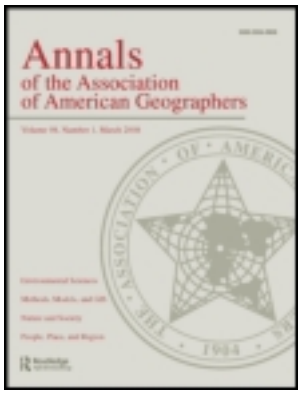

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A Fine-Grained Study of the Experience of Drought, Risk and Climate Change Among Australian Wheat Farming Households

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A Fine-Grained Study of the Experience of Drought, Risk and Climate Change Among Australian Wheat Farming Households

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An increasing body of research shows that climate change takes expression in local processes such as increased climatic variability; climatic risk is managed in relation to other risks in agricultural households; and adaptation is an everyday social process as much as a question of new crop varieties. Understanding how farming households experience the interactions of climatic variability, multifaceted risk, adaptation, and everyday social processes is crucial to informed policy development. A study of New South Wales wheat farming households during the failed harvest seasons of 2006–2007 and 2007–2008 provided a unique opportunity to examine how they approached unprecedented drought in relation to both past and future changes. We analyzed their experience of the hybrid assemblage comprising risk, climate change, and a deregulated policy environment in their everyday lives and individual bodies. These farmers are not adapting to future conditions but are in continuous interplay among multiple temporalities, including memories of the past. They see themselves as adapting in situ rather than relocating northwards with predicted rainfall movements. Capacities to deal with risk and uncertainty vary with a range of social and locational factors, tending to coalesce into patterns of vulnerability and resilience that offer strong predictors as to which households are most likely to be sustainable in the longer term. *Key Words: adaptation, agriculture, drought, New South Wales, semistructured interview.*

越来越多的研究表明，气候变化表现为局地过程，如增加的气候变异性；在农业家庭里，气候风险是依据与其他风险的关系来处理的；并且适应像新作物品种的问题一样，是日常的社会过程。了解农户如何经历气候变化，多方风险，适应，和日常社会过程的互动，是明智的政策发展的关键。一项针对在 2006–2007 和 2007–2008 年失败的收获季节里，新南威尔士小麦种植户的研究，提供了一个探讨种植户们是如何处理有关过去和将来气候变化的，空前干旱的独特的机会。我们分析了小麦种植户混合的经历组合，即风险，气候变化，和他们个体日常生活中的放松管制的政策环境。这些农民并不适应未来的条件，但是在连续的多个时段相互影响，包括对过去的回忆。他们认为自己该在原处适应，而不是随预测的降雨运动而向北调迁。处理风险和不确定性的能力，由于一些社会和位置的因素而不相同，倾向于凝聚于脆弱性和弹性的模式里，从而有力地预测哪些农户是最有可能是长期持续发展的。*关键词：适应，农业，干旱，新南威尔士，半结构化面谈。*

Un cuerpo de investigación en crecimiento indica que el cambio climático se hace evidente en procesos locales como mayor variabilidad climática; el riesgo climático en los hogares agrícolas se maneja en relación con otros riesgos; y la adaptación es un proceso social cotidiano tanto como una cuestión de nuevas variedades de cultivos. Entender la manera como los hogares agrícolas experimentan las interacciones de variabilidad climática, riesgo multifacético, adaptación y los procesos sociales cotidianos es crucial para una política de desarrollo bien informada. Un estudio de las familias que se ocupaban del cultivo de trigo en Nuevas Gales del Sur durante las fallidas cosechas de 2006–2007 y 2007–2008 proporcionó una oportunidad única para examinar la manera como ellos sobrellevaron una sequía sin precedentes en relación con cambios pasados y futuros. Analizamos su experiencia frente al complejo híbrido que incluía riesgo, cambio climático y un escenario de política no regulada en sus vidas cotidianas y cuerpos individuales. Estos agricultores no se están adaptando a futuras condiciones pero están en el juego de acciones recíprocas de múltiples temporalidades, incluyendo recuerdos del pasado. Se ven a sí mismos adaptándose en el propio lugar en vez de relocalizarse hacia el norte al vaivén de condiciones anticipadas de lluvia. Las capacidades para enfrentarse al riesgo y la incertidumbre varían dentro de un ámbito de factores sociales y locacionales, tendiendo a juntarse en patrones de vulnerabilidad y resiliencia que ofrecen buena predicción sobre los hogares con mayores perspectivas de sostenibilidad a largo plazo. *Palabras clave: adaptación, agricultura, sequía, Nueva Gales del Sur, entrevistas semiestructuradas.*

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Several decades of scholarly work has brought public attention to anthropogenic climate change and the urgent need for mitigation and adaptation. Discussions of agricultural adaptation to climate change in the global North, facilitated by strong capacities to measure and monitor both social and ecological variables, have tended to focus at national or other broad scales. In this context, adaptation is conceptualized mostly in terms of agronomic changes such as new crop varieties or different planting regimes. The complexities of implementing such changes at the household scale can be glossed over in policy development. Yet, to take the Australian example, adaptation to climate change in wheat farming, whether successful or not, will be undertaken by the almost 30,000 farming households who grow wheat (Australian Bureau of Statistics 2006). Research into everyday experiences of farming households is less well developed in the global North than in the global South, the latter having a longer tradition of bottom-up, localized research influenced by development studies and the geography of hazards. This article contributes to addressing this imbalance with a study of the experience of New South Wales wheat farmers with the drought-induced failed harvests of 2006–2007 and 2007–2008.

Although agricultural production is inherently highly sensitive to climatic factors, particularly climatic variability, and will become more so under climate change scenarios (Howden et al. 2007), exposure to climate variability is a poor predictor of the overall vulnerability of farming communities (R. Nelson et al. 2005). At this broad scale, complex interactions of geographic, economic, and social factors contribute to their sustainability or otherwise (R. Nelson et al. 2010). Indeed, rather than climate change being an entity somehow separable from normal climate, to be responded to in the future, farmers are already in a process of adaptation, whether consciously or not. Our theoretical framing brings the idea of climate change as a hybrid entity including "more-than-climate" into productive interplay with everyday experiences of risk and drought in farming households. We enhance geographical perspectives by drawing on literature on the psychology of risk, particularly "affective" responses to risk.

For 200 years, Australian wheat farming has been marked by its exposure to substantial climate variability and regular droughts. Adaptation to the sort of climate variability projected to increase over coming decades is thus built into the history of wheat farming in Australia. However, the long cycle of drought over the last seven years or so, with extremely poor harvests in the summers of 2002–2003, 2006–2007, and 2007–2008, is unusual within living memory (Figure 1). The stresses of this period were exacerbated by the lead up to the complete deregulation of Australian wheat marketing in 2008. Interviews with farming households over this period provided a unique opportunity to consider the following research questions:

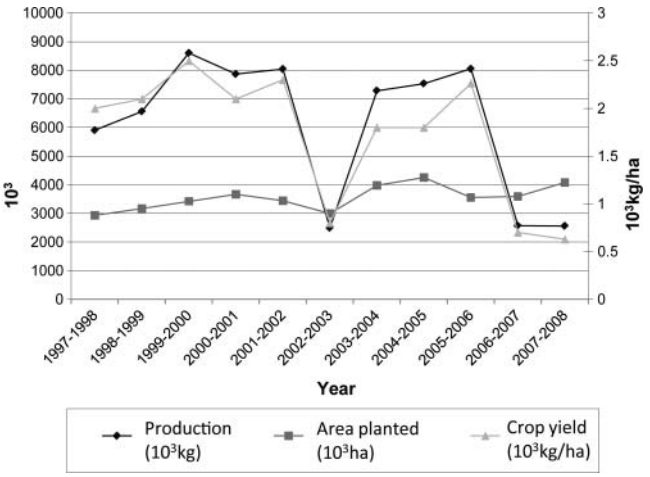

Figure 1. Wheat production, area planted and crop yield, 1997–1998 to 2007–2008, New South Wales. The statistical reporting year in Australian agriculture reports the wheat grown throughout the previous winter and spring. Thus, for example, the 2007–2008 year reports the growing season through the winter of 2007. *Source:* Australian Bureau of Statistics (2008a, 2008b).

