UNDERSTANDING CLIMATE CHANGE
AND ADVANCING ADAPTATION
IN A THIRD SECTOR SUSTAINABILITY ORGANISATION

by
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Statement of originality

The work presented in this thesis is, to the best of my knowledge, the original work of the author. No material written or published by any other person, unless appropriately acknowledged, appears in this thesis. This work has not been submitted previously, either in whole or in part, for a degree at the University of the Sunshine Coast or any other university.

Kate English

21 November 2017
Preface
This study developed from over 25 years of vocational experience in climate change policy in the United States and Australia and a growing personal concern about and deep interest in the public understanding of climate change. My interest in how the public and groups in society relate to the climate change phenomenon emerged from personal experiences working for government agencies, volunteering in third sector organisations, teaching university students and researching climate change policy and science. Over the years, I became increasingly aware that many people struggled to understand fully the dynamic and multifaceted aspects of climate change, from its causes and impacts, to effective mitigation and adaptation.

My primary objective is to contribute to the body of knowledge about the public understanding of key components of anthropogenic climate change and adaptive actions to address local climatic impacts. My intention is that this research will aid those working in third sector sustainability organisations and other community leaders and decision-makers who are instrumental in communicating actions and approaches to resolve the challenges of 21st century climate change.

Kate English
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Acknowledgements

I wrote this thesis over six years and during that time I had the support and guidance of many people. Reaching the end of this fulfilling and challenging endeavour was possible only through the assistance and encouragement of many others, who I would like to acknowledge here. First, I would like to offer my profound thanks and admiration to University of the Sunshine Coast (USC) Associate Professor Claudia Baldwin, my principal supervisor. I was fortunate to have met Claudia at a critical juncture in my research and to learn of our mutual interest in community engagement with climate change. Claudia imparted invaluable advice and support in formalising the direction and extent of my thesis, afforded guidance in brainstorming concepts, and provided encouragement, all key elements I needed to complete this research. I have learned much from her and have gained a dear friend in the process.

I would like to acknowledge several wise and supportive academics who have contributed to my research over the years. First, I send special thanks to two others on my supervisory team, Professor Bill Carter (USC) and Dr. Gail Moloney (Southern Cross University). Bill shared his extensive knowledge of sustainability and environmental management and his expertise as an editor. Gail’s guidance regarding social representations theory (SRT), her area of expertise, was invaluable to my early research on SRT and the development of my theoretical perspective. Further, I acknowledge the valuable contributions from Associate Professor Dana Thomsen (USC) and Professor Iain Walker (CSIRO) during the earlier stages of this research, and thank Professor Tim Smith (USC) and Professor Walker for supporting my research through a joint USC-CSIRO scholarship. Additional thanks go to many USC staff, especially Gail Wilkins, for providing the physical and technical support that helped me achieve this personal milestone. Finally, I would like to thank my external editor, Thea Vanags, for her helpful formatting and, importantly, her encouragement, which was greatly appreciated.

I appreciate the support I received from friends and family members. Special gratitude goes to my dear friend Dr. Lisa Ryan, who provided friendship, laughter, and encouragement over many years, writing her PhD as I wrote mine. I will miss our many writing days together. As a USC lecturer for over a decade, I acknowledge the continual support from my USC colleague and mentor, Associate Professor Neil Tindale. I extend my heartfelt thanks to my family here and abroad for their interest and encouragement, as I anticipate fun-filled reunions across Australia and in the United States in the coming months.

Most importantly, I express my profound love and gratitude to my husband, Alex Parry. His faith in my ability, and enduring encouragement, support and compassion sustained me during many years of study. Alex’s love and understanding are a constant in my life. He encouraged me to persevere during stressful moments and provided the optimistic, alternative perspective that I was lacking at times. I would not have embarked on this ultimately fulfilling effort if it were not for him. For that, I am and will always be thankful.
Abstract

Climate change is a fundamental social challenge facing humanity. Given the reluctance of governments to take clear political action, the role of third sector sustainability organisations (TSSOs) working within civil society is increasingly recognised as being important. This thesis examines how the Noosa Biosphere Reserve Board of Directors (NBR Board) charged by the United Nations Educational, Scientific and Cultural Organization (UNESCO) to protect the Noosa Biosphere Reserve, understands climate change and adaptation. Working within a TSSO, the NBR Board develops and initiates community projects, including programs to build knowledge about climate change and to promote adaptive action to address local climatic impacts. Understanding this TSSO’s shared perceptions, which may be considered social representations, of climate change and adaptation is important, as these representations influence the group’s decision making on the types of community engagement projects to undertake.

Adaptation to address present and future impacts from climate change is becoming increasingly important to local communities and policy makers. Effective local engagement with climate change requires three elements: cognition, affect (i.e. emotions) and behaviour (i.e. actions). While research into adaptation is advancing, understanding how to leverage collective adaptation efforts is an emerging field. Past research identified that a group’s social representations, that is their collective representations that emerge through individuals participating in groups, can reveal motivations for action. However, to date research into a TSSO’s social representations around climate change and adaptation has not been undertaken. Knowing how a TSSO understands climate change and adaptation can assist in identifying knowledge gaps that may perversely affect decisions on climate change projects. This understanding can be used by a TSSO to enhance its members’ knowledge and affect, important to advancing its community action.

This research draws on literature from social psychology, climate change communication and adaptation fields and uses social representations theory (SRT) as its main theoretical lens. As social representations are derived from group members’ understanding and the circulation of that knowledge through the group, SRT allows the researcher to use the individual’s knowledge and emotion associated with climate change and the group’s social identity to consider its social representations.

The overall aim of this research is to investigate the role of social representations of climate change and adaptation and social identity in relation to a TSSO developing local community projects that promote effective adaptive actions.

This single-case study of a TSSO focused on the NBR Board of the UNESCO Noosa Biosphere Reserve, an affiliate of a global UNESCO network of over 650 Biosphere Reserves. The NBR Board views climate change and its impacts as worthy of action due to the location of the NBR within an IPCC climate-vulnerable hot-spot.

The thesis begins with a review of relevant research on climate change and adaptation, referred to as expert knowledge or reified knowledge in SRT. This reified knowledge is used as a foundation from which to compare the NBR Board’s shared understanding of climate change and adaptation that forms its lay knowledge. Using the single-case study, data was collected through semi-structured interviews, which included free association tasks of 23 NBR Board members. The NBR Board’s social representations of climate change, its social identity with sustainability and the Board’s climate change and sustainability projects were analysed to explore the group’s
cognitive, affective and behavioural components to consider gaps that may impede local adaptive actions.

The findings reveal that NBR Board participants as a group held social representations of climate change, underpinned by concepts of sustainability, that focused on climate change causality and impacts. These social representations also demonstrated a limited awareness of specific adaptive actions to address local consequences of climate change thus affecting direct efforts towards community projects that do not advance intended adaptation.

This study recommends measures to close identified knowledge gaps to advance community advocacy of climate change impacts and adaptation. This can be achieved by providing targeted communication and information on adaptation couched within a sustainability context, experiential opportunities to heighten personal connections to local climatic impacts, and behavioural change strategies that encourage or reinforce adaptive actions. Understanding the role of social representations in advancing adaptive actions is an important but limited area of research. It could, however, prove valuable to TSSOs, local governments and community organisers. This study is consistent with social representations theory and research into climate change engagement that emphasise the role of behaviour in promoting adaptive action.

This thesis makes three scholarly contributions to knowledge:

1. The study extends SRT to explore the SRT and social identity in relation to climate change of a globally-affiliated TSSO operating in a particularly vulnerable ecosystem.

2. The study expands the range of methods of analysis applied to SRT by adding analysis of the free association techniques of knowledge associations and emotions associations to reveal initial impressions to the thematic analysis of the semi-structured interview data, which reveals more conscious thoughts. This combination of methods of analysis provides a new approach to revealing social representations of climate change and adaptation.

3. The study’s analyses of SRs of climate change and adaptation, social identity and social action yields proposals to improve adaptive actions through consideration of this TSSO’s cognition, affect (emotion) and behaviour (action) in relation to climate change and adaptation. This will assist community organisers and other decision makers to identify how communication can be more effective and offer ways to improve practice.

Therefore, this study’s comprehensive analysis of multiple components of the NBR Board’s understandings of and actions on climate change and adaptation present a new approach to advancing efforts by civil society to address climate change and its impacts.
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### Acronyms

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<th>Description</th>
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<tbody>
<tr>
<td>BR</td>
<td>Biosphere Reserve</td>
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<tr>
<td>GHG</td>
<td>Greenhouse gases</td>
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<tr>
<td>IPCC</td>
<td>Intergovernmental Panel on Climate Change</td>
</tr>
<tr>
<td>IPT</td>
<td>Identity Process Theory</td>
</tr>
<tr>
<td>MAB</td>
<td>Man and the Biosphere Program (UNESCO)</td>
</tr>
<tr>
<td>NBR</td>
<td>Noosa Biosphere Reserve</td>
</tr>
<tr>
<td>NBR Board</td>
<td>Noosa Biosphere Reserve Board of Directors</td>
</tr>
<tr>
<td>SCC</td>
<td>Sunshine Coast Council</td>
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<tr>
<td>SR</td>
<td>Social representation</td>
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<tr>
<td>SRT</td>
<td>Social Representations Theory</td>
</tr>
<tr>
<td>TSSO</td>
<td>Third-sector sustainability organisation</td>
</tr>
<tr>
<td>UNESCO</td>
<td>United Nations Educational, Scientific and Cultural Organisation</td>
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<tr>
<td>UNFCCC</td>
<td>United Nations Framework Convention on Climate Change</td>
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Glossary

**Adaptation** (IPCC, 2014a, Annex II, p. 1758): “the process of adjustment to actual or expected climate and its effects. In human systems, adaptation seeks to moderate or avoid harm or exploit beneficial opportunities. In some natural systems, human intervention may facilitate adjustment to expected climate and its effects.”

**Climate change** (IPCC, 2007a, p. 879): “any change in climate over time, whether due to natural variability or as a result of human activity.”

**Climate system** (IPCC, 2007a, p. 879): “the dynamics and interactions of five major components: atmosphere, hydrosphere, cryosphere, land surface, and biosphere” that are driven by “both internal and external forcing, such as volcanic eruptions, solar variations, or human-induced modifications to the planetary radiative balance, for instance via anthropogenic emissions of greenhouse gases and/or land-use changes.”

**Climate threshold** (IPCC, 2007a, p. 890): “the point at which external forcing of the climate system, such as the increasing atmospheric concentration of greenhouse gases, triggers a significant climatic or environmental event which is considered unalterable, or recoverable only on very long time-scales, such as widespread bleaching of corals or a collapse of oceanic circulation systems.”

**Committed warming** (IPCC, 2007a, p. 892): “includes other future changes; for example in the hydrological cycle, in extreme weather events, and in sea-level rise”.

**Consensual universe** (Moscovici, 1961): a lay group or by the lay public where lay knowledge is derived; this knowledge may develop where the reified knowledge of experts is not known to the lay public or might be outside the group’s particular scope of understanding; the social object or scientific phenomenon is discussed and debated by uninitiated members of a social group to make sense of reified information, which then may emerge as a social representation.

**Greenhouse gases** (IPCC, 2014a, Annex II, p. 1766): “greenhouse gases are those gaseous constituents of the atmosphere, both natural and anthropogenic, that absorb and emit radiation at specific wavelengths within the spectrum of terrestrial radiation emitted by the Earth’s surface, the atmosphere itself, and clouds. This property causes the greenhouse effect”. Water vapour (H₂O), carbon dioxide (CO₂), nitrous oxide (N₂O), and methane (CH₄), are the primary greenhouse gases in the Earth’s atmosphere. In addition, a number of human-made greenhouse gases, such as the halocarbons, contribute to climate change.
Beside CO₂, N₂O, and CH₄, the UNFCCC’s Kyoto Protocol monitors the greenhouse gases sulphur hexafluoride (SF₆), hydrofluorocarbons (HFCs), and perfluorocarbons (PFCs).

**Impacts (consequences, outcomes)** (IPCC, 2014a, Annex II, p. 1767): “effects on natural and human systems...the term ‘impacts’ is used primarily to refer to the effects on natural and human systems of extreme weather and climate events and of climate change. Impacts generally refer to effects on lives, livelihoods, health, ecosystems, economies, societies, cultures, services, and infrastructure due to the interaction of climate changes or hazardous climate events occurring within a specific time period and the vulnerability of an exposed society or system. Impacts are also referred to as consequences and outcomes. The impacts of climate change on geophysical systems, including floods, droughts, and sea level rise, are a subset of impacts called physical impacts”.

**Intended nationally-determined contributions** (Paris Agreement, 2016): a UNFCCC Paris Agreement party or signatory nation’s commitment to reduce greenhouse gas emissions

**Maladaptive actions (maladaptation)** (IPCC, 2014a, Annex II, p. 1769): actions that may lead to increased risk of adverse climate-related outcomes, increased vulnerability to climate change, or diminished welfare, now or in the future.

**Mitigation (of climate change)** (IPCC, 2014a, Annex II, p. 1769): a human intervention to reduce the sources or enhance the sinks of greenhouse gases.

**Reified universe** (Moscovici, 1961): a group where knowledge is derived from scientific research that is conducted by members who acknowledge and operate within a fixed set of scientific rules and procedures. The reified knowledge from this group emerges from their findings and can be analysed, challenged or discussed among their peers.

**Sustainability** (IPCC, 2014a, Annex II, p. 1774): “a dynamic process that guarantees the persistence of natural and human systems in an equitable manner”.

**Sustainable development** (IPCC, 2014a, Annex II, p. 1774): “development that meets the needs of the present without compromising the ability of future generations to meet their own needs”.
Chapter One. Introduction

1.1 Introduction

Evidence of climate change is compelling (e.g., Australian Academy of Science, 2012; IPCC, 2007e, 2013; National Academy of Sciences, 2001). Leading scientific institutions, including the Joint Academies of the major developed countries, the G8 + 5, and major scientific organizations, have issued statements noting that evidence of anthropogenic climate change is strong (e.g., American Meteorological Society, 2003; Australian Academy of Science, 2012). The Intergovernmental Panel on Climate Change (IPCC) (2014a) advises that climate change will have increasing economic, social and environmental impacts in decades to come. Limiting these consequences requires reducing greenhouse gas concentrations from human endeavours (IPCC, 2014b). The complexity and dynamism of climate change makes it a global ‘super-wicked problem’ (Lazarus, 2009), posing social policy dilemmas resistant to resolution (Rittel & Webber, 1973). Climate change continues as a global challenge with limited adaptive actions, partly arising from an incomplete understanding by the public of climate change and its unpredictable cascading impacts (e.g., Leviston, Price, Malkin, & McCrea, 2014), and the uncertainty within the science community of future impacts (e.g., IPCC, 2014a), which tends to be emphasised through the media.

Global leaders acknowledge the scientific consensus around climate change and support actions to reduce greenhouse gas emissions and concentrations through an internationally concerted effort. The United Nations Framework Convention on Climate Change (UNFCCC) (1992), signed by 197 parties, is the first climate change treaty and delegates meet annually at the Conference of the Parties (COP) to negotiate international policy to address the causes and consequences of climate change. In 2015, it was this body that developed the COP21 Paris Agreement, a unanimously agreed international treaty to replace the COP3 Kyoto Protocol (Kyoto Protocol to the UNFCCC, 1998). While this treaty entered into force in November, 2016 (UNFCCC, 2016), its outcomes will not be known for years to come, reducing the likelihood of prompt mitigation (Stafford Smith, Horrocks, Harvey, & Hamilton, 2011). Without immediate curbs on increasing global greenhouse gas concentrations, prospects diminish for holding a global temperature rise to below 2°C from pre-industrial levels, which the IPCC identifies as dangerous climate change (Stafford Smith et al., 2011).

The lack of comprehensive responses to the causes and consequences of climate change remains a global challenge. While in the 21st century climate change is well documented, research initially focused more on its causality. This resulted in global efforts to increasingly gain consensus on mitigation policies to reduce greenhouse gas concentrations.
Consequently, a growing understanding emerged that adaptive actions would also be needed to limit the inevitable consequences of climate change. Initially, adaptation efforts concentrated on biophysical impacts, with more recent foci on how vulnerable communities are responding and their capacity to adapt (IPCC, 2014a; Sunshine Coast Regional Council, 2010). Socio-economic impacts are now considered of equal importance (IPCC, 2014a).

Advanced through global efforts, mitigation policies from the international level (Kyoto Protocol to the UNFCCC, 1998; UNFCCC, 1992, 2015) to local governments are underway (e.g., Sunshine Coast Regional Council, 2010). Local communities, if provided with usable knowledge of climate change and adaptive solutions, can play a key role in addressing the risks from locally-observed impacts. Increasingly, there is recognition that studies focused on a locale can provide a unique perspective on the barriers and opportunities facing an area and on adaptation measures targeting vulnerabilities of specific communities (Asia Development Bank, 2005; IPCC, 2014a). As a result, this thesis contributes to this identified need through case-study analysis of a small community within an area of high biodiversity that is vulnerable to climate change.

Local third sector organisations (i.e. non-governmental organisations) and their existing networks are well placed to assist their communities. Those working on sustainability and environmental issues, for example, can promote adaptive action to climate change (Kent, 2012). In the past two decades, the increase in third sector sustainability organisations (TSSOs) in Australia and abroad have contributed to building community support for sustainable approaches to local problems (Davidson & Lyth, 2012; Kent, 2012; Lyth et al., 2016). TSSOs, as valuable local social resources, provide a key outlet for advancing climate adaptation because they influence societal norms and community decision-makers (Kent, 2012; Lyth et al., 2016). As climate change and associated impacts escalate, so does the need for individual and collective adaptive action. TSSOs are well suited to provide leadership to motivate the wider community and to model appropriate behaviour through individual and group actions (Kent, 2012; Lyth et al., 2016).

The behaviour of TSSO members is influenced by individual and group beliefs, values and practices (Moscovici, 1961). This thesis employs social representations theory (SRT), from the discipline of social psychology, to identify the beliefs, values and practices for such a group’s actions. Because TSSOs have an opportunity to engage the community, provide leadership and model behaviour, SRT provides a means to examine a social group’s thinking and communication around the dynamic and relatively new and threatening phenomenon of climate change. To construct climate change and adaptation responses effectively at the
local level requires, in part, an understanding of how TSSOs, as organisations already committed to social-environmental change, understand climate change and act to address its local impacts in their community.

Case studies are a legitimate way to investigate the understanding of a specific group with regard to a social phenomenon (Yin, 2009). A case study approach was used to investigate this issue in-depth. Based in South East Queensland, Australia, the TSSO selected was the United Nations Educational, Scientific and Cultural Organization (UNESCO) Noosa Biosphere Reserve (NBR) Board of Directors (hereafter referred to as the NBR Board or the Board). The Board’s mandate calls for development and implementation of sustainability and climate change projects across the NBR. This TSSO plays a prominent role within the Noosa community and their views often have an echo effect across the NBR, as its members are perceived as community opinion leaders on sustainability. Furthermore, since Biosphere Reserves are intended to be ‘platforms for mutual and collective learning’ and transfer of knowledge on environmental problems and solutions, the selection of a Biosphere Reserve as the location for studying a TSSO provides a forum for worldwide consideration of the outcomes. Because this TSSO is known for working to sustain an internationally-recognised diverse ecosystem vulnerable to climate change impacts, its selection as a case study exploring how this group makes sense of climate change and adaptation was a worthy choice.

1.2 Rationale for the study

1.2.1 Progress in the physical science of climate change

Climate change research initially focused on the science of global warming, the anthropogenic contribution and responses to atmospheric greenhouse gas concentrations, and the biophysical impacts of warming and climatic change (IPCC, 1990, 1995). Research into socio-economic impacts and climate change adaptation has become increasingly more prevalent over the past two decades (e.g., Wolf & Moser, 2011). In recent years, governments and scientific institutions in Australia (see BOM/CSIRO, 2012; BOM/CSIRO, 2016; QCCCE, 2007, 2008) and abroad (World Resources Institute, 2016) have dedicated funding and resources for adaptation research. Yet, efforts are slow. In 2013, USD136 billion in global funding for climate change from public sources supported mitigation programs over adaptation measures by a ratio greater than 4-to-1 (World Resources Institute, 2016). In the United States, 15 of 50 states have finalised state adaptation plans (Georgetown Climate Center, 2016). Australia’s Commonwealth Scientific and Industrial Research Organisation (CSIRO) has created a research stream dedicated exclusively to climate adaptation with the
intention of studying both the biophysical and socioeconomic impacts and policy options to address them (BOM/CSIRO, 2012, 2016). The Australian Department of Climate Change commissioned its first assessment report on the risks of climate change to Australia’s coastline in 2009 (Department of Climate Change, 2009). In 2007, the Queensland Government’s Climate Change Centre of Excellence (QCCCE) was the first state body in Australia to develop a compendium of key climate impacts and a five-year action plan to address its adaptation needs (QCCCE, 2007).

1.2.2 The importance of social science to address climate change
Research into the public's understanding and perceptions of climate change is now an important area for consideration by governments and institutions alike. In 2009, the American Psychological Association appointed a national task force to study people’s thinking on global climate change. Its report concludes that most Americans believe that climate change is an important issue but do not view it as an immediate threat and that the key psychological barriers to action were uncertainty, mistrust, denial, undervaluing risks, lack of control and habit (American Psychological Association, 2009). In 2011, CSIRO conducted a comprehensive review of Australians’ views on climate change, including their belief in its anthropogenic causes, their support for policy responses, and whether Australians’ views had changed since the 2008 Garnaut climate change review (Leviston, Leitch, Greenhill, Leonard, & Walker, 2011). The CSIRO report found that while most Australians believe that climate change is happening and that Australia should act, belief in its anthropogenic causes has waned since the 2008 Garnaut review. While most Australians believe that the government should act without waiting for a global consensus, there was no clear consensus on preferred policy actions. Social science researchers and social institutions (American Psychological Association, 2009; Leviston et al., 2011; Wolf & Moser, 2011) note that studying how societal segments and individual belief systems frame climate change is valuable in aiding decision-makers and interested parties as they develop effective social climate adaptation. Studies into the public’s thinking on global climate change strongly indicate that research into the public’s attitudes and values is crucial in providing insight into how a community can effect change (Leviston et al., 2011).

The public concern for climate change, after years of decline, is again on the rise (Leviston et al., 2014). Promoting effective long-term action to address climate change requires understanding and support from the public in addition to expert knowledge from the scientific community – both natural and social scientists. In Australia and elsewhere, numerous studies have focused on attitudes, perceptions and social representations of
climate change (e.g., Leiserowitz, Maibach, & Roser-Renouf, 2009; Leviston et al., 2011; Lorenzoni & Pidgeon, 2006; Moloney et al., 2014). Additionally, studies into the communication of climate change knowledge to the public (e.g., Moser, 2010) have found that communicators face challenges due to the invisibility of causes (i.e. greenhouse gases), geographically distant impacts (i.e. melting glaciers) and the complexity and uncertainty around the science. The difficulty for the lay public to understand fully the causes and impacts lies partly in the conceptual nature of the phenomenon. O’Neill and Hulme (2009) concluded, in research on public perceptions among British citizens, that engagement providing individuals an opportunity to consider climate change through personal values and experiences could bridge the gap between the conceptual and real.

A comprehensive review of qualitative and quantitative research into individuals’ perceptions of and attitudes towards climate change based on a variety of theories highlighted the variation and sometimes direct contradiction in findings (Wolf & Moser, 2011). The review’s conclusion calls for the need for further refinement in the knowledge of public understanding and engagement and emphasizes that no one theory can comprehensively cover the causes, variation in human experience, impacts and required actions needed to address climate change (Wolf & Moser, 2011). This thesis complements other sociological and psychological studies in this field by applying a social-psychological lens to focus in-depth on a context-specific, climate-vulnerable, coastal community.

While an active international climate change debate continues, citizens’ views differ just as their governments’ responses vary in scope and scale. Surveys and opinion polls from countries across the globe indicate that there is, at best, confusion about key aspects of climate change (e.g., Wolf & Moser, 2011). In Australia, polls show, that while Australians believe that climate change is important and corrective actions should be taken, there is no clear consensus about the best policy approaches (Leviston et al., 2011). Consistent with the pro-environmental change literature (e.g., Kollmuss & Agyeman, 2002; Rabinovich, Morton, & Duke, 2011), it can be assumed that knowledge of the biophysical climate change impacts alone is not sufficient to encourage adaptive action.

While knowledge is an important component, other factors also play a role in willingness to address the problem through policies and actions that require financial and institutional change, and individual behavioural and social change (Adger, Huq, Brown, Conway, & Hulme, 2009; Leiserowitz & Feinberg, 2007). A better understanding of the array of values and ideas about climate change across groups and among nations continues to be of importance as the international community seeks a workable, long-term solution to
addressing both greenhouse gas concentrations and climate change impacts concurrently. Knowledge of a community’s attitudes regarding the nature of climate change, the need for adaptive actions, and the urgency of the threat from its impacts are important in understanding what motivates an adaptive response or new policy initiatives. Much of the climate change research has explored the ability to act through technological, financial and institutional frameworks (IPCC, 2007c, 2014b) and many governments have enacted policy to address these areas (Australian Government, 2012; Sunshine Coast Regional Council, 2010). Moreover, actions on policies are inextricably linked to public perceptions of climate change.

In the socio-economic realm a growing focus is on understanding what motivates and promotes behaviour change and action to mitigate anthropogenic components of climate change (Moser, 2010). Less emphasis is given to understanding how society and sectors of it interpret and respond to the local consequences of climate change, and the subjective barriers and inertia that impede effective adaptive responses (Moser, 2010; Wolf & Moser, 2011). Until global mitigation efforts to stabilise greenhouse gas concentrations are fully met, the need for adaptive actions will continue to grow in significance (IPCC, 2014a). This research into one TSSO’s social representations of values, practices and actions surrounding climate change adaptation is valuable because of the dynamic and complex nature of the phenomenon, which requires directed actions across society to address its causality and effects.

1.2.3 Social representations theory
This study uses social representations theory (SRT) to investigate how a TSSO group and its members construct meaning around climate change. SRT resides within the realm of social psychology, defined as the “attempt to understand how the thought, feeling and behavior of individuals are influenced by the actual, imagined or implied presence of others” (Augoustinos et al., 2006, p. 5) (Section 3.2). Applying the theoretical lens of SRT (Sections 3.3-3.5) adds a different perspective to studies by focusing on the ideas and values generated and transformed by and within a TSSO. Social representations (SRs) are distinctive as they are generated from the collective understanding within a group, filtered through each person’s perspective about a scientific phenomenon at a particular time. SRs derive from the lay thinking, or ‘consensual’ knowledge, and communication of values, ideas and practices within a group, and assist in understanding how a community of non-experts orients to a relatively new body of scientific knowledge. Hence, SRs serve an important role in revealing the complex and dynamic phenomenon associated with challenging and
multifaceted concepts such as climate change. SRs can also provide insight to the group’s inertia or reactions to a phenomenon by helping to explain the “collective elaboration of a social object by the community for the purpose of behaving and communicating” (Moscovici, 1973, p. X).

SRT provides an analytic framework for determining how TSSO members particularly focused on sustainability advocacy and understand climate change, including its causality, consequences, and the need for adaptation. Research from a range of fields from biotechnology (Bauer, 2002; Bauer & Gaskell, 1999) to HIV/AIDS (Goodwin, Kozlova, Kwiatkowska, & Luu, 2003) has applied this theory to explain how the public makes sense of new or unfamiliar scientific concepts (Section 3.3). Hence, SRT provides an innovative way to understand lay thinking around climate change in a particularly active and, potentially, influential social grouping at the local scale.

One way for people to find inspiration and motivation to address climate change is through their personal and social identities with the phenomenon (Breakwell, 1993). Group membership can provide a shared social identity among individuals if they participate in activities with likeminded people who reinforce concepts or ideas with which they personally identify (Breakwell, 1993; Moscovici & Hewstone, 1983). The NBR Board’s mandate is to promote sustainability and educate the community about climate change. Understanding how a TSSO holds a shared social identity related to sustainability and/or climate change will contribute to understanding the nature of its social representations and motivating factors for its social actions.

Knowledge of and emotional attachment with climate change and its impacts are an important component in overcoming a lack of meaningful action on adaptation (Leiserowitz & Feinberg, 2007). Limited or different understandings of climate change science and implications contribute to lack of consensus on collective actions and indifference by individuals. The scientific community’s reified or expert knowledge of climate change and adaptation often differs from other groups in Australian society because it is frequently more exposed to and receptive to the work of the IPCC and peer-reviewed literature. The public’s lay knowledge of climate change impacts is less focused on expert knowledge and is filtered through the media, which presents the phenomenon in an alternative manner, often with a focus on uncertainty. Emotionally connecting to local impacts is a key element for adaptation (Leiserowitz & Feinberg, 2007). For large segments of a community to connect emotionally with climate change requires new and innovative measures enacted on a broad scale (Adger, Huq, et al., 2009). This study considers, at its conclusion, how the NBR Board’s
understandings of climate change and adaptation hinders or proves useful in influencing community-centred adaptation actions to address local impacts.

1.2.4 Research gaps
This thesis addresses the research gap in understanding how individuals working through a TSSO can better engage with their community about climate change adaptation. Currently, the lack of research examining the social representations of climate change and adaptation in an Australian TSSO or within a UNESCO-designated Biosphere Reserve, is filled by this study. The growing need for local knowledge of climate change and effective adaptive actions requires more than technological innovation or government regulation. Bottom-up social innovation, generated by civil society (i.e. individual citizens, community groups), complements ongoing actions from government and industry and could yield benefits to individuals and their communities (Bergman, Markusson, Connor, Middlemiss, & Ricci, 2010). Community-wide adaptation approaches are increasingly becoming the preferred scale for implementing adaptive actions (Buggy & McNamara, 2015). These often non-technical innovative efforts, including behavioural and lifestyle changes, undertaken by less powerful actors, serve a function, as follows.

TSSOs often rely on social norms (Davidson & Lyth, 2012) to enhance local sustainability approaches in their communities; those that focus on climate change action draw members who are highly motivated and publicly engaged (Kent, 2012). TSSOs facilitate social change by augmenting social connectivity, mobilising participatory citizenship, and contributing to social learning (Lyth et al., 2016). They contribute significantly to building community resilience and well-being by advancing change for sustainability across socio-economic and environmental dimensions (Kent, 2012; Lyth et al., 2016). TSSOs can enhance community awareness into alternative pathways to adaptive action and promote education for climate change adaptation (Kent, 2012). By initiating climate action projects, they provide alternative participative decision-making processes outside of government efforts that allow community members to engage with creative ideas (Davidson & Lyth, 2012). They are in a position where they can challenge unsustainable economic policies promoted by other private or public sector entities (Kent, 2012). More research into bottom-up approaches to climate change by community-level innovators is needed (Bergman et al., 2010) as contributions of TSSOs are not fully understood (Lyth et al., 2016) and community action for sustainability is an important but often neglected area for innovative activities (Seyfanga & Smith, 2007).
While existing research into perceptions and attitudes of climate change has increased in scope, questions about how the public and segments of society view this phenomenon remain. Current research often is survey-based or geographically and temporally specific. Discrepancies in results exist, even among studies conducted in the same country over similar timeframes. Often these studies have focused on the individual’s insights, understanding and awareness of climate change.

Little is known about TSSOs with regard to group members’ identity with sustainability, their understanding about climate change and their local adaptation efforts, and their motivation for promoting adaptive actions and policies in their communities. Understanding how a community advocacy group understands and communicates knowledge of climate change, and how that knowledge affects its social actions will assist policy-makers and other decision-makers in framing climate change messages about the phenomenon’s immediacy and magnitude and its place in comparison with other pressing socio-economic issues. Additional information into, if, and how easily a TSSO transfers its sustainability values into climate change actions can assist other TSSOs as they work to address climate change.

This research uses the case study of the NBR Board to consider how the Board’s understandings of climate change and adaptation hinders or proves useful in focusing community-centred adaptation actions to address local impacts. Additionally, as one of 661 UNESCO Biosphere Reserves globally (UNESCO, 2015), outcomes of this research can be shared with like-minded sustainability advocacy groups working under the auspices of the United Nations. The thesis data were analysed using a sequential qualitative-qualitative research design (Chapter Four), initially structured to consider research questions around the NBR Board’s social representations of climate change and adaptation (Section 3.3 and 3.4 and Chapters Five, Six and Seven). During the analysis process, additional insights into this TSSO’s social identity emerged and two additional research questions were subsequently analysed and discussed in later chapters (Chapters Eight and Nine). These two research questions explored social identity using SRT (Moscovici, 1961) and identity process theory (Breakwell, 1986) (Section 3.5 and Chapter Eight), and social actions around climate change and adaptation using concepts of cognition, affect and behaviour (e.g., Leviston et al., 2011; Leviston et al., 2014; Lorenzoni, Nicholson-Cole, & Whitmarsh, 2007; Pew Research Center for the People & the Press, 2009) (Section 3.6 and Chapter Nine).

In summary, the NBR Board was selected as a case study because of its key objectives of promoting sustainability and climate change education in its community. Unlike other social theories, SRT explores how a group’s collective understanding and communication of lay
knowledge forms through its shared values, ideas and practices. This approach provides a different socio-psychological perspective towards understanding how the public understands climate change and the risks from its impacts. The comparison of lay thinking or consensual knowledge to ‘reified’ knowledge (i.e. understanding derived from experts, in this case those in the scientific community) (Section 3.4) adds an additional dimension not yet considered in Australia or globally. To date, no comprehensive studies have examined the social representations of climate change or adaptation in an Australian TSSO or within a UNESCO-designated Biosphere Reserve. This study fills a gap in that body of knowledge.

1.2.5 Research aims and research questions
The overall aim of this research is to investigate the role of social representations of climate change and adaptation and social identity in relation to a TSSO developing local community projects that promote effective adaptive actions. Insights into the motivation of a group’s members can be gathered from understanding the social identity of the group as well its accomplishments in instances where the members initiate and implement the projects and activities. Therefore, the four research questions cover particular aspects of SRs, identity and actions, are posed to explore these elements. As the research is not designed as a longitudinal study, the research does not aim to look at how its SRs may change over time.

This study employs a sequential qualitative-qualitative mixed method design (Morse, 2010) (Section 4.6.1), which initially sought to address the following research questions in relation to members of a TSSO within the climate change context:

1. What is the nature, if any, of social representations around climate change within this group of NBR Board participants?

2. What is the nature, if any, of social representations around climate change adaptation within this group of NBR Board participants?

Following the sequential research design framework (Morse, 2010) (Section 4.6.1), additional questions emerged from an analysis of the data in relation to the first two questions. Thus, the subsequent two research questions identify the group’s motivations and ways in which they can be harnessed to improve action:

3. What is the nature, if any, of a social identity within this group of NBR Board participants?

4. What is the relationship among social representations, social identity and social actions of the NBR Board regarding climate change and adaptation, and what are the implications for TSSOs in general?
1.2.6 Research methods overview

The overarching methodological approach was a single-case study to collect data using the methods of semi-structured interviews, including free association questions regarding knowledge and emotions related to climate change. The data were collected from interviews with 23 participants drawn from the 65 directors of the 2012-2013 NBR Board. A multi-stage recruitment sequence provided a rich source of responses from 23 participants representing the NBR Board’s six sector boards. Additionally, NBR Board documents were reviewed to consider the NBR Board’s structure and collective engagement activities and used in the analysis of a social identity (Chapter Eight).

The recorded and transcribed interviews were analysed using a multi-tiered thematic framework to reveal the group’s social identity and social representations of climate change. The interview data were further analysed to reveal free associations of words and emotions relating to climate change to provide initial perceptions and emotional connection with climate change.

1.3 The significance of the study

This research adds significantly to the body of knowledge through the extension of SRT to explore a globally-affiliated TSSO operating in a particularly vulnerable ecosystem. It expands methods of analysis around SRT. Further it provides the basis for improving climate change adaptation practice, not just within the NBR but among other TSSOs.

While this research uses only one case study, the findings have implications for TSSOs worldwide by providing researchers with a tested theoretical application of SRT in a local advocacy group context. The research contributes to the application of theory by demonstrating the effectiveness of SRT to reveal the lay knowledge of climate change in a TSSO for the first time. In particular, considering these NBR Board participants’ personal identities with sustainability prior to joining their advocacy group and their shared social identity with sustainability as TSSO members has broadened the application of SRT.

The research adds to the range of methods of analysis applicable to SRT, which is often analysed using survey data or media documents. This study, applying thematic analysis and free association techniques to analyse the data generated from semi-structured interviews, provided a comprehensive picture of how the TSSO’s advocates understood climate change and its linkages with the group’s identity with sustainability. Specifically, the combination of the free association technique of knowledge and emotions associations to reveal initial impressions, coupled with other aspects of the semi-structured interviews to reveal more
conscious thinking, provided a new approach to revealing social representations of climate change and adaptation.

The first method, the free association task, was used to reveal first impressions of knowledge and emotions associated with climate change. This method disclosed dialogical antinomies or oppositional dyads and afforded a means to underpin and consider the group’s latent views of climate change. The second method, thematic analysis, explored more deeply the social representation of climate change and proved useful in revealing a linkage between sustainability and climate change. Finally, thematic analysis was applied to reveal the personal and shared social identity with sustainability and provided the context to understand the impetus for participation in the NBR Board. It is conceivable that this linkage would be found in other TSSOs in various forms.

This single-case study design provides practical implications for community organisers, policy-makers and other decision-makers, an outcome that will improve practice, which can be applied broadly to TSSOs in communities across the globe. The UNESCO Man and the Biosphere Programme alone has over 550 formal governing bodies worldwide. Each is charged with promoting sustainability and educating the public about climate change and adaptive actions to address its consequences. Sharing this knowledge across advocacy groups is important to the international goal of creating long-term sustainable adaptation. Governments alone cannot achieve the level of adaptive actions required to meet the challenges presented by 21st century climate change. Individual and collective efforts across all segments of society (civil, private, and government) are necessary.

1.4 Structure of the thesis
This thesis contains ten chapters. The first four chapters (Chapters One through Four) present: the thesis focus; the literature review of the subject, namely climate change and adaptation; the theoretical literature review; and methodology and methods and processes. The subsequent five chapters (Chapters Five through Nine) present the findings and analysis to answer the four research questions. Chapter Ten, the final chapter, summarises and synthesises the thesis. This section highlights the linkages among the key elements of the study across each chapter.

*Chapter One, Introduction,* framed the study and presented the focus, rationale, research aims, research questions, and significance and contribution of knowledge.

*Chapter Two, Climate change policy, and physical and social sciences: a literature review* consolidates scientific literature about climate change policy, science and adaptation to
provide the reified or expert knowledge to compare with the case study participants’ lay thinking. Further, it reviews the social science literature about the public’s perceptions, attitudes and understanding of climate change and adaptation and what might be expected to be lay knowledge. It explains how this lay knowledge is influenced by the media. From examining prior use of social representations theory, I identify a gap in application of SRT to a TSSO group and its thinking about climate change and adaptation, and a gap in our understanding of how groups perceive and take action on climate change. This is further investigated in Chapter Three.

Chapter Three, Theoretical perspective, uses SRT as the theoretical lens through which this study is conducted. The chapter begins by placing SRT within the field of social psychology, which deals with the interaction of the individual within a social environment (Section 3.2). The definitions, principles and concepts of social representations (SRs) are detailed, explaining how SRs are distinct from other cognitive process such as attitudes, perceptions or values (Sections 3.3 and 3.4). SRT is relied on to answer the first two research questions regarding social representations (Chapters Five, Six and Seven). This chapter then draws on identity process theory to review the role of identity and how individual members’ identities contribute to social identity of a group (Section 3.5). This is used to address research question three, the social identity of the Noosa Biosphere Reserve Board (Chapter Eight). Cognition, affect and behaviour as elements of social action is introduced in Section 3.6 to answer research question four, the relationship among SRs, social identity and social actions of the NBR Board regarding climate change and adaptation. The literature review of the theoretical perspectives used in this thesis concludes with Sections 3.7 and 3.8, which discuss research methods appropriate to SRT and the theoretical limitations.

Chapter Four, Methodology and methods, provides justification for the single-case study design and the data collection methods of semi-structured interviews, which include free associations of knowledge and emotions of climate change. The chapter discloses my personal connection to the study, the participants’ selection process and the design of the interview topic guide. The chapter then outlines the method of thematic analysis undertaken to explore the participants’ social identity and social representations of climate change and adaptation and cognitive, affective and behavioural elements of social action on climate change.

Chapters Five, Six and Seven, exploring the first and second research questions, examine whether social representations of climate change and adaptation exist in this TSSO case study. Chapter Five, Free associations with climate change, analyses the knowledge and
emotion associations connected to climate change providing valuable original insights into an individual’s unfiltered thoughts, which may be derived from exposure to expert knowledge and media. These unconscious understandings of knowledge of and emotions towards climate change are one component of a group’s lay thinking about this relatively new scientific phenomenon. Comparing the lay knowledge of the participants with the expert knowledge of the IPCC, can indicate areas where more usable information could enhance support for social action, especially if promoted through a respected local TSSO. Therefore, understanding the individual members’ knowledge and emotions connected to climate change builds a profile of the group’s lay knowledge in comparison with expert knowledge. This analysis contributes to the SRs of climate change considered in Chapter Six.

To answer research question one, *Chapter Six, Social representations about climate change*, presents the findings and discussion around this group’s social representations about climate change (adaptation is dealt with in Chapter Seven). This chapter considers the existence, composition and mode of communication of social representations about climate change circulating within the cohort of NBR Board participants and builds upon the findings in Chapter Five, which provided the analysis of first impression of the participants around their knowledge and emotions connected with climate change. Chapter Six expands SRT theory through the analysis of themata (i.e. latent themes) around construction and communication of climate change SRs (Section 3.4). The chapter reveals hegemonic, emancipated and polemic representations (see Section 3.4.4.1): hegemonic representations that are consensual within the group; the emancipated representations that provide specialised expert knowledge, and polemic representations that pose direct challenges to hegemonic representations. Further, this chapter examines the communication processes of anchoring (i.e. making the unfamiliar concepts familiar) and objectification (i.e. making an abstract idea into a more tangible or concrete idea) (see Section 3.4.4.2). The discussion considers the construction and cohesiveness of the climate change social representations and the mode of communication. This chapter concludes with a discussion of the consensual or lay knowledge in relation to the reified knowledge of climate change.

To answer research question two, *Chapter Seven, Social representations about adaptation*, presents the findings and discussion around the NBR Board’s social representations of adaptation. By applying the principles and concepts of SRT (Section 3.4-3.7), the individual understandings of adaptation collectively reveal the NBR Board’s social representations (Section 3.4). The discussion examines the group’s lay thinking across themes of responsibility for adaptive action, proactive adaptation and sustainable adaptation. The
consensual or lay knowledge, while not yet cohesive, revealed areas of overlay with the reified knowledge of experts in adaptation science (Section 2.4), summarised in Table 7.3. Chapter Eight, Social identity, addresses research question three by considering if the NBR Board participants held a social identity. This research question emerged from the data and analysis in Chapters Six and Seven, which found linkages between climate change and sustainability, and adaptation and sustainability, respectively. Thus, at this point, the thesis evolved into a sequential qualitative-qualitative mixed methods design (Morse, 2010) by adding two new research questions (answered in Chapters Eight and Nine). This chapter focuses on the group’s social identity, this is how participants identify with the group (Section 3.5). The chapter analyses both the participants’ individual identities and the group’s collective social identity with sustainability, illustrating that their values and actions reflect their views on sustainability. To triangulate the data, this chapter includes a review of the NBR Board report presenting the 2012-2013 Board engagement projects and activities, to consider how the group’s social identity influenced its selection of Board activities.

Chapter Nine, Social representations, social identity and social action, addresses research question four to reveal the relationship among social representations, social identity and social actions of the NBR Board to address climate change and promote adaptation, and, further, to consider the implications for other TSSOs. The findings, set within the context of the literature: social representations (Moscovici, 1961), social identity (Breakwell, 1983) and the cognitive, affective and behavioural elements of social action (Lorenzoni et al., 2007), explores the relationships among social representations around climate change and adaptation, social identity grounded in sustainability, and the NBR Board’s current social actions on climate change to consider how to enhance social action on climate change of this TSSO. Therefore, this exploration determines if the NBR Board’s responsive actions to local climate change impacts are consistent with peer-reviewed, scientific interpretations (e.g. IPCC) of effective adaptation.

Chapter Ten, Conclusion, closes the thesis by: summarising the study; presenting the research outcomes that answer the four research questions; discussing the study’s limitations and recommending further research to address them; and detailing the contribution to knowledge from this research.
Chapter Two. Climate change policy, and physical and social sciences: a literature review

2.1 Structure and rationale
This chapter focuses exclusively on the literature relating to climate change and adaptation, presenting knowledge from the scientific community and policy-making bodies, with the literature pertaining to this study's theoretical perspective in the following chapter. While Chapter Three details social representation theory (SRT) and its application in answering the first two research questions on climate change and adaptation social representations, respectively, the purpose of this extensive review of climate change policy and science, and adaptation science is to explore the best available science, that is the reified or expert knowledge, across these themes to compare with the NBR Board's lay understanding (Chapters Five, Six and Seven).

The structure of this chapter includes international policy-making and Australian policies that fulfil its treaty commitments are explored in Section 2.2. Climate change science, its causality and consequences, and areas of scientific uncertainty are the focus of Section 2.3. Section 2.4 explores adaptation, including its definition, typology and trends. Further, this section clarifies the relationship between adaptation and sustainability, which is important to this study, given that this TSSO focuses on sustainability while it is expected to address climate adaptation. Section 2.5 draws on the social science literature about how the public understands climate change and adaptation. Section 2.6 discusses the synergistic effects of the media on the public's understanding of climate change. This chapter describes both reified knowledge and potential lay knowledge which forms the basis for exploring understandings of climate change and adaptation of the NBR Board participants. It identifies a research gap that this study addresses through theoretical frameworks presented in Chapter Three.

2.2 Climate change policy
This section discusses the current international and Australian policy development and debates surrounding climate change causality, consequences and responses. The NBR Board participants are exposed to these policies to some extent. Therefore, this policy review provides the reified knowledge of the policy-makers as a foundation for comparing participants' lay knowledge about climate change policy.

2.2.1 Policy progress in international climate change frameworks
The climate change challenge remains, despite more than twenty-five years of international scientific assessments, debate and policy-making, and the COP21 Paris Agreement (UNFCCC,
2015), which entered into force in November, 2016 (UNFCCC, 2016). The science-oriented Intergovernmental Panel on Climate Change (IPCC) and the policy-focused UNFCCC are the key international institutions that interact and deliberate on climate change (Table 2.1). No central authority exists with the power to mandate actions, yet the timeframe is limited to prevent dangerous climate change, which would yield irreversible ecological impacts affecting livelihood and lives worldwide (IPCC, 2014a). Developed countries are primarily responsible for its cause (UNFCCC, 1992, 2012). All countries continuing the practices contributing to climate change have failed to implement collectively policy changes at a scale required to halt or reverse the upward trend in global warming and other consequential climatic impacts (IPCC, 2014c; UNFCCC, 2012).

The 197 signatories to the UNFCCC (2015) joined in an effort to seek solutions to the super-wicked dilemma of climate change. The COP21 Paris Agreement (UNFCCC, 2015) to limit greenhouse gas concentrations, for the first time requires all signatory nations to commit to 2030 target for its greenhouse gas emissions. The Agreement provides optimism that near universal participation will yield effective collective global action (UNFCCC, 2016). Australia signed and ratified the Paris Agreement, pledging to reduce its national greenhouse gas emissions by 26 percent to 28 per cent from 2005 levels by 2030 (UNFCCC, 2015).

The IPCC supports the UNFCCC’s policy-making endeavours by providing consensus, scientific, synthesised knowledge clustered around science; impacts, vulnerability and adaptation; and mitigation. The IPCC’s main purpose is to assist governments with national policy on climate change and disseminates its work to governments and the public alike. While the IPCC is comprised of thousands of scientists and its assessment reports focus heavily on peer-reviewed literature, the final arbiters of the omnibus assessment process are the signatory nations of the IPCC (Grundmann, 2007).

Table 2.1. IPCC and UNFCCC milestones 1988-2016 (adapted from IPCC, 1990, 2016; UNFCCC, 2016)

<table>
<thead>
<tr>
<th>Year</th>
<th>IPCC milestones</th>
<th>UNFCCC milestones</th>
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<tbody>
<tr>
<td>1988</td>
<td>IPCC, an international working group of experts tasked with reviewing and synthesising peer-reviewed research on climate change, established by UN Environment Programme and the World Meteorological Organisation.</td>
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<tr>
<td>1990</td>
<td>First Assessment Report: “...emissions resulting from human activities are substantially increasing the atmospheric concentrations of greenhouse gases” (IPCC, 1990, p. xi). IPCC calls for a global climate change treaty.</td>
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<tr>
<td>1992</td>
<td>United Nations General Assembly adopts the UNFCCC.</td>
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<tr>
<td>Year</td>
<td>Event</td>
<td>Summary</td>
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<td>------</td>
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</tr>
<tr>
<td>1994</td>
<td>UNFCCC enters into force with 197 signatories or parties. Parties agree to annual Conference of the Parties (COP) meetings to negotiate multilateral responses to climate change.</td>
<td></td>
</tr>
<tr>
<td>1995</td>
<td>Second Assessment Report: Synthesis Report plus working group reports on science; impacts, adaptations and mitigation; and socio-economics.</td>
<td>COP1: Berlin Mandate establishes a process to negotiate strengthened commitments for developed countries, laying groundwork for the Kyoto Protocol.</td>
</tr>
<tr>
<td>1997</td>
<td></td>
<td>COP3: Kyoto Protocol establishes the world’s first greenhouse gas emissions reduction treaty.</td>
</tr>
<tr>
<td>2007</td>
<td>Fourth Assessment Report: Synthesis Report plus working group reports on science; impacts, adaptation and vulnerability; and mitigation.</td>
<td>COP13: Bali Road Map charts a new negotiating process to address climate change for post-Kyoto era.</td>
</tr>
<tr>
<td>2009</td>
<td></td>
<td>COP15: Copenhagen Accord secures developed countries’ pledges of USD 30 billion in fast-start finance.</td>
</tr>
<tr>
<td>2011</td>
<td>Special Reports on Renewable Energy Sources and Mitigation (SRREN) and Risks of Extreme Events and Disasters to Advance Adaptation (SREX).</td>
<td></td>
</tr>
<tr>
<td>2012</td>
<td></td>
<td>COP18: Doha Agreement establishes the 2nd commitment period (2013-2020) for the Kyoto Protocol and works to create new treaty by 2015.</td>
</tr>
<tr>
<td>2013-2014</td>
<td>Fifth Assessment Report: Synthesis Report plus working group reports on science; impacts, adaptation and vulnerability; and mitigation.</td>
<td></td>
</tr>
<tr>
<td>2015</td>
<td></td>
<td>COP21: Paris Agreement creates new climate change treaty to replace the Kyoto Protocol. Australia signs the treaty.</td>
</tr>
<tr>
<td>2016</td>
<td></td>
<td>COP22: Marrakech Climate Change Conference meets to advance the Paris Agreement, which went into effect in November, 2016.</td>
</tr>
</tbody>
</table>

The salience of anthropogenic climate change as a global social problem rose during the 1980s as governments and scientific collaboration identified the physical changes in the world’s climate system. NASA scientist James Hansen’s testimony before the United States Congress raised climate change science to the attention of global policy-makers and the public; the United Kingdom’s Prime Minister Margaret Thatcher’s was critical in urging creation of the IPCC (Moser, 2010). By 1990, the IPCC released its First Assessment Report highlighting the first global scientific consensus as to the anthropogenic causes of climate change and consequences on the climate system (IPCC, 1990). Upon release of the Report, the IPCC called for a global climate change treaty, galvanizing international policy-makers and heightening public awareness.
In 1992, the UNFCCC, an operational but non-binding treaty, acknowledged the IPCC's consensus that 21st century climate change exists as a result from human activities outside the natural variability of the climate system. It also emphasised that its impacts on human and natural systems would escalate, if left unchecked. The UNFCCC's main objective cites the stabilisation of greenhouse gas concentrations at a level that would prevent 'dangerous climate change': holding to 2°C global long-term temperature averages from pre-industrial levels (IPCC, 2007a). While nations voluntarily committed to reduce emissions from 1990 levels (UNFCCC, 1992); this goal was not accomplished.

In 1997, the Kyoto Protocol to the UNFCCC, a binding sub-treaty to increase collective efforts to reduce atmospheric carbon concentrations, was successfully negotiated (Kyoto Protocol to the UNFCCC, 1998). The Protocol, while retaining the Convention's objectives of preventing dangerous climate change, espouses the principle of common but differentiated responsibilities by placing the primary obligation for greenhouse gas emissions reductions on developed countries, based on the premise that they were historically responsible for anthropogenic emission increases (Kyoto Protocol to the UNFCCC, 1998). The Protocol entered into force in 2005 and expired at the end of 2012, with 192 countries as parties to the treaty (UNFCCC, 2012).

The effectiveness of the COP3 Kyoto Protocol is debatable. Some analysts observed the treaty's limitations and modest success. Of concern were the binding commitments to reduce greenhouse gas emissions placed solely on the developed countries ratifying the treaty. Collectively the industrialized nations committed to reducing emissions by four per cent from the baseline year of 1990 during the first commitment period of 2008-2012 (Gupta et al., 2007). Additional concerns with the treaty focused on a key source of emissions, fossil fuel use. Global fuel consumption had increased in the decade between the treaty's negotiation and the target-reduction period, with the International Energy Agency (2014) noting that the corresponding energy-related carbon dioxide emissions increased 24 per cent during that time. The World Bank's World Development Report (World Development Report, 2010) noted, regarding developing countries, the Protocol provided limited financial support to assist with emissions reduction and concluded that, to be more effective, a treaty required additional mitigation and adaptation measures and more countries undertaking binding commitments.

The COP3 Kyoto Protocol, acknowledged for having made a significant contribution to providing a framework to address climate change over the long-term, was viewed only as an initial step (Gupta et al., 2007). The treaty's achievements include the establishment of an
international emissions trading scheme, the impetus for an array of national mitigation policies, and the formation of the Clean Development Mechanism, a market-based mitigation technology-transfer structure to assist the developing world (Gupta et al., 2007). Since 2007, UNFCCC annual negotiations attempted to build upon the UNFCCC achievements, culminating in a new climate treaty in 2015, the COP21 Paris Agreement (UNFCCC, 2015).

The Paris Agreement brings renewed commitments and a sense of optimism to the international efforts to mitigate greenhouse emissions and advance adaptation. The unanimously passed agreement embeds the goal of holding global warming to 2°C compared to pre-industrial levels; calls for zero net anthropogenic greenhouse gas emissions to be reached during the second half of the 21st century; and aims to pursue efforts to further limit the temperature increase to 1.5°C (UNFCCC, 2015). Yet, concerns with the COP21 Paris Agreement remain, including political and constitutional problems in the United States Congress regarding support and financing. In addition, countries, including Australia, are concerned that new international obligations that could constrain economic growth (De Boer, 2015). In addition, the upcoming Trump administration could bring a withdrawal of the United States from the Paris Agreement or the underlying UNFCCC (The Guardian, 2016).

While the goal is worthy, the effectiveness of the UNFCCC process after the COP21 Paris Agreement is debatable. Concerns remain as to the commitment of developed nations, such as Australia and the United States, to meet their noteworthy pledges and the capability of many lesser developed countries to meet theirs. The challenge for the Australian and American governments is to accept the international agreement and convert its intentions into effective domestic policy, thus supporting the UNFCCC’s global leadership (Carter & Ross, 2016).

