

‘I wouldn’t want to be a cow’

An ethnographic exploration of more-than-human
relational praxis on a New Zealand dairy farm



Audrey Goulding

A thesis submitted to Victoria University of Wellington in fulfilment of
the requirements for the degree of Master of Arts in Cultural Anthropology

VICTORIA UNIVERSITY OF WELLINGTON

July 2020

Cover image: guiding a calf across the calving paddock

Credit: the author

Abstract

This thesis aims to understand how industrial farmers perceive and relate to the nonhuman world. A small-scale ethnographic focus of a 250-cow dairy farm in New Zealand's Rangitikei district is presented as a proxy for approaching the underexamined field of farming ontologies. A common narrative exists that western ontology is characterised by human exceptionalism, a belief in humanity as singularly subjective beings amid a mute and objective world. Contrary to this discourse, this thesis finds that farmer relations to the nonhuman world are multiple, complex and contingent. This thesis employs Annemarie Mol's (2002) understanding of ontology as established through practice, and thereby multiple, in conjunction with a material analysis of the farm as a composite ecology of human and nonhuman agents. I argue that industrial agricultural practice is informed both by transcendent, objectivist logics, and by co-constituted, informal knowledge formed through co-habitation of multispecies lifeworlds. The unruly agency of lively materials, and the affective and intersubjective qualities of interspecies interactions, are shown to figure conditionally in farming practice. These components are managed within the bounds of industrial agriculture's outwardly utilitarian and anthropocentric systems through responsive practices of care and attentiveness, revealing that an attribution of nonhuman agency and subjectivity is essential to industrial farming practice.

Acknowledgements

This thesis is dedicated to all the wonderful humans and other mammals that made this research possible. Thank you especially to my close friends within and outside of the university walls, for bearing with me while I made you experience this with me in the form of rants, celebrations and stress. Everyone of you has been amazing but a special shout-out must be made to Sam R., Max, Odette, and Ronan for bearing the best and the worst of it.

Thank you to those who helped directly in this project. Sam R., for your encouragement, for being a loyal and enthusiastic research assistant, and for your nonsensical ramblings on the drive to and from the Rangitikei. To Liam and my unflappable mother, thank you so much for your invaluable feedback and help with proofing. Mum- as I write this, you're spending your lunchbreak proofreading my abstract - I can't imagine what I would do without your support. To my supervisors, Jeff and Grant, you are legendary- thank you so much for your ongoing encouragement, and the excellent office chats.

Finally, this entire work is owed to the generosity and kindness of the residents of the Kagan farm. Kathy and Logan, thank you so much for your patience and for showing me a vast depth of knowledge in a short period of time. I came away from fieldwork with a feeling of extreme gratitude, and in awe of the work you do.

Contents

Abstract.....	i
Acknowledgements.....	ii
List of figures.....	iv
Chapter One: Introduction	1
Background	3
Understanding industrial agriculture – the literature	8
The fieldwork	12
Theory	19
Thesis overview.....	24
Chapter two: A social license to farm.....	26
Dad’s farm.....	30
A history: colonised lands, industrialisation and intensification	34
Livestock Improvement.....	37
Intrusive and unnatural: the many meanings of animal welfare.....	44
Conclusion.....	50
Chapter three: The material farm	52
Soil and rain	54
Pasture	59
Productive bodies	63
Pregnancy.....	69
Milking.....	72
Effluent.....	78
Conclusion.....	81
Chapter 4: Working with commodity subjects	82
Intercepted motherhood	83
Angie	95
Picking up the dead calf.....	103
Conclusion.....	108
Conclusion	109
References:	114

List of figures

FIGURE 1: GRAHAM AND ETHNE'S HEREFORDS	30
FIGURE 2: PADDOCKS FOLLOWING RAIN AND COW HOOVES.....	55
FIGURE 3: RYEGRASS LEAF STAGES. (DAIRYNZ, 2016B)	61
FIGURE 4: KATHY DISTRIBUTING MAGNESIUM IN THE GRASS.	66
FIGURE 5: DAIRY COW ANNUAL DRY MATTER REQUIREMENTS.(DAIRYNZ, 2017, P. 46)	68
FIGURE 6: THE TWO VIEWS OF THE COWS IN THE MILKING SHED.	73
FIGURE 7: APPLYING SUCTION CUPS.....	74
FIGURE 8: SIPHONING OFF THE COLOSTRUM OR ANTIBIOTICS-CONTAINING MILK.....	77
FIGURE 9: EFFLUENT FLOWING INTO DRAINS.....	79
FIGURE 10: COLLECTING CALVES AND MOTHERS.	84
FIGURE 11: HERD ORGANISATION BASED ON CALVING STATUS.	90
FIGURE 12: THE THIRD PARTY FARMER.	93
FIGURE 13: KATHY TENDS TO THE UNNAMED SPRINGER, WITH ANGIE LOOKING ON.....	96
FIGURE 14: A GROUP OF 'AUNTIES' CROWD AROUND THE DEAD CALF.	105

Chapter One: Introduction

Industrial agriculture: mediating encounters with the nonhuman

A remarkable characteristic of industrial societies like New Zealand's is a general public ignorance of the more-than-human encounters that are essential to everyday life. The act of eating, for example, transcends species boundaries; it is an encounter of multiple organisms; be they plant, animal, bacteria or fungi (Haraway, 2008; Linton, 2019; Satsuka, 2011). Everyday human life is thus achieved, or co-constituted, between humans and nonhumans. This is not how many consumers actively engage with their food, however. Industrial agriculture, a relatively new, intensive system of food production, mediates subsistence relations between everyday consumers and nonhumans. This industry facilitates the commodification, circulation and consumption of animals and animal products in their de-animated form. By the time animal products reach consumers they are largely objectified, their histories veiled by complex processes of alienation and symbolic transformation (D. Stull & Broadway, 2004; Vialles, 1994). Farmers, on the other hand, specialise in a profession that requires obsessive attention to these productive processes, and constant consideration of the nonhuman world. While the mainstream consumer is alienated from the source of their protein and its history, farmers are immersed in it. It's in agriculture's complex contact zones (Haraway, 2008) of interspecies encounter that empirical relations with the nonhuman world can be observed.

This thesis offers a glimpse into the veiled world of industrial agriculture through an ethnographic study of a 250-cow dairy farm in New Zealand's Rangitikei district. This small enterprise serves as a microcosm of, and representative proxy for, the more-than-human industry of dairy farming and offers insight into how industrial humans relate to and perceive the nonhuman world.¹ While the everyday practices of dairy farming remain largely invisible to the average consumer, the significance of dairy as an industry is well documented. Dairy is New Zealand's primary export. The industry's export revenue was \$16.7 billion in 2018, and dairy has been estimated to contribute 3.5% of national GDP (DairyNZ, 2019b; NZIER, 2017).

¹ By 'industrial humans', I here refer to humans whose subsistence relations to the nonhuman world are primarily mediated by complex systems including industrial agriculture and a globalised capitalist economy.

Industrial humans are aligned with 'the west', or, perhaps more succinctly, to people described by Bruno Latour as 'the moderns' (Latour, 1993). 'The moderns' are defined by an enduring commitment to an illusory 'modern constitution' (1993, p. 29); a categorical division between nature and culture, and corresponding methods of knowing this divided world; nature, as understood through science, and the social understood through politics. Latour's argument that these conditions of modernity have been categorical in practice, but rather that all life and knowledge emerge in complex configurations of subject/object, natural/social hybrids, has had a significant influence in the writing of this thesis.

The national dairy herd narrowly exceeds the human population at 5 million. This thesis supplements such established economic knowledge with an exploration of the experiential and relational aspects of the industry, to understand the minutiae of social and material practices that make up this immense business, particularly those localised and unseen interactions between humans and the nonhuman world.

It's timely to explore industrial human relations to the nonhuman world. At first glance these relations may appear brutally asymmetrical, following a history of ill-informed, anthropocentric exploitation of the nonhuman in the name of industrial progress. The 'Anthropocene' is a term that was officially endorsed by the International Geological Congress in 2016, to identify the postulated arrival of a new geological epoch (Blanchette, 2018b; Damian Carrington, 2016). This epoch is distinguished from the previous Holocene by the fact humans are considered primary agents in worldly processes such as climate and ecosystem change (Kirksey & Helmreich, 2010). While a contested concept (see:Haraway et al., 2016), the Anthropocene hypothesis challenges and reconfigures popular narratives of nature, humanity and modernity (Kohn, 2015; Vermeulen, 2017). By attributing the shift to a new geological epoch to the presence and activities of the earth's human population, the Anthropocene is thought by some to collapse the foundational binaries between nature and culture that are considered central to modern western ontologies (Kohn, 2015; Vermeulen, 2017).

The question of how western worldviews and industries like agriculture fit into discussions about the Anthropocene is a complex one, however. There is a tension, for example, between the continued intensification and growth of agricultural industry and the spread of movements like vegetarianism, and 'local-food' activism that attempt to circumvent the 'animal industrial complex'(Noske, 1989) due to a moral opposition to its treatment of animals and its environmental impact (see;Annie Potts & White, 2007; Weiss, 2011). Clearly, there are multiple co-existent and conflicting ideas about how humans are best to conduct and perceive themselves in relation to the nonhuman world, even within 'western' industrial spaces. This observation poses a challenge to much of the literature associated with anthropology's 'ontological turn'. This emergent genre, which is explored in more detail below, is concerned with dismantling the divide between nature and culture that is thought to inform post-enlightenment western cosmologies. Ontological anthropology encourages openness to alterity to 'western' realities, in order to face difficult concepts like the Anthropocene (Kohn, 2015). Yet it rarely turns to examine the western contexts from which it seeks distance. It fails to

account for conflicting opinions and priorities that co-exist and potentially speak to different ontological states, within the same cultural context.

This thesis aims to complement and complicate the premise of ontological anthropology by applying its key focus in an industrial context. Through a focus on the quotidian, more-than-human practices of dairy farming, I present an analysis of industrial ontologies. Based on my research, I argue that farmer relations to the nonhuman world are multiple, complex, contingent, and best understood through attention to practice. Following the relational approach to ontology theorised by Annemarie Mol (2002),² I have found that it is in the *conditional relationality of practice* that the nonhuman is *enacted* as multiple objects in relation to farmers. The multiplicity of livestock (in particular) is conjured through the farmers' performance of concurrent roles as carers, owners and commodifiers, and through livestock's duality as both subjects and commodities. The irrepressible agency of the material farm as a heterogenous, lively ecology, and the matter of ethical ambiguity in stockmanship, complicate the matter of relationality further. In their work, farmers regularly enact the nonhuman as commodity resource. I argue, however, that this is neither an inherent, nor consistent, condition of their industrial ontology. The liveliness of the material beings on the farm is what gives the product value, but as will be explored, the farm's heterogeneity and unpredictability can defy human control- and this agency is not lost on farmers or repressed by them. Instead, it forms an essential part of their worldview.

Background

An industrial estrangement from agricultural production

Defining 'industrial agriculture' can be a difficult task, due to the heterogeneity of forms that fit under this umbrella term. The intensive, indoor feedlots that dominate the United States' approach to dairying, for example, are a far cry from the expansive rotational pasture-based grazing of New Zealand's dairy industry, which are often run at the family level. Both models are industrial, however, as both are guided by innovation, intensification, investment in technological advancement, minimisation of labour and maximisation of product output (Barlett, 1987). This thesis thus follows Alex Blanchette (2018b) in taking a relative approach to defining industrial agriculture. Consistent characteristics of the businesses that fit under this term are the ongoing processes of industrialisation (Blanchette, 2018b), often manifest in specialisation and vertical integration, increasing numbers of animal heads per farm,

² Explained in more detail in the 'theory' section of this chapter.

investment in the genetic improvement of animal bodies, and integration of local businesses into corporate marketing and distribution schemes (Grey, 2000; D. Stull & Broadway, 2004). Industrial agriculture is also characterised by alienation of consumers from food sources, with most production centres located in rural settings that are removed from increasingly urbanised industrial societies. This produces a remarkable discordance between the ubiquity of industrial agriculture's role in mediating human-animal bodies, and a popular ignorance of how this mediation is done (D. Stull & Broadway, 2004). By these standards, the extensive factory farms of Europe, the United States and China, and the pasture-based systems of New Zealand can all be understood as industrial agriculture.

My initial interest in this topic was sparked by this remarkable, almost paradoxical, condition of industrial societies. The global growth in intensive agricultural systems is facilitating unprecedented increases in the consumption of animal products worldwide, and the ever-increasing tens of billions of livestock animals that are captive to agricultural systems (FAO, 2019). However as global agriculture grows, more and more consumers are becoming estranged from agricultural processes. Increasingly, 'urban populations are both spatially and mentally distant from their sources of food' (Head, 2016, p. 94). In New Zealand, rates of urbanisation have been increasing since the 1960s, with a marked growth in concentrated urban centres like cities and a corresponding decline in small towns (Brabyn, 2017; Lindop, Cochrane, & Pool, 2005). The 'urban-rural divide' is a familiar term in New Zealand, adding a sense of socio-cultural estrangement to the mix (MPI, 2017b). The divide is most commonly decried by rural populations who feel misrepresented or misunderstood by the urban public or in policy, particularly when they are subject to criticism over the environmental impacts of agricultural practice or concerns over farm animal welfare. Some speculators argue that the 'divide' is over-emphasised, or even invented, by those with vested political interests in stirring antagonisms between the two populations (see: Wilson, 2017). However mythological, the concept does illustrate the alienation of majority urban New Zealanders from the everyday practices of primary industries and the processes that make the food they eat.

As an urban-dwelling, industrial human, I myself am generally quite unaware of the processes involved in producing most of the goods I consume, and I was curious about the ethical realities of working with the nonhuman in agricultural production. This curiosity was sparked further by the discourses heralded by alternative food movements like vegetarianism and local ('ethical') food production, as well as welfare-and-environmental-based critiques of agriculture. Such movements often posit themselves in opposition to the mainstream

agricultural system, a status that is achieved largely through exposure to its practices. A study by Anne Potts and Mandala White (2007), for example, found that many New Zealand vegetarians embraced a lifestyle abstaining from animal products because they equated agricultural products to the animals involved in their production. Bruckner, Colombino, and Ermann (2019) argue that such a revelation works by counteracting the commodity fetishism that is encouraged through industrial compartmentalisation, the geographic and discursive distance between production and consumption, and marketing techniques. This moral opposition intrigued me. If the agricultural industry sustains itself through processes of de-animation, commodification and the market-mediated objectification of the animals involved in the industry, I wondered how farmers themselves perceive and relate to these animals in the thick of it. Moreover, I wondered whether any such research would complicate critical discourses and public opinion on agricultural practice.

The oversights of ontological literature

On commencing my research, I found that my focus was imperfectly aligned with literature associated with the ‘ontological turn’. The ontological turn is a broad movement that was initiated in the latter twentieth century by writers like Viveiros de Castro (2014), Marilyn Strathern (1988) and Phillippe Descola (2013). Eduardo Kohn, an anthropologist more recently associated with the ontological turn, defines the field as a study of realities (2015, p. 315). A definitive assumption of the field is that the possibility for subjective alterity between different cultural groups is not limited to cultural belief systems, practices, and worldviews. Rather, their very realities, or ‘actual worlds’ (Vermeulen, 2017, p. 145) can be different. Through engaging with alterity, ontological literature seeks to dismantle an entrenched model of western thought constructed of binaries between nature and culture, mind and body, human and nonhuman. Ontological literature thus often concerns itself with the question of how people engage with the nonhuman world, and approaches this question with an open-mindedness to ‘radical difference’ (A. Tsing, 2018).

Amazonian metaphysics has proved a consistently intriguing launchpad for such inquiries. Viveiros de Castro’s influential *Cannibal Metaphysics* (2014) introduced the concept of ‘multinaturalism’ (a term used to describe perspectivism that is deliberately formulated in opposition to multiculturalism), based on his observations among Amazonian societies. Multiculturalism, the classic anthropological perspective, suggests the physiological world is constant, but that it is perceived and constructed differently between cultures. Multinaturalism

suggests that perception of the world, including between and among different species of animals, is constant, and that difference is found in the physiological and phenomenological realm (Holbraad & Pedersen, 2017). His treatise shakes the ground of anthropological thought, drawing attention to the culturally contingent character of assuming a homogeneity of physical reality (Holbraad & Pedersen, 2017). Viveiros de Castro challenges Western thinkers to reconsider their ‘multiculturalist’ perspectives to better understand alternative realities.

Phillip Descola’s (2013) *Beyond Nature and Culture* introduces the reader to several non-western, ‘alter’ realities, exemplified by differences in human relations to the nonhuman world. He posits a four-part ontological model that covers totemism, analogism, animism, and naturalism. These broad ontological categories are described as ‘modes of identification’(pp. 303-304); each is defined by the degree to which, in a given society, nonhuman entities and environments are perceived as similar to humans in their physicality or interiority.³ While Descola presents a comprehensive ethnology of non-Western examples to demonstrate animist, totemic and analogic modes of identification, his discussion of western ‘naturalism’, is brief yet sweeping, lacking contextual and grounded evidence. This ontology is characterised by continuity in physicality among humans and the nonhuman world, but a discontinuity in interiority. Human interiority, manifest in concepts like the soul or mind and qualities like self-awareness or rationality, is deemed the exceptional and exclusive domain of humanity.

A concerning lack of symmetry in ontological literature provoked and inspired my own attention to industrial ontologies. Most of the research that explores ontology through human relations to the nonhuman world focusses empirically on the non-western ‘other’ and neglects empirical reviews of western settings (Candea & Alcayna-Stevens, 2012; Yates-Doerr & Mol, 2012; Zuppi, 2017). Many of these scholars presume the alterity of non-western, non-industrial societies, and in doing so insinuate a cohesiveness of western metaphysics (Yates-Doerr & Mol, 2012; Zuppi, 2017). This imagined, or at least not empirically investigated, homogeneity of western ontology, is arguably most clearly demonstrated by Descola’s ‘naturalism’. Such an outward-looking approach towards the non-western ‘other’ treads dangerously close to carrying on problematic colonial habits of anthropology by both neglecting to engage with

³ Physicality refers to physical characteristics, and ‘and way of acting in the world’, insofar as this is determined by physiological factors. Interiority, on the other hand, can broadly be described as subjectivity, that is, consciousness, rationality, reflexivity, and in some cases; ‘immaterial principles that are assumed to cause things to be animate, such as breath and vital energy’ (Descola, 2013, p.116)

indigenous thinkers (Z. Todd, 2016), and by failing to reflect empirically on the western side of a constructed west/rest binary.

Kohn argues this emergence of ontological anthropology is in response to the singularly reality-shattering concept of the Anthropocene. He writes that the ontological turns' authors offer solutions to the challenges presented by the Anthropocene in the alter-realities that are inhabited by some non-western populations (Kohn, 2015). I would argue, on the other hand, that the focus of ontological studies, or more specifically human relations to the nonhuman world, should, for this very reason, be spotlighting how those in industrial societies, and largely the 'west' relate to the nonhuman world and understand their place in it. If industrial societies, and particularly intensive agriculture (Blanchette, 2018a; Richter, Bacon, Brecheisen, & Mobley, 2015) are responsible for the majority of the worldly change that has brought about this postulated new geological epoch, then surely this is the reality that needs interrogating.

These two gulfs; the gulf in industrial humans' understanding of the more-than-human agricultural industry, and the empirical weakness in ontological literature regarding industrial societies, led me to develop my research focus. I was initially exclusively interested in the relations between farmers and livestock, however, once I commenced fieldwork, I found that the significant, lively 'more-than-human' actors in agriculture extend far beyond just livestock. The whole of the farm, in all its heterogeneity of moving, interacting and unruly actors presented an 'ecology of materials' (Ingold, 2012) to explore. The organic (natural and anthropogenic) environment, infrastructure, climate, livestock, and countless other on-farm presences exhibited agencies wrapped up in the quotidian practice of farming, whether within or beyond the farmer's control. One of the key findings of this research, as is argued throughout this thesis, is that relations between farmers and the nonhuman world are enacted in practice and subject to change. This finding boosted my critique of the totalising qualities of ontological literature in anthropology and led me to Annemarie Mol's (2002) approach to ontology as enacted and conditional, rather than transcendent and consistent. Farming reality, in so much as it can be ascertained through relations to the nonhuman world, as a result, is multiple.

Understanding industrial agriculture – the literature

While there is a dearth in literature attending to the ontological implications of farmer relations to the nonhuman world, a rich body of literature does offer insight into the myriad ways in which these relations are influenced by their context and conditional enactment. This brief inter-disciplinary review spans social sciences literature on industrial agriculture, primarily from the field of anthropology, with some contributions from geography and sociology. The scope of the literature covered here is by no means exhaustive. It is representative of contemporary literature that explores how aspects of industrial agriculture mediate, influence, or reflect industrial human relations to the nonhuman world.

An important consideration is the situating of agricultural settings within broader socio-economic settings and ongoing processes of industrialisation. While much of this literature focuses on the hyper-industrial spaces of the United States, which has a significantly more intensive agricultural system than New Zealand's, there are relevant (and perhaps fortuitous) parallels to draw from these sources. For the last hundred years or so, the prevailing trends in agriculture have included vertical integration and the expansion of centralised food production corporations, intensification, and specialisation⁴ (Grey, 2000). Stull and Broadway (2004) are critical of a resultant shift in power to disembodied corporate entities, as farmer agency and connection to buyers is curtailed by the corporate middle-men to whom they are increasingly contracted (D. D. Stull, 2000). Blanchette (2018b) draws attention to the fact that industrialisation is not finished; production is still subject to the organic agencies and requirements of the lively materials involved. Thus, just as animal bodies and behaviours are altered and standardised for the industry, agricultural practice remains subject to the biologies of livestock.

These works also capture how agricultural business transforms regional profiles. The material impacts of agricultural sprawl include the rapid homogenisation of crops and farms and resultant changes to rural landscapes (Weiss, 2016). Intensive agriculture also bears the inherent risk of material slippage, in the form of excrement, livestock bones (Blanchette, 2018b) and airborne antibiotics and bacteria (Blanchette, 2019). Through the uncontrolled, flowing mediums of air and water, the material impacts of agricultural industries have the potential to spread far beyond the jurisdiction of responsible businesses and governments. Extending this impact further are regulations in place to control the movement of microbial

⁴ That is, a move away from the local diversity of the traditional family-owned-and-run farm model.

materials. Many have highlighted governmental standardisation of agricultural practices in the name of biosecurity (Ingram, 2011) and the resultant disciplinary control of workers' movements, bodily conduct, and social lives (Blanchette, 2015; Wentworth, 2015). Agricultural business can also transform demographic profiles, with meat processing and agricultural labour in the US attracting international migrants, often from lower-income countries in Latin America, Asia or Africa, to spaces that have historically not had particularly multicultural populations (Ribas, 2016; D. Stull & Broadway, 2004). Again, these trends see the transfer of regional power to agricultural businesses and the industrialisation of small towns. While centralised agribusiness creates jobs, their role as community custodians is notably lacking in the United States case studies offered by Stull and Broadway (2004).

Moving to the internal processes of agriculture, some important work focusses on how the violent aspects of the industry and the creation of products like meat are achieved through the material-semiotic mechanisms of agricultural spaces. Timothy Pachirat's (Pachirat, 2011) covert ethnography of a Nebraska slaughterhouse provides an in-depth exploration into a setting where 2,500 animals are killed per day. This is achieved, he found, through institutional, embodied and linguistic mechanisms of sequestration that enforce a disengagement with animal sentience. It's clear that versions of this sequestration are present across the industry. The architectural design of hyper-industrial kill-floors, for example, accommodate disengagement with the animal's transition from life, to death (Pachirat, 2011). The modern specialisation of the industry means that those farmers who are responsible for the nurturing of life, are rarely also responsible for the act of death (Wilkie, 2010). By contrast, Wentworth (Wentworth, 2015) argues that understanding animal sentience, and addressing the transition from life to death directly, was an essential practice on the smaller kill-floors where she conducted research, suggesting a difference in engagement with livestock depending on the scale of killing. Vialles' (Vialles, 1994) ethnography of French slaughterhouses argues that the ritualistic treatment of animal carcasses, and the language used to describe killing processes and meat products, function to minimise the relationship between meat products and their animal genesis. The production of meat is thus also a symbolic transformation, and one that speaks to the discomfort and enforced unfamiliarity of the general public to the realities of agriculture.

Developments in on-farm technologies and practice speak to materially-mediated changes to relations between farmers and the nonhuman. In some cases, the farmer's role as an intermediary between livestock animals and the industry has been reduced or replaced by

automation (Porcher 2012). Paul Hansen's (2014) research into automated milking systems in Japan's dairy industry captures a trending minimisation of direct trans-species contact, and the consequently blurred boundaries of animal, human, technology, workers and commodities. Similar to Blanchette's (2015) work in the US pork industry, Hansen's ethnography notes how the push towards standardisation and biosecurity in the 'microbiopolitics' (Paxson, 2008) of agriculture transforms agricultural labour by fostering attentiveness to the microbial. In addition, both human and animal labour are re-configured in the automated spaces where the machine is largely in control. Hansen suggests that this produces docility to machines on both sides of the milking parlour. Butler and Holloway (2016) argue more generally that automatic milking machines influence farmers' habitus, skills and approaches to farming through their introduction of new roles and redistribution of power. In addition to his musings on the power politics of automatic milking systems, Hansen argues that the industrial desire to mechanise the animal is limited by both the affective relations that are formed between farmers and livestock in these close contact zones (Haraway, 2008), and by the livestock's biological and wilful agencies. This argument is a common theme throughout literature on the subject (Lewis Holloway, Bear, & Wilkinson, 2014; Porcher & Schmitt, 2012; Wilkie, 2010), and has informed my own research significantly.

The introduction of robotics to agriculture reduces the time farmers spend with livestock even further. However this, too, can have unexpected implications. Porcher and Schmitt's (2012) analysis of cattle interactions with both milking robots and their farmer reveals that with the introduction of a robotic actor—a third entity in the farmer-cattle relationship—the animal-as-machine model of factory farming is challenged. Milking via robot demands coordination between the cattle and human agents, with cattle adapting to these circumstances and retaining agency within these conditions. Robotic milking systems are often marketed on the 'freedom' they offer cattle, and their ability to simulate 'naturalness' to calm and relax the cattle (Driessen & Heutinck, 2014). However, they also enforce a biopolitical model of disciplinary health management and regulation, to which both farmers and cattle subjectify themselves (Lewis Holloway et al., 2014). The elusiveness surrounding concepts like 'freedom' and 'naturalness' to which technologies like robotic milking systems are attached necessitate continual ethical evaluation of the incorporation of such technologies into agricultural practices (Driessen & Heutinck, 2014).

Another significant aspect of agriculture's 'modernisation' is increasingly detailed data-keeping and information management. These practices arguably intensify cross-species

subjectification to biopolitical power systems and may influence farmer perception of livestock as their merits are evaluated on an increasingly numeric or molecular scale (L. Holloway, Morris, Gilna, & Gibbs, 2012). In countries like the US and UK, livestock bodies and movements, for example, are increasingly regulated by law in compliance with biosecurity standards (Blanchette, 2015; Singleton, 2010). However the daily practices of adhering to these standardised processes of information management have proved to be at odds with farmers' inter-relational practices of stockmanship and care (Singleton, 2010). Biosecurity protocol also requires coordination with unruly and unpredictable on-farm agents like livestock, leading many farmers to subvert or disregard some aspects of protocol in daily practice (Singleton, 2010). New information infrastructure leads to the establishment of 'biosocial collectivities' (L. Holloway et al., 2012), term referring to the establishment and categorisation of populations based on genetic truth discourses. Through a focus on life-optimisation strategies of genetic improvement (L. Holloway et al., 2012), biosecurity (Blanchette, 2015; Lowe, 2014) and livestock growth (Beldo, 2017), for example, this perspective highlights the life-processes that are ongoing in agricultural practice, value-generation, regulation, control and risk. The value of this field of inquiry is the scope it gives to address the underlying molecular biologies that uphold the agricultural industry, and the processes by which these factors are objectified and evaluated as they are incorporated into capitalist and governmental systems.

Literature that examines the (bio)political economies of agricultural systems offers innovative ways to approach the industry in terms of production, value-generation, and incorporation of lively bodies into the bio-capital market. Geographers have long attested to the exceptional character of agricultural production, as agricultural value generation is founded in biological, living processes, differentiating it from the economic modelling of other industrial systems (Blanchette, 2018b). Re-animating concepts like 'biocapital' through a look at 'lively commodities', (Barua, 2016, 2019; Collard & Dempsey, 2013) this approach opens up opportunities to understand how organic material and metabolic processes in agriculture are essential components to value production (Beldo, 2017; Pálsson, 2009). From this perspective, some have applied a political economic critique based on the notion of livestock's conceptual role as 'labourers' in these systems of production, while also constituting the *means* of production (Beldo, 2017; Hamilton & Taylor, 2012; Porcher, 2011, 2017; Porcher & Schmitt, 2012). This approach re-animates agricultural settings and exposes the industry as one that deals in life as well as death. In opening the horizons to include nonhuman productive agents, this perspective complicates structural and humanist models of production and offers

opportunity to account for the heterogeneity of material agents involved in agricultural production and the entanglements of human and nonhuman life.

Finally, increasing numbers of social researchers are looking into the interspecies sociality of agriculture. Most successful attempts at this approach consider livestock as subjects within unequal interspecies power systems (Noske, 1989), while addressing the significance of livestock subjectivity in influencing the experience and practices of agricultural work (Buller, 2013; Crowder, 2015; Hansen, 2014; Porcher, 2011; Porcher & Schmitt, 2012; Wilkie, 2005, 2010). Much of this literature engages with the tensions that emerge from the multiple roles that farmers play in relation to their livestock, as carers, commodifiers and cullers, for example, and the ethical ambiguity that these fluctuations provoke (Crowder, 2015; Law, 2010; Singleton, 2010; Wilkie, 2005). Others address the mutually transformative encounters that occur in the intensive, capital-generating contact zones of the farm capital accumulation, and the caring and commodification that occur in these spaces (Barua, 2016, 2019). Such an approach can attest to the social, symbolic and inherently relational aspects of practices like commodification and ownership, and blur boundaries between the social, the biological and the economic in interspecies industries.

The fieldwork

Participants and methods

My methodological approach to this research was as much an unfolding experience of chance as it was determined by my pre-formed ideas. At the start of 2019, I was planning to conduct a series of semi-structured interviews with multiple farmers. I was busying myself trying to arrange these when Kathy, one of the farmers I contacted, invited me to stay on her dairy farm in the Rangitikei for two weeks in the middle of calving season. This invitation completely altered the course of my research. Rather than engage with the opinions and experiences of multiple farmers as I had originally planned, the invitation gave me an opportunity to conduct immersive observations of farming practice. As is explained further on in this section, this grounded exposure to the heterogeneity of concerns and lively actors on the farm had an inestimable impact on my research. My focus shifted from human-animal relations, to an interest in more-than-human relations more generally, an experience that speaks the formative influence and contingencies of ethnographic access (Kalir, 2006; O'Reilly, 2005).

Ethnography

My research follows the methodological principles of ethnography, which include the practice of embodied, in-situ research to capture lived experience (McCall, 2006, p. 4). The ethnographic researcher aims to find meaning through inhabiting the social and/or geographic locus of the social group or phenomena under study, and thereby learn from the perspective of her participants (O'Reilly, 2005, p. 55). The discipline is thus distinguished by its output of contextual, situated and experiential knowledge(s), placing the researcher amidst the field-site as a subject who exercises vital reflexivity, rather than assuming observational objectivity (Madden, 2010, pp. 6-7; Pink, 2007, p. 23). A key priority in the ethnographic method, and essential to my very tacit, personal and qualitative interests in farmers' working relations to the nonhuman world, is an acknowledgement of the 'partial truths' of ethnography (Madden, 2010). The value of the resultant qualitative text lies in its ability to capture meaning and experience, over quantitative, or structural, overviews of social life. The long-term, immersive experience of participant observation on the farm proved a fine opportunity for ethnographic practice, and for me to explore ethnography's iterative-inductive' relation to theory-building and meaning-making (O'Reilly, 2005, pp. 2,17). Thus, a considerate ethnographer approaches her field with an open mind, and the ability to exercise flexibility in her focus as the meat of the subject emerges through grounded immersion, not to be determined solely from a theory-down perspective (Okely, 2012).

My emphasis on open-mindedness in the ethnographic method is undoubtedly informed by my own experience. When I commenced this research, I was eager to focus solely on the intersubjective ethical relations between my participants and their livestock, yet being open to the learnings of being on farm showed me that practical relations to the nonhuman world in agriculture are much broader and more inclusive than that. On the farm, I saw factors like the rain, wind, bacteria, ryegrass, broken technology—all of these lively materials—penetrate through to the daily social life and labour of farming, and into the farmers' mindsets. Attending to the agency and activity of the farm environment's limitless materiality, I believe, enhanced my presence and understanding of farming as a participant-observer. Embodied experiences like these reveal the limitations of a purely discursive/semiotic approach to knowledge-building (Ingold, 2000; Locke, 2017), as social life is not always lived through and experienced in words. Attending to sensory and phenomenological information is also important to more-than-human research (Hamilton & Taylor, 2017). This was a key consideration, as an obvious hurdle

to the field of multispecies ethnography, for example, is the inability to practice a shared language (Bear, Wilkinson, & Holloway, 2017).

