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Public risk perceptions, understandings, and responses to climate change and natural disasters in Australia, 2010 and 2011

Final Report

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The role of NCCARF is to lead the research community in a national interdisciplinary effort to generate the information needed by decision-makers in government, business and in vulnerable sectors and communities to manage the risk of climate change impacts.

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PREFATORY NOTE AND SUMMARY STATEMENT

This report presents and discusses the findings of a second Australian national survey examining and monitoring public risk perceptions, understandings, and responses to climate change and natural disasters, undertaken between 15 July and 8 August of 2011. The study complements and extends an initial study conducted in mid-2010 in conjunction with a similar survey undertaken by the Understanding Risk Research Centre at Cardiff University. The 2010 surveys are the subject of a previous report (Reser, Bradley, Glendon, Ellul, & Callaghan, 2012b). The 2010 and 2011 surveys are distinctive in their social science based design, their longer term measurement and monitoring purpose, and their inclusion of multiple and standardised psychological questions and scales, allowing for in-depth multivariate analyses and cross study comparisons. Together, the studies provide a robust research platform and database for the monitoring of important psychological and behavioural responses, impacts, and changes related to the threat and unfolding environmental impacts of climate change and extreme weather events.

Both the 2010 and 2011 Australian studies gathered data from geographically-stratified nation-wide samples using online questionnaires. The 2010 study included responses from 3,096 Australians, approximately one-third of whom were re-surveyed as part of the 2011 exercise. In addition to this longitudinal sample, 4,347 Australians were surveyed for the first time in 2011. The current report presents findings based on the responses of these 4,347 new participants, and includes comparisons with findings from the 2010 Australian sample. A future report will present and discuss the responses of the longitudinal sample.

The pattern of responses reported here are broadly consistent with the overall picture that emerged from the 2010 survey. These findings, and North American research findings (e.g., Romm, 2012; Villar, Krosnick, & Koczela, 2011), suggest that there was underlying stability with respect to public risk perceptions, understandings, and responses to climate change during 2010-2011. In general, members of the 2011 sample, like their 2010 counterparts, were very accepting of the reality of climate change, very concerned about implications for Australia and the world, and actively engaged in considering what climate change might mean and require in terms of individual and community adaptations and adjustments, in an altering and uncertain natural environment. Nonetheless, modest but significant changes across a number of risk perception and psychological response measures were found, with their status as expected fluctuations or more persistent and directional changes yet to be fully determined. Evident risk perception, issue engagement, and adaptation changes were no doubt influenced by the extreme weather events that occurred in Australia and the world over this 12 month period, and by the ways in which these events have been discussed and reported (e.g., Bacon, 2011; Leiserowitz, Maibach, Roser-Renouf, Feinberg, & Howe, 2012a; Leiserowitz, Maibach, Roser-Renouf, Smith, & Hmielowski, 2012d).

Further national surveys are needed to build on the current standardised research platform and database.

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CONFIDENCE INTERVALS

With a sample size of 4,347, and assuming random selection, reported sample proportions are accurate to within a maximum of +1.5%. (Illustrative 95% confidence intervals are 0.89% for a 10% vs. 90% finding, 1.36% for a 30% vs. 70% finding, and 1.49% for a 50%/50% finding).

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EXECUTIVE SUMMARY

What follows is a distillation and summary of more noteworthy findings of a second Australian national survey undertaken by Griffith University researchers between 15 July and 8 August, 2011. The study was based on a geographically and demographically stratified national sample of 4347 individuals and followed a similar survey of 3096 respondents conducted in mid-2010. Both samples were further stratified by regional exposure to projected climate change impacts, extreme weather vulnerability, and gender. This second report follows our initial 2010 survey report released on 31 July, 2011, which included national and international comparison findings, methodological and statistical details, and background information. Both this current and the companion report also include the reporting and discussion of qualitative research findings.

The researchers are applied psychologists and social scientists with convergent interests and expertise relating to the phenomenon and threat of global climate change, and in particular public risk perceptions, understandings, adaptation responses, and the documentation and monitoring of the psychological and social impacts of climate change. The likely audience for this second report, as for the first, is diverse, including fellow climate change researchers, our funding bodies, federal and state level government policy advisers, the Pacific region authors of the next Intergovernmental Panel on Climate Change (IPCC) Report, multiple organisational end users, interested individuals, and an international research community. We have attempted to write a report and monograph that will be accessible and meaningful across this wide spectrum of interest, and have provided a selective glossary in those cases where terms or phrases might not be familiar to some readers and where there might exist problems of language use and meaning across disciplinary boundaries, and with respect to both historical and emergent cultures of use.

FINDINGS

The most important problem

1. The initial survey question asked was "**What do you think will be the most serious problem facing the world in the future if nothing is done to stop it?**" The most frequent serious problem mentioned by respondents was climate change or the environment, with this problem category being given three times as often (39% of respondents) as the next most frequently mentioned problem, overpopulation (13%), followed by poverty and hunger (11%) and the economy/unemployment (6%).

Monitoring change and impacts

2. Survey findings are identifying and monitoring specific psychological responses to and psychological impacts of the threat of climate change, such as climate change acceptance, concern, distress, resolve, and *psychological* as well as behavioural adaptation.
3. When the full set of responses to the 2010 and 2011 surveys are compared, the most general survey finding is one of modest change against a backdrop of appreciable

stability, and a tendency for many respondents to have strengthened their respective views, beliefs, and concerns.

Public belief in climate change

4. Survey findings in 2011 fully confirmed strong levels of belief and acceptance that climate change is both a very real threat and is already taking place in Australia. When asked, "**As far as you know, do you personally think the world's climate is changing?**", 74% of respondents in both 2010 and 2011 said 'yes'.
5. Seventy percent of respondents in 2011 either 'strongly agreed' or 'tended to agree' with the statement "**I am certain that climate change is really happening**." Seven percent 'strongly disagreed' as compared with 5% in 2010.
6. Fifty percent of respondents in 2011 reported that Australia was 'already feeling the effects of climate change'.

Scepticism

7. Scepticism with respect to the reality of climate change was carefully considered and assessed in 2010 and 2011. On the basis of answers to four individual but convergent survey questions the proportion of 2011 respondents who could be considered strong sceptics or disbelievers with respect to climate change was found to be 4.7%, using a more stringent criterion, and 8.5% using a less stringent criterion. Comparison figures for 2010 respondents were 3.0% and 6.5%, respectively. Other Australian social science-based national surveys undertaken in this time period report comparable figures of 7%.

Public concern about climate change

8. Almost two thirds of 2011 respondents (64%) reported being 'very' or 'fairly' concerned about climate change with this level of concern being similar to respondent concern levels in 2010 (66%), and with an additional 22% of respondents indicating some level of concern across both years.
9. Seventy-six percent of respondents judged that if nothing was done to reduce climate change it would be a 'very serious' (45%) or 'somewhat serious' (31%) problem for the world.
10. Two thirds of respondents (66%) in 2011 judged that climate change was a serious problem 'right now'.
11. Fifty-three percent of respondents in 2011 reported that their level of concern about climate change had increased over the preceding two years, with 35% indicating that their level of concern had stayed about the same.
12. Reasons given for reported increased concern were predominately: increased awareness about the nature, magnitude, and possible consequences of climate change; media coverage of climate change; lack of action by government on climate change; and the perceived increasing frequency and intensity of natural disasters and extreme weather events.

Energy futures

13. Respondent preference profiles for alternative energy sources in 2011 were very similar to those found in 2010. Sun/solar power continued to be the most favoured energy source. Wind power was the second most favoured energy source for both samples, with hydro-electric power the third most favoured source. Gas went from fourth most favoured energy source to fifth in 2011. Coal went from seventh rating to sixth in 2011, possibly reflecting a slight increase in preference. The rated favourability of nuclear power dropped from a ranking of sixth in 2010 to the least favoured of energy sources (eighth) in 2011.

PUBLIC UNDERSTANDINGS OF CLIMATE CHANGE

Causal understandings

14. To squarely address causal understandings of climate change, respondents were asked, "**Thinking about the causes of climate change, which of the following best describes your opinion?**", with response options covering all combinations of natural and/or human causation possibilities, and a "There is no such thing as climate change" option. Eighty-seven percent of respondents in 2011 accepted some level of human causality for climate change and only 4.2% of respondents selected "There is no such thing as climate change". The great majority of respondents (83%) thought that *both* natural and human causes were contributing to climate change.

Objective and subjective knowledge and public understandings

15. Objective knowledge of climate change was strongly associated with climate change concern (r = .59), belief/acceptance (r = .58), risk appraisal (r = .49), perceived responsibility (r = .49), psychological adaptation to climate change (r = .46), self-efficacy (r = .46), climate change distress(r = .45), trust (r = .40), behavioural engagement (r = .36), and perceived direct experience with climate change (r = .35).
16. Respondent objective knowledge levels about matters relating to the underlying science of climate change and projected impacts were modest, with respondents getting, on average, four to five out of 10 true/false/don't know statements about climate change correct.
17. In 2011 as in 2010 the relationship between self-reported knowledge about climate change and objectively assessed knowledge about climate change was very weak, with a correlation of r = .12. In both years objective knowledge was higher among female respondents than it was for males. Male respondents on the other hand had lower objective knowledge scores overall, but reported higher knowledge levels than females.
18. Objective knowledge of the underlying science of climate change and projected impacts in 2011 was slightly lower than objective knowledge scores in 2010. No significant difference was found for self-reported knowledge levels between 2010 and 2011 respondent samples.

19. Respondent *understandings* of climate change were both distinct from and more encompassing than objective knowledge of climate change science. These understandings included important emotional responses; perceived responsibility and extent of causal and corrective human agency, moral considerations, personal experience-based understandings of environmental change and extreme weather events, and cultural and symbolic associations and understandings.
20. Climate change appeared to be understood by most respondents as a very genuine risk domain, but one that is imbued with very mixed response associations with respect to its natural/technological disaster character, cost implications, media treatment and credibility, perceived scientific consensus, and faith/trust in science and societal resources to effectively manage the climate change threat.

The interrelatedness of climate change and natural disasters in public understandings

21. There is a very strong climate change signal in extreme weather events and natural disasters for both 2010 and 2011 survey respondents.
22. Research findings suggest an important nexus between climate change and natural disasters/extreme weather events in public perceptions and understandings, as evidenced by respondents' comments about, descriptions, and reported direct experiences of climate change, which reflected understandings of climate change principally in terms of extreme weather events and natural disaster manifestations and consequences.
23. In response to the question, "**Overall, how much do you think climate change is influencing the frequency and intensity of weather events?**", 47% of respondents selected the two highest causal influence response options, 'a good deal' and 'moderately', indicating that climate change is being viewed by many as an important causal factor in recent extreme weather events in Australia.