Former NASA scientist James Hansen remains sceptical that the recent agreement will effectively reduce emissions: “There is no action, just promises. As long as fossil fuels appear to be the cheapest fuels out there, they will be continued to be burned” (Milman, 2015a, para 2). United States Secretary of State John Kerry acknowledged the lack of a mandatory scheme or compliance enforcement mechanisms, but argued that national reduction plans will provide transparency. The agreement sends “a very clear signal to the marketplace of the world that people are moving into low-carbon, no-carbon, alternative renewable energy...create millions of jobs, enormous new investment in R&D, and that R&D is going to produce the solutions, not government” (Milman, 2015b, para 4).
2.2.2 Australian climate policy

Climate policy development in Australia has lagged behind many other industrialised nations. For long-term solutions to wicked problems such as climate change, consistency and stability in policy over time is most effective (Talberg, Hui, & Loynes, 2016), as it builds credibility with citizens and reassures investors (Jotzo, 2015). Australia’s commitment to addressing climate change over the past three decades is seen as inconsistent and wavering (Talberg et al., 2016). Australia’s climate policy is driven by domestic politics, which also involves institutional, economic and cultural components (Table 2.2). Australia’s political situation remains precarious, with six national-level governments in the past decade. As Australia is a coal-based economy, shifting the status quo from fossil fuels to other energy sources remains challenging. Both Labor and Liberal Governments have at various times advanced or regressed on climate change policy. For example, the 1998 Liberal Government established the world’s first government agency dedicated to reducing greenhouse gas emissions and six years later a Liberal Government dismantled it (Talberg et al., 2016).

Australia has participated in the climate change science and policy negotiations at the international level since 1988. However, its domestic climate policy efforts often fell short of its international commitments. While Australia signed the Kyoto Protocol, it did not ratify it until 2007. Since that time, numerous governments have offered their version of climate policy. Where the Rudd government attempts failed to secure passage of comprehensive mitigation policy, in 2011, the succeeding Gillard-led government, joined by independents and the Greens, successfully secured passage of a suite of bills including an emissions trading scheme, which collectively would significantly reduce Australia’s share of greenhouse gas emissions in the coming decades (Australian Government, 2012). This legislative victory came after a lengthy and contentious debate played out in the media and community fora across the country.
Table 2.2 Key Australian climate change policy milestones 1988-2016 (adapted from Australian Government (2012); Talberg et al. (2016); Workman and Talberg (2016))

<table>
<thead>
<tr>
<th>Year</th>
<th>Australian climate policy milestones</th>
</tr>
</thead>
<tbody>
<tr>
<td>1988</td>
<td>Australia becomes signatory to the IPCC.</td>
</tr>
<tr>
<td>1990</td>
<td>Australia supports IPCC First Assessment Report findings and calls for a global climate change treaty.</td>
</tr>
<tr>
<td>1992</td>
<td>Australia signs on as party to UNFCCC.</td>
</tr>
<tr>
<td>1997</td>
<td>Australia negotiates as a party to COP3 and signs the Kyoto Protocol, accepting a binding target to reduce national greenhouse gas emissions to 108% of 1990 levels by 2012.</td>
</tr>
<tr>
<td>2007</td>
<td>Australian Labor MP Kevin Rudd becomes Prime Minister of Australia. Prime Minister Rudd attended the COP13 meeting in Bali and ratifies the Kyoto Protocol for Australia. The Rudd Government develops an Australian climate change mitigation policy with an emissions trading scheme.</td>
</tr>
<tr>
<td>2008</td>
<td>Economist Ross Garnaut issues the Climate Change Economic Review (Garnaut, 2008) outlining the costs of climate change action and inaction to Australia. The Rudd Government climate change legislation is defeated in Parliament.</td>
</tr>
</tbody>
</table>
| 2011 | Australian Labor MP Julia Gillard becomes Prime Minister. Economist Ross Garnaut issues a second report, the Garnaut Climate Change Review (Garnaut, 2011) updating the costs of climate change action and inaction to Australia. The Gillard Government secures passage of a suite of 17 legislative policies to address climate change including:  
  - A carbon pricing/emissions trading scheme to establish an Australian emissions trading scheme compatible with the UNFCCC/Kyoto Protocol’s international emissions trading scheme  
  - The Renewable Energy Target (RET) requiring that 20% of Australia’s electricity supply must come from renewable sources by 2020  
  - The Australian Renewable Energy Agency (ARENA), charged with advancing renewable technologies towards commercial readiness  
  - The Clean Energy Finance Corporation (CEFC), a “green bank”, with AUD 10 billion available to finance clean energy, half of which is reserved for renewable energy  
  - The Climate Change Authority (CCA) to review and provide advice on Australia’s climate policies. |
| 2013 | Australian Liberal MP Tony Abbott runs for election on a platform to repeal climate change mitigation policies including the carbon pricing scheme, calling it a ‘carbon tax’, the RET, the CEFC and the CCA. Tony Abbott becomes Prime Minister of Australia. The Abbott Government refuses to send Australian negotiators to the UNFCCC’s COP19 in Warsaw. The Abbott Government secures passage of legislation to eliminate the Australian Climate Commission. The Climate Council, a not-for-profit entity, is established, funded by crowd-sourcing. |
| 2014 | The Australian Government’s Climate Change Authority recommends a 2020 greenhouse gas emissions reduction target of 19% from 2000 levels and a 2030 reduction target of 40-60% from 2000 levels. The Senate rejects the Abbott Government bill to abolish the CCA. The Abbott Government secures passage of legislation to repeal the carbon pricing scheme. The Abbott Government established in its stead Direct Action, a voluntary scheme to reduce carbon emissions, whereby polluters bid into an Emission Reduction Fund (AUD 2.55 billion until 2018) with the Government distributing funding to the ‘lowest cost’ method of reducing emissions. |
| 2015 | Australia negotiates as a party to COP21 and signs the UNFCCC Paris Agreement. Australia pledges to commit AUD1 billion over five years from its aid budget to assist vulnerable countries to build resilience and reduce emissions. The Australia Government releases its National Energy Productivity Plan, 2015-2030, aiming to improve energy productivity by 40% by 2030. |
| 2016 | Australia files the Australian Intended Nationally Determined Contribution (INDC) committing to a national greenhouse gas emissions reduction of 26-28% from 2005 levels by 2030. Australia ratifies Paris Agreement, November, 2016. |

*The Clean Energy Bill 2011*, which included carbon pricing, went into effect on 1 July 2012 (Australian Government, 2015a). Economic analysis by the Australian National University’s Centre for Climate Economics and Policy concluded that during the two-year period in which
Australia's carbon price had been in operation, overall emissions dropped by 8.2 per cent compared to the two-year period before the carbon price (O’Gorman & Jotzo, 2014).

Irrespective of the Labor government’s effective mitigation policy of 2011, the successive conservative Abbott-led Government reversed strides in Australia’s climate policy through passage of legislation to remove the carbon-pricing scheme, which he coined a ‘carbon tax’ (Marks, 2014). It was replaced with the voluntary Australian Emissions Reduction Fund, also known as ‘Direct Action’, an AUD 2.55 billion government-funded program (Australian Government, 2016).

Although Australia signed the COP21 Paris Agreement in 2015, the 2016 federal election, which secured a Liberal government led by Prime Minister Malcolm Turnbull, continued the limited mitigation policy of the preceding Abbott Government. The Turnbull-led Government retains the legislative push to abolish the Australian Renewable Energy Agency (ARENA), which is charged with advancing renewable technologies towards commercial readiness (Australian Renewable Energy Agency, 2015); and the Clean Energy Finance Corporation, which invests in renewable energy, energy efficiency and low-emissions technologies for a positive financial return (Clean Energy Finance Corporation, 2015). Australia’s decisions in coming months, regarding ratification of the Paris Agreement and mitigation policies to meet its pledged targets, will reveal the Turnbull government’s commitment and efficacy.

While the Turnbull Government indicates its climate treaty commitment is a significant initiative, many developing countries claim this remains a relatively modest effort (Jotzo, 2015), noting that Australia leads the developed world in per capita carbon emissions (Clarke, 2009). While many developed countries’ 2030 targets fall short of a commensurate contribution required to stabilise global temperatures to 2°C from pre-industrial levels (Suarez & Huang, 2015), Australia’s target is “relatively weak”. To achieve its target would require “significant and sustained policy effort” for “investors need to regain trust” in the government’s approach to addressing climate change (Jotzo, 2015, p. 1). Australian climate economist Ross Garnaut views the COP21 Paris Agreement’s five-yearly review process as a critical component to its success, but shared concern that a steep downward trajectory from 2025 is required (Hartcher, 2015). For Australia to meet its Paris Agreement commitment, opportunities presented by renewable energy resources and potential for biological sequestration should be undertaken (Hartcher, 2015).

Australia’s ratified Paris Agreement commitment is daunting considering that, in real terms, Australia’s emissions in 2015 rose for the first time in three years (Department of the Environment and Energy, 2015). For Australia, successful climate action requires progress
from within governments and in the private and civil sectors. One key initiative is the Breakthrough Energy Coalition, a new investment fund spearheaded by Bill Gates, who pledged AUD2 billion to invest in clean energy technology; he will join with over two dozen wealthy investors to develop zero-carbon technologies (Howard, 2015). Mission Innovation, a coalition of over 20 developed countries, including Australia, seeks to double to AUD20 billion over the next five-year research and development investments in clean energy (Clarke & Phillips, 2015). Responding to critics citing the Gates Foundation has AUD1.4 billion invested in fossil fuels, Gates replied that divesting from fossil fuels would have limited effect; however, investing in zero-carbon technologies was the key to addressing climate change. Gates claimed “…there was an urgent need for high risk investments in breakthrough technologies”, noting “a miracle on the level of the invention of the automobile was necessary to avoid a climate catastrophe” (Howard, 2015, paragraph 6). Other countries are reducing their reliance on fossil fuels; in 2015, the United Kingdom became the first major economy to set an exit date of 2025 for phasing out coal-fired power stations (Twidale, 2015).

2.2.3 Summary of climate change policy
The international policy debate primarily focuses on addressing the causality of climate change, offering policy options and pathways to implement mitigation measures across scales and sectors, and within regions, to assist signatory nations to achieve national commitments. Australia pledged to meet its international commitments by 2020, but tracking of its progress in coming months will reveal the efficacy of its programs. Some critics note that the termination of the former Labor governments’ market-based carbon scheme requiring mandatory reductions from Australia’s largest emitters will hinder Australia’s ability to meet its international obligations. With numerous governments and changes to Australian climate change policy over the past decade, it is understandable that, given the widespread media coverage of the climate science and policy debates, there is no clear consensus in Australia on how best to meet our new treaty obligations (Leviston et al., 2011; Leviston et al., 2014). An ambitious and durable strategy for addressing the causes of and impacts from climate change requires a long-term approach. Progress in climate change policy is directly linked not only to policy-makers’ understanding of climate science, but to their electors’ perceptions. As such, I next explore expert scientific knowledge of climate change, followed by climate change adaptation science knowledge.
2.3 Climate change science
Climate change research emerged from a need to understand the measurable changes in the climate system. This section discusses the complexity and contention around climate science, which yields uncertainties in some areas. Further, it addresses the connection between climate change and sustainability, which the IPCC and UNFCCC view as critical to the development of effective policy. The review is important to this study as it provides the reified knowledge of the disciplines’ experts to provide the foundation for comparing lay knowledge about advancing local adaptive actions discussed later in this study.

2.3.1 Contention over climate change science
The climate system is complex and dynamic. Climate change is defined by the IPCC (2007a, p. 879) as “any change in climate over time, whether due to natural variability or as a result of human activity”. Thus, climate science considers the natural processes such as solar cycles and activities (e.g. sun spot and solar flares), ocean currents and volcanic activities, and key human contributions, primarily from fossil fuel burning and land use (e.g. land clearing of forests) (IPCC, 2013). The effects of climate change are apparent and will escalate over time and range from socio-economic to ecological impacts. While the physical impacts are greater at the poles, incremental effects of continual temperature increases, sea-level rise and changes in precipitations patterns are coupled with increases in extreme weather events, bringing greater occurrences of flooding and storm surges (e.g., IPCC, 2014a).

Basic, applied and computational research provide important foundations for the discipline of climate change science, which is evolving rapidly. The extensive, multi-decadal research produced by the IPCC and numerous scientific institutions, such as Australia’s CSIRO, has advanced society’s knowledge of changes in the climate system and made it available for review. Since 1990, the IPCC has produced five assessment reports covering climate science, impacts, vulnerability and adaptation, and mitigation (IPCC, 1990, 1995, 2001b, 2007e, 2013).

In 1990, the First Assessment Report acknowledged anthropogenic components to climate change:

Emissions resulting from human activities are substantially increasing the atmospheric concentrations of greenhouse gases...These increases will enhance the greenhouse effect, resulting on average in additional warming of the Earth’s surface (IPCC, 1990, p. xi).
Research into greenhouse gases, their sources, and mitigation measures to stabilise or reduce atmospheric greenhouse gas concentrations is the foundation of the IPCC’s work. This knowledge critically informs governments as they struggle to implement the most cost-effective mitigation strategies to achieve near-term reduction targets.

Climate science research assessed by the IPCC has garnered widespread support from within the scientific community. For example, the joint-statement on the science of climate change, written by 17 national science academies, including the Australian Academy of Science, is one early example of the support among the science community for the IPCC’s work (Royal Society, 2001). The joint academies’ statement noted:

We recognise IPCC as the world’s most reliable source of information on climate change and its causes, and we endorse its method of achieving this consensus ("The science of climate change [editorial]," 2001, p. 1261).

Scientific research journals, statements and writings from other scientific bodies, governments and experts continue to cite its work regularly. The Fifth Assessment Report states as its key findings:

Human influence on the climate system is clear; the more we disrupt our climate, the more we risk severe, pervasive and irreversible impacts; and we have the means to limit climate change and build a more prosperous, sustainable future (IPCC, 2014c, p.2).

However, the complexity of climate system science, including greenhouse gas concentrations and attribution (i.e. whether and by how much climate change is natural or human-induced) generates debate that continues among experts, in the media and in social groups across society. From this perspective, it is expected that lay populations across society would have varying understandings of the climate system and that the vast majority of policy-makers and the public would not have a reified knowledge of climate change science. It also has implications for governments as they struggle to shift to a low-carbon economy while maintaining economic development. Confusion among groups in society about 21st century climate change and its anthropogenic causes lies partly in the complex systems-science of the climate system.

The IPCC Fourth Assessment Report (IPCC, 2007c) specifies that even with significant mitigation action to reduce greenhouse gas emissions now, the climate will continue to change due to the lock-in effect of the additional anthropogenic greenhouse gases, which will contribute additional warming for decades to come. Notwithstanding the IPCC imperative to address adaptation and mitigation concurrently (IPCC, 2001b, 2007d, 2013), in Australia, much less attention focuses on adaptation (Bonyhady, Macintosh, & McDonald, 2010). As
impacts from climate change become more widespread, this too adds weight to calls for a
greater emphasis on adaptation (Adger et al., 2007) (Section 2.4).

2.3.2 Areas of complexity where scientific uncertainty remains
One of the reasons for debate is that the multifarious and dynamic climate system presents
additional uncertainties regarding aspects of its interactions. These include the effects of
internal or external forcing on climatic variables, or the impact of climate sensitivity, the
equilibrium temperature rise that would occur in future, in response to a doubling of carbon
dioxide concentration above pre-industrial levels (IPCC, 2014c). A lesser known but critical
consideration is the long life of the greenhouse gases that are currently in the atmosphere,
described by the IPCC as the climate change commitment, due to the thermal inertia of the
globe’s oceans and other slow biosphere and cryosphere processes. Temperature changes
from this “committed warming” include “other future changes; for example in the
hydrological cycle, in extreme weather events, and in sea-level rise” (IPCC, 2007a, p. 879).
This warming commitment is analogous to a cake in an oven that continues to bake for a
time after the oven turns off. Bakers would suggest removing the cake from the oven to
prevent further baking. Currently, technology to remove greenhouse gases from the
atmosphere to prevent ‘further baking’ does not exist. It may be expected that, if this
concept were clear to all policy-makers, it would provide an added incentive to limit
additional emissions.

Additional uncertainty can also occur when research detects a climate system change
without fully understanding the reason for that change. The scientific method requires
accuracy in attribution, whereby attributing an observed system change to human activities
requires a two-stage process:

First, the observed change in the system must be demonstrated to be associated
with an observed regional climate change with a specified degree of confidence.
Second, a measurable portion of the observed regional climate change, or the
associated observed change in the system, must be attributed to anthropogenic
climate forcing with a similar degree of confidence. Confidence in such joint
attribution statements must be lower than the confidence in either of the individual
attribution steps alone due to the combination of two separate statistical
assessments (IPCC, 2007a, p. 869).

Further societal misperceptions of climate science relate to future climate projections.
Projecting future climatic conditions and change requires climate modelling of the global
climate system, a complex and dynamic field of research. Research into projecting future
climatic change uses modelling of the physical, chemical and biological properties of the
climate system components and the interactions and feedback processes (Hoffert & Flannery, 1985; IPCC, 2007d, 2014c). Climate modelling, using coupled atmosphere/ocean/sea-ice General Circulation Models (AOGCMs) that provide a comprehensive representation of the climate system, was challenging and costly when computing technological capacity was limited in the late 1980s (e.g., Hansen et al., 1988). As advancement in computing grows exponentially, more complex applications can be applied to the models. However, this improved accuracy in modelling, while aiding the scientific community in its understanding of climate change, does not necessarily make it easier for the lay public to understand or accept climate science.

The simulation of the climate is a valuable research tool for climate scientists, yet it is not without its challenges and critics. Advances have been made in climate projections and modelling results can now be compared with observational climate patterns to test the accuracy of the models (IPCC, 2000, 2007d, 2014c). The purpose of climate projections, developed with climate models, is to calculate the response of the climate system to greenhouse-gas concentrations and radiative-forcing scenarios (IPCC, 2000, 2007d), which yield debate on the incorporated assumptions. Thus, projecting future climates through climate-change scenarios, plausible yet often simplified representations of the future climate (IPCC, 2000, 2007d), continues to be a focus of concern and, in some segments of the media and public, outright derision (Moser, 2010; Oreskes & Conway, 2010).

Climate projections using modelling of complex ocean-atmospheric systems present challenges and areas of uncertainty. Yet early support for the IPCC’s work is found in an editorial in *Science* magazine, which, while acknowledging the difficulties, expresses its support of the IPCC process:

> There will always be some uncertainty surrounding the prediction of changes in such a complex system as the world’s climate. Nevertheless, we support the IPCC’s conclusion that it is at least 90% certain that temperatures will continue to rise, with average global surface temperature projected to increase by between 1.4°C and 5.8°C above 1990 levels by 2100 (“The science of climate change [editorial],” 2001, p. 1261).

Notwithstanding the overwhelming support within the scientific community, the uncertainties in climate projections, coupled with the ‘black box’ nature of climate modelling, continue to be a focus of climate scepticism (Oreskes & Conway, 2010) and adds to the confusion of the lay public (Moser, 2010).
2.3.3 Summary of the reified knowledge of climate change science

This section identified a disjunct between the scientific consensus and policy uptake of action on climate change. The IPCC and Australia’s climate science contributions reached consensus that 21st century climate change, while taking into account the natural variability of the climate system, can be attributed to human intervention. This reified knowledge from the scientific community is summarised in Table 2.3.

Table 2.3 Reified knowledge of climate change causality and mitigation (adapted from IPCC, 2007e; 2014b; 2014c; UNFCCC, 1992)

<table>
<thead>
<tr>
<th>Reified knowledge of climate change causality</th>
</tr>
</thead>
<tbody>
<tr>
<td>The scientific consensus is that climate change is real, causing global temperature increases, impacting rainfall patterns and raising sea-levels. The uncertainty resides primarily in the future rate and speed of future temperature rises and projected levels of greenhouse gas (GHG) concentrations.</td>
</tr>
<tr>
<td>Supporting evidence is:</td>
</tr>
<tr>
<td>• Increase in mean average temperature over a long-period of time, often measured in timeframes of at least thirty years. Data shows a continual upward trend in global average temperatures, with an increase of 0.75°C since pre-industrial levels</td>
</tr>
<tr>
<td>• GHGs in the atmosphere occur from natural processes and anthropogenic activities. The anthropogenic activities, primarily from the burning of fossil fuels and land-clearing for agricultural and forestry purposes, add human-induced GHGs to the natural GHGs in the atmosphere, increasing the concentration levels over time; these concentration increases correlate with temperature increases</td>
</tr>
<tr>
<td>• GHGs remain in the atmosphere from decades to thousands of years. The long lifespan creates a “lock-in” effect for GHGs already in the atmosphere</td>
</tr>
<tr>
<td>• Temperature is also a factor of the radiative forcing effects, called climate sensitivity, which can be positive (i.e. causing more warming) or negative (i.e. causing cooling).</td>
</tr>
<tr>
<td>• Global efforts are required to stabilise greenhouse gas concentrations at a level to keep global temperature increases to less than a 2°C, only additional increase from pre-industrial levels of 1.25°C</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Reified knowledge of climate mitigation to address causality</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mitigation to reduce greenhouse gas concentrations must develop as adaptation advances to address existing and project climate change impacts. Mitigation efforts can store greenhouse gases or prevent the release of greenhouse gases.</td>
</tr>
<tr>
<td>Mitigation actions can increase storage of greenhouse gases already emitted into the atmosphere (i.e. create carbon sinks) through:</td>
</tr>
<tr>
<td>• Oceans, which mitigate atmospheric greenhouse gas because they are the largest carbon sinks. The ramifications from storing carbon include ocean temperature rises and acidification, having negative impacts on marine life. Once the oceans are saturated the additional carbon will remain in the atmosphere increasing the surface air temperature.</td>
</tr>
<tr>
<td>• Forests and soils, which primarily hold carbon dioxide, methane and nitrous oxide, all regulated under the UNFCCC (1992).</td>
</tr>
<tr>
<td>Mitigation actions can prevent greenhouse gas emissions: Every economic sector emits a mix of greenhouse gases from human activities and each has a myriad of options available to reduce these emissions by eliminating the activities or switching the processes used to conduct the activity.</td>
</tr>
<tr>
<td>Mitigation policies and actions are promoted through governments from the international to the local level, including actions that encourage individuals, the private sector and civil society.</td>
</tr>
<tr>
<td>International efforts have provided funding and technical support and guidance, including structuring three market-based mechanisms to assist treaty-signatories: 1. an international emissions trading scheme, 2. the clean development mechanism, and 3. joint implementation program. The latter two mechanisms promote technology transfer of zero- or low-carbon technologies.</td>
</tr>
</tbody>
</table>
2.4 Climate change adaptation

This section reviews adaptation science and the relationship between sustainability and adaptation, important for effective responses to climatic impacts. In spite of the extensive and growing body of research in this discipline, for the purposes of this study, I limited discussion of the reified knowledge of adaptation to elements with which a TSSO, such as the NBR Board, might be familiar. These topics address adaptation definitions, typology and linkages to sustainability, rather than an extensive focus on adaptive capacity, resilience and transformative adaptation.

The term adaptation as it relates to climate change is evolving in the reified universe of science and academe, and involves a multi-faceted and dynamic process of practice and implementation. While the UNFCCC does not define adaptation (UNFCCC, 1992), definitions and practices continue to evolve across research from adapting to impacts to society-wide “climate-proofing” adaptation strategies (Schipper, 2007; Van Buuren, Vliet, & Termeer, 2015). Differing definitions of adaptation exist; the term encompasses the following concepts:

- IPCC: “the adjustment of natural or human systems in response to actual or expected climatic stimuli or their effects, which moderates harm or exploits beneficial opportunities” (IPCC, 2007a, p.869)

- Council of Australian Governments: “a process by which strategies to moderate, cope with, and take advantage of the consequences of climatic events are enhanced, developed and implemented [including] strategies to increase the resilience of systems, such as reducing pollution and pests for natural ecosystems” (Council of Australian Governments, 2007, p. 20)

- The Stern Economic Review on Climate Change: "crucial to deal with the unavoidable impacts of climate change to which the world is already committed" (Stern, 2006, p. 404).

Importantly, the IPCC definition of climate change includes both natural variability and anthropogenic causes, appropriate for its mission of explaining the science behind the changes in the climate system (IPCC, 2013). Additionally, the IPCC process dedicates an entire working group to synthesising and assessing adaptation research (IPCC, 2014a, 2014c). Yet, adaptation is not a panacea for climate change: “Even with an appropriate policy framework, adaptation will be constrained both by uncertainty and technical limits to adaptation” (Stern, 2006, p. 413).
2.4.1 The case for expanding adaptation efforts

Adaptation and mitigation are now required to effectively address climate change across its causality and consequences. While mitigation is crucial towards stabilising greenhouse gas concentrations at a level to prevent dangerous climate change (Adger et al., 2007), it does not resolve the impacts Australia is facing now and in the future. Climate change impacts range from specific local impacts to exacerbating large-scale societal problems (Burton, 2009). Effective adaptation requires local sustainable adaptive actions, contextualised to various temporal and spatial scales (Burton, 2009; Thomsen, Smith, & Keys, 2013). Early efforts in adaptation aimed to reduce the negative effects, or in some cases, to exploit the positive aspects. Societal impacts from climate change include exacerbating existing challenges such as poverty-alleviation, water and energy scarcity and supply and food security. While many socio-economic impacts reside outside of Australia, they affect citizens through governmental policies at home, as well as regional and global relationships. Therefore, adaptation has emerged as an important partner with mitigation (Burton, 2009; Pielke Jr., Prins, Rayner, & Sarewitz, 2007; Schipper, 2007).

As acknowledgement of climate change’s inevitability and irreversibility grows, adaptation is coming into clearer focus by governments and society (IPCC, 2014a; O’Brien & Selboe, 2015). Additional adaptive approaches from all societal sectors are necessary as impacts become more apparent (Giddens, 2009; Hulme, 2009). The need for a range of adaptation options and strategy will increase for a number of reasons including:

1. Limited international mitigative efforts to date now means future mitigation action to decarbonize the global economy will be decades away, creating a “timescale mismatch” (Pielke Jr. et al., 2007, p. 597).

2. Vulnerability to climate-related impacts increases from non-climate variables such as coastal population increases coupled with economic growth (Keys, Bussey, Thomsen, Lynam, & Smith, 2014).

3. Vulnerable societies, especially in developing countries that are least responsible for climate change, will face more severe climatic impacts as they become increasingly ill-equipped to adapt by themselves, thus requiring greater assistance from the international community (Adger et al., 2009; Ayer, Huq, Wright, Faisal, & Hussain, 2014; Burton, 2009).

While there are costs associated with adaptation, benefits for climate change and co-benefits to society and its ecosystems can yield immediate effects that provide some relief (Bonyhady, Macintosh, & McDonald, 2010; Thomsen et al., 2013). Global-scale, multi-sectoral cost-benefit assessments are limited, but numerous studies indicate adaptation actions are advantageous to communities (Adger et al., 2007). Economic costs are
associated with planning and implementation of adaptation measures, but the benefits of such efforts can be considerable: from the avoided damage costs to immediate reductions in outlays that accrue additional savings over time (Burton, 2009; O’Brien & Selboe, 2015; Thomsen et al., 2013). Conversely, in the longer term, a failure to adapt presents clear disadvantages: potential loss of development of coastal lands, extended droughts, and the potential liability claims against governments for a failure to act on climate change (Bonyhady et al., 2010).

2.4.2 Adaptation or maladaptation

To better understand adaptation, it is helpful to understand what does not qualify as effective adaptation. The literature discusses maladaptation or manipulation, measures disguised as adaptation yet ineffective or harmful overall (K. Brown, 2011; Burton, 1997; Scheraga & Grambsch, 1998; Smit, 1993; Thomsen et al., 2013). Maladaptation as it relates to climate change was first defined in the 1990s but definitions and foci varied (Burton, 1997; Scheraga & Grambsch, 1998; Smit, 1993). Maladaptive measures, by one definition, are those that increased vulnerability (Burton (1997). Others described it in relation to negative impacts that were as great as or greater than the avoided impacts from the adaptation (Scheraga & Grambsch, 1998). A broader context for maladaptation defined it as an unsuccessful adaptation action (Adger, Arnell, and Tompkins (2005). While strong identity with place can be an important contributing factor to adaptive communal actions, place identity can promote maladaptation if people perceive themselves to be unable to change or are unwilling to accept change (Quinn, Lorenzoni, & Adger, 2015).

Maladaptation is clarified through a typology of five categories (Barnett and O’Neill, 2010), which finds an adaptation to be maladaptive if it:

- reduces incentive increases emissions of greenhouse gases
- burdens disproportionately the most vulnerable
- produces high opportunities costs
- reduces incentives to adapt, or
- creates path dependencies.

More recently, researchers have considered an important distinction between adaptation and manipulation as it relates to internal or external adaptive actions. Adaptations make internal adjustments, whereas a manipulation focuses on external modifications to human systems at varying scales from individual to societal:
Adaptation and its relationship to concepts of resilience, vulnerability and sustainability illustrate that in many cases societies actually manipulate their social-ecological contexts rather than adapt to them (Thomsen et al., 2013).

An Australian example of manipulation that is maladaptive, which is relevant to this study, arose along Noosa’s main tourist beach. Noosa, known for its pristine surfing beaches, is a community that promotes sustainability through its Noosa Biosphere Reserve status, and its civic organisations and governance structures. Despite the key importance of Noosa’s natural beauty to its economy, its local government was not immune to unsustainable maladaptive decision-making regarding its prime tourist draw, its north-facing beachfront. Initial adaptation actions to the changing shoreline of Noosa’s Main Beach, which were sustainable even as the shoreline migrated over time, provided for businesses to operate movable beach kiosks (Thomsen et al., 2013). Decades of pressure for development of its prime hospitality centre, Hastings Street, saw these mobile venues morph into more substantial static structures causing beach erosion problems. The costly and ongoing manipulation measure in place requires continual beach replenishment. As maladaptive and manipulative measures replace adaptation options, path dependencies make it difficult to reverse (A. Smith & Stirling, A., 2010). Ultimately, true adaptation measures offer far greater opportunities for communities and their ecosystems to build adaptive capacity over the long term (O’Brien & Selboe, 2015; Pelling, 2011; Thomsen et al., 2013).

Research regarding the public’s lay knowledge about climate change impacts and adaptation, and therefore maladaptation, is limited. As knowledge is a key component to cultivating sustainable actions, understanding knowledge about best practices is necessary before it can be converted into action (Cash et al., 2003). Two-way communication through participatory processes that provide “usable knowledge” is also important (Lemos and Morehouse (2005). For adaptation, usable knowledge would be tailored to fit stakeholders’ needs and uses and be accessible to those users. Knowledge from the reified and lay universes (see Glossary) can assist a community in adjusting to climate impacts by actual re-shaping of groups’ perceptions and behaviours. The value of providing collaboratively created, experiential information on climate change and local impacts knowledge can offer legitimate and credible data to policy and decision-makers (Lemos & Morehouse, 2005).

2.4.3 Evolution of adaptation concepts
Understanding the technological procedures, legislative measures, regulatory practices and norms and behaviours to develop and promote an adaptation strategy is a complex and time consuming endeavour (Adger et al., 2005; IPCC, 2007b). Because climate change is a super-
wicked problem (Lazarus, 2009), it requires a multifaceted approach to addressing its impacts, going beyond technical fixes and encompassing measures linked to individuals’ belief systems and societal issues of power and politics (Levin, Cashore, Bernstein, & Auld, 2012). Adaptation to climate change, therefore, requires personal, societal and political transformations (O’Brien & Selboe, 2015). Additionally, multi-tiered governance responses can include small-scale community projects, to sectoral regulation and compliance, and national policy and planning of short- and mid-term policy-making (Asia Development Bank, 2005; Schipper, 2007). This section describes types of adaptation, adaptive capacity and scale.

Adaptation to climate change is moving beyond awareness of the need to adapt, towards design and implementation of actual adaptive strategies (IPCC, 2014a). This transitional phase brings new opportunities in climate adaptation research, a growing and evolving discipline encompassing a range of adaptation approaches requiring specialised knowledge. Various types of adaptation appearing in the literature range from spontaneous processes to proactive long-term planning (Table 2.4).

As the climate of an area changes, autonomous adaptation may occur in some aspects of the ecosystem, but more rapid change will curb the ability of a natural system to adjust spontaneously (Burton, 2009). As climate-related risks increase, the potential for more severe impacts exists, particularly for people in the least developed countries (Adger, Huq, et al., 2009; Burton, 2004; IPCC, 2014a; Schipper, 2007; UNFCCC, 2015). Given the increased risks, some proactive approaches to adaptation are occurring.

Two types of proactive adjustments are anticipatory and planned adaptation. Anticipatory adaptation considers adaptive actions prior to climate impacts occurring across scales from the individual to the community (Burton, 2009; Serrao-Neumann, Harman, & Choy, 2013), whereas planned adaptation encompasses a deliberate process to develop policies and actions in a concerted manner, aware that climatic impacts are forthcoming (Burton, 2009; Ranger & Garbett-Shiels, 2012; Schipper, 2007). The IPCC (2014a) documents numerous developed and developing country efforts to build adaptation into the planning process. For example, Bangladesh (Ayer, Huq, Wright, Faisal, & Hussain, 2014) and the Philippines (Ranger & Garbett-Shiels, 2012) have incorporated planned adaptation measures as a means of blocking future impacts that may prove irreversible if left unchecked or found to be prohibitively expensive or difficult to rectify later. The challenge of effective proactive adaptation is to identify, at the outset, the distinctive specific uncertainties and robust broad-reaching adaptation, while avoiding inflexible decisions that could lock-in future
climate risk or foreclose adaptation options (Ayer et al., 2014; Ranger & Garbett-Shiels, 2012; Serrao-Neumann et al., 2013). This is particularly important for actions of least-developed countries, especially where social and economic infrastructure is limited (Ayer et al., 2014; Ranger & Garbett-Shiels, 2012).

Planned adaptation, incorporating adaptive measures in development processes, is underway in Australia, the United States and Europe. Adaptive planning focusing on decision-making founded on experience applies the concept of learning from past events (Kay & Alder, 1999) and enhances the planning process by providing a responsive mechanism to ongoing management practices (McLain & Lee, 1996). Numerous international entities, including the UNFCCC, the United Nations Development Programme and the Global Environmental Facility support a proactive approach to “mainstream” adaptation by considering climate change impacts across social, institutional and infrastructural development planning (Huq, Rahman, Konate, Sokona, & Reid H., 2003; Lim et al., 2005; UNFCCC, 2001). In Australia, planned adaptation is becoming more prevalent. Federal and state governments are funding initiatives and analytical processes to assist local councils in developing local-scale adaptation initiatives to embed in their planning efforts (Serrao-Neumann et al., 2013), including assistance to local governments in South East Queensland and the Sunshine Coast (Keys et al., 2014; Sunshine Coast Council, 2010). In the late 20th century, coastal local governments began to focus their attention on impact-driven adaptation strategies in response to coastal erosion and sea-level rise. Proactive planning preparing for sea-level rise impacts, is required as “sea-level rise will generally exacerbate existing problems, such planning could have immediate benefits” (Nicholls, Hoozemans, and Marchand (1999).

Table 2.4 Type, temporal dimension and adaptation description (adapted from Burton, 2009)

<table>
<thead>
<tr>
<th>Type of adaptation</th>
<th>Temporal dimension</th>
<th>Description of adaptation</th>
</tr>
</thead>
</table>
| Autonomous adaptation | Spontaneous | Lacks a conscious response to climatic stimuli:  
  • Can occur in natural systems through ecological change  
  • Can occur in human systems through socio-economic changes |
| Anticipatory adaptation | Proactive | Occurs prior to observed climate impacts and can occur at any scale, from the individual to societal |
| Planned adaptation | Proactive | Advances policy-making resulting from conscious decision-making to address climatic conditions and inspires adaptive action from an awareness of changing climatic conditions |
Adaptation research has moved beyond the narrower focus of impact-specific adaptations to considering the capacity of systems to adapt and through societal responses focused on vulnerability, resilience and sustainability. Adaptive capacity refers to the ability of a system to address climate variability and change successfully (2007b) and is a latent property that can be activated by individuals or collectively as a response to a crisis or opportunity (Engle, 2011). The capacity of systems to adapt is context specific and depends primarily on its social, political and institutional culture (Keys, Bussey, Thomsen, Lynam, & Smith, 2014).

As adaptive capacity is location specific, adaptation assessments provide the data needed for effective targeted adaptive actions. For example, responses to the impacts from temperature increases or heat waves may differ among rural landowners and urban households. For rural Australian landowners, key elements required for adaptive change focus on revising land, water and vegetation management approaches, and enhancing individual financial capacity to implement adaptive actions (Lockwood, Raymond, Oczkowski, & Morrison, 2015). For effective household-scale adaptation, the importance of identifying governance processes and the effects of adaptive actions at the household level are important components to complement the assessment of broader government-wide risks from climate-related changes (Elrick-Barr, Preston, Thomsen, & Smith, 2014). At a regional scale, such as for South East Queensland, which encompasses the NBR, the effectiveness of an adaptation must go beyond an impact-specific focus; the planning, design and implementation of an adaptation strategy needs to take into account the region’s adaptive capacity (Keys et al., 2014).

2.4.4 Adaptation efforts in Australia

In Australia, adaptation receives limited discussion in Federal and State parliaments and sporadic reporting in the media. The focus primarily has been on national mitigation efforts and the costs and benefits associated with participating in the COP21 Paris Agreement. State planning laws on coastal climate risk are complex, inconsistencies between legislative initiatives cause confusion and delay actions, and many local governments have yet to incorporate climate risk into policy (Gurran, Norman, & Hamin, 2013; Mangoyana et al., 2012). While a range of local and regional adaptive policies and measures exist, Australian research into adaptation concludes that many adaptive actions conflict with mitigation or do not achieve the adaptation envisioned (Hamin & Gurran, 2009; Thomsen et al., 2013). For Noosa and other smaller coastal communities with a tourism- and leisure-based economy and high percentage of private assets in potentially vulnerable locations, added concerns remain over financing of adaptation, given local government resources are often highly
limited (Gurran et al., 2013; Keys et al., 2014). The cost and legalities of coastal
development, such as that found in Noosa’s canal estates and coastal villages, create
additional burdens for local governments; these increasingly considerable challenges will
require national leadership and policy (de Freitas, Smith, & Stokes, 2013).

Governance of adaptation in Australia varies across scales. While recognition of the need for
climate adaptation is growing, strategies are limited and even in coastal communities that
have developed adaptation strategies, few actions have been completed (Gurran et al.,
2013). Research, drawn from a multi-country review that included Australia, shows that
explicit adaptation planning across scales was limited and focused on a narrow range of
climatic factors with a focus on ‘low-risk capacity-building over the delivery of specific
actions’ (Preston, Westaway, & Yuen, 2011, p. 407). The review called for future approaches
to include equally important non-climate factors such as adaptive capacity and to focus more
broadly on governance (Preston et al., 2011). Enhancing adaptation frameworks and funding
sources at the international level and, in Australia, at the national, state and local level
would improve efforts to address the impacts from climate change (IPCC, 2014a). The World
Development Report (2010) questioned if the UNFCCC includes adequate provisions for
adaptation, citing that a “new body under the UNFCCC may be needed to provide guidance
to the parties, assess national adaptation strategies, and develop criteria for allocating
resources” (p. 248).

Australian adaptation strategies rely chiefly on government and institutional entities for
design and implementation. The State Governments and natural resource management
bodies lead strategy development and management of climate hazard adaptation. The
Federal Government plays a support role providing tools, policy guidance and pilot projects
administered through the CSIRO and the National Climate Change Adaptation Research
Flagship (NCCARF); limited funding and policy guidance comes from most local councils. In
the past decade, the Council of Australian Governments developed a national adaptation
policy framework that supports research and outreach through the establishment of a
national adaptation research centre, the National Climate Change Adaptation Research
Facility, to complement the work on adaptation of the CSIRO Adaptation Flagship (Council of
Australian Governments, 2007). The Federal Government supported a national coastal risk
assessment process (Department of Climate Change, 2009) and funded development of
adaptation assessment processes for landscape management (Department of Industry
Innovation Climate Change Science Research and Tertiary Education, 2013), among other
work.
In Australia, as in other countries, climate or green bonds play an innovative role in funding mitigation and adaptation measures. The Climate Bonds Initiative (2015) tracks global bond investments in climate and environmental initiatives totalling USD597.7 billion in 2015. In Australia, property developers and the banking sector fund climate bonds, currently only for mitigation initiatives. The National Australia Bank issued the first certified banking bonds for climate mitigation in 2014, totalling AUD300 million for 17 solar and wind energy farms (Moran, 2015), while ANZ Bank created AUD600 million of bonds for investments in low-carbon buildings and solar initiatives (Conroy, 2015). Globally, four percent of the climate bonds fund adaptation initiatives abroad (Climate Bonds Initiative, 2015, p. 9) indicating the potential for Australian adaptation initiative funding through climate bonds as well.

In Queensland, the State Government in 2015 committed AUD3 million over three years to draft and implement a climate adaptation strategy, to be developed in partnership with private and public sector entities at risk from climatic impacts (Department of Environment and Heritage Protection, 2016). Eighty per cent of Queenslanders live near the coast and face challenges from coastal impacts that will reshape the shoreline in future decades (Climate Council, 2014). The Queensland Government is funding coastal councils to develop hazard adaptation strategies to address risks from coastal erosion and sea-level rise through contributing coastal hazard and erosion-prone mapping data (Department of Environment and Heritage Protection, 2015). This approach aligns with research suggesting that more collaboration within and between multi-scalar governments and the private and civil sectors is necessary, specifically funding schemes and joint implementation of adaptation measures (Gurran et al., 2013; Mangoyana et al., 2012).

Local governments in Australia, including coastal councils, are beginning to develop adaptation strategies. However, many communities still do not have specific adaptation strategies set in legislation or regulations (Mangoyana et al., 2012). South East Queensland ranks as a region highly vulnerable to climate change (IPCC, 2007b, 2014a) and most of its coastal communities have detailed climate change strategies incorporating related adaptation proposals (e.g., Sunshine Coast Regional Council, 2010). Those local governments with adaptive strategies incorporated five key areas for future adaptation efforts: 1. raising awareness of council staff and the community; 2. assessing climatic risks; 3. developing adaptation plans; 4. integrating climatic projections and climate risks into planning schemes; and 5. a monitoring and evaluation process (Mangoyana et al., 2012). The Sunshine Coast Council, the local council in this study, incorporates climate change projections for 2030, 2070 and 2100 for temperature, rainfall, and sea-level rise into its
adaptation planning. For example, for planning purposes, sea-level rise projections from climate change were set at 0.2 m by 2030, 0.7 m by 2070, and 1.1 m by 2100 (Sunshine Coast Regional Council, 2010, p. 7). Less ambitious projections used for planning decisions exist for the Queensland State Government, which set a sea-level rise increase of 0.8 metres as its projection for 2100 in Queensland Coastal Planning Guidelines (Department of Environment and Resource Management, 2011), as did most Sydney coastal councils (Mangoyana et al., 2012).

2.4.5 The adaptation-sustainability nexus

Synergies exist between climate change adaptation and sustainability. Key concepts of sustainability and how UNESCO views sustainability are helpful to understanding the importance of sustainable adaptive approaches. While numerous definitions of sustainability and sustainable development exist, many include these core objectives:

- Enhancement of individual and community well-being by maintaining economic growth across generations
- Provisions for equity within and between generations, and

Sustainability is at the core of the mission of the UNESCO Man and the Biosphere Programme (MAB) and the NBR Board. The MAB embraces the definition of sustainable development as “Development that meets the needs of the present without compromising the ability of future generations to meet their own needs” (Our Common Future, Report of the World Commission on Environment and Development, 1987 UNESCO, 2005, p. 2). Further, UNESCO’s vision of development is one of integration and inclusion among social, economic and environment components:

A vision that encompasses populations, animal and plant species, ecosystems, natural resources – water, air, energy – and that integrates concerns such as the fight against poverty, gender equality, human rights, education for all, health, human security, intercultural dialogue, etc. (UNESCO, 2005, p. 2).

Sustainability is central to effective governance: sustainability addresses threats to human and natural systems and decision-makers need to know the risks and implications posed by these threats across the systems to best adjust to them (B. L. Turner, 2010, p. 572). Thirty years on from the initial sustainable development conference (World Commission on Environment and Development, 1987), some limited success in promoting sustainable
practices has galvanized through concepts built around social and environmental justice (e.g., Agyeman & Evans, 2004) and fair trade (e.g., Adams & Raisborough, 2008).

With global greenhouse gas concentrations not expected to stabilise for decades due to human activities from unsustainable human activities, primarily from fossil fuel use and land clearing practices (IPCC, 2014c), a shift to concurrent sustainable approaches to adaptation and mitigation from all levels of government is needed (IPCC, 2014a, 2014b; (e.g., IPCC, 2014c; Sunshine Coast Regional Council, 2010).. However, this requires additional knowledge on how to mainstream adaptation and its financing across policy arenas and private sector entities (Termeer et al., 2011). Climate policies are more effective when incorporated into broader development strategies (IPCC, 2007c, Section 2.1.3). Embedding sustainability into adaptation strategies necessitates comprehensive assessments of social, environmental and economic factors contributing to climatic impacts. As development can adversely affect the rate and nature of climatic changes (Asia Development Bank, 2005), identifying and evaluating key criteria of sustainable approaches to adaptation include benefits, costs, effectiveness and feasibility, and processes to eliminate maladaptive measures.

Sustainable adaptation requires a shift from the dominant defensive approach focused on building resilience to a transitional and transformative one (Pelling, 2011). Each societal sector can incorporate sustainable adaptation concepts to aid this transition (Table 2.5). Resilience-focused adaptation addresses specific local impacts, such as changing economic conditions or health threats (Berrang-Ford, Ford, & Paterson, 2011). Adaptation research is currently evolving towards systems-wide, multi-sectoral approaches across spatial and temporal scales, reflected by the IPCC (2014a), in its Fifth Assessment Report (S. Brown et al., 2014). For governments and society to embrace sustainable adaptation pathways would require societal changes resulting from a myriad of social and political actions, which most likely would challenge dominant power structures that promote unsustainable economic development (Pelling, 2011, p. 3).
### Table 2.5 Adaptation approaches by sector or function (adapted from Pelling, 2011)

<table>
<thead>
<tr>
<th>Sector/ Function</th>
<th>Defensive adaptation: Resilience</th>
<th>Sustainable adaptation: Transitional or transformative</th>
</tr>
</thead>
<tbody>
<tr>
<td>Civil society</td>
<td>Maintain status quo by focusing on individual or local actions to specific climatic impacts</td>
<td>Foster social change through multiple complementary social and cultural adaptation strategies across differing scopes and timeframes Seek opportunities for social reform through an emphasis on sustainability including addressing intra- and intergenerational inequities</td>
</tr>
<tr>
<td>Governance</td>
<td>Non-political emphasis; reactive approach; political action primarily on recovery after impacts</td>
<td>Systems-wide, longer-term approach; complementary strategies across all levels of government</td>
</tr>
<tr>
<td>Development discourse</td>
<td>Preservation of economic assets emphasising economy first approach</td>
<td>Enhance economy by fostering a balanced approach through sustainability principles, with equal consideration of economic, social/cultural and environmental concerns</td>
</tr>
<tr>
<td>Technology</td>
<td>Primarily technological solutions to specific impacts</td>
<td>Incorporate technological solutions into multi-tiered cross-cultural approaches</td>
</tr>
<tr>
<td>Primary adaptation pathway</td>
<td>Resilience pathway, which attempts to stabilise the status quo</td>
<td>Transitional or transformative pathways, which promote incremental or radical change, respectively</td>
</tr>
</tbody>
</table>

Governments will play an important role in advancing sustainable adaptation strategies, especially local government authorities as they operate closest to their constituents. Local governments will serve as a bridge, implementing top-down strategies from national and state governments, while engaging their communities in bottom-up approaches to adaptation (Adger et al. (2005) Porter, Demeritt, and Dessai (2015). Political challenges exist between addressing long-term societal problems such as climate change, while confronting short-term statutory duties. Australian local governments have statutory responsibilities regarding climate-sensitive functions such as coastal hazard planning (Pillora, 2010). However, budget constraints can limit local councils from implementing adaptation strategies (Porter et al., 2015).

TSSOs can assist local government in promoting sustainable adaptation. Effective communication, access to human and social capital, and equity in resources distribution are important to successfully delivering adaptation and sustainability (Yohe et al., 2007). Understanding how TSSOs can enhance communication and awareness-raising and contribute to accessing human and social capital in their communities would assist this
effort. Effective and enduring adaptation requires a comprehensive approach, emphasising sustainable societal responses that go beyond technological fixes or individual behavioural change. Sustainability concepts should be embedded into adaptation strategies to deliver the most meaningful adaptive actions (IPCC, 2014a). Incorporating concepts of sustainability into adaptation can enhance adaptive actions (Table 2.6). Specifically, sustainable adaptation approaches are cost-effective, sustain a community’s natural resource base, promote equity among groups and across generations, advance efficiency and clean technology, and encompass social, environmental and economic elements, the triple-bottom-line concept.

Table 2.6 Sustainability concepts and linkages with climate change adaptation (adapted from IPCC, 2014a, 2014b; World Commission on Environment and Development, 1987; Yohe et al., 2007)

<table>
<thead>
<tr>
<th>Sustainability concepts</th>
<th>Sustainability-adaptation nexus</th>
</tr>
</thead>
<tbody>
<tr>
<td>Promote a “new era of economic growth, one that must be based on policies that sustain</td>
<td>Adaptive actions should link cost-effective approaches with those that, at a minimum, sustain</td>
</tr>
<tr>
<td>and expand the environmental resource base” (World Commission on Environment and Development (WCED), p.1). Therefore, it is important to conserve and wisely use natural resources (e.g. employing recycling of consumer waste and using recyclable materials for building).</td>
<td>the natural resource base and, ideally, increase opportunities for promoting conservation, wise-use principles and environmental quality.</td>
</tr>
<tr>
<td>Encourage economic growth that is “absolutely essential to relieve...poverty” (WCED, p.1). Therefore, sustainability policies must uphold the principle of equity (i.e. equity among groups or nations now and for future generations).</td>
<td>Adaptive actions, at a minimum, must not disadvantage any group, and, ideally, will promote intergenerational and intergenerational equity.</td>
</tr>
<tr>
<td>Stimulate growth through better management of technology and social organization (WCED, p.8). Therefore, government policies can be used to promote best practices and innovative technologies (e.g. provide incentives for deployment of energy conservation technology).</td>
<td>Adaptive actions should apply building design and construction around implementing the best practices and technology, including recyclable materials and renewable energy.</td>
</tr>
<tr>
<td>Develop and manage sustainable energy paths and consumption patterns; industrial production and rapid urbanization (WCED, pp.11-17). This requires all sectors of society to make changes in the way energy is developed and distributed (e.g. incentivise non-polluting energy sources on all scales, from households upwards).</td>
<td>Adaptation strategies must ensure energy sources do not increase greenhouse gas emissions, which would be considered maladaptation (e.g., to reduce the impacts of heat waves on the elderly, an adaptation action to provide air conditioning must ensure that the energy to run the system is derived from a renewable energy source, such as wind or solar energy).</td>
</tr>
<tr>
<td>Change the nature of institutions and laws to reflect the interconnectedness of environmental and economic problems (WCED, pp.17-21). Therefore, achieve balance through triple-bottom-line assessments of social, economic and environmental elements in all decision-making.</td>
<td>Adaptation strategies should be based on triple-bottom-line assessment, focusing on social, economic and environmental elements of adaptive actions, while preventing maladaptive measures from being implemented.</td>
</tr>
</tbody>
</table>
2.4.6 Summary of reified knowledge of adaptation

Adaptation science and policy research offers basic and applied knowledge of effective adaptive approaches to local impacts faced by communities and individuals, as well as society-wide adaptation strategies. Such research cuts across societal and sectoral dimensions. Reified knowledge of climate change and sustainability, based on research, indicates that to manage global climate change effectively and comprehensively a multi-tiered approach encompassing adaptation and mitigation strategies grounded in sustainability concepts is required (IPCC, 2014c). Key information from the IPCC and others with expert knowledge regarding climate change impacts, adaptation and sustainability are summarised in Table 2.7.

Table 2.7 Reified knowledge of climate change impacts, adaptation, and sustainability

<table>
<thead>
<tr>
<th>Reified knowledge of climate change impacts (adapted from IPCC, 2014a, 2014b; World Commission on Environment and Development, 1987; Yohe et al., 2007)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Visible impacts are occurring now, and longer-term commitment to future impacts exists from locked-in climate change</td>
</tr>
<tr>
<td>Physical, social and economic impacts are time and location specific</td>
</tr>
<tr>
<td>Direct biophysical impacts occur from changes in climatic variables such as temperature, precipitation and sea-level rise; ancillary impacts to human and social systems that impact human health, livelihoods and the economy also exist</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Reified knowledge of climate change adaptation (adapted from IPCC, 2014a, 2014b; World Commission on Environment and Development, 1987; Yohe et al., 2007)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Effective adaptation to local impacts begins with knowledge of impacts and interconnected human and natural systems</td>
</tr>
<tr>
<td>Some adaptive actions may have a maladaptive effect; society needs to understand best practice options and the need for effective, sustainable adaptation</td>
</tr>
<tr>
<td>Natural systems may experience autonomous adaptation, but only if there is time for biological transitioning</td>
</tr>
<tr>
<td>Responsive adaptation (e.g. after a climatic event is underway), while useful in some instances, is less effective than proactive adaptive action</td>
</tr>
<tr>
<td>Planned adaptation, to assist human and natural systems adjust, is an effective strategy; proactive holistic approach to address the myriad of complex relationships would assist in limiting maladaptive actions and can be compared to a life-cycle analysis approach in mitigation</td>
</tr>
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<tbody>
<tr>
<td>Sustainable development is defined as development that meets the needs of the present without compromising the ability of future generations to meet their own needs</td>
</tr>
<tr>
<td>Core objectives of sustainability include:</td>
</tr>
<tr>
<td>- Enhancement of individual and community well-being by maintaining economic growth across generations</td>
</tr>
<tr>
<td>- Provisions for equity within and between generations, and</td>
</tr>
<tr>
<td>- Protection of biological diversity and conservation and wise use of natural resources and ecological processes</td>
</tr>
<tr>
<td>UNESCO’s vision is that sustainable development integrates social, economic and environment elements to promote biodiversity and conservation throughout its Biosphere Reserve network. This requires a vision that encompasses humans living sustainably among the animal and plant species within its ecosystems, conserving local natural resources and integrating concerns such as fighting against poverty, and for gender equality, human rights, and education and health</td>
</tr>
</tbody>
</table>
2.5 Social science research on climate change

The previously reviewed literature outlined the reified knowledge of climate change policy, science, and adaptation, which contributes to the public’s understanding of the scientific phenomenon. To address the identified challenges will require a greater input for the social sciences. This section draws on literature from the social sciences to discuss how the public interprets this reified knowledge and understands climate change and adaptation in terms of lay knowledge. (Note: Social science research about a group’s lay knowledge of climate change using social representations theory (SRT) is discussed in detail in Chapter Three (Sections 3.4-3.8) as it is the theoretical lens for this study; SRT considers a group's social representations by drawing from the individual’s perceptions to consider how the group understands and responds to the subject (Moscovici, 1961) and the analysis will draw on the experts’ knowledge of climate change and adaptation discussed in this chapter).

Social psychological studies explain how individuals or groups understand a phenomenon at a particular time and place. While beliefs, attitudes, and intentions are distinct cognitive concepts with a specific role in the way humans think and react, they are related constructs (Fishbein & Ajzen, 1975). Beliefs are the foundation upon which attitudes are built, while intentions are the “primary determinants of overt behaviour” (Fishbein & Ajzen, 1975, p. 510) and attitudes are defined as “a settled way of thinking or feeling about something” (Oxford Dictionary of English, 2003, p. 102). While closely related to attitudes and perceptions, social representations differ in their generation and transformation because they emerge and consolidate through interactions and communication within a social group (Sections 3.3 and 3.4). To address the identified challenges will require a greater input from the social sciences. The following sub-sections review social research on climate change.

2.5.1 Understanding of climate change – international studies

Social science research into how individuals and groups view climate change and its risks is useful to inform policy-makers and other decision-makers about how society accepts and responds to this 21st challenge. An array of approaches, from nationwide surveys to interviews of individuals in specific communities of interest or place, has been used to gauge public understanding of climate change (e.g., LeViston et al., 2011; LeViston et al., 2014; Lorenzoni et al., 2007; Pew Research Center for the People & the Press, 2009).

This section examines the understanding around climate change undertaken in international studies. Understanding how differing sectors of society (e.g. scientists, policy-makers, journalists) view climate change (if it is happening; what factors contribute to it; and if the research is viewed as valid) can reveal insights from different disciplines, each with
specialised knowledge that can contribute to forming a fuller view of the challenges and
resolutions. For example, some scientists, working through the certainty or uncertainty in
climate science is consistent with the scientific approach to analysing other ideas or
concepts; they accept that “scientific knowledge is a body of statements of varying degrees
of certainty – some most unsure, some nearly sure, but none absolutely certain” (Feynman,
1990, p. 245). Other professionals, such as policy-makers and journalists, suggest that “It is
the legal system, management and society generally that cannot cope with the open-
endedness of acceptable uncertainty” (Martin, Rogers, & Winter, 2009, p. 4). These different
approaches provide added challenges for decision-makers who seek to share information
with the public.

