Ruminant livestock and climate change: UK livestock sector discourses and practices

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A thesis submitted to the University of Gloucestershire in accordance with the requirements for the degree of PhD in Geography in the School of Education and Science

A research project co-funded by the ESRC and Defra.

February 2025

Word count: 75,920

Abstract

Within the context of highly publicised calls to reduce UK meat production and consumption, there is a need to investigate livestock farmer discourses and social practices. This PhD investigates how the UK livestock sector was responding to public debates about methane emissions from ruminant livestock in the early 2020s, identifying discourses of climate delay that were underpinned by livestock farming ontology, epistemology, and identity. The research methods incorporate critical discourse analysis of news media, qualitative interviews with livestock farmers and other livestock sector stakeholders, and a participatory Photovoice project. The PhD develops existing theory by combining concepts pertaining to ontology, epistemology, and identity, to show how these interact with "methane discourses". Findings show strong themes of climate delay and a livestock sector-specific form of climate scepticism. However, practices with side effects of reducing methane (such as efficiency gains) and sequestering carbon (such as regenerative agriculture) were often embraced, and did not trouble sectoral norms around the position of livestock in the UK's food system. This illustrates how farm-level discourses interacted with broader societal discourses around climate change, and may have promoted lock-in to existing practices. The research also identifies how methane discourses calcify boundaries between livestock farmers and non-farmers, and livestock farmers and policymakers, linking this with increasing polarisation in broader society. Contestation around methane emissions from ruminant livestock echoes comparable controversies around topics such as non-point pollution of waterways and approaches to dealing with bovine tuberculosis, with some new features. The PhD identifies a role for improved communication strategies and delivery of processes that facilitate connection between diverse groups: to reduce perceived polarisation and advance societal action on climate change.

Author's declaration

I declare that the work in this thesis was carried out in accordance with the regulations of the University of Gloucestershire and is original except where indicated by specific reference in the text. No part of the thesis has been submitted as part of any other academic award. The thesis has not been presented to any other education institution in the United Kingdom or overseas.

Any views expressed in the thesis are those of the author and in no way represent those of the University.

Signed … Date …….

DOI: 10.46289/OCXE2966

Acknowledgements

I've heard that choosing the right PhD is mostly about choosing the right supervisor, and I have been extremely lucky to have chosen two. Damian Maye and Julie Ingram have been supportive every step of the way, from my choosing to accept the offer through to the hectic final weeks of writing this thesis. They have always provided encouragement and positivity, and I've been extremely grateful to have them on my team.

The majority of this research would not have been possible without my participants, who very kindly shared their time and insights with a relative stranger. I am particularly grateful to the livestock farmers who took time out of their busy schedules to meet me, and in many cases show me round their farms. Knowing the pressure that the farming community has been feeling in relation to climate change, this was sometimes a very brave and vulnerable thing to do. I'm also extremely grateful to my acquaintances in the farming community who participated in informal interviews while I was still figuring out the difference between silage and slurry.

I'd also like to thank the rest of my colleagues at the CCRI, who have been so generous with their time and knowledge. In particular, thanks to Matt Reed for being a supportive line manager, to Aimee Morse for being a dream teammate, and to Carol Markey, Chris Rayfield, and Chris Jones for helping me through the practical and financial aspects of completing a PhD. Thanks also to ESRC and Defra for co-funding this PhD and giving me the opportunity to research such a fascinating topic.

I'm very grateful to my family and friends for listening to me ramble about sustainable agriculture, and not asking "So when do you finish?" too many times. Thank you to James Cresswell for encouraging me during the early phases of the PhD. Thanks to Natasha Simmonds for helping me cope with the unexpected twists and turns of life over the past few years, despite being on the other side of the world. Thank you to Michael Pirrie for being endlessly enthusiastic about my research topic, my academic capabilities, and my ability to recover from setbacks. This project has required me to navigate self-doubt, anxiety, and perfectionism, and to deeply examine my own motivations, biases, and identity. Therefore, finally, inspired by the advice of Dr Briana Barner, I would like to thank myself for continuing to show up and do the work.

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Chapter 1- Introduction

1.1 Introduction

One of the more contested areas within popular climate discourse is around ruminant livestock, the methane they emit as a side effect of their digestive processes, and the climate impacts of these emissions (Sanford et al., 2021). There is increasing evidence that animal agriculture is a major contributor to climate change and biodiversity loss globally (Gerber et al., 2013; Tilman et al., 2017; Willett et al., 2019), and ruminant enteric fermentation and manure management account for approximately one third of anthropogenic methane emissions (Saunois et al. 2020). However, addressing these emissions surfaces complex debates spanning land use, human diet and health, and the role of the state (Simmonds and Vallgårda 2021). These debates have profound implications for the people whose livelihoods are based on rearing ruminant livestock (Rieger et al., 2023a), and for our collective ability to mitigate climate change.

A greenhouse gas is a gas that, when present in the earth's atmosphere, produces a warming effect on climate (Lashof & Ahuja, 1990). See Table 1.1 for a breakdown of the different gases emitted by the agriculture sector. There have been high profile calls from global and national institutions, such as the UN's Intergovernmental Panel on Climate Change (IPCC) and the UK's Committee on Climate Change (CCC), for action to address emissions from agriculture (Climate Change Committee, 2019; Shukla, Skea, Buendia, et al., 2019). Meanwhile, an oft-cited (though contested) statistic is that 14.5% of global man-made emissions arise from livestock specifically (Gerber et al., 2013). This thesis is mainly focused on methane emissions from enteric fermentation and slurry management (Table 1.1)

Table 1.1: Description of greenhouse gases emitted by the agriculture sector (Greenhouse Gas Protocol, 2024; N. Ward, 2023)

Gas	Main agricultural sources	GWP 100
Methane (CH_4)	Enteric fermentation, slurry management	27.0
Carbon dioxide (CO_2)	Burning of fossil fuels by agricultural machinery, land use change	1
Nitrous oxide (N_2O)	Artificial fertiliser not taken up by crops	273

A ruminant is an animal whose digestive tract has evolved to digest the cellulose found in plant cell walls (Moss et al., 2000). They have a large first stomach called the rumen, which contains bacteria that break down cellulose (N. Ward, 2023). The by-product of this process is methane (CH_4), which is excreted through belching and, to a lesser extent, flatulence (Moss et al., 2000). There have been significant efforts to determine mitigation options for ruminant agriculture (Moran et al., 2012; Röös et al., 2017; Willett et al., 2019), with an increase in research on the reduction of enteric methane emissions since 2005 (Evangelista et al., 2024). This is a complex problem, given that mitigation efforts must also be assessed for their impact on biodiversity, eutrophication, animal welfare and public health (Moran et al., 2012).

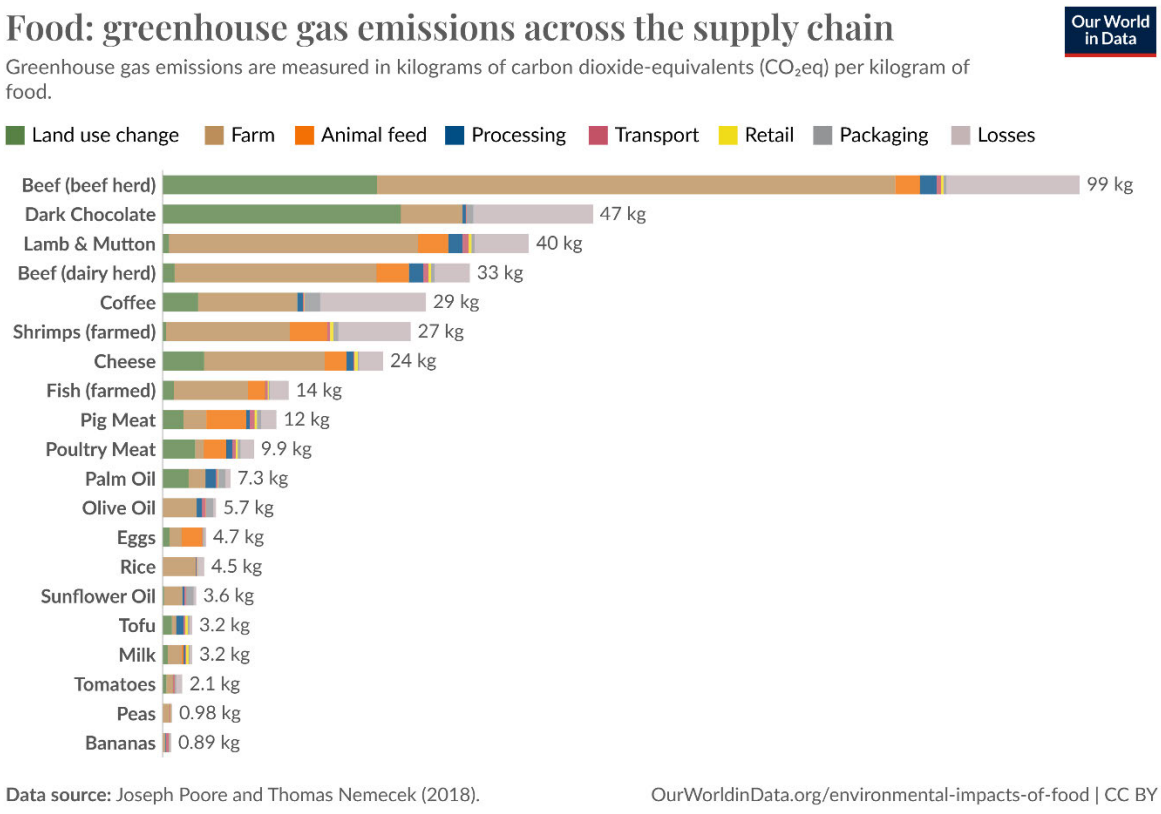


Figure 1.1: Emissions from different food types along their supply chains (Our World in Data, 2025)

Methane emissions from ruminant livestock are obviously connected with consumption of red meat. An often-shared visualisation of the climate impacts of different types of food along the supply chain is illustrated in Figure 1.1, showing that beef and lamb have high emissions per kilo of product, and that the majority of those emissions occur within the farm gate. Globally, meat consumption continues to rise; with low- and middle-income countries seeing increasing consumption as they develop (Hansen and Jakobsen 2020). In high-income countries such as the UK, red meat consumption has been decreasing yet remains higher than global averages (Stewart et al. 2021). The late 2010s and early 2020s saw numerous high profile reports calling for reductions in meat production and consumption; and particularly red meat consumption in high-income 'Western' countries including the UK and the USA (Shukla et al. 2019; Willett et al. 2019; Climate Change Committee 2020a). Meanwhile, these messages were often contested at the national level by domestic livestock industries (Lazarus et al. 2021; Larsson and Vik 2023).

In the UK, the agriculture sector contributes 10% of total GHG emissions (DESNZ, 2025): of which more than 70% can be attributed to ruminant enteric fermentation and manure

management (DESNZ, 2025, page 120). As an industrialised country, it is logical that the UK's agriculture sector will contribute a lower proportion of GHG emissions than the global average. Overall, UK agricultural emissions are declining (partly due to a reduction in cattle numbers), but at a slower rate than other sectors like energy and transport (DESNZ, 2025). Compared to global average figures for 2022, the UK was producing beef, milk, and cereals more efficiently, and sheep meat less efficiently (FAO, 2024). The UK Government has a legislative duty to achieve net zero by 2050 (The Climate Change Act 2008 (2050 Target Amendment) Order 2019, 2019), and the National Farmers' Union has set a target for the agriculture sector to achieve net zero by 2040 (NFU, 2019).

Despite this apparent alignment, I will show in this thesis that there have been high levels of disagreement between the livestock farming community and those advocating ruminant methane mitigation solutions (Simmonds & Vallgårda, 2021). What I will call "methane debates" echo previous contestations between the livestock sector and government, for example on diffuse water pollution (Blackstock et al., 2010; Inman et al., 2018) and bovine tuberculosis (Maye & Chan, 2020; Naylor et al., 2017). They therefore illuminate broader governance questions, and raise new issues around ethics and fair approaches to greenhouse gas mitigation (Reay, 2020a; Simmonds & Vallgårda, 2021).

1.2 Aims and objectives

In this thesis, I will focus on the ruminant livestock sector, referred to as "the livestock sector" for brevity. As I will show in this thesis, livestock farmer voices are often omitted from mainstream public discourse around methane emissions from ruminant livestock, therefore my research is focused mainly on this group. However, the ruminant livestock sector includes a range of actors such as vets, farm advisory services, processors, retailers, industry bodies, and policymakers, who are also included in this research.

Given the complexity of methane debates, there is a need for more social science research to better analyse and interpret the situation. The primary aim of this thesis is to explore how the UK ruminant livestock sector was responding to problematisation of ruminant livestock regarding climate change in the early 2020s. This includes how stakeholders understood interactions between livestock and climate, and which "solutions" were being proposed and implemented (predominantly by livestock farmers).

The specific objectives are as follows:

1. To analyse discourses around farmed ruminants and climate change as presented in UK news media at the national and livestock sector levels.

2. To explore how UK ruminant livestock farming sector stakeholders (predominantly farmers, including e.g. supply chain actors and policymakers) understand and experience their (and their animals') relationship to climate change.

3. To identify how these understandings are operationalised- in terms of what "solutions" are being proposed and implemented at the farm level, and how these correspond with different discourses about ruminant livestock and climate change.

4. To identify opportunities and principles that could inform future policymaking in this arena.

This PhD is an ESRC collaborative studentship co-funded by Defra, which has allowed for periodic feedback and validation with policy colleagues.

1.3 Overview of thesis

In this chapter, I have begun with a broad overview of the relationship between ruminant livestock and climate change, and set out the research objectives for this PhD.

In Chapter 2, I will present a thematic literature review to situate this thesis within existing evidence, particularly social science scholarship.

In Chapter 3, I will present the conceptual framework for this thesis, showing how it centres on discourse and combines concepts pertaining to ontology, epistemology, and identity. I will also explore theory that helps to draw connections between the farm and the wider food system, as well as societal discourses around climate change.

Chapter 4 will detail the methodological approach for this research. I will show how the chosen methods (media analysis, qualitative interviews, and Photovoice) align with the underlying conceptual framework.

In Chapter 5, I will present the findings from the media analysis, showing how the issue of ruminant livestock and climate change has increased in salience, and comparing national with farming sector media.

Chapter 6 will share findings from the interviews and Photovoice data pertaining to farming ontology, epistemology, and identity. In this chapter, I will identify the importance of livestock to ontologies of the farm, and use the concept of "boundary-making" to better understand UK livestock farmer discourses.

In Chapter 7, I will set out major livestock sector "methane discourses" based on my data. I will link these to the findings presented around ontology, epistemology, and identity, and I will show that these discourses often work to discourage changes in practice. However, I will also show that many farmers are trialling new approaches, and believe their work to be supporting climate change mitigation.

Chapter 8 is a discussion of the findings presented in the thesis, identifying connections between the different research phases, and showing how the findings are situated within existing literature and where new knowledge has been created.

Chapter 9 presents the conclusions of the thesis and suggestions for future research.

Chapter 2- Literature Review

2.1 Introduction

In this chapter, I will thematically review existing literature to contextualise the thesis and identify research gaps. I will first go into greater detail about the research context and "problem" this PhD is concerned with. I will also explore the concept of problematisation, including related concepts such as responsibilisation. Following this, I will present three major themes in the existing literature on ruminant livestock and climate change: 1) Consumer-focused 2) Producer-focused 3) Systems-focused. These each include different conceptualisations of the problem to be solved, different responsible actors, and different proposed solutions. Throughout the chapter, I will highlight areas where this thesis may contribute to gaps in the existing literature.

The literature reviewed was identified through academic database searches and following up citations in key academic papers. It encompasses primarily peer-reviewed academic papers, with some textbooks and grey literature where relevant peer-reviewed sources could not be identified. Literature from the UK and other high-income industrialised countries with a high level of meat consumption was prioritised, while literature focused solely on the impact of climate change on ruminants was not reviewed. The included literature comprises a range of disciplinary perspectives, including agri-food studies, social sciences, and natural sciences.

Through analysing the existing literature, I identify a need for greater engagement with the livestock sector when exploring the issue of ruminant livestock and climate change. In particular, there is a need to analyse farming sector news media and compare this with national news media, and a gap exists in terms of exploring this issue through livestock farmer discourses. In a situation where scientific "truth" is often contested, qualitative approaches are necessary to explore livestock sector understandings of methane emissions from ruminant livestock, and how these understandings influence farming practices.

2.2 Context

In the introductory chapter, I began to describe the relationship between ruminant livestock and climate change; considering the impact of the former on the latter. I will now continue by setting the scene for this research within a specific geography and time, and highlighting some key areas of contestation and scientific uncertainty, before introducing key concepts including problematisation, responsibilisation, and discourse.

2.2.1 Long-term trends in global and UK agriculture

This research is based in the UK, specifically England and Wales. The rationale for this is discussed further in Chapter 4. For brevity, I will often use the term "UK" during the thesis. In this chapter, many of the trends described can be generalised to the UK more broadly.

In the period since the end of the Second World War, there has been a trend towards increased productivity in UK agriculture, as well as increasing specialisation within the agriculture sector (Burton, 2004). This was partly driven by the Green Revolution, a global movement towards greater scientific involvement in agronomy which normalised the application of artificial fertilisers, the use of genetically improved seed varieties, and increased vertical integration of agriculture by large agri-food corporations (N. Ward, 2023). Furthermore, the EU's Common Agricultural Policy (CAP) was established from 1962 and used price support mechanisms to increase production, including headage payments based on livestock numbers and area-based payments which rewarded larger landowners. These measures led to unintended consequences such as overproduction and environmental harm (Dobbs & Pretty, 2008; Rude, 2008). The UK adopted the CAP when it joined the EU in 1973.

Meanwhile, from a consumer perspective, the mid- to late-20th century saw increased normalisation of supermarkets, wider variety and availability of food, and the normalisation of ultra-processed foods (UPFs) (Swinburn et al., 2011). The UK has historically maintained policy arrangements that keep food cheap relative to housing, with low- to middle- income households worse off on average than their counterparts in comparable European countries (Janan & Pittaway, 2025). The costs of maintaining low food prices are typically passed back down the value chain to farmers (Howard, 2016).

For farmers in the UK, these various changes were associated with the development of a productivist approach to farming, in which increasing yields defined a "Good Farmer" (Burton, 2004). Farmers also saw changes such as rural depopulation, promoted in part by mechanisation and the amalgamation of smaller farms (N. Ward, 2023). From the 1980s onward, agri-environmental schemes (AES) were introduced, which paid farmers for practices that protect nature (Dobbs & Pretty, 2008). More recently, Brexit has resulted in financial challenges for UK farmers, particularly those who export products, while withdrawal from the CAP has meant the phase-out of the Basic Payment Scheme (BPS), which comprised a significant contribution to farm income for beef and sheep farmers

working in less favoured areas (Defra, 2018). Each of the four UK nations has designed its own replacement scheme. England has begun to implement its Environmental Land Management Scheme (ELMS), which includes the Sustainable Farming Incentive (SFI) to promote practices that improve soil health, increase biodiversity, and reduce inputs such as pesticides, among other goals (Defra, 2025a). In Wales, the analogous scheme is the Sustainable Farming Scheme, due to be implemented in 2026 (Welsh Government, 2024). The early 2020s saw widespread uncertainty about the new schemes, with the farming community concerned that the payments would be inadequate to replace the support they received through the CAP (Swales, 2022). In 2023, the UK agricultural workforce was approximately 462,000 people, and the sector contributed approximately 0.6% to national Gross Value Added (Defra, 2024a).

As illustrated in this section, UK farmers have seen major changes within living memory, and now face increasing problematisation of their craft and an unpredictable future. In the next section I will provide further context around the climate implications of methane emissions from ruminant livestock.

2.2.2 Understanding methane's GWP

One source of contention within this arena relates to different metrics for portraying the global warming potential of methane compared to CO_2. In short, the IPCC's approach to calculating global warming potential (GWP) defines non-fossil methane as 27 times more potent than CO_2 (Greenhouse Gas Protocol, 2024). However, an alternative metric known as GWP* has been proposed, which accounts for the fact that methane is shorter-lived in the Earth's atmosphere (Allen et al., 2018b). So, methane is more potent in the short term, but will degrade within a few decades, while CO_2 remains in the Earth's atmosphere for hundreds of years (Lynch et al., 2020). Thus, in a situation not characterised by significant and rising anthropogenic CO_2 emissions, a steady herd of grazing ruminants would not lead to significant warming.

However, Lynch and colleagues (2020) argue that we are currently in a situation in which rapid decarbonisation will be necessary to limit warming to less than 1.5 degrees Celsius. Therefore, a rapid reduction in methane emissions would allow slightly more time to decarbonise sectors like energy and transport. Or, conversely, maintaining or increasing methane emissions would necessitate an even more rapid decarbonisation strategy. Ideally,

reductions in all forms of GHG emissions will be necessary to achieve international climate targets (Lynch et al., 2020).

There has been significant contestation around the merits of GWP100 vs GWP*, with the latter receiving high levels of support from livestock farmers and farming industry representatives. This reflects the way that actors who will be governed by metrics become actively and strategically engaged in seeking to shape them (Cusworth et al., 2023).

2.2.3 Carbon sequestration in grassland

Another key debate is around the relative mitigation potential of extensive versus intensive livestock production systems- typically in relation to beef or dairy production. Extensive systems refer to ruminants grazing on pasture for the majority of their lives- this can lead to more methane production as they digest fibrous plants (Garnett, 2010). Meanwhile, intensive systems often involve animals spending the majority of their lives indoors, where a proportion of their diet comes from high energy, highly digestible feed such as grains and soy. Soy feed is often imported from places like Latin America, where it may be grown on land that previously supported rainforest (N. Ward, 2023). This approach to feeding reduces methane emissions from ruminants' digestive processes, and often means they are ready for slaughter earlier, therefore intensively reared animals tend to produce lower emissions per kilogram of product (Garnett, 2010; Ogino et al., 2016). Meanwhile, there is mixed evidence regarding animal welfare and animal health consequences from keeping cattle closely confined indoors (Moran et al., 2012).

Given that extensively reared livestock tend to take longer to finish and use more land, it has been argued that these systems are inefficient (Garnett et al., 2017). However, they may in some cases help to sequester carbon in soils via increasing soil organic matter (Amelung et al., 2020). It is important to note that simply maintaining grasslands does not lead to a perpetual carbon sink (Smith, 2014). Changing management from arable cropping to pasture can lead to significant and rapid increases in soil carbon sequestration, but only to the point where soil carbon reaches an equilibrium (Jordon et al., 2024; Smith, 2014). There are also sociocultural barriers to uptake of carbon farming best practices (Amundson & Biardeau, 2018). Although farming industry bodies are vocal about the role of permanent grassland in carbon sequestration (NFU, 2019), and improved grazing management can deliver a range of benefits, the carbon mitigation potential of grass-fed livestock is often overstated outside peer-reviewed literature (Jordon et al., 2024).

Overall, our understanding of the nuanced relationship between ruminant livestock and climate change remains incomplete. Complexity is further compounded by the non-GHG environmental impacts of existing production systems (Tilman et al., 2017), ethical issues concerning the use of animals (Moran et al., 2012), and human health concerns linked to high meat consumption and intensive production- such as noncommunicable diseases and antimicrobial resistance (Bouvard et al., 2015; Giubilini et al., 2017). I will now show how different ways of understanding and theorising this problem result in different responsible actors and different proposed solutions.

2.2.4 Different scholarly perspectives on "the problem"

In the above sections, I have sought to outline both the scale and complexity of the relationship between ruminant livestock and climate change- as well as contextualising this global issue within a UK setting. In this section, I will discuss aspects of problematisation and responsibilisation as these concepts relate to the research subject.

Problematisation, a term developed by Michel Foucault, involves examining how issues come to be recognised as problems in society, and how these problems are framed and understood. For example, Joseph Gusfield has written about how alcohol came to be defined as a "social problem" in the USA (Gusfield, 1996). More recently, Isabelle Stengers has written about problematisation in relation to climate change and ecological collapse. She argues that instead of simply analysing or criticising the past, we should focus on how today's issues demand new ways of thinking and acting (Stengers, 2019). Rather than apocalyptic thinking and the resulting paralysis, she advocates that, faced with life in the ruins of capitalism, we must experiment with new ways of thinking and relating to the world. This requires us, as researchers, to allow ourselves to be affected and transformed by what is happening, rather than theorising "at arms' length" (Stengers, 2019).

A related concept is that of "responsibilisation", which refers to the way different actors are made responsible for certain issues. For example, individual carbon footprinting places responsibility on individual citizens and may ignore structural inequities (Fuller, 2017), promotion of reusable coffee cups places responsibility on the consumer for addressing plastic waste (Maye et al., 2019), and the efforts to "geoengineer" cows that emit less methane responsibilises both the cows themselves and the farmers who work with them (Ormond, 2020). Ormond argues that by focusing on reducing relative emissions, corporations are pushing responsibility down their supply chains onto individual farms;

framing this approach as a win-win for farmers (more efficiency means bigger profits), governments (no need to introduce unpopular regulation), and consumers (no need to change our diets) (Ormond, 2020).

A key way that issues are problematised is through discourse. This concept is explored in greater detail in the next chapter, but can be broadly described as a statement or story that is power-laden and persuasive (Bischoping & Gazso, 2016). For example, the ideological standpoints of broadsheet newspapers influences the stories they tell about climate change, both in terms of what the relevant facts are, and who has the authority to define these facts (Carvalho, 2007). Discourse is also related to "framing", which can be defined as repetitively presenting information in a certain way, meaning that certain other ways of understanding a situation may be sidelined or silenced (Lockie 2006; Naylor et al. 2017). From a policy perspective, frames can be considered *"a way of selecting, organizing, interpreting, and making sense of a complex reality to provide guideposts for knowing, analyzing, persuading, and acting"* (Rein and Schön, 1993, p. 146). When disagreement occurs within a frame, there are agreed rules and guideposts for reaching consensus. When disagreements occur between actors operating within different policy frames, there are few guidelines for reaching consensus – Rein and Schön call this a "policy controversy" (Rein & Schön, 1993). This relates to Latour's concept of "matters of fact" vs "matters of concern"- the latter implying debates that are messy and plural (Latour, 2004).

Further to the above, there are also different "levels" of political conflict. While there might be agreement about the nature of a problem, action also requires agreement on what solutions are appropriate, and then how these should be implemented (Baumgartner, 1989). Different ways of problematising an issue are often associated with responsibilisation of different actors, and different proposed solutions (Maye et al., 2019).

I argue that "the problem" of methane emissions from ruminant livestock is not stable or benign, and thus requires qualitative and participatory approaches to understand its creation and potential consequences. Participatory methodologies can be broadly defined as those that involve research participants in the research process beyond simply as sources of data, therefore giving the research a "bottom up" quality (Cornwall & Jewkes, 1995). Another way to summarise these approaches is doing research "with" rather than "on" participants (Vaughn & Jacquez, 2020). Cornwall and Jewkes (1995) argued that when comparing conventional and participatory approaches, "the difference between modes of research may be more one of degree than of kind" (p.1668), as the extent of participation may vary at

different points in the research process (Catalani & Minkler, 2010) . Benefits of participatory research include it being both informed by and relevant to real world contexts, and the elicitation of results that can be more effectively translated into non-academic settings (Vaughn & Jacquez, 2020). So, I argue that not only do we need qualitative research to understand the meanings that methane emissions from ruminant livestock hold for those involved, but that directly involving participants in the research process will likely increase the relevance and potential utility of the results.

In the remainder of this chapter, I will set out three different themes in the problematisation of methane emissions from ruminant livestock, showing their associated solutions and responsible actors.

2.3 Different ways of problematising ruminant livestock and climate change

I will now move to discuss key themes pertaining to methane emissions from ruminant livestock which provide different explanations of the "problem", promote different solutions, and construct different visions of the future (see Table 2.1).

The three broad themes I will discuss here are: 1) Consumer-focused, 2) Producer-focused, and 3) Systems-focused. These necessarily contain some areas of overlap, but aim to provide a logical structure within which to consider this complex topic. The three themes follow firstly from Garnett's (2014) three perspectives on sustainable food security, but develop these in the specific context of ruminant livestock and the consideration of more current proposed solutions such as cultured meat and regenerative agriculture. I also incorporate McGregor and Houston's (2018) four propositions for human-cattle relations in the Anthropocene- the *"geological epoch in which humanity is positioned as the core driver of planetary change"* (page 3). McGregor and Houston draw on the work of Latour, defining propositions as neither true nor false, but rather building on *"messy interactions to articulate different possibilities for thinking and action"* (Blok and Jensen, 2011, page 83). Propositions, then, are a little like frames and discourses, although they are more explicitly oriented towards the future and rooted in an Actor-Network Theory approach, in that they emphasise relations between things (McGregor & Houston, 2018). Finally, I also draw on Jaisli and Brunori's (2024) three pathways for considering the future of livestock in a sustainable food system: the efficiency pathway, the consistency pathway, and the sufficiency pathway.

Table 2.1: Three themes pertaining to problematisation of methane emissions from ruminant livestock

Theme	Consumer-focused	Producer-focused	Systems-focused
Relevant concepts	Demand restraint (Garnett, 2014), Sufficiency (Jaisli & Brunori, 2024), Sustainable diets, Behaviour change, Veganism, Alternative proteins.	Efficiency (Garnett, 2014; Jaisli & Brunori, 2024), Technoscience, Regenerative agriculture.	Food systems transformation (Garnett, 2014), Consistency (Jaisli & Brunori, 2024), Agroecology, Food sovereignty, Lock-in, Political economy.
Problem definition	People consume too much meat.	Farmers do not produce livestock efficiently enough.	Food system power imbalances make unsustainable production and consumption practices the norm.
Actors responsible for change	Individual consumers, some attention to policymakers and corporations	Ruminant livestock, livestock farmers.	Governments and large corporations.
Examples of proposed solutions	Regulation and taxation, choice architecture, market-driven expansion of APs.	Methane-inhibiting feed additives, genetics, reducing animal lifespan, wearable methane-capture devices.	Radical changes to the structure of the food system.

2.3.1 The consumer-focused theme

This first theme is inspired by Garnett's "demand restraint" perspective, which tends to focus on consumers, and sees inflexible natural barriers to economic growth (Garnett, 2014). The paradox of feeding human-edible plants to livestock is often highlighted as a major inefficiency in the current system, and proposed solutions tend to focus on reducing demand for GHG-intensive foods (such as meat and dairy products) while increasing demand for plant-derived foods. This is related to the sufficiency strategy which aims to *"de-animalise agriculture"* (Jaisli and Brunori, 2024, page 4), as described by scholars specifically exploring the role of ruminant livestock in future sustainable food systems. The concept of "sustainable diets" is also highly relevant, incorporating a focus on the planetary impact of different food as well as their nutritional value (Mason & Lang, 2017).

High profile publications focused on reducing demand for animal products have included the EAT/Lancet commission's global reference diet, which sought to incorporate both sustainability and human health (Willett et al., 2019). In the UK, the CCC's 6th Carbon Budget called for a 20% reduction in consumption of high-carbon meat and dairy products by 2030 (Climate Change Committee, 2020b). Recent years have also seen increased concern among the public regarding the environmental impacts of animal agriculture (Bryant and Sanctorum 2021).

The consumer-focused frame generates solutions that vary from information provision via product labelling (Gadema & Oglethorpe, 2011), to more controversial policies such as meat taxes (Springmann et al., 2016). It therefore often generates arguments around the acceptability of government intervention into citizens' food choices (Simmonds & Vallgårda, 2021). Another associated field is the science of behaviour change, known for the concept of "nudging" to elicit desired behaviours (The Behavioural Insights Team, 2023). An associated solution is "choice architecture", in which food retail and hospitality environments may be altered to make sustainable choices more convenient and desirable (Ensaff, 2021; Thorndike et al., 2012).

2.3.1.1 Media interpretations

The consumer-focused theme tends to be preferred by the news media, which often highlights individual consumer choices as the locus of concern (Kristiansen et al., 2020). Some evidence has emerged that UK national newspapers may be contributing to a process of "de-meatification". This concept has been proposed to understand possible reduction or levelling-off of meat consumption in high income Western countries (Morris, 2018)- as opposed to the

rapid "meatification" taking place in some emerging economies (Hansen & Jakobsen, 2020). In national newspaper articles covering the "Meat Free Monday" campaign, Morris (2018) found overall more positive articles than negative (38% vs. 33%), suggesting that "less meat initiatives" are more likely to be encouraged than not.

However, there is an extensive body of scholarship within Critical Animal Studies (CAS) that has drawn on Marxist and Gramscian theory to critique the "cultural hegemony of meat" (Fitzgerald & Taylor, 2014). This hegemony has been theorised as the "animal-industrial complex", defined as *"a partly opaque and multiple set of networks and relationships between the corporate…sector, governments, and public and private science. With economic, social, and affective dimensions it encompasses an extensive range of practices, techniques, images, identities and markets"* (Twine, 2012, page 23). This framework and others have been used to explore how discourses generated by media, such as advertisements and news articles, normalise and reinforce the superiority of humans and the commodification of (certain) animals to consumer audiences (Cole, 2016; Fitzgerald & Taylor, 2014; Khazaal & Almiron, 2016). For example, Cole (2016) has highlighted how euphemisms such as "meat" and "beef" serve to distance muscle tissue from the living animal that it once belonged to. Linguistic devices such as this can alleviate the anxiety associated with eating animal products (Sexton, 2018). The erasure of animal suffering in advertisements and everyday language also links to earlier ecofeminist scholarship, such as the work of Adams exploring animals as the "absent referent" (Adams, 2015). There is a need to better understand how discourses specifically pertaining to ruminant livestock and climate change may differ from these conventional media narratives.

2.3.1.2 Veganism

One of McGregor and Houston's propositions- "Veganism benefits humans, cattle and planet"- also deals explicitly with these philosophical and ethical concerns around animal agriculture (McGregor & Houston, 2018). The authors highlight that veganism has been around since before animal agriculture was identified as a major sustainability concern, thus environmental issues are "tagged on" to a pre-existing assemblage of animal rights actors. Media analysis has identified a backlash to animal rights activism from the farming sector in the 1990s, therefore there is a history of antagonism between livestock farming and vegan communities (Reisner, 1992). This proposition presents issues for workers within existing livestock systems, but also offers a vision of more diverse future human-cattle relations such as rewilding and animal sanctuaries (McGregor & Houston, 2018).

The term "veganism" refers to a *"…way of living which seeks to exclude- as far as is possible and practicable- all forms of exploitation of, and cruelty to, animals for food, clothing or any other purpose…"* (The Vegan Society, n.d.). A key concept for some vegans is "speciesism", which refers to the socially constructed hierarchy between species. This not only places humans in the dominant position, but also views certain animals as more deserving of care and respect than others (Fitzgerald & Taylor, 2014). The vegan movement has also been articulated as a form of boycott linked to broader anti-capitalist goals (Dickstein et al., 2020). However, vegans can have a variety of motivations: some may prioritise anthropocentric concerns such as a "shallow" ecology focused on the continuation of human civilisation via avoidance of environmental disaster (Heywood, 2003), or personal health concerns based on evidence that links (for example) red meat consumption with certain cancers (Bouvard et al., 2015). The avoidance of animal products may also be connected to religious practice, in traditions that predate the concept of "veganism" by centuries (B. Evans, 2012). "Vegans" are therefore a heterogeneous group, and like any large movement there are differing views on food system challenges and what an ideal future looks like. Meanwhile, parts of the vegan movement have received critique for failing to foreground human exploitation within the food system (Polish, 2016; Quach & O'Donohue, 2024), and concerns have been raised about the movement's co-optation by corporations intent on maximising profits by producing hyperpalatable vegan versions of Western dietary staples (Buckley, 2018; Clay et al., 2020).

2.3.1.3 Alternative proteins

Alternative proteins (APs) represent a consumer-focused approach, yet they also have implications for producers. APs include cultured meat, plant-based meat alternatives, and insect protein (Mylan et al., 2023). In this section, I will focus primarily on cultured meat, as it is the solution that seeks to replicate hegemonic Western food preferences most faithfully (Sexton, 2018). It is also one of McGregor and Houston's four propositions for cattle methane reduction, identified as "Artificial meat can replace cattle and their environmental impacts" (McGregor & Houston, 2018).

Shortly before the start of this PhD research, cultured chicken meat had gone on sale for the first time, having received regulatory approval in Singapore (Carrington, 2020). In 2024, the UK approved the use of cultivated meat in pet food, and the Food Standards Agency began a project to develop a safety assessment process for assessing cultured meat products for human consumption (Carrington, 2024). This technology is often hailed as a solution to the GHG emissions of the livestock sector, yet uncertainty remains as to whether scaled up

bioreactors will indeed emit less carbon overall. Burton (2019) has explored cultured meat through the lens of historical agricultural substitutions, such as synthetic vanillin replacing "natural" vanilla. He concludes that although there has been a rapid increase in the number of AP start-ups and investment, the impact any future products will have on conventional animal agriculture is highly unpredictable; with possible outcomes including a bifurcated market in which cultured meat supplies the majority while meat from livestock becomes a premium product (Burton, 2019).

Meanwhile, Sexton has explored how the AP sector must actively construct their products as "food" through material and discursive mechanisms in order to render them acceptable to consumers (Sexton, 2018). She draws on a Foucauldian biopolitical lens to explore how AP producers create "good" and "bad" foods and thus "good" and "bad" consumers. In light of heightened awareness about food-borne pathogens (of perhaps greater significance since the Covid-19 pandemic), the rebranding of cultured meat as "clean meat" implies a moral dimension to the products. It speaks to them being both materially clean (free from pathogens) and ethically clean (free from slaughter) (Sexton, 2018). Thus, conventional animal foods become "matter out of place" (P. M. Douglas, 2002), and consumers who continue to choose them are unclean, inhumane, or even cruel.

Sexton has also employed the theoretical concept of "promissory narratives" to show how the AP sector has generated stories around what they *will* achieve once they have sufficient consumer demand and capital investment (Sexton et al., 2019). These narratives construct a specific vision of the future and diagnose problems with current forms of animal agriculture-while presenting cultured meat as the logical solution. In turn, the conventional livestock sector resists these via counter-narratives that can be organised into three major themes: "not a serious threat", "not real food", and "not legally defined" (Sexton et al., 2019). Meanwhile, multinational meat companies such as Tyson and Cargill have begun adding APs to their portfolio, suggesting that any "division" between conventional and cellular agriculture is not quite so clear cut.

Many have expressed concern at the apparent monopoly of cultured meat by tech companies, venture capitalists, and corporations (Sexton, 2018). In an online article supportive of cultured meat, US scholars have argued that we need *"the political vision and energy to liberate this technology from the grips of corporate stakeholders, and to use it for the radical project of improving the human and animal condition around the world"* (Dutkiewicz &

Rosenberg, 2021). However, McGregor and Houston question the ethical claims associated with *"these new non-sentient forms of bovine life"*, arguing that *"cultured meat attempts to take the animality out of animals to better realise the techno-capitalist dream of meat machines"* (McGregor and Houston, 2018, page 12). Despite offering a similarly growth-oriented techno-utopian solution to the "super low carbon cow" (Ormond, 2020)- as well as being wary of disrupting Western consumption norms (Sexton, 2018)- the AP sector presents a vision of a future in which plentiful meat does not mean plentiful livestock.

To summarise, the consumer-focused frame includes a range of approaches, from somewhat depoliticised technical fixes targeting consumer behaviour, to solutions rooted in pre-existing ethical systems such as veganism, and the potential rise of APs such as cultured meat.

2.3.2 The producer-focused theme

This frame is concerned with the "production side" of the food system, and includes two somewhat paradoxical approaches. The first draws on Garnett's "efficiency" perspective, also described as such by Jaisli and Brunori (2024), and implies a focus on technological solutions with the goal of achieving a higher standard of living for all- but with a lower carbon footprint (Garnett, 2014). Garnett argues that this is the dominant, or hegemonic, perspective. McGregor and Houston identify this as *"the most well-funded and organised proposition"*, naming it: *"Science and technology can produce more efficient cattle"* (McGregor & Houston, 2018). The second producer-focused approach I will discuss here is regenerative agriculture, which somewhat aligns with the proposition *"Caring consumption benefits people, cattle, and the planet"* (McGregor & Houston, 2018), but is more commonly associated with specific agricultural practices and narratives about the role of large ruminants in ecosystems (Cusworth et al., 2022). These two approaches are broadly analogous to "land sparing" vs "land sharing" debates in agriculture more broadly (Fischer et al., 2014). It can be problematic to present these as a binary, and some have argued for a combination of approaches to achieve sustainability goals (Dimbleby, 2021).

2.3.2.1 Efficiency and technoscientific solutions

As discussed, the producer-focused theme tends to focus on scientific approaches. Many of these align with the concept of sustainable intensification, which can be defined as *"a process or system where agricultural yields are increased without adverse environmental impact and without the conversion of additional non-agricultural land"* (Pretty and Bharucha, 2014, page 1). An important caveat to this is the concept of Jevons' Paradox,

which posits that efficiency gains tend to increase overall consumption (Alcott, 2005; Sorrell, 2009). In relation to methane emissions from ruminant livestock, scholars have suggested that increased agricultural efficiency is likely to cause rebound effects unless accompanied by demand reduction policies to limit meat consumption (Alcott, 2005; Hayek & Miller, 2021).

One approach to support technoscientific solutions is the use of carbon accounting tools to calculate farms' carbon footprints. These seek to provide an overview of all sources of emissions, as well as calculating carbon sequestration. Farming is one of the few sectors with the potential to absorb carbon as well as to emit greenhouse gases, therefore for a particular farm it may be possible for carbon sequestration to meet or exceed its overall emissions, depending on management practices. Carbon accounting tools are faced with the same issues with soil carbon measurement described earlier in this chapter, and they require rigid boundaries to be drawn to provide reliable results, as well as appropriate use of emission factors (Adewale et al., 2018; Whittaker et al., 2013). Carbon accounting is also related to soil carbon markets, which again face challenges around definitively measuring the climate mitigation potential of soil (Ingram et al., 2025).

Turning more specifically to ruminants themselves, there are a range of proposed solutions to reduce the methane emissions resulting from their digestive processes. I will outline a few here without claiming to provide an exhaustive list. Regarding pasture-fed ruminants, researchers have found modest reduction in methane emissions via the inclusion of different forage species such as white clover (Buddle et al., 2011). More recent research has found benefits from the use of different plant species in silage mixes (Weiby et al., 2024), and even the use of essential oils has been investigated (with underwhelming results) (Benchaar & Hassanat, 2025). Turning to methane-reducing feed additives, various options have been explored (Prathap et al., 2021), and one compound was approved by the European Food Safety Authority in 2022: 3-Nitrooxypropanol, or 3-NOP, marketed as Bovaer and now available in the UK. A review has shown that this offers a mean methane reduction of 30% (Yu et al., 2021). Meanwhile, researchers have shown methane reductions using red seaweed as a feed additive (Roque et al., 2021)- although it remains to be seen whether this approach can be scaled up. At the other end of the digestive tract, manure management strategies such as direct slurry application to fields using "trailing shoe" tankers and covering slurry stores can help reduce emissions of both methane and nitrous oxide (Cheng et al., 2022).

Vaccination of animals against rumen methanogens is another route of enquiry, as is defaunation- the removal of protozoa from the rumen (Buddle et al., 2011; Hook et al., 2010). Meanwhile, genetic selection has been practiced by humans for thousands of years (Rothschild, 2020), and researchers have explored ways to select for reduced methane emissions among cattle without impacting animal productivity (Donoghue et al., 2016). Gene editing using clustered regularly interspaced short palindromic repeats (CRISPR) methods has also been proposed as a way to advance breeding of ruminants with reduced methane emissions (Giddings et al., 2020), and there have been suggestions that this technology may be more accessible in the UK following departure from the EU (Stokstad, 2021). While CRISPR is typically geared towards climate adaptation of plants and animals, there has been widespread concern about its potential impacts on biodiversity and human health (Policante & Borg, 2023). Generally, methane reduction approaches are favoured when they also have positive impacts on animals' productivity (Congio et al., 2021).

2.3.2.2 Critiques of the efficiency perspective

Ormond (2020) argues that through implementing different mechanisms to create the "super low carbon cow", corporations are dominating the conversation about how we solve climate change; pushing a narrative focused on incremental technocratic fixes rather than the large-scale social change necessary. Ormond argues that the focus on technological solutions positions cows as "low carbon meat machines" that serve their "human masters" (Ormond, 2020). This view of animals as "living machines" (Hribal, 2007) is aligned with a worldview in which nature (including non-human animals) is understood as a pool of resources to be extracted (Mignolo, 2011).

Ormond (2020) suggests that technoscientific solutions are fallacious, in that they are aimed entirely at reducing the *relative* GHG emissions per beef burger or pint of milk, rather than reducing the absolute GHG emissions of the sector. As demand for meat and dairy continues to rise globally, relative emission reductions are unlikely to have a significant impact on climate change. These concerns are echoed by McGregor et al (2021), who use a Foucauldian biopolitical approach to explore technical solutions to cattle methane emissions. They argue that: *"Rather than mitigating emissions, production-oriented cattle methane research has assisted the expansion of cattle emissions by promising an immanent solution that is never realised"* (McGregor *et al.*, 2021, page 1). Ormond's (2020) paper also adds to the literature on climate responsibilisation, showing that by placing the onus for climate change mitigation on farmers and livestock, corporations can govern from afar.

In relation to public health, Kath Weston has proposed that comprehensive monitoring of animal bodies creates a kind of "virtual hygiene", in which the traceability of animal bodies is marketed as *"…more integral to health and safety than any kind of care that creatures themselves receive"* (Weston, 2017). She describes this as a form of "techno-intimacy", arguing that it tends to reduce focus on the conditions to which animal bodies are subjected: implying an ontology in which animal bodies are inanimate products. "Virtual hygiene" is also relevant to surveillance technologies aimed at reducing GHG emissions. Weston asks: *"When small farmers kit out their cattle with novelties like solar headsets, or burp scanners and gas backpacks to minimize the methane emissions that contribute to climate change, will they use this gear in ways that differ from farms that operate on an industrial scale…?"* (Weston, 2017). She therefore troubles the stereotypes of small farms being more "caring" (Cusworth, 2023), and suggests that these types of solutions may end up focusing entirely on proxy indicators of "quality" such as low emissions, while factors such as welfare fade into the background. These critiques are valuable in the context of an economic system that values efficiency over human and animal lives in the pursuit of perpetual growth.

2.3.2.3 Regenerative agriculture

Regenerative agriculture is somewhat aligned with McGregor and Houston's second proposition- *"Caring consumption benefits people, cattle, and the planet"* (McGregor & Houston, 2018) This proposition *"opposes the disconnect that has emerged between producers and consumers through industrialisation and intensification and promotes more intimate and caring connections between farmers, cattle, landscapes and consumers (…) Caring translates in practice to eating products from grass-fed organic farms and avoiding feedlots. The assembly proposes that the worlds created through grass-fed cattle industries are more humane, sustainable and desirable for the actors involved"* (McGregor and Houston, 2018, page 9). Given the prominence of consumers in this proposition, one could consider regenerative agriculture as straddling the boundary between consumer- and producer-focused themes. However, given its foregrounding of agricultural perspectives and practices in the UK, I consider regenerative agriculture more relevant to the producer-focused theme. .

Regenerative agriculture is an umbrella term for a range of practices that seek to enhance biodiversity and improve soil health (Newton et al., 2020). In the UK, five commonly accepted principles are:

1. Don't disturb the soil

2. Keep the soil surface covered
3. Keep living roots in the soil
4. Grow a diverse range of crops
5. Bring grazing animals back to the land (J. Cherry, n.d.)

Grazing practices usually involve frequently moving livestock and allowing grass long recovery times, known variously as "holistic grazing", "cell grazing", and "mob grazing". Through adopting practices that increase soil organic matter, regenerative agriculture practitioners have found that their land is better able to absorb rainwater (thus reducing flooding), and better able to cope with drought (Giller et al., 2021). According to Gosnell and colleagues, *"…climate change mitigation and adaptation are incidental to a larger enterprise that employs a systems approach to managing landscapes and communities"* (Gosnell et al., 2019). Farmers may also see wellbeing benefits from the adoption of regenerative management (Brown et al., 2022), and their divergence from conventional agricultural norms may provide psychological benefits as they create new social groups around regenerative farming (Berger & Heath, 2008).

Regenerative agriculture has gained popularity in recent years, including within farming networks (Groundswell Agriculture Ltd, 2025), academic literature (Giller et al., 2021), and via popular documentaries such as 2020's "Kiss the Ground" (Tickell & Tickell, 2020). This popularity relates to the debates mentioned earlier in this chapter regarding soil carbon sequestration and the potential for the movement to significantly mitigate climate change. However, given the lack of consensus on a definition (unlike organic farming), regenerative agriculture is at risk of becoming a buzz word ripe for corporate greenwashing (Giller et al., 2021). It has been critiqued from an agronomic perspective for promoting exaggerated claims (Giller et al., 2021); as well as from a decolonial perspective, as North American ranching is seen as prioritising domesticated species (that can generate financial returns) over conserving the indigenous buffalo that are often cited by practitioners of regenerative agriculture (Dutkiewicz & Rosenburg, 2021; Romero-Briones et al., 2020). Scholars have argued that regenerative practices do not radically alter existing food system paradigms (Bless et al., 2023), despite their resistance of farming sector norms. One of these norms is the position of humans as a "hyper keystone species", charged with managing complex natural processes via ruminant livestock management to deliver multiple positive outcomes (Cusworth et al., 2022).

The "caring consumption" proposition mentioned above connects with extensive social science research on the subject of "care"- understood as *"the necessary ongoing work of maintenance and repair of the world so that we can live in it as well as possible"*(Krzywoszynska, 2019, page 664; Tronto, 1998). The increasing attention to soil health in regenerative agriculture has been considered alongside pre-existing literature on caring for more-than-humans (Krzywoszynska, 2024). This draws on a relational ethics approach, in which "attentiveness" is a key tool for expanding ethics into more-than-human worlds (Krzywoszynska, 2019). However, the idea that interaction with nonhumans necessarily leads to ethical regard for them has been challenged (Pitt, 2018), while others have argued that care at the local scale may ignore violence that takes place beyond the farm gate, partly due to the particularity of care (if I care for one thing I exclude others), but also because remote violence is less legible to our senses (Cusworth, 2023).

In this section, I have discussed different approaches relating to the producer-focused theme, which places responsibility on livestock and farmers for mitigating climate change. The efficiency approach is more relevant to intensive farming systems, and is more compatible with mainstream agricultural knowledge systems (Ingram, 2018), as well as being favoured by policymakers. Meanwhile, regenerative agriculture is more relevant for extensive grazing systems, and associated with farmer-led events and knowledge networks. While the main goal of the latter is not climate change mitigation, this is often advocated as a benefit. Both these approaches require changes in farming practices, and prior research has found that transitioning to regenerative agriculture can require profound shifts in worldview and farming philosophy (Gosnell et al., 2019). Scientific approaches impose particular behaviours, and it is essential to understand the real-world reception of technoscientific solutions. There is therefore an important role for participatory approaches that seek to understand farming discourses and practices (discussed further in the next chapter).

