Chapter 1

General Introduction

Anthropogenic climate change is defined as "a change of climate which is attributed either directly or indirectly to human activity, which alters the composition of the atmosphere" (UN Framework Convention on Climate Change, Article 1, as cited in Pielke, 2004, p. 515). Approximately two-thirds of global anthropogenic greenhouse gas emissions are generated by the combustion of fossil fuels within the energy sector (International Energy Agency, 2015). The dominant contribution of fossil fuel combustion to anthropogenic emissions began around 1920 and has increased up to the present (Le Quéré et al., 2015). These anthropogenic emissions are over and above the naturally occurring carbon cycle, which results in carbon being released into the atmosphere, hydrosphere and terrestrial biospheres (Archer et al., 2009). One of the primary drivers of global anthropogenic climate change is carbon dioxide, of which approximately 35 billion tonnes was released globally during 2011 (Peters et al., 2012). Globally, total greenhouse gas emissions were estimated to have reached 49.5 billion tonnes of carbon dioxide equivalents (CO_2eq) in 2010 (Victor et al., 2014). However, carbon dioxide is not the only anthropogenic greenhouse gas. The bacterial processing of both organic and inorganic inputs, and residual outputs of agriculture results in the release of a significant amount of methane, and nitrous oxide into the atmosphere (Smith et al., 2014). These agricultural non-CO_2 gases are estimated to contribute 5.2-5.8 billion tonnes CO_2eq/yr, or 10-12% of the total anthropogenic emissions (Smith et al., 2014).

In Australia, approximately 76% of all electricity generated comes from coal, while natural gas accounts for 13% (Origin, 2015). Greenhouse gas emissions from gas-fired power stations are approximately 50% less compared to coal (Victor et al., 2014). One major source of this natural gas is contained in coal seams below some of the most productive agricultural

land in Australia (de Rijke, 2013a; Williams, Stubbs, & Milligan, 2012). However, its extraction is not without economic, social and environmental consequences (Chen & Randall, 2013; de Rijke, 2013b; Freij-Ayoub, 2012; Measham & Fleming, 2014; Rifkin, Uhlmann, Everingham, & May, 2014). Although both agriculture and mining have a legal right to pursue their business aims, the land use conflict lies in the perceived primacy of each sector, and the extent to which they can co-exist.

The agricultural sector is a key contributor to the Australian economy. It comprises some 134,000 farming businesses and employs approximately 307,000 people (National Farmers Federation, 2012). The gross value of the products sold by farmers in 2010-11 was $48.7 billion, or three percent of Australia's total gross domestic product (GDP; National Farmers Federation, 2012). However, these figures do not convey the complete agricultural economic story. The inclusion of the value-adding process, together with the agri-businesses involved in providing farm inputs takes the overall value of the agricultural sector to approximately $155 billion, or 12 % of GDP (National Farmers Federation, 2012). In comparison, the mining sector in Australia, which frequently competes with agriculture over land-use, employs some 220,00 individuals (Australian Bureau of Statistics, 2015a) and contributes approximately 8.5 % to GDP (Australian Bureau of Statistics, 2014).

Despite the importance of viable and productive agricultural areas to the economy and food security of Australia (Lawrence, Richards, & Lyons, 2013), land use conflicts between agriculture and competing interests, such as the mining sector and urbanization, are not unusual. With an increasing population, the demand for both energy and food – often to be sourced from within the same geographical space – sees these two key drivers of the Australian economy in a classic land-use conflict (Harvey & Pilgrim, 2011). Beneath vast tracts of productive agricultural land lie coal seams containing substantial reserves of natural gas (de Rijke, 2013a; Geoscience Australia, 2011). The use of natural gas to generate

electricity could reduce greenhouse emissions from coal-fired power stations by as much as 50 % (Victor et al., 2014). However, the extraction of the gas from the coal seams under agricultural land potentially creates a diverse range of environmental, social, and operational challenges. These include concerns surrounding water availability and quality (de Rijke, 2013a; Hossain et al., 2013; Navi, Skelly, Taulis, & Nasiri, 2015; Poisel, 2012); negative impacts on agricultural operations (Hand & Smith, 2001); lack of respectful consultation, lack of funding for infrastructure upgrades (O'Kane, 2014); social reconfigurations (de Rijke, 2013a); fugitive gas emissions (Maher, Santos, & Tait, 2014); and fragmentation and damage to native vegetation and habitats (Chen & Randall, 2013; Stearns, Tindall, Cronin, Friedel, & Bergquist, 2005; Williams et al., 2012). Further, there are the consequences of CSG extraction on human health from events such as: possible water and soil contamination, air noise and light pollution, and CSG-related traffic. In a recent review of 109 environmental health studies, Werner, Vink, Watt, and Jagals (2014, p. 1127) concluded that there is a “lack of highly relevant” research into this domain and it “generally lacks methodological rigour”. However, they point out that an “absence of evidence does not mean evidence of absence” and that much more rigorous, longitudinal work is urgently required in this domain (Werner et al., 2014, p. 1138).

There are, of course, those who view the CSG industry in a positive light. Some industries, in particular the manufacturing sector, view CSG as a cost-effective energy source (O'Kane, 2014). Some local governments, such as the Greater Western Downs Shire Council, have embraced the industry in the belief that the employment and business benefits will revitalise flagging rural economies (Courtney, 2010). Further, the Australian Petroleum Production and Exploration Association (2013) and the Queensland Government (2013) argue that CSG extraction in rural and regional Australia will provide a range of both social and economic benefits to areas that have seen limited growth and investment in recent times.

In reality, like most other extractive industries CSG developments will bring both costs and benefits to rural and regional Australia (Carrington & Pereira, 2011a, 2011b).

Coal seam gas, also known as coal bed methane, refers to methane trapped within the macropores (i.e., cleats and fractures) and micropores (i.e., capillaries and cavities) of a coal seam (Freij-Ayoub, 2012). These coal seams usually lie between 200 and 1,000 metres below the surface (Autralia Pacific LNG, 2015). As a part of the production of CSG, the water pressure within the seam is released and this co-produced water is then treated at the surface (Williams et al., 2012). Approximately 15-20 gigalitres of water were removed from underground aquifers as a consequence of CSG extraction in 2011 (RPS, 2011). It is estimated this may increase to as much as 300 gigalitres each year (Carlisle, 2012). Approximately 540 gigalitres is currently removed from the Great Artesian Basin (which underlies most of the known CSG reserves) in Queensland for agricultural and human uses (RPS, 2011). Of concern to many farmers is the lack of bureaucratic consistency with respect of groundwater extraction. Farmers across the Great Artesian Basin (GAB) have supported and embraced the GAB cap and pipe scheme and extraction limits due to departmental concerns about the sustainability of conventional extraction rates (de Rijke, 2013a). However, these concerns about sustainability of the groundwater resources do not appear to apply to the CSG industry (Chen & Randall, 2013; de Rijke, 2013a; Randall, 2012). The major CSG basins in Australia are in Queensland (Bowen and Surat), and NSW (Clarence-Moreton, Gloucester, Sydney and Gunnedah) and cover some of Australia's most productive arable land (see Figure 1; Jones, 2011). There are approximately 7200 active wells in Australia (Australian Petroleum Production and Exploration Association, 2015c), with an estimated 40,000 to be constructed in Queensland alone by 2030 (Carlisle, 2012). Total global estimates of economically recoverable gas from all sources are approximately 719.1 trillion cubic metres (Tcm) (McGlade, Speirs, & Sorrell, 2013). Of this, worldwide CSG reserves are

estimated to be 39.2 Tcm, of which Australia has approximately 4.5 Tcm. Societal concern for global warming has provided a potentially moral justification for the expansion in exploration and production of CSG (Cook et al., 2013).

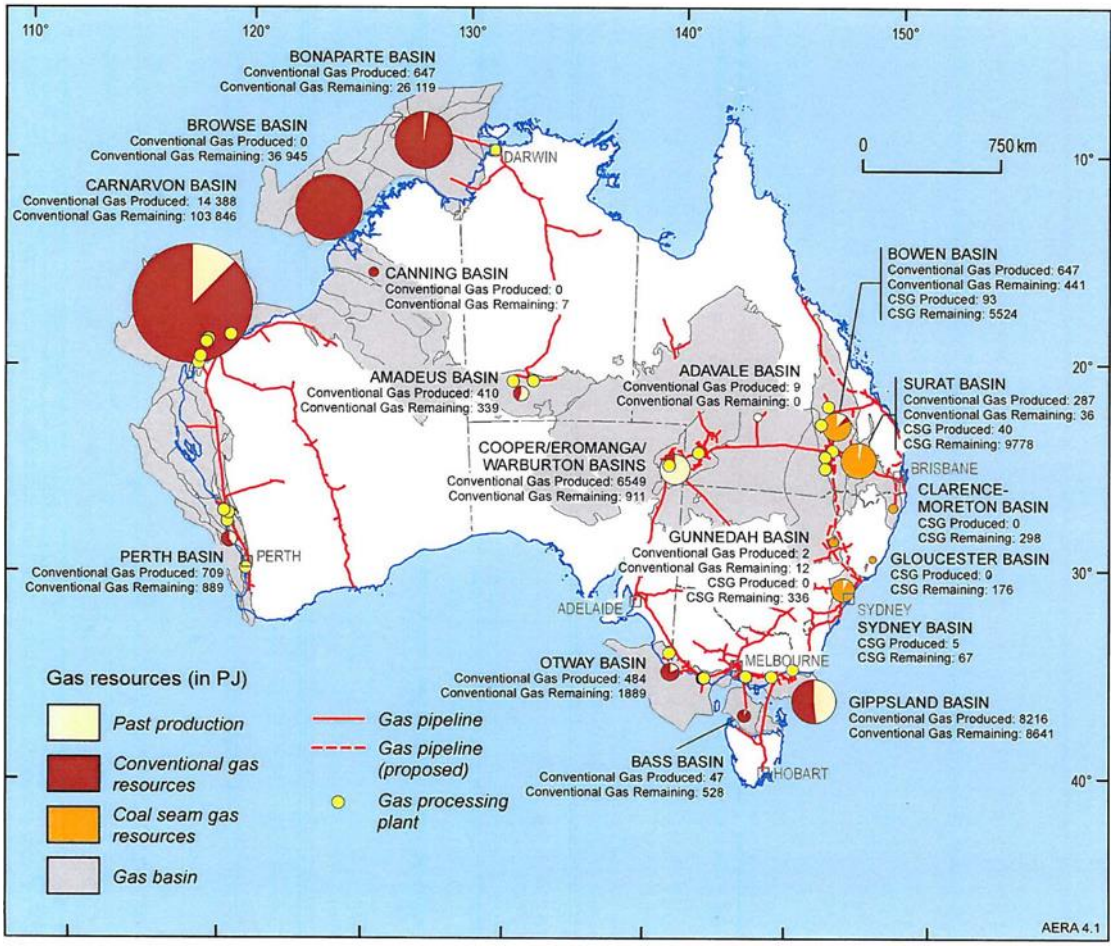

Figure 1.1 Location of Australia's gas resources.

Source: Australian Gas Resources Assessment (BREE, 2012)

Conceptual Overview

Increasing CO_2 emission will require different and effective mitigation options to maintain global temperatures below 2°C relative to pre-industrial levels (IPCC, 2014a). Given the significant contribution of coal-fired power stations to the stationary energy sector a plausible argument exists to increase the use of gas-fired power stations as a bridging source until the arrival of required advances in renewable base load power generation (Australian Petroleum Production and Exploration Association, 2015a; Freij-Ayoub, 2012). With the decline in conventional gas reserves, CSG appears to provide Australia with a viable local alternative source of energy (Freij-Ayoub, 2012). Further, the production and use of CSG is expected to contribute to a reduction in the more than one billion cubic metres of fugitive methane released from coal mines each year in Australia (Freij-Ayoub, 2012). However, the production of natural gas including unconventional sources such as shale and CSG, are not without fugitive gas concerns. Stephenson, Doukas, and Shaw (2012) note that the legitimisation of unconventional natural gas developments has overlooked factors such as fugitive gas emissions including the release of CO_2 from within the geological formations. Further, the production of CSG proses several notable challenges such as: waste water, air and water contamination, above ground infrastructure, and economic and community changes (Freij-Ayoub, 2012; Walton, Leonard, Williams, & McCrea, 2015; Walton, McCrea, & Leonard, 2014). The net contribution of CSG as a bridging power source is unclear. While it undoubtedly is a cleaner fuel source for the production of stationary energy in Australia compared to coal, it is nonetheless a fossil fuel and its extraction creates a range of social, economic and environmental issues. As detailed in Figure 1.2 this thesis explores the potential mental health outcomes to farmers confronting CSG extraction, their affective evaluations of the industry and potential drivers of anti-CSG activism. I then explore some of the psychological drivers and barriers associated with engaging farmers in emission reducing

on-farm practices. In the event that CSG extraction is halted or curtailed at current production levels, the emission benefits from these ‘greener’ power stations will need to be found elsewhere. As the second largest source of greenhouse gases, the agricultural sector will undoubtedly have a substantial role to play.

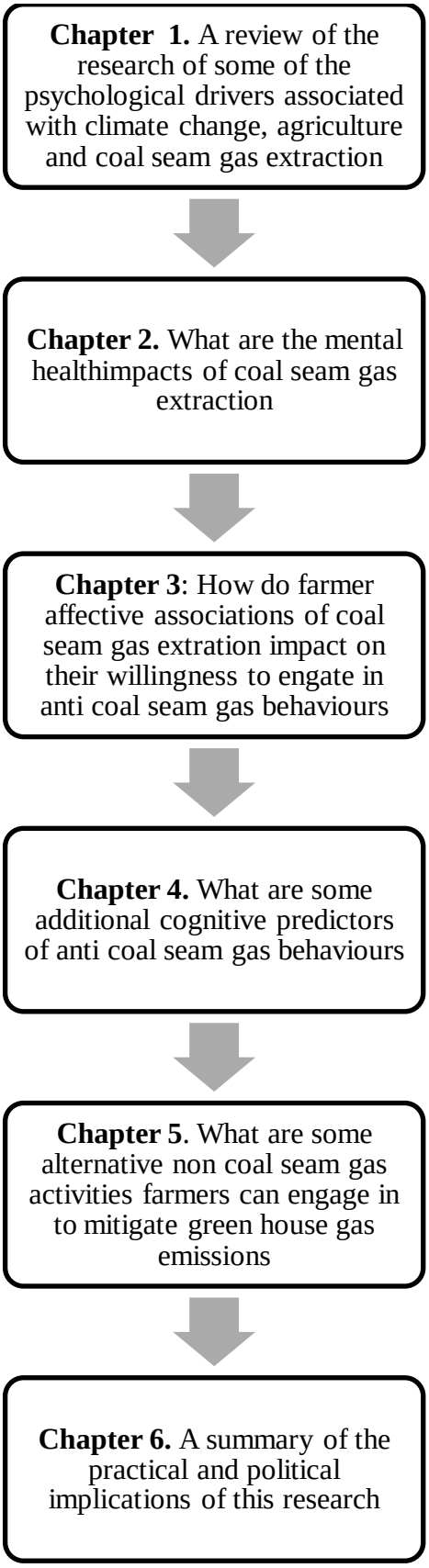

Figure 1.2 A conceptual overview of the thesis.