The Kagan farm

The epicentre of my fieldwork was a 250-cow dairy farm in Marton, in the Rangitikei district of New Zealand's lower North Island. Kathy and Logan, a middle-aged couple, own, run and live on the farm with their dog, two cats, and a collection of chooks providing daily eggs. The farm is christened 'Kagan', a mash-up of their first names, befitting the teamwork they put into running the place. They also receive help throughout the year, with a dedicated stint to care for the calves during the calving season, from Fiona, a woman who lives on a neighbouring lifestyle block with her husband and children. The farm is a relatively flat expanse of green pastures, with the odd marcocarpa-lined paddock, and a eucalyptus field at the back. The edge of the farm is bordered by a train line which would rattle with the occasional passing of freight. When I stayed there in August, the grey sky was constantly threatening rain, and my woolly hat was my constant companion. On a second visit in November, the sun and heat were cheering, and Kathy and Logan were both sporting tans that betrayed a life spent outdoors. They had bought the property and moved in about six years ago, and said it had taken years and significant investment in the land and technology around the farm to feel like they were no longer in the 'starting up' stage. In the beginning, for example, the majority of their cattle were leased from other farmers, and with each calving season they'd keep every single heifer born. Now with a full herd of their own, they said they could be more discerning in breeding and keeping calves, with the goal of herd improvement.

The Rangitikei region is unquestionably Kathy's home. She grew up on a plot of land about a 30-minute drive away from the Kagan farm, where her dad had farmed a herd of about 80 dairy cows for decades. Kathy's mother was brought up just down the road from Kathy's dad's farm, moving in after marriage and remaining there to this day. Despite her rootedness in the Rangitikei, Kathy is well travelled, has a master's degree in anthropology and has worked various council jobs as an advisor, in addition to having years of farm work under her belt. With a lifetime of experience on dairy farms, and a love of animals, Kathy does most of the farm management, although she works in partnership with Logan when making significant decisions.

When I arrived on the farm, Logan had only recently become a full-time farmer, having just quit his job at DairyNZ where he worked in effluent management. Logan grew up in nearby Palmerston North and would speak of himself as a ‘townie’ when compared to Kathy. His passion and expertise are in the science of effluent management and pasture growth, a focus that he said works in ‘healthy tension’ with Kathy’s focus on animals, allowing them both to contribute their own strengths to farm management.

Participant observation

As mentioned, my primary method of empirical research was participant observation, conducted over two weeks in the peak of calving season. During this period, I accompanied Kathy and Logan, and occasionally Fiona, on their daily tasks. Due to the time of year, regular life on the farm was interrupted by the birth of several calves every day.⁵ This meant that on top of the regular cow shifting, feeding, milking and maintenance work on the farm, Kathy and Logan were overrun with calving responsibilities, calf care, and drafting of cows into ‘mobs’ based on their calving status. Each day, I would accompany Kathy and Logan for about two to six hours of the 12 or more hours they dedicated to daily work during this intensive period. I would offer help where I could; this mainly consisted of assisting Kathy to collect new-born calves and their mothers from the paddocks, driving them back to the calf shed on a trailer attached to a quad bike, and feeding the calves. Other times I made myself useful by helping to hustle a group of cows from one paddock to another, to open or close gates, or to distribute straw or hay. Due to my lack of farming experience, much of the time I was merely accompanying the farmers on their tasks, and they would patiently indulge my constant questioning and loaded conversation starters as they went about their business.

The participant observation experience illuminated the benefits of immersive qualitative fieldwork methods and ethnography’s inductive shaping of the research focus. I have already described how my presence on farm alerted me to farming’s heterogeneity of concerns. More than this, my participants were able to point these concerns out to me while we were in the field together as they reflected on the world around them and the work they had to do. Through these spontaneous reflections, I developed an interest in the entirety of the nonhuman world of the farm. I started to think more about the rain that made the farmers anxious, how it could soften the cow’s hooves and make them vulnerable to injury if they trod on stones scattered on

⁵ Calving rates averaged around eight or nine per day during my stay.

the races. I noticed that on windy days, the yearling herd would congregate in the middle of a paddock in a spot that avoided the worst of the bluster. I paid attention to the huge slimy sacks of afterbirth that were often hidden, camouflaged by dirt, and on the concrete pathways, threatening major injury to any human unaware enough to step on one. I came to understand the various calls and movements of cattle, and appreciate the cluelessness of new-born calves and their rapid learning of basic survival habits in the warm calf nursery with their human guardians. Mastitis, footrot, colostrum milk, and whatever bacteria produced the ripe, cheesy smell of the calf shed when it needed a clean, all became salient to my research focus on the relations between farmers and the nonhuman world. These represent the real ‘fleshy’ qualities (A. Mol, 2002, p. 27) of everyday life on-farm, essential to the lives and decision making of the farmers, and to the experience of all living things there.

While the participant-observation experience was undoubtedly beneficial to the research, the immersive and in-person nature of the method, which saw me park myself as a temporary guest in the daily lives of my participants, did present some complications for data gathering. It was often in leisure times (sitting around the kitchen table after a meal, for example) that we had the most illuminating and rich discussions around the social and scientific complexities of farming. These were moments of respite from the demands of the farm for Kathy and Logan, and I, too, had dedicated these periods to being in-the-moment, as an attempt at minimising the inevitable awkwardness of the fieldwork experience. This meant that many of these illuminating conversations had to be recalled by myself, alone, often several hours or a day after they had occurred. Experiences of awkwardness and discomfort that accompany the extraordinary circumstances of ethnographic fieldwork are increasingly acknowledged in as the discipline grows more reflexive (see: Bille & Steinfeldt, 2013; Breglia & Fischer, 2009). My personal experience was one of a feeling of intrusion, especially as I was unable to commit wholly to the ‘participation; of participant observation through work, due to my inexperience with farming. Balancing the ‘work’ of fieldwork and leisure time in line with my participants’ schedules was something I had to learn throughout the course of fieldwork (Breglia & Fischer, 2009).

A townie on the farm

After the afternoon calf-feeding, I followed Fiona out to the dairy shed, where she washed her colostrum buckets. Kathy was nearby, hosing down the shed after milking. I watched the liquid, a dark greenish-brown colour, punctuated by bubbly segments of creamy milk,

flow across the concrete ground surrounding the pit and into sewerage grates. 'What's all this green stuff?' I asked.

'Green stuff? What green stuff?' Said Fiona. 'Oh!', she looked at me, face marked by disbelief, 'that's poo!'

I blushed and started trying to justify my stupidity. It seemed my instinct to constantly ask questions had betrayed my common sense. Of course the green stuff was cow poo. And I could have figured that out, if I had only thought about it before asking. But I knew how Fiona was going to react to this...

She laughed; 'Oh my god. That's the towniest thing you've ever said, hahaha!'

Contemporary ethnographers will often acknowledge the ambiguity of the 'emic' and 'etic' categories that purport to mark the distinction between research conducted at 'home', or 'away', respectively (Madden, 2010), and my fieldwork can attest to this ambiguity. I approached this research as a means of attaining a contextual understanding of a specific aspect of a culture I identified as my own. Economically and culturally, mine and my participant's lives are deeply entangled, and my field site was only a couple of hours' drive from my home in Wellington. If we adhere to the generalising models that place a country like New Zealand under a label like 'the west', then my foray into this local agricultural setting could be considered anthropology 'at home'. The research itself, however, rarely felt like this. Beyond any socio-cultural notion of an 'urban-rural divide', my lack of farming knowledge, which this chapter has already discussed as a common condition of New Zealand's urban population, was a major component to my feeling an 'outsider' researcher. Due to my professional naivete, the experience itself often felt like entering another world. This ignorance reflected a nuanced cultural distinction between myself and the participants, one which was most often made apparent when the farmers and their friends and colleagues called me a 'townie'. In fact, it became evident through this research that a cultural and discursive gulf between rural and urban groups is sometimes a powerful, and frustrating aspect of rural lives.

Outsider status, and the unfamiliarity that comes with it, can sometimes be equal parts benefit and hindrance (O'Reilly, 2005). It's here that I must include a proviso that throughout this thesis, I have attempted to represent, to the best of my ability, the agricultural knowledge, science and practice that I encountered through my fieldwork and subsequent research. Yet the formidable holistic, embodied and scientific knowledges possessed by farmers takes years to

master and I most certainly cannot lay claim to this expertise. What in subsequent chapters is presented as agricultural science and practice must be understood as interpreted through the ethnographer's gaze. Yet, on farm, my general ignorance was a great catalyst for in-depth discussion. My participants themselves often commented on how I noticed their most mundane practices, those that had become invisible to them through familiarity. All ethnographic work is subject to the risky business of cultural translation, which undoubtedly comes through with my tentative and inexpert representation of dairy farming. Recognising this, I was compelled to practice collaborative engagement with my participants over the course of researching and writing, by maintaining communication and seeking confirmation on some of the areas of my knowledge that I was more doubtful about.

Data

Audio data collected using a Dictaphone proved singularly important to my research. With my participants' permission, I would slip the Dictaphone into my pocket and record many of the daily on-farm excursions, capturing the sounds of the farm, and informal ethnographic interviews or 'situational conversations' (Munz, 2017, p. 455) between myself and the farmers. With my hands free from holding a camera, I was able to participate more in the work of farming. In addition, the time it took to transcribe the audio from the Dictaphone functioned as a remarkably immersive form of analysis. Transcribing the hours of audio from the farm I re-experienced the sounds of tractors, cows mooing and crunching on grass, the wind and rain, the sounds of gumboots and overalls moving through muddy paddocks, and, invaluable, the off-hand remarks and explanations from my participants. This experience proved to be an initial step in analysis, as I began to locate and draw out thematic recurrences and points for further inquiry and triangulate the transcribed data with fieldnotes and visual data.

I supplemented these audio recordings with photographic data. The methods of visual anthropology have become highly valued among ethnographic researchers for their ability to capture relatively direct and naturalistic data a level or two less contrived than fieldnotes (Hamilton & Taylor, 2017). Visual methods are also celebrated as relatively emancipatory mediums, producing more accessible forms of data than the written word (Hamilton & Taylor, 2017, p. 98). Visual ethnography is also considered an important resource for capturing the sociality of interspecies contact zones (Hamilton & Taylor, 2017). This expands upon the emancipatory power of visual media in capturing the experiences of the under-represented by bringing the nonhuman into the research (Hamilton & Taylor, 2017). I couldn't interview the

cattle, for example, but I could film and photograph their movements, their vocalisations, their habits and habitats, and their interactions with the farmers and each other. There are, however, limitations to the emancipatory potential of visual ethnography, and especially when it is non-participatory, the practice remains a primarily subjective one (Bear et al., 2017; Pink, 2007). For example, I alone remained in complete control of when and when not to capture visual data, and I was independent when reviewing the visual media as to what came across as pertinent to my research. The strengths and benefits of the method, however, outweigh these limitations, and some of the hundreds of photographs and stills from my videos feature throughout the chapters of this thesis as a result.

Finally, I was keeping track of daily occurrences, learnings and insights through regular notetaking using any means available and keeping a field diary. Where the audio recordings and visual material might convince the reader or myself, during analysis, of their (false, or incomplete) objectivity, the fieldnotes and field diary were a highly reflexive resource (Bear et al., 2017). These notes were a patchwork of thoughts. Detailed, thick description (Geertz, 1973) of the day's events proved a rich supplement to the empirical visual and audio data, and they were supplemented by reflexive moments of doubt, confusion, and epiphany. For this reason, I consider the fieldnote and diary write-up the first method of analysis. The end of day writing routine was as much an exercise of 'writing out' an experience, and thinking through it, as it was a process of 'writing down', or recording (Madden, 2010, p. 6). The vignettes that appear sporadically in the text that follows are post-analysis, purified and storified versions of the content of my fieldnotes and field diaries, included to re-tell specific occurrences in thick description, but with a post-thought focus on the themes that prevailed through analysis.

Following fieldwork, I conducted some weeks of intuitive thematic analysis in consultation with the literature. The primary themes that I drew from this analysis informed my theoretical approach to 'writing up' the data (Madden, 2010), detailed in the following section.

Theory

My research attempts to bridge the gap between systemic-structural analyses and the grounded and experiential knowledge produced through ethnographic research. As is argued throughout my thesis, this binary is consistently transgressed in the lived experiences of dairy farmers, whose work is inextricably caught up in the structures of the agricultural industry, but whose daily experiences are subject to change and variability far beyond the scope of structural determinants. Below I detail some of the core theoretical approaches that informed my analysis

and writing up of this research, including the multiple realities of Annemarie Mol's (2002) relational ontology and Tim Ingold's (2007a, 2007b, 2012, 2013) attentiveness to the flow of lively materials that interact with, and make, human life (among others). Finally, I discuss the value I have derived from multispecies studies, and the limitations of these approaches.

Multiple realities

The work of philosopher and ethnographer Annemarie Mol (A. Mol, 1999, 2002; Yates-Doerr & Mol, 2012) has been central to my understanding of farming ontologies. Mol's work helps to contest the ontological simplicity that has marred anthropological representation of 'the west'. She argues that ontology is not fixed and transcendent, but it is something that is made, central to experience, and changeable. To understand ontology, one must look for its emergence in relational practice. If, as is characteristic of ontological literature, reality is determined by relations to the nonhuman world, Mol's concept of *multiple ontologies* provides a framework with which to understand farmer relations to the nonhuman world. In her seminal ethnography of the atherosclerosis division of a Dutch hospital (A. Mol, 2002), Mol argues that objects like *the body, disease, treatment, doctors and patients* are not singular, objective entities, rather, they are enacted, brought into being through relational praxis. As such, objects, and thereby ontologies, are subject to relational enactment, and are thereby multiple and contingent.

Mol's approach to ontology was invaluable in addressing the multiplicity of farmer relations with the nonhuman world, especially when one expands the category of 'social actor' to include the nonhuman. The nonhuman objects (and subjects) that the farmers engaged with were enacted differently depending on the context of each encounter and the knowledge drawn upon to inform practice. A clear example are the differences in enactment of the livestock 'object', depending on the context. In one instance a 'cow' could be a digital object accessed through the aggregated data technologies provided by companies like the Livestock Improvement Corporation (LIC). The perception of this object would include a digital interface, and aggregated information such the value-calculation of production and breeding worth. In a different context, that same cow could be a familiar, friendly subject, the recipient of congratulations at the birth of her calf, or affectionate scratches on her neck or head. Understanding ontology as something that isn't transcendent, but something that is *done*, established through practice, accounts for these oscillating ways in which farmers perceive and relate to both their livestock and the material world at large. This approach shows the

contingency of nonhuman objectification or re-animation, to contest the transcendent ontological de-animation of the nonhuman world as attributed to industrial cultures by models like Descola's (Yates-Doerr & Mol, 2012).

Ingold's ecology of materials

When anthropologist Tim Ingold writes about material life, his prerogative is to remind us that we, as humans, are worldly inhabitants (Ingold, 2007a). Our experience is informed by the flux of materials around and within us, and our relational positionality in this world is where our perception is realised. In his attempts to contest the prevalent, objectively 'scientific' perspective claimed in western academia and inherited from enlightenment-era philosophy, he emphasises the non-existence of the 'exhabitant' model who *observes* the earth, rather than lives in it (Ingold, 2007a). This treatment of the human's phenomenological and subjective experience of the world is distinctly humbling. Ingold advocates for a grounded sense of *becoming* human as an ongoing process that occurs in correspondence with, against and amongst the material world (2018). Considering lived experience, and the *practices* of Annemarie Mols' approach whilst considering the *inhabitant* status of human in relation to the material world, this grounded, situated approach is valuable to a material understanding of meaning-making. This approach is particularly suited to understanding the profession and lifestyle of dairy farming, which is so consistently engaged with a galaxy of heterogenous agents.

Ingold's 'ecology of materials' (Ingold, 2012) also provides an essential anthropological perspective on the multiplicity of material coordination essential to the production of commodities like dairy. This concept expands the scope of material anthropology beyond objects and environments to address the lively, moving, developing, form-making, phenomenological properties of the material world (Ingold, 2012, 2013, 2018). His approach to material life and correspondence resonated with what I observed of my participants' grounded, responsive and volatile relations to the nonhuman world and its immanent agency. Ingold posits 'making', in terms of the production of things like commodities, as a process of correspondence (Ingold, 2012, p. 435). Production is not the 'masterful imposition of prior intentions, already settled in the imagination, upon the materials of nature' (Ingold, 2017, p. 22), but rather the 'drawing out or bringing forth of potentials immanent in a world of becoming' (Ingold, 2013, p. 31). In processes of correspondence, farmers are subject to materials as they work with them, and production is thus a reciprocally transformative process.

The value and limitations of multispecies ethnography

The emergent genres of more-than-human anthropology and multispecies ethnography (henceforth referred to as multispecies studies) follow the ethos that humans exist in ‘cohabitation, coevolution and embodied cross-species sociality’ (Haraway, 2003) with nonhumans. Spearheaded by thinkers like Donna Haraway (2003, 2008), Anna Tsing (2011, 2012; 2015) Thomas Van Dooren (2016; 2016) and Eduardo Kohn (2013), multispecies studies attempt to collapse the socially constructed binaries between the human and nonhuman, and ‘natural’ and ‘cultural’ categories of life on which disciplines like cultural anthropology are founded. It therefore has close ties to the ontological turn, with both genres attempting to de-centre the human in social literature and normalise attention to the networked, flowing and unwinding connections that figure the cross-species co-constitution of life. However, the two genres are distinct. Ontological literature attends to the radical difference in human experiences of reality, with an enduring ethnographic focus on the examples of alterity in modes of being. By contrast, multispecies writers attempt to engage directly with the more-than-human networks, interactions and assemblages that constitute life, encompassing nonhuman beings as ethnographic subjects, for example. The political or philosophical motive of multispecies studies is to redact entrenched understandings of human exceptionalism and acknowledge the plethora of nonhuman organisms deeply entwined in multiple aspects of human life (Kirksey & Helmreich, 2010).

Multispecies studies offer rich theoretical tools through which to understand human relations to the nonhuman world on a New Zealand dairy farm. From the start, my aim was to approach industrial spaces as the lauded ‘contact zones’ (Haraway, 2008) that form the sites of multispecies ethnographies. These contact zones are spaces of intimate and intense interspecies engagement, whence the co-constitutive becoming transpires in intensive and purposeful ways. In order to meaningfully re-present the nonhuman world through ethnography, the multispecies ethnographer must develop a particular skillset of noticing, perceiving and responding to beyond-human indicators of meaning that Van Dooren et. al. (2016) have labelled ‘arts of attentiveness’. The concept of ‘nature-culture’ (Haraway, 2003), which identifies the interface of a collapsed nature/culture binary (Latimer & Miele, 2013) is another useful concept stemming from multispecies thought. Nature-culture addresses the inescapably human and culturally constructed of what is commonly understood to be ‘natural’, and the inescapably bio-physiological of what is considered ‘cultural’. This approach was fundamental in shaping

my attention to the human manipulation of, and subjection to, the organic agency of non-living things, in the industrial world of agriculture.

My fieldwork experience and my own growing critique of multispecies literature turned me away from adopting an exclusively multispecies approach, however. Firstly, once I witnessed the extent of my participants', tacit, responsive, and truly co-constituted understanding of the nonhuman world on the farm, I realised my own limitations in approaching this as a multispecies ethnography. The idea of decentering the human resonated with the cause of my research, but I personally couldn't claim to understand the nonhuman world of the dairy farm well enough to re-present it ethnographically. I would be imposing, rather than co-constructing and extracting knowledge if I were to claim to do this, which would then devalue the benefits of an ethnographic approach (Madden, 2014). Moreover, multispecies ethnography is arguably too egalitarian in its representations of the entanglements of the human/nonhuman world for the purposes of my research (Dwyer, 2007; Hurn, 2012; Kopnina, 2017). While many scholars who do analyse systemic inter-species power relations attribute some inspiration to multispecies studies (see; Hansen, 2014), much of the literature tends to omit systemic discussions of power, politics and violence.

I have thus attempted to incorporate aspects of multispecies studies into an approach that acknowledges the structural and systemic centralisation of human power. Here, I found commonality with geography's 'insistence that materiality and nonhuman nature are consequential in capitalist production' (Blanchette, 2018b, p. 192). More-than-human geography emphasises that the lively properties and biologies of agricultural organisms are the axis of agricultural production. In agriculture, the primary process for surplus-value realisation, for example, is not human working labour, but the biological performance of 'metabolic' or 'reproductive' labour (Beldo, 2017) by 'lively commodities' (Barua, 2016; Collard & Dempsey, 2013). As an industry founded on the exploitation, trade, and control of life, agriculture also lends itself to biopolitical analysis that considers the nonhuman living commodity a biopolitical subject (Chrulow, 2012; L. Holloway et al., 2012). Finally, geographers like Maan Barua (2016) have made use of Haraway's (2008) concept of 'encounter value'; the 'process of value generation where bodies, ethologies and liveliness of an animal makes (sic) a difference to, and is constitutive of, those very relations that render or mobilise it as a commodity' (Barua, 2016, p. 728). In his studies of conservation and eco-tourism, Barua has attempted to formalise an analytical approach to lively commodities and encounter value, to understand the divers modes of encounter that contribute to the generation value (Barua,

2016). Such frameworks straddle an acknowledgement of nonhuman biological agency to the production of capital value, and the role of interspecies relationality in realizing this value, and were thus invaluable in understanding the complex, multiple relations between farmers and livestock.

One other takeaway from multispecies studies that I applied to this research was, in fact, an approach to understanding one aspect of farmer relations with the nonhuman. If we take a mastery of ‘arts of attentiveness’ as indicative of the multispecies skill-set, I found, rather, that the farmers are the real multispecies ethnographers. Throughout this thesis, I showcase that attunement and responsiveness to tacit signifiers of the needs, wellbeing, moods, and upcoming movements of nonhuman beings are essential to practices of good stockmanship. Co-constituted through the longitudinal and intensive co-habitation of the farm, these arts are practiced almost subconsciously, drilled into the embodied, phenomenological experience of farming. Through my fieldwork I came to understand how the practices of farming, involving so complete an immersion into the nonhuman world, functioned as a form of subjectification, of reciprocal transformation. Just as their stockmanship influences the behavioural development, movements, attitudes, demeanours and lifestyles of their livestock, so too does exposure to the livestock gradually become a part of the farmer, of her habitus, in her body, her movements, her outlook, opinions, and perception of the nonhuman.

Thesis overview

The following chapter situates the Kagan farm within its broader societal context, to demonstrate how more-than-human relations in dairying are partly mediated by external pressures and developments. The chapter commences with a brief history on New Zealand’s dairy industry, to establish the prevailing economic trends that have influenced localised practice so far. Following this, the chapter introduces two contrasting priorities for farmers that are formerly connected to agencies external to the farm. The first is the practice of livestock improvement, borne on the back of LIC, a massive genetics trading company based in the Waikato. The second is animal welfare, formalised in the government-decreed 1999 Animal Welfare law and subsequent iterations, which have historically been influenced by the pressure of public activism. Both agencies produce objective, normative resources for farmers that encourage or regulate particular modes of conducting oneself among, and understanding, livestock. The reified logics of these resources are discussed in contrast to the localised and messy realities of farming practice, in which multiple modes of relating to livestock are enacted. This chapter thus introduces a key tension in farming practice; between transcendent

logics, authorised through biopolitical ‘truth discourses’ and laws, and the tacit, co-constituted knowledge that is drawn from farming experience amid the nonhuman world.

Chapter three tells the story of milk’s material lineage, engaging holistically with the farm as a material ecology of human, anthropogenic, and nonhuman components. This chapter explores the heterogenous material agents involved in the complex processes of milk production, from the molecular ecologies of soil and ryegrass, through cattle biologies, the contact-zone of the milking shed, and collection by tanker. Through a focus on the value-generating capacities of lively commodities, and the risks of working with them, this chapter shows that farming is a practice of material correspondence, of compromise and responsive action, guided by a transcendent ‘dream’ (Singleton, 2010) of anthropocentric control. The many episodes that lead to milk production and commodification are shown to draw on multiple, conditional, modes of knowing, and working with this heterogenous landscape.

Chapter four focuses specifically on the relations between farmers and their livestock in practice. The purpose of this chapter is to showcase and acknowledge the ethical implications, and particularly moments of ethical ambiguity, that are produced through farming’s relational multiplicity. I show that ethical ambiguity in farming practice is partly due to the cattle’s oscillating dual status as commodities and subjects in relation to the farmers. To illustrate this point, the chapter discusses cases from my fieldwork, including the routines undertaken during calving season, the decision to cull a sick cow called Angie, and the discovery of a dead calf among the dry stock. Through this chapter, I show how entangled different modes of relating to the nonhuman world are in farming practice. Care and attentiveness are shown to be essential to the processes that ensnare nonhumans into systems of commodification and material exploitation. Biopolitical logic and detachment strategies function as aspects of utilitarian and objectifying modes of viewing the nonhuman world, but they are also shown to be essential for farmers managing their emotions in ethically ambiguous circumstances. This chapter attests to the significance of non-human subjectivity to farming practice, and reveals that detachment, or an objectified understanding of the nonhuman, is but one of many conditional realities enacted in farming practice.

Chapter two: A social license to farm

As I settled into my fieldwork, I quickly became familiar with the use of language like ‘farming’s social license’. The phrase propped up almost daily, especially in conversation with Logan, who was working part-time for DairyNZ as an effluent management advisor. Effluent management is a component of farming that has more weight now than in the past due to increased knowledge of the ecological harm that effluent run-off from farms causes to waterways (Baskaran, Cullen, & Colombo, 2009; Kenneth F. D. Hughey, 2016). It was a difficult task, he reflected, getting farmers to spend money and change their life-long habits to adhere to new standards of effluent management. But it was worth it; ‘it’s about keeping our social license to farm,’ he’d say.

These conversations spoke to the social, political, ecological and economic pressures beyond the boundaries of the single farm that inform farming practice. The concept of a ‘social license’ brought my very localised understanding of the agricultural sector and farmer engagements with the nonhuman world into the public sphere. The term itself reflects the often-conflicting priorities within the agricultural sector, particularly at this moment in New Zealand’s agricultural history. To continue with the example of effluent management; effluent is the water-based discharge that flows from the milking shed and paddocks of the farm through the drains running underneath. It is a conglomerate of manure, milk solids and fertiliser, and it is rich in nitrogen, phosphorus, potassium, magnesium and sulphur. Thanks to the presence of these minerals, the substance can be captured (using an effluent pond, for example,) and repurposed as fertiliser. However, it’s also these minerals that pose a risk to nearby waterways through pond stagnation caused by intense localised plant and algal growth (Foote, Joy, & Death, 2015, p. 714). Effluent straddles the conundrum of the ‘two faces of modernity’ (Boogaard, Bock, Oosting, Wiskerke, & Zijpp, 2011); the mounting threat it causes to waterway ecosystems is largely attributed to land-use intensification (Howard-Williams, Davies-Colley, Rutherford, & Wilcock, 2010). As farming maintains an onus to increase productivity and intensification in a competitive global market (Chobtang, McLaren, Ledgard, & Donaghy, 2017) it can struggle to meet new standards set by new environmental knowledge, and an increasingly informed and critical consumer public.

Significant developments in the recent history of New Zealand’s dairy industry have brought about disparate, and often conflicting, standards for farming practice. Tradition and comfort come up against new technologies and regulations, while growing awareness of the

environmental implications of contemporary agriculture issues forth new regulations that are seen by many in the industry as ‘unfair’(Alsop, 2019) or ‘unrealistic’(Pointon, 2019). The demands of keeping up with a highly competitive, intensifying industry are compromised by increasingly consumer-lead movements to improve farm animal welfare and environmental practice (Loveridge, 2011). Critique of the industry takes a more concentrated form among groups who question the very assumptions of industrial agriculture; some question to what extent humans can presume a right to enclose, capture, breed and kill animals for our own benefit (see: Feigin, Owens, & Goodyear-Smith, 2018; Annie Potts & White, 2007; R. Todd & Hynes, 2017). New Zealand farmers are regularly quoted in media as feeling misrepresented, misunderstood, and scapegoated by the government and the general public, prompting much speculation about broadening rural-urban divide (MPI, 2017b). This feeling of dissatisfaction is often contrasted to the lauded position that New Zealand’s agricultural sector has historically held in the country’s economic development and post-colonial history (Annie; Potts & White, 2008).

External social and industrial influences often result in the development of objective treatises, resources and discourses pertaining to ideal farming practice, and corresponding ideal modes of relating to the nonhuman world. The New Zealand government released 45 new animal welfare regulations in 2018, for example, while industry bodies like DairyNZ and the Livestock Improvement Corporation (LIC) are constantly updating their production-focused resources on ideal farming practice. Yet the dairy farm itself is a microcosm of multiple heterogenous human and nonhuman actors that are constantly in flux, constituting ecologies through lively correspondence (Ingold, 2013). In this context, transcendent laws, codes, resources and guidelines regarding production processes, environmental protection, and animal welfare, fail to account holistically for the complex life-worlds with which farmers work. Instead, farmers interact with these texts as *objects among many* in the daily practices that make up farming. In practice, the reified ideals contained in these objects often contravene each other, and they come up against informal societal pressures and the immeasurable hodgepodge of actions in the daily demands of farming. As a result, the meaning, or enactment, of different components of the nonhuman world varies, depending on the type of knowledge that the farmers draw from in any given moment, often in correspondence with the nonhuman agents involved.

This chapter explores how external social and economic influences relevant to New Zealand agriculture’s current moment in history construct particular ideals of farmer-livestock relations. Two case studies of such influences are presented for this purpose. First, a biopolitical lens is

applied to an analysis of the products and services of the Livestock Improvement Company (LIC), a genetic improvement company that rose to prominence over the twentieth century. The company's emphasis on a scientific approach to production, and the commodification of biocapital, are shown to enforce farmer subjectivation to a model of scientific and utilitarian relations to nonhuman life. Following this, the chapter explores the subject of animal welfare law in New Zealand as a normative treatise on the ethical treatment of nonhuman animals in industrial agriculture. Animal welfare law is shown to straddle and codify the distinct dichotomy by which livestock animals are considered both political subjects that possess discernable rights, and commodities subject to exceptional human control within the legal bounds of the capitalist state. These examples represent some of the contesting ideal constructions of livestock borne through the discourses and philosophies of both governmental and commercial objects.

As this chapter will continue to explore, however, the external forces influencing farming are myriad, and not always complementary. Farmer engagement with the historical objects produced by abstracted institutional bodies, and the principles they espouse, are conditionally informed. The resources and methods of evaluating animal worth offered by LIC, for example, are shown to infiltrate farmer perceptions of livestock. Yet farmers are also shown to exercise considerable agency in perceiving and understanding the nonhuman animals with which they work, often in defiance of the mechanised, economically rational evaluation offered through LIC's scientific logic. By contrast, New Zealand's animal welfare law is shown to be somewhat impotent in its regulation of ethical farming practice. Here, the law is considered an abstract 'morality system' (Keane, 2016) which has standardised a vague and ethically ambiguous mode of understanding and working with livestock animals' dual-status as 'sentient commodities' (Wilkie, 2010). With reference to literature from the anthropology of ethics, and an analysis of an analysis of Kathy and Logan's efforts to go 'bobby-free', I reveal that farmers often enact an alternative ethical understanding of livestock beyond what is implied in welfare law.

This chapter thus presents farmer relations to the nonhuman world as complex, diverse and contingent. These relations are shown to be subject to historical change and external influences but not wholly determined by these. The local, tacit and affective experiences of being among the lively material assemblage of agents on farm are also important in influencing how farmers perceive and relate to the nonhuman world in practice. Across these multifarious relations

multiple realities are formed, reflecting the conflicting and complex concerns that farmers face in this moment in agricultural history.

Dad's farm

I was immediately charmed by the group of yearling Herefords we encountered on Kathy's parents' farm. Bounding towards us as we approached their paddock, their excitement only increased when they heard the clicking sound that indicated an automatic fence opener was activated. They were kicking up their heels, surrounding our little vintage four-wheeler bike (affectionately known as 'the mule') as we drove into the paddock to scatter additional hay amongst them. I'd heard from Kathy that such behaviour is typical of youthful cattle like these, as well as dry stock who haven't been in the milking system for several weeks.



Figure 1: Graham and Ethne's Herefords.