A review of numerous studies found three dimensions of consensus - **manifestation**, 
**attribution** and **legitimation** - and, in most cases, revealed little difference between scientists
who have or have not participated in the IPCC process (Bray, 2010). The results of the
scientific consensus research suggest that there are now two minority groupings: one group,
only called climate sceptics or deniers, declare the IPCC overestimates its findings; a
second, emerging group, including IPCC participants, assert the IPCC underestimates some
aspects of climate change (Bray, 2010). An analysis of 928 abstracts from the peer-reviewed
literature from 1993-2003 (searched from the International Science Index database under
the key word “global climate change”) found none of the papers disagreed with the
consensus position (Oreskes, 2004). That is, those scientists who published in peer-reviewed
journals during the ten-year study period agreed with the IPCC and other professional
societies (e.g., the National Academy of Sciences) that have endorsed its work.

While the majority of climate scientists worldwide have for some time shared a concern
about warming trends and climate change (Bray, 2010), this long-term scientific confidence
has not transferred into a consistent increase in public concern about climate change
(Stanford University global warming poll, 2010) found:

- 74 per cent believed the Earth has been warming over the past 100 years,
- 75 per cent believed the warming primarily resulted from human behaviour,
- 86 per cent wanted the United States government to limit the amount of air pollution
  that businesses emit, and
- 76 per cent supported limiting business’s greenhouse gas emissions, in particular.
The study (Stanford University global warming poll, 2010) also found that to address these concerns the vast majority of Americans preferred tax breaks to encourage manufacturing of more fuel-efficient cars (81%), more energy-efficient appliances (80%), and more energy-efficient housing (80%), while opposing taxes on electricity (78%) and gasoline (72%). Contradictory findings from other American survey research within this timeframe found much less support for the anthropogenic causes of or actions on climate change. A 2009 Gallup poll (Jackman, 2009) reported that while 57 per cent of Americans believed humans contributed to climate change, only four per cent cited it as the most important issue, trailing far behind the economy (46%) and health care (13%). Perceived inconsistencies among American surveys could be due to survey structure, misinterpretations by the pollsters, or reporting by the media (Krosnick, 2010).

Inconsistency in the use or explanation of terminology has made it difficult to understand changes in public perception over time and across populations, as the terms ‘climate change’ and ‘global warming’ may have different meanings to different groups (Reser et al., 2011). One longitudinal, cross-cultural study interchanged the terms ‘climate change’ and ‘global warming’ in the years since 2007, whereby the Australian poll used the term “global warming”, while the American poll used the term “climate change” (Hanson, 2011). The explanation by the Chicago Council on Global Affairs (CCGA) in its Global Views 2010 report notes that it changed its terminology from ‘global warming’ to ‘climate change’ in 2010. The report noted that 29 per cent of respondents felt “climate change is a serious and pressing problem” (Chicago Council on Global Affairs, 2010, p. 38). “In 2008 when this same question was asked about ‘global warming’ [as opposed to climate change] more people agreed that global warming was a serious and pressing problem (43%), with most others (37%) preferring to address it gradually” (Chicago Council on Global Affairs, 2010, p. 38).

While using differing terminology between or across populations makes comparisons less clear, consistency in word choices might be problematic in broad-based surveys. American and European climate change surveys found that consistency in word choices might be difficult to implement across subpopulations (Villar & Krosnick, 2011). While word choice may affect public perceptions about the seriousness of climate change and the best policies for meaningful actions, a single choice of terminology does not appear to influence all people in the same way. Villar and Krosnick (2011) found in their American study that neither the term climate change nor global warming was perceived to be less serious in the full sample or among Americans who identified themselves as Independents by political party affiliation. However, among subpopulations who identified themselves politically as either Democrats or
Republicans there were inverse responses: the self-identified Democrats cited the term global warming as the more important problem of the two, while Republicans felt climate change was more serious (Villar & Krosnick, 2011).

The perceptions of climate change over the past decade reveal a broad range of concern or lack thereof, fluctuations in beliefs and a weakness in conviction. Responses by different publics have fluctuated. In the USA, a national survey conducted over an 18-month period from April 2008-October 2009 (Pew Research Center, 2009) showed a noticeable decline in Americans’ belief that global warming was happening: Americans’ confidence that warming was occurring dropped from 71 to 56 per cent. This change may be due, in part, to a weakness in conviction of belief in climate change or a lower priority of the importance of the issue relative to other pressing issues (Leiserowitz et al., 2009). However, acknowledging some fluctuations in opinions, over a twenty-year period, American public opinion has been relatively stable with roughly two-thirds of Americans consistently stating: 1. global warming is occurring; 2. caused, at least in part, by human activities; and 3. they support government action to reduce greenhouse gas emissions (Nordhaus & Shellenberger, 2009).

2.5.2 Understanding of climate change - Australian studies
A study of over 3000 Australian and over 1800 British respondents on perceptions and understandings of risk and responses to climate change revealed that, despite geographic, climatic, and climate change exposure differences, there are similarities between the two publics (Reser et al. (2011). There is a very high level of belief that the “world’s climate is changing” (Australians 74%; British 78%); a very high level of belief that human activities were playing a causal role (Australians 90%; British 89%); and a distinct minority of disbelievers or sceptics with respect to the reality of current climate change and/or the causal role of human activities and environmental impacts (Australians 5.8%; British 5.1%). While the vast majority of Australians and British are aware of and concerned about climate change, far fewer believe that they are currently experiencing its impacts. More Australian respondents than their British counterparts believed that they were already experiencing the effects of climate change and provided more examples of direct encounters in open-ended survey questions, suggesting that Australians have a greater awareness of local climatic impacts (Reser et al., 2011).

In Australia, perceptions of climate change knowledge exceed actual knowledge. The Australian public’s perceived and actual knowledge of climate science differ: a 2010 study of more than 3000 Australians found 75 per cent self-reported a reasonable amount of
knowledge about climate change; however, those same Australians’ objective knowledge of the underlying climate science and projected impacts showed limited knowledge, with average correct scores of 40 to 50 per cent on true/false statements (Reser et al., 2011).

In addition, research on the public’s thinking about adaptation is less common in Australia. A study into social representations of climate change and adaptation compared the public’s thinking with that of politicians and scientists (Moloney et al., 2014). Word associations from 3300 respondents showed that groups define climate change differently. While a common set of core concepts exists among groups, differences in the framing and conception of the phenomenon indicate various types of interventions may be required to encourage comprehensive climate adaptation (Moloney et al., 2014).

Australian social science research presents a broad understanding of public thinking about climate change through national surveys and cross-national comparative studies, but with limited qualitative research on how groups interact with climate change. Gaps exist in longitudinal research, consistent methodologies and methods, and terminology across surveys and studies, indicating opportunities to provide policy-makers and other decision-makers with fuller understanding of the scope, risks and implications (Reser et al., 2011). More research into understanding motivations, behavioural change and social action to best promote effective adaptation would be beneficial (Moser, 2010). Therefore, it is important to focus greater attention on aspects of socio-psychological research and data collection techniques regarding the public’s views on climate change and policy options to address it. A socio-psychological study into how TSSOs understand climate change and adaptive actions would present new knowledge about how one subpopulation of Australian society interacts with this phenomenon.

2.5.3 Understanding of climate change – sectoral studies
Social research into a particular sector’s thinking of climate change and adaptation is increasing, but limited to specific groups such as politicians and scientists (Moloney et al., 2014). With regard to TSSOs operating in UNESCO Biosphere Reserves, a 2015 UNESCO MAB survey of Biosphere Reserve managers about climate change within their reserve boundaries reveals some insights about the visibility and awareness of its impacts and the actions to adapt to them (UNESCO, 2015). The survey indicated 77 per cent of biosphere managers observed changes attributable to climate change, ranging from seasonal changes including shorter winters and longer periods of drought. Climate-related hazards such as flooding and wildfires were cited by 40 per cent of the reserves, with the most substantial changes noted in France’s Dordogne Biosphere Reserve where, over the past 40 years, the
The temperature of the Dordogne River has risen by 2°C (UNESCO, 2016, para 2). While 60 per cent of the reserves were monitoring climate change, only 38 per cent had plans to undertake adaptation measures, while 49 per cent focused on mitigation (UNESCO, 2016, para 3). The results imply that Biosphere Reserve organisations have a greater drive to implement projects and measures that reduce greenhouse gas emissions to address the causes of climate change than to develop actions to address its local impacts. While this is important, the UNESCO MAB program stresses the importance of addressing both the causes and impacts of climate change in the work of Biosphere Reserves. Specifically, the MAB recognises and emphasises the UNESCO Strategy for Action on Climate Change (UNESCO, 2015), which has as its main objective the need to build a knowledge base around climate change science, while promoting mitigation and adaptation strategies through education and awareness.

Public policy is a key component to effectively addressing the causes and impacts of climate change. In Australia, local, state and federal level politicians hold personal beliefs about climate change that largely reflect political affiliation, influence the priority given to climate change in their political work, and determine whom they referenced regarding climate change information (Hoegh-Guldberg, Fielding, Head, Laffan, and Western (2010). Statistically significant differences exist between Greens, Labor, non-aligned, and Liberal/National respondents in terms of general attitudes towards climate change (Hoegh-Guldberg et al. (2010). The Greens have the strongest beliefs, followed by Labor, non-aligned and Liberal/National, and the majority of respondents in all political affiliations, with the exception of the Liberal/National, believed that their own beliefs in climate change were stronger than their electorate. With regard to climate change science, the majority of Australian politicians view the IPCC science as reliable, climate change as a human-induced phenomenon, and its impacts as likely to enhance ecosystem threats and increase incidence of bushfires.

Coastal communities have particular concerns about sea-level rise and coastal erosion impacts from climate change. A Victorian case study revealed eight distinct groups of residents, each with a unique set of coastal-lived values, including the environment, lifestyle, climate, and proximity to water, that would be differentially affected by adaptation to sea level rise (Graham, Barnett, Fincher, Hurlimann, & Mortreux, 2014). The study concluded that a coastal adaptation policy must incorporate a suite of responses expressing the diversity of community values to be fair and to provide a measure of success and durability (Graham et al., 2014).
Understanding and connection with climate change will affect intentions. Community opinion leaders’ views on climate change will affect their engagement with the phenomenon. Politicians and opinion leaders have the ability to develop and mobilise efforts to promote adaptation. Yet the majority of opinion leaders on the Sunshine Coast, Queensland lacked knowledge and engagement with climate change and were not found to be connected with other community organisations and policy-makers (Keys et al., 2014). The research suggests that additional work on community engagement was required to connect networks and share knowledge about projected climate change impacts.

Effective climate change communication requires an understanding of societal sectors and how particular audiences think about the phenomenon and appropriate responses. In the United States, research into audience segmentation divided the public by its views on climate change. Surveyed Americans and concluded that there were “six Americas”, categorising public attitudes into six audience segments: “the Alarmed” (18%), “the Concerned” (33%), “the Cautious” (19%), “the Disengaged” (12%), “the Doubtful” (11%), and “the Dismissive” (7%) (Leiserowitz et al., 2009). Varying views on climate change align with political affiliations (Nisbet, 2009). Identification of climate perceptions between American Democrats and Republicans show public engagement with climate change could be enhanced by carefully framing the issue around partisan viewpoints held by those associating with the two major national political parties (Nisbet, 2009). In the United Kingdom, research on scepticism and uncertainty about climate change found segmentation among individuals along environmental and political lines rather than by levels of education or knowledge, while the public’s uncertainty about climate change had remained constant between 2003 and 2008 (Whitmarsh, 2011).

TSSOs are important societal sectors for advancing climate change adaptive and mitigative actions. Communicating climate change in distinct ways to varied societal groups can mobilize collective action and forge common ground among diverse audiences (Nisbet, 2009). The IPCC shares this viewpoint, noting that an in-depth understanding of how community stakeholder groups perceive the implications of climate change and their willingness to act is required to develop effective adaptation strategies (Yohe et al., 2007). Researchers have called for “additional research using in-depth interviews...to further explore, identify and test frames across audiences”, suggesting one way to reach audiences is “to recruit their influential peers to pass on selectively framed information about climate change that resonates with the background of the targeted audience and that addresses their personal information needs” (Nisbet, 2009). This TSSO study seeks to contribute to this
effort by revealing the in-depth understanding of a locally affected stakeholder group and uses SRT as the lens through which to consider its understanding of climate change and adaptation.

2.6 The media’s role in perceptions of climate change

The media’s portrayal of climate change has an influence on individuals’ views of what climate change is, whether it is a serious threat to themselves, their family, community and livelihood, and the need for adaptation to address climatic impacts. That is, among other influencers (e.g., friends, social learning), it contributes to their lay understanding of climate change. It is one element in the composition of social representations of climate change and adaptation, the first two research questions in this thesis (Chapters Five through Seven).

The scientific complexity of climate change science makes it difficult to convey the seriousness of the situation (Section 2.3.2). Despite the scientific consensus on climate change, a contingent of key policy-makers, business leaders and journalists still promote the idea that the science is highly uncertain and if climate change exists, it is questionable if it is caused primarily by human activities (Oreskes, 2004). Compounding this challenge, communication between the scientific community and the public often relies on mediation by the news media, which is “subject to the political-economic imperatives of the media enterprise and the media’s filter on ‘newsworthiness’ (e.g., stories that have drama, emotional appeal, novelty, and human interest)” (Vogel, Moser, K Kaspersonc, & Dabelkod, 2007, p. 355). The media representations around climate change often comprise scientific knowledge filtered for its ‘sensationalised’ aspects to fit journalistic objectives prior to transmission to the public (Vogel et al., 2007).

During the period of IPCC-UNFCCC collaboration, the media’s interest in climate change was inconsistent over time and across borders. While media coverage of social and environmental issues ebbs and flows, research into the media’s coverage of climate change spiked during the period of the creation of the IPCC and UNFCCC in the late 80s and early 90s (Trumbo, 1996). Grundmann (2007) wrote about the paradox wherein the IPCC’s consensus-science did not translate into widespread government actions but in opposing policies:

This puzzle not only challenges the traditional belief that scientific knowledge is objective and can be more or less directly translated into political action, but also calls for a better understanding of the relation between science and public policy in modern society (Grundmann, 2007, p. 414).
The media plays an important role in disseminating information on climate science and policy to its audiences in Australia and across the globe. Research into the media’s role in filtering the IPCC’s Fifth Assessment Report highlights areas where the media frame aspects of the climate debate with a particular bias:

The media are powerful agents that translate information across the science-policy interface, framing it for audiences. Yet frames are never neutral: they define an issue, identify causes, make moral judgements and shape proposed solutions (O’Neill, Williams, Kurz, Wiersma, & Boykoff, 2015, p. 380).

Australia’s delayed climate actions, in addition to a divisive domestic political debate, may be attributed, in part, to its media. For nearly two decades, in Australia and the United States, relatively limited resources and actions were allocated to mitigation and adaptation, compared to many European nations. For example, in 2008, the United Kingdom became the first country to adopt climate change legislation addressing both adaptation and mitigation (Taylor, Dessai, & de Bruin, 2014). In many countries, political efforts to maintain the status quo were aided by the media (Grundmann, 2007; Moser, 2010; Trumbo, 1996). Although the IPCC and CSIRO present the best available knowledge on climate change and its impacts on Australia and the region, science alone does not ensure effective national policy outcomes (Grundmann, 2007; Henderson-Sellers, 1998). Comprehensive scientific research on climate change has been miscommunicated through the media communication process, including misrepresentation by the author, misunderstanding from the audience, inaccuracy or distortion (Henderson-Sellers, 1998).

Government policies play a role in the media’s coverage of climate change. An alignment of media and policy-making is the norm in many countries (Grundmann, 2007). While the United Kingdom implemented extensive climate change policies, the United States efforts were stymied by a conservative Congress. Media coverage on climate change from these two countries differs as well. In the United Kingdom, climate science is framed as ‘settled science’, while its adaptation efforts were framed as ‘security’ (O’Neill et al., 2015). Conversely, in the United States, climate science is presented as ‘uncertain science’, while adaptation to impacts was framed as ‘disaster’ (O’Neill et al., 2015).

In Australia, the media frequently comments that climate science is highly uncertain and some policy-makers have used the uncertainty argument as a reason not to support new measures to address climate change. Australia’s media and politics align more with the US media and political stance influenced by its strong fossil fuel lobby. Australia’s politics and press emphasise uncertainty and promote the status quo as prescribed by its influential coal and gas industries. In Australia, the media reporting and commentary on climate change
aligns with government policy-making; its media approach has been defended as one of ‘balanced’ reporting. However, the balanced reporting tactic, which highlights the climate sceptics’ views of uncertainty, downplays the consensus of scientific findings of the IPCC (Moser, 2010). Through the ‘balanced reporting’ approach of the past two decades, the media continues to give voice to climate sceptics as the scientific consensus solidifies around anthropogenic climate change, leading some to identify a bias of climate change coverage of sceptical arguments (Moser, 2007; Oreskes & Conway, 2010). This reporting technique is of concern to those seeking mitigation solutions to the causes of climate change and adaptation strategies to address its effects. Science historian and author Naomi Oreskes (2005) concurs:

 proxy debates about scientific uncertainty are a distraction from the real issue, which is how best to respond to the range of likely outcomes of global warming and how to maximize our ability to learn about the world we live in so as to be able to respond efficaciously. Denying science advances neither of those goals (p. 954).

Conversely, in Germany, where a strong green movement and political presence exists, the media does not over-represent the sceptical arguments (Grundmann, 2007). Such complementary media support for the scientific consensus provided an additional communication pathway to inform the public of the need for adaptive and mitigative actions. This then facilitated translation of scientific concern into substantial policy formulation (Grundmann, 2007).

The media influences public perceptions of climate change. Together, the media and the public sway decision-making processes, policy and program developments to address climate change. The public’s perceptions of the climate system and how it works, and risks from climatic changes can add support for political, economic or social actions to address those risks. A lack of understanding by the public or a lack of understanding about how the public understands an emerging phenomenon such as climate change can affect whether a government has the support to pass legislation or implement programs or regulations.

The media representations circulating in society about climate change play a part in the framing of the issue as the media are the primary intermediary between scientists, politicians, policy-makers and citizens (Olausson, 2011). Researchers have begun to study the media’s social representations around climate change in a number of western democracies (Hoijer, 2010). The media is increasing its use of “balancing norms”, where both sides of an issue are presented with equal weight regardless of the evidence, as a means to safeguard “objectivity”. With climate change, ongoing public resistance to changing relevant behaviours remains a concern, even as public awareness of the scientific arguments.
increases (Exley & Christie, 2003). Additionally, the media play a role in influencing the public’s understanding of socio-economic and environmental issues that stem from climate change and responsive actions to address it.

The media’s coverage of climate change since 1985 has changed in focus from the claims made by scientists about causes to the policy-makers regarding remedies (Trumbo (1996). Thus, as the media’s focus on the phenomenon shifted from causes to remedies, the reliance on scientists’ input declined as the coverage politicized.

Later chapters explore the consensual or lay thinking within a TSSO regarding climate change and the need for adaptive action. The majority of people will be aware of climate change through extensive and growing media sources. Today, the public has a vast range of media from which to select. United States President Barack Obama discussed his concerns with the acceleration of media segmentation: “The Balkanization of the media means that we just don't have a common place where we get common facts and a common worldview, the way we did 20, 30 years ago” (Klein, 2016).

To foster adaptive action, the IPCC acknowledges the need for better communication of qualitative and quantitative information and calls for research into processes “for using dialogue and narrative...to influence social learning and decision-making, including governance” (Yohe et al., 2007, Section 20.8.2 para 1). To address the consequences of climate change, governance over adaptation needs to focus on “reducing vulnerabilities of specific groups to identified risks” (Nelson et al., 2007, p. 412), requiring analyses of actor-based processes of negotiation, decision-making, and action. For example, by using participatory processes to work with TSSOs, governments could offer institutional support and build adaptive capacity.

The lay knowledge that may be expected to exist within the NBR Board could include representations portrayed across various media, which are contradictory or differ from that of the scientific community. This divergent information on climate change includes the science consensus on causes, trends, level of uncertainty, the reality of climate change, impacts and need for action (Table 2.8).
### Table 2.8 Media portrayals that may influence lay thinking of climate change

<table>
<thead>
<tr>
<th>Countervailing lay thinking about climate change that may emerge from media representations</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Climate change is not a scientific phenomenon of concern</strong></td>
</tr>
<tr>
<td>Climate change is not real; it is a hoax perpetuated from a liberal media</td>
</tr>
<tr>
<td>No consensus on climate change science</td>
</tr>
<tr>
<td>Climate change is natural so, even if it is happening, nothing can be done to prevent it</td>
</tr>
<tr>
<td>The scientific community is uncertain about climate change</td>
</tr>
<tr>
<td>Climate change is not happening now or it does not impact me now</td>
</tr>
</tbody>
</table>

### 2.7 Conclusion

This chapter presented a comprehensive review of the literature to inform this thesis about the reified knowledge of the experts in climate change policy, science and adaptation. This was complemented by discussion of social research into how the public interprets the phenomenon, and what might be expected to be lay knowledge. This climate change review establishes the basis for a major contribution of this thesis, enabling, for the first time, the application of SRT to reveal a TSSO group’s understanding of climate change. The potential of SRT for use in this single-case study is further investigated in Chapter Three.
Chapter Three. Theoretical perspective

3.1 Introduction

Chapter Two reviewed the literature regarding climate change and adaptation science and policy, as well as the social science around climate change, which contribute to the public’s understanding of the scientific phenomenon. The literature review of climate change and adaptation, providing the experts’ knowledge in these areas, is used to compare to the lay thinking of the NBR Board’s social representations because some lay knowledge is drawn from the communication with others. This review also considered the media representations of climate change, knowledge that is widely shared to the public.

Some social science research into climate change has focused on individuals’ cognitive concepts, such as perceptions or attitudes, while other studies often focus on climate change SRs of general populations using survey data. This study’s alternative perspective considers how one group, a TSSO, mandated to address climate change in its charter, understands climate change looking at multiple components from SRs and social identity to social action elements of cognition, affect and behaviour. This is a new approach to an important segment of civil society that needs further exploration.

This chapter turns to a review of the theoretical underpinnings of social representations theory (SRT), identity process theory (IPT) and cognitive, affect and behavioural elements of social action used to answer the four research questions (Section 1.2.5). This study uses SRT as the underlying theory because it focuses on how a group understand a scientific phenomenon, offering a new approach to understanding how a particular group that focuses primarily on sustainability views climate change and adaptation. Research questions one and two consider the NBR Board’s social representations of climate change and adaptation, respectively, and are analysed through the theoretical lens of SRT (Sections 3.3 and 3.4). Fundamental elements of reified knowledge, and consensual or lay knowledge and modes of communication of social representations within a group are explained. Theoretical concepts of social identity, explored in research question three, are discussed as it relates to SRT and the relationship between SRT and IPT (Section 3.5). Research question four, in considering the Board’s social actions around climate change and adaptation across the NBR, considers the relationship of the NBR Board’s SRs, social identity and social activities through an analysis of the cognitive, affective and behavioural elements of the group’s interaction with climate change, adaptation and sustainability (Section 3.6). The chapter concludes with a discussion of the methods used in SRT application and the limitations (Sections 3.7 and 3.8) of this approach in this study.
3.2 Social psychology: intersection of the individual and the social
Numerous psychological theories explain an individual's thought processes and societal behaviours, whereas sociological studies focus on the society and its institutions. In the social psychological realm, examining how humans experience and understand their social world covers a range of influencing factors including perceptions, attitudes, attributions, personal and social identity, prejudice, and beliefs. At the social rather than individual level, SRT complements other social science perspectives such as social identity theory (Tajfel & Turner, 1979a). While there are commonalities, both psychological and social approaches have roles in helping to explain how people respond to and understand the world around us. Theories about attitudes (e.g., Fishbein & Ajzen, 1975), or social identity (e.g., Tajfel, 1981; Tajfel & Turner, 1979a) attempt to explain how people orient themselves in the social world. Personal construct theory (Kelly, 1955, 1963) explains how people develop internal ideas of reality in an attempt to understand the world around them; these constructs are based on interpretations of observations and experiences and can be expanded with new ideas.

3.3 Social representations theory
Social representations theory (SRT) adds a different perspective to studies of the understanding of attitudes or perceptions by focusing on the ideas and values generated and transformed by and in social groups (e.g., Augoustinos, Walker, & Donaghue, 2006; Bauer & Gaskell, 1999; Moscovici, 2008). SRs' distinctiveness arises from collective understanding within a group, filtered through each person's perspective on a social object at a particular time. SRT concentrates on the processes involved in the construction of everyday knowledge and common sense thinking (N. Smith & Joffe, 2012, p. 17) that results in how people make sense of unfamiliar information. Groups construct lay language of science knowledge to serve numerous purposes including intrinsic interest, fear of the unfamiliar or to provide a means for people to express opinions in conversations and to take a position in political debates (Wagner, 2007). This collective elaboration of a representation "across minds" (Wagner, 1999, p. 96) is what differentiates SRT from other theories of social cognition. SRT explores the understanding of a communally-constructed social object through communicated processes such as behaviours, actions or language, thus seeking to explain largely the same phenomena as other theories in social psychology, albeit through a different perspective (Moscovici, 2008; Wagner, 1999). SRT can work with these other disciplines to create a "fully integrated social psychology" (Augoustinos et al., 2006, p. 302).

As a theory of social knowledge (Howarth, 2006; Philogene & Deaux, 2001; Wagner, 1999) and social change (Duveen & Lloyd, 1990; Moscovici, 2001), SRT offers a theoretical
framework for examining a new scientific phenomenon (Moscovici, 1961) by revealing a distinctive understanding of a relatively new social object (Wagner, Duveen, Verma, & Themel, 2000, p. 5). As the NBR Board intended to promote climate change and sustainability projects and programs throughout its community, SRT is useful in the study as it can draw out the consensual and diverse aspects of a group’s thinking, which comprise the parameters of the group’s representations.

To fully understand a group’s thinking of a scientific phenomenon requires knowing how the group assimilates scientific background knowledge and other conceptual linkages incorporating cultural, social, and historical considerations as the group builds lay knowledge (Wagner, 2007). This process includes the use of metaphoric and iconic representations of scientific facts, “vernacular science knowledge”, to indicate that while “wrong in scientific terms...they are able to serve as acceptable and legitimate belief systems in discourses with other lay people” (Wagner, 2007, p. 7).

Drawing on SRT for this study contributes to the understanding of climate change from a social psychological perspective, specifically by investigating SRs of climate change or adaptation among the NBR Board. This particular focus on SRT will contribute to a new perspective and complement research into attitudes and perceptions of climate change, providing collective understanding of climate change within a TSSO.

3.4 Definitions, principles and concepts in Social Representations Theory

3.4.1 Definitions and social representation development processes

Social representations (SRs) comprise a “system of values, ideas and practices with a twofold function” of orientation and communication (Moscovici, 1973, p. XIII). This definition is important to the study of a TSSO as it incorporates knowledge, identity and actions of a group’s members. The definition of an SR was elaborated upon to include “concepts, statements and explanations originating in daily life…the contemporary version of common sense” (Moscovici, 1981, p. 181) and “an umbrella term for notions like opinion, perceptions, attitudes, values, stereotypes and risks and links them to formats of communication...” (Bauer & Gaskell, 2008, section 4, para 17). Social representations in all instances apply to the knowledge and communication of knowledge within a group; it is both a process and a result of a group’s understanding of a new concept (Moscovici, 1961).

SRs can work at two levels: the rational or ‘cool’ level of knowledge-based collective forms of thought and the beliefs and passions of the ‘hot’ level (Moscovici & Markova, 1998). They
emerge or can be understood through knowledge and emotive responses to a phenomenon (Moscovici, 1961). Social representations often comprise elements of contradiction and present as oppositional dyads through themata (Section 3.4.4), as its group members develop lay understandings to make sense and communicate about a particular social object.

The concept of representations from the individual to the communal preceded the development of social representations. The term ‘collective representations’, coined by Emile Durkheim (1898), conveys the notion of a communal shared-meaning system of cultural items and objects as collective representations. Both a social representation and a collective representation are shared and social in origin, but unlike a social representation, a collective representation is conceived as independent of the individual (Augoustinos et al., 2006; Wagner, 2012). Unlike Durkheim’s collective representation, which is a more static concept derived from traditions and longer-term historical processes (Wagner, 2012), Moscovici’s social representation was more dynamic and comprised “of objects, events and facts resulting from rapid scientific and technological advances as well as from economic, political and societal changes that are typical of contemporary societies” (Wagner, 2012, p. 1).

The “representational triad” (Figure 3.1) presents the minimal communication process of a social representation: at least two subjects who communicate shared knowledge about one social object (Bauer & Gaskell, 1999, p. 170).

![Figure 3.1 A social representation as a “representational triad”: at least two subjects communicating shared knowledge about one social object (Bauer & Gaskell, 1999, p. 170)](image)

A third dimension of time may be added to the initial subject-object-subject relationship (Figure 3.2). This illustrates how the initial subject-object-subject relationship can change over time, moving from the past into the future (Bauer & Gaskell, 1999, p. 171).
Further evaluation suggests that a social representation can emerge from events and phenomena, which are threatening or unfamiliar and disrupt the pattern of groups (referred to as sociogenesis by Wagner, 1999, p. 98). This attempt at coping with the unfamiliar in a symbolic manner often generates social representations (Moscovici, 1961; Wagner et al., 1999) (Figure 3.3).

As noted in Moscovici’s work on psychoanalysis (1961), the discourse with the social groups may develop an anchoring component from an existing representation to attach to an emerging representation, or it may lead to objectification of a representation through a
symbol, image or metaphor. Should a new social representation emerge and the group remain intact, a new social object is added to the group's collective understanding.

3.4.2 Social Representations Theory principles
Using SRT will help to explore whether SRs exist in the TSSO case study and what their nature is if they do exist, and to understand how the TSSO communicates its shared knowledge of climate change and adaptation. Examining these SRs for cohesiveness, form and function will add to the body of work on socially derived knowledge of the contemporary global issue of climate change. SRT can draw out the consensual and divergent aspects of a group's thinking, which comprise the parameters of the group's representations.

SRT is relevant for this study because it:

- seeks to reveal lay knowledge in relation to social and cultural frameworks of climate change because it makes sense of a community's communication, which also incorporates individual identities, interests, and history (Moscovici, 1961); and

- is concerned with meaning and its symbolic interpretations, and considers how individuals express identity, engage with others and interact with climate change (Wagner, 1999) and

- provides insights in practices and motivational factors and drivers (Moscovici, 1961).

Three principles of SRT are important to this study: the concept of lay knowledge; the role of communication in the development of social representations; and the acknowledgement of temporal and spatial aspects of change (Moscovici, 1961).

1. Lay knowledge. In SRT, lay knowledge comprises non-scientific knowledge, such as hearsay, and is based on assumptions; it is not acquired through material facts or personal experiences. Personal experiences, such as living through an extreme weather event, a long-term drought, heat waves or floods, can build knowledge about an aspect of climatic change. This knowledge can contribute to other forms of knowing and learning about climate change and adaptation gained through other means. Research into risk perception and policy preferences (Leiserowitz, 2006) also identifies experiential knowledge as a driver for policy support for climate change adaptation measures. The central premise of SRT considers a group's lay knowledge, presented through its social representations, as comprised of the shared values, ideas, practices and experiences of its group members to inform about the research object's understanding in the public domain (Bauer & Gaskell, 2008; Callaghan, Moloney, & Blair, 2012). Lay knowledge is not of lesser value than the reified knowledge of the scientific community; nor is it incorrect, improper or flawed.
(Callaghan et al., 2012). In this study, the NBR Board’s knowledge system is not judged, but is explored to consider how its understanding may drive the group’s behaviours and communication about climate change.

2. **Communication.** The role of communication in the development of representations is important because of this TSSO’s communal advocacy work, which displays an influence beyond their individual efforts. Communication of knowledge takes a variety of forms. Many people are exposed to information about climate change through print media, the internet and social media, radio or television, as well as conversations and films. As one source of societal information contributing to the formation of a representation, the media play an important role in the production and transformation of meaning across society (Carvalho, 2007). This study considers if the NBR Board applies a particular mode of communication for circulating its social representations through a communicative process of propaganda, propagation or diffusion (Moscovici, 1961).

3. **Change.** SRT differs from other social cognition theories in its acknowledgement of change. Social representations are dynamic, dialectical and continually developing (Moscovici, 1961). The concept of change is important to the phenomenon of climate change. It is a dynamic and multifaceted problem, and its emerging representations will morph over temporal and spatial dimensions and as segments of society continue to address its causes and impacts. This study, considering social representations of one TSSO’s thinking of climate change and adaptation is a snapshot at a specific time and locale, circulating within a particular cultural and political context.

3.4.3 Concepts of the reified and consensual universes in Social Representations Theory

A lay group will communicate about a social object or scientific phenomenon differently than a group sharing expert knowledge (Moscovici, 1961, 2001). These distinctive forms of understanding comprise the *reified universe* from the world of science and the *consensual universe* from the world of common sense:

- The *reified universe* is one where scientific research is conducted by members who acknowledge and operate within a fixed set of scientific rules and procedures that allow the knowledge that emerges from their findings to be analysed, challenged or discussed among their peers.

- The *consensual universe* is one in which the reified knowledge is not known to the lay public or might be outside the group’s particular scope of understanding; yet the social object is discussed and debated by uninitiated members of a social group to make sense
of this reified information, which then may emerge as a social representation (Moscovici, 1961).

The public and social groups use both forms of knowledge to construct and communication meaning from social change (Moscovici, 1961; Wagner, 2007). For those with expertise communicating in the reified universe, the concept of a 'knowledge-based society' strives to make knowledge acquisition accessible to all, and ideally, to permeate daily conversations in everyday life (Wagner, 2007). Yet, different societal segments hold divergent views, beliefs and ideas about particular phenomena, and their “vernacular science knowledge [determines the] success or failure of tertiary education and the public's reaction to technological change” (Wagner, 2007, p. 8).

Divergent views across the reified universe among scientific communities and consensual universes of the media and society have played a particular role in the Australian Government's approach to addressing climate change over the past two decades (see Chapter Two). The reified universe conducts much of its climate change dialogue through the work of the IPCC (IPCC, 1990, 1995, 2000, 2001a, 2007d, 2014c), national research institutes such as CSIRO, and academic journals such as Nature, and Climatic Change. For example, the Australian Government releases biannual State of the Climate reports (BOM/CSIRO, 2010, 2012, 2014, 2016). Much of this reified information reaches the public through the filter of the media circulating through every day communications of the consensual universe (Augoustinos et al., 2006; Moscovici, 2001). Policy-makers, who join with scientists and other interested parties to develop treaties and legislation, contribute to reified knowledge. Concurrently, the consensual universe of lay people has developed its own understanding of climate change. However, this lay knowledge-making, filtered through exposure to the media and through interactions with the lay groups, may or may not be consistent with those who participate in the reified universe’s dialogue. As with the extensively documented knowledge from the reified universe (e.g., IPCC, 2013), the consensual thinking around concepts of climate change serves a particular function in the development and promotion of effective and comprehensive adaptation strategies requiring public support and actions.

Common sense and the role it plays in helping lay people understand new concepts and phenomena are important because “...common sense is acquired by each of us during the normal course of our life...a mother-knowledge which we assimilate, without specific training, at the same time as our mother tongue” (Moscovici, 2011, p. 11). While not expert or specialist knowledge, neither is it consistent across all sectors of society; it could be
common knowledge and collective beliefs of a particular group (Bangerter, 1995). This common understanding among group members is culture-specific, providing guidance and constituting “the right thing to do for a member of a group” (Wagner, 1993, p. 3) in a given situation; in other words, promoting group norms and values.

SRT provides a framework to investigate the problem of “knowing how science, by spreading throughout society, turns into common knowledge or lay knowledge: in short, how science manages to become part of our cultural heritage, of our thinking, or our language, and daily practices” (Moscovici, 2001, p. 10).

3.4.4 Content and processes in Social Representations Theory
This study employs concepts of SRT in its analysis of social representations of climate change and adaptation. The analysis considers if the data reveals specific types of representations: hegemonic, emancipated or polemic. Further, it discusses the processes of anchoring and objectification, used by group members as a means to understand and communicate their concepts of a social object. This study also uses develops themata (i.e. themes) emerging from the free associations (Chapter Five), which will be explored in the analysis of climate change social representations (Chapter Six).

3.4.4.1 Types of Social Representations: hegemonic, emancipated and polemic representations
Social representations are dynamic and dialectic. Therefore, they emerge and transform through group communication of two or more group members who also gain knowledge from outside their group experiences. As the process evolves through anchoring and objectification, representations emerge and transform. During the development of SRs, “the process of representing, hence, presupposes a collective endeavour to negotiate and construct the formerly unfamiliar as a familiar item that can be addressed in speech, sign and behaviour” but it is “not necessary to have each and every member of a community participate in the collective communication” (Wagner, 2012, p. 6). Social representations operate as a multilayered communication process, beyond semantics to pragmatic and social contexts (Moscovici, 1993). Communicating at the individual and collective levels brings in personal as well as cultural components. Numerous representations can emerge and/or transform concurrently among members of the group.

As SRT evolved, three distinct types of social representations were defined and researched: hegemonic, emancipated and polemic (Table 3.1). Hegemonic representations are dominant and consensually derived and shared; emancipated representations, while not incompatible with the hegemonic representation, are constructed from supplementary knowledge and
may provide additional complementary information; and polemic representations challenge the consensual representation and may emerge from conflict with some aspect of the collective understanding.

Table 3.1 Types of social representations (adapted from Moscovici (1961); Wagner (2012))

<table>
<thead>
<tr>
<th>Type of representation</th>
<th>Knowledge foundation</th>
<th>Group role</th>
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<tbody>
<tr>
<td>Hegemonic</td>
<td>Consensual within group</td>
<td>Most prevalent</td>
</tr>
<tr>
<td>Emancipated</td>
<td>Specialised expert knowledge to complement hegemonic representation</td>
<td>Supplemental</td>
</tr>
<tr>
<td>Polemic</td>
<td>Direct challenge to hegemonic representation</td>
<td>Usually brought from outside of group</td>
</tr>
</tbody>
</table>

While hegemonic representations are most prevalent, all three types of social representations may circulate within a group simultaneously. Being consensually shared, hegemonic representations often possess components of the group’s social identity (Moscovici, 1988). Illustrated in a study of a group of parents of Israeli naval commandos training in polluted water, hegemonic representations served “the dual purpose of making the unfamiliar familiar and constructing a group identity” (Ben-Asher, 2003, p. 3). The social identity within the group’s hegemonic representation presented the elite Israeli commandos as the “holy of holies” serving “the collective...in ‘exchange’ for society’s highest regard and recognition” (Ben-Asher, 2003, p. 3). However, it also held that the explicit ‘contract’ between state and soldier specified that commandos “follow orders as required, to the extent of risking their personal safety and their lives” and the state would “guarantee full care for them and their families in case of injury in the line of duty” (Ben-Asher, 2003, p. 3).

Emancipated representations are constructed from specialized knowledge and are not incompatible with the hegemonic social representation. Emancipated representations emerge as individuals are exposed to new information and share this new knowledge with one or more group members (Moscovici, 1988). In Ben-Asher’s (2003) study of parents of Israeli navy commandos, the emancipated representation included specific knowledge about toxicity studies of the polluted waterways in which the commandos trained, and the correlation between the soldiers’ illnesses and exposure to waterborne toxins. Initially, this representation was constructed from information not initially connected to the underlying hegemonic representation.

The relevance of social context to representational formation does not denote confirmation or agreement among group members. Polemic representations may emerge alongside
hegemonic or emancipated ones and pose a direct challenge to them. They emerge in the
course of a conflict with some aspect of the collective understanding, and express an
incongruity between representations (Moscovici, 1988).

The transformation of an emancipated to polemic representation may arise from additional
conflicting information. In the Ben-Asher (2003) study, additional information of a
commando-state ‘contract of trust’ surfaced: the Israeli army knew of the toxicity of its
training area yet continued using the site and exposing its elite commandos. This new
shared knowledge formed a new social representation: “Parental acknowledgement of the
army’s refusal to take responsibility for the welfare of soldiers became a lever for
transforming the emancipated representations... into polemic ones” (Ben-Asher, 2003, p. 4).

Climate change social representations across societies and within groups present differing
representations. For example, the global scientific community comprised of scientists
working through the IPCC process holds a hegemonic representation that 21st century
climate change is largely attributable to human-induced greenhouse-gas-emitting activities
(Houghton et al., 2001). This hegemonic representation held by a majority of climate
scientists is oppositional to the polemic representation held by climate change contrarians,
who challenge that climate change today is dangerous and dependent upon human actions
(McCright, 2007).

3.4.4.2 Social representation processes: anchoring and objectification
Social representations offer opportunities for understanding latent content or drivers of
scientific phenomenon and risk among and across groups (Moscovici, 1961, 1973).
Representations define and communicate the social object, which comprises components of
identity, communication processes and socio-psychological functions (Bauer & Gaskell, 1999;
Moscovici, 1961). An existing representation, to remain active, requires engaging with the
social object and sharing commonalities of the representation through naming and
classifying the object (referred to as coding), within the context of the group members’
individual and group history, traditions and values (Moscovici, 1973).

Social representations present a way for lay people to make meaning of unfamiliar and
potentially alarming scientific phenomena and technological innovations. The communication
of a social representation is achieved through the processes of anchoring or objectification.
Anchoring is a process by which unfamiliar concepts or social objects are understood by a
lay group through its relationship with existing social representations (Moscovici, 1961).
Objectification uses symbolic coping to make abstract ideas become associated with tangible
or concrete ideas (Wagner & Kronberger, 2001; Wagner, Kronberger, & Seifert, 2002).
Therefore, the new phenomenon is transformed from its original concept into concrete existence by way of more tangible images, concepts and symbols (N. Smith & Joffe, 2012). For example, the process of objectification transformed the abstract concept of AIDS in the early 1990s and ‘concretised’ it into a “gay plague”, aligning the new phenomenon with a mass, deadly illnesses in the public’s lay thinking (Joffe, 1995).

Anchoring is transformative: “the novel or strange is rendered familiar, by comparisons with ordinary categories and classifications” (Augoustinos et al., 2006, p. 95). It is a classification and naming process to ascribe meaning to a new concept or phenomena by embedding or integrating it with existing ideas or understandings, such as traditions or practices. A group might interpret a new phenomenon differently from other groups within the same society because the information is filtered through the group’s traditions, values and practices, which may be unique to that group. Therefore, these different social milieus’ interpretations may influence how the greater community will accept or resist these new concepts over time (Moscovici, 1984).

Representations reflect the classifying and naming of an object to provide clarity and logic. The anchoring instrument highlights “the role of old categories in rendering new meanings” (Castro & Gomes, 2005, p. 4). Anchoring arises from cognitive (e.g., Castro & Gomes, 2005) and emotional (e.g., Hoijer, 2010) factors. The public’s understanding of genetically modified organisms appearing in the Portuguese press of the mid-1990s found biotechnology was anchored in understandings of how genes were programmed (Castro & Gomes, 2005). Other cognitive anchoring, in two separate studies in the United Kingdom, found climate change anchored to ozone depletion (Lorenzoni & Pidgeon, 2006; N. Smith & Joffe, 2012), while a study of German scientists revealed that climate change was anchored to extreme weather events, such as flooding (Weingart, Engels, & Pansegraau, 2000). Emotional anchoring, focused on the affect generated around a social object, has been discerned in social representation studies of climate change. A European study of social representations of climate change in the media (Hoijer, 2010) found climate change emotionally anchored to fear, hope, guilt, compassion and nostalgia. Objectification provides a pathway to make a concept or idea more relatable to the group. It transforms unfamiliar or abstract objects into concrete images to aid the commonsensical understandings of an intangible concept (Moscovici, 1961).

Three sub-processes are associated with objectification: personification of knowledge, figuration and ontologisation (1983). Personification, linking climate change to a person or group, may best be demonstrated through the former United States vice president Al Gore, who went on to share the 2006 Nobel Peace Prize with the IPCC for his work on climate
change. The image of Al Gore as the personification link with climate change occurs among those who aim to address climate change as well as from those who remain sceptical of the need for action.

*Figuration*, referring to the process where an abstraction is linked with metaphorical imagery to make it more accessible, is demonstrated through research on the impact of “Climategate” (Nerlich, 2010). In this case, some groups used the religious metaphor of “preaching” to relay how climate change was communicated by the science community, relating it as unscientific information promoted by irrational people. While metaphors can aid in a group’s understanding of an abstract concept, they can also pose challenges by eliminating or discrediting other evidence, as metaphors are taken as one “truth”. Nerlich (2010, p. 24) concludes with a warning about climate change, “In the debate over action to prevent human-induced climate change [metaphorical imagery] can contribute to political inaction and social inertia, in short, political paralysis.”

*Ontologisation* is used to objectify in instances where physical characteristics are attributed to non-physical entities. A climate change study exemplifying ontologisation is an analysis of the Swedish press, which objectifies climate change in terms of visible pollution from exhaust pipes, heavy vehicles, and smoke stacks (Olausson, 2010). Other studies objectify climate change through visual images that depict photographs of melting glaciers, polar bears on melting ice blocks and flooding (N. Smith & Joffe, 2009).

Empathy or compassion may be provoked through concrete images of severe flooding events depicting loss of property and danger to humans, parched landscapes showing cracked soils and dead animals and vulnerable polar bears (Hoijer, 2010; N. Smith & Joffe, 2009). This has been referred to as emotional objectification. O’Neill and Hulme (2009) indicate that the most iconic climate change image is the polar bear, in this case seen as an innocent victim rather than a vicious predator; it draws empathy from the viewing public.

3.4.4.3 Themata and antinomies
This study considers themata (or thema in its singular) to reveal the latent elements of common sense thinking (Markova, 2000; Moscovici & Vignaux, 2000; N. Smith & Joffe, 2012) about a climate change social representation through free associations (Chapter Five) and thematic analysis (Chapter Six). Themata, as enduring preconceptions or presuppositions, were first explored to reveal the origins of scientific thought and continues as a key concept in how scientific insights are initiated and accepted (Holton, 1978). Moscovici (1993) introduced themata into SRT as the “prototypes of common sense knowledge...rooted in a culture and anchored in beliefs” (L. Liu, 2004, p. 254).
In SRT, themata provide the “deep structure” (L. Liu, 2004) to an SR. While rarely explicit, themata, as used in SRT, are inherently dialogical (Markova, 2003) and provide a means to understand a social representation’s structure and formation (Moscovici & Vignaux, 2000). They form through discussion of values, ideas and beliefs as knowledge, where an individual or group could draw from a diversity of knowledge to use a specific mode of knowledge, contingent upon their circumstances (Jovchelovitch, 2002). Emergent social representations arise from situations where dialogical themata related to a social phenomenon may become a source of conflict or tension in the public debate (Markova, 2003).

Analysis of themata can reveal “antinomic thema” (L. Liu, 2004) of contradictions or opposition between two or more beliefs or principles. In the SR literature, they are described as ‘antagonistic representations’, ‘mutually interdependent oppositions’, or ‘dialogical antinomies’ (Markova, 2000, 2003; Moloney, Williams, & Blair, 2012). Themata can be revealed through evaluation of antinomies (Markova, 2003) and through the processes of anchoring and objectification (L. Liu, 2004).

While themata are underlying structures to group conversations and communication about a new phenomenon, the term ‘antinomies’ is used to show the way in which people think about and vacillate between varying viewpoints and positions (N. Smith & Joffe, 2012). Communicating between antinomic dyads affords individuals the ability to oscillate between different positions as they solidify ideas and opinions. This process requires people “to be versed in the basic antinomies that underpin a…dialogue” (N. Smith & Joffe, 2012, p. 28). For the purposes of this study, the term antinomies will be employed to present the oppositional dyads revealed in the free associations (Chapter Five). The antinomies are used to frame the themata explored in the thematic analysis from the interview data of a climate change SR (Chapter Six).

Examples of analyses of themata in SRT research revealed dialogical antinomies of:

- *purity/impurity* underpinned the SRs of water recycling in an Australian study on alternatives to water shortages (Callaghan et al., 2012)
- *life/death, humans/nature* and *fear/hope* exist in all societies (Hoijer, 2011)
- *us/them* occur in the Swedish media, whereby the oppositional dyad of us/them depicts the conflict between “us”, as in the European Union, acknowledging the serious threat and wanting to take action to address climate change, while “them”, the United States, refusing to act (Olausson, 2010)
- *yin/yang* in Chinese folk knowledge reveal the SR of heaven and earth, human and nature (L. Liu, 2004), and
• dirt/cleanliness, morality/immorality and life/death are the antinomies that drive the SR of AIDS as “gay plague” (Joffe, 1995)

Wagner et al. (2000) notes that “The West itself is undergoing constant cultural change entailing...oppositional representations” (p. 20), implying a role in the evolution of an SR, although others suggest its relationship in in the progression of SRT is still unclear (Hoijer, 2011). This study contributes to this gap in understanding by investigating the role of antinomies in the TSSO SR.

3.4.5 Relevance of using Social Representations Theory in this study
Climate change is a “systems science” (IPCC, 1990, 1995, 2001b, 2007e, 2013) with a multitude of attributable causal factors and an extensive range of localised impacts. To effectively address the causes and impacts requires acceptance from society. SRT may prove useful in an analysis of how lay people consider and value climate change and the need for adaptive actions as a means to discern a locally active TSSOs understanding. How the consensual universe of social groups shares their common sense knowledge of this dynamic and complex science is a key factor in framing the political and community-based discussions required to drive public policy and civil society to act.

Notwithstanding its critics, SRT is appropriate to this TSSO study of the NBR Board because the research questions concern key aspects of SRT: 1. communicative processes relating to the Board’s “cognitive-emotional construction of reality”; and 2. the “intra-individual processes for constructing social identities” (Raudsepp, 2005, p. 466). This study does not seek to use SRT to reveal how an individual uses SRs (Raudsepp, 2005), so that outstanding critique is not relevant to this study. SRT was selected for this study of a strategically-placed TSSO in a climate change hot-spot because of the dialectical approach combining individual agency and social practice, and the dichotomy between understanding and communication. As the researcher, I am cognisant that an analysis of social representations must go beyond interpreting SRs as only the “mental content of individual minds” (Raudsepp, 2005, p. 461) and must include the role of the NBR Board's social practices, which produce “consensual meaning” through coordinated activities (Bauer & Gaskell, 1999). This is addressed in the methods chapter (Chapter Four).

3.5 Social identity components in Social Representations Theory and Identity Process Theory
Social identity describes that portion of an individual's self-concept derived from their relevant group memberships (e.g. family, school, organisation, social class), where the identity dynamics motivate the relationship of the group (1978). It provides an important
source of pride and self-esteem (J. C. Turner & Oakes, 1986), is associated with positive distinctiveness (Tajfel & Turner, 1979a) and motivation (Tajfel & Turner, 1979b). Expanding personal identity to consider an individual’s self-concept within a relevant social grouping became the realm of social identity as groups provide people with a sense of belonging (R. J. Brown & Turner, 1981; Erikson, 1980; Tajfel, 1978).

Social identity plays a role in SRT as it is relevant to the generation of a group’s social representations (Moscovici, 1961). Identity process theory (IPT) emphasises the dynamic interaction between the individual’s processes, such as memory and consciousness, and the physical and societal structures and influences that together construct identity, which also contributes to social representation development (Breakwell, 1986). These aspects of SRT and IPT are applied to the examination of identity among the NBR Board participants (Chapter Eight).

SRT, which seeks to explain how people interpret and communicate meaning from the social objects in their world, focuses upon processes of interpersonal communication, in which a group’s social identity can play a role, depending on the group and its structure (Moscovici, 1961). The exploration of social representations has revealed social identity in groups at various scales in studies of:

- Ethnic groups, where SRs reveal the effect of socially shared representations of collectively significant national historical events and identities on the incorporation into social representations of ethnic identities (J. H. Liu & Hilton, 2005) and
- Ethnic minorities in Malaysia and Singapore (J. H. Liu, Lawrence, Ward, & Abraham, 2002).

Breakwell and Canter (1993) noted that more research could focus on ways in which a social group generates SRs, which serve the purposes of the group. Revealing if a group had a unifying social identity would contribute to a better understanding of the nature of an SR with regard to its internal structure, the extent of its dispersal within the group, and the function it serves (Breakwell & Canter, 1993). Social identity is both situation-specific and dependent upon existing identity structures and processes that operate along basic principles.

Key principles of social identity include continuity, distinctiveness, efficacy and self-esteem (Breakwell & Canter, 1993). Continuity accommodates growth and change over time, relating to congruence between past and present as identity develops. This is not inconsistent with Erikson’s (1980) view that individuals persist in seeking “sameness with oneself”. Distinctiveness relates to development of some unique elements of identity.
Efficacy is characterised by control and competence, as opposed to feelings of futility or alienation. Self-esteem, partially achieved through the other principles, contributes to the selective perception of information processing and value formation. These principles are considered during discussion about a unifying social identity (Chapter Eight).

SRT allows for consideration of differences in the strength of members’ group identification and the level of resistance to new scientific concepts. Moscovici’s (1961) study addressed the level of the group’s cohesion and strength among its members, which generated varying levels of resistance to the new concepts (Table 3.2). This same concept is applied to the case study and reported in Chapter Six.

Table 3.2 Characteristics of the communications process of social representations among social groups in Moscovici’s psychoanalysis study (Adapted from Bauer & Gaskell, 1999; Moscovici, 1961)

<table>
<thead>
<tr>
<th></th>
<th>Social Milieu 1</th>
<th>Social Milieu 2</th>
<th>Social Milieu 3</th>
</tr>
</thead>
<tbody>
<tr>
<td>Societal segmentation</td>
<td>Communists</td>
<td>Catholics</td>
<td>Liberal urban elite</td>
</tr>
<tr>
<td>Strength of group identity</td>
<td>Strong</td>
<td>Strong</td>
<td>Weak</td>
</tr>
<tr>
<td>Process of communication (communicative modalities)</td>
<td>Propaganda</td>
<td>Propagation</td>
<td>Diffusion</td>
</tr>
<tr>
<td>Social-psychological function</td>
<td>Stereotype</td>
<td>Attitude</td>
<td>Opinion</td>
</tr>
<tr>
<td>Contents of communication (anchoring or objectification)</td>
<td>Social representations are anchored in images of class enemies such as the concept of psychoanalysis as an “imperialistic tool”</td>
<td>Social representations are anchored in the traditions and roles of the confessional in the religious practices of Catholics</td>
<td>No anchoring or objectification</td>
</tr>
<tr>
<td>Level of rejection/resistance or reception/acceptance of new scientific concepts</td>
<td>Total rejection of psychoanalysis</td>
<td>Partial and controlled reception of psychoanalysis</td>
<td>Reception of psychoanalysis</td>
</tr>
</tbody>
</table>

Identity, therefore, plays a role is the circulation of SRs through the “communicative modalities“ of propaganda, propagation or diffusion (Castro & Gomes, 2005, p. 5). Propaganda means biased or misleading information used to promote a political point of view; propagation is an act to widely spread and promote an idea; and diffusion implies the spread of lay knowledge more widely (Moscovici, 1961). In Moscovici’s study, the communists and the Catholics who used propaganda and propagation identified strongly with the values and practices of their group, making some level of resistance to the new phenomenon possible. Alternatively, the urban liberal elites, who had a tenuous identity with
their milieu, used diffusion to share opinions, ultimately showing acceptance of psychoanalysis (Moscovici, 1961).

Social identity can change within a group over time. Each social group is unique in the way it circulates, elaborates and reformulates its social representations. Every member contributes to the formulation of a social representation through his or her interaction within the group. As the collective knowledge on a new phenomenon grows, the group shares the information among its members and a new social representation is generated or an existing representation is transformed or reconfigured in some way. This, in turn, changes or restructures the group’s identity at that point. This social representation development process continues as long as the social group remains intact (Bauer & Gaskell, 1999).