Aim of the Thesis

This thesis has two primary aims that address four research questions. First, I explore the attitudes, expectations, responses and mental health outcomes of Australian farmers confronted by CSG developments. Addressing this aim, I seek to answer three main questions.

1. Do farmers perceive CSG as a unique agricultural stressor, and if so, what are the potential consequences for their mental health?
2. What are farmers' emotional responses to CSG, and how do these responses influence (a) how they evaluate the potential costs and benefits of CSG extraction on agricultural land, and (b) decisions to engage in anti-CSG activism?
3. How can the Theory of Planned Behaviour be enlisted to better understand farmers' decisions to engage in conventional anti-CSG activism and more extreme forms of civil disobedience?

The second aim of the thesis is to explore the utility of farmers' attitudes, values, and beliefs in predicting the on-farm adoption of practices to reduce carbon emissions. If fossil fuels such as CSG are to remain in the ground in order to limit global warming, then what practical contribution to the reduction of greenhouse gas emission can farmers' make, and which psychological constructs influence engaging in such behaviour? Addressing this aim, I seek to answer the following questions.

4. What psychological constructs can be used to predict engagement in farming practices that reduce greenhouse gas emissions? Further, can they be used to identify distinct farmer segments that can be used for tailoring and targeting engagement strategies and policy development?

The following sections provide a review of the research underlying each of these research questions.

1. Farmer Stress and Coal Seam Gas (CSG)

1.1. Environmental Stress

Stress is predominately conceptualized as either a stimulus or a response (Lazarus & Folkman, 1984). As a stimulus, stress refers to environmental events (e.g., natural or man-made disasters, retrenchment and severe illness) that would normatively be assessed as stressful (Lazarus & Folkman, 1984). These stress stimuli are more commonly referred to as stressors, which is the term used throughout this thesis. Stress response refers to a physiological outcome within the individual (Lazarus & Folkman, 1984). Although an event/object may be normatively considered stressful, perceptions of stressfulness may vary considerably across individuals (Cohen, Kamarck, & Mermelstein, 1983). Psychological stress is a response to an individual's perception, that the demands of the environment surpass the adaptive capacities to deal with the stressor (Cohen, Janicki-Deverts, & Miller, 2007).

Humans have evolved to survive within a diverse range of ecosystems and built environments, and typically encounter a range of environmental conditions each day (Evans & Cohen, 2004). Environmental conditions refer to the physical properties of the existential domain within which individuals conduct activities (Evans & Kantrowitz, 2002). Many of these conditions support physical and mental health, such as clean air, recreational parks, and clean water. But others – noise, crowding, heat, hazardous wastes and other toxins, for example – do not (Evans & Cohen, 1987; Evans & Kantrowitz, 2002). Although humans have adapted successfully to this diverse range of environments and conditions, it has not been without cost (Evans & Cohen, 2004). These adaptive costs can have various psychological impacts, including negative affect, fatigue, reduced self-efficacy, increased

physiological responses, and distorted perceptions of environmental conditions (Evans & Cohen, 2004). Research indicates that the stress associated with living near a hazardous environment such as industrial manufacturing operations, has a direct effect on mental health outcomes (Downey & Van Willigen, 2005).

The growth of CSG operations in regional Australia has resulted in rapid industrial developments in many small rural towns and localities. As a consequence, many of these communities face a range of novel challenges including: increased population growth and the resulting strains on infrastructure and services; reduced housing and accommodation availability and affordability; labour shortages; changes to community values and lifestyles; and increased local traffic (Cook et al., 2013). A substantial body of research into the impacts of mining in rural areas has identified similar challenges (e.g., Carrington & Pereira, 2011a, 2011b; Franks, Brereton, & Moran, 2010; Lockie, Franettovich, Petkova-Timmer, Rolfe, & Ivanova, 2009; Tonts, 2010). The industrial activity associated with CSG developments on farms and within rural and regional communities potentially adds to the adaptive costs associated with farming.

1.2. Farming Stressors

Mental illness is the second largest contributor to the disease burden in Australia, with the social impact of mental illness culminating in a suicide rate amongst rural men up to 2.6 times that of their urban counterparts (National Rural Health Alliance Inc, 2009). Although mental health morbidity within rural and regional Australia is similar to non-rural areas, farmers have a substantially higher suicide completion rate than the national average for employed adults (Andersen, Hawgood, Klieve, Kolves, & De Leo, 2010; Arnautovska, McPhedran, & De Leo, 2014; Australian Bureau of Statistics, 2011; Fraser et al., 2005). A review of research into rural populations in the United Kingdom, Europe, Australia, Canada and the United States of America suggests that “farming is associated with a unique set of

characteristics [stressors] that are potentially hazardous to mental health" (Fraser et al., 2005, p. 340). The range of identified stressor domains that contribute to negative mental health outcomes within the farming cohort include: bureaucratic obligation, financial pressures, isolation, climatic variability and events, on-farm hazards, and time pressures (e.g., Booth & Lloyd, 2000; Brannen, Johnson Emberly, & McGrath, 2009; Deary, Willcocks, & McGregor, 1997; Firth, Williams, Herbison, & McGee, 2007; Marshall, Gordon, & Ash, 2010; Sartore, Kelly, Stain, Albrecht, & Higginbotham, 2008). Furthermore, an extensive body of research indicates these unique farming stressors contribute to adverse mental health outcomes in farmers, including increased levels of psychological stress (Booth & Lloyd, 2000), depression and anxiety (Sanne, Mykletun, Moen, Dahl, & Tell, 2004) and suicide (Judd, Cooper, Fraser, & Davis, 2006a; Judd et al., 2006b; Kõlves, Milner, McKay, & De Leo, 2012). Although it is clear that CSG extraction on agricultural land is a "hot-button" issue for many farmers, the contribution of CSG extraction to farmers' global stress burden and the subsequent potential negative impacts on mental health outcomes is not yet clear. I address this issue in Chapter 2.

1.2.1. CSG Extraction and Farmer Stressors

Throughout Australia, and around the world, productive agricultural land is being permanently lost from the food production chain in favour of industries such as mining and urban development, which often provide more attractive short-term financial returns including employment opportunities, local economic activity, and tax revenue (Greer, Talbert, & Lockie, 2011). Extractive resource operations, such as open-cut coal mining, can profoundly affect natural ecosystems, agricultural operations, and social conditions. Further, these extractive operations also have been associated with increased fears of physical illness and elevated distress related to environmental changes among those most directly impacted (Higginbotham, Conner, Albrecht, Freeman, & Agho, 2007; Higginbotham, Freeman, Connor, & Albrecht, 2010). For example, Higginbotham et al. (2007, p. 246) report that some

of the consequences of open-cut coal mining in NSW's Hunter Valley are that "families living in mining-affected zones have been relocated to make way for mine developments, while residents left on the fringe of mining and power activities are exposed to degradation of their surroundings through land clearing, pollution by noise, dust, saline water and other emissions, land subsidence, cracks in water courses, house damage from blasting, frequent truck movements, and illumination of night skies by 24-hour open-cut mining operations." The minimal above ground geo-spatial interference of CSG extraction was seen initially as an opportunity for agriculture and mining to co-exist. Indeed, it was viewed by many as a win/win situation for the farmers, local economies and mining (Greer et al., 2011).

However, like the coal mining areas, CSG developments present communities with costs as well as benefits. Proponents of the CSG industry highlight the report the potential for increased employment opportunities, government revenues, regional development, and a reduction of the migration of young people into urban areas (Australian Petroleum Production and Exploration Association, 2015a; Fleming, Measham, & Cai, 2015; Fleming & Measham, 2014; Measham & Fleming, 2014). The extraction of water from the coal seams also offers potential benefits to the local farmers including livestock and domestic water, and aquaculture and industrial uses, depending on the level of tertiary treatment (Letts, 2012). In contrast, those critical of the industry raise concerns about "the impacts on groundwater and aquifers, the extraction or recovery methods used, the treatment and disposal of extracted water, the management of salt and brine, the impact of the whole process on surface water and soils and the implications for agricultural land use where gas production facilities are located on productive land" (Rural Affairs and Transport References Committee, 2011, p. 17). In addition to the multitude of daily and seasonal stressors with which farmers must contend, the arrival of CSG operations within the agricultural landscape provides a potentially significant new range of stressors such as competition for scarce water resources,

interference with on-farm operations, environmental degradation, increased traffic, and socially divisive conduct (de Rijke, 2013a).

In 2010, meetings were held in Queensland and New South Wales, Australia, to discuss concerns about encroachment of CSG (and coal) extraction operations on to agricultural land (Lock the Gate Alliance, 2015a). The result of these meetings was the formation of the Lock the Gate Alliance, which has grown to a current membership of over 40,000 supporters and 250 local groups comprising individuals from both rural and urban backgrounds (Lock the Gate Alliance, 2015a). Most, if not all, of these people have engaged in activist behaviours such as letter writing, petition signing and political lobbying. Some have also participated in more high-risk behaviour such as blockading mining sites and locking themselves to mining equipment (Aikman, 2011; MacKenzie, Turnbull, & Shoebrige, 2012). In the following sections, I investigate some of the psychological theories and predictors relevant to explaining why farmers may engage or not engage in anti-CSG activism.

2. The Affect Heuristic, CSG Expectancies and Activism Behaviour

Humans are constantly making judgments and decisions in every facet of their lives. Intuitively, we view ourselves as rational individuals, who are more often than not engaged in opportunity maximisation underwritten by considered logical arguments – a reality we often fall short of (Tversky & Kahneman, 1986). To facilitate a quicker and easier assessment process, individuals frequently engage heuristics or mental short-cuts (Tversky & Kahneman, 1974). One such mental short-cut is the affect heuristic (Finucane, Alhakami, Slovic, & Johnson, 2000).

Although affect plays a central role in a number of behavioural theories, the important contribution of affective responses to the decision-making process is more recent (Slovic, Finucane, Peters, & MacGregor, 2007). Zajonc (1980) suggested that affective reactions are

not necessarily a post-cognitive response to a stimuli. Rather, affect should be considered a primary inescapable response to stimuli, that informs cognitions and underlies all social interactions (Zajonc, 1980). Finucane et al. (2000) and Slovic, Finucane, Peters, and MacGregor (2002) expanded Zajonc's work and developed the affect heuristic model. Dual process theorists argue that risk assessment and response generally involves the interplay between two information processing systems: (1) the experiential system, which provides a quick, intuitive response often based on automatic affective assessments, and (2) the analytical system, which provides a deliberate, rational, logical, and scientific assessment (for review, see Evans, 2008; Phillips, Fletcher, Marks, & Hine, 2015)[1]. The experiential or affective system is automatic and associated with little conscious input (e.g., impetuous decisions). On the other hand, the analytic system is within the domain of the consciousness of an individual and highlights the deliberate conscious evaluation of costs and benefits (e.g., goal setting and planned actions) (Finucane et al., 2000; Slovic et al., 2007).

Affect refers to the specific quality of goodness or badness associated with thoughts and images within the affect pool (Slovic, Peters, Finucane, & MacGregor, 2005; Västfjäll, Peters, & Slovic, 2008). Affective responses are rapid and automatic, and the experienced feeling that results from a particular stimuli is used as an integral component of the decision-making process (Slovic et al., 2005). In the event of a stimulus, relevant past thoughts and images, along with their associated affective markers, are activated (Finucane et al., 2000). The salient affective component of the decision-making process is a function of the characteristics of the individual, the task confronting them, and the interaction of these two factors (Slovic et al., 2005). As a consequence of this affective activation, individuals make an evaluation of the goodness or badness of the current event or object (Slovic et al., 2005).

[1]These two systems are known by various labels, including: *Experiential* and *Rational* (Epstein, 1994), *Heuristic* and *Analytic* (Evans, 2006) and *System 1* and *System 2* (Stanovich & West, 2003)

Over a lifetime, each individual generates their own unique reservoir or ‘pool’ of memories, each with its own affective marker (Finucane et al., 2000). These affective markers vary in valence (i.e., either positive or negative) and strength (Finucane, Peters, & Slovic, 2003). As a part of the decision-making or judgment process, individuals refer to their affect pool in assessing stimuli consequences (Finucane et al., 2000). In the event of a stimulus, relevant past thoughts and images, with their associated affective markers are activated. Finucane, Alhakami, Slovic and Johnson (2000) suggest that the use of affect in the decision-making process may vary according to the context in which the event occurs. Therefore objects or events that evoke memories with very clear positive or negative tags are more likely to be guided by the affective heuristic (Finucane et al., 2000)

The use of affect as a cue can provide a short-cut (a heuristic), to assist the decision-making process when an individual confronts difficult or complex assessments or cognitive resources are limited (Finucane et al., 2003). The affect heuristic provides an efficient mechanism to weigh risk and benefit, through the affect associated with a stimulus (Finucane et al., 2000). Increased benefit and low risk is associated with liked behaviour, whereas a disliked behaviour is typically related to low benefit and high risk (Alkahami & Slovic, 1994; Finucane et al., 2000). The affect heuristic proposes stimuli may differ in the strength and speed of association, and the length of temporal influence (Finucane et al., 2003). It also predicts affect will typically precede any rational analysis (Finucane et al., 2000). In this way, affect influences behaviour directly or indirectly by influencing conscious rational assessments of costs and benefits.

2.1. Affect and On-farm Decision-making

The decision-making process involves choosing between various alternative courses of action. Individual expectations of the potential outcomes or consequences of decisions play a role in the chosen course of action (Sjöberg, 1998). Farmers make decisions daily

about their agricultural operation. The components of successful decision-making within the rural environment are complex, involving a comprehensive knowledge of commodity and financial markets, people management skills, cropping timetables, financial and resource management, weather prophecy, courage, intuition, and luck. The decision-making process encompasses not just a rational, analytic, cognitive appraisal but also involves an intuitive "gut feeling" about appropriate options. Lowenstein, Weber, Hsee, and Welch (2001) suggests that this "gut-feeling" contains a significant affective component that comprises a range of previously identified determinants such as image vividness, immediacy, subjective probabilities, and background mood. The use of readily accessible affective impression can be advantageous compared with potentially prolonged rational deliberation, particularly when confronted with a complex decision or judgment, or cognitive overload (Finucane et al., 2003). When confronted with the potential threats of CSG extraction to the social, functional, and environmental integrity of a farm, in addition to the normal operational complexities, the affect heuristic may provide potential insight into farmers' cost-benefit assessments of CSG, as well as their decisions to engage in anti-CSG actions.

2.2. CSG-related Expectancy Outcomes

The threat appraisal process comprises three separate components: perceived severity, perceived vulnerability, and values. An individual's assessment of the existence of a threat, or the perception of a risk, is enclosed within the framework of a set of values (Gardner & Stern, 2002). For an individual to consider some feature of the environment to be a threat or risk, they must believe that it endangers something that they value (Gardner & Stern, 2002). It is then these values, along with other information sources, that initiate the psychological process of perceived severity and vulnerability (Gardner & Stern, 2002). Perceived severity is the result of a "net" individual assessment between the negative consequences, and perceived gains that may result from a particular event. Perceived vulnerability refers to the individual

assessment about the probability of a particular event occurring (Gardner & Stern, 2002). The arrival of CSG extraction into agricultural areas raises a range of economic, social and environmental issues requiring individual assessment (de Rijke, 2013b; Fleming et al., 2015; Fleming & Measham, 2014; Measham & Fleming, 2014; Rifkin et al., 2014; Walton et al., 2015).