- How was the current drought experienced and discussed, in relation both to past changes and to mooted future ones?
- How did households experience and manage the various risks associated with agriculture, in a context of both drought and climate change, in their everyday lives? What are the affective, bodily experiences of individuals?
- How do farmers' experiences interact with their understanding of climate change?

This study contributes to the growing body of work illustrating the importance of fine-grained social and cultural perspectives on adaptation, using qualitative research methods.

Together these approaches provide the basis from which we advocate a more dynamic and connected framing of climate change adaptation in agriculture. Such a framing provides better empirical recognition of

adaptive capacity and vulnerability in farming households and will help facilitate better targeted policies.

Climate Change, Agriculture, and Adaptation

Anthropogenic climate change overlays a new set of challenges on long-standing risks inherent in the practice of agriculture. Climate change is a major issue for agricultural production worldwide, such that "enhancing the capacity to manage climate risk is a core adaptation strategy" to projected and current climate change (Howden et al. 2007, 19695). One of the major concerns is increased frequency of extreme events and variability and implications for food production (Alcamo et al. 2007; Ortiz et al. 2008). Climate change interacts with a range of issues such as burgeoning demand in the developing world, food security, and biofuels (Burton and Lim 2005; Howden et al. 2007; Tubiello and Fischer 2007).With wide recognition that a significant amount of anthropogenic climate change is already locked into global systems, and that this will interact dynamically with underlying socioecological problems, it is increasingly acknowledged that adaptation is as important as mitigation (Smit et al. 2000; Adger, Arnell, and Tompkins 2005; Pielke et al. 2007).

Yet "climate change" will not be expressed or experienced separately from anything else, as a stand-alone entity. Climate change will have expression in localized and temporally specific weather processes recognizable in the present. It will also become enrolled in processes such as drought relief arrangements, carbon trading schemes, altered financial instruments, fluctuating prices of inputs such as fuel and fertilizer, public discourse, and legislation, among others. Adger and others have described these linkages as "nested teleconnections" (Adger, Eakin, and Winkels 2008; Eakin, Winkels and Sendzimir 2008). We build also on the work of Hulme (2008) by considering climate change as a hybrid assemblage made up of "more-than-climate," drawing on Whatmore's (2002) concept of "more-than-human." Following Hulme's (2008) call for geographers to examine cultures of climate, this article joins the growing body of literature focusing a critical lens on the question of climate change adaptation.

Research into climate change adaptation and agriculture has had different trajectories in the developed and developing worlds. Agricultural adaptation studies in the developed world have tended to focus more on agronomic and top-down perspectives (Heyhoe et al. 2007; Howden et al. 2007; Lobell et al. 2008). In the developing world, climate change research has been influenced over a longer period by perspectives arising out of development studies and the geography of hazards, on the key concepts of risk and vulnerability (Alwang, Siegel, and Jorgensen 2001; Fussel and Klein 2006; Lemos et al. 2007; Schipper 2007). The development studies tradition, with a strong methodological focus on case study and ethnographic research at household scales (e.g., Kelly and Adger 2000; Birkenholtz 2010), had argued from the late 1990s for more bottom-up perspectives, recognizing local social experiences. The importance of bottom-up approaches was articulated in the Adaptation Policy Frameworks for Climate Change as summarized in United Nations Development Programme (2005; van Aalst, Cannon, and Burton 2008). Social dimensions of adaptation have received most attention in relation to the developing world, where communities and nations are recognized to be particularly vulnerable to climate change (Adger et al. 2003; Ziervogel, Bharwani, and Downing 2006; Mearns and Norton 2010) and also in relation to indigenous people (e.g., Ford et al. 2008).

For example, Eakin (2005, 2006) has used an ethnographic approach to examine the relationships among climate risk, changes in agricultural policy, and vulnerability among smallholder farmers in central Mexico, arguing that "grounded, locally relevant research" is needed to understand "vulnerability from the perspective of the vulnerable" (Eakin 2005, 1936). She demonstrated the importance of subsistence production in providing a buffer against the "new risks, new volatility, and new vulnerabilities" (Eakin 2005, 1935) involved in engaging with commercial markets under scenarios of increasing climatic variability. These farmers might have higher resilience than some undertaking industrialized agriculture; for example, the farmers in our study, who farm not for their own food but solely for commercial markets. Eakin's approach demonstrates that adaptation in farming households is highly context-dependent and, consequently, generic lists and proxy indicators of adaptive capacity "alone are inadequate measures of such capacity" (Eakin 2005, 1934). Hence, "direct interaction with farmers about their decision-making process may be one way in which new insights can be gained into the process of adaptation" (Eakin 2006, 6).

The literature on adapting farming to climate change has focused mainly on the technical and agronomic dimensions of farm practice, such as altering species and varieties, altering the timing or location

Table 1. Summary characteristics of farming households interviewed, with date of interviews

Code	Location	Interviewee/family structure	December 2006	March 2007	May 2007	December 2007
A	North Central	Male 50s/family with young son		X		
B	Central	Male 40s/family with young children			X	X
C	North Central	Manager/corporate farm		X		
D	Central	Couple 60s			X	X
E	Central	Male 40s/also CEO of related businesses			X	X
F	North West	Elderly couple/adult children off farm		X		X
G	North Central	Bachelor brothers 50s		X		X
H	Central West	Elderly couple	X			
J	North Central	Retired male		X		
K	Central	Elderly/father and father-in-law of T			X	
L	North West	Male/neighbor of N				X
M	South	Male 60s/farms with son and brother	X			X
N	North West	Couple /adult children employed off farm		X		X
O	Central	Male 40s/working parents' farm, wife employed off farm	X		X	X
P	South	Elderly couple	X			
Q	Central	Elderly couple/son now farming their land			X	X
R	North West	Couple 40s/family with young children		X		
S	Central	Retired female			X	
T	Central	Daughter and son-in-law of K, couple with young children			X	
U	Central	Father and son			X	X
V	Central	Retired couple/father/mother and grandfather/mother of U			X	
W	South	Couple 50s and son/adult children on farm/related business	X			X
X	North Central	Female 50s/adult children on farm/related business		X		
Y	North West/North Central	Couple 40s/family with young children		X		X

Note: For locations, refer to Figure 2.

of cropping, and changing crop management practices (Heyhoe et al. 2007; Howden et al. 2007; Lobell et al. 2008; Howden, Gifford, and Meinke 2010). Such "adaptation" has been examined in terms of percentage yield changes and percentage impact reduction (e.g., Heyhoe et al. 2007, 175; Howden et al. 2007, Table 1). Although we recognize the significant contribution of these studies, we instead aim to draw attention to the social distance and other processes encompassed by the move from "unadapted" to "adapted."