The three communicative purposes of diffusion, propagation and propaganda are differentiated by the extent to which they are consensually shared within a group, which is influenced to some extent by the type and strength of a group’s social identity (Moscovici, 1961). Both social identity and social representations function at several levels from individual to group and beyond (i.e. external groups) and they serve to facilitate communication between group members (Breakwell, 1993). At the individual level, both identity and representations provide meaning to novel experiences with social objects or events, by setting them in a familiar contextual framework (Moscovici, 1981, 1984, 1988). Additionally, they provide “public rhetorics” from the group to “engender cohesiveness and manoeuvre relative to other groups” (Breakwell, 1993, p. 2).

Considering if there is a cohesive social identity within the NBR Board is meaningful to this study as it adds an additional dimension to the construction of SRs of the NBR Board participants. This study (Chapter Eight) considers elements of social identity drawing on SRT and IPT (Breakwell, 1986; Breakwell & Canter, 1993) to explore a social identity among the NBR Board through examination of the Board participants’ narratives.

3.6 Cognition, affect and behaviour: elements of social action
A theoretical approach to evaluate social adaptive actions examines its key elements of cognition, affect and behaviour (Lorenzoni et al., 2007). Effective action on climate change requires effective engagement, a “personal state of connection with the issue of climate change” (Lorenzoni et al., 2007, p. 446), which consists of concurrent elements: cognition, pertaining to knowledge; affect, denoting concern about and motivation; and behaviour, requiring specific action. While a number of studies considered these elements as they relate to community action to mitigate greenhouse gases (Leiserowitz & Feinberg, 2007; Lorenzoni
et al., 2007), this study employs these concepts to consider how to promote adaptive actions to local climatic impacts.

Cognition, affect and behaviour are necessary elements of individual and social action. Cognitive processes, encompassing such mental actions as knowledge, comprehension, judgment and memory, can employ existing knowledge and generate new knowledge. While a necessary element of social action, cognition alone is not sufficient to bring about individuals and social group engagement with climate change (Leiserowitz, Kates, & Parris, 2006; Lorenzoni et al., 2007).

Affect ties the individual or group to climate change and its consequences, enhancing the likelihood of engagement with the phenomenon (Leiserowitz et al., 2006; Lorenzoni et al., 2007). How people feel about an issue can potentially influence responsive actions (Slovic & Peters, 2006). An approach that also considers affect is consistent with other research promoting means of addressing climate change (S. L. van der Linden, Maibach, & Leiserowitz, 2015), which finds a need to refocus the public perceptions from a non-personal, spatially, temporally and mostly socially distant risk towards an understanding of climate change risks as being present, local and personal ones.

Effective social action requires an understanding of current behaviour; in addition to the understanding and motivation to act, with behaviour that supports social action as the goal (Lorenzoni et al., 2007). In a complex and dynamic phenomenon, such as climate change, actions are is required to mitigate effects of greenhouse gas emissions and adapt to its consequences. Effective climate change engagement requires major behavioural change (S. L. van der Linden et al., 2015) that is politically feasible and socially accepted by the broader public (Wolf & Moser, 2011).

3.7 Social Representations Theory research methods
Semi-structured interviews and free associations were selected as data collection methods for this study (Chapter Four), although a variety of empirical methodologies may be used to study the theoretical concept of social representations (Duveen & Lloyd, 1993). Key features of SRT make it especially relevant for qualitative research as it focuses on meaning and social context (Bauer, Gaskell, & Allum, 2000). Indeed, empirical research in the field of social representations has been conducted using a variety of research methods including interviews, surveys, focus groups, free associations, media analysis, questionnaires and observations, depending on the topic and types of participants (Wagner et al., 1999) using both qualitative and quantitative approaches (Breakwell, 1993) as illustrated in Table 3.3.
Table 3.3 Sampling of social representations research and methods used

<table>
<thead>
<tr>
<th>Research topic/group</th>
<th>Data collection/method of analysis</th>
<th>Reference</th>
</tr>
</thead>
<tbody>
<tr>
<td>Climate change/Australian public</td>
<td>Two online surveys/Free association</td>
<td>(Moloney et al., 2014)</td>
</tr>
<tr>
<td>Climate change/Swedish public</td>
<td>Focus groups/content analysis</td>
<td>(Wibeck, 2014)</td>
</tr>
<tr>
<td>Climate change/British public</td>
<td>Reader comments of British press/Critical discourse analysis</td>
<td>(Jaspal &amp; Nerlich, 2013)</td>
</tr>
<tr>
<td>Water recycling/Students and public, NSW, Australia</td>
<td>Self-report questionnaire/Individual difference scaling and word association</td>
<td>(Callaghan et al., 2012)</td>
</tr>
<tr>
<td>Global warming/London residents</td>
<td>Survey/Free association and thematic analysis</td>
<td>(N. Smith &amp; Joffe, 2012)</td>
</tr>
<tr>
<td>Climate change/Swedish newspaper and television media</td>
<td>Newspapers and television transcripts/Content analysis</td>
<td>(Hoijer, 2010)</td>
</tr>
<tr>
<td>Genetically Modified Organisms/Portuguese press</td>
<td>Newspapers/Thematic analysis</td>
<td>(Gomes &amp; Castro, 2005)</td>
</tr>
<tr>
<td>Organ donation and transplantation/ Western Australian public</td>
<td>Focus groups/Discourse analysis</td>
<td>(Moloney &amp; Walker, 2002)</td>
</tr>
<tr>
<td>Cultural change/Indian urban middle-class adults</td>
<td>Interviews/Thematic analysis</td>
<td>(Wagner et al., 2000)</td>
</tr>
<tr>
<td>Gender issues/UK school children</td>
<td>Ethnographic observation/Thematic analysis</td>
<td>(Wagner et al., 1999)</td>
</tr>
<tr>
<td>AIDS/UK and South African gay men</td>
<td>Interviews/Thematic analysis</td>
<td>(Joffe, 1995)</td>
</tr>
</tbody>
</table>

3.8 Social Representations Theory

Limitations to this study

SRT has gained prevalence as a useful theoretical approach for studying group communications of emerging scientific phenomenon (Moscovici & Markova, 1998; Voelklein & Howarth, 2005). As communities affect individuals’ lives, positively through grounding social identities and social construction of knowledge or negatively through marginalising or by stigmatising other groups, SRT is useful in understanding group communication and knowledge-building (Howarth, 2001). Therefore, SRT, as a theory of social knowledge and social change, offers an appropriate prism for a thesis concerned with understanding climate change and adaptation among an influential, local TSSO based in a community with rich biodiversity at risk from climate change. Yet, limitations to SRT should be considered as they may impact on this study.

As one of the more controversial concepts in contemporary social psychology (Voelklein & Howarth, 2005), SRT has drawn criticism of its formulation and application (Billig, 1987;
Potter & Litton, 1985) and its lack of mechanisms to reveal a person’s use of SRs (Raudsepp, 2005). Beyond misconceptions, proponents note the importance of addressing critics’ claims that SRT does not sufficiently distinguish SRs from attitudes or beliefs (Moscovici & Markova, 1998; Voelklein & Howarth, 2005). Others argue that much of the criticism arises from a lack of understanding of the dialectical dynamics between the individual and the social, both necessary components central to SRT (Raudsepp, 2005). Many social psychological theories depict a separation between individual perceptions and social context. SRs are simultaneous to both the individual and the social group. While SRs may appear to be contradictory (Howarth, 2001; Voelklein & Howarth, 2005), their generation reflects sense-making among individuals who interact with others (Moscovici, 1961).

3.9 Conclusion
In this study I consider how a local TSSO constructs knowledge about climate change and adaptation, applying theoretical perspectives from SRT and IPT and consider social adaptive actions through its cognitive, affective and behavioural elements. Employing these theoretical perspectives allows for consideration of the synergistic effect of the individual and the group working in concert to make sense of climate change, as yet an emerging scientific phenomenon to many segments of society. Lay knowledge from local pro-sustainability groups about climate change and adaptive responses can provide valuable alternative perspectives to assist communities in managing this phenomenon. Using SRT as the theoretical lens to answer research questions one and two fills a gap in the literature around how a TSSO understands climate change and adaptation. To answer research questions three and four, theoretical concepts around social identity, through application of theoretical concepts in SRT and IPT, and social adaptive action, through analysis of cognition, affect and behaviours of the NBR Board, were discussed and examined in this review. The NBR Board participants’ thinking about climate change and adaptation is significant in that they reside across the NBR and are active in various roles across their community; their understanding of the phenomena is amplified across the Noosa region through their community engagement efforts. Furthermore, sources of societal information, as can be provided through a prominent community organisation such as the NBR Board, which wear the imprimatur of UNESCO, can model and influence development of social representations in other groups in the community. Therefore, this study’s comprehensive analysis of multiple components of the NBR Board’s understandings of and actions on climate change and adaptation present a new approach to advancing efforts by civil society to address climate change and its impacts.
Chapter Four. Methodology and methods

4.1 Introduction
As discussed in Chapter Three, this study draws upon social representations theory (SRT) and identify process theory (IPT) to consider the social representations (Sections 3.3 and 3.4) and social identity (Section 3.5), respectively, of the NBR Board as it relates to climate change and concepts of cognition, affect and behaviour to address adaptive action (Section 3.6). It uses multiple methods in a single-case study design to examine how participants make meaning from the scientific phenomenon of climate change and how they adapt to its impacts. This chapter discusses the methodological approach (Section 4.2) and then presents the use of a single-case study approach (Section 4.3-4.5), which contributes to building knowledge from a previously unexplored third sector sustainability organisation (TSSO), the Noosa Biosphere Reserve (NBR) Board, around the significant global phenomenon of climate change. The NBR Board, as the case study, yields benefits from its global affiliations through UNESCO's Man and the Biosphere Programme (MAB) and the heightened impacts from climate change to the “vulnerability hot spot” of Noosa as identified by the IPCC (2007b). The participants were drawn through a purposive sampling method (Miles & Huberman, 1994) because of the unique social role of this TSSO, whose members commit to promoting sustainability and climate change education. Section 4.6 justifies the methods used and Sections 4.7-4.11 explains the data collection method design and collection process and ethics process.

4.2 Methodology
This study's analysis is filtered through the theoretical lens of social representations theory (SRT). Using a qualitative approach, demonstrating how people make meaning of human behaviours and their world (Creswell, 2014; Crotty, 1998), I sought to understand how the participants construct their subjective reality from their personal interpretations of values, beliefs, practices and experiences. SRT is based on the premise that interpretations are filtered through personal histories and social perspectives (Moscovici, 1961) and that people act on their social constructions of their world (Creswell, 2014; Crotty, 1998). This study develops theoretical propositions using SRT (Moscovici, 1961) as a theoretical lens through which to understand a TSSO working within the Noosa Biosphere Reserve (NBR) to share knowledge about two emerging scientific phenomena: climate change and adaptation.

4.3 Case study
This thesis employs a single-case study design. A single case, previously undocumented, is worthy of study and critical analysis (Yin, 2009) because of its complexity of this relatively
new phenomenon (Baxter & Jack, 2008). Further, this case study can inform of issues of concern to societies as well as inform strategic actions to address the issues. The benefits of using the NBR Board as the case study TSSO flow from the wider applicability of research outcomes to Biosphere Reserves (BR) worldwide and to other areas particularly vulnerable to climate change and its consequences (IPCC, 2007b) (Figure 4.1).

![Diagram of TSSO organisations, UNESCO biosphere reserve governing bodies, Noosa Biosphere Reserve Board of Directors, and Noosa Biosphere Reserve Board study participants.]

Figure 4.1 The TSSO case study in its broader context

4.3.1 The Noosa Biosphere Reserve Board within the context of the UNESCO Man and the Biosphere Programme

The aim of governing bodies of the UNESCO Biosphere Reserves is to advance sustainability (UNESCO, 1995, 1996, 2000, 2002, 2015). As of 2015, 669 globally-designated UNESCO Biosphere Reserves (BRs) operated across 120 countries (UNESCO, 2015). While this extensive MAB network has the potential to reach key stakeholders, such scientists, policy-makers and local community activists, the knowledge-sharing from its activities and their potential community benefits tends to be limited (Reed, 2016).

The NBR, one of 14 BRs in Australia (UNESCO, 2015), is charged with promoting sustainable use of the reserves’ natural resources, conserving its biodiversity (Moller, 2011) and advancing climate change education within its boundaries (UNESCO, 2015). Insight into the NBR’s role is further explained in the context of the overall UNESCO Man and the Biosphere Programme (MAB) system, which was created in 1971 to assist communities with high levels of biodiversity to address the key challenge of sustainable development (UNESCO, 1996). UNESCO BRs were created as a “concept and tool...as living laboratories of sustainable development, fulfilling three functions: conservation (ecosystems, species and genes);
development (human and economic); and logistic (observation, research, information exchange)” (UNESCO, 2005, p. 20). This approach attempts to “reconcile biodiversity preservation with human needs” and “improve understanding of the relationship between humans and their environment” (UNESCO, 2005, p. 20). UNESCO’s 1996 Seville Strategy outlined criteria for inclusion in the MAB stating that an area must contain human settlements within a rich ecosystem worthy of biological diversity conservation and a governance structure with demonstrable approaches to sustainable development on a regional scale (UNESCO, 1996).

Subsequently, the UNESCO MAB vision evolved in the 1990s to emphasise a social learning platform to support adaptive management based on different social groups and strategies for public engagement (Reed & Massie, 2013). Specifically, MAB expanded its explicit objectives to assist in “maintaining local livelihoods, including local people in decisions, and maintaining respect for the rights and responsibilities of local and indigenous peoples” (UNESCO 2000, 2002 as cited in Reed & Massie, 2013, p. 394).

In 1996, to complement sustainability, climate change was added to the mission of the UNESCO MAB. Promoting mitigation and adaptation measures throughout the hundreds of BRs worldwide highlights the importance of this global challenge to UNESCO:

MAB contributes to the fight against climate change and its negative impacts by promoting integrated, multidisciplinary, participatory approaches and networking within and among biosphere reserves on climate change mitigation and adaptation (UNESCO, 2016, para 3).

4.3.2 Justification for the Noosa Biosphere Reserve Board of Directors as a case study

The literature on the application of social representations theory identified that a research gap existed: SRT had not been applied to a TSSO’s understanding of climate change and adaptation. This case study of the NBR Board provides an appropriate context because of its: 1. UNESCO BR status; 2. Vulnerability to climate change as cited by the IPCC (2007b); and 3. Active interest by the local community and its council, which have strong sustainability values. In 2007, after a five-year community-government partnership involving thousands of hours of volunteer effort by local community groups and local council members and staff, UNESCO granted Noosa with BR status (McMullen, 2011, personal communication, November 16).

The NBR aligns with the Noosa Shire boundaries, located at the northern portion of the Sunshine Coast, about 1-2 hours north of Brisbane, Australia. The NBR comprises 1500
square kilometres of land, including national parks and nature reserves, farms, hinterland towns and coastal villages and a three-kilometre wide strip of adjacent offshore waters (Mullens, 2010). The NBR (Figure 4.2) houses 55,000 residents (ABS, 2004). As one of the most ecologically diverse regions in Australia (Noosa Biosphere Limited, 2009), it contains more than 300 bird, 700 native mammal and 1300 plant species, with at least 49 species of international significance (Noosa Biosphere Limited, 2015). It contains 44 per cent of Australia’s birdlife diversity and the largest riverine seagrass beds in South East Queensland (Mullens, 2010). However, it is essential that the NBR addresses the added stressors from climate change impacts (Hughes, 2011; McAllister et al., 2014). The IPCC identified the Noosa Shire, along with the rest of South East Queensland, as one of Australia’s six climate-change “vulnerability hotspots” (Hennessy et al., 2007; IPCC, 2007b; McDonald et al., 2010) because of the patterns of development, changes in land use, and population growth along its coastline. These conditions, coupled with projected climate change intensity, make the NBR particularly vulnerable to more intense storms, heatwaves and bushfires, and sea-level rise (Hennessy et al., 2007; McDonald et al., 2010).

4.3.3 The structure and purpose of the Noosa Biosphere Reserve Board of Directors
The NBR Board was selected because its membership is comprised of community volunteers who commit to an organisation espousing the sustainability principles of the UNESCO MAB. Specifically, this study drew participants from the 2012-2013 NBR Board. At the time of this study, the NBR Board operated as a not-for-profit company owned by the Sunshine Coast Regional Council which had been formed as a result of a forced amalgamation of three
coastal Councils, including Noosa, in 2007. While the former Noosa Council nominated the NBR, the new Sunshine Coast Council continued the commitment to support and fund its activities through 2013, the period covered by this study. Working with UNESCO, the Noosa Council formed a governance structure in 2008 that drew upon all sectors of the Noosa community: economic, tourism, social, cultural, environmental, and educational. As a result, the NBR Board, by charter, consisted of 65 volunteer Board members serving on one of six sector boards: economic; social; cultural; environment; tourism; and education, research and development. In addition, the Governance Board comprised two members from each Sector Board and two councillors. Collectively, the NBR Sector Boards, by developing a range of social, economic and environmental projects and initiatives, seek to inform and address the underlying sustainability challenges facing the Noosa community. All study participants either lived or worked in the NBR (Figure 4.3).

Figure 4.3 The NBR Board governance structure (Sunshine Coast Regional Council, 2008, p. 3).

The Board continues a close working relationship with Noosa Council, which de-amalgamated from Sunshine Coast Council in 2013 (Noosa Council, 2016a, para 3). The Council’s Corporate Plan promotes “custodianship of the Noosa environment” and a “sustainable Council” as being integral to Noosa’s future. The Noosa Council (2016b) operates according to six sustainability principles: promoting a sustainable resource base; an economy protective of its unique environment; residents who value the community’s diversity, accessibility and affordability; an inclusive, connected and resilient community; a healthy and active lifestyle; and a governance structure based on effective and efficient decision-making. The NBR Board’s charter (Noosa Biosphere Limited, 2009) highlights
sustainability and climate change as areas of focus. Inviting NBR Board members to participate in the study ensured the inclusion of individuals more likely than the general public to have an emerging or established perspective on adapting to the impacts of climate change.

4.4 Personal connection prior to the case study research
For ethical and transparency purposes, I have added this section to explain my previous work with the NBR Board. I served on the NBR Board from 2009-2010, serving on its Governance Board and its Education, Research and Development Sector Board. During that period, I co-chaired a community engagement effort to develop the Noosa Climate Action Plan (N-CAP), which was ultimately submitted to the Sunshine Coast Council for consideration of adaptation actions for the council to support and fund. I chose not to retain my position after that time for work and family reasons as well as anticipation of starting my PhD research. Throughout this study, I was not a member of the NBR Board and did not have direct access to its membership. Therefore, I went through official channels to gain the Board’s permission to gather research from its members, a process requiring approval from the NBR Board Secretariat. As social representations are time and place specific, my prior participation, which provided insights, was not directly relevant to the NBR Board’s understanding or actions at the time of the study. However, my service on the NBR Board helped me to consider how to design my PhD proposal.

Beyond my time on the NBR Board, this research concept developed from personal experience and interest in climate change science and policy over the past few decades. For over 20 years, I worked as a policy analyst for government and as a consultant covering climate change policy in the US and Australia. For the past nine years, I have taught climate change mitigation and adaptation policy to university undergraduate and postgraduate students. In the 16 years that I have lived in Australia, I have worked with a number of community groups to promote sustainability and address climate change.

Throughout that time, I have increasingly become concerned and gained a deep interest in how the public understands climate change and the need to adapt to its impacts. My personal experiences cut across the reified universe of the scientific community and the consensual universe of lay groups with whom I associate or belong, from students to community volunteers to family and friends. My roles required an in-depth understanding of the climate science, including the mitigation and adaptation aspects needed to address impacts. Serving as an adaptation policy analyst for the Queensland Government’s Office of Climate Change from 2007-2008 provided me with an opportunity to help develop and
implement the State’s adaptation strategy and deliver it to community groups across Queensland. Engaging the community and examining their views on local climate change impacts and adaptation measures provided me with an insight into some of the knowledge gaps preventing the development of best practice approaches to adaptive actions. My experience in conducting community adaptation workshops across Queensland showed me that, of those in the lay public who attended the workshops, there was an interest in, but limited knowledge about, many aspects of the local and global impacts and an eagerness to understand how to address it.

My growing interest in understanding how society and various social groups think about climate change and the need to promote local adaptation initiatives began to galvanize around the community groups with whom I worked, ultimately focusing on the NBR Board. Through my community work, I developed a desire to study how the NBR Board views key components of climate science, such as climate variability and the human activities that contribute to 21st century climate change, and the adaptation required to address its local impacts.

4.5 Participant recruitment process
The nature of this study lends itself to the use of the purposive sampling method (see Miles & Huberman, 1994) in that the participant pool has a unique role within society as members of a TSSO committed to promoting sustainability and climate change education. While the majority of the NBR Board members were unknown to me, as I had previously served on the NBR Board, I knew some of the current members. Thus, to avoid bias in the participant selection process, the participants were solicited through the NBR Secretariat, which ensured that an equal opportunity was presented to all Board members and that I was not directly involved in the selection process. In response to my request for approval to conduct this study, the NBR Board for the first time voted to permit Board members to participate in research through passage of a resolution. All participants were actively working on Board projects in the Noosa Shire at the time of their interview and volunteered their time for the interview.

Participants were recruited through two emailed invitations and announcements at sector board meetings. This resulted in 23 participants. The first nine participants volunteered as a result of the initial email invitation (with study summary and consent form) (Appendix 4.1) sent by the NBR Board’s secretariat to the Board membership in April 2012. The Board’s secretariat sent a second email in October 2012 with the same information. An additional process to secure participation involved the six Sector Board chairpersons sharing the Board
secretariat’s email invitation periodically during Sector Board meetings conducted from May 2012 to March 2013. This generated an additional 14 participants. Those wishing to participate in the study were invited to contact me, either by phone or email, and, hence, are assumed to have self-selected for this study.

This multi-staged participant selection process was helpful in achieving the objective of a cross-section of Sector Board representation from among the Biosphere Board membership. The objective of participant selection should be to maximise the potential to obtain differing viewpoints of group members (Bauer & Gaskell, 2000).

4.5.1 Sample size and demographics of participants
Twenty-three participants, over one-third of the NBR Board, which includes the Governance Board and six Sector Boards, were interviewed for this study. The semi-structured face-to-face interviews ranged in length from 30 minutes to 1.5 hours, with an average length of 60 minutes and took place within a 12-month period in 2012-2013: three interviews in May 2012; six interviews between June-August 2012; five interviews in November 2012; and nine interviews between February-April 2013.

Regarding sample size, with a limited number of differing versions of reality, a saturation point is eventually reached where “more interviews do not necessarily imply better quality or more detailed understanding” (Bauer & Gaskell, 2000, p. 43). Given the homogeneity of the NBR Board and its explicit focus on sustainability and climate change, saturation point was reached through 23 interviews. By the 19th interview, it was clear that themes were consistent and no new themes were arising. However, I had previously scheduled the remaining interviews and continued to conduct them. Twenty to 25 one-hour interviews, which could produce over 300 pages of text for analysis, should be the upper target for a single researcher (Bauer & Gaskell, 2000). This rationale focuses on the ability of the researcher to be able to absorb the essence of the interviews: “it is essential to almost live and dream the interviews – to be able to recall each setting and respondent and the key themes of each interview” (Bauer & Gaskell, 2000, p. 43). The data generated for this study includes 285 pages of over 127,000 words of transcribed interviews.

The NBR Board is not representative of the Queensland or Noosa demographic, in a number of ways; however, participants who volunteered were typical of NBR Board members. Although the peri-urban Sunshine Coast region has a higher unemployment rate than the State average (ABS, 2016), most of the NBR Board study participants were employed in a professional capacity. Participants’ careers in business included an accountant, an architect, a corporate executive and several local business owners and, among those who had retired,
a chief executive officer and a chief financial officer from two mid-sized Australian companies. Nine of the participants worked in local or state government and two were academics. Two participants chose to pursue formal education in sustainability and climate change: one studied sustainability at TAFE, and the other undertook an honours degree in climate change adaptation at the local university. Additionally, the homogeneous grouping included a relatively high level of education showing the majority held a Bachelor’s degree and over one third had post-graduate degrees of which four were PhDs. This distinguished them from the 15.8 per cent of Queenslanders with a Bachelor’s or higher degree (ABS, 2016). While not reflective of Queensland demographics, the NBR Board participants shared similarities with the Noosa region with regard to age and gender (Table 4.1). This information is not meant to indicate a representative sample of Noosa, but to provide general information to place the participants within their community. For this study, ages ranged from 19 to 75, with the majority aged 35-65. The median age in Noosa (ABS, 2016) is 45 years. The participants lived throughout the region, with half from the western hinterland communities (26%) and the Noosa town centre (26%), and the other half (48%) from its coastal villages from Sunshine Beach to the Noosa Shire’s southern boundary at Peregian Beach.

Table 4.1 Demographics of NBR Board participants and the NBR

<table>
<thead>
<tr>
<th>Category</th>
<th>Percentage (number) of NBR Board participants</th>
<th>Percentage or median within the NBR (ABS, 2016)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gender</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Female</td>
<td>52% (12)</td>
<td>51.3%</td>
</tr>
<tr>
<td>Male</td>
<td>48% (11)</td>
<td>48.7%</td>
</tr>
<tr>
<td>Age</td>
<td></td>
<td></td>
</tr>
<tr>
<td>45 and older</td>
<td>56% (13)</td>
<td></td>
</tr>
<tr>
<td>Under 45</td>
<td>44% (10)</td>
<td>Median age 45.5</td>
</tr>
</tbody>
</table>

Consistencies between the NBR Board’s composition and the participants extend to their passion for and commitment to sustainability, their higher education credentials and choice of professional occupations, illustrating participant demographics that were representative of the Board as a whole. The diversity of the participants, with an extensive age range across generations and residences across the Noosa region provides varying spatial and temporal frames exposing the participants to potentially experiencing and interpreting local climate change events in differing ways. The group’s mix of gender, ages and places of residence demonstrates the potential for interaction with and exposure to other social groups (e.g.
family, neighbourhoods, and peer groups) and the reach of the group’s communication across the region.

4.6 Justification for methods
To answer the research questions, this thesis used the data collection methods of semi-structured interviews and free associations questions. The methods of analysis included thematic analysis and free associations. Semi-structured interviews proved valuable for uncovering the beliefs, values and practices (Bauer & Gaskell, 2000) in this study around climate change, its consequences and responses. While using the semi-structured interview topic guide to steer the conversation, the flexibility of the technique elicited previously unanticipated but relevant topics that yielded personal experiences, motivations and associations. The semi-structured interviews also included a free association task (Hollway & Jefferson, 2008) to identify knowledge and emotions of climate change. While a formal document analysis was not intended nor undertaken, during the literature review, two relevant documents were uncovered and cited in this thesis: Figure 4.3, The NBR Board governance structure and Table 8.2, The NBR Board engagement activities for 2012-2013. In addition, the extensive literature review in Chapter Two provides the expert knowledge used to compare the lay knowledge drawn from the participants’ interviews.

4.6.1 Sequential qualitative-qualitative mixed method design
The sequential qualitative-qualitative research design, using a complete method with a supplemental component, both from the qualitative paradigm, is a legitimate form of mixed method design (Morse, 2010) and provides for the opportunity to expand upon the initial research questions in a systematic and theoretical approach, including analysis of data derived from semi-structured interviews, focus groups and observation (e.g., Morse, 2010; Morse & Niehaus, 2009). For this thesis, the core component and the supplementary component consist of an inductive theoretical approach, which is exploratory in nature. This thesis incorporates the sequential supplemental qualitative component to answer two additional research questions emerging from the analysis of the core project of social representations of climate change and adaptation. The supplementary component includes an analysis and discussion of the social identity of the participants and also informs the discussion around implications for practice, in this case, around the social actions of the NBR Board.
4.6.2 Link between methods and research questions

Each method was selected for its relevance to answering a specific research question (RQ) (Table 4.2).

Table 4.2 Relationship among research questions, methods and analytical tools

<table>
<thead>
<tr>
<th>Research question (RQ) (Chapter)</th>
<th>Intention to know</th>
<th>Data collection method</th>
<th>Analytical tool</th>
</tr>
</thead>
<tbody>
<tr>
<td>RQ 1: What is the nature, if any, of social representations around climate change within this group of NBR Board participants? (Chapter Five)</td>
<td>Subconscious understanding of and emotional connection to the term ‘climate change’</td>
<td>Semi-structured interviews, which included free associations</td>
<td>Free association technique</td>
</tr>
<tr>
<td>RQ 1 (Chapter Six)</td>
<td>Social representations of climate change</td>
<td>Semi-structured interviews</td>
<td>Thematic analysis</td>
</tr>
<tr>
<td>RQ 2: What is the nature, if any, of social representations around climate change adaptation within this group of the NBR Board participants? (Chapter Seven)</td>
<td>Social representations of climate change adaptation</td>
<td>Semi-structured interviews</td>
<td>Thematic analysis</td>
</tr>
<tr>
<td>RQ 3: What is the nature, if any, of a social identity within this group of NBR Board participants? (Chapter Eight)</td>
<td>Social identity of the NBR Board</td>
<td>Semi-structured interviews</td>
<td>Thematic analysis</td>
</tr>
<tr>
<td>RQ 4: What is the relationship among social representations, social identity, and social actions of the NBR Board regarding climate change and adaptation, and what are the implications for TSSOs in general? (Chapter Nine)</td>
<td>Relationship between social representations, social identity and social action</td>
<td>Semi-structured interviews</td>
<td>Thematic analysis</td>
</tr>
</tbody>
</table>

RQ 1: What is the nature, if any, of social representation around climate change within this group of NBR Board participants?

RQ 2: What is the nature, if any, of social representations around climate change adaptation within this group of the NBR Board participants?

For research questions one and two, the topic guide questions for the semi-structured interviews were developed based on the key concepts of established climate change science (i.e. reified knowledge) to assess whether social representations of climate change exist among the NBR Board participants, and if so, to what extent they are cohesive and aligned.
with best practice understandings of the scientific community. Design of the topic guide considered the analytical tools, including the free association tasks and thematic analysis.

**RQ 3: What is the nature, if any, of a social identity within this group of NBR Board participants?**

The supplemental research question three was used to probe further into the NBR Board participants' group identity as a result of analysis of the first two questions. The social identity of the NBR Board is assumed to contribute to its motivation, social representations and social actions, as suggested by the literature. Questions in the semi-structured interview topic guide asked the participants about their concerns and actions in relation to climate change risk and impacts to see if they identified with climate change. The topic guide did not include direct questions about sustainability. However, many participants offered views on sustainability and noted that sustainability was the reason for participating in the NBR Board. Unexpectedly, the identity that emerged from the data was one around sustainability. Hence, this led to the final supplemental question.

**RQ 4: What is the relationship among social representations, social identity, and social actions of the NBR Board regarding climate change and adaptation, and what are the implications for TSSOs in general?**

This additional supplemental question, research question four, addressed in Chapter Nine, analyses and summarises the results from the interview data analysed in Chapters Five, Six and Seven identifying the social representations of climate change and adaptation and, in Chapter Eight, the group’s social identity with sustainability. Chapter Nine considers how those elements relate to the NBR Board’s social actions around climate change and adaptation. The meta-analysis from the summaries is considered across the categorisations of cognition, affect and behaviour (Leiserowitz & Feinberg, 2007) to reveal the extent to which these aspects were present. Further, it analyses these aspects and makes recommendations for enhancement of social adaptive actions.

### 4.7 Instrument design for semi-structured interviews

Semi-structured interviews were used to uncover the participants' understanding of climate change and its consequences from their personal experiences, motivations and associations. Semi-structured interviews involve themes to be explored in-depth through use of a pre-determined set of open questions that prompt discussion. As a former NBR Board member, I had a keen understanding of the NBR Board’s objectives and activities prior to undertaking this study. This prior knowledge assisted in developing relevant and meaningful semi-
structured questions (Cohen & Crabtree, 2006). Because of my personal knowledge of the NBR Board processes, as the interviewer, I was able to probe particular themes or responses further, and, through a conversational approach, able to follow relevant trajectories that stray from the topic guide as appropriate. Interviewees had the freedom to express their views in their own terms thus the technique provided the opportunity to identify new ways of seeing and understanding the topic at hand (as per Cohen & Crabtree, 2006). An explanation of the two parts of the interview follows.

4.7.1 Free association questions about knowledge and emotions connected to climate change

The free association questions were developed following the Hollway and Jefferson (2008) free association approach, which used one question per association task. I developed two questions: one question to solicit words denoting the participant’s initial impression of knowledge about climate change and a second question to solicit an initial emotion associated with climate change. These two questions appear in the topic guide in Appendix 4.2: “What words or images come to mind?” and “What feelings or emotions do you experience when you think of climate change?” The first round of nine interviews provided intriguing results and the questions were left in the interviews.

Identifying initial thoughts about what climate change means to the participants can add to understanding how lay thinking of climate change is conceived and framed (Moloney et al., 2014). The free association process elicits spontaneous initial unconscious thoughts. The value of uncovering the roots of an individual’s understanding, resides in their spontaneity: “[they are] not structured according to conscious logic, but according to unconscious logic; that is, the associations follow pathways defined by emotional motivations, rather than rational intentions” (Hollway & Jefferson, 2008). This approach is useful to this study because “[F]ree associations defy narrative conventions and enable the analyst to pick up on incoherences (e.g., contradictions, elisions, avoidances) and accord them due significance” (Hollway & Jefferson, 2008, p. 310). Free association techniques eliciting knowledge and emotions about climate change have been used to consider how audiences understand climate change in Australia (e.g., Moloney et al., 2014) and in international contexts (e.g., Leiserowitz, 2006; N. Smith & Joffe, 2012).

In this thesis, considering emotions associated with climate change provides an added dimension to the examination of how the participants perceive and relate to the research object. Seeking emotive associations specifically provides additional and nuanced knowledge about affect (Hollway & Jefferson, 2008). Considering the positive or negative emotions
provides additional context regarding a group’s relationship to the research object, perhaps with the potential for active consequences (Hoijer, 2010). For example, international research into climate change perceptions has studied emotional associations of climate change among American (Leiserowitz, 2006) and Swedish populations (Hoijer, 2010). In the Swedish case, there was emotional anchoring and objectifying of climate change in the media, which enhanced engagement with the public (Hoijer, 2010). However, if the climate change narrative is too heavily laden with negatively emotive scenarios, at least some segments of society may become indifferent or disillusioned (Hoijer, 2010; Moser & Dilling, 2007).

To consider social representations, dialectical components, which may appear as antinomies, may be present in group thinking and communication as its members grapple with understanding a social object that may be unfamiliar (N. Smith & Joffe, 2012). Free association tasks, providing initial connections with a research object, can provide a structure from which to identify the dialectical components, which aid in uncovering patterns within social representations (Augoustinos et al., 2006; Moloney, Hall, & Walker, 2005). For example, in seeking SRs of organ donation and transplantation, one study discerned two prominent and stable elements that were antagonistic in nature: life/death (Moloney et al., 2005). Prominent elements of an SR of climate change that emerged from the word associations in this thesis circulate around the climate change themata of cause, impacts and responses. Other researchers have used antinomies as an initial step to the analysis of themata because they provide a way to structure the “numerous themes that emerge from the informant’s stories” (L. Liu, 2004, p. 255). Free associations have been employed in questionnaires and surveys to collect data (Wagner (1997) Moloney et al. (2005); N. Smith and Joffe (2012). N. Smith and Joffe (2012) used word associations to develop binary opposites from which to analyse themata to reveal social representations of climate change among Londoners. In uncovering the antinomies, I followed the process of the constant comparative method of analysis (Glaser & Strauss, 1967; Lincoln & Guba, 1985; Maykut & Morehouse, 1994).

Themata, uncovered through antinomies emerging from the free association technique, will be used to frame the analysis of an SR of climate change (Section 3.4.4). Moscovici (2001, p. 32) observes that “social representations occur in pairs, each one having its alternative, such as sacred and profane representations in religion or standard and nonstandard paradigms in science”. These inconsistent elements within the representation, while interrelated, often form a dialectical relationship, which is mutually antagonistic. The
contradictory or inconsistent nature was considered in coding interview data by antinomies because the dialogical contradictions between two beliefs, that are themselves reasonable, can assist in the analysis process and can reveal how knowledge and emotions evolve (N. Smith & Joffe, 2012). While paradoxical, these contradictions occur within SRs in a number of studies (Bauer & Gaskell, 2002; Moloney et al., 2005).

4.7.2 Semi-structured interview questions

The topic guide presented sub-sections on climate change attribution, impacts, risks, adaptation, and future climate change; each sub-section moved from general to more specific questions. This type of structure aimed to elicit participants’ views with the least bias from the interviewer. As climate change and adaptation were the foci of this study, the topic guide did not include climate change mitigation questions, although some participants introduced the topic as they answered questions.

The topic guide did not directly ask the participants about sustainability, although most of the participants offered views on sustainability or the importance of sustainability to their lives or to addressing climate change (Chapter Eight). Thus, it was important to incorporate the sequential research design into this thesis to further explore this previously unanticipated area revealed through the topic guide process (Section 4.3). The topic guide and semi-structured nature of the interview provided flexibility to both interviewer, and interviewee, allowing for a natural progression to the conversation that would not be possible in a more rigid format or questionnaire. It provided an opportunity to delve in-depth about the personal values and motivation for service on the NBR Board that was not initially planned, but ultimately proved valuable to its findings.

During the literature review, I uncovered a document that proved useful for the purpose of verification and triangulation of interview data, reported in Chapter Eight (Table 8.6). In the interviews, many participants discussed their NBR Board activities or rationale for serving as an NBR Director. The document review and analysis afforded an opportunity to confirm the participants’ recollection of activities and perspectives. Analysing the NBR Board and Council documents relevant to the NBR Board’s projects and purpose enabled an exploration of the NBR Board from multiple perspectives and improved interview data credibility (Baxter & Jack, 2008). The reviewed documents were collected from a personal visit to the NBR Board offices and from online document searches.

An analysis of relevant institutional documents from the NBR and the Noosa Shire Council and, subsequently, the Sunshine Coast Council, provided the context for consideration of a social identity of the NBR Board (Chapter Eight). Miller (1997, p. 77) notes the value of
institutional document analysis in providing a “practical social context of everyday life within which they are constructed and used”. Because the Noosa Shire Council, and subsequently the Sunshine Coast Council, funded the NBR Board’s engagement activities, a review of Council documents was included. Documents and website information included the Council’s NBR application to UNESCO, Corporate Plan, and budget documents, and the NBR’s website, reports and project profiles. These were reviewed to better understand the responsibilities and activities of the NBR Board during the study period of 2012-2013 as these projects were initiated by the Board itself and not mandated by the Council or outside authority. This also provided confirmation of interview comments about participants’ work on specific NBR projects and activities. The documents were selected through an initial literature review, with additional documents examined as they were mentioned by the participants.

4.8 The interview process, data collection and transcription
For the free association task (Chapter Five), all participants were asked if any words describing understanding or emotions, respectively, came to mind when they heard the term ‘climate change’. To generate data for the social representations of climate change and adaptation (Chapters Six and Seven), I followed the topic guide questions, while allowing the participants to discuss other ideas and issues that came to mind. Cognisant that “the nature and contour of elements themselves are influenced by the investigation method, and by the choices made by the researcher when subsuming empirical data into “elements” (Lahlou & Abric, 2011, p. 20.26), I made an effort to minimize my influence by limiting my interjections and allowing the participants to complete their thoughts before returning to the topic guide.

Transcription began in May 2012 after completing the initial three interviews. I listened to each interview first and then began transcribing the entire interview verbatim, correcting only for errors in grammar and omissions of audible pauses, such as “ah” and “um”. After listening to an interview, I wrote a summary of the interview focusing on the main ideas, from which I developed initial themes from which to later segment the data.

I personally transcribed 11 interviews. The remaining 12 were transcribed verbatim by a university-approved transcriber. To review these contracted interview transcriptions for accuracy, I listened to each interview recording while reading the completed transcripts. This approach allowed me the opportunity to edit the transcripts as necessary and to develop a structure of emerging themes for future exploration.

4.9 Thematic analysis process
Guided by the tenets of SRT, thematic analysis was used to develop codes and themes to analyse the interview data (Chapters Five to Nine). While trained in the use of NVivo
software, I initially used this research tool to code the interviews. Several months into the initial coding process using NVivo, my computer became disabled. Therefore, I lost a large amount of research and time required to input and create the coding structure in NVivo. However, I had the data and coding in print and I understood my data fairly well. At that point, I chose to continue to develop my coding and analysis structure by creating my own coding process using Microsoft Word. An advantage of eschewing NVivo for a more personal, hands-on approach to coding and analysis is less distance exists between the researcher and the data (Baxter & Jack, 2008).

To begin the coding process, I initially coded the first nine interviews to develop themes and subthemes. This process ran concurrently with the data collection process for the remaining 14 interviews. Microsoft Word documents for each of the initial nine transcripts were created and quotes were identified to illustrate themes.

After the completion of the data collection process, I compiled a master document incorporating all 23 interview transcripts into one Word document, with each interview with its own identifier, from 1 to 23, indicating individual participants. I chose, at this point, to implement a process of double coding a set of data to enhance the trustworthiness of the coding process (Krefting, 1991 as cited in Baxter & Jack, 2008). Therefore, I recoded the initial nine transcripts as part of the master document of the complete body of 23 interview transcriptions. This allowed me to compare the initial coding with the secondary coding in the master document to consider theme development over time. The results showed no meaningful coding differences between the two sets.

In the master transcription document, I placed an extract identifier, which incorporated a code for both the interview transcript and the interview quote. For example, an extract identified as 1.C1 indicates the first interview transcript and the first interview quote regarding a cause of climate change. Extract identifiers for interview quotes cover causes (e.g. 1.C1); impacts (e.g. 1.I1); responses (e.g. 1.R1); adaptation actions (e.g. 1.A1); and sustainability concepts (e.g. 1.S1) and appear in text boxes and tables in Chapters Five to Eight.

4.9.1 Analysis of climate change knowledge and emotion associations
In this study, free associations (Hollway & Jefferson, 2008; N. Smith & Joffe, 2012) serve as a foundation for key theme development for analysis of social representations of climate change (Chapter Six). During the data collection, two free association questions were posed,
one on knowledge and one on emotions connected to the term climate change (Section 4.7.1).

This study codes free associations as first-order and subsequent-order associations to delve deeper into the initial understandings of climate change (N. Smith & Joffe, 2012). Two questions in the interview topic guide asked for the participants’ understanding and values (hereafter called knowledge associations) and emotions (hereafter called emotive associations) around climate change and comprised the free association task. These two questions were used to identify initial spontaneous perspectives and emotions as a first step to uncover latent patterns within representations (Chapter Five). Associations relating to a phenomenon are valuable in uncovering the roots of an individual’s understanding (Hollway & Jefferson, 2008) and have been used in social representations research previously, for example to explore the public’s views on organ donation, but not within a TSSO in Australia or abroad.

To present the results of the knowledge and emotive associations, I read the transcripts and created two tables in Microsoft Excel. The knowledge and emotive associations from each transcript were placed, in order of delivery, into an Excel spreadsheet placed next to the participant identifier code (e.g. SA1). Each participant could offer up to four knowledge associations and four emotive associations. Using SRT as a theoretical guide, I organised the word association data into emerging themes appearing as antinomies or oppositional dyads (Chapter Five) as a means to consider the role contradiction can play in social representations of climate change (Chapter Six).

The second phase of the free association task sought to reveal the range of emotions generated from the term climate change, as emotions affect social action (Leiserowitz & Feinberg, 2007). Emotive associations can reveal “the kind of narrative that is not structured according to conscious logic, but according to unconscious logic; that is, the associations follow pathways defined by emotional motivations, rather than rational intentions” (Hollway & Jefferson, 2008, p. 309).

4.9.2 Analysis of social representations
The first and second research questions examine social representations of climate change and adaptation. SRT, a socio-psychological theory, sits at the intersection of the individual and the group. By definition, social representations (SRs), are collective understandings derived from individual understandings of a subject (section 3.4). The methods of analysis used to reveal SRs (section 3.7) include the coding of interview data from the level of the individual, including the individual’s knowledge and emotions to clarify the group’s
understanding. This was achieved through coding the transcribed interview quotes into themes as is standard SRT analysis to make an assessment of the group’s understanding based on the scope and depth of its collective understanding (section 3.4.4).

The coding of the interviews followed the process of the constant comparative method of analysis (Glaser & Strauss, 1967; Lincoln & Guba, 1985; Maykut & Morehouse, 1994) to use the participants’ own words to code and build themes. The constant comparison method identified new themes as the analytic process evolved. The themes were coupled as antinomies, using a recognized approach to consider social representations (N. Smith & Joffe, 2012). In addition, the analysis considers if hegemonic, emancipated or polemic representations contributed to a climate change SR.

I began the coding process by developing a matrix using the broad categories in the topic guide: sustainability, climate change, impacts and risk, adaptation to impacts, and responses to climate change. I paid particular attention to the conceptual nature of the text in the coding process.

After the initial review of transcripts, upon subsequent readings, I coded each interview in the master transcript document for each pair of antinomies and developed tables of interview extracts that emerged from the word association tasks: causality, impacts and responses. The themes and subthemes were divided into a priori or deductive themes emanating from the literature and a posteriori or inductive themes, generated by the researcher from analysis of the data. Using the constant comparison method, some subthemes were merged or renamed as new data were reviewed and added to the initial data generation document.

The constant comparison method (S. J. Taylor, Bogdan & DeVault, 2016), which I followed included the following steps:

- Data were coded by refining the themes as I better understood the categories and as the relationships between categories developed;
- While I commenced the coding and theme development initially in the review and transcription phase, I continued to refine my interpretation and analysis according to established practices used consistently by researchers in the field of social representations;
- I began by creating a list of possible antinomies (e.g. anthropogenic/natural causes of climate change) and highlighting illustrative quotations;
• For use in writing my findings, I created a list of quotes that were relevant to the antinomies, descriptive in nature or that demonstrated an inconsistency with scientific thinking on climate change.

Some emerging antinomies had been considered as possibilities because they were prominent in the climate change literature, such as the causes of climate change being naturally or anthropogenically induced (Leviston et al., 2011; Leviston et al., 2014; Oreskes & Conway, 2010). Once a pair appeared in the data, they were added to an initial list. The final a posteriori coding table shows emerging themata of climate change causality, impacts and responses. The analysis included an examination of whether there were hegemonic, emancipated or polemic representations of climate change and/or adaptation and provided examples of the SR communicative processes of anchoring and objectification. I examined these representations for cohesion, to understand if they were solely or primarily hegemonic, largely consistent or overlapping constructions, or if, additionally, there were emancipated and polemic representations that offer alternative meaning.

4.9.3 Analysis of social identity
To code the data to address research question three, seeking to know if there was a social identity among the NBR Board participants, I sought to identify relevant themes, following the above-mentioned constant comparative method. I coded, as extracts, quotes relating to a participants’ connection to sustainability principles or practices or climate change advocacy or practices during or prior to their work with the NBR Board. The themes and subthemes emerging from the data relating to the participants’ shared identity were exclusively a posteriori or inductive process.

Through this coding exercise, it became clear that many participants had a personal connection to sustainability, revealed through their narratives around how they first became aware of sustainability principles or how they employed sustainability in their personal lives. As these ideas emerged from the data, I began coding for themes of personal knowledge and experiences around the participants’ formative concepts about sustainability; activities that reinforced their commitment to sustainability; and examples of how they applied sustainability in their lives (Chapter Eight). Using thematic analysis, I coded the interview extracts by the emerging themes of sustainability experiences: 1. Formative sustainability (Section 8.3); 2. Reinforcing sustainability (Section 8.4); and 3. Applying sustainability (Section 8.5). This allowed for an analysis of social identity elements of continuity, distinctiveness, efficacy and self-esteem (as introduced in Section 3.5).
4.9.4 Analysis of the relationship among social representations, social identity and social action

To address the research question four, the relationship among the Board’s social representations, social identity and social actions around climate change and adaptation (Chapter Nine), in addition to the findings of SRs and social identity, I considered the cognitive, affective and behavioural elements of social action (as per Leiserowitz & Feinberg, 2007). Specifically, the findings of this TSSO’s social representations and social identity are categorised as cognitive (Section 9.3.2), affective (Section 9.3.3) or behavioural (Section 9.3.4) according to Lorenzoni et al. (2007). For the purposes of this study, social actions are those projects and activities undertaken by the Board members to advance the goal of the UNESCO Noosa Biosphere Reserve, namely to advance climate change and sustainability (Section 4.3). This process enabled consideration of the relationship to the participants’ shared social identity with sustainability and their relationship to climate change from SRs. It also offered a comparison between the NBR Board participants’ identity and SRs, and the NBR Board social actions demonstrated through projects about sustainability and climate change.

4.10 Ethics

This study’s data-generation techniques and data analysis were conducted under the University of the Sunshine Coast (USC) ethical standards and code of conduct under permit USC/S/12/386. All phases of the research were developed within the ethical principles of professional competence, integrity, social responsibility, scientific and professional responsibility and respect for individual and human rights (D. C. Miller & Salkind, 2002). Prior to the interview, each participant received an information sheet (Appendix 4.1) alerting them that all interviews would be recorded, their transcripts could be reviewed and they could withdraw from the study at any time. All interviews conformed to ‘informed consent’ principles, which ensured that participants received the necessary information about the study, understood it was voluntary, and that data would be aggregated so that they could not be identified. Each participant signed a consent form acknowledging the process prior to the interview. After the recorded interview concluded, participants were offered an additional opportunity to request a chance to review their interview transcript and were provided with a currently operating email address to request a transcript or withdraw from the study in the future. No requests were forthcoming. As researcher/interviewer, I was cognizant of the importance of impartiality and consistency throughout the interview phase. Prior to my research, I advised the USC ethics committee of my previous volunteer role.
Chapter Five. Free associations with climate change

5.1 Introduction
First impressions count. Considering free associations with novel or even established phenomena provides valuable original insights into an individual’s unfiltered thoughts. These unconscious understandings of knowledge of and emotions towards climate change are one component of a group’s lay thinking about this relatively new scientific phenomenon. Comparing the lay knowledge of the participants with expert knowledge, can indicate areas where more usable information could enhance support for social action by the NBR Board. The public’s accurate understanding of the climate change dilemma can enhance effective social actions, especially when it is promoted through a respected local TSSO.

This chapter covers the results and discussion of the free association tasks around initial understanding, the knowledge and values offered, and emotions connected with the term climate change. As these associations reveal recurring linguistic or affective elements, analysing associations of a particular group may reveal patterns of antinomies, conceptualising contradictory or inconsistent elements related to a scientific phenomenon. The chapter begins by summarising why the free association task was used for this study. The results present word associations that align with three themata (i.e. themes) relating to climate change: cause, impacts and response. From these three themata, antinomies are presented (to be further analysed in Chapter Six) and provide a first insight into these participants’ social representations of climate change. The results identify the knowledge and emotions presented in the free associations with the term climate change. The discussion considers the implications of the free associations to the Noosa Biosphere Reserve (NBR) Board’s understanding of climate change.

The following results and discussion present associations derived from the interviews with study participants. The free association task developed a posteriori antinomies, which emerged from the data, providing an initial means to consider original insights into climate change by the participants. In each interview, prior to discussing the topic of climate change, I asked for words that come to mind when hearing the term climate change, and secondly, if the term produced any emotions.

5.2 Results of free associations with climate change
This section presents the results of two free association tasks: words relaying knowledge of climate change and emotions connected to this phenomenon.
5.2.1 Knowledge associations with climate change
I used the free association task initially to explore words that convey the participants’ knowledge behind the socially constructed understandings of climate change (hereafter called knowledge associations). Each participant was given an opportunity to offer up to four words associated with climate change. From the 23 participants, 72 knowledge associations with climate change were elicited (Appendix 5.1). While participants were not required to offer any associations, all 23 offered at least one knowledge association with climate change; 15 participants provided four associations. The first-order associations were tabulated separately from the subsequent associations: a compilation of the second-to-fourth-order associations (N. Smith & Joffe, 2012). Where appropriate, for preservation of distinctive patterns, associations were homogenised, with semantically similar words, plurals, and singular words categorised under the most frequently occurring association (Moloney et al., 2012).

Analysis of the themata arising from the knowledge associations reveal three distinct categories: cause, impacts, and response to climate change. Nearly all of the 72 knowledge associations lie within this framework. First-order associations are equitably distributed showing a plurality of associations with cause, closely followed by impacts and response (Table 5.1). However, the findings of the subsequent-order associations show a majority of knowledge associations with impacts, while less than half comprise response and cause combined.

Table 5.1 Knowledge associations with climate change cause, impacts and responses

<table>
<thead>
<tr>
<th>Thema</th>
<th>First-order*</th>
<th>Subsequent-order*</th>
<th>Total*</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cause of climate change</td>
<td>7 (32%)</td>
<td>9 (18%)</td>
<td>16 (22%)</td>
</tr>
<tr>
<td>Impacts of climate change</td>
<td>6 (27%)</td>
<td>28 (56%)</td>
<td>34 (47%)</td>
</tr>
<tr>
<td>Responses to climate change</td>
<td>6 (27%)</td>
<td>13 (26%)</td>
<td>19 (27%)</td>
</tr>
<tr>
<td>Other</td>
<td>3 (14%)</td>
<td>0 (0%)</td>
<td>3 (4%)</td>
</tr>
<tr>
<td>Total</td>
<td>22 (100%)</td>
<td>50 (100%)</td>
<td>72 (100%)</td>
</tr>
</tbody>
</table>

*Note: Percentages in parentheses are indicators of word association emphasis given to each category and are for reflective purposes rather than statistical significance.

Cause of climate change
Most participants accept human intervention as a contributing factor to 21st century climate change (Table 5.2) as illustrated within three causality subthemes: anthropogenic intervention, natural processes, or an anthropogenic/natural combined causality. The
majority of associations relate to human intervention, such as “the influence of man’s intervention”, “reactions caused by humans”, “processes caused by human activity”, and “result of non-sustainable practices”. One association, “anthropogenic-enhanced variability”, indicates the joint effect of human-induced contributions coupled with the inherent natural variability of the Earth’s climate. Two associations focused exclusively on the climate’s “variability”, which describes the collective natural physical activities that, in any one period, provide variations in the weather over time.

Table 5.2 First-order knowledge associations with cause of climate change

<table>
<thead>
<tr>
<th>Anthropogenic</th>
<th>Anthropogenic/Natural</th>
<th>Natural</th>
</tr>
</thead>
<tbody>
<tr>
<td>“Reactions caused by humans”</td>
<td>“Anthropogenic-enhanced variability”</td>
<td>“Climate variability” (2)</td>
</tr>
<tr>
<td>“Man’s intervention”</td>
<td></td>
<td></td>
</tr>
<tr>
<td>“Result of non-sustainable practices”</td>
<td></td>
<td></td>
</tr>
<tr>
<td>“Processes caused by human activity”</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total (4)</td>
<td>Total (1)</td>
<td>Total (2)</td>
</tr>
</tbody>
</table>

Most of the participants who offered subsequent-order knowledge associations within the cause of climate change relate specific anthropogenic activities such as “polluted Asian cities” or “fossil fuel burning” (Table 5.3). Two associations address a natural component of the cause of climate change over millennium, “ice ages” and “solar radiation”.

Table 5.3 Subsequent-order knowledge associations with cause of climate change

<table>
<thead>
<tr>
<th>Anthropogenic</th>
<th>Natural</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pollution (4) [“pollution”; “polluted Asian cities”; “pollution”; “fossil fuel burning”]</td>
<td>“Ice ages”</td>
</tr>
<tr>
<td>Other (3) [“growth in urban areas”; “unstainable behaviours”; “generated by people who deny”]</td>
<td>“Solar radiation”</td>
</tr>
<tr>
<td>Total (7)</td>
<td>Total (2)</td>
</tr>
</tbody>
</table>

Impacts of climate change

A preponderance of participants identify with impacts from climate change as concrete concepts from the physical world. These physical impacts may be considered by their proximity to the case study area, where the severity and occurrences have a direct effect on the participants’ lives and livelihoods and the health of their community or their geographic distance from it.
Most of the first-order impacts of climate change are consequences of a physical change which could occur within the NBR; signifying a geographically close or a proximal impact (Table 5.4). In contrast, the sole physical impact of “melting ice” presents an image geographically removed from the NBR, indicates its geographic distance from the participants.

