

On the Frontlines of Change:

A discursive approach to understanding real and envisioned climate adaptation pathways of drought-affected primary producers in NSW

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Declaration

This work is substantially my own, and where any part of this work is not my own, I have indicated this by acknowledging the source of that part of those parts of the work.

Abstract

The most severe drought on record continues to devastate rural communities and primary producers across most of South-Eastern Australia; signalling current adaptive responses are failing to keep up with the rate of change in climatic conditions. As the first line of resistance or participation in new climate adaptation and mitigation policies, primary producers on small-scale farms can be considered consequential actors in driving transformational change. Despite the dire implications of inaction for Australia's agricultural industries, there is a paucity of research into the socio-political dimensions underlying decision-making in climate adaptation planning at the farm-level. Noting that the livestock industry is highly vulnerable to the impacts of climate change, a significant contributor to Australia's share of releasing greenhouse gas (GHG) emissions, and possesses the potential to transform vast landscapes into a great 'carbon sink', this research endeavours to provide a more in-depth *understanding* of the discourses that influence responses to climate change at the farm-level in one of Australia's defining industries. In-depth guided interviews with 16 graziers across drought-afflicted areas of North-Western New South Wales constitute the scope of this research. A discursive analysis of interview data provided insights into the limitations of current hegemonic discourses and mainstream agricultural adaptation and mitigation strategies. Nonetheless, interview data enabled identification of sites of resistance; where alternative discourses and novel framing practices can be seen as opportunities for facilitating transformative change *within* the livestock industry and agricultural sector more broadly.

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Introduction

I believe we are starting to experience an accelerated desertification of Western NSW after a century of practices which have degraded our soils, dehydrated our landscapes and destroyed our local water cycles. To put it another way, I believe the effects of climate change (CC) and the desertification of our landscapes are colliding – Glen Morris, Farmers for Climate Action (FCA)¹

Desertification [mass noun] – The process by which fertile land becomes desert, typically as a result of drought, deforestation, or inappropriate agriculture (Oxford English Dictionary, 2019)

Research Problem

While drought has long typified and afflicted the landscape of rural NSW, the severity and longevity of the current drought² has produced unanimous claims from rural communities and primary producers across the state that this is the “worst drought in living memory”. At the end of summer in 2019, the entire state was declared under drought conditions with 89% of the North-West region suffering “Intense Drought” (see Figs. 1&2, p. 13) (NSW Department of Primary Industries [DPI], 2019, 28 March). Last year, the driest September and the third hottest year on record exacerbated the impacts of rainfall deficiencies, producing very poor harvest conditions and decimating crop yields across the region (DPI, 2018). The widespread experience of ‘agroeconomic drought’ across South-Eastern Australia created significant “feed gaps”, placing immense strain on livestock producers across these

¹ This quote is from initial correspondence with Glen Morris via email. He also participated in a phone interview and a brief face-to-face interview (see appendix B).

² According to the Bureau of Meteorology [BOM] significant rainfall deficiencies have affected most of NSW since the beginning of 2017. The BOM have also called this drought the most severe on record; records go back 120 years (Jones, 2019).

regions (DPI, 2018). Such “exceptional drought conditions” forced the Department of Agriculture to allow permits for Australia’s first significant wheat import in 12 years (a shipment of 57,000 tonnes of Canadian grain arrived in Port Kembla in June) (Endacott, 2019). As the biggest wheat exporter in the Southern Hemisphere, this “rare purchase” has signalled looming food security issues and confirmed that predictions of vulnerability for Australia’s agricultural sector can no longer be considered a distant threat.

2019 was a unique year for political parties and their constituencies across rural and regional Australia; branded as a “battle for the bush”, extensive media coverage and political campaigning was directed towards highlighting or appeasing the growing dissatisfaction of rural Australia with their elected representatives. Crippling drought and water management crises exacerbated growing disillusionment with traditional political parties and institutions across regional and rural Australia, resulting in state-wide swings against the Nationals of 1% and a ‘rise of the independents’ in major parties’ previously stronghold seats (Chan, 2019; Davis, 2019). Geographically speaking, more than half of NSW is now represented by the Shooters, Farmers and Fishers party (SFF).

In the absence of any coherent climate policy, let alone a national strategy for agricultural adaptation to CC, the failures of Australia’s current approach to environmental governance are exposed in the Intergovernmental Panel on Climate Change’s (IPCC) recent special report, *Land Use and CC* (IPCC, 2019). It is against this background – at a decisive moment in the debate over the future of rural communities and primary industries in Australia, that this research seeks to contribute to a deeper understanding of the lived experiences of drought and preferences for future climate adaptation pathways of livestock farmers across North-West NSW.

Despite the implications of inaction for Australia’s agricultural sector, there is a paucity of research into the socio-political dimensions informing decision-making in climate adaptation planning at the farm-level. As such, the underlying factors driving or preventing change on farms in the midst of an extreme climatic event constitutes the primary focus of this research. Noting that the livestock industry is highly vulnerable to the impacts of CC, culpable in releasing greenhouse gas (GHG) emissions, and possesses the potential to transform vast landscapes into a great ‘carbon sink’, this research endeavours to provide a more in-depth *understanding* of the discourses that influence responses to CC at the farm-level in one of Australia’s defining industries.

Livestock producers and small-scale farms constitute the focus of this research as they can be considered ‘high-leverage’ decision-makers for two reasons. Firstly, considering 56% of total land used in Australia is for extensive grazing (Australian Bureau of Statistics, 2018), landholders and livestock farmers (graziers) will play a significant role in driving change towards more sustainable and resilient agricultural systems and thereby ensure the viability of Australia’s primary industries in the face of a variable climate and growing concerns for food security. Moreover, as the first to feel the direct impacts of CC and associated policy responses, drought-affected primary producers will be the first line of resistance and/or participation in any agricultural adaptation/mitigation strategy, and therefore decisive actors in determining the success of such measures (Molnar, 2010).

This research will attempt to contribute timely new findings to existing literature and debate by addressing the following research question(s);

How do drought-affected livestock farmers (graziers) understand their role in climate adaptation and mitigation?

Data collection and analysis is primarily informed by the following sub-questions;

1. How is CC conceptualised by graziers in the context of ongoing experience of an extreme climatic event?
2. How does this inform their determination of responsibility in responding to CC and the appropriateness or feasibility of potential ‘solutions’ or adaptation pathways?
3. What discourses influence these perceptions and responses at the farm-level?

This research agenda is guided by the recommendation of Fleming and Vanclay (2009b) that an understanding of the discourses and social context that inform perceptions of CC, and in turn, climate adaptation pathways is important for bridging the gap between Research, Development and Extension³ (RD&E) programs and the needs

³ Definitions of agricultural extension vary across time and space. This research adopts the definition used by researchers with the Australian Farm Institute; “‘agricultural extension’ refers to activities by both the public and private sectors to transfer knowledge to and between farmers about ways to improve farm productivity and sustainability. The knowledge may be transferred either directly to farmers, or indirectly through farm service providers” (Keogh, 2014).

and preferences of livestock farmers. Moreover, analysis of the discourses used by graziers to “legitimate and justify” their behaviour and decision-making in responding to CC can provide insights into how dominant actors and discourses influence the pathways and parameters of adaptation at the farm-level (Fleming & Vanclay, 2009a). Moreover, detailed description of novel responses to CC at the farm-level and the alternative discourses and worldviews that inform them can provide empirical examples for improving adaptation and mitigation outcomes. Highlighting these instances (and creating discourses that empower farmers) is an essential first step for expanding the potential pathways for transformative adaptation towards the goal of a sustainable agricultural systems.

Research Findings and Significance

In total 12 guided in-depth interviews with 16 participants (4 dual participant interviews) constituted the focus of analysis for this research. The data provided rich insights into their lived experiences, perceptions of CC, the types of knowledge privileged in adaptation-planning and preferences for future adaptation. While data collected is not necessarily generalisable, detailed description of the social and political contingencies that inform adaptation at the farm-level has provided critical insights into the limitations of dominant discourses in agricultural climate adaptation and mitigation and the opportunities that exist for facilitating transformational adaptation on-farm. As such, the findings of this research have important implications for future research and policy design in rural primary industries on a regional and national scale.

Chapter Organisation

The purpose of **Chapter 1** is twofold; to outline the significance of the livestock industry in North-West NSW as rationale for the selection of focus for this research, and secondly, to establish the existing academic debates and research that provide an empirical background, theoretical frameworks and methodological recommendations from which this research takes guidance and seeks to contribute new knowledge to.

Chapter 2 establishes the epistemological/ontological learnings of this research in justification of the overall methodological approach. This is followed by a discussion of the strengths and limitations of the research method.

Chapter 3 provides a brief overview of the dominant problematisations of CC across government and industry discourses and the mainstream adaptation pathways they prescribe for livestock graziers in NSW.

Chapter 4 is concerned with providing detailed description of the discourses on drought and CC that influence and are in turn influenced by the social conditions of respondents in the area.

Chapter 5 builds on the findings and analysis of chapter 4 to enhance understanding of the multiple adaptation pathways that are being pursued (or envisioned) by graziers' on-farm, each of which are informed by different discourses of CC and grounded in differing epistemological assumptions.

The **final chapter (6)** considers the research's key findings in light of existing academic debates as well as the broader political and socio-ecological context of agricultural, and especially livestock, production and adaptation in Australia. Drawing from the recommendations of several notable academics across multiple bodies of literature, the findings of this research reiterate the need for an ongoing critical assessment of the normative discourses that perpetuate 'best practices' in agricultural adaptation research and policy design. The chapter concludes with recommendations for policy design and suggestions for further research to contribute to better outcomes for Australian primary producers, the rural communities that depend upon them, and the health of local and global ecosystems.

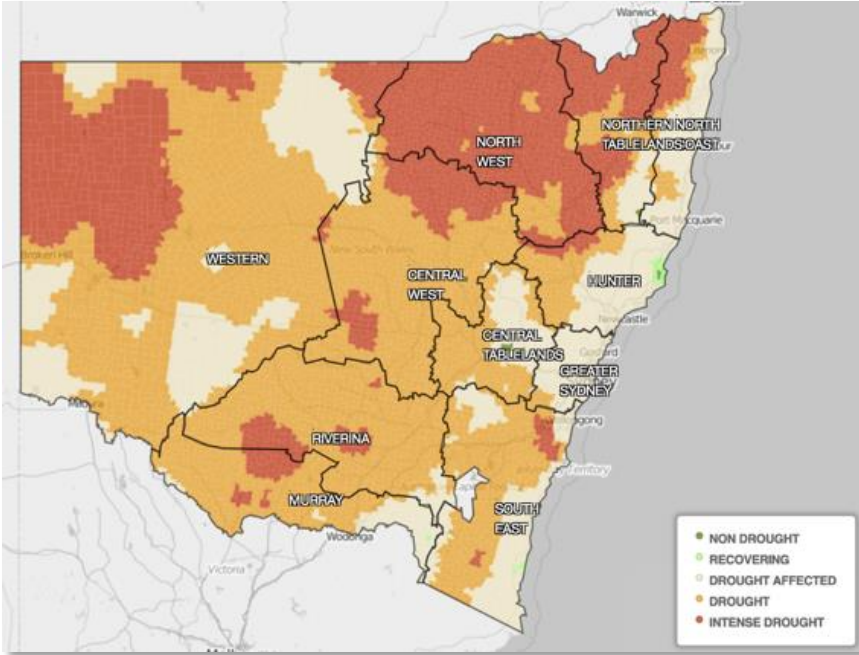
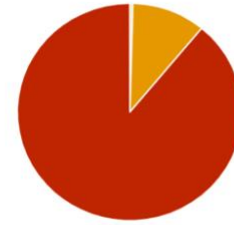


Figure 1. Combined Drought Indicator (CDI) Map, March (DPI, 2019, 28 March)

North West Summary



● Drought Affected: 0.4 %
● Drought: 10.6 %
● Intense Drought: 89.0...

Figure 2. CDI Regional Summary (DPI, 2019, 28 March)

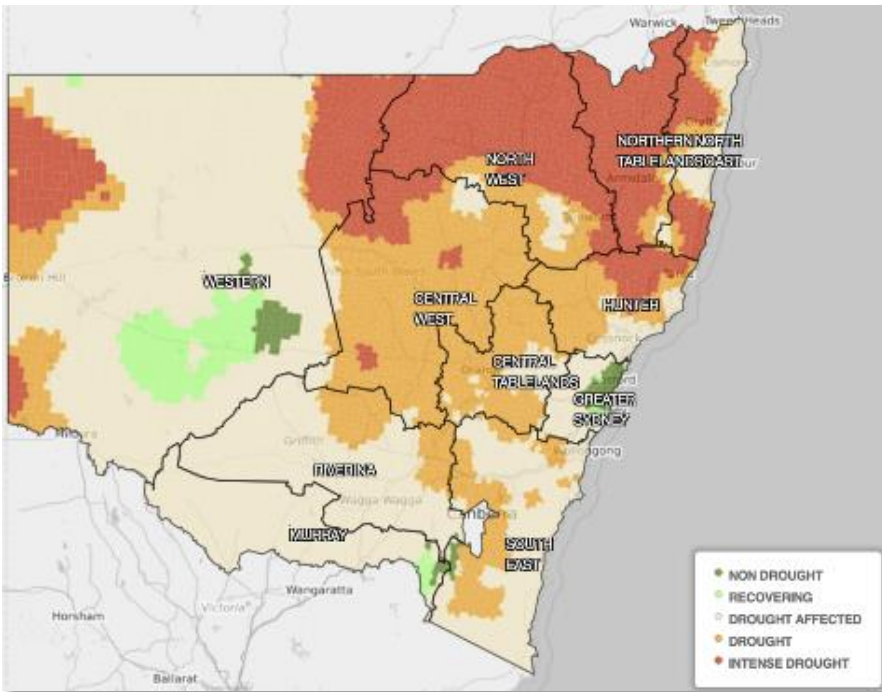


Figure 4. CDI Map, September (DPI, 2019, 4 September)

North West Summary



● Drought Affected: 5.0 %
● Drought: 16.6 %
● Intense Drought: 78.4...

Figure 3. CDI Regional Summary [September, 2019] (DPI, 2019)

(See Appendix A for measures of CDI)

Chapter 1: Background and Literature Review

The rationale for the research agenda and methodology will be derived from a review of two major pools of knowledge. The first requires an overview of the literature evidencing the significance of Australia's livestock industry as a major player in local and global environmental issues. This is followed by a review of academic debates and existing research into CC adaptation and mitigation in the context of agricultural primary industries. Comparison of theoretical frameworks and empirical studies has allowed for gaps in existing research – in terms of methodological approach, focus and scope of research and epistemological perspective – to be identified. It is against this background that this research seeks to contribute new knowledge and insights to.

Climate Change and Australia's Livestock Industry

Climate Change Impacts on the Livestock Industry in Australia

The IPCC modelling of the impacts of CC on the agricultural sector (IPCC, 2007) have been accepted as consensus knowledge via reproduction in government reports, popular media and public opinion alike (Donnelly, Mercer, Dickson, & Wu, 2009; Garnaut, 2008; IPCC, 2007; Milne, Stenekes, & Russell, 2008). In particular, the predicted rising temperatures, abnormal and reduced frequency in rainfall patterns, and changes in the quality and quantity of livestock pastures pose a direct threat to the future productivity and viability of Australia's livestock sector (Garnaut, 2008; Henry, Charmley, Eckard, Gaughan, & Hegarty, 2012). The vulnerability of Australia's livestock sector extends beyond the threat to cattle graziers' incomes, land management and productivity of land to the viability of agriculturally dependent rural communities and state and national markets and economy (Hughes, Rickards, Steffen, Stock, & Rice, 2016; R. Nelson, Kokic, Crimp, Meinke, & Howden, 2010b). Despite these projections, at the time of writing there remains no national climate policy, let alone an "actual framework to help farmers manage these risks and implement solutions" as FCA's CEO Verity Morgan-Schmidt explained (Cox, 2019).

The Impacts of Livestock Industry and Pastoral Farming on CC

There is a growing body of literature contributing to knowledge of the detrimental impacts of livestock production (particularly in its' industrialized form) and indirectly, meat and dairy consumption on local and global ecosystems (Fitzgerald & Taylor, 2014; Garnett, 2009; York, 2011). The 2008 Garnaut Review corroborated previous findings and explicitly outlined the contribution of the livestock industry to Australia's overall GHG emissions, which were found to be the "highest (per capita) of any OECD country and are among the highest in the world" (Garnaut 2008). Yet despite over a decade passing since the revelation that emissions from livestock (primarily from enteric fermentation in rumen-animals) contributed to 66% of Australia's agricultural emissions leading to recommendations that Australia reform its' livestock industry to adopt more sustainable farming practices and land use, at the time of writing there remains no coherent policy framework for mitigating emissions from livestock, nor **a national strategy for reforestation of landscapes**. The climate policy 'vacuum' in Australia and limited critical assessment of the future of the livestock sector, are reflective of a broader trend that Arcari (2016) has identified as "a consistent failure in the sustainability and CC research and policy space to afford [the livestock sector] proportional attention relative to energy and transport". Over the past decade, bodies such as the UN's Food and Agriculture Organisation (FAO) have emphasised the importance of building resilient livestock industries as vital for ensuring equitable rise in global health standards and food security (Guinot, Huang, & Legg, 2015).

However, the findings of the "first ever comprehensive look at the whole land-climate system" (IPCC special report *CC and Land*), is significant for drawing explicit, peer reviewed recommendations to ensure livestock can no longer remain 'CC's forgotten sector' (Bailey, Froggatt, & Wellesley, 2014). The report states;

CC can exacerbate land degradation processes (high confidence) including through increases in rainfall intensity, flooding, drought frequency and severity, heat stress, dry spells, wind, sea-level rise and wave action, permafrost thaw *with outcomes being modulated by land management*⁴ (IPCC, 2019, pp. 6-7)

⁴ Emphasis added

Emphasising the consequential role of land management in the climate system reaffirms the necessity of affording greater attention to the agricultural sector in designing adaptation and mitigation strategies *alongside* dramatic reforms in energy and transport sectors. These calls have been echoed by local community organisation groups with Farmers for Climate Action (FCA) demanding a “fully-funded national strategy on CC in agriculture” (Cox, 2019).

Various pools of literature are aligned in presenting the case for the re-thinking of livestock industry in Australia as a normative, ethical issue as well as a matter of necessity (Arcari, 2016; Fitzgerald & Taylor, 2014; Nordgren, 2011). A widely reported recommendation from the IPCC report was that dietary changes in Western countries present major opportunities for mitigation of CC and reversal of land degradation (IPCC, 2019). This reaffirms Cudworth’s claim that the “establishment of Western intensive production and the promotion of Western eating habits are more likely to increase social inequalities and insecurities” (Cudworth, 2011, p. 323). Noting the fundamental incompatibility of intensive cattle and sheep grazing with the relatively fragile ecosystems and variable climate that characterise much of the Australian landscape if further cause for change, especially as CC exacerbates pressure on Australia’s agricultural resources and farmable land (Henry et al., 2012).

Potential for Further Research

The preceding review provides rationale for the focus of this research and selection of case-study. The significance of the agricultural sector in the context of CC mitigation and adaptation is threefold; its vulnerability to negative impacts of CC, relatively high share of culpability in intensive production of GHG emissions, and unique potential for carbon sequestration. The intersection of vulnerability, responsibility and potential, provide multiple conditions of risks and benefits for transformative adaptation.