Respondents' cumulative life experience with natural disasters

24. Many respondents reported extensive exposure to and experience with natural disasters, with the percentages of respondents in 2011 reporting direct experience with differing types of disasters being: cyclones (18%), bushfires (23%), drought (25%), and floods (29%).
25. Reported direct disaster experience over the 12-month period preceding the survey and including the 2010-2011 'summer of disasters' was also very substantial, with 29% of the national sample of 4347 experiencing flooding event(s), and 9% experiencing cyclone event(s), over this period. Ninety-nine *individuals* experienced a cyclone event more than once over this period, 44 experienced a bushfire more than once, 29 experienced drought more than once, and 203 experienced floods more than once during this eventful year.
26. Cumulative life experience with natural disasters did not evidence strong or noteworthy associations with other climate change response variables.

Direct experience with environmental changes or events thought to be associated with climate change

27. A striking finding in both the 2010 and 2011 surveys was that 45% of respondents reported having had direct personal experience with changes or events thought to be associated with climate change.
28. Even more noteworthy was that such encounters or experiences appeared to be particularly significant and influential, with dramatic differences found across all core response measures between those having had such encounters and those without such reported experience.
29. Analyses from multiple quantitative and qualitative vantage points indicate that these differences are not simply a reflection of believing is seeing. Rather, they seem to reflect a powerful combination of direct experience, personal confirmation, and a realisation that the more indirect, virtual, and psychologically distanced phenomenon and threat of climate change is actually a very real and current reality in one's local, known, and 'own'environment and place.

Psychological impacts of climate change and natural disasters

30. Survey findings suggest that the Australian public has been experiencing a range of psychological impacts relating to the threat of climate change, with these psychological responses and impacts in turn associated with psychological adaptation processes and behavioural responses.
31. In addition to the 86% of respondents reporting *some* level of concern about climate change, 27% of respondents reported thinking about the issue of climate change 'a great deal' or 'often', and 20% of respondents reported feeling, at times, appreciable distress at the prospect and implications of climate change and its consequences.
32. Experienced psychological distress in response to the climate change threat was found to be the strongest predictor of psychological adaptation to climate change in the comprehensive structural equation modeling analyses undertaken, with psychological adaptation powerfully mediating the relationship between distress and behavioural engagement.
33. As suggested by the above finding, the psychological impacts of climate change appear to be strongly motivating for many, with strong associations found between climate change distress and each of: adaptation (r = .75), felt responsibility (r = .67), self-efficacy (r = .65), green self identity (r = .54), and behavioural engagement (r = .52). These figures underscore the fact that psychological adaptation to climate change has both costs and benefits.
34. While direct experience with extreme weather events and natural disasters was associated with strong psychological impacts for many respondents, cumulative adverse experience with natural disasters surprisingly evidenced only very modest associations with a limited number of research variables, including indirect exposure (r = .20), residential exposure/vulnerability (r = .13), and psychological adaptation (r = .10), suggesting nonlinear, weaker, and/or more complex relationships across these and other research variables.

Exposure and vulnerability

35. Forty-five percent of respondents reported that they live within 50 kilometres of areas "frequently affected by extreme weather events or natural disasters.
36. Fifty-four percent of respondents thought that the region where they lived was vulnerable to the impacts of climate change, with 28% of respondents indicating that their location was 'very' or 'likely' vulnerable.
37. Residential exposure (i.e., proximity of one's residence to perceived climate change threats) and 'indirect exposure' (i.e., consumption of climate change risk messages via multi-media and personal contacts) were associated with climate change belief/acceptance, concern, and behavioural engagement. Analyses revealed that these two types of exposure each contributed uniquely and positively to a range of climate change-related perceptions and responses.
38. Perceived residential exposure to extreme weather events and the impacts of climate change was positively associated with variables such as acceptance of climate change (r = .38), climate change concern (r = .45), climate change distress (r = .35), psychological adaptation to climate change (r = .40), objective knowledge of climate change (r = .33), and self efficacy (r = .36), with all of these variables contributing to judgments as to the salience, local relevance, and perceived importance of known and anticipated environmental threats.

Public perceptions of and trust in scientists, government, and media

39. In response to the question, **"How much do you trust what different sources say about the environment?"** 54% of respondents responded 'completely' or 'very substantially' in the case of 'scientists' as compared with 49% in 2010. The corresponding 2011 figures for the media and for government sources were only 5% and 9% respectively.
40. When asked for extent of agreement with the statement, **"I trust the Australian government to take appropriate action on climate change,"** 23% of respondents either 'strongly agreed' or 'tended to agree' as compared with 16% of respondents in 2010. Extent of disagreement with this statement went from 64% in 2010 to 55% in 2011, suggesting a marked and significant change in the direction of greater trust, though from a low base.

Self perceptions with respect to the environment

41. Over 50% of respondents in 2010 and 2011 saw themselves as individuals who were very concerned with environmental issues, with 40% of each sample identifying with the aims of environmental groups such as Greenpeace and Friends of the Earth.
42. Most respondents also evidenced a close felt connection and bond to their natural environment, with, for example, 78% of respondents in 2011 reporting some level of agreement with the statement, "**I often feel that I am part of nature**".

Responsibility and moral considerations

43. Many respondents made reference to a felt moral responsibility in answering an open-ended question concerning reasons for engaging in pro-environmental behaviours, with responses such as ‘doing my bit’, ‘making a difference’, ‘making a contribution’, and ‘doing the right thing’ constituting the second highest category of self-reported motivations.

Motivation

44. Self-reported motivation to address climate change was very strong in 2011, with findings being very similar to those in 2010. Sixty-four percent of respondents in 2010 and 61% of respondents in 2011 either ‘strongly agreed’ or ‘tended to agree’ with the statement “**I am prepared to greatly reduce my energy use to help tackle climate change**”.
45. Additional motivation items in 2011 revealed that approximately 40% of respondents either ‘strongly agreed’ or ‘tended to agree’ with the statements, “**I want to change my lifestyle in ways that help to address climate change**”, and “**I feel a personal obligation to do what I can to prevent climate change**”.
46. Felt responsibility to act was also strongly related to behavioural engagement, more so in 2011 than in 2010.
47. In an open-ended survey question in 2010 asking why individuals were engaging in behaviours that would reduce their carbon footprint, the most frequent responses given were associated financial benefit (17%) making a difference/doing my bit (14%), protecting/ helping the environment (11%), normative expectations (6%), and concerns for/caring for the environment (5%).

Political and policy considerations

48. Political party identification was closely associated with climate change beliefs, concerns, and behaviours, with respondents who identified with the Greens and Labor displaying greater acceptance, deeper distress, and more adaptive and mitigating behaviour than did those identifying with the National or Liberal parties.
49. When asked whether and in what way the Labor government’s planned tax on carbon emissions might have changed their voting intention, 8% of respondents indicated that the tax had made them ‘much more likely’ to vote Labor, 8% were ‘slightly more likely’ to vote Labor, 39% reported that their voting intentions were unchanged, 11% were ‘slightly less likely’ to vote Labor, and more than one-third of the sample 35%, were ‘much less likely’ to vote Labor.
50. The issue of a tax on emissions appeared to have polarised members of the community, rather than having caused substantial numbers to change their voting intention, with the carbon tax-induced swing away from Labor coming primarily from non-Labor voting respondents.

Psychological adaptation

51. Survey findings suggest that Australians are clearly adapting to the threat and perceived environmental impacts of climate change by way of changes in thinking, feelings, risk perceptions and appraisals, motivations, and other psychological and behavioural responses to climate change.
52. Survey respondents who evidenced high levels of psychological adaptation were more likely than other respondents to accept anthropogenic climate change, believe that Australians are already experiencing the effects of climate change, and have greater objective knowledge about climate change. These survey respondents also were more likely to have had what they believe to be personal encounters with environmental events or changes associated with climate change, be concerned and distressed by the implications of climate change, be engaged with the topic and issue, and see themselves as more exposed and vulnerable to the anticipated consequences of climate change.
53. Survey findings in 2011 again highlighted the crucial roles played by *psychological* adaptation to climate change in mediating other core psychological factors and behavioural engagement. This psychological adaptation was best predicted by climate change-induced distress, indirect media exposure to climate change messages, and felt responsibility to act, and it, in turn, directly predicted behavioural engagement.
54. Research findings strongly suggest that taking action and being engaged with the issue serves important needs with respect to psychological coping and emotion management, in addition to providing environmental benefits.

Behavioural adaptation and engagement

55. Proportions of respondents who both had the opportunity *and* reported engaging in carbon reduction behavior varied from 51.9% (recycling) to 12.8% (reduce travel/vacation travel). Relatively high engagement was found for using energy efficient light bulbs (44.9%), conserving water (44.2%) and using less electricity (43.5%), while relatively low proportions were found for reducing air travel (14.6%), carpooling (19.1%), using public transport (20.1%), and buying carbon offsets (20.2%).
56. In the case of all behavior categories a substantial proportion of respondents (8 to 50%) reported engaging in the behavior partly because of climate change.
57. For 2011 respondents, buying organic food, using renewable energy, and reducing air travel were engaged in more than was the case in 2010. Least favoured in both surveys were carpooling and buying carbon offsets.

Interrelationships between variables and mediating roles

58. Structural equation modeling identified numerous predictors of belief in climate change, with strong linkages from climate change belief through distress and self-efficacy to psychological adaptation, and from there to behavioural engagement.

59. Across multiple models, behavioural engagement was shown to be a joint function of cognitive variables (e.g., risk perception, self-efficacy), affective variables (e.g., concern, distress), motivational variables (e.g., perceived responsibility to act), and social variables (e.g., indirect exposure, normative influences).
60. Each of these variables represents a potential target for future interventions aimed at increasing environmentally-sustainable behaviours.

Summary statement

When a composite statement of individual survey item findings for 2011 are brought together, the clarity and strength of public views and sentiments becomes clearer. For example, 74% of respondents *personally thought* that climate change is occurring, with 69% 'very' or 'fairly' *certain* that this was happening, 50% judged it is *already happening in Australia*, and 45% reported having had *direct personal experience* of an environmental change or event likely due to climate change. In addition 42% reported it being '*a serious problem right now'*, 64% reported being *very or fairly concerned* about climate change, 43% reported that climate change was an *extremely or quite important issue* to them personally, and 27% reported that they *think about climate change a lot*. Approximately 20% of respondents reported feeling, at times, *appreciable distress* at the prospects and implications of climate change and its consequences. Respondents, on the whole, appear to feel that they themselves can and should be addressing this environmental threat (59%), and that the Australian government, state governments, and corporate Australia should be doing the same. Well over one half of respondents (61%) reported being prepared to greatly reduce their energy use to help tackle climate change (61%) and many are psychologically adapting to the threat of climate change and changing their behaviours and lifestyle with respect to reducing their own carbon footprint (Reser, et al., 2012b).