2.3.3 The systems-focused theme

This frame is inspired by Garnett's food systems transformation perspective, for which increased sustainability is an outcome of greater equity between food system actors (Garnett, 2014). The focus is therefore on power relations across the food system. More generally, food systems transformation is a popular term that implies fundamental shifts in existing structures, with goals including equitable food security and access to healthy and sustainable food for all (J. Von Braun et al., 2021). Considering the future role of livestock in food

systems, Jaisli and Brunori (2024) propose a classification analogous to Garnett's (2014), which they call "consistency". They suggest this involves "alignment of resource flows with natural process [sic]" (Jaisli and Brunori, 2024, page 4), and the classification is therefore aligned with concepts such as circular economy (Kirchherr et al., 2017). They also include practical considerations such as reducing livestock feed components that compete with human-edible crop production (Schader et al., 2015). Fundamental changes in the food system will require radical "paradigm shifts", which include harmonising healthy diets with sustainable food production, increasing rural-urban linkages, and moving from linear to circular agri-food supply chains (Ruben et al., 2021a).

Zooming in on agriculture, another relevant term is "agricultural transition". This refers to the process of change within agricultural systems, encompassing shifts in practices, structures, and socio-economic frameworks to adapt to new challenges or opportunities. Transitions are often nonlinear and contested, reflecting trade-offs between environmental conservation, economic growth, and rural livelihoods (Marsden, 2013). They may have various drivers, including climate change and sustainability concerns (Ingram, 2018). In essence, agricultural transition highlights the ongoing evolution of agricultural systems in response to complex, multi-scalar pressures; underscoring the need for adaptive, inclusive, and context-specific strategies (Darnhofer, 2014b; van der Ploeg, 2021).

As the systems-focused theme tends towards theory rather than practice, many of its components are discussed in greater depth in Chapter 2. At this stage, I will discuss the agroecology movement as a key example of a systems-focused approach, then briefly mention some of the relevant concepts that will be detailed in the next chapter.

2.3.3.1 Agroecology

Historically and presently, "agroecology" is used interchangeably to mean a scientific discipline, a type of agricultural practice, and a movement against industrial agriculture (Wezel et al., 2009). It therefore straddles the three themes in this literature review, and I am choosing to discuss it here because of the latter definition. Globally, agroecology is associated with social movements, particularly the so-called "peasants' movement" in Latin America, predominantly lead by the collective La Via Campesina. This movement advocates small, family run farms integrating crops, trees and livestock, with a focus on regenerating soil health and minimal "external inputs" (such as pesticides and fertilisers) (Rosset & Martínez-Torres, 2012). Furthermore, in agroecology there is a strong focus on the political concept of food sovereignty: another somewhat ambiguous term that has been defined in

different ways through the years (Patel, 2009). La Via Campesina offers the following definition:

"Food Sovereignty is about systemic change – about human beings having direct, democratic control over the most important elements of their society – how we feed and nourish ourselves, how we use and maintain the land, water and other resources around us for the benefit of current and future generations, and how we interact with other groups, peoples and cultures." (European Coordination Via Campesina, 2018)

There is therefore a strong social justice foundation to agroecology; one that envisions a future in which humans are more integrated with nature (Garnett, 2014). However, despite the movement's radical anti-capitalist roots, agroecological methods are increasingly co-opted by "institutions of the corporate food regime" (Holt-Giménez & Altieri, 2013) as depoliticised tools that can sit alongside Green Revolution technologies such as genetically modified organisms. For example, scholars have analysed how a UK policy document conceptualises agroecology as another "tool in the toolbox" within an overarching paradigm of sustainable intensification (Ajates Gonzalez et al., 2018). This is an example of discursive power (Sievert et al., 2020) being used to assimilate radical ideas into a dominant paradigm. During this research project, it was necessary to pay attention to which "type" of agroecology was being referred to when discussing the future of UK livestock farming, and whether this fitted within a radical paradigm or was being conceived as an apolitical technical fix. Meanwhile, the valorisation of family farms *"in all their conservative glory"* (Campbell, 2020) associated with movements such as agroecology can be problematic, particularly in obscuring gendered power relations. Feminist scholarship has explored how patriarchal structures create distress for farming women and men (Price, 2010); I will discuss this literature further in Chapter 2.

2.3.3.2 Concepts pertaining to the systems-focused theme

Several concepts detailed in the next chapter are relevant to the systems-focused theme. The political economy tradition in the social sciences seeks to unveil hidden power dynamics and liberate oppressed groups (Prasad, 2017). Scholars inspired by this have followed products "beyond the farm gate" to show their interaction with global supply chains, thus connecting on-farm practices with broader power systems (Cook, 2006). Meanwhile, sociotechnical transitions theory provides the concept of "lock-in", which describes how technologies may become normalised via sociocultural (Burton & Farstad, 2020) and structural arrangements. For example, in findings aligned with previous literature, Farstad et al (2020) suggests that

formal organisations in the agricultural sector have an interest in livestock production continuing to follow a "productivist/modernisation pathway" (Darnhofer, 2014a; Farstad et al., 2020). In the next chapter, I will also discuss discursive power; defined as the power to influence the norms and values that guide behaviour (Sievert et al., 2020). This informs my conceptual framework, and is foundational to Critical Discourse Analysis, one of the methodologies I use in this thesis.

2.4 Research gaps addressed by this PhD

As this chapter has shown, there are a range of different research strands that inform current understandings of methane emissions from ruminant livestock. From a social science perspective, there has been limited empirical engagement with livestock farmer perspectives on, and understandings of, this topic. Producer-focused research tends to be technoscientific and focused on reducing relative emissions, or on understanding specific practices such as regenerative agriculture, in which climate change mitigation is addressed via soil carbon sequestration. Livestock farmer discourses on methane emissions from ruminant livestock have so far been relatively unexamined (RQ 2). Furthermore, a gap exists in terms of investigating differences between national and livestock sector news media in their presentation of issues around methane emissions from ruminant livestock (Kristiansen et al., 2020; Morris, 2018) (RQ1). There has also been limited use of participatory approaches to better involve farmers and other livestock sector stakeholders in understanding the problematisation of methane emissions from ruminant livestock, as well as what solutions are implied (RQ 2 and 3). These conclusions echo more general calls to better engage agricultural actors in discussions around the future role of livestock in sustainable food systems (Morris et al., 2021). In a situation where scientific "truth" is often contested, qualitative and participatory approaches are essential to analyse meaning and better understand livestock sector discourses and practices. This work is necessary to better inform practitioners and policymakers seeking to understand and address the complexities of food system transformation (RQ 4).

2.5 Chapter summary

In this chapter I have explored the complex problems presented by GHG emissions from ruminant livestock on a planet inhabited by billions of humans with a growing appetite for

meat. I began the literature review by providing an overview of the UK agricultural context, and some of the contested areas of debate pertaining to methane emissions from ruminant livestock. I also discussed the concept of problematisation. I then set out three broad, overlapping themes that describe different ways this research area can be understood: showing how they problematise the issue differently, assign responsibility to different actors, and generate different solutions. The consumer-focused and producer-focused themes provide important context, and illustrate some of the potential solutions that livestock farmers may have heard about, encountered, or implemented. Meanwhile, the systems-focused theme provides concepts that can help to connect agri-food issues with broader social processes, and to identify overlooked instances of oppression and inequity.

In the next chapter, I will present the conceptual framework for this thesis, and explore some of the concepts introduced above in greater detail.

Chapter 3- Conceptual Framework

3.1 Introduction

In this chapter I will discuss major relevant concepts and develop a conceptual framework for the methodological approach and empirical work of this PhD. As illustrated in the previous chapters, the impact of methane emissions from ruminant livestock on climate change is at the centre of several interconnected and highly contested debates, and viewed as problematic by various authoritative bodies at national and international scales, as well as those with an ethical interest in reducing demand for animal products. The literature review identified three key themes on relation to ruminant livestock and climate change: consumer-focused, producer-focused, and systems-focused, with the latter of these incorporating several concepts that will be discussed in this chapter. This PhD aims to explore how the UK ruminant livestock sector (and particularly livestock farmers) is responding to problematisation of ruminant livestock regarding climate change. This includes how stakeholders understand interactions between livestock and climate, and which "solutions" are being proposed and implemented at farm level. To do this, I will draw on a range of theoretical concepts.

The chapter begins with an overview of the conceptual framework, drawing on the interconnections between discourse, farming identities, farming ontologies, and epistemology to understand methane discourses. I argue that the interconnection of ruminant livestock farming and climate change is highly contested, taking place within the context of power imbalances within the agri-food system, and wider societal debates about how we should respond to climate change. To fully understand livestock farmer discourses and strategies on methane emissions from ruminant livestock, the thesis considers theoretical approaches to farmer behaviour, how the farm interacts with the broader supply chain, and broader trends in how society talks about climate change and climate action.

In the second section, I discuss different approaches to understanding livestock farmer behaviour. Over time, this has moved from more individualistic approaches to those that account for symbolic meanings, social norms, and the way that the state and other actors influence the range of options (Burton, 2004; Shove, 2010). From this literature I focus on the concept of the Good Farmer identity (Burton et al., 2020), and discuss how gender identities may also influence farming practice. I then introduce a "political ontology" approach to

conceptualising the farm (Campbell, 2020), and expand on the concept of firm and permeable boundaries via the concept of boundary-making (R. Jones, 2008).

In the third section, I discuss approaches that situate the farm within the context of the broader agri-food system. I focus mainly on political economy, particularly its utility for unveiling power concentration within food systems. I also discuss the Multi-Level Perspective from sociotechnical transitions literature (Geels, 2010), illustrating how the concept of lock-in may prove useful, and briefly sketch some tenets of Actor-Network Theory and its association with feminist literature on care (Puig de la Bellacasa, 2010).

In the final section, I explore concepts that situate livestock farmer discourses within broader societal discourses around climate change and climate action. I begin by defining and discussing discursive power, then introduce tools for analysing discourse, focusing on Critical Discourse Analysis (Fairclough, 1992). In the following subsection, I discuss trends towards "response scepticism" as an evolution of outright climate change scepticism (Lamb et al., 2020), and how modernistic discourses can prevail in climate policymaking. I then draw on the field of political epistemology to discuss the visibility of sustainable farming approaches, and different forms of polarisation and how these might relate to livestock farmers (Carolan, 2006; Judge et al., 2023). Finally, I discuss the just transition concept, showing how this is becoming more prevalent in agri-food and how procedural justice in particular is becoming a greater focus for society in general, yet may not always be extended to the livestock farming community (Reay, 2020a). In drawing these together, the chapter provides a novel conceptualisation of ruminant livestock and climate change, unearthing previously unexplored but essential connections between farming ontologies, epistemology, farming identities, and livestock farming discourses and other social practices.

3.2 Conceptual framework

This thesis foregrounds discourse throughout. I argue that discourse is a viable route to understanding complex, value-laden "matters of concern" (Latour, 2004) with inherent power imbalances (Sievert et al., 2020). This is because a discourse is a type of story: and stories have world-making effects (Chaplain, 2024; Cheah, 2012; Short, 2012). Discourses therefore both shape, and are shaped by, ontology. Considering discursive power helps to analyse how actors seek to influence norms around ruminant livestock and climate change (Sievert et al., 2020). Through the methodology (Chapter 4), I will highlight interactions between national level media discourses, livestock sector discourses, and how these discourses constitute and

can interact with social practices. I refer to livestock sector "methane discourses" because they are triggered by methane debates, even when they are focused on other GHGs, for example on carbon sequestration.

Given the world-making impacts of discourse, I draw inspiration from Campbell's (2020) "political ontology" of the farm, which incorporates political economy ways of thinking as well as perspectives from Actor Network Theory (ANT) and postcolonial theory. I will discuss and develop Campbell's theory in this chapter, with a primary takeaway being the idea of "ontological boundaries". I expand on this by drawing on the field of "boundary studies" within geography, which provides a lens for analysing how discourses might become manifest in the material world (D. Newman & Paasi, 1998).

Considering the farm level, I argue that farming ontologies form a nexus with farming epistemologies and farming identities. First, considering epistemology, I suggest that ways of knowing interact with ways of being, and vice versa. I draw on literature that illustrates misalignment between scientific and lay knowledge (Wynne, 1996), as well as work by Carolan (2006) which theorises how "epistemic distance" influences perceptions of conventional and sustainable agriculture. I also consider the formation of polarised groups, particularly in the context of increasing perceived polarisation within society more generally (Judge et al., 2023).

Turning to identity, I argue that this is formed in part through social practice (Burton, 2004), and also interacts with ways of being and ways of knowing. I utilise the Good Farmer identity as a key concept (Burton et al., 2020), and seek to expand this to understand livestock farmers specifically, within the context of climate crisis. I therefore theorise the Good Farmer via farming ontologies and epistemologies, showing how the three shape, and are shaped by, discourse.

Moving beyond the farm gate, the conceptual framework also incorporates broader influences on the farm. Firstly, as mentioned, I consider the farm's relationship to the broader agri-food system via power dynamics (Campbell, 2020). I also borrow the concept of lock-in from sociotechnical transitions theory, to illustrate how unsustainable practices can persist due to path dependency (Geels, 2010). Furthermore, I consider societal discourses around climate change, in particular the "Discourses of Climate Delay" that move from climate scepticism to "response scepticism" (Lamb et al., 2020), to investigate the extent to which these are present in the livestock sector. Figure 2.1 illustrates the interconnections between these key concepts.

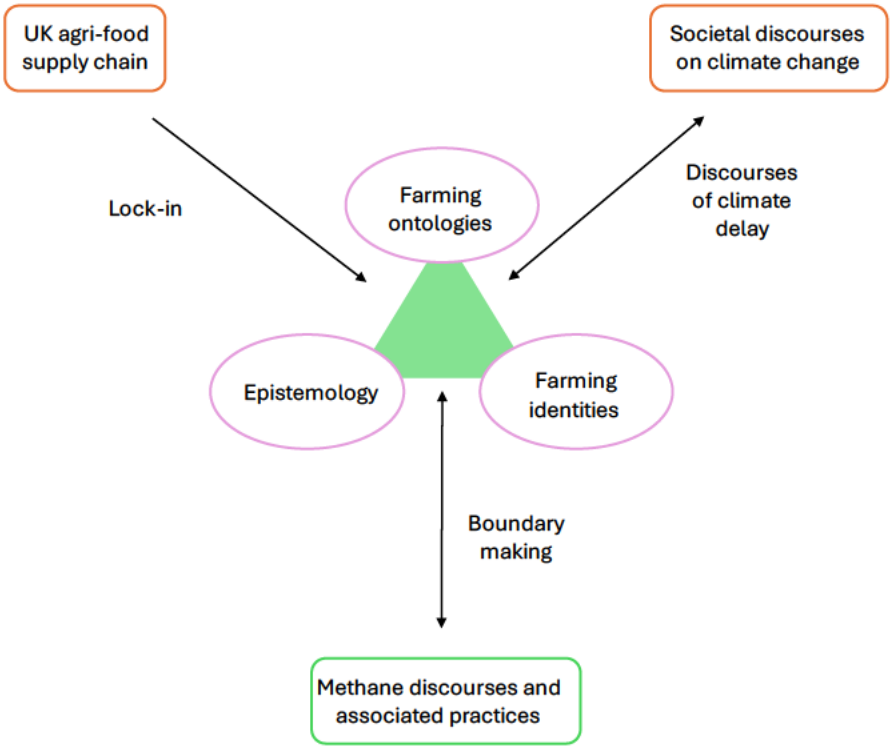


Figure 3.1: Conceptual framework

The rest of the chapter is organised into three main sections that elaborate elements of the conceptual framework and their interconnections. The first section will consider concepts relating to behaviour at the farm level, then the second will consider relevant concepts that situate the farm within the wider agri-food system. The third section will focus on discourse and discursive power, including concepts pertaining to societal debates around climate change. Throughout, I will illustrate how concepts can shed light on the research question: how is the UK livestock sector responding to problematisation of ruminant livestock regarding climate change?

3.3 Ways of understanding farmer environmental behaviour

Over the years there have been many and varied initiatives- by government and private sector actors- to shift the day-to-day behaviours of farmers and land managers to realise landscape-scale goals. As mentioned in the previous chapter, there was a push to increase and optimise productivity in the years following the Second World War, alongside the agronomic advances

of the Green Revolution (Mills et al., 2017). In more recent decades, as the environmental degradation caused by this narrow focus became apparent, stakeholders moved towards promoting pro-environmental behaviours and practices, often via incentives and regulation (Burton, 2004; Mills et al., 2017). In the 21st century there has been an increased interest in voluntary pro-environmental behaviour, and how this might be underpinned by social norms and values (Barnes et al., 2013; Burton et al., 2020; Mills et al., 2017). I will begin this section by discussing a range of concepts from various disciplines that contribute theoretically to this study of farmer environmental behaviour.

3.3.1 Research into farmer environmental behaviour

Past research with farmers has often employed the Theory of Planned Behaviour (TPB) developed by social psychologist Icek Ajzen (Ajzen, 1991; Maye & Chan, 2020). The theory states that behavioural intention is closely associated with action, and that the former is dependent on three factors: 1) personal attitudes 2) subjective norms and 3) perceived behavioural control (Ajzen, 1991). Personal attitudes are an individual's beliefs, worldviews and opinions that pertain to the behaviour in question. For example, farmers may have financial, agronomic, or environmental motivations to engage in pro-environmental behaviour (Mills et al., 2018). Subjective norms refer to whether the behaviour is considered normal in comparison to one's peers, while perceived behavioural control refers to how easily one believes one will be able to carry out the behaviour (Mills et al., 2017).

Meanwhile, Rogers' (1995) diffusion of innovation theory has also been implemented to understand farmer environmental behaviour. This theory highlights that a potential adopter of an innovation will be influenced by their perception of five key attributes: rate of adoption, relative advantage, compatibility, complexity, trialability, and observability (Rogers, 1995). The last of these describes the extent to which the results of an innovation are visible to others. This theoretical approach has been used to show, for example, the diffusion of organic farming (Padel, 2001) and identify barriers to diffusion of precision livestock farming (Greig et al., 2023).

While these approaches focusing on intrinsic determinants of behaviour have been widely used, their view can be somewhat restricted in two ways. Firstly, there is increasing recognition that individual farmers are rarely the sole on-farm decision-makers (Ingram, 2008), and a range of other actors contribute to shaping farm practices (Mills et al., 2017; Rose et al., 2018). Research has therefore sought to identify actors involved in agricultural

norm-setting. In addition to the "farmer's wife" (explored further below), family members in general play a key role in shaping social norms and influencing farmer behaviour (Elliott et al., 2011; Mills et al., 2017). Vets are often trusted as advisors by livestock farmers, particularly in relation to animal health (Alarcon et al., 2014; P. J. Jones et al., 2015), while farm consultants can also be influential (Bruijnis et al., 2013). Finally, other farmers are a highly valued source of information (Elliott et al., 2011), and peer to peer learning is considered vital for the development of pro-environmental behaviours (Skaalsveen et al., 2020). The broad range of influences on individual farmers has been conceptualised by Mills et al (2017) as operating at three levels: farm, community, and societal. This leads to the next critique of individualistic approaches.

A key problem for intrinsic approaches such as the TPB is the so-called "value-action gap", sometimes known as the intention-behaviour gap (Rhodes & De Bruijn, 2013). Basically, people don't always do what they say they're going to do, and their behaviour does not always align with their values (Shove, 2010). The TPB assumes that intended behaviour is highly correlated with actual behaviour, which may not be the case. This may be partly due to the range of influences mentioned in the previous paragraph, but the gap between intention and behaviour also requires consideration of the social, economic, and political situation within which choices are made (Argent & Walmsley, 2009). Scholars have argued that an individualistic paradigm leads to a focus on "problem non-adopters", shifting attention away from the state and detracting attention from the potential for collective action to achieve more fundamental change (Castree et al., 2014). Much behavioural research in this field is therefore depoliticised (Rieser, 1973), failing to acknowledge the political, economic and regulatory conditions that "*configure the fabric and the texture of daily life"* (Shove, 2010, page 1281).

For example, innovations such as carbon calculators are often presented as apolitical means of measuring CO_2 emissions- yet they seek to responsibilise farmers to 'solve' climate change, and their outcomes *"are subject to the politicized and commercial agendas of the worlds they attempt to link"* (Ormond & Goodman, 2015, page 1). This neoliberal focus on leading with technical innovations which must then be adopted by farmers, rather than more participatory and systemic approaches to solving sustainability challenges, aligns with the producer-focused theme outlined in Chapter 2.

Different conceptual frameworks have been developed to address these blind spots in intrinsic approaches. For example, Mills et al (2017) consider the overlaps between

"willingness to adopt" (individual values etc), "ability to adopt" (including factors such as finance, time, and labour), and farmer engagement (including farmer networks and farm advisors). Farmers who are willing, able, and engaged are most likely to successfully implement pro-environmental practices. Meanwhile, an Australian study by Gosnell et al. (2019) accounts for the political dimensions of behaviour change using theory developed from interviews with livestock farmers and farmer educators who had already made fundamental changes to their craft. The authors utilise the concept of three "spheres of transformation" (Gosnell et al., 2019). Here, the personal sphere is the locus of individual and collective beliefs, worldviews, and values, where discourses and framings emerge. It therefore influences the solutions that are considered possible and desirable within the other two spheres. The political sphere refers to where the "rules of the game" are set, and may produce policies that constrain or enable transformation. Finally, the practical sphere represents technical solutions and behaviours, including socio-technical and cultural innovations. Alone, these solutions are unlikely to bring about system change, without enabling conditions within the other two spheres. For example, the authors found a recurring theme of participants having experienced some sort of "crisis" that led to a re-appraisal of their values and their relationship to the land. Only once this shift had occurred within the personal sphere was the "gate opened" to engagement with alternative farming philosophies (Gosnell et al., 2019). This aligns with the concept of "trigger events" that result in new behaviours and practices (Sutherland et al., 2012). This is an interesting approach. However, the retrospective nature of these findings means further research would be needed to identify whether one can use this framework to predict optimal future conditions for change.

These conceptualisations illustrate the importance of considering wider factors beyond individual social psychological models and technical solutions for understanding farmer environmental behaviour. In the next section, I will further consider one aspect of the "personal sphere"- social identity- as a determinant of behaviour.

3.3.2 Farming identities

As mentioned previously, farmers influence one another's behaviour. One way this has been theorised is via the "Good Farmer" identity. This identity is expressed via *"forms of productivity, cleanliness, good record keeping and symbolic values in the eyes of other farmers"* (Maye & Chan, 2020, page 5). This work therefore places greater emphasis on wider sociocultural determinants of behaviour. Burton (2004) describes how the concept of

the “Good Farmer” draws on symbolic interactionism- a sociological theory that explains how meaning is created via interactions, and why people form social groups. This approach also links the Theory of Planned Behaviour more explicitly to social norms.

According to symbolic interactionism, reproduction of group norms and behaviours provides a sense of security and a framework through which to interpret the world. Burton found that increasing yields was central to the Good Farmer identity- however, this was decoupled from the profits associated with that yield (Burton, 2004; Burton et al., 2020). The goal wasn’t so much about making money, but about demonstrating one’s ability to farm well and produce plentiful food. Burton describes this as ‘productivist’, which he defines as: *“the overwhelmingly utilitarian approach to land use based on intensive forms of agricultural production (and accompanying attitudes, goals, roles and behaviours) that results in a uniform landscape”* (Burton, 2004, page 198). He argues that in efforts to encourage farmers to diversify e.g. by growing woodland, there is excessive focus on economic incentives and a paucity of attention to the sociocultural meanings associated with their practices; and thus, the social loss they are likely to experience by changing their role. There is a need to revisit this concept within the context of net zero and increasing demands on livestock farmers to reduce emissions (Burton et al., 2020).

The Good Farmer literature resonates with the concept of farming “life-worlds”. Following from the work of German philosopher Alfred Schütz in the mid-1900s (Schutz & Luckmann, 1973), life-world refers to “the intersubjectively constituted, taken-for-granted context of life structured by a common frame of meaning” (Schneider et al., 2010, page 333). Members of a social group interact on the basis of shared meanings, norms, and tacit and explicit knowledge. For example, Schneider et al. (2010) have used this concept to investigate Swiss farmers’ perspectives on soil erosion and soil conservation measures. This also relates to literature on social capital, which can influence sustainable soil management practices (Rust et al., 2020).

Bourdieu’s concepts of capital are a popular way to theorise the Good Farmer identity (O. Shortall et al., 2018; Sutherland et al., 2024). Shortall et al. (2018) explain how the habitus (a socialised body) exists within a set of social structures which are governed by the “rules of the game”. In the case of UK dairy farms, the authors suggest that the rules of the game are changing due to economic hardship and intensification. They go on to compare two archetypal farmers: the “good stock keeper” and the “commercial farmer”, in terms of

economic, social and cultural capital. They argue that vets tend to prefer working with the "commercial farmer" due to a shared epistemology around disease- based on laboratory testing rather than visual appraisal (O. Shortall et al., 2018). This demonstrates a connection between identity and epistemology, and also relates to the modernist farming ontology discussed later, in which there is a focus on what is measurable and countable (Campbell, 2020).

Meanwhile, considering water pollution mitigation behaviours, Inman et al. (2018) found that the productivist culture among farmers they interviewed resulted in indifference to activities that might challenge their primary role as food producers. The authors argue for modification of social norms via strategies such as "double loop learning", and engaging the farming community more deeply in deliberation about the role and purpose of rural landscapes (Inman et al., 2018). Interestingly, one of their participants described his preference for productivity over environmental management as "macho" (Inman et al., 2018, p22). The association of productivism with masculinity, and the decision-making roles played by different genders in a farming context, necessitate some engagement with gendered identities to better understand farming identities and discourses.

Within the UK's traditional heterosexual farming family structure (acknowledging that different configurations exist), women are a major influence on (male) farmer decision making (Farmar-Bowers, 2010). However, this role is often diminished by a dominant traditional discourse (Dunne et al., 2021), with the male-identified partner seen as "the farmer" while the female-identified partner plays the role of "the helper" (Price, 2010) or the "farmer's wife" (Keller, 2014). This has led to women being theorised as "invisible farmers" (Riley, 2009). Price (2010) highlights how both men and women reproduce and reinforce these gender roles, viewing them as inherent to the farming "way of life". For example, it has been shown that women's compliance with patrilineal inheritance structures is essential to the survival of small family farms (Price & Evans, 2006), and farming is viewed as the primary occupation of the household even when it is subsidised by women's off-farm labour (S. Shortall, 2002). Thus, from a pragmatic perspective it is essential for researchers to recognise women's role in influencing on-farm processes; while there is a theoretical need to contextualise gendered farming relationships within broader patriarchal and capitalist structures (Price, 2010; Price & Evans, 2006; S. Shortall, 2002). Furthermore, 'doing' feminist research can account for the material and emotional impact of patriarchal structures on people of all genders (Price, 2010).

A recent paper by Shisler and Sbicca (2019) concluded that women expand the role of "the farmer" beyond a masculine ideal. Their study draws on interviews with women who identify as farmers in the USA, using the philosopher Judith Butler's classic theorisation of gender as 'performative'. According to Butler:

"The view that gender is performative show[s] that what we take to be an internal essence of gender is manufactured through a sustained set of acts, posited through the gendered stylization of the body. In this way, it show[s] that what we take to be an "internal" feature of ourselves is one that we anticipate and produce through certain bodily acts" (Butler, 2002, page xv-xvi)

Shisler and Sbicca (2019) argue that women farmers carve space for themselves within a male-dominated, patriarchal field by conceptualising what they do as "carework". This includes caring for people (both their families and customers), often by performing the act of feeding, and caring for nonhuman entities like plants, animals, the land and the soil. Within this understanding of their work, there is a greater focus on the environment and relations between things rather than traditionally masculine domination of nature (Shisler & Sbicca, 2019). However, there is tension here: in a way these women are still conforming to traditionally "feminine roles" and performances i.e. as caregivers. The concept of an ethic of care (Puig de la Bellacasa, 2010) is discussed further in the next section.

Considering farmers' desire to "feed" people brings us back to the productivism exhibited in the papers by Burton (2004) and Inman (2018) discussed above, and performances of masculinity. However, that doesn't quite fit for Shisler and Sbicca's participants, who often spoke about wanting to "feed" lots of people and considered this a "feminine" trait. Yet there seems to have been a greater focus on the quality of the food produced rather than purely quantity: providing nutritious food free from pesticides, with sustainability in the foreground (Shisler & Sbicca, 2019). Was this simply productivism in a different guise, or something else?

Another connection is between the performativity of gender, and the performative nature of identities such as the Good Farmer. Burton tells us the latter is performed in part via visual cues such as tidy hedgerows and neat lines of crops. If, indeed, "The landscape of any farm is the owner's portrait of himself [sic]" (Leopold & Calkins, 1939, page 316), then these repeated citations of a norm may be analogous to the "gendered stylization of the body" (Butler, 2002, page xv). However, such a comparison can only go so far. According to Butler,

being gendered is a requirement for becoming a subject: for becoming human at all. One can be considered human without being a Good Farmer! An interesting question might be, how does one's citation of gendered norms make one more or less qualified to be considered a "Good Farmer" by one's social group? And how do these performances relate to different ways of understanding and dealing with GHG emissions from ruminant livestock?

In this section I have discussed a large body of research into farmer environmental behaviour, highlighting first some of the critiques of individualistic approaches, before moving to discuss the impacts of social identity on behaviour. This has included the Good Farmer identity, as well as how this may interconnect with gender identities. I have touched briefly on how identity may relate to epistemology (ways of knowing), and in the next segment I will discuss the role of ontology (ways of being).

3.3.3 A political ontology of the farm

Drawing on rural research in New Zealand, Campbell has developed a "political ontology" approach to theorising the farm. Campbell's work is relevant to this study as he provides us with a definition of "conventional" farming, arriving at the concept of "the modernist farm". When we speak of "alternative" farming, the modernist farm is the answer to the question "alternative to what?". Campbell defines the modernist farm as having firm ontological boundaries and thus being disconnected from social and ecological networks. This results in a *"…lack of capacity to manage (or even recognize) all its effects and consequences outside that ontological boundary"* (Campbell, 2020). These consequences result in a narrowing of future possibilities due to environmental change, and challenges to farmers' *"social license to farm"*. Social licence to farm indicates a measure of public acceptability and legitimacy, and may be challenged by factors such as poor animal welfare (Logstein & Bjørkhaug, 2023).

Campbell (2020) uses the example of intensive dairy systems in New Zealand- made possible via artificial irrigation to allow dry land to support high yield ryegrass for grazing Friesian cattle. He suggests that farmers and their advisors focus on what can be measured (milk yield, milk prices), while consequences beyond farm boundaries (catastrophic nutrient runoff into freshwater lakes) are remote and abstract.

Campbell (2020) also explores the history of the modernist farm, showing how it was used as a tool of colonisation to actively silence indigenous land use practices in New Zealand, as part of colonial ambitions to transform the islands into pasture. Farming in the UK has a different relationship to colonisation, and a longer history of cultivation during which the

transition from feudalism to capitalism shaped relationships to land, its ownership, and its enclosure (Neeson, 1984). As discussed below, farming incorporates many socio-natural hybrids (Latour, 1993), thus the modernist farm is a concept rather than an explicit description of existing farms.

Campbell's (2020) approach is useful for situating farming practices within a broader ontology, and the concept of boundaries is of particular value for understanding how ontology interacts with social practices. The ontological turn in agri-food studies also highlights the need for greater reflexivity among researchers about their own positions (Todd, 2016). Later in this chapter, I argue that attention to epistemology as well as ontology is necessary to explore UK livestock sector responses to public debates around farmed ruminants and climate.

3.3.4 Boundary-making

As shown above, Campbell's (2020) political ontology of the farm places emphasis on the concept of boundaries, with the modernist farm having firm boundaries, and alternative farming having softer boundaries and greater connectivity with broader social and ecological networks. The field of boundary studies has been pertinent in Geography for decades, originally being concerned with international borders and their sociopolitical impact (D. Newman & Paasi, 1998). In the 21st century, boundary studies has become more concerned with the boundaries between categories, such as nature and culture (Tadaki et al., 2012), urban and rural (Hommes et al., 2019), male and female (Butler, 2011), and different agricultural knowledge systems (Ingram, 2018). Jones (2009) argues that boundaries between categories are not fixed, but rather "inchoate", meaning not fully formed. The boundaries are therefore incomplete and must be continuously made and remade. This is illustrated by Cudworth and Hobden (2022), who argue that boundaries are inherently leaky, even including those between species in an age of zoonotic pandemics. Jones (2009) also introduces a paradox- that boundaries can be recognized as fluid and incomplete, but cognitively we perceive them as solid containers with firm walls. The focus of research, therefore, is not on the boundaries themselves, but on boundary-making; the process emphasised through the word "inchoate" (R. Jones, 2008).

As geographers have noted, *"The construction of boundaries at all scales and dimensions takes place through narrativity"* (Newman & Paasi, 1998, page 195). Discourse is therefore essential to the making of boundaries and of social identities (Somers, 1994). For example,

Butler (2011) argues that sex, as well as gender, is socially constructed- in that it cannot exist prior to discourse. Defining sex requires the setting of boundaries (e.g. in relation to chromosomes, hormones, and body parts). Thus, gender establishes and gives meaning to sex; producing it as "natural" and pre-discursive. Sex is *"not what one has or is, it is one of the norms by which one becomes viable at all, which qualifies a body for life within the domain of cultural intelligibility"* (Butler, 2011). To become human, one must be gendered. Just as *"nature serves to define what it means to be human"* (Uggla, 2010), being a man or woman is defined in opposition to the abject, genderless figures outside the boundaries of the human (Butler, 2011). Boundary-making is therefore linked with discursive power and (farming) identity.

Looking to more recent scholarship employing this approach, Hommes et al. (2019) discuss urban-rural boundary making from the perspective of water management, illustrating longstanding conceptualisations of the rural as a "dumping ground" for urban excess. They also discuss how physical infrastructure has sociopolitical consequences, for example in the case of hydroelectric dams, and highlight the need to account for inter-urban and inter-rural inequalities (Hommes et al., 2019). This idea of the power implications of physical infrastructure is echoed by Evans and Adams (2016), who analyse how an elephant fencing project in Kenya exacerbated inequalities between pastoralists and landowners, arguing that a physical boundary such as a fence *"cannot be separated from the political landscape in which it is embedded and which it defines, and whose divisions it exacerbates"* (L. A. Evans & Adams, 2016, page 226). In Ireland, scholars analysed how the boundaries of a community fund, created to support those impacted by a new high voltage power line, were created, contested and implemented. Discourses of impact and proximity had real world implications in terms of who benefited from the fund (Devine-Wright & Sherry-Brennan, 2019). Boundary making is also highly pertinent to carbon footprinting, which requires firm spatial boundaries, as well as boundaries around which data is included and excluded (Adewale et al., 2018). Boundaries are therefore articulated in different ways, including spatial, social, numeric, or political.

Boundary-making provides a useful heuristic for understanding how discourses influence social identities, and may illuminate connections between discourse and social practices. In this thesis I will adopt and expand Campbell's (2020) idea of boundaries as central to farming ontologies, and use this to investigate UK livestock sector discourses and strategies on methane emissions from ruminant livestock.

In this section I have focused on the farm level, discussing concepts relating to farmer environmental behaviour. I began by highlighting individualised theoretical models such as the Theory of Planned Behaviour, and highlighting some of the critiques levelled at these. I have shown how attention to symbolic meanings associated with the Good Farmer identity has become more popular, illustrating connections between identity and behaviour. Overall, the field has moved away from viewing farmers as rational economic actors, towards a deeper understanding of the meanings associated with different practices. I then briefly explored how gender identities structure farming life and may interact with the Good Farmer identity. In the next segment I introduced a political ontology of the farm, showing how this can facilitate understandings of behaviour. Finally, I have expanded this by further exploring the field of boundary studies, and suggest that boundary-making may provide a useful heuristic for investigating connections between discourse and social practice.

To truly understand UK livestock sector discourses and strategies on methane emissions from ruminant livestock, it will be necessary to explore concepts that go further; beyond the farm gate. This includes how farms relate to the broader agri-food system, as well as how farming discourses relate to broader societal discourses around climate change. Many of the concepts discussed already have raised the issue of power, and how this might influence activities on the farm. The next two sections will unpack this in greater detail.

3.4 Situating the farm within the broader agri-food system

In this section, I will acknowledge major conceptual approaches that situate the farm, and farmer behaviour, within the context of the broader agri-food system. I will show how these are incorporated in the conceptual framework, and illustrate any theoretical tensions this may raise. I will begin with the political economy approach in agri-food studies, then consider sociotechnical transitions literature, before moving to discuss Actor Network Theory.

3.4.1 Political economy approaches in agri-food

Critiques of capitalism and modernity form part of a broader political economy tradition in the social sciences that seeks to unveil hidden power dynamics and liberate oppressed groups. This tradition has its roots in Marx's writings on capitalism and the revolutionary liberation of the working classes, and the various scholars that subsequently developed his work (Prasad, 2017). For example, Gramsci's concept of ideological hegemony posits that worldviews promoted by the ruling classes become so pervasive that they can be described as

"common sense", and thus taken for granted. Meanwhile, the scholars collectively known as the Frankfurt School, and Habermas in particular, developed Marx's work during the 20th century. This work sought to understand the spread of fascism, but also the "dysfunctional consequences of modernity" (Prasad, 2017).

In the agriculture sphere, the "New Rural Sociology" applied Marxist and Weberian critiques of capitalism and modernity respectively to the agriculture sector (Newby, 1983). From the New Rural Sociology grew agri-food studies, which paid greater attention to global supply chains and began to follow commodities beyond the farm gate (Friedland, 2001). An influential body of political economy work became prominent during the 1980s, with Marsden and others calling for further development of a political economy of capitalist agriculture (Marsden et al., 1986). Marsden argued that agriculture is qualitatively different from other sectors, in that its dependence on land and soil give it unique spatial and temporal qualities. The subsumption of small farms by capital is therefore more likely to be via contracts and substituting technological inputs for human labour, thus increasing dependence on larger firms beyond the farm gate (Marsden, 1988).

More recently, Howard (2016) set out the issue of concentration in food systems. He illustrates the oligopoly created when a small number of firms own a significant share of the market, and are therefore able to artificially increase prices. Howard (2016) describes the food system as being shaped like an hourglass, with a large number of farmers at the top, and an even larger number of consumers at the bottom. Between them lies a small number of retailers and other firms who control the flow of food through the system, and hold a disproportionate amount of power. For Howard, power is equivalent to capital. The accumulation of capital by firms takes place in pursuit of greater power to control the systems under which they operate and limit undesired state interference (Howard, 2016). This is particularly relevant to the UK food system, where six supermarkets hold 82.7% of the grocery market (M. Ward, 2024), and have little motive to promote dietary changes that could impinge on their profits (Trewern et al., 2021).

Campbell (2020) discusses how political economy approaches have been critiqued for neglecting to consider aspects such as gender inequality, non-human agencies, and the power dynamics inherent in scientific knowledge production. For example, in Marxist and neo-Marxist scholarship the family farm is often idealised as an agent of anti-capitalist struggle- thus erasing the patriarchal power dynamics that govern such social arrangements (discussed in the previous section).

The above literature offers a critical perspective on agri-food systems, and provides a useful lens for understanding UK livestock sector discourses and strategies on methane emissions from ruminant livestock. In particular, this lens facilitates attention to power, which is discussed further as this chapter continues. Political economy approaches can sometimes neglect human agency, thus it is useful to balance them with consideration of the drivers of behaviour discussed in the previous section.

I will now briefly discuss sociotechnical transitions theory as another theoretical tool for connecting on-farm practices with the wider agri-food system.

3.4.2 Sociotechnical transitions and lock-in

Sociotechnical transitions (ST transitions) literature has considered a range of sustainability transitions including those within agriculture, and is an influential approach for placing climate behaviour within a broader systemic context (Geels, 2019). ST transitions literature includes concepts like the multi-level perspective (MLP), which has origins in evolutionary economics and posits that existing "regimes" are characterised by lock-in and path dependence (Geels, 2010). Lock-in refers to the situation where certain (unsustainable) behaviours and practices are favoured by structures, rules, and norms of the existing regime (Geels, 2004; Unruh, 2000). Different forms of lock-in may exist, including economic (Stuart & Schewe, 2016) and sociocultural (Burton & Farstad, 2020). In the latter example, Burton and Farstad (2020) found that shifting sociocultural norms around labour and gender roles were promoting intensification of dairy farms via significant investment in equipment, which may have been leading to increased emissions. This highlights the value of social science research in understanding interactions between macro level trends and farm level behaviour (Burton & Farstad, 2020).

The MLP suggests that radical innovation is to be found in "niches", and may break through if cracks emerge in the regime due to external "landscape" pressures (Geels, 2010). The MLP was developed through analysis of historical transitions, but is now commonly applied to ongoing sustainability transitions (Geels, 2019). Power is less explicit in this literature compared to political economy approaches, however previous research has incorporated theories of the policy process (Kern & Rogge, 2018), and utilised ST transitions concepts combined with analysis of different forms of power (Siawsh et al., 2021).

Applying the MLP to agri-food studies, Darnhofer (2014) highlights that the three levels (niches, regimes, and landscapes) are not necessarily defined by their geographical scope, but

rather by their degree of stability. Regime actors will often exert their institutional power to resist and delegitimise niches that threaten their stability. In this theoretical context, "institutions" refer to *"all those 'rules of the game' such as norms, conventions and ways of doing things that structure human interaction and activity"* (Darnhofer, 2014a). This suggests that structural aspects of regimes exert power by limiting the options available to individual actors.

Climate change is an example of a "landscape" factor that is putting pressure on existing agricultural regimes, as well as potentially providing opportunities for niches. Although there is generally broad agreement that improving sustainability and protecting biodiversity are important, the questions of which solutions will achieve these goals is highly contested, as demonstrated in the previous chapter (Farstad et al., 2020). Overall, Darnhofer (2014) reminds us that this theoretical perspective does not allow us to identify and prescribe "what works", due to the complex and context-specific nature of sociotechnical transitions.

Sociotechnical (ST) systems research has been critiqued for implying an inappropriate focus on incremental change, which neglects to fully account for politics and power dynamics (Gillard et al., 2016). Scholars have suggested that this paradigm therefore implicitly endorses the Western hegemonic perspective on how climate change mitigation is to be achieved. Gillard et al (2016) advocate a more pluralistic approach to facilitate transformational change: which implies asking questions such as: *"Whose envisioned future are we pursing and along which pathways? Who bears the cost of the transformation and who reaps the benefits? What weighting is given to environmental, social, and economic priorities?"* (Gillard et al., 2016). These questions relate to discourse, which may, for example, problematise niche innovations, or disrupt existing regimes. The role of discourse is discussed in the next section.

In this PhD I adopt the concept of lock-in for understanding how macro level trends and norms can influence behaviour and limit potential for change on the farm. However, I will go further than the MLP to analyse power dynamics, particularly as these pertain to discourse, all of which is discussed further below.

3.4.3 Science and Technology Studies approaches in agri-food

In this sub-section I will briefly mention actor-network theory (ANT) from the field of Science and Technology Studies (STS), as it forms part of the inspiration for Campbell's (2020) political ontology of the farm. Campbell's approach draws on insights from ANT

which, in a manner related to indigenous ontology (Todd, 2016), considers the agency of non-human animals and objects (Latour, 2017). For Campbell, incorporating such insights is primarily a means to recognise pre-existing indigenous ontologies that have been silenced and erased through colonisation in New Zealand. However, the approach holds an ontological tension, in that Campbell is explicit about the role of power in shaping and maintaining farming ontologies, and narrowing future options. This departs from more classical ANT approaches, which avoid "power" as an explanatory concept (Puig de la Bellacasa, 2010).

In the agri-food sphere, the "ontological turn" with which ANT is associated emerged as a critique of prevailing political economy approaches around the turn of the century (Goodman, 2001). The latter tend to be concerned solely with human activities, failing to acknowledge the non-human entities and agencies that comprise our world. According to ANT, non-humans, plants, and objects are "lively" and have agency (Puig de la Bellacasa, 2010). Latour's work in this area critiques the modernist view of science as rational progress explaining "matters of fact", by re-conceptualising issues and objects as "matters of concern" (Latour, 2004). He also resists assigning "power" as the causal explanation for everything, arguing that *"One major symptom of critical excess is the abuse of notions of power, used as causal explanations 'coming out of the deep dark below' to undermine what others present as facts"* (Latour, 2004, page 229).

Like Latour, Puig de la Bellacasa is wary of critique for the sake of critique- agreeing that scholars in the critical traditions can end up adopting a view "from nowhere" (Haraway, 1988) as they 'dismantle' the world (Puig de la Bellacasa, 2010). Puig de la Bellacasa has further developed STS from a feminist perspective to re-cast "matters of concern" as "matters of care"- arguing that *"Ways of studying and representing things can have world-making effects"* (Puig de la Bellacasa, 2010). This relates back to the work cited in the previous chapter on care and soil health (Krzywoszynska, 2019). As a reminder, care is defined as *"the necessary ongoing work of maintenance and repair of the world so that we can live in it as well as possible"* (Krzywoszynska, 2019, page 664; Tronto, 1998). Puig de la Bellacasa (2010) argues that, as constructivists, the way we represent networks and attend to neglected concerns can be done "with care": in a way that seeks a more live-able world. In this way, a feminist lens can be valuable for "re-affecting" objectified things. This is useful when researching understandings of livestock and climate change, as the former are often commodified and objectified via the synergistic effects of capitalism and modernism (McGregor et al., 2021).

Another conceptual point to raise here, pertaining to discussions of both ontology and power, is the nature/culture divide: a foundational component of Western rational philosophy (Plumwood, 1991). Historically, the concept of nature and culture as separate entities has its roots in religion, and solidified in Europe during the Enlightenment (Mignolo, 2011; Uggla, 2010). From this perspective, humans are defined in contrast to what is "natural" (Plumwood, 1991); or rather, *"nature serves to define what it means to be human"* (Uggla, 2010). Furthermore, the metaphor of nature as a mechanism or machine was established during the Enlightenment. This metaphor is intimately linked to Western liberal capitalism, in that "nature" is considered in terms of "natural resources" that may be extracted to benefit culture/humankind (Mignolo, 2011). This is highly relevant to ruminant livestock, as different production practices involve different understandings of nature, and the "naturalisation" of different practices may occur to enhance their social acceptability (Cusworth et al., 2022). The ontological separation of nature and culture differs significantly from many indigenous philosophies, which, as well as incorporating sentient environments, view humans as part of nature and thus interconnected with the earth, plants, and non-human animals (Todd, 2016). A similar philosophy may underlie some UK "nature friendly" farming practices, albeit within a capitalist system that imposes certain norms.

This PhD is not explicitly situated within an ANT perspective, however, some of the tenets mentioned above are valuable for going beyond a human-centric view of agri-food systems, and incorporating a feminist ethic of care in the research approach.

This section has illustrated different ways to conceptualise how farm-level norms, values, and behaviours are situated within broader agri-food systems. Political economy approaches provide a lens through which to view supply chains and analyse power dynamics therein, while ST transitions literature offers the concept of lock-in to explain why unsustainable practices persist within stable regimes and systems. Finally, the ontological turn and ANT offer a language for incorporating the "more than human" world into understandings of agri-food systems. This thesis therefore seeks to extend prior approaches by accounting for both structural factors and agency, with a particular focus on how discourse constructs different versions of and responses to the same "problem". In the final section I will discuss discursive power, and situate farming discourses within broader societal discourses around climate change and climate action.

3.5 Societal discourse around climate change

In this section, I will situate farmer understandings of ruminant livestock and climate change within broader societal debates and discourse around climate change. I will begin by defining discursive power, and different understandings of the term "discourse". I will then discuss the conceptual underpinnings of Critical Discourse Analysis, and show how attention to discourse can expose hidden power dynamics. In the next sub-section, I will discuss shifting societal debates around climate change, and a heuristic for identifying "discourses of climate delay". I will then move to discuss political epistemology, showing how different ways of knowing are associated with different farming practices, and broad societal trends towards polarisation and online incivility are relevant to debates around climate change and ruminant livestock.

3.5.1 Different forms of power

A review paper on the topic of political challenges to reducing red and processed meat consumption identified three key forms of power: instrumental, structural, and discursive (Sievert et al., 2020). Instrumental power refers to the direct influence of one actor in relation to the behaviour of another (Clapp & Fuchs, 2009); for example, industry actors influencing policymakers through lobbying (Lazarus et al., 2021). Structural power is defined as the power to control the scope of options available to others, such as government food procurement standards setting out what choices are available in public institutions like hospitals and schools (Sievert et al., 2020). Finally, discursive power refers to the power to influence the norms and values that guide behaviour, including the frames within which certain actions are interpreted (Morris et al., 2024). For example, private interest groups may frame meat reduction as being part of an extreme vegan agenda, or as being the responsibility of consumers thus necessitating a focus on solutions such as product labelling (Sievert et al., 2020). This framework is helpful for understanding how powerful state and corporate actors can influence the range of options available to individual citizens (including livestock farmers). This thesis will draw particularly on the concept of discursive power, and I will now discuss this and its relation to the more general concept of "discourse" in greater detail.

3.5.2 Different approaches to discursive power

Previous literature has used different analytical frameworks to examine the "stories" transmitted in text and speech. These include framing analysis, which involves studying

processes of meaning construction and the emphasis of different components of an issue over others (Morris et al., 2024; van Hulst et al., 2024), and narrative analysis, which is more explicitly connected with storytelling through the identification of characters, settings, and events (van Hulst et al., 2024). This thesis is concerned with discourse, as discourse analysis considers language as power-laden and involves greater attention to the role of discourse in (re)producing social structures (van Hulst et al., 2024). It is therefore valuable for exploring and critiquing the problematisation of different issues.

Discourse tends to be defined in different ways by different scholars and disciplines. Foucault defined discourses as *"including statements and systems of statements that are power-laden, persuasive, employed strategically, and part of social practices, interactions, behaviors, and ways of being"* (Bischoping & Gazso, 2016, page 131). Instead of treating power as being possessed by people or institutions, he emphasised its relational quality by using the term "power relations" (Bischoping & Gazso, 2016). Foucault saw power and knowledge as interdependent, and viewed discourses as embedded with power-knowledge relations.

It is challenging to take an emancipatory standpoint if analysing discourse via a Foucauldian lens, because he rejected the idea of the "knowing subject". Instead, he viewed his work as narrating a fiction, and therefore only ever a construction of what happened. This is in contrast with more traditional critical theorists. Foucauldian discourse analysis is therefore *"a strategy for understanding how we come to construct as coherent something that is contingent, messy, and haphazard"* (Egan-Sjölander & Gunnarsson-Payne, 2011).

To emphasise the materiality of the real-world impacts of discourse around ruminant livestock and climate change, this PhD will consider discourse as a type of social practice (Carvalho, 2008; Fairclough, 1992), following a Critical Discourse Analysis (CDA) approach. CDA is inspired by the critical theory of the Frankfurt School, whose scholars tended to adopt a critical realist stance: that there is a concrete world in which social processes have material consequences for people (Bischoping & Gazso, 2016; Sayer, 1997). Scholars have argued that *"CDA advocates interventionism in the social practices it critically investigates"* (Blommaert & Bulcaen, 2000, page 449), therefore the activist (realist) position of CDA is in tension with its social constructionist approach. This is a significant deviation from the work of Foucault- who resisted the "all knowing" position of the social critic prescribing how society "ought" to be (Bischoping & Gazso, 2016). Reflexivity about one's own position and biases can help to make discourse analysis more transparent (Stibbe, 2017).