Expectancy models have also been used to provide an insight into behaviours, such as participation in high risk sporting activities and aggressive/illegal behaviour (Fromme, Katz, & Rivet, 1997), assertiveness (Ames, 2008), and participation in pro-environmental behaviours (Axelrod & Lehman, 1993). A general finding from the literature is that the higher the expectation of a positive outcome of a behavioural intention, and the more an individual values the outcome, the more likely the individual will engage in the corresponding behaviour (Axelrod & Lehman, 1993). Expectancy scales measure beliefs about outcomes (costs and benefits) associated with engaging in particular behaviours (Goldman, Reich, & Darkes, 2006). This thesis contributes to the environmental psychology literature by investigating expectancies associated with CSG extraction, and developing the first CSG expectancies measure.

2.3. Environmental Activism

Considerable research has been conducted on the behavioural-basis of activism (e.g., Ashmore, Deaux, & McLaughlin-Volpe, 2004; Polletta & Jasper, 2001; Simon & Klandermans, 2001); Coring and Myers (2002) provide a useful overview. Activism refers to behaviours that provide support to some political issue or concern, via a diverse range of actions from conventional acts such as starting a petition, through to more extreme acts of civil disobedience (Klar & Kasser, 2009). Despite the extensive body of research into activism, environmental activism has not received the same level of attention. Although sign-wielding protestors marching through the streets are often the public face of activism, most

social movements rely on a much broader base of less visible and less active supporters (Stern, Dietz, Abel, Guagnano, & Kalof, 1999), from which potential recruits are sourced (Klandermans & Oegema, 1987), and into which activists may retreat to re-energise and/or reassess their participation (Snow, Rochford, Worden, & Benford, 1986). Environmental activism as a sub-set of activism refers to behaviours such as participating in protests, blockades, boycotts, and letter writing campaigns aimed at protecting or enhancing some natural asset (Fielding, McDonald, & Louis, 2008a; Haluza-DeLay, 2008; Seguin, Pelletier, & Hunsley, 1998). The possible range of individual responses to potential environmental, social, or health risks, can range from silence and inactivity, through to various forms of activism (Neuwirth, Dunwoody, & Griffin, 2000). While there has been research into the psycho-social drivers of environmental activism associated with issues such as animal rights (Herzog, 1993), air quality (Lubell, Vedlitz, Zahran, & Alston, 2006), and forest management and conservation (McFarlane & Hunt, 2006; Tindall, Davies, & Mauboules, 2003), there is limited research into the predictors associated with farmer protection of agricultural land.

2.4. Farmer Activism

There have been many environmental issues within Australia that have resulted in farmer activism, for example, changes to irrigation water policy (Byrne, 2007; Newsweekly, 2007) and the management of environmental water allocation (Malcolm, 2014). However, extractive industries – particularly those with overlapping land-use interests, such as mineral sands extraction, coal mining and CSG – have generated increased protest and resistance within farming communities (e.g., Aikman, 2011; Hinman, 2008; McFadden, 2015; Organ, 2014). For the purpose of this thesis, farmer activism is defined as behaviours undertaken by farmers that are aimed at protecting farmland from CSG extraction by influencing government policy and mining operations.

3. Applying the Theory of Planned Behaviour to CSG Activism

In Australia, CSG companies would prefer a symbiotic co-existence and relationship with farmers whose lands lie above vast reserves of gas (Greer et al., 2011). It is suggested that the remuneration to farmers for hosting extraction wells will provide a regular income and reduce some of the financial risks inherently associated with farming (Greer et al., 2011). However, many farmers are not convinced, and they are actively resisting and obstructing CSG developments. Using an extended Theory of Planned Behaviour model (TPB; Ajzen, 1985, 1991), I investigate some of the psychological drivers of farmer activist behaviours.

3.1. CSG Activism

Social movement researchers distinguish between two activist behavioural orientations: conventional (e.g., lobbying politicians) and high risk (e.g., damaging property) (e.g., Coring & Myers, 2002; Klar & Kasser, 2009). The separation of these types of activism acknowledges the potentially different levels of activist commitment. To measure only conventional activist behaviours would underestimate the commitment of those individuals who engage in high-risk activities. Conversely, to only measure acts of high risk behaviour would underestimate conventional activists (Coring & Myers, 2002). Despite the obvious overlap, researchers in the area of environmental activism have generally avoided an activist sub-group distinction.

In Chapter 4, I investigate two distinct types of farmer activism. The first involves engaging in behaviours that are generally considered ‘legally permissible’. This involves actions such as lobbying politicians to oppose CSG development, and participating in community groups that oppose CSG extraction. In line with the literature, I labelled these behaviours *conventional activism*. The second group of behaviours straddle or exceed legal boundaries. This group of behaviours, which I labelled *civil disobedience*, includes actions such as participating in blockades, disabling or destroying CSG equipment and trespassing

onto CSG sites. Many farmers, together with other members of the community, have engaged in one or more of these behaviours (Aikman, 2011; MacKenzie et al., 2012). Using the theory of planned behaviour (Ajzen, 1985, 1991) I investigate some of the psychological constructs driving these activist behaviours.

3.2. Theory of Planned Behaviour

A central aim of applied psychology is to understand the factors that drive and constrain human behaviour. As a consequence, a great many theoretical models have been proposed to explain these behaviours (Darnton, 2008; Michie, West, Campbell, Brown, & Gainforth, 2014). The Theory of Planned Behaviour (TPB; Ajzen, 1985; 1991) has been used to provide insights into a diverse range of behaviours including safe sex practices (Armitage & Talibudeen, 2010); leisure (Ajzen & Driver, 1992); transportation choices (Bamberg, Ajzen, & Schmidt, 2003); recycling (Cheung, Chan, & Wong, 1999); pollution reduction (Cordano & Frieze, 2000); exercise (Davies, 2008); sustainable farming practices (Fielding, Terry, Masser, & Hogg, 2008b) and environmental activism (Fielding et al., 2008a). Unlike its predecessor, the Theory of Reasoned Action, TPB incorporates a third proximal antecedent construct, Perceived Behavioural Control, to accommodate the "possibility of incomplete volitional control" (Ajzen, 2005, p. 117). The inherent strength of the TPB model is the use of behaviour-specific proximal predictor constructs. According to the theory of planned behaviour, the most proximal construct is the intention to engage in a specific behaviour. The model suggests that the behavioural intentions are, in turn, influenced by three distinct cognitive constructs: one personal, one social and one pertaining to perceptions of control (Ajzen, 2005).

The personal construct refers to attitudes, which are an individual's evaluative disposition towards the behaviour in question, that is, the extent to which a behaviour is assessed in either a generally positive or negative manner (Ajzen, 1991; Williams & Hine,

2002). The social construct – subjective norms – is generally considered to be an assessment by an individual as to whether significant 'others' would expect them to undertake a behaviour (Ajzen, 1985). Finally, perceived behavioural control is the "perceived ease or difficulty of performing the behaviour" (Ajzen, 2005, p. 111). These clearly defined constructs, together with comprehensive instructions for scale construction (Ajzen, 1991, 2002a; Ajzen & Fishbein, 1980), have contributed to the consistent ability of this model to explain unique variance in behavioural outcomes (Armitage & Conner, 2001; Conner & Armitage, 1998).

Armitage and Conner's (2001) meta-analysis of 185 research studies found that 39% of the variance associated with intentions was explained by attitudes, subjective norms and perceived behavioural control, while intentions and perceived behavioural control explained 27% of the variance in behaviour. Similarly, a review conducted by Sutton (1998) found the TPB model to explain between 40-50% of the variance in intentions. While the relative explanatory power of the antecedent constructs associated with the TPB model varies across different studies, the overall efficacy remains intact. Ajzen (1991, p. 199) indicated that the TPB model was "in principle, open to the inclusion of additional predictors if it can be shown that they capture a significant proportion of the variation in intention or behaviour after the theory's current variables have been taken into account".

3.2.1. Improving the Predictive Ability of the TPB Model

The TPB model provides a parsimonious modular explanation of the drivers of behavioural engagement (Ajzen, 1991). However, there is growing evidence that its predictive ability can be improved by including additional predictors such as personal norms and past behaviour (e.g., Bamberg et al., 2003; Fielding et al., 2008b; Manstead & Parker, 1995; Norman, Conner, & Bell, 2000; Read, Brown, Thorsteinsson, Morgan, & Price, 2013). Personal norms refer to an obligation to behave in a particular way in specific situations

(Schwartz & Fleishman, 1978). They are a personal feelings of responsibility to engage, or not, in a certain behaviour (Ajzen, 1991). They represent an additional normative pressure in the decision-making process, particularly in situations that require a moral assessment, and frequently they invoke a sense of guilt if the actual behaviour is counter to the norm (Conner & Armitage, 1998). Further personal norms have been found to predict behaviours such as travel choice (Hunecke, Blöbaum, Matthies, & Höger, 2001), recycling (Nigbur, Lyons, & Uzzell, 2010) and water conservation (Harland, Staats, & Wilke, 1999). Many on-farm decisions are made by farmers as a result of an ethical obligation to care for, and enhance the natural landscape under their control (Greiner & Gregg, 2011). Farmers, who perceive a potential existential threat to their land and livelihood, are likely to feel a moral obligation to engage in some form of CSG activism.

The inclusion of past behaviour as a predictor is particularly important for predicting behaviours that are performed repeatedly (Ouellette & Wood, 1998). People who have engaged in a behaviour such as environmental activism in the past are more likely to engage in the future than those who have not engaged (Norman et al., 2000). Past behaviour has consistently been shown to be a strong predictor of intentions, across a diverse range of behaviours, explaining up to eight percent unique variance above that accounted for by the traditional TPB variables (Conner & Armitage, 1998; Norman & Conner, 2006; Read et al., 2013). Guided by the literature above, Chapter 3 investigates the ability of the traditional TPB constructs (i.e., attitudes, subjective norms, perceived behavioural control), together with personal norms and past behaviour, to predict farmer activist behaviours.

4. Low Emission Agricultural Practices as a Potential Solution

In the event that farmer opposition to CSG extraction successfully halts any further expansion into any productive agricultural landscape, how then might the potential lost reductions in CO_2 from the energy sector be recovered? It seems fair that the most proximal

beneficiary of such scenario – the agricultural sector – would help to make good the efficiencies lost to the energy sector. This would require, in part, the identification and implementation of on-farm, geo-spatially appropriate agricultural behaviours to reduce greenhouse gas emissions that ideally would also improve the financial, and environmental viability of current farming operations.

Australian farmers manage approximately 52 % of the Australian landmass, and produce 93% of the fresh food consumed daily, while the complete agricultural sector employs 1.6 million jobs, which contributes 12% to Gross Domestic Product (National Farmers Federation, 2012). Approximately 52% of the Australian landmass, or 398.5 million hectares is dedicated to agricultural activities (Australian Bureau of Statistics, 2012b). The primary sources of greenhouse gas emissions in agriculture are the methane and nitrous oxide emissions that emanate from practices such as manure management, enteric fermentation in livestock, agricultural burning (i.e., grass and crop stubble), and agricultural soil use (Department of Climate Change and Energy Efficiency, 2012b; Johnson, Franzluebbers, Weyers, & Reicosky, 2007).

An understanding of the range of individual on-farm behaviours is important to countering agricultural emissions. For example, approximately 10-15% of the feed energy consumed by sheep and cattle is converted to methane, and subsequently unavailable for animal production (Knox et al., 2005). Improving feed conversion efficiencies, using techniques such as improved feed digestibility, genetic improvements, and dietary supplements, all contribute to improving farm productivity and profitability while reducing methane emissions (Knox et al., 2005). As methane and nitrous oxide have global warming potentials equivalent to 21 and 310 times CO_2 respectively (Eckard, Grainger, Graham, & Griffin, 2008; Knox et al., 2005), it is imperative that farm management addresses these sources of emissions.

The agriculture, forestry and fishing sector in Australia contributes 18.3% of the total 549.4 million metric tonnes of CO_2 equivalent released (Department of Environment, 2015). This is second only to the electricity, gas and water sector, which contributes 34.9% or 191.8 million metric tonnes of CO_2 equivalent. The transition from the current reliance on coal and oil to a cleaner, reliable source of renewable energy will inevitably see gas as a bridging resource (Taylor et al., 2012; Weijermars et al., 2011). The CO_2 emissions from modern gas-fired power stations are approximately 50% of that of a coal-fired operation (Victor et al., 2014). Further, the use of gas in preference to coal reduces the water consumption of the power station and improves urban air quality (i.e., reduced fine particle emissions) (Australian Petroleum Production and Exploration Association, 2015a). However, Stephenson et al. (2012) argue that, even though gas offers many benefits relative to coal, the overall cost-benefit calculus associated with the extraction and production of CSG remains contested within the academic literature. Further, the concerns over possible long-term damage to agricultural resources, such as water supplies, and farm operational integrity as a result of CSG extraction are compounded by plausible long-term net economic benefits of agriculture-only compared to the CSG-only and CSG-agriculture coexistence alternatives (Chen & Randall, 2013). Do we risk agricultural operations and potentially food security to extract a resource that can help reduce greenhouse gas emissions? And, if society ventures down that path, then what can farmers do to reduce agriculture's substantial contribution to anthropogenic climate change?

4.1. Sustainable Farming Practices

Many Australian farmers are confronted with a range of operational challenges including fluctuating international markets, limited government support, infertile soils, and extreme climatic variability (Department of Agriculture Fisheries and Forestry, 2006). There has been a growing awareness of not only the contribution of agricultural practices to

greenhouse gas emissions, but also that cost effective on-farm management practices can be implemented to meaningfully reduce them. Knox et al. (2005) identified six on-farm operational domains that increase farm efficiency and productivity, improve environmental outcomes and reduce greenhouse gas emissions: livestock, nitrogen (or fertilizer), soil, water, energy and vegetation management. A similar range of agricultural practices were identified in the *Fourth Assessment Report of the Intergovernmental Panel on Climate Change* (Smith et al., 2007).

These agricultural practices include:

1. Livestock management practices are primarily aimed at reducing methane emissions (Knox et al., 2005). The total volume of methane emitted is influenced by amount of time taken to reach production targets (e.g., carcass weights, litres of milk produced). Management practices including improved feed digestibility, rotational grazing, dietary supplements, and overall genetic improvement of the herd, all contribute to the reduction of methane emissions.
2. The nitrogen or fertilizer practices are aimed at reducing one of the major nitrous oxide emissions in Australia. By accurately determining the amount and type of fertilizer required, together with application techniques incorporating the nitrogen below the surface, losses through runoff or leaching can be reduced. Further, the use of nitrogen fixing legumes in rotational cropping and pasture programmes can increase nitrogen levels, thus reducing the need for artificial fertilizers.
3. Maintaining a healthy, well-structured soil profile can minimize the loss of soil carbon while increasing plant production. These aims can be achieved through the adoption of minimum tillage practices, green manure crops, controlled traffic flows, and crop rotations.