Climate Change in Rural Australia: Experiences, Perceptions and Responses

This section provides a review of theoretical literature and extant research that provide a framework for understanding the various, overlapping phenomena that influence farmers' perceptions of CC, experiences of drought and knowledge needs. This will cover international and domestic research, however, will focus on research conducted in a rural Australian context and on issues pertaining to governance and development.

Perceptions of Climate Change in Rural Australia

To date, the most comprehensive qualitative descriptions of primary producers' perceptions of CC are government-funded market research papers. Milne et al. (2008)'s exploratory study *Climate Risk and Industry Adaptation (CRIA)* at the time was a notable exception to the lack of research into the link between farmers' perceptions of CC and motivations for adaptation. A key finding was that "major uncertainty" existed in understanding of the relationship between drought and CC. From this, *Australia's Farming Future (AFF)* sought to develop an "evidence based communication strategy [to] encourage farmers, fishers and foresters to adapt the effects of CC and reduce their emissions" (Donnelly et al., 2009). In the decade following, consecutive studies of rural landholders' perceptions or 'belief' in CC revealed that there is broad public awareness that CC is occurring and rising concern for its' impacts on rural communities and primary industries (the root causes and nature of change, however, remain subject to dispute) (Anderson, 2014; Laurie Buys, Miller, & van Megen, 2011; Fleming & Vanclay, 2010; Mazur, Curtis, & Rogers, 2013; Milne et al., 2008; Molnar, 2010) These findings underscore the limits of the "deficit model" (ie. access to knowledge about the risks; see, Kempton, 1997) in explaining barriers to rural communities' engagement with CC (L. Buys, Aird, van Megen, Miller, & Sommerfeld, 2014). Despite this, reports such as *AFF* and *CRIA* remain the primary empirical basis for government intervention in agricultural climate adaptation-planning (Hogan, Berry, Ng, & Bode, 2011). Given the passage of over a decade since their release and marked shift in public debate over CC in Australia, there is a growing need for complementary research into perceptions and responses to CC in the current context. In particular, there is an opportunity for research to contribute to the gap in understanding the relationship between experience of drought and engagement with climate

action (CA) of resource-dependent producers (which remains poorly understood across the literature) (N. A. Marshall, Stokes, Webb, Marshall, & Lankester, 2014).

Understanding Resilience, Vulnerability and Adaptive Capacity in Australian Primary Industries and Rural Communities

Following successive IPCC attempts to define key issues and markers for international bodies and governments to address, the concepts of resilience, vulnerability and adaptive capacity are now at the cornerstone of contemporary CC research (albeit subject to debate). Given the official responses of government are guided by IPCC definitions of these key terms, for the sake of coherency, this research also adopts these general definitions (see, Denton et al., 2014).

A distinction between two different interpretations of vulnerability is imperative for conceptualizing the relationship between the prioritization of knowledge and preferred responses to CC (O'Brien, Eriksen, Nygaard, & Schjolden, 2007). The 'scientific framing' of CC that has dominated official discourses (IPCC, UNFCCC, CSIRO) views vulnerability as a function of "exposure, sensitivity and adaptive capacity" and thus, places urgency on developing more accurate and precise climate models (Dessai, Hulme, Lempert, & Pielke, 2009, p. 69). This 'end-point' approach to vulnerability often prescribes 'sociotechnical transitions' (Gillard, Gouldson, Paavola, & Van Alstine, 2016) pathways to reduce the "net impact of the climate problem" (O'Brien et al., 2007).

Noting the inherent limitations of climate prediction (Pielke & Sarewitz, 2002; Sarewitz, 2004) combined with the imperative for immediate action (with a degree of climatic change 'locked-in) encouraged a shift in the goal of adaption planning in official documents towards optimizing decision-making and governance under conditions of uncertainty (Adger, Lorenzoni, & O'Brien, 2009; R. Nelson, Kokic, Crimp, Meinke, & Howden, 2010a). A 'human-security' framing of CC or 'starting point' conceptualization of vulnerability (Kelly & Adger, 2000) allows for such an approach (Schlosberg, Collins, & Niemeyer, 2017). As such, in more recent years, public and private research began directing its efforts towards understanding the "social limits to adaptation" (Adger, Dessai, et al., 2009). In the literature concerned with responses to CC in rural Australia, this culminated in growing

research into social vulnerability (N. A. Marshall et al., 2014; R. Nelson et al., 2010b), community resilience (Wilson, 2014) and primary producer's adaptive capacity or 'barriers to change' (N. Marshall & Stokes, 2014; N. A. Marshall, Park, Adger, Brown, & Howden, 2012). Of particular importance for this research is Wilson's extension of a social resilience framework to explain how "path dependencies are shaped by 'lock-in' effects which shoehorn communities into positive or negative pathways of change" (2014). The findings of the aforementioned pool of literature corroborate O'Brien and Eriksen's (2007) and Schlosberg et al. (2017) emphasis that often "subtle impacts" and personal values such as, sense of belonging (McManus et al., 2012), attachment to place or occupation identity (N. A. Marshall et al., 2012) are important determinants of decision-making in rural communities and primary industries.

Rural Sociology and CC Adaptation

There has been a significant increase in research contributing to a micro-level understanding of socio-emotional impacts of drought in rural Australia (Anderson, 2014; L Cheshire, 2016; Drought Policy Review Expert Social Panel, 2008; Mazur et al., 2013; McManus et al., 2012; Sherval & Askew, 2011). There is a significant theme emerging from this body of literature; that prolonged and recurring experiences of drought (and other environmental shocks) have exacerbated the 'self-help' mindset that has long permeated the cultural consciousness of rural Australia (Lynda Cheshire, 2006). Anderson's depiction of the overarching narratives of endurance and uncertainty has broader resonance with the findings of research into rural perceptions and responses to CC (Laurie Buys et al., 2011; Fleming & Vanclay, 2010; Mazur et al., 2013; Sherval & Askew, 2011). Across the aforementioned literature, findings reveal that rural discourses are dominated by a "celebration of the local" (Cheshire 2016) that promote a "community capacity-building approach" to CC adaptation (Anderson 2014).

As Fleming and Vanclay (2009) first identified, the "general belief and optimism in the 'resilience' of farmers is both a strength and weakness for rural Australia" (Buys, Miller et al. 2011). Buys, Miller et al, make an interesting contribution, arguing that despite adaptive capacity being higher in places where variable climate and drought events are 'normal' (Reser, Bradley, Glendon, Ellul, & Callaghan, 2012) the normalisation of such

experiences could “impede the uptake, effectiveness and efficiency of new technology and processes designed to help rural communities mitigate and adapt to the impacts of CC” (Buys et al., 2011). This reveals a central tension in the literature; between the need to normalise drought for more effective drought management and responses (see Drought Policy Review Expert Social Panel 2008) and the need to harness and translate concern for human-induced changes into decisive and extensive CA. This critical tension will serve as a central focus of this research’s collection of new, qualitative data.

Sociological studies of farmer behaviour and decision-making processes, while well adopted in the field of agricultural extension, remain yet to be effectively incorporated in existing mainstream climate adaptation research (Fleming & Vanclay, 2009b). In addition to the findings of Leiserowitz’s (2006) seminal study of CC perceptions that experiential knowledge is more compelling than abstract information about risks (Epstein, 1994), studies of farmer decision-making have found they are more likely to rely upon localised, tacit knowledge derived from observations (or those of their neighbours) than information produced by experts (Gray, Lawrence, & Sinclair, 2009; Holloway, 1999; Kaup, 2008). As such, several studies have drawn attention to the limits of mainstream approaches to CC research (which often places a premium on developing more accurate and precise climate projections and predictions at a range of geographical and temporal scales eg, see Füssel, 2007) (Dessai et al., 2009). Moreover, sociological studies emphasise the possibility of a fundamental incompatibility between determinations of what is ‘rational’. For example, Gray et al. (2009) explain the decision to remain on unviable land or in an unviable industry is likely to more appealing and easier, preferable than doing what might be predicted as ‘rational’ from a scientists’ perspective. As Ingram (2014) notes, what is frequently termed ‘barriers to adaptation’ in official discourses are often understood as legitimate reasons for non-adoption at the farm-level.

New Approaches in Climate Research: Transformational Adaptation and Social Change

Noting that mainstream research has failed to engage with the “real adaptive challenge” of CC, O’Brien argues for a new research agenda in order to address and challenge the ‘underlying drivers of risk and vulnerability’ (K. O’Brien & Selboe, 2015). This led to calls for the design and conduct of post-normal science or ‘Neo-Research’

in order to understand and address CC in innovative ways (Smith, 2009). Further, more recent research in climate adaptation has urged critical assessment of *whose interests* are being served by different adaptation pathways (Eriksen & Selboe, 2015; Giddens, 2013; Karen O'Brien, 2012). Confirming Sarawitz's (2004) assertion that "political controversies with technical underpinnings are not resolved by technical means", O'Brien and Selboe argue, "adaptation to CC is unlikely to have long-term effects if it is treated as only a technical problem" (2015, p. 311). Moreover, noting the post-structuralist consensus that language is never value-free, controversies over competing 'truth claims' about CC which "are produced by different disciplinary frameworks built on different value systems and assumptions" are inevitable (Fleming & Vanclay, 2009a). As such, Fleming and Vanclay assert that an understanding and engagement with the multiplicity of different discourses on CC is the first step in understanding resistance to transformative adaptation and behaviour change by farmers. Thus, a deeper, contextualised understanding of the relationship between information and practice in agriculture can be used as a 'tool' for facilitating change (J. Martin, Rogers, & Winter, 2009).

Further, the introduction of "transformation as an adaptive response to CC opens a range of novel policy options" (Pelling, O'Brien, & Matyas, 2014). Across climate adaptation literature, 'transformation' is generally used to describe non-linear and fundamental change to the functioning of systems. O'Brien notes the importance of distinguishing between deliberate and unintentional transformations (O'Brien, 2011). Ultimately, transformative responses are united in their requirement of a re-thinking of normative socio-cultural, economic or political structures and underlying power relations. Nelson et al. (2007) reintroduce the concept of 'tipping points' in adaptation literature to explain how movement between adaptive pathways can be engendered by failures that are "absolute (untenable) or relative (undesirable)" (cited in Pelling, 2010). However, because these 'tipping points' or 'thresholds for resilience' are determined as much by subjective values and socio-political context as actual 'thermodynamic, ecological or economic constraints' pushing the system towards transformation, an understanding of local social context, values and discourses that inform interpretation of various shocks and stresses on-farms is important. The widespread nature and intensity of the current 'agroeconomic drought' provides a unique context for identifying "adaptive possibilities for organisations or individuals, either forced by systems failure or chosen in

anticipation of collapse and movement to a novel social-ecological systems state” (Gillard et al., 2016). Moreover, as Pelling and Dill argue that a post-disaster context provides opportunities for governments to use their discursive powers to bolster state legitimacy, an analysis of the government’s response to drought could provide insights into the efficacy of natural resource management and environmental governance in a rural context (Pelling & Dill, 2010).

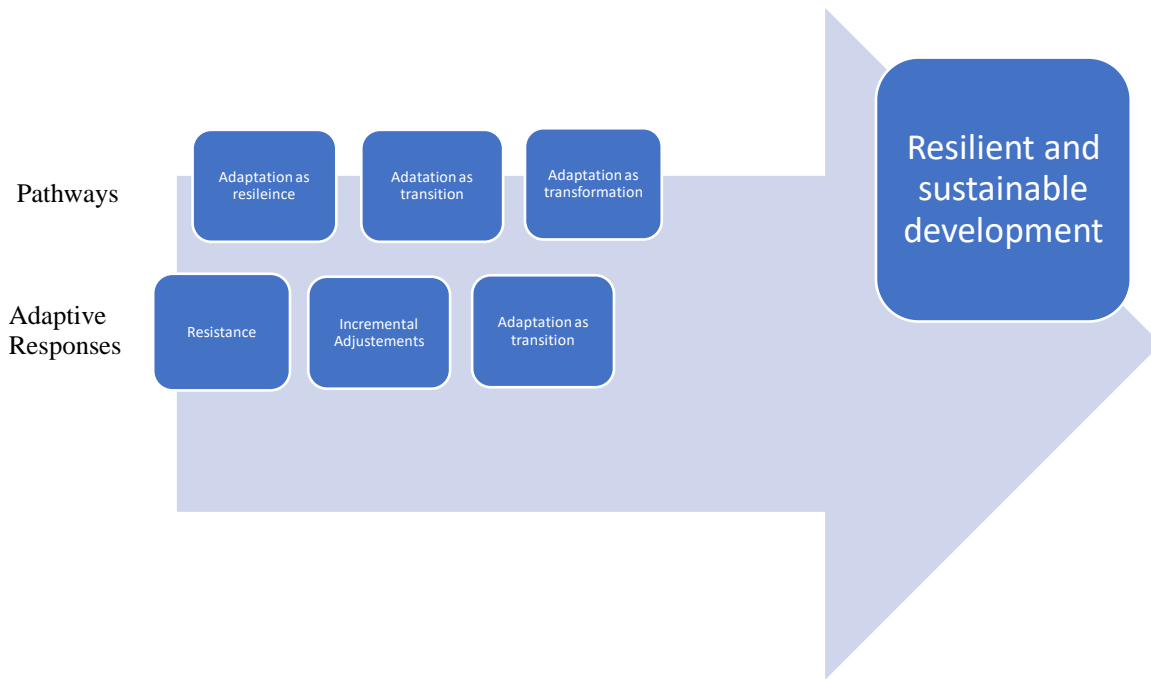


Figure 5. A Typology of Adaptation Pathways and Adaptive Responses (Pelling, 2011; Pelling et al. 2014)

This research will use Pelling’s typology of adaptation pathways as a theoretical framework for the consideration of the relationship between discourses, vested interests, politics, power relations and socio-cultural norms and the adaptive responses that are enacted on-farms (see Fig. 5). It is important to note that while transformation has been studied as a desirable state or goal of adaptation research, subsequent development of the concepts in reference to theories of social change have emphasised that the developmental process or progression from resilience to transformation is hardly linear (although incremental adjustments can open the doors for transformation), and each pathway has inherent benefits and disadvantages, hence, the necessity of critically examining the social context in which adaptation takes place.

Chapter Summary

A review of multiple bodies of literature related to CC adaptation and mitigation in rural Australia revealed significant gaps in research into the socio-political dimensions of climate adaptation and a limited understanding of the relationship between experience of drought and responses to CC. Noting the significance of small-scale livestock farmers in ensuring effective CA within the industry and guided by the recommendations from the aforementioned literature, this research seeks to integrate perspectives from social theory, climate adaptation, and rural sociology/extension research in order to provide a more “fuller understanding” of social change within the livestock industry.

Chapter 2: Research Design and Methods

Research Design and Methodology

Amidst growing research seeking to define and predict systems and change (or barriers to change), this research notes the theoretical and practical benefits of detailed micropolitical description of social change and resistance, in the context of agricultural (livestock) adaptation to CC (Gillard, Gouldson et al. 2016). The research methodology is guided by Fleming and Vanclay's (see, 2009a; 2009b) appropriation of Foucauldian theories of discourse, power and resistance in rural sociology studies, and drawing from social theory literature which foreground the role of individual agency and power relations (Fleming & Vanclay, 2009a, 2009b; Fleming, Vanclay, Hiller, & Wilson, 2014). Following this, a focus on the *contingency* rather than the *functionality* of systems becomes an analytical priority for this research (Gillard et al., 2016).

The strategy of research design is largely exploratory and descriptive, prioritising the collection and analysis of new data to enhance existing (albeit limited) knowledge of the socio-political contingencies that inform decision-making and adaptation planning at the farm-level.” The in-depth guided interview was deemed the best method for gaining such insights. The lived experiences, perceptions of CC, and reasons for resistance or behavioural change on-farm, as constructed by graziers themselves constituted the primary focus of analysis. In following the ‘generalised method’ of grounded theory (GT) interviewing, an analysis of *how* information and experiential knowledge is recounted and interpreted becomes just as important as the explicit content, or the ‘*whats*’, of the interview process (Johnson & Rowlands, 2012). Previous studies of GT interviewing provided practical guidance for methods used in the collection and analysis of data in this research. (Charmaz & Belgrave, 2012; Holstein & Gubrium, 1997; Nikander, 2012).

Case Study Selection

A cross-sectional case-study of livestock farmers in North-West NSW constitutes the scope of this research for two key reasons; firstly, the absence of any (as yet published) research into livestock producers' perceptions of CC and planned adaptations in the context of the current drought at the time of writing and secondly, the statistical significance of the area in terms of vulnerability to adverse impacts of CC (Fig 7. reveals the severity of drought experienced in the region, ie. vulnerability in exposure units) and culpability in expediting its' impacts (Fig. 6 reveals the high-concentration of emissions-intensive farming activities – primarily from enteric fermentation of rumen animals). While not initially guiding case-study selection, the Normalised Difference Vegetation Index (NDVI)⁵ for the North West Northern Tablelands (see Fig. 8) is significant to note because it shows extent of damage and loss of carbon sequestration potential across the region(s).

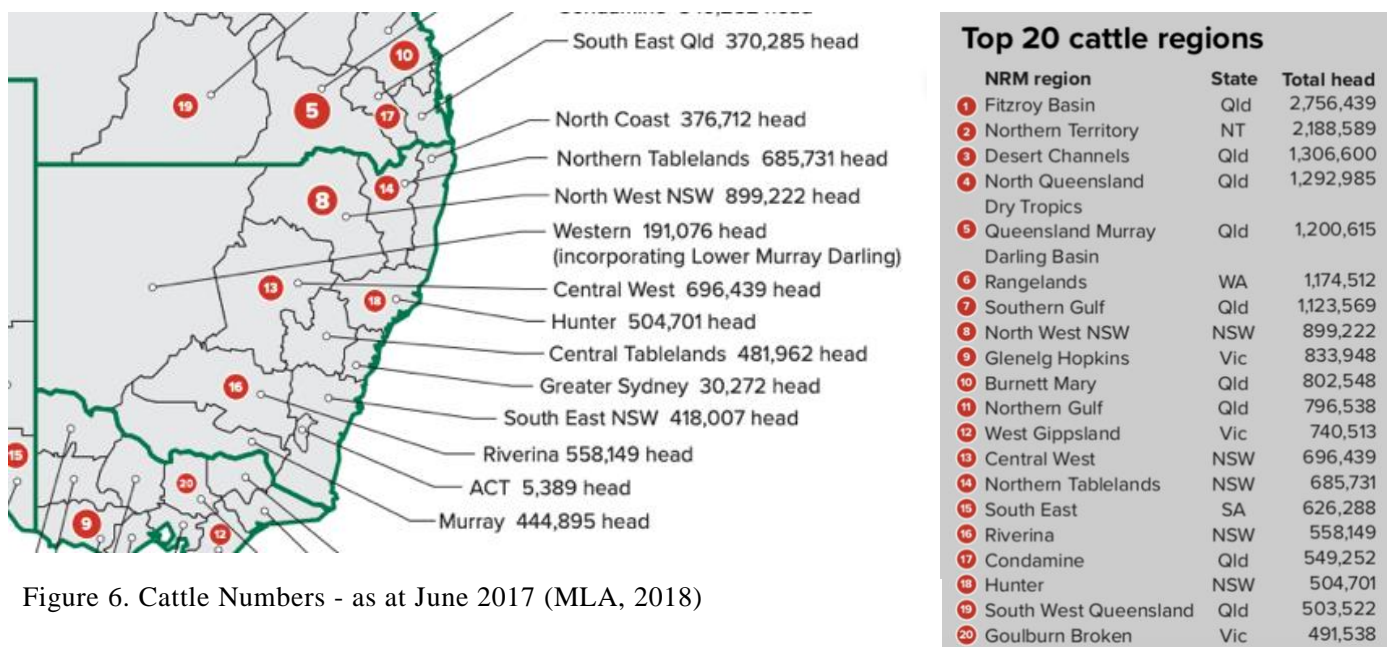


Figure 6. Cattle Numbers - as at June 2017 (MLA, 2018)

⁵ NDVI is an index that provides a measure of vegetation density and condition. The NDVI anomaly is the separation of the current NDVI from the long-term average for this time of year (NSW DPI Climate Unit, 2019). The NDVI shows very poor on-ground cover, with plant greenness levels well below the long-term expectations for July.