Further information regarding the 2010 and 2011 survey procedures, measures, overall methodology and administration, and associated research program publications can be obtained from Joseph Reser in the School of Applied Psychology, Griffith University, Gold Coast Campus.

Queries relating to this report and research program can be directed to Joseph Reser j.reser@griffith.edu.au or Graham Bradley g.bradley@griffith.edu.au

INTRODUCTION

The present research report and survey findings are part of a larger research program and initiative. Ideally this report would be read in conjunction with the more encompassing research report and monograph which reports and addresses the comparison baseline 2010 national survey findings. While comparisons between the cross-sectional respondent samples of 2010 and 2011 are reported and discussed in the present report, and summarised in particular detail in Appendix B, the previously published companion report (Reser et al., 2012b) explains more fully the larger context and objectives of the research program, and provides a current overview and commentary on relevant national and international studies, sources, and reviews. As well, a full explanation and history of this research initiative and program, and our initial collaborative 2010 research with the Understanding Risk Research Centre at Cardiff University, are explained in detail in the report and monograph (Reser et al., 2012b) which precedes this current 2011 study report.

An important objective of the current report has been to report and present the findings in an accessible a way as possible, along with the items, measures and overall methodology and procedures used, rather than attempt a fuller and more reflective interpretation and discussion of the findings and evident theoretical and policy implications. These latter and important considerations are being addressed in more focused and targeted journal articles.

This continuing research program focus encompasses and addresses:

- The social representation of climate change and natural disasters.
- Public risk perceptions, understandings, and responses to climate change and natural disasters.
- Psychological and social (psychosocial) environmental impacts of the threat of climate change and natural disasters.
- Measuring and monitoring important psychological and social changes in the human landscape in response to the threat and unfolding impacts of climate change.

These objectives have required the establishment of a database, standardised measures and protocols, and a research monitoring program to document important psychological changes and impacting processes, including intra-individual psychological adaptation and extra-individual behavioural and social processes of adaptation and adjustment.

The specific objectives of the 2011 research were to:

- Undertake a second phase national survey a year following the 2010 survey using identical sampling and administrative procedures, as well as standardised items and measures.
- Contribute to and utilise the database established in 2010 to examine important changes that may have taken place with respect to public risk perceptions, understandings and responses to climate change over the eventful 12-month period

between mid-2010 and mid-2011 through cross-sectional group comparisons and longitudinal, within-subject comparisons.

- Further refine items and measures inaugurated in 2010, in order to enhance sensitivity and construct validity, and to progress full scale development of core variables, such as climate change distress and psychological adaptation to climate change.
- Demonstrate ways in which important psychological constructs and variables can be operationalised and credibly measured in the context of a nation-wide online survey using standardised, multi-item, psychometric scales.
- Communicate the importance and relevance of psychological constructs and processes of crucial importance to interdisciplinary climate change science, namely environmental risk perception and appraisal, sense making and causal attribution, associated and ongoing environmental stressors and responses, protection motivation, psychological adaptation and coping processes, the importance and distinctions between direct and indirect exposure and experience, and the nature and extent of current psychological impacts relating to the threat of climate change.
- Provide a companion research report and monograph addressing 2011 survey findings, enabling other researchers, research consumers, and interested community members to have more direct and transparent access to an emerging database and set of national findings relating to public risk perceptions, understandings, and responses to climate change and natural disasters.

While the 2011 survey was not collaboratively linked with any other survey, it included many identical items and measures from the 2010 Griffith survey as well as selected standardised items from two established North American survey programs at Stanford University, theWoods Institute for the Environment, and at Yale Universitiy, the Yale Project on Climate Change Communication (e.g., Krosnick, 2008; Krosnick & MacInnis, 2011; Krosnick & Villar, 2010; Leiserowitz, Maibach, Roser-Renouf, & Smith, 2010a; Leiserowitz, Maibach, & Roser-Renouf, 2010b; Leiserowitz, Maibach, Roser-Renouf, & Smith, 2011a; Leiserowitz, Maibach, Roser-Renouf, Smith, & Hmielowski, 2011b; Leiserowitz et al., 2012a). The strong focus of the 2010 Griffith survey on public risk perceptions, understandings, and responses to climate change and natural disasters remained in 2011, but the importance of our cross-sectional and longitudinal research monitoring program documenting psychological processes associated with psychological changes, adaptations, and impacts was also an important objective and priority in 2011. The second phase of the national survey ran from 15 July to 8 August 2011, with the final sample including 1037 repeat 2010 respondents, and 4347 new respondents constituting an independent, cross-sectional sample. The sampling procedure was the same as that employed in 2010 and the survey was administered through the same service provider, Qualtrics. These substantial respondent numbers allow for sensitive within-respondent comparisons of responses and change scores between 2010 and 2011 for the 1037 repeat respondents, and a quite separate independent group comparisons of findings for the 3096 (2010) respondents and the 4347 new (2011) respondents. The focus of this report is on the responses of new survey respondents in 2011 and respective cross-sectional independent group comparisons between 2010 and 2011.

The 2010 and 2011 surveys included a focus and emphasis on natural disasters and extreme weather events as well as on climate change. A particular objective of the research was to explore the nexus between these arguably inter-related risk domains with respect to public risk perceptions, understandings, and responses. Our principal 2010 research funding was through the Disaster Management National Adaptation Research Plan of the National Climate Change Adaptation Research Facility (NCCARF). A parallel research objective was to explore the nature of *direct* and *indirect exposure* and *experience*, that is, exposure through direct personal experience as contrasted with exposure through multi-media coverage and social/cultural representations of climate change and extreme weather events. These findings relating to respondent direct experiences of disaster warning situations and extreme weather impact events, both over the 12 months preceding the survey and over respondents' lifetimes, are particularly informative. Equally interesting and indeed compelling are current findings with respect to the significance and influence of direct encounters with perceived climate change-related environmental changes and events.

It is useful at this point in time to make a few overview comments about what has been accomplished to date and to provide some indication of where the research program is heading. The project has seen the development of a survey instrument and a set of standardised items and scales addressing psychological and social variables, processes, and impacts relating to climate change and natural disasters. It has also established a national database and research platform for measuring, monitoring, and documenting important psychological changes and impacts over time. The particular focus has been on providing a psychological and social science-based perspective of climate change adaptation and mitigation.

A number of other researchers have adopted and utilised selected items, scales, and other aspects of this survey instrument and research platform in their own Australian, Canadian, and North American research. Research funding was sought and received for a major project broadening the scope of this national exercise to include an examination of climate change adaptation and impacts in a remote region of Queensland and the Northern Territory (e.g., Memmott, Saltmere, & Reser, 2012, NCCARF, Aboriginal responses to climate change in arid zone Australia), and a second substantial project examining further aspects of the current data set with respect to the undertaking of segmentation analyses and targeted public engagement strategies, based on these survey sample segmentation analyses (Hine, Reser, Phillips, Cooksey, Marks, & Nunn et al., 2012, NCCARF, Communication and adapting to climate change). Further research collaborations involving shared data bases are under consideration.

This second report, along with the companion report and monograph reporting 2010 findings, provides a distinctive and valuable examination of multiple psychological variables, processes, and considerations within the context of dramatic geopolitical events within Australia and globally that are relevant to climate change and natural disasters, and through the perceptions, understandings, and experience of individual Australians, who are coming to terms with and adapting to climate change.

DOCUMENTING ADAPTATION AND CHANGE

The nature of the *adaptation* construct and associated processes in the social and health sciences, and the conceptual perspective and set of assumptions underlying adaptation to climate change, would strongly suggest that such adaptation and adjustment takes place *within individuals and their psychological systems*, as well as within communities, organizations, and meta systems (e.g., Reser, Bradley, & Ellul, 2012a; Reser & Swim, 2011). Such adaptation also assumes interdependent interactions or *transactions* (Altman, 1990) between individuals and their physical and social environment and settings. As well, human ecological perspectives, environmental psychological perspectives, and indeed much of social science presumes and addresses the nature and dynamics of human responses and adaptations to environmental threat and change (e.g., Bell, Greene, Fisher, & Baum, 2001; Lever-Tracy, 2010; National Research Council, 1992, 1999, 2010a; Winkel, Saegert, & Evans, 2009). The present research program set out to measure and document important psychological and behavioural changes and impacts taking place in the human landscape in association with the threat and unfolding impacts of climate change and extreme weather events. This report, as with the preceding report and research monograph associated with this research program (e.g., Reser et al., 2012b), examines possible changes relating to theoretically relevant variables, processes, and impacts that might reasonably be associated with the processes of psychological adaptation to climate change.

RESEARCH PROGRAM AND METHODOLOGY

The 2011 survey was the second stage of an envisioned multi-stage national survey and monitoring exercise. The sequenced online surveys and research program reflect a multiphase longitudinal and repeated cross-sectional design (e.g., Menard, 2002, 2008; Newsom, Jones, & Hofer, 2012), using the same respondents when and where available, and a substantial new and independent national sample at each iteration of the survey, allowing for systematic measurement and monitoring of core variables and indicators over time. The research program also approximates a psychosocial environmental impact assessment (PSIA) and monitoring exercise, involving a particular focus on the psychological *impacts of and responses to* the threat and perceived environmental impacts of climate change (e.g., Morrison-Saunders & Arts, 2006; Reser & Bentrupperbäumer, 2001, 2005, 2008). Together these intersecting methodologies provide a particularly informative research avenue for more closely measuring, monitoring, and investigating psychological variables, processes, impacts, and changes associated with psychological (including behavioural) adaptations to the threat and experienced environmental impacts of climate change.

As the 2011 survey was the second iteration of a prior national survey, methodological considerations with respect to item wording, content, instrument design, sampling, and mode of presentation were very similar to and in most instances identical to those of the 2010 survey with these fully described in Reser et al. (2012b). The survey was administered online to panel respondents residing in geographically stratified areas with particular population centres designated. The project used a highly regarded service provider, Qualtrics (Australia), for survey administration, data collection, and initial processing. The survey achieved a broadly representative national sample aged 15 years and older. A substantial review of the literature examined the relative strengths and merits of traditional survey administration methodologies compared with online surveys, with the strong consensus being that well-designed and executed online surveys typically achieve very comparable if not superior results to conventional best practice (e.g., Birnbaum, 2004; Chang & Krosnick, 2009; Rao, Kaminska, & McCutcheon, 2010). The extent, geographic diversity, and logistical challenges which characterise the Australian continent, in the context of a national study of global climate change risk perceptions and responses, also meant that an online survey was the only practical option for an in-depth survey including multiple rating scales, considered responses, and open-ended qualitative response items.