4. Water management practices concern the efficient use of often scarce water resources in Australia. They include soil moisture monitoring, crop variety selection, and improved drainage to reduce water logging. These behaviours improve profits, and help reduce carbon dioxide emissions from water pumping and the denitrification of waterlogged areas.
5. Energy practices refer to efficiencies associated with agricultural equipment including tractors, on-farm vehicles, electric motors and installation of renewable energy supplies. Likewise, the adoption of minimum tillage techniques reduces on-farm fuel consumption while improving soil structures.
6. Vegetation management refers to the establishment and protection of bio-diverse native vegetation areas. The benefits of these types of behaviours include carbon sequestration, windbreaks for livestock and crops, and increasing levels of soil carbon due to reduced erosion, together with habitat provision for predators of crop and pasture pests. Despite not being an exhaustive list of potential behaviours, these management techniques improve financial viability, environmental stability and reduce anthropogenic contribution of agriculture to greenhouse gas emissions (Knox et al., 2005).

These six on-farm operational domains represent a sample of best management practices that achieve three primary aims: (1) improved profitability, (2) increased environmental sustainability, and (3) reduced greenhouse gas emissions. If agriculture prevails in the land use conflict with CSG extraction, an increased uptake of farming practices such as these represents an emission offset for the potential gas-fired benefits lost to the energy sector.

5. Thesis Overview

The overarching aim of this thesis is to better understand farmers' responses to two major perceived threats to Australian's agricultural industry: CSG extraction and climate change. Four main research questions address this aim:

1. Do farmers perceive CSG as a unique agricultural stressor, and if so, what are the potential consequences for their mental health?
2. What are farmers' emotional responses to CSG, and how do these responses influence (a) how they evaluate the potential costs and benefits of CSG extraction on agricultural land, and (b) decisions to engage in anti-CSG activism?
3. How can the Theory of Planned Behaviour be enlisted to better understand farmers' decisions to engage in conventional anti-CSG activism and more extreme forms of civil disobedience?
4. Finally, if fossil fuels such as CSG are to remain in the ground in order to limit global warming, then what practical contribution to the reduction of greenhouse gas emission can farmers make and do attitudes, values and beliefs predict farmer engagement in these activities? Further, can they be used to identify distinct farmer segments that can be used for tailoring and targeting engagement strategies and policy development?

The first three questions empirically investigate the psycho-social constructs associated with the impacts of CSG development on rural and regional communities. In the event CSG extraction is not allowed to develop to its maximum output, or in the extreme scenario, halted entirely due to its adverse impacts on productive agricultural land, the lost potential reductions of greenhouse gas emissions in the energy sector will need to be found in other sectors. As the second largest emitter of greenhouse gas, and the direct beneficiary of

any capping or halting of CSG development, the agricultural sector could reasonably be expected to make a greater contribution to national reduction targets. Finally, this thesis looks at the psycho-social constructs associated with sustainable agricultural practices that can meaningfully reduce the contribution of agriculture to global greenhouse gas emissions. Engagement in these low emission agricultural behaviours may go some way to offset the lost benefits of not extracting and using CSG for stationary power generation, while maintaining the productive agricultural lands that society requires for food security.

Chapter 2 investigates the contribution of CSG to the global stress burden in a sample of Australian farmers. I contribute to the existing research into farmer stress in four important ways. First, I extended the Edinburgh Farming Stress Inventory that is used to assess the job-related stress within six unique farming domains: farming bureaucracy, finance, isolation, acts of God, personal hazards and time pressures (Deary et al., 1997). Using exploratory factor analysis, I identified two new CSG-specific stressors: (1) Off-farm CSG Concerns – potential impacts of CSG extraction on human health, community, and the environment, and (2) On-farm CSG Concerns – impacts of CSG on farm operations, profitability, and personal privacy. Second, I examine whether these two CSG-specific stressors explain unique variance in farmers' mental health outcomes after controlling for the traditional farming stressors (e.g., farm bureaucracy, finance, isolation, weather, personal hazards and time pressures). Third, using the farming stress subscales obtained in the present study, I developed a farmer stress typology to identify four subgroups within the sample that share the same stress profile. Both the CSG-stressed and the Globally-stressed groups reported clinically relevant levels of depression. Reported depression in both the Non-stressed and Finance-stressed groups was within the normal range. This research was the first to identify the unique contribution of CSG to the mental health outcomes within the farming community.

In Chapter 3, I employed the affect heuristic model to understand how farmers' affective associations with CSG influence their cost-benefit judgments about the industry and decisions to engage in CSG activism. In this study, I develop the CSG expectancies measure to be used to assess farmers' perceptions about the possible likelihood of a range of potentially positive and negative outcomes associated with CSG extraction. I also investigate how CSG expectancies vary as a function of farmer engagement with the CSG industry (i.e., no-lease, lease but no approach, in negotiation, and rejected approach). Finally, I explore the role of affect heuristic in explaining farmers' assessments of the costs and benefits of CSG extraction in settings traditionally associated with food production, and also their decisions to engage in CSG-related activism.

Chapter 4 employs an extended TPB model to explain some of the psychological constructs associated with engaging in two types of CSG activist behaviours: Conventional activism (e.g., lobbying politicians, or participating in community groups opposed to CSG) and civil disobedience (e.g., disabling or destroying CSG equipment, or participating in a blockade). Personal norms and past behaviour were added to the standard TPB predictors (i.e. attitudes, subjective norms, perceived behavioural control) to predict the two types of activism behaviour. Although the TPB model has been used to understand environmental activism, this earlier research has viewed it as a uni-dimensional construct. In addition to the standard regression-based TPB analysis, I also applied latent profile analysis to identify farmer activist sub-types and determine which of the variables in the extended TPB model best distinguishes between different types.

Chapter 5 examines which farmers in our sample had adopted low emission agricultural practices (LEAP) and some of the psychological constructs driving these behaviours. Together with developing a new behavioural measure for farming practices, I explore the contribution of farmer attitudes, values, and beliefs on engagement in LEAP. We

used latent profile analysis to segment the sample into four subgroups, each of which shared the same values, attitudes and beliefs about climate change, environmental attitudes, time perspectives, efficacy and beliefs in financial benefits. Then I demonstrated members of the Green Adopter and the Profit-driven Adopter profile groups were more likely to adopt low emission agricultural practices than members of the Non-green Dismissive and Uncommitted groups. Finally, I made recommendations about the most effective way to engage each profile group to encourage them to adopt low emission practices.

Chapter 6, the General Discussion, provides a summary of the main outcomes of the empirical chapters and includes a discussion of the strengths and limitations of the current research. In summary, this thesis is the first research to empirically investigate the psycho-social impacts of CSG extraction on Australian farmers. It also shows that profiling can be used to identify meaningful sub-groups within a sample. This segmentation information can be used to more accurately and efficiently direct information and resources to the relevant audience.

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Chapter 2: Study 1

Stressed: Coal Seam Gas Extraction and Farmers' Mental Health

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Abstract

Farmers are exposed to a unique range of vocational stressors, and while mental health morbidity is similar to their non-rural counterparts, suicide rates are higher. We examined the contribution of coal seam gas (CSG) extraction to the global stress burden and mental health of 378 Australian farmers (mean age = 53.08 years; *SD* = 10.28). Exploratory factor analysis revealed that CSG items added two unique dimensions to the Edinburgh Farming Stress Inventory: Off-farm CSG Concerns (concerns about possible impacts of CSG extraction on human health, communities, and the environment) and On-farm CSG Concerns (potential CSG impacts on farm profitability, disruption of farm operations, and privacy). Subscales based on the new factors correlated significantly with farmers' self-reported levels of depression, anxiety and stress reactivity, as assessed by the DASS-21. Latent profile analysis categorized farmers into four distinct segments based on their overall stress profiles: *Non-stressed* (39%), *Finance-stressed* (31%), *CSG-stressed* (15%) and *Globally-stressed* (15%). Farmers in the *CSG-stressed* and *Globally-stressed* categories exhibited clinically significant levels of psychological morbidity. This information can be used to inform strategies for improving mental health outcomes in the agri-gasfields of Australia.

Morgan, M. I., Hine, D.W., Bhullar, N., Dunstan, D. A., & Bartik, W. (revision under review) Stressed: Coal Seam Gas Extraction and Farmers' Mental Health. Submitted to *Journal of Environmental Psychology* 18th June 2015

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Research Progression to Study 2

The farming stress burden is unique, complex and often geo-spatially influenced. In Study 1, I explored the contribution of CSG extraction to the global stress burden confronting Australian farmers. In this sample, two unique CSG-related stressors were found: (1) Off-farm CSG concerns – potential impacts of CSG extraction on human health, community and the environment; and (2) On-farm CSG concerns – potential impacts on farm operations, profitability and personal privacy. Off-farm CSG concerns were rated as the most stressful of the stressors in this study, together with weather and economic viability. Off-farm CSG concerns explained significant unique variance in depression (1%) and stress reactivity (2%). Using these stressors, a new farmer stress typology was developed. Four unique stress segments were identified, one of which, CSG-stressed, was uniquely associated with CSG concerns. The rapid changes within communities as a consequence of CSG development have generated both positive and negative responses. While some embrace the economic opportunities the industry provides, others are actively resisting the development through a range of protest behaviours. In Study 2, a CSG expectancies measure was developed and used to identify the underlying perceived costs and benefits associated with the industry. The affect heuristic model was applied to explore the potential influence of affective associations and expectancies on farmers' intentions and activism behaviour.

Chapter 3: Study 2

Locking the gate: How emotion and analysis drive farmers' opposition to coal seam gas

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Abstract

The rapid development of coal seam gas (CSG) in Australia has elicited a mix of support and opposition within affected communities. In this study, we surveyed 407 Australian farmers (mean age = 53.23; *SD* = 11.06) about their thoughts and feelings about the expansion of CSG operations into traditionally agricultural areas. Factor analysis of a newly developed 41-item CSG expectancy measure indicated that farmers discriminated between five main types of expected outcomes: on-farm productivity declines, environmental damage, increased farm labor wages, lifestyle disruptions, and economic benefits. Farmers' scores on the five expectancy dimensions varied as a function of their level of engagement with the CSG industry. Farmers who were engaged with the CSG industry (e.g., by having wells on their property) expected more economic benefits and less on-farm productivity declines, environmental damage, and lifestyle disruption compared to farmers who had rejected overtures from the industry. Mediation analyses revealed that farmers with negative affective (emotional) associations with CSG extraction expected greater on-farm productivity declines, environmental damage, and lifestyle disruption, which, in turn, lead to higher levels of engagement in CSG activism. Our results are consistent with Slovic's affect heuristic model, which suggests that affective responses are an important driver of human judgment, decision-making and behaviour.

Morgan, M. I., Hine, D. W., & Bhullar, N. Locking the gate: How emotion and analysis drive farmers' opposition to coal seam gas. Submitted to *Energy Policy*, 29th February 2016

Research Progression to Study 3

For Study 2, the affect heuristic model was employed to investigate how farmers' affective associations influenced their cost benefit judgments about the industry and their decisions to engage in CSG activism. Further, a unique CSG expectancies measure was developed and applied to a sample of Australian farmers to determine the perceived risks and benefits associated with CSG developments. Our results indicate that affective responses are an important driver of the cost benefit judgments taken by farmers engaging in CSG activism. In Study 3 I extended the activism research in Study 2 by distinguishing between two distinct types of CSG activism. Using the Theory of Planned Behaviour model, I investigate the psychological constructs associated with engaging in these two distinct CSG activism behaviours. Finally, using a latent profile analysis, I investigated the the possible existence of subtypes of farmer activist groups and determined which of the TPB variables best distinguishes between different groups of farmer activists.

Chapter 4: Study 3

Understanding farmer activism against coal seam gas: An application of the theory of planned behaviour

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Abstract

Many individuals are concerned about the potential environmental and health impacts of extracting coal seam gas (CSG) from under agricultural land. In this study, we sampled 273 Australian farmers (mean age = 52.14; SD = 10.84) and applied an extended Theory of Planned Behaviour (TPB) model to investigate two types of CSG activism: (1) conventional activism (e.g., lobbying politicians, and participating in a group that opposes CSG extraction on agricultural land); and (2) civil disobedience (e.g., blockading of CSG mining sites, and disabling or destroying CSG equipment). Regression analyses revealed that attitudes, subjective norms, personal norms, and past behaviour all significantly predicted farmers' intentions to engage in conventional activism. All of these predictors and perceived behavioural control predicted intentions to engage in civil disobedience. Latent profile analysis, based on intended and past activism behaviour, identified four activist profiles: *Non-Activist* (23%), *Mainstreamers* (44%), *Primed Civil Disobedient* (28%) and *Active Civil Disobedient* (5%). Discriminant function analysis indicated that farmers' attitudes, subjective norms and personal norms, which all loaded on the first function, distinguished between the Non-Activist, Mainstreamer and Civil Disobedient segments. Perceived behavioural control, which loaded on a second function, discriminated between the Primed and Active Civil Disobedient segments. Our results indicate that TPB is a useful framework for understanding engagement in conventional activism and civil disobedience related to CSG extraction, and for identifying types of farmers who are most likely to engage in these activities.

Morgan, M. I., Hine, D.W., & Bhullar, N. (under review), Understanding Farmer Activism Against Coal Seam Gas Extraction: An Application of the Theory of Planned Behaviour. Submitted to the *Journal of Environmental Psychology* 13th November 2015.

Research Progression to Study 4

In Study 3 I used the Theory of Planned Behaviour (TPB) to investigate the drivers of farmer participation in behavioural responses to CSG extraction. Guided by the social movement literature, I distinguish between two types of CSG activism behaviours: (1) conventional activism – lobbying politicians, participating in anti-CSG community groups, participating in public demonstrations, seeking legal advice, discussing the negative impacts of CSG with friends and neighbours, and entering into 'bad faith' negotiations; and (2) civil disobedience – blockading CSG extraction operations, refusing entry on to land, disabling or destroying equipment, removing survey pegs on private land, removing survey pegs on public land and trespassing onto CSG sites. Further, profiling and discriminant function analyses were conducted to identify subtypes of farmer activists and determine which TPB variables best distinguished between them. Agriculture is the second largest contributor to Australian greenhouse gas emissions (Department of Environment, 2015). If the extraction of cleaner transition fuels for electricity generation, such as CSG, is to be limited in order to protect agricultural productivity and subsequently food and water security, then there will be pressure to cut anthropogenic emissions in other sectors. Agriculture is one sector where potential reductions can be made that have multi-faceted benefits including; financial, environmental and reductions in greenhouse gas emissions. In Study 4 I investigate which farmers in the sample have adopted low emission agricultural practices. Further, I explore the contribution of farmer attitudes, values, and beliefs, to engagement in these farming practices.