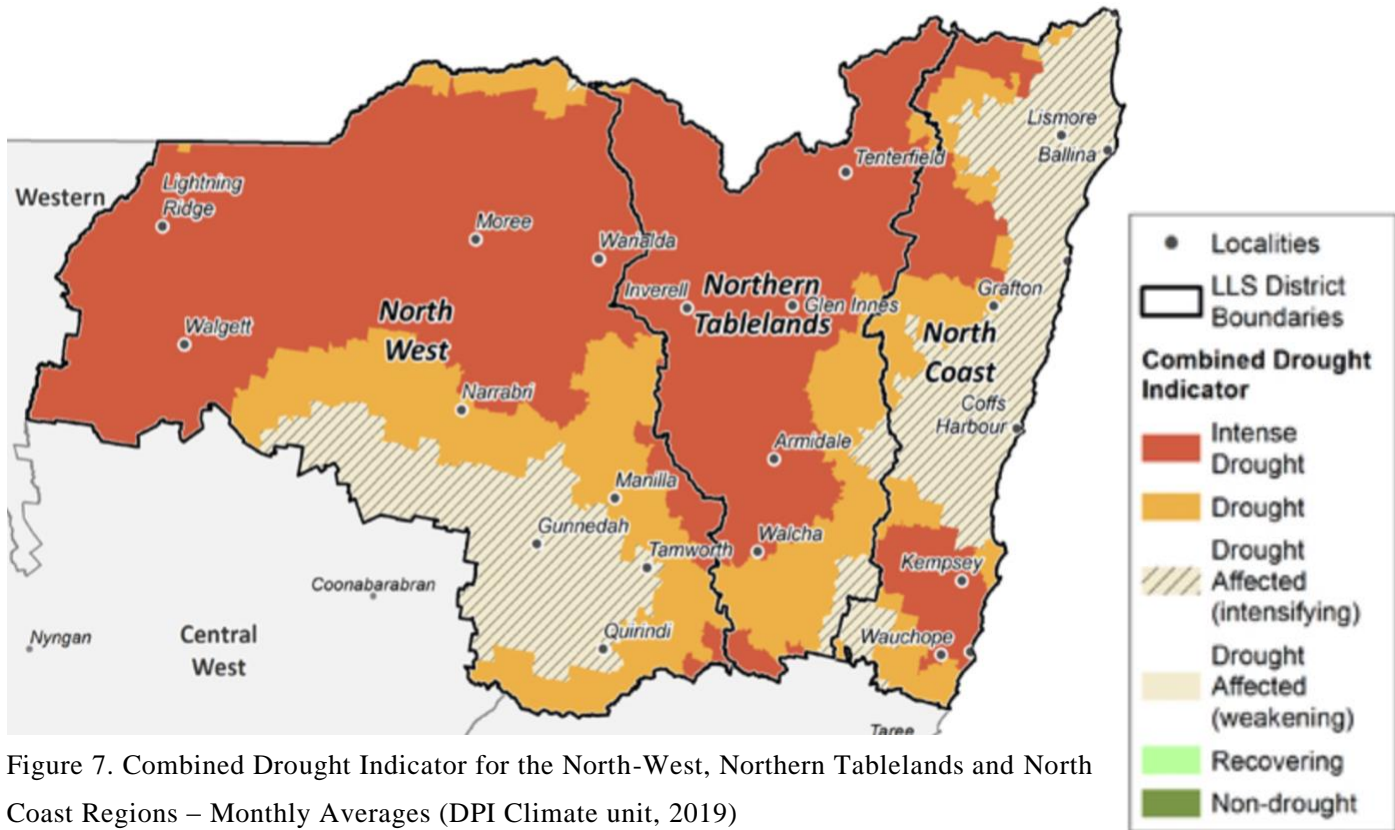


Figure 7. Combined Drought Indicator for the North-West, Northern Tablelands and North Coast Regions – Monthly Averages (DPI Climate unit, 2019)

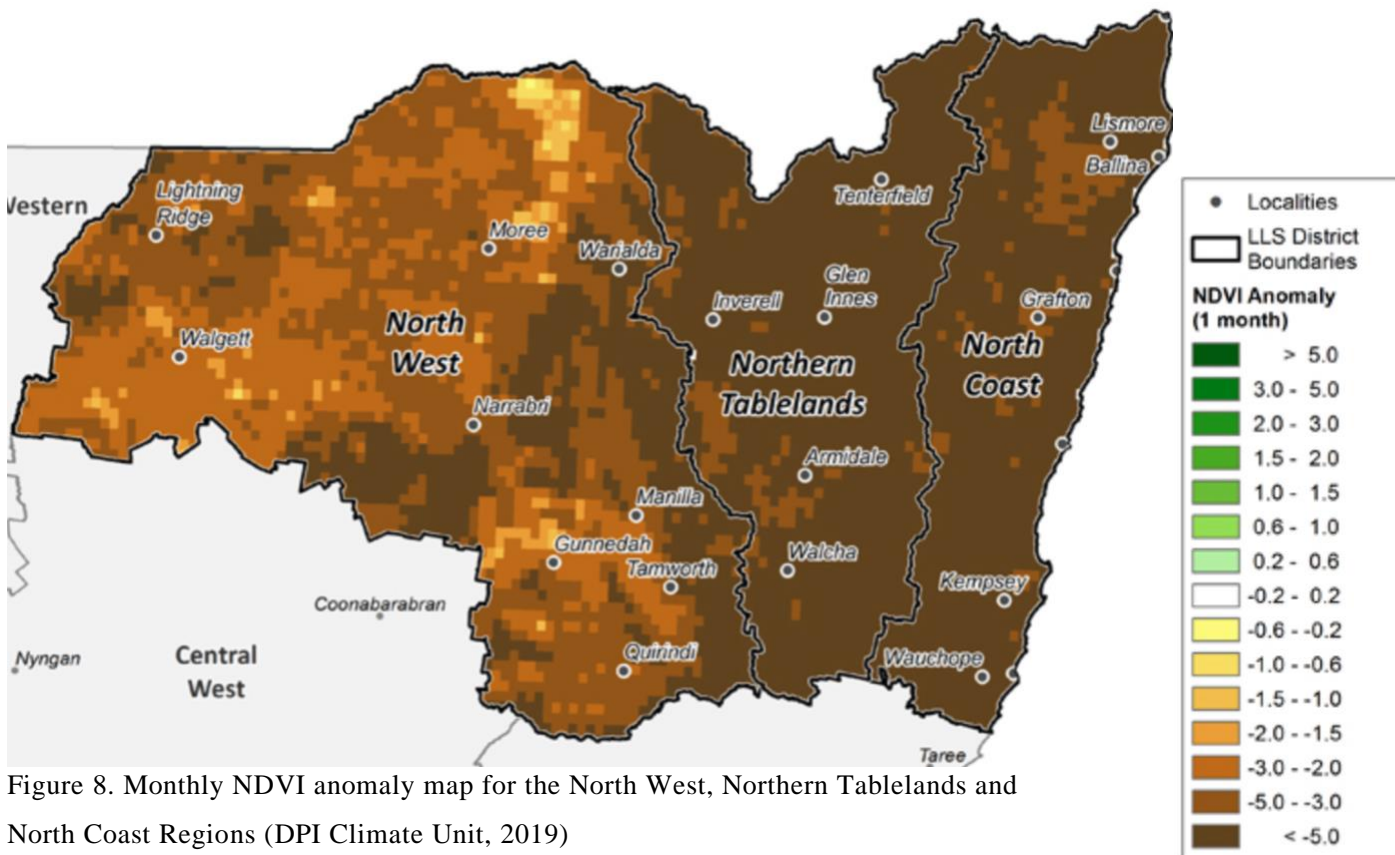


Figure 8. Monthly NDVI anomaly map for the North West, Northern Tablelands and North Coast Regions (DPI Climate Unit, 2019)

Sampling

A purposive sampling strategy was used to nonrandomly identify and select potential participants that can be *logically assumed* to be representative of the population (Lavrakas 2008, Betin 2012). These “best informants” were able to provide thick description of the experiences of an extreme climatic event, perceptions of CC and real or envisioned climate adaptation pathways from the farm-level of the livestock industry. Potential interview participants were indirectly contacted via distribution of invitation flyers by local community organisations and local government bodies⁶ (see appendix B). Tamworth, Gunnedah and Inverell host the 4th, 5th, and 7th largest livestock saleyards in NSW respectively and consequently organisations in these regions were the primary targets for sampling.

Criteria for the sample population were;

- The primary means of employment/occupation is rearing of beef cattle and/or sheep⁷
- Prolonged and recent experience of extreme drought
- Individuals are the primary decision-makers, or heavily involved in the management of the business/property

In total 12 guided interviews with 16 participants (4 interviews with partnerships) were conducted over a 3-week period in July. Interviews ranged in duration from 45mins to 90mins. The majority of these interviews were conducted face-to-face (9/12), and over half conducted on the property of the respondent(s) (7/12).

⁶ It is interesting to note that organisations such as FCA, the CWA and NSW Farmers’ Association had the highest response rates, suggesting community organisations have greater rapport with local graziers than official bodies.

⁷ This was later expanded to include managers of livestock producing farms

The In-Depth Guided Interview

Conducting the Interview

The location of the interview was considered an integral part of the interpretation of the findings. Conducting an interview within the social and physical context of the focus of research allowed for elicitation of more naturalised discourses and in-depth responses (description of property operations and impacts of drought often involved indicating features in the landscape to the interviewer) (Herzog, 2012).

A grounded theory approach to interviewing assumes the most significant points of interest cannot, or should not, be identified prior to research. Following this logic and seeking to enhance the exploratory nature of the research, interviews were largely unstructured, and interviewees were invited to guide the interview and identify topics they deemed to be the most relevant. Initially a semi-structured questionnaire was designed as a guide for interviewing, however none of the interviews followed the structure entirely and most evolved into a guided discussion. The research questions were addressed in some manner, either explicitly or implicitly, at some stage of the interview process with each respondent. Where appropriate, interviewees were also probed about whether they thought their experiences were representative of the broader sentiment of their local community or the experiences of other graziers they know. In situating their values, ideas and interests associated with adaptation within a broader context, sites of resistance and competing discourses became apparent.

Data Analysis

Interviews were audio-recorded and later transcribed for further analysis using NVivo. Memo-writing aided the analysis process in two key ways; firstly, by ensuring transparency of data collection by linking it to the interviewers' own interpretations of the data (including any experiential struggles in making sense of the data), and secondly, for identification of interesting emerging themes or points to revisit for clarification and recording of non-verbal cues. The structure of responses (including silences, omissions and aversions) were included in the analysis.

Following Charmaz's GT interview method, the interviewer conducts concurrent data collection and

analysis to move successively between studying concrete realities (inductive data) and “building a conceptual understanding from these data” (Charmaz and Belgrave 2012). The process of initial or ‘open’ coding (reading transcripts and re-listening to interviews) was used to identify conceptual reoccurrences and similarities in the discursive construction of participants’ experiences (both what is said and how it is said). From this, concepts or themes became apparent as the participants interacted with interview question, and through the process of constant comparative analysis – an active process that involved drawing upon the interviewer’s prior experiential knowledge, the body of literature and other interviews (Birks and Mills 2011).

As fieldwork progressed and interesting themes and concepts arose it became necessary for initial questions to be adapted in alignment with emerging research interests. As such, theoretical sampling was used to follow up interesting themes identified by initial data analysis (interviews with graziers). This was undertaken in subsequent interviews and in identifying local media or government/industry information sources that were cited by interview respondents and could be understood as forums for the perpetuation of dominant discourses in the region.

Ethical Considerations

The use of audio-recording was required for practical and ethical reasons (transparency). All participants provided written consent to the use of recording equipment. Participants have been re-named for the purposes of confidentiality.

Strengths and Limitations of Method

The guided interview offers many advantages for the purposes of this research but is not without its limitations. As the sole interviewer and noting the constructivist consensus that humans interpret, organise and recall information in terms of pre-conceived ideas and past experiences, a degree of subjectivity is an inherent consideration for all stages of data analysis and collection. However, audio-recording, transcribing and memo-writing were used to increase transparency, and considered sufficient to counter this inherent limitation.

§ Glen Morris consented to his name being included in the final thesis due to his position as an influential member of the nationally renowned grassroots organisation, FCA.

The most significant challenge was building positive rapport and gaining enough trust so as gain insights into the more personal aspects of farmers' lived experiences (eg, emotional toll of experiences of drought). This limitation was apparent in the few interviews conducted over the phone, wherein probing was often not able to elicit the same depth and emotiveness in responses as those conducted face-to-face. Moreover, considering there are many subtle techniques that require experience and training to implement in the interview context, a lack of previous experience as an interviewer as well as limited insider knowledge of the features/dynamics of local communities and farming practices, may have impeded the quality and depth of data collection. As the interviewing technique became more refined and responsive to unexpected data as the interviews progressed, returning to interview the same respondents some time apart could have provided greater depth of insights (including a time progression dimension as the drought wore on or 'broke'). However, given the voluntary nature of research and time required to travel between interview locations, follow-up interviews were neither appropriate nor feasible. Ultimately, the limitation of inconsistency in the structure and content of interviews was not considered to be significant given generalisability is not a research priority. The elicitation of more naturalised discourses through a conversational interview style took precedence.

Conversely, given the well-documented sentiments of scepticism or mistrust of government officials and academics in existing extension/rural sociological research, presenting as an outsider with limited knowledge of farming practices and industry conventions proved to be a great strength of this method. Respondents appeared less threatened, more responsive and open to discussing farming practices as well as mistakes they had made with someone who presented as an interested outside observer. Moreover, the process of explanation at a more fundamental level (assuming the interviewer had limited knowledge) revealed more naturalised discourses.

Fortuitously, the timing of this research – conducted in the midst of the worst drought in living memory, combined with the recent holding of state and federal elections in the context of growing public concern for CC – provided an environment conducive for the collection of new data. Accordingly, the in-depth guided interview allowed for the collection of lived experiences and capture of significant moments of “reflection and reflexivity” (Anderson, 2014).

Chapter 3: Discourses Influencing On-Farm Adaptation Pathways and Mitigation Strategies

The purpose of this chapter is to provide a brief overview of the mainstream approaches to agricultural (specifically livestock) climate adaptation and mitigation strategies as prescribed by dominant discourses. From an ongoing process of initial consultation with organization leaders, to informal conversations with community members and the interviews themselves, three main groups emerged as significant – due to their power to influence or facilitate pathways for agricultural adaptation to CC at key envision stages, high engagement with graziers in the region and/or high rapport and cultural capital as a source of advice.

Government

Discourses of Disaster and Responsibility

The 2012 COAG agreement that states “local initiative and private responsibility will be at the forefront” of climate adaptation and mitigation in Australia, remains a primary point of reference for local and state governments in designing regional responses to CC (see; OEH, 2016). The rhetoric of individualizing responsibility through recommended programs of “self-determination and endogenous action” has been criticized as part of the broader neoliberal trajectory of economic growth that seeks to de-politicize crises, disperse costs and delegate responsibility for systems failure in order to protect the *status quo* (Lynda Cheshire, 2006).

The severity of the current situation that has pushed several agricultural systems towards their ‘tipping points’, provided a fortuitous opportunity for reform of drought policy to consolidate post-disaster legitimacy. However, in the wake of the current drought, a reversion to previous models of drought policy was solidified with the establishment of a new ‘secure, revenue stream’ or the Future Drought Fund (The Fund) to ‘enable drought resilience, preparedness and recovery’ (Cormann & Littleproud, 2019). By failing to explicitly use what discursive powers the government has to connect the need for The Fund and resilience incentives as a result of CC, the *Future Drought Fund Act* (2018) represents another in a string of missed opportunities to develop CC mitigation and

Table 1. Dominant Actors and Their Key Publications

Dominant Actors Organisations	Most Relevant Source of Information	Media, Publications, Sources of Information, Extension Programs for Graziers in the Region
Government	<p>COAG Select Council on CC</p> <p>Department of Agriculture (federal)</p> <p>NSW Department of Primary Industries (DPI)</p> <p>Local Land Services (LLS) * North-West Regional Office</p> <p>Department of Planning, Industry and Environment (DPIE) * Office of Environment and Heritage (OEH)</p>	<p>2012 statement on <i>Roles and Responsibilities for CC Adaptation in Australia</i>.</p> <p>Coordinate Drought Policy, Drought and Rural Assistance schemes.</p> <p>DroughtHub (online)</p> <p>Coordinate regional extension activities and information, networks and resources for farmers.</p> <p>NSW Climate Change Policy Framework</p> <p>AdaptNSW (online)</p> <p>'Increasing Resilience to CC' Grants (in partnership with Local Governments' NSW)</p>
Industry	<p>Red Meat Advisory Council</p> <p>Meat & Livestock Australia</p> <p>Australian Meat Processor Corporation (AMPC)</p>	<p>The Red Meat Industry Strategic Plan 2020</p> <p>More Beef from Pastures Online Module</p> <p>Drought Preparedness Modules</p> <p>EverGraze</p> <p>Future Beef</p> <p>Significant investment in RD&E, for example, <i>Problem to Profit: Developing a sustainable feed base from agricultural wastes using single cell protein</i></p>
Community	<p>NSW Farmers' Association</p> <p>Local Media</p> <p>Landcare (in partnership with Local Governments)</p>	<p><i>The Farmer</i> (Magazine)</p> <p><i>The Land</i>, <i>Northern Daily Leader</i>, <i>The Inverell Times</i>, <i>Glen Innes Examiner</i></p> <p>Multiple community-based programs and extension activities. Weekly Newsletter.</p>

adaptation strategies within the new drought policy framework (COAG National Drought Agreement 2018).

Climate Adaptation Pathways and Mitigation Strategies for Primary Industries

Adaptation and mitigation strategies are often discussed using discrete narratives with differing research agendas and pathways. Borrowing Gillard et al.'s terminology, the former can be described as 'socio-ecological resilience' and the latter 'socio-technical transition' pathways (2016). RD&E from government bodies such as BOM and CSIRO have been guided by the latter; producing significant investment into enhancing predictive capabilities at a range of scales and development of tools to assist primary producers and landholders better manage and prepare for risks associated with CC and variability. The Department of Agriculture and Water Resource's (DAWR) research into potential options for mitigation and sequestration of emissions on livestock farms engendered development of projects such as the Emissions Reduction Pathways Project, and resulted in schemes such as the Carbon Farming Initiative and Emissions Reduction Fund (DAWR, 2016). These approaches to transitioning agricultural systems place a high premium on the effective transfer of knowledge and new skills to graziers.