Our visit to these Herefords came at the end of a half-day's work on Kathy's parents farm. She and Logan were leasing some of the land from her retired parents, Graham and Ethne, to graze their additional, non-milking herd stock.⁶ Logan would come out here once every few days to shift the herd, and feed and tend to Graham and Ethne's young Herefords. There weren't many of this lot- just enough to keep the old farmers busy following retirement, once the work of dairying got a bit too much for them.

Kathy's parents, Graham and Ethne, had lived on this farm for upwards of sixty years, raising Kathy and her two sisters here. The property was only about 30 minutes' drive away from

⁶ The non-milking herd included some beef and dairy yearlings and some autumn calvers.

Kathy and Logan's, but it felt really different. Unlike the broad, square mass of the Kagan farm, Graham and Ethne's place was long and thin, with a line of paddocks following a small stream away from the public road. It was much hillier than the Kagan farm, with drier, more sandy-red soil underfoot. The property's long use as a dairy farm ended with Graham's retirement about ten years ago. In the weeks prior to my visit, Graham had been put into a care home with advanced dementia. Ethne remained, and I had the pleasure of meeting her as we arrived. Later in the day, Logan smiled as he told me that Ethne had lived in the same block her whole life, having grown up on a parallel street and only having moved on the occasion that she moved in with Graham following their marriage.

On the drive to the farm, Logan had said that it was 'like a museum', telling me that Graham had applied a fix-it attitude to anything and everything he could, leaving antique structures, tools and equipment in his stead. We visited the old dairy shed to access the generator for the day. It hadn't been in use for twenty years, and was notably different to Kathy's and Logan's, sporting only 10/aside, half of their shed's yield. The significantly wider pit was framed by metal partitions that were bent into a zig-zagging frame, allocating specific spaces for the cattle. The smaller pit made sense for a much smaller farming operation, as Kathy's family only farmed up to 100 cattle here for the many decades it was in operation. Farming was a different story then, Logan was saying as he fiddled with the electric fence meter that hung from the wall, ticking like a metronome. 'Check this out', he said, pointing out a single-line, antiquated telephone that was hung up next to the meter. Graham had installed the piece, it connected only to the telephone inside the house, 'so if the kids or Ethne were at home, they'd crank the handle, and Graham could hear the bells ringing here and come answer it'. He had also laid a line all the way out to the hayshed.



Figure 2: Graham's milking shed and the single-line telephone.

The old phone and the dairy shed that lingered years after their practical use were just some of many material indexes of a generation of human life here. Logan was also keen to tell me about the tripod-style cylindrical storage tanks on the driveway near the house. They had been painted a lemony-beige colour, but rust had long been getting at the edges in this exposed environment. While once commonplace on farms, construction of such tanks hasn't been permitted since 1996, due a history of structural issues. Effort has since been put towards decommissioning the remaining tripod tankers as they have continued to pose a health and environmental risk following several reported incidences of collapse. Logan had to grapple with other forms of antiquated or dysfunctional technology all day, sharing a single battery, for example, between the two tractors he was using to dispense bailage.

These material conditions triggered Logan to reflect on the farm's history. He told me about the meaning of this farm to the family, expressing a level of discomfort about interfering too much with the way of things. While he was leasing the farm, he said he was wary of doing things 'differently to how dad would have done it'. Throughout the day he talked about how confusing it could be to try to pick up and work with how the farm was left. He reflected that the isolation of the work meant that the family weren't cognizant of Graham's ailing health for a long time. there were, however, little indications across the farm that Logan had encountered:

'I've been quite surprised; you know, Graham was quite fussy about doing stuff right. But since we've taken over, we can see what he didn't... there was stuff that was too hard for him, no-one kinda realised, like, - everyday, he'd come out on the farm and spend all day out her, but he just couldn't work out what to do'

Logan pointed out the disordered condition of the hayshed. Stacks of hay were placed randomly, their edges scuffed and unruly from lots of movement;

'Graham spent a lot of time here in the last... He's been gone about 3 weeks, probably a few months before that, he was just shifting hay, from one place to the next, and hence a lot of the bales are broken, because they've just been shifted so much'



Figure 3: feeding out to Graham and Ethne's young Herefords.

After shifting the cattle to their new respective paddocks, juggling the responsibilities of the tractors with their single battery, feeding out hay and experiencing the buoyancy of the yearling Herefords, Logan and I fare-welled Ethne and hit the road, making for Palmerston North to pick up some feed before heading back to Marton. On the drive, Logan pointed out several buildings scattered across the landscape, bearing tell-tale signs of abandonment in their opaque (covered) windows and degenerating structural states. These were once local dairy factories, ran and operated by small-scale collectives.

With the centralisation of the industry, these buildings gradually became redundant, and were left to mark the landscape, representing what was a significant period in New Zealand's colonial history, but ultimately a small blip in the history of the land. Like the old, continuously repaired technology, dairy shed and fuel tanks, and later the misplaced items and scuffed haybales on Grahams farm, these buildings mark prosperity, ingenuity and decline, whether of an individual farm, local industry or of the mind of a single farmer. And of course, the seeming permanence of humanity's mark on the earth manifest in the disorderly residue of a history ongoing.

A history: colonised lands, industrialisation and intensification

To fully appreciate the ethos and development of dairy farming in New Zealand, it helps to acknowledge its genesis in the colonial project of New Zealand settlement by Europeans. This is important to consider because this thesis explores industrial dairy farming as a specimen of 'western' society's relations to the nonhuman world more generally. The colonisation of New Zealand land was propelled by Victorian ideologies regarding 'progress' and 'improvement' (Stenhouse & Beattie, 2007) entailing the rapid occupation of indigenous lands by European settlers, uptake of advancing agricultural technologies, and the growth of globalizing trade networks.

Agrarian capitalism thus represents the inexorable materiality of New Zealand's colonisation. Developing tracts of land for agriculture involved the introduction of exotic plants like the perennial ryegrass that adorns near all pasture-based farming across the country, the extensive culling of tracts of native bush and the draining of swamps (Peden & Holland, 2013). As of 2016, 45.3 percent (12.1 million ha) of New Zealand's land is in use for agricultural or horticultural farming (StatsNZ, 2018). The general attitude towards land use by proponents of colonisation was one of a rights bestowed by cultivation (McAloon, 2013, pp. 78-79). The drive to cultivate productive land was also laden with religious morality, as the development of perceived 'waste-lands' (those that weren't in use, for example, to grow food) was encouraged by settler-politicians to be seen as 'god's work' (Stenhouse & Beattie, 2007) (Rowarth, 2013, p. 85).

The old dairy processing units that Logan and I saw on our drive back to the farm are a throwback to an era in New Zealand farming before the industry's centralisation. Kathy and Logan could remember a time when they were still in use, reminiscing one day about their

childhoods, witnessing farmers transporting their own milk to these buildings in metal barrels, before the new ubiquity of the truck-based tanker system was established. Their popularity, however, peaked in 1920, numbering 600, following a period of rapid technological advancement and market development. The advent of refrigeration in 1882 allowed for dairy exports in forms other than cheese and butter, and in the same decade the now globally-recognised Anchor brand was developed (Steel, 2005, pp. 182, 184). The development of comprehensive railway systems made milk and dairy product transportation easier and more profitable. As a result, During the first half of the twentieth century the dairy and protein industry primarily characterised by growth and expansion⁷, with an assured and reliable export market to the UK, boosted by their purchase of all New Zealand exports during wartime (Belich, 2007). A post-wartime boom saw a generally optimistic cultural outlook regarding the agricultural industry (Gordon, 2009; Rowarth, 2013).

Today's centralised and international industry was largely shaped by two significant economic changes that occurred in the latter half of the twentieth century. The economic reforms of the 1980's saw the deregulation of the market and the sudden halt of farmer subsidies, and the centralisation of dairy co-operatives across the 1990s, eventually leading to the Dairy Industry restructuring act and the formation of industry giant Fonterra in 2001. Following deregulation in the 1980s, which was precluded by the UK's entry into the European Economic Community (EEC) (now the European Union) in 1973 and the resultant loss of a guaranteed market, the New Zealand dairy industry had to expand its market and diversify products (Evans, 2004; Willis, 2004). This shift saw the transition of primary exports from cheese and butter to milk powder and casein, while the export market has expanded significantly to include Latin America and South-East Asia as some of the more significant markets (Evans, 2004). The formation of Fonterra, a merge of cooperatives the New Zealand Dairy Group and Kiwi Co-operative and the government-entity the New Zealand Dairy Board, marked the deregulation of the dairy industry itself, as a deregulated corporate entity was believed to perform better on the global market.⁸ Where other primary industries saw economic decline due to neoliberal reform changes, dairy came out on top. In 2017-8, dairy contributed 27% of export revenue, contributing 18.1 billion to the year ending June 2019 (DairyNZ, 2019c).

⁷ With some setbacks, such as the extensive soil-degradation that had occurred by 1920 only being overcome by the arrival of aerial top-dressing of nitrogen and phosphorus fertiliser.

⁸ Tatua and Westland are remaining cooperatives that aren't under the Fonterra umbrella. There is a growth in non-cooperative companies like Open Country, to whom Kathy and Logan supply.

A competitive and productivist ethos in this global market precipitated the rise of another key trend in the dairying business; intensification. Intensification refers to the increased production per hectare, achieved through increased stocking rate and inputs like feed (Chobtang et al., 2017; Foote et al., 2015). Today, intensification is an ongoing objective for most farmers, and it accompanies a trend of a decline in numbers of farms, and growth in herd size. Given the dairy industry restructure in 2001, it's notable that the number of dairy farms herds declined from 13,649, in 2001/2 to 11,372 in 2018/9. Average herd size has increased in the same time by 164 cows to 435 (LIC, 2001; LIC & DairyNZ, 2019). I saw evidence of these changes in the stark difference between Kathy's farm of 250 cattle, and her fathers', which could hold 100 in its heyday. Intensification is classically achieved through an increase in input like feed for cattle, but I would also argue that it is achieved through genetic livestock improvement strategies⁹, reflecting the increasingly molecular focus of farming epistemologies and the growing livestock genetics industry.

Both input-based intensification and livestock improvement strategies centre approaches to increased milk-solids production the mechanised bodies of the livestock themselves. As a result, cattle biologies have been significantly affected by industry demand. Kathy would often distribute magnesium powder, which is a supplement that helps cattle absorb calcium, across the hay that she would feed-out to her cattle. I asked her one day whether she thought all farmers used magnesium. She responded that, today, most dairy farmers would, but then she started talking about her dad:

'My dad, when he was farming, he never did. It was the 70s, the 80's, production wasn't as high. I think it's the demand, there's much more demand on the cow to produce more milk, so there's so much more calcium out of their bloodstream'

This brief economic history of the New Zealand dairy industry sets the stage for understanding how external influences have shaped farmer relations to the nonhuman world. Kathy's reflection on magnesium use demonstrates the subjectification of both farming practice and livestock bodies to developments in seemingly transcendent historical, economic processes.

⁹LIC state that; "The trend towards quality over quantity is apparent in the increased uptake of herd improvement services, with farmers using herd testing to monitor cow performance and wellbeing and artificial breeding to make the most of their best genetics, with a view to producing more milk from fewer cows" (2019, p. 5).

Livestock Improvement

A priority during calving season was adhering to herd improvement strategies through selective breeding and artificial insemination. Kathy and Logan use the products and services provided by LIC, an industry behemoth that gained traction from the trends of centralisation, intensification, and the geneticisation of livestock and agri-production knowledge. The company has roots in several dairy associations dating back to 1908 (Bayly, 2009). The 1970s and 1980s saw the amalgamation of these associations into one major body that was entirely horizontally integrated; a status LIC proudly claims due to the fact the company covers herd testing, artificial breeding, data aggregation and farm management. Their industry presence is impressive; in 2009, LIC could boast that four of five dairy cows in New Zealand had been sired by an LIC bull (Bayly, 2009, p. 79). In addition to providing semen straws, artificial insemination services and bulls for mating season, LIC have developed aggregated data structures and farm management guides that are easily accessible for farmers and which Kathy and Logan used daily.

Biopolitics of the more-than-human

The influence and function of industrial bodies like LIC can be understood using biopolitical theory. The concept of biopower was originally introduced by Foucault (1990) to address the increasingly complex and pervasive manifestations of power systems in post-classical society (Rabinow & Rose, 2006). A basic understanding of this model is offered by its etymology; biopower relates to power over *life*, and it emerged in social theory as a contrast to the juridical structures of sovereign power prevalent in classical law. Compared to the restrictive centrality of sovereign power, which Foucault called the power to ‘*take* life, or *let* live’ biopower is presented as a *positive* force, in that it ‘optimises’, multiplies, and gives order to life (Foucault, 1990, pp. 136, 137). It is manifest in rationalised and administrative systems that govern populations, and in the practices through which individual members of the population are subjectified, or indeed, subjectify¹⁰ themselves, as docile and productive subjects, to a set population.

Rabinow and Rose (2006) developed a useful expansion on Foucault’s skeleton application of this theory. They write that biopower derives from:

¹⁰ Here, (when related to discussions on biopower): subjectification refers to the processes by which individuals ‘work on themselves, under certain forms of authority, in relation to truth discourses, by means of practices of the self, in the name of individual or collective life or health’ (Rabinow & Rose, 2006, pp. 202-203)

'Truth discourses about the 'vital' character of living human beings; an array of authorities considered competent to speak that truth; strategies for intervention upon collective existence in the name of life and health; and modes of subjectification, in which individuals work on themselves in the name of individual or collective life or health' (2006, pp. 195-196)

Administrative structures in education, workplaces and healthcare systems exemplify the authorities through which truth discourses are espoused. They also serve as centres through which information about the 'vital' qualities of populations are collected and governed. As this definition shows, biopower rests on the collection and reproduction of data about subjects. This results in the establishment of 'biosocial collectivities'(Rabinow & Rose, 2006, p. 197), which combine biological and social markers to categorise groups of people, in turn generating normative identities, ethnicity, gender and sexuality, for example.

While biopolitical theory has traditionally been applied to human beings as biopolitical subjects, some theorists have argued for the inclusion of nonhumans in biopolitical theory (see:Chrulew, 2012; L. Holloway et al., 2012; Kirk, 2017). From this perspective, the growth of the livestock improvement industry provides fruitful grounds to understand how both agricultural workers and livestock are subject to mechanisms of biopower within the industry.

LIC's growth is owed to the successful commodification of genetic material, genetic knowledge, and genetic technologies, all of which are seized and marketed by the company itself. These genetic commodities are marketed based on the discursive reproduction of a particular 'bio-social collectivity'; the 'national herd'.¹¹ The individual farmer directs herd improvement strategies for their personal herd ostensibly to maintain their standing in a competitive market based on product yield and quality. Kathy and Logan said, however, that in their years practicing herd-improvement strategies, they hadn't perceived any notable improvement. While at the level of the individual farm, herd improvement may not appear to make much of a difference, aggregated national (and regional) level data, provided regularly by publications by industry bodies like DairyNZ and LIC present dramatic improvements (see:LIC & DairyNZ, 2019). The validity and market logic of herd improvement strategies thus rest on the assurance and authority of information that exists beyond the experience of most dairy farmers. It also rests on acceptance of such constructs as 'the national herd', which is not

¹¹ Holloway et. Al (2012, p 397) define biosocial collectivities, in the context of livestock biopolitics as; 'intentional groupings in which what is at stake in a set of social relationships is a fundamentally biological issue'

actually a unified object. Encompassing nearly five million animals, it is an aggregated data structure made of objectified numeric values regarding the productive and breeding capacities of the majority of dairy cattle in New Zealand.

The massive uptake of genetics-based livestock improvement strategies is in part due to the fact that the industry straddles two hegemonic ‘truth discourses’ of the modern western state: the capitalist economic system, and the western scientific enterprise. This conforms to Sunder-Rajan’s (2006) discussion on the deep entanglement of epistemology, technological innovation and market exchange in the world of biotechnology and genomic science. LIC’s confidence in the importance of genetics is emphasised by its attribution of *true* value to the cows that are shown to carry a history of ‘three to six’ generations of quality milkers, over the assets of individual cows (Rural Delivery, 2017). The company also rests on an accepted logics of promise and innovation, as biotechnology is ‘played in the future’ (Sunder Rajan, 2006, p. 34), it’s promises and logics are both spatially and temporally removed from individual farming experiences, but it’s salvation rests on and re-produces the epistemic credibility of both life-sciences and the commodification and exchange of genetic material.

Herd improvement and corresponding data management strategies engender practices that function as modes of subjectification, through which both farmers and livestock are implicated as subjects within this corporate biopolitical system (L. Holloway et al., 2012, p. 405). Today, record-keeping and data management are essential aspects of everyday dairy farming. The data on which LIC’s authority rests consists of genetic data spanning over a hundred years and comprising more than 25 million animals (Bayly, 2009). Kathy and Logan engage with herd-management and calving management programmes provided by LIC on a daily basis, entering information about the vital or productive properties of livestock, or checking information provided by LIC. Kathy and Logan contract out for quarterly herd testing, which is most commonly conducted by LIC technicians themselves. Herd testing returns individual results for cattle, identifying the high producers and poor performers, and those with mastitis. As such, the farmers are motivated to subjectify themselves to these market entity-introduced systems by the promise of economic reward. While these practices are standard now, they speak to this particular moment in farming history. Kathy’s father, for example, never participated in herd improvement strategies, and didn’t have the luxury of discerning the objective quality of his replacement stock based on abstracted scientific truths.

The MINDA app – perceiving the digital cow

One reason, it seems, that LIC has managed to become so central to mainstream dairy farming is the accessibility and helpfulness of their technology to farmers in practice. Kathy and Logan were always using LIC's MINDA phone application (the MINDA app), for example. MINDA (Management Information for Dairy Animals) has existed as an aggregated data base and farm management guide since 1985 (Bayly, 2009). The MINDA app, which combined four previously separate LIC-managed applications,¹² was released in 2015. Kathy and Logan would compare the usefulness of the MINDA app, which is a corporate/private venture, to the difficulties of the jarring government-enforced modes of data keeping, like recording National Animal Identification and Tracing (NAITT) movements; 'If only they'd make an app for that, it would be so much easier'. This attitude and corresponding practice are demonstrative of the co-dependency of technological and economic innovation for the rise of biopolitical practices and power systems (Barua, 2019; Sunder Rajan, 2006).

Accessible anywhere through a smartphone, the app saw a lot of action on the Kagan farm. In the field, they referred to MINDA when making decisions about what to do with a cow that appeared unwell or showed signs of calving, for example. The farmers might murmur 'wait a minute, who are you...', before pulling up the cow's profile on their phone. This gave them access to a host of information, including the cow's age, ancestry, calving experiences, milk solids yield and quality. The ancestry component of the app connects the cow to the network of cattle across the country, as the database sustains information about genealogical connections established through breeding. Because of this genetic network, a cow's profile is continually updating based not only on her own breeding and lactation performance, but also on her parents' and offspring's productive and breeding qualities, due to an automatic, networked feedback system.

Apps like MINDA, and the livestock improvement philosophy more generally, enforce a particular mode of perceiving and relating to livestock informed primarily by their bodily condition and corresponding value to the farm. Ostensibly, MINDA is an information resource used for general herd management and planning seasonal programs like insemination. In practice, the app is an interface through which farmers perceive and interact with their cattle, and represents livestock based on simplified and abstracted value markers. An animal's MINDA profile tells the farmer of its Production Worth, Breeding Worth and Lactation Worth

¹² These apps were independently called: Mating, Lookup, Calving and Pasture

(represented as: PW, BW and LW)(LIC, 2018).¹³ These modes of evaluation are connected to Economic Values (EVs) that estimate the value of certain productive/breeding traits to farmers based on aggregated market forecasts and cost/benefit analysis (LIC, 2018). Through farmer engagement with this technology, the cow is simultaneously enacted as a mechanised productive tool, but also as a profit-returning commodity, the ultimate profitability of which is objectively calculable.¹⁴

This digital cow presented by MINDA is a separate entity to that experienced in the interactive and communicative inter-species lifeworld of the material farm, however. While the objective value markers offered by this technology are considered useful by Kathy and Logan, their practical daily interactions with the herd constitute other modes of knowing and perceiving the cattle. A particular conversation with Kathy made me aware of this:

Kathy came home in the middle of the day after a busy morning assisting calving. She seemed a little stressed, with a lot on her mind. She sat down with a sandwich and brought out her mums' fruitcake and some tim-tams for me. We started talking about a cow that had just calved, number 6.

'I have to go out there again and check on her (the calf)- she'll be wanting a drink, but I don't think her mum's very interested in her,' she said.

'Is it her first baby?' I asked.

'Oh no, she's been here a while, this is probably her 6th year. She's a really good cow, actually.'

I laughed; 'maybe she thinks she's too old for this!'

'Yea well, she probably is!' said Kathy. She cringed, making this guilty, face that I was beginning to recognise- she made it every time our conversations hinted at the hard life of

¹³ **Production Worth**, or PW, is an estimate of a cow's lifetime production ability. It helps farmers identify the top performers in their herd, to decide which cows to keep, cull and assist in determining a value for buying or selling. Like cow BW, PW (and PVs) is also based on ancestry, individual and offspring records. Cows are given PVs for five individual traits: protein, fat, volume, liveweight, somatic cell count....

Breeding Worth, or BW, is the industry's national breeding objective, set by NZAEL. It estimates an animal's ability to breed profitable and efficient replacements...

Lactation Worth, or LW, ranks how profitable and efficient a cow will be within the current season only. A cow's LW combines her current-season producing ability for: protein, fat, milk volume, liveweight. LW is based on a cow's own herd test records as well as liveweight.' (LIC, 2018)

¹⁴ As is discussed later in this chapter, these indicators can be used to help farmers decide on which calves to keep as replacement, or alternatively which calves to send on the bobby truck.

cows. She pulled out her phone, opening up the MINDA app to check on the cow in question. 'Here she is, oh she's 10 years old,' she said. We went through her data, to surprising results. It turned out she had slipped last year, probably in June. She made it through the season without calving and spent the year out of the milking shed because she wasn't lactating.

'Some people would say it's really expensive, keeping them on the grass when she's not producing milk. She's a lucky one, she's lucky she's still here' said Kathy. 'Oh, she's got one daughter in the herd!', she continued. 'Wow, she's really lucky! Logan would have a fit if he knew this, he hates it when we keep cows that aren't doing us any good....you would say that she [number 6] has got issues calving. Usually we wouldn't keep one of her calves, even if it was a girl' ¹⁵

We continued looking at her stats. Her production and breeding worth were actually pretty low, Kathy murmured. After a while, Kathy exclaimed: 'well it's like me! I haven't had a baby. If I was a cow, I would have had my head cut off!'

In some ways, our conversation revealed the authoritative power of the MINDA app and the information it provides. Based on the objective value markers and breeding history accessed through the app, Kathy was open to accepting that her understanding of cow number 6 was mistaken. The 'digital cow' presented by MINDA is a cow who's continued place in the herd was now questionable, not to mention the place of her daughter. Kathy implied that if they been more judicious about checking statistics prior to the last insemination round, cow 6 might not have a life on the farm. The same can be said of the decision to keep cow number 6's calf; her mother's repeated pregnancy failures would have probably condemned her to the bobby truck.

On the other hand, the authority of the app is diminished when one considers that there is more than one 'cow number 6' in this story. The cow-as-subject is enacted through Kathy's affective reflections on her experiences with the cow. Evidently, within biopolitical systems, and weaved throughout the 'truth discourses' that maintain them, actors retain the freedom and agency to resist normative, scientific evaluations. Despite the potential condemnation of both cows suggested by the MINDA app, cow Number 6 remained alive and kicking on the farm. Indeed, she had managed to convince Kathy of her value through their shared, direct experiences.

¹⁵ Success at calving is largely considered to be a genetic attribute in the livestock improvement world, so, according to livestock improvement logic, it's ill-advised to keep the daughters of those who have problems calving in the herd.

While resources like the MINDA app are useful to farmers, this doesn't mean that they are always in use. Kathy would often make decisions about replacement calves on the fly, for example, based on an initial, material assessment and her familial knowledge of the mother. Our conversation revealed the ability of Kathy's experiential knowledge to overtake biopolitical 'truths', and her autonomy to relate to the cow, despite MINDA's utilitarian objectification of the animal. Michael Lambek refers to this state as 'underdeterminism' (2015, p. 2), denoting the limited freedoms of human actions from conforming to powerful external determining forces. When Kathy made the direct comparison between herself and the valuation of a cow's life based on successful pregnancy, she was embracing the irony of the situation, an irony which is conjured in logical incongruence of the simultaneously pragmatic, utilitarian, and empathetic relations that farmers develop with their livestock.

This example initiates a recurring theme throughout this thesis- that is, the friction between objective, transcendent and standardised ways of *knowing* the nonhuman other in farming, and the localised and tacit knowledges that are formed through experience. What I have termed the 'digital cow' represents an iteration of ideal model of farmer-livestock relations espoused by an industry body, informed by biopolitical logics. There are many different examples like this of abstracted ideals that are distilled, for example, in the publications and regulations of companies, government departments, NGOs and other organisations. These pedagogic and regulatory objects reflect prominent social and structural developments that influence agricultural practice and they entail the conditional enactment of livestock, with variances in political, social and commodity status. Their standardised content is abstracted from the lived experience of farming and can't account for the very local heterogeneity of actors at work or the ultimate subjective agency of farmers themselves.

Intrusive and unnatural: the many meanings of animal welfare

The morality system of welfare law

While an altogether different object to the resources provided by corporations like LIC, New Zealand's animal welfare law is also a transcendent body of standardised guidelines regarding human-livestock relations. The official codification of welfare law performs the social function of a 'morality system'. This concept, first introduced by philosopher Bernard Williams (1985) and subsequently expanded on by anthropologist Webb Keane (2016), refers to the transcendent, reified understandings of moral obligations and notions of 'right' and 'wrong' in a given society. Morality systems are constituted from the generalised collection of disparate moral sentiments and empowered through top-down enforcements of, rules, regulations, and in this case, formal law. As such, New Zealand's 1999 Animal Welfare Act represents the dominant, normalised, societally endorsed modes of relating to nonhuman animals. As this section will show, however, the normative principles of welfare law don't fully reflect the outlooks and ethically informed practices through which farmers practice their own ideals of human-livestock relations on a daily basis.

New Zealand's animal welfare law is a complex beast with a short history. Today, farmers must comply both to the general 1999 Animal Welfare Act (the Act), the Animal Welfare Care and Procedures Regulations (the Regulations) that took effect in October 2018, and the minimum standards set by the codes of welfare (the Codes). These vary in degree of specificity regarding the ideal treatment of animals at human hands, and corresponding scales of enforcement and penalties. The Act is a high-level, generic, whole-sector document that works to establish a scheme of preventing serious harm to animals. The Regulations, 'fill the gap between the Act and codes of welfare' (MPI, 2019a), detailing more specific procedures, regulations and penalties for practices that could engender low-to-moderate offenses if not followed. Unlike the Act and the Regulations, the Codes cannot be directly enforced or entail offences, rather, they recommend best practice and redirect farmers to legal regulations. Current reform to welfare regulations are informed by the National Animal Welfare Advisory Committee (NAWAC), who purport to employ cross-disciplinary scientific perspectives in providing information. Significantly, they emphasise animal sentience as a core consideration. The first point on its first page of the 2015 amendment to the Act declares the legislation's purpose:

to reform the law relating to the welfare of animals and the prevention of their ill-treatment; and, in particular,—
(i) to recognise that animals are sentient:

This condition reflects a general turn in both commercial and governmental attention to sentience as a chief concern in the primary industries. The formalisation of this trend is evidenced in the wording of the newly introduced Codes, with the Dairy Cattle Code of Welfare, emphasising farmers meet the ‘behavioural needs’ of livestock in order to practice good stockmanship (NAWAC, 2019).

The hegemonic model of human-animal relations carried through animal welfare law is not wholly uncontested. There exists a boundless diversity of opinions regarding animal welfare and animal rights, which have the potential to shift an ostensibly political issue into the ontological realm. The polar ends of the spectrum that underlines debates on animal welfare and animal rights are founded on opposing philosophical constructions of the nonhuman animal. By attributing political *rights* to animals, animal rights activists renounce the enclosure and exploitation of nonhuman bodies in anthropocentric enterprises like agriculture and science, as many of these practices are perceived to infringe on their rights (Kopnina, 2017; Taylor, 2004). This, arguably, represents an ontological re-configuration of the animal, a departure from humanist perspectives (R. Todd & Hynes, 2017). Animal welfare discourse, by contrast, does not oppose the dominant worldview behind animal use in agriculture and science, but rather tries to reform the practices involved to limit ‘harm’ or ‘suffering’. It fits neatly into the structures of capitalism through this reformist, rather than revolutionary, function (Buller & Roe, 2012; Taylor, 2004). Fisher and Mellor (2008, p. 101) surmise that: ‘notwithstanding the view from some groups, the common view, representing that of most members of society and the culmination of a long tradition of moral reflection, is that the use of animals is acceptable provided that the animals are treated humanely’.

So, animal welfare law is ontologically founded in the understanding of a feeling and perceiving animal, but one that it nonetheless commodified and constrained within anthropogenic systems like agriculture. Objects like New Zealand’s animal welfare act, therefore, implicitly support a hierarchical and humanist ontology behind ‘the dominant model of encountering the animal’ (R. Todd & Hynes, 2017, p. 731).

What I found interesting about animal welfare law was the general ambivalence with which my participants engaged with it. That’s not to suggest that they were opposed to its sentiments in ensuring livestock comfort and wellbeing—these were clearly primary concerns for Kathy and Logan. Yet the law itself didn’t make a dent in their practices, even with recent changes to

the codes. During my stay on the farm, we talked about some recent introductions to welfare regulations, including the prohibition of killing calves by blunt force trauma (since 2014), and the upcoming regulations requiring the use of anaesthetic when de-horning or disbudding cattle (commencing October 2019). Kathy and Logan were pleased about the introduction of these regulations, regarding them a long time in the making. This ambivalent relation to the regulation is demonstrative of the morality system's generic and largely uncontroversial overview of hegemonic moral outlooks and corresponding practices (Keane, 2016).

By contrast, Kathy and Logan exercised considerable agency in discerning and practicing their own animal welfare standards on their understandings of cattle wellbeing. This was demonstrated, for example, by their critical opinions of cattle synchronisation practices. Synchronisation refers to processes by which cattle oestrus systems are synchronised through the introduction of hormones, to assert more control over the timing of calving, and ensure greater calving successes.

Kathy and Logan aren't into injecting hormones to synchronise cows during mating season, because, they say, it's 'intrusive and unnatural'. Yet they also agreed that any dairy farm, including their own, is 'intrusive and unnatural'.

'I wouldn't want to be a cow', said Kathy.

- 5 August fieldnotes

I was intrigued as to how they had decided that this practice in particular was 'intrusive and unnatural', because from my perspective, it didn't too seem far removed from artificial insemination and other biological interventions that they *did* partake in. It was clear that Kathy and Logan were cognizant of this irony, as 'with the modern high yielding dairy cow it is hard to say where technology stops and the animal begins' (Driessen & Heutinck, 2014, p. 6). The impetus to maintain a semblance of 'naturalness' in agriculture is a common standing on which the industry is morally evaluated, especially in the context of the increasingly pervasive technologies that livestock bodies are subjected to (Boogaard et al., 2011; Driessen & Heutinck, 2014). The morally-laden terms 'natural' and 'unnatural', then, embody the compromises and ethical ambiguity inherent to a system that confines, manipulates and exploits nonhuman bodies, whilst maintaining the political and social status of these ensnared subjects, whose sentience the industry is expected to account for.

Bobby calves and ethical agency

Fiona, the farmhand who visited daily in the height of calving season to assist with calf care, spoke highly of Kathy's efforts to go 'bobby free' this year. She has a great affection for all of the calves she cares for, allocating the same dotting attention to each, whether they're bobbies, replacements or 'beefies' (Hereford-crosses). One day, as I was helping her with feeding the calves, we stopped to watch the older bobbies run around their pen in an endearingly clueless way (their physical ability and restlessness develops ahead of their grace and coordination). 'I reckon they're just the most beautiful, photogenic things', she said, 'how could you send them on the truck, when you see them like this?'



Figure 4: Bobby calves.

Bobby calves, a controversial bi-product of the dairy industry, are a particularly numerous problem in New Zealand. MPI defines bobby calves as 'calves surplus to farm requirements that are typically sent to slaughter aged between 4-14 days' (MPI, 2017a, p. 4). They are commonly understood to be the bulls born to a dairy cow, which are essentially useless in dairy production. This is a misconception, however, as bobby calves also include surplus heifers born of heifers, whose mother's lack of a milking history means the calf lacks the ancestry data that could indicate if she could be a valuable herd member. There is thus an evident connection

between the biopolitical epistemologies espoused by genetics companies like LIC and the classification of replacement vs. bobby calves. Logan even mused one day that improvements in insemination practices and increased access to ‘scientific’ information regarding cattle production values could be responsible for much of the increase over bobby numbers in recent decades. While there may be some weight to this hypothesis, the reason bobby calf numbers reached a peak of 2.2 million in 2016, is most accurately pinned to the fact that New Zealand’s dairy herd had grown by about 2.6 million cows since 1990 (MPI, 2017a; Thomson, 2018). Their increase in number is therefore inexorably linked to advancements in dairying technology and the massive growth of the industry that occurred following its centralisation. Their prevalence in New Zealand specifically is due to our seasonal calving practice, which is planned based on seasonal pasture growth and supply. As a result, there is a very short period of calving over about two months in July-September every year, during which millions of calves are born, initiating the milking season. Quite simply, there is not enough land or pasture to rear this incredible yearly influx in its totality (Thomson, 2018).