Chapter 5: Study 4

Landholder Adoption of Low Emission Agricultural Practices: A Profiling Approach

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Abstract

Agriculture is the second largest source of greenhouse gases emissions in Australia. Any substantial reduction in national emissions will require behaviour changes within the farming community. This study aimed to identify the primary psychological drivers and barriers associated with the adoption of low emission agricultural practices (LEAP) in a sample of 551 Australian farmers (mean age = 51.40 years; *SD* = 11.99). Multiple regression analysis revealed that farmers were more likely to adopt LEAP if they: perceived a clear financial benefit for such practices, believed they possessed the relevant knowledge and skill, were future orientated, and exhibited low levels of environmental apathy. Latent profile analysis categorized the sample of famers into four distinct segments: *Non-Green Dismissive* (11%), *Uncommitted* (57%), *Green Adopters* (20%) and *Profit-Driven Adopters* (12%). Both *Green* and *Profit-Driven* adopters engaged in more LEAP than members of the *Uncommitted* and *Non-Green Dismissive* segments. Our results indicate that unique combinations of psychological drivers and barriers may influence LEAP adoption in each segment. This information can be used to inform the development of segment-specific messaging and engagement strategies.

Morgan, M. I., Hine, D. W., Bhullar, N., & Loi. N. M. Landholder Adoption of Low Emission Agricultural Practices: A Profiling Approach. *Journal of Environmental Psychology*, 41(2015) 35-44 doi:10.1016/j.jenvp.2014.11.00

CHAPTER 6

General Discussion

1. Introduction

The primary aim of this thesis was to better understand farmers' responses to two major perceived threats to Australians' agricultural industry: CSG extraction and climate change. Over and above the potential economic benefits to both individual farmers and rural communities, CSG extraction for use in power generation potentially offers a broader community benefit – the opportunity to reduce greenhouse gas emissions (Weijermars et al., 2011). However, this broader benefit is offset by widespread public concern about potential negative impacts on water supply, agricultural productivity, individual well-being (Geiger, 2007; Stearns et al., 2005; Stepans, 2008; Werner et al., 2016) and food security (Greer et al., 2011). In the event that public concerns prevent or slow CSG expansion to traditional food producing areas, what can the agricultural sector do to minimize the potential loss in community benefits associated with leaving these gas reserves in the ground? Given that agriculture is the second largest emitter of greenhouse gas emissions after the electricity, gas and water sector, it has a potentially major role to play in meeting Australia's emission targets (Department of Environment, 2015).

This thesis sought to answer four main questions:

1. Do farmers perceive CSG as a unique agricultural stressor, and if so, what are the potential consequences for their mental health?
2. What are farmers' emotional responses to CSG, and how do these responses influence (a) how they evaluate the potential costs and benefits of CSG extraction on agricultural land, and (b) decisions to engage in anti-CSG activism?

3. How can the Theory of Planned Behaviour be enlisted to better understand farmers' decisions to engage in conventional anti-CSG activism and more extreme forms of civil disobedience?
4. Finally, if fossil fuels such as CSG are to remain in the ground in order to limit global warming, then what practical contribution to the reduction of greenhouse gas emission can farmers make and do attitudes, values and beliefs predict farmer engagement in these activities? Further, can they be used to identify distinct farmer segments that can be used for tailoring and targeting engagement strategies and policy development?

A summary of the main findings, together with the practical implications, is presented in the sections that follow. I also address the limitations of the current research and future research directions. Finally, I present a summary of the main conclusions.

2. Main Findings

2.1 Coal Seam Gas Extraction and Landholders' Mental Health

The primary aim of Study 1 was to determine if farmers perceived CSG extraction as a unique agricultural stressor. The Edinburgh Farming Stress Inventory (Deary et al., 1997) was adapted to include new items assessing concerns about CSG extraction in agricultural settings. The CSG items produced two new factors: (1) Off-farm CSG Concerns – potential impacts of CSG extraction on human health, community, and the environment; and (2) On-farm CSG Concerns – impacts of CSG on farm operations, profitability, and personal privacy. The relative severity ratings indicate that farmers in this sample perceived Off-farm CSG Concerns to be as stressful as Weather (e.g., drought events and flooding) and Economic Viability (e.g., rising costs and declining commodity prices). Further, Off-farm CSG Concerns were significantly associated with depression and stress reactivity. These

results are consistent with the recent qualitative research examining perceived impacts on mental health and well-being associated with mining and CSG industries (e.g., Hossain et al., 2013). Further, the findings of this study support the substantial body of work into impact on mental health outcomes from extractive industries such as coal mining (e.g., Connor et al., 2004; Higginbotham et al., 2007; Moffatt & Baker, 2013).

A latent profile analysis was conducted using the nine agricultural stressors to create a new farmer stress typology. Four unique farmer stress segments in the present study were identified: Non-stressed, Finance-stressed, CSG-stressed, and Globally-stressed. Two segments, CSG-stressed and Globally-stressed, were characterized by high levels of concern about CSG extraction, and both exhibited clinically significant levels of depression. However, only the Globally-stressed reported clinically significant levels of anxiety and stress reactivity (i.e., scores > 7 and > 9 respectively on the DASS-42 scale; Lovibond & Lovibond, 1995a).

Practical Implications. In Study 1, four unique farmer stress segments were identified: Non-stressed, Finance-stressed, CSG-stressed, and Globally-stressed. The development of these profiles can facilitate effective tailoring and targeting of appropriate engagement strategies for both mental health professionals and industry. It allows the interested stakeholders to identify the defining stress characteristics of each segment, which can then be accurately addressed. For example, the identification of a CSG-stressed segment with clinically significant levels of depression indicates that, even in the absence of the more traditional farming stressors, mental health providers should be aware of the potential for negative mental health outcomes associated with previously unknown, structurally disruptive industries such as CSG extraction. Further, CSG concerns were a predominant stressor with the Globally-stressed segments. With this information, mental health professionals working in areas where future CSG developments may occur could provide pre-emptive interventions

that improve coping responses and increase resilience within the communities. This could involve providing the community with problem-focused strategies (e.g., problem-solving and planning) to tackle issues that can be changed, and emotion-focused strategies (e.g., social support, regular exercise, and healthy emotional expression) to support mental health and well-being in the presence of an enduring stressor.

2.2 The Affect Heuristic and Farmer Engagement in Coal Seam Gas Activism

Study 2 employed the affect heuristic model (Finucane et al., 2000; Slovic et al., 2002) to understand how farmers' affective associations with CSG influence their cost-benefit judgments about the industry and decisions to engage in CSG activism. Participants were asked to provide a thought or image associated with CSG wells on their property. Over 92% of the responses were either negative or very negative. Further, a unique CSG expectancies measure was used to assess farmers' perceptions about the possible likelihood of a range of potentially positive and negative outcomes associated with CSG extraction. An exploratory factor analysis revealed five distinct factors, consisting of four costs (i.e., On-farm Productivity, Environmental, Farm Labour, and Lifestyle) and one benefit (i.e., Economic). I also investigated how CSG expectancies vary as a function of farmer engagement with the CSG industry (i.e., no-lease, lease but no approach, in negotiation, and rejected approach). Finally, I explored the role of affect heuristic in explaining farmers' assessments of the costs and benefits of CSG extraction in settings traditionally associated with food production, and also their decisions to engage in CSG-related activism. Farmers who expressed negative affective associations towards CSG wells on their property expected greater cost to On-farm Productivity, Pollution and Lifestyle and fewer Economic Benefits, were more likely to have engaged in CSG activism and would intend to do so in the future.

In the current study, I found farmers, regardless of their level of engagement with the CSG industry, were largely unconvinced that the economic benefits associated with CSG

development would eventuate. Despite the engaged farmers reporting significantly higher perceived economic benefits compared to the other engagement groups, they report the likelihood of economic benefits occurring at just above the neutral mid-point. These results suggest that farmers are largely unconvinced that the economic benefits will actually eventuate. In comparison, this sample reported that costs with the On-farm Productivity, Environmental, Farm Labour, and Lifestyle factors were likely to occur.

Practical Implications. Recent research into the impacts of CSG development in rural communities has identified a range of social and economic benefits (Measham & Fleming, 2014; Walton et al., 2013)[15]. Compared to the positive assessments of the impact of CSG offered by both the industry and governments (e.g., Australian Petroleum Production and Exploration Association, 2015a; Queensland Government, 2010), the current study found an overwhelming negative affective reaction. These conflicting community expectations represent a significant public relations hurdle for the CSG industry. These results may reflect the 'individual benefit' versus the 'community cost' of CSG developments. Although fortunate individual landowners may achieve a large economic windfall from well placements or construction work, other outcomes, such as environmental and farm labour costs are borne by all farmers in the area. Future expansions may benefit from adequately addressing these concerns well before the construction of extraction infrastructure. For example, CSG operators may gain increased social acceptance by investing in future-focused community infrastructure that could provide opportunities and services long after the industry has left. This might include contributing to the upgrade of current utilities such as water and sewerage treatment. Furthermore, the population increases might allow for off-shoot long-term infrastructure projects such as recycling depots and the reuse of treated town water into irrigation projects that would provide long-term business and employment opportunities to

[15] Walton et al. (2013) also note an extensive list of concerns associated with CSG extraction.

the area after the development phase. Alternatively, the creation of a substantial community investment trust fund into which a percentage of the revenue is placed would acknowledge and compensate the entire community for any perceived inconvenience.

A review of affective categories reveals a more diverse number of negative associations compared to the expectancies measure. The salience of these negative outcomes may explain why some farmers oppose the CSG industry despite the potential benefits. Therefore, communication efforts that only highlight the potential benefits of CSG and ignore the perceived costs are unlikely to meaningfully change broad community perceptions. An understanding of the affect heuristic model and the interplay between the experiential and analytic systems may inform the communication of the risks and benefits associated with CSG extraction by policy makers and other interested parties.

2.3 Understanding Farmer Activism Against Coal Seam Gas Extraction: An Application of the Theory of Planned Behaviour

In this study, an extended TPB model was employed to better understand CSG activism in a sample of Australian farmers. Together with the traditional TPB constructs (i.e., attitudes, subjective norms and perceived behavioural control), our extended model included personal norms and past behaviour. Further, using the activism behaviours identified in the previous research chapter, Study 3 differentiates between two distinct types of activism: conventional and civil disobedience. The TPB variables explained significant variance in farmers' intentions to engage in both types of activism behaviours. In particular, farmers were found to be significantly more likely have engaged in conventional activism in the past and intend to engage in this type of activism in the future than they were to civil disobedience (CD). Overall, the extended TPB model explained 72% and 57% of the variance in conventional and CD-activism intentions respectively. In line with past research, the current

study found past behaviour to be the strongest predictor of both of our activist behaviours (e.g., Norman & Conner, 2006; Read et al., 2013).

Further, four activist profiles based on respondents' reported activism intentions and past activist behaviours were identified: Non-Activists, Mainstreamers, Primed-CD, and Active-CD. A discriminant factor analysis found the TPB variables could discriminate between activist types. Using attitudes, perceived behavioural control, subjective and personal norms, two meaningful discriminant functions were produced. The first function, reflecting differences in attitudes and norms, differentiated between the Non-Activists and Mainstreamers, but did not discriminate between the two CD segments, primed and active. The second function, reflecting perceived behavioural control, discriminated between the Primed and Active CD segments.

Practical Implications. The results of this study have several practical implications for the parties engaged in CSG resource development. First, the identification of four distinct farmer activist profiles (i.e., Non-activist, Mainstream, Primed-CD, Active-CD), based on past behaviour and intentions, may assist in the development of information and communication strategies. The results of the discriminant function analysis suggest that the transition from non-activism to mainstream activism appears to be as a result of a strengthening of attitudes, subjective norms and personal norms. This strengthening is also apparent in the transition from mainstream activism to the more extreme activism segments. Further, this strengthening of attitudes, subjective norms and personal norms may represent the first step in the escalation to more extreme activist engagement.

Although less than 22% of the farmers in this study are classified as Non-Activist, on average even they have reported engaging in at least one past conventional activism behaviour and intend to engage in at least one in the future. The remaining 78% of farmers in this study have engaged in three or more of the possible six conventional activism behaviours

investigated. These levels of engagement in activism behaviours suggest a level of dissatisfaction with CSG extraction within our sample. Given the industry acknowledges people are afraid, worried and generally concerned about a range of issues associated with CSG extraction (Heber, 2013), the provision of truthful, objective, scientific information addressing the identified concerns of the community would be critical to any future expansion of the industry.

2.4 Landholder Adoption of Low Emission Agricultural Practices: A Profiling Approach

Study 4 examined which farmers in our sample had adopted low emission agricultural practices (LEAP) and some of the psychological variables driving these behaviours. A unique farming practices behavioural measure was developed for this research. I explored the contribution of farmer attitudes, values, and beliefs on engagement in LEAP. The study found that farmers were more likely to engage in LEAP if they perceived a financial benefit; perceived they had the required knowledge and skills; were future orientated; and had low levels of environmental apathy. We used latent profile analysis to segment the sample into four subgroups, each of which shared the same values, attitudes and beliefs about climate change, environmental attitudes, time perspectives, efficacy and beliefs in financial benefits. Then we demonstrated members of the Green Adopter and the Profit-driven Adopter profile groups were more likely to adopt low emission agricultural practices than members of the Non-green Dismissive and Uncommitted groups. Both the Green Adopters and Profit Driven Adopters engaged in significantly more LEAP behaviours than the other two segments. However, they do so for entirely different reasons. Green Adopters engaging in these behaviours not only see the economic benefits of the practices, they had a strong belief in climate change, and reported ecocentric environmental attitudes. In contrast, the Profit Driven Adopters reported low levels of belief in climate change or its impacts, together with high

levels of environmental apathy. However, they also report high levels of knowledge and financial efficacy, and perceived economic benefits. Finally, we made recommendations about the most effective way to engage each profile group to encourage them to adopt low emission practices.

Practical Implications. This study identified four different 'farmer-subtypes': Non-green Dismissive, Uncommitted, Green Adopters and Profit-driven Adopters. The identification of these "farmer sub-types", based on a diverse range of psychological drivers and barriers, may provide useful insights for tailoring and targeting communication strategies. For example, an examination of the Uncommitted segment reveals that not only are they the largest profile, potentially representing the highest return on any behaviour change expenditure, they report moderate scores across all profiling variables. This suggests the potential barriers are limited and targeting interventions aimed at priming pro-environmental behaviours and highlighting financial benefits may increase LEAP adoption in this segment.

3. Limitations and Future Research Directions

I have primarily adopted a quantitative approach, in particular a self-report questionnaire, to each of the studies outlined in this thesis. While this approach has many strengths, such as allowing quantitative predictions, ease of data collection – particularly for a large sample, and the ability to measure multiple constructs, the results are general and lack the localised contextual inferences that qualitative research provides (Cooksey & McDonald, 2010). Future empirical research into the impacts of CSG would benefit from a mixed methods approach. It should be noted that the substantial qualitative research in this domain represents an important first step in achieving this outcome (e.g., de Rijke, 2013a; Lloyd et al., 2013; Walton et al., 2013). The overarching issue with this thesis relates to the causality and directionality of the effects reported in all four studies. Future research could use longitudinal studies and/or experimental designs to further investigate the psychological

drivers and barriers associated with CSG developments and LEAP. For example, longitudinal studies are required to help clarify the precise nature of how the association between agricultural stressors and mental health develops over time, and the primary direction of causality. In terms of the potential impact of CSG stress dimension on farmers' mental health, future research should target soon-to-be developed agri-gas fields and monitor farmer stress and mental health as development progresses. Likewise, the experimental manipulation of information relating to the potential costs and benefits of CSG developments would assist in clarifying the causality and directionality between affect associations and activism.