The recognition that adaptation research needs to include "bottom-up" approaches (Wilbanks 2005), at scales down to, and within, the household or farm management unit (Roberts and Hollander 1997; Meinke et al. 2007; Thornton et al. 2008; Heltberg, Siegel, and Jorgensen 2009) has led to new applications of social and cultural research methods and approaches (Bryant et al. 2000) in developed world agriculture. These include questionnaires (Smit, McNabb, and Smithers 1996), focus groups (Brklacich et al. 1997; Crimp et al. 2006), and participatory approaches (Kelkar et al. 2008). Farmer attitudes have been studied by Holloway and Ilbery (1996) and Bryant et al. (2000). Following early critiques of the narrow treatment of nonclimatic

forces in definitions of adaptation (e.g., Chiotti et al. 1997), there is now widespread recognition that people do not respond deterministically to climate scenarios (Chiotti and Johnston 1995) and that adaptation and adaptive capacity have social and cultural dimensions as well as biophysical, economic, and policy dimensions (Risbey et al. 1999; Smit et al. 2000; O'Brien et al. 2006; Smit and Wandel 2006; Gorman-Murray 2008; Marshall et al. 2010; Nielsen and Reenberg 2010). This research has built on the heritage of household-scale analysis seen more often in developing country contexts, but application of the ethnographic tradition to developed world agriculture in the context of climate is still rare (West and Vásquez-León 2008; Vásquez-León 2009). In the global North the implications of climate change for the farmer and farming household have not been considered as thoroughly as the implications for their crops.

The later shift toward fine-grained sociocultural research into adaptation in the global North might be because relatively wealthy, well-educated countries are often assumed to have strong adaptive capacity, deducible from macroscale variables such as governance and market signals (Brooks, Adger, and Kelly 2005). In the Norwegian context, however, O'Brien et al. (2006) have argued that a national perception of high levels of adaptive capacity has led to a dangerous complacency about climate change, and an overreliance on technological rather than social solutions.[1] Further, it is not only that characteristics associated with strong adaptive capacity—governance, civil and political rights, literacy—are found more often in the developed world but that these are the types of indicators that are visible and measurable at a national scale (Scott 1998; Brooks et al. 2005). Broad-scale mapping of exposure to climate variability has been undertaken by R. Nelson and colleagues (R. Nelson el al. 2005; R. Nelson, Howden, and Stafford Smith 2008; R. Nelson et al. 2010) for Australian broad acre farming. These researchers also map the vulnerability of the communities, using a variety of regional-scale social, economic, and environmental proxy indicators, demonstrating a limited relationship between climate risk and total livelihood vulnerability. It is necessary to consider fully how climate change interacts with other drivers, including socioeconomic ones (Australian Bureau of Agricultural and Resource Economics 2004; Wall and Smit 2006; Thomas et al. 2007; Wei et al. 2009). Approaches that focus only on the response to climatic factors are likely to miss broader connections and advocate misguided policy outcomes.

Even so, to understand how a combination of factors plays out in any one household, it is necessary to use in-depth research methods to explore how farmers juggle multiple risks (Smit and Skinner 2002; Bradshaw, Dolan, and Smit 2004; Meinke and Stone 2005; Smit and Wandel 2006; Adger et al. 2007; Howden et al. 2007; Bryan et al. 2009). "Adaptation is a continuous stream of activities, actions, decisions, and attitudes that inform decisions about all aspects of life and that reflect existing social norms and processes" (D. Nelson, Adger, and Brown 2007, 397). The everyday processes of coping with existing climatic variability and conditions provide insight into the way that longer term climate change can be dealt with (Smit, McNabb, and Smithers 1996; Smit and Skinner 2002; S. Reid et al. 2007; Stokes and Howden 2010). Hence, more fine-grained spatial scales of analysis go along with more fine-grained temporalities and the recognition that farmers juggle multiple temporalities, from intraseasonal to generational succession planning (Kingwell, Pannell, and Robinson 1993; Risbey et al. 1999; Meinke and Stone 2005; Howden, Gifford, and Meinke 2010, Table 3.1).

Studies on risk and danger that distinguish between external (= analytical, scientific, expert) and internal (= affective, individual) definitions are now being applied to questions of climate change adaptation (Lowe and Lorenzoni 2007). Dessai et al. (2004) and Lowe and Lorenzoni (2007) stressed that recent literature has focused on the science-based issues of climate change, with insufficient attention to the human elements. These researchers draw on the concept of the social amplification of risk, when different perspectives and types of risk interact with one another. For example, in the case of Hurricane Katrina, Dessai et al. (2004) argued that:

> Internal definitions of dangerous climate change—"danger as experienced"—warrants [*sic*] at least as much attention as external definitions—"danger as defined" . . . the reflexivity between external and internal definitions in particular suggests that radical new methods of participatory research are necessary to truly elicit what level of climate change might be regarded as dangerous by different cultures, communities and constituencies. (21)

The external and internal perspectives are paralleled in the psychological literature on risk by analytic and experiential modes of thinking (Slovic et al. 2004). Being able to connect both modes of thinking is argued to enhance public engagement with the challenges of climate change. For example, Lorenzoni et al. (2006), based on survey data from 2002–2003,

found that climate change was psychologically distant for most individuals in both the United Kingdom and the United States. We argue that most of the farmers in this study combine both analytic and experiential modes of thinking in the way they approach climate and other risks. By using research methods that focus on internal, affective, and experiential dimensions, we show that farming households are strongly engaged with climate variables but that levels of "belief" in climate change do not correlate in a straightforward way with adaptive actions (Mortreux and Barnett 2008; Patt and Schröter 2008; Blennow and Persson 2009). Nor are individual experience and belief isolated from wider social processes. The household is now being conceptualized in sustainability research as a vibrant site of "meso" scale work that connects individuals to the wider community and polity (L. Reid, Sutton, and Hunter 2010), and we use that household scale of analysis here.

Scholarly rigor is vital to cultural analyses of the concept and discourse of adaptation (Holloway 1999; Liverman 2008, 2009; Adger et al. 2009). Following Hulme (2008, 5) we contest adaptation as a purified scientific object and understand it as simultaneously "physical transformation and cultural object, as a mutating hybrid entity in which the strained lines between the natural and the cultural are dissolving" (see also Thornes and McGregor 2003; Head 2008). Hulme's encapsulation, incorporating discourse and policy as well as weather, is borne out in diverse ways in contemporary geographic research (Slocum 2004; Boykoff 2007, 2008; Pollard et al. 2008; Boykoff and Goodman 2009).

In summary, our theoretical contribution is to bring together a framing of climate change as a hybrid assemblage, comprising more-than-climate, with a household scale of research in which everyday, embodied experiences of risk and drought are documented and analyzed. For a farmer in the wheat belt of New South Wales, global climate processes take first expression in local processes such as the timing and intensity of the autumn break, the reliability of winter and spring rains, or the presence or absence of frost. It is to this area that we now turn.

Context and Study Area: The New South Wales Wheat Belt 2006–2008

Australian wheat production is part of a global network tying together climate, finance, and people in a set of nested teleconnections (Eakin, Winkels, and Sendzimir 2008; Adger, Eakins, and Winkels 2009). In 2003–2004, Australia was the world's third largest wheat exporter, behind the United States and Canada (Australian Bureau of Statistics 2006). Its exports represent around 15 percent of the world wheat trade. (This was not the case with the 2006–2007 and 2007–2008 harvests, when severe drought led to most of the production being kept for domestic consumption.) Farmers in the New South Wales wheat belt today log on to the Internet as they brew their morning coffee, checking the price of wheat in Chicago (Cronon 1991) along with the daily weather forecast. Conversely, conditions in the New South Wales paddock link back to global circuits of climate and capital.