It is possible that the spatially and professionally compartmentalised model of the New Zealand dairy industry sustained New Zealand’s high bobby calf numbers for many years. Whilst strict welfare guidelines regarding bobby treatment have been released in recent years, the bobby’s necessity to New Zealand’s industrial dairying model remains. The violence of the industry is systematically concealed through a division of labour, and mechanisms by which consciousness- or sight- are obscured (Pachirat, 2011). Modernisation has seen agriculture develop a specialised and compartmentalised system of responsibilities, and for example the killing of livestock often has its’ own specialised realm, mentally and geographically distant from the farm, (Wilkie, 2010) (hence the collection of bobby calves by the truck-load). Structural elements like this are supported by industry jargon. Euphemistic phrases, such as the term ‘slink’ animals to describe on-farm causalities, terms like ‘culling’ rather than ‘killing’, and the effective de-animation achieved in the naming of products like *beef* and *pork*, support the veiling of industrial violence (Shukin, 2009). These features of the industry encourage a sense of detachment, allowing for a feeling of ethical coherence for those who work with them.

In recent years, this system of veiling has been compromised by activism and critical media releases. For example, in 2015 the animal rights organisation SAFE for animals (SAFE), released undercover video footage of the mistreatment of bobbies during collection and transportation, which initiated public outrage and government investigation (Tulloch & Judge, 2018). Their campaign demonstrated the role of ‘consciousness raising’ in evolving public

perceptions of issues, which in turn can influence historic ethical and moral development, and ultimately morality systems (Keane, 2016). In this context, consciousness-raising has capitalised on a human tendency to empathise with nonhuman animals when they bear witness to their shared subjectivities. By presenting confrontational images of the individual animal subject to systemic violence, particularly ‘the eyes, or that cognitive control centre we might call the face—if we accept that anthropomorphism’ (Buller, 2013, p. 158), activists deploy a ‘politics of sight’, ‘whereby the repugnant is made visible’ (Pachirat, 2011; Tulloch & Judge, 2018, p. 18). Much of the resultant public condemnation was directed at the poor treatment of the calves that tends to occur on the trucks that transport them to the meat works. The incongruence of the bobby industry and consumer interests has led to government-led efforts to improve bobby welfare, farmer-led efforts, like Kathy’s, to reduce bobby numbers. This corroborates the fact that the consumer economy enforces an important determinant for farming’s ‘social license’: welfare practices themselves, and not just the products, must be commodifiable (Buller & Roe, 2012).

Kathy and Fiona’s own aversion to the bobby calf industry is founded in similar outlooks to those generated through consciousness-raising efforts. SAFE’s campaigns are formatted on eliciting, from the audience, the attribution of subjectivity to the nonhuman animal. Kathy and Fiona, on the other hand, spend hours a day interacting with calves, caring for them. As I describe in chapter 4, caring for calves is a job that relies heavily on the ‘arts of attentiveness’ (van Dooren, Kirksey, & Münster, 2016) inherent to stockmanship; affective, embodied and responsive modes of relating to livestock, a form of knowledge-practice that demands that attribution of, and familiarity with, animal subjectivity (Wilkie, 2010). Through these intimate engagements with these animals, farmers are likely to perceive and encounter bobbies as cute, innocent, vulnerable and feeling subjects, a perception that sometimes uncomfortably accompanies their status as commodities.

This attribution of subjectivity to bobby calves, and public disdain for the bobby calf industry, can be understood as ethical ‘affordances’ from which potential courses of action is assessed. Keane argues that ethical evaluation rests on the affordances of a given situation to a given person- this means that ethical decisions are influenced by the referential resources available to the actor (Keane, 2016, pp. 27, 28). While social concerns are mounting, there are also increasing industry-internal resources available to curtail bobby cow numbers. Reducing bobby numbers has been a priority of Kathy’s for a long time; she had bred many of her heifers with Hereford bulls for years, so that the bulls could be reared as beef cattle. 2019 was her first year

experimenting with Wagyu straws in addition to Hereford for this purpose, involving a partnership with the emergent grass-fed Wagyu beef company Firstlight. Finally, she and Fiona had succeeded in finding a hobby farm owner to buy and rear the remaining dairy bobbies, which she estimated to number about 50. This industrial level of autonomy exercised against questionable industry norms, at great time and effort for Kathy, demonstrates the extent to which farmers develop their own mode of perceiving livestock and practice their own iterations of ‘welfare’ beyond the reified principles contained in morality systems. These subversions emerge in moments like Kathy and Logan’s disdain for oestrus synchronisation, or in concerted efforts like going bobby free.

Conclusion

It was an odd sight, seeing another herd pass through Kathy and Logan’s farm. A neighbouring farmer had needed to shift his stock across the property to get to a another property on the other side. Kathy and Logan had given him the go-ahead, to save him the trouble of shifting using the public roads, so a group of about fifty cows passed through. The cows looked different to Kathy’s, a lot thinner, and a more unison tan colour. The farmer himself was a big guy, driving through in his truck and getting out occasionally to shift a gate.

‘Gosh, his cows are looking really skinny. Look at those bones,’ said Kathy.

‘Doesn’t look like he’s scrimped on feeding himself, though!’ Logan laughed, although his disapproval regarding his care for the animals was as apparent as Kathy’s.

Farming’s ‘social license’ is a term that connotes the visible and public place of a business which in day-to-day practice is largely covert and removed from the public eye. This chapter has shown examples of how broader factors, in the industrial realm, in law, and in public opinions on farming, are important influences on farmer-livestock relations. As I have shown throughout this chapter, these standards are consistently changing in response to social, economic and technological developments. The vignette above, detailing Kathy and Logan’s disappointment in a farmers’ treatment of his stock, reveals a tendency for farmers to be critical of their peers, and the variety of standards of treatment within the industry as well. Farmers adapt to changing standards at their own pace, and as this chapter has shown, the competing demands—between keeping up with a competitive industry, and upholding farming’s ‘social license’, means that the ideal standards of farmer-nonhuman relations are largely subject to individual interpretation and enactment.

This chapter has provided a discussion on the purportedly objective truths offered through institutions that emerge as prevalent to New Zealand dairy's current historical moment. I have argued that different formal institutions, here represented by LIC and the animal welfare law (as a proxy for centralised agricultural governance), espouse different ideal relations between farmers and livestock, and different perceptions of cattle, based on their ultimate purposes. LIC serves an aim of increasing the productive and breeding capabilities of the national herd to strengthen New Zealand's hold in the international dairy market, and presents a value-based, economic image of livestock to farmers. It's common for farmers to subjectify both themselves and their cattle to the interventional strategies espoused by companies like LIC, thereby embroiling themselves in this biopolitical system. Animal welfare law, by contrast, emphasises dairy farmers' accountability to their livestock as sentient creatures, but only to the extent that the regulations it espouses fit neatly into model of the Dairy Industry. Implicitly, animal welfare law reinforces the dominant, anthropocentric enactment of livestock as possessable and killable objects, within the bounds of 'acceptable' human-animal relations.

As this chapter has shown, however, there are tensions and multiplicity in the daily practices of farming that these generic objects can't capture. Every day, farmers are immersed active practical engagements with the nonhuman world. In practice, external factors like governmental regulations and industry resources, and public opinions of farming act as factors among many in the work completed in the heterogenous lifeworld of the farm. The tacit, affective and relational forms of knowledges that are constituted through practical engagement with the nonhuman on farm come up against these external influences to conjure multiple realities of farmer-nonhuman relations.

Chapter three: The material farm

following the vital agents in milk production

Kathy turned to look at me, the Spring Rotation Planner laid out on the table in front of us. She had just finished explaining the intricacies of the sheet; the rotation lengths, mob allocation, growth rates, pasture intake, and balance dates. The planner claims to ‘take the guesswork out of grazing’ but most of it went over my head, or entered in a destructive and chaotic way, threatening to undermine everything I thought I had learned about farming. I had this feeling almost daily during fieldwork.

‘There’s so much you have to think about all the time!’ I said, ‘all these different aspects to farming!’

I was overwhelmed by the volume of new information I was trying desperately to absorb, to be on the same page as the farmers, to get the fundamentals out of the way so I could focus on their relations with livestock. I soon realised that this would be near impossible, because the farmers’ relations to their livestock were rarely isolated from their holistic understanding of the farm as a whole, and all of the lively agents it encompasses.

‘I know, there’s so much. Sometimes, I think my head’s going to explode,’ said Kathy.

Producing milk is no easy feat. The proteinous substance is formed through a complex history of material assemblages, the networks of which sprawl out in the meetings of molecular-scale agents and the interactions of organisms. During my fieldwork I came to understand the farm more as an ecology than an impassive piece of property; an ecology not limited to ‘natural’ biotic and abiotic agents, but inclusive of farmers and anthropogenic infrastructure as well. The farm is alive, and the work of farming is immediate and responsive to this liveliness.

This is the crux of agriculture as an industry founded on the commodification of organic materials. The life of the commodities, and the activity of the agricultural setting, are what generates their value (Collard & Dempsey, 2013), but these conditions also constantly pose a threat to human control. DairyNZ’s Spring Rotation Planner, identified in the short vignette above, is a guiding object for New Zealand dairy farmers that rationalises and ‘purifies’ (Latour, 1993) pasture production, providing advice on pasture growth based on seasonal climatic changes, and yearly calving patterns. It distils heterogenous processes into a simplified

and universalistic tool that can be used to determine rates of pasture allocation to ensure continued supply before the balance date.¹⁶ While the planner itself allows for personalisation, as farmers can enter data pertaining to their own farm, the calculation it offers is standardised. In the day-to-day practice of farming, however, farmers practice other modes of knowing their lively surrounds, developed in correspondence (Ingold, 2013) with the farm's lively activity. Compared to the predictive logic of the Spring Rotation Planner, knowledge co-constituted in correspondence with the farm-ecology are holistic, tacit, embodied, and subject to the agency of the material world.

This chapter tells the story of milk production on the farm, from its genesis in the soil, through the growth of ryegrass and the bodies of cattle, to the milking shed and its retrieval by milk tanker. This story is told through a more-than-human lens that attends to some of the countless material correspondences on which the dairy industry is founded. These range from the molecular relations occurring within, and between, soil and pasture, to cattle metabolisms and the bacterium in milk, to the influences of abiotic forces like weather, and anthropogenic factors like farm infrastructure and human intervention. The previous chapter introduced a functional dichotomy between historically produced *social objects* that comprise transcendent, and universalistic models of farming practice (represented by LIC's genomic science-based resources and animal welfare law), and the lived complexity of farming in a landscape that comprises a complex, moving assembly of heterogenous agents. This chapter explores the second half of that dichotomy in more detail to understand how the production, extraction and commodification of milk is achieved in practice.

This chapter aims to understand how the farmer, as an 'inhabitant' (Ingold, 2007a) of the farm-ecology interacts with heterogenous agents to achieve desired ends. Ingold (2007b) writes that human engagement with the material world is not concerned solely with inert, sealed objects, but with 'currents of the lifeworld' (p.1). Within this lifeworld is activity between living beings, but also between mediums, things, inert objects and so on. In this context, we can understand the farmer as an 'inhabitant' of an almost-wild world, participating in milk 'production' as '*a process of correspondence: not the imposition of preconceived form on raw material substance, but the drawing out or bringing forth of potentials immanent in a world of*

¹⁶ Balance date is the date that pasture growth rate meets cattle feed demand. Pasture growth starts to increase through spring but coming out of winter the feed demand still outweighs the pasture supply. For this reason, it's important for farmers to record pasture growth rates and ration their pastures prior to the balance date.

becoming' (Ingold, 2013, p. 31). This perspective highlights the precarity of farming as a profession that is intimately entangled in, and subject to, the activity of the nonhuman world.

This chapter continues the assertion that farmer relations to the nonhuman world are complex, multiple, and conditionally determined. The episodes that feature here as part of milk's material lineage showcase the destructive and creative potentials of just some of the materials involved in milk production. Farm design, management, and planning tools like those provided by LIC are here shown to represent a 'dream of control' (Singleton, 2010) or the 'imposition of preconceived form' (Ingold, 2013, p. 31), in the practices of apprehending, manipulating, and commodifying the nonhuman. The conditional awareness and acute responsiveness to the activity occurring around them shows that farmer ontologies accounts for the diverse networks of animated, nonhuman materials and lively beings. While acknowledging the inevitably unequal interspecies power structures that are enacted throughout farm management, design, and practice, this chapter moves past structural understandings of these relations, and looks into the minutiae of practice, informed by the argument that ontology itself is not imposed, or structural, but, rather, comes out in practice (A. Mol, 2002). By equalizing the playing field of human and nonhuman agents, this chapter explores more-than-human relationality to emphasise the co-constitution of earthly life and problematise notions of human exceptionalism (Tsing 2012).

Soil and rain

A little over a week on farm, and my attention turns to the weather. It's been really rainy these past few days. The gashes that have been worn into the concrete races over time are filling with muddy water. I'm spending a lot of time inside, with the cats and the fireplace. The farmers come and go, bringing the elements with them on their dirty, sodden overalls.

Last night after dinner, Logan stood at the kitchen sink, looking out the window into the darkness outside. 'God, listen to it', he said, as the rain pounded on the roof, 'actually, you're not supposed to listen to it, it'll drive you insane'.

I laughed and mused aloud on his farmer-specific reaction; 'most people think rain on the roof is calming!'

'Well I guess it depends on the season. In summer, you'd be dancing in the rain', he responded.

Now, in August, rain means stress. It's not just my personal adversity to the foul weather keeping me indoors. The tension is palpable, and in spite of how hospitable they have been, I don't want to burden the farmers with the added hassle of accommodating my repetitive questions. I did join Kathy for a couple of hours today, however, donning waterproof pants over my coveralls, and trudging up and down muddy paddocks. Every activity is made that much more difficult by the rain. It weighs on the clothes, the paddocks are much harder to walk through, communication is strained. The muddy conditions have been exacerbated by the tread of cow hooves as they push up against the edges of the paddocks in an attempt to escape the downpour.

-Fieldnotes, August 2019



Figure 2: Paddocks following rain and cow hooves.

Cultivating underground ecosystems

During fieldwork, soil came across as the initial point of farmer engagement with the nonhuman world. Its foundational significance to the farming operation was evident in our discussions about the poor weather and the stress that any resultant soil damage could cause.

From a linear, humanist perspective, it's easy to consider soil as a starting point for all life as we know it; etymologically speaking, the term 'culture' itself traces back to the cultivation of soil and crop-raising (Minami, 2009, p. 604). A history of pre-and post-industrial human engagement with soil has led to global impacts to the pedosphere, manifest in erosion, compaction, and contamination, for example. Today, human activity is estimated to have impacted over half of the world's land, with over half of the soil suitable for agricultural cultivation already in use for that purpose (Hooke, Martín-Duque, & Pedraza, 2012). 'Global soil change indicates how the Earth as a natural planet is transitioning to a human-natural system' writes pedologist Daniel Richter, (2015, p. 7), arguing that soil conditions are a key indicator of the extent of anthropogenic changes in the geological epoch of the Anthropocene.

Human-soil relations in agriculture bear unsettling disruptive potentials. During the early twentieth century, New Zealand soils were pushed to their ecological limits by the impacts of human-induced erosion and fertility decline through processes of deforestation, brush clearing and rabbit infestation (Brooking & Wood, 2013; Roche, 1997). Government-lead conservation activity was initiated, but production declined as a result of these developments. With the ready availability of pilots and aircrafts following World War II, a new practice of superphosphate fertiliser application by aerial topdressing revived the industry, increasing the fertility of soils (Brooking & Wood, 2013). However, the extraction of the minerals for superphosphate eventually destroyed whole islands in the Pacific, (Teaiwa, 2015) as is detailed in the 'pasture' section of this chapter. This exemplifies the precarity of the co-constitutive histories and futures between humanity and soil, and the potential to understand the global interconnectedness of social groups and environments through a focus on soil (Minami, 2009; Richter et al., 2015; Teaiwa, 2015).

My participants' engagements with the soil demonstrated a circumstance-dependent relationality with the material. In normal daily practice, as a constituent of the embodied experience of being on the farm, soil is walked on and around, experienced as a sealed and singular material object. In this state, it rarely enters human consciousness. In other moments, my participants would exhibit intimate understanding of soil's complex microbial composition and how it interacts with other material and living agents on the farm. Their yearly plan for the farm is modelled on predicted rates of pasture growth, which waxes and wanes with gradual changes in soil temperature. I was told, for example, that you'd get the 'best bang for your

buck' putting out fertiliser when the ground read between '12 to 14 degrees', which could be gauged by plugging in a ground thermometer, or just eyeing the rate of pasture growth.

At other points, when the work called for it, the farmers evidently thought of soil as an ecosystem. Whether consciously or not, their concerns about pugging, compaction and water-logged soils spoke to the essential, infinitesimal underground agents 'working' to generate commodity value in the chain of material correspondence resulting in milk production. Soil is a varied composite of myriad mineral and microbial elements, which form synergetic relationships with the plants that take root in it, and the arthropods and other animals that burrow through it. To illustrate these symbiotic networks; organisms that live in the soil (including arbuscular mycorrhizal fungi, bacteria,¹⁷ worms and protozoa,) produce glomalin,¹⁸ polysaccharides,¹⁹ organic acids, and amino acids in the soil, which combine with exudates released by plant roots (Havlicek & Mitchell, 2014). This results in the aggregation of soil clusters, between which are open pore spaces essential for water infiltration and habitation by soil-dwelling organisms like arthropods, earthworms and microbes that feed on living and dead plant matter (Havlicek & Mitchell, 2014). The relationship between plants and soil is thus mutually beneficial (Winger, Jon Stika, & Tilley, n.d.). Logan pointed out the advantage of their rotational grazing method of pasture management; because the grass isn't completely uprooted in this method, this symbiotic relationship is maintained year-round. This compares to cropping, which removes the plant in its entirety and can potentially hinder soil fertility.

The dangers in the ground

Manifest in farmer-soil relations is the tenuous precarity of farming, due to its dependence on unruly materials and heterogenous agents in the production of agricultural commodities. As I accompanied Kathy and Logan on farm, they'd often make the effort to point out 'ruined' paddocks to me. These patches of bald, trodden mud were examples of soil compaction and pugging, which occur under moist and saturated soil conditions respectively (Faulkner & Parkes, 2013). It would most often materialise at the gates of paddocks, or where the ground naturally dipped. Kathy and Logan's land is particularly at risk as their soil type is low-

¹⁷ Rhizobia are a kind of bacteria that attach to the roots of legumes like clover- these bacteria are necessary for nitrogen fixation (conversion into ammonia) for use by plants.

¹⁸ Glomalin is a glycoprotein produced abundantly on hyphae and spores of arbuscular mycorrhizal (AM) fungi in soil and in roots.

¹⁹ long chains of carbohydrate molecules, specifically polymeric carbohydrates composed of monosaccharide units bound together by glycosidic linkages. This carbohydrate can react with water (hydrolysis) using amylase enzymes as catalyst, which produces constituent sugars (monosaccharides, or oligosaccharides).

infiltration, prone to pooling water rather than allowing it to drain through easily. Such damage threatens pasture production and nitrogen fixation by clover, and increases runoff, causing soil loss and the release of sediment, nitrogen and phosphorus to waterways (Faulkner & Parkes, 2013).

This is a hefty potential consequence, both emotionally and economically. One day, Kathy and Fiona were talking about a spring a couple of years prior that had been so relentlessly rainy that they both had to feed their livestock from hay and baleage for weeks, an extremely expensive last resort. It was ‘crying material’, they said, and they had nowhere to put their cows without causing damage to their plots. Kathy told me that her paddock number 12, off the driveway at the entrance to the farm, was still ‘smashed’ from that spring, unused and in the slow process of recovery. The cows had been stuck out there in the mud, up to their knees. Their herd behaviour had exacerbated the muddy conditions, as they tend to crowd together, often at the edges of the paddocks, during periods of rain, churning up pasture and compacting soil.

In turn, ill-managed soil can threaten cattle bodies, requiring immediate responsive attention and care on the farmers’ part. The dangers of winter grazing were brought to national attention in July-August of 2019, when drone footage was released of cattle in the South Island, covered in mud, with no pasture around to graze on, and in some cases giving birth in these conditions (Taunton, 2019). Their farmers were strip-feeding crops, a process by which cattle are kept in a restricted plot at high density, and not moved till the section is fully eaten (MPI, 2019b). The practice is intended to preserve rye pastures over the winter/spring season, when restricted daylight and cooler temperatures limit pasture growth (MPI, 2019b). When not managed properly, cropping can result in completely churned-up, muddy paddocks, as the cropped land compromises the integrity of the soil structures. These conditions, Kathy and Logan told me, can have extremely negative impacts on cattle wellbeing, with some believing it increases the risk of illness or lameness, due primarily to exhaustion, wetness, and lack of access to food.

Kathy and Logan demonstrated a keen, almost subconscious awareness of the networked interactions between cattle bodies, wet conditions, and the build-up of mud around the farm. They don’t usually practice cropping and would often voice their relief at the fact that they had a wintering shed to house their cattle during periods of rain. As we walked around on the concrete runs between paddocks, they would stoop to pick up rocks on the hard ground and

throw them away from the hard walkway and into the paddocks. When I asked why, they told me the wet conditions caused the cows' feet to get soft and covered in mud. Like 'meat dipped in egg, and then dipped in breadcrumbs', their soft, wet hooves would pick up the stones from the ground, and they could go lame as a result. The habitual, near unconscious practice of removing these pebble-threats demonstrates how 'arts of attentiveness'(van Dooren et al., 2016), embodied in the responsive and caring practices that account for the subjectivities and agency of nonhuman beings, are essential farming knowledge-practices developed in correspondence with these lively networks of materials.

It's clear, then, that what we call 'soil' is in fact multifarious -not only taxonomically, but also in its potential to act, and its shifting subject-object relations with farmers, livestock and the many other agents with which it interacts on the farm. Given the circumstance, farmers exercise a tacit knowledge of the essential microbial composition of soil and its role in pasture growth. This knowledge emerges in emotions, stress, but also in management and planning. In applying nitrogen and phosphorus fertiliser, for example, farmers are performing singular delegated activities that respond to the relations within the soilscape and with the plants it hosts. At other times, soil interacts with humans and other on-farm agents as a threat, or merely as the solid ground on which they walk. The object of soil is thus multiple (A. Mol, 2002), drawn into various realities in practice. The implication of this understanding is a recognition of humans as material agents among many. They exercise a prevailing agency that is legitimated and empowered through the structures of industrial capitalism, but their agency is still subject to, and shaped by, external nonhuman forces (Ingold, 2007b, 2012).

Pasture

Perennial Ryegrass: A Colonial Plant

In New Zealand, the agricultural ubiquity of ryegrass is a material contrivance of colonisation. The landscape and flora of the Rangitikei is much changed with human settlement, but most dramatically following European arrival. Once a heavily forested region, the majority flora of Rangitikei is now the exotic ryegrass and clover pastures that sustain its agricultural economy. The rich soils that previously sustained indigenous podocarp-hardwood and beech forests (among other trees) were considered ideal for establishing farmland (Department of Conservation, 2015; McEwen, 1987). As a result, few areas of indigenous vegetation remain in the Rangitikei, and ryegrass expands in all directions. Ryegrass embodies industrial 'naturecultures' (Haraway, 2003). Its presence is both outcome and tool of colonisation, as

both a natural and social process, yet it exercises an organic agency in its growth and interactions with the materials around it. Its' impact is unextractable, it is now *of* New Zealand's physical and cultural environment. The trees that feature on Kathy and Logan's farm are likewise exotic; a tall collection of swaying eucalyptus trees at the back of the farm provides a sweet-smelling section of shade for the cattle, and some of the paddocks are lined with conifers like macrocarpa.

It is important to acknowledge that the exotic pastures that carry New Zealand's agricultural industry rely on imported mineral fertilisers like phosphate and nitrogen, which implicate networks of global neo-colonial relations. Katerina Teaiwa (2015) has written a comprehensive account of the social, economic and environmental impact of phosphorus mining in the Islands of Kiribati. While these minerals are imported globally, the extraction of phosphate from these islands was critical in the development of New Zealand's' agricultural economy. Aerial top-dressing of the substance countered low-phosphate levels in the soil, and lead to New Zealand's 'second grasslands revolution' in the mid twentieth century (Brooking, 2006). Extraction continued through the 1970s, with globalising markets sustaining neo-colonial relations of resource exploitation that resulted in the ecological devastation of the islands of Nauru and Banaba and relocation of the majority of indigenous inhabitants (Teaiwa, 2015). In New Zealand, the use of phosphate (and nitrogen) fertiliser has also been shown to result in increased algal and underwater plant growth which can choke and stagnate waterways and threaten their ecologies (Foote et al., 2015, p. 714). The single material of phosphate thus exemplifies the 'multi-sited, multiscalar and multivocal' (Teaiwa, 2015, p. 3) networks of economical-colonial relations that are implicated in New Zealand agriculture, and the resultant inequal distribution of benefits and negative implications for both humans and nonhumans.

Pasture Management, a pride of New Zealand agriculture

A dairy farm in New Zealand is almost equally a pasture farm, and the growth and management of pastures is a critical knowledge-practice to hone. There's a certain pride in the ubiquity of grass-fed dairy in New Zealand²⁰ and the ryegrass lifecycle has been pivotal in the development of the country's dairy farm management. Logan told me all about it on the evening of my first day on the farm, as we were shifted the colostrums to their paddock in the north-west of the

²⁰ Fonterra's website, for example, reads: 'In New Zealand, we farm the way nature intended, with our cows naturally grazing on pasture. Grass is a natural food source for cows, and New Zealand is one of the few places in the world where cows can graze on grass, year round' (Fonterra Co-operative Group, 2020).

property. Perennial ryegrass lives for about a year, he told me, and each tiller only ever supports three live leaves, only one of which may grow at a time. Once it ‘throws’ its third leaf, the first dies, in order for a new leaf to emerge. Live leaves are significantly more nutritious than dead leaves, and farmers will ideally graze their cattle on a paddock of ryegrass just before the third leaf is thrown, to maximise on the nutritional value of the plant and to ensure its recovery over time. The growth rates of pasture are impacted by climate and soil temperature, and the pasture grazing rates and nutrient requirements are subject to changes in cattle states, whether they are dry or lactating, for example (DairyNZ, 2015b).

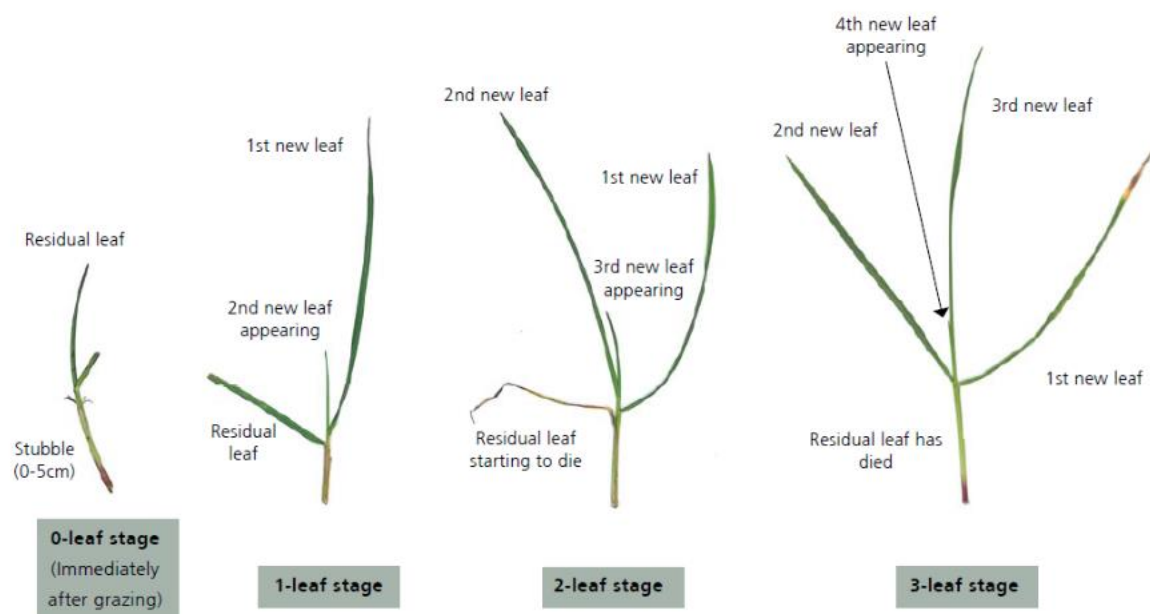


Figure 3: Ryegrass leaf stages. (DairyNZ, 2016b)

I asked Logan, who is particularly passionate about pasture management, how he went about allocating a new break to a mob. His approach is measured, scientific, and mainly informed by those removed and universalistic resources provided by organisations like DairyNZ—examples of the objective texts explored in chapter 2. After providing his brief exposition on the lifecycle of the ryegrass plant, he talked about the standard measure of dry matter eaten by the cattle a day (18 kilos). Based on the length of the grass in this paddock (from which he could estimate the amount of dry matter/meter), these colostrums would require 80 square meters a day each to meet that need, he said. Using his gait as an approximate measure for a meter, he paced out 800 square metres for the 20 cattle overnight (the next day, he would shift them to another 800 sq. metres). Together, we punched a row of standards into the ground and

strung an electric fence wire through them. When it was hooked up, we unhooked the previous wire fence to let the mob through.

He started talking about the ‘Spring Rotation Planner’, which, as explained previously, is a tool provided by DairyNZ that farmers can use to manage their rotational grazing during calving to ensure adequate pasture cover for the following months. The resource is freely downloadable in a print-out, or Excel spreadsheet form, and it allows farmers to enter information about their farm size, stock numbers, and grazing rates throughout the season. Using the planner, the farmer can calculate efficient pasture management to ensure pasture recovery in line with both rotation length²¹ and cattle nutrition needs. The ideal practice allows for maximum extraction of dry matter from pastures with the assurance of timely regeneration.

Logan and Kathy take some guidance from the planner, he said, but their personal experience has shown that strict adherence can be overly frugal with the pasture, resulting in surplus. They take its advice with a grain of salt, saying that the cows ‘tell them’ whether they’ve over-or-under fed them, based on how much they’ve left in the paddock when it comes time to shift them. Logan compared his by-the book, scientific approach to pasture management, to Kathy’s much more tacit approach:

‘Kath- it pisses me off, cos she’s actually pretty bloody good at it. I get out there, and I pace, and I get my app out, cos I’ve got this- kinda, black and white kind of science mind, and - she just walks out there and is like oh, yeah well just put it (the electric fence) here- and most of the time, it’s kind of ok’

The Spring Rotation Planner, and all standardised resources advising farmer activity, are manifestations of agriculture’s ‘control dream’ (Singleton, 2010). This concept was coined by sociologist Vicky Singleton to describe the United Kingdom’s Cattle Tracing System (CTS), a government initiative to limit the spread of cattle disease between farms (Singleton, 2010). The CTS imposed standardised procedures of tagging, record keeping and logging cattle movements. Singleton found, however, that the on-the-ground reality of CTS implementation proved to be inconsistent and troubling for many farmers. Their tacit approaches to stockmanship, and their fluid, responsive practices of care, were often contradicted or compromised by the rigidity of the government-decreed CTS routines (Singleton, 2010). The agency of the cattle themselves also defied the intended function of these regulations. The

²¹ Rotation length refers to the number of days between grazing for a plot of grass.

scope of the control dream is ultimately limited by its ability to account for the local conditions of implementation, or the heterogeneity of actors at work on a single farm. This friction, between dream and reality, speaks to the premise of Latour's (1993) seminal work in which he identifies the dream (or illusion) of modernity, which lies in the 'purification' of hybridised networks of agents (1993, p. 11) into strict domains, nature and science, for example, are separate from the social and politics. The networked, and subjectively informed practice of farming, almost social in its slow-developed familiarity of heterogenous landscapes, fits awkwardly into this dichotomy.