Noting the inevitability of some climate-related changes (reached lock-ins), official discourses have shifted to emphasise the need for anticipatory adaptation. The development of 'AdaptNSW' solidified the shift in prioritisation of enhancing adaptative capacity in social and ecological systems over mitigative strategies (DPIE, 2019). For primary industries, the approach is described as reducing vulnerability to climate risks by enhancing adaptative capacity towards the overarching goal of 'building resilience'. The OEH defines it's official position in facilitating 'climate-resilient pathways' (an IPCC term) as "committed to using adaptative management to improve on-ground management decisions for ecological, social and/or economic outcomes" (DPIE, 2019). Reflexivity and 'learning by doing' are the cornerstones of an adaptive management approach. This managerialist approach to environmental governance is broadly consistent with the "long-established principles of endogenous development" in rural Australia that advocates for local control and inclusion of localised, tacit knowledge in decision-making and planning programs (Lynda Cheshire, 2006).

DPIE's Integrated Regional Vulnerability Assessments (IRVA)⁹ provide an example of such a focus. IRVA are designed in collaboration with multiple local stakeholders in order to provide a "sound basis for enabling regional adaptation and planning" (OEH, 2013). Considering the lack of any coherent policy framework for agricultural adaptation (at a state or federal level), the IRVA for New England and North West NSW – the Western Enabling Regional Adaptation (WERA) project – remains the most comprehensive point of reference for analyzing the official discourses for responding to CC in the region. The WERA outlines "CC adaptation pathways [for] transitioning key New England North West systems towards a more resilient future", one of which is 'Grazing' (OEH, 2017) (See Fig. 9).

The WERA 'model of change' "envisions transformational change toward a desirable future as a series of transition pathways that emerge from current practice either through existing innovations or because of new drivers of change" (OEH, 2017, p. 28). As such, the WERA model is an empirical example of 'adaptation as transition' pathways, wherein "transitional action is targeted at reform in application of governance" (Pelling, 2011). The promotion of carbon farming initiatives and agroforestry represent examples of incremental adjustments with the potential to effect transformative change and accrue benefits for multiple stakeholders. Moreover, the inclusion of 58 different stakeholders in a series of workshops – "using participatory learning techniques" (OEH, 2017) – is laudable, and represents a potential for "bottom-up, aggregate transformational change" (Pelling, 2011). However, given that all of the organisations represented on the project's steering committee are government affiliated bodies, the attempt at 'good' governance may be perpetuating what Few, Brown & Tompkins call the "illusion of inclusion" (2007), as adaptation pathways have been shaped at key envisioning stages by "a tendency to try and control this potentially creative force through a process of isomorphism, managerialist steering and consensus building" (Gillard et al., 2016).

⁹ The IRVA models seek to combining contextual assessments of vulnerability that are sensitive to local socio-economic and cultural 'drivers of change' with quantitatively focused measures of vulnerability in terms of exposure units.

Grazing

Using pastures to feed livestock

2050

SYSTEM DRIVERS

Demographic and attitude changes in farmer population
Shifts in production systems and grazing species
Commodity markets
Land degradation
Shifts in rainfall seasonality
Foreign investment & corporate ownership

2016

BUSINESS-AS-USUAL

Traditional grazing systems retained under financial pressure: semi-set stocking, not accounting for land capability, and riparian zone stock access
Traditional livestock selling: sale yards, paddock sales, livestock agents
Increasing efficiency of grazing, breeding, production: increased feed conversions, pasture variety selection, smaller core breeding herds
Genetic selection of livestock for specialised traits: marbling, carcass conformation
Limited government incentives for improved land and environment management

Support R D & E that is independent, locally relevant, acknowledges climate risks and includes genotype selection, disaster management and whole farm planning

Encourage rapid adoption of improved animal welfare practices that reduces threats to livestock: natural disasters, pests and diseases, predator and environmental stress

Support consumer education and market development matched to regional produce

Promote integration of carbon farming to diversify farm incomes and accrue benefits from agroforestry in farming systems

Encourage adoption of technologically enhanced precision agriculture (drones, sensors, remote cameras) to improve farm management efficiency and weather forecasting

Support increased use of renewable energy and battery storage on farms

TRANSFORMED SYSTEM

Biodiverse landscapes that support viable grazing systems through payments for ecosystem services
Whole of system approach to agricultural enterprises that meet environmental and production objectives
Comprehensive farm management plans incorporating climate adaptation, disaster preparedness, drought resilience, succession planning and livestock welfare
Renewable energy production embedded in farming systems to diversify incomes and reduce production costs
Tech-savvy farmers employing 'remote' farming systems while remaining on the land
Integrated transport systems supporting efficient movement of freight

Figure 9. WERA Change Model for Grazing (OEH, 2017).

Moreover, the potential success of the WERA is likely to be thwarted by the model's considerable theoretical and practical limitations; the first being that it is unlikely these conservative transition pathways that seek resilience in core system functions and features will result in genuine transformation of systems. The 2050 outlook is likely perceived as too vague and distant, potentially downplaying the urgency of behavior change. The second, is the underlying assumption of relative homogeneity in farmers' capacity to act and means of processing

information which has produced relatively simplistic assumptions about the efficacy and reach of the community involvement process. For example, the encouragement of ‘technological enhanced precision agriculture’ frames graziers as ‘end-users’ and so assumes a role of supply-led development. The following chapters will provide insights as to how trustworthy and effective these schemes are judged to be by their intended audiences.

Industry

As the leading industry body funding and disseminating research and training for livestock producers, Meat & Livestock Australia (MLA) is arguably the strongest coherent ‘voice’ representing industry stakeholders (corroborated by interview data wherein the majority of respondents mentioned MLA as a primary source of information for adaptation and drought preparedness) (MLA, 2019b). This has encouraged the construction of a largely consistent framing of CC and prescription of adaptation pathways and mitigative strategies in the context of livestock production.

The approach of industry is largely characteristic of what Pelling terms ‘Adaptation as transition’, where incremental adjustments allow for re-organization of RD&E without causing major systemic disruption. A socio-technical transitions pathway enables such an approach. Significant investments in technological innovations and developments in agricultural science combined with the effective transfer of new technologies and skills to graziers (eg, Farm300 program), effectively passes off responsibility of dramatic changes into the future, while appeasing current demands. The MLA’s approach to adapting livestock farms to climate variability can be surmised by the following statement, “one of the most effective strategies is to make many small adjustments rather than waiting and being forced to make large more radical or costly decisions” (MLA, 2019a).

Industry stakeholders’ RD&E is often collaborative with government and consistent with government research agendas. For example, the MLA collaborated with government to coordinate the National Livestock Methane Program (NLMP) under the Carbon Farming Futures program (‘Filling the Research Gap’). Moreover, the Department of Agriculture and DPI websites frequently provide links to MLA information pages with programs,

practices and tools for reducing GHG emissions. Mitigation of GHG emissions from livestock are exclusively referenced in conjunction with the greater, consistent goal of increasing on-farm productivity and profitability. For example, the overall goal of the MLA's 'More Beef from Pastures' online module is "to achieve a sustainable (economic and environmental) increase in kilograms of beef produced per hectare through optimal management of the feedbase" (MLA, 2014).

The MLA maintains a framing of government intervention (eg, command-and-control policies) as a potential CC-related risk, "Agriculture will also be affected by GHG mitigation policies as governments respond to the threat of CC" (MLA, 2019a). According to this framing of CC, the 'problem' to be addressed by mitigation strategies is meeting government-implemented obligations, rather than a duty to reduce the sectors' share relative to other emissions-intensive industries. Industry bodies such as the MLA have discursively de-politicised their recommended climate adaptation pathways, effectively bypassing the 'climate debate' while encouraging uptake of adjustments on-farm that will have the added benefit of reducing the industry's relative share of GHG emissions.

The value of the MLA in influencing on-farm adaptation cannot be understated. The accessibility and quality of the information, training and planning tools has had high uptake among interview respondents. However, given that these responses are characterized by a preference for restorative stability over disruptive alternatives, or 'adaptation as resilience', these adaptations are unlikely to be in the best interests of the graziers in the long-term. There is a risk that government collaboration with the MLA (often as the sole industry representative) could foreshorten the potential range of innovative adaptation and mitigation strategies for livestock producers.

Community/Other

Several local media sources were either implicitly or explicitly referenced as important avenues through which farmers "test and interrogate the information they receive" (Donnelly, Mercer, Dickson, & Wu, 2012). Local community media provides a forum for discussion and debate about CC and other environmental governance issues. In *The Land*, 'Opinion' section, the legitimacy of various scientific findings and the viability of certain adaptation

pathways are frequently debated.

A particularly interesting finding was the emergence of ‘alternative’ framings of CC in reference to re-emerging research from a UNE professor, Dr. Robert Baker (Murphy, 2019). Baker recently conducted a series of free public seminars to educate local farmers about the potential efficacy of long-range forecasting based on historical records of rainfall patterns and study of solar magnetic cycles (especially the Southern Oscillation Index [SOI]). Having claimed to have predicted the severity and approximate duration of this drought over a decade ago, Baker approached government with his research (Baker, 2008) but it was not ‘taken on board’¹⁰. This narrative of elites ignoring the information needs and knowledge priorities of farmers (who use unique methods of prediction and learning) resonates with the ‘silencing’ of Indigo Jones¹¹.

Popular discourses and media sources perpetuate an embellishment of rural farmers’ capacity for innovation and endurance through periods of uncertainty. The following headline of a special edition print of *The Farmer* (2019a, July), “Drought is tough but we’re in it for the long haul” and byline from *The Land*¹² (Nolet, 2019, 13 July) “Farmers work incredibly hard and face levels of uncertainty and constraint most non-farmers would find overwhelming” are testament to this. Broad consensus across urban and rural populations of the stoic resilience of rural communities and farmers (see Milne et al., 2008) while inspiring respect for the nation’s primary producers and optimism in their capacity to adapt, given the current context of an impending climate catastrophe, is concerning at best and dangerous at worst.

Chapter Summary

The chapter asserts that the diagnosis of the CC ‘problem’ in dominant discourses has led to prescriptions of ‘solutions’ that have serious limitations in incentivizing the kinds of changes that are necessary to ensure the

¹⁰ This is according to notes from a presentation of Baker that an interview respondent forwarded to me (TAM2).

¹¹ Indigo Jones was meteorologist (1872-1954) whose forecasting theory based on astronomical observations and the repetition of weather cycles had a large following among primary producers in Australia and was published widely across rural media, including the *Pastoral Review*. His theories and presence in meteorological circles were divisive, culminating in widespread criticism from several scientific review panels (Obituaries Australia, n.d.).

¹² The Land is a state-wide rural newspaper. Acknowledged at Australia’s leading rural weekly newspaper, it is arguably the most influential sources of community media.

viability of rural primary industries and the communities that depend upon them, despite this being in the best interests of all groups. An analysis of these dominant discourses provides an empirical example for Pelling's claim that dominant adaptation pathways are designed to accommodate change by modifying current systems and paradigms without critical assessment of their underlying structures that give rise to systemic vulnerability (Pelling, 2011). Against this background, the following chapters will elucidate how the 'flow of information' from these dominant actors and forums influence the pathways and parameters of adaptation on-farms.

Chapter 4: Perceptions of Risk, Vulnerability and Responsibility in the Face of Extreme Climate Variability

The focus of this chapter is guided by the hypothesis that experience of prolonged and intense drought could push resource-dependent primary producers towards (or in some cases past) their thresholds for coping/resilience and thereby create the potential for a rupture in the current trajectory of farm adaptation, and critical rethinking of the dominant discourses that underpin it. However, this chapter will argue that various, socio-political and personal factors have, through discourse, contributed to a raising of ‘thresholds for coping’ above what one might predict based on rational assessments of social change. The reconstruction of lived experiences of drought and other environmental changes during interviews provided a rich dataset for analysis of the discourses that influences graziers’ perceptions of CC, knowledge needs, determination of responsibility and preferences for adaptation at the farm-level.

Drought: Lived Experiences and Social Discourses

Discussion of lived experiences and responses to drought provided insights into the local socio-cultural context that shape individual values, beliefs and motives. Ongoing comparative analysis revealed several noteworthy discursive themes across respondent’s discussion of drought.

Severity and Impacts of Drought

The first was the significant consistency in the way graziers re-constructed their experiences across the region. All participants were asked to explain how this drought compared to previous droughts, which resulted in a unanimous claim that this was the worst drought “in living memory”. Respondents were then asked to explain how they judged this measure of severity (“how can you tell? What makes this drought different?”). The *length* and *geographical extent* were cited by all respondents as exceptional characteristics of the current drought (10

respondents noted both in conjunction). There was an emerging narrative that these exceptional circumstances, compounded otherwise manageable impacts (i.e. rainfall deficiencies). In order to ‘keep up’ with the demands of maintaining the condition and health of their stock, respondents reported having to source feed from inter-state (mostly from Victoria, but as far as South Australia) and pay significantly inflated prices. It is for this reason that all but two (GUN1 and GUN2) respondents explicitly stated that the worst impact of this drought was financial.

Rarely was the severity of the drought measured *exclusively* in terms of ‘exposure units’ (i.e. rainfall, temperature, wind erosion). Rather, the discussion of indirect socio-economic and personal impacts of drought for themselves, the local community and the industry as a whole contributed to an overall contextualised framing of vulnerability. This also provided insights into what is valued and what constitutes damage. Respondents were often concerned with the more subtle impacts of drought such as the loss of a herd with great sentimental value (generations of family management of a core genetic breeding line), succession issues (as children of graziers’ need or want to seek employment elsewhere), having to sell “beautiful” cows and wean calves early, deciding whether to shoot or continue to “drag” cattle through the drought, and physical exhaustion and emotional strain. This finding reiterates the necessity of designing context-sensitive and flexible agricultural adaptation strategies.

Moreover, although drought was consistently referred to as an inevitable, perpetual feature of the region’s landscape, there was a tendency to discuss the impacts of the current drought using rhetoric of a natural disaster. According to this framing, drought is seen as a disruptive moment, a pause, interrupting plans and ‘progress’ on-farm. As one respondent explained;

TAM1: You've got a small window when you can actually plant [new pastures] ... so it just holds up your whole system of what you normally want to do. Especially because we already had a fair bit of work to catch up when we arrived two years ago. So, the droughts just delayed all that.

In this sense, for TAM1 and many other respondents who understood the severity of the drought as an *abnormal* instance of a *normal* process, current conditions were not a cause for change in management practices, or perspective (concern for anthropogenic CC) but rather an incredible costly and disruptive inconvenience. As such,

many respondents adopted the discursive constructions of drought that successive drought policy reviews explicitly advised against perpetuating.¹³ (Drought Policy Review Expert Social Panel, 2008). Underlying narratives that celebrate quiet resolve and stoicism (*BOG1*: “farmers don’t want hand-outs from the government... nor do they need them”) suggests that regional cultural values do not favour reliance solely upon government assistance. However, the broader ‘exceptionalist and apolitical’ (Pelling and Dill, 2010) construction of severe drought perpetuates the framing of this drought as a *natural abnormality*, thereby, obfuscating the link to anthropogenic CC and undermining a sense of urgency in normalizing severe drought as the new ‘normal’.

A Social and Historical Memory of Resilience

Because drought is a constant feature of the landscape it has become more of a ‘cultural term’; with its primary connotations relating less to rainfall than to “an overarching, mythic narrative of endurance” (Anderson, 2014). As such, social discourses have perpetuated historical memory of resilience in the face of variable climates and other shocks, which has created a ‘lock-in’ in community adaptation pathways. Because the “core features” of the agricultural system in the region are predicated on variability and multiple overlapping changes/stresses, resilience¹⁴ is a normative goal of farming; *GUN3*: *We get the extreme conditions and that’s always been something Australian farmers have had to cope with and learn to adapt to.* In particular, there seems to be an *industry-specific* notion of resilience that is founded on an assumption of even more dramatically variable shifts in the system as the *modus operandi* of livestock farming. Respondents perceived the exposure and social vulnerability of graziers to be greater than that of other primary producers because exogenous system stresses such as drought require immediate and decisive responses to ensure the survival of their stock; *GUN1*: *“Hit the hardest yes, because its immediate. You’ve got to rush out and buy feed. Wheat you plant, if it doesn’t come up and you sit there and watch*

¹³ Successive reviews of drought policy between 1997 and 2011 found that EC assistance was ineffective and “could result in businesses being less responsive to drought conditions” (Department of Agriculture, 2019). Rather, greater incentives during ‘good times’ were recommended to “encourage commercially and environmentally responsible management under variable seasonal conditions” (Drought Policy Review Expert Social Panel, 2008).

¹⁴ As defined by the IPCC as; “the ability of a system and its component parts to anticipate, absorb, accommodate, or recover from the effects of a hazardous event in a timely and efficient manner, including through ensuring the preservation, restoration, or improvement of its essential basic structures and functions” (Denton et al., 2014).

it, well it didn't come up...” The normalisation of climatic variability and fluctuating risks was made apparent in several respondents description of “how they could tell” this drought was different or that the overall climate was changing, wherein their properties, farms, or region were described as previously being “safe” (4 respondents explicitly described their farms as “safe”), despite still regularly being afflicted by droughts and other exogenous shocks. As one respondent stated; TAM3: *“we still always had something. Now we’ve got nothing, we’ve had no time to recover, to build stocks up again, to repair. That’s how I know, this is really foreign drought territory that we’re in.”* Several respondents referred to historical examples of their predecessors learning and responding to change in similar ways to today. In the case of this respondent, the suggestion from politicians that farmers need to adapt better or change their practices in response to shocks was met with resistance;

INV1: ...well, what do you think we've done for the last 200 years out here? Like those convicts that were sent out here in bloody 1788, the farming practices that they did back in England that they tried down here didn't work, so they had to adapt. ... Farmers are adapting out here all the time, you go out and go "right that's not working, what can I do to change that?" or "that's something new"

Interview data revealed this set of shared values and experiences have, through discourse, contributed to an embellished perception of local resolve in coping with and surviving climatic extremes and threats to livelihoods. This is significant because it appears to have undermined a sense of urgency in pre-emptively preventing or responding to impending climate variability/change.

Perceptions of CC

Experiences of Extreme Climatic Events and Environmental Change

Given the length of time the vast majority of participants had spent working and living in the region (often decades on the same property), their discussion of observable environmental changes in their lifetime revealed they were highly sensitive and responsive to shocks in the ecosystem. Respondents were all largely open to discussing

changes in climatic conditions when the discussion was probed using terminology of “climate variability” or “weather patterns” or when framed in the context of long-term natural or historical trends. Interestingly, discussion of observable changes in the environment was relatively consistent across interviews, with the majority of respondents stating they had noticed most (or all) of the following changes over the past ‘few years’?.

- Hotter summers, less cold days in winter
- Changes in the length and timing of seasons
- Less frequent, more volatile rainfall
- Weather events becoming less predictable
- Longer time spent in drought, more frequent droughts
- Increased soil erosion
- Poor crop yields
- Decline in biodiversity

A minority of participants attributed these observable changes to anthropogenic CC and were highly concerned about the threat unmitigated CC posed to their farm, community and broader ecosystems. The majority of respondents were sceptical of the nature and causes of the change in climatic conditions and expressed low to moderate concern for changes in average climatic conditions dramatically increasing their farms’ vulnerability and risk. Interestingly, there was limited denial of the impacts of human activity on atmospheric temperature. Although, for a majority of respondents, problematisation of CC as an uncertain, distant and overwhelmingly complex impeded association of human activity, and more specifically, intensive grazing systems with the aforementioned observable changes in the natural environment and climate. Confirming existing studies, there was broad recognition or at least awareness among rural populations that changes in the average climate were occurring. There was, however, divergence in how these changes were framed, and their associated prescription of appropriate responses.