In designing the survey instrument particular consideration was given to item and question framing, and response options, as it was important, where possible and within the constraints of comparability and standardised items, to frame questions in an unbiased way, and to use response formats and scales that had sufficient sensitivity and face and construct validity to allow for a reasonable and defensible *measurement* of responses and the constructs and variables of interest. As the 2011 survey used a number of established psychological measures in addition to those employed in the 2010 data collection, modified in most instances to be climate change specific, this assisted with meeting our objective of being able to measure and document possible changes in risk perceptions and psychological responses to

climate change. In addition to quantitative measures and items, the 2011 survey, as with the 2010 survey, included a number of open-ended items, allowing respondents to provide their own thoughts, feelings, and views with respect to a number of matters, unconstrained by structured response options.

SURVEY SAMPLING AND COMPARISONS

The sampling procedure and ultimate survey sample reflected, in part, the nature of survey panels used by international research survey companies such as the service provider used. Qualtrics was provided with population centre nodes and radiating suburban, peri-urban and rural regions with designated postal codes, and desired participant numbers. These geographically stratified nodes and proximal regions were then used to establish survey invitations to panel members reflecting respondent quota numbers sought. Smaller centres were less likely to have resident panel members, whereas larger towns and cities had much larger numbers of available panel members. This meant that respondent numbers for smaller centres in regional Australia had few respondents. Hence, this was a national survey with the above mentioned caveats and limitations. Queensland was strategically oversampled as a number of climate change-related research projects are in train, and the geographic heterogeneity of Queensland along with the diversity of population centre sizes and locations made Queensland an ideal State-based survey catchment. While the population of Queensland represents 20% of the Australian population, Queensland respondents (917) represented 30% of the survey sample in 2010 and 22% of the survey sample in 2011.

This report contains findings comparing the independent sample of 2011 (n = 4347) with the 2010 respondents (n = 3096), providing for a particular type of study and analysis of changes. Proportions of male and female respondents were very similar (46%/47% male; 54%/53% female respectively). The age profile of Australian respondents in 2010 was (<35, 26%; 35-54, 42%; 55+, 32%), with the corresponding profile for 2011 respondents being (28%, 44%, 28%), Seventy-five percent of respondents in 2011 reported living in urban or suburban areas, with a further 14% living in a country town, and remaining respondents residing in rural areas. The 2010 comparison figures were 70%, 17%, 13% respectively.

The principal focus of the current report is on the initial statistical analyses of our quantitative data relating to the new respondents undertaking the national survey in July and August 2011, and comparisons with findings for our corresponding 2010 national sample. The 2010 *and* 2011 findings, however, are seen to provide the real 'database' moving forward, with 2010-2011 comparisons of primary interest with respect to measurement and procedure, validation and refinement, rather than the documentation of clear changes and impacts over this brief and single temporal period. See Appendix C and H for a full listing of the composite measures for the 2011 cross-sectional survey protocols.

These comparison figures and scores are for the two independent, 'cross-sectional', samples of respondents, from mid-2010 and mid-2011. They are not *change scores,* as different individuals and samples are involved. However, they do provide an overall and approximate indication of possible population changes. True change scores for individuals,

and at a group level, are available for the additional group of repeat respondents, that is, for those 1037 respondents who completed both the 2010 and 2011 surveys. The repeat respondent longitudinal data set and comparisons will provide the basis for a separate report. Virtually all reported climate change surveys in Australia and overseas reporting comparative findings over time have been cross-sectional, using independent samples of respondents, with several notable exceptions (e.g., Leviston & Walker, 2011). Presentation of cross-sectional data findings for 2010 and 2011 in this report thus makes comparisons with other reported survey findings much easier and more meaningful.

MEASURES

The 2010 and 2011 surveys included 24 multi-item psychological measures/scales including existing but modified psychological scales specific to climate change or disaster events, and composite scales comprising selected and convergent survey items which together address and measure a particular construct, such as 'residential exposure and vulnerability' and 'felt personal responsibility and willingness to act'. (Refer to Table 1). All such scales were examined and where necessary modified with respect to psychometric integrity. The inclusion of such scales allowed for more sensitive measurement of important psychological variables and processes of theoretical relevance to climate change perceptions, understandings, responses, and impacts, and enabled the use of multivariate statistics and modelling analyses. (Further information is provided in Appendices C and H).

Table 1. *Composite Measures for 2011*

Variable	Illustrative item
Residential Exposure and Vulnerability	How vulnerable do you think the region where you live is to the impacts of climate change?
Objective Knowledge	Australia's average temperature has increased by approximately 1°C from 1910 to 2002.
Connection to Nature	I often feel close to the natural world around me.
Green Identity	I think of myself as someone who is very concerned with environmental issues.
Trust	I trust the Australian Government to take appropriate action against climate change.
Indirect (Media) Exposure	How often in the past six months have you obtained information about climate change from… newspapers?
Belief in Climate Change	I am certain that climate change is happening.
Control– Pessimism	The progression and consequences of climate change are now past the point of turning things around and exercising human control.
Control-Collective Efficacy	World governments and scientists, working together, can greatly influence the longer term impacts of climate change.
Climate Change Normative Influence	My friends take positive steps to reduce their contributions to climate change.
Coping-Help-Seeking	If you think about how you are responding to and dealing with the prospect and consequences of climate change, to what extent would you say you are using or relying on each of the following strategies? Seek out others for comfort; Get advice from someone about what can be done to address climate change ...
Coping-Positive Reframing	If you think about how you are responding to and

	dealing with the prospect and consequences of climate change, to what extent would you say you are using or relying on each of the following strategies? Focus on the positive aspects of the problem; Look for the good in what is happening...
Coping-Denial	If you think about how you are responding to and dealing with the prospect and consequences of climate change, to what extent would you say you are using or relying on each of the following strategies? Avoid thinking about climate change; Refuse to believe that climate change is occurring.
Motivation to address Climate Change	I want to change my lifestyle in ways that help to address climate change
Traumatic Exposure Severity Scale	We would now like to ask you some questions based on the most personally significant extreme weather or natural disaster situation you have experienced…Were you physically injured in the disaster?
Neuroticism	I see myself as someone who…is depressed, blue
Climate Change Concern	How concerned, if at all, are you about climate change, sometimes referred to as 'global warming'?
Risk Perception	Climate change will have a noticeably negative impact on my health (over the next 25 years).
Distress	At times I find myself thinking and worrying about what the world will really be like for future generations because of climate change.
Felt Personal Responsibility and Willingness to Act	I feel a sense of urgency to change my behaviour to help to reduce climate change.
Cumulative Adverse Experience	…please indicate the type of event(s) and the approximate number of times you have experienced each type of event during your lifetime, including the past 12 months…cyclone, bushfire, drought, flood, other
Self-efficacy	I can personally help to reduce climate change by changing my behaviour.
Psychological Adaptation	I have often discussed my thoughts and feelings about climate change with others over the past several years.
Behaviour	What actions are you currently taking to reduce your carbon footprint? (e.g., recycling, using less water)

It should also be noted that a number of the psychological variables are dispositional, that is, they are longer term and often more personality-based characteristics of individuals which are unlikely to change appreciably over relatively short periods of time. These would include such variables as green identity, connection to nature, coping style, and neuroticism. Other variables which might normally be considered dispositional variables, such as self-efficacy, adaptive capacity, and optimism/pessimism, have been defined and measured in the context of climate change in this research, and are thus more likely to be subject to changes as perceptions of, or experience with, climate change or extreme weather events change. A further set of individual difference variables relate to cumulative lifetime experience and exposure, such as prior experience with natural disasters. Other variables are much more current situation and circumstance dependent, and one might expect that these could well change with changing events and circumstances over time. These variables include objective and subjective knowledge, trust, acceptance of climate change, concern about climate change, experienced distress at the implications of climate change, felt personal responsibility, and motivation to take action.

These differences in survey variables types and their operationalised survey measures are important as there was an expectation that some of these latter parameters might have changed appreciably over a very eventful 12-month period, while other dispositional variables were not expected to evidence change. An important objective of the current research has been to consider and trial variables and appropriate measures that might be sensitive to changes in public risk perceptions, understandings, and responses to climate change and natural disasters, and to possible psychological impacts of climate change, and to ascertain whether salient and/or important changes might have in fact taken place over the 12-month period between mid-2010 and mid-2011.

The 2010 and 2011 national surveys have as their primary purpose the establishment of a robust database for further strategic and systematic monitoring and documentation of important changes over time, with 2011 data and findings validating and refining procedures and measures.

RESEARCH FINDINGS

The following report selectively presents and examines the 2011 research findings. All 2010 survey findings were extensively reported in the companion research monograph and report (Reser et al., 2012b). Comparison descriptive statistical findings by individual survey items, including rating scale distribution frequencies, for both 2010 and 2011, are found in Appendix B, with item numbers corresponding to the 2011 survey instrument. Appendix B is particularly helpful when reading through the findings which follow. Appendix B contains items and scales introduced in the 2011 survey, and for these items only 2011 results are reported. Appendix C and H provide more detailed information concerning the psychological measures used in the surveys. Correlational findings for the 2011 and 2010 data sets are found in Appendices E and F. Regression analyses results and structural equation modeling results are provided in the body of the report. The order of coverage and the headings in this section of the report generally follow the sequencing of items and measures in the survey instrument, but with some inter-related items covered under common headings.

THE MOST IMPORTANT PROBLEM

The initial question in the 2011 survey is one form of a generic question that has come to be known as the "most important problem question" in the environmental and political survey research literature. This was, **"What do you think will be the most serious problem facing the world in the future if nothing is done to stop it?"** (#1) The question was included, in part, as it addresses a commonly reported finding with respect to public risk perceptions and views concerning climate change, namely that, as an environmental, social, or political problem or issue, climate change is often found to be relatively low down the list of important problems facing a country or the world. This research literature, however, reflects a perennial issue in such question framings and responses, namely, that the ultimate rank ordering of climate change is strongly influenced by the wording of the survey item and its response framework (e.g., Yeager, Larson, Krosnick, & Tompson. 2011a).