This type of friction, between standardised guidelines and regulations and implementation is evident across farming practice, and when considered through the lens of material engagement, this friction accounts for the unruly heterogeneity of the localised farm-ecology. This fact isn't controversial; through my research it seemed generally, if not formally, understood among agriculturalists that the generic methods of management espoused by centralised agencies like DairyNZ are insufficient alone, and are best implemented cautiously, in conversation with the local knowledges and understanding of materials underfoot and in the environment. Another factor influencing pasture growth, for example, are the cattle themselves. Their taste (a preference for the ryegrass leaves over the stems), and their tendency to destroy wet pastures—these factors can have a significant influence on the life-story and vitality of pastures. Recognising these factors, and the lively, unruly qualities of the materials involved, is a particular, co-constituted form of knowledge developed through an intimate inhabitation of this material world (Ingold, 2013). In these circumstances, any notion of the absolute sovereignty humans exercise over their 'property' wanes in legitimacy. As rye-grass tells, in practice, control of organic organisms is most successfully exercised through the responsive and attentive practices of *care*, the 'tinkering' nature of which allows for the influence of the nonhuman and unruly occurrences (A. M. Mol, Ingunn & Pols, 2010; Singleton & Law, 2013).

Productive bodies

The cattle wrap their long tongues around the ryegrass, twisting it into a ropey grip to tug it free of the earth. The grazing is near-constant, particularly among the milking herd. Sometimes even those who have just calved, and those whose calves we are taking from them, are preoccupied by the abundance of grass that they are offered in their exclusive calving paddock, or the paddocks we pass as we lead them to the colostrum paddock.

'Wow, they love grass, don't they?' I commented naïvely one day. In response, Kathy explained that the calving process is exhausting, and they may not have eaten in a really long time.

Feeding and supplementation

Ideally, grass-fed dairy cattle get almost all their sustenance from ryegrass. Through photosynthesis, involving engagement with biotic (microbial) and abiotic (weather and light) forces in the environment, ryegrass produces glyceraldehyde 3-phosphate (G3P). G3P can then be converted to carbohydrates such as glucose, cellulose or starch, which are essential for milk production (DairyNZ, 2019a). Ryegrass also contains proteins and fibre, which play roles in functions like cattle growth, lactation, reproduction, and stimulating rumination activity (Sherwood, Hillar, & Yancey, 2005, pp. 661-666). The cattle's complex ruminant digestive system is a requisite for the high, tough fibre content of the pasture. A ruminants' stomach is divided into four compartments; the rumen and reticulum (which primarily break down the food with microbes), omasum and the abomasum (which primarily digest the food)(Sherwood et al., 2005, pp. 661-666).

Micro-processes in agriculture like pasture ingestion and rumination weave their way into farmer consciousness and extend networks of material engagement beyond a linear tract of nutrients from soil to milk. Chewing cud, an essential process in ruminant digestion and milk production, is an example of this. After feed has passed through the rumen and reticulum and has been partially broken down, it is sent back to the mouth for a second time as cud (Sherwood et al., 2005, pp. 662-664). Cattle chew cud forty to sixty times before passing it back through the final two stomachs, where enzymes act upon it and it is ready to be absorbed as nutrients for the cow, or else converted into milk (Sherwood et al., 2005, pp. 662-664). Chewing the cud is thus an important aspect of a milking cows' daily habits as their bodies are employed in milk production. As we rode through the paddocks on the four-wheeler together one day, Kathy pointed out a group of milkers who were lying down in the sun, their mouths active, slowly moving side to side. 'This is the sight you like to see,' she said, 'when they're past calving, they're relaxed, and they can chew their cud.' She told me that once the nervous and unsure heifers got used to milking, they'd start chewing their cud in the milking shed along with the other cows. This told Kathy that the cows found it an enjoyable, relaxing experience, and observing this is correspondingly rewarding and relaxing for Kathy.

Regardless of the milking herd's apparent 'relaxation', the process of making milk, and having it extracted daily, takes a lot of work from a cow's metabolism, requiring regular supplementation. The toll of milking is evidenced in the sauntering gait and slow demeanour of the milking herd, compared to the lively and impatient activity of the dry herd. Mineral deficiency is a more serious potential of the milking herd's lifestyle. Cattle expend magnesium, for example, in lactation, and their bodies don't store reserves of the micromineral (DairyNZ, 2017). Deficiency occurs when dietary intake fails to replenish expenditure, and this can cause hypomagnesaemia, or grass staggers, particularly in high-producing cows (DairyNZ, 2020).

Like many on-farm practices, supplementation is practiced through 'tinkering'; a form of 'experimental care that responds to the contingencies at hand' (A. M. Mol, Ingunn & Pols, 2010, p. 13). Some supplementation is generalised and pre-emptive; magnesium, for example, is piped into water troughs across the farm, to be ingested when the cattle drink. Sometimes supplementation is more responsive and unmeasured. Kathy would often return to the house rubbing her hair and face, complaining of a dryness from her exposure to the magnesium and calcium powders she scatters through pasture and hay, in generous, indefinite quantities. The substance is so fine, it billows up around in dusty clouds. She doesn't usually distribute like this; but because it's wetter during the spring season, the cattle don't drink as much water, so they are likely lacking the magnesium provided through the troughs. Distributing magnesium through food encourages consumption despite its 'yucky' taste, said Kathy. She laments the wastage, but told me they won't eat it straight.



Figure 4: Kathy distributing magnesium in the grass.

Supplementation is particularly critical during calving season, as the sudden colostrum production and exhaustion from calving can drain calcium stores from the blood without sufficient replacement. This condition, known as ‘milk fever’ or hypocalcaemia, is also affected by magnesium deficiency as magnesium is necessary for cattle to produce the hormones that allow for calcium absorption from the gut and calcium mobilisation from bones (DairyNZ, 2019b).

I witnessed the effects of hypocalcaemia on my first evening on the farm, when Kathy pointed out a large Friesian²² cow sitting dormant and alone in the middle of a fenced-off patch of grass. Kathy explained that the cow was ‘down’ with milk fever, displaying typical signs of stagnation and exhaustion. We headed to the supply shed, where Kathy picked up a black container with a narrow, screw-top lid, with large white letters proclaiming its purpose; ‘ENERGY DRENCH’.

Back at the paddock, I followed Kathy to the down cow. She unscrewed the top of the energy drench with a gloved hand. The lid was stained with a dark, viscous, greenish-brown substance. Kathy approached the cow and turned so that she and the cow were facing the same direction, with the cow on Kathy’s right-hand side. She grabbed hold of the cow’s neck with her whole

²² All of Kathy and Logan’s cattle were Holstein-Friesian Jersey crosses. Throughout my fieldnotes, however, and in conversation with Kathy and Logan, we would refer to them as ‘Friesians’ or “Jerseys” based on whichever breed they most closely resembled.

arm, so close that the back of the cow's muscular neck was in her armpit. She inserted a couple of fingers into the cow's mouth with her right hand, and with her left, she up-ended the spout of the drench into the cow's mouth. A struggle ensued: Kathy's small frame fought hard to maintain control of the cow who was now thrusting her neck around with considerable strength. The viscous brown substance was slipping out of place, I could see that it was spotted with more solid matter as it seeped down the cow's lower lip. It smelled extremely sweet and ripe. The cow struggled so much that she managed to bend her back legs underneath her body and force herself up. Kathy quickly backed off, eyeing the cow, who was now standing still, apart from her tail, which was flicking from side to side. Kathy was delighted at this outcome.

Milk production as metabolic labour

Attending to these microbial and metabolic processes highlights the role of cattle bodies as loci of production, a site of material information in a chain of commodification of lively materials. Through the labour of material transformation, which incorporates the imminent commodifiable properties of materials like soil and pasture into the production of milk, cattle bodies function as a site of value-generation (Collard & Dempsey, 2013). This process of commodification speaks to the significance of 'encounter value'²³ (Barua, 2016, p. 727; Haraway, 2008, p. 46) in the interface between human and nonhuman agents in capitalist spaces. Industry bodies like DairyNZ's have attempted to formalise the mechanics of 'encounter-value' through projections of the average conversion rates from 'dry matter' (the nutrient value of ryegrass and other cattle feed) to milk solids, as shown in the figure below. This formalisation of transcendent, predictive scientific knowledge once again represents the 'control dream'(Singleton, 2010) of industrial agriculture.

²³ See theory section in introduction for a discussion on encounter value (p.23).

Annual requirements tonnes DM/cow/year at 11.0 MJ ME/kg DM

Breed	kg Lwt	Milksolids production (kg MS/cow/year)							
		250	300	350	400	450	500	550	600
Jersey	375	3.5	3.8	4.2	4.5				
Jersey	400	3.6	3.9	4.3	4.6	4.9	5.3		
Jersey	425	3.7	4.0	4.4	4.7	5.0	5.4		
Kiwicross	450	3.8	4.2	4.5	4.8	5.2	5.5	5.9	
Kiwicross	475	3.9	4.3	4.6	4.9	5.3	5.6	6.0	
Friesian	500	4.1	4.4	4.7	5.1	5.4	5.8	6.1	
Friesian	525		4.5	4.8	5.2	5.5	5.9	6.2	
Friesian	550		4.6	4.9	5.3	5.6	6.0	6.3	6.7

The annual requirements include walking 4 km/day on flat ground for 270 days in milk per cow.

Figure 5: Dairy cow annual dry matter requirements. (DairyNZ, 2017, p. 46)

These inter-species relations of production, in which cattle convert pasture into milk, enact a tripartite cattle object. They simultaneously function as means of production, commodified property and labourers. Multispecies studies allows an understanding of how this material transformation functions within an interspecies political economy, and the apprehension and trade of ‘lively commodities’ (Barua, 2016; Collard & Dempsey, 2013; Haraway, 2008). Les Beldo’s (2017) concept of *metabolic labour* is particularly salient to understanding how a molecular scale of material activity and nonhuman agency inform interspecies power relations and the role of encounter-value in the processes of milk production.

Metabolic labour accounts for the value-transformation processes that are undertaken by nonhuman life-forms in the integration of biocapital into the commodity economy. Beldo, who is critical of the historically humanist take on production in Marxist literature, writes ‘metabolism is a process yoked by capital that creates surplus value. It should not matter if it is microbes or cellular structures that labour instead of subjects’ (Beldo, 2017, p. 119). The narrative that equates industrial production to the exclusion of life is countered by metabolic labour, as animal bodies themselves are industrialised. Plants, farm animals, and countless other nonhuman life-forms are ‘subcontracted’ (p. 115) to perform material transformations that human-made machinery cannot duplicate. The humanist conceptualisation of labour and exploitation are also challenged in this perspective. Because the animal is both the labourer and the site of production, exploitation has a biological centering. This is notably distinct from the human labourer’s traditionally peripheral role to the means of production (Beldo, 2017, p. 117),

a tenuous position in itself as automation increasingly enters production spaces. Labour is not willingly sold by livestock, but performed on a molecular scale, experienced in bodily stresses, and met by the provision of feed at the quantities that only an industrial farming operation can offer.

While industrial power structures maintain a semblance of control over the processes of metabolic labour, farmers nonetheless work in *correspondence* with these active phenomena, and must respond to occasional slippages outside of the ‘dream of control’ (Singleton, 2010). As exemplified by the story of the down cow, the embodied strain of metabolic labour was visibly exhibited by many of Kathy and Logan’s cattle. Her body was pushed to make ever-increasing milk solid averages, one of many ongoing pressures for the multiple lively agents on farms pushed by continued industrial intensification (Barua, 2019; Chobtang et al., 2017). Energy depletion and nutrient loss—and subsequent need for supplementation—mark the point at which human intervention in the cattle’s metabolism exceeds their ‘natural’ regenerative capacities.

The dependencies in metabolic labour performed by subjects are not only material; successful milk production and retrieval is also an interspecies social relationship that depends on the collaboration of cattle. When working with subjects like cattle, this means attending to their ability to act, whether in accordance or defiance to the farmer’s plans. Part of realizing encounter value thus depends on the use of the affective and tacit technologies of ‘stock-sense’ (Wilkie, 2010). The activity of cud chewing, as explained previously (p. 64), exemplifies this set of relations. A farmer’s control of this essential activity is limited- its performance is up to the cattle. Farmers can, however, provide the necessary care to encourage this comfort-dependent activity, exemplifying the tacit interspecies understandings in achieving the control, exploitation, and ongoing commodification of livestock in agricultural systems.

Pregnancy

While metabolic labour fuels milk production, pregnancy hormones must be activated before any milk is produced at all. As such, the reproductive organs of cattle are also regularly engaged in ‘reproductive labour’ (Beldo, 2017, p. 125), the products of which (directly- calves, and secondarily- milk) are apprehended and incorporated into the commodity economy by farmers and industry bodies. In New Zealand’s dairy industry, this is achieved through a robustly scheduled system of human-controlled cattle impregnation that occurs between the months of

October and December. Successful impregnation initiates lactogenesis, during which a high concentration of oestrogen and progesterone are produced, which stimulates the development of the udders' milk-duct system, and the synthesis of enzymes required for milk production (Sherwood et al., 2005, pp. 753-755). Milk secretion is blocked by the pregnancy hormones until parturition, when the loss of the placenta clears much of the oestrogen and progesterone (secretion blocking) hormones (Sherwood et al., 2005, pp. 753-755). The activity of suckling by a new-born calf, or simulation of this process, by human hands or milking apparatuses, stimulates the hormones prolactin and oxytocin, which sustain milk production and allow for milk 'let down' (Sherwood et al., 2005, pp. 753-755).

The entire system of the dairy industry thus rests on successful human manipulation and exploitation of cattle oestrus cycles, the biology of which determines farming activities over the calendar year. Mating season is thus the 'most important time of year', Kathy told me, because a cow that fails to get in calf is worth next to nothing to the farm. The primary goal of mating season is get the herd milking on time the following year, with replacement calves and herd improvement being secondary productive aims. Insemination practices are generally undertaken shortly after calving season finishes, with insemination timing largely determined by the requisite six week 'holiday' for the cattle (as Kathy calls it), between drying off in May, and the beginning of calving season in July.²⁴ This break is necessary to restore the udder after the degradation it can experience through at least eight months of daily milking. It's clear, then, that not only insemination practices, but the overall management of New Zealand's entire dairy system, are subject to cattle reproductive processes.²⁵ Once again, the cow as labourer and locus of production is central to this system, the nonhuman agency and value-generating vitality of which, provide a limitations to the sovereign control that farmers can truly exert in commodifying the living material world.

Getting 'in calf'

For most modern dairy farmers, artificial insemination (AI) is the initial course of action for mating season. As discussed in chapter two, Kathy and Logan purchase most of their bull semen, and contract AI technicians, from LIC. The biopolitical 'truth discourses' (Rabinow & Rose, 2006, p. 197) that sustain genetics-based companies are highly influential in the decisions

²⁴ See chapter four (p.90) for a flow-through chart detailing the yearly developments in farm/herd management as determined by cattle pregnancy rates.

²⁵ Pasture growth rates, which are seasonal, subject to temperature and weather changes.

that go into insemination practices. Kathy and Logan plan the distribution of semen straws (which vary in quality and price) among their cattle based on breeding worth (BW)- matching quality sire semen to quality herd members. Contracted insemination programmes are where the work of livestock improvement is played out, based on the genomic science-based ‘truth discourses’ that promise improved milk production, breeding, and herd health through controlled reproduction.

I visited the farm again towards the end of the mating season, to catch up with Kathy and Logan and see how the farm was changing over the seasons. Pulling into the driveway, I noticed two large red and white bulls relaxing in the paddock to my left. Kathy later explained that she’d gone through the AI process with the LIC technicians, and now she was ‘running’ the bulls with the heifers and the remaining stock who hadn’t yet got in calf. A chart was spread out on the kitchen table where we were drinking tea. The ID numbers of herd members were entered into the leftmost column and the adjacent columns contained dates marked with ticks or crosses. Kathy said it was the season planner, it marks insemination attempts, successes and failures. I commented on one of the rows, where a sad face had been crudely drawn next to the third date on her row. ‘Oh, that’s 95,’ said Kathy. ‘She’s a lovely cow. But we don’t think she’ll get in calf this season. I’ll be sad to get rid of her’ she said. Then, as she often did when faced with ethical ambiguity, she laughed, grimaced, and said she didn’t want to talk about it. Cow 95’s story speaks to the high-stakes of mating season, which are managed to an extent through accurately timed insemination practices, and the biopolitical logics that render life valuable or disposable in agricultural system of production.

The high-stakes routines of mating season are partially managed through transcendent scientific knowledge and technologies, and partially through tacit, embodied knowledge-practices. AI scheduling is timed by cattle oestrus cycles, which run at intervals of 17-24 days. Data-based technologies like the MINDA app and mating planners keep track of cycles, but Kathy and Logan say it’s best to look for physical or behavioural indicators such as ‘bulling’: when cows mount other cattle in the paddock, or when cows allow other cows to mount them. To gain some control over the situation, farmers will also make the most of intimate ‘contact zones’ (Haraway, 2008) like the milking shed. Here, farmers get to know their cattle through their regular behaviours, such as the order in which they enter the shed. Any abnormal behaviour, I was told, is a sign a cow might be in heat. Kathy informed me that this term is quite literal, and that AI technicians can tell whether a cow is in heat through touch. They check

on the readiness of the cow with gloved hands before applying the pipette with the semen, often remarking on whether she's 'hot', or 'sticky' inside.

This yearly interception and commodification of cattle reproductive systems and progeny serves the re-production of uneven species hierarchies, and the legal and moral exceptions regarding human contact with other species that are particular to industrial farming and other modernistic industries. Gabriel Rosenberg (2017) provides a disconcerting take on how the logics of artificial insemination and genetic improvement establish realms of moral exception in the regulation of human-animal relations. 'Biopolitical systems arraign a bestiary of creatures according not only to how they can be exposed to violence but also by how they can be opened to somatic contact', he writes (Rosenberg, 2017, p. 475). This commentary highlights the legal exemptions that are necessary for the underlying reproductive economy of animal husbandry in practice, as exempt from the legal status of bestiality. In the context of industrial agriculture, he argues, the difference between a farmer (or in the context of this research, a contracted AI technician), and a bestialist, is determined not by relation to animals, but relation to capital (Rosenberg, 2017, p. 475). The nitty-gritty details of artificial insemination, which I didn't see, but I did talk to the farmers about, are disarming and confronting. Yet it is rationalised, and makes sense in a system in which the 'imprisonment and genetic standardisation' (A. Tsing, 2012, p. 144) of domesticated animals is generally accepted.

Milking

One afternoon, Kathy invited me to join her in the milking shed: 'you might get shitted on, but you'll be alright'. It smelt like piss, a sensation that got stronger and stronger as the milking went on. The ground was a smooth concrete, but the raised platforms on either side where the cattle stand were lined with black rubber mats. Regular mechanical sounds rang out; the sharp, whistle-like tones of the suction, and the soft banging of the tank. All around, the pit and the platforms were wet, stained a rich dark green, and shaded by the white wooden ceiling above us.



Figure 6: The two views of the cows in the milking shed.

The cattle entered to one side of the herring bone. Kathy was guiding them through remotely, using a chain from inside the pit that was connected to a moving part of the metal fencing outside where the herd had amassed.

The shed can host up to twenty a side, but this is dependent on the proper, close-knit alignment of the cattle. During calving season, twenty a side is particularly difficult to achieve, as many of these cattle were heifers prior to their recent calving. They aren't used to lining up in the shed. For many, this would have been among their first experiences of milking. Kathy explained how this kind of thing—not fitting the maximum amount into the shed—adds up, eating into the day.

'If you wanna get through these cows in an hour and a half, you keep them moving. Every 30 seconds longer it takes on the row, adds up - ten rows, its half an hour longer. So, it's just - move it, move it, move it, come on, girls'

We walked through the pit, beside the row of suction cups hanging on hooks, suspended from rubber tubes connecting to a line of pipes above us. The cylindrical cups themselves were made of steel, with ends and liners of black rubber. The cups were grouped together in clusters of four, connected in the centre by a 'claw,' a clear, plastic compartment with black buttons on it.

Kathy pushed a button, initiating a *whooshing* sound of air releasing. She handed me a suction cup and told me to put my thumb inside. It fit neatly, the suction wasn't constant, but pulsating. She explained that the speed of the 'suck', and how hard it sucks, are designed to increase the speed of milk retrieval. But it's a balance; if it's too hard or fast, you can damage the cow's teats, and 'she won't have a positive experience'.



Figure 7: Applying suction cups.

She turned to apply the cups to a cow, guiding them with her fingertips atop the opening of the rubber lining. 'You don't look,' she said, 'if you look, you'll get kicked. You already know where the teat is, and you're just looking for the top and then...' she popped them on, one at a time. All four cups were now hanging from the teats, which were dragged downwards from the weight. The claw at the centre of the cluster filled with milk, swirling around before draining through the tube. Kathy made her way down the line of cows, connecting suction cups. Almost all were soon feeding into a central pipe above us, which was flowing into the massive metal vat in the building next door. Some, however, were filling into buckets. These cows, she explained, were either colostrums, or they were on antibiotics. Industry standards dictate that

milk from cattle on antibiotics must be separated, and contamination of the Open Country tanker collection can result in heavy fines. The colostrum milk was saved to feed to the calves in their pens. Kathy has to mark these cows out, or else specifically remember and recognise which cows have these requirements. But, I thought, perhaps this isn't that hard; she once told me that she knows her cows best by their 'bums', as milking is her most intimate and lengthy engagement with them.

Finished up with milking this lot, Kathy moved down the row, spraying their udders with antiseptic to prevent mastitis. Once they were all sprayed, the cows filed out slowly as Kathy opened the partition, and the next group of cows readied themselves to enter.

The milking shed: a socio-mechanical device

The milking shed functions as a 'device' (Singleton & Law, 2013) that realises encounter-value (Barua, 2016; Haraway, 2008) through the coordination of human and nonhuman actors. The term 'device' is used by STS scholars Singleton and Law to describe 'a set of implicit and explicit strategies that work more or less repetitively to order, sort, define and arrange a heterogeneous but relatively discrete social and material field' (Singleton & Law, 2013, p. 260). The architecture and technology of the milking shed are utilised through repetitive and practiced human actions. As such, the routinised, ritualistic movements of both farmers and cattle, and the directional function of the shed's materiality enact, in a microcosm, the asymmetrical power relations between cattle and farmers. In the pit, Kathy's embodied, repetitive knowledge-practices work in alliance with the architecture (the milking pit and herring bone) and the technology (the pipes and pumps), that help to harness the biological and subjective agency of the cattle, and draw the product of their metabolic labour into the capital economy. The environment manifests the farmer's intent and extends her agency beyond that of her physical body, centralizing her power through the coordination of heterogenous agents (Singleton & Law, 2013).

To truly successfully apprehend the movement of cattle subjects within the device, and milk efficiently, however, requires the exercise of responsive and tacit acts of care. 'Caring', write Singleton and Law (2013, p. 264) 'is more about experiment or iteration and less about pre-formatting'. As an embodied technique, care is employed to prevent or respond to moments of disruption or uncooperative subjects within the device. The concentration of cattle, the

unnatural setting of the shed, and the requisite for cooperation by heterogenous agents are prime conditions for cattle to act out of order- by kicking off the suction cups, lumbering in slowly, taking up excess space, and even kicking the farmer herself. These unpredictable, subjectively performed actions are met with, or pre-empted by, Kathy's tacit and familiar relational techniques. While working, Kathy would take the time to talk to the cattle, to rub or pat their backs, to coo at them. Her 'don't-look' application of the suction cups, and how she moved about the pit and spoke to the cattle, are embodied, tacit practices of stockmanship that are constituted through affective relations and years of proximity to the bodies of this other species.

These interspecies relational practices are critical to the dairy industry. Due to the cattle's simultaneous status as labourers, commodities, and means of material transformation, their metabolic labour can only be harnessed, in New Zealand's model of agriculture, through techniques that account for their subjectivity. Kathy's tacit actions of care represent an 'embodied epistemology' (Heath & Meneley, 2010) that serves a goal of mechanical efficiency, while reassuring the cattle of the safety, and (for some) the relaxing quality, of the experience. These practices, while often affectionate in intention, reveal how both care and control, and scientific and tacit/embodied knowledges, are conditionally deployed in animal husbandry. Relational processes are necessitated by the agency and subjectivity livestock, their potential to defy; and their ability to be lulled into acquiescence. The necessity of interspecies participation in this productive activity demonstrates the status 'encounter value' as the 'axis of lively capital' (Haraway, 2008, p. 65), a form of economic value that is realised through the coordination of human intention, subjectification to ethology and nonhuman agency, and tacit technologies of interspecies understanding (Barua, 2016).

Managing microorganisms

The more-than-human encounters occurring in the milking shed are not limited to the meeting of cattle, humans and technology. This contact zone also features microbial agents, and the disembodied, larger-than-life structures of western capitalism. The presence and perceived risk of microbial agents is also incorporated into the device-function of the milking routine, accounted for in cumbersome cleaning tasks, and siphoning off the anomalous milk strands.

These biosecurity practices are aimed at preventing a material 'invasion' or 'breaching of boundaries', otherwise termed an infection (Lowe, 2014, p. 301). The existence of such boundaries speaks to the biopolitical evaluation of certain life-forms over others (Blanchette,

2015; Paxson, 2008) adding a microbial element to the enactment of industrial agriculture's 'control dream'(Singleton, 2010). Mastitis, for example, is a bacterial life form that threatens the vitality and economic viability of its host subject. Milk from the Kagan farm is tested with every tanker collection for the presence of somatic cells, which indicate infection. Yet the method by which this infection is controlled, using antibiotics, also poses a carry-on risk of further infection to cooperative dairy industry bodies themselves. Kathy's controlled partitioning of the milk from those cattle on antibiotics is a costly measure of control that must be done in order to abide by industry standards. The risk is in the process; milk from a single cow containing antibiotics is liable to be mixed into a vat containing milk from hundreds of other cows, from which it can't be extracted.



Figure 8: Siphoning off the colostrum or antibiotics-containing milk.

Outside the farm, industrial bodies like Open Country aspire to uniformity in production processes in order to claim control over heterogenous microbial agents. Open Country undertakes its own practices to limit the vitality of unwanted lively materials, through drying and pasteurisation. On their website, Open Country proudly proclaims that their food safety practices exceed the highest-level accreditation 'with engineered technologically designed

plants we ensure the uniformity and consistency of all product categories, through to the processing and packaging' (Open Country, 2015). Such procedures are important due to a prevailing Pasteurian market climate (Paxson, 2008), aimed at asserting control over the human-nonhuman hybridity by which microbes 'make us' (Ingram, 2011, p. 111), and the microbial mediation of human-nonhuman bodies (Wentworth, 2015). Critical analysis of human-microbial relations by scholars like Mrill Ingram (2011), Heather Paxson (2008) and (Wentworth, 2015) have produced new understandings of microbial management as governmental processes that serve to regulate the actions and bodies of human producers and consumers of animal products.

Effluent

This chapter's second visit to the ground considers the dangerous and unruly aspects of dairy farming's materiality with a brief discussion on effluent management and nutrient run-off and contamination. Through its potential for environmental damage, and its opportunistic application to the earth as fertiliser, effluent is shown to represent the material finitude and circulation of nature-cultures in the farm ecology.

I first became aware of the significance of effluent in the daily routines and design of farming practice when I accompanied Kathy in her post-milking routine one evening. She was hosing down the concrete ground, and an opaque, muddy liquid, thick, green, and blotched with milk, was running into a drain. I noticed then that the entire design of the farm's concreted spaces was sloped to accommodate and direct this flow. Kathy and Logan had recently paid two hundred thousand dollars to install a new effluent pond, which was stationed near the milking shed. Fecal matter, milk slippage and water are siphoned, via the drains, to this pond for storage. When the conditions are right, the effluent extracted from the pond is distributed onto the pastures, either through irrigation, by a slurry truck, or as a solid. These methods of nutrient distribution are understood in the agricultural community to be efficient and economical alternatives to the application of nitrogen fertiliser.



Figure 9: Effluent flowing into drains.

Effluent is a material that straddles multiple realities in its relations to farmers and the landscape. It contains water, spilt milk, detergent and soil carried by cattle bodies, and it is also rich in nitrogen, phosphorus, potassium, and sulphur. These properties can make it dangerous, but they can also be opportunistically harnessed and repurposed as a valuable resource through farmer-led application to pastures, or by direct deposit from cattle. The absorption of these minerals by in-soil microbes, fungi, and the ryegrass and clover plants contribute to plant growth and vitality. Through this process, the mineral components of the fecal matter are recaptured and applied in a manner that intensifies and mimics pre-industrial ecological systems of plant growth and nutrient cycles. This hyper-concentrated mimicry of organic ecological systems is essential to the rate at which biocapital is produced, particularly in New Zealand, due to the naturally low-phosphate in the soils.

The components and properties that give effluent its value to farmers are also what make the substance risky. Its dangerous potential is realised when its tractability and containment is compromised, the potential causes of which are myriad, including damage to soil structures, infrastructural failure and sudden wet weather. These can cause nutrient leaching and water run-off, resulting in nutrient loss for the farm. In addition, as these nutrients flow through

waterways (often beyond farm property), they can encourage highly localised, concentrated plant and algal growth, resulting in stagnation and ecological damage down-stream (Foote et al., 2015). This outcome implicates ever-expanding networks of people and materials affected by the practices of a single farm, and here again a broader scope of ontological reckoning is circumstantially deployed by those farmers who are conscious of these risks. This awareness of expansive material implications is enacted, for example, when farmers assess ‘soil water deficit’ which indicates how much effluent be added to soil for healthy absorption that avoids incidences of ponding, runoff or leaching.

Logan took pains to teach me how the system works. He explained that a key factor influencing rates of effluent run-off is soil structure. Grabbing a pencil, he illustrated his thoughts; one of his drawings showed a ‘matrix’ soil structure, consisting of lots of little soil aggregates which accommodate pore space for the passage of water, air, and organisms. The denser, clay-heavy soil on the Kagan farm doesn’t conform to this ideal model. At the Kagan farm, water and effluent tend to just ‘roll off’, he said. In order to address the low water infiltration of their farm and increase nutrient absorption by soil, Kathy and Logan have used mole-piping throughout their paddocks. Mole-piping is a subsurface drainage system that’s good for high-clay soil. It is installed by a specialised plow that drags a large ‘bullet’ across a paddock at regular intervals. This action breaks up the dense soil structures of the low-infiltration paddock, drawing water down into the ‘pipe’ tunnel made by the bullet. Gravity then draws the water through the tunnel to existing watercourses or holding dams. Several cracks in the ground that occur from the mole-piping processes make it easier for nutrients to penetrate the soil, reducing the risk of nitrate leaching and run-off.

Revisiting soil at the end of this material journey through milk production implicates many of the agents that have already featured in this story to highlight material finitude and circulation. The pre-industrial landscape that Kathy and Logan’s farm is now settled on maintained heterogenous relations between indigenous organisms and material agents. Intensive human intervention, as exemplified here by the Kagan farm, has inserted exotic plants, animals and materials into these systems, and permanently altered the balance of agents and their relations. Cattle effluent is one such introduced substance that interacts with heterogenous agents in its environment. Its vital agency can be apprehended and exploited in the biopolitical cultivation of plant life, yet its agency can escape farmer control, and spread the impact of agricultural activities beyond the jurisdiction of the responsible farm. This focus resonates with Choy and

Zee (2015)'s work exploring the autonomy of materials born through the medium of atmosphere, and their ability to elude human control in the Anthropocene era. The effluent case highlights another medium of movement, of the carrying of elusive, and transformed, human agency, through the medium of flows, water, and gravity.

Conclusion

Sitting down with Kathy and Logan towards the end of my fieldwork, they asked me how the research was going and whether my focus had changed. I told them that I was more attuned to how complex the material management of the farm is, how they have to keep on top of, or at least aware of, a sweeping range of processes going on all around them. I listed off just some of the things that they work with; soil structure, irrigation, effluent management, mating, milk quality, pasture quality, weather, greenhouse gas emissions. These are not stable, stagnant things—their very activity is where farming cultivates value, but their liveliness also where, (viewed from a humanist perspective), most of the risk is. They agreed- the work is very complex, and it's becoming more complex with social and political pressures adding to their responsibility to the land and society. But, they said, in the day-to-day, it's just a series of small jobs. Unless some event calls for them to reckon with the bigger picture, the scale of the work is largely lost in moments of practice.