CDA was developed in the mid-late 20th century by scholars including Fairclough, Wodak, and van Dijk. As with the political economy approach described above, it is explicitly concerned with power and seeks to change material conditions in society. It does not have a unified strategy, but is rather an uncentered movement of scholars interested in the semiotic dimensions of power and social inequality (Fairclough, 1992; van Dijk, 2008; Wodak, 1999). Overall, *"analytical emphasis is on language in the creation, framing, and understanding of social interactions and problems"* (Bischoping & Gazso, 2016, page 143). In CDA, *"discourse is viewed as a type of social practice (...) [that] both constitutes and is constituted by social phenomena"* (Carvalho, 2008, page 162).

According to Fairclough, discourse can be conceptualised in three ways (Bischoping & Gazso, 2016; Fairclough, 1992). Firstly, as text; in terms of linguistic characteristics and format such as grammar and metaphor, where analysis is at the word level. Secondly, as practice; a thing that is created, disseminated, and consumed, where analysis is at the text level. Thirdly, as social practice; meaning the ideological or hegemonic impact, such as how discourse may change for strategic reasons of oppression and resistance. For this third component, analysis is at the norm level. Fairclough's approach assumes that language can be used to change behaviour; language is therefore a tool of power. CDA can be helpful for understanding what the sender of a text wants to convey to the recipients, and what behaviour the sender wishes to provoke in the recipients (Fairclough, 1992). It implies a somewhat unidirectional relationship between discourse and behaviour, whereas this thesis acknowledges a more complex interrelationship between discourse and on-farm practice.

A critique of CDA is that scholars interpret on behalf of the reader, when a single text could be interpreted in myriad different ways by different readers (Blommaert & Bulcaen, 2000). Furthermore, CDA involves accounting for the context within which the text was produced: and who decides which context is relevant and which should be excluded? According to critics of CDA (Schegloff, 1997), this means that: *"Analysts project their own political biases and prejudices onto their data and analyze them accordingly"* (Blommaert & Bulcaen, 2000, page 455). As mentioned previously, this makes reflexivity essential in projects employing CDA.

Carvalho (2008) presents a framework for conducting CDA with news media, using the concept of "critical discourse moments" to introduce a temporal perspective and better illustrate the impact of contextual events in shaping news media discourses (Carvalho, 2008).

This offers greater insight than analysing texts at a single moment in history, which would only provide a "snapshot" of discourses that may be in flux. This approach has illustrated shifting climate change discourses in UK news media, showing how the ideological standpoints of newspapers influences what "facts" are reported, and which actors are considered "agents of definition" on scientific matters (Carvalho, 2007).

Meanwhile, others have sought to build upon the tenets of CDA to create a more "positive discourse analysis" (Hughes, 2020). This seeks to highlight discourses that the researcher interprets as positive i.e. promoting a better world. This is reminiscent of Puig de la Bellacasa's (2010) work mentioned in the previous section, which rejects "critique for critique's sake" and adopts a feminist ethics of care that works towards "a more live-able world" (Puig de la Bellacasa, 2010). Positive discourse analysis is less widely used than CDA, and requires a high level of transparency and reflexivity for the researcher (Stibbe, 2017). In this PhD I will adopt a CDA methodology (discussed further in the next chapter), mindful of the need to identify discourses that resist norms as well as reinforce them. I will now turn to discuss broader societal discourses around climate change.

3.5.3 Trends in discursive representation of climate change

Although climate scepticism has been prevalent for several decades, climate scholars have recently identified a turn away from outright climate change denial towards "climate obstructionism"- efforts to block the action required to move towards a low carbon future (Mann, 2021; Painter et al., 2023; Sanford et al., 2021). This is prevalent among those who benefit from ongoing use of fossil fuels, but has also been recognised in the agriculture sector (Lamb et al., 2020). Lamb et al (2020) develop the heuristic "discourses of climate delay" (Figure 2.2) to identify such discursive strategies in news media, policy documents, and political rhetoric. For example, "Whataboutism" refers to the tendency to deflect attention towards other sectors or countries, emphasising their contributions to global emissions. Discourses of climate delay build on legitimate concerns about rapid climate action, but move into misrepresentation and imply that change is neither desirable nor possible (Lamb et al., 2020).

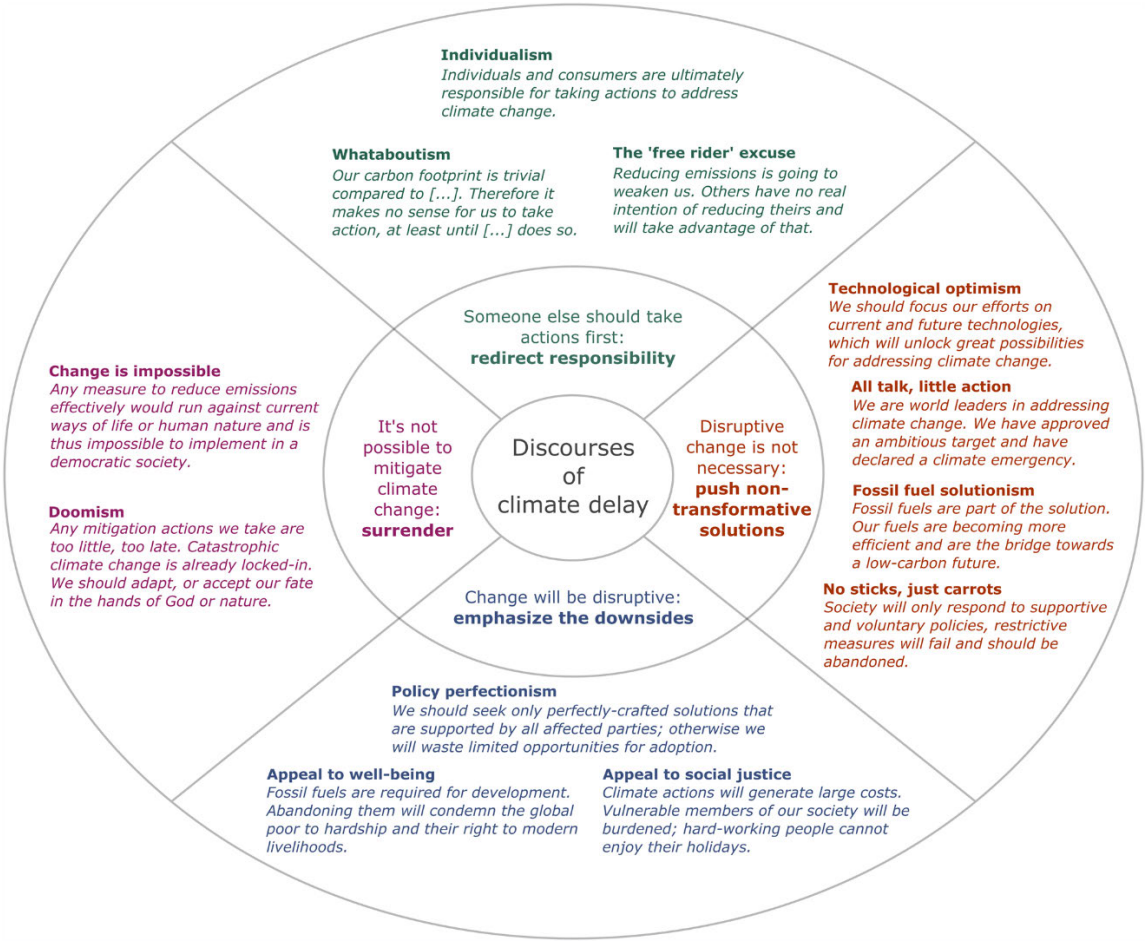


Figure 3.2: Diagram showing discourses of Climate Delay (Lamb et al., 2020)

Scholars have also identified the association of climate discourses with a broader "culture war" (Sanford et al., 2021). Carvalho (2007) identified that climate change was more salient (meaning more frequently reported) in left-leaning newspapers, and this has also been identified for articles specifically discussing animal agriculture and climate change (Kristiansen et al., 2020). Meanwhile, meat eating has traditionally been associated with masculinity (Adams, 2015; Hurley & Roe, 2022; Morris et al., 2025), and the consumption of animal products being linked with white masculinity can be identified in texts from the colonial era through to alt-right Twitter dialogue in the 2010s (Gambert & Linné, 2018).

Considering discursive trends at the policy level, in a paper that resonates with the concept of "boundary-making" discussed earlier, environmental sociologist Ylva Uggla has explored how the nature/culture divide manifests in international climate change and biodiversity policy (Uggla, 2010). She argues that "nature" is an ambiguous and elastic concept, imbued with variable meanings by different social contexts and actors. Any definition of nature requires boundaries to be drawn, which ignore that our world comprises many "socio-

natural" hybrids (Latour, 1993). Agriculture is an area where socio-natural hybrids abound, and may be defined as *"…a radical reorganization [sic] and simplification of flora to suit man's [sic] goals."* (Scott, 1998, page 2). Uggla argues that despite recognising the structural factors perpetuating environmental problems, a "sustainable development" paradigm *"…promotes further, not less, modernization, responding to criticism of contemporary society with a modernistic answer involving research, technological innovation, market forces, and so on"* (Uggla, 2010). This resonates with the efficiency component of the producer-focused theme set out in the previous chapter.

These discursive trends necessitate awareness during data collection and analysis, to identify any connections with ruminant livestock discourses. The concept of discourses of climate delay also offers a heuristic framework for interpreting data, while the other examples listed reiterate the value of attention to boundary-making. I will now discuss concepts pertaining to political epistemology and polarisation as these relate to climate change discourses.

3.5.4 Political epistemology and polarisation

Earlier in this section I discussed the relevance of ontology: the nature of being (Stainton Rogers, 2011). However, epistemology, the philosophical question of the nature of knowing, is also valuable for understanding debates around ruminants and climate. The epistemological foundation of this PhD is constructionist, as it seeks to understand the meaning a phenomenon has for those involved (Merriam, 2009), and therefore presumes reality to be socially constructed. This is in contrast with studies that assume measurements of reality reflect the true nature of things, which share a positivist epistemology. The use of CDA generates tension with this overall approach given its underlying critical realist ontology (Gorski, 2013; Sayer, 1997). However, as Leach and colleagues argue, different approaches may have different ontological and epistemic foundations, but we can triangulate between them to shed light on the problem from different angles (Leach et al., 2020).

Considering epistemology is a way to consider what sources of information are considered valid, legitimate, and worthy of trust. For example, the modernist farm described previously might be associated with a positivist epistemology, in which numerical outcomes such as grass and milk yields are prioritised over sensory inputs (Campbell, 2020). In the context of climate change, this resonates with Ormond's (2020) work on super low carbon cows, and the focus on emissions per kilo as a way of knowing ruminants' environmental impact. Design scholars have argued that food system sustainability advice is usually global in scope, and

difficult to reconcile with the personal, locally situated nature of people's interaction with the food system (Wilde et al., 2021). Policymakers are more likely to speak in broad and general terms, while individual eaters (or producers) make sense of the food system based on their own experience. This relates to the concept of tacit knowledge- usually understood in terms of tasks that we "just know" how to do, and would have to think about before explaining to another person (Tsoukas, 2005). Within the agricultural sphere, Krzywoszynska (2016) has argued that caring for non-human others requires "experiential knowledge" or "situated expertise" (Krzywoszynska, 2016).

Carolan (2006) has explored how the costs and benefits of sustainable vs. conventional agriculture are experienced via the five senses. In sustainable agriculture, benefits such as increased soil biodiversity and less nutrient run-off are less visible to farmers, while costs such as reduced yields and more weeds are clearly visible. On the other hand, the benefits of conventional agriculture, including high yields and tidy fields, are very visible, while the costs are "externalised" because they are "epistemically distant". Carolan argues that epistemic distance is not only spatial and scalar, but also constituted through social interactions (Carolan, 2006). Factors that increase epistemic distance include:

- Temporal extension- the conventional approach is oriented towards the here and now, and practices have relatively swift results, such as the reduction of weeds. Meanwhile, their costs are often felt at the generational scale.
- Complexity/uncertainty- cause and effect relationships in conventional agriculture are relatively linear and straightforward- I do this and *this* happens. Technologies whose benefits are unclear/uncertain have lower adoption rates (Kremer et al., 2001). Meanwhile, sustainable agriculture is more holistic, so it's about the combination of various practices rather than each one having a tangible result.
- Controversy- the meaning here is "when causal chains become exposed to public/scientific debate and scrutiny" (Carolan, 2006, page 237). For Carolan, this includes Whataboutism, though he doesn't name it as such. In this case, the work of farming sector representatives to create doubt about the impact of methane on climate change would be a strategy to increase epistemic distance.
- Practice- epistemic distance is not just a product of physical characteristics, but also socio-organisational arrangements. For example, different producers "see" different things; Carolan (2006) gives the example of "wildflowers" vs. "weeds".

These conceptual categories of epistemic nearness/distance are not fixed, but rather heuristic devices (Carolan, 2006). The boundaries between them are inchoate (R. Jones, 2008). Furthermore, from a temporal perspective, sustainable agriculture requires a long-term view. However, farmers can be locked into structural arrangements that may not facilitate long-term planning, such as debt, supermarket contracts, and high-cost inputs. Transitioning to more sustainable systems can involve a period of lower yield, which may be challenging to reconcile with the Good Farmer identity (Burton, 2004).

Turning back to broader societal trends around climate change brings us to scholarship around polarisation. A particular challenge to political action within the climate and livestock arena is that it is often considered to be polarised (Sanford et al., 2021). Polarisation describes *"a situation in which strongly held opposing opinions form around an issue in society, creating a sense of 'us versus them' divides"* (Judge et al. 2023, p.1). Moreover, polarisation may be actual or perceived, and scholars have differentiated between "opinion polarisation" and "intergroup polarisation". Opinion polarisation indicates a bimodal clustering of opinions, with a significant lack of agreement between the two groups. Intergroup polarisation is about group members' perceptions of the opposing group, and their perceptions of the opposing group's opinions. If there is a significant level of negative emotion directed toward a perceived outgroup, then this is intergroup polarisation. Intergroup polarisation can be increased by animosity and negativity (including in news media) between opposing groups (Judge et al., 2023).

A related perspective from philosophy suggests that an "echo chamber" is created when a group has significant distrust of people and information from opposing groups (Nguyen, 2020). This is in contrast to an "epistemic bubble", which exists when a group is simply not exposed to conflicting opinions (as perpetuated by social media algorithms) (Nguyen, 2020). An international focus group study found that while people occupy individually constructed media environments incorporating a range of sources in which social media play a key role, professional media outlets remain an important source of information and awareness of priority issues (Happer & Wellesley, 2019).

Despite widespread concern about polarisation on various topics, Judge et al. (2023) show that actual polarisation is lower than perceived polarisation; people think that society is more polarised than it really is. While groups with extreme views at either end of the opinion spectrum may be polarised, most people are exposed to heterogenous opinions and have more

moderate views. Both actual and perceived polarisation are problematic for environmental decision-making, as they discourage conversations around climate and reduce capacity for collective action (Judge et al., 2023). Recent evidence has shown that UK farmers experience "cultural loneliness", which refers to a feeling of disconnection and marginalisation from mainstream society, and contributes to poor mental health within the farming community (Wheeler et al., 2022). Attention to boundary-making in this thesis may help draw attention to the creation of boundaries between groups, and points at which this creates or perpetuates intergroup polarisation.

Given the contested nature of debates around ruminants and climate, with multiple competing truth claims, attention to epistemology will be vital, and literature on polarisation can complement the aforementioned focus on boundary making to identify opinion polarisation and intergroup polarisation. I will now turn to discuss the concept of a "just transition" and how this might apply to methane emissions from ruminant livestock.

3.5.5 Just transitions and procedural justice

The final concept I will discuss in this chapter is of a "just transition", which can provide a broader frame for contextualising the work in this thesis. The concept has been applied by energy sector workers and their advocates for several decades, and posits that decarbonisation should be carried out in such a way that it not only avoids creating inequalities, but actively seeks to reduce existing inequalities. Recent years have seen this concept applied more specifically to agri-food, and particularly ruminant livestock farmers (Reay, 2020a).

The just transition concept incorporates several types of justice. For example, distributive justice is about ensuring the costs and benefits of the transition are shared fairly across the population. In the case of ruminant livestock, there is evidence that a shift towards more sustainable diets containing less meat would disproportionally impact the livelihoods of farmers specialised in this area (Lehtonen et al., 2022; Rieger et al., 2023a). Evidence suggests that a perceived lack of distributive justice may exacerbate polarisation (Judge et al., 2023).

Another component of the just transition concept is procedural justice. This asks whether people are involved in decisions that affect them. Increased "voice", the opportunity to speak and be heard, tends to positively impact assessments of procedural justice (Lind et al., 1990). When the outcomes of a procedure (e.g. climate policymaking) are severe for a specific

group, procedural justice has a mitigating effect on that group's perception of the outcome (Konovsky, 2000). The more severe the outcome, the more important the role of procedural justice in influencing overall perceptions of the event (Konovsky, 2000).

Recent years have seen increasing academic and public discussion of deliberative processes such as climate assemblies (Simmonds et al., 2025; Willis, 2020; Willis et al., 2022). In a climate assembly, the goal is for a representative group of the broader population to learn from experts on climate issues, deliberate together, and achieve consensus on a set of recommendations to policymakers (Devaney et al., 2020). For example, the UK held a climate assembly in 2020, in which assembly members recommended a reduction in meat consumption, which should be achieved through voluntary means (Elstub et al., 2021). The increased focus on deliberation is partly a response to the increased societal polarisation discussed above. This approach can be in tension with one of the tenets of a just transition, which is not to delay action on climate change (Atteridge & Strambo, 2020a).

The fact that farmers both feel removed from the general public (Wheeler et al., 2022) and may not see themselves as included in public policymaking (Mills et al., 2018) is likely to influence how they respond to problematisation of ruminant livestock regarding climate change. Awareness of (in)justice provides an ethical framework for the thesis, and positions it in relation to just transition frameworks being adopted and explored in the UK devolved administrations (Scottish Government, 2021; Wales Centre for Public Policy, 2022).

3.6 Summary and conclusions

In this chapter I have presented a conceptual framework and discussed major relevant concepts for the methodological approach and empirical work of this PhD. As illustrated in the previous chapter, ruminant methane emissions are at the centre of several interconnected debates pertaining to global climate change. To analyse UK livestock sector understandings of and solutions to this "problem", this PhD will draw on different theoretical approaches to understanding livestock sector methane discourses. In the first section, I presented an overview of the conceptual framework, as illustrated in Figure 2.1, which I will reprise below.

In the second section, I discussed concepts that mostly pertained to activities on the farm. Tracing a brief history of theoretical approaches to farmer behaviour change, I showed how these have moved from more individualistic approaches to those that account for symbolic

meanings and the way that the state and other actors influence the range of options. In particular, I discussed the Good Farmer identity and its relationship with productivism, and how gendered identities can influence decision-making on the farm, highlighting potential interactions between different dimensions of identity. I then introduced Campbell's (2020) political ontology of the farm, illustrating how ontology can influence what behaviours are possible and imaginable. Campbell offers a definition of "conventional farming" by describing the modernist farm, with firm boundaries being a key component of this archetype. Inspired by this approach, I went on to discuss concepts from the field of boundary studies, and explore "boundary-making" as a specific concept that might help illuminate understandings of and solutions to methane emissions from ruminant livestock, particularly given its connection with discourse (D. Newman & Paasi, 1998).

In the third section, I sought to situate methane emissions from ruminant livestock within the broader agri-food system, and considered some theoretical perspectives that might facilitate this. I first discussed the political economy approach, in particular how this illuminates where power is concentrated within the food system. Secondly, I discussed ST transitions literature, focusing on the concept of lock-in and showing how I might adopt this. I also discussed the broad field of scholars using ANT, and showed how this relates to ontology and literature around care.

In the fourth and final section, I discussed concepts pertaining to broader societal discourse around climate change. I first considered different forms of power, then moved to focus on discursive power. Acknowledging that there are different ways to understand discourse, I presented critical discourse analysis as the theoretical tool that will inform part of the methodology of this thesis, and its tenet that discourses have material impacts on people's lives. I then discussed some of the broad trends in climate change discourse in the UK, and its association with ideology and identity, before moving to highlight insights from political epistemology and introduce the concept of epistemic distance (Carolan, 2006). This led to a discussion of polarisation more broadly, and in the specific context of ruminant livestock and climate change. Finally, I discussed the concept of a "just transition", and how a lack of voice in climate policymaking may enhance perceptions of injustice. This therefore provides an ethical framework which supports the goal to investigate livestock farming discourses, as mentioned in the previous chapter. Furthermore, it draws attention to the distributive impacts facing livestock farmers, and the risk of these impacts leading to increased polarisation and climate delay.

To summarise the conceptual framework (Figure 3.1), I argue that discourse provides a valuable concept for understanding complex, value-laden "matters of concern" (Latour, 2004) with inherent power imbalances (Sievert et al., 2020). Discourses are types of story, and therefore have world-making effects (Chaplain, 2024; Cheah, 2012; Short, 2012). Discourses therefore both shape, and are shaped by, ontology. CDA can be a tool to investigate discourses and their material impacts (Carvalho, 2008; Fairclough, 1992). With this thesis, I am focused specifically on livestock sector understandings of debates around climate change and ruminant livestock, and, more specifically, the discursive and material responses from livestock farmers. Campbell's (2020) farming ontologies therefore provides a route to analyse this at the farm level. Furthermore, this approach incorporates both an awareness of structural factors, drawing on the work of political economists, and a consideration of agency, which may be lacking in more structuralist accounts of the world. I expand the farming ontologies concept: firstly with greater attention to boundary-making and the work of discourse to form and re-form boundaries (D. Newman & Paasi, 1998). Secondly, I expand the farming ontologies concept by linking it with epistemology, particularly political epistemology and the idea of epistemic distance and its implications for sustainable agriculture (Carolan, 2006). Furthermore, I link ontology and epistemology with identity, which helps to further incorporate agency into the conceptual framework. The Good Farmer identity is often analysed using a Bourdieusian approach which accounts for different forms of capital (Sutherland et al., 2024), however in this thesis I conceptualise it by showing how it is interrelated with ontology, epistemology, and discourse. Finally, I borrow the concept of lock-in from sociotechnical transitions literature, to illustrate how on-farm practices are connected with the broader (unsustainable) food system, or regime (Geels, 2010).

In this chapter, I have set out key relevant concepts and sought to illustrate their interconnections and relevance for this PhD. In the next chapter, I will show how these concepts inform the methodology and empirical work of the PhD.

Chapter 4- Methodology

4.1 Introduction

In this chapter I will set out the methodological approach taken in this PhD, following from the conceptual framework described in the previous chapter. I will begin by reprising the aims and research questions, before moving to a discussion of the research design organised by "phases". For each phase, I will show how the methodology draws on the conceptual framework and research questions, provide the rationale for the specific methodologies applied (media analysis, semi-structured interviews, and Photovoice), and set out in detail how data was collected and analysed. Following this, I will discuss ethics, positionality and reflexivity, before finishing with a summary of the chapter.

4.2 Research design

4.2.1 General approach

This PhD seeks to understand livestock farmer methane discourses and associated practices by building on the concept of farming ontologies. I argue that farmer voices are not always prominent in mainstream debates around methane from ruminant livestock, therefore this research places the farm/er at the centre of its conceptual framework. With this focus, I also draw on the concept of the Good Farmer, as well as attention to epistemology. However, as discussed in the previous chapter, the farming ontologies approach draws attention to power, including from beyond the farm gate. I therefore seek to highlight connections with the wider agri-food system, and with popular discourses around climate change, using the concepts of lock-in and discursive power. In addition to addressing a knowledge gap in terms of how livestock farmers understand and act on methane emissions from ruminant livestock, this PhD therefore extends and develops Campbell's (2020) political ontology approach to theorising the farm. I propose that farming ontologies interact with methane discourses and practices, and seek to make these interactions more visible through the empirical work of this PhD.

This PhD seeks to address the following research questions:

1. What are the discourses around farmed ruminants and climate change presented in UK news media at the national and livestock sector levels?

2. What are UK ruminant livestock farming sector stakeholders' (predominantly farmers, including e.g. supply chain actors and policymakers) understandings and experiences of their (and their animals') relationship to climate change?

3. How are these understandings operationalised as social practices- in terms of which "solutions" are being proposed and implemented at the farm level- and how do these correspond to different discourses about ruminant livestock and climate change?

4. What opportunities and principles could inform future policymaking in this arena?

I have sought to demonstrate validity by explicitly linking the research questions to the study design. Table 4.1 illustrates the logical connections between the research questions, the research methods, and the different components of the conceptual framework set out in the previous chapter. It also shows how the methodology will be divided into three "phases" in this chapter to enhance clarity.

Table 4.1: Research design

Research phase as set out in this chapter	**Method(s)**	**Research questions addressed**	**Main relevant conceptual framework components**
1	Critical discourse analysis of news media	1	Discursive power, discourses of climate delay
2	Qualitative interviews with livestock sector stakeholders	2, 3	Lock-in, ontology-epistemology-identity nexus
3	Qualitative walking interviews with livestock farmers	2, 3	Ontology-epistemology-identity nexus, boundary-making.
	Photovoice	2, 3	Ontology-epistemology-identity nexus, boundary-making.

As discussed in the previous chapter, this PhD adopts a constructionist epistemology, as it seeks to understand the meaning a phenomenon has for those involved (Merriam 2009). Qualitative research methods are therefore appropriate to explore how farmers create, interpret and act on discourse around climate change and livestock. As cited in previous chapters, there is a strong tradition of utilising qualitative methods to understand challenges and changes facing the agri-food sector (Burton & Farstad, 2020; Mills et al., 2018; Sexton et al., 2019).

Rather than being assessed on generalisability and objectivity, as is necessary for positivist research, quality in qualitative research must be demonstrated and assessed through different strategies. Malterud (2001) has written extensively on the value of qualitative research within the health field, and argues that key considerations for high quality qualitative research are relevance, validity, and reflexivity.

Relevance can be maintained via the production of detailed reports to provide justification that the research question is a relevant issue (Malterud, 2001). Validity is more related to whether the study design (including the sampling technique) is appropriate to answer the research question. Internal validity refers to whether the study actually investigates what it intended to examine, while external validity considers which contexts the findings may be applied in, including for example links to policy or public discourse (Malterud, 2001). Reflexivity refers to consideration of the researcher's positionality and how this may impact the research- discussed below in a separate section.

In qualitative research, sample sizes tend to be smaller than in positivist research, and purposive or theoretical sampling is commonly appropriate. Findings are therefore not intended to be valid for the broader population, but rich or "thick" description (Ponterotto, 2006) of the context and study setting allows consideration of how the study findings might be applicable in other settings. In a paper discussing in-depth qualitative interview studies, and taking a realist epistemology, scholars have argued that even small sample sizes of 20 or less can be advantageous (Crouch & McKenzie, 2006). These allow repeated contacts with participants and greater involvement of the researcher, which can enhance internal and external validity, as well as rich multi-layered understandings of the phenomena studied. These types of studies can generate propositions- or "hypotheses" in the words of Malterud (2001)- but do not set out to verify them as would be the case in positivist research.

4.2.2 Researching farming ontologies

As mentioned above, this PhD seeks to extend Campbell's (2020) political ontology approach, to better understand UK livestock sector methane discourses and associated practices. Campbell's approach is based on his own experiences from childhood as a 6th generation settler farmer in New Zealand, plus a long career in rural research involving hundreds of visits to farms and interviews with farmers. He also draws on the work of historians to build a narrative of how farms operated as tools of colonisation in New Zealand and worked to 'invisibilise' indigenous ontologies and land use practices.

Not only am I applying this concept in a new area with different historical relationships to the land, but I am seeking to "know" about farming ontologies empirically through a single PhD project, from a starting point as a non-farmer. My positionality has therefore informed the research design from the outset. The question being- how can I, as an outsider, come to know about farming ontologies? I argue that I must access this knowledge through discourse, and that boundary-making is an important way that ontologies are expressed and reified. However, I also saw great value in being physically emplaced on farms during data collection.

For some, this argument might suggest an ethnographic approach, utilising methods such as participant observation. However, as mentioned, my pre-understanding of farm life was relatively sparse. I was aware in theory that farms are very diverse: for example, there are significant differences between upland sheep farms and lowland dairy farms, including different income levels, different proportion of income from agricultural subsidy payments, and different relationships with their supply chain. Furthermore, different methane "solutions" are more or less feasible in different farming systems, such as for housed livestock versus those living outside year-round. Meanwhile, as an outsider I had various preconceptions of what livestock farming was, including a tendency to generalise about "farmers". Engaging with a broader range of farms than permitted by an in-depth ethnographic approach would help me to understand the diversity within the sector, as well as get a sense of some commonalities. Furthermore, the attention to discourses and discursive power made this approach valuable, as I could analyse patterns and observe repetition across a range of farm types. I therefore chose to use walking interviews and Photovoice with livestock farmers, plus online interviews with livestock sector stakeholders, as the main methods to address RQs 2 and 3.

In-person interviews have a range of benefits, such as allowing better interpretation of body language and swifter rapport. Interviewing farmers and their families "in place" has been shown to give access to different types of information as well as revealing some of the micropolitics at play on the farm (Riley, 2010). For example, rather than placing emphasis solely on the often male "principal operator" of the farm, interviewing in place facilitates the (planned and spontaneous) involvement of otherwise invisible actors such as women and farm employees, as well as facilitating the articulation of tacit knowledge relating to farm labour. I also felt that, as a non-farmer, in-person interviews would offer deeper insights into the context in which farmers understand methane emissions from ruminant livestock, as discussed above.

I also chose to augment the interviews with a participatory Photovoice project. Participatory photographic methods have been shown to elicit richer data when combined with qualitative interviewing, including generating additional themes (Kong et al., 2015). Furthermore, the method offered a way to, in a quite literal sense, "see through livestock farmers' eyes" and bring their voices more explicitly into the research (Catalani & Minkler, 2010). Using a participatory approach would also help limit perpetuating the lack of farmer participation that I perceived in mainstream debates on methane emissions from ruminant livestock.

4.2.3 Critical Discourse Analysis

As introduced in the previous chapter, I used Critical Discourse Analysis (CDA) as an interpretive tool to analyse the news media data, which introduced some ontological tension. To summarise, CDA provides a method to explicitly examine discursive power, defined as the power to influence the norms and values that guide behaviour (Sievert et al., 2020). CDA is broadly pluralist, in that it features ontological contradictions. On one hand, it takes the constructionist perspective that discourse is socially constructed and constituted by power-knowledge relations. On the other hand, it adopts the activist standpoint of realist critical theory committed to emancipation and social change (Maeseele, 2015). This means CDA considers discourses to have both social and material drivers and consequences (Bischoping & Gazso, 2016). A key critique of CDA is that the researcher's interpretation of a text does not necessarily correspond with the average reader's interpretation, thus one can only speculate as to its real-world impacts (Blommaert & Bulcaen, 2000). This critique can be partially addressed via contextualisation (Carvalho, 2008).

Scholars have previously used CDA to better understand key issues related to farming and climate change. A 2015 study demonstrated how media discourse around genetically modified crops facilitated or impeded democratic debate by contributing to processes of politicisation and de-politicisation (Maeseele, 2015). Previous work on climate change discourse in UK media showed how ideological standpoints of different newspapers had impacts on various dimensions of science communication, including the interpretation of "facts", the recognised agents of definition, and the goals associated with knowledge (Carvalho, 2007). Another study used CDA to identify climate change metaphors used in a Swedish farming magazine (Asplund, 2011). Three metaphors were identified, each emphasising specific aspects of climate change without portraying the whole picture, and tending to explicitly or implicitly advocate climate change mitigation, rather than adaptation. I therefore argue that CDA is a useful analytical tool for addressing research question (RQ) 1, despite its ontological contradictions (Simmonds et al., 2024).

Having reprised the research questions and the links with the conceptual framework, I will now set out the structure of the research methodology and the rest of this chapter.

4.2.4 Structure of the research steps

To show how this PhD addresses the research questions using the conceptual framework, the methodology will be presented in three phases:

- Phase 1 sought to address RQ1, focusing on societal discourses on climate change through attention to UK news media, using the concept of discursive power and CDA as a methodological tool.
- Phase 2 involved consideration of the broader agri-food sector, through qualitative interviews with livestock sector stakeholders, and began to address RQs 2 and 3. Lock-in provided a key concept, and thematic analysis was used to abstract the data and identify key themes.
- Phase 3 arrived at the farm level to engage more deeply with RQs 2 and 3, using qualitative walking interviews and a participatory Photovoice project with livestock farmers. This phase centred around farming ontologies, as expressed through discursive boundary-making, also drawing on the Good Farmer identity and attention to epistemology. Data were analysed using thematic analysis.

- RQ 4 will be addressed in the Discussion chapter, drawing together insights from all three phases. The collaborative nature of the studentship permitted targeted feedback from policy colleagues throughout the research which helped inform this synthesis.

In the next sections, I will discuss the methods used for each of the three phases, beginning with the use of media analysis to understand discourses around methane emissions from ruminant livestock.

4.3 Phase 1: Societal discourses on climate change and ruminant livestock: media analysis

4.3.1 Rationale for approach

Media analysis methodologies have been used by a range of agri-food scholars to examine how different topics are presented and may be (de)politicised in popular media (Almiron & Zoppeddu, 2015; Donnison et al., 2023; Kristiansen et al., 2020; Maeseele, 2015; Morris et al., 2024). Meanwhile, there is a burgeoning body of research using news media analysis to understand the portrayal of meat, livestock and climate change (Kristiansen et al., 2020; Morris, 2018; Mroz & Painter, 2023; Simmonds et al., 2024), in addition to those investigating the same topic using social media (Maye et al., 2021; Sanford et al., 2021). I use the phrase "news media" in this thesis to describe online and printed formats of news brands containing primarily articles written by professional journalists. Scholars have argued that news media messages are an important factor in reproducing societal norms, and have the potential to influence public opinion and public knowledge on specific topics (Carvalho, 2008; Morris, 2018). They are therefore a relevant source of data for understanding societal discourses on methane emissions from ruminant livestock.

If an issue is discussed more prominently in the media, it is said to be more salient, and this contributes to agenda setting amongst readers (Scheufele & Tewksbury, 2007); frequency of articles is one way to measure issue salience (Rust et al., 2021). While media analysis can be highly valuable for understanding social norms and narratives, it is difficult to ascertain whether the media is the source of new ideas, or simply reflecting those originating from readers. The reality is likely a bidirectional influence (see Figure 3.1), with news media and public discourse contributing to issue framing (Zhou & Moy, 2007). For example, a study of US news media coverage of an oil spill found evidence of "reverse agenda setting", where the news media responded to online search trends, indicating that influence is a "two way street" (Ragas et al., 2014). More recently, a qualitative analysis of UK farming sector media and

interviews with farmers demonstrated that both presented sustainable agricultural practices within agronomic or economic frames more commonly than within environmental frames (Rust et al., 2021). News media analysis can therefore provide valuable insights, and it is likely beneficial to triangulate findings with interview data, as discussed in the next section.

Morris' (2018) study of UK newspaper coverage of a meat reduction campaign found differences in how the issue was discussed in national newspapers compared to local newspapers that catered to more rural populations. Considering future research, she suggested that including farming industry-specific media outlets could add greater insights and may show different framings of contested topics. Using media analysis is therefore valuable for understanding discourses on methane emissions from ruminant livestock, and a research gap exists in terms of comparing national news media with livestock sector news media.

4.3.2 Sampling

In this section I will discuss the sampling approach taken for the media analysis conducted as part of this PhD. This includes the use of news media over other forms of media, the selected newspapers, the key words used, and the date range when searching for articles (Simmonds et al., 2024).

This study focuses on UK media to align with the scope of this PhD. From an international perspective, the UK is an interesting case study as it has many regions specialised in livestock production (Defra, 2023), and a diet that features high meat consumption compared to national nutrition guidelines (Stewart et al., 2021). In terms of national news media, previous climate and livestock research has selected "elite media" to analyse, due to the levels of trust and readership these publications enjoy, and their orientation towards international readership (Kristiansen et al., 2020). Kristiansen et al (2020) selected one left-leaning and one right-leaning UK publication- The Guardian and The Telegraph respectively. Carvalho also makes a case for using "quality newspapers" to explore climate change discourses, arguing that *"a debate on this complex issue is excessively simplified or excluded in other media"* (Carvalho, 2007, page 226). She asserts that her chosen broadsheets- The Guardian, The Times, and The Independent- play an important role in agenda-setting both for the public and other media sources; as well as being preferred by policymakers.

However, tabloid newspapers often have a wider readership and are popular online (Mroz & Painter, 2023). For example, MailOnline was used by 15% of respondents to a Reuters survey

in 2020 (N. Newman et al., 2020), and in 2021 had significantly more Facebook followers than many broadsheet newspapers. I therefore contend that these publications may also play a role in meaning making and agenda-setting among their readership, which, as for the quality newspapers, also includes livestock farmers and their communities. Meanwhile, Morris (2018) found that regional newspapers were more likely than national newspapers to report meat reduction campaigns negatively and paid more attention to impacts on the livestock farming sector. The author suggests this may be due to these publications having a more rural audience, and highlights the need to examine farming sector media as well as news media aimed at a general audience, *"as part of a wider research effort…that engages agricultural actors in deliberating the challenges of meat production and consumption"* (Morris 2018, p.448). To gain a broad picture of the discourses around methane emissions from ruminant livestock, I selected a cross section of national broadsheets, national tabloids, and farming sector news media.

Four national newspapers searchable on the LexisNexis platform were selected, guided by the approach taken in previous studies (Carvalho, 2007; Khazaal & Almiron, 2016; Kristiansen et al., 2020). To incorporate a range of perspectives, one left-leaning and one right-leaning quality newspaper (The Guardian and The Daily Telegraph), plus one left-leaning and one right-leaning tabloid (The Mirror and The Daily Mail) were selected. Newspaper selection for each category was based on having the highest multiplatform reach, while also taking into consideration numbers of Twitter and Facebook followers- given that these were the social media platforms most commonly used for news in the UK at the time (N. Newman et al., 2020).

Farmers Weekly and Farmers Guardian were selected to represent UK farming media, as these had the widest readership (Rust et al., 2021). Although there are many livestock sector magazines targeted at specific production systems (e.g., British Dairying, Sheep Farmer), general farming magazines tend to be more influential within the sector and have more followers on social media platforms. Furthermore, from a pragmatic perspective, the former tend to have less searchable archives and would require manual scanning of past editions to locate relevant articles.

The following string was used to search the national newspapers using the LexisNexis database:

("climate change" OR "global warming" OR carbon OR methane OR "greenhouse gases") AND (livestock OR cattle OR cow OR sheep OR beef OR dairy OR ruminant)

Omission of the term “meat” was to minimise the number of articles not specifically discussing ruminants. Farming news media were searched using their individual websites with the phrase “climate change”, as search functions were not compatible with Boolean operators.

The selected date range for all news media sources was 1st January 2016 to 21st November 2021; a period of almost six years representing the “post Paris era” following the 2015 Paris Agreement (UNFCCC, n.d.) and including COP26 in Glasgow in the final month. This range also captures the start of the “Brexit era”, as the UK’s referendum on EU membership took place in 2016. Furthermore, the late 2010s saw publication of both the EAT/Lancet commission (Willett et al., 2019) and the IPCC’s report on land use (Shukla, Skea, Calvo Buendia, et al., 2019), which provoked a lot of attention in traditional media and public discussion on social media (Sanford et al., 2021), and were not captured in many previous analyses (Kristiansen et al., 2020; Lee et al., 2014; Morris, 2018).

These search terms and parameters were entered into Lexis Nexis, and the headlines of returned articles were scanned, and those appearing relevant were read in full. Articles were included in the overall corpus if they met the following criteria:

- All article formats except readers’ letters
- More than one sentence on the connection (or lack thereof) between ruminant livestock and climate change
- UK focus, or other country with explicit reference to UK interests.

Articles were excluded from the corpus if they focused entirely on the impact of climate change on animal agriculture with no mention of the opposite relationship. Table 4.1 shows the number of results returned by the search, the number of included articles, and the number of articles undergoing detailed CDA (explained further in the next subsection).

Table 4.1: Number of results returned by search, articles included in corpus, and articles analysed in depth.

Search location	**Results in date range**	**Included articles**	**Articles undergoing detailed CDA**
National news media (The Guardian, The Telegraph, The Daily Mail, The Mirror)	3425	660	91
Farming sector news media (Farmers Weekly and Farmers Guardian)	1525	336	63
Total	**4950**	**996**	**154**

4.3.3 Data analysis

I adopted the CDA approach proposed by Carvalho (2008), which was developed specifically for news media and had previously been applied in the UK. The approach employs a timeline perspective, focusing on events and periods that caused discourses to shift and re-form. These are known as "critical discourse moments" (Carvalho, 2008). Critical discourse moments (CDMs) are events that "make discourse on an issue especially visible" (Gamson 1992, p.26). They cause "perturbation", and provoke stakeholders to reassert discourses and use these to interpret the latest development. Carvalho (2008) defines CDMs as:

"…periods that involve specific happenings, which may challenge the ''established'' discursive positions. Various factors may define these key moments: political activity, scientific findings or other socially relevant events." (Carvalho 2008, p.166)

She argues that as time passes, discourses calcify and become more recurrent. Researchers have previously used the CDM approach to analyse coverage of the early 2000s SARS epidemic in Belgian media, identifying four "moments" in the corpus, which comprised 57 news items (Joye, 2010).

During the process of screening articles for relevance and building the corpus, I kept a data journal to record emerging themes based on the initial reading, and to identify "Significant Happenings" and possible CDMs (Carvalho, 2008). Once the corpus was complete, I plotted the number of articles published per month on a bar chart to identify periods of increased publication frequency, denoting increased salience. This information, triangulated with the notes kept during the inclusion process, identified 26 Significant Happenings (Figure 3.2), defined as events that were discussed in a higher than usual number of articles, as well as suspected discursive shifts. Articles pertaining to each Significant Happening were collated and re-reviewed. An article was defined as belonging to a specific Significant Happening if it met the following criteria:

- More than a passing mention of the inciting incident (>1 mention)
- Within one month of the inciting incident

Articles covering each of the 26 possible Significant Happenings were then re-reviewed to assess whether new arguments emerged (Carvalho, 2008)- at this stage seven were excluded, leaving 19 Significant Happenings for detailed analysis (see Figure 4.1).

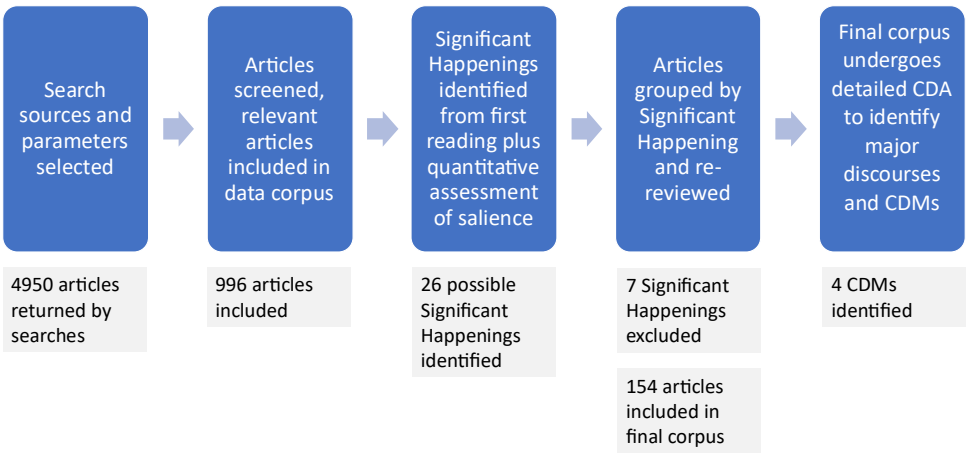


Figure 4.1: Process of CDM identification

The articles pertaining to these 19 Significant Happenings were grouped in folders and entered into NVivo 12. I used Carvalho's (2008) framework to guide the analysis (see Table 4.2), and discourses were identified inductively via attention to language, grammar, and

rhetoric, while the Discourses of Climate Delay (Lamb et al., 2020) were used as a deductive heuristic. CDMs were defined when new discourses emerged or prior discourses changed significantly, in both cases across multiple articles. Comparative-synchronic analysis meant comparing articles from different sources covering the same incident. Historical-diachronic analysis involved accounting for contextual factors and examining the evolution of discourses over time (Carvalho, 2008).

Table 4.2: Components of CDA process, adapted from Carvalho's (2008, p167) framework for analysis of media discourse.

Components of CDA	
Textual analysis	Contextual analysis
1. Layout and structural organisation 2. Objects 3. Actors 4. Language, grammar, and rhetoric 5. Discursive strategies 6. Ideological standpoints	1. Comparative-synchronic analysis 2. Historical diachronic analysis

4.3.4 Ensuring quality

In this section, I have detailed the method, sampling technique and analytical process for the media analysis to illustrate that it was appropriate to answer the research question, demonstrating validity. The design process and analysis was augmented by discussion with supervisors throughout, to ensure that design decisions were justified and that there was inter-researcher agreement on data interpretation. External validity was enhanced by the attention to context, facilitated by Carvalho's (2008) approach including historical diachronic analysis. The data journal provided space for reflections pertaining to reflexivity, and this component of quality is discussed further later in this chapter.

4.4 Phase 2- Analysis of the agri-food system and lock-in: sector stakeholder interviews

4.4.1 Rationale for approach

As discussed earlier, Campbell's (2020) farming ontologies approach is political, in that it incorporates political economy perspectives on power. This aligns with other work highlighting the importance of viewing farmer behaviour as taking place within a broader system that enables or constrains change (Shove, 2010). Detailed engagement with (for example) supply chain actors was beyond the scope of this PhD; however, I sought to incorporate perspectives from beyond the farm gate via two main strategies.

Firstly, I conducted semi-structured interviews with 17 livestock sector stakeholders, defined as people with a professional relationship with farmers but who did not farm as their main profession. There was a small degree of overlap with livestock farmer interviewees, as some of the latter held roles in local or regional organisations, and some livestock sector stakeholders were also involved in farming activities on a daily basis.

Secondly, I asked all interviewees (including livestock farmers) about the supply chain for products from ruminant livestock. For livestock sector interviewees, this was worded as follows: "Tell me about the journey a typical cow or sheep goes on to get from farm to fork. Where does your work fit into that?". For livestock farmers, I asked "Tell me about the supply chain journey these animals (or this milk) goes on." I also asked them, "How do your supply chain relationships influence your sustainability?".

4.4.2 The qualitative interview

In this section, I will set out the rationale for using qualitative interviews, which applies to research Phases 2 and 3. The qualitative interview is a purposeful conversation between the researcher and one or more participants, in which the participants' perspectives, beliefs, and ideas may be explored to discover things that cannot be directly observed (Merriam, 2009). According to King (2004), *"The goal of any qualitative research interview is…to see the research topic from the perspective of the interviewee, and to understand how and why they come to have this particular perspective"*. For participants, it is possible (but not guaranteed) that the interview may lead to greater self-understanding and better insight into the social conditions of their lives (Crouch & McKenzie, 2006).

Interviews can be structured, semi-structured or unstructured. The former is often used in quantitative data collection when the goal is to complete a standardised questionnaire. Unstructured interviews are the opposite; the researcher provides little or no guidance apart from perhaps suggesting a broad topic for discussion and asking open-ended questions (Merriam, 2009). Semi-structured interviews were chosen as most relevant to answer the research question, as they allow for relevant topics and questions to be discussed with all participants, but with flexibility to follow tangents and spend time exploring unexpected lines of enquiry. In this case, the interview guide will typically contain a mix of more and less structured questions (Merriam, 2009).

King (2004) differentiates between realist interviews (those that presume participants' reports of their experiences to be an accurate representation of reality) and constructionist interviews (in which the interview is interpreted as an interaction constructed in a specific context, with an indefinite number of interpretations). Roulston (2010) further categorises qualitative interviews- into neo-positivist, romantic, constructionist, postmodern, transformative, and decolonising- showing how each type involves different ideas about what constitutes a "quality" interview. This typology aims to make more explicit the theory-method connection in qualitative interviewing, rather than prescribing firm boundaries between categories.

For example, neo-positive interview studies are concerned with demonstrating the truth and accuracy of accounts provided by participants, and showing that the researcher has minimised their influence on the generation of data (Roulston, 2010). Meanwhile, a romantic perspective on interviewing is far more accepting of the researcher's place in the study- the interview is geared towards establishing rapport and empathic connection to generate "self-revealing" conversation. Both of these styles assume that *"researchers are able to access the authentic selves of interview subjects via interview talk"* (Roulston, 2010, page 218); but in the latter there is a greater focus on reflexivity as an indicator of quality. The third interview type that can be considered relevant is the transformative interview, in which the researcher intentionally sets out to challenge and change participants' understandings. Within this, action research is one example. This technique may involve participant input into research design, analysis and presentation, and analysis often draws on critical theory. Quality can be assessed through the extent of participation (Evans-Agnew & Rosemberg, 2016) and the extent to which the project has generated dialogue and action towards realising social justice goals (Roulston, 2010).

To address the research questions, my interview guide adopted some neo-positivist assumptions, in that I sought to use consistent wording of certain questions for each participant, and minimised discussing my own opinions or position in relation to the research topic. However, I also made considerable efforts to generate rapport and empathic connection with participants, both in the recruitment phase and during the interview encounter. It could therefore be argued that the interviews had a somewhat romantic perspective, in that I was seeking to access participants' "authentic selves". Regardless of whether I apply the label neo-positivist or romantic, reflexivity was essential in terms of deciding which "parts" of myself to bring into interviews and which to leave out- this is discussed further later in this chapter. Interviews were not particularly "transformative", as I did not set out to particularly challenge participants' views. However, this approach and its attention to participation as a measure of quality is relevant to the Photovoice component of data collection, discussed later in this chapter. Overall, the interview approach I took can be described as constructionist, as it is understood that the interviews represented specific encounters which could be interpreted in various ways.

I will present how I developed the interview guides during the section on Phase 3, as the interview guides for livestock sector stakeholders and livestock farmers were developed in parallel.

4.4.3 Sampling approach

For both groups of interviewees, sampling was purposive (targeting specific stakeholder voices and perspectives), utilising a snowballing strategy to increase participation. While it was not necessary to generate a representative sample to address the research question, I utilised sampling matrices as a form of stakeholder analysis to ensure a range of experiences were included in the data. This was reviewed regularly during data collection, and if a specific characteristic appeared underrepresented, I sought to purposively engage participants with that characteristic.

To obtain a cross section of UK livestock sector stakeholders I constructed a sampling matrix of the main groups that would have either a potential influence on constraints to farmer behaviour (such as retailers and policymakers), or expertise relevant to ruminant methane emissions (such as agricultural consultants and agri-tech stakeholders). I also included livestock farming representatives and NGOs that either focused on a specific livestock farming type or had an environmental orientation. As this research progressed in tandem with

livestock farmer interviews, I was also able to include groups that were mentioned by livestock farmer interviewees as being important or influential. The sampling matrix and resulting sample are shown in Table 4.3.

