market provision such as foraging or growing one's own food. However, low-income households are again economically constrained in accessing these spaces and pursuing these practices. Opening 'spaces for materially-grounded, commons-based socio-ecological relations' (Figueroa-Helland et al., 2018, p. 173) and creating food sovereignty, security, and resilience – here applied to a Global North context – would require niche practices that have been in decay for decades, with significant knowledge lost, to be scaled up. That, in turn, would necessitate expansion of accessible (green) space(s), dedicated time (leisure or professional), and serious social and financial

investment (Oncini et al., 2024); a lack of the latter may be due to expectations of financial returns of investment in the private, and austerity in the public, sphere.

### 5.2. Alternative frameworks for resilience research and policy

The evident contradictions in resilience discourse raise the question how to help the existing shoots of deep, systemic interventions to flourish at a scale that is socially and ecologically relevant. Why, however, is the obvious use value of "free" food that we showcase above overshadowed by structural barriers to transformation? Pixová and Plank (2024) show how capitalism's hegemony over urban governance favours land use that entails a higher exchange value, such as real estate development and a corporate food regime, over allotment gardens for self-provision. It is a function of the system itself that deep changes appear as "unattainable". Materially, however, the opposite is true: a system in a state of polycrisis is un-*sustain*-able, whether it ends tragically, in a world of turbulence and chaos, or through concerted and resolute transformation. The latter requires the adoption of alternative frameworks aimed at systemic change.

As opposed to micro-economistic foci on firm or supply chain resilience, the term '*civil food resilience*' (Lang et al., 2025; see also Hirth et al., 2025b) focuses on Human Rights and securing provision for (all) citizens against shocks and stressors. This can only be achieved by shifting power relations and applying leverage aimed at barriers deeply ingrained in both the food and political-economic system. The hegemony of the industrial, productivist food regime (e.g. Ilbery and Bowler, 1998), typically relying on globalised just-in-time production, serves the vested interests of individual and corporate incumbents. In *The Times*, Lang warns that 'stresses and strains are beginning to show up in the [just-in-time supply] model that assumes: one, cheap energy; two, constant availability; three, constant [good] weather; four, no political disruptions. All those assumptions are now wrong' (Clover and Eccles, 2023; see also Lang et al., 2025). That they are now wrong should not be mistaken as a temporary coincidence of unfortunate factors – the system is increasingly vulnerable and constant availability can no longer be taken for granted (Fig. 2). The alternative just-in-case model, that also occurs in the sample (Carolan, 2022), exchanges monetary efficiency for greater resilience, but it is not a systemic turn away from profit motives *per se*. Its potential for change can range from shallow self-preservation applied by (some) businesses to a deep and preventative 'whole of society approach' (Lang et al., 2025, p. 10) focused on civil contingencies and welfare.

The framework of food sovereignty can be helpful to critically inform academic and policy approaches towards civil food resilience and avoid business-as-usual reactions. Food sovereignty inherently politicizes land use against the background of class antagonism by highlighting struggles of landless workers reduced to selling their labour in the interest of capital (Alonso-Fradejas et al., 2015). It links sustainable and resilient food provision to oppressive and unequal structures regarding the ownership of the means of production (Marx and Engels, 1992 [1848]). Regaining civilian sovereignty over growing and consuming food equates to (struggles over) 'the rights to use and manage lands, territories, waters, seeds, livestock and biodiversity' (Alonso-Fradejas et al., 2015, p. 432).

When applying this food sovereignty lens to the review sample's focus on so-called "developed" market societies, valuable lessons can come from East European food systems which differ from "Western" societies in that they tend to depend less on mere *exchange* (i.e. capitalist market relations), but to a higher degree also on *transfer* of foods through gifts and (self)*production*, with a significant share of people relying on land and skills to produce or forage their own foods (Jehlička et al., 2020). In other words: there is a greater degree of sovereignty and resilience due to systemic multiplicity in post-socialist societies; that sovereignty and resilience, however, are at risk from neoliberal (Pixová and Plank, 2024) and (semi)authoritarian (Visser et al., 2015) restructuring. Food sovereignty, as Visser et al. (2015, p. 524) point out, 'is neither irrelevant nor fully absent' in East Europe, but in absence of a "loud" social movement, they read the greater emphasis on self-provisioning relative to merely capitalist consumerism as a form of 'quiet food sovereignty' (drawing on the notion of 'quiet sustainability' by Smith and Jehlička, 2013). While East European models have merit for resilience research in general, the vector of societal development there arguably points away from rather than towards resilience: non-systemic changes in line with a corporate food regime are prioritised, whereas 'radical alternatives includ[ing] public procurement […] and authentic farmers' markets providing short food supply chains', which would 'require more public intervention in relation to public assets, social services, and regulations', are neglected (Pixová and Plank, 2024, p. 1536).