This chapter has provided an exploration into some of the material assemblages that make and interact with the practices, structures, and systems of the dairy industry. The farm comprises a lively ecology of anthropogenic, organic, mechanical, indigenous and non-indigenous materials, all in flux, interacting with one another, and influenced by material forces like weather. Farmers inhabit this ecology; they follow a 'dream of control' (Singleton, 2010), legitimised and rationalised by structures of western capitalism and scientific knowledge, but this dream is consistently compromised by the heterogenous agency of localised material assemblages unaccounted for in transcendent logics. Milk production and commodification, in this landscape, is achieved through complex, in-flux practices of human-nonhuman correspondence (Ingold, 2012, 2013), manifest in the multifarious tasks of farming, in which the farmer's relations to the nonhuman world, is enacted as multiple, and circumstance dependent (A. Mol, 2002). Farming is an active, lively, responsive practice, with farming practices largely revolving around the maintenance of a tenuous relation of control over an animate landscape

Chapter 4: Working with commodity subjects

‘It gets harder every year’

So far, this thesis has shown that relations between farmers and the nonhuman world are complex and contingent. This is perhaps most poignantly evident in relations between farmers and their livestock, which oscillate significantly between remarkably different iterations through everyday practice. In one moment, a dairy farmer will speak to an individual cow like a friend, invoking cooing vocal cadence and using funny nicknames. In another, the cow is enacted as a piece of physical property or an aspect of a broader productive system, equated to the function of her metabolic and reproductive labour as an economic asset. As has been shown, the status-in-flux of livestock emerges through the contingent relationality of farming practice (Crowder, 2015; Wilkie, 2010). The previous two chapters revealed how these relations are influenced by both external social and economic processes, the dairy industry system, and the heterogenous materiality of the farm-ecology. I have argued that, while farmer-livestock relations ultimately serve the centralisation of human control across an imbalanced interspecies power scheme, processes of domestication and commodification in industrial agriculture are more than an exercise of absolute human tyranny over an objectified nonhuman world. The minutiae of farming’s more-than human relational praxis reveals that farmers, and systems of farm management, are subject to the multifarious nonhuman agents present on-farm. These observations demonstrate that even the most anthropocentric ventures are nonetheless co-constituted between humans and the nonhuman world (Hamilton & Taylor, 2017; Haraway, 2003; Latimer & Miele, 2013).

The current chapter continues this argument by exploring how the multiplicity of relations between farmers in livestock is achieved in practice, and the ethical implications of this flux. The chapter commences with a section detailing the routines of calving season, including the practices of calf and mother retrieval and separation, and subsequent practices of care and exploitation for both parties. The dairy industry is shown to be founded in the human interception and appropriation of the relationship between mother cows and their calves. The farmers’ third-party role in this relationship is manifest in minute farming practices that intercept and mimic both the affective and physiological roles of the mother and calf. Secondly, the chapter recounts the story of a cow called Angie, who was both the only cow in the herd with a name, and the only one that Kathy and Logan were planning to send to the slaughterhouse while I was staying with them due to the development of cancer eye. Through the contrasting frameworks of biopolitical theory and care practices, Angie’s story exemplifies

the farmers' oscillating perception of, and relations to, livestock as they are mediated by conflicting concerns. Finally, the chapter tells a brief vignette of the discovery of a dead calf among the dry stock. By focusing on the ambivalence with which the farmers regarded the dead calf, in contrast to the attention they paid the mother, this story tells about how 'arts of attentiveness' can implement a prioritisation of care and how the heterogeneity of concerns in farming necessitates the regular navigation of ethically ambiguous circumstances.

Through these examples, this chapter explores in greater depth the multiple and co-existent farmers' modes of perceiving and relating to livestock. The objectifying, biopolitical logics of life-optimisation are present in each of the case studies discussed, but so too are the co-constituted and affective 'arts of attentiveness' that multispecies ethnographers are encouraged to develop in order to meaningfully understand the nonhuman (van Dooren et al., 2016). In practice, these modes of relating to animals are often entwined; the practice of tacit, inter-relational arts of attentiveness is oftentimes essential to the functioning of the farm as a biopolitical system of production and the incorporation of livestock bodies into this system as commodities. Yet, the genuine affection for livestock cultivated through these practices can be incongruent with the blunter, more utilitarian aspects of farming, and there is a corresponding incongruence between the farmers' interactions with cattle as subjects, and their commodity status within the agricultural system. This chapter makes a point of exploring some of these more ethically ambiguous circumstances in dairying and investigates the methods by which farmers attain a semblance of ethical coherence throughout this ongoing fluctuation. Techniques of detachment provide some of this coherence, as they are essential to the practical enactment of livestock as commodities in their structural and embodied manifestations. In this chapter, detachment is also shown to help farmers manage the conflicting modes of relating to livestock as commodity subjects.

Intercepted motherhood

My impression of the dairy industry was strongly influenced by the fact that most of my fieldwork was conducted in the middle of calving season, with around five to ten births occurring daily. We spent every day collecting new-born calves from the paddocks and bringing them 'home' to care for them in the warm, sheltered calf pens that were segregated according to the ages of the calves. Collecting the calves from the paddocks was achieved through intimate acts of encounter with cattle, requiring a specific set of inter-relational and

physical skills. Every experience was different; variables included the number of calves we picked up, the age of the calf (and its consequent ability to struggle, which increases dramatically over mere hours), the cleanliness of the calf, the temperament of the mother, and the weather. The general process, however, remained the same. We'd drive the quad bike, trailer attached, to a paddock where a cow (or several) had recently given birth. Then we'd use any of several available techniques, which are detailed later in the chapter, to get the calf into the open trailer. Kathy or I would spray its navel with iodine to help prevent infection, or 'navel rot', and use spray paint to mark an identifying number on its body. Kathy would record this number, along with the mother's identity, in her phone or a notebook. We'd close the trailer and bring the calf back to the calf pens. Usually, we'd bring the mother with us, to drop her off in the colostrum group that was kept in the northern paddocks, far away from the calves.



Figure 10: Collecting calves and mothers.

The first time I participated in calf retrieval, I was treated to the drama of an extreme reaction from the mother cow. She ran spiritedly on either side of the trailer, emoting a call that fluctuated between a loud, agitated bellow, seemingly directed at myself and Kathy, and a low, throat-based moo as she would slow down to walk alongside the trailer and her calf. Her spindly-legged calf was just standing in the trailer, shaking, still sticky with afterbirth. I, too, was shaken and confused, both by the mother's reaction, and Kathy's comparative nonchalance, which indicated the routine nature of the episode. We left the paddock and drove

down the race, with the mother still following along. We stopped at a junction; to the south was the race that led to the central hub of the farm, with access to the milking shed and the calf pens. To the north, a race led to the secluded paddock where the colostrums are kept. Here, Kathy got off the trailer and started waving her arms about, to get the cow to move onto the northern race, so that she could close the gate behind her and take the calf south. The cow twirled around and started moving towards the northbound race, but she kept turning back to look at her calf, still mooing. Eventually, we got her behind the gate and secured it. As we drove off, she stood there, watching us, still mooing. It was moving to me. By the time we had returned from the calving pens, however, she was no longer where we'd left her, having evidently followed the race to join the other colostrums.

Calf retrieval

Throughout dairying, farmers intercept the relationship between mother cows and their calves as a third party. They employ affective and material methods to mimic the actions and roles of both sides of this relationship, in order to nurture, control, and elicit profit. The daily routines of calf retrieval consist of a series of intimate interspecies encounters, through which the calves' and mothers' mutual attachment to each other is advantageously appropriated by farmers to serve their needs. While the cattle's subjectivities are subsumed to their commodity status in terms of rights, it is in fact their subjectivities that are utilised by farmers to achieve their commodification. In these moments, at the breaking of the maternal bond, the mother and calf commence their respective roles in the farm's system of production. As will be described further below, the farmers enforce this transition through embodied, social navigation of these intersubjective encounters. Both the pre-formed planning and management of calf retrieval, and the momentous, impromptu decisions, actions and demeanor of the farmers during these routines account for the cattle's ability to perceive the farmers and their potential to act against the farmer's will. As such, calf retrieval practices reveal that the 'co-constitution' of multispecies affairs like agriculture is not always tantamount to the constitution of egalitarian or mutually beneficial relationships (Hurn, 2012; Ogden, Hall, & Tanita, 2013; A. Williams, 2004).

Affective mimesis

Because of the deliberate apprehension and exploitation of the bonds between mothers and their calves in practices that ultimately implicate both into the productive system of the farm, calf retrieval routines became an aspect of industrial farming that I found particularly ironic. I would gradually understand this sense of irony to reflect my personal feelings of ethical

incongruence during these practices. During my first calf retrieval experience, as described above, for example, Kathy managed to draw the mother in a planned direction by encouraging her to follow her calf in the trailer as we made our way slowly across the paddock. My adverse reaction to this practice was due to the evident strength of attachment that the mother had for her calf, and the ease with which Kathy was able to utilise this attachment to achieve her goal, which, at that moment, was separating the two.

Not all mothers put on the same display as the first, however; their reactions were myriad, requiring responsive and improvisational action from the farmers and me, most of which still utilised the mother-calf attachment. Very few mothers were as evidently upset or animated as the mother of the first calf we picked up. In fact, subsequent cows would often get distracted by grass in the untouched paddocks we'd lure them through. They'd mull around and eventually start munching. In these cases, Kathy would often turn around, and call out to them; 'Come on! *BLLLEHHH! BLEEHHH!*', adopting a guttural call that mimicked the bleating of calves. This was often enough to get the cows to turn to the bike, pick up their pace and resume following the trailer. As I began to drive the trailer myself, I also picked up this technique. This logic of exploited attachment was mirrored in our attempts to move some of the more static calves or those that were too strong or heavy for Kathy to carry. In these situations, we'd mimic their relations to their mother by rubbing their muzzles with our fingers and putting our fingers in their mouths, to initiate an instinctual suckling action. We took advantage of this encounter of somatic attention to draw them towards the trailer, where Kathy would lift them in.

These calf retrieval practices demonstrate the extent to which industrial agriculture '[takes] account of animal sentience' (A. Williams, 2004, p. 45). The farmers attain control over the bodies of livestock by intercepting and mimicking the cattle's affective relations with each other, exploiting their desire to be together to lead them in a certain direction. While I was surprised that these subjective factors were used in such a way, I learnt subsequently that this is not an uncommon approach to farming. Anna Williams (2004) argues that industrial farm design and practice has always incorporated human understandings of animal behaviour and subjectivity, when this understanding benefits the purpose of the industrial enterprise. She posits this argument in opposition to idea that the agricultural industry functions through systematic repression and denial of animal subjectivity (A. Williams, 2004, pp. 46-49). Incorporating a knowledge of animal sentience into agricultural technologies and routines, she argues, represents a form of industrialisation and rationalisation. Acknowledging this does not 'diminish [the agricultural industry's] history...as a leviathan of manufacturing violence' (A.

Williams, 2004, p. 53), as the exploitation of sentience still pursues the centralisation of human power.

Williams argues that apprehension and utilisation of animal subjectivity often takes the form of disciplinary power. Disciplinary apparatuses secure acquiescence to agricultural practice through repetitive methods of livestock subjectification, rather than force. This is conducive to efficiency, as livestock co-operation minimises the need for extra human labour, while the economic value of livestock is preserved by avoiding bruising or other forms of damage that could incur using force (A. Williams, 2004). I saw some hints of disciplined acquiescence on the Kagan farm, with one example being the ‘device’ of the milking routine described in chapter 3 of this thesis (pp. 75-76). They learn to walk in a certain direction before and after milking, and many appeared to actually want to enter the milking shed on time each day. Kathy pointed out how much more relaxed the older, more experienced cattle were in the milking shed, how she only really had to guide those who were new to the process. Many of them were so eager to get milked, she told me, that they would start to ‘let down’ their milk while waiting outside, anticipating the release from the suction cup. Kathy understood this behaviour as a sign of comfort and felt the same way about cud-chewing during milking. In a sentience-aware farming environment, Williams argues, behavioural traits of both cattle and farmers (like docility and compassion, respectively) can become industry commodities through their incorporation into farm design of formalised agricultural knowledge.

Ethnographic attention to the relations between farmers and cattle gives partial credence to Williams’ argument, however this idea is complicated when one the interspecies sociality of farming, and the unruly potential of cattle agency. It’s true that contemporary farm design and farming practice accounts for animal sentience as a means to successfully and efficiently commodify livestock. Yet, it is also evident that livestock subjectivity arises in many forms across the inter-species relationality of dairy farming, whether predicted and utilised by farmers, or not. There remain incalculable and unruly aspects of the nonhuman other. Generating a toolbox of cross-species sensitivities and responses is both a necessary, and inevitable, outcome of farming’s more-than-human encounters (Wilkie, 2010). My participants’ apprehension of livestock subjectivity often took the form of empathy, for example. Even the calf-separation routines provided evidence of this. ‘It gets harder every year’, Kathy told me once, as we drove away with the calf of a particularly upset mother who was lingering at the gate where we’d left her. Below, I detail another example of the unruly

sentience of livestock, and the empathy evident in the tacit and responsive management of such situations by farmers.

Detachment and attentiveness

To respond to moments where a cow's affective agency emerges in unplanned ways, farmers practice arts of attentiveness (van Dooren et al., 2016). van Dooren et al. (2016) argue that practicing arts of attentiveness follows from the ethical imperative for social scientists to address the entanglement of all lively beings, to dismantle human exceptionalism and refigure humans within multispecies landscapes (2016, pp. 15, 16). It is interesting to see the fundamentals of these 'arts' in the anthropogenic settings of everyday agricultural practice. This form of knowing reality, so radical in the scholarly context, is on the farm merely an inevitable outcome of a life of immersion among members of other species. The industrial dairy farm shows how the farmer's close attentiveness to the life-worlds of nonhuman species can play a part in reproducing imbalanced interspecies power relations. Attentiveness is thus a necessary component to the processes of 'correspondence' (Ingold, 2013) by which cattle are drawn into the political economy of the farm.

While these arts do not strictly emerge in the tacit, they are most effectively and efficiently exercised in their embodied, almost instinctive iterations. In the presence of a heated cow, such as a mother who was particularly resistant to the uplift of her calf, the farmers would yell out 'don't look her in the eye!' This was one of many embodied techniques that they advised me to practice, but which I never quite mastered. Avoiding eye contact draws on established ethological knowledge; that engaging in eye contact constitutes threatening and antagonistic behaviour (Moran & Doyle, 2015). Due to my inexperience in the field, however, I didn't know how to achieve this in the time-sensitive, intersubjective realm of the farm. Kathy, on the other hand, would instinctively respond to an upset cow by pulling out a flat palm to the side of her eyes like a blinker and looking down while walking away.

What's achieved here is twofold. Firstly, the cattle's line of sight to the eyes of the farmer is broken. This draws on the ethological knowledge that some mammals interpret sustained eye contact as signalling threat, so the action reduces the risk of further upsetting the cow (Moran & Doyle, 2015). For the farmer, aversion of eye contact achieves a tactical detachment, breaking an intimate moment, undermining the intersubjective interaction that is conjured in the reciprocated sight and perception of the other (Dave, 2014). This action thus performs a stark transition from the care and attentiveness engaged in luring the cattle to the race leading to the colostrum paddock. The cow's exercise of agency in resistance, which might otherwise

conjure empathy from the farmer—and thereby curtail preformed plans—is inferior to the farmers’ responsive and immediately deployable techniques of detachment. As Kim Crowder (2015) has argued in her ethnographic research on the stockmanship of the ‘pigmen’ in British pig farms, detachment can be mutually beneficial for both farmers and livestock. It stabilises power relations, and, as described above, reduces the upset of cattle, in turn reducing the emotional labour for the farmer. Yet in their deployment, detachment strategies also demonstrate the complexity of farmer-livestock relations. Because they account for the subjectivity, and often-unpredictable agency, of the cattle, these relational techniques demonstrate the co-constitution of farming practice between humans and livestock. Detachment in itself betrays an inevitable tendency to humanise and empathise with livestock which would hinder the agricultural project if unchecked (Buller, 2013; Crowder, 2015; Pachirat, 2011; Wilkie, 2010).

Herd management and the biology of motherhood

On top of these affective interspecies relational practices, calving routines are also a highly material process. The affective and relational techniques described above are subject to and mediated by cattle biologies and other material processes. Being more commensurable with scientific epistemologies, the material practices undertaken during calving are often outlined in objective resources like those discussed in chapter two. Farmers can consult advice from organisations like DairyNZ, for example, for a refreshment on the signs of labour, or ‘when to intervene’ if a calf is ‘abnormally presented’ during calving (DairyNZ, 2016a). Yet, these objective, scientific guidelines are often implemented through tacit, responsive and innately social arts of attentiveness (van Dooren et al., 2016). This section explores the materiality informing the process of ‘drafting’ cattle, herd management, and the practices of post-parturition care and commodification of cattle bodies. These examples reveal how the biological aspects of cattle reproduction, pregnancy, and post-parturition regulate farm management and practice, and showcase the intersection of formal and tacit, or scientific and attentive, knowledge-practices.

During calving season, herd organisation is determined by the cattle’s pregnancy and post-pregnancy status. Figure 3 presents the flow-through process of segregation by which the cattle were organised when I was on the Kagan farm. At the beginning of the calving season in July, the entire herd is ‘dry’, meaning they aren’t producing milk. The standard practice is to ‘dry off’ cattle at least six weeks before calving, so that their mammary tissues can re-build (DairyNZ, 2014). As the cattle start to ‘spring up’ and display physical signs that they are days

out from calving, they are segregated into the ‘springer’ group.²⁶ Springers are kept closer to the centre of the farm so that the farmers can keep a close eye on them and, if necessary, assist in calving. Cows are relegated to the ‘colostrum’ group following calving, as they produce colostrum milk for about four days to one week after parturition. They are milked once a day, in the morning, and their milk is retained to be fed to the calves in the calf pens by the farmers. After four days to a week, colostrums start producing regular milk, and commence the twice-daily milking routine that will carry them through to the following May.

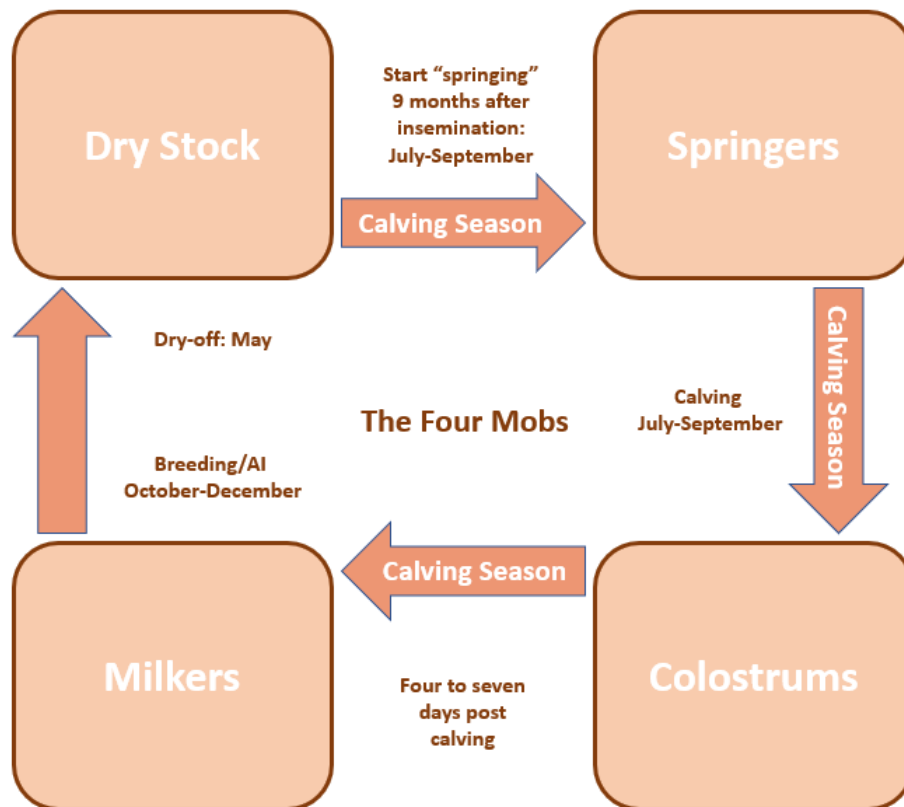


Figure 11: Herd organisation based on calving status.

These differences in pregnancy, calving and milking statuses are understood to have significant impacts on cattle behaviour, which also informs herd organisation. Kathy called the dry herd ‘the crazies’ as they tended to be very animated, running around, mooing loudly as we approached, and kicking up their heels. This mob is kept far from the central station of the farm. They need little attending by the farmers due to the fact they aren’t milking, and they need less feed. Kathy told me that if they see the farmers approaching, they tend to get ‘excited’,

²⁶ Kathy described the signs of ‘springing’ to me as follows: ‘they just go, they go flappy round the bum, right around the vulva they’re flappy, and they’re just starting to almost pink up or swell up at the top of the udder. They’re just starting to fill out a little bit’. Still, I would try to identify near-springs from within the herd daily, with very little success.

so it's best to limit contact with this mob to the essentials. Colostrums are also quite animated, a condition attributed to their tendency to have a strong attachment to their calf and a desire to reunite with them. To counter this, the colostrums on Kathy's farm were kept in a paddock bordered by thick macrocarpa trees at the far north of the farm, out of sight and hearing of any calves. There were many cows who retained this attachment to calves after they'd been drafted into the milking mob. These cows would often hold up the milkers as they were ambling down to the milking shed. If they caught sight of any calves in the paddocks they were passing, they'd stop and call out for theirs. Overall, however, the milking herd are known for their relatively docile, predictable and relaxed nature. Compared to the other groups, they are most often seen lying on the grass, chewing their cud, which is generally taken to be a sign of contentment and well-being.

This ideal model of a cleanly segregated four-part herd is aspirational. Its implementation depends on the farmer's accurate exercise and control over interrelational practices requiring tacit attentiveness to cattle bodies. This is best exemplified by the complex, coordinated process of 'drafting' cattle; a system by which an entire mob is segregated based on the farmers' perception of their calving status. During drafting, Kathy and Logan would sequester the 'dry' mob to one end of a race. Kathy would take up her station on the other end, stretching an electric fence wire across the exit. The mob would congregate where Kathy stood, and she would let two or three out at a time. Her movements were coordinated with Logan's, who stood on the other side of the race with his own electric fence. As she let the cattle out, Kathy would call out; 'Dry!', or 'Springer!', as the cows walked towards Logan. Also using wire fencing, Logan would guide the oncoming cattle into their allotted spaces; the springers were led to the wintering shed, while the dry mob were kept on the race outside.

The practice is time sensitive and risky; due to its active nature, and the heterogeneity of factors involved, drafting isn't sure-fire. The nameless herd members took their own time wandering between the two stationed farmers; the farmers had to coordinate their movements and adjust to accommodate the will of the cattle. Kathy had to quickly assess the cattle she had just let out, whilst moving back into place to prevent further numbers from coming through. It was clear that she tried to only let cattle with the same status through at the same time, however as this was most accurately assessed from behind, she sometimes had to retract her previous call. Logan, too, would have to respond swiftly and accurately, to guide the right cows to the right paddocks. There were many cases on the farm where drafting wasn't done on time or was done incorrectly. This can result in the early placement of a still-dry cow among the springers, or,

perhaps more fatefully, overlooking a springer who remains in the dry herd. The final section of this chapter centres on a vignette detailing our discovery of a dead calf amongst the dry herd, exemplifying the risk and ethical ambiguity of this model of herd organization and revealing the insecurities of farmer ‘control’ over their lively commodities.

The third-party farmer

Essentially, farmers insert themselves into the cow-calf relationship as a third-party. They fulfil, to some extent, the biological and affective roles of the mother to her calf, and vice versa. However; certain aspects of this natural relationship are intensified, or industrialised, in human hands. Colostrum is a good example of this; rather than allow for calves to stay with their mothers who are producing colostrum post-calving, the separation of the calf from its mother within 24 hours of birth is seen as essential to ensure it is ingesting *enough* colostrum (DairyNZ, 2015a). Calves are born vulnerable to pathogens because the placenta prevents the absorption of many antibodies while the calves are still in utero. The viscous, golden colostrum milk is rich in antibodies which are essential to calf-growth and development throughout life, in addition to fending off disease in its infancy. According to MPI (NAWAC, 2019), it’s necessary for new-born calves to ingest between 4-6 litres of colostrum milk in the first 24 hours following birth (but ideally within the first six hours), as their ability to absorb antibodies from this milk practically ends in the first 24-36 hours.



Figure 12: The third party farmer.

Management of farmer-led calf feeding demonstrates how nurturing practices initiate the incorporation of calf bodies into the biopolitical system of the farm (L. Holloway et al., 2012). The concentration of antibodies in colostrum milk naturally wanes over the days following birth, but farmers tend to continue feeding out colostrum to their calves for days following the natural end of the individual cow's colostrum generation, to provide additional gut immunity. Kathy and Logan stressed the importance of successful feeding as something that would impact the calves' growth rates and health over their whole life. This, too, is a point stressed by industry bodies like LIC and DairyNZ, the latter of which specifically advises that 'extra effort now will pay dividends throughout her milking life' (DairyNZ, 2015a). This rationale combines the investment logics of capitalism with the biopolitical strategies of life-optimisation. A very particular understanding of cattle wellbeing is propagated, acted upon, and considered synonymous to the economic livelihood of the farm. Yet this is achieved through intuitive and responsive practices of attentiveness and care.

The messy, somatic, and attentive implementation of calf practices founded on scientific knowledge was evident in the decision-making processes that occurred when we would check on new-born calves in the paddocks. Kathy would determine what actions to take during this

critical period by pressing her hands into the sides of calves to see how full their bellies were, and by assessing their cleanliness and dryness. Whether or not the mother had licked off the afterbirth, and the amount they had been fed shortly following calving, were indicative of the type of care one could expect a calf to receive from its mother. This tactile assessment was thus important in determining whether to leave the calf with its mother for the day or overnight, or whether material interception was required immediately. Similar to the subjective and tactile assessment of pregnancy status in drafting, this assessment is an exercise of experience-based embodied knowledge, co-constituted between human and nonhuman inhabitants of the farm ecology.

A final example of the farmers' third-party role is the uncanny symmetry employed in the somatics of farmer-led calf feeding, and the technology of the milking shed. In order to entice the calves to drink colostrum, the physiology of the suckling process is mimicked. Milk is warmed before being fed to the calves, and the rubber teats mimic the malleability of their mother's teats. To attract the ungainly, confused younger calves to the bottles, we would put our own fingers in their mouths to initiate their instinctive suckling response, to draw them onto the teat of the bottle. After a while, this physical act generated a form of obsession in the calves, as they would learn to follow us around in the shed, crowding us and trying to suck on our overalls if we stood still for too long. The counterpart to this occurs in the milking pit, with the suction cups specifically designed to mimic the suckling motions of the calves to initiate milk let-down. Because farmers insert themselves into these kin-spaces, attentiveness emerges in the nurturing and affective methods of care and interspecies communication.

Angie

Aside from being the only cow in the herd with a name, Angie was also distinguished by the fact that Kathy and Logan were planning to send her to the works. Despite these attributes she was somewhat unremarkable; she resembled any other large Friesian in the herd and seemed disinterested in temperament. Still, Kathy and Logan always noted her presence among the herd, and consistently called her by her name. This was noticeable, as other cows would only occasionally be gifted nicknames, always temporary and meaningless, like 'Jemimah' (Kathy) or 'you silly tart' (Logan). Most often, cows were addressed by the number on the plastic tags hanging from their ears.

At the breakfast table one morning, I asked about the cow they had been calling Angie.

'She's a dog, worst cow in the herd', said Logan. That's when they told me she was destined for the works. It turned out that her name was pretty arbitrary. Logan's daughter had bought into the farm about seven years ago, and her investment added up to about one cow in the herd. Hearing this, she randomly pointed at a cow, called it Angie, and declared that she was 'hers'.

If there is a precedent set by being named, Angie didn't live up to it. Kathy looked up Angie's profile on the MINDA app and showed me that, due to her low milk yield, Angie would provide about \$208 less in profit than the average cow from her year. This had been a particularly bad year for her, as she had also aborted her calf. That didn't matter much, however, as her fate was already decided. She had developed cancer eye, a common affliction among dairy and beef cattle that can affect production and calving rates.

A few days following this discussion, a vet came to assess Angie alongside another cow with an unclear calving status.²⁷ They were both cordoned to a section of the race next to the herring bone in the milking shed, lined up single file behind the cattle handler. I asked Kathy why Angie needed a vet check-up, if she was going to the works anyway.

'Well, she's got a bad eye- she probably needs a vet certificate to go,'²⁸ she replied. 'The vet will give her a check-up and he'll write a certificate to say 'yes, she's been seen by a vet, she's been treated, and she's good to go,' and that means she gets priority treatment at the

²⁷ Kathy was unsure whether or not this cow had calved so she decided to get the vet to check while he was on farm for Angie.

²⁸ The care and procedures (2018) amendments to the 1999 Animal Welfare Act states that if a livestock animal's eye cancer is bleeding or discharging, is not visibly confined to either the issues of the eye or of the eyelid, causing the eye to discharge or is over 2cm in diameter, must be accompanied by a vet certificate in order to travel to slaughter premises ("Animal Welfare (Care and Procedures) Regulations 2018," 2018).

works. So, she'll go to the closest works, and she's killed pretty much as soon as she arrives. She won't be standing around, waiting.' I immediately assumed that these measures were in place as an assurance for food safety standards. I was surprised when Kathy corrected this assumption; the measures were in place for animal welfare. She had to be in good enough condition to travel without too much discomfort, and her quick admission to works was to reduce any pain, fear or discomfort that she might experience. The younger cow with the unclear calving status received most of the attention during the vet exam. Everyone was laughing at Kathy's overly cautious nature, as it was quite clear to the vet that the cow was still in calf. 'Oh, well,' laughed Kathy, turning to the cow, 'I guess you'll be going back to the springers, again!'



Figure 13: Kathy tends to the unnamed springer, with Angie looking on.

Both cows were given a drench, and then let out of the hold to mill around in the race, which was fenced off at the other end to prevent them from walking away. That's when Kathy brought up Angie, who, unlike her nameless companion, would not be going back to the herd. The vet confirmed that Angie was in good enough condition to go to the works. Everyone acknowledged that she wasn't actually 'in bad nick'.

'She's actually looking really good, in my opinion', said the vet assistant.

'...she's lost a bit of weight, just since she slipped- she's only slipped quite recently, I think.' said Kathy.

The tone of the conversation turned; Logan stated that she was probably one of the worst cows in the herd. 'She is. I think she is the worst' said Kathy. Based on previous cases,

the vet warned of the possibility that they might find more cancer in the body once she went to the works. If this was the case, she would have to go 'down the chute', and her body would be rendered into non-meat products, or maybe pet food. Kathy said she didn't want to think about that. 'I mean, she's gotta go, cos she'll get worse' she said.

The biopolitical logic of Angie's death

Biopolitical 'truth discourses' (Rabinow & Rose, 2006, p. 197) relating to the optimisation of agricultural life were influential in determining Angie's fate, and can explain the predominant mode by which the farmers and vet related to her during her check-up. In chapter two, 'a social license to farm', I introduced biopolitical analysis as a framework to understand how the prevalence of scientific epistemologies of the body, centralised infrastructural data on the 'national herd', and technology's role in mediating human engagement with livestock health sustain cross-species power systems to which both farmers and livestock are subjectified (L. Holloway et al., 2012). Through a case study of livestock improvement strategies, I discussed how the authoritative truth discourses founded on genetic science function within a market of commodified genetic technologies and materials, to influence farmers' subjectification to the improvement of the bio-social collectivity (L. Holloway et al., 2012) of the 'national herd'. This was a classic example of how biopower is enacted through discursive systems centred on control of the body, to re-produce a docile and productive living population. Angie's case illustrates a similar but distinct phenomenon in more-than-human biopolitics; that the same truth discourses directed at optimizing life and productivity can also influence the decision to *end the life* of a member of a bio-social collectivity.

In agriculture, biopower emerges in the 'optimisation' of life, as long as the bodies involved slot neatly into productive systems, and are still able to perform the metabolic labour that farmers exploit (Beldo, 2017; L. Holloway et al., 2012, pp. 63, 65). The interventional strategies that purport to foster and organise life are informed both by science and a capitalist understanding of vitality as measured by productivity. Cancer, as is understood in this context, is a pathological cell presence in the body, the growth and spread of which results in the death of healthy cells. Upon noticing Angie's cancer, the farmers felt they could readily predict the outcome of the illness based on their understanding of how the illness progresses, as supported by a history of truth discourses espoused by western scientific institutions. This attests to a very 'modern' faith in the authority of purified scientific knowledge, in spite of its separation

from the heterogenous locality of lived experience (Latour, 1993). The predictive logics of western veterinary science, paired with value-logics of capitalist production, determined that Angie's productive ability, and therefore her value to the farm, would decrease alongside her ailing health. Her relation to the human farmers, by this logic, is one of a decreasingly productive object.

Systemic detachment

In an industry that revolves so much around practices of nurturing and care, it is necessary for farmers to exercise ambivalence and detachment in circumstances of killing (Crowder, 2015; Wilkie, 2010). Kim Crowder (2015) argues that, contrary to some critical discourse about industrial agriculture, detachment is far from a constant state in farmer relations to livestock. Many farmers value an emotional and affective approach to stockmanship, and this necessitates the parallel development of detachment strategies as deliberative means to control emotions and make 'rational' decisions (Crowder, 2015). Successful detachment strategies include relational practices that enact livestock as a capital generating object commodities, and thereby elevate productivist thought in decision making (Crowder, 2015). There are also structural and systemic aspects of the agricultural industry that re-produce detachment in workers through a 'machinistic reduction of the farm animal to a component within a multitudinous productive unit' (Buller, 2013, p. 160).