Table 4.3: Sampling matrix and sample numbers for livestock sector stakeholders

Type of organisation	Number of interviewees
Livestock farming representatives/NGOs	4
Agricultural consultants and advisors	2
Vets	2
Packers and processors	2
Agri-tech stakeholders	2
Retailers	2
Policymakers	3
Total	**17**

4.4.4 Addressing bias/quality

In this subsection, I will highlight the main considerations for research quality pertaining to semi-structured interviews, which also applies to the walking interviews in Phase 3. Firstly, in any research that considers aspects of behaviour, an important consideration is the intention-behaviour gap (Rhodes & De Bruijn, 2013). While this study is not focused on measuring behavioural outcomes, it is important to remember that stated intent to implement a certain methane solution is not equivalent to having carried out the behaviour. As I only met most participants at one time point, it was not possible to verify whether they went on to implement specific solutions. As my research question was about understanding discourses and how these related to different strategies, one interview encounter was sufficient.

A common source of bias in positivist research is selection bias, in which the individuals who agree to participate are more likely to share certain characteristics. In this study, the participant population contained a relatively high proportion of women and people utilising alternative farming approaches (such as regenerative agriculture) compared to the general farming population. This is likely due to my research being framed in terms of sustainability and climate- topics which livestock farmers can often experience negatively. People who were already engaged in enhancing their farm's sustainability, or who were used to engaging with researchers, were therefore more likely to be open to participation. Although a

representative sample and generalisable results are not necessary for this type of research, the nature of the sample reinforces the need for close attention to context, as well as avoiding making general statements about UK livestock farmers based on this research. This is discussed further below, and in the Discussion chapter.

Finally, in semi-structured interviews the role of the researcher as a "research instrument" is particularly relevant. Interviewing incorporates numerous interpersonal skills: such as active listening, building rapport and sensitively dealing with difficult or traumatic topics. It is easy to see how the researcher's level of experience may influence the data collected- for example, by moving on too quickly when a participant takes a long pause, or by failing to gently bring a participant back on course from a lengthy tangent. As an early career researcher, I will have gained experience over the course of the PhD, with later interviews possibly being more skilfully managed. This is largely unavoidable, and partially addressed by carrying out a relatively high number of interviews and triangulating data with other methods.

4.5 Phase 3- Analysis of livestock farmer ontologies: interviews and Photovoice

So far in this chapter I have detailed the methodology pertaining to understanding societal discourses around ruminant methane emissions, and the position of the farm within a broader sector with inherent power dynamics. In this phase, I will set out the methodology for fully addressing RQs 2 and 3. This represents the heart of the thesis- seeking to understand farming ontologies and their relationship with ruminant methane discourses and associated practices. I will begin with the livestock farmer interviews, then describe the Photovoice methodology, before discussing the data analysis procedure for research phases 2 and 3.

4.5.1 Livestock farmer interviews

4.5.1.1 Rationale

As discussed earlier in the chapter, this PhD seeks to extend Campbell's (2020) political ontology approach and apply it empirically. I argue that discourse presents a route to "knowing" about farming ontologies, and hence qualitative interviews are a valid method to utilise. In this subsection I will discuss some theoretical and practical considerations around the location of the interview encounter. Having commenced my PhD in October 2020, various practical considerations had gained increased significance due to the Covid-19 pandemic. Although my initial PhD proposal envisaged on-farm, in-person interviews, I considered the possibility of online interviews and how this might impact data collection.

In-person interviews have a range of benefits, such as allowing better interpretation of body language. As discussed above, I also felt that, as a non-farmer, in-person interviews would offer me useful insights into the context in which farmers understand methane emissions from ruminant livestock, and offer a deeper sense of place (Riley, 2010). However, in-person interviews carry a logistical burden (Saarijärvi & Bratt, 2021), particularly in remote and rural locations, and may necessitate focus on a specific geographical area for practical reasons rather than theoretical. There are also safety considerations related to lone working (Chiswell & Wheeler, 2016).

Meanwhile, digital interviews offer benefits in terms of eliminating the need for transport (which both saves time and reduces GHG emissions associated with the project), and ease of recording (Saarijärvi & Bratt, 2021). Evidence suggests that online and in-person approaches can be equivalent for structured interviews, with participants being more likely to follow through with arranging an online interview (Peasgood et al., 2023). Drawbacks of digital interviews include the need for a reliable internet connection (which may be particularly problematic in rural areas), lack of digital literacy presenting a barrier to participation (Saarijärvi & Bratt, 2021), and the possible reduced ability for all parties to interpret non-verbal cues.

Another consideration was to minimise the travel emissions associated with the project- this is discussed further below. Through discussion with my supervisors, it was agreed that in-person interviews, ideally with a walking component, would be the "gold standard" for my interviews with livestock farmers due to the benefits outlined above. I could then revert to online or telephone interviews if necessary for reasons relating to infection control, travel logistics, or strong participant preference. For the interviews with livestock sector stakeholders in Phase 2, online interviews were deemed more appropriate, as this would facilitate engagement with a range of participants while minimising travel, and there was less to be gained by being "emplaced" in their place of work, in terms of addressing the research questions.

4.5.1.2 Preparation

In this subsection, I will discuss how the interview guides were designed for both livestock farmers and livestock sector stakeholders (Phase 2). The interview guide refers to the list of questions and topics for discussion developed in advance, and is informed by the researcher's pre-understanding and theoretical framework (Merriam, 2009). It can therefore incorporate insights from informal preliminary work, such as discussion with individuals who have

experience of the research area (King, 2004), as well as the initial media analysis phase in the case of this PhD. I conducted informal discussions with acquaintances working in the livestock sector to improve my pre-understanding of the research area and pilot potential questions prior to formal interviews. This helped to increase the participatory nature of the project, given that these early insights informed the research design (Prasad, 2017).

Merriam (2009) recommends the following typology of "good" questions for eliciting rich data in qualitative interviewing: hypothetical, devil's advocate, ideal position, and interpretive questions. I have described these together with examples of questions relevant to the research topic in Table 4.4.

Table 4.4: Four types of interview questions with examples (adapted from Merriam 2009)

Type of question	Example
Hypothetical: asks participant to consider a particular scenario and/or what they might do in that scenario	Suppose I'm a new livestock farmer coming into the sector for the first time. What challenges am I likely to face?
Devil's advocate: challenges the participant to consider an opposing view or situation	Some groups would say that reducing meat consumption is the most important solution for reducing agricultural GHG emissions. What do you think about that?
Ideal position: asks participant to describe and ideal situation	What changes would you want to make on the farm if you had no financial constraints?
Interpretive: the researcher proposes tentative explanations for what the participant has been saying and seeks their reaction	It sounds like you think the first solution is more feasible, would that be right?

The interview guides were informed by the initial informal interviews, and structured around the conceptual framework (see Appendix 1). For example, I included questions that pertained to farming ontologies, farming identities, lock-in, and discursive power. I also structured the interview guide in such a way as to facilitate rapport, especially for livestock farmer interviewees: beginning with more general questions about the farm and its day-to-day workings, before moving to more sensitive topics such as climate change debates. Table 4.5 shows some examples of questions linked to specific concepts.

Table 4.5: Example interview questions linked to concepts

Concept	Example questions
Farming ontologies	- Tell me what you would do on a typical day on the farm/talk me through your day yesterday. - What are the major challenges facing UK livestock farmers? - How do activities on a farm effect the surrounding countryside? - What is the relationship between your farm and the local community?
Powerful discourses	- There is a lot of discussion in the media and on social media about methane emissions from cows/sheep. Does this affect you in any way? - Which groups do you think have the most power in these debates? - What future do you see for cows and sheep in the UK?
Lock-in	- Tell me about the journey one of these animals goes on to get from farm to fork. - Why do you think that [solution] wouldn't work for your farm? - What are your future goals for the farm?
Farming identities	- What makes a Good Livestock Farmer? - What roles do farmers play in our society? - Do you think the qualities of a Good Farmer are influenced by someone's gender? - If I were a young person just starting out in beef/sheep/dairy, what advice would you give me?

During the interviews I also made use of "probes", which are verbal or non-verbal messages from the researcher that seek to elicit further information: ranging from silence to fully formed sentences. Deploying these appropriately can result in richer data, and can be improved with practice (Merriam, 2009). Being emplaced on the farm meant that the

workings of the farm were a significant topic of discussion, and this usually led to further ad hoc questions that provided deeper insights into the research topic.

The interview guide evolved slightly during the data collection process as certain questions were reformulated to improve clarity, and some new topics of interest emerged spontaneously (King, 2004). Interviews with livestock farmers usually took between one and two hours. The interview guides can be found in Appendix 1.

4.5.1.3 Sampling strategy

A key component of the sampling strategy for walking interviews was the location. As mentioned previously, transport emissions were an important consideration. I decided to focus on two "walking interview zones" for the pragmatic reasons of minimising emissions and facilitating timely data collection. The first area was Sussex and Kent, featuring mainly lowland grazing with areas of chalk grassland, and a high proportion of agricultural land classified as "good to moderate" (Natural England, 2010a). The second was Cumbria and Northumberland, featuring a high proportion of Less Favoured Area (LFA) upland farming (Defra, 2025b), with a higher proportion of land classified as "very poor" (Natural England, 2010c, 2010b). The latter region has a higher proportion of beef and sheep farming relative to dairy, and this approach therefore facilitated inclusion of a range of livestock farm types. From the literature review and initial interviews, it was clear that different types of farms faced different challenges in relation to methane emissions from ruminant livestock. For example, dairy farms would be likely to have compliance with carbon audits written into their milk contracts. Beef and sheep farmers received a higher proportion of their income from CAP payments, and were therefore more likely to struggle financially as these were phased out (Hubbard et al., 2018). There are also more generalised differences between the Southeast and Northern counties in terms of population density and levels of investment (County Councils Network, 2022).

To recruit participants I used a purposive sampling approach incorporating a range of strategies. Firstly, I asked livestock sector stakeholders whether they would recommend interviewing any specific farmers. Secondly, I wrote a short recruitment call, which one of my colleagues posted on the Pasture for Life discussion forum on my behalf, and which I sent to a friend working as a vet in Northumberland, who added it to their practice's newsletter. I posted a recruitment call on Twitter, attended an agricultural show in Sussex where I approached farmers and handed out flyers, and posted a recruitment call on The Farming Forum (a UK farmer discussion group). I also used a snowballing strategy, asking farmers for

recommended interviewees at the end of our interviews. Some were reluctant to suggest anyone else, likely due to the controversial nature of the research topic, while some enthusiastically put me in touch with other farmers. I often found that this latter technique made it easier to build rapport with new interviewees, as we had been introduced via a trusted person.

During the above recruitment process, I also made contact with participants who lived outside the two study areas: in Wales and in two other English counties. Some of these were included to incorporate further perspectives, as recruiting sufficient numbers proved challenging- this is discussed later. Interviews outside the walking interview study areas were conducted online or by telephone.

I identified "livestock farmers" as those whose main occupation was farming, and who therefore would be the ones enacting top-down or grassroots methane solutions. As with the livestock sector stakeholders, I created a sampling matrix to help include a range of farm types. Obviously, there was some overlap between characteristics, for example with many participants running combined beef and sheep enterprises. Table 4.6 illustrates the sampling matrix employed for livestock farmers.

Table 4.6: Sampling matrix for livestock farmers

Variable	**Characteristics**		
Farm size (FTE)	Small	Medium	Large
Main product	Beef	Dairy	Sheep
Main route to market	Direct to consumer	UK retail	Export
Approach to farming	Intensive	Extensive	Organic

4.5.1.4 Details of sample

The above strategies resulted in 32 farm interviews with 37 interviewees, of which 24 were conducted in-person, five online, and three by telephone. The mean participant age was 50.9 years, and the median age was 45.5 years. The smallest farm by area was 12 acres (plus some additional grazing), while the largest was 2000 acres. The mean area was 593.9 acres, and the median area was 1,005 acres. In terms of full time equivalent (FTE), the minimum farm size

was “part time” (0.5 to less than 1 FTE), and the largest was “very large” (5 or more FTE). The majority of farms were classified as “small” or “medium” (Defra, 2024b).

Tables 4.7- 4.10 show descriptive data including location, interviewee gender, main product, main supply chain route, and tenure. The majority of farms were extensive, with two of the dairies running housed systems that I considered intensive. Six farms sold certified organic produce.

Table 4.7: Participant locations and gender

Location	**Number of interviews**	**Number of interviewees (number of women)**
East Sussex	4	6 (2)
West Sussex	5	6 (2)
Kent	3	3 (1)
Cumbria	7	9 (2)
Northumberland	7	7 (2)
South Wales	3	3 (1)
Misc.	3	3 (0)
Total	32	37 (10)

Table 4.8: Number of farms by enterprise

Farm type	**Number of farms**
Beef and sheep	17
Beef	6
Sheep	2
Dairy	5
Goats and sheep	1
Arable (grazed by livestock)	1

Table 4.9: Number of farms by main supply chain route (NB total is 31 as one farm only grazed other people's livestock)

Main supply chain route	Number of farms
Supermarket contract	4
Livestock auction	9
Direct to consumer	9
Dairy co-op	4
Other (including private sales to other farmers, selling direct to processor, and selling to local butcher)	5

Table 4.10: Number of farms by land tenure

Land tenure	Number of farms
Owned	19
Fully tenanted	4
Mixed	8
Farm manager	1
Additional access to commons grazing	4

4.5.1.5 Addressing bias/quality

Considerations for ensuring quality were similar to those for the qualitative interviews detailed in Phase 2, which I don't repeat here.

I will now discuss the Photovoice methodology, before describing the approach to data analysis.

4.5.2 Photovoice

4.5.2.1 Rationale

Photo elicitation methods broadly refer to qualitative methods that involve asking participants to take photographs, often pertaining to a specific theme or topic. One of the most widely used is Photovoice, developed by Wang and colleagues in the 1990s. This method is inherently participatory, in that it focuses on empowerment, community strengths, and balancing research and action (Catalani & Minkler, 2010). It was developed as a means of

disrupting power differentials when working with marginalised groups, given that it seeks to give participants agency in choosing what to photograph and to display the world "through their eyes" (Wang & Burris, 1997).

Wang and Burris' (1997) often cited article, setting out the rationale and practical considerations for Photovoice, is based on a project conducted in rural China. Researchers entered a collaboration with a local NGO and aimed to conduct an assessment to explore the health needs of rural women farmers. Although a lack of education was often believed to be the cause of their health problems by outsiders, the project revealed that poor access to clean drinking water, lack of childcare and unreliable transport networks were all undermining women and girls' ability to remain in education and take care of their health (Wang & Burris, 1997).

Photovoice methods can vary considerably based on the context and constraints of different projects (Catalani & Minkler, 2010). In the classic method described by Wang and Burris (1997), participants are given cameras and asked to photograph things that relate to a certain topic or question. They do so individually and in their own time, then reconvene with the researcher and other participants to discuss the photos. Participants are asked to select their favourite images for discussion, and a trained facilitator explores the circumstances in which the photo was taken and the meanings it holds. This often uses the SHOWeD technique (Catalani & Minkler, 2010):

- What do you See here?
- What's really Happening here?
- How does this relate to Our lives?
- Why does this problem, concern or strength Exist?
- What can we Do about it?

The group then collectively analyses the photos to generate thematic codes and creates captions for the images (Evans-Agnew & Rosemberg, 2016). Some researchers apply codes to the actual photos, but for many the analytical focus is on the dialogue generated by group discussions. The photos and accompanying texts can be used to communicate with other stakeholders and policymakers, for example via an exhibition at the end of the project, as well as being gifted to the people that feature in them (Wang & Burris, 1997).

I had not considered photo elicitation methods when I submitted my PhD research proposal, but became interested in them as a means to obtain richer data in the event of pandemic restrictions precluding face-to-face interviews. While the question of whether livestock farmers in the UK represent a marginalised group might be contested, my initial reading of academic and newspaper articles suggested that their voices were often under-represented in policy discussions, particularly in relation to climate change and net zero. Furthermore, Photovoice had previously been used in comparable populations. For example, a study by Bulla and Steelman (2016) used it to explore climate change on small family farms in North Carolina, USA. They worked with seven farmers, two of whom kept livestock while the rest predominantly grew vegetables. They found that farmers were experiencing a changing climate, and using adaptive behaviours and reliance on community support to ensure the viability of their farms. By remaining dedicated to their farming philosophy, the authors observed that the farmers were echoing a "living with climate change" ontology, which is based on mutuality between nature and society (Bulla & Steelman, 2016). Farmers perceived themselves as participating in an ideological battle between proponents of an industrialised food system and the small-scale, local, organic food movement they were a part of. Photovoice was felt to be an appropriate research method as it facilitated a rich understanding of the context and generated "a depth of place-based experience" (Bulla & Steelman, 2016).

Meanwhile, a study exploring evaluation of land management, conducted with South African livestock farmers, found that photo elicitation methods added valuable additional information to semi-structured interviews (Kong et al., 2015). The authors used a photo elicitation technique with individual farmers in one region, and an adapted Photovoice technique in a second region. They found that both methods added greater depth to the interview data and resulted in focus on somewhat different themes. For example, grassland condition was not discussed often in the interviews, but featured strongly in the photo elicitations. Furthermore, Photovoice discussions produced additional subthemes over and above the individual photo elicitation data, and provided a forum for mutual learning among participants.

The authors also found another key benefit of photo elicitation methods: they helped build rapport between researchers and participants, which in turn enhanced the level of detail in the data (Kong et al., 2015). Meanwhile, giving participants the power to choose what and how they wished to photograph led to an increased sense of ownership and pride in the research, which enhanced participation. Limitations included equipment expenses (the authors purchased digital cameras for the project) and time requirements. Overall, the authors did not

explore whether photo elicitation could replace semi-structured interviews, but the fact that different themes emerged in the different forms of data led them to conclude that photo elicitation can enhance researchers' understanding of farmers' knowledge and perspectives over and above semi-structured interviews alone.

Based on this prior research, I argue that Photovoice was an appropriate addition to the walking interviews with livestock farmers, to help achieve the aim of investigating farming ontologies.

4.5.2.2 Preparation

In this subsection, I will set out how I designed the programme for the Photovoice workshops. To prepare for this phase of data collection, I participated in a 5-day "Online Comprehensive Training" course provided by a UK company also called "Photovoice". This taught the principles and practicalities of running a participatory photo project, including the opportunity to take photos, generate captions, and discuss them with other participants and a facilitator. This gave me a basic structure for the project, as well as several example activities for breaking the ice, building group dynamics, and allowing participants to try interpreting photos. I had a lot of ideas and wanted to ensure sufficient time to allow relationships to form within the group, however this needed to be balanced with ensuring convenience for participants. I spoke to each participant on the phone as I was designing the programme to determine what would suit them in terms of day and time.

The final programme involved four two-hour workshops, delivered online via Zoom on Thursday evenings in autumn 2022. The sessions were recorded, with my analytical focus being primarily on the talk data rather than the photos themselves. Over the 4-week programme, we moved from discussing the power of photography to provoke social change, to practicing taking photos unrelated to the research topic, to trying activities that involved interpreting photos in different ways, to taking photos related to the research topic, to discussing these using the SHOWeD technique (Catalani & Minkler, 2010), to generating captions. Please see Appendix 2 for an example workshop schedule. When the project was complete, we agreed to display participants' favourite photos in a digital exhibition, via a website which I developed in spring 2023: https://farmervoices.co.uk/.

In this section I have discussed the development of the interview guides and the Photovoice workshop schedule. In the next section, I will discuss the sampling strategies for this phase of the research.

4.5.2.3 Sampling strategy

Recruiting participants for the Photovoice component was more pragmatic, given the demand on participants' time and the need to create a positive group dynamic. I therefore only approached farmers I had already interviewed, and who had expressed interest when I mentioned the photo project at the end of our interview. A 2010 systematic review of 37 peer reviewed articles using Photovoice in public health research found that the number of participants ranged between four and 122; with a median of 13 (Catalani & Minkler, 2010). I aimed to recruit a maximum of ten participants, as any more would make online meetings impractical. When the time came for recruitment, I contacted those who had been most enthusiastic, and who represented a cross section of geographical areas and farm types. I was also more likely to approach farmers with whom I felt I had developed a good rapport, as I would be asking them to give up their time and possibly step outside their comfort zones.

4.5.2.4 Details of sample

The Photovoice project included eight participants from six farms: five individuals plus three members of one family who participated together. Of those three, one did not take photos, but still contributed to the workshops. In the end, those who were able to commit included individuals from both case study areas plus Wales. Unfortunately, none of the contacted dairy farmers were able to participate, therefore the group comprised people who mainly farmed beef and sheep.

4.5.2.5 Addressing bias/quality

There are a few key considerations relating to research quality when using participatory photographic methods. Firstly, one of the key recommendations by Photovoice (the company) is to give participants relatively cheap digital cameras on which to take photos. This gives participants more of a level playing field if their own smartphones or cameras are of varying quality. It can also be a valuable way to promote trust between researchers and participants. Having prioritised spending my research budget on travelling to in-person interviews, I designed the project with participants using their own smartphones to keep costs down. This was discussed with participants ahead of time- as they all carried smartphones and often took pictures anyway, none of them expressed any issues with this plan.

Secondly, quality in this phase could be assessed partly through the general requirements for qualitative research (relevance, validity, and reflexivity) (Malterud, 2001), and partly through the degree of participation. Catalani and Minkler (2010) assessed the quality of participation in 37 Photovoice projects, using a tool that rated 10 aspects of community-based participatory

research projects, from selection of research question to dissemination of findings. The authors found no relationship between the number of participants and quality of participation, but noted that the quality of participation tended to increase with project duration. Among the low-participation studies, participants tended to have minimal interaction with the researcher or with each other. Across all studies, among projects that did include an explicit action phase, 96% of these involved a community photo exhibition that often included policymakers or influential actors. The fact that this PhD project allowed a significant level of interaction between participants was positive, as was the fact that they played a role in generating initial themes and that we agreed on an explicit action phase (the online exhibition).

A more recent review of Photovoice projects found that many resulting journal articles fail to privilege participant voices in a way that can be meaningfully experienced by readers (Evans-Agnew & Rosemberg, 2016). Although reviewed studies were purposely selected because they involved participants in collective discussions, just under half of these did not use said discussions as the main basis for development of themes. Furthermore, participants did not always influence which photographs were to be exhibited at local events, and were even less likely to influence which photographs were included in published journal articles. These considerations therefore remain pertinent in research dissemination and impact.

4.5.3 Data analysis for research Phases 2 and 3

In this section I will discuss the data analysis approach for the qualitative interviews and Photovoice project, which were analysed together.

4.5.3.1 Tools for transcription and analysis

Whether in-person or digital, once interviews and workshops have been conducted the recording must be transcribed. This may be done by the researcher, which can allow a deeper understanding of the data and initial identification of connections and themes. However, transcription is a time-intensive process, and there is now AI-driven software available to automatically transcribe data. This can generate a "first pass" transcript with up to 90% accuracy in ideal conditions, which can then be reviewed by the researcher to correct any errors: potentially resulting in significant time savings (Bokhove & Downey, 2018). Automatic transcription raises certain ethical issues, as it requires an external actor having access to interview data which may be stored outside the country of origin. However, provided this is planned for in advance with a rigorous approach to informed consent, the risks to privacy can be mitigated (Hafferty, 2020).

Due to time constraints and the challenges associated with recording outdoor interviews, I utilised a blended approach to transcription. Approximately 40% of the interviews were transcribed professionally, then reviewed by me prior to analysis. The remainder were transcribed using the programme Otter.ai, then reviewed and edited by me. The latter created transcripts varying between approximately 60% and 90% accuracy, therefore requiring detailed attention to identify where the AI had made a "best guess" and altered the meaning of a statement.

Many analytical approaches were developed prior to the advent of digital tools. However, Qualitative Data Analysis Software is now widely utilised and accepted within the social sciences. NVivo is a popular tool that facilitates coding by allowing interview excerpts corresponding to a shared theme to be bundled in "nodes". This allows the researcher an overview of all content related to a specific theme across the entire dataset. NVivo has been used previously in research employing discourse analysis and thematic analysis (Krzywoszynska, 2024; Rust et al., 2021).

Transcriptions from interviews and Photovoice workshops were imported to NVivo as pdfs. I will now discuss in detail how the interview and Photovoice data were analysed.

4.5.3.2 Thematic Analysis

Thematic analysis is widely used in qualitative research and can be applicable across a variety of research questions and epistemologies (Nowell et al., 2017), including within a critical framework (Clarke & Braun, 2017). However, this flexibility can result in lost consistency and coherence in the development of themes- furthermore, there is less detailed literature on thematic analysis compared to approaches like grounded theory. Nowell and colleagues (2017) recommend using the following criteria to demonstrate trustworthiness in qualitative research: credibility, transferability, dependability, and confirmability. They describe how these can be optimised in each of the six phases of thematic analysis via practices such as triangulation, detailed documentation of developing themes, and reflexive journaling.

I used a mixed inductive and deductive approach to coding with the conceptual framework in mind. I did not impose the identified media discourses from Phase 1 as a deductive framework in Phases 2 and 3, but rather let the interview and Photovoice data "speak for themselves". I began with the interviews and finished with the Photovoice workshops. As the inductive codes proliferated, I recognised the "discourses of climate delay" appearing

regularly, and therefore incorporated these as a deductive heuristic (V. Braun & Clarke, 2006; Lamb et al., 2020). I also began to group nodes in categories based on the conceptual framework and interview guide. For example, groups included “Boundaries”, “The Good Farmer”, and “Discursive power”. During the analysis process, I kept a “Coding Diary” (Nowell et al., 2017) where I made notes including how I was interpreting different ideas, and where I suspected nodes would need to be merged or revised. This helped to keep an overview of the large volume of data.

Due to time constraints in the Photovoice project, it was challenging to involve participants to a great extent in generating initial themes. To ameliorate this, I suggested some initial themes during the final workshop session, and participants discussed and refined them.

4.6 Ethics

In the previous three sections, I have set out the methodology for this PhD, detailing the three major sources of data and their relevance to the research questions. I will now discuss the ethical considerations pertaining to these methods.

As the media analysis phase involved previously published data and no human participants, this did not require ethical approval. I sought and received ethical approval from the University of Gloucestershire’s School of Natural & Social Sciences Research Ethics Panel to conduct the interviews and Photovoice project.

4.6.1 Consent and confidentiality

Interview data was kept confidential and participants will be anonymised in any published research outputs. Interviewees were assigned a number for data storage and research outputs. There may be some reference to simple demographic data (gender, age range) and to the general location of the participants in research outputs, but not in a way that will make the person(s) identifiable.

Confidentiality cannot be guaranteed in Photovoice workshops due to their nature. To ameliorate this, we established a “group agreement” during the first workshop, which included principles around confidentiality and sharing of images.

Written informed consent was taken at the beginning of interviews and prior to commencing Photovoice workshops. Further written informed consent was taken with Photovoice participants at the end of the project to cover permissions to use photographs in an agreed

output (such as an exhibition) and future ownership of images. For any photos that contained images of human subjects, informed consent was taken from the "model" to use the image for project outputs.

4.6.2 Data protection

The project complied with University of Gloucestershire data protection and IT policies / requirements, and with EU General Data Protection Regulation (GDPR). I abided by the approved CCRI research data protection statement throughout. I also complied with University of Gloucestershire IT polices with respect to email, wifi use, internet and user accounts. Regarding GDPR, special categories of personal data such as personal political or philosophical views were sometimes elicited during interviews and workshops. The following data protection measures were therefore taken.

Data were stored on my University of Gloucestershire OneDrive, accessed via my laptop which is accessible only by fingerprint or pin code. Documents linking participant codes with participant demographic and contact details were stored in the password protected "Personal Vault" within OneDrive. At the end of the project, data will be stored for a further 2 years and then destroyed. Participants could request to withdraw from the study and have their data destroyed up to 30 days after their interview, or 30 days after the final Photovoice workshop they attended.

4.6.3 Safety and risk management

I completed a general risk assessment as part of my ethical approval application, prior to conducting interviews. Major risks pertained to lone working, being in a working farm environment, driving, and Covid-19. Specific measures included avoiding contact with livestock, discussing potential risks with the farmer, and regular hand sanitising and Covid-19 testing. I made efforts to take public transport as far as possible and practicable, using a hire car when necessary to reach rural areas with minimal transport links. This safety measure aligned with my goal of minimising travel emissions. I also ensured my supervisors and a colleague at the CCRI main office were aware of my timetable; in terms of where and when I would be, and when I expected to finish each day. I also carried a mobile phone and emergency battery pack with me at all times.

There was a small risk to participants of psychological intrusion from interview questions, due to the sometimes toxic nature of debates around farmed ruminants' role in climate

change. Poor mental health among livestock farmers has been linked to (among other factors) anti-meat reporting in the media and direct actions by animal rights groups. To minimise the risk of harm, I maintained an empathetic interview style and was vigilant for verbal and non-verbal signs of discomfort. Overall, I sought to maintain a collaborative and participatory approach, in which different opinions and values were respected and given space. During fieldwork, I carried with me printed leaflets signposting mental health resources for farmers (see Appendix 3), to be shared in the event of an interviewee expressing low mood or other mental health difficulties.

In this section I have summarised the main ethical considerations for the PhD and how risks were mitigated.

4.7 Reflexivity

In this section, I will discuss considerations pertaining to reflexivity.

4.7.1 Reflexivity as a measure of quality

As mentioned above, reflexivity is an important component of quality in qualitative research. Rather than seeking to minimise the impact of the researcher on the research, a reflexive approach seeks to make this explicit to the reader. Doing so entails understanding that knowledge is partial and situated (Haraway, 1988), and seeks to account appropriately for the impacts of the positioned researcher on study design, data collection, analysis and reporting (Malterud, 2001). For example, as a white British person I share cultural norms with many UK livestock farmers, which may have the benefit of facilitating trust and rapport. However, this could also lead to shared blind-spots, and a less critical gaze on said norms. Another example is that I often read The Guardian (one of the newspapers in the media analysis phase), and would very rarely read the other three. I therefore had to be aware of the risk of viewing Guardian articles as more "correct" or authoritative.

Approaches to reflexivity have evolved beyond simply providing a "laundry list" of characteristics such as race, gender, age, and so forth (Folkes, 2023). There is increased awareness that positionality can be fluid, and vary between interviews and even during the interview encounter. For example, as fieldwork progressed, it became clear that a key aspect of my positionality was being a non-farmer, as well as being someone who lives in a city. However, I have a rural background, which sometimes came to light during interviews, and the importance attached to my position as a non-farmer varied significantly between

participants. One strategy I used to maintain a reflexive approach was so-called "kitchen table reflexivity", creating space to discuss positionality with other researchers in less formal settings (Kohl & McCutcheon, 2015). In particular, I had discussions with another PhD student with a background in farming who was researching a similar topic and interviewing livestock farmers. I also recorded brief reflections after interviews that had been challenging or caused me to reflect on my position. This was helpful while out in the field without ready access to fellow researchers.

4.7.2 The insider-outsider spectrum

A prominent aspect of my positionality was as an "outsider" to the UK farming community. Although the categories of insider/outsider in anthropology and sociology have in the past been treated as binary, more recent work has highlighted the complexity of positionality (Merriam et al., 2001), and there is awareness that it exists on a spectrum (Bukamal, 2022).

The farming community can be viewed as "hard to reach" (Nye & Wheeler, 2023), and research has shown a strong sense of disconnection from the non-farming public (Wheeler et al., 2022). Mindful of this, I took care to "perform" credibility and approachability (Mayorga-Gallo & Hordge-Freeman, 2016) to facilitate recruitment and generate rapport during interviews. Despite often creating barriers to recruitment, the outsider position can also be beneficial, as participants may feel more comfortable discussing their views with someone outside their community (Greene, 2014).

Another key aspect of my positionality in relation to this research topic is being vegan. This necessitated regular reflection to understand potential impacts on data collection, as well as my interpretation and analysis of the data. In common with Nye and Wheeler (2023), I do see a role for ruminant livestock in future food systems, but this is not something I personally support through my own consumption practices. Although it is not uncommon for researchers to hold beliefs that differ their participants, I argue that the emotional intensity associated with debates around meat and livestock justified advance planning for whether to "divulge, dissemble, or divert" (Nye & Wheeler, 2023) this aspect of my positionality. Through reflection and discussion with my supervisors, I decided ahead of time not to share my position unprompted, but that I would divulge if asked directly and if the situation felt safe to do so. It has previously been noted that being a younger female researcher interviewing farmers carries certain risks to emotional safety (Chiswell & Wheeler, 2016), and the added layer of dietary difference meant that I was highly conscious of participants' tone and mood

while I was in the field (Steadman, 2023), resulting in a higher burden of emotional labour than that experienced by my contemporary confidante who came from a farming background (Hochschild, 2012).

In this section I have highlighted some of the key considerations pertaining to reflexivity, which will be discussed further in the Discussion chapter.

4.8 Data presentation in thesis

I will present the results of the CDA and the thematic analysis in subsequent chapters, organised by Critical Discourse Moments and major themes respectively. Quotations will be in italics, denoted with quotation marks. "/" will indicate when someone has ended mid-sentence, and "(…)" will indicate where text has been removed for brevity and clarity, as in the following example:

"Interviewer: I'd like to/ How will we illustrate quotations in this thesis?

Interviewee: Well, I think (…) just use italics, personally."

In this section I have summarised the data analysis process for the interviews and Photovoice workshops, and shown how data will be presented in the rest of the thesis.

4.9 Chapter summary

In this chapter I have set out the methodological approach taken in this PhD. The methodology is informed by the conceptual framework, and therefore incorporates qualitative approaches that seek to understand the meaning of relevant phenomena for participants. By triangulating between a combination of methodological approaches, this PhD seeks to highlight connections between societal discourses and farm-level social practice. In the next chapter, I will present the results from the media analysis phase of the research.

Chapter 5- Results: Critical discourse moments in media coverage of ruminant livestock and climate change

5.1 Introduction

The results from the empirical work of this thesis are now presented in Chapters 5-7. I begin with the media analysis component, which was conducted first to increase my pre-understanding of debates around ruminant livestock and climate change prior to commencing interviews. Per the conceptual framework described in Chapter 3, the media analysis investigates societal discourses around climate change which may be interacting with farm-level processes (Simmonds et al., 2024).

Chapters 6 and 7 both utilise data from the stakeholder interviews, livestock farmer interviews, and Photovoice project. Chapter 6 focuses on the ontology-epistemology-identity nexus, while Chapter 7 examines methane discourses and shows where these illuminate risks of lock-in. Chapter 8, the Discussion Chapter, takes an overview of the three results chapters and shows their interrelations.

As discussed previously, this PhD will consider discourse as a type of social practice (Carvalho, 2008; Fairclough, 1992), following a Critical Discourse Analysis (CDA) approach. This is to emphasise the materiality of the real-world impacts of discourse around ruminant livestock and climate change. This chapter considers societal discourses around climate changes, acknowledging the turn away from outright climate change denial towards "climate obstructionism"- efforts to block the action required to move towards a low carbon future (Mann, 2021; Painter et al., 2023; Sanford et al., 2021). Lamb et al (2020) have developed the heuristic "discourses of climate delay" (see Figure 3.2) to identify such discursive strategies in news media, policy documents, and political rhetoric. For example, "Whataboutism" refers to emphasising the emissions of other sectors or countries; to deflect attention away from one's own sector or country. Discourses of climate delay build on legitimate concerns about rapid climate action, but move into misrepresentation and imply that change is neither desirable nor possible (Lamb et al., 2020).

In this chapter, I will present the findings from the media analysis phase of the thesis described in Chapter 4 which addresses RQ1: "To analyse discourses around farmed ruminants and climate change as presented in UK news media at the national and livestock sector levels". See Chapter 4 for detailed justification for using news media data. I will begin

with an overview of the news media corpus and major patterns identified therein, then present detailed findings from each critical discourse moment (CDM), demonstrating emerging discourses and discursive strategies, and comparing national with farming news media.

5.2 Overview of UK news media CDMs pertaining to ruminant livestock and climate change

As detailed in the previous chapter, the media analysis involved two farming media publications and four national news media publications. The number of results returned and articles included for each source are shown in Table 5.1 below. The overall corpus totalled 996 articles, comprising 660 from national media sources and 336 from farming media sources.

Table 5.1: Number of search results, articles included in corpus, and articles analysed in depth.

Search location	**Results in date range**	**Included articles**	**Articles undergoing detailed CDA**
National news media	3425	660	91
Farming sector news media	1525	336	63
Total	4950	996	154

Over nearly six years from 2016 to 2021, the topic of ruminant livestock and climate change became increasingly salient (more frequently mentioned) in the included news media sources. Figure 2 illustrates the number of included articles published each month, showing a general upward trend. This trend accelerated in January 2019, with the highest volume of relevant articles appearing in October and November 2021, coinciding with the UK-hosted COP26. Similar patterns emerged in both national and farming sector media. For instance, in January 2016, only three relevant articles were published across both media types, with similar numbers observed in January 2017 and 2018. By January 2019, this number exceeded 30, and by October 2021, it had risen to over 70 articles.

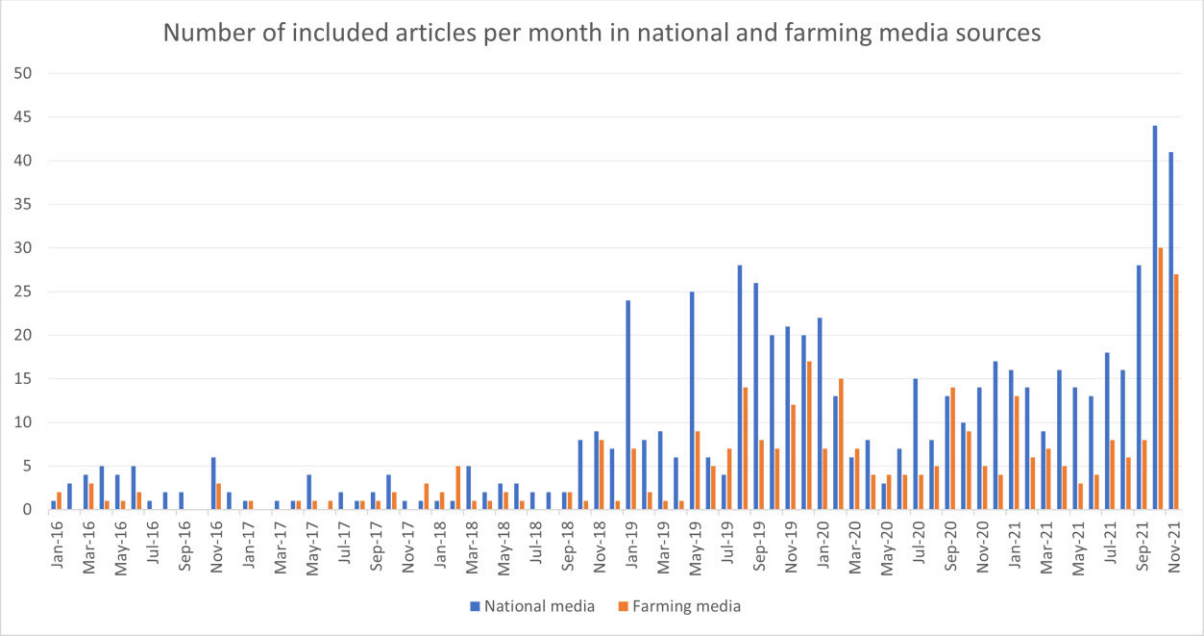


Figure 5.1: Number of included articles by month of publication.

Certain discourses appeared frequently, with five particularly prevalent across more than 30 articles: “Meat is harmful to planetary health” (59 articles), “Us vs. them” (50 articles), “UK livestock farming is efficient and sustainable” (38 articles), “Livestock farming is part of the solution to climate change” (37 articles), and “Radical restraint is necessary” (36 articles). Of these discourses, the first and last were more common in national media, while the remaining three were predominantly found in farming media. Among the Discourses of Climate Delay, the most prevalent were “Whataboutism” (30 articles), “Individualism” (30 articles), and “Technological optimism” (17 articles). A complete list of discourses appearing in five or more articles is shown in Table 5.2.

Table 5.2: Discourses identified in five or more articles (DCD = Discourse of Climate Delay)

Name	Articles
Meat is harmful to planetary health	59
Us vs. them (outgroup polarisation)	50
UK livestock farming is efficient and sustainable	38
Livestock farming is part of the solution to climate change	37
Radical restraint is necessary (dramatic reduction in meat consumption)	36
DCD: Individualism	30
DCD: Whataboutism	30
Systemic solutions are needed to address climate impacts of ruminants	30
International trade and trends (influence emissions, including from ruminant livestock)	27
Imported foods are worse for the environment (than foods from ruminant livestock)	23
The media is biased and spreading disinformation	23
Politicians are not willing act on meat reduction	20
DCD: Technological optimism	17
Meat is beneficial to human health	15
Traditionality of grassland narrative (physical and human-made limitations of land)	15
Climate campaigners are hypocrites	14
Grassland and hedges are important carbon sinks	14
Methane reduction is an opportunity to mitigate climate change	14
Agroecology and regenerative agriculture are sustainable approaches	12
Meat is harmful to human health	12
We need a more equitable food system	11
Meat is important for maintaining traditional UK landscapes	10
Ruminants are not a problem for the environment	10
The public need to be educated about methane emissions from ruminants	10
Proposed government action on methane emissions is suspicious and misguided	9
The livestock sector needs to speak out more	9
Vegan activists are a problem	9
DCD: All talk, little action	8
Environmentalists are guilty of green neocolonialism	8
Methane from ruminants is part of a cycle and therefore not a problem	8
The issue of methane emissions from ruminants is complex and nuanced	8
We should eat less and better meat	8
Appeal to nature (ruminants are natural)	7
Brazilian farmers and ranchers are responsible for the Amazon fires	7
GWP100 over-emphasises methane’s warming potential	7
The market will solve the problem of methane emissions from ruminants	7
Farmers' mental health is negatively impacted by these debates	6
DCD: Appeal to social justice	5
Food security is at risk in the UK	5
Pigs and poultry are less environmentally friendly than ruminants	5

Using an adapted critical discourse analysis (CDA) process drawing on Carvalho (2008), I identified four CDMs: 1) Low salience, diverging discourses, 2) We must eat far less meat, 3) Fighting the anti-meat agenda, and 4) Policy (in)action at COP26. Table 5.3 provides an overview of these CDMs, including their timescale, context, and coverage across national and/or farming sector media. The CDMs are not rigidly bounded; their prominent discourses often emerged sporadically earlier in the timeline before becoming more cohesive and salient. This pattern is demonstrated in Figure 5.2, which highlights two example discourses that appeared intermittently throughout the corpus but gained prominence during specific CDMs.

Table 5.3: CDMs and their characteristics

Name	1. Low salience, diverging discourses	2. We must eat far less meat	3. Fighting the anti-meat agenda	4. Policy (in)action at COP26
Timescale	Jan 2016 – Dec 2018	Jan 2019 – Sept 2019	Aug 2019 – Apr 2020	Oct - Nov 2021
Summary	Low salience punctuated by publication of scientific papers and reports.	Initially associated with EAT/Lancet report and CCC Net Zero report, reiterated around e.g. university "beef ban" and 2019 Amazon fires.	Commences with publication of IPCC Special Report on Climate Change and Land, and runs parallel to CDM 2, reiterated around e.g. BBC documentary "Meat: A threat to our planet?" and Covid-19 lockdown.	Increased issue salience around publication of UK's Net Zero strategy and COP26 in Glasgow.
Site	Divergent discourses in national and farming sector media.	Predominantly in national media.	Predominantly in farming media.	Similar salience in national and farming media, discourses remain largely polarised.

For each CDM, I assessed whether to describe a discourse as "prominent" based on its salience (frequency of occurrence in articles), and its novelty (whether it had emerged for the first time) or rearticulation (whether earlier discourses had been reframed in response to a Significant Happening). As well as being somewhat "leaky" in terms of their related discourses, CDMs also overlapped temporally. For example, CDM 2 (We must eat far less meat) emerged in early 2019, mainly in national media, while CDM 3 (Fighting the anti-meat agenda), which was more prominent in farming media, began approximately seven months later. Discourses central to both CDMs were already evident earlier but became more pronounced and distinct in response to Significant Happenings, as detailed below. Figure 5.2 presents a visualisation of these temporal and discursive overlaps.

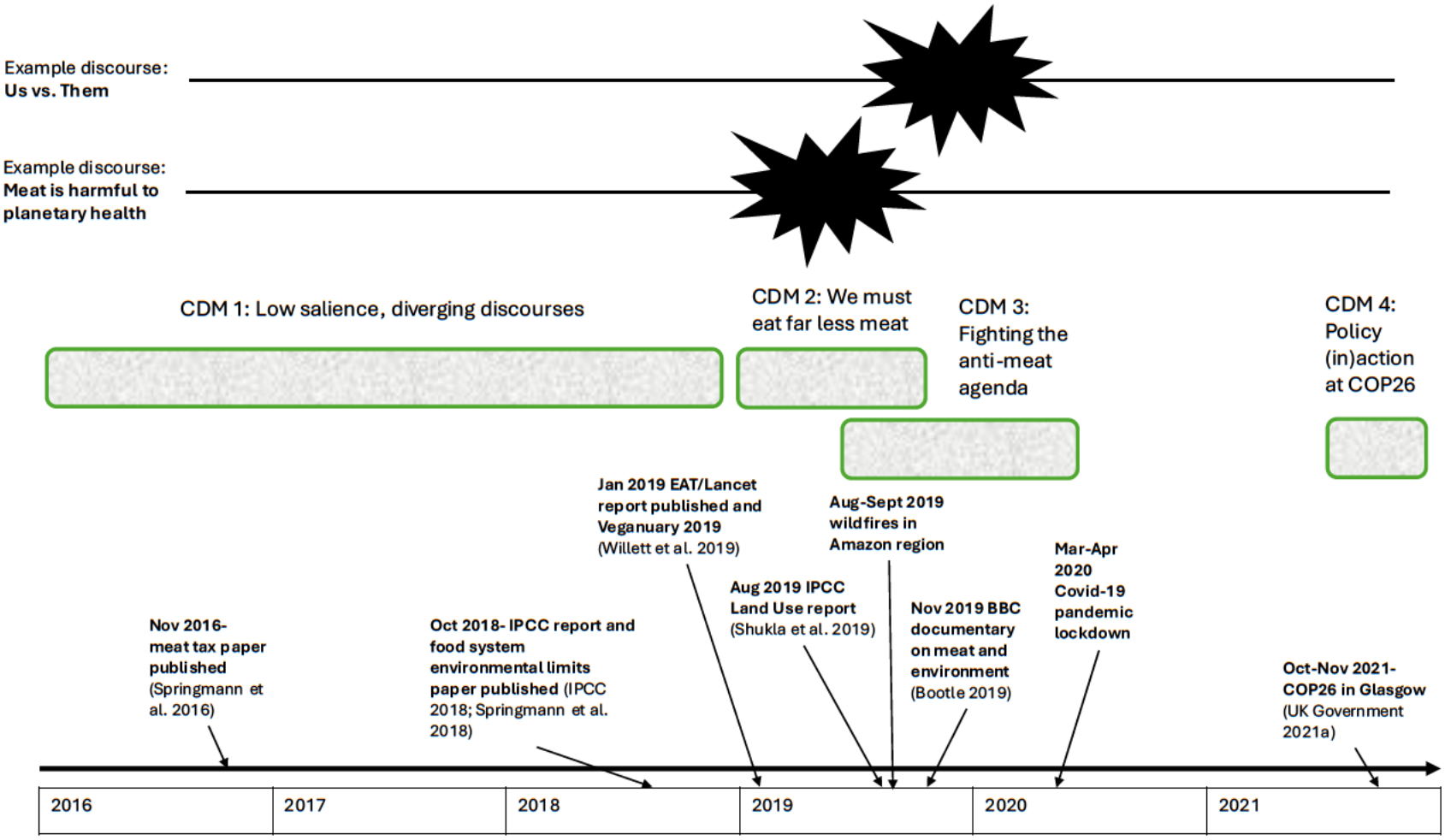


Figure 5.2: Timeline of CDMs, showing selected Significant Happenings and examples of discourses becoming prominent

5.3 CDM 1: Low salience, diverging discourses

CDM 1, summarised in Table 5.4, describes approximately the first three years of the study period. It is characterised by low overall salience of ruminant livestock and climate change, punctuated by occasional publications that received some media attention. Discourses emerged that were then reiterated or became more salient later in the corpus. For example, "Meat is harmful to planetary health" is the discourse repeated in the highest number of analysed articles (59 articles) throughout the entire corpus. In this first CDM, it mainly relates to national media reporting of the ways meat production may impact climate and other aspects of planetary health:

"The research, published in the journal Nature Climate Change, evaluated the tax required for each food type to compensate for the climate damage its production causes. Beef has a heavy footprint, due to the deforestation and methane emissions associated with cattle and the grains they are fed, and needed a 40% tax on average across the world." The Guardian, 7th November 2016

In this quotation, the article's author legitimises the research in question by mentioning its publication in Nature, a respected academic journal. They also report on global averages, and imply that cattle are universally grain-fed, overlooking the UK prevalence of grass-fed ruminant livestock and the role of pigs and poultry in consuming grain. The verb "needed" in reference to the "40% tax" implies acceptance of taxation as a necessary part of governance, consistent with an ideological standpoint that sees government intervention in food systems as broadly acceptable.

Table 5.4: Significant Happenings and prominent discourses in CDM 1

Significant happenings	**Nov 2016- meat tax paper published** (Springmann et al., 2016)	**May 2017- eating insects paper published** (Alexander et al., 2017)	**May 2018- food system environmental impacts paper published** (Poore & Nemecek, 2018)	**Oct 2018- IPCC report and food system environmental limits paper published** (IPCC, 2018; Springmann et al., 2018)	**Nov 2018- CCC land use report published** (Climate Change Committee, 2018)
Prominent discourses	"Meat is harmful to planetary health", "Us vs. them".				

CDM 1 also showed diverging discourses in the national and farming sector media. For example, this quotation and the next one below are both reporting on the same scientific publication:

"Government and campaign groups have had little appetite for tackling the overconsumption of meat, but Alexander said awareness of the issue is growing rapidly, though action is slow. "We are moving slowly in the right direction," he said." The Guardian, 5th May 2017

Despite emerging early in the corpus, the discourse "Politicians are not willing to act on meat reduction" remained quiescent for a few years, re-emerging only in 2021 when the UK published its Net Zero strategy. In the above quotation from a national newspaper, "the overconsumption of meat" is treated as an accepted fact, while the issue is politicised through the mention of "government". However, this CDM also features a strong "Individualism" discourse (a Discourse of Climate Delay), with a focus on individual dietary changes rather than systemic approaches.

Several new discourses also emerged in the farming media:

"She said: "Many things could help reduce climate change attributed to emissions, such as reducing dependence on the combustion engine or cutting use of plastics, but it is a sad fact that often it is meat eating that is in the firing line." Farmers Guardian, 10th May 2017

The use of metaphors such as "hit back", "attack", and "firing line" are prevalent throughout the corpus, especially in the farming media, creating an image of the ruminant livestock sector as a victim defending itself from violence. This contributes to an "Us vs. them" discourse, in which we see increasing construction of two distinct "sides" in a metaphorical battle. The quotation above is also the first example of "Whataboutism" in the corpus, with the speaker redirecting attention to fossil fuels via "the combustion engine" and plastics. This DCD remained common throughout the study period, especially in the farming media, as I will demonstrate later in this chapter.