Given the sample size (n = 4347), the open-ended nature of the item, and time considerations, a subsample of the first 1000 respondents was used to generate a rank ordering of responses that could be compared to other international survey research findings. In line with established convention, only the first problem mentioned by each respondent was coded (Yeager, Larson, & Krosnick, & Tompson, 2011b). Table 2 presents the relative frequencies rank-ordered by response category. It is clear that when the most important problem question is framed in this way, the category of 'climate change/the environment' responses far outnumber any other problem category, constituting 39% of all responses. The next most frequently mentioned problems were overpopulation (13%), poverty/hunger (11%), the economy/unemployment (5%), terrorism (4%), and peace/war (3%).

In studies systematically examining and comparing 12 differently framed versions of the most important question in the United States, Yeager et al., (2011a) found that the question framing used in this current survey resulted in 'global warming/the environment'

responses accounting for 25% of the responses (2009, *n* = 906, internet national survey platform), with 'the economy/unemployment' and 'terrorism' being the next most frequent responses, each constituting 10% of the responses overall. It is noteworthy that the relative percentage of climate change responses for Australian responses, 39%, is considerably higher than in the case of American respondents (25%).

Clearly the surveys were undertaken in two very different countries, and two years apart, 2009 and 2011. And without doubt the relative salience of problems differed in these two countries, with the economy/unemployment, for example, being rarely mentioned by Australian respondents. Yet these comparison figures of 39% (Australia) and 25% (U.S.) for 'climate change/the environment' responses, while being the most frequent response category in both cases, are notably different. Climate change specific survey findings for Australia and the United States over the past few years are actually not very divergent with respect to acceptance of climate change, and public risk perceptions and concerns (e.g., Leiserowitz et al., 2010a, 2010b, 2011a, 2011b; Rabe & Borick, 2010; Reser et al., 2012b), but this comparison of responses suggest that, relatively speaking, climate change and environmental problems are viewed as a particularly salient and interlinked problem and risk domain in Australia.

Table 2. *Percentages of Australian and U.S. Respondents Endorsing each of Several Options as the Most Important Problem*

Problem	What do you think will be the most serious problem facing the world in the future if nothing is done to stop it?	
	Australia 2011	**U.S. 2009**
Global warming/the environment	39.4%	25%
Overpopulation	13.4%	5%
Poverty/hunger	11.5%	3%
The economy/unemployment	5.3%	10%
Terrorism	4.0%	10%
Peace/war (in general)	2.7%	5%
Government/politics	1.4%	5%
Energy issues	1.4%	4%
Crime/drugs	1.3%	3%
Money/cost of living	1.1%	4%
Morals/values	1.0%	3%
Debt/government spending	0.6%	2%
Disease/AIDS	0.6%	1%
Income distribution	0.6%	-
Nuclear weapons	0.4%	2%
Health care	0.3%	5%
National security	0.1%	-
Social security	0.1%	-
Racism/prejudice	0.1%	2%
Socialism/liberalism	-	2%
Iraq/Afghanistan	-	-
Education	-	-
Other (e.g., end of the world, lack of resources, water issues, religious/ideological conflict, refugees, genetically modified organisms, wrath of God, greed)	14.7%	4%

All responses were coded into existing categories established by the Stanford University Research Group (Yeager et al., 2011b).

A differing version of the Most Important Problem question was used by the ANUpoll in September of 2011 (n = 2001) (McAllister, 2011), "What do you think is the most important problem facing Australia today?" With this framing, and some six weeks

following the Griffith 2011 survey, the rank ordering of most important problems was: economy/jobs (22.1%), better government (17.6%), immigration (15.8%), and environment/global warming (9.8%), poverty/social inclusion/inequality (3.8%), carbon tax (3.8%), plus 24 other less frequently mentioned categories. When followed by a second Most Important Problem question, "And what do you think is the second most important problem facing Australia today?", the top four categories were again economy/jobs (14.7%), immigration (14%), environment/global warming (9.0%), and better government (8.1%). It is interesting that carbon tax fell to 3.9%, at 9th place. This Australian National Institute for Public Policy survey finds that environment/global warming is the fourth and third most important problem facing Australia today (in September 2011). Nonetheless, using what is the most comprehensively researched version of the Most Important Problem question in the current Griffith survey, the category of 'climate change/the environment', at 39%, was three time more frequent than the next most frequent response (overpopulation).

ENERGY FUTURES

ALTERNATIVE ENERGY SOURCES

While attitudes to alternative energy sources reported by these two national samples between mid-2010 and mid-2011 evidenced modest shifts, the overall profiles were very similar, with sun/solar power continuing to be the most favoured energy source for both samples, although its favourability slipped slightly (see item #2). Wind power was the second most favoured energy source for both samples, with hydro-electric power third. Gas went from fourth most favoured energy source in 2010 to fifth in 2011. The rating of biomass-sourced energy improved modestly from 2010 to 2011, and while gas remained steady, it shifted from fourth (in 2010) to fifth favoured energy source in 2011. Coal went from seventh rating in 2010 to sixth in 2011, reflecting a slight increase in preference. It is noteworthy that the rated favourability of nuclear power dropped significantly from a ranking of sixth in 2010 to the least favoured of energy sources (eighth) in 2011. Overall, these results suggest some real but very modest changes over this 12-month period, during which the political debate about a carbon tax and renewable energies was heated, and the acceptability of nuclear power was badly tarnished by the earthquake and tsunami-triggered Fukushima power plant failure (e.g., Aldhous, & Marks, 2012; Marks, 2011).

NUCLEAR POWER

When asked specifically about the benefits and risks of nuclear power generation in Australia, there were modest but very significant differences in views between our independent 2010 and 2011 national samples (#3). In 2011, 28.2% of respondents thought that the benefits of nuclear power outweighed the risks, as compared with 36.4% in 2010. Similarly, 52.3% of respondents in 2011 reported being of the view that the risks of nuclear power outweighed the benefits, as compared with 42.4% in 2010. It is more than likely that the Fukushima Daiichi disaster as a result of the earthquake and tsunami in Japan on 11 March 2011 profoundly influenced public views around the world about the risks versus the benefits of nuclear power plants, notwithstanding the counterarguments and mix of risks and benefits associated with coal-fired plants (Wallard, Duffy, & Cornick, 2012).

As was the case for the previous question, the respective level of support for and opposition to the construction of nuclear power plants is clear, but shifting. When respondents were asked to indicate whether they favoured or opposed the construction of nuclear power stations in Australia, a greater number of respondents were opposed in 2011, 57% as contrasted with 48% in 2010 (#4). Twenty-seven percent of respondents in 2011 were in favour, as compared to 37% in 2010. These levels of support differed significantly by year ($p < .001$).

VOTING INTENTION AND CLIMATE CHANGE POLICIES

The survey item relating to relative support/or opposition to energy futures in Australia was, "**If you were to vote on the following matters today, how do you think you**

would vote?" (#16). This reflected an important collaborative component of the joint national survey exercise with Cardiff University in 2010. Support or opposition was framed in terms of how respondents would vote in the context of the energy policy initiatives described. Respondent opposition to the building of new nuclear power stations in Australia was much stronger in 2011 than in 2010. Forty-one percent of 2011 respondents indicated they would 'definitely vote against' such a policy initiative, as compared with 26.6% of 2010 respondents, with overall opposition versus support being 58.9% opposed to, and 30.2% supportive of, with the remaining respondents selecting 'would not vote', 'no opinion', or 'don't know'. This was reflected in significantly different mean ratings of $M = 2.03$ (2011) and $M = 2.36$ (2010) on an effective 4-point scale, with a rating of 1 reflecting a definite voting intention against the policy initiative, and 4 reflecting a definite voting intention for such an initiative.

Findings with respect to the building of new wind farms in Australia in 2011 were very similar to 2010 findings. Only 3.5% of respondents indicated that they would definitely vote against such an initiative, and 58.5% reported that they would definitely vote for such an initiative. Overall opposition was 8.3% and overall support was 86.5% in 2011, as compared with 4.3% opposition and 92.1% support in 2010. The mean rating difference of $M = 3.49$ (2011) and $M = 3.65$ (2010) was modest but significant ($p < .001$), reflecting a slight drop in what was and continues to be very strong support for, and very weak opposition to, the policy initiative of building new wind farms in Australia.

The next two matters addressed are perceived to be vexed issues with respect to public motivations and climate change policies (#17). When respondents were asked to indicate their extent of agreement with the statement, "**I am prepared to greatly reduce my energy use to help tackle climate change**", 61% of 2011 respondents either 'strongly agreed' or 'tended to agree'. This was slightly less than the corresponding 64% proportion of 2010 survey respondents. However, nearly two-thirds of survey respondents reported that they were in reasonable agreement with such a sentiment. Survey responses to the statement, "**I am prepared to pay significantly more money for energy efficient products**" were less supportive of energy conservation. Indeed the virtually identical but modest proportions of respondents who either 'strongly agreed' or 'tended to agree' were 23.5% in 2011 and 23.2% in 2010.

BELIEF IN CLIMATE CHANGE

Important survey items related to climate change beliefs, risk perceptions, and understandings. The most central and determining of these is arguably respondent acceptance, or belief in the reality of contemporary climate change. While survey items reflect the prevailing use of 'belief' in this climate change context, for communication clarity and comparison reasons, *acceptance* of the reality of this current phenomenon and risk better reflects and captures the cognitive and emotional processes and responses involved, and the manner in which the risk is presented and communicated by most social representations of climate change (e.g., Deaux & Philogene, 2001; Wagner & Hayes, 2005). It is also arguable that the complex global phenomenon, convergent issues, and risk domain of climate change is not very comparable to, or commensurate with, conventional attitudinal or belief 'objects' (e.g., Crano & Prislin, 2008; Eagley & Chaiken, 1993). In the context of a survey such as this, and given the research focus on public response to *the threat* of climate change, it is worth noting that many questions about climate change are premised on a presumption that respondents accept that the threat and/or phenomenon of climate change is 'real'. In the world of perceived or subjective risk and exposure, this 'real or not real' quandary is a natural aspect of risk or threat perception and appraisal; one appraises the credibility or substance of a threat, as well as matters of seriousness and vulnerability if the danger is deemed to be 'clear and present' (e.g., Breakwell, 2007; Tulloch & Lupton, 2003).

In the context of belief about climate change we enter a more complicated realm of politics, party affiliation, vested interest agendas, often slanted media coverage, and differing notional and objective climate change impact exposures across Australia (e.g., Dunlap & McCright, 2008; McCright & Dunlap, 2011a, 2011b; Pew Research Center, 2012). Hence, depending upon context, asking a question about belief in climate change can be interpreted, as a question about one's values, trust in science, political views and affiliation or in-group/out-group status. Notwithstanding the complexities of the phenomenon, the threat, and the convergent and contested issues associated with climate change, it has been very important to document as accurately as possible where survey respondents 'stand' on this matter of belief or acceptance of the threat of contemporary climate change.