Technologies offered by biopolitical institutions like LIC aide farmers in achieving detachment. The MINDA app, as discussed in chapter 2, intercepts the farmer-cattle relationship and re-presents a cow on the basis of its potential economic return to the farm. This is a 'new way of knowing' animals, founded on aggregated information, wholly different from the social experience of being *with* livestock (Lewis Holloway & Morris, 2008, p. 1710). Like cow number 6 discussed in chapter 2, the data-constructed profile of Angie on MINDA is a digital entity contrived of a different knowledge to that attained from personally perceiving and interacting or corresponding with her. When Kathy showed me Angie's statistics- her BW and PW on the MINDA app, she demonstrated her faith in the ability of these systems and data-technologies to reveal the link between Angie's waning health and her value to the farm. The molecularisation of Angie's body is a process of 'mechanisation' by which her subjectivity is subsumed to the status of the herd, and the farm, as a productive whole (Buller, 2013, pp. 160-161).

The structural (and geographic) division of labour in the industry also works to encourage detachment and ambivalence in these circumstances. Through industrialisation, contemporary

agriculture has sustained compartmentalised systems of labour, between which individual actions contribute to a greater whole (Bruckner et al., 2019; Hurn, 2012; Pachirat, 2011; Vialles, 1994). The alienation of this system was evident in the distribution of roles and responsibilities that prompted Kathy and Logan to consult with a vet regarding Angie's condition, and to send her away on a truck to the works, rather than culling her on-farm. This structural division of labour, between 'producers' and 'slaughterers' is founded on a division in accountability for 'livestock' and 'deadstock' (Wilkie, 2010). Wilkie (2010) argues that within this divided system farmers normalise and rationalise the killing of animals, for example; it has to be the right time (the animal must be of an acceptable age), and the right place (sending the animal to the works, a place dedicated to slaughter, is preferable to on-farm killing, as the farm is a place dedicated to fostering life). It's for this reason that on-farm culling of livestock that is occasionally necessitated by the outbreak of zoonotic disease can be a cause of disruption and emotional distress for farmers (see: Law, 2010).

A biopolitical take on Angie's story demonstrates the ambiguous moral status of livestock animals and the corresponding exceptional power over life and death allocated to farmers by the economic and legal structures of the capitalist state. While animal welfare rules are also enforced by the state, the fact that it is acceptable for livestock animals to be culled based on a diagnosis of cancer and their predicted resultant cost to the farm, is revealing of their primary legal status as productive commodities. Her cancer is deviant to the material processes that are essential to the farm as a productive unit. With reference to human populations, biopower is generally considered to represent a general shift from previously dominant systems of 'sovereign power', which, at its most simplistic, can be defined as a juridical power including 'the right to decide life and death' (Rabinow & Rose, 2006, p. 196). When nonhumans, like livestock, are considered biopolitical subjects, it's interesting to see how sovereign power and biopower are entwined and mutually reinforcing; the biopolitical institutions which generally foster life, are enacted to authorise the exercise of sovereign power. The disassociation and de-anthropomorphosis performed through the technologies of genetic evaluation, capitalist valuation, and the structural division of labour, work reduce animals to the de-politicised status of 'zoê', or 'bare life', upon which the act of killing is socially sanctioned (Agamben, 1998).

Practicing care in the vet consultation

'Although all stages of the production process throw up expected and unexpected paradoxical challenges, this is accentuated at the point of animal death.'

– Wilkie (2010, p. 148)

Another approach to Angie's story is to look at the minutiae of inter-relational practices that were undertaken prior to, and during, her vet consultation. It's clear that biopolitical logic reigned in ultimately determining Angie's fate, providing a transcendent and detached means of evaluating her value to the farm as measured against her cost. However, in the processes of arranging and undertaking the vet consultation, and in determining her fate, multiple *versions* of Angie, as both a herd member and as an individual, sentient being, were enacted in practice. The multiplicity of these relations complicates the ubiquitous vision of science and capital-based power systems invoked by a purely biopolitical reading. Here I offer a complimentary, alternative, interpretation using the lens of care (Law, 2010; A. M. Mol, Ingunn & Pols, 2010).

Applying care as a framework to this matter contributes to literature from Science and Technology Studies (STS) that emphasises the connections (and spectrum) between institutional scientific objectivity and care practices (A. M. Mol, Ingunn & Pols, 2010). Care, once considered the feminine domain of the home-worker, can now be understood as a mode of technology used throughout institutional settings (A. M. Mol, Ingunn & Pols, 2010). John Law (2010, p. 9) writes that 'care is best understood as a set of materially heterogeneous practices involving not simply particular kinds of subjectivities, but also instruments and technologies together with other material elements, texts and inscriptions.' In agriculture, where transcendent logics captured in objective resources and regulations uphold illusions of complete and utilitarian control of heterogenous landscapes, care practices are often necessary to implement these plans. Because care is responsive to the unpredictability of the lively materials and subjects involved, oftentimes these pre-formed plans, and farmer control, are compromised in practice (Singleton, 2010).

Likewise, Angie's vet consultation (and the events leading up to it) exemplified the responsive caring and attentive implementation of seemingly pragmatic and utilitarian biopolitical logics. Firstly, that Angie was identified and individuated from the herd at large was a material-semiotic act. As was established in the previous chapter, the farm is a mess of unruly entities. A requisite for making order out of these conditions is practicing and honing attentive ways of knowing the bodies and movements of other organisms and things (Ingold, 2012; Saramifar, Plonska, & Kootstra, 2018). It was through the exercise of co-constituted arts of attentiveness that farmers were able to notice and comprehend the potential risk of Angie's physical state, and draw her into more formalised, routinised practices of veterinary medicine. To my eyes, as someone unfamiliar with cattle bodies, Angie's cancer would have been unnoticeable. The farmers took pains to point it out to me; raw, peachy-white skin, bulbously protruding around

a weepy eye. Angie's individuation from the herd was a result of the farmers' embodied epistemologies of perception in consultation with a formalised knowledge of veterinary pathology.

In individuating and separating Angie from the herd, the farmers also, by contrast, enacted the ideal homogeneity of the herd as a single (healthy) entity (Buller, 2013), demonstrating the variances in scale at which farmers perceive and relate to their livestock. Kathy and Logan were constantly surveying the herd for deviance to the ideal of homogeneity, in cattle gait, speed, demeanour, or physical appearance. Blanchette (2015) has observed that managers of factory farms in America perceive livestock differently to lower-tier workers based on their working relations to them. Where lower-tier workers share a corporal experience working 'with' individual pigs, managers work 'on' 'The Herd'—a unit comprising 'spreadsheets, computer tabulations, scroll charts, or other abstract representations' (Blanchette, 2015, p. 648). These differences in the scale of perception have profound consequences for the significance of the individual pig, as The Herd allows for a detached and rational emphasis on the health and productive ability of the whole, rather than attention to the individual bodies that make up this whole.

In smaller operations like the Kagan farm, these modes of and working *on* or *with* livestock are practiced by the same people, depending on the context. Thus, the practices by which Angie was individuated and drawn from the herd enacted the single cow as an object of care, whilst invoking the ideal of the homogeneously healthy and productive herd. It's in these circumstances that the objective, rationality of biopolitical technologies are really valuable to farmers; their authority allows them to indicate a clear course of action under ambiguous circumstances when multiple objects of care are invoked. The MINDA app validated the option to cull Angie, for the sake of herd cohesion and economic rationality, exemplifying the intersection of care practices and scientific and capitalist epistemologies on farm.

On the day of her check-up, by contrast, Angie's subjectivity was continuously acknowledged and invoked through tacit practices of interspecies relationality. Angie, like all cows on the farm, seemed relatively comfortable around Kathy as the most familiar human. Kathy was the one who would usually show up to take them somewhere, to bring them hay or bailage or to take them to the milking shed. Bringing Angie and the pregnant cow to the cattle handler, Kathy deployed familiar methods of communicating with the cattle. Following behind as they walked to the cattle handler, Kathy spoke constantly, as she always does; 'come on, sook, come

on Angie - in there', applying a light touch, here and there to encourage movement. She moved her own body into the spaces she didn't want the cattle to enter and extended her arms out calmly to guide them through. Her walking speed, the tone of her voice, where she directed her attention; these are all honed, embodied communicative technologies developed in practice with cattle to achieve intentional movement together, as companion species (Despret, 2013; Haraway, 2003). After the check-up, Kathy used the cattle handler to give Angie a supplementary drench, to keep her strength up during her final days at the farm. Upon being let go, Angie moved briskly away from the handler into the race outside, only to find the exit closed. She turned, and looked at Kathy, awaiting direction as Kathy gave a drench to the springer who was still behind the handler. Kathy ended up separating the two while the pregnant one went back to the springers; Angie was led to her own paddock at the front of the farm.

Thus, even in the actions leading to her death, Angie's subjectivity was brought into being as an object of care, and her relation to the farmers played out as an intersubjective one. Angie's ability to perceive was clearly accounted for in the interactive practices that take place in the routine of sending her to the meat works. So, even though the biopolitical determinants of Angie's death are founded on her machinisation and objectification, a priority in care practices is for her to experience a 'good death' (Law, 2010, p. 5), through a combination of the embodied affective interrelational techniques, and the authorised logics of veterinary science and animal welfare law. When Kathy justified her decision with the scientifically-backed assertion that she would 'get worse,' it was clear in her tone that her awareness of Angie's continued suffering supplemented the fact that she would cost the farm to keep.

It's important to consider that the final object of care in this episode is the farmers themselves. To state the obvious, Kathy and Logan's economic well-being is entangled in the overall health of the herd, so paying heed to livestock ailments is inherently an act of self-care in that sense. In precise, interactional moments of practice, however, self-care is also performed through detachment strategies. Kathy, for example, actively avoided discussion of what awaited Angie once she left the farm. Talking to the vet, she took on an unsentimental, rational, and objective outlook. When the discussion turned to Angie's 'good nick', Kathy and Logan used justification tactics to explain why sending Angie to the works was the best course of action. The reified logics of veterinary medicine, and the standard practices of dealing with cancer eye as promoted by New Zealand's animal welfare code, here, fulfil the roles of ethical affordances (Keane, 2016), which provide farmers with the rationale to make pragmatic decisions in

ethically ambiguous circumstances.²⁹ The attachment and affection that Kathy had for her cattle was clear in her respectful treatment of the sick cow, but not in the objective language that she used to talk about her during the consultation. Discursive techniques of detachment are commonly deployed to reduce the potential stress and ethical dilemmas of agricultural practice (Crowder, 2015; Pachirat, 2011; Wilkie, 2010). Like the structural compartmentalisation of violent practices in the industry (Hurn, 2012; Pachirat, 2011), farmers often have to learn how to compartmentalise their feelings in agricultural work (Crowder, 2015). The ethical ambiguity conjured in the oscillating relations between farmers and livestock means that farm management also necessitates the management of emotions.

Picking up the dead calf

Logan lifted the electric fence by the hook, and started winding it around the reel, opening a new break of long grass for the herd. They bounded out, kicking up their heels in that wild, kooky manner the dry stock are known for. As they cleared the section, I noticed a motionless black heap on the ground, left in the middle of the paddock.

‘Oh look, oh no, someone’s calved. Someone’s had a baby’, Logan said.

The dead calf’s face was clean- there was no evidence of lingering afterbirth. One of its front legs was stretched out and pressed up against its face.

We had taken the four-wheeler to the far east of the farm where the dry herd was stationed. Still far from calving, this group were the were least in need of attendance and could be kept further from the house and the milking sheds. At least, that is how it was meant to work, with successful drafting practices. Our trip out there was routine—we had planned simply to move them to a new break for more pasture. The dead calf was entirely unexpected.

Following this unfortunate discovery, Logan briefly tried to locate the mother in the herd. It was of paramount importance, he explained, as she would need to be drafted out of the dries and into the colostrums. She would need a milk and a check-up. He pulled out his phone to check the MINDA app for any cows that might have been due to calve that day and scanned the herd from a distance. After a few minutes he conceded that he would only waste time searching for the mother, that this was a job best left for Kathy. As we drove away, Logan and

²⁹ See chapter 2 (“A social license to farm”) for more on ethical affordances.

I talked about the dead calf. He explained that it probably wasn't a slip- the calf looked like it had gone full-term. I asked Logan why the calf would have died, if this was the case.

'Can't answer,' he said, 'It could'a been a long calving, it could'a been hungry.

Though...I doubt it died cos of hunger, cos I think it had been licked. Sometimes, if they don't care about their calf, they'll spit this calf out, and its face is covered in this afterbirth, and it suffocates. But I don't think...'

'Its face looked quite clean to me' I said,

'Yea, it did look quite clean....'

Kathy and I returned to the field a short while later, this time pulling the quad bike, trailer attached, up next to the calf. Our proximity to the dead calf must have triggered something; very shortly after we got off the trailer, Kathy pointed out the familiar sound of the low-frequency *moo* that new mothers make in the presence of their calves. She walked into the herd, touching, talking to, and cooing at the cows, looking among them for evidence of birth. 'Oh mother, is that you, number 5?' she said. 'no- it can't be you. You're too big,'. However, when number 5 turned around, Kathy noticed blood on her rear; 'oh it is you. Come on, we better be going'.

Kathy came back to the dead calf and loaded it onto the trailer, after which we got on the bike and drove through the herd with it. The presence of the calf lured number 5, the mother, to follow. We also managed to collect several of what Kathy called 'aunties'. These were other cows who joined number 5 in crowding around, mooing and licking at the air around the calf. While we were drawing them out, Kathy kept turning to the collection of cows, saying 'come on mother, come on,' and making 'ttch'-ing noises with her tongue. She was also using the high-pitched, bleating, 'calf call' that she used when drawing cows out to follow their living offspring. Kathy told me that those who were motivated to follow the dead calf were probably approaching calving themselves, so she took advantage of their interest to bring them into the springers too.



Figure 14: A group of 'aunties' crowd around the dead calf.

Later, Kathy confirmed that she and Logan had probably overlooked the mother during drafting, meaning she evaded the routines designed to uphold a seamless calving season. The death could probably have been prevented if the mother had been drafted into the springers as she should have been, where they could have kept an eye on her. While I was on the farm, there were plenty instances of calving among the dry herd, however most were discovered in fine health. This dead calf revealed to me the inherent risk of subjective and slippery practices like drafting and other active practices aimed at managing the heterogenous, and often unruly, herd.

Death, detachment and the prioritisation of care

In an industry founded on the exploitation of the biological processes of living beings, the uncontrolled death of a livestock animal has massive implications for its' commodity value and 'social life' (Appadurai, 1986). In dairying, value is created through exploitation of the microbiological processes occurring within these lively commodities (Barua, 2019; Beldo, 2017; Collard & Dempsey, 2013). Replacement heifers are raised for about a year before this value is returned to the farmers through breeding and milk production following her first

pregnancy. After an uncontrolled ‘casualty’, as they call it in the industry, this capital-generating potential is lost. Correspondingly, death marks the end of this commodity’s social and economic value; it exits the commodity state (Appadurai, 1986) and is marred by negative characteristics. The lively potential of the body is now perceived as risk: microbial agents outside of human control cause disruption in the form of rot and the potential spread of pathogens.

The dead calf’s body, a burden on time and finances, is essentially a waste product to the farmers. When we drove away after first sighting the calf, Logan was telling me about a company called Wallace Corp. who provide casualty collection and rendering services, dubbing themselves an ‘agri-recycler’ (Wallace Group LP, 2020). He told me that while Wallace Corp. used to charge twenty dollars for collection, they had recently raised their price to fifty dollars; ‘If they keep up like this, soon enough it’d be cheaper just to dig a big hole’. This attitude was in stark contrast to the care administered among the living calves in the pens at the farm’s centre. The farmer’s interactions with this dead calf slotted it neatly into the classic category of dirt, as ‘matter out of place’ (Douglas, 2003), and their manner of dealing with it was uncannily similar to municipal waste collection. The body was left near the driveway to the farm, picked up and loaded onto the Wallace Corp. truck to be taken to a rendering plant far away.

The farmer’s actions and reflective comments betrayed no consideration of the sentience of the life lost; instead, they directed their attention to the material threat posed by the body’s lingering presence, and the still living mother who required attention. This very explicitly directed detachment reflects the oscillating concerns conjured through the heterogeneity of lively agents on the farm. Just as caring for livestock in an intersubjective and affective way is an essential aspect of farming, so too is economic pragmatism and the objectification of the cattle as material commodities, given the circumstance. The direct contrast between their actions towards the mother and calf demonstrates how these two perspectives can be enacted at once. The ‘mosaic of concerns’ (Driessen, 2012) that these conditions produce can be conflicting and difficult to navigate, and as an outside observer I found it difficult to comprehend how farmers could move from the caring role they took when looking after calves, to the blunt and pragmatic outlook and actions required in situations like this one. Pragmatism, here, manifests in the prioritisation of care.

The methods used to locate and care for the mother of the calf encapsulated the tacit and affective technologies of care and co-constituted ‘arts of attentiveness’ (van Dooren et al., 2016). The MINDA app, designed to objectify, rationalise and predict cattle biologies and advise herd management, could not help Logan when he tried to locate the mother amidst a disorderly collection of moving and lively bodies. Kathy, on the other hand, managed to locate and collect the mother using affective techniques, combining the same exploitation of maternal attachment that she frequently used to collect new mothers, with an immersive, somatic and communicative investigation among the herd itself. This is one of many ambiguous circumstances where Kathy’s extensive experience on farm came to the fore, compared to Logan who was relatively reliant on objectifying technologies like MINDA. A comparison of Logan and Kathy’s responses to the discovery of the dead calf demonstrates the entanglement of practices of care and practical knowledge that are highly valued in animal husbandry, or ‘stock-sense’ (Wilkie, 2010, p. 39).

This was salient; the contrast between the practiced ambivalence towards the discovery of the dead calf and the urgent care for its mother. As I have discussed in this chapter, nurturing and caring are essential to affective stockmanship, and by extension, they are essential to the commodification of nonhuman bodies. These practices are informed less through objective, rational overviews of dairy farm management, and more through the inherent sociality and learned behaviours of the farm as a lifeworld. Yet the dairy industry does not persist through nurturing relations alone; as a system, it’s inherently violent, exploitative and, of course, modern, and industrial. The rational, objective and economic vision of livestock, a more-industry-friendly version, represents another side of dairy farmer-cattle relations. Both perceptions were practiced in this encounter. The immediate, tacit and social practices of identifying and collecting the mother and ‘aunties’, compares starkly to the pragmatic treatment of the calf’s body as waste material. These contrasting relations, and realities of cattle as commodity-subjects, generate patches of ethical ambiguity for farmers. It’s through both systemic and embodied practices of detachment that farmers can attain ethical coherence through the sticky, messy work they conduct between their herd-as-subjects, and their farm as an economic entity.

Conclusion

This chapter has brought the multiplicity of farmer relations with livestock to the fore. Through three case studies; the routines of calving practice, the vet consultation pre-empting the culling of a sick cow called Angie, and the discovery of a dead calf among the dry stock, I have shown that in the minutiae of farming practice, livestock are enacted, and interacted with, as multiple, incongruent objects and subjects. These oscillating relations are mediated by the heterogeneous concerns that farmers manage, between caring for livestock, commodifying their bodies and managing the farm as a biopolitical system of production. As has been demonstrated, however, while these different relational practices contribute to oscillating enactments of cattle objects/subjects, they do not preclude each other. Rather, both ultimately contribute to the ongoing commodification of cattle. The co-constitution of industrial agriculture in design and practice is shown thus to be both a material and affective phenomenon, as inhabitation and understanding of the intersubjective sphere is essential to stockmanship. This is evident throughout the examples in this chapter, but particularly in the affective and material mimicry of the relations between mothers and their calves that sustain the commodification of cattle bodies essential to the dairy industry.

As has been argued throughout, the incongruence of the relations enacted between farmers and cattle in the dairy industry necessitate detachment strategies. Detachment is both a systemic/structural and embodied phenomenon. It is attained through the compartmentalisation of the industry and the functional organisation of responsibility for the lives and death of livestock (Pachirat, 2011; Wilkie, 2010), and through use of biopolitical logics and technologies offered by industrial bodies like LIC. It is also, however, an embodied phenomenon- present in the 'rational' ways that farmers talk (or avoid talking) about livestock, or they act around them, when faced with an ethically ambiguous situation. While detachment might be considered evidence of brutal and objectifying relations between farmers and livestock, I argue quite the opposite; that the intimacy fostered through attentive interspecies relations of care in stockmanship are what necessitates the development of these strategies, demonstrating the relational complexity of working with commodity subjects.

Conclusion

The third chapter of this thesis featured a short vignette about a particularly rainy night on the Kagan farm. This story led into a material analysis of the networked assemblages involved in the production of milk, and the farmers' active and responsive role in this material ecology. Here I return to that night, to tell the story of how a butterfly effect of micro decisions and lively material activity culminated in an experience that, for me, epitomised the relations between humans and nonhuman life on the farm.

It was the first night since my arrival that Kathy decided not to go out and check on the cows before bed. Every night up until this point, and every night following, Kathy would diligently rouse herself a couple hours after dinner, grab the four-wheeler and drive around the farm, just to make sure everything would be ok for the night. She adopts this habit for the hectic calving season, and on at least one occasion during my stay, she returned to the house having assisted in a calving, declaring that the springer in question wouldn't have managed without her help. On these night rides, she would undertake other cumbersome duties like feeding the new calves out in the paddocks, identifying near-calvers among the springers, and shifting them to a private paddock as needed. But this night was wet and miserable, and it followed a hard day's work. The two cows she was sure were going to calve had already done so. So she made the call to have an early night, and I commended her for giving herself a break.

That night, however, I lay in bed for hours before finding sleep. I was acutely aware of a cow who sounded unusually close to my sleepout. She was mooing, incessantly and extremely loudly, for hours. It struck me as a sorrowful, or distressed call; deep and rounded in the beginning and sharpening up to a harsh brass sound towards the end, almost like a cry or a wail. It sounded like the call that many colostrums and new milkers make when they pass the calf paddock. I learnt about this call on first day at the farm, when we were in the calving paddock, tending to a new calf and its mother. A group of milkers were passing on their way to the milking shed. They stopped, turned, and started 'calling for their babies', as Kathy explained it. Decontextualized that rainy night, the effect was deeply disturbing. Shouldering this feeling of distress, I struggled through a largely sleepless night.

The next day Kathy and Logan told me about a gate that the milking herd had breached the night before. The latch hadn't been fixed properly in place, and during the night several cows

broke out onto the race. 'It wouldn't have happened if I had gone out last night and checked that gate' Kathy said. Most of the cows made for other paddocks rich with grass. They caused some damage, stomping around in these wet paddocks, churning up grass and compacting the soil. One cow, however, had walked to a spot just across the garden from my sleepout, which was also right next to the paddocks Kathy had dedicated to the calving cows, new mothers and new-born calves. I had, then, correctly identified the cow's maternal call.

The calf of the cow in question would, by this point, have been shifted to the calf shed in a different part of the farm, if it hadn't already left the farm as one of the bobbies purchased by the lifestyle farmer. I asked Kathy about this distressing maternal drive, the post-parturition tendency to call for the calf. She estimated that it usually takes about four days for a colostrum to become calmer and more docile, like a milker, and stop being distracted by calves while moving about the farm. All too often, however, certain milkers, usually the ones who had recently been drafted from the colostrums, would lag outside this paddock and call out in futility. On this occasion, a string of material circumstances worked in tandem with the unruly characters of these lively commodities, to set in motion a night of soil-damage and disturbed sleep.

This thesis has aimed to complicate and contribute to understandings about industrial ontologies through an examination of multispecies relations on a New Zealand dairy farm. Ontological literature tends to attribute to western societies, by default, a de-animated, objective and scientific understanding of the nonhuman world, and a belief in human exceptionalism. That this narrative is largely inherited from the work of enlightenment philosophers, is a starting point from which to critique this flawed assumption as unrepresentative (Yates-Doerr & Mol, 2012). However, the trajectory of western societies as a whole, a common reification of scientific logic, the expanse of exploitative industrial pursuits, and the ensnarement of nonhumans in the bounds of anthropogenic ventures like intensive agricultural systems perhaps support this premise. Yet this image of the 'naturalist' west—the ontological sub-group who inhabit the world as singularly superior beings on the basis of unique 'interiority', and who rest in assurance of the constancy of the 'natural' physical world as decipherable through science—is rarely supported by empirical evidence. By exploring a microcosm of New Zealand's modern industrial society in the intense more-than-human contact zones of the dairy farm, this thesis aims to address this ontological oversight.

An important finding throughout this research has been the functional tension that occurs between objective (and objectifying) understandings of the nonhuman world and the relevance and role of these understandings in farming practice. Yates-Doerr and Mol (2012) argue that the bones of ‘naturalism’ may emerge in the sterile guidelines, say, of scientific institutions. They state, however, that ‘western practices are complex juxtapositions of different modes of ordering containing contrasting and overlapping repertoires’ (p. 58). Their argument, drawn from an analysis of the varying enactments of *meat* in different western contexts, is consistent with what I found on a farm in the Rangitikei. The nonhuman, whether classically ‘natural’ or not, emerges in multifarious guises and associated meanings through its engagement with industrial humans. The multiplicity of farmer relations to the nonhuman draws from a range of knowledges with tacit, affective and embodied understandings proving essential to farming practice. Scientific and objective knowledge itself is multifarious and contradictory (Yates-Doerr & Mol, 2012) and these conditions set the stage for ontological multiplicity.

If ‘naturalism’ exists in agriculture, it functions conditionally as a ‘dream of control’ (Singleton, 2010), or an ‘imposition of preconceived form’ (Ingold, 2012, p. 435) onto the material world. I have not tried to argue that the scientific objectification of the nonhuman is not important; indeed, its logic is a prevailing influence in farming. As was argued in chapters 2 and 3, farmers regularly subjectify themselves, for example, to the biopolitical truth discourses of herd improvement, and in the process support the growth of massive genomics companies like LIC and the biocapital economy. Their management of microbial threats in the disciplined disinfecting of teats post-milking, and their cleaning of the shed, for example, also abide by decreed scientific logics and processes regarding the treatment of nonhuman life forms that are not phenomenologically perceivable. Their use of cattle evaluation technologies such as the production, lactation and breeding worth standards provided by MINDA are another example of the prevailing, removed logics of western science, and its entanglement with capitalist value-logics. As was shown through the story of the cow Angie, scientific understandings of microbial threats and their corresponding threats to the economic viability of livestock can be crucial in decisions, such as whether to kill or keep cattle.

Despite the prevailing influence of removed scientific institutions and their ‘naturalist’ discourses, farming practice is, of course, a local affair. The Kagan farm proved to be a messy, heterogenous mass of materials-in-flux in which anthropogenic, organic and indigenous materials were constantly interacting to create an ecology of materials (Ingold, 2012). My fieldwork revealed some of the many instances in which co-constituted, tacit and embodied

knowledges, developed through active inhabitation of this material ecology, were essential to farming practice, over the objectified logics and resources provided by scientific or government institutions. Assessment of cattle health, pasture allocation, management of herd behaviour, and identifying livestock that needed care, are some of the examples where ‘arts of attentiveness’ (van Dooren et al., 2016) were exercised in response to the moving, changing and circumstantial material realities of farm life.

The liveliness of the farm’s heterogenous materials also figures in farming ontologies as valuable, animate, and unruly. The process of making and extracting milk, as was shown in chapter three, involves active engagement with multiple materials, the agency of which extends beyond farmer control. In working with living and moving materials, farmers extract value through manipulating and exploiting organic resources, but their liveliness is also a source of risk. The ‘control dream’ of sovereign, centralised human power over these materials is constantly compromised. There are frequent material slippages, instances where the materials don’t act in accordance to plan, or act in multifarious ways that influence and affect the project of the farm. In farming, the production of ‘lively commodities’ (Collard & Dempsey, 2013) must be achieved in correspondence with the flux of the material world (Ingold, 2013). This is achieved through practices of care, and tinkering (Singleton & Law, 2013), responsive, and inherently social engagements with the material ecology.

As this thesis has shown, the relationships between farmers and livestock do involve aspects of emotion and affection, and they have ethical implications. Farmers regularly invoked the subjectivity of the cattle, whether while interacting with them, reflecting on their character, or empathising with them. Practices of care between farmers and livestock often enacted interspecies intersubjectivity, even in circumstances of structural violence, such as the vet consultation leading up to the killing of the cow Angie. There’s no doubt that an innate sensitivity to livestock interiority emerges through the responsive and co-constituted knowledge-practices developed by farmers. Yet, these intersubjective practices co-exist in the agricultural industry among structural and practical factors that enact livestock as commodities. A dual status of livestock as commodity-subjects produces, in turn, instances of ethical incongruence.

Detachment strategies help farmers to work through, or avoid, this ethical incongruence. Detachment is a practical facet of agricultural settings; it is encouraged in systemic aspects like the industry’s geographic and professional compartmentalisation that mediates livestock

transition from ‘livestock’ to ‘deadstock’(Wilkie, 2010). It presents in the ambiguous and indirect language employed to speak of the violence in the industry, or to perform the work of commodity fetishism through symbolic transformation of agricultural products (Pachirat, 2011; Shukin, 2009). Yet, as I saw through my fieldwork, detachment itself can also be an intuitive, embodied practice, deployed through interspecies ‘arts of attentiveness’. A farmer’s deliberate or habitual disassociation from the subjectivities of livestock can in itself be an act of care, by re-establishing a semblance of order and control in these complex interspecies power systems. Detachment practices themselves, in their conditional, and affective deployment, attest to the fact that farmers recognise a form of shared interiority with nonhuman animals. Detachment, and the objectification of the nonhuman is not a precondition of industrial ontologies, but a method of finding ethical coherence among the contradictory practices of agriculture.

The night discussed at the beginning of this chapter awakened me (figuratively and literally) to the tenuous control that farmers have over the heterogenous agents with which they work. A minor lapse in routine, on this night, was fateful. The cattle, spewing out of their designated lots and wandering around on their own accord, managed to undermine the careful planning of pasture allocation, and waste the feed-value generated through the symbiotic relationship between soil and ryegrass. The farmers were somewhat irked by this occurrence, but their reaction, to my surprise, was measured. Such were the risks of the business; Kathy and Logan had accepted that. For me, the significance of the experience was the emotional toll of hearing the mother call for her lost calf. Combined with my exhaustion, I felt a deep sympathy and frustration that night, unable to disassociate from the moment and the meaning I drew from her call. Yet, the following day, and for the remaining days of my fieldwork, I continued to accompany Kathy on the four-wheeler to collect the calves and separate them from their mothers. We’d comment, occasionally, on the beauty of a particular calf, or congratulate the mother on her work, but each trip would end the same, with the calf driven to the calf pens, and the mother sent to the colostrum paddock. With each day, I found myself approaching this task more skilfully and pragmatically; I was better with the cattle, but I was also better at detaching, not looking back at the upset mothers, but moving forward to get the calves into the pen for a feed.