5.4 CDM 2: We must eat far less meat

CDM 2 coalesced from January to September 2019 and is summarised in Table 6. It emerged in January 2019, at the time of the EAT/Lancet commission report's publication, and was subsequently reiterated in various ways, most notably in response to fires in the Amazon region of Brazil in summer 2019. The "Radical restraint is necessary" discourse, which had emerged briefly in the previous CDM, saw a large increase in salience in response to publication of the EAT/Lancet commission and its "global reference diet":

"Globally, the diet requires red meat and sugar consumption to be cut by half, while vegetables, fruit, pulses and nuts must double. But in specific places the changes are stark. North Americans need to eat 84% less red meat but six times more beans and lentils. For Europeans, eating 77% less red meat and 15 times more nuts and seeds meets the guidelines." The Guardian, 16th January 2019

This quote, from The Guardian, shows that the "we" in this CDM's title, "We must eat far less meat", signifies people in high-income "Western" countries such as the UK. In this quotation the journalist reports the diet factually and with limited emotion, though the word "stark" suggests the proposed changes are viewed as radical. In contrast, national tabloids were more likely to frame the proposal in a dismissive or delegitimising manner:

"Full English to fool's English? In place of a full English, the report suggests brown rice, peas, half a baked potato, a quarter of a rasher, spinach and red pepper. Really?" Daily Mirror, 17th January 2019

This example frames the "Radical restraint is necessary" discourse as an attack on traditional values, by linking meat consumption to "Englishness." The rhetorical question at the end works to delegitimise the reference diet, which was often interpreted literally by sceptical journalists. For example, daily recommended allowances for foods such as beef were reported in a way that emphasized restriction, rather than offering a more flexible interpretation over weekly or monthly consumption.

Table 5.5: Significant Happenings and prominent discourses in CDM 2

Significant happenings	**Jan 2019 EAT/Lancet report published and Veganuary 2019** (Willett et al., 2019)	**May 2019 CCC Net Zero report** (Climate Change Committee, 2019)	**Aug 2019 IPCC Land Use report** (Shukla, Skea, Calvo Buendia, et al., 2019)	**Aug 2019 Goldsmiths removes beef from campus food outlets** (Wilson, 2019)	**Aug-Sept 2019 wildfires in Amazon region**
Prominent discourses	"Meat is harmful to planetary health", "Radical restraint is necessary", "Imported foods are worse for the environment". "Individualism".				

This Significant Happening also saw the emergence of a new discourse: "Climate campaigners are hypocrites":

"…the head of lifestyle economics at the Institute of Economic Affairs – said: "The hypocrisy of this is breathtaking. This is a campaign telling ordinary people they should be eating less than half a rasher of bacon per day for the sake of the environment, while the patron is flying people around the world in private jets creating one enormous carbon footprint." Daily Mirror, 18th January 2019.

In this example, a spokesperson from a right-wing, libertarian think tank is quoted in a left-leaning tabloid passing comment on the reference diet and its funder. The words "ordinary people" imply one of the discourses of climate delay: an "Appeal to social justice". This discourse suggests that climate change mitigation will be expensive, and the costs will fall on those least able to afford it (Lamb et al., 2020). In this situation the discourse is deployed cynically, to advocate the quoted organisation's distaste for top-down governance. There is also an element of "Whataboutism" in the quotation, with the focus on aviation emissions caused by the EAT/Lancet report's funder.

Meanwhile, the discourse "Proposed government action on methane emissions is suspicious and misguided" appeared in nine articles, first emerging in response to the Climate Change Committee's (CCC's) May 2019 Net Zero report:

"Last night the Government backed the radical plans drawn up by the influential Committee on Climate Change, saying it would legislate to make Britain the first major world economy to reduce its carbon footprint to zero by 2050." Daily Mail, 2nd May 2019

Concerns were raised later in this article that the plans would be "economic suicide", transitioning to a "Whataboutism" discourse in which the idea of reducing UK emissions ahead of other countries is foolish as our emissions are comparatively trivial. The report was also described as "stark" and "dramatic", and quoted a stakeholder from a free market think tank. I therefore interpret the use of words like "radical" in the above quotation as implying that the Net Zero report was unusually severe, and suggest the journalist may be sceptical of the CCC's "influential" relationship with the government. This interpretation is also informed by the article being published in a right-leaning newspaper, and thus likely to be aligned with their ideological standpoint.

A Significant Happening that only involved articles from the national media was the August 2019 "beef ban" at Goldsmiths, University of London. This event was notable because several articles organised discourse to present a "culture war" framing of the issue. One article used the headline "Now snowflakes ban beef burgers", using the pejorative term for (often young) people who are believed to be overly sensitive. Another article ended with a timeline of "University crackdowns", such as "A pro-life student group was barred from three different freshers' fairs". These articles therefore implicitly associated climate concerns

around beef with other progressive values within the so-called culture war, and therefore positioned them as a potential threat to conservative values (Simmonds et al., 2024).

Towards the end of CDM 2, the "we" in "We must eat far less meat" was further calcified by media responses to the Amazon fires in summer 2019. The discourse "Imported foods are worse for the environment" became salient, repeatedly making explicit the connection between deforestation in the Amazon and UK consumption habits:

"It's all very well for European governments to condemn Bolsonaro, but western demand for Brazilian beef is contributing to deforestation. The EU imported more than £490m worth of beef from Brazil last year. Consumers in Britain were indirectly responsible for the destruction of the equivalent of 500 football pitches of rainforest in Brazil last year…" The Guardian, 25th August 2019

Placing responsibility on UK consumers errs on "Individualism", although later in the article the journalist politicised the issue by highlighting the EU-Mercosur trade deal as a way to negotiate enhanced rainforest conservation. The discourse "Imported foods are worse for the environment" was also used to critique plant-based foods from overseas, often by actors seeking to refute climate concerns around beef and lamb.

Across the corpus, the "Individualism" discourse and the discourse "Systemic solutions are needed to address climate impacts of ruminants" both appeared in 30 articles. "Individualism" was somewhat more prevalent during CDM 2, especially at the start due to its alignment with the "Radical restraint is necessary" discourse illustrated in some of the quotations above. However, one discourse notable by its scarcity was "Big Food is powerful". This only appeared in one article (in The Guardian), which highlighted the power of corporations to control the food system by mentioning "powerful vested interests and misplaced economic incentives" and "dark money". Although many articles mentioned the need for government action and redirection of subsidies to improve the food system, few acknowledged the power corporations hold to maintain the status quo, or imagined transformative solutions beyond market-based incentives and subsidies (Simmonds et al., 2024).

5.5 CDM 3: Fighting the anti-meat agenda

CDM 3 began in August and ran parallel to CDM2 (shown in Figure 3), primarily in the farming sector media. To avoid confusion, it is shown in Table 7 as spanning October 2019 to April 2020. Many of its key discourses were present early in the corpus, but their salience only reached a critical mass with publication of the August 2019 IPCC Land Use report, shown in Table 6 under CDM 2. At this point, the farming media produced a significant shift in the "Us vs. them" discourse:

"Rather than letting the likes of NFU president Minette Batters spend their time tackling the anti-farming brigade on Twitter, it is time for the unions, representative bodies and levy boards to come together to form an action plan which seeks to properly communicate the proactive contributions of British farming, both at an environmental and societal level." Farmers Guardian, 16th August 2019.

A popular framing in earlier articles was to talk about the "anti-meat agenda". In this quotation, the journalist (in this case the newspaper editor) talks about those highlighting the climate impacts of ruminants as "anti-farming". The object being defended therefore shifted from the product (meat) to the people (farmers) (Simmonds et al., 2024). This framing persisted alongside the "anti-meat" framing for the remainder of CDM 3.

The above quotation was responding to the way national media had reported on the IPCC's "Climate Change and Land" report (Shukla, Skea, Calvo Buendia, et al., 2019), choosing to lead with provocative headlines regarding meat reduction rather than the more nuanced recommendations within the report. This response in the farming sector media led to a strong reiteration of the discourse "The media is biased and spreading disinformation", which persisted through the rest of CDM3. The farming sector response also involved repetition of the discourse "Livestock farming is part of the solution to climate change", which was present throughout the corpus:

"NFU president Minette Batters said: "Having gone through the report in detail, it is clear that the IPCC recognises the important role animal products play in a balanced diet, and when produced sustainably in low greenhouse gas-emission systems, it is actually part of the solution to climate change."" Farmers Weekly, 9th August 2019

The other implied discourse here is "UK livestock farming is efficient and sustainable", as the UK presumably counts as a place where animal products are "produced sustainably in low greenhouse gas-emission systems". The NFU president represented a key actor who was regularly quoted on the topic of methane emissions from ruminants in the farming media as well as (less frequently) in national media.

Table 5.6: Significant Happenings and prominent discourses in CDM 3

Significant happening	**Oct 2019 Animal Rebellion action in London meat market**	**Nov 2019 BBC documentary on meat and environment** (Bootle, 2019)	**Feb 2020 Backlash to Veganuary 2020**	**Mar-Apr 2020 Covid-19 pandemic lockdown**
Prominent discourses	"Us vs. them", "UK livestock farming is efficient and sustainable", "Livestock farming is part of the solution to climate change", "The media is biased and spreading disinformation", "Whataboutism", "Farmers' mental health is negatively impacted by these debates".			

Moving to October 2019, a blockade of a meat market in London by activist group Animal Rebellion showed strong salience of the "Climate campaigners are hypocrites" discourse:

"Climate change campaigners forced meat traders out of London's most iconic meat market and replaced them with stands of imported fruit and vegetables. Industry members on the scene photographed pears from Belgium and salad leaves from France, suggesting they had 'less than desirable' air miles." Farmers Guardian, 9th October 2019

The journalist does not include the name of the group (an explicitly vegan wing of Extinction Rebellion) in the article, instead labelling them generic "climate change campaigners". This discursively constructs a poorly defined opposition, that could include anyone involved in climate campaigns. The fact the campaigners "forced" entry to the "iconic meat market" implies a dangerous incursion on valued cultural spaces, while the focus on air miles is identified as "Whataboutism", with a "Climate campaigners are hypocrites" flavour. It also

links to the discourse "Imported foods are worse for the environment (than foods from ruminant livestock)", and we again see a focus on aviation as being highly problematic in terms of carbon emissions.

A November 2019 BBC documentary on the planetary impacts of meat production initiated a strong backlash from the farming media, plus a couple of articles in the national media echoing the farming sector's position. At this point there was a strong reprisal of the discourse "UK livestock farming is efficient and sustainable", one of the most prevalent in the corpus:

""It has been frustrating to see the continued media portrayal of red meat production as the same throughout the world – especially when the truth is that British red meat is some of the most sustainable in the world, produced by farmers who care – with a greenhouse gas footprint 2.5 times lower than the global average," he added." Farmers Guardian, 25th November 2019

The above quotation works to legitimise British farmers by saying that they "care", implicitly about the environment as well as their animals. The "2.5 times lower" statistic was often repeated, especially by the actor being quoted. It reveals a focus on the relative emissions of animal products (emissions per unit), rather than absolute emissions which account for the level of consumption (Ormond, 2020). So, increased efficiency may be counteracted by increases in consumption: we need both measures to understand the full picture. Following the BBC documentary, one article extended solidarity to Brazilian farmers, quoting two of them describing their environmentally friendly practices. However, "UK farming is efficient and sustainable" was often repeated, and frequently used to critique farming in other countries; especially those striking trade deals with the UK and thus potentially impacting ruminant livestock sector profits.

The next Significant Happening occurred in February 2020, with a surge in articles responding to that year's Veganuary campaign; a public engagement initiative encouraging people to adopt veganism for the month of January. During this time, discourses within the "Fighting the anti-meat agenda" CDM became more organised and cohesive, explicitly addressing the emotional impacts of the so-called "anti-meat agenda" and focusing on three agenda-setting fronts: reducing emissions, refuting accusations, and educating the public.

One notable development was the emergence of the discourse “Farmers' mental health is negatively impacted by these debates”. This discourse appeared in three national media articles and was particularly salient in the farming media, where it was frequently linked to high suicide rates among farmers. One example from *The Guardian* stated:

“The issue of meat consumption has been particular [sic] sensitive for farmers. This week the National Farmers' Union (NFU) said that the "anti-meat agenda" had become an added strain on farmers' mental health and that the demonising of livestock farmers was having "real-life consequences".” The Guardian, 27th February 2020

I interpret the above quotation as depoliticising the issue, with a focus on “anti-meat” rhetoric rather than on structural factors such as the adequacy of rural mental health services or support for transitioning away from EU farming subsidies. The use of scare quotes around “anti-meat agenda” also suggests scepticism on the part of the author, implying that the term reflects the NFU’s framing rather than an objective fact. This contrasts with farming media articles, which often reported the concept as self-evident.

While responses to earlier Significant Happenings typically portrayed farmers as “angry” or “furious,” this event marked the first instance where the media highlighted more feminised emotions, such as sadness and vulnerability. Women were most frequently quoted in articles discussing these emotions, whereas male farming sector representatives tended to reiterate established discourses about being “under attack.” This suggests a persistent hesitancy among men within the livestock sector to openly discuss the emotional toll of these debates, at least when speaking to journalists.

The onset of the Covid-19 pandemic in March-April 2020 constituted the final Significant Happening within CDM 3. National media and farming media framed this event in markedly different ways regarding ruminant livestock and climate change. For example, *The Guardian* published two articles arguing that meat consumption drives pandemics by increasing human-wildlife contact through agricultural expansion. This reiterated the “Meat is harmful to planetary health” discourse and further solidified elements of CDM 2.

In contrast, farming media focused on the reduction in air pollution during Covid-19 lockdowns, which generated a “Whataboutism” discourse:

"The farm sits under a flight path to Stansted Airport and, since the lockdown began, with nearly all flights grounded, [farmer's name] has noticed the difference in air quality, which makes her question whether farmers are shouldering an unfair amount of blame for the climate crisis." Farmers Weekly, 1st May 2020

This sentiment, reproduced in several farming media articles, conflated air quality data (relating to nitrogen dioxide and particulate matter) with methane emissions to argue that ruminant livestock do not contribute to climate change. Journalists sought to legitimise these claims by combining data from the National Centre for Atmospheric Science with the sensory experiences of farmers near airports and major roads. I interpreted this as an example of an "Us vs. them" discourse, where blame for climate issues is perceived as being unfairly directed at farmers as individuals, rather than the animals they manage or the resulting products (Simmonds et al., 2024).

5.6 CDM 4: Policy (in)action at COP26

The fourth and final CDM, summarised in Table 8, signifies a "political crunch time", in which we see a mix of political action and inaction in response to opportunities to legislate around ruminant livestock and climate. Significant Happenings such as the United Nations' 26th Conference of the Parties (COP26) led to a high volume of relevant articles.

Table 5.7: Summary of Significant Happenings and prominent discourses in CDM 4

Significant happenings	**Oct 2021- UK Net Zero Strategy published** (UK Government, 2021b)	**Oct-Nov 2021- COP26 in Glasgow** (UK Government, 2021a)
Prominent discourses	"Methane reduction is an opportunity to mitigate climate change", "Politicians are not willing act on meat reduction", "Systemic solutions are needed to address climate impacts of ruminants".	

First of all, the October 2021 publication of the UK's Net Zero Strategy ahead of COP 26 provoked the national media to generate numerous relevant articles. Right-leaning newspapers tended to focus on potential costs to the public, while left-leaning newspapers tended to argue that the strategy was inadequate to meet climate goals. Key subjects of

critique were the lack of legislation on food and aviation. Meanwhile, the UK Government's Behavioural Insights Team, then part of the civil service, published a report online that was swiftly deleted again. It contained proposals for regulatory measures such as taxation on frequent flyers and on meat, which provoked increased salience of the discourse "Proposed government action on methane emissions is suspicious and misguided" in news media. Meanwhile, left- and right-leaning newspapers suggested that present and future climate action would require behaviour change among the general public, representing a reiteration of "Radical restraint is necessary".

Meanwhile, the discourse "Politicians are not willing act on meat reduction", dormant since CDM 1, re-emerged strongly:

"The Government said: "This was an academic research paper, not government policy. We have no plans to dictate consumer behaviour in this way. Our net zero strategy published yesterday contained no such plans."" The Daily Telegraph, 21st October 2021

The use of the word "dictate" reflects an ideological stance against government intervention, portraying it as a restriction on personal freedom. The repeated phrase "no…plans" underscores the government's rejection of the report's recommendations. This incident seems to reinforce earlier concerns expressed during CDM 1, suggesting that even by 2021, political will for meat reduction policies remained limited.

The second Significant Happening in this CDM was the UK-hosted COP26. One key outcome was the Global Methane Pledge, spearheaded by U.S. President Joe Biden and signed by over 100 nations. This led to the emergence of a new discourse: "Methane reduction is an opportunity to mitigate climate change":

"The joint initiative, launched by US and European leaders, will tackle the potent greenhouse gas which is crucial to keeping warming limited to 1.5C. It is also one of the fastest ways to reduce global warming." Daily Mail, 3rd November 2021

This article, published in a right-leaning outlet, employs crisis rhetoric such as "crucial" to convey the pledge's urgency and efficacy. It emphasizes leadership by "US and European" nations, while several other articles highlighted the absence of participation from China, India, and Russia. Consequently, the pledge was framed as a "Western" initiative- associated

with capitalist actors- unlike earlier responses to university beef bans, which linked meat reduction to leftist ideological standpoints, and in one case specifically with communism. As methane arises from various sources including fossil fuels, it's possible that the Global Methane Pledge was more ideologically acceptable than focusing exclusively on ruminant livestock emissions (Simmonds et al., 2024).

The implications of the methane pledge for livestock farming were discussed in various media, with some articles expressing concerns and others offering reassurance that impacts would be minimal:

"NFU president…told the Farmers Weekly podcast: "The global methane pledge will cause concern in its name, but it is primarily focused on fracking, oil and coal sites. It's a chance for us to talk up the solutions on how we do lower methane [emissions in livestock]."" 3rd November 2021

This statement reiterates the discourse "Livestock farming is part of the solution to climate change," along with "The livestock sector needs to speak out more." Another article spotlighted methane-reducing feed additives that at the time were not yet licensed in the UK, representing the DCD "Technological optimism". I will discuss feed additives in more depth in Chapter 6.

In CDM 4 overall, the discourse "Systemic solutions are needed to address climate impacts of ruminants" was more salient relative to the "Individualism" discourse:

"…they said farmers should be supported in partnership with government and industry to produce more with less environmental impact. "It is vital that agriculture, land use and biodiversity policies are practical and properly funded, with a portfolio of measures across many different farm types."" Farmers Weekly, 4th November 2021

Systemic solutions highlighted in left-leaning national media often revolved around regulation, such as taxation or redirecting subsidies. By contrast, farming media typically emphasized subsidy reform and payment schemes for environmental stewardship.

In conclusion, despite the political focus at COP26 and high salience in national and farming media, the methane pledge did not explicitly target ruminant livestock (Simmonds et al., 2024). Both sides of the polarized debate saw mixed outcomes: cattle and sheep remained in

focus as high methane emitters, but were not specifically targeted by UK legislation. Instead, there was an increased focus on technical solutions aiming to sustain current production and consumption levels.

5.7 Chapter summary

In this chapter, I have presented findings from the media analysis phase of this thesis, involving comparison of UK and farming sector news media over an almost 6-year period from 2016 to 2021. This showed increasing salience of ruminant livestock and climate change in news media, with a steep increase in salience in 2019 that persisted for the remainder of the study period. Four CDMs were identified, with CDMs 2 and 3 representing respectively a mainstream conversation around reducing meat consumption, which was met with a backlash from the farming sector media. Meat was discursively portrayed as being harmful to planetary health, while another very salient discourse was "Us vs. them", suggesting increasing polarisation between the farming sector and national newspapers. See Chapter 8 for further discussion of these findings.

This initial phase of the research identified some of the major discourses that livestock farmers were likely to have encountered in the early 2020s, both from mainstream media and from their own sector. It therefore increased my pre-understanding of debates around ruminant livestock and climate change, as well as some of the main solutions that had been suggested. This complemented the later phase of research with livestock sector stakeholders, illustrating the evolution of methane discourses within the sector more broadly. The media analysis also informed the interview guides for the next phases of research, and provided me with greater fluency in farming language and terminology from reading the livestock sector newspapers. As an outsider researcher with low baseline farming knowledge, this helped me to save time clarifying basic terminology during the livestock farmer interviews, and thus expedited rapport-building through affiliation and empathy (Prior, 2018).

As discussed, there is likely a bidirectional influence between media and public discourses (Ragas et al., 2014; Zhou & Moy, 2007). In Chapter 8, I will highlight linkages between the media data and data from subsequent research phases: noting that the research design is not intended to infer causation, but rather to show areas of alignment and divergence that may provide useful insights. In the next two chapters, I will discuss findings from the qualitative interviews and Photovoice project.

Chapter 6- Results: Ruminant livestock farming ontologies

6.1 Introduction

In this chapter, I will examine themes pertaining to theoretical understandings of the Good Farmer and to livestock farming ontologies. As set out in Chapter 3 and shown again below in Figure 6.1, the theoretical framework for this PhD incorporates several concepts. I have introduced the ontology-epistemology-identity nexus as a major factor in shaping methane discourses and associated practices, in part via a discursive process of boundary-making. I also use the concept of lock-in to analyse how the agri-food supply chain interacts with farm level processes, and use the Discourses of Climate Delay (DCDs) as a heuristic for comparing broader societal climate change discourses with the livestock sector. The major role of this chapter is to engage with the ontology-epistemology-identity nexus, to show how this underpins the methane discourses and practices discussed later.

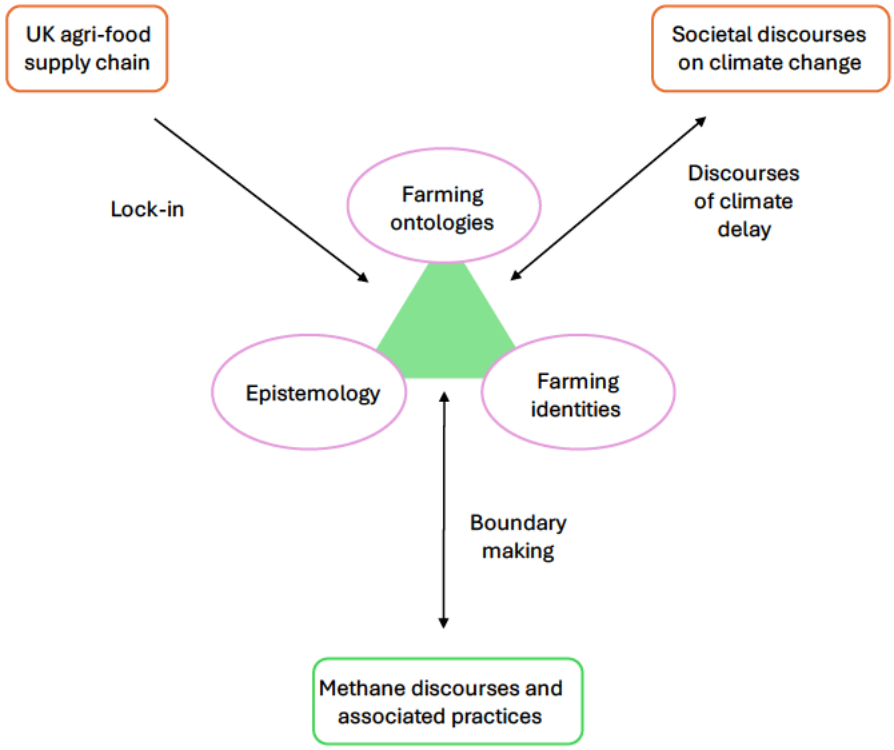


Figure 6.1: Conceptual framework

I will begin with thick description of the qualitative interview corpus, and more specifically of the types of farms and farmers who engaged with the research, to ground and give a sense of what I term 'livestock farmer lifeworlds' (Kings & Ilbery, 2015). I will then discuss three themes from the data that are focused on livestock farmer identity, particularly how this relates to the Good Farmer concept. Then, I will move to discuss spatial and social boundary-making and its ontological and epistemological consequences. The foundations laid in this chapter will be built upon in the next chapter, which focuses more specifically on methane discourses and associated practices, combining further insights from the farmer data and interviews with stakeholders in the wider livestock sector.

6.2 Livestock farmer participant lifeworlds

While the previous results chapter dealt with the news media data, this chapter and the one that follows incorporate data from the qualitative interviews and Photovoice project. I conducted 32 farm interviews with a total of 37 interviewees, of whom 8 were also involved in the Photovoice project, plus 17 interviews with livestock sector stakeholders. I will now provide an overview of the livestock farmers involved in the research.

6.2.1 Demographic data

Tables 6.1- 6.4, repeated from Chapter 4, show descriptive data including location, interviewee gender, main product, main supply chain route, and tenure. The majority of the farmers interviewed were based in one of two walking interview zones- Sussex/Kent or Northumberland/Cumbria. They purposively included a range of farm systems and sizes, across varied landscapes, to give an in-depth account of different livestock farmer experiences. Despite the breadth in terms of systems, farm types, and supply chain relationships, there were some commonalities within the sample. There was a high representation of "alternative" farming interviewees, whether that be organic, regenerative, or agroecological. Farmers had often been involved with researchers in the past (although perhaps not social scientists), and so were connected to broader networks in terms of sectoral and academic research communities. Most farmers owned at least some of their land, with only four being fully tenanted. There was also higher representation of women (approx. 27% of livestock farmer interviewees) compared to the 16% of farm holders in England who are female according to latest available UK farming workforce statistics (Defra, 2016).

As mentioned in Chapter 4, the mean participant age was 50.9 years, while the median age was 45.5 years. The median age of English land holders is 60 (Defra, 2016), so interviewees tended to be on the younger end of the spectrum. The smallest farm by area was 12 acres (plus some additional grazing), while the largest was 2000 acres. The mean area was 593.9 acres (240.3 hectares), and the median area was 1,005 acres (406.7 hectares). In a recent large-scale survey, farms from 20 to 100 hectares were classified as "medium", while farms over 100 hectares were classified as "large" (NICRE, 2024), therefore the average farm area for this sample could be considered large. In terms of full time equivalent (FTE), the minimum farm size in my sample was "part time" (0.5 to less than 1 FTE), and the largest was "very large" (5 or more FTE). Through an FTE lens, the majority of farms would be considered "small" or "medium" according to Defra classifications (Defra, 2024b), and this spread is consistent with recent large scale surveys of farm businesses (NICRE, 2024). The majority of farms were running extensive systems, while four of the dairies were running housed or partially housed systems that I considered intensive. Six farms sold certified organic produce.

Table 6.1: Participant locations and gender

Location	Number of interviews	Number of interviewees (number of women)
East Sussex	4	6 (2)
West Sussex	5	6 (2)
Kent	3	3 (1)
Cumbria	7	9 (2)
Northumberland	7	7 (2)
South Wales	3	3 (1)
Misc.	3	3 (0)
Total	32	37

Table 6.2: Number of farms by enterprise

Farm type	Number of farms
Beef and sheep	17
Beef	6
Sheep	2

Dairy	5
Goats and sheep	1
Arable (grazed by livestock)	1

Table 6.3: Number of farms by main supply chain route (NB total is 31 as one farm only grazed other people's livestock)

Main supply chain route	Number of farms
Supermarket contract	4
Livestock auction	9
Direct to consumer	9
Dairy co-op	4
Other (including private sales to other farmers, selling direct to processor, and selling to local butcher)	5

Table 6.4: Number of farms by land tenure

Land tenure	Number of farms
Owned	19
Fully tenanted	4
Mixed	8
Farm manager	1
Additional access to commons grazing	4

In addition to the livestock farmer interviews and Photovoice data, this chapter also draws on the livestock sector stakeholder interviews. As mentioned in Chapter 4, there was some leakage between these categories, with many stakeholders (especially sector representatives) also actively farming. When presenting examples from these interviews, I will give some indication as to the interviewee's position.

Now, to begin to convey the identities of farmer participants, I will now present three "archetypes" in the form of vignettes. Many participants could claim characteristics from all three archetypes in some respect, so these are not intended as distinct typologies, but rather an effort to convey the broad characteristics of farmer participants. Following the vignettes, I

will turn to presenting the findings, beginning by discussing themes pertaining to farming identities.

6.2.2 The mob grazer

Many farmers within the sample were involved in practices that fall under the umbrella of regenerative agriculture (Gosnell et al., 2019). As a reminder, this is an approach to agricultural land management that foregrounds soil health, diversity, and the presence of livestock to enhance the former. Many of my participants had adopted "regenerative" approaches to grazing, which they referred to by different names, the most common being "mob grazing".

Imagine this. You've come back to the family farm after several years away- perhaps working abroad, perhaps in a different career. Your dad ran the farm the way his dad did before, and it never excited you. However, some circumstances in your life bring you back, or perhaps something calls you. As you become more involved in helping out, you start reading more about new approaches in livestock farming and join some online forums. This idea of regenerative agriculture keeps popping up.

Soon, you're making tweaks on the home farm. Buying portable electric fencing, experimenting with moving the cows (it's usually cows) around differently, making detailed spreadsheets of your grazing plan. You spend hours convincing your dad to accept changes- he knows he can't run the place alone, so he slowly comes on board. Soon you're posting pictures of your swards online and making videos about cowpats, going to Groundswell, connecting with a network of like-minded farmers; many of them at a similar life stage to you.



Figure 6.2: Moving the cows, from Photovoice project

"I mean, when I first came back, I was gonna make this thing wholly sustainable, but then you think actually hang on. Yeah we'll do sustainable but then we need to go into regenerative. And then by the time we get halfway through our regenerative journey it'll be like, shit, there's something else, you know, so we've gotta keep moving forward. But that's the key to it, isn't it? You keep evolving and learning stuff and talking to people and discussing things and hopefully, we'll go on a sort of journey together in the right direction."
Farm interview 29

You've seen with your own eyes how managing the cows differently has improved the health of your soils, increased biodiversity on your farm, and even improved the health of your cows. You often advise people to watch Allan Savory's TED Talk, and you believe strongly that livestock are essential for sustainable land management. You probably sell to a high-end supermarket, a local butcher, or direct to consumer.

6.2.3 The traditional hill farmer

Many of my participants were hill farmers, meaning that the majority of their land was at higher altitude and classified as less-favoured area (LFA) (Defra, 2025b). This was obviously more common for those based in Cumbria, Northumberland, and Wales.

So, imagine. Your family have been farming in these hills for generations, and you're the latest in a long line. Your sheep (it's usually sheep) are hefted, meaning that the flocks have become accustomed over generations to a particular territory, and don't need to be fenced in. They are hardy breeds who need little assistance with lambing, and don't care for being cooped up in sheds. You might be involved with a network of people who farm a particular breed of sheep, and you might have access to common land for grazing and be involved with a commoners' organisation. You might sell your lambs at the auction, to a local butcher, or perhaps direct to consumer. You probably also have a herd of cattle on the farm.

A good amount of your land is left for nature, whether that's woodland, peat bog, or riparian corridors, and you see a great deal of wildlife when you're out working in the fields. Curlews, lapwings, birds of prey, deer, hares, foxes, toads; they're all part of your farm's ecosystem. You view yourself as a steward of these hills, and are unimpressed by book-smart people from Natural England coming in and telling you how to manage your farm.



Figure 6.3: Sheep being gathered, from Photovoice project

"…the Lakeland farming community, I would like to think of us as being part of that natural habitat that we live in. So we're part of it. We don't live within it. We are it. We're part of it. Yeah? And if you take us somewhere different. We would still be a good stockman, and we would still be perfectly good at making money out of farming, but we wouldn't be at home." Farm interview 15

You work with sheepdogs and other old technologies, but that doesn't mean you're a luddite. You might be investigating using no-fence collars for your small herd of cattle, or actively engaging with journalists and the public. Your farming methods have been around since long before the industrial revolution, so you don't see why they would be relevant to climate change. Your farm has faced a variety of existential threats over the last few decades, from the foot and mouth crisis to phase-out of the single farm payment, and people talking about eating less meat to save the planet is just the latest iteration.

6.2.4 The efficient farmer

The third archetype was more applicable to lowland farms, although not exclusively. Most of my participants were looking at ways to make their farms more efficient, but for some this was a strong foundational ethos that guided a lot of their decision-making, including actions related to climate change. It was also very prevalent among the dairy farmers I interviewed, perhaps more so than those operating beef and sheep systems.

Imagine you run a farm. It might be a dairy farm. You've invested in it significantly and have things like mortgages and loans to pay off. You love farming, but it's not just a lifestyle for you. It's business.

You use an array of spreadsheets and software to document your key performance indicators: milk yield, fertility, feed performance ratio. You work with a network of experts and advisors to formulate your animals' feed, track their performance, and engage in preventative healthcare. You might be working closely with a specific retailer to experiment with new approaches (in return for data), or you might be involved in research with a university or the AHDB.

Everyone on the farm has to pay their way. If an animal isn't performing well, she's out (although you do have favourites who might get a little more leniency). You're open to trying new things, whether that's high-tech approaches like automated milking systems, or low-tech strategies like mob grazing. You might run an outdoor system or a housed system, and if it's the latter you're engaging in newer approaches to slurry management.



Figure 6.4: Calves on a dairy farm, author's photo

"...when you take them to the auction. You go to the office, get your cheque. You don't, you've lost sight of them lambs then. When you send them to the slaughterhouse, you've got that information there. And if you can see, if we've got 20 Aberblack lambs, 20 Texel lambs, or 20 mule gimmer lambs, or wether lambs... you can tell how will them lambs have graded, each breed? So if you were trying to make your business more efficient, you can look at that data, think "I need to go down that sector", Aberblacks or Texel or whatever. That's the tup, ram I need to use next winter. I need to produce them lambs. They're giving me the better return." Farm interview 20

You're probably open to reducing your methane emissions; you might not believe that methane contributes to climate change, but less methane means more efficiency, so you're interested.

6.3 Farming identities and ontologies

6.3.1 Being a Good Livestock Farmer

Having given an overview of some characteristics of livestock farmers who were involved in the research, I will now draw on the Good Farmer concept (Burton et al., 2020) to understand how participants understood their relationship with livestock.

When asked directly, the most common qualities associated with being a Good Livestock Farmer were being open to change, attention to detail, being a good businessperson, and empathy:

"Probably patience, a bit of empathy, and just really general sort of stockmanship, stockman's eye of knowing when something isn't quite right before it you know / a lot of good stockmen can see something's sick before it is sick, that sounds silly, but you sort of just get the feeling or when something's not feeding properly or not feeding quite right, before it's really ill and not feeding, just a bit of almost like a sixth sense as it were…" Farm interview 32

This quotation illustrates the value of tacit knowledge in determining one's skills as a livestock farmer. Meanwhile, empathy tended to be related to care, and to thinking like an animal. It was also sometimes associated with women:

"…there tends to be a bit more empathy with ladies than blokes sometimes in terms of animal husbandry and welfare and stuff. They're generally far better at rearing calves, you know, tend to be more patient, spend more time than the blokes. That's an awful generalisation. But that tends to be what we find." Farm interview 11

The idea of women being better at rearing calves came up fairly often, with some viewing it as a straightforward observation, others as a stereotype. A couple of the livestock sector stakeholders expressed this differently (the person quoted worked for a farming NGO in addition to farming full time):

"I think that, there's sort of the archetypes, if I can put it that way, of gender characteristics, the male tends to be more head centred, obviously more sort of egotistical, less intuitive, less

emotional. And the female archetype is much more intuitive, more centred in their emotions, and more reconciling and more, I think, just generally aware and sensitive and caring. And I think that women, or people who have more evolved principles of that kind, work much better with animals." Livestock sector interview 11

Therefore, to be a Good Livestock Farmer, there must be a *softening*; both of the self, and of the boundary between human and animal. To know what an animal needs, one must be able to empathise, literally to feel the animal's feelings. This runs counter to livestock farming demographics and stereotypes around hard physical labour, strength, and masculinity. If we consider gender as performative, we can say that the livestock farmers in this research valued the performance of feminine qualities, when these assisted in producing healthy animals. However, the benchmark for a "Good Farmer" was typically a man- even when women's qualities were praised, they were described as "better than the men". Furthermore, as I will discuss below, masculinised traits such as "being a good businessman" were also highly valued.

On a related note, participants often discussed animals in a way that personified them, or described them as sentient beings:

"They do like going outside, cows, we've always been a farm where our cows went out in the summer, no matter what. (…) You spent the whole winter looking forward to the day you could kick them out in the summer. And then some days in the summer when it's absolutely hammering down for two or three days on end, and they're all stood at the gate shouting and want to come back in. "Oh, we just want to come into a shed!"" Farm interview 12

"If you put a sheep handling system up, a round pen, put a load of Herdwicks in it. If you take a pin out, go, walk through, don't put the pin back in, right, and then step 15 yards one way or the other way. Look at all the Herdwicks, they will be looking at that pin. They know there's no pin in the hurdle, which means they know when they run at it, they can open that hurdle up." Farm interview 28

As in the first quotation, participants often quoted their animals, making them pass comment on different situations and practices. They would often identify emotions in their animals- happiness, cheekiness, boredom. As in the second quotation, they would also often talk about them as sentient beings, with preferences, friends, and capacity for thought.

Another strong theme within the Good Farmer's relationship with livestock was that of care, in terms of caring for the animals; even when it was uneconomical to do so. Some acknowledged the tension in terms of livestock's ultimate purpose:

"…the only nights I lie awake at night is when I think that I haven't done me duty of care. I can think back to the Beast from the East. And I can think about lying awake at night, thinking about me animals out, like thinking about them outside. And I know it sounds... But it's true that you, you know, because we slaughter them at the end of the day, I think there's a general belief that, "Oh, well, you don't care about animals". But that night I never slept…" Farm interview 14

This also came up during one of the Photovoice workshops, and a young farmer described "always questioning" what they do, and feeling a responsibility to give their stock a high quality of life. Among participants, that responsibility tended to be associated with being a Good Farmer, while bad farmers were perceived as being those with poor animal welfare. A bad farmer could often be recognised by observing his or her stock:

"…still over winter, when you go back, I visit my parents, you still see cows up to their knees in mud, I think it's just / it's not good for the soil, it's not good for the cow, the cow looks unhappy, why are you doing it, you've got buildings right there that the cows would be happy in, why aren't they indoors." Farm interview 4

While there was a concern with welfare for welfare's sake, it was also considered important for productivity, which I will discuss further now.

Alongside the above feelings of responsibility towards livestock, there was also a theme of viewing animals as workers, and therefore having a more economic relationship with the farmer:

"I've seen cows up to 15,16 years old. Dare I say it, because we were fairly "ruthless", if you will. Everything's got to be working on the farm eh. We don't carry any passengers. Because everything's got to be run so efficiently, you see." Farm interview 20

This idea of animals "paying their way" came up several times, in relation to livestock and working animals like sheepdogs. This made them distinct from pets: they were being fed and cared for in return for their labour. As mentioned above, a Good Livestock Farmer was seen as someone with good business sense, therefore if one's care practices were overly inefficient, one might lose the respect of one's peers:

"…talking about collaboration with our neighbours and all that sort of stuff, I couldn't necessarily sort of hold my head up with them if they knew that I was losing loads of money. They know that we're not / we're doing it on a small scale but they can see that it's 'commercial' you know, umm, so it's something about wanting to be real, and we're small, but actually wanting to work in a sort of real economy." Livestock sector interview 6

The above quotation illustrates the idea that to be a "real" farmer one must be generating revenue, again making the distinction between "good" livestock farmers and hobbyists. There was therefore an element of productivism in the "Good Livestock Farmer" identity among my participants.

Another quality commonly mentioned by participants as making one a Good Livestock Farmer was being "open to change":

"I think we sort of come from a different angle really, umm, because we you know / it's not like / how can I say it / some farms where it's all passed down, inherited, it's like Dad's always done it this way, so that's the only way, but we look at / we're not scared to try and change things and look at different methods…" Farm interview 23

The idea of being open to change was often associated with being a new entrant, or with having a period away from the farm- whether one had been working elsewhere in the UK, working abroad, or pursuing non-farming careers. Valuing the ability to change aligns with previous research findings that adaptability and flexibility are valued components of farming identities (van der Ploeg, 1993; Wynne, 1996)

However, being "open to change" tended to describe being open to changes in farming systems, such as moving to regenerative practices, rather than anything more radical. While the changes in question may have involved significant shifts in attitudes and practices on one farm, they did not trouble more ingrained norms such as the role of livestock in food systems or current land ownership models.

Climate mitigation was not explicitly connected to being a Good Farmer, but many farmers discussed feeling that their practices contributed to climate change mitigation. For some, this was just through owning and managing grassland:

"…you don't have to farm regeneratively to have good carbon stores in your soil (…) even just your standard livestock farmer from 10, 20 years ago, you go and measure the soil in a

grass field and you go and measure the soil in the arable field next door, grass field has loads more carbon in it…" Farm interview 12

Discourses around the carbon sequestration potential of grassland are discussed further in the next chapter. Meanwhile, other participants felt that they contributed to climate change mitigation through specific livestock management practices that aimed to increase soil organic matter. Some of these practices were antithetical to conventional symbols of good farming, such as having tidy fields and hedgerows:

"So if you look at this, before, when you said what do I feel as a farmer, I would have said this is terrible to see a field like this, you know it's not been grazed enough. And it's very thatched, if you look in there. It's miles down to get to the soil. But I think my attitude now is completely different, which is that underneath there are roots going down equally as far. These cows will, with this process, they will slowly eat and trample that in. And this actually isn't bad. You know, it's good." Farm interview 1

The symbols of being a Good Farmer therefore differ between proponents of different practices, with those using more regenerative approaches viewing "untidy" fields and hedges as being better for soil organic matter, and thus for climate change mitigation (see Chapter 7 for further details).

To generalise within the sample, farmers tended to see themselves as delivering a "public good" by maintaining grassland rather than allowing it to be ploughed for cereal cultivation (and releasing carbon) or planted with trees (taking it out of food production). This therefore positioned keeping ruminant livestock as the best use of land, especially in the uplands where cereal cultivation is less feasible. So, the idea that ruminants are very important for helping to sequester carbon in grassland complemented existing ideas around ruminants being the best way to produce food from marginal land, and reinforced keeping ruminant livestock as a symbol of being a Good Farmer within the livestock farming community.

As mentioned above, the Good Farmer identity also involved qualities such as empathy and care. This suggested a closeness with animals, rather than viewing them simply as a means to generate profit. Despite the capitalistic drive to view livestock as "meat machines" (Hribal, 2007), many of the farmers in this study had a friendly relationship with their animals, and would sometimes base decisions on these emotional connections over and above financial considerations. I argue that this connection with animals was part of the ontology of the farm.

For consumers, there are various discursive, physical, and symbolic barriers between us and animals. We talk about their products using euphemisms such as "beef" (Cole, 2016), and their body parts are presented in homogenised packaging in supermarkets. Producers, however, have a connection to the animal as a living, breathing, shitting, lively being. While connections with animals may be obstructed by factors such as lack of shared language, different objectives, the exertion of control by human actors, and humans' knowledge of the animals ultimate destination, the farm is still a place where interspecies conviviality may emerge. Farmers in this study were acutely aware of animals' agency- often in resisting their preferred way of doing things. Living alongside animals was therefore an important component of what it means to be a livestock farmer for my participants; tied up in one's identity and in the ontology of the farm. Therefore, the idea of reducing UK livestock production to reduce methane emissions could be experienced as a threat- both to one's identity and to the experience of "being" a farmer.

In this section, I have given an overview of the main themes pertaining to participants' relationships with their stock, and how this was interlinked with a Good Livestock Farmer identity. I suggest that being a Good Livestock Farmer was associated with having visibly high animal welfare, being able to turn a profit, and being open to changes (that did not disrupt deep-rooted norms around food production). While climate change mitigation and methane reduction were not strongly associated with being a Good Farmer, many participants described providing a public good through their practices' impact on soil carbon sequestration. I argue that living and working with animals is a key component of livestock farming identity and ontology. I offer this section first to better understand the livestock farmer methane discourses, and I will refer to some of the illustrated themes later in this thesis.

6.3.2 Farming is natural to the UK

As described in the previous section, being a Good Livestock Farmer involved aspects like high animal welfare and the ability to turn a profit. However, another component of participants' identities was their national identity, whether this was being "British" or being "Welsh".

Cupples (2009) found that air pollution in Christchurch, New Zealand, was partly driven by citizens burning wood to heat their homes. The burning of wood was tied up in people's identities, particularly in expressions of masculinity related to chopping logs and lighting

fires, but also their national identity (Cupples, 2009). This illustrates the connection between identity and social practice. In my research, participants tended to be very aware of soft boundaries between countries in terms of the flow of imports and exports. They therefore saw their role as food producers being important not only for UK consumers, but also for preventing harm overseas. This illustrates the interrelationship of boundary-making and identity. The following quotation was discussing the risk of reducing livestock production in the UK resulting in increased imports:

"Not just palm it off on some poor people to chop down their forests, and do it [grow food] badly, and then buy it off them for cheap. Because it's still the same world just because it's not in our country." Farm interview 13

This quotation illustrates awareness of the interconnected nature of planetary systems such as climate, which do not adhere to national borders. It also connects with the discussion of the spatial boundaries of the farm which I attend to later in this chapter. The idea of "exporting our emissions" was prevalent, and participants often expressed concern for people and ecosystems in other countries that might be impacted. However, participants also reiterated one of the discourses identified from the media analysis in Chapter 4, that UK livestock production is more efficient and sustainable than in other countries:

"And that's why Arla have started trying to measure really accurately on their farms and I think they / even after the first year of gathering data, they say yes, our British dairy farms have I think it's half the carbon footprint of dairy farming globally, of the average globally, in Britain it is half because we're that much further ahead I suppose." Farm interview 4

This discourse was more concerned with metrics and relative emissions per kilogram of product. These metrics construct more rigid boundaries between countries, while the focus on average values obscures variation between UK producers. Discourse was therefore a means to both soften and calcify boundaries between countries, and in the latter case to valorise national production in terms of its lower relative emissions.

As well as the above themes around emissions and international trade, the "traditionality of grassland narrative" (Broomfield et al., 2025) was also prevalent. This describes the idea that a large proportion of UK land is only suitable for growing grass, and therefore supports the continued presence of ruminant livestock in the landscape:

"I can never remember quite the figure, but it's around 63% of land in the UK is only suitable for grazing, so you can't grow any other crops on it, you know, you couldn't grow wheat, or maize or whatever on it (…) the way to be able to get nutrition from that is to put livestock on it and graze the grass. So it kind of helps utilise the landscape but also keeps it tidy, and keeps it in line and keeps, you know, our green rolling hills." LS interview 4

Ruminant livestock were therefore seen as highly integral to the UK landscape with its "green rolling hills". Another common phrase from livestock farmers and livestock sector stakeholders was to describe farmers as "custodians of the landscape". There was therefore a sense that farmers serve to define and safeguard UK national identity through their land management role- and that ruminants are integral to this process. Within this theme, there was less focus on people in other countries, and a greater focus on concepts like food security and self-sufficiency.

To summarise, domestic production of ruminants was positioned as being logical (in terms of the available resources) and more climate-friendly than importing food from overseas. This was interwoven with a sense of farming being integral to national identity. In the next section I will discuss the concept of "working with nature" and how this interacted with participants' identities.

6.3.3 The Good Livestock Farmer's relationship with nature

In this section, I will discuss how participants talked about "nature", and how this interacted with their farming identities, building on previous literature (Cusworth et al., 2022; Gosnell et al., 2019; Mills et al., 2018; Uggla, 2010).

Firstly, many farmers used some form of the phrase "working with nature". This perspective was grounded at the local level:

"I think nature repays us by letting us have all these birds around us and, you know, the small mammals that underpin all the raptor populations. And all the little birds that eat the insects that exist around these healthy fields." Farm interview 15

The word "repay" suggests a transaction, with nature as a business partner. It was very common for participants to mention farmland birds as visible evidence that their farming practices were beneficial (Carolan, 2006). The benefits mentioned tended to be within the farm boundary or in the local area, such as the shining cob nut portrayed in Figure 6.5.

Benefits to and from nature were therefore understood based on what one could see and hear on one's farm.

Another common theme was the idea that working with nature was more financially prudent:

"I mean, obviously there's no chemicals go on the farm and we do try and look after nature the best we can and farm with it, rather as against it. Now we enjoy farming that way, but a lot of it has been driven through, we thought for us it was the most sustainable way financially as well as the system being sustainable, ecologically and environmentally, it was important for us to be sustainable, financial, because (…) the farm has three mortgages, three families living off it…" Farm interview 14

Working with nature was therefore not always an end in itself, nor driven entirely by conservation goals, but rather a means to greater financial security. This harks back to the previous section, where I highlighted that being a Good Livestock Farmer meant being a good businessperson. This may explain why the financial benefits to working with nature were often emphasised by participants during interviews, as they wished to be perceived as "good".

Another theme on this aspect was the sense that working with nature involved a "slowing down", which was experienced positively:

"I've just found that like, now I'm managing the animals more in a natural way that they hardly ever need the vet. Very, very rarely. (…) They're not, they're working at their natural speed. I think a lot of the problems with the welfare of animals is you're pushing them to go faster than they want. So like producing too much milk or getting fat too quick or whatever. Then the, you know, that puts extra pressure on the system." Farm interview 18

Therefore, the benefits of working with nature came to the farmer, in terms of profit and seeing more wildlife, and to the livestock, in terms of health and welfare. The latter generated further profit for the farmer, as it was often mentioned that healthy animals were more likely to perform well. Furthermore, having visibly healthy animals meant that one was more likely to be seen as a Good Farmer by one's peers. Therefore, working with nature helped to maintain one's identity as a Good Livestock Farmer, through both generating profit and having high animal welfare.

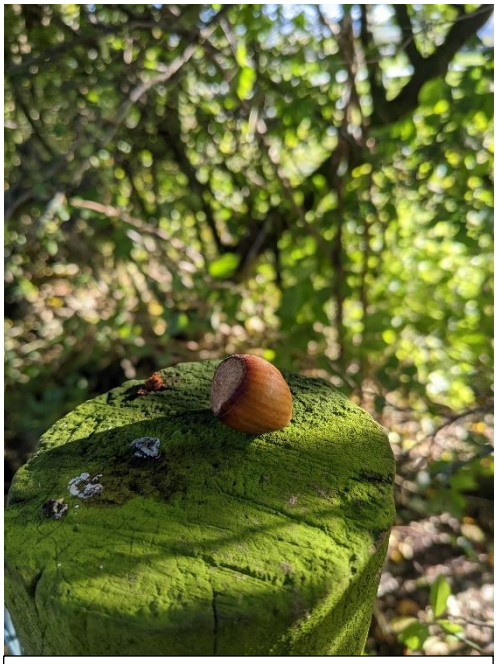


Figure 6.5: Cob nut, from Photovoice project

Working with nature was also seen to benefit the farmer via an improved work/life balance:

"...springtime is just the best, you know, for all, lots of reasons, but this is definitely one of them. Yeah, I think, I'm getting to enjoy it more and more as our system's evolved over the years. It wasn't always great fun. We used to have quite an intensive system of cattle, (...) which didn't necessarily give birth easily. We used to have to do night shifts with them. They were heavier muscled animals compared to what we're dealing with now (...) last two years, there's only been 1.5 percent assists, you know, so we really do rely on them just getting on with it. And it just makes it so much more fun." Photovoice participant

Although a culture of hard work within the farming community was apparent within the data, many participants (especially those under 50) were enthusiastic about how doing things "more naturally" often meant less strenuous work and therefore greater enjoyment of one's work.