The question, "**As far as you know, do you personally think the world's climate is changing?"** is one of the most direct questions addressing the matter of belief or acceptance of the reality of climate change (#6). There was virtually no difference between the 2011 respondent sample and 2010 respondents in their acceptance of climate change, with 74.2% of 2011 respondents and 73.9% of 2010 respondents reporting that, yes, they thought that the world's climate was changing. It should be noted that this is an arguably conservative question framing and finding, as the respondent must rely on their *own knowledge* and appraisal, and are asked for their *personal* thoughts. Hence this interpretation, along with other belief/acceptance item findings, including that relating to causal attribution, would suggest that acceptance levels are actually substantially higher than these figures would indicate.

COMPOSITE MEASURE OF BELIEF

The matter of public *belief in or acceptance of climate change* was examined through a number of separate items throughout the survey. When these items are brought together in the context of a composite measure of belief or acceptance of the reality of climate change, and mean sample scores compared across the 12-month interval of the study, it would appear that acceptance of climate change fell slightly in 2011, with the mean score of 15.9 in 2010 falling to 15.6 in 2011 ($p < .01$) (possible range 4-20). There is reasonable evidence and a cogent argument to the effect that media coverage of a contested political issue such as climate change can substantially influence public beliefs and concerns (e.g., Brulle, Carmichael, & Jenkins, 2012). Such arguments and evidence provide a very plausible explanation for this finding. It should be noted, though, that this modest change does not diminish the very strong survey findings overall with respect to respondent acceptance that climate change is indeed happening.

The matter of public acceptance of the reality of a profoundly consequential change in the world's climatic patterns is of course of particular importance in the context of this contested environmental, political, and social issue; hence the importance of carefully measuring and monitoring public understandings and responses to this dramatic global threat. A fuller treatment of belief/acceptance as a construct, and reference to relevant literature is in Reser et al. (2012b).

The Australian results are very similar to figures reported for North American and Britain social science based surveys, which fluctuate around 72% of respondents, with, for example, quite high (19%) 'don't know' responses in the case of the frequently cited Yale Center for Climate Change Communications findings (e.g., Leiserowitz et al., 2010a, 2010b).

The Griffith survey figure of 74% is very similar to that reported by a Commonwealth Scientific and Industrial Research Organisation (CSIRO) survey undertaken in late 2010 by Ashworth and her colleagues (Ashworth, Jeanneret, Gardner, & Shaw, 2011). They reported that 78% of their respondents from a sample of 1602 indicated their belief that climate change was real. This figure is also virtually identical with more recent CSIRO national survey findings for reported belief that climate change is happening (77%) (Leviston & Walker, 2011).

SCEPTICISM

'Belief' in climate change is arguably a rather odd notion, given the multiple meanings and referents of climate change (threat, change in greenhouse gas concentrations in atmosphere, human consequences, human causality, political party affiliation, etc) and the meaning of 'belief', but this has been the language used in both public discourse and by survey researchers to frame such questions. In the present context we have followed suit both for comparison purposes, and because it was necessary in the context of other questions to ascertain whether respondents accepted this contested phenomenon and threat as real. As indicated in the previous discussion of belief, framing the matter of acceptance or non-acceptance of climate change as a matter of belief, rather than as a risk perception and appraisal, relating to an actual threat or altered condition of Earth's current climate systems has a number of associated logical and theoretical problems. That climate change is also a contested and polarising political issue further exacerbates conceptual fuzziness and respondent as well as measurement confusion. Asserting one's belief or non-belief in the 'reality' of this threat and phenomenon can be, and clearly is, seen as a salient matter of political party identification and affirmation, and values and world view expression (e.g., Leiserowitz et al., 2010a, 2010b, 2011a, 2011b; McCright & Dunlap, 2011a, 2011b; Milfont, Harré, Sibley, & Duckitt, 2012; Schwartz, 1992). A further complexity is that the matter of belief in climate change is often implicitly framed and understood, not simply as a matter of acceptance of the phenomenon or risk, but as a matter of perceived scientific acceptance and consensus, and/or a questioned credibility of scientists (e.g., Jacques, Dunlap, & Freeman, 2008; Lewandowsky, 2011; Lewandowsky, Gignac, & Vaughan, 2012; Oreskes & Conway, 2010; Stocking & Holstein, 2009).

Given the importance attributed to public acceptance of the reality of anthropogenic climate change, the complex nature of these climate processes and impacts, the questioned credibility of climate change science and scientists, and relative near term and longer-term risk, the 2010 and 2011 surveys addressed respondent perceptions and beliefs with a number of differing but convergent questions. This was done in as simple and standardised a way as possible, while still allowing for a more in-depth analysis of underlying public understandings and views. The procedure allowed for a consideration of question framing, and response option effects, and for the reasonably unambiguous identification of respondents who could be characterised as de facto climate change disbelievers or strong sceptic. Table 3 summarises findings from differing questions relating to acceptance or belief in 'climate change' and provides individual item differences in response distributions, which produce the differing estimates of scepticism on a proportional basis. As already noted, there is basically no difference between the 2010 and 2011 samples in acceptance levels that climate change is taking place (#6), with this conservatively framed question achieving 74% agreement. In 2011 a greater proportion of respondents 'strongly agreed' with the statement "**I am certain that climate change is really happening**", moving from 30.8% to 33.2%, or one third of all respondents. At the same time the proportion of those who 'strongly disagreed' with this statement, went from 4.7% in 2010 to 7.3% in 2011. These findings reflect a 'firming up' of personal views on this and other matters for many respondents. With

respect to causal attributions for ‘climate change’ (#7), the proportion of respondents endorsing the statement that “climate change is entirely caused by natural processes” went from 4.9% in 2010 to 6.6% in 2011, while the proportions endorsing the statement that “climate change is entirely caused by human activity” stayed virtually the same at, 4.2% and 4.1% respectively. The proportion of respondents who see climate change as reflecting both human and natural causes, with varying relative emphases, shifts moderately, going from 86.0% to 82.9%. This is reasonably explained by the increased proportion of respondents agreeing with the “entirely caused by natural processes” statement option. With respect to judgments of when Australia will start feeling the effects of climate change, 50% (#12) of 2011 respondents compared with 54% of 2010 respondents agreed that “We are already feeling the effects.” The percentage endorsing the response option “Never” went from 5.5% in 2010 to 8.0% in 2011, again suggesting that a small proportion of uncertain but sceptical respondents may have reduced their uncertainty about climate change and projected impacts by shifting from a position of moderate scepticism to dismissal. That 74% of our respondents in 2010 and 2011 said ‘yes’, “that they thought the world’s climate is changing”, and that a further 8% of respondents did ‘not know’, is nonetheless a strong statement of majority *acceptance*.

Table 3. *Relative Findings from the Four Criterion Items Relating to Beliefs Concerning 'Climate Change'*

Q6. As far as you know, do you personally think the world's climate is changing?		
	2010 %	2011 %
Yes	73.9	74.2
No	18.2	18.2
Don't know	7.8	7.6

Q10a. To what extent do you agree or disagree with each of the following statements about climate change?

		Strongly agree %	Tend to agree %	Neither agree nor disagree %	Tend to disagree %	Strongly disagree %	No opinion %	Don't know %
*I am certain that climate change is really happening	2010 %	30.8	40.6	12.2	10.1	4.7	0.3	1.2
	2011 %	33.2	36.2	11.8	9.7	7.3	0.6	1.2

Q7. Thinking about the causes of climate change, which, if any, of the following best describes your opinion?

	2010 %	2011 %
a)Climate change is entirely caused by natural processes	4.9	6.6
b)Climate change is mainly caused by natural processes	12.6	13.8
c)Climate change is partly caused by natural processes and partly by human activity	45.8	43.9
d)Climate change is mainly caused by human activity	27.6	25.2
e)Climate change is entirely caused by human activity	4.2	4.1
f)I think there is no such thing as climate change	2.7	4.2
g)Don't know	1.9	1.5
h)No opinion	0.4	0.8

Q12. When, if at all, do you think Australia will start feeling the effects of climate change?

	2010 %	2011 %
We are already feeling the effects	54.0	50.0
In the next 10 years	9.2	7.8
In the next 25 years	7.5	6.7
In the next 50 years	4.5	4.7
In the next 100 years	2.3	3.3
Beyond the next 100 years	2.6	5.0
Never	5.5	8.0
Don't know	12.9	12.6
No opinion	1.5	1.9

[1]Stringent classification as disbeliever or strong sceptic was determined by highlighted responses to the four questions, with this operationalisation including all respondents who answered 'no' to question #6, and selected either 'a' or 'f' to question #7, either 'strongly disagree' or 'tend to disagree' to question #10a, and selected 'never' in response to question #12. The more inclusive (less stringent) 6.5% (2010) or 8.5% (2011) figure was calculated on the basis of a no response to question #6, and 'disbeliever' or 'strong sceptic' responses to two of the three remaining belief questions (#7, #10a, #12).

The 2010 survey findings across items suggest what initially appears to be appreciable inconsistency, varying from a 7.6% strong sceptic or disbeliever (combined) count in response to endorsement of either #7a or 7f (item #7) to an 18.2% strong sceptic or disbeliever response to question #6. This demonstrates the powerful framing effects of differing question wordings and response formats (e.g., Schwarz, 1999; Singer, Couper, Raghunathan, Antonucci, Burmeister, & Hoewyk, 2010; Tourangeau, Rips, & Rasinski, 2000). Notwithstanding that 71.4% of Australian respondents either 'strongly agreed' or 'tended to agree' with the statement, "**I am certain that climate change is really happening**" (#10a), while only 4.7% strongly disagreed', the actual percentage figure for those identified as not accepting the reality of climate change is marginally greater. When "strong scepticism or disbelief" is operationalised in terms of responses to questions #6, #7, #10a, #12, and requiring a consistent disbelief or sceptical response for each of these four items, the proportion of such respondents is 3.04%, or 94 individuals. When a less stringent criterion is adopted, requiring a 'no' response to question #6, and a non-belief or sceptic response to at least two of the three questions #7, #10a, and #12, the proportion of survey respondents who could be characterised as disbelievers or strong sceptics becomes 6.5%, or 202 individuals. It is noteworthy that just under two thirds (65%) of the 202 respondents in 2010 identified as sceptics were males, a finding that is consistent with the emerging picture of conservative white males sharing a distinctive and system-justifying world view contributing disproportionately to levels of climate change denial in countries such as the United States (e.g., Feygina, Jost, & Goldsmith, 2010; McCright & Dunlap, 2011a). What appears to be the case for disbelievers and strong sceptics, on the basis of our own and other research findings, is that these views are strongly held and closely associated with self-perceptions, world views, and value stances (e.g., Dunlap & McCright, 2010; Krosnick, 2010; Krosnick & Villar, 2010). The influence of such discrepant and polarised beliefs on survey means and overall statistics can be appreciable.