"Quiet" resilience and sustainability are a result of people naturally tending to their needs. Arguably, what is needed in turbulent times is a *vocal*, or at least determined, turn towards systemic changes for food sovereignty and civil food resilience. Well-meaning, but overall toothless, municipal initiatives to grant urban citizens access to public land and grow their own foods exist, e.g. in Manchester, UK,[1] but decades of austerity have not just increased poverty but also eroded public funding. A serious approach to civil food resilience could benefit from semi-professional approaches in which gardeners employed by councils would support citizen prosumers in urban gardening and foraging (Oncini et al., 2024), and climate, biodiversity, and societal targets would benefit from polycultural and woodland-based food systems in rural and peri-urban areas (Hirth et al., 2025a) linked with short supply chains. Where the means of production have been systemically eroded, somebody needs to disseminate land, seeds, tools, and skills that can be made available to the public. However, the political tide needs to turn from austerity, aimed at shallow system recovery, to public ownership. Deep change in that context indeed means a more widespread, internationalist working class struggle to reappropriate sovereignty from the capitalist food regime – working to uphold that with the interest of short-term recovery in mind is anticipated to result in civil unrest (Jones et al., 2023) and unprecedented insecurity regarding food and shelter (Lenton et al., 2023; Ripple et al., 2023). The increasingly explicit intensification of global crisis shows that what is (biophysically) unattainable is to perpetuate a food and economic system that cannot help but exploit human labour and natural resources.

## 6. Conclusion

The review shows a strong salience of COVID-19 in debates on resilience and, in turn, a relative neglect of climate change, biodiversity decline, and economic crises as causes of food supply disturbance. Exhibiting stronger reactivity to short-term shocks, the "shallow" framings of resilience in the aggregated literature in the sample partly make it complicit with the recovery of an unsustainable food system that is not just at risk of becoming dysfunctional but itself a major cause of current socio-environmental crises. This comes at the expense of "deep" changes and adaptations towards long-term resilience and sustainability for which existing systems need to be thoroughly overhauled or replaced. Deep changes may initially be harder to achieve as they face resistance from system incumbents, but with progressing systemic decay they are the only attainable alternative to a world of intensifying insecurity. Future research avenues could explore (1) more specific actor-related and institutional responsibilities to leverage deep transformations, (2) pin down vested interests, disinformation campaigns, and lobbyism in the way of those transformations, (3) indicators for a good balance between short and long supply chains; rural, domestic production and international trade; local, seasonal produce and cosmopolitan nutritious diets; and (4) link resilience discourse more

[1] https://growingmanchester.org/.