For a majority of graziers, a rise in average global temperatures was often understood as far too abstract to

be perceived as a significant threat to livestock production¹⁵. Furthermore, there was a tendency among the majority of respondents to interpret various climate-related risks as spatially (“where we are here, we’re not worried personally”) or temporally distant (“right now we’re worried about drought”), and therefore not personally relevant. This distancing of risk is significant for this research as it appears to have reduced adaptive capacity in two ways; interest in researching or experimenting with alternatives (intrinsic motivation) and necessity – external shocks would be required to motivate a change in behaviour on-farm practices.

Association of Relationship Between Drought and CC

Despite widespread acknowledgement of indicators of change associated with rising GHG emissions, for a majority of graziers, there was low level of association of the severity of the current drought as an instance of anthropogenic CC. Despite this, and somewhat ironically, it appears that the well-established narratives of endurance and uncertainty associated with drought, have been readily and seamlessly extended to account for and pacify concerns over claims of anthropogenic CC. For example, the majority of respondents drew upon past experience of changes in the average climate or knowledge of climatic conditions as cyclical and naturally fluctuating when discussing climate variability. These respondents cited the observed reduced and variable rainfall as an extension of normal processes that have long typified the region’s climate and therefore something, they could adapt to or at least survive “till the good times”. Historical and social memory of intergenerational differences in experiences of ‘normal’ or ‘average’ rainfall and seasons were often drawn upon as proof of normality in long-term changes in climatic conditions; *GUN2*: “*both of us remember when we were kids it was wet, we had wet summers all the time, and we may not see that in our time but our kids may see that.*” This sentiment is at the forefront of discussion of “CC and variability” on the MLA’s website (2019a).

There was a tendency to discuss drought as a discrete variable in environmental or climatic change. Rainfall patterns were understood as cyclical and naturally occurring wherein extended periods of below average rainfall –

¹⁵ One respondent rationalised the potential threat of a rise in temperature by noting that graziers from Alice Springs to Tenterfield breed the same type of cattle (Hereford) despite the significant; *INV1*: “*ranges of -12 to 48 degrees, yes they have to get used to it and that sort of thing but you know they're talking 2 degrees shift in what 50 years...*”

or drought – was understood as inevitable and uncontrollable. The following example is representative of an emerging theme, whereby, by separating rainfall and temperature, association of drought with CC was effectively weakened.

TAM1: But I do believe in the temperature part of CC because you know, since I was little it's gotten warmer, and more extremes... you have the hot and you have the cold but it's not as consistent as it used to be, so you know I do believe in it

Respondents of similar perspectives were asked to consider the potential (or 'hypothesised' in cases where respondents were sceptical of rising average temperatures) impacts of a 2 degree Celsius rise in temperature on their land management and productivity of their farms, taking rainfall patterns as given (ie, naturally occurring in cycles – not influenced by human activity).

TAM1: Well if it gets hotter in temperature, it doesn't affect it if you get the rain you know.

INV3: I mean, it all boils down to moisture in farming. It doesn't really matter how hot it gets, if there's water you can work with it, if not then you're in drought anyway.

These are representative of the overall weak association of average temperature rise compounding naturally occurring weather events such as drought or expediting existing processes such as soil erosion.

Conflation of environmental issues also appeared to impede association of the causes and impacts of anthropogenic CC with experiences of drought in the region. For example, sceptical respondents often oscillated between terminology associated with ozone-layer depletion, solar activity, pollution, and 'global warming'. The latter was apparently preferred to CC and allowed for change in long-term average temperature to be discussed and considered as a discrete variable. One respondent appropriated multiple framings of CC:

GUN1: But that's not global warming either, it is now, but that's out of our control, sunspots or whatever, it's not us causing pollution it's - some people are saying we're at fault, I don't think we're helping with all the pollution that's going up in the air or whatever

The widespread substitution of terminology associated with CC in the responses of interview participants suggests the existence of several alternative and contradictory framings or discourses of CC are competing for dominance in this social field. Conflicting information and claims about the nature and indicators of change was cited by several respondents as a cause for non-concern and by extension, non-action or no change in behaviour; “So who do you believe?”.

Concerned Respondents

An alternative narrative concerning the relationship between drought and CC was evident in a significant minority of respondent’s identification of a ‘silver lining’ to the widespread experience of such a severe drought; *BOG1: “It probably sounds bad for me to say this, but sometimes really bad droughts are good for prompting innovation and change”*. Concerned graziers were unanimous in expressing their hope that the current drought would precipitate a rupture of dominant perceptions of CC and thereby encourage a shift in the current trajectory of agricultural production away from business-as-usual. One respondent (livestock trading agent) in his interaction with many graziers across Glen Innes and Inverell communities, reported having noticed a change in perspectives of as many as “75-80 per cent” of his clientele because of the “immediate circumstances”.

QU: Being the drought?

GLN3: Yeah with the current drought, and because it just has been so bad for the last 20 years, But... if we got average rainfall over the next 6 months, I’d say 90% would go back to their old ways. I think they really need to be convinced with the objective realities and with this drought they’re starting to make the connections.

This is an interesting observation, because if true, it suggests the need for urgent association of the drought as an instance of CC before concern dissipates.

Worldviews Underlying Problematization of CC and Determination of Responsibility

An analysis of problematization of CC and associated determination of responsibility and appropriate

responses by interview respondents revealed two dominant understandings of human-society-ecological relations.

Mainstream

Under this framework, the land is primarily viewed as an asset. The productivity and profitability of the land is a function of inevitable and uncontrollable circumstances (drought, other exogenous risks) and the knowledge, skills and training of the individuals ‘managing’ the land. Respondents harbouring this understanding of socio-ecological relations often made implicit or explicit reference to the limits of effective management or individual decision-making in improving a given resource base. This normative rhetoric of environmental determinism is used to justify failure (income loss, unproductive land) and/or no-change in behaviour or practices. For example, one respondent explained his attempt to implement a widely recommended change for maximising a farm’s long-term productivity and profitability; *GUNI*: “*We have been pointing down that line, towards more sustainable agriculture, as in rotational grazing and whatever, but yeah it's just if the seasons don't go with it there's not much you can do about it.*” The conceptualisation of environmental change as largely ‘locked-in’ (or at least too large and too complex for individual farms to influence) could explain why recognition of instances of changes in the climate did not translate into intrinsic motivation for CA or radical behaviour change, but rather, led to graziers’ envisioning their responses as effectively managing the risks (enhancing effective management techniques eg, measuring and balancing stocking rates, pasture and feed utilisation to maximise carrying capacity and productivity). There was a minor theme emerging wherein graziers that were concerned about of CC (and acknowledged causation with human impacts) were also relatively unmotivated or apathetic about any attempts to intervene and encourage more dramatic shifts in agriculture. This was often supported by a ‘belief’ in socio-technological adaptation pathways and rational economic principles necessitating change as unviable practices simply would not survive as the climate (as well as society and ecosystems) changed.

Alternative

Around a third of respondents expressed *significant* concern for anthropogenic CC which they saw as interacting with and exacerbating extant environmental change such as desertification, caused by the dominant model of industrialised agriculture and livestock production in Australia. Under this framing of socio-ecological

relations (society, economy, culture and agriculture as indivisible from the land), livestock in itself is not the problem to be eradicated as a solution to mitigating global CC, but rather, the *way* livestock is managed that is the problem, and therefore, radical changes in land and livestock management is understood as an important ‘solution’ to mitigating dangerous CC and environmental destruction. Although respondents accepted that events such as drought place great stress on land and livestock, vulnerability to extreme climatic conditions is understood as primarily the function of an individual’s *ongoing* decision-making, planning and management of the land; a perspective that one respondent surmised;

SOM1: Yes, we have extreme weather conditions, but if you've got a really bad drought and you've lost all your ground cover, it's because of the way you've managed it. It's not just because of lack of rain. You can see that around here, you can see places where it's bare because they've continued grazing it at high levels. And then you can see areas where there's still grass.

Noting the complexity of the issue, they saw CC solutions as requiring collective responses that should be led by governments.

Information Sources and Privileged Knowledge: A Relevance Gap

Interview data vindicates the complexity of graziers’ knowledge needs both during and outside times of ‘crisis’. Observations of changes in weather or climatic conditions often drew upon tacit knowledge, for example, SOM2 observed “*Long dries... that's just a sense, that's how it feels.*” Moreover, the following quote from URA1 reiterates that decision-making can be quite abstract, with graziers’ often preferring to rely on instinct or intuition in decision-making.

QU: You mentioned using BOM, where else do you get most of your information for forecasting and planning?

URA1: Ah, out of the paper I suppose, off the news, depending on which time it is, what I'm looking for...

QU: DPI?

URA1: Ah, not really. A lot of the time I look out and see what the jets are doing, if there's a vapour trail I think "oh well there's water up there, we might get something".

This is consistent with existing literature that found farmers in rural Australia often draw on personal observations (or their neighbours) in assessing the accuracy or validity of climate or weather-related information (Buys et al., 2014). Interview data also revealed that the assumption of a normative scientific approach to prediction and forecasting was resisted by a couple of respondents. For example, the assertion of accuracy associated with weather forecasting sources rendered sites such as BOM liable, in some cases, for decision-making on-farm that negatively affected long-term viability and/or productivity. There was an emerging narrative of information sources that align with the interests and needs of farmers being silenced by elites seeking to manage and control the flow of information and framing of CC. Elements and findings of Baker's work were frequently cited in what could be understood as a means of resistance to paternalistic top-down approach to information-sharing. Two respondents I interviewed claimed the research changed their outlook and perspective of CC;

QU: Do you think CC has affected the frequency and intensity of this drought?

TAM1: I don't think that CC has affected the drought. Before I went to this thing, I thought it might've, but after going and listening to this professor I think the rainfall is not affected by it. It's purely the temperature.

TAM2: I've been sceptical about CC for quite a long time and didn't really have an opinion either way, but after listening to this professor and him being able to show that data, it gives you a totally different element...

While TAM1 and TAM2 were the only respondents to explicitly cite Baker's name, several other respondents mentioned key terms and theories that constitute the focus of Baker's research and approach to long-range forecasting (eg, sunspots and solar activity, magnetic fields, El Niño/La Niña cycles, cooling of the stratosphere – "some people say it's actually getting cooler"). The 'take' of Baker's work among such a relatively small population sample could be explained by a preference for localised, experiential knowledge and a desire to develop long-range forecasting based on historical patterns or even intuition. In the face of one of the worst climatic extremes ever experienced, risk perception literature provides guidance in terms of the psychological barriers or 'lock-ins' that

can create a path-dependency in the types of knowledge that are privileged during adaptation planning (W. E. Martin, Martin, & Kent, 2009; Reser et al., 2012; Rogers, Curtis, & Mazur, 2012). As such, the rapid spread of Baker's research could be explained because it corroborated previously held ideas, values and worldviews and challenged the normative science that presented such a threat to their livelihoods and identity; as one respondent observed of his peers; *GLN3*: "but I guess they're also looking for alternatives, they probably want it to just be part of natural cycles". Ultimately, interview data reveals that increasing accuracy and quality of forecasting tools may have been at the expense of "research into mitigation and adaption options" (Pielke and Sarewitz, 2003), especially considering absolute certainty and accuracy is not necessarily desired by graziers.

Moreover, there was an emerging narrative that saw RD&E disseminated top-down often being dismissed by graziers; "there's nothing they can show us that we haven't already tried". The following excerpt from INV1's interview reveals such a trend;

QU: How much communication do you have with Local Land Services, for example?

INV1: Ah, it depends which ones they are

[break]

QU: What makes a good advisor?

INV1: Some of the ex-uni student types, that've got their first job and are "I know everything" and it's "listen to what I'm going to tell you, I'm going to tell you all about this" and it's like "yeah mate... we tried that 20 years ago and it didn't work then".

Moreover, an emerging narrative noted that politicization of science and/or institutional processes were serving as barriers to change. Individual political interests were seen as a barrier to making research/discoveries such as Baker's widely accessible for farmers; *TAM1*: *The politicians aren't interested because they're only interested in the short-term, what they get out of it - and it's no benefit to them short-term so they're not interested*". As such, an incompatibility between the research agendas of government bodies and the 'realities' of on-farm decision-making

and adaptation is reiterated. This has significant implications for more effective policy design and extension activities.

Conversely, the only consistent ‘variable’ among those highly concerned about CC appeared to relate to personal aptitude for continuous learning and a more far-reaching information and knowledge network. Interviews with SOM1 and SOM2 suggested that greater exposure to different experiences and learning (not necessarily formal) resulted in a capacity for interrogating normative assumptions and openness to confronting uncomfortable information. As such, they were often critical of normative science and communication strategies seeking to enhance adaptation via top-down information sharing. Rather, these respondents frequently cited alternative or controversial sources of information (see Table 3). These respondents generally had weaker informal networks and social ties (some described themselves as ‘ostracised’ from mainstream of community) but stronger external information sources (more likely to quote or reference various research, often experiments on farms outside of the region, and overseas). This has strong resonance with the findings of Dowd et al’s (2014) study. The admission of relative isolation in their experimentation with novel strategies implies a potential for farmer-to-farmer learning that has not yet been ‘tapped into’. Most of their information sources were subscription based or paid classes. This suggests there is an opportunity for governments to make available, through various sources, information about successful experiments of transformative adaptors via mainstream forums. These concerned graziers often expressed necessity of integrating farmer-based knowledge and scientific knowledge to engage with their unconcerned peers which represents cause for optimism in the capacity for innovation through extensive and on-going knowledge-sharing.

Chapter Summary

This chapter contributes important new insights for understanding how social discourses mediate perceptions of and responses to CC at the farm-level. A dominant theme emerged; that psychological lock-ins, historical memory of resilience and local cultural values, as perpetuated through social discourses, appear to have

undermined perceptions of vulnerability while embellishing perceptions of adaptive capacity. The existence of such discursive constructions combined with underlying socio-ecological worldviews (i.e. relationship with land), can explain why experience of an extreme climatic event did not translate into radical behaviour change for the majority of respondents. Moreover, the complexity of knowledge needs of graziers and their waning trust in various information sources – compounded by the existence of contradictory narratives diagnosing the nature and causes of CC across the social field – has ensured many ‘solutions’ prescribed by these dominant approaches are often “fundamentally at odds with the sociocultural norms of their intended destination” (Gillard et al., 2016). The following chapter will explore the implications of these worldviews, discourses and social context for decision-making in climate adaptation planning.

Chapter 5: Understanding the Pathways and Parameters of Adaptation

The first section of this chapter will explore how ongoing experience of extreme climatic variability has influenced current climate adaptation planning at the farm-level. The following sections will elucidate the multiplicity of adaptation pathways being pursued by graziers, each of which are informed by different discourses grounded in differing epistemological assumptions. The chapter will conclude with an analysis of graziers capacity for agitation, innovation and resistance to mainstream or undesirable developmental pathways. This provides insight into where opportunities exist “proactively opening windows of opportunity to drive social and political change” at the farm-level (Gillard et al. 2016).

Coping with Drought and Adapting to Change

Discussion of respondents’ drought preparedness responses was important for this research because it allowed for analysis of graziers’ adaptative responses and priorities even where respondents were sceptical of anthropogenic CC. Interviewees were probed to elaborate on the changes in land and livestock practices they had made (or planned to make) over the course of the drought. Respondents were asked to discuss whether they felt they had the capacity for long-term planning during the current conditions, and what kinds of assistance (if any) they felt had, or could allow them, to better prepare for future climate variability. There was a strong theme of path-dependency determining many changes in management practices made over the course of the drought and influencing longer-term climate adaptation planning.

Drought ‘Proofing’ and Drought Preparedness = Proactive Climate Adaptation?

In interview data, as with the longstanding approach to policymaking, there was a strong sentiment that enhancing preparedness and drought-proofing tactics were crucial for ensuring survival and/or minimising the impacts of inevitable drought. Interviews revealed strong initiative and a preparedness to invest in costly projects

if there were foreseeable positive returns in the long-term (whether it be increased profitability and productivity or a healthier ecosystem). Whilst there was cause for initial optimism in the “local initiative and private responsibility” of graziers at the forefront of climate adaptation. This pre-disposition – created by experiential knowledge and perpetuated through discourse by collective social and historical memory of drought preparedness – suggests a potential for ‘anticipatory and preventative’ adaptation (Giddens, 2013). However, this research found rather than bolstering capacity for anticipatory climate adaptation, a history of experience of drought has created a path-dependency in the types of responses and practices graziers adopted or considered adopting. For many respondents, this was largely characterised by an ‘adaptation as resilience’ approach or building up adaptive capacity and resilience to environmental shocks in the short-term in the hope of survival “‘till the good times”.

A ‘Right’ Approach to Drought Preparedness

Discussion of drought responses and preparedness strategies revealed a widespread existence of shared interests, values, sources of information and knowledge between actors in this social field. Interview data revealed a strong narrative of there being a ‘right’ way to prepare for drought. This became increasingly apparent as interviews progressed (high repetition in content) and in the rhetorical construction of drought preparedness tactics/practices that they ‘should’ have been adopting at the time. Table 2 highlights the significant discursive similarities between industry recommended drought responses and the management practices adopted by interviewees. Moreover, the frequent use of the generic *you* (you as an indefinite pronoun) when describing necessary or ideal means of preparing for drought conditions gave the impression that respondents perceived the ‘best practice’ for drought preparedness was representative of the collective group. This was reiterated by the frequent use of collective nouns to describe learning processes, for example, TAM3: “*These are things we’re just learning how to do*”. As such, social discourses were relatively cohesive when discussing drought and produced largely consistent responses. While this in itself is not a surprising finding, reveals the extent of influence dominant discourses have in shaping the boundaries of acceptable or conventional behaviour. This suggests the potential for future climate adaptation pathways being limited by a pre-established ‘flow of information’. The implications of this finding are discussed later in this chapter.