The Australian wheat belt lies in the southwest and southeast crescents of the continent (Figure 2). Our case study comes from southern New South Wales, the most productive part of the southeast crescent. Planting occurs in the southeast wheat belt after a hoped-for "autumn break" (rainfalls that come at the end of summer) and then depends on winter and spring rainfall for growth, prior to an early summer harvest. For example, the 2006–2007 production figures in Figure 1 reflect the wheat harvested mainly in November through December 2006. In the past this has proved reasonably successful with an approximately one year in seven drought cycle, when a poor harvest is often followed by a bumper harvest. Older farmers compared the 2006–2007 harvest failure with the drought of the 1940s, particularly the failed harvest of 1946. In the early 2000s, however, a number of farmers experienced only one good year (2005), leading to long-term decline in soil moisture levels. In 2007, early good rains led to much speculation of just such a bumper harvest, but hopes evaporated as the winter and spring rains failed to materialize. For those who did manage to harvest some grain in 2007, the financial outcomes were not as poor as the year before, because in the intervening twelve months the price farmers could get for their wheat had risen considerably.

Although drought is a regular feature of the Australian environment, droughts vary in their duration and extent. In Australia, exceptional circumstances (EC) are declared when:

> [R]are and severe events outside those a farmer could normally be expected to manage using responsible farm management strategies occur. Events must be rare, that is not have occurred more than once on average in every 20–25 years; must result in a rare and severe downturn in farm income over a prolonged period of time; cannot be planned for or managed as part of farmers' normal risk management strategies; and must be a discrete event that is not part of long-term structural adjustment processes or of normal

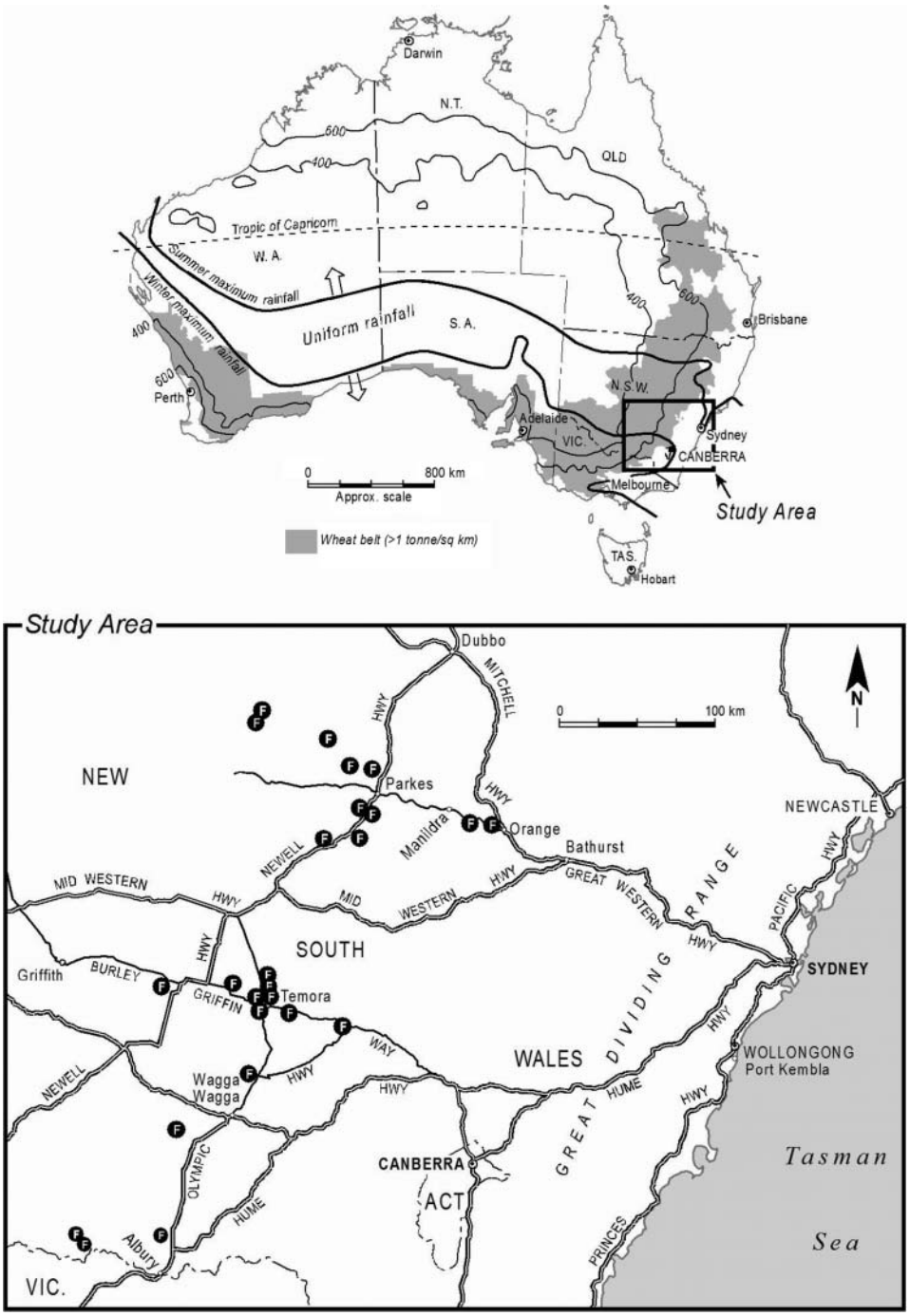

Figure 2. Location of the Australian wheat belt and rainfall zones and study area including generalized farm locations (F). Adapted from Australian Bureau of Statistics (2006, Figure a) and Bureau of Meteorology (2005): Australian average rainfall, annual; Jeans (1987): summer winter rainfall zones. Locations from Table 1: North West is north of Mid Western Highway and west of Newell Highway; North Central is north of Mid Western Highway and east of Newell Highway; Central West is south of Mid Western Highway and west of Newell Highway; Central is south of Mid Western Highway and east of Newell Highway; South is as for Central but closest to the town of Albury on the Murray River.

fluctuations in commodity prices. (Australian Government Department of Agriculture, Fisheries and Forestry 2009)

In July 2008 the Federal Minister for Agriculture declared nearly two thirds of Australian agricultural land to be covered by seventy-four EC declarations (Australian Government Minister for Agriculture Fisheries and Forestry 2009). These years thus provide a research window onto climate change scenarios of more frequent droughts.

Wheat farmers are responding to drought and climate change in a deregulated market of "competitive productivism," the outcome of an export-oriented agricultural sector and a neoliberal political orientation (Dibden and Cocklin 2005, 2009; Andree et al. 2010). Ongoing deregulation of the sector culminated in the 2008 abolition of the "single desk" arrangements, under which

Table 2. Interview questions

1	Can you please describe your position in the wheat production chain; for example, your job responsibilities and the people that you would work with on a daily basis?
2	How does your work vary at different times (seasons, times of year, drought, flood, etc.)?
3	How does wheat grade and quality affect your work? Is this something that you can manage or control?
4	How vulnerable is wheat production to environmental factors (e.g., drought, soil quality, weeds, and pests) and to what extent are these important to your business?
5	What technologies (harvesters, transport, storage, milling equipment, computers, etc.) are employed in your part of the production chain?
6	What are the important economic influences on your business (e.g., price of oil, interest rates, finance)?
7	Where does wheat go when it leaves your part of the production chain? How is it sold and how much value has been added?
8	What is the most important thing that the consumer (e.g., person eating bread) needs to understand about what you do?

the Australian Wheat Board had held the monopoly on export sales. Farmers in our study area also have a number of options for domestic sales, including for flour milling, stock feed processing, and industrial manufacturing. These choices and options bring with them a significant office workload that has an impact on everyday farm life.