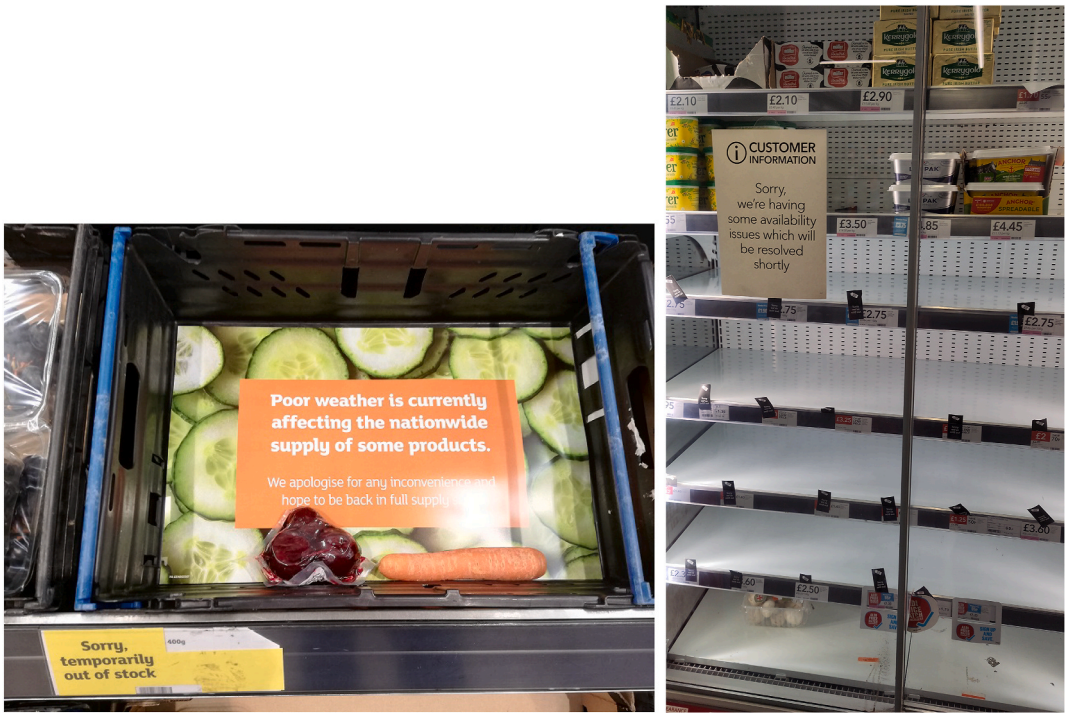


**Fig. 2.** Supply chain disturbances in big British retailers in vegetable (picture taken March 25, 2023) and cold chains (May 14, 2025). Images: courtesy of the main author.

strongly to social and activist movements in the genuine interest of civil wellbeing and Human Rights, i.e. approaches to achieve societal resilience and sustainability through civil sovereignty over food systems and the means of production. Taking a food system resilience perspective, how supply chains typically operate today may have proven resilient to short-term shocks, but they are far from responsive to longer-term threats. Academic foci, policy ambitions, and the supply chain practices seem to avoid deep systemic transformations, but it is precisely these which are needed to lift the typical set of existing best practices and ambitious ideas out of the margins and turn the tide towards civil food resilience and sovereignty based on societal and planetary health.

## CRediT authorship contribution statement

**Steffen Hirth:** Writing – review & editing, Writing – original draft, Visualization, Validation, Methodology, Investigation, Formal analysis, Data curation, Conceptualization. **Elizabeth Morgan:** Writing – review & editing, Writing – original draft, Visualization, Validation, Methodology, Investigation, Formal analysis, Data curation, Conceptualization. **Romain Crastes dit Sourd:** Writing – review & editing, Validation, Supervision, Software, Data curation, Funding acquisition. **Gülbanu Kaptan:** Writing – review & editing, Validation, Supervision, Funding acquisition. **Anne Tallontire:** Writing – review & editing, Validation, Supervision, Project administration, Funding acquisition. **William Young:** Writing – review & editing, Validation, Supervision, Resources, Project administration, Funding acquisition.

## Funding sources

This work was supported by the 'Transforming UK food systems' programme which funds the H3 project (www.h3.ac.uk) on which the authors work [BB/V004719/1].

Box 1: Resilience concepts and definitions

The only constant in life is change. The saying, attributed to Greek philosopher Heraclitus, condemns us, for better or worse, to react to changes if we are to persist. Who, however, is the "we" that seeks resilience to shocks? To aptly define and make effective use of the concept of resilience, two aspects need scrutiny: the scope of actors involved and the boundaries of the system.

Firstly, the contexts in which "resilience" is being used, including actors, scales, and geographies, can differ substantially. Some scholars, for example, take a micro-economic focus and define resilience as 'the ability of a firm to be alert to, adapt to, and quickly respond to the changes brought by a supply chain disruption' (Ali et al., 2021a, p. 95). The FAO focuses on 'restoring and improving livelihood systems in the face of threats that impact agriculture, nutrition, food security and food safety' (FAO, 2023). To adopt a food systems approach, we widen the scope of resilience to include the relationships between key supply chain actors such as farmers, manufacturers, distributors, retailers, and consumers (e.g. Peterson et al., 2023, pp. 1–2).

Secondly, definitions that confine resilience to the restoration of a previous state of a system insufficiently address not just the need, but also the barriers to, transforming it. We agree with Rotz and Fraser (2015, p. 460) that food supply chain resilience, defined as the ability 'to address stresses and disturbances while providing stable levels of consistent nutrition to the public', should not 'exclude attention to power, politics, and normative goals of resilience'. Thus, we align with those authors who understand resilience not just as an absorption of a shock by a taken-for-granted system, but as a critical, adaptive process that overhauls the system and transforms it into a state that is desirable in the long run (e.g. Nichols et al., 2022; Sperling et al., 2022; Steenwerth et al., 2014; Tendall et al., 2015; Zollet et al., 2021). It is thus through a long-term perspective that resilience to shocks is entangled with sustainability (Tendall et al., 2015).

## Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

## Acknowledgments

We are grateful to the reviewers for their helpful comments. This

work was conducted as part of the H3 project (www.h3.ac.uk) funded by the UKRI's 'Transforming UK food systems' programme [BB/V004719/1].

## Data availability

No data was used for the research described in the article.

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