On the basis of 2010 survey responses (n = 3096), and the operationalisation of scepticism explained above, it was suggested that 3.0% or 94 individuals meet a more stringent criterion for genuine scepticism, while 6.5% or 202 individuals meet a very inclusive criterion. In the context of the 2011 survey sample (n= 4347), and using the same operationalisation of scepticism, 4.7% or 204 respondents meet the stringent criterion for genuine scepticism and 8.5% or 370 individuals would meet the less stringent criterion for scepticism. Estimates of strong scepticism or disbelief of the reality of climate change from other researchers in Australia based on national survey responses have varied from 5.6% to 7.0% (e.g., Ashworth et al., 2011; Leviston & Walker, 2010, 2011).

Given the importance associated with climate change scepticism and denial in media coverage, and public discourse, we would like to make it very clear that this seeming and very modest elevation of climate change scepticism in this most recent survey may well reflect a number of possible factors other than substantive change in acceptance of climate change. These include a frustrated *dismissal* of the issue by those who are 'over' following what at times seems a media-driven and pointless debate, and/or a less conscious simplification and uncertainty reduction for some which has associated protection-motivation

(i.e., anxiety reducing) benefits. Alternatively, there is the real possibility that the 2010 and 2011 independent samples were in fact different from each other in a number of ways, and while they still constitute reasonable comparison and reference groups, these differences might provide a cogent alternative explanation for any differences found. Hence, the real and dynamic population parameter with respect to scepticism as operationally defined by convergent survey items in this and similar research is very probably around 7%. When similar emphasis is given to the proportion of respondents who *accept* that climate change is a contemporary reality and a matter of appreciable concern, then the comparison percentages are far more meaningful, with over 75% of Australian, and North American and European survey samples clearly accepting that climate change is a very real phenomenon and threat.

RISK PERCEPTION AND APPRAISAL

While many surveys addressing climate change use the language and constructs of *public opinion*, *attitudes*, *beliefs*, and *concerns*, the matter at issue is also clearly one of *risk perception*, as what is being addressed is a seemingly profound risk and threat. This framing of climate change in 'risk' and 'perception' terms emphasises the importance and relevance of the interdisciplinary risk literature (e.g., Fischoff, 1995; O'Riordan, 1995; Pidgeon, Kasperson, & Slovic, 2003; Sjöberg, 1987, 2006; Slovic, 2000, 2010) and the fact that what is being addressed are human perceptions and judgments of the nature, magnitude and possible implications and consequences of this threat and risk domain. Unfortunately the survey research literature addressing public perceptions and responses to climate change in risk perception terms is modest, while the numerous alternate framings and constructs, include attitudes, opinions, beliefs, concerns, threat appraisal, subjective exposure, and experienced vulnerability. An implicit distinction between risk perception and concern is that risk perception and appraisal relates more specifically to information processing and sense making relating to an *external threat*, *phenomenon*, or *situation* whereas concern relates more directly to *one's psychological responses* to the risk or threat appraisal of the perceiver (e.g., Reser, 2010).

Conceptualisations of risk as analysis and risk as feeling underscore the distinction between perceptual judgment and experiential response (e.g., Loewenstein, Weber, Hsee, & Welch, 2001; Slovic, 2010; Slovic, Finucane, Peters, & MacGregor, 2004). While a decision was made to more strongly focus on public concerns about climate change in terms of a more detailed consideration of psychological responses and impacts, the survey nonetheless included an existing 6-item measure of 'climate change risk perception' (Kellstedt, Zahran, & Vedlitz, 2008). See Appendix C and H. It also addressed several more applied and theoretical avenues relating to threat appraisal within the context of coping and adaptation, and with respect to the socially and culturally constructed nature and content of the 'risk domain' of climate change.

Clearly responses to the Most Important Problem Question (#1) indicate that the environment and climate change constituted the most important and salient problem category for survey respondents. This was similarly the case for climate change concern, across a substantial number of survey items (#s 5, 8, 9, 12, 13, 14, 15, 19, 20, 50, 51, 55). In #s 8 and 9, for example, climate change was considered to be a serious problem for Australia 72% (2010) and the world 76% (2011), down from 78% and 73% in 2010. The fact that 50% respondents in 2011 and 54% of respondents in 2010 felt that Australia was already experiencing the effects of climate change, with this risk appraisal rising to 65% and 71% in the next 25 years for 2011 and 2010 respondents respectively (#12), suggests that the threat, for many, had become reality. Responses to residential vulnerability tell a similar story with respect to subjective exposure and vulnerability (#s 13b, and 50, 51, 63). The risk perception scale findings (#55a-e) support the above, both with respect to perceived likelihood and seriousness of the climate change risk. In the case of this multi-item measure, no significant difference was found between 2010 and 2011. Risk scores on this measure (Kellstedt et al.,

2008) in 2011 evidence strong associations with concern (r = .75), distress (r = .66), belief/acceptance (r = .63), psychological adaptation (r = .63), responsibility (r = .61), self-efficacy (r = .60), objective knowledge (r = .49), and behaviour (r = .46). (See Appendix E) With individual risk perception items, the pattern across 2010 and 2011, consistent with other findings, was one of modest but significant decreases in perceived/appraised risk, though not in the case of Kellstedt et al.'s scale. No significant difference was found for risk perception across the 12-month period of the research with the mean score in 2010 (18.94) being very close to that found in the 2011 survey (18.88) (possible range 5–30).

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CONCERN

The initial and very direct survey question relating to public concern about climate change (#5) was, "**How concerned, if at all, are you about climate change, sometimes referred to as 'global warming'?**" This item addressed a core variable and indicator relating to psychological response to the threat and phenomenon of climate change. Concern is also an appropriate and sensitive measure and indicator of psychological impacts in the context of environmental threat, changes, and impacts (e.g., Reser & Bentrupperbäumer 2001, 2008). The proportion of 2011 respondents reporting being 'fairly' or 'very' concerned was 63.8%, as compared with 66.3% in 2010. Mean ratings of climate change concern were modestly but significantly different $M = 2.84$ (2010) and $M = 2.77$ (2011), $p < .01$, with the higher rating indicating greater concern. Hence reported concern about climate change was marginally lower in 2011, though still high, with almost two thirds of respondents selecting 'very concerned' (25%) or 'fairly concerned' (39%).

Additional items directly relating to climate change concern included two statements, one worded in terms of *personal* relevance, and one in terms of *societal* relevance (#14, #15): "**Considering any potential effects of climate change that might affect you personally [that there might be on society in general], how concerned, if at all, are you about climate change?**" While mean reported concern levels that might affect respondents *personally* were slightly but significantly less ($p < .01$) in the case of 2011 respondents, the proportions of respondents reporting being 'very concerned' were identical in both surveys (19.6%), and the proportion of those reporting being 'fairly concerned' was only slightly higher in 2010 (42.2%) than in 2011 (38.7%). Nonetheless, 10.7% of 2010 respondents reported being not concerned at all, whereas this proportion was 15.6% in 2011.

When considering responses to the similar item relating to *society* in *general*, there was again no appreciable difference between the proportion of respondents reporting being 'very concerned' in 2010 (25.8%), and in 2011 (25.3%), but the proportion of respondents selecting 'fairly concerned' was higher in 2010 (42.8%) than what was found in 2011 (39.3%). Again, while 8.7% reported being 'not at all concerned' in 2010, 13.8% of respondents selected this response in 2011. Overall mean concern ratings dropped from $M = 2.87$ in 2010 to $M = 2.78$ in 2011, with this very modest change being significant ($p < .01$) and noteworthy. Just over two thirds of respondents reported being 'very' or 'fairly concerned' about the potential effects of climate change for society in general in 2010, with slightly less than two thirds of respondents selecting these two alternatives in 2011. There are, of course, a number of explanations for these findings. Global events, national events, and media coverage of these events between mid-2010 and mid-2011 might well have elevated protection motivation levels for many respondents, leading to greater use of defensive and anxiety-reducing psychological distancing strategies and optimism bias in mid-2011 (e.g., Weber, 2006; Weinstein, 1987).

These findings indicate relatively high levels of respondent concern in each year, but with concern about personal consequences being somewhat less than concern about potential consequences for society in general. The findings are consistent with what we know about

optimism bias, and far-sightedness or hyperopia with respect to one's own location and circumstances, and increasingly objective and less distorted risk perspectives and appraisals at greater geographic distances (e.g., Taylor & Brown, 1988; Uzzell, 2000; Weinstein, 1980). It is also interesting that these modest changes across rating options appear to be taking place mainly among those who are less concerned about the implications and consequences of climate change.

COMPOSITE MEASURE OF CONCERN

The construct of *climate change concern* was also examined with via a number of convergent survey items (see Appendix H). Mean concern scores across 2010 and 2011 samples evidenced a modest decrease across the 12-month period between surveys, going from $M = 23.3$ in 2010 to $M = 22.2$ in 2011 ($p < .001$) (possible range 7 - 32). This slight but significant drop in mean concern levels is consistent with the parallel decrease in acceptance of the reality of climate change, as indicated previously, and with a number of other measures. Again, there are multiple reasons why this might be the case, and this finding of modest fluctuations in public risk perceptions and responses, against a comparison background of much more stable public views and sentiments, has been a common international finding in social science based survey work addressing public perceptions of and responses to climate change (Boric & Rabe, 2012, Höppner, 2010; Leiserowitz, Maibach, Roser-Renouf, & Hmielowski, 2012b; Romm, 2012). Available and cogent explanations for this difference in reported concern might well be that this was, in part, a response to media coverage of the contested political discourse in Australia relating to climate change policy responses (Bacon, 2011), and/or to the extent and intensity of extreme weather events across Australia preceding and during the intervening period between surveys. An emerging argument is that there is a sense in which the public feels that they have come through everything that nature can throw at them, and that the threat and foreshadowed manifestations of global climate change are perhaps not so dire (Leiserowitz, 2012b; Seery, Holman, & Silver, 2010) . The reasonableness of such explanations and interpretations, however, requires further and careful examination of our database. The correlation matrices provided in Appendix E and F provides additional insight into interrelationships between climate change concern and other core variables investigated in the surveys 2010 and 2011.