Meanwhile, there was also a prominent theme around livestock themselves being natural:

"...you've got little streamlets, so where the cattle cross these, you get a hoof print, which is (...) basically the depth of a milk bottle really, you know, or half a milk bottle, if you think a milk bottle's a pint, so each foot print will hold water and that streamlet then spreads (...) rather than the water staying to a little channel, reach the stream much quicker, you get a better spread. Within each of these (...) hoof prints you've got a microclimate of invertebrates and gosh knows what in there really, but migrating, for the wading birds you

know with the longer beaks obviously (…) so you've got a huge amount of benefits there…" F24

Again, this was often described through the biodiversity or conservation benefits that livestock could bring at the local level, and how they positively impacted other species of animals, insects, and plants. Another way this ontological position was reinforced was through positioning livestock as very ancient and indigenous to the land:

"…that's what I think is really important that they need to understand is, you know, this, it is a balance between food production and the environment. But we've always been doing these things. We've been doing it for centuries. So it's not a new thing. Although the themes and the wording may change, a lot of it remains the same. And, you know, like I said, families have been doing these sort of things for centuries..." Photovoice participant

This quotation illustrates an ontological overlap between "natural" and "longstanding". There was a common refrain that we need to "go back" to a time before high input, highly mechanised farming to achieve better outcomes. This positioned livestock, and farmers themselves, as a normal part of the landscape, and something necessary to preserve. Large wild herbivores such as buffalo and extinct aurochs were sometimes mentioned to argue for the importance of cattle to natural ecosystems, as noted in Cusworth et al.'s (2022) research on regenerative agriculture. The authors refer to this as a "naturalisation" of livestock, as part of a "green rebranding" that seeks to position cattle as environmentally friendly; and therefore farmers as essential workers required to manage these socio-natural hybrid ecosystems (Cusworth et al., 2022). This naturalisation of ruminant livestock works to secure their ongoing role in food systems.

In this section, I have discussed how participants viewed "nature", and how their experiences of "working with nature" intersected with their identities as Good Livestock Farmers. I will now move to discuss boundary making in relation to ruminant methane emissions.

6.4 Boundary-making in relation to ruminant methane emissions

I will now discuss boundary-making in relation to ruminant livestock farming, and show how this relates to methane emissions from ruminant livestock. Boundaries are inchoate, meaning that they are constantly being formed and re-formed (R. Jones, 2008). Discourse, performances of identity, and other social practices play an important role in boundary-

making, and therefore influence understandings of ruminant methane emissions, and the possibility for (collective) action within the farming community.

6.4.1 Spatial boundaries of the livestock farm

Campbell's (2020) "modernist farm" is characterised by firm boundaries, including its connection with social and ecological networks. As mentioned previously, my participants tended to err toward the "alternative" end of the farming spectrum, with strong representation of organic farming, regenerative agriculture, and the adoption of various sustainability practices. Participants saw their farms as connected with broader systems at different scales.

Firstly, many livestock farmers discussed connections (or lack thereof) between their farm and the local area. Participants often experienced their farms as being connected to other humans via water. This was expressed through nutrient runoff into watercourses.



Figure 6.6: Sunrise, from Photovoice project

"I guess it depends on the individual farmer, because you can be quite isolated, and not have any kind of, so the direct communication with people clearly that's going to depend on the farmer and whether they like talking to people or not. Clearly, water quality is a big one. So if you're letting slurry and stuff go into the river, it's obviously clearly having a very negative effect on society." Farm interview 2

This was also illustrated in Figure 6.6, from the Photovoice project. The photographer's caption included the following:

"When we discussed the flood plains, [my son] described them as "protecting the village from becoming a grimy swamp!", which in a way is true. Villages along the River [name] do flood on occasions and it is comforting to know that our farming practices assist

in holding back some of the water that could be otherwise devastating." Photovoice participant

While farmers expressed a clear sense of exactly how much land they managed and where its borders lay, the above quotations illustrate the permeable and inchoate nature of these boundaries, particularly in relation to river systems. This aligns with Campbell's definition of "alternative farming", in which there is greater ontological connectivity with social and ecological networks.

Another perspective that emerged from interviews was to consider the spatial boundaries of the farm on the vertical plane, as well as horizontal. I noticed that there was almost always a plane overhead when conducting walking interviews in good weather, and participants noted this too:

"It was amazing when we come down and lockdown, because we're like, we're close to Gatwick. On a flightpath. We didn't hear any planes for two years. Then lockdown started to lift, and we were like "Jeez it's busy here isn't it", and it's literally planes every couple of minutes. Now that thing up there in that sky. That is chucking out more pollutant than these, than my cows in that field we've just been and visited. And there's one of those every couple of minutes." Farm interview 28

This relates closely to the Whataboutism discourse highlighted in Chapter 4 (see also Simmonds et al., 2024), but it also illustrates Campbell's description of the modernist farm, in which: "what happens on the farm stays on the farm" (Campbell, 2020). The vertical spatial boundaries of the livestock farm are far less tangible than those on the horizontal plane, and the vertical dimension of air space is under-theorised (Williams, 2011). Despite boundaries being relatively intangible, there is still a sense that emissions happening at farm level are not associated with (literal) higher-level activity and changes. Air spaces are produced through practices and discourses (Williams, 2011), and the discursive separation of "up there" from "down here" helps to position ruminant methane emissions as less relevant to climate change. This could also be conceptualised as an example of epistemic distancing, which works to lessen the urgency of climate action (Carolan, 2006).

However, it is not just about the vertical boundaries per se, but about the ontological and epistemic qualities of the emissions themselves:

"So yeah, if you have more things that produce methane, which is living things like you, if you have more people, if you have more oysters. If you have more moose in the wild, more cows, I guess there's got to be more methane cycling hasn't there. I know it oxidises. Again, I don't know these things. These are things that I've heard. But you know, I can't see it." Farm interview 26

From an epistemic perspective, emissions from livestock are invisible, while those from aeroplanes are visually apparent. From an ontological perspective, methane emissions are part of the air that surrounds us. We do not notice the air, in the same way a fish may not notice the water in which it swims. Thus, like air pollution, methane emissions are both literally and ontologically invisible (Carolan, 2006; Landau & Toland, 2022). This invisibility underlies some of the discourses set out in the next chapter, which deny that methane emissions from ruminant livestock are a problem.

In this section, I have discussed the horizontal boundaries of the farm in terms of connections with broader social and ecological networks, showing that in my data these often related to rivers and water. I have also discussed the vertical boundaries of the farm relating to air spaces, and how these can work to disconnect on-farm emissions from atmospheric impacts. Finally, I have highlighted the epistemic and ontological invisibility of methane emissions, a theme I will revisit later in this thesis.

6.4.2 Farmers' relationship to non-farmers

In this section, I will discuss the nature of boundaries between farmers and non-farmers, and how these relate to methane emissions from ruminant livestock.

Overall, farmers tended to describe face-to-face meetings with non-farmers as positive, while also having a sense that they were viewed negatively by the general non-farming public. Either way, the boundary between farmers and non-farmers was reinforced, partly due to them having very different ways of being on farm:

"…it is good, people need to get out more and understand the countryside and get out and about, it's a nice place to be, and it's good for health and for mental health, but they just need to understand that it's not a playground, it's a working landscape, and to an extent it's for peoples' safety that they don't wander straight through a field of cows…" Farm interview 30

This quotation illustrates the way farmers perceived themselves as workers who are connected with the landscape, while non-farmers are (broadly) constructed as temporary visitors engaging in leisure. Ontologically, the farm is a place of work, and therefore a place where one generates revenue.

Despite this ontological difference, many participants viewed the practice of public engagement as positive and desirable:

"I think as a society, we're quite far removed from it [farming]. And that's a worry. I'd like to, think that we can start to bring people back into the countryside. And farmers have got to learn to be more open? You know, I would encourage all farmers, like if you've got people on your footpath walking like, just to spend a bit of time and talk about what you're doing. Ultimately at the end of the day, they're your customer, and we've probably not got the best of reputations as far as like welcoming strangers onto our farms you know?" Farm interview 14

As illustrated in this quote, farmers were sometimes critical of other farmers who were less keen on public engagement. While this theme somewhat reinforces the distinction between farmers and non-farmers, it also shows a softening of the farm's physical boundaries, in terms of welcoming outsiders to enter. Among livestock farmer participants, it was generally felt that involving non-farmers would help to dispel negative views they might hold about ruminant livestock farming.

However, welcoming outsiders was not always viewed positively:

"I don't really want to get too involved with general public, I just want to get on with what I'm doing and then that's my job, I don't go to their office, why should they come to mine (…) I know that isn't what you want to hear, because people want, you know, farmers to [do] Open Farm Sunday and (…) this, that and the other, but I've just found a lot of those things just end up and you're getting robbed, the garage is emptied, the quad bike's gone, this has gone, that's gone, so I'd rather not have everybody wandering about on the farm and that's just me…" Farm interview 32

The above quotation illustrates the vulnerability that can result from being more open, and thus reinforces the physical boundaries of the farm as a means to protect against non-farmers with malevolent intentions. The word "office" also reinforces the ontology of the farm as a workplace.

There were also occasionally more critical descriptions of non-farmers, particularly in relation to climate change. These included themes such as hypocrisy and laziness, with indoor activities such as watching television often cited:

"...we need to go back to proper food and then ultra processed foods are polluting more than anything, as well as the health risk, but the packaging it's all stuffed in, you know. Blame the farmer, blame some sheep on a hillside, while we sit there in front the telly eating our 2 minute meal out a plastic tray, it's absolutely, you know, it's nonsensical really, but no one stands up and says it." Farm interview 24

This quotation brings together a few different strands: it performs a boundary-making function between farmers and non-farmers, it involves a Whataboutism discourse, and it implies that farmers have limited discursive power. In some interviews, farmers also connected issues around modern diets with health conditions such as obesity. I would argue that the idea of "the public" as ignorant and lazy (and prioritising television) is a classist trope drawn upon by a range of actors, not just livestock farmers. However, here it performs boundary work in the context of ruminant methane emissions, positioning non-farmers as more disconnected from farming and rural landscapes. Reinforcing a boundary between farmers and non-farmers resonates with existing work highlighting the "cultural loneliness" experienced by farmers, in which they feel disconnected from the general public (Wheeler et al., 2022).

On the other hand, another popular theme that emerged was that farmers have "common sense". When I asked one interviewee about the roles that livestock farmers play in our society, he replied:

"The last bastions of common sense. [laughing] And there's fewer and fewer about! I don't know, you just, you just see the way debates go, and you just think yeah, you all need to relearn the lessons of the past. So it's, we're a tiny role these days, because there's so few of us." Farm interview 12

This theme saw farmers constructed as being more grounded and practical than the rest of the population. In the above quotation, farmers are positioned as having greater access to "the past", and minimal discursive power. From a Gramscian perspective, "common sense" is inherently normative (Prasad, 2017), although interviewees tended not to view themselves as having power to set social norms; either due to being few, or not listened to. The alignment of farmers with a non-specific "past" resonates with the tendency discussed earlier for livestock

farming to be associated with national identity, which is itself often expressed through reference to the past (Heywood, 2003).

However, despite discursively reinforcing a boundary between farmers and non-farmers, particularly when discussing climate change, interviewees also described ways in which they were integrated with their local communities. For example, some discussed their role in supporting their community during extreme weather:

"…if there's an emergency, it's always the farmers that turn out and, you know, it's like Storm Arwen we spent four days clearing the road because the road was blocked with trees. Well, you know, nobody else would do it, and the council didn't have time to do it, or the, you know, so it's again, you know, that when the floods were on it was the farmers that were out rescuing cars and people and stuff. So it just like, because you've got the equipment and the knowledge you go and do it." Farm interview 18

This connects back to the earlier section on the spatial boundaries of the farm, with these emergency practices reinforcing social connectivity. There was therefore a more collective ontology which emerged in response to the impacts of the climate crisis via farmers' social practices.

To summarise this section, livestock farmers tended to construct their identities as distinct from the non-farming public. This was partly through their ways of being on the farm, which was constructed as a place of work, as well as through critique of non-farmers' perceived views of livestock farming and its relationship to climate change. Creating this boundary helped to reinforce farmers' identities as being associated with "common sense" and therefore distinct from those (less sensible) people seen to have negative views of livestock farming because of methane emissions. However, when facing climate impacts such as extreme weather, livestock farmers often described participating in practices to assist their local non-farming community, demonstrating a softening of the farmer/non-farmer boundary.

6.4.3 Farmers' relationship to decision-makers

In this section I will discuss how livestock farmers perceived decision makers and institutions in relation to methane emissions from ruminant livestock, also incorporating insights from the livestock sector interviews. In general, scientific knowledge about methane was associated with the urban, with policymakers, and with people holding greater discursive

power. Meanwhile, their own knowledge about livestock farming was seen as grounded in the rural, and without significant discursive power.

A common theme was concern about people from outside the farming community having the power to design agricultural policy:

"Well, anybody who hasn't worked in agriculture probably has a limited, partial understanding. And most of the people who are making policy, including all the people in the environmental NGOs, most of them have never been agricultural practitioners. And it seems to me ludicrous that all the people who are making policy don't understand agriculture, or are unwilling to listen to people who do." Livestock sector interview 11

This quotation illustrates the sense that people outside the farming community are different and less trustworthy. However, it also implies a frustration with the imposition of generalised "expert knowledge" based on science, and a consistent lack of engagement with localised lay knowledge systems. Farmers also discussed issues like TB and water pollution through this lens, suggesting that distrust pre-dates debates about methane, but that the latter may be reinforcing existing boundaries between farmers and decision makers.

There was also a spatial element to the boundary between farmers and experts. In general, those involved in policy and those advocating meat reduction (including policymakers and journalists) tended to be associated with urban spaces:

"And then it just seems that people who [inaudible] who make the news and do all these things quite often don't live in the rural, they don't live in the countryside, they're like in the city and then think that everybody should stop eating meat. And then they can push their agenda quite nicely, I guess, without ever actually coming and looking at the countryside." Farm interview 13

This quotation suggests that people with these views hold significant discursive power to "push their agenda". The city was therefore associated with both instrumental power, in terms of policymakers, and discursive power. Meanwhile, farmers were seen as having little discursive power in livestock and climate debates. People advocating meat reduction, including groups such as vegans who may have been critiquing livestock farming for many years preceding these debates (Reisner, 1992), were associated with the city and therefore ontologically both remote and powerful.

At the same time, cities were viewed as the source of a lot of GHG emissions:

"…if you go into a city you sit in gridlock traffic all day with cars pumping out fumes and buildings pumping out air conditioning with doors open and food waste in hotels and, yeah, I hate going into a city these days because I just see all this waste around me, whereas people from the city might come here and they just / awful that you can smell cows, I don't know."
Farm interview 4

This sentiment can be interpreted as Whataboutism, however, the quotation also links to epistemology in terms of the (in)visibility of emissions discussed previously. There is a focus on sensory sources of information, in terms of what one can see and smell. In general, there was a sense that people advocating meat reduction tended to live in cities, and were therefore hypocritical due to their high carbon lifestyles. Interestingly, evidence shows that people living in cities tend to agree that cities are the source of most (air) pollution, and that rural spaces have more "clean air" (Noël et al., 2022). Again, this theme works to make farms ontologically distinct from places where policy decisions are made, and seeks to direct blame for climate change towards the latter.

Turning to the planetary scale, participants often discussed international trade deals as a source of concern, both in terms of GHG emissions and the ongoing viability of UK farming. The farmer in the following quotation was discussing a local MP who incorrectly thought that lambs born in spring were sold in spring:

"Everybody's so out of touch with what's going on! You know, she's a Conservative MP for Berwickshire in Northumberland, the north of Northumberland, and she doesn't even know when the lambs are ready, you know, the main glut of lambs are ready from August onwards sort of thing. (…) She's so out of touch with the whole thing, you know, so how can you trust somebody like that to be responsible for making a good job of, you know, selling our trade?"
Farm interview 9

This quote further illustrates the idea that farming knowledge is a marker of legitimacy, and those without it are untrustworthy.

Another related theme that emerged in this area was the idea that government activity was suspicious, and being driven by unelected individuals or undeclared interests:

"…they say Carrie [Johnson] pulled the strings, her and Zach Goldsmith, you know, the anti-animal legislation what came in in them few years, was unbelievable, umm, and none of it was democratically voted for. Goldsmith lost his seat so they give him a Lordship so he could

stay there. And you know things / these are way above people like us I'm afraid, we can't change this, but in our own little farm, we can make a stand and say, no, we're not doing this, we're not putting up with that…" Farm interview 23

These ideas were more prevalent among participants who had been recruited from an online farming discussion forum, and therefore were likely more normalised within that specific epistemic community. It is perhaps unsurprising that trust in government was low at the time of the interviews, given the broader context of the Covid-19 pandemic and, for example, relatively recent scandals around inappropriate contracts for medical supplies. The quotation above suggests a lack of agency in terms of influencing government policy, but that on-farm practices could be a means of claiming autonomy.

Among some participants there was less of a sense that decision makers were actively hostile towards livestock farming, but rather that they were indifferent:

"…there's a lot of regulations that haven't quite hit us, but are going to hit us like a steam train very soon on ammonia emissions, water regulations, clean air, all sorts of stuff. So we're seeing less support from the government. And that's not just necessarily financial, but the feeling that they actually don't really care about the farming industry. So you're seeing a government who are willing to let the industry kind of slide because they can import all the food back in." Farm interview 2

Given that a Good Livestock Farmer is one who both produces food for the nation and cares a great deal about their animals, this lack of governmental support and care was felt as a threat to UK farming identities. The use of the phrase "hit us like a steam train" implies that the impacts of this lack of care are experienced as a form of violence, which connects back to some of the discourses identified in the media analysis around "Fighting the anti-meat agenda". This quotation also relates to the earlier section in this chapter regarding spatial boundaries, in terms of the mention of importing food which is seen as a threat to "good" UK farmers.

Overall, there was a sense from participants that urban concerns were prioritised in the UK. For example, during the Photovoice project, we completed an activity in which participants arranged photographs along a spectrum from hope to fear:

Photovoice participant: *"And we thought the very last one of the modern train and the modern skyscrapers, to us as country folk seemed to be, you know, needing to be on the (…) fear side of things…"*

Researcher: *"What, why does that, tell me more about why that relates to fear?"*

Photovoice participant: *"Well, just, I think, to us country bumpkins, or me myself, I'm talking probably myself now. There seems to be more and more of the world getting developed. And, you know, we've still got to produce food and we've got to feed all these people (…) we've got the HS2 tearing up loads of farmland coming up, to have people get there just a tiny bit faster. And yet on the other side of the coin, we're all supposed to be lowering our carbon footprint. And, you know, it doesn't matter about, as long as the fast ones, the hedge fund people driving on the train or whatever can get from London to (…) Birmingham or wherever it's coming to."*

This quotation illustrates the feeling that urban concerns were being taken more seriously than rural concerns, and that the former were associated with people with more (financial) power. This conversation also surfaced a great deal of self-awareness, for example the above participant saying, "I'm talking probably myself now", as participants reflected on their positionality and how different people could experience the same image in different ways. This reflexivity among participants was a strong feature of the Photovoice data. The feeling of being deprioritised and disempowered compared to urban areas contributed to an ontological isolation of the farm, and the previously mentioned sense of the farm as a space where one could exercise one's autonomy. These features helped calcify social boundaries between the farm and the rest of the world.

Another major theme in this area was the idea that the current level of environmental degradation was created by policymakers, who had been incentivising unsustainable land use practices since the period following the Second World War:

"…people think all farmers are evil and all farmers are not evil. Most, they're doing what they were told to do by the government. The government told them to rip up hedges and paid them to do it. I don't think anyone did it gladly, then [inaudible] there's a whole generation that thinks that's the way to do it. And they've lost the knowledge that actually a hedgerow is full of biodiversity. And guess what, when you have floods, a hedgerow takes up 60% of the water flow. [inaudible] 60% of the water flow! We've ripped them all up and you wonder why there's flooding, well because there's no hedges left!" Farm interview 31

This livestock farmer participant also had a role as a governmental advisor, and thus straddled the leaky boundary between livestock farmer and livestock sector stakeholder. The exasperation in the quotation is palpable, and similar refrains were prevalent throughout the data. It suggests a feeling of being unfairly blamed, and an experience of a lack of accountability from government institutions for past mistakes. Methane debates therefore sit within this broader context of farmers experiencing inconsistent demands within (for many older farmers) relatively recent memory. This aligns with a sense that scientific institutions are responsible for the environmental destruction we are now seeing, yet deny their responsibility, leading to further damaged trust among the lay public (Beck, 1994; Wynne, 1996).

Related to the above was a strong theme of participants feeling like policymakers don't respect farmers' knowledge:

"It's the same issue with government, they kind of, they do their own thing, get advice from experts who are nothing to do with farming, and then they try and include farmers now, so they come with these proposals, and this is what we want to do, and it's going to make it horrifically complicated (…) And we're like, "Well, what? Why don't you ask us what would be good?" Ask US [emphasis]. And then you can get your experts to look at that. (…) So it's just the same old, same old from the government, really. They come up with the proposals, and then it's up to us to try and get them to backtrack on certain things." Farm interview 12

There was a sense that things had been improving due to the fact there were now more consultations than in the past, however most participants felt that this level of participation was inadequate. Farmers often spoke about wanting policymakers to visit their farm and see what they do. This suggests a desire to achieve a shared epistemology- for policymakers to experience the farm with their own senses rather than remotely and through data. There is a persistent assumption within institutions that farmers will assimilate scientific knowledge and thus adopt certain practices (Wynne, 1996). However, these data show that farmers also view government actors as having a deficit of knowledge, which could possibly be remedied through grounded engagement with the farm environment. Farmers are therefore operating, to some extent, on a knowledge deficit model in which the provision of information will lead to decision-makers realising they are wrong. Given that this would require a significant shift in the latter's worldview, such a "conversion" is unlikely (Mouffe, 1999).

To summarise, the data showed that boundary-making between farmers and policymakers created an ontological sense of the latter as being remote and not grounded in the countryside, as well as operating on a different epistemic basis (Wilde et al., 2021).

6.5 Chapter summary

In this chapter, I have provided rich description of the types of farms and farming identities involved in the research. I then discussed the qualities that participants associated with being a Good Farmer, finding that these centred around high animal welfare, good business skills, and the ability to adapt to change. Notably, methane reduction was not mentioned and climate change mitigation was not a strong theme, except in relation to regenerative agriculture and the carbon sequestration potential of grasslands.

I then discussed how being a Good Farmer was associated with national identity, particularly in terms of landscapes and food security. Following this, I turned to the concept of "working with nature" and showed how this helped reinforce participants' Good Farmer identities. These three sections added greater depth to the descriptions of the research participants, and began to illustrate how they related to methane emissions from ruminant livestock.

I then moved to three sections which were more focused on discursive and social practices pertaining to boundary making. Firstly, I discussed the spatial boundaries of the farm, and its connectivity with wider social and ecological networks. I also introduced the concept of the vertical boundaries of the farm, showing how these interact with the invisible nature of methane emissions to make the latter less tangible and less important in terms of climate change.

Turning to social boundaries more specifically, I illustrated how farmers discursively reinforced boundaries between themselves and the broader non-farming public, and how this was more relevant for an imagined public rather than the people they met in-person, for example on footpaths. However, I also discuss how emergency situations resulted in greater community cohesion and a softening of farmer/non-farmer boundaries.

Finally, I discuss how farmers often viewed themselves as separate from people in positions of power, the latter of whom were associated with urban areas and included policymakers and those advocating meat reduction. The farm was meanwhile seen as a space where one could exercise autonomy. Ontologically, power was at a distance yet capable of exerting violence.

Epistemically, farmers described experiencing an indifference towards their lay knowledge, and expressed wishing to share their knowledge with policymakers.

Overall, this chapter shows how the livestock farm is a somewhat ontologically isolated entity, despite a degree of connectivity with social and ecological networks. In particular, farmers broadly see themselves as distinct from the non-farming public, particularly in relation to debates around land use and climate change. However, many of the boundaries discussed fluctuate in their porosity. Many of the ontological and epistemic characteristics highlighted in this chapter provide the foundation for livestock farming sector discourses on methane emissions, which I will discuss in the next chapter.

Chapter 7- Results: Methane discourses and practices

7.1 Introduction

In the previous results chapters I have shared results from the media analysis phase and presented findings pertaining to farming ontologies and identities. The media analysis illustrated some of the major discourses and discursive shifts on ruminant livestock and climate change that took place in the "post Paris era" from 2016 to 2021. The findings showed significant polarisation between national and farming sector newspapers, as well as a lack of engagement with food system power dynamics. Discourses such as "UK livestock farming is efficient and sustainable", and "Us vs Them" were prevalent in the farming media, as was the use of "Whataboutism"; one of the discourses of climate delay. As discussed, media narratives may influence public opinions and agendas, but the influence is likely bidirectional, with media outlets responding to public priorities as well as contributing to shaping them (Simmonds et al., 2024).

My fieldwork in 2022 provided the data for the previous chapter, which drew on qualitative interviews with livestock farmers and industry stakeholders, and a Photovoice project to investigate farming ontologies and identities. This helped to characterise the farmers who participated, and to understand how their identities as Good Farmers were influenced by their ability to demonstrate good animal welfare (through having visibly healthy animals), and running a successful business. They also discussed being open to change, although this generally referred to changes in farming systems rather than anything more radical, and was unlikely to involve climate change mitigation except through soil carbon sequestration. Importantly, I sought to understand farming identities via discourse, as in previous research (Burton, 2004; Sutherland et al., 2024). From an ontological perspective, I also explored different boundaries (including spatial and social), illustrating their inchoate nature, and beginning to show how these influence farmers' understandings of methane emissions from ruminant livestock.

In this chapter, I will present further findings from the qualitative interviews with farmers and other livestock sector stakeholders, and from the Photovoice project. I will focus more explicitly on discourses and practices pertaining to ruminant methane emissions. A major finding from this research is that participants, in discussions with them about relations between livestock farming and climate change, tended to focus on whether methane

emissions from ruminant livestock were a problem. The chapter is therefore divided into two main sections: discourses on whether methane emissions from ruminants are a problem, and discourses on possible solutions. In the subsequent discussion chapter, I will illustrate further how the findings in the three results chapters are interconnected, including how the media discourses identified earlier compare with the discourses identified in this chapter.

I understand the term "discourse" as language use that constitutes social practice (Carvalho, 2008; Fairclough, 1992). This definition is informed by critical discourse analysis, which is concerned with the relationships between texts and social processes (Carvalho, 2008). I consider discourses to be broadly analogous to stories, in that they seek to convey information and provoke a desired response in the recipient (Donnison et al., 2023). Discourse is also a key component of boundary-making (Paasi, 1998), as illustrated in the previous chapter.

For this thesis, framing represents a type of discursive strategy. For Carvalho, framing refers to how an actor organises discourse "according to a certain point of view or perspective" (Carvalho 2008, p. 169). This differs from a more general framing analysis, in which framing is defined as repetitively presenting information in a certain way, meaning that certain ways of understanding a situation may be sidelined or silenced (Lockie 2006; Naylor et al. 2017). Other discursive strategies include (de-)politicisation and (de-)legitimisation. Politicisation is the attribution of a political nature to a situation, while legitimisation involves justifying an action or situation on the basis of normative or other reasons (Van Leeuwen & Wodak, 1999). For this research topic, another important set of discursive strategies are the discourses of climate delay, which build on legitimate concerns about rapid climate action, but move into misrepresentation and imply that change is neither desirable nor possible (Lamb et al., 2020).

I will now begin by discussing discourses that emerged from the interviews and Photovoice project pertaining to whether methane emissions from ruminant livestock are a problem.

7.2 Are methane emissions from ruminants really a problem?

A major finding from this PhD research has been that livestock sector discourses are often situated at the problem level of political conflict (Baumgartner, 1989). Prior to data collection, I had anticipated the interviews being more focused on the solution and implementation levels. When directly asking livestock farmers about solutions, they would

often return to discussing whether methane emissions from ruminant livestock were a problem in the first place.

Like the discourses of climate delay, livestock sector discourses around methane were often based on legitimate concerns about the potential negative impacts of decarbonisation, yet also worked to resist change and delay action. Further, unlike contemporary conversations around fossil fuels, some livestock sector methane discourses actively deny connection between methane emissions from ruminant livestock and climate change. I argue that they do so by drawing on a mix of lay and scientific knowledge, between which there is a porous boundary allowing for various types of knowledge to be recruited.

The major forms of discourse presented in this chapter are summarised in Figure 7.1, which also illustrates that methane discourses work to refute threats to farming ontologies and identities.

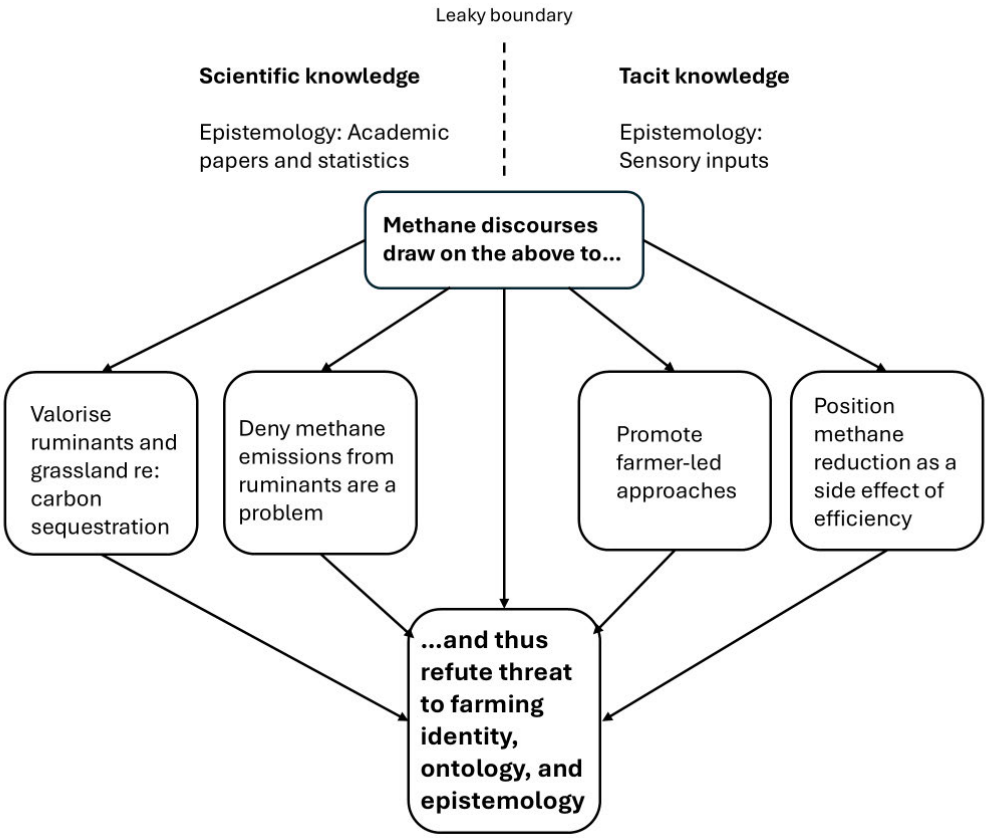


Figure 7.1: How methane discourses draw on different forms of knowledge to protect farming identities

In this section, I will discuss the following prominent discourses: Grassland is an important carbon sink; Methane doesn't matter; Methane is part of a cycle; Methane's Global Warming Potential is lower than previously thought; Whataboutism; and It's about more than just methane.

7.2.1 Grassland is an important carbon sink

A strong discourse that emerged from livestock farmers and sector stakeholders who were more closely aligned with livestock farming was that grassland is an important carbon sink. This was very often articulated by farmers practising regenerative agriculture:

"I think the more I'm figuring out with umm this pasture group and the regenerative side is actually, ruminants especially, have a role to play in not only okay they are producing methane, but they're also benefiting the soil, because they are creating / you know they start to break down the grass and then that's going to improve the soil structure and feed the soil, which will make them take in all the carbon and, I don't suppose it's methane, but it's the carbon sink…" Farm interview 22

There was therefore a strong view that grazing ruminants are important for improving carbon sequestration. More specifically, the practices associated with regenerative agriculture (such as mob grazing and diverse swards) were associated with increased carbon sequestration. Thus, as identified by Cusworth (2022), there is an essential role in regenerative agriculture for humans and their grazing management practices. There was also a stronger association with cows than with sheep, given their different grazing habits.

Part of this discourse was around returning to older practices, and that technologies associated with agricultural corporations were worse for soil carbon sequestration:

"So the modern grasses that science has sort of evolved, they tried to stop them putting stuff back in the ground because they thought that was a waste of nutrition basically. So the grasses that most people would plant for grazing don't put much back, whereas the old fashioned grasses that have grown up over millions of years do. So that's quite a bit of modern, very modern sort of thinking really in the fact that actually we've been probably doing the wrong thing, because we thought this is worse for nutrition, but actually it's putting stuff back in the land so that you don't have to add artificial stuff or anything." Farm interview 18

There was therefore a slight suspicion of "science", particularly science associated with intensification, while lay knowledge was felt to be more reliable. Because those practising regenerative agriculture were less reliant on inputs and products from agricultural corporations, they were perhaps more comfortable with vocalising their distrust of them (Wynne, 1996).

Some participants were not involved in regenerative agriculture practices, but still advocated the discourse that grassland is a major carbon sink:

"…basically when the grass grows it does suck in a certain amount of carbon and obviously if we just let it grow and it stopped growing obviously it's sucking more carbon in, so I know the cows excrete methane and that's / all the time they keep eating the grass, grass keeps growing, so they are sucking in the carbon, so they are sort of / I would say we're probably not carbon neutral, what we're / we're not far away from it, I wouldn't have thought, so it's / it is a balancing act…" Farm interview 32

There was therefore also an idea that any form of grazing was associated with carbon storage. Simply by owning or renting land, and maintaining that land as grassland, one was having a positive impact on the climate. This was sometimes contrasted with more intensive, housed livestock systems; a point I will return to later in this chapter.

Some participants also articulated a belief that grassland can continuously absorb carbon:

"…if you've got a field, a permanent pasture, it's never gonna be ploughed up again, or until it gets ploughed up. All the time you're increasing the, (…) what I'm trying to get to, talking about the carbon thing is, you've got all this root system underneath and the mycorrhizal activity and everything else. Which is sucking in carbon and storing it. And it all gets broken down into the next layer. And I think that soil scientists have [inaudible] science, but the basic crux of it is it just keeps absorbing, absorbing, absorbing all that carbon. And obviously, the more we rotate the animals and make the grass grow and everything else, that's obviously storing carbon. Taking it out the atmosphere and pulling it into the ground." Farm interview 29

This idea was in contrast with some of the livestock sector stakeholders, especially those in policy roles, who highlighted that carbon stocks in grassland reach an equilibrium rather than increasing indefinitely. There was therefore significant optimism among some livestock

farmers and sector stakeholders about grassland's capacity as a carbon sink, which was not shared by those outside the farming community (or supported by current scientific evidence).

The value of maintaining grassland was often contrasted with arable farming by farmers operating more grass-based systems:

"I mean, because you'd go well, the best thing to do here would probably be 1000 acres would keep 10 cows on this site. Then you'd be going. "Ten on here, that's great", you know. I wouldn't own it, I'd be bankrupt, I wouldn't own it. And if I didn't own it, the chances are that it could turn into a monoculture wheat place, you know, so like, if I didn't make a living from it, and if grassland farmers didn't make a living from it, what would come in would be the plough. And with the plough, you'd come in with big monoculture cropping." Farm interview 14

Arable farming was broadly viewed as being more damaging to the climate, due to factors such as nitrogen application, the use of large machinery, and poorer soil health:

"...there's a lot of discussion about it now, isn't there, about soil health. These upland soils are usually in fairly good nick. It's the arable soils that have been, perhaps over exploited by growing the same crop over and over and over again, just soaking all the nutrients and stuff out the soils, but our soils are fairly, in fairly good nick, load of organic matter. There's all sorts of microbes and the soil biology is pretty good. The worms are in, everything seems to be working quite well." Farm interview 15



Figure 7.2: Cows grazing, from Photovoice project

There was a strong sensory epistemology running through comparisons with arable farming, with farmers highlighting the visual differences in soil, as well as the extent of soil run-off

they observed from nearby arable farms. Ontologically, grassland was viewed as "stable" (Farm interview 14), without the constant flux and external inputs associated with arable farming. The caption accompanying Figure 7.2 includes the following text:

"That land isn't suitable for growing crops, it can't be cultivated or harvested. So it's acting as a massive carbon store as well, because the soil's not been disturbed." Photovoice participant.

Because of the feeling that arable farming was more damaging, both in terms of the soil's ability to absorb carbon and to soil health in general, livestock farmers often highlighted a perceived injustice in the new ELMS scheme:

"I know SFI, they're concentrating on arable farms to start with. Think, where's all the carbon? Grassland, that's where it is. What about grassland? You're letting the arable farmers have some money." Farm interview 12

Again, this resonates with livestock farmers feeling that their positive impacts are under-appreciated by those outside the farming community.

A final component of the discourse that grassland is a major carbon sink was the idea that grassland is better than trees for sequestration:

"…a narrow focus on carbon is now leading to all of the, for instance the airlines carbon offsetting, you know, maybe taking, you could take all this land out of production and plant trees. You know if you're importing those trees, it might take 12 years, before you're even in the Carbon positive anyway. Where do the trees come from? Are we spreading diseases around? Plastic, transport with the trees, all of that kind of stuff. And then we might end up with something that's not as good as what we started with, anyway. So my gut feeling is that they'll be chopping down all those trees they're planting. So they can put it back into agriculture, at some point. But there'll be grants for that as well so don't worry!" Farm interview 26

The above quotation illustrates a lot of the discourses that emerged relating to trees: that large scale tree planting is often the work of powerful actors seeking to offset their emissions from fossil fuels, that trees take a long time to store high levels of carbon, and that tree planting is associated with high levels of plastic pollution. Furthermore, the final sentence illustrates a view of government incentives as inconsistent. This was highlighted in the previous chapter in relation to a sense that the government had historically promoted unsustainable practices

such as removing hedgerows. There was therefore a strong distrust of those promoting tree planting; despite many farmers having areas of woodland on their farm which were a source of pride.

In this section, I have discussed the discourse "Grassland is an important carbon sink". Ruminants were seen as a vital tool for maintaining and improving soil organic matter, and that this made their methane emissions broadly irrelevant. Overall, within this discourse ruminants were seen as either neutral, or a net positive in terms of their climate impacts. In the following sections, I will turn to discourses about methane more specifically.

7.2.2 Methane doesn't matter

A prominent discourse that emerged from livestock farmer and some stakeholder interviews was that "Methane doesn't matter". This was explained in a few different ways, as I will demonstrate below. Firstly, the discourse "Methane doesn't matter because ruminants do good" went as follows:

"But my view, like with how we farm, is if you're not intensive and the good that you're doing is outweighing the harm, it's like everything, you've just got to balance it haven't you." Farm interview 6.

The "good" implied in this discourse was relatively vague, with livestock viewed as having either a neutral or even positive impact. The above quotation illustrates the common view that less intensive systems were "better". I will return to this point later in relation to differing views as to methane emissions from intensive vs extensive systems. The "balance" metaphor was also common here, suggesting an awareness of some negative impacts from ruminant livestock (e.g. methane).

Data from farm interviews demonstrated an epistemology based on tacit knowledge and personal experience. For example, many farmers using regenerative practices had physical or photographic evidence of improved soil organic matter as a result of their grazing practices. However, methane emissions are not appreciated with the five senses:

"I find it hard to believe, but I presume my cows are belching out methane, because I, you can't see it or anything. So I would say that I think that the, the whole focus on the cows and their methane is totally, it's just misguided. And it's very, very unhelpful. Because actually, cattle are going to be the saviours of the, grazing animals are going to be the saviours of

climate change, because the soil is one huge, great big potential carbon sink." Farm interview 1.

As discussed in the previous chapter, the fact that we "can't see" methane meant that farmers were less likely to view it as important (Carolan, 2006). For all of us, our knowledge on methane emissions largely comes from climate science based on complex calculations that few of us can follow. These emissions were therefore less tangible for many participants than were visible changes in soil structure or landscape.

Another iteration of this discourse was "Methane doesn't matter because there have always been ruminants".

"You know, like you look at history, you know, Europe had like, bison, you know, 1000s of millions of years ago, North America had massive herds of bison, you know, there's probably not any more cows now. Or methane producing animals in the world than there ever has been." Farm interview 25

Bison, wildebeest, and aurochs were all referenced as being either previously or currently populous, presumably to the same extent as ruminant livestock. This discourse relates to themes in the previous chapter about livestock being "natural" (Cusworth et al., 2022). The idea that there have always been ruminants also touched on the ontology of farmed ruminants discussed in Chapter 5, in relation to "animals as workers". In the below quote, an upland livestock farmer somewhat humorously posed the question of whether wild ruminants are valuable, given that they don't produce (large amounts of) food for humans:

"But we also then have to think about how we look at huge herds of wildebeest, caribou, and bison, because they're all doing exactly the same thing, aren't they? And not providing anything in terms of supporting a hungry planet by producing food, unless you go and kill them all and eat them." Farm interview 15

In this quotation, livestock are implied to have more value than wild ruminants because of the work they do providing food for humans. This aligns with the subtle productivist elements of the Good Livestock Farmer identity discussed in the previous chapter. Overall, livestock farmers often repeated the discourse "Methane doesn't matter" in the above formats. I interpret this as a form of climate scepticism- not denial that climate change is occurring, but that methane emissions from ruminant livestock contribute to it.

7.2.3 Methane is part of a cycle

A commonly repeated discourse among livestock farmers and some stakeholders was that methane is part of a natural cycle, and therefore not a problem. This related to the way methane is broken down into carbon dioxide and water in the earth's atmosphere after approximately seven to ten years:

"…the grass is 8" high, it's lush green grass, and the sheep are eating it. Now what they're breathing out or belching is going into the atmosphere. I think I'm right in saying it's a seven-year cycle, methane, and it turns into carbon dioxide eventually and the grass absorbs it back, so there's that natural cycle." Farm interview 23

This relates to a similar discourse around global warming potential (GWP), discussed below. The word "natural" was often used to describe the methane cycle, with many connecting it with the historical ruminant populations mentioned in the section above. Methane emissions from ruminant livestock were therefore positioned as both natural and distinct from the "man-made" emissions arising from fossil fuels. Some referred to this as "biogenic methane" (a term used to describe methane from biological sources rather than fossil sources), as illustrated in the quote below from a livestock sector stakeholder involved in agroecological consulting:

"So, and then the other side of that coin is the discussion around biogenic methane, and methane that's emitted from ruminants is part of a carbon cycle. And if you, if you are farming in a way, an agroecological way that's restoring the biodiversity within that system, you will be soaking up a lot of that methane with methanotrophs, and your whole water cycling system will alter those methane dynamics. And for me, that's missing, a big missing piece with just taking these single carbon related metrics, I think they're potentially very misleading." Livestock sector interview 3

Some farming interviewees also highlighted their low use of fossil fuels, particularly those using low-input systems who mentioned, for example, walking to check stock rather than using a quad bike. The prevalent discourse that methane is part of a cycle was present across participants running intensive and extensive farm systems. It implied a lack of action to address ruminant methane emissions, but was sometimes associated with practices that reduce fossil fuel use, and with agroecological practices that increase soil organic matter.

7.2.4 Methane's Global Warming Potential is lower than previously thought

Another theme relating to whether methane is a problem in term of climate change was disagreement around the global warming potential (GWP) of methane. In IPCC reporting, this is measured using GWP100, which reports methane's GWP in terms of its equivalence with carbon dioxide over 100 years. According to this metric, methane's GWP is 27 times greater than that of carbon dioxide (Greenhouse Gas Protocol, 2024). However, researchers have suggested an alternative metric known as GWP*, "GWP star", which accounts for methane being short-lived in the earth's atmosphere; breaking down to carbon dioxide over a period of approximately 12 years (Allen et al., 2018a). According to this metric, maintaining a stable ruminant herd size creates no additional warming, but increasing the herd size would do so. Meanwhile, reducing methane emissions would initiate global cooling (Allen et al., 2018a).

Livestock farmer participants often pointed to GWP* as a reason why methane emissions from ruminants were not a big problem in relation to climate change:

"the IPCC created something they called GWP100 (...) To try and equate one gas all back to carbon and GWP100 shows that methane is an extraordinarily global warming gas (...) so that implicates cattle as causing an awful lot of global warming. They've now reviewed the GWP100 metric and replaced it with GWP, but because of inertia, all the media and governments still work on GWP100, so that's on the one side."* Farm interview 21

This discourse was often associated with the idea that methane is part of a cycle. Some farmers were optimistic about GWP* meaning they had been vindicated, while others were more cognisant of the fact that GWP100 continues to be utilised by the IPCC and therefore would continue to be relevant. Regardless, discourses around GWP* implied a lack of engagement with methane reduction, as they worked to deny that a problem existed.

Another major component of this discourse was the utilisation of expert knowledge:

"...unfortunately, the IPCC really aren't listening to their own scientists, because most of the IPCC don't really understand methane to start with. So instead of listening to the former lead author, Professor Myles Allen, who wasn't the lead author on the latest report, who was constantly telling them all well, getting rid of ruminants will not reduce climate change at all. So, but when it gets in the politicians' hands, they just say, "Oh right, well, let's reduce methane by 30%"." Farm interview 12

As illustrated in the above quotation, some farmers and livestock sector stakeholders would cite specific scientists, further legitimising their claims by mentioning that the research had come from Oxford University. In the discourses set out in the previous sections, I discussed how these discourses were built on and compatible with lay knowledge systems; in some cases featuring a lack of engagement with scientific evidence (e.g. on soil science). Discourses around GWP* were more likely to draw on expert knowledge, with some farmers becoming well-versed in scientific papers, and information being shared in online fora. Cusworth et al. (2023) call this "reflexive performativity", when actors that will be governed by metrics become actively and strategically engaged in seeking to shape them.

Another theme within this discourse was that declining stock numbers meant UK farmers were already contributing to global cooling:

"...there's no acknowledgement that actually, cow numbers have been declining since 1974. So farmers have actually been cooling the planet in this country. Never mind, with all these carbon payments, well, why aren't we paying the farmers?" Farm interview 12

There is a theme running through this thesis of farmers expressing frustration at being viewed as climate villains. This is another example of them expressing desire for their environmental achievements to be recognised.

Among livestock sector stakeholders, some held a view that GWP* might not be as beneficial to livestock farming as hoped, such as the following sector representative:

"...there's a big, there's a big push for, for GWP to be the recognised measure for farming, which people say is more accurate. And it could well be, but we've got to bear in mind that that brings us other problems, you know, if you go down that route, and suddenly say, right, okay, so we've gone down GWP* then suddenly, our up-front impact is huge. And (...) if you were trying to cause trouble from the other side of things, you may turn around and say (...) "Well, that's an easy win, we'll just get rid of all livestock, and that'll solve our problem up front". And then we find ourselves in the same position in 20 years with carbon going in. So I think we've got to be careful what we ask for in terms of that."* Livestock sector interview 4

There was therefore an awareness within the sector that GWP* simply represented a different metric, rather than indicating that methane emissions from livestock are unrelated to climate change. The speaker mentions someone "trying to cause trouble from the other side of

things", implying a polarised arena in which the livestock sector is in opposition to those who wish to reduce livestock numbers.

Among the small number of civil servants interviewed, there tended to be a sense that the ongoing debates around GWP* were not conducive to climate action:

"…it is getting to a point of, the debate around it's probably doing the industry a disservice. And that it's allowing a debate to kind of go round in circles, distracting (…) and as I say, it's been going on for five odd years now. Probably be better suited for everyone to be actually looking at opportunities and how we can kind of move forward rather than debating how we're accounting for it." LS 14

There was an implication that the debate was unproductive, illustrated here by the phrase "going round in circles". Livestock sector stakeholders in this sample therefore were sometimes less enthusiastic about GWP* debates than individual livestock farmers.

Overall, livestock farmer and stakeholder discourses around GWP* commonly suggested that the metric indicated that methane emissions from ruminant livestock did not significantly contribute to climate change, and therefore absolved livestock farmers of responsibility to change their practices. Farmers drew on expert knowledge to legitimise their claims in this area. Meanwhile, livestock sector stakeholders (particularly those in public institutional roles or with a broader overview of the sector) felt the issue was less clear cut and not as vindicating for the sector.

7.2.5 It's about more than just methane

Another discourse I will discuss in this section is "It's about more than just methane". This discourse suggests that a narrow focus on methane, without accounting for other aspects of sustainability, can obscure important trade-offs and potential problems.

"…the risk is that we get this intense, this land sparing rather than land sharing approach, and then you'd end up with a bit of a horror situation, which might be more wilded areas, but there'd be an awful lot of very intensive farming. And that people say, people will use the carbon thing to argue that that's the most carbon efficient, but I would say it's absolutely pointless just looking at carbon, because you've got to look at biodiversity, you've got to look at the soils, they're all connected with each other…" Farm interview 1

This was particularly prevalent among interviewees using regenerative agriculture practices, particularly those who had tacit knowledge of biodiversity benefits such as increased farmland birds associated with their farming system. It also illustrates that many participants were concerned by "intensive farming", seeing this as distinct from their approaches. I will return to this issue later in the chapter.

Others highlighted the broad range of skills that livestock farming requires, and that it involves considering a range of competing factors:

"...we try really really hard to tie together all these strands of environmental pressures, climate change, productivity, animal welfare, human welfare, try and marry all those together as best we can, but it sort of feels like whatever we do we're never going to make anybody happy, not because we're not focusing on one thing, we're focusing on lots of things." Farm interview 3

This quotation, from an intensive dairy farmer, ties into discourses around farmer mental health, and the feeling many participants shared of being constantly criticised. This discourse overall worked to delay action on ruminant methane. However, one could also argue that it generated important critique of narrow policy goals that may risk unintended consequences.

7.2.6 Whataboutism

One of the discourses of climate delay, Whataboutism (see Chapter 5 and Simmonds et al., 2024), was very prevalent in the interview data. Whataboutism contributed to boundary-making, both at a local scale and globally:

"I think everyone focuses on the methane, because, like in the media, because they don't like livestock. And that's where it comes from. But it doesn't just come from that, does it? It comes from like China's emitting landfills, and mines, and like shafts and some of that comes from, there's loads of stuff that comes from not just cattle, like big things, which are quite easy fixes." Farm interview 13

China was mentioned by interviewees as a major emitter, and the subject of food waste going to landfill was also prevalent. There was relatively broad awareness of the different sources of methane emissions globally. This quotation also mentions "the media", illustrating a common feeling that mainstream news media held significant discursive power and could impact opinions among the general public.