References:

- Agamben, G. (1998). *Homo sacer : sovereign power and bare life*. Stanford, Calif: Stanford University Press.
- Alsop, S. (2019). 50 Shades of Green protest: Farmer Sully Alsop's speech to Parliament. *New Zealand Herald*. Retrieved from nzherald.co.nz/the-country/news/article.cfm?c_id=16&objectid=12285222
- Animal Welfare (Care and Procedures) Regulations 2018, (2018).
- Animal Welfare Act 1999, (2018).
- Appadurai, A. (1986). Introduction: Commodities and the Politics of Value. In A. Appadurai (Ed.), *The social life of things : commodities in cultural perspective* (pp. 3-63). Cambridge, [England: Cambridge University Press.
- Barlett, P. F. (1987). Industrial Agriculture in Evolutionary Perspective. *Cultural Anthropology*, 2(1), 137-154. doi:10.1525/can.1987.2.1.02a00110
- Barua, M. (2016). Lively commodities and encounter value. *Environment and Planning D: Society and Space*, 34(4), 725-744. doi:10.1177/0263775815626420
- Barua, M. (2019). Animating capital: Work, commodities, circulation. *Progress in Human Geography*, 43(4), 650-669. doi:10.1177/0309132518819057
- Baskaran, R., Cullen, R., & Colombo, S. (2009). Estimating values of environmental impacts of dairy farming in New Zealand. *New Zealand Journal of Agricultural Research*, 52(4), 377-389. doi:10.1080/00288230909510520
- Bayly, C. (2009). *100 years of herd testing, 1909-2009 a farming partnership*. Hamilton [N.Z: Livestock Improvement Corporation Ltd.
- Bear, C., Wilkinson, K., & Holloway, L. (2017). Visualizing Human-Animal-Technology Relations : Field Notes, Still Photography and Digital Video on the Robotic Dairy Farm. *Society & Animals*, 25.
- Beldo, L. (2017). Metabolic labor: broiler chickens and the exploitation of vitality. *Environmental Humanities*, 9(1), 108-128.
- Belich, J. (2007). *Making peoples : a history of the New Zealanders : from Polynesian settlement to the end of the nineteenth century*. North Shore, N.Z: Penguin.
- Bille, T., & Steinfeldt, V. (2013). Challenging Fieldwork Situations: A Study of Researcher's Subjectivity. *Journal of Research Practice*, 9(1).
- Blanchette, A. (2015). HERDING SPECIES: Biosecurity, Posthuman Labor, and the American Industrial Pig. *Cultural Anthropology*, 30(4), 640-669. doi:10.14506/ca30.4.09
- Blanchette, A. (2018a). How to Act Industrial around Industrial Pigs. In I. G. Natalie Porter (Ed.), *Living with Animals* (pp. 130-141). Ithaca: Cornell University Press.
- Blanchette, A. (2018b). Industrial Meat Production. *Annual Review of Anthropology*, 47, 185-199.
- Blanchette, A. (2019). Living Waste and the Labor of Toxic Health on American Factory Farms. *Medical Anthropology Quarterly*, 33(1), 80-100. doi:10.1111/maq.12491
- Boogaard, B., Bock, B., Oosting, S., Wiskerke, J., & Zijpp, A. (2011). Social Acceptance of Dairy Farming: The Ambivalence Between the Two Faces of Modernity. *Journal of Agricultural and Environmental Ethics*, 24(3), 259-282. doi:10.1007/s10806-010-9256-4
- Brabyn, L. (2017). Declining Towns and Rapidly Growing Cities in New Zealand: developing an empirically-based model that can inform policy. *Policy Quarterly*, 13, 37-46.
- Breglia, L., & Fischer, M. M. J. (2009). THE "WORK" OF ETHNOGRAPHIC FIELDWORK. In J. D. Faubion & G. E. Marcus (Eds.), *Fieldwork Is Not What It Used to Be* (1 ed., pp. 129-142): Cornell University Press.
- Brooking, T. (2006). *Pasture, present and future – A brief history of pastoralism in New Zealand*. Wellington: Ministry of Agriculture and Forestry
- Brooking, T., & Wood, V. (2013). The grasslands revolution reconsidered In E. Pawson & T. Brooking (Eds.), *Making a new land : environmental histories of New Zealand* (pp. 193-208). Dunedin: University of Otago Press.

- Bruckner, H., Colombino, A., & Ermann, U. (2019). Naturecultures and the affective (dis)entanglements of happy meat. *Agriculture and Human Values*, 36(1), 35-47. doi:10.1007/s10460-018-9884-2
- Buller, H. (2013). Individuation, the Mass and Farm Animals. *Theory, Culture & Society*, 30(7-8), 155-175. doi:10.1177/0263276413501205
- Buller, H., & Roe, E. (2012). Commodifying animal welfare. *Animal Welfare*, 21. doi:10.7120/096272812X13345905674042
- Butler, D., & Holloway, L. (2016). Technology and Restructuring the Social Field of Dairy Farming: Hybrid Capitals, 'Stockmanship' and Automatic Milking Systems. *Sociologia Ruralis*, 56(4), 513-530. doi:10.1111/soru.12103
- Candea, M., & Alcayna-Stevens, L. (2012). Internal Others: Ethnographies of Naturalism. *The Cambridge Journal of Anthropology*, 30(2), 36-47. doi:10.3167/ca.2012.300203
- Chobtang, J., McLaren, S. J., Ledgard, S. F., & Donaghy, D. J. (2017). Environmental trade-offs associated with intensification methods in a pasture-based dairy system using prospective attributional Life Cycle Assessment. *Journal of Cleaner Production*, 143, 1302-1312. doi:10.1016/j.jclepro.2016.11.134
- Choy, T., & Zee, J. (2015). CONDITION—SUSPENSION. *Cultural Anthropology*, 30(2), 210-223. doi:10.14506/ca30.2.04
- Chrulaw, M. (2012). ANIMALS IN BIOPOLITICAL THEORY: BETWEEN AGAMBEN AND NEGRI. *New Formations*(76), 53-67,150.
- Collard, R.-C., & Dempsey, J. (2013). Life for Sale? The Politics of Lively Commodities. *Environment and Planning A*, 45(11), 2682-2699. doi:10.1068/a45692
- Crowder, K. (2015). Artisanal Affection: Detachment in Human-Animal Relations Within Intensive Pig Production in Britain. In M. Candea, J. Cook, C. Trundle, & J. Yarrow (Eds.), *Detachment: Essays on the Limits of Relational Thinking* Manchester: Manchester University Press.
- DairyNZ. (2014). Dry Period. Retrieved from <https://www.dairynz.co.nz/animal/cow-health/mastitis/dry-period/>
- DairyNZ. (2015a). Calf care. Retrieved from <https://www.dairynz.co.nz/animal/calves/calf-care/>
- DairyNZ. (2015b). DairyNZ FeedRight: Busting the myths on cow nutrition. In DairyNZ (Ed.). Hamilton: DairyNZ.
- DairyNZ. (2016a). Calving Cows. Retrieved from <https://www.dairynz.co.nz/animal/calves/calving-cows/>
- DairyNZ. (2016b). Leaf stage. Retrieved from <https://www.dairynz.co.nz/feed/pasture-management/assessing-and-allocating-pasture/leaf-stage/>
- DairyNZ. (2017). *Facts & figures : a quick reference guide for New Zealand dairy farmers* (2nd edition. ed.). Hamilton, New Zealand: DairyNZ.
- DairyNZ. (2019a). Carbohydrate. Retrieved from <https://www.dairynz.co.nz/feed/nutrition/principles-of-nutrition/carbohydrate/>
- DairyNZ. (2019b). Dairy plays a key role in latest economic success. Retrieved from <https://www.dairynz.co.nz/news/dairy-plays-a-key-role-in-latest-economic-success/>
- DairyNZ. (2019c). QuickStats about dairying – NEW ZEALAND. Retrieved from <https://www.dairynz.co.nz/media/5792398/quickstats-about-dairying-new-zealand-2019.pdf>
- DairyNZ. (2020). Grass Staggers. Retrieved from <https://www.dairynz.co.nz/animal/cow-health/grass-staggers/>
- Damian Carrington. (2016). The Anthropocene epoch: scientists declare dawn of human-influenced age. *The Guardian*. Retrieved from <https://www.theguardian.com/environment/2016/aug/29/declare-anthropocene-epoch-experts-urge-geological-congress-human-impact-earth>
- Dave, N. (2014). WITNESS: Humans, Animals, and the Politics of Becoming. *Cultural Anthropology*, 29(3), 433-456. doi:10.14506/ca29.3.01

- Department of Conservation. (2015). Podocarp and Hardwood Forests. Retrieved from <https://www.doc.govt.nz/nature/native-plants/podocarp-hardwood-forests/>
- Descola, P. (2013). *Beyond Nature and Culture* (J. Lloyd, Trans.). London: University of Chicago Press.
- Despret, V. (2013). Responding Bodies and Partial Affinities in Human–Animal Worlds. *Theory, Culture & Society*, 30(7-8), 51-76. doi:10.1177/0263276413496852
- Douglas, M. (2003). *Purity and danger : an analysis of concepts of pollution and taboo*. London: Routledge.
- Driessen, C. (2012). Farmers Engaged in Deliberative Practices: An Ethnographic Exploration of the Mosaic of Concerns in Livestock Agriculture. *Journal of Agricultural and Environmental Ethics*, 25(2), 163-179. doi:10.1007/s10806-010-9293-z
- Driessen, C., & Heutinck, L. (2014). Cows desiring to be milked? Milking robots and the co-evolution of ethics and technology on Dutch dairy farms. *Agriculture and Human Values*, 32(1), 3-20. doi:10.1007/s10460-014-9515-5
- Dwyer, J. (2007). A Non-companion Species Manifesto: Humans, Wild Animals, and "The Pain of Anthropomorphism". *South Atlantic Review*, 72(3), 73-89.
- Evans, L. (2004). *Structural Reform: the Dairy Industry in New Zealand* Paper presented at the APEC High Level Conference on Structural Reform, Tokyo, Japan.
- FAO. (2019). Livestock Patterns. Retrieved from <http://www.fao.org/faostat/en/#data/EK>
- Faulkner, T., & Parkes, R. (2013). *Soil compaction and pugging on dairy farms*. Wellington: Greater Wellington Regional Council Retrieved from <https://www.gw.govt.nz/assets/Land-Management/Soil-Compaction-and-Pugging-on-Dairy-Farms.pdf>
- Feigin, S., Owens, R. G., & Goodyear-Smith, F. (2018). A clean, green New Zealand? An in-depth look at the personal experiences of animal rights activists. *Qualitative Report*, 23(3), 616-635.
- Fisher, M., & Mellor, D. (2008). Developing a systematic strategy incorporating ethical, animal welfare and practical principles to guide the genetic improvement of dairy cattle. *New Zealand Veterinary Journal*, 56(3), 100-106. doi:10.1080/00480169.2008.36817
- Fonterra Co-operative Group. (2020, April 2020). Grass Fed. Retrieved from <https://www.fonterra.com/nz/en/what-we-stand-for/trusted-goodness/grass-fed.html>
- Foote, K., Joy, M., & Death, R. (2015). New Zealand Dairy Farming: Milking Our Environment for All Its Worth. *Environmental Management*, 56(3), 709-720. doi:10.1007/s00267-015-0517-x
- Foucault, M. (1990). *The history of sexuality*. London: Penguin.
- Geertz, C. (1973). *The interpretation of cultures selected essays*. New York: Basic Books.
- Gordon, A. (2009). The history and trends in farming and land use in the Rangitikei catchment. *New Zealand journal of forestry (1999)*, 54(1), 20-26.
- Grey, M. A. (2000). The Industrial Food Stream and its Alternatives in the United States: An Introduction.(Food and Power: Case Studies in Industrial Agriculture and its Alternatives in the United States). *Human Organization*, 59(2), 143. doi:10.17730/humo.59.2.xm3235743p6618j3
- Hamilton, L., & Taylor, N. (2012). Ethnography in evolution: adapting to the animal "other" in organizations. *Journal of Organizational Ethnography*, 1(1), 43-51. doi:10.1108/20466741211220642
- Hamilton, L., & Taylor, N. (2017). *Ethnography after Humanism : Power, Politics and Method in Multi-Species Research*. London: London: Palgrave Macmillan Limited.
- Hansen, P. (2014). Hokkaido's frontiers: Blurred embodiments, shared affects and the evolution of dairy farming's animal-human-machine. *Critique of Anthropology*, 34(1), 48-72. doi:10.1177/0308275X13510186
- Haraway, D. (2003). *The Companion Species Manifesto: Dogs, people, and significant otherness*. Chicago: Prickly Paradigm Press.
- Haraway, D. (2008). *When Species Meet* (Vol. 3). Minneapolis: University of Minnesota Press.

- Haraway, D., Ishikawa, N., Gilbert, S. F., Olwig, K., Tsing, A. L., & Bubandt, N. (2016). Anthropologists Are Talking - About the Anthropocene. *Ethnos*, 81(3), 535-564.
doi:10.1080/00141844.2015.1105838
- Havlicek, E., & Mitchell, E. A. D. (2014). Soils Supporting Biodiversity. In J. D. a. J. A. Krumins (Ed.), *Interactions in Soil: Promoting Plant Growth* (pp. 27-59). New York Springer.
- Head, L. (2016). *Rethinking agriculture, rethinking Anthropocene* (1 ed.): Routledge.
- Heath, D., & Meneley, A. (2010). The naturecultures of foie gras: techniques of the body and a contested ethics of care. *Food, Culture & Society*, 13(3), 421-452.
- Holbraad, M., & Pedersen, M. A. (2017). *Natural Relativism: Viveiros de Castro's Perspectivism and Multinaturalism*. Cambridge: Cambridge University Press.
- Holloway, L., Bear, C., & Wilkinson, K. (2014). Re-capturing bovine life: Robot-cow relationships, freedom and control in dairy farming.(Report). *Journal of Rural Studies*, 33, 131.
- Holloway, L., & Morris, C. (2008). Boosted bodies: Genetic techniques, domestic livestock bodies and complex representations of life. *Geoforum*, 39(5), 1709-1720.
doi:10.1016/j.geoforum.2008.03.006
- Holloway, L., Morris, C., Gilna, B., & Gibbs, D. (2012). Contesting genetic knowledge-practices in livestock breeding: biopower, biosocial collectivities, and heterogeneous resistances. *Environment And Planning D-Society & Space*, 30(1), 60-77. doi:10.1068/d2911
- Hooke, R. L., Martín-Duque, J. F., & Pedraza, J. (2012). Land transformation by humans: A review. *GSA TODAY*, 22(12), 4-10.
- Howard-Williams, C., Davies-Colley, R., Rutherford, K., & Wilcock, R. (2010). *Diffuse pollution and freshwater degradation: New Zealand Perspectives*. Paper presented at the Issues and Solutions to Diffuse Pollution, Québec.
https://www.landcareresearch.co.nz/publications/researchpubs/Howard_williams_2013_Diffuse_pollution_and_freshwater_degradation.pdf
- Hurn, S. (2012). *Humans and other animals : cross-cultural perspectives on human-animal interactions*. London: Pluto Press.
- Ingold, T. (2000). *The perception of the environment : essays on livelihood, dwelling and skill*: London New York : Routledge, Taylor & Francis Group.
- Ingold, T. (2007a). Earth, Sky, Wind, and Weather. *The Journal of the Royal Anthropological Institute*, 13, S19-S38. Retrieved from <http://www.jstor.org/stable/4623118>
- Ingold, T. (2007b). Materials against materiality. *Archaeological Dialogues*, 14(1), 1-16.
doi:10.1017/S1380203807002127
- Ingold, T. (2012). Toward an Ecology of Materials. *Annual Review of Anthropology*, 41(41), 427-442.
doi:10.1146/annurev-anthro-081309-145920
- Ingold, T. (2013). *Making: Anthropology, Archaeology, Art and Architecture*. New York: Routledge.
- Ingold, T. (2017). On human correspondence. *Journal of the Royal Anthropological Institute*, 23(1), 9-27. doi:10.1111/1467-9655.12541
- Ingold, T. (2018). One world anthropology. *HAU: Journal of Ethnographic Theory*, 8(1-2), 158-171.
doi:10.1086/698315
- Ingram, M. (2011). Fermentation, Rot, and Other Human- Microbial Performances. In M. Goldman, P. Nadasdy, & M. Turner (Eds.), *Knowing Nature: Conversations at the Intersection of political ecology and science studies* (pp. 99-112). Chicago ;: University of Chicago Press.
- Kalir, B. (2006). The field of work and the work of the field: Conceptualising an anthropological research engagement. *Social Anthropology*, 14(2), 235-246.
doi:10.1017/S0964028206002564
- Keane, W. (2016). *Ethical life its natural and social histories*. Princeton: Princeton University Press.
- Kenneth F. D. Hughey, G. N. K., Ross Cullen. (2016). Public perceptions of New Zealand's environment (Online). *Public perceptions of New Zealand's environment (Online)*.
- Kirk, R. G. W. (2017). The Birth of the Laboratory Animal: Biopolitics, Animal Experimentation, and Animal Well-being In M. Chrulaw (Ed.), *Foucault and animals* (pp. 193-221). Leiden Brill.

- Kirksey, S. E., & Helmreich, S. (2010). THE EMERGENCE OF MULTISPECIES ETHNOGRAPHY. *Cultural Anthropology*, 25(4), 545-576. doi:10.1111/j.1548-1360.2010.01069.x
- Kohn, E. (2013). *How forests think : toward an anthropology beyond the human*. Berkeley University of California Press.
- Kohn, E. (2015). Anthropology of Ontologies. *Annual Review of Anthropology*, 44, 311-327.
- Kopnina, H. (2017). Beyond multispecies ethnography: Engaging with violence and animal rights in anthropology. *Critique of Anthropology*, 37(3), 333-357. doi:10.1177/0308275X17723973
- Lambek, M. (2015). *The ethical condition : essays on action, person, and value*. Chicago ;: University of Chicago Press.
- Latimer, J., & Miele, M. (2013). Naturecultures? Science, Affect and the Non-human. *Theory, Culture & Society*, 30(7-8), 5-31. doi:10.1177/0263276413502088
- Latour, B. (1993). *We have never been modern*. Cambridge, Mass: Harvard University Press.
- Law, J. (2010). Care and Killing: Tensions in Veterinary Practice In I. M. AnneMarie Mol, Jeannette Pols (Ed.), *Care in Practice* (pp. 57-72). New Brunswick: Transaction
- Lieberman, K. (2016). The Reversibility of Landscapes in advance. *Environmental Philosophy*. doi:10.5840/envirophil201631431
- LIC. (2001). *Dairy Statistics 2000-2001*. Retrieved from Hamilton: https://www.lic.co.nz/documents/484/New_Zealand_Dairy_Statistics_2000-2001.pdf
- LIC. (2018, Feb 5, 2018). Animal evaluation. Retrieved from <https://www.lic.co.nz/about/animal-evaluation/>
- LIC, & DairyNZ. (2019). *New Zealand Dairy Statistics 2018-2019*. Hamilton: Livestock Improvement Corporation Ltd. and DairyNZ Ltd
- Lindop, J., Cochrane, W., & Pool, I. (2005). New Zealand Regions, 1986-2001: Population Geography. In (Vol. 2006:1). Hamilton: University of Waikato, Population Studies Centre.
- Linton, K. (2019). On Eating and Killing Multispecies Entanglements and Implications for Ecology. *NatureCulture*. Retrieved from <https://www.natcult.net/on-eating-and-killing-multispecies-entanglements-and-implications-for-ecology/>
- Locke, P. (2017). Elephants as Persons, affective apprenticeship, and fieldwork with nonhuman informants in Nepal *HAU: Journal of Ethnographic Theory*, 7(1), 353-376.
- Loveridge, A. (2011). Farm Practices and Animal Welfare. *New Zealand Sociology*, 26(1), 89-109.
- Lowe, C. (2014). Infection. *Environmental Humanities*, 5(1), 301-305. doi:10.1215/22011919-3615559
- Madden, R. (2010). *Being ethnographic : a guide to the theory and practice of ethnography*. London: SAGE.
- Madden, R. (2014). Animals and the Limits of Ethnography. *Anthrozoös*, 27(2), 279-293. doi:10.2752/175303714X13903827487683
- McAloon, J. (2013). Resource Frontiers, Environment and Settler Capitalism In E. Pawson & T. Brooking (Eds.), *Making a new land : environmental histories of New Zealand* (pp. 70-85). Dunedin: University of Otago Press.
- McCall, G. J. (2006). The Fieldwork Tradition. In DickHobbs & RichardWright (Eds.), *The SAGE handbook of fieldwork* (pp. 3-22). London: SAGE Publications Ltd.
- McEwen, W. M. (1987). *Ecological regions and districts of New Zealand*. Wellington: Department of Conservation. Retrieved from <https://www.doc.govt.nz/documents/science-and-technical/ecoregions3.pdf>
- Minami, K. (2009). Soil and humanity: Culture, civilization, livelihood and health. *Soil Science and Plant Nutrition*(5), 603-615.
- Mol, A. (1999). Ontological politics. A word and some questions. *Sociological Review*, 47(1_suppl), 74-89. doi:10.1111/j.1467-954X.1999.tb03483.x
- Mol, A. (2002). *The body multiple : ontology in medical practice*. Durham: Duke University Press.

- Mol, A. M., Ingunn , & Pols, J. (2010). Care: putting practice into theory. In Annemarie Mol, Ingunn Moser, & J. Pols (Eds.), *Care in Practice: on tinkering in homes, clinics and farms* (pp. 7-27). Bielefeld: Transcript.
- Moran, J., & Doyle, R. (2015). *Cow Talk: Understanding Dairy Cow Behaviour to Improve Their Welfare on Asian Farms*.
- MPI. (2017a). *Mortality rates in bobby calves 2008 to 2016*. (2017/01). Wellington: Ministry for Primary Industries Retrieved from <https://www.agriculture.govt.nz/dmsdocument/16501/direct>
- MPI. (2017b). *New Zealanders' views of the primary sector*. Wellington, New Zealand
- MPI. (2019a). Regulations and the animal welfare system. Retrieved from <https://www.agriculture.govt.nz/protection-and-response/animal-welfare/guide-to-the-animal-welfare-care-and-procedures-regulations/regulations-and-the-animal-welfare-system/>
- MPI. (2019b). *Winter Grazing Taskforce Final Report & Recommendations : Improving Animal Welfare on Winter Grazing Systems*.
- Munz, E. A. (2017). Ethnographic Interview In M. Allen (Ed.), *The SAGE encyclopedia of communication research methods* (pp. 454-457). Los Angeles: SAGE.
- NAWAC. (2019). *Code of Welfare: Dairy Cattle*. Wellington
- Noske, B. (1989). *Humans and other animals : beyond the boundaries of anthropology*. London: Pluto.
- NZIER. (2017). *Dairy trade's economic contribution to New Zealand*. Retrieved from Wellington: <https://www.dcanz.com/UserFiles/DCANZ/File/Dairy%20economic%20contribution%20update%20FINAL%2021%20February%202017.pdf>
- O'Reilly, K. (2005). *Ethnographic Methods* London: Routledge.
- Ogden, L., Hall, B., & Tanita, K. (2013). Animals, Plants, People, and Things: A Review of Multispecies Ethnography. *Environment and Society*, 4(1), 5-24. doi:10.3167/ares.2013.040102
- Okely, J. (2012). *Anthropological practice : fieldwork and the ethnographic method*. London ;; Berg Publishers.
- Open Country. (2015). Our Quality. Retrieved from <https://www.opencountry.co.nz/our-pride/our-quality/>
- Pachirat, T. (2011). *Every Twelve Seconds: Industrialized Slaughter and the Politics of Sight*. New Haven:: Yale University Press.
- Pálsson, G. (2009). Biosocial Relations of Production. *Comparative Studies in Society and History*, 51(2), 288-313. doi:10.1017/S0010417509000139
- Paxson, H. (2008). Post-pasteurian cultures: the microbiopolitics of raw-milk cheese in the United States. *Cultural Anthropology*, 23(1), 15-47.
- Peden, R., & Holland, P. (2013). Settlers Transforming the Open Country. In E. Pawson & T. Brooking (Eds.), *Making a new land : environmental histories of New Zealand* (New edition. ed., pp. 89-105). Dunedin: University of Otago Press.
- Pink, S. (2007). *Doing visual ethnography images, media and representation in research / Sarah Pink* (2nd ed.). London: SAGE.
- Pointon, N. (2019). Farmers vent frustrations over government's new freshwater policy. *RNZ*. Retrieved from <https://www.rnz.co.nz/news/national/399164/farmers-vent-frustrations-over-government-s-new-freshwater-policy>
- Porcher, J. (2011). The Relationship Between Workers and Animals in the Pork Industry: A Shared Suffering. *Journal of Agricultural and Environmental Ethics*, 24(1), 3-17. doi:10.1007/s10806-010-9232-z
- Porcher, J. (2017). *The Ethics of Animal Labor: A Collaborative Utopia*. London: Palgrave Macmillan.
- Porcher, J., & Schmitt, T. (2012). Dairy Cows: Workers in the Shadows? *Society & Animals*, 20(1), 39-60. doi:10.1163/156853012X614350

- Potts, A., & White, M. (2007). *Cruelty-Free Consumption in New Zealand: A National Report on the Perspectives and Experiences of Vegetarians & Other Ethical Consumers*. Retrieved from <https://www.canterbury.ac.nz/media/documents/oexp-arts/Cruelty-Free-Consumption-in-New-Zealand.pdf>
- Potts, A., & White, M. (2008). New Zealand Vegetarians: At Odds with Their Nation. *Society & Animals*, 16(4), 336-353. doi:10.1163/156853008X357667
- Rabinow, P., & Rose, N. (2006). Biopower Today. *BioSocieties*, 1(2), 195. doi:10.1017/S1745855206040014
- Ribas, V. (2016). *On the line : slaughterhouse lives and the making of the new South*. Oakland, California: University of California Press.
- Richter, D., Bacon, A., Brecheisen, Z., & Mobley, M. (2015). Soil in the Anthropocene. *IOP Conference Series: Earth and Environmental Science*, 25(1). doi:10.1088/1755-1315/25/1/012010
- Roche, M. (1997). 'The land we have we must hold': Soil erosion and soil conservation in late nineteenth- and twentieth-century New Zealand. *Journal of Historical Geography*, 23(4), 447-458.
- Rosenberg, G. (2017). How Meat Changed Sex: The Law of Interspecies Intimacy after Industrial Reproduction. *GLQ: A Journal of Lesbian and Gay Studies*, 23(4), 473-507.
- Rowarth, J. S. (2013). Dairy cows : economic production and environmental protection. In J. Dymond (Ed.), *Ecosystem services in New Zealand : conditions and trends* (pp. 85-93): Manaaki Whenua Press.
- Rural Delivery (Producer). (2017). Elite Genetics at LIC. [Video media] Retrieved from <https://www.ruraldelivery.net.nz/stories/Elite-Genetics-at-LIC>
- Saramifar, Y., Plonska, O., & Kootstra, J. (2018). Parliament of things and enactment of third entities: object-subject/subject-object encounters from cuban urban gardens to United States' robotic labs. *Journal for Cultural Research*, 22(3), 293-309. doi:10.1080/14797585.2018.1546928
- Satsuka, S. (2011). Eating Well With Others / Eating Others Well *Kroeber Anthropological Society Papers*, 99/100, 134-138.
- Sherwood, L., Hillar, K., & Yancey, P. H. (2005). *Animal physiology : from genes to organisms* (1st ed. ed.). Australia: Thomson/Brooks/Cole.
- Shukin, N. (2009). *Animal capital : rendering life in biopolitical times*. Minneapolis: University of Minnesota Press.
- Singleton, V. (2010). Good Farming: Control or Care? . In *Care in practice : On tinkering in clinics, homes and farms* (pp. 235-252). Bielefeld: Transcript.
- Singleton, V., & Law, J. (2013). DEVICES AS RITUALS: Notes on enacting resistance. *Journal of Cultural Economy*, 6(3), 259-277. doi:10.1080/17530350.2012.754365
- StatsNZ. (2018). Agricultural and horticultural land use. Retrieved from http://archive.stats.govt.nz/browse_for_stats/environment/environmental-reporting-series/environmental-indicators/Home/Land/land-use.aspx
- Steel, F. (2005). "New Zealand is butterland": interpreting the historical significance of a daily spread. *New Zealand Journal of History*, 39(2), 179-194.
- Stenhouse, J., & Beattie, J. (2007). Empire, Environment and Religion: God and the Natural World in Nineteenth-Century New Zealand. *Environment and History*, 13(4), 413-446. doi:10.3197/096734007X243159
- Strathern, M. (1988). *The Gender of the Gift - Problems with Women and Problems with Society in Melanesia*. Cambridge: University of California Press.
- Stull, D., & Broadway, M. (2004). *Slaughterhouse Blues: The Meat and Poultry Industry in North America*. Belmont, CA: Thomson/Wadsworth.
- Stull, D. D. (2000). Tobacco Barns and Chicken Houses: Agricultural Transformation in Western Kentucky.(Food and Power: Case Studies in Industrial Agriculture and its Alternatives in the

- United States)(Statistical Data Included). *Human Organization*, 59(2), 151.
doi:10.17730/humo.59.2.r553k512777w434
- Sunder Rajan, K. (2006). *Biocapital : the constitution of postgenomic life*. Durham: Duke University Press.
- Taunton, E. (2019). Cows in mud: Images stir up winter cropping concerns once more. *Stuff*. Retrieved from <https://www.stuff.co.nz/business/farming/114607024/cows-in-mud-new-images-stir-up-cropping-concerns-once-more>
- Taylor, N. (2004). In It for the Nonhuman Animals: Animal Welfare, Moral Certainty, and Disagreements. *Society & Animals*, 12(4), 317-339. doi:10.1163/1568530043068047
- Teaiwa, K. M. (2015). *Consuming Ocean Island : Stories of people and phosphate from Banaba*. Bloomington: Indiana University Press.
- Thom van, D. (2016). Lively Ethography: Storying Animist Worlds. *Environmental Humanities*, 8(1), 77-94. doi:10.1215/22011919-3527731
- Thomson, B. (2018). Bobby calves a time bomb. *New Zealand dairy exporter (1988)*, 93(10), 80-84.
- Todd, R., & Hynes, M. (2017). Encountering the animal: Temple Grandin, slaughterhouses and the possibilities of a differential ontology. *The Sociological Review*, 65(4), 729-744. doi:10.1177/0038026116677201
- Todd, Z. (2016). An Indigenous Feminist's Take On The Ontological Turn: 'Ontology' Is Just Another Word For Colonialism. *Journal of Historical Sociology*, 29(1), 4-22. doi:10.1111/johs.12124
- Tsing, A. (2011). Arts of Inclusion, or, How to Love a Mushroom. *Australian Humanities Review*, 50, 5-22. doi:10.22459/AHR.50.2011.01
- Tsing, A. (2012). Unruly Edges: Mushrooms as Companion Species. *Environmental Humanities*, 1, 141-154.
- Tsing, A. (2018). A multispecies ontological turn? In G. O. Keiichi Omura, Shiho Satsuka, Atsuro Morita (Ed.), *The World Multiple: The Quotidian Politics of Knowing and Generating Entangled Worlds*. Oxfordshire Routledge
- Tsing, A. L. (2015). *The mushroom at the end of the world : on the possibility of life in capitalist ruins*. Princeton, New Jersey: Princeton University Press.
- Tulloch, L., & Judge, P. (2018). Bringing the calf back from the dead: video activism, the politics of sight and the New Zealand dairy industry. *Video Journal of Education and Pedagogy*, 3(1), 1-20. doi:10.1186/s40990-018-0021-3
- van Dooren, T., Kirksey, E., & Münster, U. (2016). Multispecies Studies: Cultivating Arts of Attentiveness. *Environmental Humanities*, 8(1), 1-23.
- Vermeylen, S. (2017). Materiality and the Ontological Turn in the Anthropocene: Establishing a Dialogue between Law, Anthropology and Eco-Philosophy. In L. Kotzé (Ed.), *Environmental Law and Governance for the Anthropocene* (pp. 137-162). London: Bloomsbury.
- Vialles, N. (1994). *Animal to Edible*. Cambridge: Cambridge University Press
- Viveiros de Castro, E. (2014). *Cannibal Metaphysics*. Minneapolis: University of Minnesota Press.
- Wallace Group LP. (2020). Your Agri-recycler: Globally Focused - Locally Operated. Retrieved from <https://wallace.co.nz/>
- Weiss, B. (2011). MAKING PIGS LOCAL: Discerning the Sensory Character of Place. *Cultural Anthropology*, 26(3), 438-461. doi:10.1111/j.1548-1360.2011.01106.x
- Weiss, B. (2016). *Real pigs : shifting values in the field of local pork*. Durham: Duke University Press.
- Wentworth, K. (2015). Sensing Sentience and Managing Microbes: Lifedeath in the Slaughterhouse. *Mosaic: An Interdisciplinary Critical Journal*, 48(3), 141-157. doi:10.1353/mos.2015.0028
- Wilkie, R. (2005). Sentient commodities and productive paradoxes: the ambiguous nature of human-livestock relations in Northeast Scotland. *Journal of Rural Studies*, 21(2), 213-230. doi:10.1016/j.jrurstud.2004.10.002
- Wilkie, R. (2010). *Livestock/deadstock : working with farm animals from birth to slaughter*. Philadelphia: Temple University Press.

- Williams, A. (2004). Disciplining animals: sentience, production, and critique. *International Journal of Sociology and Social Policy*, 24(9), 45-57. doi:10.1108/01443330410790768
- Williams, B. (1985). *Ethics and the limits of philosophy*. Cambridge, Mass: Harvard University Press.
- Willis, R. (2004). Enlargement, concentration and centralisation in the New Zealand dairy industry. *Geography*, 89, 83-88.
- Wilson, S. (2017). New Zealand doesn't have an urban-rural divide – but National's trying its hardest to create one. *The Spinoff*. Retrieved from <https://thespinoff.co.nz/politics/18-09-2017/new-zealand-doesnt-have-an-urban-rural-divide-but-nationals-trying-its-hardest-to-create-one/>
- Winger, M., Jon Stika, & Tilley, D. (n.d.). *How Does Soil Function*. United States Department of Agriculture
- Yates-Doerr, E., & Mol, A. (2012). Cuts of meat: disentangling Western natures-cultures. *Cambridge Anthropology*, 30(2), 48-64. doi:10.3167/ca.2012.300204
- Zuppi, A. (2017). Naturalism and the representation of animals in the Southern French Pyrenees *Anuac*, 6(2), 129-154.