**Table 5.4 First-order knowledge associations with impacts of climate change**

<table>
<thead>
<tr>
<th>Proximal</th>
<th>Distal</th>
</tr>
</thead>
<tbody>
<tr>
<td>Change in weather</td>
<td>(2)</td>
</tr>
<tr>
<td>Environmental change</td>
<td>(2)</td>
</tr>
<tr>
<td>Heat</td>
<td>(1)</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>(5)</td>
</tr>
<tr>
<td>Melting ice</td>
<td></td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>(1)</td>
</tr>
</tbody>
</table>

Participants who chose to provide subsequent-order knowledge associations offered 28 impact-related associations (Table 5.5). Twenty associations reflect proximal impacts that relate to the NBR, with over half of those lying within the subthemes of sea-level rise, heat and flooding. Other proximal impacts offered by more than one participant include storms, fires, or changing weather. Eight associations relate to distal physical events; the majority relating to ice melts. Other distant impacts offered were the iconic image of a “polar bear on an iceberg”, “salt lakes in the Murray”, referring to Australia’s Murray-Darling Basin, and “Sandy”, referring to Hurricane Sandy on the east coast of the United States in October 2012, which was reported widely in the Australian press during the data collection period.

**Table 5.5 Subsequent-order knowledge associations with impacts of climate change**

<table>
<thead>
<tr>
<th>Proximal impacts</th>
<th>Distal impacts</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sea-level rise (5)</td>
<td>Melting ice (5)</td>
</tr>
<tr>
<td>Heat (4) [including “global warming”; “globe on fire”; “temperature gauge rising”]</td>
<td>“Polar bear on iceberg” “Hurricane Sandy” “Salt lakes in Murray”</td>
</tr>
<tr>
<td>Flooding (3) [including “changes in water levels”]</td>
<td></td>
</tr>
<tr>
<td>Extreme weather (2) [including “volatile weather patterns”]</td>
<td></td>
</tr>
<tr>
<td>Storms/cyclones (2)</td>
<td></td>
</tr>
<tr>
<td>Fires (2) “Disasters”</td>
<td></td>
</tr>
<tr>
<td>“Polluted under-ground water”</td>
<td></td>
</tr>
<tr>
<td><strong>Total</strong> (20)</td>
<td><strong>Total</strong> (8)</td>
</tr>
</tbody>
</table>
Response to climate change

The knowledge associations aligning with the response to climate change relate to environmental or socio-political actions, nearly evenly split between the two subthemes. The environmental responses mostly address climate-specific activities of mitigation or adaptation, but also include broader actions of sustainability. Most of the socio-political actions focus on political barriers or challenges. The first-order word associations within the response to climate change category split evenly between environmental and socio-political responses (Table 5.6). The associations reflecting environmental responses are non-specific and could relate to either individual or collective responses, whereas the socio-political associations all indicate a collective political response outside of individual self-efficacy: “biggest political challenge”, “political arguments”, and “political agenda”. No first-order associations directly relate to climate-specific actions.

Table 5.6 First-order knowledge associations with response to climate change

<table>
<thead>
<tr>
<th>Environmental</th>
<th>Socio-political</th>
</tr>
</thead>
<tbody>
<tr>
<td>“Sustainability” (2)</td>
<td>“Biggest political challenge”</td>
</tr>
<tr>
<td>“Good environmental decisions”</td>
<td>“Political arguments”</td>
</tr>
<tr>
<td></td>
<td>“Political agenda”</td>
</tr>
<tr>
<td>Total (3)</td>
<td>Total (3)</td>
</tr>
</tbody>
</table>

Subsequent-order knowledge associations also align with environmental or socio-political responses to climate change subthemes (Table 5.7). Of the environmental actions, all focus on climate change responses to mitigate greenhouse gas concentrations or adapt to climate change impacts. The majority of responses address mitigation, such as “energy efficiency”, which was offered twice, “solar and wind energy”, and “clean tech”, with two associations providing adaptive responses, of which one focused on flooding, “wet-season sandbags”.

The socio-political responses to climate change were less cohesive. Responses ranged from the responsibilities of the ‘other’, from the political (e.g. “political frustration” and “climate sceptics”) to the scientific, (e.g. “realm of scientists”). Some of the more positive responses address the need for enhanced communication, (e.g. “education and awareness-raising”) and behavioural change (e.g. “important to change habits”), reflecting an action-oriented response that could be undertaken by individuals or actioned collectively.
Table 5.7 Subsequent-order knowledge associations with response to climate change

<table>
<thead>
<tr>
<th>Environmental</th>
<th>Socio-political</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mitigation (5) [including “energy efficiency”; “clean tech”; “solar and wind energy”]</td>
<td>“Political frustration”</td>
</tr>
<tr>
<td>Adaptation (2) [including “wet-season sandbags”]</td>
<td>“Climate sceptics”</td>
</tr>
<tr>
<td></td>
<td>“Dead-end road”</td>
</tr>
<tr>
<td></td>
<td>“Education and awareness-raising”</td>
</tr>
<tr>
<td></td>
<td>“Important to change habits”</td>
</tr>
<tr>
<td></td>
<td>“Realm of scientists”</td>
</tr>
</tbody>
</table>

Total (7) | Total (6)

5.2.2 Antinomies from knowledge associations

Three key antinomies emerge from the knowledge associations: anthropogenic/natural relates to antinomies of 21st century climate change causality, proximal/distal conveys geographical proximity of related impacts, and environmental/socio-political relays to the emphasis for responsive action.

The antinomy of anthropogenic/natural presents a dialectic element relating to the role of human intervention as a contributing factor of climate change (Table 5.8). In this antinomy, over two-thirds of the word associations connected an anthropogenic component to causality of 21st century climate change, while a minority note the natural aspects of the climate system as the cause.

Table 5.8 Antinomy of anthropogenic/natural cause of climate change

<table>
<thead>
<tr>
<th>Anthropogenic</th>
<th>Natural</th>
</tr>
</thead>
<tbody>
<tr>
<td>Human-induced (5)</td>
<td>Climate variability (2)</td>
</tr>
<tr>
<td>Pollution-specific (4)</td>
<td>Specific natural cause (2)</td>
</tr>
<tr>
<td>Other human influences (3)</td>
<td></td>
</tr>
<tr>
<td>Total (12)</td>
<td>Total (4)</td>
</tr>
</tbody>
</table>

The proximal/distal antinomy demonstrates a perceived link with climate change impacts relative to the proximity to the participants, either connected to their community or geographically removed (Table 5.9). Nearly two-thirds of associations in the impacts antinomy indicate physical impacts that have already occurred within the NBR case study area, which may signify their importance or familiarity. Over one-third of the elicited associations are physical impacts that are geographically outside of the NBR case study area, with seven of the nine relating to ice.
Table 5.9 Antinomy of proximal/distal impacts of climate change

<table>
<thead>
<tr>
<th>Proximal impacts</th>
<th>Distal impacts</th>
</tr>
</thead>
<tbody>
<tr>
<td>Heat</td>
<td>Melting ice</td>
</tr>
<tr>
<td>Sea-level rise</td>
<td>Polar bear on ice cap</td>
</tr>
<tr>
<td>Changes in weather</td>
<td>Other geographically distant impacts</td>
</tr>
<tr>
<td>Flooding</td>
<td></td>
</tr>
<tr>
<td>Storms/cyclones</td>
<td></td>
</tr>
<tr>
<td>Fires</td>
<td></td>
</tr>
<tr>
<td>Other local impacts</td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>Total</td>
</tr>
<tr>
<td>(25)</td>
<td>(9)</td>
</tr>
</tbody>
</table>

The environmental/socio-political antinomy emerged from the response to climate change theme, with two-thirds of the environmental responses relating specifically to climate change actions (Table 5.10). Mitigation, adaptation and sustainability are responses that can be either individual or collective approaches. Most of the socio-political responses required collective actions outside the scope of individuals, primarily from politicians.

Table 5.10 Antinomy of environmental/socio-political response to climate change

<table>
<thead>
<tr>
<th>Environmental</th>
<th>Socio-political</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mitigation</td>
<td>Political</td>
</tr>
<tr>
<td>Adaptation</td>
<td>Social</td>
</tr>
<tr>
<td>Sustainability</td>
<td></td>
</tr>
<tr>
<td>Other environment</td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>Total</td>
</tr>
<tr>
<td>(10)</td>
<td>(9)</td>
</tr>
</tbody>
</table>

In summary, three a posteriori or emerging themata, each demonstrating an antinomy, were revealed from the initial thoughts invoked by word associations with climate change (Table 5.11). All three themata were well represented among the knowledge associations. The impacts theme, garnering nearly half of all associations, focused primarily on local impacts. Response-themed associations represented over one-quarter of all associations elicited. Environmentally-oriented associations were offered twice as often as socio-political responses. The cause of climate change theme elicited over one-fifth of all associations, weighted toward the anthropogenic over natural contributors.
Table 5.11 Antinomies from knowledge associations with climate change

<table>
<thead>
<tr>
<th>Knowledge association theme</th>
<th>Antinomies from knowledge association</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cause of climate change</td>
<td>Anthropogenic (12) Natural (4)</td>
</tr>
<tr>
<td>Impacts of climate change</td>
<td>Proximal (25) Distal (9)</td>
</tr>
<tr>
<td>Response to climate change</td>
<td>Environmental (10) Socio-political (9)</td>
</tr>
</tbody>
</table>

5.2.3 Emotive associations with climate change

The second phase of the free association task explored the initial emotional connections with climate change, providing an added dimension to the participants’ understanding. Emotions, as instinctive or intuitive feelings distinct from reasoning or knowledge, also contribute to an individual’s relationship with a research object or phenomenon (Robinson, 2009). Considering affect, as a positive or negative feeling, is an important aspect of an individual’s interaction with a research object or other stimuli, such as climate change (Hogg, Abrams, & Martin, 2010).

In considering the role of emotive associations, this thesis presents the results with regard to their affect valence, the intrinsic attraction (positive valence) or aversion (negative valence) that an individual associates with an event, object, or situation (Frijda, 1986, p. 207), in this case climate change. Second, it considers the emotive associations through a typology. From the interview data, 36 emotive associations were recorded. All but one participant, when asked to provide an emotion associated with the term climate change, offered at least one association, while nine participants elicited an additional 14 emotions (Appendix 5.1). An analysis of the emotive associations, categorised by affect, indicating negative, mixed or positive emotions, suggests a relationship to climate change that was predominantly negative (Table 5.12). Over three-quarters of the emotive associations align with negative feelings. No participant expressed positive associations as a first elicitation. However, in subsequent-order associations, positive associations appeared about one-third of the time.

Table 5.12 Affect from emotive associations with climate change

<table>
<thead>
<tr>
<th>Affect</th>
<th>First-order</th>
<th>Subsequent-order</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Negative</td>
<td>20</td>
<td>9</td>
<td>28</td>
</tr>
<tr>
<td>Mixed</td>
<td>2</td>
<td>0</td>
<td>2</td>
</tr>
<tr>
<td>Positive</td>
<td>0</td>
<td>5</td>
<td>6</td>
</tr>
<tr>
<td>Total</td>
<td>22</td>
<td>14</td>
<td>36</td>
</tr>
</tbody>
</table>
An initial emotion associated with climate change was offered by all but one of the 23 participants; with ten sharing two or more (Table 5.13). Nearly all of the initial associations presented demonstrated negative feelings about the term climate change. The majority of negative emotions were passive, with numerous participants citing “concern” and also “sadness”, and “worry”; several active negative emotions, such as frustration, fear and blame also appeared. Two associations, “ambivalence” and “confused” show mixed or contradictory feelings about climate change. No positive emotions were offered as first-order associations.

*Table 5.13 Affect from first-order emotive associations with climate change*

<table>
<thead>
<tr>
<th>Negative affect</th>
<th>Mixed affect</th>
</tr>
</thead>
<tbody>
<tr>
<td>Anger</td>
<td>Ambivalence</td>
</tr>
<tr>
<td>Blame</td>
<td>Confused</td>
</tr>
<tr>
<td>Concern (5)</td>
<td></td>
</tr>
<tr>
<td>Cynical</td>
<td></td>
</tr>
<tr>
<td>Disappointment</td>
<td></td>
</tr>
<tr>
<td>Fear</td>
<td></td>
</tr>
<tr>
<td>Frustration (3)</td>
<td></td>
</tr>
<tr>
<td>Futility</td>
<td></td>
</tr>
<tr>
<td>Pessimism</td>
<td></td>
</tr>
<tr>
<td>Resignation</td>
<td></td>
</tr>
<tr>
<td>Sadness (2)</td>
<td></td>
</tr>
<tr>
<td>Worry (2)</td>
<td></td>
</tr>
<tr>
<td>Total (20)</td>
<td>Total (2)</td>
</tr>
</tbody>
</table>

Nine participants offered subsequent-order emotions associated with climate change, two-thirds of which were negative (Table 5.14). Most of the negative emotions expressed passive feelings such as “sadness” or “resignation”. One-third of the subsequent-order associations were positive emotions such as “hope” or “compassion”. 

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Table 5.14 Affect from subsequent-order emotive associations with climate change

<table>
<thead>
<tr>
<th>Negative affect</th>
<th>Positive affect</th>
</tr>
</thead>
<tbody>
<tr>
<td>Blame</td>
<td>Compassion</td>
</tr>
<tr>
<td>Concern</td>
<td>Excitement</td>
</tr>
<tr>
<td>Fear</td>
<td>Hope (2)</td>
</tr>
<tr>
<td>Frustration</td>
<td>Positive feelings</td>
</tr>
<tr>
<td>Resignation</td>
<td></td>
</tr>
<tr>
<td>Pessimism</td>
<td></td>
</tr>
<tr>
<td>Sadness (3)</td>
<td></td>
</tr>
<tr>
<td><strong>Total (9)</strong></td>
<td><strong>Total (5)</strong></td>
</tr>
</tbody>
</table>

Emotions found in this study include fear, anger, sadness, hope, and worry. Robinson (2009) developed a framework to categorise emotions by their associations. The emotive associations in this study align with Robinson’s event-related, future appraisal, or object’s properties categories (Table 5.15). Robinson (2009) further categorised emotions across three criteria used in cognitive experiences: a strong motivating subjective quality (i.e. pain or pleasure); a response to an event or object; or a motivator to behaviour. Motivating behaviours of future appraisals align with the emotions’ affect (Robinson, 2009).

In this study, the emotions of hope and fear are associated with future appraisal around climate change. The cognitive experience of hope correlates with the expectation of a positive outcome. Few emotive associations reveal emotions with positive affect (e.g. hope) that would suggest positive motivation. A number of negative event-related emotions (e.g. blame, concern, frustration and disappointment) arise from the perceived resistance to the fulfilment of individual will.
Table 5.15 Type of emotions and affect from emotive associations with climate change (adapted from Robinson, 2009)

<table>
<thead>
<tr>
<th>Type of emotion</th>
<th>Emotions with positive affect</th>
<th>Emotion with negative affect</th>
</tr>
</thead>
<tbody>
<tr>
<td>Phenomenon or event-related</td>
<td>Excitement</td>
<td>Anger</td>
</tr>
<tr>
<td>Positive feelings</td>
<td></td>
<td>Blame (2)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Concern (6)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Disappointment</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Frustration (4)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Pessimism (2)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Sadness (5)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Worry (2)</td>
</tr>
<tr>
<td>Future Appraisal</td>
<td>Hope (2)</td>
<td>Fear (2)</td>
</tr>
<tr>
<td>Related to object or phenomenon’s properties</td>
<td>Compassion</td>
<td>Cynical</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Futility</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Resignation (2)</td>
</tr>
</tbody>
</table>

5.3 Discussion of free associations with climate change
The free associations of words and emotions related to climate change reveal the boundaries of social representations of climate change held by participants. Analysis of the word associations divulges visceral, latent impressions to this abstract scientific phenomenon across the key components of cause, impacts and response, reflecting the participants’ frames of reference around climate change. Analysis of the emotions associated with climate change reveal that first-order associations were predominantly negative, whereas subsequent-order associations were a mixture of positive and negative emotions.

Knowledge associations reveal a framing of climate change by participating NBR Board members in a context of the key aspects of the phenomenon currently under negotiation within the scientific and political communities across scales from global to local. The three themata and their subthemes reflect expert knowledge, categorised according to the key research areas in the IPCC process and working groups (see Section 2.2.1): Working Group I addresses climate science, exploring the components of causality; Working Group II examines climate change impacts and adaptation; and Working Group III assesses mitigation responses to reduce the human-induced activities at the heart of 21st century climate change. Not only does this provide a framework for analysis of the data, but it is directly relevant to the type of action (e.g., adaptation or mitigation measures) that may be recommended by the NBR Board.
From an SRT perspective, the dialogical structure of SRs provides an awareness of the range of viewpoints within which a group can communicate through dialectical thinking and sharing, but it does not imply or require agreement with all elements with the framework (Moscovici, 1961). Theoretically, social representations may contain contradictory elements denoting ambivalence about an issue (Moscovici, 1961, 1973), which is conceivable with an emerging abstract phenomenon such as climate change. Free associations can provide an insight into the scope of ideas around which group members can consider counter-attitudes or inconsistent or changing viewpoints as they construct their commonsensical social thinking about climate change.

In the past decade, the public has become exposed to the established scientific views on climate change, but this information is often filtered through the media. The media’s portrayal of climate change (Section 2.6) is a major influencer of the public’s perceptions and media representations are often fear-inducing or incite doubt. The prevalence of the media, from television, newspapers and social media, in our society plays a role in how individuals view new scientific phenomena, as they are key cultural tools for mass communication. The Moscovician concept that SRs are generated through knowledge-sharing communicated among group members acknowledges that this knowledge can be gained through personal experience or from media (Moscovici, 1961). The established science informs us that multiple causal factors for 21st century climate change, both natural and anthropogenic, exist. The media promotes the idea of a high level of disagreement about the cause of climate change, often presenting a polarity between a natural occurrence and a constructed crisis. At times, the media presents solutions to climate change as incurring an economic cost to address an uncertain or unsolvable problem. Therefore, segmentation has occurred within society where groups perceive a range of causes, impacts and responses to climate change. The word associations in this study relating to the cause of 21st century climate change reveal a dialectical opposition between human intervention and the natural variability of the climate system, with the balance towards human-induced activities.

Nearly all associations within the theme of causality are reflective of the work of the IPCC and other climate science research, which details the numerous natural processes attributable to the Earth’s climate (IPCC, 2014c). Only one participant offered a hybrid association, specifically noting both anthropogenic and natural processes, “anthropogenic-enhanced variability”, which indicates a broader spontaneous response. This one association
reflects the conclusion of the IPCC: that 21st century climate change is a combination of natural forcings coupled with anthropogenic activities globally (IPCC, 2014c).

The knowledge association findings of the NBR Board participants reveal that first impressions of climate change impacts often highlight “ice” through images of ice melting or polar bears on ice sheets. For most people, these impressions would be gleaned through media representations. These findings are consistent with SRT research in Sweden and the United Kingdom, as well as in Australia (Section 2.6)

An important finding from the analysis is the types of words that were not offered through associations. In the associations relating to impacts of climate change, no social or economic impacts were elicited. The scientific data of the IPCC (2014a) note specific social impacts such as heat stroke, particularly in the elderly and the spread of vector borne diseases; economic impacts cut across all sectors from agriculture to tourism to transportation.

Emotive associations suggest a personal connection with climate change, primarily a negative emotions and affect. These emotive associations ran counter to the enthusiasm and positive affect that the NBR Board participants revealed in discussions of their sustainability and climate change community projects revealed in the other part of the interviews (Chapter Eight).

The literature on emotions and their effects on motivation and engagement with climate change is a growing area of research. Media representations of climate change greatly influence public perceptions and are often fear-inducing (Carvalho & Burgess, 2005; Hoijer, 2010; O’Neill & Nicholson-Cole, 2009). Society, to a great extent, relies on media narratives to inform about incomprehensible yet dangerous phenomena, such as climate change (O’Neill & Nicholson-Cole, 2009). However, the institutional organisations often choose to present the narratives around climate change in a “dramatic” sense, highlighting negative consequences or worst-case scenarios (Trumbo & Shanahan, 2000). Yet research suggests that negative emotions such as fear may be counterproductive if the goal is public engagement to address climate change (O’Neill & Nicholson-Cole, 2009). Fear-inducing representations can act initially as an attention-grabbing device, but sustained exposure to negative narratives about climate change can trigger barriers to actions (Lorenzoni et al., 2007).

The findings of emotive associations, when considered by type (Robinson, 2009), reveal a preponderance of emotions responding to the event of climate change. This study’s findings reveal multiple associations across a range of discrete negative emotions associated with the
phenomenon itself, especially noting “concern”, “sadness”, “frustration” and “worry”. Very few emotions relate to the future appraisal of climate change (e.g. hope or fear). Negative emotions enhance information processing (Finucane, 2008), thus serving as important determinants of climate change risks. Both negative affect and cultural worldviews are key indicators of policy support for climate change (Leiserowitz, 2006). However, emotions proved to be the most powerful variables with regard to policy options that address climate change, with “worry” the single strongest predictor to indicate support for national climate and energy policies in the United States (N. Smith & Leiserowitz, 2014). These findings are also consistent with research that found experiential factors that include discrete emotions and affect can play a critical role in risk-processing (Finucane, Alhakami, Slovic, & Johnson, 2000).

While research on affect and engagement suggests a negative affect may encourage information seeking about climate change (Yang & Kahlor, 2012), other research into negative connotations of climate change indicates it promotes denial (Norgaard, 2011). With regard to global climate change, viewed by the international scientific and policymaking communities to cause widespread and potentially catastrophic impacts, negative impressions, often portrayed through media representations, are prevalent across societies. Therefore, collective climate denial, found in research across cultures (e.g., Lorenzoni et al., 2007; Norgaard, 2011) is not surprising. Research into climate denial suggests an avoidance to acknowledge disturbing information or to avoid negative emotions such as fear, guilt or helplessness; it does not indicate a lack of or rejection of scientific knowledge or lack of concern for the environment or future generations (Norgaard, 2011). Collective climate denial may be tempered in some groups through their social environment, which can strongly influence the way an individual uses climate change information (Yang & Kohler, 2012). Concurrent with other research, in certain situations, negative associations can be motivating and yield positive outcomes (Ehrenreich, 2009).

Insights into emotions demonstrate that a negative affect does not necessarily preclude actions to address climate change and in a third sector sustainability organisation (TSSO), such as the NBR Board, where the social environment produces a shared social identity, the predominantly negative emotions in this study may induce information-seeking. Furthermore, this may motivate behaviours that would have a positive impact on addressing the causes and impacts from climate change. This is consistent with the findings of O’Neill and Nicholson-Cole (2009) who suggest that negative emotions must be coupled with
positive connections to climate change to instil the relevance to individuals and their communities in taking responsive actions.

The findings show that all the positive emotions, including hope and excitement, emerged from the subsequent-order associations. Positive emotions can provide useful motivating effects. N. Smith and Leiserowitz (2014) found that positive emotions such as hope and interest are important to support climate action. Promoting efforts to encourage positive emotions around climate responses may be more effective than public appeals using fear or guilt. Sjoberg (2007) argued that while risks are perceived as threatening, options to mitigate the threat yielded optimism, satisfaction and interest and were strong predictors of attitudes toward risks across a variety of phenomenon including nuclear waste repositories, radiation and mad cow disease. Hoijer (2010) found that hope and compassion were emotions that motivated people to learn more about the hazards of climate change impacts and to consider adaptation measures.

To summarise, the analysis of free associations of words relating to knowledge and emotions from the NBR Board’s participants reveals initial unconscious aspects which show a wide range of initial impressions across causality, effects and responses. The antagonistic components within each category (e.g. the anthropogenic/natural causality, the proximal/distal physical impacts and the environmental/socio-political responses) add to the diffused nature of the representation within the NBR Board participants. The unconscious emotions associated with climate change highlight an initial negative affect.

5.4 Conclusion

In this study, the free associations revealed lay knowledge and emotions to provide insights into the participants’ social construction of climate change. The knowledge associations conveyed a focus of lay thinking across its components of causality, impacts and responses. Understanding and emotions related to these components were derived from analysis of the antinomies. The anthropogenic/natural antinomy relating to causality of climate change suggests the group’s overall knowledge associations reflect an initial connection with human interference with the climate system, with a minority of participants demonstrating knowledge of the natural elements that contribute to the climate’s variability.

The proximal/distal antinomy of biophysical impacts included proximal risks to participants from sea-level rise, flooding and heat. Knowledge associations with impacts revealed concrete ideas of localised physical impacts such as sea-level rise, heat and flooding, with a few participants identifying that its impacts reach far beyond Australia to the polar ice caps. This unconscious thinking around geographically distant aspects of polar ice melt and
endangerment to its ecosystem suggests a level of distancing from the phenomenon due to
the participants’ lay understanding of the global impacts or exposure to extensive media
representations of climate change focused on images of melting ice.

The *environmental/socio-political* antinomic dyad around responses reveals actions and
measures around mitigation, adaptation and sustainability. Knowledge associations
emphasised collective measures including governance and the role of politicians in providing
a comprehensive response strategy. The initial impressions around socio-political
associations were primarily negative, such as “political arguments”, “political agenda” or
“political frustration” and aligned with the highly negative affect revealed through the
emotive associations.

Emotive associations demonstrate personal connections that can be leveraged to address
social action. The emotive associations reveal primarily negative emotions, most notably
“sadness” and “concern”, indicating that participants’ share an emotional connection to the
phenomenon. Socio-political knowledge associations were also often negative, which may
indicate that the participants’ view responses to climate change as outside their control.

The free associations of the NBR Board participants indicate a high degree of thinking and
emotional connection to climate change on an unconscious level as revealed by analysis of
the antinomies: 1) *anthropogenic/natural*, 2) *proximal/distal*, and 3) *environmental/socio-
political*. These associations will contribute to the group’s cognitive, affective and behavioural
connections and social identity, which will be further considered in the following chapters.
Analysis of the participants’ knowledge and emotive associations creates a starting point
from which to further explore the emergent social representations of climate change from
the perspective of causality, impacts and response, explored in Chapter Six.
Chapter Six. Social representations about climate change

6.1 Introduction
This chapter considers the existence, composition and mode of communication of social representations about climate change circulating within the cohort of NBR Board participants and builds upon the findings in Chapter Five, which provided the analysis of first impression of the participants around their knowledge and emotions connected with climate change. The analysis is guided by construction and communication of social representations (Moscovici, 1961) (Section 3.4), and contributes to the advancement of the theory. The specific SRT concepts explored in this chapter relate to themata (i.e. latent themes), which will help to reveal the hegemonic representations that are consensual within the group; the emancipated representations that provide specialised expert knowledge, and polemic representations that pose direct challenges to hegemonic representations (adapted from Moscovici (1961); Wagner (2012) (Section 3.4.4.1). Further, this chapter examines the communication processes of anchoring (i.e. making the unfamiliar concepts familiar) and objectification (i.e. making an abstract idea into a more tangible or concrete idea) (e.g., Markova, 2000, 2003; Moscovici, 2011; Moscovici & Vignaux, 2000) (Section 3.4.4.2). This analysis builds upon the free associations (Chapter Five) that frame the parameters of the representations around climate change to consider the themata around cause, impacts and responses. Participant interviews are presented through quote extracts and coded and analysed around the three themata of anthropogenic/natural; proximal/distal; and environmental/socio-economic that flowed from the knowledge association task. Each thema was analysed to reveal the anchoring and objectification elements and hegemonic, emancipated or polemic representations within the social representations. The discussion considers the construction and cohesiveness of the climate change social representations and the mode of communication. This chapter concludes with a discussion of the consensual or lay knowledge in relation to the reified knowledge of climate change.

6.2 Results of climate change social representations
During the semi-structured interviews, participants freely discussed climate change including causality, risks and impacts, and responses, often volunteering information on sustainability as it relates to their lives, their work on the NBR Board or as a means of addressing climate change (Chapter Eight). Consensus exists among participants about the existence of climate change as a phenomenon with real impacts, with a range of specific and more general understandings.
The free association task (Chapter Five) reveals three themata: anthropogenic/natural causality; proximal/distal impacts; and environmental/socio-economic responses. In this chapter, (Sections 6.2.1 to 6.2.3), each thema is further analysed by subthemes emerging from the coding and categorisation process using thematic analysis. The extracts appearing in this chapter are coded with extract identifiers that include an interview transcript number and quote extract identifier within the transcript (e.g. 1.C1 signifies interview transcript 1 and quote extract C1). Interview extracts can be found in Appendices 6.1 to 6.6.

6.2.1 Anthropogenic/natural causes
a. Overview of participant perspectives

The thema of anthropogenic/natural causality illustrated the breadth of the NBR Board study participants’ thinking around the causes of climate change. The dialogue around causality among this cohort found a hegemonic representation emphasising the human activities contributing to this 21st century phenomenon, with an emancipated representation providing further sense making around the climatic elements relating to its natural variability components. The interviews provided evidence of social representational components of anchoring and objectification in construction and communication of their understandings. Table 6.1, drawn from the interview quotes, provided examples of anthropogenic and natural elements, with twice the number of extracts discussing human-induced activities rather than natural as an underlying cause of climate change.

Table 6.1 Interview quotes showing anthropogenic and natural causes of climate change

<table>
<thead>
<tr>
<th>Anthropogenic causes*</th>
<th>Natural causes*</th>
</tr>
</thead>
<tbody>
<tr>
<td>“We have to be affecting it, propelling it, accelerating it...”</td>
<td>“Variability in the planet’s overall climate”</td>
</tr>
<tr>
<td>“it’s [human activity is] very definitely not only a contributor but a cause”</td>
<td>“swings from glacial to interglacial over a geological time period”</td>
</tr>
<tr>
<td>“changing over time due to the influence of man’s intervention”</td>
<td>“ice ages and land-bridges”</td>
</tr>
<tr>
<td>“it’s caused in most part by human activities”</td>
<td>“evolution of plants and animal species”</td>
</tr>
<tr>
<td>“we’ve probably added about 99.9% of the current observable changes”</td>
<td>“a great big complex, self-regulating system”</td>
</tr>
<tr>
<td>“anthropogenically-enhanced variability”</td>
<td>“a natural phenomenon”</td>
</tr>
<tr>
<td>“the human-induced increase”</td>
<td>“increased variability of climate”</td>
</tr>
<tr>
<td>“human beings through their activities are changing that cycle”</td>
<td>“nature, nature just having its way”</td>
</tr>
<tr>
<td>“pollution...there is a limit to it, and there must be a limit”</td>
<td></td>
</tr>
<tr>
<td>“we’re totally to blame”</td>
<td></td>
</tr>
</tbody>
</table>
b. Anthropogenic causes

A *hegemonic representation* emerged as most participants express a link between climate change and human intervention with the climate system. Some participants disclosed the potentially hazardous effects from anthropogenic climate change. Others viewed a duality between human activities and natural processes weighted towards anthropogenic causes. The prevalence of an emphasis on anthropogenic causes of climate change revealed the consensual nature and level of attention to human intervention in the Earth’s climate system.

A large number of interview extracts indicated humankind’s involvement or note specific activities, such as fossil fuel burning or creating pollution. “We have to be affecting it...we’re propelling it, accelerating it” [2.C4]; “the world’s climate is affected” by “the influence of man’s [sic] intervention” [1.C1]; and “very definitely...a cause...rise of jet, of air travel...pollution...it’s a no-brainer; I don’t understand how people can’t put all those things together and think, ‘Hmm’” [22.C4]. These extracts forcefully proposed that humans are the primary culprits. One participant cited the reified knowledge of the scientific community to bolster the argument of anthropogenic causality by saying that it reflects an agreement “with the scientific data” [1.C1]. Climate change’s anthropogenic causality and its negative consequences for society are linked: “human activity...will present...difficulties in maintaining lifestyle” and a challenge to our existence such as “supporting the way populations around the world exist” [4.C1]. This coupling of human intervention with negative consequences expressed the long-term impacts of human activities currently on future generations.
Several participants employed objectification (Section 3.4.4), a communication process linking abstract ideas with more tangible or concrete ideas. For example, there was a disproportionate role of greenhouse gas (GHG) emissions from human activities, whereby a small percentage of atmospheric GHG concentrations significantly influences the climate system, which produces negative consequences. One participant objectified climate change through the process of figuration, displaying a metaphor from the fairy tale Goldilocks and the Three Bears. The participant highlighted the fragility of the Earth’s atmosphere to changes in its composition: “...but in terms of our existence and the very fine Goldilocks’ bind of balance that we live in, it’s [human influences are] extraordinarily important” [20.C8]. In the fairy tale, Goldilocks seeks a balance between her porridge being too hot or too cold, and her bed being too hard or too soft. Here the analogy of balance is transferred to human intervention in the climate system; the participant noted how “extraordinarily important” the concept that small changes in atmospheric greenhouse gas concentrations can threaten “our existence” [20.C8].

The communication process of anchoring (Section 3.4.4), by which unfamiliar concepts or social objects are understood by a lay group through its relationship with existing concepts or representations, was employed to align climate change with unambiguously negative imagery. While carbon dioxide, methane and nitrous oxide are invisible and odourless gases, some NBR Board participants discussed visual forms of human-induced pollution of coal and diggers and quarries [11.C1]: “human impact from fossil-fuel burning” and “coal burning stacks and waste”, directly linking these images to “rising temperatures” [11.C1]. Another participant raised similar adverse images, “You can't keep digging up the coal and burning it up forever”, explicitly declaring “We can’t keep turning this place into a quarry”, raising a dystopian image of the Earth becoming a barren wasteland, concluding that “we are going in the wrong direction” [12.C1].

Constructed from supplementary and often complementary information, an emancipated representation (Section 3.4.4) concurring with and expanding upon the anthropogenic contributions, provided additional knowledge of the natural components of 21st century climate change. One participant coined the term “anthropogenically-enhanced variability” to convey its natural and human components [13.C1]. While the concept aligns with the reified knowledge of the scientific community, the phrase is not commonly used. This participant considered climate change to be “caused in most part by human activities” with some “background level of climate change that takes place over a geological timespan”, noting “most people understand that human beings through their activities are changing that cycle”
The human-and-natural causal duality was also communicated in natural processes such as “ice ages” and human intervention in “pollution” converge until “there must be a limit” because “the Earth won’t swallow it all” [6.C1]. This participant employed the objectification process of personification, whereby the Earth, as a human, is incapable of drinking in all the pollution forced upon it [6.C1].

This dual causality is also expressed by assigning humanity with the all of responsibility, “we’re totally to blame”, before modifying the claim by noting “a mixture of natural phenomena” also contributes [7.C1]. By reinforcing the view that human intervention plays a large role, it was asserted we need to “take responsibilities as societies that we have caused change”, which is “detrimental” to all living beings [7.C1]. People were identified as playing a key role: long-term trends “clearly indicate, in my view, that man is having an impact upon the climate”, but implies natural factors are also at work, “the extent of [human] impact is where you get into the debate” [14.C1]. “Anthropogenic factors..accelerate..other underlying patterns and systems and flows”, implying natural processes are the primary drivers of the climate system [22.C2].

Anchoring of climate change in sustainability provides an evaluative lens through which to communicate understanding of the phenomenon. For one participant, climate change presented as “the pointy end of a terminology for sustainability”, due to “unsustainable practices” [16.C1]. “People are motivated to behave in a certain way” with “ramifications of unsustainable behaviour”, explicitly linking these two concepts, “When I think about climate change, I think about sustainability” [16.C1]. Another anchoring approach uniting sustainability with climate change began by defining sustainability as “actions that we do” and “something that we can change” but grounded it in sustainability by relating “climate change is a result of non-sustainable practices” showing we are “doing something wrong” [3.C1]. This communication exchange continued with specific damaging imagery that anchors climate change to sustainability: “it’s very much a direct link” between climate change and “mass populations and the mass use of fossil fuels and waste” and “unethical behaviour” [3.C1].

c. Natural causes

The data did not reveal a distinct polemic representation (Section 3.4.4) that would either challenge or be in direct conflict with the consensus around anthropogenic climate change. However, three participants spoke exclusively to natural processes contributing to climate change occurring for millennia, in line with views espoused by climate “deniers” (Leiserowitz, 2006). One participant emphasised the “natural phenomenon”, which “swings from glacial to
interglacial over a geological time period” as a component of the “complex, self-regulating system” including “ice ages and land bridges”, with “evolution” as the mechanism by which it would self-correct [10.C1]. Another participant’s preference was for the term climate change over the term “global warming” as “climate change means increased variability of climate” [12.C1]. Objectification, employed through personification, highlighted the natural process of this phenomenon, “nature just having its way”, whereby “nature” was referred to as a powerful person, having a mind of its own in unleashing climate change upon Earth; this metaphor was reinforced in, “Nature is pretty powerful when it wants to do something” [9.C1].

d. Summary of a social representation about climate change causality

The analysis of anthropogenic/natural causes of climate change attributed by participants showed a consensual hegemonic representation focused on human activities, discussed in both general terms and through specific processes such as the burning of fossil fuels, jet fuel or other activities emitting greenhouse gas pollution. An emancipated representation, presenting a concurrent element and additional complementary knowledge suggested both anthropogenic and natural contributions to causality, with the communication involving objectification elements personifying some physical impacts as ‘mother nature’. Construction of this lay knowledge included anchoring elements grounded in sustainability and human-induced pollution. These components contributed to a social representation of climate change that presented anthropogenic contributions to 21st century climate change as a key element of the cohort’s lay knowledge of climate change.

6.2.2 Proximal/distal impacts

a. Overview of participant perspectives

The theme of proximal/distal impacts demonstrated the breadth of this cohort’s lay thinking of physical or socio-economical proximal impacts and physical or temporal distal impacts (Table 6.2). Many participants identified climate change with impacts from their personal experiences with climate events or awareness-raising experiences. The hegemonic representation highlighted an understanding of proximal physical climatic impacts within the NBR that may affect participants, their families and community. The proximal impacts emerging from the data arose from lay knowledge and from personal experiences with, or awareness-raising activities about, climatic impacts. Many of these proximal impacts affected ‘the self’. However, the hegemonic representation also presented a component of ‘the other’ in its consensus around distal physical impacts emphasising the iconic imagery identified in
both the scientific literature and highlighted in media representations: melting polar ice caps and polar bears.

**Table 6.2 Summary of proximal and distal impacts of climate change**

<table>
<thead>
<tr>
<th>Proximal impacts*</th>
<th>Socio-economic</th>
<th>Distal impacts*</th>
<th>Temporal</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sea level rise</td>
<td>Crop damage from drought</td>
<td>Polar ice melts</td>
<td>Not imminent</td>
</tr>
<tr>
<td>Cyclones</td>
<td>Tourism loss from Irukandji</td>
<td>Melting glaciers</td>
<td>100 years</td>
</tr>
<tr>
<td>Coastal storms</td>
<td>Economic change</td>
<td>Polar temperature increases</td>
<td>In 50, 100 or 200 years</td>
</tr>
<tr>
<td>Coastal beach erosion</td>
<td>Tourism decreases</td>
<td>Polar bears</td>
<td>Humanity’s long-term future...children and grandchildren</td>
</tr>
<tr>
<td>Flooding</td>
<td>Property devaluation</td>
<td>Global sea level rise</td>
<td></td>
</tr>
<tr>
<td>Tidal surges</td>
<td>Economic loss to the agricultural sector</td>
<td>Mudsslides in Peru/Indonesia</td>
<td></td>
</tr>
<tr>
<td>Intense rain</td>
<td></td>
<td>Tsunamis</td>
<td></td>
</tr>
<tr>
<td>Wind damage</td>
<td>Economic costs to small businesses</td>
<td>Texan heatwaves</td>
<td></td>
</tr>
<tr>
<td>Weather pattern changes</td>
<td></td>
<td>Russian heatwaves</td>
<td></td>
</tr>
<tr>
<td>Species migration</td>
<td></td>
<td>New York City blizzard</td>
<td></td>
</tr>
<tr>
<td>Crocodile migration</td>
<td></td>
<td>Water scarcity</td>
<td></td>
</tr>
<tr>
<td>Irukandji migration</td>
<td></td>
<td>Global political conflict</td>
<td></td>
</tr>
<tr>
<td>Wetter with colder winters</td>
<td></td>
<td>Changing landscapes</td>
<td></td>
</tr>
<tr>
<td>Warmer winters</td>
<td></td>
<td>Marshall Islands’ sea-level rise</td>
<td></td>
</tr>
<tr>
<td>Drought</td>
<td></td>
<td>Kiribati/Tuvalu saltwater intrusion</td>
<td></td>
</tr>
<tr>
<td>Extreme heat</td>
<td></td>
<td>Torres Strait sea-level rise</td>
<td></td>
</tr>
</tbody>
</table>

* Note: Table 6.2 is drawn from interview quotes from transcripts.

Many of the negative physical ramifications related to coastal impacts dominated by sea-level rise and warming ocean temperatures, including species migration, beach erosion, tidal surges, and intense storm events producing cyclones, flooding, intense rain and wind damage. To a lesser extent, ramifications from rising surface temperatures such as drought also emerged.

**b. Understanding proximal impacts through personal experiences with climatic events**

Floods and droughts have long been a part of Australia’s and Queensland’s extremely variable weather patterns, as acknowledged in the scientific literature (e.g., BOM/CSIRO, 2012, 2014, 2016; QCCCE, 2008). A hegemonic representation, including impacts from intense rainfall and conversely from droughts, developed from discussions of personal
experiences with climatic impacts. One participant who had previously lived near a river “noticed regular flood alerts” in more recent times [1.E12]; while a long-time Noosa hinterland resident noted that the 2012 Pomona flood was one “that I hadn’t experienced before in my 75 years...from memory I think there were about five homes [that went] under in a street” [6.E12]. Another, noting that he had lived in the NBR for 15 years, described the local infrastructure damage from “…the worst couple of floods I have ever seen…[with] 188 ml in one hour.... Yes, I’ve seen changes” [12.E12]. This participant described the post-event effort to pull together after a climatic event and indicated its inevitability, “People help out in a disaster. We are in this together. Occasionally, things like that are really good. They make us step up. The thought of us controlling climate is wrong. We are just a pawn in this big thing we call the Earth” [12.E15].

Some participants connected their personal experiences with their recollections or perceptions. One noted, “That’s anecdotal but that’s my impression” [1.EI12] about changes in weather patterns over time:

I have now given up trying to speculate when it is best to come up to Noosa. In the summertime, where it used to be our traditional Queensland summer when it used to pour rain...but it doesn’t necessarily happen anymore. Now we can get that rain in June. I guess that also is an indicator and it has been happening now for, I’d say, the past 6 to 10 years [5.EI12].

This participant no longer advised friends and family when to visit Noosa:

Our whole weather pattern has changed. Now it’s potluck. You come when it is convenient. There is no guarantee...So they are the examples of what is happening; it gives us that support for our beliefs” [5.EI12].

Thus, this participant connected personal experiences to support the ‘belief’ that climate change is real and happening now in the NBR [5.EI12]. Another provided anecdotal evidence to demonstrate a changing climate: “My perception is the winters are different now than they were 45-50 years ago...I used to see those winters as endless westerlies; I don’t any more though” [1.EI2]. These examples also demonstrate the participants’ acknowledgement of the unpredictability of weather patterns relative to their past experiences.

Unpredictability in weather patterns also emerged as a concern for others, with one participant noting that the weather was not “as predictable as it used to be” because “we don’t have the seasons as we used to” [5.EI12]. Another participant, a long-term Noosa resident, had also experienced the unexpected frequencies of local extreme weather events “in the last five or so years” and “not previously”, specifically citing “those Kin Kin floods a
couple of years ago...not very well predicted events, quite localised”, concluding that this is a change from the “sort of pattern I can remember that from 20 years ago” [8.EI2]. Perceptions of changes that include recent intense rainfall were noted: “It has been very wet in the last two years and that is not as normal as the past” [11.EI12] and “with the floods and the intensity of the floods...there is a change” [12.EI12].

Other participants also remarked about rising temperatures and drought as a climatic impact: “How do you classify nine years of drought?” [1 EI3]. This participant continued by discussing adaptive measures taken by the family, such as water conservation: “three buckets in the shower...you adjust your behaviour to suit” [1 EI3]. Another spoke of “lots of experiences [with drought]...I just grew up with it [red dust]”, specifically mentioning “the impact on agriculture and agribusiness...in a rural South Australian community...on the Murray” [16.EI3].

One participant discussed in detail personal experiences with intense rainfall events, while describing Noosa’s relative preparedness to adapt:

I've experienced numerous events, which were consistent with climate change. The most obvious, I suppose, are in the last ten years in terms of the increased intensity of rainfall...Obviously in Noosa we've got the sea-level rise, storm surges, which a place that I own will become an island - much more risky than Noosa Waters - Noosa Lakes Resort [21.EI11].

This participant noted that the current planning in Noosa would help it to adapt to future impacts:

Noosa has managed its natural environment and has got a large degree of buffer capacity; it's likely to fare better than other places. For example, if you compare the complete opposite development style in Kawana, and it is ranked at the top three risks in Australia, because it's allowed all the coastal plains to be developed [21.EI11].

c. Understanding impacts through learning experiences

The hegemonic representation about proximal, and in some cases distal, impacts developed from participants’ involvement in awareness-raising activities such as reviewing flood maps or weather data, various training experiences, employment, and volunteering on the NBR Board.

Several participants indicated their information-gathering about weather and climatic events from a number of sources: the “SOI report on the news” is accurate, continuing, “Yet it surprises me how little the community seems to be engaged in consuming that information
and being prepared” [8.AI3]. Another noted the usefulness of flood mapping, “I have checked the flood models” which suggest that while currently safe, “we might need a canoe to get in and out of the house” in decades to come [9.AI5].

A few participants became aware of climate change impacts through their jobs. A participant working in property valuations demonstrated personal awareness of impacts from sea-level rise when discussing an interest in “how to accommodate buildings and retrofit buildings, and reset land use patterns in the new environment...sea-level rise to looking at more severe weather events, and how you actually design and adapt the built environment to suit” [17.AI7]. A local community leader spoke “from my work role as the regional disaster coordinator. We were unprepared for the broad geographic impacts and the multi-event nature of what was happening” [21.AI15], mentioning experience with “increased intense events” and extreme flooding across Noosa, in particular:

If we lose the frontal dunes, then you’ve either got huge real estate impacts, or you’ve got huge engineering costs. And no one knows how frontal dunes are going to respond to higher sea temperatures and more intense wave action [21.AI6].

Another participant gained a frame of reference from discussion with older people:

We have had extremes of weather over the last twelve years that I’ve been here. I’ve talked with the old people... there’s going to be a cyclone. We haven’t had it yet, but we’re close...just the other day, dumping all that rain on us. We’ve had nearly our annual rainfall so far this year and we’re only just into the fourth month [20.AI10].

Some participants attributed their understanding of climatic impacts from reading, tertiary study and working with and attending NBR Board workshops on climate change (12.AI2; 4.AI2], with consequences “going to be a cost in life, a cost in infrastructure” [4.AI2].

One participant became aware of geographically distal impacts by participating in *Floating Land*, an NBR Board-supported art festival:

*Floating Land* is about art and we had artists come from Tuvalu...many visually graphic images...So I am aware of the risk but it is not happening to me personally...That was one where I understood that Tuvalu was involved in climate change directly...Tuvalu is built on a coral atoll and of course as the sea is rising it is taking over [5.AI4].

Many participants discussed localised climatic impacts by using language that objectified or anchored these impacts within a social representation. One participant used objectification, to make the abstract concept of storm surge more concrete, employed personification by giving voice to the ocean, “Wake up call, here we go, going to throw some big waves at
you” and “you’re going to get a slap in the face, so we’re getting a slap in the face at the moment”, concluding that “we deserve it”, implying that humans’ current interactions with “nature” are problematic [3.I1].

Lay thinking about the impacts affecting the NBR economy emphasised the connectivity with the self, adding to the hegemonic representation. Specific economic impacts, particularly to tourism, agriculture and property values, were linked to particular consequences that place direct pressure on the Noosa economy. The economic uncertainty of “trying to find a way to support our region...would be a big undertaking” if Noosa were to lose “our greatest resource...the ocean” [17.I5]. The acknowledgement of the importance of the ocean to Noosa’s economic sustainability was highlighted by four other participants, who spoke specifically about the impacts from a southern migration of the dangerous and often deadly Irukandji jellyfish, affecting local tourism, an important part of the Noosa economy (ABS, 2005). One participant exclaimed, once the Irukandji arrive, “you don’t go to the beach” [23.I28]. “As a result [of climate change], we’re starting to see Irukandji jellyfish at Fraser Island” [22.I7], the largest sand island in the world, located in the Cooloola Shire, just north of the NBR. It could have “phenomenal” economic impacts only “five or ten years away”, due to increasing sea temperatures [21.I5].

Negative emotions arose in participants when discussing local impacts of Irukandji affecting ‘the self’ and community. One participant expressed frustration with those less concerned: “people get cranky...when I mentioned this [Irukandji migration]” [21.I17]. Another stated “I’m probably a little pessimistic” about the communities’ lack of vision by relying on “easy tourism” now instead of preparing for to a warmer future [23.I28]. This participant vacillated between pessimism and optimism about climate change, with the cognitive dissonance ending on an optimistic note, “I’ve got it. We’ve got it with the hinterland...we can do it [23.I28]. This participant’s expression of a particular concern but overall optimistic outlook on climate change was reflective of many participants.

Some participants focused on negative economic consequences on property values within the NBR: “rising sea levels will wipe out squillion-dollar properties” [20.I15], while noting that the flow on effect to homeowners and their lenders of still-mortgaged properties. This participant demonstrated frustration with “the most obstinate denier” who remained uninformed about the consequences to all. The interview ended with a plea for the “denier” to “ask the insurance companies and the finance companies because they know” and to seek information “well before the actual flood’, which will bring forth “the harsh reality”.

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NBR coastal zone impacts from sea-level rise, beach erosion, and species migration enhance the hegemonic representation of proximal physical impacts. One participant discussed financial and social costs from coastal impacts “that will push people back from coastlines, which will interfere with how the populations live” stating that “If we are not aware of that, the repair bills are going to get bigger, the insurance costs are going to get larger and people are going to lose their lives” [4.I1]. Finally, this participant discussed solutions that align with reified knowledge of impacts and adaptation (IPCC, 2014a), tying coastal impacts with the need for awareness of both mitigation and adaptation solutions through, “a rethink” that shows “how we can mitigate these risks” and undertake adaptive actions, such as “build[ing] bigger and stronger houses back from the coastline” [4.I1].

One participant acknowledged coastal impacts, “Noosa’s or the coastline in the Sunshine Coast is one of the four places in the world that UNESCO predicts that we are going to have this problem [of sea-level rise]” [4.I3] and discussed personal options “we should probably, sensibly be out of our home by 2017…You know there are economic drivers and it is one of our principal sources of retirement in terms of our superfund” [4.I3]. Two participants mention challenges of coastal living from climate change: sea-level rise and increased storms are reasons to “develop attitudes about change, fast change and being resilient to change in the community...for people living on the coast” [7.I1], and “watching the Noosa beach disappear, and the building blocks, the foundations of the Hastings Street stabilisation” [20.I13].

While a few participants discussed the concept of increasing temperature or intense heat, one participant anchored climate change in two images: “I picture the temperature gauge and it is rising pretty much...I picture the globe on fire” [18.I3].

d. Distal impacts

Distal impacts referred to both geographically and temporally distant impacts. The hegemonic representation includes one prevalent distant impact: melting ice. Ice melting in the Polar Regions was the one consensual distal impact that appeared in numerous participant interviews, adding a component of ‘the other’. Imagery of melting ice and polar bears anchored four participants’ understanding of this polar region impact. Examples include:

- “the difference between solid and liquid. Two degrees here [in Noosa] is not a big deal, but two degrees in Antarctica is massive” [1.I3];

- “polar bears on ice flows, really small ice flows floating out to sea” [2.I3];
• “the Antarctic and the ice slides and the polar bears with less to walk on and survive on” [5.I3]; and

• “glaciers carving squillion ton blocks of ice that have been there for two or three hundred, million years...But here they come, right down the mountain, into the sea, poof; that’s climate change” [20.I19]

The focus on the polar ice melts was consistent in the anchoring of climate change to the visual images [11.I1, 15.I1, 22.I6]. One participant colourfully described “glaciers carving squillion ton blocks of ice that have been there for two or three hundred, million years..But here they come, right down the mountain, into the sea, poof; that’s climate change” [20.I19].

An emancipated representation emerged offering additional distal impacts with a range of negative consequences in Southeast Asia, the Pacific and South America, indicating awareness across a broad scope of global impacts from the equator to the poles. One participant acknowledged blizzards in New York [2.I1] and “volatile or pronounced” weather patterns, with heatwaves in Texas, then Russia, followed by a discussion of climate change risks in Tuvalu [5.I3]. Negative consequences from sea-level rise for distant places outside Australia were raised by a number of participants. Participants shared their views on Bangladesh and other low-lying countries and in the Torres Strait where “community displacement” that would occur as a result [8.I3] and “salt water inundation” in Kiribati and Tuvalu [22.I8]. One participant cited numerous complications: the “disappearing out of the sea” of “the Marshall Islanders’ whole lifestyle” and the “mudslides in Peru and Indonesia”, with concluding thoughts noting that “significant...a lot of us are going to have to die” [20.I14]. One participant cited a positive benefit to some who are “going to win out of it...Canada’s supposed to do all right” [23.I6].

Temporally distant impacts and future consequences to ‘the other’ were discussed by some:

• “It hasn’t directly affected me or any close friends or family members...not imminent...not at the forefront. I am aware of the risk of climate change..It’s not in my face” [5.I2].

• “…as soon as I am off the Earth...100 years” [18.I5]; and

• “It’s not my problem, I’m 67 years old, and I’m going to be dead. Now I’m concerned, but probably my view of risk of climate change is that we’re talking about fifty, hundred or two hundred years…” [14.I2].
However, one participant expressed concern for future generations: “…concern more than anything else, for humanity’s long-term future we have to think about doing something about it. I have children and grandchildren and I raised two environmental activists” [1.I2].

e. Summary of a social representation about climate change impacts

Participants identified an understanding of proximal and distal variables of impacts within the NBR and elsewhere when discussing their climate change perspectives. These include proximal impacts that were physical and socio-economic, and distal impacts that were physical and temporal. Understanding of proximal impacts was derived from both personal experience with climatic events or more directed learning experiences.

The consensual or lay thinking and communication around climatic impacts form a hegemonic representation primarily comprised of physical consequences, with anchoring around sustainability. Most of the physical impacts described could occurred locally, with the exception of geographically distant impacts relating to melting ice in the Polar Regions. Understanding of proximal physical impacts developed from their personal experiences or awareness-raising activity, emphasising coastal impacts, including sea-level rise alongside melting polar ice. These representational components, including coastal consequences from sea-level rise, beach erosion, predatory species migration, and flooding, emphasise the consequences to ‘the self’. This hegemonic representation of proximal impacts suggested an awareness of the connectedness between the participants, as ‘self’ and adverse effects from the consensus view of anthropogenic climate change. The distant melting polar ice imagery, alternatively, provided aspects of ‘the other’, removed from the participants’ lives and communities, but acknowledged in this cohort of participants. An emancipated representation existed providing additional complementary knowledge about temporally distant impacts on future generations adding to the ‘otherness’ with this phenomenon, but it was less cohesive. No polemic representation emerged.

6.2.3 Environmental/socio-economic responses

a. Overview of participant perspectives

Identified responses to climate change incorporated wide-ranging solutions across environmental, social, and economic components and across scales from the individual to the global. While a number of themata were evident, the dialectical dyad emerging from the thematic analysis presented as environmental/socio-economic. The analysis further subcategorised the extensive range of socio-economic responses into social responses relating to community actions or political/governance actions. Some included a third
subcategory of economic responses, with instances of both mitigation and adaptation in this climate change SR (Table 6.3).