Aviation was also a popular topic among livestock farmers, illustrated in this interview with three members of the same upland farming family:

Speaker 2: "[inaudible] it's good for the general public to be able to blame the cow, instead of blame their lifestyle/"

Speaker 1: "The fact that they're driving up and down and they're going/"

Speaker 3: "Or they're going on holiday 3 times a summer." Farm interview 25

This also tied into reinforcing the farmer/non-farmer boundary, with taking holidays seen as less achievable for farming families, whether due to cost or inability to take time off from caring for livestock.

Overall, this discourse worked to discourage practices to limit methane emissions from ruminant livestock, as adopting these would be pointless without action on other factors. This is summarised in the below quotation:

"…there are lots of countries in the world and lots of industries in the world and if British agriculture is carbon neutral in 10 years' time, 15 years' time, if nobody else is, you won't make any difference at all whatsoever, so unless it's going to be, you know, everybody, every industry, and every country, is going to take it on board, it's a pointless exercise." Farm interview 32

Whataboutism was therefore geographical, in terms of other countries, as well as being sectoral, with aviation and other forms of transport often highlighted (as mentioned in the previous chapter). It also worked to reinforce boundaries between urban and rural, with urban dwellers seen as having greater responsibility for GHG emissions.

So far in this chapter, I have discussed discourses pertaining to whether methane emissions from ruminant livestock are a problem in terms of climate change. These indicate that one livestock sector solution to public debates around cows, sheep, and climate change was to deny that a problem existed. This was performed through valorising ruminants and grassland in terms of carbon sequestration, and using different discourses that deny methane is a problem, as illustrated in Figure 7.1. The discourses refute the threat to the farming identities discussed in the previous chapter, and imply that action is unnecessary, therefore working to discourage changes in practice. However, in the next section I will discuss how even while

expressing such beliefs, many farmers were engaged in practices that would reduce methane emissions, though perhaps motivated by different reasons.

7.3 Practices that reduce methane emissions

In this part of the chapter, I will discuss how farmers understood and acted upon different solutions for reducing methane emissions from ruminant livestock. These solutions sometimes emerged spontaneously in the interviews, and sometimes in response to me probing whether interviewees had heard of any solutions (which I knew were prominent in the wider livestock and climate science literature). I will show in this section that farmers were more positive about solutions they perceived as "farmer-led" and as having co-benefits for their farm business.

7.3.1 Efficiency

Many farmers were engaged in different practices that would "accidentally" reduce their emissions. These can broadly be referred to as efficiency solutions, which were often associated with genetics and animal health.

Firstly, genetics was seen as a vital way to make the farm more efficient:

"And so what we do, so our efficiency drive on genetics is that all these females in here will be DNA tested within the next month. The DNA goes off to the US, analysed, and we get the genomic result for each animal which will tell us how good or bad it is. So I can show you one probably... Won't let me refresh. I'll do that as we're talking." Farm interview 3

The farmer being quoted went on to show me the app they use for understanding DNA test results, which included a high level of detail about the animal's phenotype, including milk yield, disease risk, and fertility. The use of high-tech biomedical approaches was therefore one way to enhance livestock genetics. In turn, this provided a route to improved animal health, and better business returns; both of which were compatible with the qualities of a Good Farmer discussed in the previous chapter. The farm business in question was also working to optimise their herd's feed efficiency, and the farmer mentioned that this would improve their carbon footprint. So, while methane emissions reductions were not the primary goal, they were considered a positive side effect.

Additionally, some farmers mentioned genetic improvements that were focused on methane:

"…they've got it in New Zealand, you get a special box, and then you put your ram in it, and then it measures how much methane it emits in five minutes or whatever, and then do the next one. And then you find your tups which don't produce half as much methane as your other ones, and then you use them." Farm interview 13

None of my interview participants were involved in selecting for animals with lower methane emissions, but several were aware of this being a possible solution.

Secondly, approaches for improving animal health were sometimes mentioned as being relevant for reducing methane emissions:

"Health, you know, getting rid of endemic disease. Because another thing I realised with UK farming compared to European farming, we have a lot more endemic disease. (…) And that hugely impacts efficiency and feed conversion ratios and therefore, production and emissions." Livestock sector interview 1

The connection between animal health and emissions was more commonly mentioned by participants who had a veterinary background or were particularly interested in animal health; again, it was very aligned with the qualities of a Good Farmer highlighted previously. Meanwhile, many participants discussed the different practices they undertook for improving their animals' health, but did not connect these with emissions reduction. The ability to produce healthy livestock is a symbol of good farming in its own right, but it also symbolises one's ability to do well financially (Sutherland et al., 2024).

Overall, efficiency gains were seen as being desirable because they could improve profits, as indicated in this quotation from a retailer employee:

"And then kind of the other bit you could go down feed efficiency, so by improving feed efficiency and performance, you reduced the lifetime, therefore it's not put as much methane out because it's lived less. That's kind of the obvious simple one, which provides financial benefits for everybody." Livestock interview 9

This stakeholder also discussed working with farms to achieve efficiency gains:

"So it's quite a big commitment from a corporate company [a net zero target], and [we're] still figuring out how to do it across the full supply chain. But we started off by measuring farms because obviously at least if you measure you've got somewhere to start and if you know where you're starting from then you can build an action plan moving forwards. (…) So

200 farms so far baselined and then obviously working a lot closer with these project farms to understand their full systems and what changes they need to make to get to that net zero position." Livestock interview 9

Efficiency gains were therefore well aligned with the Good Livestock Farmer identity and welcomed by supply chain actors; especially when these gains were measurable and therefore contributing to the organisation's net zero targets. So, while many farmers were making efficiency gains spontaneously, some were being encouraged and supported to do so through their supply chain relationships. This situation could risk promoting lock-in to more intensive systems that are more amenable to metrification; discussed further below.

While some farmers had very positive relationships with their supply chain, many spoke more critically of retailers and the power they held within the food system, even citing academic concepts as in the case of this Welsh upland farmer:

"Interviewee: The supermarkets have far too much power. (…) I've got a book here somewhere and it talks about the problems with worldwide agriculture and it said, you can imagine food supply as being like the, you know, the champagne glasses, the ones that are sort of fluted and then come down and back to a base, do you know the ones?

Interviewer: Yeah, yeah.

Interviewee: And it said what you've got is you've got a large number of people at the top who eat food, everyone eats food, got a large number of suppliers at the bottom who grow food, but then you've got the pinch-point in the middle which is the food conglomerates who buy the food, so there's a small number of companies who control the food supply, so they allow very very low prices." Interview 21

There was broad agreement among livestock farmer participants that many problems in the current system (including prioritisation of cheap food and excessive specialisation of farms) were associated with the rise of supermarkets over the latter 20th century. The power held by supply chains could also be enacted through climate targets:

"So Arla, our cooperative, and all the kind of direct links with them through to the other buyers and retailers and things like that. So they want to know everything that goes on on our farm. So we have to report on all health, aspects of health of our animals. And, and do climate, so like carbon tools. So we do that annually. And all this data goes to loads of people, basically goes into the retailers, because everyone wants to tell a good story now. So

those people have a massive impact, even though we never see them. Those people who sit in Tesco and Sainsbury's and Aldi have a huge impact on us." Farm interview 2

Efficiency gains from climate mitigation were therefore often associated with supply chain actors for livestock farmers with relevant contracts. While some appreciated the support they received to increase their efficiency, others viewed this as yet another imposition by powerful actors looking out for their own interests.

7.3.2 Carbon accounting tools

Another solution mentioned often was the use of carbon accounting tools, and these were often also associated with increasing efficiency:

"They're basically looking at what the carbon footprint is per kilo of milk sold. (…) I'm not a massive fan of these tools. Because obviously, they're using, they can't use everything on the farm. So they don't take how much we're drawing down into the soils into account. But, so they'll look at amounts of milk that we produce, our feed that we've bought in to do that. The lifespan of those cows, the amount of muck that we produce, how it spreads, the diesel that we use, the quality of the forage we make, so they kind of use it, and it's really a tool for efficiencies." Farm interview 2

Many of the livestock farmers interviewed had either undertaken a carbon audit or had investigated the process and decided against it. There was therefore fairly broad awareness of carbon accounting as a way to identify areas for improvement in one's farming practices: to increase efficiency.

As suggested in the previous quotation, farmers were often sceptical about carbon accounting tools, as they felt they did not accurately represent the ways their farm sequestered carbon:

"I just tried a couple of different ones. So you're going through it and you know, there was one where hedgerows weren't included, you know, and you go hold on, we've done 1000s of metres of hedgerows. You know, how can they not be included in our carbon audit? Because they're like, they're a great carbon sink. Especially young hedge, you know, and, yeah, so just... But these things all take time, isn't it?" Farm interview 14

This relates to the theme of farmers feeling that their pro-environmental work goes under-appreciated. The farmer quoted above was, however, optimistic that carbon accounting tools would improve in future.

Another issue in relation to this solution was that the highly metricised approach of carbon auditing tools requires rigid boundaries to be drawn around the farm:

"…you know there's talk about carbon / doing your carbon account and things like that. It happened a few years ago. I still / there was I think Sainsbury's actually got the carbon count of this farm. But you know where does it start, where does it finish…" Farm interview 30

Carbon accounting therefore promotes an ontology in which the farm has firm boundaries. This is similar to the effect of talking about one's carbon footprint, which can sometimes lead to inappropriately individualised responsibility (Fuller, 2017), and inhibit more collective approaches to reducing emissions (DuPuis & Mulvaney, 2024). Meanwhile, one farmer also highlighted the difficulty of collecting data (for example on diesel usage) from external contractors who might come to help make hay or harvest crops. The permeable nature of the farm's boundaries and all the inputs and outputs that flow across them mean that these tools can only ever be an approximation of the farm system.

On a similar note, one livestock sector stakeholder who worked with carbon calculators highlighted the limitations of scientific approaches for understanding the complexity of a farm's GHG emissions:

"I think one of the challenges that we have is that a lot of the people that write the policy, or do the research, especially in greenhouse gas research, is that it's never done on a farm, you know, it's done in a greenhouse, it's done where everything is very very tightly controlled, or it's done on a model, a lot of it is just done in modelling based systems and often those models don't reflect reality on what you've got out on farms…" Livestock sector interview 10

This illustrates the natural scientific approach, in which all the factors that cannot be controlled are eliminated (Wynne, 1996). Therefore, solutions developed under laboratory conditions may struggle to provide reliable results when applied to a more complex system. Furthermore, carbon accounting tools rely on accurate data entry to provide meaningful outputs. They therefore impose specific behaviours on the farmers using them (Wynne, 1996), whether they are entering the data themselves or together with an advisor.

Overall, carbon accounting tools were often viewed as a possible mechanism to identify areas for increasing efficiency. Some farmers were sceptical about these tools' ability to present a "true" picture of their farming system due to not accounting for the sequestration they felt was occurring, while one livestock sector stakeholder with expertise in carbon accounting

highlighted the challenge of applying a model with rigid definitions to a complex farm system.

7.3.3 Feed

The solutions to methane emissions from ruminant livestock most frequently mentioned by participants were those pertaining to changing or adding to animal feed. One particular feed additive that was mentioned relatively often was seaweed, as in the below quotation from a regenerative farmer in Essex:

"Interviewee: I mean the only way I've really, sort of, thought sounded quite convincing was the seaweed one. And I don't even know who has done that research, is it a university?

Interviewer: I think it's someone in California.

Interviewee: Right. Well, I don't know any more than that. And I don't know if it works. And I don't know anyone who's tried it. So I can't really say any more about that really. (…) You don't hear much about it, do you, or I don't." Farm interview 7

Many farmers were similarly unenthused by the prospect of seaweed, feeling that it was either unproven or unfeasible. One the other hand, one farmer running an intensive dairy was more positive, as it would be straightforward to add to their animals' rations. Generally, the consensus was that participants did not feel they knew much about it.

Several participants voiced concerns about the knock-on effects of scaling such a solution:

"…it'd be an interesting thought experiment. (…) So every cow in the country, you know, 30 grams of seaweed a day, well what would, what would you actually have to do? I guess you'd have a seaweed farm. How would they do that? What's the knock on to all of the ecology, whereas really, we're trying to fix a problem, which isn't actually a problem in first place." Farm interview 26

While some were positive about the idea of using a "natural" feed additive, the quotation above illustrates concern with the potential ecological impacts of harvesting seaweed at scale. Another participant highlighted the potential need for fossil fuels to harvest, dry, and transport large amounts of seaweed. For these participants, methane was not a problem, as they explained using many of the discourses presented earlier in this chapter; and, therefore, creating a new industry to solve it was superfluous.

Farmers also spoke about methane-inhibiting feed additives more generally. Only one livestock sector stakeholder mentioned the specific compound which was approved by the European Food Safety Authority in 2022: 3-Nitrooxypropanol, or 3-NOP, marketed as Bovaer (the subject of recent controversy, discussed in Chapter 8). Many farmers expressed being quite disengaged from the topic:

"Well, there is talk, putting additives on feed to reduce methane. I have heard of it. And that's all. I haven't, you know, if I see an article about it, I don't read it. If that was the headline of an article I would not, I wouldn't go out me way to read that article. So yeah, until it becomes an issue at my level, then I'll start looking into it and deal with it at that point. But until that happens…" Farm interview 16

This suggests that some people actively avoided engaging with methane solutions; it's possible that discourses around methane not being a problem supported this lack of engagement, alongside methane debates presenting a threat to identity.

Some farmers and livestock sector stakeholders also highlighted other potential challenges for implementing feed additives:

"…there's feed additives which will reduce the amount of methane output from livestock. However, I don't think any of the ones that are currently being looked at have any health or performance benefits. So you're putting in an extra cost and an extra additive, the farmer won't physically be able to see any difference in the methane coming off a cow." Livestock sector interview 9

Feed additives were therefore often seen as an unnecessary additional cost, with invisible benefits (Carolan, 2006), in the context of a year that already saw drastically increased input costs. Meanwhile, feed additives were often seen as irrelevant to those with grass-fed livestock, unless they could be delivered via mineral lick or bolus.

For one participant, some experience with research into feed additives had led to a more positive view:

"we were part of a college study for a degree student, umm, and she put some supplement in the feed for a trial period, (…) I think we were thinking that if we were producing less methane, that methane was converted to energy, so that energy should be going into growth, so there should have been a growth difference in the calves that we're having to supplement [and] the ones that weren't / and there was no significant difference, so it didn't actually

show anything. But that was quite an interesting trial and I can see actually if we can put things in feed to make animals belch less and convert it into energy better, then that could be a benefit" Farm interview 22

As discussed in the previous section, the primary incentive for farmers to implement feed additives was increased efficiency. However, participants were not convinced that efficiency gains would manifest, nor would they be able to see any tangible result (Carolan, 2006). It was therefore unclear whether using feed additive would contribute to one's identity as a Good Livestock Farmer. While some were open to the idea of feed additives, many felt they represented an unnecessary cost that would not bring them any benefits, and may even cause harm elsewhere. So, while this solution was commonly mentioned, the major discourse was one of disengagement, inconclusive evidence, and potential problems.

7.3.4 Slurry management

Another solution for reducing methane emissions was different practices for storing and disposing of slurry. Ammonia was often mentioned as the main polluting gas from slurry, with methane being less prominent. Discussions around slurry management were far more pertinent for dairy farmers, although some beef farmers who housed animals for all or part of the year also mentioned slurry management. Beef farmers who outwintered their cattle were obviously less likely to bring this up.

Several participants, mostly dairy farmers, had invested in new slurry management technology:

"We invested in a slurry tank three years ago that puts the slurry below the plant, straight onto the soil, so instead of spraying it up in the air, like used to happen all the time, we're putting it right down there, and even if you stand right behind the tanker you can't smell a thing because we're not launching ammonia up into the air, so I guess that's a very farmer driven thing. It's something we can practically do. We know it's better for the plant, better for the soil, yeah, and it gets those nutrients down there instead of down / on the soil, instead of up in the air, which has to be good." Farm interview 4

The perception of this technology being "farmer driven" seems to have made it more acceptable and worthy of investment. This may have been because it does not particularly threaten farming identities. In fact, among my participants there was a general feeling that spreading slurry in the traditional way was undesirable, while using more recent techniques

was more associated with being a Good Farmer. From an epistemic perspective, traditional methods of slurry spreading are very apparent to at least two of the five senses, and the above participant highlights that with their new approach "you can't smell a thing". Smell was often mentioned as a way that farmers might experience discord with their non-farming neighbours. Previous research has identified that being a Good Farmer can include being a valuable citizen, therefore improving relations with one's community through using less offensive slurry management practices may have supported this identity (Burton et al., 2020). This also speaks to a softening of boundaries between farmers and non-farmers, akin to clearing roads after storms (see Chapter 6); which interestingly also involved the use of specialised heavy machinery.

Meanwhile, there was more uncertainty about solutions relating to slurry storage, such as this quotation from a more intensive dairy farmer:

"I mean, we're supposedly going to have to put lids and roofs and covers on all these lagoons. But actually, if you're going to put a cover on it there to reduce emissions and then spread it, you pretty much lose everything that you've saved. By putting a lid on it and then spreading it, there's not a lot of point putting the lid on it in the first place." Farm interview 11

This quotation refers to the 2019 Clean Air Strategy, which states that all slurry stores will need to be covered by 2027 (Defra, 2019). Farmers tended to discuss covering slurry stores as being a more top-down solution, often highlighting difficulties they expected to have with implementation, and suspicion as to whether covering slurry stores would lead to any long-term reduction in emissions. The use of low-emission spreading equipment was also mandated in the Clean Air Strategy (Defra, 2019), so it's interesting that these two different solutions had such a different reception among livestock farmers. I suggest this is partly due to the epistemic factors mentioned above, where the benefits of newer slurry spreading technologies are more legible both visually and from an olfactory perspective, whereas emissions from slurry storage are less visible (Carolan, 2006).

Another discourse regarding slurry was its ability to replace expensive inputs such as artificial nitrogen:

"…this year, because of the fertiliser prices we've been putting slurry on cereal crops, which we have done in the past and we've been lucky with the weather this year, it's allowed us to do it. So that field down there in the distance between the two groups of trees, is a field of

winter wheat, and that will have had all of its phosphate, potash and sulphur requirements from slurry, and about a third of its nitrogen. We just did that last week. Can't always do it, the weather's been really kind this time, but that has saved a lot of money." Farm interview 3

The high cost of agricultural inputs in 2022 following the Russian invasion of Ukraine had led to many participants reducing their fertiliser use, and replacing this with slurry. Utilising slurry was therefore seen as another contributor to farm efficiency, like many of the solutions mentioned above. However, farmers were also aware of the positive side-effect on GHG emissions, and sometimes spoke about reducing fertiliser use as helping to reduce their "carbon footprint".

7.3.5 Technological fixes

There were a couple of further methane solutions that haven't fitted neatly into the previously described categories. I present these as technological fixes, given that they focus on devices or infrastructure to reduce methane emissions from ruminant livestock.

The first of these is the idea of putting masks on cows to reduce exhaled methane emissions, a solution by the company Zelp that made headlines in 2021 (Bryce, 2021). This was viewed negatively by livestock farmers and livestock sector stakeholders:

"…even things like, and as ridiculous as it sounds, having something on the back of the cow which collects methane, which is just bonkers, really, but obviously, a lot of these, a lot of things are being tried to try and keep the system the same, but just add a bit of magic dust in somewhere which will magically reduce the methane emissions. So yeah, a lot of that is unproven or trying to be proven at the moment, and a lot of people obviously want their product to be the product which saves the world, clearly." Farm interview 2

The methane mask idea was generally presented as being at the extreme end of the "methane solution spectrum", with some farmers and stakeholders expressing concerns about animal welfare, while others simply derided the idea as unfeasible and unnecessary. Discourses around methane being part of a natural cycle were often connected with seeing invasive tech solutions as superfluous. The above quotation implies critique from farmers engaged in more regenerative practices directed at those who wanted to "keep the system the same" i.e. high input, more intensive practices. I unpack this further in relation to methane emissions in the next section.

Meanwhile, another methane solution I will mention in this section is the idea of capturing methane from housed animals, and possibly also using said methane to power farm vehicles. This came up occasionally in interviews, with some being critical of the underlying logic:

"…don't talk to me about people trying to capture methane from buildings and then put all the cows in a building. Yes, if you really feel that having a 1,000-cow dairy with 1,000 cows in a building, is the way to go, then we're not on the same book, let alone on the same page." Farm interview 10

Again, those who were engaged in regenerative practices were more likely to be critical of this kind of approach, and rhetorically distanced themselves from such ideas, such as the phrase "we're not…on the same page" in the above quotation.

However, a minority of farmers and livestock sector stakeholders were enthusiastic about the possibilities of using captured methane as fuel:

"What could you do if you can capture it? Maybe you could do something really fantastic. And start finding a whole new sustainable fuel source. Grown by cows. Wouldn't that be amazing? How many cows are seen as a hero?" Farm interview 31

Interestingly, the farmer being quoted was very engaged in regenerative practices, but through their other work had a broad overview of the livestock sector and the different production systems within it. Policymakers were also likely to mention capturing methane from housed farming systems, and this aligned with a technological innovation focused approach to reducing methane emissions from farmed ruminants (NFU et al., 2022). However, for many farmers there was limited agreement around how methane emissions differed between intensive and extensive farm practices. I will discuss these differing opinions in the next section.

7.3.6 Intensification vs extensification

Among the livestock farmers and livestock sector stakeholders interviewed, there was a lack of consensus around which farming systems led to the most methane emissions, among other markers of environmental sustainability. This was related to longstanding debates around land sparing vs land sharing.

Many farmers felt that intensive farming was likely to produce more methane than extensive practices because it involved large numbers of animals being fed diets they weren't adapted to:

"The methane thing (...) I haven't really got to the bottom of the science of it yet, because there is an element of truth there, because where you've got, particularly in Brazil, Argentina, America, you know, parts of South America, Canada, where you've got huge feed lots, which their entire land is ploughed, grows corn and that corn is brought into the feed lots and fed to cattle, that cattle's diet is predominantly grain. Well you know, when we mix grain in any form of gut or anything, the reaction, the chemical reaction there is, you know, it's a ruminant, never really to be designed to be fed predominantly grain, so you're going to have gases given off..." Farm interview 24

Discussions about intensive farming often adopted a Whataboutism discourse, pointing to practices in other countries, with the USA being a popular example. Feedlots were often mentioned as being particularly environmentally damaging, though the details as to why were often vague. Feedlots were often described as "huge", with the implication that being larger, or having a higher concentration of cattle in one area, was problematic. As in the quotation above, some participants also highlighted the practice of feeding grain to cattle as something that might cause them to release more greenhouse gases. This aligned with the nationalistic component of the Good Livestock Farmer, which focused on UK farming as being more efficient and sustainable than in other countries.

In addition, participants operating more extensive systems raised concerns about the broader impacts of intensive farming, considering emissions beyond the farm gate:

"Like when it comes to dairy cows, if you think about the most complicated way to keep a cow. If it's inside, you know, you've got to have bedding for it, you've got to scrape away all its muck, and you've got to get rid of that muck, you've got to put feed, you've got to cut all your grass and take all your feed in, they use mixer waggons to mix feed up, to feed to them. It is the most complicated way that you could keep a cow and probably the most expensive way. If it was out on grass, which it's developed for 1000s of years to do. It does its muck, it's spreading its muck itself, it's eating the grass that's in front of it and stuff like that." Farm interview 25

This critique included considerations such as where imported feed was grown (highlighted earlier in this chapter), and the use of fossil fuels in preparing and transporting said feed. This

quotation illustrates a shared sentiment that intensification was unnecessarily complex; extensive systems were implicitly simpler. This idea reflects a paradox in terms of epistemology. In intensive systems, complexity is reduced as far as possible via a formulaic approach to rearing livestock and tracking their performance. Metrics are fundamental, and directly linked to profits via supply chains. At the other end of the spectrum, extensive and regenerative approaches involve integrating livestock with complex natural systems. There may still be tight control, for example in terms of managing mob grazing (Cusworth et al., 2022), but there are many more variables at play, some of which may even be unknown to the farmer. The latter is more associated with tacit knowledge, and therefore, as discussed previously, invisible emissions such as methane are more challenging to appreciate. Thus, intensive and extensive systems involve different forms of complexity.

Policy stakeholders and farmers running more intensive systems were more likely to discuss how methane emissions from grass-fed ruminants are actually higher:

"There's a lot of misconceptions, especially amongst farmers, really. Because I keep being told by dairy farmers who like grazing that their animals produce less methane than mine, that are inside most of the time. And that's absolutely not true. It's completely the other way round. But because it suits their agenda, it's the same, farmers are just the same as the general public and everybody else, you know, they speak their own truth. And they will go tell their customers and mates and everything else, and everybody'll believe them. So we have the same problems within the industry as you have without the industry." Farm Interview 3

The farmer being quoted highlights the disagreement in the sector as people speaking "their own truth", with truth meaning whatever best supports one's own system. This is a common critique of "evidence based" practice- that scientific evidence may be cherry picked to support any position (Greenhalgh & Russell, 2009). There was therefore disagreement within the sample as to which systems produce the most emissions. This problem reflects a broader lack of consensus within the livestock sector around scientific research. While policymakers and supply chain actors might favour more intensive approaches that facilitate measurement and reporting, this runs counter to many farmers' tacit knowledge around ruminant health and wellbeing in extensive systems.

Meanwhile, extensive farmers tended to raise concerns about how accurately emissions from intensive systems are measured:

"…he was very much looking at making sure your cattle grow very quickly and at more efficiency, you know, more kilos of meat per hectare produced sort of thing, in a shorter period of time, so that your cattle aren't there as long eating as much grass or producing as much methane. But then, you know, you have to end up using cereals, and you've had to then you know, grow the cereal, all the diesel involved in that, harvest it, mill it, and get it all ready for the cattle, whereas if they're more extensive, which is what we are, all right, your cattle aren't gonna get to market quite as quickly. (…) It's a balancing act, you know, like, there will be some very efficient beef farmers that can reduce their carbon per (…) kilogramme of beef produced (…) by reducing days to slaughter and increasing, you know, live weight gain per day (…) But at the end of the day, they're still throwing fertiliser on (…) the animals are finished on cereal crops" Farm interview 9

As shown in this quotation, those running extensive systems sometimes highlighted the embedded emissions in intensive systems, as well as the environmental impact of agricultural inputs such as feed and fertiliser. There was therefore significant disagreement among participants, varying from those based on lack of knowledge to more in-depth critiques of different approaches. This is an example of boundary-making between different subgroups of livestock farmers.

From a different perspective, the fact that measured methane emissions from cows in intensive systems can be lower may reinforce lock-in, as seen in this quotation from a policy stakeholder discussing food companies' net zero commitments:

"…my presumption with that is that they will give like a premium uplift on suppliers who have demonstrated a certain, sort of ticked a number of boxes in terms of their performance and environmental credentials. (…) And they, they reward their farmers with a premium uplift, depending on certain things that they want to do. (…) And I think one of the big opportunities really, through that mechanism is to get farmers to start measuring their climate emissions, and actually understanding what goes on on the farm. Which, by the way, is a really good proxy for business efficiency and business management, too. So in that way, I think there's a real potential to sort of upskill the whole sector, as well as see some improvements in performance. But again, I think it comes with that tension around that most of that stuff leads you to an intensification and productivity increase type output, not an extensification one." Livestock sector interview 15

As discussed above, the legibility of intensive systems through metrics makes them more appealing to stakeholders who wish to measure tangible progress towards sustainability targets. This is more straightforward to achieve on a farm where variables are tightly controlled, and the system is vertically integrated within a supply chain. I therefore argue that an epistemology based on measurable reductions in methane emissions may reinforce intensification and lock-in to practices that, while reducing relative methane emissions, may have fewer environmental and societal co-benefits.

In Chapter 6, I highlighted different ways that livestock farming ontologies and discourses distance livestock farming from the non-farming public. I also showed that discursive boundaries emerged between livestock and arable farming in response to debates about environmental sustainability. In this section, I have shown there were additional boundaries drawn between different types of livestock farming, particularly in terms of the practices associated with different systems and their relationship with methane emissions.

7.3.7 Destocking

In this final section I will discuss a solution to methane emissions from ruminant livestock that was less popular among farmers: that of reducing stock numbers and, on the other side of the coin, reducing meat consumption. As this chapter so far has illustrated, these were generally seen as undesirable and to be resisted. Farmers were very aware of the potential risks to their livelihoods from destocking, as illustrated in this quote from a lowland beef and sheep farmer:

"…I mean there's always going to be a need for imports, we're never going to be self-sufficient I don't think, umm, unless we cut down our consumption, pay a bit more for it, or focus on British, but there's always a challenge if you cut down and there's a risk it'll impact on farm level." Farm interview 30

Others were more explicit about plans to "kill all the cows" (Farm interview 13) to reduce methane emissions from ruminants, therefore this solution was often framed as violent. This aligns with the findings in Chapter 6, in which a reduction in livestock numbers was antithetical to farming ontologies and represented a threat to farming identities.

Meanwhile, there was a sense that farm-level impacts were more likely to be felt by smaller family farms, which were seen as a) not major contributors to emissions and b) very important for the social fabric of rural communities:

"…the other thing that's missing in all this discussion about the land, is that the people who farm it are in and of themselves precious. They make up the communities in the countryside and, you know, if you're up in the Yorkshire Dales, the Yorkshire Dales is built on the farming community in the Dales. And if you're down here, people might not know it, but we know, I mean he knows everybody, [other interviewee] knows absolutely everybody (…) there's a web of people that you know (…) So this is precious and these people, him [pointing to other interviewee], he's precious because he knows how to farm here. And he's, you know, he's keeping this web that is a tapestry, farming is a tapestry that binds the countryside together. And you start pulling away at these threads and it will go…" Farm interview 31

For many rural areas, issues such as urbanisation and second home ownership mean that communities are smaller than in the past, and therefore the risks to livelihoods from reduced meat consumption were associated with an exacerbation of these trends. This speaks to the idea of a just transition, which stipulates combining decarbonisation with increased social equity, and ensuring fair distribution of costs and benefits (Reay, 2020a).

Despite concerns around the impacts of destocking, some farmers expressed feelings that current levels of meat consumption were too high:

"Interviewee: I can't say I've come across any actual solutions but I mean if you really think about it, logically, the only solution is for us to stop consuming as much of everything as we do, because I'm as guilty as anybody you know when it comes to meat, particularly, but when I think back to what my Mum / the amount of meat my Mum would think a good meal, when I was a child, and judge by what we eat now, you know /

Interviewer: Which way did it go?

Interviewee: Oh it's twice as much now. (…) Sort of / I / we would have had one chop, you know, and obviously vegetables and potatoes and whatever, whereas now, I mean, we always have two and I suspect a lot of people do, you know" Farm interview 17

There was a sense that many people, including those within the farming community, ate too much meat, and sometimes that they ate too much poor-quality meat. Some farmers therefore expressed a "less but better" attitude towards meat consumption, especially those operating more extensive systems. This attitude was also somewhat more prevalent among those who sold their products direct to consumer.

In this section on methane solutions, I have presented discourses that fit into two main categories: promotion of farmer-led approaches, and positioning methane reduction as a side-effect of efficiency (see Figure 7.1).

7.4 Chapter summary

In this chapter I have discussed discourses pertaining to methane emissions from ruminant livestock, based on the interview and Photovoice data. The chapter was split into two main sections: the first containing discourses regarding whether methane emissions are a problem, and the second about potential solutions to methane emissions.

The major finding presented in this chapter is that livestock farmers and some livestock sector stakeholders are more focused on the problem level of political disagreement (Baumgartner, 1989), employing various discourses to question whether methane emissions matter in terms of climate change. These discourses appeared to discourage action to reduce methane emissions. However, many farmers were involved in practices which they viewed as increasing carbon sequestration, and therefore did think about and discuss climate change in relation to these. Another finding is that methane reduction tends to be seen as a "side effect" of practices to increase on-farm efficiency. The uncertain financial situation for livestock farming, particularly in the early 2020s, may have contributed to the focus on efficiency and remaining in business. Solutions and practices that are more specific to methane reduction (such as feed additives) were broadly seen as unnecessary and undesirable.

The discourses in this chapter are closely related with the ontological and epistemological findings in the previous chapter, and many reproduce discourses identified in the media chapter. In the following chapter, I will discuss these interrelations and how these findings build on the existing body of literature.

Chapter 8- Discussion

8.1 Introduction

In this chapter I will demonstrate how the empirical work of this PhD compares with and builds upon existing literature, and has developed theoretical concepts. I will start with a brief summary of the thesis so far, before presenting the main findings organised into five themes. I will present these findings in the context of existing literature, showing how they complement previous findings and where they advance knowledge. Following this, I will discuss some key implications for policymakers and practitioners that can be taken from the findings.

In the literature review (Chapter 2), I set out existing research pertaining to ruminant livestock and climate change, identifying three major themes (consumer-focused, producer-focused, and systems-focused). These each involved different ways of problematising GHGs from ruminant livestock, different responsible actors, and different solutions. I identified a research gap in terms of analysing farming sector media, comparing this with mainstream news media, and investigating livestock farmer (and sector stakeholder) discourses and practices.

The primary aim was to explore how the UK ruminant livestock sector was responding to problematisation of ruminant livestock regarding climate change. This includes how stakeholders understood interactions between livestock and climate, and which "solutions" were being proposed and implemented (predominantly by livestock farmers).

The specific objectives were as follows:

1. To analyse discourses around farmed ruminants and climate change as presented in UK news media at the national and livestock sector levels.

2. To explore how UK ruminant livestock farming sector stakeholders (predominantly farmers, including e.g. supply chain actors and policymakers) understand and experience their (and their animals') relationship to climate change.

3. To identify how these understandings are operationalised- in terms of what "solutions" are being proposed and implemented at the farm level, and how these correspond with different discourses about ruminant livestock and climate change.

4. To identify opportunities and principles that could inform future policymaking in this arena.

To address these, I adopted a qualitative approach underpinned by a constructionist epistemology; with some necessary epistemic pluralism to accommodate the use of Critical Discourse Analysis. As mentioned above, I identified a research gap in terms of understanding how livestock farmers and other sector stakeholders are responding to methane debates. A gap also existed in terms of analysing how the farming media discusses this issue. I therefore adopted "discourse" as a key concept for understanding how people speak about topics in ways that are persuasive and make certain actions more (or less) desirable and imaginable. In this thesis, I have understood discourse as a form of social practice (Fairclough, 1992), and discursive power as the power to influence social norms (Sievert et al., 2020). As part of the conceptual framework I also developed Cambell (2020)'s political ontology of the farm, to show how this forms a nexus with epistemology and the concept of the Good Farmer identity (Burton et al., 2020).

This conceptual approach outlined in Chapter 3 informed the choice of methods, discussed in Chapter 4. These were qualitative media analysis, interviews with livestock farmers and other stakeholders, and Photovoice. The results chapters (5-7) presented this PhD's findings on discursive presentations of ruminant livestock and climate change in news media, and livestock sector discourses, practices, and ontologies. I will now discuss the theoretical contributions of this thesis. In the rest of the chapter, I will reiterate the findings in four thematic sections which look across the data from the different stages of the research, and finish with a section on implications for policymakers and practitioners.

8.2 Developing and implementing the farming ontologies concept

8.2.1 Developing the concept

In this section I will discuss how the thesis has developed Cambell's (2020) approach to theorising the political ontology of the farm. As discussed in Chapter 3, Campbell's theory is developed from a lifetime of engagement with the farming sector in New Zealand, both as a farmer and as a researcher. In his book, *Farming Inside Invisible Worlds*, Campbell (2020) seeks to make visible the role of the farm itself as an agent of colonisation, which works to actively silence Indigenous forms of land management. He uses the idea of boundaries to help explore the nature of different styles of farming. The "modernist farm", Campbell

(2020) argues, has firm ecological and social boundaries, being ontologically disconnected from the surrounding landscape and community. To paraphrase his thesis: "what happens on the farm, stays on the farm". He also suggests that modernist farming is the norm from which "alternative farming" deviates. Modernist farms have increasingly limited future possibilities, due to ecological change and the resulting erosion of their "social license to farm" (Campbell, 2020). Alternative farming, meanwhile, is characterised as having soft boundaries, and therefore being more interconnected with ecological and social networks.

In my PhD I have sought to apply this concept in an empirical sense, using it to interpret qualitative data collected in a particular time and space. The UK has a different relationship to colonisation than New Zealand, with a history of enclosed farming going back centuries (Neeson, 1984). I am not so much focused on the agency of the farm itself, but rather how livestock farmers' ways of being makes different forms of climate action more or less possible, desirable, and imaginable. Campbell's general proposition of 'farming ontology' is therefore particularly inspiring as a way to understand livestock sector discourses. In this thesis, I have analysed the ontology of "being a livestock farmer", which is closely interrelated with the physical landscape as well as with farming identities. The "political" component of Campbell's theory involves considering actors and systems beyond the farm gate too. Overall, the theory seeks to balance an understanding of farms as existing within the structures of global supply chains and policy at different scales, while also accounting for the different (human and more-than-human) agencies that result in ecological harm.

To better understand the farm-level processes at play, I have extended the political ontology of the farm by creating the ontology-epistemology-identity nexus (see Figure 8.1). This allows incorporation of insights from political epistemology, with attention to how different ways of knowing can influence understandings of ecological phenomena and proposed solutions (Carolan, 2006; Wynne, 1996). Attention to epistemology also allows consideration of how different groups and institutions may be trusted and legitimised, including through processes of polarisation (Judge et al., 2023; Simmonds et al., 2024) and within different epistemic communities and echo chambers (Nguyen, 2020).

I also incorporate farming identities, given that ways of being are intimately connected with identity. I utilise the Good Farmer identity as proposed by Burton (2014), which draws on symbolic interactionism, a psychological theory that focuses on how group identity is communicated to others. Burton's work with arable farmers in the UK explored how symbols

such as tidy hedgerows and neat lines of wheat worked to communicate one's identity as a Good Farmer to other farmers. Overall, he identified a productivist approach, with a strong focus on yield (rather than profit) as a source of pride. By applying this concept in a new context, this thesis has underlined that identity is not fixed (Sutherland & Darnhofer, 2012), and being a "Good Livestock Farmer" has some different associated qualities, while still having productivist foundations (Sutherland et al., 2024).

By integrating these three concepts at the farm level, I have been able to deeply investigate the ways of being and knowing that underpin livestock sector discourses and practices pertaining to climate change and ruminant livestock. I have also developed Campbell's theory by placing greater emphasis on "boundary-making" as a process that occurs through discourse and other forms of social practice. As Jones (2008) argues, boundaries between categories are inchoate, meaning they are constantly being made and remade, in part via discourse. In this thesis, I have sought to illustrate how boundaries (including spatial and social) are constantly in flux, and can be softened or calcified through methane discourses (See Figure 8.1). This is synergistic with the political epistemology approach mentioned above, as the latter can further unpick and analyse how boundaries between social groups are created and eroded (Judge et al., 2023; Lees & Cikara, 2021; Lewandowsky & van der Linden, 2021; Nguyen, 2020). Boundary-making also helps to inform us about identity, as people identify themselves through non-membership of certain groups as well as membership of their preferred group, as noted in social identity theory (i.e. "I'm not like them"). This matters because it means in this case farmers are more likely to trust 'in-group' members, as was illustrated when participants discursively reinforced boundaries between themselves and the non-farming public, arable farmers, and in some cases intensive farmers.

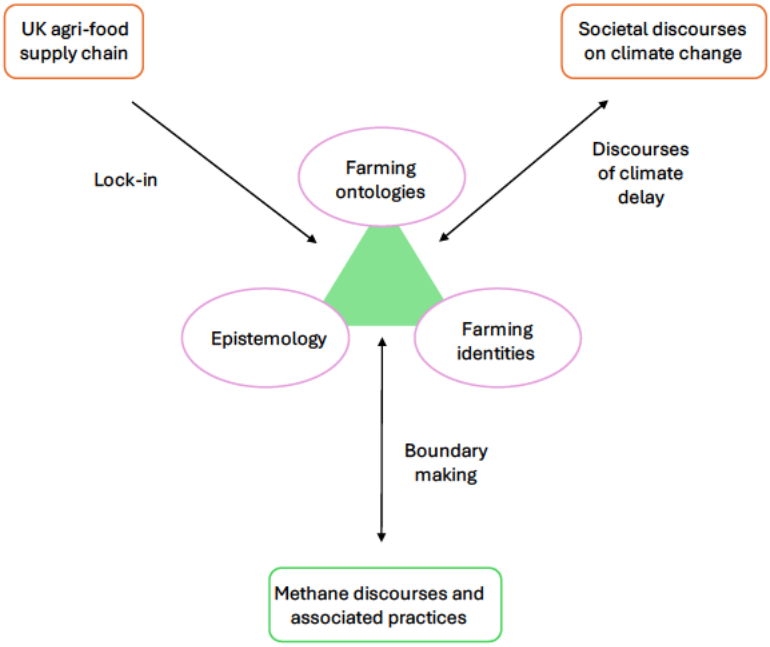


Figure 8.1: Conceptual framework

8.2.2 Insights into methane discourses

As discussed earlier in this thesis, using this augmented political ontologies approach has helped to explain, as well as identify, some of the major livestock sector discourses and practices pertaining to methane emissions from ruminant livestock, thus contributing to addressing RO 2 and 3. The approach has also offered a deeper insight into farming norms and values, which has been vital as an outsider researcher with limited pre-understanding of the UK livestock sector.

I argue that the prevalence of discourses of climate delay and polarisation discussed below is understandable given the underlying farming ontology-epistemology-identity nexus. Farmers in this study were closely connected with farms, which had firm spatial boundaries on both horizontal and vertical planes. They valued tacit knowledge, based on inputs from the five senses. Invisible GHG emissions that enacted change at atmospheric level were therefore challenging to incorporate into the ontology of the farm. Furthermore, methane discourses tended to reinforce boundaries between the farming community and the non-farming public, as well as between the farming community and policymakers. They also worked to increase "epistemic distance" between ruminant livestock and climate change (Carolan, 2006). Furthermore, the most prominent ways livestock farmers could demonstrate their identity as a

Good Farmer were through having visibly healthy animals, a successful farm business, and being open to change. The Good Farmer identity was rarely connected with mitigating climate change, except via regenerative grazing practices (discussed below).

The Good Livestock Farmer identity also foregrounded qualities like empathy and care. This illustrated a closeness with animals that went beyond seeing them as means to generate profit. For all the productivist drive to view them as "meat machines" (Hribal, 2007), many farmers had a friendly relationship with their animals, and would sometimes make decisions based on these emotional connections rather than on a purely financial basis. Living alongside animals was therefore an important component of what it means to be a livestock farmer for my participants; tied up in one's identity and in the ontology of the farm. It is therefore clear that the idea of reducing UK livestock production to reduce methane emissions would be experienced as a threat- to both identity and the experience of "being" a farmer. Despite the positive associations with farm-level care practices, scholars have argued that these can obscure violence occurring at different scales outside the farm gate (Cusworth, 2023), such as the remote impacts of climate change.

8.2.3 Reflexivity and suitability of methods

Choosing in-person interviews as the main method for understanding the ontology-epistemology-identity nexus proved successful. From a reflexive perspective, my position as an outsider to the farming community highlighted some of the boundaries between farmers and non-farmers via the affective responses I observed from interviewees and within myself. For example, I had decided in advance I would answer truthfully if participants asked me directly whether I ate meat. For some participants this exchange was unremarkable, while for a few this led to a decline in rapport and finding myself positioned in the role of 'opponent' (E. Cherry et al., 2010). This situation was infrequent, but when it occurred it required greater emotional work from me in terms of signalling solidarity and providing empathic responses to maintain rapport (Prior, 2018). When transcribing the interviews, I realised that in these situations I subconsciously began to speak more quietly, slowly, and at a slightly higher pitch. I was automatically speaking in a more 'feminine' manner to avoid being seen as threatening: foregrounding certain aspects of my positionality. This resonates with the experiences of other female-presenting scholars interviewing farmers, who found that their *"'unthreatening' position as young women alleviated the pressures of the interview context and invited participants to see us as confidantes or listeners"* (Chiswell & Wheeler, 2016,

page 232). Therefore, there were benefits to conducting interviews in-person, as these facilitated more opportunities to read body language and obtain affective data, which enhanced my empirical understanding of boundary-making and farming ontologies. However, this approach also had implications for exposure to emotional danger: a risk which should be accounted for by outsider researchers who plan to engage directly with farmers on contentious and emotive topics such as climate change and ruminant livestock.

Another key benefit of the chosen methods was the capacity-building aspect of the Photovoice project. Participants reported enjoying the workshops, and the repeated contact meant we could develop stronger rapport, which allowed us to explore sensitive topics such as livestock death. Participants also developed their photography skills, which several of them valued due to running farming-oriented social media accounts. Furthermore, after project completion I organised a workshop with a farming-focused journalist, who offered feedback on their photos and suggestions for how they might implement their newfound skills going forward (including communicating with their customers and engaging with journalists). The research therefore had a strong participatory component which facilitated greater understanding of livestock farming norms, values, and identities.

Having discussed how this thesis has developed the political ontologies approach set out by Campbell (2020), I will now turn to themes based around prominent methane discourses identified in the data.

8.3 Theme 1: Societal discourses and trends relating to climate change

In this section, I will discuss the first major finding of this thesis, which addresses Research Objectives (ROs) 1 and 2. When I began this research project, I expected to focus on livestock sector solutions to GHG emissions from ruminant livestock. The research has revealed that livestock sector discourses and social practices are primarily focused on whether these emissions are a problem, rather than on debating and implementing solutions. This thesis has identified a strong theme of climate delay in relation to methane emissions within the UK ruminant livestock sector. It has also identified ongoing climate scepticism in terms of whether methane emissions from ruminant livestock contribute to climate change. Furthermore, the media analysis revealed polarisation on this topic, and overall showed a mismatch between journalistic and producer engagement with food system power dynamics. These findings are drawn from the media analysis, the interview data and the Photovoice data.

To understand discourses presented in UK news media (RO1) I utilised critical discourse analysis (CDA) as a tool for investigating media discourses. I therefore adopted a pluralist epistemology following from the CDA tradition, in which discourses both construct reality and have material consequences. I maintained this standpoint in the chapters discussing the qualitative interviews and Photovoice project. During the media analysis, I adopted Carvalho (2008)'s approach to CDA which involves the use of CDMs (critical discourse moments) to understand temporal shifts in discourse, as well as comparing between different media sources. This allows better contextualisation of media discourses than simply assessing a single point in time. It also illustrated the dynamic nature of the issue of ruminant livestock and climate change, which provided important context for the interviews and Photovoice project.

The media analysis conveyed a picture of UK national and livestock sector media discourses on climate change and ruminant livestock in the "post Paris era" (2016-2021). This gave an idea of the societal discourses that farmers and other livestock sector stakeholders were likely exposed to (to varying extents) in the years preceding fieldwork (Simmonds et al., 2024). To better understand how these societal discourses interacted with livestock farmer methane discourses, I conducted qualitative interviews with 32 livestock farmers, of which 24 were walking interviews, in 2022. Walking interviews facilitated a deeper rapport between interviewer and interviewee than online interviews, and access to different types of knowledge (Riley, 2010) as well as a more emplaced understanding of the farm environment. I also conducted online interviews with 17 livestock sector stakeholders, and an online Photovoice project with 8 livestock farmers whom I had previously interviewed. These methods allowed in-depth investigation of the farming ontology-epistemology-identity nexus, as well as its relationship with discourses and social practices pertaining to ruminant livestock and climate change.

8.3.1 Discourses of climate delay

The media analysis surfaced a consistent prevalence of discourses of climate delay (DCDs); in particular Whataboutism, Individualism, and Technological Optimism. The former was favoured by the livestock industry, with sectors such as aviation and road transport often being highlighted as problematic. Meanwhile, Individualism was also common across mainstream and farming sector newspapers, with a strong focus on individual dietary choices over systemic changes. Technological Optimism was also present in both mainstream and

farming sector media, and included solutions such as improved genetics (selecting for low methane-emitting phenotypes), and methane inhibiting feed additives. In the interview data, Whataboutism was the most prevalent DCD by a large margin, with livestock farmers often highlighting car use and people taking overseas holidays as being problematic in terms of GHG emissions.

While previous analyses have highlighted the national news media's role in reinforcing animal agriculture, the media analysis findings align with research indicating a process of "demeatification" in UK national media (Morris, 2018; Mroz & Painter, 2023), particularly regarding climate change. Additionally, the findings suggest a decline in outright climate change denial within news media, aligning with research showing a shift toward "response scepticism," which seeks to delay policy action (Painter et al., 2023). In some contexts, this scepticism is supported by networks of conservative advocacy groups, foundations, and think tanks (Painter et al., 2023). Overall, various forms of climate scepticism are more prevalent in right-leaning media (Carvalho, 2007; Painter et al., 2023), a pattern that was evident in this analysis.

This research underscores that the link between ruminant livestock and climate change remains highly contentious; likely more so than debates surrounding connections between fossil fuels and climate change. These findings echo Sanford et al.'s (2021) study of Twitter responses to the 2019 IPCC Land Use report, which revealed significant contention around dietary choices and the IPCC's credibility. Sanford et al. (2021) concluded that the intersection of animal agriculture and greenhouse gas emissions had "strongly entered the climate change arena" (p. 59).

As highlighted by other scholars, the relationship between public opinion and the media is likely bidirectional (Ragas et al., 2014; Zhou & Moy, 2007). This concept was also illustrated in a study by Rust et al (2021), which used media analysis and interviews with farmers to show that farming media outlets and the farming community broadly share an economic frame when discussing sustainable agriculture. While this thesis cannot illustrate a temporal relationship between media and public discourses, it does illustrate a shared Whataboutism discourse that may be mutually reinforcing.

8.3.2 Polarisation

Using a temporal approach in the media analysis helped to observe the rise of a prominent meat reduction narrative within national media and a subsequent counter-response in farming

sector media, highlighting opinion divergence between these outlets. During the Critical Discourse Moment (CDM) "Fighting the anti-meat agenda", the farming media data also showed a strong "Us vs. them" discourse between farmers and "anti-meat" stakeholders, reinforcing those group identities. This discourse was also prominent in the interview data, with discursive reinforcement of boundaries between farmers and non-farmers, and farmers and policymakers. However, there were also intra-group differences within the farming sector, with livestock farmers sometimes calcifying boundaries between themselves and arable farmers, or between extensive and intensive farming systems. The data collectively showed both opinion polarisation (different views held by different groups) and intergroup polarisation (negative views held about an opposing group and their opinions) (Judge et al., 2023). Additionally, framing ruminant livestock emissions as a facet of a broader "culture war" in some national newspapers may have further entrenched polarisation (Tak et al., 2024). Given that high levels of perceived or actual polarisation can lead policymakers to adopt risk-averse positions (Howlett, 2014), media-driven polarisation could hinder efforts to advance collective action for food system transformation (Judge et al., 2023; Tak et al., 2024).