Further, the influence of perceived behavioural control on civil disobedience behaviours is unclear and may prove to be fertile ground for future research. At least two possible explanations present themselves: either those experiencing increased levels of perceived behavioural control have the confidence to translate intention in action, or the actual engagement in civil disobedience behaviour leads to a greater sense of control.

In a world of climate change and ever increasing population growth, the LEAP research provides exciting research opportunities. First, with constantly changing technology and scientific advances, the LEAP measure will require further developmental work to include the use of new equipment and farming practices that benefit the environment and reduce greenhouse gas emissions while providing financial advantage. Second, I used a relatively comprehensive 178-item survey to create the LEAP segments. This large number of items may be of limited use for practitioners wishing to quickly identify which profile their client may belong to. The development of a more concise LEAP measure, which could provide real time profile membership information, would allow farming consultants such as agronomists and extension officers to tailor the delivery of information in an appropriate and more effective manner. Finally, the results of the LEAP research suggest the highlighting of financial benefits may be the most effective way to engage with farmer groups. While it is

undoubtedly an effective strategy, not everyone shares this view. Thogerson and Crompton (2009) suggest that, despite the short-term effectiveness of strategies that are narrowly focused on financial outcomes, they may in fact facilitate long term negative outcomes by reinforcing worldviews that are not compatible with environmental sustainability. Their suggestion of deep framing, which is aimed at activating community and collective value sets, will provide a beneficial spill-over across multiple pro-environmental domains. Future research should explore the short- and long-term utility of engagement strategies and messaging that attempt to alter specific behaviours.

4. Conclusion

Like most natural resource developments, CSG extraction involves a complex and often contested assessment of costs and benefits. On one side of the equation are the interests of the financial beneficiaries, which include the resource companies, state treasury departments, small regional businesses, some farmers, and the employed workforce (Fleming et al., 2015; Fleming & Measham, 2014; Measham & Fleming, 2014). These parties view this type of development in rural and regional Australia as a positive financial benefit both to themselves and the broader community. In contrast, many farmers and members of the broader community perceive substantial costs to both rural communities and broader eco-systems, leading to the conclusion that CSG development unacceptable (Walton et al., 2015).

Although the representatives of the CSG industry generally highlight the economic benefits to both the regional areas concern and the state more generally (e.g., Australia Pacific LNG, 2013b; Australian Petroleum Production and Exploration Association, 2013), the issue of ‘stranded assets’ is an additional important concern. Up to the 2014-15, CSG production in Queensland totalled approximately 524 petajoules, with a further 42,733 petajoules estimated to lay in reserve across the state. Despite the fall in international liquid natural gas prices from as high as US$20/mmBtu (million British thermal units) to a current

spot price of approximately US$4.62/mmBtu, the current unprocessed CSG reserves represents an undeveloped asset valued at approximately US$186 billion (Macro Business, 2016). As set out in section 147C of the Petroleum and Gas (Production and Safety) Act (2004), current royalties are 10% of the wellhead value of disposed of or produced gas in the return period representing approximately US$18.6 billion at current prices, to the Queensland Governments revenue over the life of the development. This is a substantial amount of money that can be allocated to help fund, among other things, health, education, and environmental initiatives across the state.

Historically the development of extractive industries and urbanisation has been viewed as more commercially important than the preservation of agricultural land (Greer et al., 2011). However, the agricultural industry in Queensland comprises approximately 30,500 businesses, contributing more than AUS $10 billion to the state's economy annually (Queensland Government, 2015). While economic comparisons between agriculture and extractive industries are not straightforward (e.g., weather, commodity prices, and exchange rates); a viable agricultural sector represents a substantial long-term economic driver. Indeed, research into the economic impacts of both these industries suggests that "under some plausible scenarios, the long-term economic net benefits from agriculture-only exceed those from CSG-only and CSG-agriculture coexistence" (Chen & Randall, 2013, p. 1). The establishment of community groups such as the Lock the Gate Alliance has resulted in increased media attention on the long-term impacts of CSG extraction on agricultural sustainability and increased political pressure to restrain and/or cease any activity which damages productive farmland (Greer et al., 2011).

The question then becomes 'Can these issues be resolved, to provide a win-win situation for both agriculture and CSG mining?' The mishandling of the complexities surrounding this land-use conflict may have serious social implications. For example, as

outlined in Chapter 2, the contribution of CSG extraction to negative mental health outcomes of those living within or near the agri-gasfields is likely to place an extra burden on the already limited mental health services within rural Australia. Further, the additional stress and negative affect associated of CSG extraction may dramatically increase anti-CSG activism. As described in Chapter 4, not all CSG activists are the same. Despite attitudes, subjective norms, personal norms and past behaviour being shared psychological constructs between activists profiles, perceived behavioural control discriminated between the four groups (i.e., Non-Activist, Mainstreamers, Primed-CD and Active-CD). Almost 34% of the sample in this study was classified as either Primed- or Active Civil Disobedients. These are people willing to engage in behaviours that push, and in some instances over step, the legal boundaries. This then presents authorities with the problem of how can you address these behaviours. The risk is that governments operating with a 'mining has economic supremacy' mindset may react by enacting what some may consider to be draconian laws. Indeed in March 2016, the NSW government passed protest law amendments allowing for up to seven years in jail for mining protestors, while giving the police new powers to break-up protests, to search and destroy private property (Hogdgson, 2016). Such moves may only further incite civil disobedience.

In a recent review of local community concerns about CSG extraction, Walton et al. (2015) identified six broad categories: water, human health, landowner issues, local infrastructure and facilities, economic changes, and community changes. In contrast, the CSG industry suggests that these concerns are often overstated or non-existent (Australia Pacific LNG, 2013a). Despite the assurances of the CSG industry, there is a growing dissent towards further CSG development. The issue then confronting politicians is to objectively determine the veracity of community concerns and the efficacy of the industry solutions. In order to achieve these goals, objective empirical research into all areas of concern needs to be conducted. Once the veracity of these concerns is evaluated through scientific research,

decision-makers can then proceed to implement evidence-based outcomes. Without objective research into the areas of concern, CSG extraction will continue to be a catalyst for protest and civil disobedience. This thesis extended the literature by providing the first empirical evidence into the negative mental health impacts of CSG extraction. Further, it investigated the cognition associated with activist behavioural responses to CSG extraction. I established that affective associations are an important driver of the cost-benefit judgments of farmers towards CSG and they in turn predict the decision to engage or not in activism behaviours. Any future expansion of the CSG industry will require a concerted effort to not only provide objective evidence to allay concerns but will need to be framed in such a manner as to counter any negative assessments within the community. Using an extended TPB model I highlighted the heterogeneous nature of farmer activist groups. I note the importance of the role of perceived behavioural control to discriminate between farmers intending to engage in civil disobedient behaviours, and those who are engaged in such behaviours. An understanding of the different psychological attributes of the different activist groups will assist the engagement process. These results can provide policy-makers with an insight into some of the human impacts of future CSG developments; allowing them to consider some of the social costs associated with any extensions of this industry.

5. References

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Appendix A – CSG Survey

Only items used in the thesis appear in this appendix

Word Association

This section deals with word associations - that is thoughts and images that immediately spring to mind when you hear a specific word or phrase.

In the spaces provided, please list three thoughts or images that come to mind when you read the phrase: “Coal seam gas wells on my property".

After you have listed your three thoughts or images please rate your immediate emotional reaction to each thought/image you have listed.

Please list your three thoughts or images below	Very Negative	Negative	Neutral	Positive	Very Positive
1.	❍	❍	❍	❍	❍
2.	❍	❍	❍	❍	❍
3.	❍	❍	❍	❍	❍

Encroachment Expectancies Measure

The following scale includes statements about possible outcomes that might occur IF Coal Seam Gas (CSG) extraction operations were to proceed on your property. Please rate how LIKELY or UNLIKELY it is that the outcome listed will occur, the DESIRABILITY of the outcome and when you would EXPECT the outcome to occur.

	Likelihood of outcome occurring					Desirability of outcome					If this outcome were to occur, please indicate expected time of occurrence			
	Very Unlikely	Unlikely	Neither	Likely	Very Likely	Very Undesirable	Undesirable	Neither	Desirable	Very Desirable	Immediately	Near Future	Medium Future	Distant Future
1. Underground water supplies on my property will decline significantly	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍
2. Employment opportunities in my community will increase	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍
3. Underground water in my community will become contaminated	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍
4. Revenues for the CSG wells will improve my financial stability	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍
5. There will be greater division between rich and poor in my community	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍
6. Local housing costs will become unaffordable for non-miners	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍
7. CSG extraction will destroy my children's future	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍

	Likelihood of outcome occurring					Desirability of outcome					If this outcome were to occur, please indicate expected time of occurrence			
	Very Unlikely	Unlikely	Neither	Likely	Very Likely	Very Undesirable	Undesirable	Neither	Desirable	Very Desirable	Immediately	Near Future	Medium Future	Distant Future
8. CSG extraction will reduce the value of my properly	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍
9. Local businesses will experience higher turnover	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍
10.Yields from my agricultural operation will fall significantly	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍
11. Pasture and/or crop quality will be adversely affected by CSG operations (e.g. dust from mining traffic on property roads, wastewater contamination, well flares etc.)	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍
12. Livestock health/production will be adversely affected by CSG operations (e.g. dust from the mining traffic on property roads, wastewater contamination, well flares etc.	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍
13. The natural environment will be negatively affected	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍
	Likelihood of outcome occurring					Desirability of outcome					If this outcome were to occur, please			

											indicate expected time of occurrence			
	Very Unlikely	Unlikely	Neither	Likely	Very Likely	Very Undesirable	Undesirable	Neither	Desirable	Very Desirable	Immediately	Near Future	Medium Future	Distant Future
14. Increased State royalties will benefit my local community	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍
15. My privacy will decline substantially	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍
16. My lifestyle will be negatively impacted	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍
17. I will lose control of the operation of my property	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍
18. My community's infra-structure will improve	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍
19. Future development of my property will be compromised	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍
20. Farm labour will become more difficult to source	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍
21. Farm labour will become more expensive	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍
22. CSG will provide a "cleaner" source of electricity	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍
23. Rental accommodation will become unaffordable for non-miners	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍
	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍
	Likelihood of outcome occurring					Desirability of outcome					If this outcome were to occur, please indicate expected time of			

											occurrence			
	Very Unlikely	Unlikely	Neither	Likely	Very Likely	Very Undesirable	Undesirable	Neither	Desirable	Very Desirable	Immediately	Near Future	Medium Future	Distant Future
24. Public roads will deteriorate due to mining traffic	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍
25. Increased traffic on the public roads will result in more accidents	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍
26. The cost of living (food, trade services, etc.) in my community will rise	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍
27. Families will leave smaller communities and move to the mining centre	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍
28. Conflicts will occur between farmers who allow access and those who resist	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍
29. The value of my property will be diminished	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍
30. Increased illicit drug availability will occur	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍
31. Increased public unrest (i.e. public drunkenness, fighting, etc.)	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍

	Likelihood of outcome occurring					Desirability of outcome					If this outcome were to occur, please indicate expected time of occurrence			
	Very Unlikely	Unlikely	Neither	Likely	Very Likely	Very Undesirable	Undesirable	Neither	Desirable	Very Desirable	Immediately	Near Future	Medium Future	Distant Future
32. Community cohesion will decline (i.e. the influx of mining employees will create an "us and them" situation)	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍
33. Government supported services (e.g. Dept. of Agriculture/Primary Industry, Community Services, Environmental Protection, etc.) will improve in my community	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍
34. Medical services in my community will improve (more doctors, dentists and allied health professionals)	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍
35. Wastewater from the CSG extraction process will pollute the local environment (e.g. leak from containment ponds, be used to settle dust on roads, etc.)	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍
36. My family's physical health will be negatively impacted	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍

	Likelihood of outcome occurring	Desirability of outcome	If this outcome were to occur,

											please indicate expected time of occurrence			
	Very Unlikely	Unlikely	Neither	Likely	Very Likely	Very Undesirable	Undesirable	Neither	Desirable	Very Desirable	Immediately	Near Future	Medium Future	Distant Future
37. Stress levels in my household will decrease	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍
38. My family's mental health will be negatively impacted	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍
39. Other (please specify)_____ _	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍

Mining Status

Which of the following best describes the status of the Coal Seam Gas (CSG) development on your property?

❍ No CSG lease exists over my property that I am aware of.
❍ CSG leases exist over my property, but no approach has yet been made by a CSG company.
❍ CSG leases exist over my property, and approaches have been made by the CSG company
❍ CSG leases exist over the property, and drilling/extraction has started

If you have selected the first option in this question, please proceed to the Coping Styles question on page 16.

Legal Protest Behaviours

This section deals with a range of legal protest behaviours farmers may engage in when approached by a Coal Seam Gas (CSG) extraction company. Each section is followed by a series of questions relating to the listed behaviours. Please indicate if you have and/or intend to engage in the behaviours listed below:

	Yes	No	Yes	No
1. Lobby political representatives to oppose CSG extraction on agricultural land (i.e. letter writing and/or phone calls)	❍	❍	❍	❍
2. Participate in a community group that opposes CSG extraction on agricultural land (e.g. Lock the Gate)	❍	❍	❍	❍
3. Participate in a public demonstration opposing CSG extraction on agricultural land	❍	❍	❍	❍
4. Engage an advisor for advice on how to legally oppose CSG extraction on agricultural land	❍	❍	❍	❍
5. Talk to neighbours and nearby landholders about the potential negative impacts of CSG extraction on agricultural land	❍	❍	❍	❍

Please indicate on the following scales the position which best reflects your beliefs or feelings towards the "legal protest behaviours" described above

Engaging in legal protest behaviours to prevent CSG companies from accessing agricultural land is:	❑ 1. Undesirable	❑ 2	❑ 3	❑ 4	❑ 5	❑ 6	❑ 7. Desirable
	❑ 1. Important	❑ 2	❑ 3	❑ 4	❑ 5	❑ 6	❑ 7.Unimportant
	❑ 1. Ineffective	❑ 2	❑ 3	❑ 4	❑ 5	❑ 6	❑ 7. Effective
	❑ 1. Beneficial	❑ 2	❑ 3	❑ 4	❑ 5	❑ 6	❑ 7. Beneficial
	❑ 1.Foolish	❑ 2	❑ 3	❑ 4	❑ 5	❑ 6	❑ 7.Wise

With respect of the legal protest behaviours described above, please indicate how much you agree or disagree with the following statements.