Climate change productivity projections for Australian wheat at 2030 are regionally variable and include predictions of both decreased and increased productivity under different rainfall scenarios (Heyhoe et al. 2007). Rainfall conditions are predicted to be wetter in the north and drier in the south, but there is considerable ongoing uncertainty about the role of enhanced CO_2 and its interaction with rainfall and temperature across the continent (Ludwig and Asseng 2006). As Harle et al. (2007) pointed out, anthropogenic climate change will interact with underlying climate variability in two main ways:

> First, many of the impacts of climate change are likely to be through changes in the extremes of natural variation (higher peak temperatures and fewer frosts) rather than as a result of changes in average temperatures. Second, climate change models predict that climate variation will increase with climate change. (75)

Of particular implication for Australian wheat is that the rainfall decreases are projected to be greatest in the growth seasons of winter and spring (Gunasekera et al. 2007, Table 2).

Methods

We interviewed twenty-four farming households, from Albury in the south to Parkes in the north, and from Orange in the east to Griffith in the west (Figure 2; Table 1). Participants were approached through personal contacts in the private agronomy industry and also recommended by government agronomists in the New South Wales Department of Primary Industry. Our sample encompasses most of the socioeconomic diversity in the region. During fieldwork in December 2006, March 2007, May 2007, and late November and December 2007, twelve participants were interviewed once, eleven twice, and one three times (Table 1), depending on availability (a total of thirty-seven interviews). Taped interviews lasting one to two hours usually took place in farmers' homes and were often followed by a walk or drive around the farm. During the two December trips the poor harvests gave farmers more time to talk to us. In ten cases we were able to talk to couples who manage the farming enterprise together. We also had several examples where two or three generations of the family were working together, so we could discuss successional issues and elucidate generational differences in educational background and approach to risk (e.g., Households K and T, U and V, W; see Table 1). In some examples the older generation has retired off the land and is now living in town. "Dad" or "Granddad" has a presence in a number of interviews without being there physically; farmers talk about how "he" did things differently or thought differently about things. On the other hand, some of the study participants are not from the bush at all but came from the city to be farmers (e.g., Household Y).

The farmer interviews are part of a wider study on the cultural ecology of Australian wheat, in which we are also interviewing people throughout the wheat network (including truckers, millers, financiers, manufacturers, food scientists, bakers, and consumers; Atchison, Head, and Gates 2010). For all participants there is a set of common questions about their relationships to wheat and how it is enmeshed in their daily lives (Table 2). In the initial interviews, the questions were used as a starting point for conversations that could go in various directions. For example, farmers could take an hour or

more to talk us through their seasonal cycle (Question 2), by which time answers to most of the other questions had been covered.

In the follow-up interviews in December 2007, the central question was "How has your year/season been since we saw you last?" We would refer to specific details from our earlier visits. For example, among those who had been interviewed in March or May of that year, there had been hopes of a good season, since dashed by lack of rain or rain that came too late. Many farmers throughout Australia were reported as having suffered by forward selling of crops that did not eventuate. The political climate was also highly charged at this time, as these interviews were undertaken one to two weeks after an election campaign in which a change of federal government occurred. Australia's failure, with the United States, to sign the Kyoto Protocol under the conservative Howard government had been a topic of great interest in the election campaign in November. Indeed, the first official act of the new Rudd Labor government was to commence the process of ratifying the protocol. Throughout 2007 climate change had become more prominent as a topic of national conversation in Australia, reflecting international landmark events such as the Stern Review and Al Gore's *An Inconvenient Truth*. We brought up the topic of climate change in these December 2007 interviews if the farmers themselves did not mention it. It is important to emphasize that this work captured climate change discussions among farmers at an emergent time in the national discourse. We contend, however, that the situation of flux and uncertainty captured here is precisely indicative of the new normality in which many resource management decisions have to be made (Gober et al. 2010).

Interviews were transcribed in full and imported into the qualitative data analysis program NVivo (QSR NVivo 8 2008). Transcripts were then read through and indexed at nodes generated by the text. Some of these nodes reflected the terms of our questions (descriptive codes such as drought), and others emerged in the course of the interview (analytic or thematic codes such as our categorizations of risk; Cope 2005; Dunn 2005; Waitt 2005).

Results

Our results are organized into three themes. First, we outline how drought was experienced and talked about in the period from December 2006 to May 2007 and the extent to which it was linked to longer term climate changes. Second, we examine the way drought and climate risk interact with other types of farming risk in the experience of these farmers. Third, we show how climate change was discussed in December 2007.

Drought and Time

All interviewees spoke extensively about the drought, and all understood drought as a normal and expected part of farming in Australia. There is no single experience of this process, because, as Farmer T said, "When the drought starts . . . it just happens really slowly and the dams go down slowly and everything, and you sort of adjust with it." We have examined those interviews conducted between December 2006 and May 2007 for the extent to which the current and recent droughts were characterized as "normal" or indicative of bigger climate changes. As Table 3 shows, several farmers were inclined to think of present conditions as being part of normal variability. More think that the present drought is significantly different, because of its length (between three and seven years, depending on location) and intensity. The latter is expressed mostly in long-term depletion of soil moisture levels. This group includes the oldest study participants, who have personal memories of the 1940s drought (Farmers H, K, P, Q, S, and V). Stories of earlier droughts also become part of the climate memory of younger generations, who have listened to grandfathers and other older men over the years. On two of these older properties (H and Q) we were shown family logs that provide long-term documentation of rainfall records. Farmer perceptions that the current drought is significantly different are supported by the changed practices that they describe (Table 3). These included having to cut and sell wheat for hay rather than grain and having to buy in seed for next year's planting.

Although more farmers than not considered the current circumstances to indicate a significantly different drought regime or a changed normality, this was not generally attributed to climate change. In the twenty-four interviews undertaken during this period, climate change or global warming was mentioned in seven. In two of the seven the drought was attributed to long-term climatic cycles rather than anthropogenic climate change, and in two there was attribution to climate change, albeit with some uncertainty. For example:

> When you listen to all the media and global warming and the changing environmental issues right around the world, maybe there is the possibility that things have changed so radically that perhaps the big rain events historically may be a lot further away for us. So the confidence for me has gone to a large degree. (Farmer T, May 2007)

Table 3. Experiences of drought, December 2006–May 2007

	Farmers
Similarities to normal droughts	
Every year is different.	A
I don't doubt that there is some climate change, with what we're putting into the atmosphere but the drought hasn't been a climate change thing, it's been a drought, it's been a pendulum effect.	D (older)
I don't know whether you call it normal or not. It's things that you learn to live with.	F (older)
Normally in bad years you'll have less commodity but it will be higher value.	G
We've got no say over the drought.	M
We are just going through a cycle at the moment.	R
Differences from normal droughts	
Worst drought on our records and they go back to 1882.	H (older) N
I suppose there hasn't been a lot of happy moments in the last six or seven years. But before that it used to just amaze me, like to see a beautiful stand of wheat and it was green and healthy and just amazing.	O
Worst from a production point of view that anyone can remember.	P (older)
It's a lot, lot drier than I've ever seen it.	Q (older)
Three years prior to this year, the three driest autumns on record, since records have been kept in the district since 1884 . . . these droughts are worse than the droughts that were there when I started farming because I believe with those droughts and the sophisticated farming methods we have now, we would have grown a lot of wheat in some of those droughts.	S (older)
Worse than the 40s because so prolonged.	T and
Historically a lot of the droughts seem to have run for sort of one or two years and then you might get a good year and then sort of another year or two, but this one seems to have been a lot more consistent. Would that be a fair comment K? Yes	K (older)
Back in the 40s . . . it was very dry years . . . but not as bad as this.	V (older)
When you strike the worst drought in 100 years it really does test you.	W
Changed practices because of this drought	
The drought has been the biggest driver in change.	C
We've cut most of it for hay which we've never done before.	O
This is probably the first time I've ever been short of seed [in a drought].	P (older)
There's no way you can store grain and stuff . . . like five years possibly going to six . . .	R
We've stopped planting trees in the last five years because there's been no moisture and it would have been just incredibly disappointing to . . . see them all die.	T

Note: "Older" includes here those participants who are in their sixties and/or retired from farming.