Table 6.3 Summary of environmental and socio-economic responses

<table>
<thead>
<tr>
<th>Environmental*</th>
<th>Socio-economic*</th>
<th>Economic</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Social (Community)</td>
<td>Political will</td>
</tr>
<tr>
<td></td>
<td>Social movement</td>
<td>Political response</td>
</tr>
<tr>
<td></td>
<td>Community activism</td>
<td>Political long-term focus</td>
</tr>
<tr>
<td></td>
<td>Social divisiveness</td>
<td>Political leadership</td>
</tr>
<tr>
<td></td>
<td>Buy locally</td>
<td>Address the biggest risks first</td>
</tr>
<tr>
<td></td>
<td>Use peer pressure</td>
<td>Building codes and retrofitting</td>
</tr>
<tr>
<td></td>
<td>Address social inertia</td>
<td>Planning scheme change</td>
</tr>
<tr>
<td></td>
<td>Buy personal insurance</td>
<td>Challenge climate deniers</td>
</tr>
<tr>
<td></td>
<td>Promote ecological tourism</td>
<td>Slow political change</td>
</tr>
<tr>
<td></td>
<td>Individual behaviour change</td>
<td>Address political inaction</td>
</tr>
<tr>
<td></td>
<td>Reduce over-consumption</td>
<td>Advocate for political activism</td>
</tr>
<tr>
<td></td>
<td>Community resilience building</td>
<td>Population limits</td>
</tr>
<tr>
<td></td>
<td>Noosa Biosphere Economic Board information sharing</td>
<td>Holistic approach from governments</td>
</tr>
<tr>
<td></td>
<td>Lack of leadership and community interest</td>
<td>Local government flood assistance</td>
</tr>
<tr>
<td></td>
<td>Change values to protect biodiversity</td>
<td>New Noosa Council leadership</td>
</tr>
<tr>
<td></td>
<td>Collective awareness raising</td>
<td>Political, social and business leadership</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Government buyback of flood-prone land</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Political leadership for mitigation and adaptation</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Promote economic benefits from adaptation</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Political leadership to collaborate with community and industry</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Impose government regulations on individuals</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Local government planning scheme restrictions</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Government planning for infrastructure adaptation</td>
</tr>
</tbody>
</table>

*Note: Table 6.3 is drawn from interview quotes from transcripts.
The participant responses to climate change were explored within the following categories: governance responses; society-wide, private corporate sector and technological responses; behavioural changes; mitigation and adaptation actions; and sustainability practices.

b. Governance responses

Social responses to address climate change covered a range of political and governance actions from the local to the global scale, and across the social spectrum of civil, private and government sectors. Participants identified twenty ideas as responses to climate change that could be made by government, covering an array of issues, from current limited international approaches, to ways to assist developing countries, and address overconsumption and population growth. Emotional responses of frustration and pessimism were apparent.

Frustration with current government responses to climate change was raised by four participants. One expressed frustration with the political system’s response, “[climate change is] more [of] a political agenda” than a “really serious issue that we must address now” [14.R4]. Another reflected that politicians underestimate the citizenry, “The difficulty...is the political system will underestimate the willingness of the community to take significant action and the ability to communicate in a way that will allay the short-term economic concerns” [21.R4]. One participant identified frustration with all levels of government, covering a lack of meaningful mitigation and adaptation:

I mean the political arguments that go round the divisive nature of the topic...ranging from is your property safe from sea-level rise, flooding...Governments are going to have to bite the bullet, relocate vulnerable communities...there will be costs to the community, either at the local level or a national level or internationally indeed; the cost of changing from fossil fuel; the whole debate of the carbon tax or not. How effective they are going to be or carbon trading systems and how they are going to work the political, the economic, and the how things are going to affect us at a personal level [8.R5].

One participant expressed frustration with the higher order governance efforts, “The debate has been hijacked...there are some certain blocking mechanisms out there at a national and international scale” [16.R5]. This participant continued with a change to a positive focus on how individuals can change behaviour and provide the next generation with tools and information and provide the impetus to take advantage of our democratic process and right to vote [16.R5]. Another participant echoed the sentiment that global action is required, “It can only be solved globally...” but noting pessimism that it will happen in the next few decades, “I think the 50 years after the first really major impacts, or until we get a majority
of people understanding the major influences and impacts...The best case used to be two degrees; best case is four degrees now. Yeah, I don’t think there are too many places to escape to” [21.R20].

Another expressed frustration for a lack of concern for future generations: “we lack leadership in Australia, political, social or business-wise” [14.R3]. This participant continued to cite continued political failure on climate change action: “we’re just going to continue to do what we’re doing, that people will...promote their own agendas and the change that might happen is going to be fundamentally insignificant and have little impact upon improving our environment” [14.R3]. Echoing this sentiment: “No, I think the political system is too short-term in nature in order to address the longer term risks...They are diametrically opposed. I see [Noosa] as changing for the worse. I don't see it as apocalyptic but yeah; I don't see it turning for the better” [16.R9].

One participant noted pessimistically about the linkage between population growth, consumerism and climate change, “It’s a huge challenge because you have to get major countries that have huge populations and huge population growth to come on board and sign up to various protocols to do anything...massive resources that are used in packaging that just goes to waste...I don’t think significant progress is going to be made as things stand currently, because it’s just getting worse” [22.R15].

One who had lived through World War II called for Australia to treat climate change as if it were a war:

Politicians...Nobody takes responsibility for anything these days...There’s never a sense that humans can achieve by working together peacefully and in harmony...the problem is that we do not deal with the climate change and humans’ effect on the world on a war footing, and it is. We’re at war with ourselves; we are at war with our relationship with the world. We are really battering the world, and the world is battering back [20.R19].

One participant expressed sympathy for politicians, “It is uphill for politicians on how they sell that”, noting “the 24-hour news cycle” as one aspect of the dilemma. “I don’t think policy-makers have a clue about how to get the message across” [1.R5].

c. Society-wide, private corporate sector and technological responses

Two participants called for joint government/community/industry actions. One notes that governments must “create the conditions where community, industry...can be engaged, [where government has] the responsibility for coordination...we're all responsible [21.R14]. Another echoed the needed synergistic effects: “Individuals won’t do it unless they’re forced
to by government...we have to work in tandem with governments” [22.R14]. This participant continued by discussing the current political climate in Australia, “[climate change] it’s fallen off the political agenda so it has to be back on the political agenda” [22.R14]. This participant concluded with a view about the private sector’s role, “industry has a responsibility to help fund it...it might be by introducing clean tech products and services into their own business processes or industrial processes to reduce their own energy, water and waste [22.R14].

Additional collective responses through enhanced private sector leadership and technological solutions were positively framed by several participants. One participant equated solving cancer and climate change through technological breakthroughs developed by “people who are passionate” [18.R9]. Another expressed a positive outcome will take time and require leadership: “It’s all doable, but it takes a while [and] a few leaders, real leaders. Politicians are not the leaders, they follow, for an example, it could be a Bill Gates...could be somebody just decides to make it their passion” [19.R2]. One participant noted that “business was starting to come on board” prior to the global financial crisis, but that “bigger organisations that are spending an enormous amount of money” to address climate change [23.R3].

d. Behavioural changes

Several participants spoke about the need for behavioural change, embracing the inclusiveness of “we” as opposed to others. One participant expressed dismay, saying “I don’t know that we’re taking it seriously enough, quickly enough...we may be moving a lot faster towards really impacting the future of the Earth...it may reach that point of no return...so that frustrates me” [2.R5]. Another noted that it is the responsibility of “individuals and collective groups across our region...education at a very young age...raising the awareness and changing people’s behaviour” [5.R1]. This participant voiced a response focused on sustainability: “Regardless of climate change...by changing people’s perceptions and...behaviours and embracing the more energy efficient way of living our lives, it’s a win-win anyway...they are contributing whether they like it or not” [5.R1]. Another commented that the problem lies in, “behaviour and actions...of which logical argument can be a very small part. So their beliefs, the cultures...values and attitudes...” [21.R8]. One participant remarked on the quixotic nature of people’s attention spans: “five minutes later everybody’s forgotten about it again. That’s the bit that I find concerning, after [extreme weather] events...we’ve got such short memories” [23.R12].
An emancipated representation emerged around responses with an environmental focus, often directly related to mitigation or adaptation by individuals. To a lesser extent, the cohort shared specific mitigation or adaptation approaches to directly address the causes or impacts, respectively, with limited understanding of individual actions to assist in addressing climate change. Although the participants viewed themselves as community activists and demonstrated knowledge of and efforts to promote sustainability in their communities (Chapter Eight), with regard to personal responses to climate change, there were relatively few individual measures. The personal responses mostly covered specific climate change measures to mitigate greenhouse gas emissions or adapt to climatic impacts.

e. Mitigation and adaptation actions

Several personal mitigation responses addressed specific actions such as limiting air conditioning use or buying solar panels. One participant spoke of the financial trade-offs to making a personal contribution to address climate change, “I’m still paying off a car loan because I elected to go to a hybrid..and that’s reduced my holiday options” and “I consciously live in a very small space”, specifically noting that much of Australia’s housing stock has a high embedded energy load [21.R19]. One participant focused on mitigation options that included renewable energy and water conservation. This participant juxtaposed the self/other framing, “people in general look to government” but “we have a responsibility as individuals”, citing examples of buying “solar panels [for] our roof and a water tank” [22.R11].

NBR Board participants, while discussing specific mitigation responses to climate change, provided various reasons for actions. One participant discussed mitigation training, which encouraged awareness of energy and water use, noting “it’s not just about the dollar” [23.R21]. This implied that while there were economic savings other reasons were at play. Conversely, another participant indicated that the driver of climate change actions were economic, noting reducing energy use was important because energy was expensive, “It is about money not about the environment” [18.R10].

When discussing effective mitigation approaches to climate change, the self/other framing presented again. One participant, when discussing the effectiveness of peer-pressure in promoting mitigation efforts, noted that “my friends react to me”, when discussing the importance of recycling and leading by example to promote “good habits”, so that friends “would make a little joke about it but they would carry out what I said” [18.R11].
One participant indicated that when looking “at the current political situation” in Australia, personal political activism was ultimately important because of “all the things I was adapting to help adapt or mitigate climate change...it’s the systems-level changes” that are crucial [21.R16]. This participant continued to discuss the individual’s need for conscious decision-making about “mitigating their own personal footprint” or “making sure they’re prepared and understand how to adapt to what’s coming”, coupled with “becoming more active in the community” including “your choices for those who make decisions for it, on your behalf” [21.R18].

Two participants, when discussing climate change responses, specifically discussed the need for adaptation. Two participants shared adaptation responses gained from personal experience with climatic events. One talked about how adapting to coastal conditions allowed the family to experience the thrill of watching coastal storms because their home was built to withstand them: “[We] enjoyed the storms. We had great, big, thick windows...We built [our house] knowing [the risks], yeah. That’s adapting, I suppose, to the environment...we knew the beach, how hard [the wind] blew” [19.EI4]. Another expressed the proactive adaptive actions to prepare for future cyclones: “I was up there taping the windows” and reflected how “that could become normal behaviour if we get continuing and more frequent severe weather events” [22.EI12]. This participant reflected on the personal adaptive action of relocating away from the waterfront: “Well, I now live on the primary dune...Yeah, that’s the one we’re selling... if I was looking to buy a property, I would advise people...not to buy in Noosa Waters or near the river, or on Weyba Creek “[22.EI12].

f. Sustainability practices

Participants identified a range of sustainability practices when discussing how to respond to climate change, such as a need for change in consumption patterns, values and reliance on government. With regard to adaptation, one participant promoted self-sufficiency through specific adaptive measures to particular impacts, such as a change in farming practices and drilling bores to use flood waters, to buying personal insurance to cover the likelihood of increasing natural disasters. In a few instances, the responses reflected behavioural changes to force social change through peer pressure to minimise one’s environmental footprint or reduce water consumption, and political change through advocating activism in the political process. Again, anchoring of climate change in sustainability appeared, making the connection between “climate change and that subset of looking into conservation and keeping the environment in shape”, concluding with adaptation concepts of “be prepared, adapt and change” as a way to “accommodate that new normal” [17.R6]. Consistent with
the anchoring in sustainability, another participant noted the importance of reducing consumption:

Tread lightly on the Earth again...It’s not as if we didn’t have the information on how to...see past the consumerism...We have to exercise restraint...Replace the values...you ban advertising because...They spend billions twisting your brain to tell you that you cannot be a happy human being, unless...[20.M17].

Anchoring climate change in sustainability also appeared in several participant extracts focusing on larger societal issues. One participant discussed that when NBR Board efforts focused more broadly on societal change, community members would become more aware of climate change:

I’m not interested so much in climate change as in having resilient communities that are independent, and can do lots of stuff for themselves, and they’re aware of the environment they’re living in [7.R2].

Another participant detailed why a broader sustainability approach to life would address climate change, stating that “I guess climate change in itself doesn’t actually mean that much to me” [9.R2]. This participant said that “all the mitigation and adaptation actions...are just good decisions that we should be making anyway in terms of the environment”, citing specifics such as energy efficiency and clean technologies [9.R2]. This participant expressed the view that climate change is “a label so people can understand why we are doing this, ‘it’s for climate change”’ [9.R2].

g. Summary of a social representation of climate change responses

To summarise, a hegemonic representation emerged that was comprised primarily of socially-oriented responses. This representation included political responses, such as political will, and a political long-term focus. Some mentioned the Australian Government’s climate change policy-making as a “slow political change” and noted a need to “address political inaction”. Numerous participants noted the need for governments to take a leading role on climate change. There was only one instance of citing the specific role of the “new Noosa Council leadership”. More specific ideas about government responses included changes in building codes and retrofitting or changes in planning schemes, buyback of flood-prone land or other types of flood assistance. Therefore, the hegemonic representation around responses to climate change reflects the cohort’s lay thinking that governments should act to address climate change, often anchored in sustainability principles and actions. A limited emancipated representation contributing complementary knowledge about individual actions
enhances understanding of other efforts to reduce greenhouse gas emissions and actions to assist in adapting to climate change impacts.

6.3 Discussion of climate change social representations

Climate change is a complex and multi-faceted phenomenon, which manifests its meaning differently based on a range of influences, including knowledge, personal experiences, emotions, social networks, demographic background and cultural values (Lorenzoni et al., 2007). Some connections with climate change affect the individual, but equally important are concepts of the phenomenon that affects “distant others”, through linkages with cultural or humanistic values (Adger, Barnett, Brown, Marshall, & O’Brien, 2013, p. 114). Hegemonic and emancipated representations found in this study range from ‘the self’ to ‘the other’ and are discussed in this section. The consensual or lay knowledge discussed in this section will then be discussed in relation to the reified knowledge of climate change in the conclusion of this chapter.

Research notes the linkages between adaptive actions and cultural values (Adger et al., 2013; O’Brien & Wolf, 2010). Climate change, presenting global and local challenges, can provide connection between individuals and distant consequences (Adger et al., 2013). The hegemonic representation relating to melting ice and polar bears is an example of identifying with climate change by “forming symbolic identities with distant others and ‘elective’ communities” (Adger et al., 2013, p. 114).

The analysis of cognitive knowledge and emotive associations reveal climate change SRs coalescing around its causality, impacts and responses and within hegemonic and emancipated representations (Section 3.4.4.1). Further, the analysis demonstrates that the cohort of NBR Board participants employs propagation as the mode of communication (Section 3.4.4) to share their understanding of climate change, often by anchoring it to sustainability principles and practices gleaned from their experiences or knowledge. (Chapter Eight further explores the NBR Board participants’ identity with sustainability.)

6.3.1 Composition of climate change social representations

The interview analysis, which compiles the participants’ individual knowledge to describe the group’s lay thinking of climate change covers: 1. a multiplicity of causes from human activities and natural processes; 2. an array of local community and far-reaching impacts, with consequences for individuals and their community and societies in Australia and abroad, occurring now and in the future; and 3. a broad range of individual and collective responses to both its causes and effects across the sustainability spectrum. These three themata reveal
components that formulate a consensual-derived hegemonic representation and an emancipated representation constructed from supplementary knowledge that affords complementary evidence.

The *hegemonic representations* emerging from this cohort of NBR Board participants coalesce around anthropogenic causes, physical impacts and social responses of a primarily socio-political nature. The focus on human activities is consistent with other research using SRT to explore SRs of climate change (e.g., N. Smith & Joffe, 2012). The dominant lay thinking regarding impacts emphasises local physical impacts occurring within the NBR, such as sea-level rise and flooding, directly affecting participants, their families and their community. Additionally, shared thinking emerged with the geographically distant impact of “ice”, which is consistent with other findings of climate change social representations among Australians (Moloney et al., 2014) and Americans (Leiserowitz, 2006). Some studies have shown that distant and negative images, such as ice caps melting or polar bears stranded on small free-floating ice blocks, may lead to psychological distancing and response-avoidance (O’Neill & Nicholson-Cole, 2009). However, this hegemonic representation, while including this negative imaging of melting ice, was balanced with the personally relevant local impacts, demonstrated through the participants’ experiences and awareness-raising examples and their thinking around responsive measures stressing collective socio-political actions. The social representation of climate change is anchored in numerous examples of negative imagery linking human activities to pollution. Additionally, climate change is anchored in sustainability across discussion of causality and responses, indicating that it is a commonly understood communicative method for this cohort. Objectification was used to associate the anthropogenic causes of climate change with its hazardous consequences. Shared consensual knowledge of this climate change SR includes local socio-economic impacts, directly relating to the participants’ personal lives. These components coupled with the local physical impacts emphasise the relationship to ‘the self’ with this climate change social representation.

*Emancipated representations* provide knowledge supplementary to the group’s dominant lay thinking focused on the natural variability in the climate system and socio-economic impacts. This complementary shared knowledge aligns with that in the scientific community (i.e. reified knowledge) (BOM/CSIRO, 2014; IPCC, 2014c) regarding 21st century climate change arising from both anthropogenic contributions coupled with the natural variability of the climate system and the array of social, economic and environmental impacts discussed extensively in the literature (e.g., IPCC, 2014a). An example of *objectification* of the natural
component of climate change was displayed through imagery of ‘mother nature’. Both the
hegemonic and emancipated representations within this social representation are consistent
with the deeper understanding of the broad array of climate change consequences discussed
in the scientific literature (Adger et al., 2007; Pelling, 2011; Schipper, 2007). In the
emancipated representation, knowledge-sharing of distant impacts on ‘the other’ may
indicate shared humanistic values across cultures and national boundaries (Adger, Huq, et
al., 2009). Awareness and acknowledgement of individual and collective actions aligns again
with the views of those in the scientific community (e.g., Burton, 2009; O’Brien & Selboe,
2015). This study’s data do not reveal a polemic representation (i.e. one that directly
challenging the consensual understanding). There were no instances of participants
countering the prevailing views of an anthropogenic contribution to its cause or claiming that
impacts would not occur or that actions do not need to be undertaken.

A social representation with climate change emerges from the extent of lay thinking around
causality and consequences, with less cohesion around specific responsive actions required
to address its cause and impacts. However, research suggests that continually providing
scientific data alone, without a community engagement mechanism providing opportunities
for dialogue and awareness-raising around risks and options, will likely incur further
resistance (Moser, 2009). Therefore, for this group, it is argued that greater care is needed
to frame the responses to climate change, and in particular the adaptation options, to assist
communities in addressing local impacts. This is consistent with climate change
communication research suggesting effective climate responses require a focus on specific
options with the choice left to the affected population (Moser, 2010).

6.3.2 Communication of climate change social representations
A communicative modality around propagation exists, as the NBR Board participants share
their understanding of climate change often by anchoring it to sustainability principles and
practices gleaned from their experiences or knowledge. Communicative modalities of social
representations introduced in Moscovici’s work (1961) identify three types: propaganda,
propagation and diffusion (Section 3.5). This study does not find propaganda or diffusion as
the means of communication among the NBR Board participants. Whereas Moscovici’s
communists firmly rejected psychoanalysis through propaganda, this study’s participants do
not reject climate change or communicate through stereotypes or biased or misleading
political points of view, as would, by definition, climate change deniers. Unlike Moscovici’s
urban liberal elite, who simply spread lay knowledge of psychoanalysis without a group
connection to the phenomenon (i.e. diffusion), the NBR Board participants hold an emotional
connection to the phenomenon and share a social identity grounded in sustainability (Chapter Eight) with other group members. Further, they demonstrate a strong acceptance of climate change.

This thesis thus argues that the NBR Board participants use propagation to disseminate their climate change SRs among the third sector sustainability organisation (TSSO) cohort and across the community, through explicit messages to transmit strongly and widely held ideas about climate change. Moscovici (1961) applied the term *propagation*, to the spread of Parisian Catholics’ SRs of psychoanalysis as an alignment with their religious values and practices. Thus, propagation requires a strong identification and widespread promotion of underlying beliefs. Through propagation, while a group may display levels of resistance to the research object of the scientific phenomenon, the group’s attitudes of its acceptable components are disseminated (Moscovici, 1961). The participants accept the reality of climate change, its demonstrated local and distant impacts, and its anthropogenic causes that should be addressed through individual and collective actions. They align climate change with their group’s cohesive ideas and social identity with sustainability (Chapter Eight) and promote sustainability as a legitimate response to effectively address climate change and its consequences. To further explore the NBR Board’s communicative modality of propagation, the NBR Board participants’ climate change social representations are compared to that of Moscovici’s Catholics’ social representation of psychoanalysis (Section 3.4.4) (Table 6.4).
**Table 6.4 Comparison of SR communications processes between NBR Board participants and Moscovici’s Catholics (Adapted from Bauer & Gaskell, 1999; Moscovici, 1961)**

<table>
<thead>
<tr>
<th></th>
<th>The NBR Board participants</th>
<th>Moscovici’s Catholics</th>
</tr>
</thead>
<tbody>
<tr>
<td>Societal segmentation</td>
<td>2012-2013 NBR Board</td>
<td>1950s Parisian Catholics</td>
</tr>
<tr>
<td>Strength of group identity</td>
<td>Strong</td>
<td>Strong</td>
</tr>
<tr>
<td>Process of communication</td>
<td>Propagation</td>
<td>Propagation</td>
</tr>
<tr>
<td>(communicative modalities)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Social-psychological function</td>
<td>Attitude</td>
<td>Attitude</td>
</tr>
<tr>
<td>Contents of communication</td>
<td>SRs are anchored in images of human-induced pollution; biophysical impacts (e.g. sea-level rise, flooding, ice melting) and holistic, sustainable responses addressing not only carbon pollution but also to more broadly protect the environment through sustainable practices</td>
<td>SRs are anchored in the traditions and roles of the confessional in the religious practices of Catholics</td>
</tr>
<tr>
<td>Level of rejection/resistance or reception/acceptance of new scientific concepts</td>
<td>Partial and controlled reception of climate change focused on sustainability over specific mitigation and adaptation practices</td>
<td>Partial and controlled reception of psychoanalysis</td>
</tr>
</tbody>
</table>

*Propagation* is a mode of communication that transmits ideas with the aim of integrating a social object into an existing and well-defined reference framework (Moscovici, 1961). In this case, the NBR Board participants attempted to integrate their ideas of climate change into the NBR Board objectives of promoting sustainability with its biosphere. Additionally, propagation’s objective is to make the social representation acceptable to all members, as opposed to generating schisms within the group (Moscovici, 1961).

### 6.4 Conclusion

The data reveal social representations with climate change within the group of NBR Board participants, with the strongest representations from lay knowledge of its causes and consequences. These often align with reified knowledge of the scientific community (section 2.3), which is summarised in Table 6.5.
Table 6.5 Comparison of consensual knowledge of NBR Board participants and reified knowledge from climate change literature

<table>
<thead>
<tr>
<th>Summary of consensual knowledge of NBR Board participants</th>
<th>Summary of reified knowledge from climate change literature *</th>
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</thead>
<tbody>
<tr>
<td><strong>Causality:</strong></td>
<td>Causality:</td>
</tr>
<tr>
<td>The majority of NBR Board participants acknowledge that 21st century climate change was grounded in anthropogenic causes, as well as elements of natural variability.</td>
<td>Concurs with scientific community findings demonstrating human activities and the natural variability of the climate system combine to cause 21st century climate change (e.g. IPCC, 2013).</td>
</tr>
<tr>
<td><strong>Impacts:</strong></td>
<td>Impacts:</td>
</tr>
<tr>
<td>The majority of the NBR Board participants were informed about the physical impacts from climate change, both proximal and distal.</td>
<td>Concurs with scientific consensus on global physical impacts across regions (e.g. IPCC, 2013).</td>
</tr>
<tr>
<td>The participants, to a lesser extent, address social or economic impacts or the interconnected between direct impacts and flow-on impacts to social and economic systems.</td>
<td>Scientific consensus emphasises the consequences across social, economic and environmental components of society, stressing the importance of a sustainable approach effective immediately to reduce the likelihood of reaching a threshold of dangerous climate change (IPCC, 2013).</td>
</tr>
<tr>
<td><strong>Responses:</strong></td>
<td>Responses:</td>
</tr>
<tr>
<td>NBR Board participants allocated most of the responsibility for climate change to governments.</td>
<td>Concurs with scientific consensus calls for actions from all segments of society, with concurrent sustainable approaches to address causality (through mitigation) and impacts (through adaptation) (e.g. Burton, 2009; IPCC, 2014a).</td>
</tr>
<tr>
<td>Few participants discussed the role of the private sector or the use of technology to address climate change. Those who did discussed specific mitigation measures such as energy efficiency or clean technology to address climate change.</td>
<td>Scientific consensus (e.g. IPCC, 2014b) around mitigation indicates that a shift to a low carbon future requires efforts from the private sector as well.</td>
</tr>
<tr>
<td>Many participants offered ideas about mitigation, while few offered specific adaptation measures.</td>
<td>Scientific consensus emphasises the major role that clean technology and efficiency will play in stabilising greenhouse gases in the coming decades (e.g. IPCC, 2014b).</td>
</tr>
</tbody>
</table>

* Note: The reified knowledge here presents a summary of the literature review of climate change science in Section 2.3.

The cohort holds social representations about climate change that primarily cover its causes of and impacts with climate change, but not about adaptation (discussed further in Chapter Seven). A less cohesive representation of responses that primarily focused on governance and sustainability and communicated through a process of propagation was also found. The key social representations include the following.

1. A **hegemonic representation** with climate change that emphasises attribution to anthropogenic causes; current and projected consequences from physical impacts, primarily local in nature but also including distant impact of “ice”; and collective, primarily socio-political responses. **Anchoring** incorporates negative imagery of human-induced pollution (e.g. pollution spewing smokestacks and fossil-fuel burning) and physical impacts (e.g. polar bears on floating ice blocks). **Anchoring** climate change to sustainability principles and
sustainable practices links this cohort’s connection with sustainability to the phenomenon in a way that provides meaning and a communication mechanism.

2. An emancipated representation that adds knowledge about the role that natural variability plays in the climate system; local socio-economic impacts; and individual responsibility for climate change responses. Objectification of natural processes includes personifying physical impacts as acts of Mother Nature. The emancipated representation also included a wide-range of responses to climate change, primarily focused on governance and how various levels of government can address climate change, including some specific actions on mitigation, or focused on sustainability. The importance of collective actions by governments is important because many adaptation responses requiring proactive planning under the control of governments or guided by regulations and legislative changes.

3. A communicative modality of propagation, whereby sustainability serves as a chief and legitimate response to effectively addressing climate change, is circulated through shared attitudes grounded in sustainability principles and actions. Further, it is anchored in images of human-induced pollution; physical impacts (e.g. sea-level rise, flooding, ice melting); and, a perception of climate change focused on sustainable responses addressing not only carbon pollution but also sustainability actions to build resilience in and protect the natural and human systems.

This cohort of NBR Board participants constructs its strongest social representations from lay knowledge around causes and consequences of climate change that align with reified knowledge about climate change. A less cohesive SR circulates around a wide range of climate change responses. Additionally, the data reveal limited knowledge about specific responses addressing mitigation of greenhouse gas emissions or detailed adaptation efforts. Research suggests enhanced engagement and action would be more likely if scientific knowledge is coupled with direct dialogue and awareness-raising among the affected population (Moser, 2010). Within this cohort, climate change SRs are framed through a sustainability paradigm, with propagation as the group’s mode of communication.

This study continues in Chapter Seven by considering if a social representation around adaptation to climate change impacts exists, or is emerging among the participants, and, if so, what does their lay thinking reveal about its construction and circulation.
Chapter Seven. Social representations about adaptation

7.1 Introduction
Chapter Six explored climate change social representations (SRs), revealing sense-making that emphasised primarily anthropogenic causes, physical impacts, and socially-oriented responses grounded in sustainability. This chapter continues to draw on Moscovici’s (1961) social representations theory (SRT) to reveal if SRs of adaptation exist among NBR Board participants. This chapter presents the findings of an adaptation social representation by applying the principles and concepts of SRT (Section 3.4-3.7) to analyse the NBR Board participants’ interview data to reveal the NBR Board’s collective lay thinking. The analysis of adaptation responses is presented across the dialogical dyads of individual/social, with the social responses further coded as socio-political or socio-economic. The discussion considers the findings and concludes by considering the implications for this third sector sustainability organisation (TSSO).

7.2 Results of an adaptation social representation
During the interview process, the questions about climate change impacts and adaptation followed the broader questions about climate change and responses to the phenomenon. While a number of adaptation actions were elicited, all came from only eight of the 23 participants, suggesting limited lay thinking about adaptation from the group as a whole (Table 7.1).
Few participants offered adaptation solutions to address climate change impacts, with half of the adaptation measures coming from two participants. Of the 22 adaptation actions, 16 were social and six individual adaptations. The extracts appearing in this chapter are coded with extract identifiers that include an interview transcript number and quote extract identifier within the transcript (e.g. 4.A1 signifies interview transcript 4 and extract A1).

A focus on social responses to adaptation, indicating responsibility for solutions from ‘the other’, aligns with the participants’ views that social responses should be undertaken to address the climate change more broadly (Chapter Six). Three-quarters of 16 social adaptation actions focused on socio-political responses. Of the 12 socio-political actions, nine called for more assistance from government, either through the creation of new programs or enhancement of existing programs towards areas focusing on sustainability or climate change. One participant suggested the need to “assist in job creation that addresses climate change impacts” [16.A8]. While this response indicates that collective action from governments is required, it lacks specificity with regard to what kinds of jobs or what types of impacts would be important for government to address.

Three of the 12 socio-political adaptive actions called for governments to cease or reverse existing policies or actions perceived as exacerbating climate change impacts. One
participant provided six social responses, four of which were socio-economic actions. Two of these offered specific ideas, such as providing an incentive to buy local products [23.19], and promoting eco-tourism [23.A18]. However, many of the recommendations were of a general nature, including promoting economic opportunities for individuals who employed adaptation practices in the near future [23.A16] or encouraging local sustainable approaches to adaptation [23.A17], creating the dual approach of mitigation and adaptation [23.A5], or advancing collective action against risks from impacts [23.A14].

7.2.1 Individual adaptation responsibility
When speaking about specific adaptation initiatives, five of the eight participants who offered adaptation responses mentioned specific actions to be undertaken by individuals. Four gave specific responses from their personal experiences [3.A2, 16.A4, 20.A14, 21.A18]. These four participants offered adaptation measures from their personal farming experience and family farming. When discussing their prior personal experiences, all expressed optimism that they could adapt successfully.

One participant discussed the impact of drought on the family farm and the measures to adjust to drier conditions:

[I learned by] seeing my father adapt his farming methods [and] his management techniques...now there’s more education and communication about this holistic method of farming, using native pastures...not using fertilisers [3.A2].

Another participant with farming expertise shared knowledge about farming practices and experience in adapting crops to meet changing precipitation in the Murray-Darling. Acknowledging the need to adapt to physical climatic impacts in the future, this participant called for “better practices around irrigation, drip irrigation...” and incentives such as training and grants. This participant concluded:

In a long-term investment, tree crops as a cropping mechanism have to change. So how is the food bowl of the future going to be impacted? Where is it going to be?...Not as simple as let's just go a thousand kilometres north or south...Where are the water sources...the soil type...So no frost, no significant cool period, to actually get the fruit quality up [16.A4].

This participant realized that there was a lack of knowledge of how the food bowl would be impacted and about uncertainty over effective adaptive actions. However, there was optimism about building on existing capacity to continue farming into the future: “We are going to do research. I have many years in agro-business and experience and I can grow stuff” [16.A4].
One participant who owned a large rural property discussed personal responsibility and preventative adaptation planning by conducting due diligence prior to purchase. However, even with precautions, unexpectedly heavy rains caused some water logging:

...importantly we’re 70m above the astronomical high tide, I made sure we were before we bought the block...water drains out of the valley we’re in...The house has been built strategically on the high side...It was one of the criteria that we checked...and now since the rains have started, soggy. We can't do anything with it, can't even walk on it. And, you know, anyway, we got a bore, so we don’t mind the water soggy [20.A14].

One participant explained current adaptation efforts on rural property in the Noosa hinterland:

On my property, I’m climate-proofing it. We have our own water, will have our own electricity...our own chooks...our own fruit, we've got our own vegetables...we are working collaboratively, collectively to sustain ourselves at a basic level of existence, and possibly happier than we've ever been in our life [20.A20].

This participant raised the issue of family security and a future need to be self-sufficient, noting: “[I] included...an armoury of weapons, those that will stop people from eating my vegetables. I think that is what is going to happen...others will be starving” [20.A20].

The fourth participant with farming experience discussed a range of personal responsibilities that individuals should implement:

Mitigating...or reducing their personal footprint..It’s about making sure they’re prepared and understand how to adapt to what’s coming...Becoming more active in the community, and about making conscious decisions in terms of your choices, for those who make decisions for it, on your behalf [21.A18].

Personal responsibility is an important aspect of adapting to climate change impacts (Breakwell, 1986, 1993). Four of the eight participants who offered individual adaptation responses expressed that they gained their knowledge from personal experiences with climatic events, indicating that a connection with climate change contributes to understanding how to address its impacts.

7.2.2 Socio-political adaptation responsibility
Of the eight participants who offered adaptation responses, seven identified government-implemented actions. Three of the seven participants identified actions to modify government policies that exacerbate climatic consequences and create maladaptation, such as local planning schemes that increase biodiversity decline. Nine of the 12 responses suggested government actions that would assist adaptation efforts, with several participants sharing frustration with the lack of effective government measures. One participant called
for “common sense” and compared adaptation to a “social insurance policy”, similar to an individual insuring their home:

“[Adaptation] is common sense... It’s like the risk thing... When you have people that are climate change deniers, there’s enough evidence there that even if you’re sceptical, you want to take out an insurance policy, or I would. You know? It’s a no brainer. You wouldn’t think not to! Naturally, most people wouldn’t think about not having their house insured. So why wouldn’t you actually do something that gave you some sort of insurance as a society” [23.A15].

Two specific adaptation initiatives that could be offered by government were proposed. One participant asked “What are the jobs of the future going to look like as a consequence of climate change?” [16.A8]. There was a link made to “education systems” that could enhance these efforts, which would also assist the private sector, “I suppose it is being at the head of the curve with agro-business: looking at those long-term crops of the future” [16.A8]. Another cited that governments were buying back flood-prone land [19.A3].

Several participants wanted the government to take a more holistic, long-term approach. When discussing adaptive actions one participant focused on sustainability and the government’s lack of accounting for the costs from future losses of natural resources, such as bees and forests:

That’s part of the climate-proof thing... One of the major reasons bees are dying out in America? Monsanto... genetically inserted an insecticide, so the bees collect the honey, the nectar from the rapeseed; take it back to the hive and the whole hive dies... just because we can, doesn’t mean we should. We need to think about what we’re doing, rather than rushing along and assess it against values that are currently not measured [20.A21].

The participant also discussed a lack of a long-term perspective or a gap between knowledge and action with additional examples of maladaptive government actions. He referred to the cost of $10,000 per hectare to clear-cut forested land, even though the “forest took 50 years to grow and it produces X amount of good stuff for the air” [20.A21] and added that “polar bears have the highest concentration of PCBs of any living animal, because they’re the end of the food chain” [20.A22]. This participant suggested that government inertia prevented meaningful action to protect the koala population [20.A22], without offering what type of activities would be ‘meaningful’. Another participant shared the view that effective adaptation requires community activism: “adaption [sic] is realising that you have to be more active in your community... That’s probably the most significant” [21.A17]. Another called for the local government planning scheme to focus more on environmental conservation than development:
Have the council put into the planning scheme getting back to the Noosa feel for developments, not turning Hastings Street into a concrete jungle as they have done. It’s totally different from when we first came here and it’s completely lost its natural feel, so what used to be lots of trees, lots of shade and they’re going to have to get back to that in public places [22.A13].

Two extracts imply resistance to adaptation. One participant stated that “people do not make behavioural changes until they have to” [3.A1]. Another considered it will take “a range of triggers” [21.A3] before change occurs:

It’s interesting that the increased occurrence of significant events is not changing large-scale political systems. I think it’ll be when more fundamental and far-reaching ecosystem services are denied to the society. That might do it. Or when there’s a freak or serendipitous convergence of political generation change [21.A3].

Socio-political adaptation responses are appropriate and important to effectively adapting to climate change, given the key role that governments must play to develop and advance broad-based adaptive strategies (e.g., Burton, 2009; Pelling, 2011).

7.2.3 Shared responsibility for adaptation
Two participants indicated a need for both personal and collective actions. One participant noted that individuals, communities and governments were responsible for providing “warnings about what might be effective in terms of adapting lifestyle” [4.A1]. Another offered broad views about individual and social actions for both migration and adaptation:

Individuals have a range of personal responsibilities, they span from mitigating their own personal footprint, or reducing their personal footprint to aid the mitigation, but it’s about making sure they’re prepared and understand how to adapt to what’s coming [21.A18].

This participant observed the need for a social role and that each individual’s responsibility is to contribute to the socio-political process: “It’s about what I said – becoming more active in the community, and about making conscious decisions in terms of your choices, for those who make decisions for it, on your behalf” [21.A18]. A shared responsibility approach aligns with the views of reified knowledge expressed in the scientific literature (e.g. IPCC, 2014c).

7.2.4 Socio-economic benefits of adaptation
One participant adaptation discussed a number of socio-economic benefits from undertaking local adaptive actions. This NBR Board participant, with a background in business and service on the NBR Economic Sector Board, underscored the sustainability aspects of local adaptation efforts. Beginning the discussion by highlighting the economic advantage to those who act now, this participant stated the economic benefits of taking early action:
“Early adapters will actually get a commercial benefit...You’ll either have an economy that is structured and able to deal with [change], or you’re going to be left behind” [23.A16]. This participant felt optimistic that the NBR community would promote sustainable adaptive approaches:

[Noosa has] early sustainability credentials, and that’s one of the comparative advantages...We’ve got UNESCO Biosphere accreditation, we’ve got a whole bunch of people that are really focused on this and interested in it, we’ve got a really strong, emerging, clean tech sector. We’ve got the highest uptake of solar in the country [on the Sunshine Coast]...There are opportunities on a regional basis; for individual companies there’s an advantage [23.A16].

Continuing to discuss the benefits from adaptation, the participant spoke about the personal and communal advantages of buying locally grown food, and “building materials [that] will start to be more local, which is another adaptation measure, because you’re actually dealing with the climate locally” [23.A17] and promoting the “huge opportunities for this region in tourism. Ecological tourism, educational tourism associated with these sorts of things, food tourism” [23.A18]. These benefits will only occur through changes, as this participant concluded: early sustainable adaptation requires more “leadership and discussion” with “a role for [the] Biosphere [Board] to do more” but that there are already benefits to the Noosa economy because “the customer is demanding [it], which we’re seeing at [a local resort]” [23.A19].

The socio-economic benefits from adaptive actions are important components of adaptive actions and require third sector, private sector and government efforts. The reified knowledge of adaptation highlights that actions should be prioritised when they contain ‘win-win’ components, those additional benefits not directly addressing climate change (IPCC, 2014c).

7.2.5 Concurrent adaptation and mitigation

Several participants spoke of adaptation and mitigation when asked about adaptive actions. One participant expressed optimism that a newly de-amalgamated Noosa Council would provide leadership on climate change:

Obviously to me, rarely do we get a second chance at a new beginning, and that’s what a new Noosa Council reform could be, and I think that is the window of opportunity...to become carbon neutral, how to become more adaptive and what are the transition steps? We have...the climate change and peak oil strategy from Council [21.A13].
This participant offered: “I was one of the first people to promote the Noosa Climate Action Plan in the Noosa Shire” [21.A13] and continued by proposing that the local council concurrently implementing adaptation and mitigation approaches. Further, the participant suggested the “key criteria for successful, sustainable communities... [is its] leadership about the shared vision”, again tying climate change to the sustainability principles [21.A13].

Another cited the urgency of concurrent actions of mitigation and adaptation to prevent what the IPCC has defined as dangerous climate change:

I can still see the opportunity, but it’s actually getting harder to see a solution. We’ve really got to go very hard on the mitigation, but we’ve got to go awfully hard on the adaptation because we’re locked in [to rising temperatures], there’s an element of that and the capacity of the world to move quickly enough to keep us at our two degrees” [23.A5].

While many participants could clearly distinguish between mitigation and adaptation actions to address differing aspects of climate change, some expressed views that showed a conflation of the two terms. Two participants, when discussing adaptation, freely offered mitigation responses to address greenhouse gas concentrations causing 21st century climate change. One participant initially mentioned “adapting lifestyle” without providing specific information on adaptation. Yet, when continuing the thought, the specificity appeared around mitigation actions to reduce climate change’s anthropogenic causes, “and how we live and our consumption and energy and all that sort of thing and doing what we can without completely destroying our standards of living but adopting new technology and making some hard decisions” [4.A1].

Another participant was unsure about the term adaptation:

[Adaptation], I have heard it but not on a regular scale. To me it means adapting to the environment. That is where I come in” [18.A8].

However, in this extract, the participant conflates adaptation with mitigation by providing examples of specific mitigative actions to reduce greenhouse gas emissions:

To me that is what we have to do to adapt...Woolies bags, you know the cloth bags, not the plastic bags...Like turn off the air-con...If I see there is no green bin I will throw it in the recycling bin. A couple of years ago I would not have done that” [18.A8].

The mitigation actions offered by the participants were consistent with the literature (Bonyhady et al., 2010; Engle, 2011). Several echoed the IPCC (2014a) calls for a broad understanding of the need for an overarching climate change strategy with concurrent responses to mitigate greenhouse gas concentration levels and adapt to current and
projected impacts. However, a few participants, when responding to the question about adaptation, proposed mitigation actions solely, suggesting a conflation between the terms mitigation and adaptation.

7.2.6 Impacted and responsive entities

The results show, when analysed through the typology of adaptation responses (Section 2.4.3), many of the NBR Board participants’ adaptive actions align with proactive adaptation. While proactive adaptation can yield significant benefits (e.g., Burton, 2009), many adaptive actions identified by NBR Board participants focus on social, primarily government, measures, over those by individuals, the private sector or civil society. Some of the proactive actions to address impacts on individuals were offered as responses that individuals could implement often related to rural farming or land management. Three participants presented four individual adaptive actions to shift farming practices to address consequences from temperature and precipitation changes such as drought or flooding [3.A2, 16.A4, 20.A18 and 20.A20]. Some participants, when considering adaptation to address impacts that affect the individual, indicated that the responsibility for adaptive actions should come from others, such as government entities (Table 7.2).
Table 7.2 Impacted entity, responsive entity and adaptation response

<table>
<thead>
<tr>
<th>Impacted entity</th>
<th>Responsive entity</th>
<th>Type of adaptation response*</th>
</tr>
</thead>
<tbody>
<tr>
<td>Individuals</td>
<td>Individuals</td>
<td>Adapt family farming practices to address drought [3.A2]</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Adapt farming practices to address temperature and precipitation changes [16.A4]</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Undertake due diligence on property to address flooding; bore to use flood water [20.A14]</td>
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<tr>
<td></td>
<td></td>
<td>Take individual responsibility [20.A18]</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Become self-sufficient in applying adaptation to personal property [20.A20]</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Individual preparedness [21.A18]</td>
</tr>
<tr>
<td>Individuals</td>
<td>Social and/or private sector</td>
<td>Assist in job-creation that addresses climate change impacts [16.A8]</td>
</tr>
<tr>
<td>Individuals and private sector</td>
<td>Social (government) and private sector</td>
<td>Promote economic benefits of adaptation [23.A16]</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Encourage sustainable, buy-local approach to adaptation [23.A17]</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Promote ecological tourism [23.A18]</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Provide local incentives to meet customer demand</td>
</tr>
<tr>
<td>Individuals, private sector, environment</td>
<td>Social (government)</td>
<td>Create government buyback of flood prone land [19.A3]</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Reverse maladaptation in local government planning scheme [22.A13]</td>
</tr>
<tr>
<td>Environment</td>
<td>Social (government)</td>
<td>Reverse maladaptive government policies promoting biodiversity loss [20.A22]</td>
</tr>
<tr>
<td>Non-specific</td>
<td>Social (government)</td>
<td>Encourage political action on adaptation [21.A3]</td>
</tr>
<tr>
<td>Non-specific</td>
<td>Social</td>
<td>Advance holistic community activism [21.A17]</td>
</tr>
<tr>
<td>Non-specific</td>
<td>Social (government)</td>
<td>Advance collective action against risks from impacts [23.A14]</td>
</tr>
<tr>
<td>Non-specific</td>
<td>Social (government)</td>
<td>Remove government maladaptation that hinders action [3.A1]</td>
</tr>
<tr>
<td>Individuals</td>
<td>Individual and social</td>
<td>Individual and social adaptation to address lifestyle and consumption [4.A1]</td>
</tr>
<tr>
<td>Environment</td>
<td>Individual and social</td>
<td>Promote sustainable, holistic adaptation by changing values to protect biodiversity</td>
</tr>
<tr>
<td>Non-specific</td>
<td>Individual and social</td>
<td>Encourage individual and community action on mitigation and adaptation [21.A18]</td>
</tr>
<tr>
<td>Non-specific</td>
<td>Non-specific</td>
<td>Create dual approach of mitigation and adaptation [23.A5]</td>
</tr>
</tbody>
</table>

*Note: Table 7.1 data are drawn from interview extracts.

Such social adaptive actions include promoting economic benefits, encouraging sustainable, buy-local approach, promoting local ecological tourism or local incentive to meet customer demand, and a government buyback of flood prone land. Some participants spoke more broadly about reversing current maladaptive policies, for example, within government planning schemes or adding new regulations promoting adaptation or mitigation generally.
In sum, the results show that the participants held a wide range of views on adaptation responses, from general to specific. Most of the adaptive actions, to address both individual and collective impacts, were weighted towards government intervention, solely or in conjunction with efforts from individuals and the private or civil sectors.

7.3 Discussion of an adaptation social representation
As climate change is multi-causal, its solutions require multi-scalar actions from across society (IPCC, 2014c), with responsibility from individuals and governments alike. Participants offered a wide range of responses, from individual sectoral efforts to broadly identified social measures. The analysis of adaptation responses reveals a limited understanding or connection to adaptation among the cohort of NBR Board participants, with just eight participants proposing the 22 adaptive responses. Further limiting this understanding was that 14 of the 22 adaptive actions came from just three participants. However, the three participants proposing the majority of adaptive actions showed a relatively in-depth knowledge of adaptation in specific areas, such as farming practices or economics. Overall, social responses highlighted the need for actions by governments, with few proposing third sector or private sector initiatives. Only one participant identified the corporate sector’s role and advantages of early actions.

The data reveal that this cohort does not hold a social representation of adaptation at this time, given the limited number and generalised nature of the adaptation responses. However, the insights of some participants regarding specific adaptive actions, especially those emanating from personal experiences, infer some understanding of adaptation.

Individuals who shared individual adaptive actions, expressed optimism when relaying their personal experiences with farming or rural property management, adapting to climatic events, expressed. While a number of participants spoke about adaptation and mitigation concurrently, there were different levels of understanding about the terminology. Some participants were confident about their understanding and spoke at length about specific individual and collective actions across adaptation and mitigation. Others agreed for a need for actions on climate change but were either uncertain about or conflated the terminology, or did not offer specific measures. This reflects the complexity of the climate change phenomenon and the multi-faceted aspects of a comprehensive and effective response.

A number of participants, when asked about adaptation, offered actions that address climate change causality (i.e., mitigation), and do not directly address adapting to the impacts from the phenomenon. This demonstrates a conflation of the two approaches. One participant
offered replacing plastic bags with reusable cloth ones [18.M8]. Another referred to measures to reduce energy use by foregoing air conditioning. This was linked to reducing greenhouse gas emissions if the energy source is from fossil fuels [4.A1]. While no questions were asked of participants regarding how to mitigate climate change or how to reduce greenhouse gas emissions, some participant responses provided more general actions to address climate change through specific mitigation measures addressing the human activities producing greenhouse gas emissions. No participant asked for a clarification of or questioned the term “adaptation”. Most responded with some ideas.

A clearer understanding of climate change adaptation would assist in broadening the desire for and urgency around social action to address individual and community-wide impacts, including more usable knowledge about the concepts and rationale for concurrent adaptation and mitigation and sustainable adaptation approaches. This is consistent with the literature (Chapter Two) that indicates that knowledge of sustainable adaptive actions (e.g. Pelling, 2011) to address current and projected local impacts and information about building community-wide support is needed (e.g., Bonyhady et al., 2010; Thomsen et al., 2013). The literature also indicates that awareness of the distinctive roles of adaptation and mitigation and the need for concurrent immediate action is required (e.g., Engle, 2011).

While the majority of participants identify with sustainability (Chapter Eight), few focused on sustainable aspects of effective adaptation. Most did not make the direct link between sustainability and climate change adaptation. However, many NBR Board participants did connect climate change overall with sustainability. Therefore, opportunities exist to extend this connection to adaptation. The scientific literature (Sections 2.3.5 and 2.3.6) emphasises the importance of enhancing adaptive capacity within human and natural systems through sustainable approaches to climate change (e.g., Engle, 2011; Keys et al., 2014).

As climate change is multi-causal, its solutions require actions from across society (IPCC, 2014c). Participants offered a range of responses, from mitigation to adaptation, and from individual sectoral efforts to broadly identified social measures. The complexity of the phenomenon’s impact on social, environmental and economic aspects of life may be one reason why so many participants identified social responses, and in particular government actions, when discussing how local communities could adapt to climate change. At the same time, they acknowledged that without government involvement in the solutions, limited progress would be made.
7.4 Conclusion
This chapter presents the findings of an adaptation social representation. By applying the principles and concepts of SRT (Section 3.4-3.7), the analysis of the NBR Board participants’ interview data was analysed to reveal the NBR Board’s collective understanding. As a group, the Board displays no discernible cohesive social representation related to climate change adaptation, and a limited understanding and connection with adaptation. However, the analysis of the group’s lay thinking revealed some general themes, particularly around the allocation of responsibility for action, proactive types of adaptation and linking sustainability to adaptation. The consensual or lay knowledge, while not yet cohesive, revealed areas of overlay with the reified knowledge of experts in adaptation science (Section 2.4) and summarised in Table 7.3.

Table 7.3 Comparison of consensual knowledge of NBR Board participants and reified knowledge from adaptation literature

<table>
<thead>
<tr>
<th>Summary of consensual knowledge of NBR Board participants</th>
<th>Summary of reified knowledge from adaptation literature *</th>
</tr>
</thead>
<tbody>
<tr>
<td>Allocation of responsibility for adaptation:</td>
<td>Allocation of responsibility for adaptation:</td>
</tr>
<tr>
<td>1. Social. Socio-political responses were the focus of many NBR Board participants who allocated most of the responsibility for adaptation to government, and to a lesser extent, joint responsibility shared by all.</td>
<td>Scientific consensus calls for sustainable adaptive actions from all segments of society – government, civil and private sectors as well as contributions from individuals; adaptation should be conducted in tandem with sustainable approaches to address causality through mitigation (e.g. IPCC, 2014a; 2014b; Pelling, 2011).</td>
</tr>
<tr>
<td>2. Individual. Some participants discussed adaptive actions to be undertaken by themselves or other individuals, with specific actions offered primarily from participants with personal experiences with climatic impacts. Few participants discussed the role of the private corporate sector.</td>
<td></td>
</tr>
<tr>
<td>Types of adaptation:</td>
<td>Types of adaptation:</td>
</tr>
<tr>
<td>Some participants offer proactive adaptation through individual actions to address specific future impacts. Some participants discussed the need for planned adaptation undertaken by governments, such as incorporating sustainable adaptation approaches into government planning schemes.</td>
<td>Concurs with adaptation literature supporting proactive adaptation through individual and government efforts and highlighting sustainable adaptation through transactional and transformative adaptive approaches (e.g. Burton, 2009).</td>
</tr>
<tr>
<td>Benefits of adaptation:</td>
<td>Benefits of adaptation:</td>
</tr>
<tr>
<td>Some participants supported adaptive actions that offered socio-economic benefits to the local community. Some participants noted the importance of concurrent adaptation and mitigation would have benefits.</td>
<td>Concurs with economic analyses (e.g. Garnaut, 2008, 2011), which highlights the social, economic and environmental benefits from early adaptive actions and the costs of delay. Concurs with concepts of sustainability (e.g. Australian Government, 1992).</td>
</tr>
<tr>
<td>Adaptation-sustainability nexus:</td>
<td>Adaptation-sustainability nexus:</td>
</tr>
<tr>
<td>Many participants offered ideas about adaptation that were non-specific and focused on measures that would address sustainability over all.</td>
<td>Concurs with scientific consensus (e.g. IPCC, 2014a), which highlights the most effective adaptive actions are based on sustainable adaptation approaches.</td>
</tr>
</tbody>
</table>
Only eight of the 23 NBR Board participants offered adaptation responses. Of the four participants offering adaptive responses addressing individual responsibility, all spoke enthusiastically about specific adaptation actions gained from personal experiences of farming or rural property management. This suggests that obtaining personal experiences with climatic impacts can play a role in understanding effective adaptive actions and retaining a positive connection with climate change. However, most other adaptation responses suggested government-imposed actions, often of a general nature, deferring responsibility for adaptation to ‘the other’. A level of specificity in the socio-political adaptive actions indicated concern about climate change but limited knowledge of how to respond to change the economic model currently in existence.

Chapter Eight expands upon the initial findings in Chapters Six and Seven regarding a sustainability focus among the participants as they discuss climate change and adaptation. The chapter explores further the participants’ connection with sustainability, considering their views on living sustainably and activities and philosophy around sustainability prior to and during their tenure on the NBR Board. The chapter concludes with a discussion about the participants’ personal and social identity with sustainability.
Chapter Eight: Social Identity

8.1 Introduction

This chapter considers the third research question, exploring if a social identity exists among the NBR Board participants. This research question emerged from the data and analysis in Chapters Six and Seven, which found linkages between climate change and sustainability, and adaptation and sustainability, respectively. Thus, at this point, the thesis evolved into a sequential qualitative-qualitative mixed methods design (Morse, 2010) by adding two new research questions (Chapters Eight and Nine).

This chapter focuses on the group’s social identity, which is comprised of how participants identify with the group. The chapter analyses the participant’s identity with sustainability to assess if this identity exists and whether it influences understanding of climate change and discusses the group’s collective social identity. Also, to triangulate the data on social actions, this chapter includes a review of the NBR Board report presenting the 2012-2013 Board engagement projects and activities, and considers how the group’s social identity influenced its selection of Board activities.

While the topic guide did not include specific questions about sustainability (Appendix 4.2), the majority of the participants offered personal views on sustainability and relayed information about sustainability concepts and actions in response to questions regarding climate change and adaptation. Thus, further analysis was conducted to consider in what capacity the participants identified with sustainability. From the master transcript, I searched for the word or word segment “sustain”. I then read all interview extracts that contained this word or word segment to see if they address sustainability and compiled and coded a data set according to emerging themes and subthemes (Section 8.2).

The study participants represent a broad array of Noosa residents who chose to serve on the UNESCO NBR Board of Directors. Their advocacy of sustainability is demonstrated through their committed time and effort, prior to and during their NBR Board tenure, developing projects and programs that address climate change and loss of biodiversity: issues that have developed over time from unsustainable practices. The NBR Board collectively implements projects generated by its members that fulfil its commitment to UNESCO; namely, to promote sustainability and climate change throughout the NBR. As NBR Board participants, they accept the premise, outlined in the UNESCO Man and the Biosphere charter (UNESCO, 1996) that economic growth can be sustained through a balanced approach that focuses on social, environmental and economic factors working in concert within a community.
The results (Sections 8.3 to 8.6) inform this study about how sustainability is incorporated into participants’ lives and lifestyles across three dimensions: formative sustainability concepts; reinforcing sustainability activities; and applying sustainability in their careers and personal lives. The results also present the NBR Board’s community engagement and outreach activities during the study period of 2012-2013, which focused on sustainability and climate change. The discussion section (Section 8.7) draws upon social representations theory (SRT) and identity process theory (IPT) (Section 3.5) to examine the NBR participants’ personal identity and social identity.