	Strongly Disagree	Disagree	Neither Agree nor Disagree	Agree	Strongly Agree
1. Most of my family thinks I should engage in the legal protest behaviours opposing CSG extraction on agricultural land	❍	❍	❍	❍	❍
2. Most of my close friends think I should engage in the legal protest behaviours opposing CSG extraction on agricultural land	❍	❍	❍	❍	❍
3. I believe many farmers in my district are engaged in the legal protest behaviours opposing CSG extraction on agricultural land	❍	❍	❍	❍	❍
4. I believe many farmers across the State are engaged in legal protest behaviours opposing CSG extraction on agricultural land	❍	❍	❍	❍	❍
5. I have control over whether or not I participate in the community activism behaviours listed above	❍	❍	❍	❍	❍
6. If I wanted to I could easily engage in the community activism behaviours listed above	❍	❍	❍	❍	❍
7. In general, I am confident I can perform the community activism behaviours listed above, if I wanted to	❍	❍	❍	❍	❍
8. I believe I can successfully carry out the community activist behaviours listed above, if I set my mind to it	❍	❍	❍	❍	❍

Active Resistance Behaviours

This section deals with a range of active resistance behaviours farmers may take to discourage or prevent a CSG company from entering productive privately owned freehold land. Each section is followed by a series of questions relating to the behaviours. We acknowledge that participation in some of these active resistance behaviours may be considered illegal in some States. While the researchers do not condone participation in illegal activities it is the intention of this research to accurately identify the extent to which some farmers may be prepared to go to protect their property. Please note that the identification code you created at the beginning of this survey is completely anonymous and untraceable even to the researchers. Thus we encourage you to be as honest as possible.

Please indicate if you have and/or intend to engage in the behaviours listed below:	Have you engaged in this behaviour in the last 12 months?		Do you intend to engage in this behaviour in the next 6 months?	
	Yes	No	Yes	No
1. Participate in a blockade to prevent a CSG company from entering a property or district	❍	❍	❍	❍
2. Refuse entry of a CSG company onto your property (i.e. locking the gate)	❍	❍	❍	❍
3. Disable or destroy equipment owned by CSG companies	❍	❍	❍	❍
4. Remove or destroy CSG company survey pegs that are on your property	❍	❍	❍	❍
5. Remove or destroy survey pegs from public land	❍	❍	❍	❍
6. Collected samples of water and/or soil for analysis from CSG (e.g. enclosed well heads, drilling sites, containment ponds, etc.)	❍	❍	❍	❍

Please indicate on the following scales the position which best reflects your beliefs or feelings towards the "active resistance behaviours" described above

Engaging in active resistance behaviours to prevent CSG companies from accessing agricultural land is:	☐	❑ 1. Undesirable	❑ 2	❑ 3	❑ 4	❑ 5	❑ 6	❑ 7. Desirable
	☐	❑ 1. Important	❑ 2	❑ 3	❑ 4	❑ 5	❑ 6	❑ 7.Unimportant
	☐	❑ 1. Ineffective	❑ 2	❑ 3	❑ 4	❑ 5	❑ 6	❑ 7. Effective
	☐	❑ 1. Beneficial	❑ 2	❑ 3	❑ 4	❑ 5	❑ 6	❑ 7. Beneficial
	☐	❑ 1.Foolish	❑ 2	❑ 3	❑ 4	❑ 5	❑ 6	❑ 7.Wise

With respect of the active resistance behaviours described above, please indicate how much you agree or disagree with the following statements.

	Strongly Disagree	Disagree	Neither Agree nor Disagree	Agree	Strongly Agree
1. Most of my family thinks I should engage in active resistance behaviours to prevent CSG companies from accessing agricultural land	❍	❍	❍	❍	❍
2. Most of my close friends think I should engage in active resistance behaviours to prevent CSG companies from accessing agricultural land	❍	❍	❍	❍	❍
3. I believe that many farmers in my district are engaged in active resistance behaviours to prevent CSG companies from accessing agricultural land	❍	❍	❍	❍	❍
4. I believe that many farmers across the State are engaged in active resistance behaviours to prevent CSG companies from accessing agricultural land	❍	❍	❍	❍	❍
5. I have control over whether or not I participate in the active resistance behaviours listed above	❍	❍	❍	❍	❍
6. If I wanted to I could easily engage in the active resistance listed above	❍	❍	❍	❍	❍
7. In general, I am confident I can perform the active resistance behaviours listed above	❍	❍	❍	❍	❍
8. I believe I can successfully carry out the active resistance behaviours listed above, if I set my mind to it	❍	❍	❍	❍	❍

General Farming Concerns

Please indicate the severity of the stress caused to you by each of the following events during the previous 12 months:

	None	Low	Moderate	High	Very Severe
1. Not enough ready cash	❍	❍	❍	❍	❍
2. Current level of debt	❍	❍	❍	❍	❍
3. Concerns about farm viability	❍	❍	❍	❍	❍
4. Worrying about owing money	❍	❍	❍	❍	❍
5. Worrying about commodity prices	❍	❍	❍	❍	❍
6. Unpredictability of the weather	❍	❍	❍	❍	❍
7. Machinery breakdowns	❍	❍	❍	❍	❍
8. Bad weather conditions	❍	❍	❍	❍	❍
9. Personal illness during busy times	❍	❍	❍	❍	❍
	None	Low	Moderate	High	Very Severe
10. Unplanned interruptions	❍	❍	❍	❍	❍
11. Reduced crop/livestock yields due to adverse weather conditions	❍	❍	❍	❍	❍
12. The death of a family member	❍	❍	❍	❍	❍
13. The breakdown of an intimate relationship	❍	❍	❍	❍	❍
14. Conflict with a family member, living on the property (parent, or in-law, child etc.) over operational issues	❍	❍	❍	❍	❍
15. Succession plans	❍	❍	❍	❍	❍
16. Illness of family member	❍	❍	❍	❍	❍
17. Increased work load at peak times	❍	❍	❍	❍	❍
18. Long hours of work	❍	❍	❍	❍	❍

19. Few holidays away from the farm	❍	❍	❍	❍	❍
20. Too much work and too little time	❍	❍	❍	❍	❍
21. Having to work to a timetable	❍	❍	❍	❍	❍
22. Felt alone and isolated	❍	❍	❍	❍	❍
23. Having a long distance to travel for services, health care, shopping	❍	❍	❍	❍	❍
24. Not seeing enough people	❍	❍	❍	❍	❍
25. Lack of close neighbours	❍	❍	❍	❍	❍
26. Having no-one to talk to all day	❍	❍	❍	❍	❍
27. Adjusting to new bureaucratic regulations and policy	❍	❍	❍	❍	❍
28. Complying with bureaucratic requirements (i.e. Veg. management, GST, NLIS, etc.)	❍	❍	❍	❍	❍
29. Complying with Occupation health and Safety requirements	❍	❍	❍	❍	❍

	None	Low	Moderate	High	Very Severe
30. Dealing with government bodies (e.g. workers compensation, environment and resource departments, etc.)	❍	❍	❍	❍	❍
31. The impact of CSG extraction on the water supply	❍	❍	❍	❍	❍
32. Concern about my future as a farmer by the whole mining/extraction issue	❍	❍	❍	❍	❍
33. Inter-personal dealings with CSG company representatives	❍	❍	❍	❍	❍
34. Impact of CSG operations on profitability of my property	❍	❍	❍	❍	❍
35. The threat to human health as a result of CSG encroachment	❍	❍	❍	❍	❍
36. The degradation of the environment due to CSG development	❍	❍	❍	❍	❍
37. The loss of privacy due to CSG traffic on my property	❍	❍	❍	❍	❍
38. Declines in feed/ crop quality and/or livestock health as a result of CSG exploration/drilling	❍	❍	❍	❍	❍
39. Destruction of my children's future on this property as a result of CSG exploration/drilling	❍	❍	❍	❍	❍
40. Reduction in my property valuation as a result of CSG exploration/drilling	❍	❍	❍	❍	❍
41. Deteriorating community values as a result of the influx of CSG workers	❍	❍	❍	❍	❍

42. Farming related accident	❍	❍	❍	❍	❍
43.No farm help or a lack of it when needed	❍	❍	❍	❍	❍
44. Presence of hazardous material (chemicals etc.)	❍	❍	❍	❍	❍

	None	Low	Moderate	High	Very Severe
45. Threat from overseas imports (i.e. disease, commodity prices)	❍	❍	❍	❍	❍
46. Dealing with new technology	❍	❍	❍	❍	❍
47. Understanding new information	❍	❍	❍	❍	❍
48. Media portrayal of farmers	❍	❍	❍	❍	❍

Mental Health The next section of the questionnaire consists of several mental health measures. We would like to remind you that this survey is completely anonymous and your honesty in answering these questions is greatly appreciated. If you find that you are distressed in any way upon completing this section, we would draw your attention to the free confidential services and the contact details provided at the beginning of this questionnaire.

Please read each statement and indicate how much the statement applied to you over the past week. There are no right or wrong answers. Do not spend too much time on any one statement.	Did not apply to me at all	Applied to me to some degree or some of the time	Applied to me a considerable degree, or a good part of the time	Applied to me very much, or most of the time
1. Found it hard to wind down	❍	❍	❍	❍
2. I was aware of dryness of my mouth	❍	❍	❍	❍
3. I couldn't seem to experience any positive feelings at all	❍	❍	❍	❍
4. I experienced breathing difficulty (e.g. excessively rapid breathing, breathlessness in the absence of physical exertion)	❍	❍	❍	❍
5. I found it difficult to work up the initiative to do things	❍	❍	❍	❍
6. I tended to over-react to situations	❍	❍	❍	❍
7. I experienced trembling (e.g. in the hands)	❍	❍	❍	❍
8. I felt I was using a lot of nervous energy	❍	❍	❍	❍
9. I was worried about situations in which I might panic and make a fool of myself	❍	❍	❍	❍
10. I felt that I had nothing to look forward to	❍	❍	❍	❍
11. I found myself getting agitated	❍	❍	❍	❍
12. I found it difficult to relax	❍	❍	❍	❍
13. I felt down-hearted and blue	❍	❍	❍	❍
Please read each statement and indicate how much the statement applied to you over the past week. There are no right or wrong answers. Do not spend too much time on any one statement.	Did not apply to me at all	Applied to me to some degree or some of the time	Applied to me a considerable degree, or a good part of the	Applied to me very much, or most of the time

			time	
14. I was intolerant of anything that kept me from getting on with what I was doing	❍	❍	❍	❍
15. I felt I was close to panic	❍	❍	❍	❍
16. I was unable to become enthusiastic about anything	❍	❍	❍	❍
17. I felt I wasn't worth much as a person	❍	❍	❍	❍
18. I felt I was rather touchy	❍	❍	❍	❍
19. I was aware of the action of my heart in the absence of physical exertion (e.g. sense of heart rate increase, heart missing a beat)	❍	❍	❍	❍
20. I felt scared without good reason	❍	❍	❍	❍
21. I felt that life was meaningless	❍	❍	❍	❍

Demographic Questions

What is your age?		
What is your gender?	❍ Male	❍ Female

What is your highest level of education completed?

- ❍ Primary School
- ❍ Part High School
- ❍ All High School
- ❍ Trade/Technical Certificate
- ❍ Agricultural College
- ❍ Diploma/Associate Diploma
- ❍ University Degree
- ❍ Higher Degree (e.g. Masters, PhD

How many years have you lived on your current property?	
How many years have you been engaged in the agricultural industry as a farmer?	
What is the total area of land owned or managed by you in hectares? (Approximate conversions. 100 acres = 40.4 ha, 1000 acres = 404 ha)	
In percentage terms please indicate your contribution to the day to day decision-making process on your property (e.g. 50% or 100%).	
Please enter your postcode.	

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Appendix B – LEAP Survey

Only items used in the thesis are listed in this appendix

General information about your operation and you.

Q.1 What is your age?

Q.2 What is your gender?

○ ○ Female

Q.3 What is your highest level of education completed?

- ○ Primary School
- ○ Part High School
- ○ All High School
- ○ Trade / Technical Certificate
- ○ Agricultural College
- ○ Diploma / Associate Diploma
- ○ University Degree
- ○ Higher Degree (e.g. Masters, PhD

Questions pertaining to your profession

Q.4 How many years have you been in the agricultural industry?

Q.5 What is the total area of land owned or managed by you in hectares? (Approximate conversions. 100 acres = 40.4 ha, 1000 acres = 404 ha)

Q.6 What best describes the ownership status of your property?

O Family owned .Please go to Q.8

○ Corporation Owned. Please go to Q.8

○ Other. Please go to Q.7

Q.7 If other, please describe	

Q.8 What is your position in the agricultural operation?

O Owner/Co-Owner .Please go to Q.10

○ Property Manager. Please go to Q.10

○ Other. Please go to Q.9

Q.9 If other, please describe	

Q.10 Please indicate which group you are an active member of. If you have multiple memberships, please select the group you dedicate the most time and energy to.

O Landcare (e.g. Murilla, Southern New England, etc.)

○ Organic Farmers Group (e.g. Biological Farmers of Australia)

O State farm organisation or commodities council (e.g. AgForce, NSW Farmers Federation, Victorian Farmers Federation, NT Cattleman's Assn, etc.)

O Cattle Breed Society (e.g. Shorthorn, Angus, Charolais Society, etc.)

○ Water Catchment Management Authority

O Natural Resource Management Group

○ Environmental Group (e.g. Australian Conservation Foundation, WWF etc.)
○ Other group Please go to Q.11
○ I am not an active member of any group

Q.11 Please nominate what other group you are a member of.

Agricultural Behaviours

The following questions investigate participation levels of the following on-farm practices identified from the Australian agricultural literature. Please read each statement and consider how frequently you perform the described practice.

Livestock Management Practices

○ **Q .12** If you don't run any livestock please tick the box and move to Soil Management Practices section**.**

Q.13 Please indicate how often the following Livestock Management Practices are performed on your property.

	Never	Seldom	Sometimes	Usually	Always
Providing more easily digested feed to ensure more energy is available for production.	○	○	○	○	○
Utilising a rotational grazing plan, which will help maintain a greater proportion of highly digestible leaf material	○	○	○	○	○
Minimising the timeframe livestock spend on pasture (e.g. selling feeder cattle or custom feeding own stock).	○	○	○	○	○
Using dietary supplements to overcome deficiencies of key nutrients (such as minerals and nitrogen) in low quality feeds.	○	○	○	○	○
Implementing genetic improvement programmes (e.g. using EBV data in seed stock selection or purchasing higher performance breed types) aimed at achieving shorter finishing times.	○	○	○	○	○

Q. 14 To what extent do you agree or disagree with the following statements?

	Strongly Disagree	**Disagree**	**Neither Agree nor Disagree**	**Agree**	**Strongly Agree**
I am confident I have the knowledge to successfully engage in the livestock management practices described above.	○	○	○	○	○
I have sufficient financial resources to carry out the livestock management practices described above.	○	○	○	○	○
I believe I have the skills to successfully carry out the livestock management practices described above.	○	○	○	○	○
In general, I believe the livestock management practices described above are effective in reducing farm related greenhouse gas emissions.	○	○	○	○	○
In general, I believe the livestock management practices described above will improve the profitability of my agricultural operation.	○	○	○	○	○
In general, I believe the livestock management practices described above will help ensure the long term sustainability of my agricultural operation.	○	○	○	○	○

Soil Management Practices

Q.15 If you don't have any farming country please tick the box and move to Nitrogen Management Practices Section**.**

Q .16 Please indicate how often the following soil management practices are performed on your property.