The three other mentions of climate change related to the likelihood of a changed economic environment, such as the possibility of getting carbon credit for tree planting, rather than to weather, drought, or climate per se.

Risk: Strategic and Reactive

Participants discussed drought as a risk that farmers must manage and also as a phenomenon that goes far beyond climate. Risk emerged from our data as a recurring theme; for example, in Questions 3, 5, and 6, as well as the environmental questions. Farmers and their households are au fait with the language and experience of risk and talk about a number of different risk domains. There were differences, however, in the extent to which study participants felt themselves victims of risk or embraced it as providing opportunities. Table 4 summarizes the main types of risks identified in the context of two broad approaches to risk we have called *strategic* and *reactive*. There are many possible combinations of approaches to the risks in Table 4. We recognize that individuals or households might not fall neatly into these categorizations; few are either totally strategic or totally reactive. The categorizations were developed empirically from the interview data. There are intersections with the way adaptation and risk have been understood and categorized in other agricultural studies (e.g., Bryant et al. 2000; Smit and Skinner 2002; Bradshaw, Dolan, and Smit 2004; S. Reid et al. 2007).

Strategic approaches emphasize the active role of the farmer in negotiating risk. Sometimes this is to the point of seeing new opportunities in difficult circumstances. Reactive approaches see risk as being out of their control and tend to position the farmer as a victim. For

Table 4. Types of risk and examples categorized as strategic and reactive approaches

Risk	Strategic approach	Reactive approach
Climate, weather, drought	Variability viewed as normal part of farming; insurance purchased every year; additional resources mobilized if crop needs to be attended to quickly.	Variability viewed as setback; no insurance or insurance purchased sporadically.
Location, geographic	Purchase and leasing of additional land; holdings in different rainfall zones.	Restriction of holding to original family farm location and size.
Production, agronomic	Niche cropping utilized; preventative spraying; sowing within agronomic guidelines; stockpiling animal feed in good years; production history documented; fertilizer and chemical inputs matched to specific soil quality and yield history.	Use of favored varieties; decisions made on the run on a day-to-day basis; purchase of stock feed as required; untargeted and overapplication of fertilizer to increase yields.
Financial	Debt viewed as a normal part of business; increasing debt where necessary to gain size efficiencies; proactive demonstration of sound financial planning to loaning institutions; clear allocation of time and personnel to financial management; constant evaluation of productivity and efficiencies; off-farm income consistent; utilization of vertical integration model.	Debt viewed as a burden, something to be minimized; financial institutions approached with apprehension; evaluation of business based on profit alone; off-farm income sought during periods of financial difficulty.
Marketing	Marketing knowledge viewed as essential to business success; marketing failures viewed as learning experience; global knowledge of markets; development of a marketing strategy early on; storing grain on farm when prices or climatic conditions are not favorable; cautious forward selling and futures trading.	Markets viewed as too volatile to engage with; previous bad experiences change future decisions; family, local, and national knowledge of markets (silos, warehousing, pooling, Australian Wheat Board); marketing strategy developed after harvest; taking whatever price is available; restricting selling to local avenues; no forward selling or futures trading.
Institutional	Changing institutional arrangements viewed as an opportunity; confidence in own marketing knowledge.	Status quo preferred (single desk marketing viewed as providing security and protection from volatility).
Technology and innovation	Agronomy and finances managed on computer (book keeping and cropping programs specified); grain storage innovation; Internet technology utilized; careful timing in investment (outsourcing for a period if early purchase is too costly); travel and exposure to new ideas in other countries.	Agronomy and finances managed generally and informally (kitchen table, records in memory); fear of paperwork; technology viewed as a cost; limited computer and Internet technology; investment in new technology only when old wears out; new technologies bought too early before they are fully tested.
Regulation	Thorough knowledge of regulation; regular maintenance of equipment; compliance failures viewed as bigger cost.	Poor knowledge of regulations; compliance viewed as too costly.
Human resources	Concentrate on areas of talent; outsourcing expertise (agronomic, marketing, etc.) where required.	All labor, management, and marketing undertaken by single person.
Family	Planning and building viable opportunities into farm business for family members to become involved; investment in higher, tertiary education opportunities for children.	Family members need to learn the business for themselves; family members should be able to experiment and make their own mistakes; decisions made centrally by head of family after opinions are heard; only secondary education of children affordable.

example, several farmers used gambling as a metaphor for their cropping experiences. Although this is sometimes an example of laconic humor used by even the most successful farmers, it emphasizes that some farmers feel vulnerable and perceive as unmanageable the array of risks they are exposed to and must negotiate.

Our interview data show that different types of risk interact and tend to coalesce into patterns of vulnerability (reactive approaches; see Household N, Table 5 for an example) and resilience (strategic approaches; see Household W, Table 5). Although it is not a neat and tidy process, approaches to drought risk interact with

Table 5. Examples of strategic and reactive approaches to risk

Farming household context	Sample quotes
Household W (strategic) is in the south of the study area, and has part of its cropping area under irrigation due to possession of a license to tap into an aquifer. Because of its location, Household W has many options for marketing wheat, including to the stock feed mill not far away. Household members are well traveled; for example, having been to Argentina to look at innovations such as silo bags for on-farm grain storage. Succession planning has been very deliberate in this family, with three adult children all tertiary educated in agriculture or business-related areas.	And the weather is just a risk that you've got to manage because that's just what happens if you're farming. You never ever think what's going to happen long term with the weather, so you just factor that in and just hope for the best . . . So even though we've had to borrow a lot of money to develop it [irrigation farming] it's sort of a risk management tool from a business point of view because we're constantly aware that you can have droughts. . . . Farming you just try to constantly manage risk, that's really what we're doing nearly all the time. You have to think of the worst-case scenarios and how we can best try and deflect those. We won't be able to stop them but you try and deflect them. Sometimes it works and sometimes it doesn't work as well.
Household N (reactive) is in the far northwest of the study area and described various economic struggles; for example, not being able to borrow money to replace old equipment. The husband drives trucks off farm to help pay the bills. At the far western margin of wheat viability, the household members openly discussed having cleared some areas of native bush, ahead of legislative prohibitions, to expand the cropping area. The three adult children would like to continue working on the farm, which at the moment only supports one child. Another adult child has completed an apprenticeship and will take whatever laboring jobs are available to make ends meet, while assisting parents on weekends.	I always laugh when we go to church, they condemn gambling, I'm thinking farmers are the biggest gamblers out. . . . Like you borrow money, you borrow money, thousands of dollars and stick it in the ground and keep your fingers crossed that in eight months down the track you're going to get something out of it . . . we may as well plant our money in the ground because at least at the end of the year we can dig it up again.

approaches to marketing. Another important variable is geographic location. Farmers further west not only have lower yields due to less reliable rainfall but also fewer marketing choices because of higher transport costs. Where the farm has been struggling for many years there has been less opportunity for the next generation to gain tertiary qualifications that would strengthen the business. In the east and south, several farms have adult children with tertiary qualifications in agriculture, agronomy, economics, and finance, who have entered the family business in different ways. This is not to say that the demise of the former is inevitable but that its sustainability and security is much less assured.