8.2 Genesis of study participants’ identity with sustainability

Many study participants provided unsolicited musings about their early interest in sustainability and how they incorporated sustainability into their lives through lifestyle practices, work choices, or educational pursuits, often prior to joining the NBR Board. Using thematic analysis, I coded the interview extracts by the emerging themes of sustainability experiences: 1. Formative sustainability (Section 8.3); 2. Reinforcing sustainability (Section 8.4); and 3. Applying sustainability (Section 8.5). This allowed for an analysis of social identity elements of continuity, distinctiveness, efficacy and self-esteem (as introduced in Section 3.5).

The findings across these three categories draw upon the participants’ views on the importance of sustainability to their lives. The formative sustainability theme indicates how participants incorporated early experiences prior to joining the NBR Board. This theme allowed for consideration of the identity element of continuity with sustainability concepts over time, in some cases from early in life, thus presenting congruity between past and present identities.

Reinforcing sustainability indicates how participants strengthened their commitment to sustainability through study or engagement in this field. Applying sustainability indicates how participants employed or shared knowledge in sustainability through professional development or in their private life. These two themes provided for analysis of identity elements of distinctiveness, efficacy and self-esteem across aspects of education, career and lifestyle choices.

Participants responded to the opportunity to talk about climate change, and offered views on sustainability, with considerable interest. I sensed passion and a high level of commitment to sustainability during the interviews, as well as a willingness to share how they incorporated sustainability into their personal, social and professional lives. Some are lifelong residents of the NBR, whose families have lived in Noosa for generations; others have come to Noosa for
a lifestyle change, some stating they have brought with them their passion and commitment to sustainability and their willingness to share their time and efforts with their new community. As such, the participants demonstrated a diversity of personal experiences and activities: some were retired; others worked in jobs across the non-profit, government and corporate sectors; some had returned to study. Regardless of their background, all shared a common interest in dedicating time to advancing sustainability efforts within the NBR.

8.3 Formative sustainability

Many participants spoke of how they initially came to appreciate sustainability, their early sustainability actions, personal values, and emotional connection with sustainability. They discussed how and when they began to incorporate sustainability in their lives. Some expressed reflections about interactions with family and friends; involvement within their community; or the need for governance. Thus, I further categorised the formative sustainability data into two subcategories: 1. Individual responsibility to act sustainably; and 2. Personal values and positive affect with sustainability.

8.3.1 Individual responsibility to act sustainably

Many participants shared their beliefs that they had a responsibility to act sustainably for current and future generations. Some participants stressed that sustainability was an overarching principle within which they make daily personal life choices.

One participant, who identified themselves as a sustainability advocate, proposed that “anyone is a sustainability advocate if they’re practicing sustainability in their daily life” and then explained that this approach involved being “taught to have a holistic viewpoint” to see “how everything fits in”, giving an example of shopping, where she continually attempted “weighing things up” to make sure she was making the best choice from a sustainability perspective. “You might buy something at the shop that says organic, but if it is packaged in something that is not going to break down then maybe you should choose something else” [3.S2].

A daily practice of weaving sustainability into all aspects of one’s life was at the fore of this participant’s views of sustainability:

You define it in your own home or you define it in the social issues of your area that you’re living in, or you define it in the governance...personally, I live by a very soft footprint...I’m careful with recycling, I don’t waste things, I don’t buy excessively. I’m not a fan of consumerism [3.S1].

Two participants linked food and sustainability. A discussion of growing one’s own food led to this participant’s personal definition of sustainability:
(I) took the more practical approach of being an organic grower and...I used the old spyglass, the three-lens spyglass [to define sustainability]. So the one, the big wide one out there is the ecology...a big, long-term picture and then nested within that is the social lens...and the one closer to your eyes is economics...when you look through the whole three you get the correct, unblurred vision” [21.S2].

A positive association emerged for another participant between the quality of home grown food and community engagement: “I grew up caring about food source and quality of food and...so it may be just going back to roots...slow food, community gardens...there’s a real need” [2.S3]. This participant elaborated on the connection between local healthy food and her self-efficacy with sustainability:

It started off...having access to healthy food, having access to local food. Local economies were changing...for decades a rich source of local produce, was starting to erode as it became more urbanised. A lot more food was coming in from foreign countries. So I became interested in the slow food movement...in community gardens...run by people who had a passion for gardening...and then [they] would donate the food to a lot of shelters and homeless people, or families that didn’t have a lot of the financial means to feed themselves and their kids” [2.S1].

Three participants spoke of the importance of galvanizing support in their local communities. One participant wanted to help sustain the local economy by re-establishing local food markets:

It started off around...having access to local healthy food...a rich source of local produce was starting to get eroded so I became interested in the slow food movement...community gardens, locally [2.S1].

Another anecdote pertains to a participant’s effort to garner support to oppose State Government action to removing environmental education and climate change science from the Queensland school curriculum. This participant went online to petition the government, noting the irony that, at that time, it was the United Nations International Year of Sustainability:

I’m going to forward it to all of the Biosphere Boards to get members to log on. So when we talk about trying to introduce and raise awareness and get people to start doing things, that is really very sad, particularly, making that announcement in this year of sustainability, I was disappointed” [5.S1].

Along these lines, another focused on awareness-raising to highlight the benefits of natural resources conservation:
What we need to do is to sell it to people because they don’t get into it that much, but I think inherently people who move here and tourism operators’ golden egg is the beaches, the good air and good water. So they know about it. I think they need encouragement to champion it more [12.S1].

Two NBR Board participants stressed that their sustainability philosophy emerged from their responsibility to future generations, as sustainability requires long-term commitment, beyond the current generations. Many addressed the perpetual nature of sustainability. One participant began by stating, “I think the first thing is future generations”, continuing “When I think of sustainability, I just think of everything, of the ‘circle of life’ [3.S4]. One lifelong Noosa resident told of a family legacy of sustainability: “Sustainability and resilience… I especially felt very strongly that my grandparents, my parents, my great-grandparents knew about resilience because that was a way of life…because we’re pioneer people out here” [15.S2]. This participant connected her past with the future by expressing that she was fearful for a society that did not grasp sustainability, framing the issue as a collective “need to learn to be more creative in our thinking” because “what’s important is survival… if we don’t become more sustainable in our way of life, then maybe there’s not going to be a life” [15.S1].

8.3.2 Personal values and positive affect with sustainability
Six NBR Board participants spoke positively about their connection to sustainability, some in terms of a life philosophy and personal value system.

“[A]ll of my professional life, and I graduated as an architect in the middle of the 1970s during the middle of the oil crisis, so I have been taking those philosophies on board since that time: reuse, recycle, reimagine” [1.S1]. Two participants included sustainability as part of their personal value system: one simply stated “…sustainability, it’s a core part of my life, the concept of understanding that we’re in trouble” [20.S1], while the other remarked “…whilst I’m an advocate for sustainability, I don’t proclaim to know really very much about climate change” [17.S3].

Two participants discussed their long-term connection with sustainability. The continuity with sustainability, which began for one participant in the 1970s, continued in later years even as he felt alienated from the norm:

When I lectured at university in the late 90s, I wondered where the activists had gone. If you are interested in sustainability, you carry that with you. Or you naturally gravitate towards things with that framework within which you see yourself. It was that long-term thinking – that’s sustainability [1.S1].
Another participant expressed a positive emotional connection to sustainability, while expressing awareness that many other people do not share this association:

I think I have a different perception of sustainability to a lot of people because when I think of sustainability I think quite positively, but I know that a lot of people don’t. Or they, I remember a while ago there was all this discussion about the term sustainability, is it a good term to be using? But I think it’s a really good term, personally, yeah” [3.S7].

Two participants revealed their personal values with sustainability when discussing climate change, with one noting that semantics were important when discussing climate change:

Frustration with the fact that [climate change is] becoming such a political debate as opposed to something that can create collaboration and head us in the same direction. So I choose to use terminology around sustainability rather than climate change as a consequence. It is a lot friendlier and a lot more conducive to, I guess, positive reactions rather than climate change just polarizing some communities and some conversations [16.S2].

Another participant emphasised only a sustainable approach to climate change will be effective:

What’s important is survival. So if you are not sustainable and if we do not become more sustainable in our way of life, then maybe there’s not going to be a life. There’s not going to be survival because if the disasters that are happening already…they’re going to increase because the temperature’s rising...So with sustainability, we need to learn to be more creative in our thinking [15.S1].

8.3.3 Summary of formative sustainability
Eight participants discussed their initially connections with sustainability, often through early family experiences or development of personal values, providing examples of individual actions and the positive connections gained from them. These examples inferred continuity with sustainability concepts and actions. Along with enhancing self-esteem, carrying a philosophy of sustainability over time strengthens identity within an individual.

8.4 Reinforcing sustainability
NBR Board participants discussed how they continued to reinforce their sustainability sensibilities. Thus, I further categorised the reinforcing sustainability data into four subcategories: 1. Tertiary study to enhance sustainability knowledge; 2. Supporting sustainability through UNESCO Biosphere Reserves; 3. Supporting sustainability through third sector activities; or 4. Supporting sustainability in governance.
8.4.1 Tertiary study to enhance sustainability knowledge
Post-secondary studies provided continuity for some participants’ personal commitments to sustainability. Five offered as background information their formal degrees in sustainability or climate change: a TAFE sustainability diploma [2.S2] to climate change studies in undergraduate [13.S1] and postgraduate areas [3.S5], to PhDs focusing on sustainability in planning [7.S6] and agricultural systems [21.S1].

One Board participant, who worked full-time while completing a sustainability diploma at the local TAFE, mentioned an ability to then use that knowledge to “champion sustainability” in the workplace and through her community service. “I completed the diploma in sustainability, which was fabulous. Certainly opened my eyes far, far better than what I had previously known about climate change…” [2.S2].

Another undertook a PhD in the area of planning for sustainability to advance conservation efforts through the private sector and community service:

[I]t was a big problem that everything in the conservation strategy was a job that the government had to do. I don’t think governments can do everything, and so I was one of the people in our area that advocated that there should be more community involvement in the implementation of the conservation strategy that was in Brisbane at the time [7.S6].

Two participants studied sustainability issues at the local university, one undertaking an Honours degree in biodiversity and another completing a Master’s degree in climate change adaptation [3.S5]. During their university studies, both had become aware of the NBR and wanted to commit time to the NBR Board’s community projects.

8.4.2 Supporting sustainability through UNESCO Biosphere Reserves
Five participants identified their pursuits in promoting sustainability and aspirations for their community and local council to adopt sustainability principles and actions. This aligns with the UNESCO MAB principles and the UNESCO Strategy for Action on Climate Change (UNESCO, 2015). Five participants discussed UNESCO’s approach to sustainability. One observed that the UNESCO version of sustainability required a balance of environmental, social and economic considerations [17.S1] and another “wanted to contribute to …UNESCO’s vision: that communities would do research” noting that the NBR Board work on climate change achieved that goal [7.S1]. Another expressed an “interest in climate change and sustainability and the Noosa community” [22.S1]. Others stressed the role of the NBR Board was to encourage Noosa residents to champion sustainability [12.S1] and a belief that
“Noosa is going to be a model of sustainability; Noosa won the best sustainable council in the country award” [10.S1].

8.4.3 Supporting sustainability through third sector activities
Three participants spoke about their community volunteer work with passion, identifying with likeminded individuals in pursuit of promoting sustainability within the NBR. One participant when discussing volunteer efforts to help sustain the Noosa economy noted:

I was passionate about the economic development in our region and business prosperity and then...we saw a lot of synergies around sustainable economic development. We had already been talking about population cap, and clean green technologies and low-footprint-type activities... [16.S3].

Another expressed inspiration obtained from sharing a common purpose in sustainability:

And they'll do everything they can to help you, so that's what I try and do. And then meeting likeminded people, it's so refreshing...I'm always inspired by all these volunteers putting their hearts and so much of their time and effort into this beautiful conservation work [3.S6].

A participant who championed several NBR Board projects, including a schools initiative, a community resource database, the formation of the Biosphere Institute for Sustainability, and the Noosa Biosphere Festival, mentioned the difficulty of TSSOs to “find another advocate or champion” to work on ongoing projects [7.S3].

8.4.4 Supporting sustainability in governance
Support for enhanced governance was reinforced by six NBR Board participants, who spoke of their belief that individuals had a responsibility to promote sustainability through governance. Four participants proposed that government should support sustainable approaches to policy decision-making through initiatives such as the United Nations International Year of Sustainability [5.S1]; “establish[ing] good standards” [6.S2] through the local council for initiatives such as “green buffer [zones]” [5.S2]; and starting a “community care group” [7.S7]. One participant observed that a sustainable community is not possible with a balance between its economic and environmental goals, “you can't have a good environment without a decent economy; vice-versa is also the case” [23.S4]. Sharing this sentiment, one participant remarked that the current government “actually recognise[s] that getting that balance is important” [23.S5].

8.4.5 Summary of reinforcing sustainability
Thirteen of the 23 NBR Board participants discussed how they reinforced sustainability concepts through tertiary study, volunteer work in their community or by supporting
sustainability approach by their government. Participants demonstrated a reified knowledge of sustainability gained by post-graduate study, while others identified linkages between sustainability and good governance through identification of sustainable approaches to community challenges. These formal and informal means of reinforcing sustainability concepts provides continuity with sustainability over time, while building self-esteem and enhancing self-efficacy, all components that build identity.

8.5 Applying sustainability in career and lifestyle choices
Participants remarked about how they applied sustainability over time by incorporating it into their careers. Sustainability played a role in their work experiences, which cut across a range of jobs in the corporate, public and non-profit sectors. The third sector employed a number of participants, who were or had been working to support local community efforts to retain or improve the natural environment by implementing sustainability projects in Noosa and the region. The formative sustainability data was further categorised into: 1. Career choices incorporating sustainability; and 2. Lifestyle choices incorporating sustainability.

8.5.1 Career choices incorporating sustainability
Sustainability played a role in work choices and work/lifestyle balance for eight NBR Board participants, solidifying a personal identity with sustainability. Participants gained personal worth, thus enhancing self-esteem and added control over one's life, thus enhancing self-efficacy, that proved to be reinforcing and recurring indicators of their personal and social identity with sustainability (Breakwell, 1986).

One participant combined family life and career when choosing where to live and what to do for a living: “…basically sustainable living; that fitted really well, coming from Noosa” [22.S2]. Another worked as an environmental planner, noting that the community’s efforts to protect the region’s unique biodiversity was a key reason for moving to a coastal village in Noosa, expressing the view that a goal was to protect “ecological corridors, important to places that are core areas for biodiversity” [7.S10]. This participant expressed that the government alone could not solve complex and dynamic problems resulting from unsustainable practices, and therefore, sought out a community that aligned with personal values, “And so I found…the only place on the Sunshine Coast where people were seriously thinking about that [and it] was in the Noosa Biosphere”. This participant augmented identity with sustainability through these efforts that built self-efficacy and self-esteem.

Five NBR Board participants identified themselves in relationship to sustainability or shared emotional connections to it that motivated them in their professional or personal lives. One
participant indicated that they promoted sustainability at work and “obviously in the Noosa Biosphere” [2.S2]. Two participants spoke of sustainability advocacy: “I was one of the people in our area that advocated that there should be more community involvement” [7.S6] and another identifying as a sustainability advocate by defining the term, “I think anyone is a sustainability advocate if they’re practicing sustainability in their daily life” [3.S6]. One participant spoke of sustainability through efforts to provide a stable economic base for Noosa businesses, “I joined [The NBR Board] because I’m passionate about business continuity [16.S4]. Another indicated the sustainability-minded community, “I feel blessed to be living in [Noosa] an area that seems to be a little bit more environmentally aware” [2.S2].

Building self-esteem and self-efficacy came to one participant through sustainable design: “All of my professional life I have been taking those philosophies on board: reuse, recycle, reimagine” [1.S1]. With a focus on building “smarter houses” that meet the needs of society, his goal was to sell “the idea that bigger is not always better; that quality trumps quantity for me every time.” However, he voiced that at times, he had to forego some design work because of his principles; “When a client comes in and says they want it a certain way, when you are running your own business, you need to say that these are the conditions that I will or won’t work under.” One of his potential clients “wanted to make kit houses out of Indonesia hardwoods and I asked where the timber would come from and when he told me I said I couldn’t do it. It was that those foreign practices weren’t renewable”.

In addition to their community volunteer work, two participants chose work in TSSOs, where they had coordinating roles on local projects. One advocate held several non-profit jobs advancing community sustainability. Working as an environmental coordinator with bushland communities, one participant stressed of sustainability advocacy, “It’s about coaching” noting “So you all get together and you say, ‘Hey, let’s all get sustainable’ and then every week you meet.” This advocate continued by expressing the value of the non-profit sector as a component of sustainability noting, “I don’t think governments can do everything, and so I was one of the people in our area that advocated that there should be more community involvement in the implementation of the conservation strategy…” [3.S2]

8.5.2 Lifestyle choices incorporating sustainability
Lifestyle choices, including what community or type of house to live in, were presented through the lens of sustainability for many participants of the NBR Board. Six spoke about the natural environment and its beauty of where they live, “I feel blessed to be living in [Noosa]...the environment and sustainability is more built into the way people want to live here”, noting the community is “very supportive of local farmers and producers” [2.S2]. One
participant directly linked climate change and sustainability, offering a cautionary warning that “areas that are uneducated in climate change risk...which comes back to all those sustainability principles and putting them into action in your local community” [3.S8].

One NBR Board participant linked individual and community actions: “a good place to start, working on you and doing things around the home, and then venturing out...There are some community groups that are doing a great job, doing something but they could be doing it in a sustainable way” [3.S9]. Others conveyed that lifestyle choices included sustainability in home design: “We built a new house with sustainability in mind...with really big eaves and without air conditioning” [12.S2] and installing solar panels with batteries to disconnect from “the grid” [12.S3]. One participant stated “I’m climate-proofing [my property]. We have our own water, will have our own electricity, we’ve got our own chooks, we’ve got our own fruit, we’ve got our own vegetables” [20.S2].

8.5.3 Summary of applying sustainability
Ten of the 23 NBR Board participants identified ways in which they applied sustainability to choices they made in their careers and lifestyles. These participants demonstrated an understanding and personal connection to sustainability that provided motivation and self-efficacy to undertake solutions and built self-esteem to continue their pursuit of sustainability over time.
8.6 Noosa Biosphere Reserve Board activities as indicators of applying sustainability

This section provides a detailed presentation of NBR Board activities during the period of service of the study participants. At the time of this study, the NBR Board initiated, approved and participated in a range of projects and activities to address unsustainable economic, environmental and social challenges.

Table 8.1 presents the official report (NBL, 2013) of the NBR Boards projects and activities during the 2012-2013 term. As the participants initiated and volunteered on specific projects, this data serves to highlight the group’s interest base. Section 8.7 considers whether the interests are tied to the group’s collective social identity.

<table>
<thead>
<tr>
<th>NBR Board activity (adapted from Noosa Biosphere Limited, 2013)</th>
<th>Objective of project or activity</th>
<th>Key focus of challenge or component of sustainability addressed by activity</th>
</tr>
</thead>
<tbody>
<tr>
<td>Noosa Biosphere Festival</td>
<td>Provide a community event celebrating the anniversary of Noosa Shire becoming the UNESCO Noosa Biosphere Reserve, held in September 2012 to raise awareness of sustainability and promote community cohesiveness.</td>
<td>Enhancement of social component of sustainability</td>
</tr>
<tr>
<td>Noosa and Hinterland Story Project</td>
<td>Benchmark and monitor the social identification with the Noosa Biosphere Reserve, and develop and communicate community engagement activities. This activity was designed to build social cohesion and enhance the social component of sustainability.</td>
<td>Assessment of social component of sustainability</td>
</tr>
<tr>
<td>State of the Biosphere Report</td>
<td>Develop measures to monitor the health of Noosa Biosphere resource base through collaboration with community groups and other relevant organisations and institutions.</td>
<td>Assessment of environmental component and biodiversity challenge to sustainability</td>
</tr>
<tr>
<td>Balance / Unbalance Conference</td>
<td>Conduct a three-day conference, hosted by the Noosa Biosphere Reserve Board, in association with Floating Land (31/5 – 2/6/2013), at Central Queensland University’s Noosaville campus, with satellite events at Lake Cootharaba in the Noosa hinterland, considered sustainability approaches across the spectrum of economic, environmental and social/cultural challenges.</td>
<td>Enhancement of social component of sustainability</td>
</tr>
<tr>
<td>Biosphere Institute For Sustainability - Noosa</td>
<td>To develop a proposal for The Centre for Excellence in Sustainability, Research &amp; Application – Biosphere Institute For Sustainability – Noosa, supporting an internationally recognized centre for collaboration between researchers, educators, practitioners and the community on all aspects of sustainable development and conservation.</td>
<td>Enhancement of all components of sustainability</td>
</tr>
<tr>
<td>Noosa Climate Action Project and Community Adaptation Plan</td>
<td>Facilitate the engagement of the Noosa community, its council and other stakeholders in the development and implementation of a comprehensive community-inspired and developed climate adaptation strategy incorporating sector-based actions and measures to reduce the impacts of climate change on the hinterland and coastal settlements throughout the Noosa Biosphere.</td>
<td>Climate change challenge to sustainability</td>
</tr>
<tr>
<td>Biosphere Art Prize</td>
<td>Recognise and support a local artist or collaborative artistic team to create a ‘green art’ work for Floating Land 2013.</td>
<td>Enhancement of social (cultural) and environmental</td>
</tr>
<tr>
<td>NBR Board activity (adapted from Noosa Biosphere Limited, 2013))</td>
<td>Objective of project or activity</td>
<td>Key focus of challenge or component of sustainability addressed by activity</td>
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<tr>
<td>Dr. Christy Fellows Schools Award</td>
<td>Develop school programs aimed at generating community awareness and involvement, including the production of creative works that demonstrate NBR principles in action.</td>
<td>Enhancement of social and environmental components of sustainability</td>
</tr>
<tr>
<td>Economic Forums</td>
<td>Initiative of the Noosa Biosphere Economic Board, to create a platform for an ongoing dialogue within the local business community around “future-proofing” the Noosa region, with the goal of ensuring a sustainable and prosperous economic future.</td>
<td>Enhancement of economic and social components of sustainability</td>
</tr>
<tr>
<td>Schools Initiative: Workshops, Curriculum Mapping, Biosphere Day</td>
<td>Engage schools in projects and activities that promote sustainability in the NBR through education programs, including a focused program and resources related to Biosphere Day.</td>
<td>Enhancement of all components of sustainability</td>
</tr>
<tr>
<td>Sustainable Tourism Working Group</td>
<td>Reinvigorate the working relationship with Tourism Noosa and establish a Sustainable Tourism Working Group to focus on the promotion of sustainable tourism and educational tourism in the region.</td>
<td>Enhancement of economic and social components of sustainability</td>
</tr>
<tr>
<td>Eco-Education Development</td>
<td>Continue to build on education of sustainable tourism as an industry that provides direct benefit to the community and businesses in the region.</td>
<td>Enhancement of economic and social component of sustainability</td>
</tr>
</tbody>
</table>

NBR Board members, including study participants, had an opportunity to initiate, endorse or participate in any of these NBR Board engagement activities. Many of the participants served in developing and coordinating positions and played an instrumental role in bringing major sustainability projects across the region to fruition.

A number of NBR-wide projects emphasised different components of sustainability. For example, the State of the Biosphere Report measured the health of Noosa Biosphere ecosystems, such as the quality of the Noosa River. The Noosa and Hinterland Story Project benchmarked the social identification of the region (Noosa Biosphere Limited, 2013). Conferences, workshops and school competitions were developed, including the Balance/Unbalance Conference hosted by the NBR Board’s Social and Cultural Sector Boards, in conjunction with the annual regional arts festival Floating Lands (Noosa Biosphere Limited, 2013).

NBR Board members with backgrounds in finance or business served on the Economic Sector Board, which initiated activities that would enhance the economic sustainability of the NBR. For example, an economic viability analysis of small and medium-sized businesses in
downtown Noosa Heads (Noosa Biosphere Limited, 2012a) and a program focused on protecting the health of the Noosa River (Healthy Waterways, 2012) as this resource was valuable to its ecotourism focus, were developed from within the sector board.

The Noosa Climate Action Project was one major initiative from the NBR Board 2012-2013 term that focused on climate adaptation. At this time, the Sunshine Coast Council was reviewing its climate change strategy and considering options to implement mitigation and adaptation projects (Sunshine Coast Regional Council, 2010). The NBR Board chose to build upon this work by developing a complementary community-led adaptation plan, the *Noosa Climate Action Plan: Preparing together* (Noosa Biosphere Limited, 2012b), to demonstrate support and build knowledge within the NBR and highlight for Council the community preferences for adaptation. To inform its members about climate change, the NBR Board held a series of presentations and workshops with academics from the University of the Sunshine Coast to discuss the causes and impacts of climate change (Mullens, 2010). The Noosa Climate Action Project (N-CAP), a multi-year initiative to develop a community-wide climate adaptation plan for the NBR, resulted from the initial climate change dialogues. N-CAP was a multi-organisational undertaking comprising members from the NBR Board, the Noosa Residents and Ratepayers Association, and Southeast Queensland Catchments, a third sector natural resource organisation. This NBR initiative developed a community adaptation plan through a bottom-up approach, wholly created from community input identifying and ranking local climatic impacts and garnering ideas for adaptation actions to counter them. The NBR Board and partners solicited NBR residents' ideas by facilitating community-based workshops from the hinterland to the coast, coordinating local media events and soliciting input through the NBR Board's website to attempt to engage the community throughout the multi-year process. The N-CAP's final report was delivered to the community and presented to local council in late 2012 (Noosa Biosphere Limited, 2012b).

Other major NBR Board projects, initiated and implemented by the NBR Board, covered a range of issues across social, environmental and economic realms. Climate change, while important to the Board's mission, was addressed in just one of a dozen major projects undertaken by the NBR Board, the N-CAP. Nevertheless, the climate change project demonstrated a range of opportunities for the NBR Board to be engaged with the community about climate change.

The breadth of the NBR Board across the NBR and within specific sectors demonstrates a collective connect with sustainability, often highlighted through its social components. This is consistent with the personal identity with sustainability of many of its members.
8.7 Discussion of a social identity

Social identity, as explained in identity process theory (IPT) (Section 3.5), can influence group actions (Breakwell, 1993). The NBR Board participants personally identify with sustainability and the group has a social identity grounded in sustainability. Most participants have long related to sustainability and discussed their early interests, academic pursuits and professional career choices demonstrating continuity (Breakwell, 1986, 1993) with this issue. The positive affect, illustrated through their narratives, demonstrates key components of self-esteem, self-efficacy and positive distinctiveness inherent to identity development (Breakwell, 1986; Jaspal, Nerlich, & Cinnirella, 2014), in this case with sustainability. Self-efficacy is present in their ability to initiate and implement projects that promote and provide continuity with sustainability. Indeed, for many, the rationale for joining the NBR Board provides present-day continuity with sustainability through their volunteer efforts working with like-minded community members.

8.7.1 Personal identity with sustainability

The majority of NBR Board participants reported long-established personal commitments to sustainability that influenced their approach to their NBR Board activities. Committing to sustainability in their personal and professional lives enhanced their self-esteem and self-efficacy, which augmented their identity with sustainability. Many participants demonstrated a motivation to act sustainably or showed a positive affect with sustainability through identifying themselves as ‘sustainability champions’ or ‘sustainability advocates’. Other participants identified a sustainable approach to living and provided concrete examples of these from their choice of professions or volunteer activities. These instances reflect a personal worth (self-esteem) and control over one’s life (self-efficacy) that are reinforcing and recurring indicators of their personal and social identity with sustainability (Breakwell, 1986).

Another element of personal identity is the individual’s motivation gained from collaboration with others on a shared pursuit. Instances of collaboration were revealed through participant discussions with community activities or work experiences. These collaborative efforts help create a positive affect within the individual that is evident in the fulfilment obtained from shared values (Breakwell, 1986), while also building self-esteem and self-efficacy. Participants enhanced their self-esteem and personal persistence through multi-year education pursuits in sustainability at the post-graduate level.

Building emotional connections and actions with sustainability in their personal lives and through their NBR Board activities over time enhanced the self-continuity of individuals and
the group-continuity through the NBR Board practices (Breakwell, 1993; Jaspal et al., 2014). This was an important component of the NBR Board’s identity and provided a foundation for building the Board’s social identity. The NBR Board recognises threats to its BR’s long-term health from loss of biodiversity and impacts from climate change and addressed those pressures through its community work. This reinforcement of its social identity was demonstrated through the Board’s continual and ongoing sustainability initiatives, even as threats to the NBR’s biodiversity and climate change continued. The NBR Board’s identity from those engagement efforts are grounded in sustainability. Hence, the NBR Board’s initiation and implementation of its engagement activities provide the Board with continuity. This is anchored in elements of identity found through self-esteem, self-efficacy and positive distinctiveness. As many Board participants exhibit a penchant for learning around sustainability, the NBR Board membership demonstrates openness to learning and new knowledge.

8.7.2 Social identity with sustainability

NBR Board participants hold a social identity built upon shared sustainability principles and reinforced through its advocacy activities. This is consistent with other TSSOs in the UNESCO BR network. Research into Canadian BRs concluded that while BR members shared “a vision about the overall purpose of BRs, they did so from a range of epistemologies and practices”, noting that “social or collective learning processes are never value-neutral” (Reed, Godmaire, Abernethy, & Guertin, 2014, p. 238).

The social identity exhibited by NBR Board participants is founded on elements of identity, such as self-esteem, self-efficacy, distinctiveness and continuity (Breakwell, 1986, 1993). These are not only demonstrated through the personal sustainability efforts of members prior to joining the NBR Board as described in the previous section, but also through the group’s sustainability practices. The importance of sustainability is reflected in the Board’s collective volunteer efforts in fulfilment of its commitment to UNESCO, focused at sector-specific projects in areas such as economics, arts and education, and in community-wide programs and events. The Board’s output of community engagement projects confirms that the group advanced sustainability projects across these areas during its tenure (Section 4.5). As the NBR Board initiated, designed and implemented the projects through their volunteer networks, the initiation and group support in selecting projects indicates a social commitment to and identity with sustainability. The social identity of the NBR Board contributes to its motivation to develop and enact projects. Its projects are internally generated from its membership. The group’s continuity with sustainability was shown...
through sustainability projects that enhanced the natural environment or social connectedness of the NBR, such as the annual Noosa Biosphere Festival or the Noosa and Hinterland Story Project, each designed to raise awareness of sustainability and promote community cohesiveness.

The majority of NBR Board activities and projects for the study period of 2012-2013 focused on enhancing the social component of sustainability. However, there were a few examples of activities that primarily focused on sustainability’s economic or environmental components. Two activities specifically focused on challenges to sustainability addressed biodiversity loss and climate change impacts.

Many of the Board’s numerous activities that focused on components of social sustainability aimed to fulfilled a key UNESCO MAB objective of social cohesion (UNESCO, 1996). For example, the Noosa Biosphere Festival, an annual September event, served to build a community identity through a day of music, culinary and cultural activities and opportunities to learn about sustainability. The Noosa and Hinterland Story Project sought to engage the community through solicitation of their views on the Noosa identity. This is consistent with other research into BR local engagement activities showing that BRs can assist local communities in becoming contributors to building community capacity around sustainability (Mendis-Millard & Reed, 2007). Mendis-Millard and Reed concluded that BR groups “may also serve to build [community capacity], thereby meeting a social objective of research – to generate positive social change” (Mendis-Millard & Reed, 2007, pp. 543-544). These examples demonstrate the NBR Board’s commitment to enhancing social components of sustainability in the NBR.

The NBR Board participants’ reflections on their academic and professional achievements in this area indicate a level of self-esteem grounded in these efforts. Self-esteem, distinctiveness and self-efficacy are verified through their personal testimonies about how sustainability guided their personal decisions and behaviour. A strong social identity with sustainability underpins the cohesiveness of the group, even as the group’s composition indicates a wide range of ages, a mix of genders, and residencies from the hinterland to the coastal communities. This is reflected through participants’ expressed interest in working with like-minded individuals to advance these values and practices throughout the wider community. Additionally, the participants, when discussing their views on climate change and adaptation, often grounded their responses in sustainability, subsuming climate change challenges as a broader sustainability challenge. These findings are consistent with other studies (e.g., J. H. Liu & Hilton, 2005; L. Liu, 2004) that indicate that a social identity, by
legitimizing the group’s roles and mandating its actions, has a significant impact on its response to new challenges.

Continuity of self-identity with the Board’s social identity is reflected in the commitment to the types of major sustainability projects undertaken by the Board during the study period of 2012-2013. Collectively, the NBR Board’s focus was on sustainability projects, providing continuity from personal identities to the group’s social identity grounded in sustainability. The Board’s participants initiated the project concepts, solicited Board support and funding and implemented through fruition of a range of activities. These projects demonstrate the Board advocates’ continuity with their self-identity around sustainability, often focused on conservation and natural resources. Sustainability projects relating to sustainable natural resource use and biodiversity conservation, another UNESCO MAB objective, were often led by sector-specific boards. The cultural sector board and the social sector board collaborated with the Floating Lands Festival committee to organise and run the first of an anticipated annual Balance/Unbalance Conference. This three-day event focused on sustainability approaches to conserving natural resources while advancing economic growth, building social cohesion and protecting the environment, reflecting triple-bottom-line concepts of sustainability. The Environment Sector Board led the State of the [Noosa] Biosphere Report, which compiled a snapshot of the NBR’s natural assets, while the Education Sector Board led school initiatives such as workshops and an art competition promoting sustainability in primary and secondary schools and ran eco-education programs for international visitors. Finally, the Economic Sector Board promoted sustainability of Noosa’s economic base through the Board’s Economic Forums. This is an initiative to create a platform for an ongoing dialogue within the local business community around ‘future-proofing’ the Noosa region to protect its socio-economic base and its natural resources. The goal is to ensure a sustainable and prosperous economic future beyond its tourism and agriculture base.

Developing climate change projects poses challenges for all TSSOs because of the nature of the phenomenon. Awareness of many sustainability challenges, such as polluted waterways or species loss, can be demonstrated through imagery. Pollution on shorelines can galvanise residents into clean-up efforts. In the NBR, the health of the Noosa River and the decline in the koala population were issue of concern to the NBR Board, which were raised in its State of the Biosphere Report. For many sustainability dilemmas, this direct link from unsustainable practices to proposed solutions can be visually demonstrated. However, climate change developed from long-term unsustainable human practices presenting a particular challenge because the change is insidious: greenhouse gases are intangible and
invisible. This makes climate change awareness-raising and solution-solving more difficult for TSSOs, such as the NBR Board.

Participants volunteer to support the NBR Board, which operates under the auspices of the UNESCO MAB, committed to addressing sustainability and climate change. While the participants would be aware of these dual objectives, no participant indicated that their reason for NBR Board membership was to engage with climate change specifically. However, during the 2012-2013 term, the NBR Board fulfilled its commitment to UNESCO’s objective to climate change education and action by undertaking the Noosa Climate Action Project, N-CAP, the Board’s two-year community adaptation project (Table 8.9). UNESCO MAB philosophy states that climate change is the “central sustainable development challenge of our time” (Moller, 2011, p. 6), placing at its core the promotion of climate change awareness and engagement. The N-CAP (Noosa Biosphere Limited, 2012b), was the Board’s climate project to meet the MAB objective. This climate initiative to inform, engage and develop a community-crafted adaptation plan was a significant undertaking for a partnership of volunteer organisations. The community-supported adaptation plan was presented to the local council for review and implementation. The project’s dual purpose of educating the community about local impacts and encouraging action fulfilled its UNESCO mandate. Of the dozen key sustainability projects reported for the two-year term of these participants, this was the only one to address climate change.

The participants’ choice of joining the NBR Board to pursue their interests in sustainability reflects their understanding of sustainability as it aligns with the reified knowledge (see Table 2.7), as well as their desire to enhance their community’s natural and social assets. Currently, their commitment to sustainability does not guarantee a common understanding of how climate change impacts will impact the NBR or how best to support adaptive actions. The NBR Board activities, while demonstrating a good understanding, affect and action on sustainability, do not demonstrate these same elements with regard to climate change.

It is clear that many NBR Board participants incorporated sustainability into their lives at an earlier stage, reinforced its concepts through educational pursuits and applied it in their professional and private lives as well as their community advocacy projects, demonstrating personal identity with sustainability. Leveraging the participants’ and their TSSO’s identity with sustainability to link to climate change may prove valuable in enhancing knowledge and actions to address its impacts.
8.8 Conclusion
The NBR Board’s social identity demonstrates that the NBR Board participants identify with sustainability and that the Board’s social identity is grounded in sustainability. The Board participants demonstrated through their interests in sustainability prior to Board membership across numerous alternative pathways incorporating sustainability in their lifestyle practices, work choices, and educational pursuits. The participants held climate change SRs that included knowledge of causality, impacts and, to a lesser extent, responses (see Chapter Six). Yet it is their identity with sustainability that was clearly revealed from the data of their discussions of climate change and adaptation. Therefore, the NBR Board currently holds a unifying social identity grounded in sustainability and applied through the group’s primary focus on initiation and implementation of sustainability projects, with less emphasis on climate change engagement.
Chapter Nine. Social representations, social identity and social action

9.1 Introduction
The preceding findings chapters (Chapters Five through Eight) address the first three research questions and present the findings on social representations and social identity. This chapter address research question four to reveal the relationship among social representations, social identity and social actions of the NBR Board to address climate change and promote adaptation, and, further, to consider the implications for other TSSOs. Here, the findings are set in the context of the literature: social representations (Moscovici, 1961), social identity (Breakwell, 1983) and the cognitive, affective and behavioural elements of social action (Lorenzoni et al., 2007). This chapter explores the relationships among social representations around climate change and adaptation, social identity grounded in sustainability, and the NBR Board’s current social actions on climate change to consider how to enhance social action of this third sector sustainability organisation (TSSO). Understanding what motivates the NBR Board may provide insights on how to enhance social action on climate change within TSSOs. Additionally, I consider the implications for the NBR Board and other TSSOs working on climate change in their communities. The previous findings can be extrapolated to the NBR Board itself, as this study provided in-depth analysis from over one third of the existing membership, drawing participants from all six sector boards and the overarching governance board (Chapter Four). Therefore, this exploration determines if the NBR Board’s responsive actions to local climate change impacts are consistent with peer-reviewed, scientific interpretations (e.g. IPCC) of effective adaptation. This chapter builds on the findings from previous chapters to consider how to assist communities in promoting local actions to enhance climate adaptation. The discussion frames the discussion around three key elements: cognition, affect and behaviour (Lorenzoni et al., 2007). Social identity and social representations differ among communities and within social groups because they present a group’s understanding at a particular time and place, making sense of a new social scientific phenomenon or social object; in this case climate change. Social identity can guide a group’s thinking and practices (Breakwell, 1986, 1993). As social representations are neither “right” nor “wrong” but simply a “truth” reflecting the group’s thinking and practices at a particular time, they also direct a group’s communication (Moscovici, 1961, 2011).

9.2 Third sector adaptive action to address local impacts
Engaging TSSOs and other local community groups in addressing climate change impacts is one component of the shared responsibility of adaptation, which requires the involvement of
all actors (e.g. individuals and groups) and institutional and governance structures (Adger, 2003; Adger, Dessai, et al., 2009; Adger, Huq, et al., 2009; Australian Government, 2015b). Building resilience to climate change through effective adaptive actions requires context-specific adaptive actions that are often addressed best at the local levels (Australian Government, 2015b). Adaptive action can be a social response to a dynamic phenomenon. The capacity to adapt successfully includes the ability to act collectively (Adger, 2003). Effective adaptive action requires purposeful deliberation with the public on issues of public concern, collective decision-making and better exchange of knowledge and experiences (Moser & Pike, 2015). Pro-sustainability advocacy groups can complement government efforts in sharing the responsibility for enacting adaptive action at the local level.

A collective adaptive action strategy combines multiple tactics to achieve a range of effective outcomes. While some benefit from one-way information-sharing exists, creating a two-way relationship such as consultation or collaboration, (i.e. active engagement), enhances the likelihood of behavioural change resulting in best practice outcomes (OECD, 2001). A deliberative two-way process incorporating dialogical interactions between individuals with local and lay knowledge, and people with expert learning and understanding yield the best outcomes for community engagement (Petts, 2006; Petts & Leach, 2000). Groups and individuals vary in their reaction to climate change, by coping, adapting or transforming mechanisms (Aldrich, Page, & Paul, 2016). Elevating coping mechanisms to higher preventative responses can build social capital and reciprocal adaptive actions (Adger, 2003; Aldrich et al., 2016).

Australian local governments face cross-scale barriers to adaptation including governance, planning, financial and community obstacles (Mukheibir, Kuruppu, Gero, & Herriman, 2013). Social and community engagement can assist with key community barriers of lack of community understanding of climate risks and access to impact-related information by enhancing community consensus on local climate impacts, risks and actions (Mukheibir et al., 2013). A key barrier to engaging the lay public with adaptation is the lack of capacity-building among groups and communities in Australia (Measham et al., 2011; Mukheibir et al., 2013) and abroad (Moser & Ekstrom, 2010). Barriers are defined as “obstacles that can be overcome with concerted effort, creative management, and change of thinking...” (Moser & Ekstrom, 2010, p. 22029). Social barriers are malleable and can be overcome with social support, effort and resources, but societal limits to adaptation based on values, ethics, knowledge and culture remain (Adger, Dessai, et al., 2009; Adger, Huq, et al., 2009).
To address community barriers, TSSOs can assist in breaking through community barriers by creating new community engagement pathways leveraged through staff, volunteers and the support base to enhance capacity that enables understanding and achieves consensus about climate risks and impacts. While most barriers can be overcome with concerted effort, creative management, and change of thinking and resources (Moser & Ekstrom, 2010), values, ethics knowledge and culture affect adaptation (Adger, Dessai, et al., 2009).

Previous chapters reported that the NBR Board embraced sustainability and their climate change representations coalesced primarily around causality, impacts and, to a lesser extent, responses to climate change. While support exists for responsive action to climate change, the range and general nature of the individual and collective types of responsive measures precluded identification of a cohesive social representation around adaptation. Participants’ collective actions emanated from their individual interests, attitudes and initiatives, and culminated primarily in Board sustainability activities unrelated to climate change. This is consistent with other studies, which revealed that “identity processes may determine how people process social representations about climate change and that they mediate the link between representations and environmental behavior” (Jaspal et al., 2014, p. 110).

The climate change social representation relating to individual and collective beliefs, values and practices presents its own ‘truth’ about the phenomenon. This cohort’s climate change representations incorporated pre-existing representations grounded in sustainability with a blend of common-sense knowledge and expert opinion on the best available climate science information, particularly around anthropogenic contributions to causality and climatic impacts.

This cohort’s climate change representations were not especially cohesive, particularly with regard to best adaptation practices, while its social identity with sustainability appears to be stronger and more widespread. The participants’ SRs, attributing causality to human intervention and acknowledging proximal and distal impacts, demonstrated linkages with the best available science, such as the findings of the IPCC (2014c) and the UNFCCC (2012) that emphasised the importance of addressing the anthropogenic causes of climate change. Nevertheless, the participants digressed from the scientific community in its lay thinking around impacts, which accentuated the temporal and spatial distancing of the impacts, while understating the need for local adaptive responses. For example, the IPCC (2014c) and the signatory nations to the UNFCCC (UNESCO, 2015; UNFCCC, 2012), reflecting reified knowledge, concur that more action in the near future is required for society to ward off dangerous climate change and adapt to its increasing impacts. The social representation of
climate change among the participants is in accord with this assertion and found to be consistent with other groups in society. Research (e.g., Gifford, 2011; Leiserowitz, 2006; Schoenefeld & McCauley, 2015; Weber & Stern, 2011) showed that the public, while concerned about climate change, does not view it as an urgent concern, either with regard to limiting GHG emissions or addressing current and impending impacts. The participants’ understanding aligned more closely with the views of the public’s lay knowledge in these studies.

Acknowledging Breakwell’s (1986, 1993) claims regarding the relationship between SRT and IPT in regards to social representations and social action, the remainder of this chapter addresses how to enhance the NBR Board’s adaptation efforts, based on the new understanding of the participants’ social identity and social representations. Advancing a particular change in approach to an existing social action requires an identified understanding and the introduction of additional information, at a minimum (Breakwell, 1986, 1993). Breakwell (1986), in considering the relationship between a group’s social representations and the need to advance action and change, notes “rather than relying on the natural erosion of the [challenging or problematic] social representations, positive steps could be taken to eradicate it” (p. 61). Thus, proactive measures to more expeditiously negate a representation that impedes adaptive action may prove preferable. In this instance, advancing specific adaptive actions to address local impacts requires identifying the existing social representation of climate change and, from there, promoting usable knowledge through enhancing knowledge about best practices (Breakwell, 1993; Moscovici, 2011). With this goal in mind, and acknowledgement that the NBR Board held a particular, valid truth about climate change, the next section considers how to work with the Board’s current understanding and practices to advance enhanced adaptation efforts.

9.3 Results of the relationship among SRs, identity, and social action
The results present the NBR Board’s current understanding of climate change and adaptation through its social representations; its motivation through its social identity with sustainability; and social actions through promoting sustainability and climate change throughout the NBR. The results are presented through by considering the cognitive, affective and behavioural elements underpinning this cohort’s knowledge, motivation and action (Lorenzoni et al., 2007).
9.3.1 Social actions promoting sustainability, climate change and adaptation by the Noosa Biosphere Reserve’s Board of Directors

While community awareness of climate change’s causality and impacts may have increased in the past decade, barriers to local action and engagement continue to exist, partially due to limited government focus (Lorenzoni et al., 2007). Effective action on climate change requires engagement through three concurrent elements: cognition, affect and behaviour (Section 3.6). Therefore, it is useful to consider these elements in the context of the findings regarding this study’s SRs, social identity and social actions of the NBR Board. A summary of the findings (Table 9.1) present the NBR Board’s social actions across their cognitive, affective and behavioural elements. The discussion then examines the gaps in, knowledge, communication and practices that may limit social adaptive actions, which is a stated purpose and interest of the NBR Board.
<table>
<thead>
<tr>
<th>Element of social action</th>
<th>Action with sustainability</th>
<th>Action with climate change and adaptation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cognition (Lay knowledge, values, ideas)</td>
<td>The NBR Board participants display knowledge of: sustainability concepts and effective measures to promote sustainability (Chapter Eight)</td>
<td>The NBR Board participants display knowledge of causality of climate change and local and global impacts from climate change (Chapter Six) The NBR Board participants have limited knowledge of effective mitigation actions to address causality and adaptation measures to address local impacts (Chapters Six and Seven)</td>
</tr>
<tr>
<td>Affect (identity, concern and motivation)</td>
<td>The cohort of NBR Board participants: - Holds a social identity with sustainability and its advocates hold mostly positive feelings towards sustainability - Identifies with sustainability which builds self-esteem, self-efficacy, and positive distinctiveness - Provides motivation to continue relationship with sustainability (Chapter Eight)</td>
<td>The cohort of NBR Board participants: - Holds no personal or social identity with climate change and mostly negative feelings about climate change - Mostly lacks self-efficacy over effective responses and displays no indication of relationship to self-esteem or positive distinctiveness - Shows little evidence of personal motivation to establish relationship with climate change or personal responsibility for solutions (Chapters Six and Seven)</td>
</tr>
<tr>
<td>Behaviour (personal and collective action)</td>
<td>The NBR Board participants incorporate sustainability measures into personal lifestyle and through educational and professional pursuits The Board’s main purpose is to initiate and develop social actions to promote sustainability across community (Chapter Eight)</td>
<td>The NBR Board participants have: - Limited experience with mitigation and adaptation actions and some conflate responses to address causality with actions to alleviate local impacts - Show limited personal experience with climate change adaptation to local impacts (Chapters Six and Seven) The NBR Board, through its practices, demonstrates an interest in but little social action promoting adaptation and no indication of promoting mitigation actions across community (Chapter Seven) The NBR Board, through its social identity with sustainability, plays a role focusing on broader sustainability solutions to addressing climate change and adaptation, fulfilling a group’s main objective of social action on sustainability but not directly promoting climate change solutions (Chapter Eight)</td>
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### 9.3.2 Cognitive elements of NBR Board’s actions

*Cognition* is a required element of individuals and social group engagement with climate change (Leiserowitz et al., 2006; Lorenzoni et al., 2007). The NBR Board’s knowledge of climate change and adaptation, analysed through its social representations, revealed a mixture of consensual (i.e. lay) understanding blended with expert (i.e. reified) knowledge of its causality and impacts, and to a lesser extent, responses to climate change (Chapters Six and Seven). The group’s values and ideas emphasised sustainability concepts and practices to a degree that reflected a social identity with sustainability and knowledge of its principles and effective measures to promote sustainable practices across its community. The Board’s
social identity cut across social, environmental and economic sectors including biodiversity conservation, community cohesion and economic prosperity and, to some extent, climate change and demonstrated extensive knowledge of effective measures to promote sustainability. In addition, the group showed broad knowledge of causality of climate change, and local and global impacts from climate change. However, its gaps in best practice approaches to specific effective mitigation approaches to reduce greenhouse gas emissions and adaptation measures to address local impacts hindered its ability to implement a comprehensive adaptation strategy, if it chooses to do so. Additionally, some Board participants, when discussing adaptive responses to climate change, conflated sustainability and climate change actions, such as using cloth bags instead of plastic ones. While advancing sustainable approaches to natural resource use or biodiversity conservation is a UNESCO imperative, it does not directly address adaptation to climate change. According to the IPCC (2014c) and other climate adaptation experts (e.g., BOM/CSIRO, 2014; Moser & Pike, 2015), adaptive strategies must be sustainable to be effective. However, the specific actions or measures must respond to climatic impacts or reduce vulnerability to be viewed as adaptation. Therefore, providing usable knowledge about key concepts and broader awareness-raising about sustainable, practical adaptive actions is a first step, which can be championed through TSSOs. Additional efforts to develop specific adaptive actions through bottom-up community initiatives would then be more acceptable and more effective.

9.3.3 Affective elements of NBR Board’s actions
Affect promotes engagement by tying the individual to the social phenomenon of climate change (Leiserowitz et al., 2006; Lorenzoni et al., 2007). Built upon affective connections, the NBR Board participants held a social identity with sustainability but not a discernible social identity with climate change. The Board’s focus on sustainability projects (Chapter Eight) demonstrates that its social identity with sustainability may provide motivation to leverage adaptive actions within this group, as social identity builds self-esteem, self-efficacy, and positive distinctiveness (Breakwell, 1986; Jaspal et al., 2014). The NBR Board participants’ personal experiences with sustainability dominated their narratives and extended through to the Board’s sustainability efforts. While some participants cited experiences with climatic impacts, the linkage with specific examples of adaptive actions to impacts was more tenuous. Creating shared learning opportunities for the NBR Board and community members to learn from others who share personal experiences and sustainable adaptive actions to negate negative climatic impacts could enhance their emotional connection to climate change (Lorenzoni et al., 2007). Additionally, these opportunities
promoting a sustainable approach to addressing local impacts could enhance the Board’s social identity with sustainability, aligning climate change with their connectedness to sustainability.

9.3.4 Behavioural elements of the NBR Board’s actions
Regardless of knowledge and affect with a social phenomenon, behavior that promotes social action is key to effectively addressing climatic impacts (Lorenzoni et al., 2007). Climate change engagement needs to result in behavioural changes to mitigate effects of greenhouse gas emissions and adapt to its consequences. The NBR Board participants demonstrated limited personal or group actions to promote climate change, while placing significant time and effort into sustainability. This was established in their self-identity with sustainability, which was revealed through narratives of formation, reinforcement and application of sustainability in their lifestyles and through educational and professional pursuits. They were motivated to develop and implement projects that promoted local sustainability benefits to their community and enhance the natural resource base of the NBR (Chapter Eight). However, an understanding and desire to act sustainably, while critical to address climate change’s causes and impacts, did not necessarily translate to a clearly identifiable understanding of climate change. The group’s social representation with climate change indicated its limited understanding and experience with specific mitigation and adaptation actions. The group’s practices demonstrated an interest in, but little action promoting adaptation and no indication of promoting mitigation actions across the community. The Board’s social identity with sustainability played a role in focusing efforts on broader sustainability initiatives.

9.4 Discussion of the relationship among social representations, social identity, and social action
Understanding the social identity, values, ideas and attitudes of TSSO members will help to ascertain the most appropriate cognitive and affective elements that will resonate with that particular audience and thus assist in advancing social action. The following sub-sections consider options for augmenting cognitive and affective understanding of adaptation.

9.4.1 Adaptation as a shared responsibility across government, private and third sectors
Developing effective responses to climate change, perhaps the greatest sustainability challenge of our time, is a shared responsibility (Adger, 2003; Adger, Dessai, et al., 2009; Australian Government, 2015b) and requires informing and encouraging broad public
support of socially acceptable climate change adaptation strategies and associated local, state and national policy-making (Moser & Pike, 2015). The UNFCCC (1992) acknowledges as a key principle the “common but differentiated” responsibilities of its member states. While Australian governments play a crucial role, public acceptance will also be driven by other factors including community engagement and community advocacy, through local civil and private sector entities with broad community-wide outreach.

Schneider’s (2014) analysis of 15 years of business management literature regarding the responsibility of private sector adaptation concluded that public security depends on effective climate change adaptation by the private sector. Of concern, however, is that the private sector’s awareness of climate change is much lower than in government and the media, and the private sector’s reputation for respecting sustainable development principles is not strong (Reid, Ampomah, Olazabal Prera, Rabbani, & Zvigadza, 2012). More research into private sector adaptive actions would help understand how it can build capacity for and advance public acceptance of adaptation. Private sector investments into adaptation planning are essential to assist third sector joint-effort, leverage government activities and mobilize financial resources and technical expertise (A. Miller, 2016).

From individuals and households to local and larger scale TSSOs, civil society plays an equally significant role in advancing adaptive action. Third sector efforts are especially important in highlighting social and environmental vulnerabilities to climate change and in identifying gaps in government policies. Noting that limited research in Australia and abroad exists on how people adapt to climate change information and initiatives, Unsworth et al. (2013) conducted several studies into individual-level adaptive actions to understand the effects of both adaptive and maladaptive coping. They found that both beliefs and goals together strongly related to adaptive behaviour. They concluded that individual-level adaptation can be improved regardless of people’s level of interest in addressing climate change. Studies have also been conducted at the household level. Case study research into Australian households’ climate change mitigation and adaptation actions found limited adaptive action by family units (Elrick-Barr et al., 2014). Noting that more capacity needs to be developed, the study suggested that emphasising the rewards to householders for early adaptive action and addressing the personal and contextual barriers to households are important aspects in enhancing these societal adaptation efforts (Elrick-Barr et al., 2014).

TSSOs’ responsibilities in promoting adaptation are linked to local government collaboration on project development and community awareness-raising, and to information-sharing regarding citizen involvement in governance processes that support climate change
initiatives. Local TSSOs, working at the community level, can influence their Councils through demonstration and awareness-raising of successful pilot projects promoting adaptation (Reid et al., 2012). This approach was undertaken by the NBR Board during its initiation and implementation of the N-CAP project highlighting the community-generating adaptive actions (Noosa Biosphere Limited, 2012b). However, as noted by Reid et al. (2012), while advocacy actions on adaptation may be limited by human and financial resources, TSSOs such as the NBR Board can contribute through awareness-raising and adaptive action development.

While the NBR Board demonstrated an understanding of and engagement with adaptation, its community efforts promoting specific effective local adaptive actions could be enhanced. The following sections consider the NBR Board participants’ social identity with sustainability, understanding of climate change through the elements of cognition, affect and behaviour elements, identified by Lorenzoni et al. (2007) as necessary components of adaptive action.

The impacts of climatic changes affect communities differently, depending on factors including the severity and extent of the impact and the ability and quality of the response (IPCC, 2014c). Therefore, it is important that the local community understands not only the broader complex and dynamic nature of the problem, but the specific spatially and temporally sensitive impacts that they need to address currently and over time.