Table 2. Comparison of Industry and On-Farm Drought Preparedness/Responses

	Action/Theme	MLA Drought Preparedness Checklist (see appendix F)	Interview Responses
Before Drought	Pre-determined strategies; setting ‘tipping points’ for later decision-making	It is also important to set strategies ahead of “crunch time” as it is easier to take action under stress if you’ve already got a plan in place	<i>GUN1: Keeping them [cattle stock] ... – a bit longer than we probably should have”</i> <i>TAM2: Everything has an annual schedule, so if you don't do everything at the correct times still you've lost that production for another 12 months</i>
	Planning during the ‘good’ times	Maximise profitability in good seasons to ensure adequate equity and financial strength to manage poor seasons.	<i>TAM3: We all know you have to work extra hard in the good times, to put more away in the good times to get through the longer drought</i>
During Drought	Using forecasts for planning timeline for drought responses	Determine likely duration of drought and worst-case scenario (based on historical rainfall records), consider the MLA Pasture to Growth Outlook Tool	<i>INV1: So, the Bureau of Met are saying ‘we’re going to have above average rainfall’, so you look at it and think, ‘right I’m not going to sell all these cows, we’ve got plenty of feed, we’ve got enough water to last us’</i>
	Managing pastures	Consider pasture resources a. Grazing management b. Opportunistic fodder cropping	<i>SOM2: We got a bit of rain in May... it was warm enough for the Lucerne to grow, so we were able to rotate them [the cattle] really slowly though those paddocks</i>
	Maintaining animal condition	It is often more efficient to maintain condition using supplementary feed than it is to put weight back on or increase condition later.”	<i>BOG1: Well really, you’ve got to get in early. You’ve got to cull early, and feed early before they get too poor, because it costs more to feed a poor cow than it does a cow in good condition. Because you want them to still be able to reproduce</i>
Long-term consideration	Minimising price risk by expanding fodder storage capacity	Consider options to manage fodder supply and price risk a. Financial reserved b. Store fodder on-farm (long-term costs; adequate storage infrastructure)	<i>URA1: I put two new silos and new feedlots, which were all things I was going to do anyway, the [interest-free loan] just sped the process up.</i>
	Adjustment of land management practices	Optimise pasture growth, including use of drought tolerant perennial pastures	<i>GUN3: That’s why we want to plant some more tropical grasses, because they respond to just a little bit of rain</i>

Changes in Land and Livestock Management Practices over the Course of the Drought = Tipping Points?

The severity of the current drought has revealed that an extension of traditional/conventional drought responses – despite vast improvements in technology and infrastructure – is failing to ‘keep up’ with the rate of change in climatic conditions and extreme weather events; URA2: “*Whereas now, even though we’ve gotten better at preparing and storing fodder, no one has any feed at all*¹⁶”. While the majority of graziers stated they felt they had done everything they could during the ‘good’ times to prepare for this drought, the exceptionally *prolonged* and *widespread* experience of drought provided conditions that not even the best manager could be expected to be prepared for; GUN1: “*You just don’t expect them to go for that long*”. As such, interviews revealed there were widespread instances of graziers in the region experimenting with novel practices. For example;

TAM3: Tactics like burying fodder underground so the pests can’t get to it, those stocks can last, and you can dig them up 5, 7 even 10 years down the track. This is something we’re just learning how to do; it’s been around for years, but we’ve never really needed to.

However, for most graziers’ these changes in management practices over the course of the drought were initiated for the purpose of survival, their management practices at the time of interviews could be described as tactical adjustments made in the hope of ‘holding out’ and ‘sitting tight’ while ‘praying’ and ‘hoping’ for rain. Around half of respondents harboured a view that once the drought ‘broke’ (which would require multiple bouts of ‘good’ rain) and following a lengthy and costly recovery period, they would be able to return to ‘business-as-usual’ on their properties, and therefore did not express plans to radically change farming practices in the future.

[Ir-]Rational Decision-Making

A significant but not surprising finding was that many on-farm decisions are not made based on rational calculations of risk, particularly during times of great emotional and financial stress. A poignant example is that GUN1 and GUN2 (married partnership) at the time of interview had recently sold the last of their self-replacing

¹⁶ This was in comparison to the 60s drought, which several respondents drew upon as a previous example of severe and prolonged drought.

herd which signified the loss of a genetic breeding line of over 60 years. In hindsight, they could evaluate their decision to 'hold on' to cattle as 'irrationally' calculated;

GUN1: But also, keeping them a bit longer - you're hanging on to hope, because I can see this now that we're left with nothing, trying to hang on to those cows for as long as possible and thinking if it rains at least we'll have our cows left, and that's where the money is, is or was going to be...

Moreover, for some respondents, strong value for stock raised coping thresholds above 'normal' capacity and provided incentives for a few respondents to 'hold-on' to stock despite the incredibly high-cost of doing so;

INV3: We'll, I've still got my core breeding herd, they're in it for the long-haul. They have to be... I've put so much money into feeding them and bringing them through this drought, I have no choice now but to keep going. But at least I'm still getting good prices for my stock... That's the only thing keeping me going.

In these cases, markets were not providing strong incentives for behaviour change (i.e., changes in management practices or consideration of alternative industries) through price signals as the government assumes it will (as stated in the 2012 COAG agreement). As with interpreting and interrogating information regarding climate risk and recommended responses, graziers' decision-making processes do not follow predictable pathways on the basis of rational economic principles. These findings reiterate that incentivising on-farm adaptation, based on the assumption that graziers' respond to risks in similar and predictable ways, will be unsuccessful in achieving the kinds of widespread and proactive adaptations these schemes desire.

There were instances where respondents observed or insinuated that this drought constituted a tipping point in coping thresholds for many graziers in the region and a minority of respondents expressed concerns that they would not have the capacity to return to 'business-as-usual' in the wake of this drought. These respondents explained that the severity of the current drought had created barriers to full recovery not previously experienced in this region, especially for high quality breeders and livestock traders (drought caused a depletion of state-wide herd population and lack of demand in livestock trading). For GUN1 and GUN2, having completely destocked, the drought had necessitated consideration of re-location or moving to a new industry. However, despite considerable

barriers to re-entry of the industry, and a loss of a key component of identity (attachment to family breeding line) these respondents envisioned themselves re-adjusting to new conditions by offering agistment for other graziers. The social conditions that led to decision-making for incremental adjustments (to ‘hold on’ and adjust practices over the course of the drought despite the incredibly high cost of doing so) also appeared to impede consideration of exiting the industry and further, forestalled transformative adaptation. This aligns with Marshall et al. (2012)’s study of peanut farmers in Queensland, that found strong attachment to place and occupation often served as a barrier for transformational adaptation.

There was a largely implicit narrative of this drought being the “straw that broke the camel’s back” for the livestock industry (and agricultural sector more broadly). Several respondents observed current drought conditions had expedited pre-existing social changes across the agricultural sector in NSW (rural decline, aging farming population etc.). The most commonly noted change envisioned for the livestock industry was corporate take-over of family farming land as drought conditions provided an incentive for struggling, older farmers to ‘pack-up’ and ‘sell up’. Corporate agricultural companies were already gaining a significant presence in the area and some respondents noted these businesses could have greater capacity for adapting to future climate variability, although they reserved judgment on whether this represented a positive or negative change for Australian agriculture. These widely observed changes within and outside of the industry suggest an opportunity for facilitating transformative reform of agricultural systems in NSW.

Capacity for Long-Term Planning for Climate Variability

Corroborating the findings of similar studies (Fleming, Dowd, Gaillard, Park, & Howden, 2015), this research found that a lack of financial and/or emotional resilience and a sense of exhaustion appeared to have undermined capacity and obscured the perceived necessity for longer-term planning. One respondent (a livestock trader with high engagement in the region) aptly characterised the general sentiment regarding planning for future climate variability in the context of experience of severe drought;

GLN3: Oh, for sure it's survival mode. Surviving the drought, remaining viable, putting food on the table and keeping their stock healthy. The major drama in their lives is not what's outside their immediate financial problem currently... at the moment everyone is just praying for rain.

Moreover, there was a reoccurring sentiment that respondents were doing or had done everything they could to prepare for and minimise the impacts of drought, with some insinuating they had even exceeded what would be assumed to be 'rational'.

INV1: And you even though you've got the best intentions of doing all this, you're listening to what they're saying, you're doing it, you're putting money away on FMD, you've improved yards, you've done a bit of fencing, whatever, you know the \$50,000 that you put away on FMD has gone down the throats of your cows trying to keep them alive and... you're in 2019 and they're going "oh yeah farmers' should've been better prepared", and you go I can't – you can't do it

As such, advice proffered from metropolitan elites in this context of exhaustion and fatigue was often interpreted as irrelevant and ill-considered. This played into an emerging theme from across all interviews of a disconnect between state planning/grants/assistance schemes and the 'realities' of planning and preparedness strategies on-farm; GUN2: *"Their plans are just black and white and written on paper; no farmer can afford to put that much food away"*. This is significant as it suggests bureaucrats paying 'lip-service' to long-term climate planning without explicit reference to, and acknowledgement of, the local social context is at risk of being dismissed by graziers on the basis of irrelevance or even insensitivity. Further, this suggests the mainstream approach of governments in individualising calls to action will likely fall short of its' desired outcomes.

A history of responding to climatic extremes such as drought using tactical measures has created a path-dependency, whereby the majority of interviewed graziers appear to be trapped in a cycle of short-term responses. Many graziers revealed that decisions made at the outset or earlier stages of the drought had 'locked-in' adaptation pathways for its duration. The most frequently cited tactical decision that could dramatically reduce vulnerability and increase resilience through drought was de-stocking. Choosing when and how much stock to cull as drought

conditions worsened was cited by many respondents as being an important decision that had significant ramifications for outcomes on-farm at the time of interview. In particular, de-stocking too late or holding on to too much stock resulted in great damage for a few. The gradual nature of drought meant that respondents often did not realise the gravity of their decisions until many months had passed. As such, there was a recurring rhetoric of being ‘drawn into’ current conditions and ‘trapped’ or ‘stuck’ with current management practices;

URA2: Most people around here were drawn into it, you committed to feeding your stock by hand, throwing money at them, you get drawn into it slowly, thinking that its’ going to rain next month. Next thing you know you’re kind of stuck, and that much money into it, with no fodder in storage and no prospect of rain.

These instances of drought creating financial path-dependencies apparently justified only limited consideration of alternative practices or exit of industry. Further, they were often underlined with an assumption of environmental determinism. However, interviews with other respondents revealed several graziers maintained relative capacity for long-term planning for climate variability, despite having experienced the same impacts of drought. This provides a counter to the dominant narrative of there being a ‘limit’ to the extent on-farm management can defer the impacts of severe climate variability.

Interviews also revealed that elements of the new drought policy reform structured towards resilience has made it easier to rely upon traditional methods of ‘drought-proofing’, and thereby superficially and temporarily raising thresholds for coping. Nearly all respondents had accessed some form of drought assistance with most respondents claiming the Farm Management Deposit (FMD) scheme enabled them to survive the drought. At least half of the respondents claimed that the infrastructure they had built prior to the current drought had increased their resilience and prolonged their farm’s productivity as drought conditions worsened. However, of those that had recently built infrastructure, the majority claimed government grants and financial assistance schemes allowed existing plans to be implemented rather than incentivising new or radical changes. Moreover, many respondents expressed concerns that the schemes were not financially sustainable and there was a growing anxiety that many farmers would not be able to pay off their large (often multiple) debts, even *if* the drought was followed by consecutive ‘good’ years for rainfall, growth and overall productivity. Of greater concern is that the government

Exceptional Circumstances-type loans, are encouraging farmers to fall into a cycle of short-term adjustments, accruing greater debt, which not only is financially negligent but is perhaps preventing serious consideration of alternative farming practices that address the root causes of vulnerability or exit of unviable farms from the industry.

Adaptation as Resilience

Interview data reveals a preference for tactical drought-proofing and preparedness measures for periods of drought, over more dramatic changes in land and livestock management practices, to address the root causes of systemic vulnerability on farms (e.g., intensive grazing). The widespread preference for such an approach, or ‘adaptation as resilience’, not only stems from social memory and a long history of experiential learning but aligns with dominant discourses of industry leaders and government. While experience of drought appears to have created a pre-disposition for incremental adjustments and therefore lowered barriers to transitive adaptation, it has raised the barriers for transformative adaptation by obscuring the necessity of addressing the underlying factors affecting variability.

Real and Envisioned Climate Adaptation Pathways

This section seeks to elucidate the multiplicity of *climate* adaptation pathways being pursued by graziers, that is, where future climate variability was acknowledged as a potential risk as necessitating a *degree* of behaviour change. Pathway are each informed by different discourses of CC (i.e., framing of the problem in relation to livestock production) and grounded in differing epistemological assumptions of socio-ecological relations. However, the recommended adaptative and mitigative strategies and practices of such discourses significantly overlapped.

Implications of Worldviews for Management Style and Adaptive Responses

Table 3 is an attempt to integrate the findings of this research with existing theoretical frameworks across climate adaptation literature (largely borrowing from social vulnerability literature and Pelling’s adaptation

pathways typologies). A discursive analysis of the real and envisioned adaptation pathways on-farm revealed underlying worldviews (or more specifically, conceptualization of socio-ecological relationships with land) as a point of divergence between transformative adaptors and resilient or incremental adaptors. Given the significant similarities between adaptive responses and resilience and transitions adaptation pathways¹⁷, this research found it more useful to conceptualise adaptation in terms of ‘mainstream’ and ‘alternative’ pathways (instances of transformative adaptation).

Adaptation as Resilience - “We’ll adapt as we go” (Resistance)

Real Responses

When asked how they planned to adapt to future climate variability, most respondents revealed plans to increase or expand upon existing infrastructure and/or management practices that represent an extension of extant risk management or drought preparedness strategies. These were often characterised by tactical adjustments to increase the resilience of their property to exogenous shocks. For example, the majority of respondents stated they had focused on; maximising fodder and feed storage capacity (building infrastructure on-farm), managing pasture resources (opportunistic fodder cropping), and building cash reserves in the lead up to the current drought (using FMDs). The mainstream approach, to “put more away” in the good times to last longer through the bad times is consistent with historical approaches to drought preparedness.

¹⁷ In Table 3 (pg. 64), the blue highlighted boxes indicate significant overlap in on-farm responses of graziers despite varying levels of concern for CC.

Table 3. Explaining Adaptation Pathways on-Farm: Integrating the findings of this research with existing theoretical frameworks across climate adaptation literature

	Mainstream Approaches to Land and Livestock Management	Alternative Approaches to Land and Livestock Management
Socio-Ecological Relations	Land is primarily viewed as an asset. Environmental Determinism.	Reject environmental determinism. Land management crucial variable in determining health of ecosystem and productivity of land.
Measures of 'success' in land and livestock management	Maximising profitability and productivity of property/farm throughout periods of 'good' and 'bad'. Desirable management style = Effective Management: Managing land to best of ability. Timeliness of decision-making, skill and aptitude of farmer key determinants of relative success.	Varying measures of success, e.g., ecological restoration of inherited land to an ecosystem of health and diversity, social health and happiness. E.g., Holistic Management: Aims to strategically mimic nature through planning and constant monitoring. Success = balancing key social, environmental and financial considerations. Emphasis on decision-making to ensure sound outcomes across <i>all</i> considerations.
Vulnerability Framing. 'Problematisation' of CC	CC is probably occurring, however, too complex (too distant, too uncertain) for individual farms to affect <i>real</i> change. 'end-point' or outcomes vulnerability.	CC is exacerbating pre-existing vulnerability, i.e. a present inability to cope with external pressures or changes, e.g., desertification of landscapes, protracted drying 'Starting-point' vulnerability
Adaptation Pathways, 'Solutions'	Adaptation as Resilience Emphasis on enhancing drought proofing preparedness Exclusively adaptation	Adaptation as Transformation Emphasis on challenging and rethinking normative socio-ecological and economic relations Mitigation and adaptation strategies (emphasis on carbon sequestration potential of land)
Adaptive Responses	Tactical, short-term adjustments (e.g., extension of drought proofing capacities)	Transforming land and livestock management practices (e.g., holistic management, regenerative agriculture)
Main Sources of Influence/Information	Social and historical memory of adaptation (drought preparedness and 'drought proofing'). Industry guides and planning tools.	Post-Normal Science (e.g., Christine Jones) Holistic Management (e.g., Alan Savoy) Regenerative Agriculture (e.g., Charles Massey) Indigenous Agroecology (e.g., Bruce Pascoe's <i>Dark Emu</i>)

Envisioned Pathways

Even graziers that were not convinced of the urgency of mitigating and adaptation to anthropogenic CC, envisioned themselves responding to real or hypothetical climate risk as it occurred. In this sense, climate adaptation pathways resembled the way graziers responded to other, abnormal and uncertain changes that necessitated an adaptive response. Graziers drew on past experience of responding to risks such as; market-price shocks, changes in regulatory environment or the introduction of pests as an example of how they had adapted in the past and therefore planned to do so in the future, should anthropogenic CC present a serious risk to their livelihoods and operations. Moreover, uncertainty over the nature and causes of CC were emphasised to justify gradual adaptation; *INV3: “You never know how it’s going to change, and I guess we’ll just have to work out how to adapt to it”*. Several respondents noted the limited applicability of certain scientific and technological breakthroughs in agriculture for their own farm, and instead, expressed a preference for relying upon traditional approaches to learning and adaptation. *INV3: “Yeah, I’ve heard of them [tropical grasses], but as we’re going at the moment, I guess we’ll just be looking to adapt as we go. But yeah, it’s interesting.”* When presented with hypothetical scenarios, these respondents acknowledged there could be a necessity for a change in behaviour, farming and management practices, however these adaptations would consist of mere adjustments to traditional practices. There was a firm belief that some aspects of pastoral farming either would not or could not change. *INV3: “Yeah, yeah, I guess it could. But I just don’t see it changing that much that we’ll have to dramatically change everything // Go back to a normal season and it won’t be necessary” (GUNI)* These kinds of gradual responses represent the greatest departure from the kinds of urgent and profound adaptation required to ensure the viability of the region, however, only two respondents could be characterised as following a purely ‘adaptation as resilience’ pathway. This suggests norms are shifting towards transitive adaptation.

Adaptation as Transition – Incremental Adjustments

Real Responses

The ‘problem’ identified by respondents adopting incremental adjustments is a potential increase in

vulnerability. The prescribed 'solutions' often focus on improving adaptive capacity by enhancing knowledge of effective management techniques and uptake of new technologies. While the respondents adopting incremental adjustments were diverse in character and differed in their perceptions of CC (from sceptical to concerned), interviews revealed a strong theme of describing adaptations as being motivated by a foreseeable increase in profitability, productivity and efficiency. This was usually incited by a shift in conditions that made tradition or 'business-as-usual' practices and strategies unviable – many of which could be linked to anthropogenic CC or ongoing processes of land degradation due to grazing. This causation, however, was not often explicitly acknowledged. For example, more extreme and variable weather events and less predictable climatic conditions, were frequently cited as encouraging graziers to experiment with more resilient pastures (perennials and tropical grasses) and genetic breeding for more resilient stock, yet were often not described as a deliberate adaptive response to anthropogenic CC. As such, even those that were sceptical or questioning the link between experiences of drought and CC often revealed having made or being in the process of making incremental adjustments to their land and livestock management practices in response to experienced or foreseeable CC-related shocks. The following adjustments appeared frequently across interviews;

- Experimenting with more resilient pastures (tropical grasses)
- Genetic breeding for more resilient animals.
- Experimentation with mixing feed high in nitrate to maintain animal condition
- Establishing containment areas or “sacrifice paddocks” during drought times to allow other pastures to recover
- Improving pastures through optimal pasture utilisation and optimal soil fertility
- Improving fencing to allow for rotational grazing
- Adjusting stocking rates, prioritising animals for offload more quickly

The responses detailing planned or current management practices gave the impression that respondents were reading from a script or that there was a set of appropriate or desirable behaviours and practices. Unsurprisingly, all of these adjustments appear on both government and industry information sheets for “managing the impacts of

climate” and reducing the carbon footprint of farms “while improving productivity”. Although the goals and outlook of the MLA were infrequently explicitly mentioned as motivating adaptation changes, its’ rigid adaptation pathways prescribed in the form of easy step-by-step guides appear to have influenced on-farm decision-making and planning of many graziers. The benefits of such influence are apparent in the widespread uptake of more efficient farming practices which have the potential to reduce the net methane emissions of livestock farms. While these incremental adjustments may achieve successes in technical terms the absence of critical assessment of the drivers of systemic vulnerability, reveals that a preference for “restorative stability” (on farms as well as built into recommended adaptation pathways) has forestalled more dramatic transformative adaptation.