	Never	**Seldom**	**Sometimes**	**Usually**	**Always**
Using minimum till practices to help prevent the degradation of soil structure and loss of organic matter including carbon dioxide.	○	○	○	○	○
Using green manure cropping techniques.	○	○	○	○	○
Rotating crops to help maximize soil carbon input and improve soil fertility through increased root biomass and nitrogen fixation.	○	○	○	○	○
Minimising vehicle traffic to reduce soil compaction, maintain soil structure and improve water infiltration.	○	○	○	○	○
Implementing erosion control measures such as contour banks and swales.	○	○	○	○	○

Q.17 To what extent do you agree or disagree with the following statements?

	Strongly Disagree	**Disagree**	**Neither Agree nor Disagree**	**Agree**	**Strongly Agree**
I am confident I have the knowledge to successfully engage in the soil management practices described above.	○	○	○	○	○
I have sufficient financial resources to carry out the soil management practices described above.	○	○	○	○	○
I believe I have the skills to successfully carry out the soil management practices described above.	○	○	○	○	○
In general, I believe the soil management practices described above are effective in reducing farm related greenhouse gas emissions.	○	○	○	○	○
In general, I believe the soil management practices described above will improve the profitability of my agricultural operation.	○	○	○	○	○
In general, I believe the soil management practices described above will help ensure the long term sustainability of my agricultural operation.	○	○	○	○	○

Nitrogen Management Practices

Q.18 Please indicate how often the following nitrogen management practices are performed on your property.

	Never	Seldom	Sometimes	Usually	Always
Timing fertilizer applications to coincide with crop or pasture requirements.	○	○	○	○	○
Using split applications to ensure the fertilizer supplied is most advantageous for crop or pasture growth.	○	○	○	○	○
Using soil and/or plant tissue testing to establish existing nitrogen levels prior to application.	○	○	○	○	○
Ensuring a well-balanced supply of other nutrients to assist with nitrogen use by crops or pastures.	○	○	○	○	○
Using application methods that place fertilizers close to plant roots (e.g. incorporation or deep placement as opposed to surface application).	○	○	○	○	○

Q.19 To what extent do you agree or disagree with the following statements?

	Strongly Disagree	**Disagree**	**Neither Agree nor Disagree**	**Agree**	**Strongly Agree**
I am confident I have the knowledge to successfully engage in the nitrogen management practices described above.	○	○	○	○	○

	Strongly Disagree	**Disagree**	**Neither Agree nor Disagree**	**Agree**	**Strongly Agree**
I have sufficient financial resources to carry out the nitrogen management practices described above.	○	○	○	○	○
I believe I have the skills to successfully carry out the nitrogen management practices described above.	○	○	○	○	○
In general, I believe the nitrogen management practices described above are effective in reducing farm related greenhouse gas emissions.	○	○	○	○	○
In general, I believe the nitrogen management practices described above will improve the profitability of my agricultural operation.	○	○	○	○	○
In general, I believe the nitrogen management practices described above will help ensure the long term sustainability of my agricultural operation.	○	○	○	○	○

Water Management Practices

Q.20 Please indicate how often the following soil management practices are performed on your property.

	Never	Seldom	Sometimes	Usually	Always
Monitor soil moisture profiles, to facilitate the appropriate times to engage in activities such as planting and/or irrigating.	○	○	○	○	○
Improve drainage to avoid water logging.	○	○	○	○	○
Selecting crop and pasture varieties that are more water efficient.	○	○	○	○	○
Engaging in water conservation measures (e.g. capping and piping bores or pivot applications instead of flood irrigation).	○	○	○	○	○

Q.21 To what extent do you agree or disagree with the following statements?

	Strongly Disagree	**Disagree**	**Neither Agree nor Disagree**	**Agree**	**Strongly Agree**
I am confident I have the knowledge to successfully engage in the water management practices described above.	○	○	○	○	○
I have sufficient financial resources to carry out the water management practices described above.	○	○	○	○	○
I believe I have the skills to successfully carry out the water management practices described above.	○	○	○	○	○
In general, I believe the water management practices described above are effective in reducing farm related greenhouse gas emissions.	○	○	○	○	○

	Strongly Disagree	**Disagree**	**Neither Agree nor Disagree**	**Agree**	**Strongly Agree**
In general, I believe the water management practices described above will improve the profitability of my agricultural operation.	○	○	○	○	○
In general, I believe the water management practices described above will help ensure the long term sustainability of my agricultural operation.	○	○	○	○	○

Energy Efficiency Practices

Q.22 Please indicate how often the following nitrogen management practices are performed on your property.

	Never	**Seldom**	**Sometimes**	**Usually**	**Always**
Selecting energy efficient machinery, appliances and vehicles when making purchases.	○	○	○	○	○
Conducting regular maintenance on existing equipment to improve efficiency.	○	○	○	○	○
Adopting minimum till practices to reduce fuel consumption.	○	○	○	○	○
Using alternative fuel where possible (e.g. LPG).	○	○	○	○	○
Installing renewable or alternative energy sources.	○	○	○	○	○

Q.23 To what extent do you agree or disagree with the following statements?

	Strongly Disagree	**Disagree**	**Neither Agree nor Disagree**	**Agree**	**Strongly Agree**
I am confident I have the knowledge to successfully engage in the energy efficiency practices described above.	○	○	○	○	○
I have sufficient financial resources to carry out the energy efficiency practices described above.	○	○	○	○	○
I believe I have the skills to successfully carry out the energy efficiency practices described above.	○	○	○	○	○
In general, I believe the energy efficiency practices described above are effective in reducing farm related greenhouse gas emissions.	○	○	○	○	○
In general, I believe the energy efficiency practices described above will improve the profitability of my agricultural operation.	○	○	○	○	○
In general, I believe the energy efficiency practices described above will help ensure the long term sustainability of my agricultural operation.	○	○	○	○	○

Vegetation Management Practices

Q.24 Please indicate how often the following vegetation management practices are performed on your property.

	Never	Seldom	Sometimes	Usually	Always
Actively controlling invasive weeds and pests (e.g. rabbits, rubber vine, and blackberry).	○	○	○	○	○
Planting deep rooted perennial vegetation.	○	○	○	○	○
Maintaining areas of biodiversity to provide a habitat for predators of crop and pasture pests.	○	○	○	○	○
Maintaining areas of biodiversity for stock and protection of crops and pastures.	○	○	○	○	○
Using fencing and/or other methods to prevent erosion due to farming and grazing operations.	○	○	○	○	○
Implementing re-vegetation programmes on my property as part of my property management strategy.	○	○	○	○	○

Q.25 Please indicate the primary reason you have protected existing remnant vegetation.

Ecological Concerns	Both ecological and legal reasons	Property productivity	Property productivity and ecological	Required to by law	There is no remnant vegetation on the property	
○	○	○	○	○	○	○

Q.26 To what extent do you agree or disagree with the following statements?

	Strongly Disagree	**Disagree**	**Neither Agree nor Disagree**	**Agree**	**Strongly Agree**
The existing State Government vegetation management laws provide a useful framework for the overall sustainability of my agricultural operations	○	○	○	○	○
I am confident I have the knowledge to successfully engage in the vegetation management practices described above.	○	○	○	○	○
I have sufficient financial resources to carry out the vegetation management practices described above.	○	○	○	○	○
I believe I have the skills to successfully carry out the vegetation management practices described above.	○	○	○	○	○
In general, I believe the vegetation management practices described above are effective in reducing farm related greenhouse gas emissions.	○	○	○	○	○

	Strongly Disagree	Disagree	Neither Agree nor Disagree	Agree	Strongly Agree
In general, I believe the vegetation management practices described above will improve the profitability of my agricultural operation.	○	○	○	○	○
In general, I believe the vegetation management practices described above will help ensure the long term sustainability of my agricultural operation.	○	○	○	○	○

Time Perspective

Q.27 Please read each item and, as honestly as you can, answer the question:

"How characteristic or true is this of me?"

	Very untrue	Untrue	Neutral	True	Very true
I believe that a person's day should be planned ahead each morning.	○	○	○	○	○
Thinking about the future is pleasant to me.	○	○	○	○	○
When I want to achieve something, I set goals and consider specific means of reaching those goals.	○	○	○	○	○
Meeting tomorrow's deadlines and doing other necessary work comes before tonight's play.	○	○	○	○	○
It seems to me that my future plans are pretty laid out.	○	○	○	○	○
I think that it's useless to plan too far ahead because things hardly ever come out the way you plan.	○	○	○	○	○

It upsets me to be late for appointments.	○	○	○	○	○
I tend to lose my temper when provoked	○	○	○	○	○
I get irritated at people who keep me waiting when we've agreed to meet at a given time.	○	○	○	○	○
I complete projects on time by making steady progress.	○	○	○	○	○
I make lists of things to do.	○	○	○	○	○
I keep working at a difficult uninteresting task if it will get me ahead.	○	○	○	○	○
I am able to resist temptations when I know there is work to be done.	○	○	○	○	○
I do things impulsively, making decisions on the spur of the moment	○	○	○	○	○
I believe that getting together with friends to party is one of life's important pleasures.	○	○	○	○	○
If I don't get done on time, I don't worry about it.	○	○	○	○	○

	Very untrue	**Untrue**	**Neutral**	**True**	**Very true**
I try to live one day at a time.	○	○	○	○	○
It is fun to gamble when I have some extra money.	○	○	○	○	○
I feel that it's more important to enjoy what you are doing, rather than to get the work done on time.	○	○	○	○	○

I don't do things that will be good for me if they don't feel good now	○	○	○	○	○
I take risks to put excitement into my life.	○	○	○	○	○

<u>Sense of Place</u>

Q.28 Please indicate how much you agree or disagree with the following statements.

	Strongly Disagree	**Disagree**	**Neither Agree or Disagree**	**Agree**	**Strongly Agree**
Everything about my property/farm is a reflection of me.	○	○	○	○	○
My property/farm says very little about who I am.	○	○	○	○	○
I feel that I can really be myself at my property/farm.	○	○	○	○	○
My property/farm reflects the type of person I am.	○	○	○	○	○
I feel relaxed when I am on my property/farm.	○	○	○	○	○
I feel happiest when I'm at my property/farm.	○	○	○	○	○
My property/farm is my favourite place to be.	○	○	○	○	○
I really miss my property/farm when I am away from it for too long.	○	○	○	○	○
My property/farm is the best place for doing the things I enjoy most.	○	○	○	○	○
For doing the things that I enjoy most, no other place can compare to my property/farm.	○	○	○	○	○

My property/farm is not a good place to do the things I most like to do.	○	○	○	○	○
As far as I am concerned, there are better places to be than at my property/farm.	○	○	○	○	○

Environmental Attitudes

Q.30 Please indicate how much you agree or disagree with the following statements about the environment.

	Strongly Disagree	**Disagree**	**Neither Agree nor Disagree**	**Agree**	**Strongly Agree**
One of the worst things about overpopulation is that many natural areas are getting destroyed for development.	○	○	○	○	○
I can enjoy spending time in natural settings just for the sake of being out in nature.	○	○	○	○	○
Environmental threats such as deforestation and ozone depletion have been exaggerated.	○	○	○	○	○

	Strongly Disagree	**Disagree**	**Neither Agree nor Disagree**	**Agree**	**Strongly Agree**
The worst thing about the loss of the rain forest is that it will restrict the development of new medicines	○	○	○	○	○
Sometimes it makes me sad to see forests cleared for agriculture.	○	○	○	○	○
It seems to me that most conservationists are pessimistic and somewhat paranoid.	○	○	○	○	○
I prefer wildlife reserves to zoos.	○	○	○	○	○
I do not think the problem of depletion of natural resources is as bad as many people make it out to be.	○	○	○	○	○

I find it hard to get too concerned about environmental issues.	○	○	○	○	○
It bothers me that humans are running out of their supply of oil.	○	○	○	○	○
I need time in the bush (nature) to be happy.	○	○	○	○	○
The thing that concerns me most about deforestation is that there will not be enough lumber for future generations.	○	○	○	○	○
I do not feel that humans are dependent on nature to survive.	○	○	○	○	○
Sometimes when I am unhappy I find comfort in nature.	○	○	○	○	○
Most environmental problems will solve themselves given enough time.	○	○	○	○	○
I don’t care about environmental problems.	○	○	○	○	○
I’m opposed to programs to preserve wilderness, reduce pollution and conserve resources.	○	○	○	○	○
It makes me sad to see natural environments destroyed.	○	○	○	○	○
The most important reason for conservation is human survival.	○	○	○	○	○
One of the best things about recycling is that it saves money.	○	○	○	○	○
Nature is important because of what it can contribute to the pleasure and welfare of humans.	○	○	○	○	○
Too much emphasis has been placed on conservation.	○	○	○	○	○
Nature is valuable for its own	○	○	○	○	○

sake.

	Strongly Disagree	**Disagree**	**Neither Agree nor Disagree**	**Agree**	**Strongly Agree**
We need to preserve resources to maintain a high quality of life.	○	○	○	○	○
Being out in nature is a great stress reducer for me.	○	○	○	○	○
One of the most important reasons to conserve is to preserve wild areas.	○	○	○	○	○
Continued land development is a good idea as long as a high quality of life can be preserved	○	○	○	○	○
Sometimes animals seem almost human to me.	○	○	○	○	○
Humans are as much a part of the ecosystem as other animals	○	○	○	○	○

Belief in Climate Change

Q.31 Please indicate how much you agree or disagree with the following statements about climate change.

	Strongly Disagree	**Disagree**	**Neither Agree nor Disagree**	**Agree**	**Strongly Agree**
Climate change is something that frightens me.	○	○	○	○	○
The effects of climate change are likely to be catastrophic.	○	○	○	○	○
Claims that human activities are changing the climate are exaggerated.	○	○	○	○	○
The evidence for climate change is unreliable.	○	○	○	○	○
I do not believe climate change is a real problem.	○	○	○	○	○
The media is often too alarmist about issues relating to climate change.	○	○	○	○	○
It is too early to say whether climate change is really a problem.	○	○	○	○	○
The possible effects of climate change are considered as part of my risk management strategies.	○	○	○	○	○

Concern for Global Warming

Q.32 Please indicate how much you agree or disagree with the following statements.

Climate change / global warming will have a noticeably negative impact.

	Strongly Disagree	**Disagree**	**Neither Agree nor Disagree**	**Agree**	**Strongly Agree**
On my health in the next 25 years.	○	○	○	○	○
On my economic and financial situation in the next 25 years.	○	○	○	○	○
On the environment in which my family and I live.	○	○	○	○	○
Public health in my State.	○	○	○	○	○
Economic development in my State.	○	○	○	○	○
The environment in my State.	○	○	○	○	○

Demographics

More information about you.

Q.33 What is your postcode?

Thank you for completing this questionnaire. If you would like to receive a copy of the final results of this survey project please send an email with the subject line "Request for Final Survey Summary" to Methuen Morgan at mmorgan5@une.edu.au