To address and mitigate polarisation, Judge et al. (2023) propose several strategies. Polarisation often stems from overlooking the distributive effects of environmental policies, particularly when groups perceive unequal impacts. For example, transitioning to sustainable diets is likely to disproportionately affect regions heavily dependent on livestock production (Lehtonen et al., 2022; Rieger et al., 2023). Policymakers could reduce tensions by adopting a "just transition" framework for decarbonisation, which seeks to ensure equitable outcomes (Reay, 2020; Judge et al., 2023). This is discussed further later in this chapter. Additional strategies include reframing policies to emphasise co-benefits that resonate with diverse value systems, fostering citizen participation through deliberative processes (Willis, 2020), and correcting societal misperceptions about other groups (Lees & Cikara, 2021). Such approaches could assist policymakers and practitioners in anticipating media reactions to future publications and developing proactive measures to reduce division and facilitate cross-group collaboration (Lewandowsky & van der Linden, 2021). Journalists can also play a pivotal role by capturing the complexity of food system challenges, representing diverse perspectives, and refraining from amplifying polarisation through sensationalist headlines (Rousseau, 2021).

8.3.3 Food system power dynamics

The "critical" in CDA involves considering what is not said, as well as what is (Carvalho, 2008). A recent systematic review of barriers to change in agri-food systems highlighted the significant influence of political economy factors in shaping the direction of change (Conti et al., 2021). Applying critical discourse analysis (CDA) allowed a closer examination of this dimension. While national media often supported shifting away from high meat consumption and both national and farming media acknowledged systemic solutions to methane emissions from ruminants, these discussions were predominantly framed within a neoliberal paradigm emphasising market incentives and subsidies (Simmonds et al., 2024).

Notably, influential food system actors such as large retailers were frequently overlooked. Proposed solutions were often simplified to individual actions, such as reducing meat consumption or choosing specific types of meat, echoing findings from previous research (Kristiansen et al., 2020). In some outlets, reducing ruminant meat consumption was framed as a threat to personal freedoms and traditional values, consistent with broader trends observed in high-income countries (Sievert et al., 2022). Additionally, consumer voices, particularly those of individuals living in poverty, were rarely represented in these discussions (Tak et al., 2024).

Through using CDA, we observed that despite indications of a "demeatification" process in UK mainstream media (Morris, 2018), there remains limited willingness to consistently critique powerful agri-food interests or envision transformative changes that extend beyond neoliberal governance and consumer-based responsibility (Simmonds et al., 2024).

Meanwhile, in the interview data, farmers often highlighted the power imbalance between them and large supermarkets. This came across as general points around large retailers controlling product prices and passing costs along to their producers, but also specifically around retailers incentivising activities to reduce their supplying farms' carbon footprints (see Chapter 7). Therefore, power dynamics between retailers and producers were often invisible or obscured in the media data, yet regularly highlighted in the interview data.

In this section I have highlighted major findings of this thesis pertaining to discourses of climate delay, polarisation, and food system power dynamics.

8.4 Theme 2- Climate scepticism: "Methane emissions from ruminants are not a problem"

In this section, I will discuss the form of climate scepticism identified in this research, namely that methane emissions from ruminants are not a significant contributor to climate change. To be clear, participants were aware of the changing climate based on their experiences working mostly outdoors in a role highly mediated by the weather and changing seasons. For example, part of my fieldwork was conducted during a significant drought, and participants often highlighted this and pointed out physical impacts such as persistent cracks in the ground. However, climate change was felt to be driven by factors outside the farming sector; primarily activities that involved burning fossil fuels. As well as employing "Whataboutism" discourses that pointed to non-farming causes, participants employed discourses that worked to question the link between ruminant methane emissions and climate change. This is an example of controversy as a mechanism to increase epistemic distance (Carolan, 2006) i.e. to help mask the relationship between ruminants and climate change. This section addresses RO 2 and 3.

The major components of this theme I will discuss are about methane's global warming potential (GWP), and methane as part of a biophysical cycle.

8.4.1 Methane's GWP

In the media data and interviews, a common theme was the different metrics for determining the global warming potential of methane. As discussed in the literature review, GWP100 is the metric used in the Paris Agreement and in IPCC reporting (Greenhouse Gas Protocol, 2024). It compares emissions from different gases by modelling their warming effect over a 100-year period. So, with this metric, methane can be expressed in units of "CO_2 equivalent" (CO_2e). When using GWP 100, methane has a warming potential 27 times higher than CO_2 (Greenhouse Gas Protocol, 2024). However, a new metric has been proposed in recent years which takes account of methane and other "short lived gases" not remaining in the Earth's atmosphere for much more than a decade; compared to CO2, which persists for hundreds of years. GWP* uses a different approach to calculating warming impacts of different gases, leading to the conclusion that maintaining a stable herd of cattle contributes no additional warming, but that adding to the herd would generate a significant amount of warming from the resulting methane "pulse" (Allen et al., 2018a). Simultaneously, GWP* also suggests that

decreases in ruminant livestock numbers could initiate global cooling, while GWP100 understates the impact of reducing methane emissions (NFU et al., 2022).

The emergence of GWP* has been highly discussed within the livestock sector, with stakeholders suggesting that this new metric absolves the sector of responsibility for climate change (Cusworth et al., 2023). Consistent with previous literature, this research found that farming media and livestock sector stakeholders often (re)produced discourses along the lines of "Methane's Global Warming Potential is lower than previously thought". GWP* was broadly presented as evidence that methane doesn't matter, and therefore action on methane emissions from ruminant methane was unnecessary. Livestock farmers and livestock sector stakeholders often pointed to the metric's origin being the University of Oxford to emphasise its credibility and legitimacy, as identified in previous research (Cusworth et al., 2023), and would even cite specific academics when discussing the metric. This is an example of livestock farmers drawing on scientific knowledge to construct methane discourses and increase epistemic distance (Carolan, 2006; Wynne, 1996). However, some livestock sector stakeholders did not see GWP* as a significant gamechanger; on the contrary, it might be a distraction, or even something that led to greater demands on the livestock sector to reduce emissions. Research by Cusworth et al. (2023) analysed GWP* in terms of "reflexive performativity", in which actors that will be governed by metrics become actively and strategically engaged in seeking to shape them. This thesis has identified a similar level of engagement for some farmers and livestock sector stakeholders seeking to continue business models that involve current or higher numbers of livestock.

Within the scientific community, the idea that methane absolves the agriculture sector of climate action is less prevalent. Rather, the ability of methane reductions to initiate cooling, and the greater impact of methane reduction under GWP*, means methane reduction could be seen as a way to "buy time" to decarbonise sectors that mainly emit CO_2. One policy stakeholder interviewee expressed this as "be careful what you wish for" (Livestock sector interview 15).

As Cusworth et al (2023) argue, metrics cannot be separated from politics, thus one must engage with them critically (Cooper, 2015; Duncan, 2014). Within the climate sphere, emission metrics serve to make complex biophysical processes legible, to allow both emissions reporting under the Paris agreement, and to facilitate their integration into financial markets as tradable offsets (Cusworth et al., 2023). These issues also relate to prior agri-food

governance challenges, such as measuring and governing non-point water pollution (Duncan, 2014). To conclude, this research supports existing literature to suggest that GWP*, an alternative to GWP100 for understanding the global warming potential of different greenhouse gasses, has been broadly welcomed by the livestock sector and viewed as justification to delay taking action to reduce methane emissions from ruminant livestock.

8.4.2 Methane is part of a cycle

Another component of the climate scepticism identified in this research is the discourse that "methane from ruminants is part of a natural cycle". This was another iteration of the idea that "methane doesn't matter", and it also involved generating controversy to increase epistemic distance between methane emissions from ruminants and global climate change. It also overlaps with the next thematic section, which discusses ruminant livestock's perceived role as climate saviours. "Methane from ruminants is part of a natural cycle" was related to the conversations around GWP*, as it focused on methane being a "flow gas" that is broken down more rapidly in the Earth's atmosphere than CO_2. According to this discourse, once methane is broken down into water and CO_2, it is reabsorbed by plants such as grass, before being consumed and converted back into methane by ruminants. Methane emissions from ruminants are therefore described as "biogenic methane", distinct from fossil methane, as noted by other scholars (Cusworth et al., 2022). According to the IPCC, non-fossil methane has a GWP100 of 27, while fossil methane has a GWP100 of 29.8; so the two are considered distinct, yet calculated to have similar warming profiles (Greenhouse Gas Protocol, 2024).

The idea that methane is part of a cycle can be considered climate scepticism because of the work it performs to cloud the connection between ruminants and climate change, and to naturalise livestock. The idea of livestock as natural was noted in Chapter 6, with strong ontological themes around livestock farming as integral to the UK landscape, and ruminant livestock as ancient and indigenous to the land. In Chapter 7, this was highlighted in the discourse "Methane doesn't matter because there have always been ruminants". This was illustrated through reference to wild animals such as bison, wildebeest, and ancient aurochs. These discursive justifications have also been identified in previous research. Cusworth et al (2022) highlight key "strategies" in the naturalisation of livestock, one of which is "political ecological baselining". This involves "invoking a valued past to naturalise present projects that aim to deliver desired futures" (Cusworth et al, 2022, page 9). The past being invoked tends to be an indistinct period when there were many more wild large herbivores,

comparable with the modern domesticated cattle population, and focuses on the "natural" way they would graze, moved on by large predators. This baselining works to establish a general, historical, nonspecific "nature", which is only loosely linked to place (for example, UK actors highlighting historic buffalo populations in the USA) (Cusworth et al., 2022).

These discourses of climate scepticism therefore work to render action on ruminant methane emissions unnecessary. Interestingly, they were reiterated by participants operating a range of farming systems, and so did not necessarily imply a conventional approach. They were sometimes employed in favour of "alternative" practices such as regenerative agriculture, as I will discuss further in the section on Theme 4. Either way, these discourses worked to construct a future in which livestock farming remained profitable, aligning with farming ontologies that involved working closely with animals and maintaining rural communities.

8.5 Theme 3: Livestock sector solutionism: "Ruminant livestock are part of the solution to climate change"

Another major theme identified in livestock sector discourses is the idea that ruminant livestock play a vital role in sequestering large amounts of carbon, making them key players in carbon removal practices and therefore part of the solution to climate change. I will show that this idea has broadly emerged from the regenerative agriculture movement, but was also prevalent among participants running various farming systems. I position this theme as an iteration of the DCD "Fossil fuel solutionism", which is the idea put forward by fossil fuel companies that their products are an important part of a low-carbon future (Lamb et al., 2020). This may include funding advertisements that promote "cleaner" products "while emotively linking these products to everyday activities and human wellbeing" (Lamb et al., 2020; Sheehan, 2018). In the livestock sector iteration, ruminants are "rebranded" as climate saviours (Cusworth et al., 2022). In this context it is not about them being "cleaner", but rather that their emissions are broadly irrelevant (see previous section), and their approach to grazing is beneficial for mitigating climate change. However, often proponents will advocate that said grazing must be carefully managed (by human actors) for maximum benefits. This section addresses RO 2 and 3.

From a natural science perspective, there is good evidence that grasslands do not act as a perpetual carbon sink (Smith, 2014). Changing management from arable cropping to pasture can lead to significant and rapid increases in soil carbon sequestration, but only to the point where soil carbon reaches an equilibrium (Jordon et al., 2024; Smith, 2014). Ongoing good

management is important, as soils can lose carbon again through practices such as over-grazing or tillage for reseeding (Herrero et al., 2016). There remains significant controversy and disagreement in this area, with stakeholders advocating particular practices (such as regenerative agriculture) citing very high estimates of ongoing soil carbon sequestration potential (Jordon et al., 2024). Due to the complexity of the systems involved and a lack of consistent agreed methodologies for measuring soil carbon, this is a key area of ongoing research.

In terms of interactions between regenerative agriculture and more conventional approaches, research with the UK permaculture community suggests that alternative agricultural communities can be inward-looking, which can make them less accessible from the outside (Ingram, 2018). This research also illustrates the difficulty of diffusing between different epistemologies and epistemological languages (O'Kane et al., 2008), with mainstream knowledge systems being more reliant on empirical knowledge, and niche actors favouring tacit knowledge (Ingram, 2018). This reflects research findings that farmers often draw on sensory data such as the look and feel of soil to indicate increased organic matter (Krzywoszynska, 2024).

Turning to the idea of human-managed grazing systems, Cusworth et al (2022) argue that regenerative agricultural ontology positions humans as a "hyper keystone species", charged with managing complex natural processes via regenerative practices to deliver multiple positive outcomes. This resonates somewhat with my data: while regenerative practitioners tended to be highly aware and respectful of complex natural systems, the approaches they advocated, such as mob grazing, necessitated human management in the absence of natural predators. There was no particular interest in reintroducing natural predators to achieve more "natural" ecosystems; in fact, when ideas such as "rewilding" came up in interviews, they were generally critiqued. Instead, human-mediated ecosystems (that made business sense) were championed as part of the solution to climate change.

This human-mediated approach resonates with Indigenous critiques of regenerative agriculture emerging from the USA. Regenerative ranching is seen as prioritising domesticated species (that can generate financial returns) over conserving the indigenous buffalo that are often cited by practitioners of regenerative agriculture (Dutkiewicz & Rosenburg, 2021; Romero-Briones et al., 2020). Indigenous scholars have argued that regenerative ranching represents a means to control (and profit from) Indigenous lands,

following a history of dispossession driven by agricultural expansion (Romero-Briones et al., 2020; Wozniacka, 2021). Furthermore, it has been argued that a Western conceptualisation of regenerative agriculture fails to move beyond a producer-consumer framework and ignores (or actively erases) Indigenous knowledge (Sands et al., 2023; Wozniacka, 2021). In the UK, this resonates with a regenerative agriculture movement that focuses predominantly on practices and profit, while urging individual consumers to adopt different meat consumption habits. Therefore, regenerative practices do not radically alter existing food system paradigms (Bless et al., 2023), despite their resistance of farming sector norms such as tidy fields (Burton et al., 2020).

A related issue is that regenerative agriculture is not well-defined, and in fact incorporates a range of discourses which can make it vulnerable to corporate greenwashing (Giller et al., 2021; Gordon et al., 2023). In fact, many agri-food corporations have adopted the label, which lacks the stringent conditions of, for example, organic farming (Giller et al., 2021). Building on these critiques, scholars have recently argued that regenerative agriculture does not hold significant potential for just and sustainable food system transformation, given its exclusion of issues of equity and power that are more inherent to movements such as agroecology (Bless et al., 2023). My data revealed a broadly instrumental engagement with regenerative agriculture centred around practices such as mob grazing, with the potential for improved profitability often being highlighted (aligning with one's identity as a Good Livestock Farmer) in addition to the environmental benefits. While those engaged in regenerative practices sometimes expressed humility in the face of complex natural systems, their farming systems (and those systems' climate change mitigation potential) were inherently mediated by humans.

Meanwhile, another critique of regenerative agriculture suggests it works to legitimise meat consumption while side-stepping conversations around planetary boundaries (Ehgartner & Hirth, 2024). Despite the discursive boundaries drawn by some of my participants between them and "conventional" agriculture, scholars have argued that the two are interconnected through, for example, the use of regeneratively farmed cereals for animal feed, and the sale of pedigree cattle into conventional systems (Ehgartner & Hirth, 2024). Crucially, my data also demonstrate that discourses advanced by the regenerative movement (such as methane being part of a cycle and grassland being an important carbon sink) bleed into the agriculture sector more broadly, with farmers practicing more conventional agriculture also using these discourses to advocate continuation of business as usual.

Despite having provided the above litany of critiques, there is something I personally find inherently appealing about the regenerative agriculture movement. Participants often spoke about the sense of community they felt with other regenerative practitioners, in a way that felt very collective and collaborative. Meanwhile, grassroots knowledge-sharing events such as Groundswell have grown considerably in popularity in the early 2020s. There is something alluring about the pragmatism and the positive nature of regenerative agriculture discourses- we are actually *doing something*; we're saving the world *and* making a profit! Perhaps the allure I experience speaks to my positionality. If affect serves an epistemic function (Game, 1997), then my positive feelings towards the regenerative agriculture movement may belie their palatability to white, middle-class, (vegan) consumers with sufficient privilege and access to devote time to thinking about where their food comes from. This palatability may support the aforementioned lack of disruption to pervasive food system structures that entrench inequality, enacted through movements that suggest we can consume our way out of climate and ecological crises (Clay et al., 2020).

Reflexivity aside, my data revealed a sense of positivity around ruminants and their potential role in the climate crisis that was in opposition to the somewhat doom-laden proclamations of Guardian articles (Simmonds et al., 2024) and international organisations (Shukla, Skea, Calvo Buendia, et al., 2019; Willett et al., 2019). Farmers may also see wellbeing benefits from the adoption of regenerative management (Brown et al., 2022), and their divergence from conventional agricultural norms may provide psychological benefits as they create new social groups around regenerative farming (Berger & Heath, 2008). I suggest that practitioners benefit from regenerative agriculture by being able to proclaim themselves Good Livestock Farmers from a climate mitigation perspective, in addition to having healthy animals and demonstrating profitability. Doing so necessitates a strong belief in the high carbon sequestration potential of grassland.

In this section, I have discussed the theme of livestock sector solutionism generally advanced by practitioners of regenerative agriculture, but also sometimes adopted by those operating more conventional systems. In the next section, I will discuss a theme which is more aligned with conventional directions in the ruminant livestock sector.

8.6 Theme 4: Business as usual and lock-in: "Methane reduction is a side effect of increased efficiency"

In this section I will discuss the final major theme of this thesis: UK livestock sector discourses that position methane reduction as a side effect of efficiency improvements. This was expressed by participants operating a range of farming systems, but it was particularly aligned with more intensive systems such as housed dairy. It addresses RO 2 and 3.

As noted in Chapter 6, the livestock farmers and livestock sector stakeholders who participated in this study tended to focus on whether methane emissions from ruminants were a problem. However, they did also discuss different solutions to these emissions- often following probes from me. In Chapter 5, I also showed that efficiency discourses, notably "UK livestock farming is efficient and sustainable", were prevalent in the media data, and particularly in the farming media, which aligns with previous research (Rust et al., 2021). I therefore again highlight a bidirectional relationship between news media and public discourses (Ragas et al., 2014; Zhou & Moy, 2007).

The solutions most often highlighted by interviewees were genetics, carbon calculators, and animal health (in relation to growth rates). The primary motivation for these practices was to increase efficiency, and thus profit, in alignment with both the Good Livestock Farmer identity and supply chain stipulations. Methane reduction was seen as a benign, or sometimes positive, side effect of these approaches. From an epistemic perspective, these practices often involved embracing technology and metrics to be able to define, test, and track efficiency gains, and therefore involved relationships with apps and companies. Another solution that came up in interviews was methane-reducing feed additives. While these were broadly decried, occasionally participants would connect them with a broader drive for increased efficiency.

The major issue with foregrounding efficiency as a solution to livestock sector emissions is the focus on relative emissions rather than absolute emissions (Herrero et al., 2016; Ormond, 2020). So, the relevant metric is kg CO_2 per unit of product, rather than total emissions for the farm or the entire sector. Ormond (2020) has critiqued this focus on incremental relative gains, arguing that they will do little to mitigate climate change when global meat consumption is still growing. This relates to the idea of Jevons' paradox, which states that efficiency gains don't just fail to reduce resource use, but can in fact lead to increased consumption: so-called "rebound effects" (Alcott, 2005; Sorrell, 2009). Economists have

called for more research into the factors that make these effects more or less likely to occur (Sorrell, 2009). From an agricultural perspective, scholars have identified Jevons' Paradox in increased overall water use from efficient irrigation systems (Sears et al., 2018; Singh et al., 2024), and increased agricultural expansion associated with intensification and yield increases (Ceddia et al., 2013; Goulart et al., 2023). In relation to GHG emissions from livestock, researchers have suggested that increased agricultural efficiency is likely to cause rebound effects unless accompanied by demand reduction policies to limit meat consumption (Alcott, 2005; Hayek & Miller, 2021).

Another key component of this theme was that efficiency means different things to different people (Garnett, 2014). For example, several farmers operating more extensive systems highlighted that to achieve a lower age at slaughter (the ultimate way to reduce methane emissions), it was necessary to adopt practices such as supplementary feeding that might themselves be carbon intensive. They often raised concern about the issue of bought-in feed, particularly grains, and soy from Latin America which may be associated with deforestation. They would also highlight the inefficiency of feeding human-edible food to livestock (Garnett, 2014). Meanwhile, intensive farmers sometimes highlighted the fact that ruminants in extensive systems usually emit more methane: due to taking longer to reach slaughter weight and having increased exposure to tough forage containing lots of cellulose, rather than easily digestible grains. There was therefore a degree of Whataboutism which took place within the farming sector, in addition to the Whataboutism concerning the non-farming public discussed earlier in this chapter. These nuances within methane debates serve as a reminder that it is inappropriate to generalise about "farmers", as those operating different systems may have very different views on what constitutes a sustainable approach.

Increasing on-farm efficiency practices was associated with symbols of Good Farming for many participants, particularly one's identity as a good business person, as mentioned above. Although some participants argued that intensive conditions are less healthy for animals, intensive farmers tended to be proactive about animal health given its association with increased efficiency. Furthermore, efficiency practices allowed farmers to signal open-mindedness via the adoption of new technologies and the production of healthy animals. Furthermore, at the time of data collection, Defra were positioning themselves as supportive of these efficiency approaches and advocating a shift towards more intensive housed systems (NFU et al., 2022). These "Danish-style" systems were advocated as also facilitating solutions such as methane capture. There are therefore strong psychological and systemic

factors which may align with this framing of methane emission reduction and promote intensification of the ruminant livestock sector. This may lead to sociocultural and economic lock-in for individual farms (Burton, 2004; Stuart & Schewe, 2016), and at sector level may have less desirable side effects such as impacts on animal welfare, decreased sector resilience through reliance on imported feed, increased use of fertilisers and pesticides, and challenges associated with slurry management (Moran et al., 2012).

8.7 Implications for policy and practice

This thesis has aimed to explore how the UK ruminant livestock sector is responding to problematisation of methane emissions from ruminant livestock regarding climate change. This includes how stakeholders understand interactions between livestock and climate, and which "solutions" have been proposed and implemented by different stakeholders. Its major findings include a prevalence of discourses of climate delay and climate scepticism within the livestock farming sector, as well as strong discourses within farmer-led movements about the carbon sequestration role of grassland and ruminants, and the more positive reception of methane solutions that have efficiency co-benefits (or rather, efficiency solutions that have methane reduction co-benefits). These findings are vital in the context of the urgent need to accelerate emissions reductions in the agriculture sector to meet climate targets (Climate Change Committee, 2024).

The final research objective was to identify opportunities and principles that could inform future policymaking in this arena. I now present these as implications for policymakers and practitioners to allow flexible interpretation according to the current policy landscape.

8.7.1 Implication 1: Efficiency and identity co-benefits

As shown in Chapter 7, the methane solutions that were most positively received by farmers were those that had efficiency co-benefits. These included optimising animal health, which helped to enhance one's identity as a Good Farmer by having visibly healthy livestock, and raising animals more efficiently, which symbolised one's Good Farmer identity by running a successful business. Furthermore, the adoption of new efficiency-focused technologies could demonstrate that one was an open-minded farmer.

Importantly, efficiency was more prominently mentioned by dairy farmers and those running systems closer to the "intensive" end of the spectrum. For those at the regenerative end of the spectrum, efficiency was more about profitability (via reducing inputs) and having high

animal welfare. There could therefore be synergies with climate change mitigation here too in terms of reducing artificial nitrogen inputs and decreasing stocking densities. Based on these findings, one might suggest we avoid getting into arguments about whether methane is a problem by continuing to frame solutions as efficiency improvements rather than as climate solutions.

However, as set out in the section above, there are significant dangers with wholesale support for efficiency discourses. There is evidence that increased efficiency can paradoxically lead to increased consumption overall (Alcott, 2005), particularly as it involves focusing on relative rather than absolute emissions (Ormond, 2020). This effect has been seen in increased water usage following the adoption of efficient irrigation systems (Sears et al., 2018; Singh et al., 2024), and increased agricultural land expansion associated with sustainable intensification (Ceddia et al., 2013; Goulart et al., 2023). Efficiency discourses are highly prevalent in the livestock sector, supported by farming media (Rust et al., 2021), compatible with the Good Farmer identity and business as usual, and have been favoured by Defra. Therefore, this route will likely meet little resistance. However, it risks leaving farmers locked in to unsustainable systems that are dependent on bought-in inputs and lack resilience to external shocks (Burton & Farstad, 2020).

Despite the lack of resistance to efficiency discourses, many of the livestock farmers in this research were operating more extensive systems, and carrying out practices associated with movements such as agroecology and regenerative agriculture. There is therefore a strong grassroots movement towards alternative approaches, driven in part by the belief that ruminants support carbon sequestration in grassland. The powerful discourses advanced by the regenerative agriculture community could perhaps prove synergistic with policy goals such as improving soil health and restoring nature.

Overall, a key point is that while livestock farmers are broadly aligned in the way they understand and talk about methane emissions, there are significant intra-group differences in terms of practices. Therefore, there is likely value in targeting policy communication in more granular ways that account for these differences, also recognising the significant value placed on other farmers for learning about new practices (Rust et al., 2022).

8.7.2 Implication 2: Understanding and working with livestock farming identities and ontologies

As mentioned previously, I began this research with the expectation that it would have a large focus on livestock sector solutions to methane emissions from ruminant livestock. However, the data soon revealed that the livestock sector was predominantly focused on whether said methane emissions were a problem in terms of climate change. I also identified a boundary between livestock farmers and policymakers; one factor that strengthened this boundary was a view from livestock farmers that policymakers did not hold tacit agricultural knowledge.

One does not necessarily have to have farming experience to be able to write good agricultural policy. Furthermore, sectors that are the subject of (potential) regulation often resist government action discursively (Simmonds & Vallgårda, 2021), and policymakers have the difficult task of balancing the needs and desires of their assigned sector with the needs and desires of society at large. However, the findings of this PhD suggest that there is value in policymakers and government workers also having some practical understanding of the sector(s) they are involved with. Specifically, it is likely beneficial for Defra employees to have a good understanding of livestock farmer methane discourses and how these convey differences of opinion and differences in values when it comes to GHG emissions reduction.

In recent years, policy stakeholders have increasingly sought farmer engagement on post-Brexit agricultural policy, and approaches such as co-design have become popular (Vargas et al., 2022). This research has revealed significant disagreement when it comes to defining the "problem" of methane emissions from ruminant livestock. Co-design may be challenging in cases where farming representatives are operating from a different baseline (methane doesn't matter) to policymakers (it's important that we reduce methane emissions). Furthermore, the negative impacts of conventional farming are less visible at the farm scale, while they are more apparent to those with an overview of entire landscapes (Carolan, 2006). As Carolan (2006) suggests, changing one's epistemic worldview can involve a major "conversion", analogous to a religious experience, which I suggest is unlikely to emerge from a few codesign workshops. Policymakers therefore need to be aware of farming worldviews when planning participatory processes such as co-design, to ensure that likely differences in problem definition are anticipated and understood. On a more optimistic note, this research identified an appetite for policy co-design among livestock farmers, as well as willingness to engage with participatory methods.

Another relevant finding is the overall broad disconnect between livestock farmers and the non-farming public. This resonates with previous literature regarding "cultural loneliness" (Wheeler et al., 2022) mentioned above. As noted in my findings, policymakers and the general public tended to be associated with urban areas, veganism and vegetarianism, and problematic practices such as flying. I therefore suggest that while policymakers and other actors would benefit from making efforts to understand farming ontologies, there is also work to be done by rural stakeholders to better understand the challenges faced by urban residents, particularly those impacted by poverty (W. Evans, 2025). This research therefore echoes calls for increased investment into initiatives that facilitate collaboration and understanding between different food system stakeholders (Wheeler et al., 2022).

Meanwhile, another relevant finding from this research is that livestock farmers obtain and integrate information from a range of sources to form (and support) their views on methane emissions from ruminant livestock. This includes tacit knowledge, sensory inputs, other farmers, Defra, online forums, and academic literature. As mentioned in relation to GWP*, farmers often cited specific academics and institutions by name. So, a challenge exists in terms of bridging expert and lay knowledge, but it is also the case that livestock sector stakeholders will draw on scientific research to support their existing views, as is the case in other sectors (Wood et al., 1998). Communication from policy sources would benefit from accounting for this phenomenon and being informed regarding current developments in livestock sector discourses and citation practices.

Furthermore, the media analysis component identified polarisation between mainstream and farming sector news media, and aligned with previous research findings that ruminant livestock's relationship to climate change is highly contested (Sanford et al., 2021; Simmonds et al., 2024). Generating controversy represents one mechanism to increase epistemic distance (Carolan, 2006), and this issue will not be unique in facing the challenges associated with sensationalist reporting, online misinformation and disinformation, and echo chambers (Lewandowsky & van der Linden, 2021; Nguyen, 2020; Rousseau, 2021). Furthermore, at the time of writing, there has been recent public controversy around use of the methane reducing feed additive Bovaer by Arla, a major dairy cooperative (James, 2024). Public acceptance of novel feed additives was not commonly referenced in my data, but this will be an important consideration necessitating social science expertise if methane inhibitors are indeed a preferred solution (Herrero et al., 2016). Interventions that help reduce epistemic distance

between ruminant livestock and climate change, while accounting for the sensitivities around ontology and identity, may be valuable (Carolan, 2006).

Overall, this research identified longstanding issues with distrust of changing government priorities over the past 80 years. Debates around methane emissions from ruminant livestock were promoting calcification of an existing boundary between farmers and policymakers. Softening this boundary will involve working to improve knowledge and understanding between different social groups, identifying ways to build bridges between food system stakeholders, and optimising methodologies such as co-design and co-creation to facilitate farmer involvement in the policy process.

8.7.3 Implication 3: Potential frameworks for increased collaboration with the farming community

In this section, I will set out two potential frameworks that could help support increased collaboration between the farming community, policy stakeholders, and wider agri-food system actors.

8.7.3.1 Food systems

Using a systems approach to agri-food issues is becoming increasingly mainstream in policy circles (Government Office for Science, 2020), aided in part by the 2021 National Food Strategy (Dimbleby, 2021). This independent report adopted a food systems perspective to analyse interconnected issues such as obesity, (food) poverty, land use, and GHG emissions from agriculture. It identified two major "Negative feedback loops": the "junk food cycle" and the "invisibility of nature" (Dimbleby, 2021). The latter of these highlights how environmental harms from the food system are often ignored or overlooked because current metrics fail to make them visible. This speaks to the point discussed earlier: that metrics are political (Cooper, 2015).

Food systems include: *"…all elements and activities related to food production, processing, distribution, preparation, consumption and disposal – including market and institutional networks for their governance – and they include the outcomes of these elements for health, livelihoods and the environment"* (Ruben et al., 2021, page 1424). A systems perspective seeks to identify components such as feedback loops and emergent properties (when the whole has consequences that could not be predicted from the sum of its parts) (Dimbleby, 2021) and requires one to consider the different "leverage points" at which one might intervene in the system (Meadows, 1999). This approach helps to conceptualise the

complexity of food systems, and allows greater cognisance of unintended consequences and what kinds of intervention will have the greatest impact (Meadows, 1999).

A benefit of this approach is that it may help to identify components that are overlooked or taken for granted. For example, the media analysis component of this research identified a blind spot in terms of the role of food companies and retailers in reducing methane emissions from ruminant livestock. The focus was mainly on individual consumer choices, with some attention to agricultural practices. Meanwhile, farmers and other livestock sector stakeholders were more likely to mention retailers as having significant control over on-farm decision-making when the farmer had a retailer contract. The hourglass model of the food system illustrates that while there are high numbers of producers and consumers, a lot of power is held by the relatively few corporations that process and sell the food travelling from former to latter (Howard, 2016). A systems perspective would ask one to consider where in the supply chain interventions might be most effective, and how this might have unintended consequences in other areas. In the wider literature, food systems approaches have been used to harmonise planning for climate adaptation across different governance levels in Ghana (Helfgott et al., 2023), and to increase acceptance and consumption of beans in UK primary schools (J Ingram et al., 2025).

This research has shown that many farmers are already using "systems thinking" to approach the topic of methane emissions from ruminant livestock; whether that's considering the potential negative consequences of farming seaweed at scale, observing how retailer policy changes impact them at farm level, or considering the potential for ruminants to contribute to GHG sequestration as well as emissions. This concept could therefore provide a useful framework to facilitate communication and understanding between livestock farmers and policy stakeholders.

8.7.3.2 Just transitions

Another conceptual approach that may facilitate communication between farmers and policymakers is a just transition framework, such as the one committed to by the Scottish Government (Scottish Government, 2021). A just transition involves maximising the co-benefits of decarbonisation and making society fairer, while crucially also not delaying climate action or allowing further creation of carbon lock-in (Atteridge & Strambo, 2020b). Different forms of justice are involved in a just transition framework (McCauley & Heffron, 2018). Distributive justice is about how the costs and benefits of transition are shared between different groups in society. Procedural justice is about whether groups have a say in

decisions that affect them, and whether those decisions are made fairly (Brandstedt & Brülde, 2019). Intergenerational justice refers to distributive justice between generations; ensuring that present needs are met without compromising the needs of future generations (Wales Centre for Public Policy, 2022).

Livestock farmers face negative distributional consequences from populations adopting more sustainable diets (Reay, 2020b), which could threaten livelihoods in areas with a high proportion of livestock farming (Rieger et al., 2023b). This research suggests that farmers clearly perceive the unjust implications of these consequences. Judge et al (2023) highlight that distributive injustices can promote development of intergroup polarisation. One potential way to ameliorate polarisation might be to focus on procedural justice i.e. farmers having input into decisions that affect them (like the codesign approaches mentioned above). Evidence has shown that increased procedural justice can improve perceptions of even severe procedure outcomes (Konovsky, 2000). Deliberative processes such as citizens' assemblies and Climathons may be useful ways to allow farmers space to be heard, with appropriate lead-in and follow-up engagement (Devaney et al., 2020). However, as noted in this research, any engagement about "climate change" can elicit a defensive response from livestock farmers, and more work is needed to find optimal ways to include farmers in deliberative events without making them less accessible for other groups (Simmonds et al., 2025). A key tension in just transition approaches is managing the urgency of the climate crisis with the drive to ensure citizen involvement in decision-making, and the need to identify potential negative unintended distributional consequences (Ciplet & Harrison, 2020).

As we have seen (recently at the time of writing), the farming community can mobilise large-scale protests if they feel threatened by removal of subsidies (Partridge, 2024). Meanwhile, policymakers also have the challenging job of managing justice at different scales (Walker et al., 2023). Something that might appear fair at the farm scale might cause injustices when one looks at the whole county, or even the entire country. Applying this type of thinking and sharing best practice between different national and international governance bodies may facilitate understanding of these complexities to aid decision-making.

To summarise this section, I have illustrated three major implications for policymakers based on the findings of this PhD. I began with the topics of efficiency and identity co-benefits, and working with livestock farming identities and ontologies for effective communication and collaboration. I have also sought to highlight where caution is necessary, especially with

regard to prioritising efficiency without close attention to rebound effects and unintended consequences. I have also suggested two concepts that could provide frameworks for policymakers and practitioners to collaborate with livestock farmers on the issue of methane emissions from ruminant livestock.

8.8 Chapter summary

In this chapter, I have discussed the findings of this PhD and situated them in the context of previous research, showing where they have advanced theory and knowledge. I began with an introduction reiterating the methodology, before discussing the findings structured as four major themes.

The first theme was about theoretical development, particularly in relation to Campbell's (2020) political ontologies approach, which I have applied empirically and developed by showing how farming ontologies form a nexus with epistemology and identity. This theoretical approach has facilitated explanation of the methane discourses and practices illustrated by this research. In theme 2, I discussed trends in climate change discourses, showing how methane discourses in the livestock sector align with Lamb et al's (2020) Discourses of Climate Delay, within a broader trend towards response scepticism. I also discussed the issue of polarisation as this relates to methane emissions and ruminant livestock, as well as the invisibilisation of powerful corporate food system actors by journalists reporting on this arena.

In the third theme, I highlighted the climate scepticism identified in this research via discourses around the global warming potential of methane and its role in carbon cycles. In the fourth and fifth themes, I discussed two discursive themes that did not fit neatly into the existing DCDs. One was that ruminants support high levels of carbon sequestration in grasslands, which was associated with regenerative and agroecological practices, but also mentioned by participants using more conventional grazing practices. The other was about methane reductions being a convenient "side effect" of practices aiming to increase efficiency (and thus profits).

In the final main section of this chapter, I set out major implications for policymakers and practitioners that can be inferred from these findings. While this thesis is focused on the livestock sector, it will likely resonate with researchers, practitioners, and policymakers working on climate change mitigation in other sectors. It illustrates that scientific and

political leaders have failed to “bring people with them” and achieve consensus on the relationship between ruminant livestock and climate change. Policymakers and practitioners might be keen to avoid conflict with the farming community by using economic and efficiency framings to encourage farmers to adopt practices that reduce methane emissions. However, there are major risks of rebound effects and inappropriate lock-in to intensive practices. Most importantly, this thesis illustrates the greater challenge of overcoming boundaries between societal groups and facilitating collaboration across differences in ontology, epistemology, and identity. Potential frameworks include a just transition approach, which includes people in decisions that affect them while seeking to avoid delaying climate action, and using a food systems approach to this complex problem. There is likely value in community engagement activities at local level that seek to integrate farming and non-farming publics, provide space for respectful face-to-face conversations, and facilitate shared solution-building (Simmonds et al., 2025). In the next chapter I will present the conclusions of this thesis.

Chapter 9- Conclusions

This PhD has used qualitative methods to investigate how the UK ruminant livestock sector was responding to problematisation of ruminant livestock regarding climate change in the early 2020s. It therefore addresses questions around how farmers and other livestock sector stakeholders are responding to calls for reduced meat consumption and production (Morris et al., 2021), and has identified strong themes of climate delay and a livestock sector-specific form of climate scepticism. The participants in this research used different methane discourses to argue that methane emissions from ruminant livestock are not a problem, and that many potential solutions are therefore unnecessary. They also highlighted power imbalances in the food system that maintain cheap food, with costs typically being passed to producers. Methane reduction practices that were viewed as "farmer-led" or had efficiency co-benefits were generally discussed more positively.

Given the qualitative approach for this PhD, the sample is not intended to be representative. However, contextual factors must be considered: a high proportion of participants were farming in less conventional ways, such as organic farming, producing grass-fed livestock, and/or using regenerative agriculture practices or traditional farming methods. The median age of included farmers was lower than the median age of English land holders (45.5 compared to 60 years), and there was a higher representation of women (approx. 27% of livestock farmer interviewees) compared to latest available UK farming workforce statistics (Defra, 2016). Future research on this topic would benefit from accessing a higher proportion of farms running intensive systems. Access to such farms was partly limited by the selected locations, but also likely reflected my networks and possibly the unwillingness of more conventional farmers to be interviewed by a non-farmer about climate change.

One limitation is that it was not possible to conduct all farm interviews as walking interviews. This was for two reasons. Firstly, I chose two main "walking interview zones" to limit transport costs and emissions. Secondly, to recruit sufficient participants, I drew on existing contacts and advertised via some online channels, which resulted in attracting several participants outside of the two walking interview zones. I therefore conducted eight out of the 32 interviews online or by telephone. Remote interviews used the same interview schedule, with the main difference being fewer opportunities for spontaneous questions and interjections provoked by the farm environment. The benefits of walking interviews were

prioritised as far as possible within the context of logistical factors and participant preferences.

This research and its findings are significant in the context of ongoing calls for reductions in UK production and consumption of red meat to support climate and biodiversity goals (Climate Change Committee, 2020a; Stewart et al., 2021; Vonderschmidt et al., 2024). Reducing methane emissions, including those from ruminants, is seen as vital to achieve international obligations under the Paris Agreement (Global Methane Pledge, 2025). Meanwhile, the UK government has a legislative duty to achieve net zero by 2050 (The Climate Change Act 2008 (2050 Target Amendment) Order 2019, 2019). It is therefore highly important to identify how the livestock sector is responding to, and seeking to actively shape, methane debates. As recent (at the time of writing) farmer protests have shown, top-down governance that threatens farming livelihoods (and therefore futures) can elicit strong backlash (O. Douglas, 2024). The findings of this research are likely to resonate with other sectors that face distributive impacts from decarbonisation.

This PhD has shown that farmers have strong motivations to overstate the importance of grassland as a carbon sink, as this validates their current practices via a climate lens. The regenerative agriculture movement is popular, positive, and farmer-led; and the discourses arising from this movement are impacting the livestock sector more broadly. Policymakers would likely benefit from further research into framing and communication strategies that can achieve similar traction, and doing so will require transdisciplinary approaches co-designed with livestock farmers and other sector stakeholders. A key question would be how practices that reduce net emissions can be associated with social identities, and whether these identities promote collaboration across disciplinary boundaries, or require boundary-making to distinguish themselves.

The findings also illustrate how ruminant methane debates sit alongside broader societal issues in the context of media polarisation and online mis/disinformation (Simmonds et al., 2024). Future research could triangulate media data with interviews with journalists and news editors, to identify mechanisms that reinforce individualist discourses around climate change, and suggest approaches that can better support journalists to translate climate change research in a nuanced way. Overall, research that explores how to reduce polarisation on climate change is likely to be beneficial, including diverse strategies such as changes to link recommendation algorithms (Santos et al., 2021), deliberative processes (Willis et al., 2022),

and approaches to ameliorating perceived polarisation (Lees & Cikara, 2021). Such avenues may support eroding boundaries between farmers and non-farmers, and incorporate and/or facilitate the transdisciplinary research suggested above.

On the topic of boundaries, another major finding of this research was the way participants discursively constructed boundaries between livestock farmers and the non-farming public. This aligns with previous findings that farming communities experience a disconnect from broader society (Wheeler et al., 2022). It also speaks to pre-existing matters of concern relating to the livestock sector, such as diffuse water pollution and bovine tuberculosis (Inman et al., 2018; Naylor et al., 2017). Future research to investigate ways to build trust and promote collaboration could be beneficial for farmer mental health, and may enhance progress toward climate goals by facilitating collective solution-building (Goodin & Dryzek, 2016). For example, deliberative processes can be adapted to rural settings, and can provide space for intersubjective learning and collectively imagining different futures (Lodato & DiSalvo, 2016; Simmonds et al., 2025; Turkel et al., 2019).

The ontological approach used in this thesis and the development of the ontology-epistemology-identity nexus has helped to analyse and understand livestock sector methane discourses. However, alternative approaches could have illuminated the topic in different ways. For example, a more focused utilisation of ANT could have facilitated greater understanding of the non-human agencies involved in these entanglements (Campbell, 2020; McGregor & Houston, 2018). Alternatively, this thesis could have drawn more heavily on social practice theory to better understand how practices are transmitted between different actors and interact across time (Shove, 2022).

It was beyond the scope of this PhD to investigate consumer perceptions around methane emissions from ruminant livestock. Future research could elicit this data and possibly facilitate information sharing between urban consumers and rural food producers to build knowledge capacities for food system transformation. Furthermore, global events such as the Covid-19 pandemic, the cost of living crisis, and geopolitical instability, including the USA's withdrawal from the Paris Agreement, have contributed to an increased focus on food system resilience in the face of likely future shocks (Lang et al., 2025). For many consumers, cost represents a major barrier to accessing healthy and sustainable food (The Food Foundation, 2025), while food producers are facing increasing impacts from climate-related extreme weather (Wheeler & Lobley, 2021). Climate change mitigation in the food system is therefore

at risk of being overshadowed by shorter-term economic difficulties (The Food Foundation, 2025), despite widespread support for net zero in the UK (Climate Barometer, 2024). However, there remains strong potential for synergies and co-benefits between climate change mitigation, adaptation, population health, and reducing social inequity (McCauley & Heffron, 2018; Oliver et al., 2023; Reay, 2020b; Stewart et al., 2021; N. Ward, 2023).

Overall, this PhD has developed existing theory to generate new knowledge on a vital UK sector that faces increased public scrutiny and climate-related governance. The approach and findings have illuminated implications for livestock sector stakeholders, as well as providing broader insights into sectors that face distributive impacts from decarbonisation in high-income countries. In an era of polycrisis, how society organises itself to provide enough food for a growing population on a finite planet is a persistent and fundamental question for social science researchers.

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Appendix 1: Interview guides

Interview guide linked to concepts- farm interviews

Interviews will be semi-structured, evolving from broader, open questions to more specific enquiry.

Concept	Example questions
Farming ontologies	- Tell me what you would do on a typical day on the farm/talk me through your day yesterday - How has the livestock sector changed/evolved during your time in it? - Tell me about the life cycle of one of your animals - What are the major challenges facing the livestock sector right now? - Talk me through ways activities on the farm can affect the surrounding countryside. - What kind of social relationships do you associate with livestock farming? - What's the best way to use our land in the UK - What is the relationship between your farm and the local community?
Powerful discourses	- Do you undertake any specific practices on-farm in relation to greenhouse gases like carbon dioxide, methane, and nitrous oxide? - Do you think these work? - If not, why not? - What other options have you considered? - There is a lot of discussion in the media and on social media about methane emissions from cows/sheep. Does this relate to your work? - What solutions are you aware of for reducing methane emissions from cows and sheep? - What kind of solutions are farmers around here trying?

	- Which groups do you associate with different “solutions” to this issue? - Which groups do you think have the most power in these debates? - Have your views changed during your time as a farmer? - What will be different for the next generation? - What future do you see for cows and sheep in the UK? - What will this land look like in 100 years?
Lock-in	- Tell me about the journey one of these animals goes on to get from farm to fork - Tell me about the supply chain journey these animals go on - You mentioned that you thought about [solution] but it didn’t work out. Would you tell me more about why that was? - How do your supply chain relationships influence your sustainability? - Are there any barriers that prevent you from running the farm the way you’d ideally like to run it?
Farming identities	- What qualities make a good livestock farmer? - What roles do farmers play in our society? - Do you think the qualities of a good farmer are influenced by someone’s gender? - If I were a new farmer just starting out in beef/sheep/dairy, what advice would you give me? - What do you think about the ELMs system that’s replacing the single farm payment?

Interview guide linked to concepts- livestock sector interviews

Interviews will be semi-structured, evolving from broader, open questions to more specific enquiry.

Concept	Example questions
Farming/livestock sector ontologies	- Tell me about the work you do. - Tell me what you would do on a typical workday/talk me through your day yesterday. - How has the livestock sector changed/evolved during your time working in it? - What are the major challenges facing the livestock sector right now? - Talk me through the ways activities on a farm might affect the surrounding environment? - How can farmers reduce any potential risk? - What kind of social relationships do you associate with livestock farming? - What people and groups have expertise on livestock farming? - What's the best way to use our land in the UK?
Powerful discourses	- What "solutions" are you aware of in terms of reducing greenhouse gases in ruminant livestock farming? - Which do you think are most effective? - Which do you think are most feasible? - Which kind of groups do you associate with the different solutions? - Which groups do you think have the most power in these debates? - There is a lot of discussion in the media and on social media about methane emissions from cows/sheep. Does this affect you in any way? - How have your views on this topic changed during your time in the ruminant livestock sector? - What will be different for the next generation of farmers?

	- What future do you see for cows and sheep in the UK? - What do you think the UK's land will look like in 100 years?
Lock-in	- Tell me about the journey a typical cow or sheep goes on to get from farm to fork- how does your work fit into that? - What challenges do you think farmers face when it comes to adopting/implementing different "solutions"?
Farming identities	- What qualities make a good livestock farmer? - What roles do livestock farmers play in our society? - Do you think the qualities of a good farmer are influenced by someone's gender? - If I were a new farmer just starting out in beef/sheep/dairy, what advice would you give me? - What do you think about the ELMS system that's replacing the CAP?

Appendix 2: Example Photovoice workshop schedule

Photovoice Workshop 1

Phase 1- session overview

1900-1905 On a slide

Phase 2- introductions

1905-1920

Gallery mode. Ask each person to introduce themselves with the following:

Name

Region

Why you wanted to join the workshops

One photo from their camera roll

Phase 3- housekeeping, group agreement

1920-2000

Housekeeping (slides):

- Schedule/dates
- How we keep in touch
- Tech we will be using- Google doc, emails, Google Drive. Why not Whatsapp.
- Zoom basics- mute, chat, reactions, raise hand, share screen
- Online etiquette- microphones muted if noisy background, if host disconnects and meeting ends, try to rejoin with the same link or check your email for further instructions, ask questions as they arise, use computer rather than phone, video on when possible

https://docs.google.com/document/d/1qbyIW1hqITgtWKubPi1qYxKQrAkL_UnHfU8VUO9Rpvs/edit?usp=sharing

Group agreement (gallery mode): 1 minute to think of one or two rules that would help create a positive experience for us all as we work together

Then feed back one at a time- Pippa record on Google doc. Pippa to highlight any obvious omissions.

Sample group agreement:

- Keep to agreed start and finish times
- Mobiles off/on silent
- Listen to each other
- Encourage others to participate
- Share only what you want to share
- Respect difference
- Respect people's need for confidentiality (social media)

BREAK- 15 mins, get a snack, have a screen break

2000-2015

Phase 4- Photography and social change, introducing visual literacy (slides)

2015-2030

Slides. Use Dorothea Lange photo.

https://www.history.com/news/migrant-mother-new-deal-great-depression

Phase 5- Visual literacy activity

2030-2055

https://www.pexels.com/

Choose one photo- demo how to screen share/add to Google doc. One minute to choose.

Into break out rooms- 10 mins to discuss

WHAT DO I SEE?

WHAT DO I FEEL?

WHAT DOES THAT MAKE ME THINK?

• What is in the photograph?

• How has the photographer chosen to frame it?

• What angle has been chosen and does it affect what we think or how we feel about the subject?

• What has been included in the frame, and what has been left out?

• What is in the background? What does this tell us about the subject or the situation?

• What do you think the photographer wanted to communicate?

• Is what I am thinking universal, cultural or personal?

2045

Whole group- each group shares a photo and feeds back to the rest of the group

Phase 6- Activity and next week

Introduce photo treasure hunt

Plan for next week

Appendix 3: Resources for farmers

Resources for farmers (shared if participants expressed low mood or other signs of poor mental health)

YANA (You Are Not Alone)- rural mental health support https://www.yanahelp.org/

If you are involved with farming or another rural business in any way and are feeling low or if you are worried about a member of your family, a colleague or a friend, YANA can help. Call our helpline **0300 323 0400** for confidential support or email helpline@yanahelp.org.

RABI (Royal Agricultural Benevolent Institution) https://rabi.org.uk/

RABI provides support to the farming community across England and Wales. Support is provided to those who are currently working in agriculture and those who are no longer working due to illness, injury, disability or age.

If you or someone you know might benefit from our support, please call us on our confidential freephone helpline **0800 188 4444** 9am-5pm Monday to Friday. Alternatively email us at help@rabi.org.uk.

FCN (The Farming Community Network) https://fcn.org.uk/

Whether the issue is personal or business-related, FCN is here for you. We run a confidential, national helpline and e-helpline which is open every day of the year from 7am to 11pm and our volunteers provide free, confidential, pastoral and practical support to anyone who seeks help.

Helpline: **03000 111 999** Email: help@fcn.org.uk

Forage Aid https://forageaid.org.uk/

We help farmers whose feed or bedding supply has been disrupted by extreme weather or an Act of God by sourcing and distributing feed and bedding with the help of donations from the farming community.

Apply for help, or to donate, via the website.

Samaritans https://www.samaritans.org/

If you need someone to talk to, we listen. We won't judge or tell you what to do. 24-hour free helpline: **116 123**