Specific recommendations for enhancement of NBR Board engagement with adaptation and address three key aspects: greater cognitive understanding of spatial and temporal relevance of impacts to their community; affective and experiential connection to local impacts; and behavioural change to encourage specific, practical solutions, some providing immediate results (Table 9.2).
Table 9.2 Comparison of current sustainability and climate change actions and recommendations to address cognitive, affective or behavioural gaps in adaptive action

<table>
<thead>
<tr>
<th>Element of climate change social action</th>
<th>NBR Board participants’ personal actions and the NBR Board’s collective actions regarding sustainability, climate change and adaptation</th>
<th>Recommendations to address cognitive, affective or behavioural gaps in adaptive action</th>
</tr>
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<tr>
<td><strong>Cognition</strong> &lt;br&gt; (Knowledge)</td>
<td>The Board’s participants demonstrated: &lt;br&gt;Knowledge of sustainability and effective measures to promote sustainability in areas of natural resource use and biodiversity conservation &lt;br&gt;Some knowledge of key role of sustainability in addressing climate change, with limited understanding of specific local adaptive responses &lt;br&gt;Knowledge of causality of climate change and local and global impacts from climate change &lt;br&gt;Limited knowledge of effective mitigation actions to address causality and adaptation measures to address local impacts</td>
<td>To address cognitive gaps to enhance adaptive action, provide opportunities to strengthen cognitive understanding by: &lt;br&gt;1) Building upon the group’s knowledge of sustainability by highlighting the linkage between climate change and non-sustainable human activities &lt;br&gt;2) Highlighting relevance of local impacts to individuals, family and neighbourhood, as well as community-wide and regional impacts. &lt;br&gt;3) Offering occasions for the group to learn about specific aspects of climate change that relate to their personal and family life, and community needs by providing usable knowledge about: &lt;br&gt;a) Present, local and personal risks, and &lt;br&gt;b) Specific adaptation measures to address locally identified climatic impacts.</td>
</tr>
<tr>
<td><strong>Affect</strong> &lt;br&gt; (Identity, concern and motivation, personal experience)</td>
<td>The Board’s participants: &lt;br&gt;Identified with sustainability builds self-esteem, self-efficacy, and positive distinctiveness but mostly lacks self-efficacy over effective climate change responses and displays no indication of relationship between self-esteem or positive distinctiveness and climate change &lt;br&gt;Provided motivation to continue relationship with sustainability but shows no evidence of significant personal motivation to establish relationship with climate change or responsibility for personal solutions &lt;br&gt;Had limited experience with mitigation and adaptation actions and some conflate responses to address causality with an interest in but little social action promoting adaptation &lt;br&gt;Held a personal and social identity with sustainability, but no identity with climate change &lt;br&gt;Held positive feelings of sustainability but mostly negative feelings about climate change.</td>
<td>To address affective gaps to enhance collective adaptive actions, provide opportunities to strengthen affective connections by: &lt;br&gt;1) Building self-esteem and self-efficacy among group members and enhance social identity with adaptation by linking group’s knowledge of and identity with sustainability and its ability to successfully implement specific achievable adaptive actions that provide immediate visible results to the greater community through existing outreach efforts, such as local media events and the annual Noosa Biosphere Festival. &lt;br&gt;2) Tapping the NBR Board’s motivation obtained from the positive associations with sustainability and developing direct linkages between sustainability concepts and sustainable aspects of adaptive actions through Biosphere projects by highlighting local relevance of impacts with local adaptive actions by the group &lt;br&gt;3) Orchestrating personal experiences with climatic impacts through a lived event or through simulation, relating to extreme weather events, such as flooding or heatwaves, to increase affective linkages that build awareness and acceptance of risks &lt;br&gt;4) Promoting positive affect with climate change by emphasising the “gains” from adaptation to their community, rather than the “losses” from climate change.</td>
</tr>
<tr>
<td><strong>Behaviour</strong> &lt;br&gt; (Collective adaptive action)</td>
<td>The Board’s participants incorporated sustainability measures into personal lifestyle and through educational and professional pursuits but show little personal experience with climate change adaptation to local impacts &lt;br&gt;The Board’s main objective was to initiate and develop social actions to promote sustainability across their community &lt;br&gt;The Board’s social identity with sustainability played a role focusing on broader sustainability solutions even when directly focusing on climate change and adaptation, fulfilling the group’s main</td>
<td>To address behavioural gaps to enhance adaptive actions, provide opportunities to encourage adaptation planning and actions by: &lt;br&gt;1) Leveraging NBR Board social group norms and promoting collective efficacy by describing and providing examples of how other pro-sustainability groups advance sustainable approaches to adaptation thus reinforcing norms &lt;br&gt;2) Integrating adaptation into the range of existing community-wide sustainability projects thus addressing climate change while supporting societal and ecological outcomes concurrently &lt;br&gt;3) Orchestrating a NBR Board goal of evaluating and revising the existing Noosa Climate Action Plan, initiating a comprehensive strategy that provides short-term adaptive actions yielding immediate results to build motivation and momentum, while</td>
</tr>
</tbody>
</table>
Element of climate change social action | NBR Board participants' personal actions and the NBR Board’s collective actions regarding sustainability, climate change and adaptation | Recommendations to address cognitive, affective or behavioural gaps in adaptive action
---|---|---
| | objective but not directly promoting climate change solutions. | appealing to the Board’s social identity with sustainability to highlight intrinsically-valued, long-term goals for economic, social and environmental viability across the Noosa community.

Cognitive elements of the NBR Board participants’ with social actions revealed knowledge of sustainability concepts and effective measures to promote sustainability in areas of natural resource use and biodiversity conservation and some knowledge of key role of sustainability in addressing climate change, with limited understanding of specific local adaptive responses. Regarding climate change, they demonstrated knowledge of causes and impacts of climate and limited knowledge of effective mitigation and adaptation actions. The NBR Board, to enhance cognitive understanding of climate change, could provide linkages between sustainability by:

1. Providing knowledge connecting climate change and non-sustainable human activities;
2. Highlighting relevance of local impacts to individuals and the NBR; and
3. Offering learning opportunities about climate change risks and targeted adaptive actions.

Social action elements relating to affect were presented by the Board participants’ identity with sustainability built self-esteem, self-efficacy, and positive distinctiveness, positive affect, and a motivation to enhance community sustainability efforts. These elements were not found to that extent in relation to climate change. To strengthen the group’s affect towards climate change, the NBR Board could:

1. Enhance social identity with adaptation by linking specific achievable adaptive actions with sustainability held by the NBR Board members;
2. Leverage positive affect with sustainability with positive associations of adaptive measures;
3. Orchestrate adaptive learning experiences relating extreme weather events with risk awareness and adaptive solutions; and
4. Emphasise community successes from adaptation.

Social behavioural elements revealed the participants prior experiences with sustainability but relatively limited personal experiences with climate change, which carried through to the
Board’s efforts primarily focused around sustainability projects. To enhance social adaptive actions, could include:

1. Promoting collective efficacy by offering opportunities to link other TSSO efforts with sustainable approaches to adaptation thus reinforcing existing social norms;

2. Integrating adaptation into the range of existing community-wide sustainability projects; and

3. Evaluating and re-establishing dormant NBR Board adaptation efforts, such as the Noosa Climate Action Plan.

9.4.2 Increase cognitive understanding of adaptation

The cognitive elements underlying the NBR Board social actions efforts are revealed through their social representations of climate change and their understanding and identity with sustainability. The SRs reveal lay thinking blended with some expert knowledge around sustainability concepts and causality and impacts of climate change but limited detailed understanding of responses. This is consistent with research demonstrating existing knowledge gaps regarding effective mitigation actions to address causality and adaptation measures to address local impacts (Moser & Pike, 2015; Wolf & Moser, 2011) and showing the need for greater emphasis of lay groups’ knowledge of concepts and terminology around the phenomenon (Lorenzoni & Pidgeon, 2006; Moser, 2014). Communicating knowledge about the potential local climate change impacts is especially beneficial (Lorenzoni et al., 2007; Wolf & Moser, 2011) to address the persistent lack of public engagement with serious challenges from climate change (Gifford, 2011; Leiserowitz, 2006; Weber & Stern, 2011). In the climate change science community, the term adaptation is commonly understood by the scientific and policy-making communities in the way the IPCC defines it (Chapter Two). However, for reasons that include simplification or obfuscation, the lay public has been introduced to numerous synonyms for addressing climatic adaptation, such as climate-proofing and climate-resistance (Section 6.3). Therefore, information-sharing about terminology and basic, consistent usable knowledge regarding what adaptation is and how it would enhance the community’s effort in addressing climate change would be a valuable contribution from this TSSO. This is consistent with communication science research that identifies the need for basic scientific literacy and education around impacts and adaptation (Moser, 2014; Moser & Pike, 2015).

Proposals to address cognitive knowledge gaps between local consequences and effective adaptation cover understandings temporal and spatial dimensions. Climate change
discourses of scientists and policy-makers emphasise time scales of a few decades through
to the end of the century (IPCC, 2014c; UNFCCC, 2015). When risks of a future threat,
particularly one with uncertainties promoted through the media (e.g., climate change),
people tend to heavily discount its consequences when immediate actions to address future
threats are costly, inconvenient or otherwise undesirable (Berns, Laibson, & Loewenstein,
2007). This is because they psychologically construe future event risks as differing from
present event risks (Slovic & Peters, 2006; Trope & Liberman, 2010). Similarly, people
discount spatial elements of climate risk, systemically judging increased risks to other people
or places rather than to themselves or their community (Gifford, 2011; Leiserowitz, 2005).

Effective engagement must include an understanding of present, local and personal risks
and specific adaptation measures to address locally identified climatic impacts (S. L. van der
Linden et al., 2015). To enhance cognitive understanding of temporally and spatially relevant
consequences from climate change, the NBR Board could highlight the relevance of local
impacts to individuals, family and neighbourhood, as well as community-wide and regional
impacts. In addition, the Board could build upon the group’s knowledge of sustainability by
emphasising the linkage between climate change and non-sustainable human activities and
providing concrete examples of successful adaptive measures from communities
experiencing similar consequences. A key message to deliver to this group is the significant
relationship among personal and family life, and community needs, and local impacts.

9.4.3 Augment affective and experiential connection to local impacts
The affective elements of the NBR Board activities appear most strongly in its social identity
with sustainability, demonstrated through the initiation and selection of sustainability
projects focused on conservation of the NBR’s biodiversity and wise use of its natural
resources, with limited attention to climate change adaptation (Chapter Eight). Additionally,
the climate change SRs, demonstrating less cohesion around responses, indicates a visceral
connection to sustainability and a desire to include sustainable approaches to respond to
anthropogenic causality and climatic impacts. Therefore, enhancing an affective connection
with climate change and adaptation would assist this TSSO in fulfilling its climate change
objectives.

An emotion connection can motivate people to take actions (Slovic & Peters, 2006), while
other processes play a role in decision-making. Two human brain processing systems that
continually interact are at play in decision-making: the fast processing using intuition,
experience and affect; and the slower processing employing deliberation, analysis, effort and
rational thought (Kahneman, 2012). However, the faster system plays a greater role in directing decision-making (LeDoux, 1989). With regard to climate change, the free association task on emotions to climate change (Chapter Five) revealed that the group held a primarily negative affect and showing limited connections to knowledge associations.

Experiences with a phenomenon add to an individual’s affective connection to it (Leiserowitz & Feinberg, 2007). A higher degree of affect towards climate change can make this relatively abstract phenomenon more personal and relatable. Climate change is often presented to the public through statistical information or scientific terminology (S. L. van der Linden et al., 2015), its causality is invisible (Moser, 2014) and it cannot be experienced directly (Weber, 2006): factors that contribute to detachment. These factors are more likely to resonate through brain process functions of analysis, deliberation and rational thinking, the slower brain processing pathway (Kahneman, 2012). However, people often experience extreme weather events, such as flooding and cyclones and these personal relationships can lead to a greater connection to climate change (S. L. van der Linden et al., 2015). Using relevant personal experiences through recall, scenarios and narratives is likely to increase affective connections to climate change (Marx et al., 2007). Building upon personal relationships and experiences to enhance affective connections with climate change is one way to assist lay public engagement.

Stressing the significance of local climatic impacts could potentially link it with a group’s social identity. Place identity also plays a role in how groups and individuals view the need to adapt in the face of present climate risks. This is consistent with social identity research (Jaspal et al., 2014) and research into identity of place that affects how people understand and lend support to adaptation efforts (Moser, 2014; Whitmarsh, O’Neill, & Lorenzoni, 2013). As climate change impacts manifest primarily at the community level, working with the community and its civic organisations to implement appropriate solutions requires an understanding of identity at the scale of the adaptation action.

This study proposes enhancing behavioural change to elevate current NBR Board engagement efforts with adaptation through proposals addressing affective and experiential connections. One area for affective linkages with adaptation is through the group’s social identity with sustainability and motivation to promoting sustainability in communities across the NBR. Emphasising the wins from successful sustainability projects and making links with adaptation benefits would enhance the NBR Board’s collective efficacy to address the causality of and global impacts from climate change. While research demonstrates that
negative affect can be a strong driver of climate change risk perception (Leiserowitz, 2006), it is not a guarantee for long-term behavioural change as other factors come into play. The resulting positive emotions from Board achievements will build self-esteem and self-efficacy among group members that may then reinforce social identity around adaptation (Jaspal et al., 2014). Another proposal to increase a personal connection with local impacts and adaptation is by offering experiential opportunities. Providing personal experiences with climate change through opportunities for simulation exercises or to relive a climatic event and recall how they responded or conject on how they would respond are also identified as useful approaches to make affective connections and build risk-awareness and acceptance (S. L. van der Linden et al., 2015).

9.4.4 Foster behavioural change
The existing behavioural elements of the NBR Board’s community engagement reveal initiation and implementation of projects focused on sustainability, consistent with the participants’ demonstrated prior experiences with sustainability. The relative lack of projects address adaptation is consistent with the Board participants’ relatively limited personal experiences with climate change (Chapter Eight).

As the scope and scale of the problem requires personal behavioural change at the individual to the collective levels of society, individuals need to know how they can effect change. Information-sharing regarding specific individual practical measures or governance policies and processes that individuals could champion would address immediate and projected local climate change impacts.

Extensive individual and social behavioural change is required to effectively advance meaningful social action on climate change (S. L. van der Linden et al., 2015). The NBR Board demonstrated some engagement with adaptation, through its leadership role in initiating and shepherding development of the Noosa Climate Action Plan: an adaptation strategy developed and supported by residents from across the NBR. However, few NBR Board members participated directly. As the IPCC has identified, South East Queensland, of which the NBR is a part, is a vulnerability hotspot (IPCC, 2007b). The NBR Board’s local sustainability and climate change projects show noteworthy local achievements. However, they would also require ongoing efforts, including additional financial resources or a shift in existing funds to successfully prepare for future risks from climate change.

The NBR Board addresses its main objective through social actions around sustainability endeavours, with some limited climate change activity. Group members incorporate
sustainability measures into personal lifestyle and through educational and professional pursuits but show little personal experience with adaptation to local impacts. The group’s social identity with sustainability plays a role focusing on broader sustainability solutions even when directly focusing on climate change and adaptation, fulfilling the group’s main objective but not directly promoting climate change solutions. Group members have limited experience with mitigation and adaptation actions and some conflate responses to address causality with an interest in but little social action promoting adaptation.

One proposal to enhance behavioural elements of adaptive engagement would build upon the Board’s social norms and actions to close the gap between the NBR Board’s objectives to address climate change in their community and the level of social actions to date. Activating descriptive norms, which describe how others behave rather than prescribe how people should behave, could be an effective approach to influence this pro-sustainability group to enhance its adaptation outreach (Cialdini, Kallgren, and Reno 1990). One pathway would be to work through the UNESCO MAB program, which offers model programs about what Biosphere Reserves are doing to advance sustainable adaptation strategies. This approach is consistent with other climate engagement research noting that talking about climate risks and the need for action within one’s social networks (e.g. colleagues, friends and family) is likely to alter how an individual will perceive the risks to themselves and take action (Renn, 2010; P. J. Van der Linden, 2015).

Another important pathway to enhance adaptation is to encourage integration of sustainable adaptive actions into the Board’s existing community-wide sustainability projects, thus addressing climate change while supporting societal and ecological outcomes. Reinvigorating the NBR Board’s goal of community adaptation, initiated through its Noosa Climate Action Plan, could start with a review of the original plan, evaluation of progress on its adaptation strategy to date, and development of a revised comprehensive engagement plan. Social engagement would be enhanced by collaborating with a cross-section of community groups to develop a new adaptation action strategy that provides short-term adaptive actions yielding immediate results to build motivation and momentum, while appealing to the Board’s social identity with sustainability to highlight intrinsically-valued, long-term goals for economic, social and environmental viability across the Noosa community.

Climate adaptation science, as a nascent but burgeoning discipline (Chapter Two), can inform social engagement efforts with regard to types of adaptation planning, actions, and evaluation initiatives that are most effective across communities and regions. A review of 57
adaptation plans from Australia, the United Kingdom and the United States with the goal of identifying gaps in framing, pathways and practices reveals that 72 per cent of adaptation options were classified as "building adaptive capacity", mostly through "gathering and sharing information" (Preston et al., 2011, p. 423). Beyond information-sharing, specific adaptation actions are limited, creating significant deficiencies in adaptation planning in Australia (2011). Enhancing social engagement from civic organisation that addresses community-wide and sector-focused adaptive actions would assist in efforts to address these deficiencies. Cost-effective advancement of community adaptation through TSSO advocacy includes targeted communication and engagement, leveraging direct dialogue and peer-persuasion (Moser, 2010).

9.5 Enhancing social adaptive action
TSSOs can develop strategies to promote social engagement with climate change by considering goals, objectives and specific adaptive actions to enhance cognition, affect, and behaviours of its members (Table 9.3).
Table 9.3 Goals, objectives and proposals for enhancing social adaptive action

<table>
<thead>
<tr>
<th>Goal</th>
<th>Objective</th>
<th>Proposal</th>
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<tbody>
<tr>
<td><strong>Enrich cognition (Knowledge) by supplementing lay knowledge revealed in climate change SRs and social identity with sustainability</strong></td>
<td>Provide targeted usable information on effective adaptation measures couched within a sustainability context to address local impacts</td>
<td>Present community workshops to enhance knowledge:</td>
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<td>• Disseminate knowledge of current and longer-term localised climatic impacts relevant to TSSO members, residents, businesses and decision-makers</td>
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<td>• Deliver accessible information would be delivered in lay language, covering best available adaptation measures and user-friendly discussion-generating tools, such as local flood mapping and computer-modelling of projected climatic changes in precipitation and temperature</td>
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<tr>
<td><strong>Heighten affect (emotional connection) with climate change and adaptation by leveraging sustainability identity and creating linkages through experiential learning</strong></td>
<td>Offer opportunities for making personal connections to climate change by providing experiences of climatic impacts from climate change</td>
<td>Create simulation exercises to build positive attitudes around adaptation:</td>
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<td>• Relay personal experiences that can internalises the understanding of abstract concepts</td>
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<td>• Share experiences of those who have lived through climatic events to assist individuals in making the connections between humans and climatic risks from local impacts, as many of these impacts can be life-threatening</td>
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<td>• Engage experts in developing community simulation exercises organized by professional organizations such as the SES or fire service and assisted by government support to provide group experiences and offer real-time skills and practices</td>
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<tr>
<td><strong>Augment behaviours by building upon existing NBR Board efforts</strong></td>
<td>Furnish opportunities to join locally-implementable, socially-relevant adaptation projects and measures</td>
<td>Build sustained momentum for behavioural change over time by:</td>
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<td>• Craft portfolio of adaptive actions through a comprehensive and layered strategy from top-down government measures to individual behavioural changes and social actions.</td>
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<td></td>
<td>• Lend support for individuals to implement personal behavioural change to build efficacy by undertaking personal actions and voicing an opinion in the broader societal debate</td>
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Three proposals for promoting effective adaptation actions in local communities, which could be advanced through the NBR Board and other TSSOs, are as follows:

1. **Provide targeted information on effective adaptation measures couched within a sustainability context to address local impacts.**

The current climate change SRs and limited lay thinking around adaptation reveal gaps between climate change understanding and specific effective adaptation approaches for individuals and the community (Chapters Six and Seven). Therefore, efforts to supplement
the NBR Board’s lay thinking with reified knowledge about targeted local impacts and best adaptive practices could infuse new emancipated representations of climate change that, over time, could shift the SRs to include effective adaptive actions.

The NBR Board should be encouraged to focus community workshops on the current and future local impacts relevant to residents and businesses. For the TSSO and the broader community, this would include:

- disseminating useable knowledge of the longer-term localised consequences and best available adaptation measures;
- connecting this knowledge to their current lives and future well-being; and
- using discussion-generating tools such as GIS mapping of current and future climatic conditions such as flood mapping and computer-modelling of projected climatic changes in precipitation and temperature.

This approach would bind personal connections to climate change, which can leverage social action by better preparing individuals to focus on how best to address the changes ahead.

2. **Offer opportunities to experience impacts from climate change, such as simulation exercises.**

The study reveals emotional connections through an identity with sustainability, and an SR of climate change that is anchored in sustainability, enhancing the affect with sustainability (Chapters Six to Eight). However, the limited affect towards climate change or adaptive responses does not translate directly into an emotional connection or motivation to act on climate change. Research shows that emotional ties with a scientific phenomenon can be created through experiential learnings. Therefore, the current NBR Board’s affect with sustainability could be leveraged to embrace adaptation, if linkages between climatic impacts can be tied to ‘the self’, including family and community.

Personal experiences often internalises the understanding of abstract concepts. As individuals have different lived encounters, not all residents in a particular community will have experienced the climatic impacts personally. As many of these experiences can be life-threatening weather events, such as a prolonged heatwave or severe flooding, most will never have this intrinsic understanding by chance. Community simulation exercises organized by professional organizations such as the SES or fire service and assisted by government support can provide group experiences and offer real-time skills and practices.
providing insights for residents that could buttress resolve to address the challenges, which often require difficult choices and long-term planning and foresight.

3. Propose locally-implementable, socially-relevant adaptation actions.

The existing behavioural elements of the NBR Board’s community engagement reveal initiation and implementation of projects focused on sustainability, consistent with the participants’ demonstrated prior experiences with sustainability. The relative lack of initiative relating to climate change projects is consistent with the Board participants’ relatively limited knowledge of adaptive actions, and personal connection so experiences with climate change (Chapter Eight).

Positive attitudes benefit efforts to promote change, which often requires sustained momentum over time. Dynamic, complex or wicked large-scale problems such as climate change require a comprehensive and layered strategy from top-down government measures to individual behavioural changes and actions. Residents in a community will best be served by understanding the breadth of levels and specific responses for each. While an individual can choose to implement personal changes, knowing the practical and implementable responses for other segments of civil society and government, can create a broader understanding within each citizen. Additionally, individuals can lend their support to measures proposed or undertaken in the private sector, community organisations and government entities. Complex, multi-faceted problems benefit from broader understanding from its citizens as to the range of individual and collective responses, from personal behavioural change and to structural reforms within government. To promote optimism, individuals need to know they can be part of the solution through personal actions and voicing an opinion in the broader societal debate. Information on specific individual actions and government strategies promoting practical measures implementable by individuals and strategic governance responses in which they can lend their support would assist in addressing current and projected local climate change impacts.

9.6 Conclusion

This chapter answers the fourth research question, which explores the relationship among this TSSO’s SRs of climate change and adaptation, its social identity with sustainability and its social actions. It reveals that the NBR Board does engage with sustainability to a greater degree than climate change. It also considered how this TSSO’s social representations about climate change and adaptation (Chapters Six and Seven), and social identity (Chapter Eight), currently limit its social adaptive actions, but could be leveraged to enhance adaptive actions.
across the NBR. While a detailed discussion of the contributions of this chapter are found in Chapter Ten (Section 10.2.4), the specific proposals offered ways to better promote local adaptive actions with a view to assisting the TSSO’s efforts in building ties between climate change and sustainable adaptive actions. The Board’s social identity grounded in sustainability and its climate change SRs focused primarily on the causes and consequences of climate change over specific adaptation actions to present and future climatic impacts demonstrates that the Board’s understanding of the phenomenon does not fully align with the views of the expert community, especially around effective adaptive responses.

This chapter continued by proposing ways to provide reified knowledge that could enhance the group’s lay thinking and infuse the group with additional emancipated representations that may yield future SRs that include better understanding of best adaptive practices. The discussion investigated approaches to supplement cognitive, affective and behavioural elements to enhance social actions on climate change, particularly in the area of adaptation. Further, it recommended proposals to augment the connection with climate change through experiential learning opportunities. Finally, it offered ways for enhancing this TSSO’s current understanding and practices with a view toward instilling an identity with the present local and personal risks from climate change and a desire to incorporating “best practice” adaptation approaches in their community.

Chapter Ten, concluding the thesis, discusses the key findings and contribution to knowledge from this study. The chapter begins with a summary of the research objectives, research questions, limitations and methods of the study. This overview is followed by a synthesis of the contribution to knowledge from the four research questions addressing this TSSO’s social representations, social identity and current and potential social actions. The chapter concludes by discussing implications for practice that may be applied to other TSSOs and recommendations for further research opportunities arising from the contribution to knowledge by this study.
Chapter Ten. Conclusion

10.1 Summary of study

The single-case study allowed in-depth exploration of SR of climate change and adaptation, social identity, and social actions of a particular third sector sustainability organisation (TSSO), the Noosa Biosphere Reserve (NBR) Board, affiliated with a global UNESCO network of over 650 Biosphere Reserves. The NBR Board views climate change and its impacts as worthy of action due to the location of the NBR within an IPCC climate-vulnerable hot-spot.

The study has implications for TSSOs across the globe: first, by offering researchers a tested theoretical application from which to consider a TSSO’s social representations, social identity and social actions around climate change. This multi-focused process applied three theoretical perspectives: social representations theory (SRT), identity process theory (IPT), and cognition, affect and behaviour (CAB) as components of social action. This approach contrasts with studies of individual perceptions and attitudes of climate change and with studies of climate change understanding conducted with other subpopulations and groups.

This study applies SRT, and the theoretical perspectives of IPT and CAB to a qualitative methodology of a TSSO operating within the NBR in coastal South East Queensland, Australia to explore the group’s “common sense” or lay conceptualisations of climate change and adaptation. The study considered the social identity and social actions of the NBR Board to assess how this TSSO translates its climate change understanding and social identity with sustainability into its adaptive actions to address local climatic impacts.

This single-case study analysed 23 semi-structured interviews, encompassing over one-third of the NBR Board, to reveal insights into social representations about climate change and adaptation among this group of NBR Board participants, a relationship that has not been studied previously in Australia or among members of other UNESCO Biosphere Reserves to date.

10.2 Research outcomes: answers to the research questions

Four research questions were designed to reveal the lay thinking and personal connection with climate change and adaptation among this TSSO, as revealed through the NBR Board participants. For a specific TSSO, these addressed the nature of social representations and social identity, and the relationship among social representations, social identity, and social actions to determine how the TSSO addresses climate change and adaptation, and implications for TSSOs in general.
10.2.1 Research question one

*What is the nature, if any, of social representations around climate change within this group of NBR Board participants?*

Overall, the findings revealed emerging climate change SRs with some cohesion around causality and impacts but limited insight into responses. Although the climate change SR around responses was not clearly defined, it was grounded in sustainability concepts.

The initial analysis, from the free associations of words relating to knowledge about climate change reveal personal connections to climate change which align across three themata reflecting climate change’s cause, impacts and responses, respectively: 1. anthropogenic/natural, 2. local/distant, and 3. environmental/socio-political. These themata set the parameters for analysis of the interview data. While the emotive associations demonstrate a primarily negative affect toward climate change, this did not preclude the cohort from connecting with the phenomenon through shared knowledge around sustainability-related aspects.

The data analysis of interview data demonstrates social representations with climate change within the NBR Board participants’ comprising the following:

1. *Hegemonic representations* provided cohesive, consensual lay thinking around climate change, emphasising its anthropogenic causes, consequences from local physical impacts and also the distant impact from “melting ice”, as well as responses focused on socio-political actions and climate change anchored to sustainability concepts and practices and to negative imagery of human-induced pollution and destructive physical impacts.

2. *Emancipated representations* that provide complementary knowledge supporting the consensual representations, and add elements of the role that natural variability plays in the climate system. This representation also includes information about various distant impacts outside the Polar Regions, temporally distant impacts to future generations and individual responsibility for climate change. The process of objectification of natural variability reveals that some physical impacts were personified as acts of Mother Nature.

3. *A communicative modality of propagation* emerged whereby sustainability serves as a chief and legitimate response to effectively addressing climate change. This circulates through shared attitudes grounded in sustainability concepts and actions; and anchors in images of human-induced pollution, physical impacts (e.g. sea-level rise, flooding, ice melting), and acceptance of climate change and responsive actions, often grounded in a sustainability.
The strongest climate change SRs indicate the cohort constructs its lay thinking primarily around cause and consequences of climate change, with limited knowledge on specific responses addressing mitigation of greenhouse gas emissions or detailed adaptation efforts. However, the findings indicate that much of the lay knowledge about climate change is framed within a sustainability paradigm. The group's employs the communicative modality of propagation to share its thinking on climate change through its sustainability prism.

This study's findings of social representations about climate change among the group's participants have implications beyond the immediate group and contribute to knowledge. The findings reveal the climate change social representations:

- build knowledge about the how this TSSO understands the drivers of 21st century climate change, its impacts and proposed responses to them,
- have utility beyond the purpose of informing this TSSO as it provides information for other researchers considering interested in advancing climate change action with other TSSOs about how shared lay knowledge within a TSSO plays a part in informing group decisions, and
- inform processes (i.e. methods) for understanding a TSSO's discourse on climate change, which could be used to change the discourse underpinning climate change and the approaches to engage the public in addressing this scientific phenomenon.

10.2.2 Research question two

*What is the nature, if any, of social representations around climate change adaptation within this group of NBR Board participants?*

While an SR of adaptation did not emerge, there is some understanding of adaptation with regard to the need to address local impacts. Adaptation was most often discussed in general terms or through a sustainability lens. Effective adaptive actions were more likely to be identified by those with personal experiences of climatic events, with specific adaptive practices that aligned with the reified knowledge found in the scientific literature.

The thematic analysis indicates a limited understanding of adaptation as a reified concept. The initial analysis, from the free associations of knowledge, revealed the cohort identifies climate change responses as the dialogical dyads of environmental/socio-political. However, when analysing the data regarding adaptive actions to address climate change impacts, little cohesion around specific adaptation measures appears. Adaptive actions include individual and collective responses. Individual responses emerged from participants who offered
positive assessment around personal experiences with past climatic events relating to farming or rural property management. Most participants, however, did not have direct experience with climatic change responses. While indicating that adaptation was important, discussion of adaptive actions were often of a general nature focusing on social action. The wide range and imprecise, often ambiguous, nature of responses around adaptation indicate a detachment from adaptive actions, which may relate to a limited understanding, lack of personal experience with or personal responsibility towards responding to climatic impacts. Thus, obtaining personal experience with climatic impacts and enhancing relevant knowledge can play a role in understanding effective adaptive actions and retaining a positive connection with climate change.

10.2.3 Research question three
What is the nature, if any, of a social identity within this group of NBR Board participants?

The cohort demonstrated a social identity with sustainability, which often emerged through participants’ early personal identities with sustainability. An identity grounded in sustainability often yielded initiatives with a sustainability focus. The NBR Board itself, through its stated commitment to sustainability, reflected this social identity through its advocacy work. Specifically, the data demonstrate the participants committed to sustainability by incorporating its principles and actions into their personal lifestyles prior to their work on the NBR Board; continued to focus on sustainability through higher education and professional pursuits emphasising sustainability to a greater degree than the Australian public; identified sustainability as a motivating factor in joining the NBR Board; and selected primarily sustainability projects for their volunteer engagement initiatives.

10.2.4 Research question four
What is the relationship among social representations, social identity and social actions of the NBR Board to address climate change and promote adaptation and what are the implications for TSSOs in general?

The analysis revealed a relationship among climate change SRs, a social identity grounded in sustainability and social adaptive actions that presents gaps in cognitive, affective and behavioural elements limiting social action. While the NBR Board does engage to some extent with climate change, sustainability was the galvanising issue for this TSSO, as its social identity was grounded in sustainability. As the climate change SR focused primarily on the causes and consequences of climate change, understanding and affect with the concept and need for adaptation existed but was of a limited nature.
Social adaptive actions among this TSSO can be strengthened (Table 10.1) through implementation of a range of proposals to enhance cognitive, affective and behavioural elements that relate to climate change and adaptation. The proposals include community-based workshops to augment lay knowledge around current understanding and practices with a view toward instilling an identity with the present, local and personal risks from climate change and a desire to incorporating “best practice” adaptation approaches in their community.

Table 10.1 Summary of proposals to enhance social adaptive action

<table>
<thead>
<tr>
<th>Goal</th>
<th>Objective</th>
<th>Proposal*</th>
</tr>
</thead>
<tbody>
<tr>
<td>Enrich cognition</td>
<td>Provide targeted usable information on effective adaptation measures couched within a sustainability context to address local impacts</td>
<td>Present community workshops to disseminate knowledge in lay language, covering best available adaptation measures</td>
</tr>
<tr>
<td>Heighten affect</td>
<td>Offer experiential opportunities for making personal connections to climate</td>
<td>Create simulation exercises to build positive attitudes around adaptation</td>
</tr>
<tr>
<td>Augment behaviour</td>
<td>Furnish and support behavioural change strategies that encourage or reinforce adaptive actions</td>
<td>Build sustained momentum for behavioural change over time by crafting a community portfolio of adaptive actions</td>
</tr>
</tbody>
</table>

* Proposals emerged from the analysis of the findings in Chapter Nine

10.3 Study limitations and opportunities for further research

This study has been enhanced significantly from the original PhD proposal and the successful completion of the PhD confirmation process. Specifically, the university-approved proposal included: 1. A single-case study of the NBR Board; 2. Data collection through semi-structured interviews; and 3. Two research questions seeking to understand the nature of social representations about climate change and adaptation, respectively, among the NBR Board’s membership. Throughout the research process, enhancements to strengthen the study were implemented: 1. Free association questions seeking knowledge associations and emotion associations about climate change were addition as an additional data collection method (Chapter Five), strengthening the analysis of the social representations (Chapters Six and Seven); and 2. Two research questions focusing on the group’s social identity (Chapter Eight) and its social action (Chapter Nine) emerged from the initial data analysis and were incorporated through the sequential qualitative-qualitative mixed method design (Morse, 2010), strengthening the findings and enhancing the contributions from this study. However, as with any research, more could be added to this study or in future research.

While the study was limited to a single-case study approach, it was subjected to extensive analysis based on SRT and associated methods as outlined above. However, future studies
could extend the methods used. Further research proposals could go beyond this single-case study to include a comparative study with other UNESCO Biosphere Reserves in developed and developing countries. For example, research cited in this thesis was conducted in Canadian Biosphere Reserves (Reed et al., 2014; Reed & Massie, 2013) and UNESCO has reported on Biosphere Reserve governance bodies that have taken a lead on climate change (UNESCO, 2016). Targeted research into the lay knowledge of climate change and, in particular, adaptation, of UNESCO MAB network’s TSSOs could enhance past efforts through expansion of methods within single-case studies and development of comparative case studies. Specific limitations are discussed below, followed by future research concepts and objectives (Table 10.2).

Table 10.2 Study’s limitations and further research to address limitations

<table>
<thead>
<tr>
<th>Limitations</th>
<th>Further research</th>
<th>Objective</th>
</tr>
</thead>
<tbody>
<tr>
<td>Semi-structured interviews only</td>
<td>Build in second phase to include focus groups, which could be added in conjunction with a comparative study</td>
<td>Provide additional alternative methods for data collection to enhance data around SRs and identity when focusing on a single TSSO</td>
</tr>
<tr>
<td>Semi-structured interviews were focused solely on climate change and adaptation</td>
<td>Extend interview queries and focus groups to include sustainability</td>
<td>Knowing that TSSOs in the UNESCO MAB network focus on sustainability as well as climate change, include sustainability in the topic guide questions (and future focus groups) would ensure that each participant had the opportunity to contribute views directly about sustainability</td>
</tr>
<tr>
<td>Limited time horizon revealed only social representations from a specific time and place, which may have highlighted particular climatic elements</td>
<td>A follow-up study of this TSSO to compare the NBR Board’s past and current knowledge, practices and ideas, which would inform about new lay thinking in the intervening years since the initial data collection in 2012-2013</td>
<td>As SRs and identity evolve over time, a multi-staged study would provide data for a comparison of how one TSSO’s lay thinking of climate change adaptation evolved</td>
</tr>
<tr>
<td>Single-case study design of one TSSO operating in the UNESCO MAB network</td>
<td>Comparative studies with other UNESCO Biosphere Reserves governance bodies in developed and developing countries</td>
<td>Consider if SRs and social identity of TSSOs in the UNESCO MAB network share similar SRs of climate change and adaptation and an identity with sustainability</td>
</tr>
</tbody>
</table>

The methods, while offering benefits, presented some limitations. For each limitation, further research and objectives are discussed:
1. **Only semi-structured interviews and free associations were analysed.**
   This study used one main data collection method, semi-structured interviews, to reveal lay thinking and communication of climate change and adaptation; and one main data analysis method, thematic analysis. However, the sequential qualitative-qualitative mixed method design, using a main qualitative method with a supplemental component of a secondary qualitative method (Section 4.6.1), provided an opportunity to expand upon the initial research questions in a systematic and theoretical approach. The sequential design yielded richer findings than would be possible from exploration of the initial research questions alone, bringing additional knowledge and greater depth to the implications and significance of the study. Adding focus groups provide an additional alternative method for data collection to enhance data around SRs and identity from group interactions.

2. **Semi-structured interviews were focused on climate change and adaptation.**
   The topic guide for this study focused exclusively on climate change and adaptation. However, data revealed that the NBR Board participants connected climate change with sustainability and participants spoke extensively about their philosophy and practices around sustainability. While the sequential research design provided an opportunity to explore the participants' connection with sustainability, the lack of specific question during the interview process regarding concepts of sustainability and linkages to climate change emerged as a limitation. Further research could expand the scope by including in the topic guide specific questions about sustainability. As TSSOs hold a particular interest in sustainability, this would ensure study participants had the opportunity to contribute directly their views about sustainability.

3. **The data collection covered one term of the NBR Board, 2012-2013.**
   The limited time horizon revealed climate change SRs from a specific time and place, which may have highlighted particular climatic elements or excluded others, which is the nature of SRs. A follow-up study of this TSSO may reveal changes in SRs or identity in the intervening years since the initial data collection. Since 2013, the NBR Board has been restructured with new leadership. Conducting a new study of this TSSO would identify if the SR of climate change has evolved and if an SR of adaptation has emerged. If this study were repeated, it would be of interest to know if the new leadership has a more cohesive understanding of specific adaptive actions and, if so, how they developed.
Also, if there remains a sustainability identity and, if so, does it encompass aspects of climate change?

4. Single-case study design of one TSSO in the UNESCO MAB network.
   This study’s focused on a single TSSO, which provides an overarching set of goals and objectives. Comparative studies conducted at the same time with the same methods but in different countries or continents could provide particular perspectives of the similarities and differences of SRs, identity and actions on this global phenomenon. A comparative study of TSSOs in the UNESCO Biosphere Reserve network may reveal differing adaptive approaches to similar climatic impacts that could then be shared across TSSOs.

   These opportunities for additional research could provide insights into how TSSOs understand the key components of climate change, particularly the lay thinking around specific effective responses, how SRs emerge and circulate within TSSOs, and how social identity contributes to social adaptive actions. These additional research proposals would provide new knowledge about targeting and framing climate change messages to TSSO members and other lay audiences. Additionally, further research could inform ways to leverage TSSO community activism to better promote adaptive responses to local climate change impacts.

10.4 Contribution of this research
   This research adds significantly to the body of knowledge by extending SRT to explore a globally-affiliated TSSO operating in a particularly vulnerable ecosystem; expanding methods of analysis around SRT; and providing a basis for improving climate change adaptation practice (Table 10.3).
Table 10.3 Study’s contribution to knowledge across theory, methods and practice

<table>
<thead>
<tr>
<th>Contribution to knowledge</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Theory</strong>: The study extends SRT to explore the SRT and social identity in relation to climate change of a globally-affiliated TSSO operating in a particularly vulnerable ecosystem.</td>
</tr>
<tr>
<td><strong>Methods</strong>: The study expands the range of methods of analysis applied to SRT by adding analysis of the free association techniques of knowledge associations and emotions associations to reveal initial impressions to the thematic analysis of the semi-structured interview data, which reveals more conscious thoughts. This combination of methods of analysis provides a new approach to revealing social representations of climate change and adaptation.</td>
</tr>
<tr>
<td><strong>Practice</strong>: The study’s analyses of SRs of climate change and adaptation, social identity and social action yields proposals to improve adaptive actions through consideration of this TSSO’s cognition, affect (emotion) and behaviour (action) in relation to climate change and adaptation. This will assist community organisers and other decision makers to identify how communication can be more effective and offer ways to improve practice.</td>
</tr>
</tbody>
</table>

Suggestions include:

- providing targeted usable information on effective adaptation measures couched within a sustainability context and presented through community workshops
- offering experiential opportunities to enhance personal connections to climate by creating simulation exercises about climatic impacts and adaptive actions
- Furnishing behavioural change strategies that encourage or reinforce adaptive actions by crafting and disseminating community-specific portfolio of adaptive actions

The study can be applied broadly to TSSOs in communities across the globe. The UNESCO Man and the Biosphere Programme alone has over 550 formal governing bodies worldwide; each Biosphere Reserve charged with promoting sustainability and educating the public about climate change and adaptive actions to address its consequences.

The thesis builds knowledge of theory by applying SRT to reveal the lay knowledge of climate change in a TSSO for the first time. This globally-affiliated sustainability advocacy group operates in an ecologically vulnerable region in Australia, a country especially susceptible to climate change, due to its extremely variable climate. This research substantiates the use of SRT as a valuable theoretical perspective, offering a new approach to understanding a TSSO’s social representations about climate change and its social identity, in this case with sustainability.

The research extends knowledge around the range of methods of data collection and analysis applicable to SRT, IPT and CAB to reveal the role of social identity, lay thinking through its SRs of climate change and adaptation, and social actions through a TSSO’s advocacy work. These methods provide alternative analysis approaches to those used in the collection of survey data or media documents. While others have used free association techniques to reveal mitigation actions of climate change or climate change SRs in other
subpopulations, this study extends their work (e.g. N. Smith and Joffe, 2012; Moloney et al., 2014) by analysing the free associations to reveal themata, which were then explored subsequently in the interview data. By applying thematic analysis and free association techniques to analyse the data generated from semi-structured interviews, this study provides an detailed view of how the NBR Board understands climate change, its linkages with sustainability and the need for adaptive action. It is conceivable that this linkage would be found in TSSOs with the UNESCO Biosphere Reserve organisations and in other TSSOs in various forms.

The study adds to knowledge of climate change and adaptation understanding and action. This knowledge is needed to offer avenues to inform about best adaptive practices. Specifically, it contributes to understanding a group’s thinking, emotional connections and behaviours to climate change and adaptation by studying the group’s SRs and identity, which contribute to the knowledge and motivation needed to deliver effective adaptation projects.

The study provides a framework for further studies to identify understanding of the cognitive, emotive and behavioural factors in play. This TSSO's cognitive, affective and behavioural aspects around climate change, adaptation and sustainability, explored in this single-case study design offers in-depth analysis and practical implications for this TSSO, community organisers and others working in third sector organisations.

Finally, the study can assist UNESCO Man and the Biosphere (MAB) programme, which has over 550 formal governing bodies worldwide. Each Biosphere Reserve is charged with promoting sustainability and educating the public about climate change and adaptive actions to address its consequences. Therefore, the knowledge about climate change and adaptation emerging from this TSSO can be applied broadly to TSSOs in communities embedded in Biosphere Reserves across the globe.

10.5 Concluding thoughts
The overall aim of this research has been to investigate the role of social representations of climate change and adaptation, and social identity in motivating a TSSO to develop local community projects that promote effective adaptive actions. The thesis argues that a TSSO's lay thinking around climate change and adaptation, revealed through its social representations and the group's social identity with sustainability can be used to motivate and advance adaptive action. This study's comprehensive analysis of multiple components of the NBR Board’s understandings of and actions on climate change and adaptation present a
new approach to advancing efforts by civil society to address climate change and its impacts. Revealing a TSSO's cognitive, affective and behavioural elements establishes the foundation upon which to develop a strategy for enhancing its connection to effective and meaningful adaptive actions, which can then be shared across the broader community.
References


McMullen, B. (2011, November 16).


Trumbo, C., & Shanahan, J. (2000). Social research on climate change: Where we have been, where we are, and where we might go. Public Understanding of Science, 9, 199-204.


Appendix 4.1 Study invitation, study information sheet and consent form

*Invitation letter to Noosa Biosphere Board of Directors*

Dear Noosa Biosphere volunteer,

I am a lecturer and researcher at the University of the Sunshine Coast’s Sustainability Research Centre. I have been awarded a joint USC/CSIRO research scholarship to study the understanding of climate change among sector boards of the Noosa Biosphere Limited (NBL).

As you are a volunteer or board member of the NBL, your participation in this study would be valuable to my research. As some of you may know, I am also an NBL volunteer, serving on the Governance Board and the Education, Research and Development Sector Board. My involvement in our organization’s efforts to promote sustainability principles within the Noosa Biosphere Reserve has sparked my interest in the NBL membership as participants in my research.

Public understandings and individual perceptions of climate change and its risks are significant elements which play important roles in decision-making processes to develop policies and programs to address this phenomenon. Policy-makers do not operate in a vacuum; the public’s perceptions of the climate system and how it works, and of the risks from climatic changes can add support for political, economic or social actions to address those risks. Current research suggests that a better understanding of various social groups’ views on climate change, its impacts and risks, and adaptation can assist decision-makers in crafting policies and measures that can address this global phenomenon. To help answer these research questions I would like to talk with you and other NBL members.

Involvement in the study includes participation in one face-to-face interview of 30-60 minutes. During this interview I will seek your personal insights regarding climate and climate change. Please note that participation in the study is entirely voluntary and anonymous. You will have opportunities to review and, if requested, amend the recorded interview and any analysis that arises from the study. You may also withdraw from the research at any point, should you choose not to participate.

Thank you for considering my request. If you would like to learn more about the study or if you wish to participate, please contact me at the address or phone number provided below.

Kind regards,

*Kate*

Ms. Kate English
Lecturer and Researcher
University of the Sunshine Coast
J Building, J 5.08
Maroochydore DC 4558
Email: kenglish@usc.edu.au
Phone: (07) 5456 5116
Study information sheet and consent form

RESEARCH PROJECT INFORMATION SHEET

Title of the research project: Social representations about climate change in the Noosa Biosphere Reserve: How social groups in an Australian community understand a changing climate.

Ethics approval number: USC/S/12/386

Researcher/interviewer: The study is being conducted by Kate English, Lecturer and Researcher, University of the Sunshine Coast, Faculty of Arts and Business, Sustainability Research Centre and supported by a joint USC/CSIRO scholarship

Purpose of the research: This research will investigate the public understanding of climate change among social groups of the Noosa Biosphere Limited (NBL), the governing body of the UNESCO Noosa Biosphere Reserve. The research is grounded in the literature relating to social representations theory. Social representations are culturally or socially shared understandings of a concept or object resulting from its public translation filtered through common-sense knowledge. The study will involve a series of qualitative face-to-face interviews with individuals volunteering or working within the NBL.

Participant interviews and information: Interviews will be recorded using a digital audio recorder and transcribed for subsequent analysis. When transcriptions have been created and approved, audio files will be deleted. My research will be conducted under the guidance of a USC/CSIRO supervisory team (from USC: Drs Dana Thomsen and Bill Carter; from CSIRO, Drs Iain Walker and Gail Moloney), who have extensive training in social and environmental science techniques.

As the primary researcher, I will involve participants in a feedback process to ensure that all content accurately reflects participant views. Participants will be sent the interview transcription and a summary of the results of the research. Some of the analysis may also involve verbatim quotations from the interview transcripts where it strengthens the analysis and impact of the research. If this is to occur, explicit approval will be sought before it is used in my PhD thesis or any publication relating to it. Participants may also amend or withdraw any information during the research period. It is not the intention that any individual participants will be identifiable during data collection, analysis and/or in any publications arising from the research. Participants should be aware that a residual risk may still exist that your identity could be inferred. To minimise this occurrence, I will be mindful of the way information is published (e.g. it is the intention of this research to highlight the understanding of climate change and related concepts among sector boards of the NBL rather than to focus on the organization or any of its members). To minimise any harm to either the organisation or individuals, if content arises that is controversial but may contribute information toward improved understanding of climate change, these comments can be taken out of the context of the organisation and discussed in a meta-analysis of overall learnings. This will only occur through the
process of feedback identified and where you have given approval, remembering that you may change material in any way that you wish, remove material completely, or withdraw from the study at any time without the need for explanation. It is expected that the research will be conducted over a 7-month period (May-November 2012).

**Voluntary participation and use of data:** Please note that participation is voluntary and that a choice not to participate will involve no penalty or loss to you. It is intended that the information will be disseminated in the findings of the research within my PhD thesis and it may also be included within a refereed journal article or articles. It is expected that interview synthesis and analysis will provide real-world insights into issues of how social groups generate and transform concepts around climate change, a global phenomenon of dynamic and complex proportions. It is anticipated that the risks/burdens of participation are minimal (time to participate in an interview of one-hour in duration and time to ensure that participant views are accurately reflected in written form and contain no risk of harm). Any information provided by participants during the research will be used only for the purposes of the research project. If you have any complaints about the way this research project is being conducted you can either raise them with the principal researcher or, if you prefer an independent person, contact the Chairperson of the Human Research Ethics Committee at the University of the Sunshine Coast: (c/o Research Ethics Officer, Office of Research, University of the Sunshine Coast, Maroochydore DC 4558; telephone (07) 5459 4574; facsimile (07) 5459 4727; e-mail humanethics@usc.edu.au.

**To volunteer for the study:** Participants are able to take your time to think about whether you wish to participate in this study. If after having some time to think about it you decide you would like to participate, please contact the principal researcher (Ms Kate English) at the telephone number/e-mail address supplied. Your response by (insert date three weeks after sent) would be appreciated as it is planned to commence the study by April 2012. If you choose to be involved in this study you are encouraged to keep a copy of this information sheet. Thank you for your time, the researchers and the University of the Sunshine Coast appreciate your assistance with this research project.

*Kate English*

Lecturer and Researcher
University of the Sunshine Coast
J Building, Room J 5.08
Maroochydore DC 4558
Email : kenglish@usc.edu.au
Tel. (07) 5456 5116
CONSENT TO PARTICIPATE IN RESEARCH

Project Title: Social representations of climate change in the Noosa Biosphere Reserve: How social groups in an Australian community understand a changing climate.

Ethics approval number: TBD

I have read, understood and kept the contents of the Research Project Information Sheet.

I realise that this research project will be carried out as described in the Research Project Information Sheet.

Any questions I have about this research project and my participation in it have been answered to my satisfaction.

I agree to participate in the research project: Social representations of climate change in the Noosa Biosphere Reserve: How social groups in an Australian community understand a changing climate.

I give consent for data about my participation to be used in a confidential manner for the purposes of this research project, and in future research projects.

Participant

Date
Appendix 4.2 Semi-structured interview topic guide

Semi-structured Interview Topic Guide

CLIMATE CHANGE

- What does climate change mean to you?
- What words or images come to mind?
- What feelings or emotions do you experience when you think of climate change?

CLIMATE CHANGE ATTRIBUTION

- Do you think climate change is happening now?
- What do you think causes climate change?
- To what extent does human activity contribute to climate change?
- As of today, what influence have humans had on the climate system?
- Do you think humans will continue to influence the climate system?

CLIMATE CHANGE IMPACTS

- What do you think the impacts of climate change are or will be?
- What specific impacts come to mind?
- Do you think extreme weather events have increased globally in recent times?
  - What extreme weather events come to mind globally?
- Do you think extreme weather events have increased in the Noosa area in recent times?
  - What extreme weather events come to mind in the Noosa area?
- Have you experienced extreme weather recently?
  - What specific extreme weather event comes to mind?
- Have temperature increases caused significant problems worldwide?
  - What specific problems come to mind?
- Have increased global average temperatures caused problems here in Noosa?
  - What specific problems come to mind?

CLIMATE RISK

- How concerned are you about the risk of climate change to others abroad?
- What specific risks does climate change pose to others?
- How concerned are you about the risk of climate change to you in Noosa?
- What specific risks does climate change pose to you in Noosa?
- What risks does climate change currently pose to the community?
- What future risks will climate change pose to Noosa residents?
ADAPTATION

- What do you think of when you hear the term “climate change adaptation”?
- Do you think Noosa is adapting to climate change now?
- Who is primarily responsible for developing adaptation options and actions to address climate change?
- When you experienced an extreme weather event what did you do?
  - Would you do anything different next time?
- Do you expect global average temperatures to continue to rise in the coming decades as they have over the last century?
- What aspects of rising temperatures are you most concerned with and how would you adapt to them?
  - What concerns you about future temperature increases?

FUTURE CLIMATE CHANGE

- Who is primarily responsible for addressing climate change problems?
- What other entities are responsible?
- To what extent are individuals responsible for addressing climate change?
- How much would you personally be prepared to sacrifice to address climate change?
- Do you think that new measures are needed to address climate change?
- What measures would be required and how soon are they needed?
- How should new climate change measures be funded?
- Can climate change be stabilized?
- When do you think significant progress will be made?
- How do you picture life in Noosa in a warmer climate with more extreme weather?

PARTICIPANT BACKGROUND DATA

- Gender
- Age
- NB Board: Governance Board or Sector Board/s
- Years living in/visiting Noosa
- Years with NBR Board
- Resident of: Hinterland/Town/Coastal Village/Greater Noosa Area
- Occupation
- Level of climate science knowledge (self-assessed)
Appendix 5.1 Free association tasks: Knowledge associations and emotive associations

<table>
<thead>
<tr>
<th>Participant</th>
<th>1st word association</th>
<th>2nd word association</th>
<th>3rd word association</th>
<th>4th word association</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>social intervention</td>
<td>polar bear on iceberg</td>
<td>growth in urban areas</td>
<td>x</td>
</tr>
<tr>
<td>2</td>
<td>volcanism weather</td>
<td>ice flow melting</td>
<td>humans impacts</td>
<td>x</td>
</tr>
<tr>
<td>3</td>
<td>result of non-sustainable processes</td>
<td>the silence of the climate changing</td>
<td>dead and road</td>
<td>realm for science</td>
</tr>
<tr>
<td>4</td>
<td>processes, caused by human activity</td>
<td>generated by people who deny</td>
<td>generated by people who deny</td>
<td>x</td>
</tr>
<tr>
<td>5</td>
<td>problem happening for some time</td>
<td>education and awareness raising</td>
<td>more energy efficiency</td>
<td>volatile weather patterns</td>
</tr>
<tr>
<td>6</td>
<td>weather bureau</td>
<td>pollution</td>
<td>wet season sandstorms</td>
<td>x</td>
</tr>
<tr>
<td>7</td>
<td>reasons for atmosphere change</td>
<td>sea-level rise</td>
<td>climate change</td>
<td>flooding</td>
</tr>
<tr>
<td>8</td>
<td>good environmental decision</td>
<td>extreme weather</td>
<td>energy efficiency, clean tech</td>
<td>x</td>
</tr>
<tr>
<td>9</td>
<td>climate variability</td>
<td>ice ages</td>
<td>x</td>
<td>x</td>
</tr>
<tr>
<td>10</td>
<td>rising global temperature</td>
<td>fossil fuel burning</td>
<td>polar ice caps melting</td>
<td>sea-level rise</td>
</tr>
<tr>
<td>11</td>
<td>variability of climate</td>
<td>flood</td>
<td>fire</td>
<td>sea-level rise</td>
</tr>
<tr>
<td>12</td>
<td>anthropogenic-enhanced variability</td>
<td>pollution</td>
<td>solar radiation</td>
<td>melting ice sheets</td>
</tr>
<tr>
<td>13</td>
<td>political agenda</td>
<td>x</td>
<td>x</td>
<td>x</td>
</tr>
<tr>
<td>14</td>
<td>changes in weather</td>
<td>changes in water levels</td>
<td>polar ice melts</td>
<td>cold and wind energy</td>
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<tr>
<td>15</td>
<td>sustainability</td>
<td>long-term changes</td>
<td>unsustainable behaviours</td>
<td>disasters</td>
</tr>
<tr>
<td>16</td>
<td>conservation of sustainability</td>
<td>storms</td>
<td>heat</td>
<td>sea-level rise</td>
</tr>
<tr>
<td>17</td>
<td>environmental change</td>
<td>important to change habits</td>
<td>temperature gauge rising</td>
<td>globe on fire</td>
</tr>
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