Risk: Affective, Embodied, and Everyday

The different dimensions of risk management extend into many aspects of daily life. The affective or emotional aspects of risk take a variety of expressions. As a result of the deregulated economic environment and its global teleconnections, daily life on all these farms now involves engagement with much more than the weather and the tractor. Both strategic and reactive farmers described complex juggling of information. In this process, farmers need to be just as tied into global communication networks as any urban office worker, but they also have to maintain a daily paddock life with one eye on the weather. Farmers varied between feeling swamped by this and accepting it as part of the skills required to do business in the present day. Older farmers such as Farmer H grimaced at the blizzards of paper providing demands and information: "I can't get over the material I'm supposed to read and when it [the paper pile] gets about that high, I haven't had time to read it, I put it in the waste paper basket and start building another one" (Farmer H). Farmer M contrasted the current situation with "the old days" when there were fewer decisions to be made:

> The old days, you just cart your wheat to the silo and get whatever money. You don't do that anymore. You're just on a mobile phone all the time ringing up, see who's got the best money for just about every load. (Farmer M)

The young and business-savvy Farmer B provides a rare example of relative comfort with the constant switching between farming and office modes of work:

> Hop on the Internet every morning, have a look, see what the market's doing . . . you get the live, 15-minute delay on the Internet. See what the market's doing and ring up the broker and he'll tell you. It's all pretty easy. (Farmer B)

A further instructive example is the emergence of new technologies of on-farm grain storage as an important generic risk management strategy. On-farm storage enables the farmer to control the timing of selling, rather than having to sell everything at harvest when the price is lowest. Farmers have been increasing the amount and type of on-farm storage; for example, using harvest or silo bags, a low-cost polyethylene bag developed in Argentina that can store up to 300 tons in an airtight environment (Lawrence and Caddick 2006). In a broader context that now includes a deregulated market, many farmers have in effect become their own grain traders. This is burdensome because it increases the amount of time spent on the phone and the Internet, relative to time spent in the paddock. In some larger farming households, one person can specialize in the business and marketing side, but this is rare.

Approaches to risk are not immutable and not solely an outcome of individual psychology, but they do have expression in individual bodies. This is seen particularly in relation to the multiple risks entailed in forward selling part of the crop. During the early part of 2007 a number of farmers had been encouraged by their banks to forward sell, in anticipation of a good season. One couple spoke honestly about their experience of being burnt by forward selling (Table 6). For farmers like these, adaptation to climate change might in the end be measured by evaluation of changes in quality of life, rather than a raw economic or environmental viability decision.

The physical symptoms of the husband in Household Y are just one illustration of how the combination of drought, climate change and financial concerns can have pervasive outcomes for well-being within households.

Understandings of Climate Change, December 2007

Climate change was discussed in nine of the twelve interviews undertaken in late November and the first half of December 2007. Table 7 illustrates attitudes toward climate change together with its expected manifestation for those nine. Even when a farmer professes "belief" pro or con climate change, there is still considerable uncertainty over whether the current drought is a manifestation of that or just another drought. Intellectual understandings based on reading or media engagement and memories interact with embodied experiences. Further, decision making is mostly still framed through climate variability, and the necessity of living with it, rather than something called climate change. In this respect, the long-term outlook and the present season interact. The price of seed and fertilizer interacts with underlying soil moisture, the timing of the autumn rains, and international grain prices, among other things. All of these phenomena and processes are rolled into the assemblage.

These detailed examples illustrate several things. First, only two farming households (E and G) did not really believe in climate change, but no household would unequivocally attribute the current drought to it. Second, participants reiterate the detailed ecological knowledge that is part of any farmer's life, observing the interactions of soil, soil moisture, rainfall, evaporation, and seasonal changes, among many other things. Farmers' beliefs about climate change are only partly

Table 6. The embodied experience of stress

Household Y includes a couple and two young children. During the year, between our interviews in March and December 2007, a year when "every weather forecaster known to man was forecasting that the drought had finished and that this was going to be a higher rainfall year," the household had also forward sold part of their crop. With humor as dry as the paddocks around her had been, the woman said, "They weren't wrong, they were just a bit late." At the time of our interview in December 2007, late rain had then delayed the harvest of what little wheat there was.

> We had a little discussion earlier in the year which is quite amusing and we talked about forward selling and I said, "Oh look, I don't like it." It seems to me that whenever you do this forward selling thing half the time you're better off and half the time you lose money on it, seems to me why put yourself through the stress you should just sell it when you've got it. . . .

She went on to discuss how the stress had caused her husband physical stresses such as headaches and sleeplessness. He was not the only one in the district having these experiences.

> I think also, like besides even the money lost, it seemed to cause an enormous amount of stress through all the second half of the season really, when it stopped raining, because they were all really worried about whether they were going to be able to fill their contracts. Our neighbor who's a fabulous farmer and his crops are looking beautiful and I was saying, "Oh you know, your crops are really holding on," and he said "Oh look, if I hadn't forward sold so much I wouldn't be worried at all." . . . He was not sleeping at night was he and really under a lot of stress because of the forward selling.

Table 7. Attitudes to climate change and its expected manifestation, November and December 2007

Farming household	Attitude to climate change	Expected manifestation
B	It's happening but I'm not blaming the drought that we've just had on climate change.	The extremes of droughts and storms are going to be greater but if you're going to be a farmer you've got to be able to handle that variability.
D (older)	We're hoping that it's only a pendulum swing actually, these dry years and climate change, I guess there's, on the information that we can read about it does look like it's happening.	With climate change and with global warming I was always led to believe that we would have increased rainfall even though it mightn't be as reliable and it mightn't be as often, but we would be having more rainfall. So I guess we'll do our best to . . . be able to manage it . . . if we get climate change, our environment will probably change a little bit with it too and we'll work with it. We've got no choice.
E	I'm not too big on climate change.	A lot of people use it as an excuse for failure.
G	I think it's climate variability and it's always been and it always will be . . . Mother Nature, she overrules everything. She always will. So there's been a lot of coverage of it in the press lately, but, if you had a detailed bar of the past 10,000 years you'd find we have had significant climate shifts before, and we'll get them again.	And we'll do what we've always done, we'll adapt because we have to . . . that's what farmers do now, we work out the weather every day and try and do the best with what Mother Nature deals a hand. That's our job description.
M	Well, I sort of wondered for a while but I think I've got to go with it a bit now, I think something's going on isn't there? But then you talk to older people, some of the older fellows and . . . the 30s were like this.	We've been able to grow crops in these dry years which I'd say years ago you wouldn't have grown anything . . . they're still stripping crop on a record dry year, so we must be getting a bit better somewhere.
O	There'll be lots of opportunities but you just don't know with the climate what's really going to happen. . . . It's definitely warmer.	I mean we'll all stay here and we'll all keep going, we might just have to cut back our cropping acres or stop growing canola and grow barley and shorter season crops that can handle dry times and just change your management a little bit. . . . We get more evaporation so the rain that does fall disappears into the atmosphere quicker so that's going to limit our yields.
Q (older)	Climate change and all . . .	There will be a series of good seasons after the drought breaks.
U	Son: If you'd asked me that twelve months ago I would have said it probably wasn't really happening but I've kind of changed my view. . . . It's definitely going into a different cycle. I still have my doubts about how much interaction or effect that humans are having and I think that's something that keeps getting blurred . . .	Son: It's definitely probably going to affect our management decisions in the next few years. . . . Even if we do have it dry all year you still have to think about . . . what you do at sowing time, it's not something you can do gradually as you go along. . . .
	Father: And how much is getting mixed up in just a drought too. . . . If you go back in history in the 40s and so forth, farmers back then were saying the same, this is what happened back then. They'll often say there's no such thing as climate change it's just repeating itself.	If you had a list of management decisions you had to be thoughtful of next year it wouldn't be the top one . . . probably nutrient management is number one. It all comes back to trying to guess the climate . . . knowing how low we can go with our inputs without penalizing the outcome at harvest next year.
W	I think we probably said last year [December 2006] that climate change and this drought in my opinion are two separate things. Definitely we're having a climate change, I don't think anybody could deny that in the world, but this drought is just sort of a cycle in the weather itself.	The whole ethanol thing is really an opportunity . . . I think when there's a certain period of anxiety about the future then there's always new ideas come out of that and if you can tap into the new ideas and be in there early enough then quite often you can actually make some good money out of that.