Envisioned Pathways

Belief in Technological Innovation – Several incremental adaptors harboured a predominantly behavioural or technical view of social change. The respondents exhibiting this perspective emphasised the role of technological innovation in providing the breakthroughs required for agriculture to adapt to CC.

BOG1: It’s more about managing correctly today, investing in the right tech and infrastructure and adopting certain practices that suit the near future outlook in order to ensure it will remain profitable and sustainable in the longer-term... whether it’s the irrigation systems you install, or the feed you give to your cattle, everything is about efficiency.

Both concerned and unconcerned graziers expressed such belief or optimism in socio-technical transitions as enabling them to manage future changes.

Potential to Develop an Industry Identity – A significant minority saw CC as an opportunity for rethinking and redesigning mainstream livestock farming practices and the dominant model of industrialised production that it perpetuates. These respondents were often involved more in the corporate side of agricultural management, and in appropriating logics of comparative advantage and rational decision-making, envisioned CC engendering traditional farming practices unviable in the near future. This, therefore, presents an opportunity for Australia to develop its livestock industry around a new identity to align with increasing global consumer demand for quality

meat produced under sustainable farming conditions. These respondents explained how investment decisions in agriculture will increasingly be made based on risk assessments that considers long term viability of farming lands. This will include assessment of how adaptative the land is predicted to be to long-term climate variability, based on assessment of previous management practices.

GLN3: I've been suggesting to people who don't believe in it, that well, lenders are likely to believe in it, insurance companies are likely to believe in it, the people in town are going to believe in it, and eventually the community and other tax-payers aren't going to keep propping up failing farms and properties because they refuse to accept scientific facts and do something about it.

While it may still fall short of the radical changes required to avoid climate calamity, this suggests potential for system flexibility as socio-ecological conditions shift (i.e., demand for sustainably produced meat), and appears to support redundancy (accepts those that can't/don't want to adjust will make room for more innovative enterprises). Moreover, while it was a minor theme across the interviews, local media revealed this shift is perhaps the most widely accepted instance of dramatic incremental adjustments (e.g., in *The Land* article, "Disaster forged a new beef mindset" (Brown, 2019)). As such, following Pelling's logic this suggests the opportunity for incrementally shifting entire systems towards a more sustainable normative *modus operandi*. This could open scope for reconsideration of economic relations underlying agricultural systems (e.g., ecological health, biodiversity valued by mainstream economics). However, this 'radical conservative' view remains "committed to functional persistence", whereby extensive grazing, and indirectly meat exports and consumption, remain an integral component of regional economy, society and land use.

Instances of or Opportunities for Transformative Adaptation

This section of the chapter will address the discourses, practices and strategies of respondents adopting novel or radical approaches for agricultural adaptation and mitigation. These not only present practical lessons for mitigation and adaptation strategies in primary industries, but also reveal the "undercurrents of discontent and

conduits for innovation” where CC is seen as an opportunity to radically rethink and rebuild social, ecological and economic relations (Gillard et al., 2016). This thesis notes that transformative adaptation of agriculture and food systems more broadly would likely involve redistribution of land currently used for extensive grazing of livestock to more sustainable agricultural production or re-forestation. However, given none of the graziers’ interviewed expressed a desire to exit the industry, the following analysis reveals instances of transformative adaptation *within* the industry. Such alternative approaches to pastoral farming, although highly variable in practice, often derived their management style from a shared understanding of the society economy and culture as indivisible from the land.

Shifts in Management Style and Goals of Production

Holistic Management

Four respondents adopted a form of holistic management or holistic grazing as popularized by Alan Savory. Rather than trying to ‘manage’ the land which is inherently unmanageable, the process of holistic grazing aims to “strategically mimic nature”; frequent rotation of livestock paired with strategic planning can regenerative damaged pastures (Savory & Butterfield, 1999). These graziers saw society, culture, economy and health as indivisible from the land/ecosystem. This radical discursive construction of human-ecological relations runs counter to the dominant model of industrialised food production that seeks to maximise or ‘balance’ outputs with inputs (maximise carrying capacity to the brink of environmental destruction). Respondents measured success in various ways (eg, ecological restoration of inherited land to an ecosystem of health and diversity, social health and happiness), but were consistent in their emphasis on improving strategic decision-making to “balance key social, environmental and financial considerations” during adaptation planning (Savory Institute, n.d.). Interestingly, although perhaps not surprisingly, respondents that prescribed to such an epistemology and management style exhibited greater resilience than their neighbours that adopted the more mainstream approach to ‘drought-proofing’ and ‘preparedness’. The method remains controversial and the environmental benefits of holistic management are still contested in many academic spheres (Mann & Sherren, 2018). However, this research argues that the encouragement of a paradigm

shift, and emphasis on holistic decision-making and careful strategic planning, is a crucial first step for fostering transformative adaptation in agricultural systems.

Mainstreaming of Regenerative Agriculture

Recognition of the damages caused by overgrazing and poor land management have mainstreamed some regenerative agricultural practices in discourses and on-farm. The most notable example is rotational grazing, with almost all respondents describing a change in grazing practices over the last few years to allow sections of land to rejuvenate. This widespread acknowledgement of the necessity of “looking after your country better” is the first step in tapping into the carbon sequestration potential of rural farms. It is worth noting as it represents a shift towards redefined norms and goals within the industry, that until very recently saw predominantly set stocking on livestock properties across North-West NSW and prioritisation of “biggest and best weening weights” at cattle saleyards.

Sequestration and Carbon Farming

Following the assumption that well-balanced decision-making and holistic land management can reverse anthropogenic environmental changes, sequestration of emissions through carbon farming was the most frequently advocated means for reducing net emissions from livestock production. A significant minority of graziers’ saw themselves as playing an important role in climate action on behalf of the industry and agricultural sector more broadly. *GLN3*: “*there's no other way really you can pull carbon from the air*”. Local media sources often reiterated the important role Australian farmers could play in climate action; carbon farming articles, tips and notices of information sessions had significant coverage in *The Land*. However, interview data suggests that carbon farming as a viable and even profitable potential adaptation pathway for graziers’ in the region was not as widely acknowledged at the farm-level as in government documents, media and locally based information sources. Instances of carbon farming included in farm risk-management or long-term planning was largely guided by concern for CC, with financial benefits subsidiary, and the guidance of industry leaders peripheral.

Transformative Adaptation on Large Scale – Redesigning the Energy Grid

The Sapphire Wind and Solar Farms – between Inverell and Glen Innes – is the first community co-investment into a large-scale wind farm in Australia. The reports of “overwhelming positive responses” from local community members was reflected in conversations with interview participants (NSW Farmers, 2019b). Three interview respondents from the Glen Innes area were connected to the wind farm grid¹⁸. The co-funding of the wind farms and widespread transition to renewable energy represents an instance of transformative adaptation enacted on a larger scale than incremental farm-level adaptations, requiring significant organisation and community support. This represents a significant effort to reduce GHG emissions from farming properties in the area (most of which are involved in livestock production) by transforming the energy-grid. It is unclear whether this push was enacted out of a collective sense of responsibility to mitigate emissions from the region, or out of financial benefits (cheaper energy source), however, given the urgency of the issue, the distinction is perhaps not necessary. Moreover, it is likely with such a large collective effort and contribution to the project, multiple, overlapping interests and values were advanced in the process. This reveals the creative potential of social interactions within a “social field where shared interests and understandings exist between actors ... more at stake than mere instrumental power or rational competition” (Gillard et al., 2016).

Chapter Summary

In appropriating existing theoretical frameworks of adaptation pathways and referring to studies of farmer decision-making this chapter has argued that the many adaptive responses pursued and envisioned by graziers on-farm can be explained by reference to several, overlapping influences. These factors include; historical memory of drought preparedness, path-dependencies in adaptation planning, social discourses of climate change (framing of problem and prescription of solutions), and conceptualisation of socio-ecological relations. Ultimately, new interview data found that underlying worldviews were more compelling than concern for or acceptance of

¹⁸ One of those had invested in wind turbines on his property, and the other two were surrounded by turbines and looking to buy in the next round.

anthropogenic CC in driving actors (graziers) towards transformational adaptation pathways. Interviews with these graziers revealed several noteworthy instances where alternative discourses and novel farming practices can be seen as opportunities for initiating more widespread and radical social change. The implications of these findings will be discussed in the succeeding chapter.

Chapter 6: Expanding the Relevance of this Research

This chapter will begin with a discussion of this research's original contributions. What follows is a consideration of key findings in light of existing academic debates and the broader political and socio-ecological context of agricultural, and especially livestock, production and adaptation in Australia. Aligning with many of the key recommendations of several notable academics and researchers from a variety of disciplines, this research concludes by drawing implications and recommendations for policy design and further research towards the goal of facilitating widespread transformative adaptation *within* the industry.

Significant Findings

Original Contributions – Empirical

There has been no (as yet published) in-depth research into the social discourses that inform graziers' perceptions of and responses to CC in the midst of prolonged experience of an extreme climatic event in NSW (i.e., intense drought). Further, this represents the first critical study of the socio-political context that underpins adaptation pathways and mitigation strategies in one of the largest cattle-producing regions in Australia. Fortuitously, the timing of this research, conducted in the midst of the worst drought in recent memory, increasing public concern for CC and calls from industry and community groups for a coherent climate policy for agriculture has provided a conducive environment for the collection of new data. The timing also allowed this research to go beyond speculation or prediction of what on-farm responses and adjustments may entail because the current drought necessitated dramatic adjustments in farming practices for *all* respondents. As such, this research has provided a much-needed update to existing knowledge of the social context that informs farmers' decision-making and adaptation planning.

Original Contributions – Theoretical

By “moving beyond” a systems perspective of social change, this research has presented a more politicised and interdisciplinary view of the drivers of change and resistance at the farm-level of the livestock industry (Gillard et al., 2016). As such, rather than seeking to verify existing knowledge of resource-dependent primary producers' perceptions of CC and adaptation pathways, new data provides insights into the socio-political phenomena underlying some of these observed trends and themes. Notably, the multiplicity of knowledge needs and preferences for adaptation of graziers in the region, each of which are informed by different discursive constructions of CC and assumptions of socio-ecological relations. The exploratory, data-driven research methodology (guided by the principles of GT interviewing methods) allowed for great flexibility, whereby interesting or significant topics/themes emerging in interviews were followed-up in reference to academic literature, government documents, industry-stakeholder RD&E or community media sources. This largely descriptive approach has afforded a more holistic picture of how dominant discourses, in concurrence with the local social conditions they are interpreted in, construct meaning and define the pathways and parameters of adaptation at the farm-level.

Situating the Findings of this Research within Existing Academic Debates

Findings of this research have broad resonance with existing studies of farmer decision-making and adaptation planning, especially those that emphasized that the “conditions under which farm families make decisions or ‘adapt’ are socially constructed in historical as well as in ongoing discursive terms” (Ayeb-Karlsson, Fox, & Kniveton, 2019). These discursively constructed conditions emanated from social context (narratives of endurance and uncertainty) and historical memory (drought preparedness – ‘adaptation as resilience’), as well as being perpetuated and shaped by dominant actors in the social field (industry bodies, government). Interview data has suggested that the adaptation pathways on small-scale farms have been heavily influenced by dominant industry (RD&E) and community discourses (social learning) and to a lesser extent, government incentives and schemes. While this in itself is far from a concerning finding (given all bodies have positively influenced adaptation and

information-sharing in some way), earlier work in the field of adaptation research encourages a critical analysis of whose interests are being served by various adaptation pathways.

In the case of the livestock industry, it is clear the steering committee behind the ‘adaptation as resilience’ strategy is made up of powerful stakeholders with a vested interest in preserving the *status quo*, that is, maintaining the ‘productivist line’ (Gray et al. 2009) that currently defines agricultural systems in the region and contributed to the dominance of the industry in Australia’s primary exports economy. Considering it is undeniable the institutionalized model of livestock farming promoted by the industry is incompatible with the fragile ecosystems and variable climates of much of the land used for extensive grazing, it is likely the adaptation pathways promoted by the industry will worsen already occurring CC, continue to contribute to Australia’s share of global GHG emissions and undermine the possibility of transforming land for carbon sequestration. As such, it is unlikely these pathways and incremental changes will be in the best interests of the graziers adopting them in the long run nor ensure the viability of the industry into the near future.

A significant finding was that an individual’s perceived relationship with the land had a was a more compelling determinant of adaptive responses than their degree of concern for CC. This suggests the current emphasis on enhancing scientific understanding of regionally specific vulnerabilities and more accurate predictive capabilities paired with communication strategies to convey this information to farmers, will fall short of its’ desired outcomes. Interview data has revealed that many ‘solutions’ prescribed by dominant actors are often “fundamentally at odds with the sociocultural norms of their intended destination” (Gillard et al., 2016), This is especially apparent during discussion of knowledge needs and trusted sources of information. This research revealed that there exists an institutional incompatibility between the values and privileged knowledge of bureaucrats designing policies and strategies for regional adaptation and those of the individuals best placed to adopt (or reject) them. Discursive analysis revealed the existence of multiple local values, knowledge needs and adaptation priorities that differed from those that might be considered ‘rational’ by scientists or behavioral economists. A continuation of the current trajectory without critical rethinking of the underlying assumptions of ‘models for system change’ will continue to produce simplistic assumptions about farming populations and graziers’ varying needs and

preferences for behavior change. This research concludes that while typologies and vulnerability assessments provide a useful starting point for identifying important trends across primary industries, they should not be viewed as an endpoint from which rigid policies and strategies are derived.

The overwhelming sentiment of apathy with traditional political institutions and processes is a concerning trend if genuine participatory decision-making and inclusive deliberative outcomes are to be achieved. Moreover, while the inclusive and collaborative approach to the design of regional adaptation pathways is a promising feature of governance, the research agendas and recommended adaptation pathways are designed in collaboration with a few, homogenous industry stakeholders. Such a limited pool of contributors in research not only impedes the creative potential of agricultural RD&E to design novel practices and strategies (many of which are being trialled on-farm with success) but ensures adaptation and mitigation strategies are susceptible to conservative reductivism. Given the urgency of mitigating CC, such an outcome is at best, foreshortening the acquisition of maximum optimal benefits for actors within the region, and at worst, potentially dangerous.

In sum, the findings of this research represent an empirical example of what Alan Savory described as “a bewildering array of success and failure” (Savory, 1999). That is, success in transitioning towards more desirable socio-technical systems and adopting incremental adjustments that open scope for innovation and controlled social change, however this results in a widespread failure to consider underlying socio-political and economic conditions that contribute to systemic vulnerability in the first place. Or, what O’Brien terms, a failure to engage with the “real adaptive capacity” (K O’Brien, 2011). However, new research, interviews with drought-affected graziers across North-West NSW revealed there are several instances where disruptive actors are experimenting with novel practices and creating new discourses that could engender transformative adaptation. As such, the findings of this research corroborate the importance of ongoing critical analysis of the discourses framing CC and guiding adaptation pathways.

Implications and Recommendations

In the wake of the release of the most recent IPCC report, foregrounded by increasing public demand for government action on CC, this research can make a timely contribution to the emerging debate and provide recommendations for policy design in agriculture. Echoing the recommendations from pre-eminent international organizations overseeing CC and environmental governance, the key recommendation from this research is the need for urgent critical rethinking of agricultural systems and models of food production. Aligning with the conclusions made by leaders in the field of research into social change in the context of agricultural and rural adaptation to CC in Australia (notably, Fleming and Vanclay), this research asserts that framing of the CC issue needs to move “towards a more complete understanding of how societal norms and ideologies constrain behaviour through discourse” (2009a).

Implications for Further Research

The primary implication of these findings is the need for more politicised and interdisciplinary research as a precursor for any effective policy design and implementation. This suggests the importance of on-going, in-depth research, over widespread, generalizable studies of sample populations (the resources and time required for many of these undertakings engender them vulnerable to redundancy yet encourage reversion to these studies for many years). Rather, the urgency of the issue necessitates a more flexible research agenda, whereby, continuous engagement with populations is necessary to identify and describe the socio-political and emotional dimensions of behaviour change and decision-making in response to climatic extremes and adaptation at the farm-level. Just as reflexivity should be paramount in official policy design and facilitation of farmer learning, reflexivity should be integral for any research agenda in climate adaptation and mitigation strategies.

Tap-in to farmer-to-farmer learning processes

Perhaps one of the most significant contributions of this research is the suggestion from interview data that graziers are more frequently relying upon alternative sources of information. The works of Alan Savory, Charles Massey, for example, clearly have inspired experimentations with alternative and novel farming techniques on

small-scale farms. The success of which is likely due to the information being conveyed farmer-to-farmer and thereby aligning with traditional learning processes. This represents an opportunity for facilitating transformative change *within* the industry. To date, literature on livestock climate adaptation have afforded great attention to understanding and mapping the ‘barriers to change’ that exist at the farm-level. Given the urgency of the issue, and observable resistances to leaving the industry, research agendas and adaptation/mitigation strategies should afford more attention to highlighting instances of actors experimenting with novel or alternative sustainable farming practices and land management styles.

Implications for Policy Design

Despite the findings that many respondents were adopting sustainable farming practices *despite* or *in advance* of government assistance and that many of those adopting more incremental adaptations were doing so in resistance to normative ‘top-down’ recommendations, this thesis notes the significant role government bodies can play in facilitating transformative adaptations on-farm while addressing issues of justice in broader regional adaptation planning and reform (Schlosberg et al., 2017).

This research suggests three priorities for policy framework should include:

1. Raising awareness and creating space for alternative discourses
2. Incentivizing transformation on-farm and legitimising alternative adaptative pathways.
3. Facilitating just transformation of agricultural systems, includes just transition for the livestock industry

Acknowledging and Critical Engagement with Multiple Discourses and Pathways¹⁹

To avoid perpetuating merely an “illusion of inclusivity”, government bodies must acknowledge and engage with a plethora of alternative discourses in CC and agricultural adaptation to include a range of novel and innovative farming practices as legitimate adaptation pathways. This should include, for example, more serious consideration of agroecology perspectives, incorporating all three pillars of mitigation, adaptation *and* ensuring

¹⁹ “The creation of multiple appropriate alternative discourses, as well as widespread awareness and critical engagement with them, is the way forward” pg 162 book.

food security (York, 2011). This also requires a critical rethinking of mainstream approaches to climate science and innovation.

Interview data reveals instances where graziers are experimenting with and trialing a range of novel land management practices. These instances should be highlighted as examples of legitimate adaptation pathways. Furthermore, interview data reveals that examples and ‘success stories’ from other farmers is more likely to be perceived as trustworthy and appealing advice (hope and efficacy are important factors in encouraging behavior change) (Fleming & Vanclay, 2010). Expanding the range and diversity of recommended adaptation pathways will not only incentivize on-farm innovation (empowering discourses) but could incite critical discussion about the underlying power relations and preferences supporting each through comparison. Ultimately, this research concludes that no discourse on CC should be considered to be all-inclusive. Nor should any adaptation pathway be accepted as a new norm without being subject to criticism. However, given the urgency of the issue, focusing on single-adaptation pathways and designing ‘best practice’ responses are unlikely to ensure the necessary behavior change required to avoid climate calamity. Rather than investing more time to debating the relative truth of climate-related claims and efficacy of various strategies, resources could be more effectively mobilised in promotion of multiple adaptation pathways.