Note: "Older" includes here those participants who are in their sixties and/or retired from farming.

relevant to the processes by which seasonal climate variability is mediated. Third, as Table 7 indicates, it is only strategic thinkers such as Households O and W who are even contemplating the possibility that climate change will provide positive opportunities. And when the interviewer suggested to the very strategic Household W that they sounded well prepared for the future, the mother replied, "As long as it rains."

Discussion

The study period captured this group of farmers and their households at an emergent time in the national discourse about climate change. These farmers are not the only members of Australian society pondering the extent to which recurring features of Australian environmental conditions (drought, bushfire, flood, and dust

storms) are crossing, or have crossed, a threshold to a different sort of "normality." Farmers are distinctive, however, at least compared to most urban Australians, in the extent to which an engagement with weather and climate is central to their decision making.

All of the farmers in this study know that drought is normal, and all talk about the necessity of accepting this reality, but there was a clear majority opinion that the current drought is not normal and that conditions have changed for the worse in both frequency and intensity of rainfall. These expressed opinions can be tested against the memory of old-timers, long-term farm records, and changes in participants' practices. One example of a changing practice mentioned by several farmers is cutting wheat crops for hay. This had a clear emotional impact: whereas some were able to treat it as a simple business decision, those whose identity was strongly invested in being a grain farmer felt they had failed if they did not produce a crop.

If the current drought is understood as not just another drought, but something new and different, why was it not generally attributed to climate change? First we should reiterate that there is considerable uncertainty, and a degree of ongoing watchfulness, expressed. Farmers talked of not knowing, of being uncertain. Intergenerational discussions were observed (for example, Households T and K in Table 3, father and son U in Table 7). Some farmers expressed ambivalence (e.g., M, who concedes both that "something's going on" but that "the 30s were like this"; Table 7). There were also specific articulations of having changing opinions over time, notably son U, who said, "If you'd asked me that twelve months ago I would have said it probably wasn't really happening but I've kind of changed my view." So it is possible that we are observing a process of shifting mindset that will become apparent in future research. It is also important to note that all farmers interviewed showed a good understanding of the overlapping temporalities of weather and climate, including long-term cyclicity in climate trends. Further, it is relevant that the everyday juggle for most households includes more urgent problems than those that will need to be faced twenty years hence.

It is instructive here to consider more closely some of the households interviewed at both the beginning and end of the study period. In each case there are strong, albeit different, expressions of coping strategies and resilience. Possibly because climate change is often presented as something society will not be able to cope with, these households might not consider it to be climate change because they are showing themselves to adapt well to change. Couple D talked in both interviews about pendulum swings and living through cycles. Brothers G discussed enjoying the challenge of dealing with bad years and referred to themselves as making their own luck. In this they share something of fellow climate skeptic E's view that "a lot of people use it [climate change] as an excuse for failure." Households O and W are among the most strategic in the study group. They are the two households who discussed climate change as offering positive opportunities, rather than seeing it as only a negative impact. For example, Household W had considered shifting to crop production for ethanol, although its options were increased due to proximity to markets and availability of irrigation licenses.

To interpret how these farmers, both as households and as a group, are likely to adapt in the future to the additional challenges of climate change, we return to our consideration of risk. We have shown the diversity and complexity of risk management among this group of farmers and illustrated some of the ways in which climate risk is entwined with other risks. Climatic and weather variables are relevant at a range of temporal scales, both daily and in particular the seasonal scale, and climatic phenomena are expressed in very specific ways that affect cropping—rainfall, soil moisture, frost, and drought.

At the farm scale, our research shows that climate risks are filtered and managed with a range of other risks in a total network. Although globalized in sensibility and economic connection, the farmers' management of risk and uncertainty is embedded in the social intricacies of localized daily lives. The everyday practices of farming include daily information gathering and filtering, particularly of financial information, using a broader range of communication technologies than in the past. Although farmers can feel that they are losing control in this process, one set of responses is to increase local control through increased on-farm storage of harvested grain.

These wheat farmers have many necessary skills and capacities to deal with risk and uncertainty. Capacities vary primarily due to education, family structure, socioeconomic status, and geographic location with respect to rainfall and transport options. Although there are not neat correlations between different types of approaches to risk, our interview data show that different types of risk interact and tend to coalesce into patterns of vulnerability (reactive approaches) and resilience (strategic approaches). Even the more resilient and strategic farming households, however, are making

their adjustments in situ. It is common for them to own several areas of noncontiguous land to deal with spatial variations in conditions, including stock feed as well as cropping. Participants see themselves as staying in the same area in the future, and several explicitly ruled out a move to, say, northern Australia if, as predicted, rainfall moves north. It will be important for research to document these processes in the future.

Conclusions: More-Than-Climate

We have argued that research into everyday experiences of climate change adaptation among farming households is less well developed in the global North than in the global South, the latter having a well-established tradition of bottom-up localized research. In this article we have sought to bring together a framing of climate change as a hybrid assemblage, comprising more-than-climate, with a household scale of research in which everyday, embodied experiences of risk and drought were documented and analyzed. The challenges of climate change require these fine-grained approaches to be understood as interacting with policy and marketing frameworks that usually operate at broader scales. The southern New South Wales wheat belt provided a significant case study because of its exposure to substantial climatic variability and regular drought. The long cycle of drought in the period from 2002 to 2008, with successive failed harvests unprecedented in living memory, provided an opportunity to examine farmer experiences of conditions projected to become more frequent under climate change scenarios. That this was combined with the lead-up to the deregulation of wheat marketing in 2008 allowed us to examine the interaction of multiple stressors on households. We have built on the heritage of household-scale qualitative analysis seen more often in developing country contexts, linked to an understanding of the global connections in which Australian wheat farmers are embedded.

Even in this context of severe drought and successive failed harvests, climate change is not expressed or experienced separately from anything else. Climate change will have expression in localized and temporally specific weather processes recognizable in the present. Farmer decision making simultaneously pins together different time scales, from the week of this season's planting through the next few years' financial viability to generational succession planning and beyond. Participants are not adapting to future conditions but are in continuous interplay among multiple temporalities, including memories of the past. We identified differences in the extent to which farmers felt themselves victims of risk, or embraced it as providing opportunities, summarized as reactive and strategic approaches, respectively. For all farmers interviewed, the process of risk management is becoming more demanding in everyday life, seen in the complex juggling of paper and electronic information and in the embodied experience of stress. More farmers than not (particularly older ones) considered the current circumstances to indicate a significantly different drought regime or a changed normality, but this was not generally attributed to climate change. Whether these farmers "believe" in climate change is only partly relevant to the processes by which they mediate this complexity in their daily lives. Any strategies that aim to simply educate farmers about the "facts" of climate change will likely miss the point and also risk undervaluing existing adaptive capacities.

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Note

1. It is relevant to also consider the extent to which Australia and the United States are still making up research ground (by comparison with say Canada) because of the high levels of federal government climate change skepticism under the Howard (1996–2007) and Bush administrations.

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