Considering interview data revealed that although CC elicits concern among resource dependent primary producers, weak associations of the severity of the current drought and CC appears to have undermined a sense of personal vulnerability to climate-related risks that are often a precursor to behaviour change. As such, this research recommends reforming drought policy in conjunction with design of CC policy for agriculture. By, incorporating CC adaptation and mitigation strategies with drought preparedness/responses as inextricably connected, institutional norms and policy rhetoric can be used as a forum for facilitating change in perceptions and behavior.

Incentivizing Transformation

Following the creation of multiple discourses and engagement with various adaptation pathways, it is necessary for governments to create a coherent policy framework for agriculture. Without such a framework, setting ambitious goals and incentivization of sustainable farming initiatives is not possible. For example, promotion of

carbon farming as an avenue for the agricultural sector and rural landholders to make a highly valuable contribution to mitigating CC. However, currently there is no strategy to iterate the actual changes (in terms of dramatic changes in land and livestock management practices) required for grazing farms in the region to meaningfully contribute to such desirable outcomes through carbon sequestration. Currently, the limited promotion of financial incentives serves to delegitimize the transitions pathways of WERA. “Carbon farming” is at risk of becoming merely a ‘buzz word’ in the ‘change model for grazing’ rather than an actionable pathway for widespread and radical transformation of the agricultural sector.

Ensuring Just Transitions

Agriculture is the lifeblood of the Australian population. Not only is an individualistic approach ineffective (as this research evidences) it is arguably inequitable. Despite foreseeable whole-of-society impacts of the widespread experience of agroeconomic drought, this research argues that the costs associated with worsening climatic conditions have thus far been relatively concentrated on those on the ‘frontlines of change’. Equally, the responsibility of making radical changes in behavior and/or practice, have been disproportionately attributed to individuals in small-scale farming enterprises. This research asserts the need for responsibility in transformative adaptation of agricultural and food systems to be more justly distributed. It should be assumed that many graziers may be unwilling or unable to adopt more radical behaviour change and transformative adaptations. However, considering the immense impacts of intensive grazing on ecosystems, governments should ensure drought policies and assistance are not propping up unviable farms. Rather, efforts should be directed towards ensuring just transitions. That is, providing exit subsidies and training for graziers unable or unwilling to dramatically change land and livestock management practices. Land should be repurposed to maximize carbon sequestration potential. Finally, governments must establish the “rules of the game” before corporations begin irreversible damage.

Concluding Remarks

All of the successes are in the artificial manmade world of technology which is mechanical in nature. This fits with our prevailing mechanical scientific, economic and ecological paradigm. When we look at the areas of failure, already apparent and looming, we find all lie in the area where things are not mechanical – the real or natural world of multi-dimensional relationships (Savory, 1991).

This quote from Alan Savory has deep resonance with the findings of this research. Currently the successes of adaptation and mitigation strategies within the industry, while impressive in terms of technological development and uptake of such, have obscured the urgency of critical rethinking of the dominant models of agricultural production. Nonetheless, new interview data has revealed several instances, at a range of scales, where adaptative responses and decision-making are characterized by adaptation as transformation pathways. These examples of bottom-up, aggregate resistance to mainstream developmental pathways must be highlighted as potential avenues for facilitating a shift in dominant models of production in agricultural systems towards more sustainable farming and land management. The implications of inaction will be dire and associated costs are likely to be concentrated in rural communities and primary industries on the frontlines of change. However, the potential benefits of transformative adaptation are boundless and non-exclusive, and consequently, should be adopted as a avoid climate calamity.

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Appendix A – Description CDI Maps

The graphs (Fig X and Fig Y) are taken from the NSW Department of Primary Industries' Seasonal Conditions Information Portal (SCIP). The Combined Drought Indicator uses three indices determine drought category at a given time:

- Rainfall Index (RI),
- Plant Growth Index (PGI)
- Soil Water Index (SWI)

From these, a fourth index, drought direction (DDI), is developed. The DDI tracks the trend in meteorological conditions over the past 200 days. DPI states that the CDI is not a predictive index, it is best used for categorising a “recovering or warning phase” (NSW Department of Primary Industries, 2019).

Appendix B – List of Interviewees and Reference Names

The following organisations were contacted and agreed to distribute ‘call to participate in research invitation’ flyers:

- CWA Branches: Tamworth, Gunnedah, Inverell, Glen Innes
- NSW Farmers North-West and Northern Tablelands division
- LLS region North-West NSW
- Farmers for Climate Action (FCA) put me in direct contact with Glen Morris who passed on information about the research to graziers across the region who he thought might be interested in participating. *GLNI* and *URA2* contacted me in response.

Passive sampling strategy was adopted meaning interview participants contacted after receiving a call to participate invitation flyer through any of the following grassroots organisations:

Reference Name	Location (Shire)	Means of Contact	Interview Details	Occupation	Description of Farm/Property
TAM1 (M)	Tamworth	CWA Tamworth Branch	Face-to-face, conducted on property of interviewees. 18th July	Cattle breeding (Hereford stud)	Married Partnership. One son working on-farm. Primary operation is breeding of Hereford studs. Up until drought ran commercial cattle and small flock of trading lambs which had been completely de-stocked at time of
TAM2 (F)				Cattle breeding (Hereford stud) Some minor off- farm sources of	

			1.25 hrs.	income (“hobbies”)	interview (sold over a period beginning January 2018)
TAM3 (M)	Tamworth	NSW Farmers’	Face-to-face, conducted on property of interviewee. 16 th July 1hr	Sheep grazier	Managing multiple conjoining properties – all of which are family members’ farms. At time of interview his flock were in agistment in Wagga Wagga. Has since informed me he has completely destocked.
SOM1 (M)	Tamworth	CWA	Face-to-face.	Cattle grazier	Married Partnership. Share property/farm management with surrounding neighbours (most are family members). <100 cattle head, destocked approx. 60% of herd. experimenting with alternative practices and crops, Part of the property listed as ...
SOM2 (F)		Tamworth Branch	Conducted on property of interviewees. 23 rd July 1.5hrs	Off-farm income (income <50% of SOM1+2’s combined income, makes household ineligible for many drought assistance subsidies)	

GUN1 (M)	Gunnedah	CWA Gunnedah Branch	Face-to-face. Conducted on property of interviewees. 22 nd July 1hr	Cattle breeding (Hereford stud)	Married Partnership. Prior to the drought were breeding and rearing a self-replacing herd (Hereford stud). Recently sold last of stock, signalling the end of a breeding line started by GUN1's Father 60 years ago. No stock on farm. After drought...
GUN2 (F)				Last year found off-farm income in town	
GUN3 (F)	Gunnedah	CWA Gunnedah Branch	Conducted via phone. 21 st July. 45mins	Cattle grazier. Minor income from cropping.	Shares farm management with husband and eldest son. Large property, significantly de- stocked. Hand-feeding at the time of interview.
BOG1 (M)	Narrabri and Moree Plains	NSW Farmers'	Face-to-face. Conducted in public library. 24 th July	Farm and rural asset management (within company)	Manages multiple farms across NW NSW. International agricultural investments consultancy. Experience working on cattle ranches overseas.

			45mins		
GLN1 (M)	Glen Innes	Through Glen Morris	Face-to-face. Conducted on property of interviewees.	Semi-retired. Primarily cattle grazier, small sheep flock, limited cropping.	Married Partnership. Predominantly cattle, small mob of sheep. Significantly de-stocked, still have core breeding herd. Claim to operate a ‘carbon-neutral’
GLN2 (F)			28 th July 1.5hrs	Semi-retired. Off- farm income.	farm. Connected to Sapphire Wind Farms energy grid. Looking to invest in turbine in next round.
GLN3 (M)	Glen Innes	Through GLN1	Conducted via phone. 30 th July 50mins	Livestock trading agent.	Due to his profession, has high interaction with many graziers around Glen Innes region. Has been working in region since 1980s. Active member of local National party branch; lobbying for Climate policy.
INV1 (M)	Inverell	LLS	Face-to-face. Conducted at a public library.	Cattle grazier. Previously had off-farm income	Primarily breeding Hereford studs, trading cows. Has significantly de- stocked. Hand feeding stock since mid-2017.

			25 th July 1.25hrs	(inspections for hail damage) but has not been able to find work since mid-2018.	Shares management of farm with neighbours (mostly family members).
INV2 (M) / Glen Morris²⁰	Inverell (also manages farm in Grafton)	FCA	Email consultation prior to conducting fieldwork. Phone interview 3 rd July: 45 mins Face-to-face in town in Tamworth: 30mins	Primarily cattle grazier – general manager of two farms; Inverell (beef) and Grafton (pork)	Studied sustainable agriculture – focused on carbon sequestration. 16 years’ experience researching and practicing advanced land stewardship model. Activist with Farmers for Climate Action. Protests demanding a national policy/strategy for CC and agriculture.
URA1	Uralla	NSW Farmers’	Face-to-face. Conducted on property of interviewee 31 st July	Sheep and cattle grazier.	Before the drought had 3,500 sheep and 90 cattle; at the time of interview had 2,600 sheep and 35 cattle. Has been living and working on the same property his ‘whole life’ (long history of family succession).

²⁰ Gave consent to be identified in research.

			55mins		Lived experiences of 60s and 2000s droughts.
URA2	Uralla	Through Glen Morris	Conducted via phone. 31 st July 40mins	Sheep grazier. Business partner/Wife has off-farm income that disqualifies their farm from accessing freight subsidies.	Significantly de-stocked. Still feeding core mob of sheep. Practices regenerative agriculture. Highly concerned about CC. Actively engaged with FCA.

Appendix C – Guide for Interview Questions and Themes

Initial questions:

- nature of business / farm / property:
- size of business / farm / property:
- primary income of interviewee?

The following questions were used as a guide during all interviews. The majority of the following themes were addressed in some manner, either explicitly or implicitly, at some stage of the interview process with each respondent. The remainder of the interview consisted of probing questions seeking elaboration or clarification of interesting (based on existing knowledge gained from the literature) or contradictory statements or claims.

Establish context, history of occupation and residence, identity formation

Tell me a little bit about how you came to be a cattle grazier, and how long you've been working and living on this property?

[theme: attachment to land]

[Probe – eg, where do you see yourself in 5, 10 years? // How do you envision this land to look after the same amount of time // how will this farm operate?]

Can you explain what being a grazier means to you? // for example, do you see it primarily as an occupation, a lifestyle, a family tradition?

[Theme: attachment to occupation]

[Probe - What do you enjoy most about ____?]

What are some of the biggest everyday challenges you face ____ here?]

Have you ever considered a change in industry or vocation?

[Probe - Expand: if so, why, what to?]

If no: can you envision there ever being a situation where you would consider a change?]

Personal networks, sense of belonging

Do you think there are values or characteristics common to graziers in this region?

Do you think there is a strong sense of community in _____ ? How connected do you feel to your community?

[theme: emotional resilience, extension practices, sense of coherent plan = ^ adaptation capacity]

[probe: what kinds of groups, organisations do you belong to / are involved with?]

Experiences and Impacts of Drought

What have been the major impacts/changes of drought over the last few years on your property?

[theme: risk perception, ... what constitutes damage – specific values]

[Probe: elaboration]

Can you explain how this has affected you personally?

What about the broader community?

How does the current drought compare to previous droughts that you've experienced? Why is this drought different?

[Theme: Turning point? Thresholds for resilience. Link to CC?]

Probe: relationship between prior experience and belief in their capacity to adapt / resilience – do you think your resilience through drought in the past has made you more confident you'll be able to cope in the future.

Can you explain some of the changes you have adopted in order to cope or manage the impacts?

[themes: tactical coping (storing of fodder) vs strategic long-term planning (land rejuvenation)]

Can you elaborate on the types of changes you've made in terms of livestock and land management practices?

Have approaches to risk management changed over duration of the drought?

Do you think that these changes have been planned for the short term (to get through the drought) or for the long term?

Do you think you have the resources or capacity to think about long-term risk management or adaptation-planning currently?

[theme: perceived adaptive capacity, self-efficacy]

Tell me about how you learned to handle extreme weather conditions, such as the current drought? // Can you explain the process of adopting new land or livestock management practices?

[Theme: access to information about adaptation, what kinds of information sources are trusted, privileged]

What sources would you say have been the most useful for learning new management practices / coping strategies.

Source of info/motivation for adopting new practices: trial and error, experimentation, experiential knowledge, from other graziers, from government reports...?

What about for the broader community, how are businesses and farms coping? How are the major risks associated with drought being managed?

[theme: collective adaptive capacity]

Perceptions of CC and Climate Risk

What do you think about CC?

[Theme: system understanding, source of knowledge, experiential factors]

Probes:

Elaboration on causes and effects – eg, “what do you think is causing X?”

Concern for future, risk perception, eg, “do you think X is getting worse”, “how concerned are you about these impacts”

How much do you think CC is influencing the frequency and intensity of drought in this area?

[Theme: system understanding, vulnerability framing – biophysical, critical, human-environment]

Probes:

[if so] what are the signs/indicators, how can you tell? → in what time frame have you noticed these changes?

[if no] when do you think it will happen//what do you expect will happen? // this is just a really bad one?
There'll be rain soon?

Do you feel that your experiences with recent and ongoing drought has influenced the way you think about CC?

What do you think will be the main impacts of CC on your property/for your business?

[theme: risk perception, vulnerability framing]

Where do you gain most of your understanding of CC from?

[themes: preferred types of knowledge in adapting to CC; scientific or uncertain, human-centric knowledge]

Is it enough? Do you feel like you have sufficient access to quality information to be able to make decisions for your property and business?

how often do you seek access to new research and information?

Information sharing between farmers? In different regions, countries

Can you explain how you have or how you plan to adapt to CC?

[theme: perceived adaptive capacity. Pelling's typology of adaptation planning: resilience (maintaining status quo), transition (incremental change) and transformation (radical change)]

Probes:

How confident are you in your capacity to adapt to or manage the risks posed by CC?

Is CC included in your businesses risk management strategies?

Do you see a difference between managing drought (an extreme event) as opposed to CC (a change in the average climate), how so?

What do you expect the impacts of CC will be on the livestock industry?

[theme: collective capacity for adaptation]

[Probe: industry-specific impacts and responses – shared sense of resolve/motivation? Coherent plan/approach to mitigation and adaptation? Industry-specific information and/or guidance:

How has it / how will it impact pastoral farming?

Would you say CC is a big issue within your industry?

How are other graziers' responding?

Is there any guidance from industry leaders/bodies? // Is there a sense of a coherent plan?

How do you think livestock rearing will change over the coming years // in response to CC?]

What would you say are some of the greatest challenges / barriers for adopting the kinds of adaptation strategies that could ensure the long-term viability and prosperity of properties/farms such as your own?

[theme: perceived adaptive capacity, barriers to transformation adaptation]

Intervention: Role of government in drought preparedness and management, and in mitigating risk of CC to vulnerable primary industries

How has the government assisted you during the drought? // Can you explain the forms of assistance or support schemes you have accessed or received over the past 2 or 3 years.

[Probes: evaluate successes/helpfulness, overall impact on practices]

- which ones have offered the best support?
- What about advice and counselling services... eg, seasonal forecasts modelling – have you accessed any of the DPI maps/forecasts/models? Where do you get most of your data/info from?

Do you feel that access to these assistance schemes/programs, you're more able to focus on longer-term risk management strategies and planning for future climate variability?

[probe: if so, how so, what aspects have helped. Advice? Financial income?]

[Probe: if not, why? what are barriers? What could help? What would it take?]

- What assistance would you like to see them providing to enable you to manage drought and plan for CC?

[Probe: so would you say your capacity for **long-term planning** is about the same / less / than say 5 years ago?]

Overall, how satisfied are you with the governments' approach to drought assistance and management?

- What assistance would you like to see them providing to enable you to manage drought and plan for CC?

In terms of climate adaptation and mitigation, do you feel like you have a voice or the power to influence the policies that will affect yourself and your community?

[theme: institutional and legislative frameworks as barriers to transformational adaptation, evidence of effective collaboration and information-sharing, involvement of vulnerable people/groups in the decision-making process = just climate action]

[probe: if so, how? Who/what orgs are points of contact?

If no, how could communication and/or collaboration be improved? Are there leaders or groups that you feel could represent your interests?

What realistically should be the government's role regarding CC?

[themes: responsibility in CA: what actors, who should initiate, top-down or bottom-up]

[probe: supportive of interventionist policies?

What about in terms of mitigating GHG emissions?]

Thinking about your own industry, what role should industry stakeholders or leaders play in encouraging changes to minimise the risk of CC to primary producers?

- If they don't mention it – what about in terms of mitigation? How important do you think it is that stakeholders of the livestock industry work towards strategies to reduce emissions?

- If yes, what stakeholders should initiate? Who has responsibility to encourage or regulate emissions reduction?

Concluding question(s):

- Finish with something positive about the resilience of farmers, and how they envision the future of their farm/industry/community.

After reflecting on your experiences with _____ is there something you would like to add?

Is there anything you would like to ask me?

Appendix D – Recommended Drought Preparedness Responses

MLA Drought Preparedness ‘Checklist’. (Source: Website, *Module 1.08. Drought preparedness*).

When faced with a failed season:

1. undertake an audit of feed reserves, labour resources and support network, including information sources.
2. determine likely duration of drought and worst case scenario (based on historical rainfall records), consider the MLA Pasture to Growth Outlook Tool (see Tool 1.4).
3. determine current value of livestock.
4. determine probable cost of feeding (or agisting) each livestock class
 - a) secure sources of fodder (roughage), concentrates (energy) and supplements
 - b) consider options to reduce price risk.
5. determine value of any production gained if stock class is kept.
6. determine future value of each class of livestock when drought breaks.
7. calculate likely cost–benefit of drought management options for each livestock class
 - a) feeding
 - b) selling and replacing after drought (also consider alternative enterprises)
 - c) capital cost of replacing stock
 - d) profitability of alternative enterprises
 - e) physical ability and knowledge to run alternative enterprise after drought

f) agistment during drought.

8. consider cash flow implications of feeding, including peak debt, ability to fund feeding and impact on profit for at least 3–5 years post drought.

9. consider if funding sources are secure for a period of drought.

10. consider possibility of production feeding any livestock class.

11. consider natural resource management

a) protect pasture resources – avoid erosion

b) ability to feedlot stock

c) audit of water resources.

12. consider pasture resources

a) grazing management to optimise pasture growth and preserve pastures

b) opportunist fodder cropping.

13. monitor physical and financial reserves regularly during drought.

Long-term considerations

1. Funding sources during drought.

2. Consider options to manage fodder supply and price risk

a) financial reserves

b) store fodder on-farm (buy when cheap or produce on farm in good seasons)

i. long-term costs ii. adequate storage infrastructure.

3. Use forward contracts.

4. Use financial instruments to manage price risk.

5. Ensure enterprise fits with pasture growth curve to minimise impact of adverse seasons.

6. Ensure enterprise flexibility to fit pasture growth curve.

7. Optimise pasture growth, including use of drought tolerant perennial pastures.

8. Ensure adequate infrastructure, including water reserves.

9. Maximise profitability in good seasons to ensure adequate equity and financial strength to manage poor seasons.

10. Review drought policy after each drought, and finetune for future drought.