IMPORTANCE

The survey item (#20) "**How important is the issue of climate change to you personally?**" is an important indicator of issue salience and engagement, and has been an important predictor of both voting preference and environmental engagement (Krosnick, Holbrook, & Visser, 2000). It is possible that rated personal importance may also be a key indicator of changes in public risk perceptions and responses over time. The mean ratings of reported personal importance of climate change were very modestly but significantly different across the independent respondent samples, with 2010 respondents having a mean rating of $M = 4.14$ as compared with $M = 3.96$ for 2011 respondents ($p < .001$) (possible range 1-6). The fact that rated importance dropped slightly in 2011 could be attributable to many factors, including the contested political debate in Australia, events relating to the proposed carbon pricing scheme in Australia, and the outcome of the United Nations Climate Change Conference in Copenhagen, Denmark, in December 2009. The scale and intensity of extreme weather events in Australia during the period following the 2010 survey might also have reduced the relative perceived threat of climate change, as the immediate challenges of these sequenced events required sustained attention, monitoring, and for many, focal attention and engagement. However, the overall mean ratings, and the distribution of percentages across the scale, indicate that many of these respondents belong to the 'issue public' engaged with climate change in Australia (e.g., Krosnick, Holbrook, & Visser, 2000; Villar et al., 2011), and that this parameter and measure constitutes a sensitive indicator of important changes taking place in public thinking and feeling about the threat and phenomenon of climate change.

PERCEIVED CAUSES OF CLIMATE CHANGE

The causal attribution item (#7), "**Thinking about the causes of climate change, which, if any, of the following describes your opinion**" was used in concert with our 2010 Cardiff research colleagues, to ascertain the extent of perceived human causal contribution to climate change (Figure 1). Quite apart from the distinction between anthropogenic climate change and climate variability, such causal *understandings* are a fundamental component of sense making and public understandings of climate change. The 2011 findings indicated that 87% of respondents attributed some level of human causality to climate change, compared with 90.2% of respondents in 2010. The overall distributions of responses across available categories for 2011 and 2010 respondent groups differed modestly but significantly ($p < .01$). The proportion of respondents who reported that they did not believe in climate change increased from 2.7% in 2010 to 4.2% in 2011. What is clear is that very few respondents in 2011 thought that climate change was entirely caused by human activities (4.1%), or entirely caused by natural processes (6.6%), whereas most saw it as resulting from *both* types of contributing causes (82.9%). This matter of causal attribution and its relation to public understandings is more fully discussed in the companion research monograph (Reser et al., 2012b) and in the discussion section of this report.

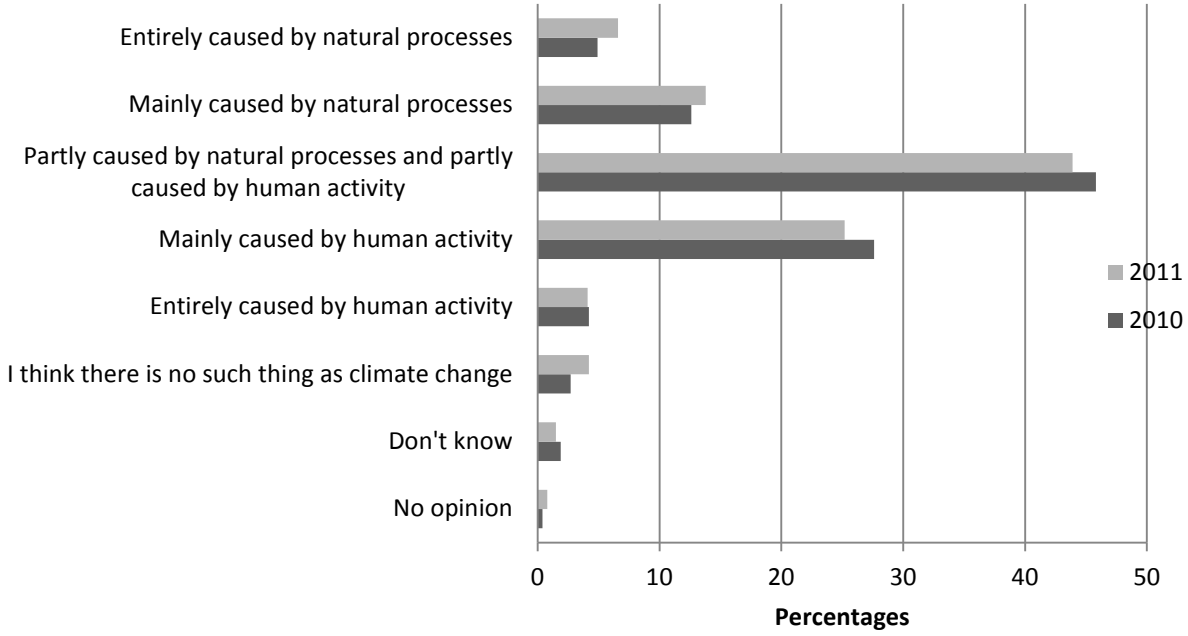

Figure 1. Perceived Causes

Again, it is instructive to compare these findings with other international survey findings, such as that of Leiserowitz et al. (2010a), where the question asked and relative percentage responses were, "Assuming global warming is happening, do you think it is: caused mostly by human activities (47%); caused mostly by natural changes in the environment (36%); none of the above because global warming isn't happening (9%); or caused by both human activities and natural causes (volunteered) (6%)". While the question

and response format are not directly comparable, it seems clear that the majority of US respondents in survey reports using similarly worded items and response formats also believed that human activities constituted a contributing cause to current climate change. It is particularly noteworthy that the response format in this widely cited recent study (Leiserowitz, 2012b) did not offer a response option which covered both 'human activities and natural changes' and these had to be *volunteered* by respondents. This suggests that there might well exist a pervasive under-reporting of public acceptance of the contributing causal role of human activities in the context of climate change. (Reference to Appendix I comparing national and international survey findings relating to causal attributions of climate change is particularly helpful to what follows.)

Public acceptance of anthropogenic forcing of climate change is ostensibly a contested matter in Australia, hence it is informative to examine this matter across a larger national and international canvas. Question framing and response options are clearly important in such comparisons. When examining similar questions, but somewhat different response options, comparisons across surveys provide strong support for widespread acceptance of some level of human causality. The one discrepant finding across these studies is readily explained in terms of limited response options (See Figure 2, and Appendix I).

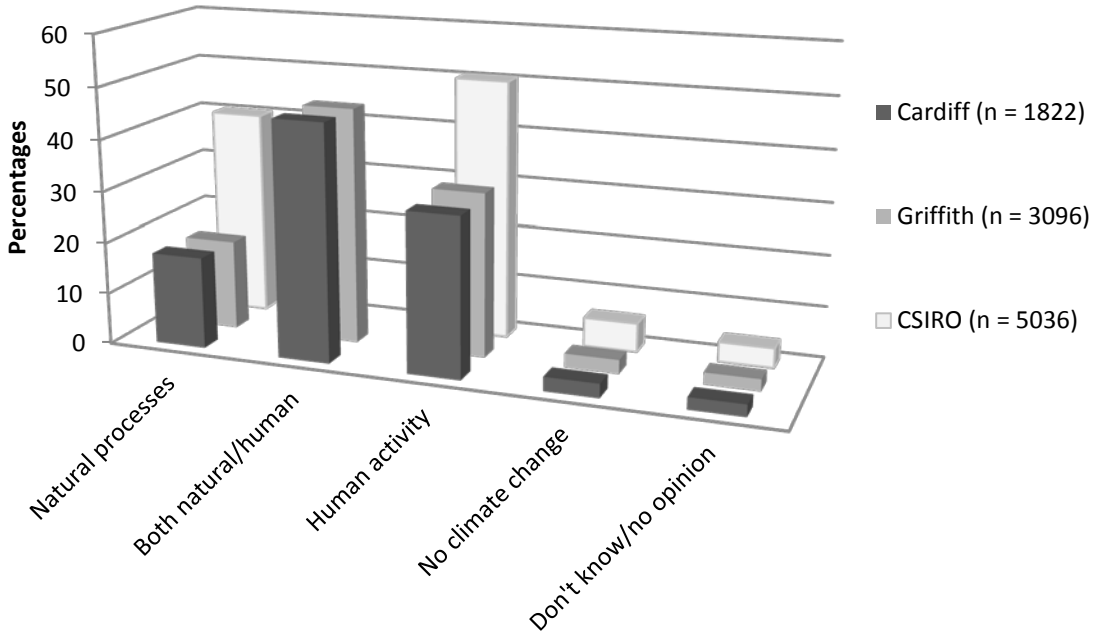

*Figure 2***.** Framing Effects

In the case of the 2010 CSIRO national survey results presented in Figure 2 (Leviston & Walker, 2010) the question itself does not raise the matter of causation but the response options clearly do. These CSIRO response options provide only two options which pertain to human causal contribution, "I think that climate change is happening, but it's just a natural fluctuation in Earth's temperatures", and "I think that climate change is happening, and I think that humans are largely causing it". Hence respondents who accepted that climate

change was happening had a very difficult choice, with no real option allowing for substantive natural *and* human causal contributions. In contrast the other surveys in Appendix I, with the exception of the Leiserowitz survey, mention causation in the question or item statement, and each of the other surveys provide at least three response alternatives relating to differing natural/human causation possibilities or accounts. In the case of the Griffith and Cardiff surveys, there were five response options which related to differing causal possibilities, and all were well utilised by respondents.

An independent and subsequent, but as yet unpublished, research study undertaken at Griffith University in late 2011 (n = 200 +) clearly indicates that independent groups of survey respondents randomly assigned to receive either the Griffith or CSIRO framings and response options, systematically varied, replicated both the Griffith and CSIRO findings in otherwise similar online survey instruments, providing strong evidence that the independent effect of differing response options accounted for these seeming discrepant findings (Reser, Bradley, Lewis-Driver, Glendon, & O'Gorman, 2012c).

Most of the survey findings in Appendix I have since been replicated in 2011 with very little change in terms of causal attributions and beliefs. Both the Griffith research group and the CSIRO research group have replicated their 2010 findings with large national samples of new respondents (Leviston & Walker, 2011, Reser, et al., 2012b). The response options for the respective survey items remained identical. These 2011 findings strongly suggest that the differing response alternatives available to respondents very substantially determined what have been reported as very different findings relating to public acceptance of a human causal contribution to climate change. These national and international findings overall with respect to acceptance of anthropogenic climate change have important implications not only for public understandings and successful public engagement, but with respect to disaster perception and response more generally, as will be discussed, along with multiple motivation, adaptation, and behavioural engagement implications.

SPATIAL AND TEMPORAL DISTANCING: THE LOCAL AND THE GLOBAL

An important item in the survey related to the immediacy of the climate change threat and unfolding impacts. Respondents were asked (#12): "**When, if at all, do you think Australia will start feeling the effects of climate change?**" Figure 3 provides relative percentages across response options for respondents in 2010 and 2011.

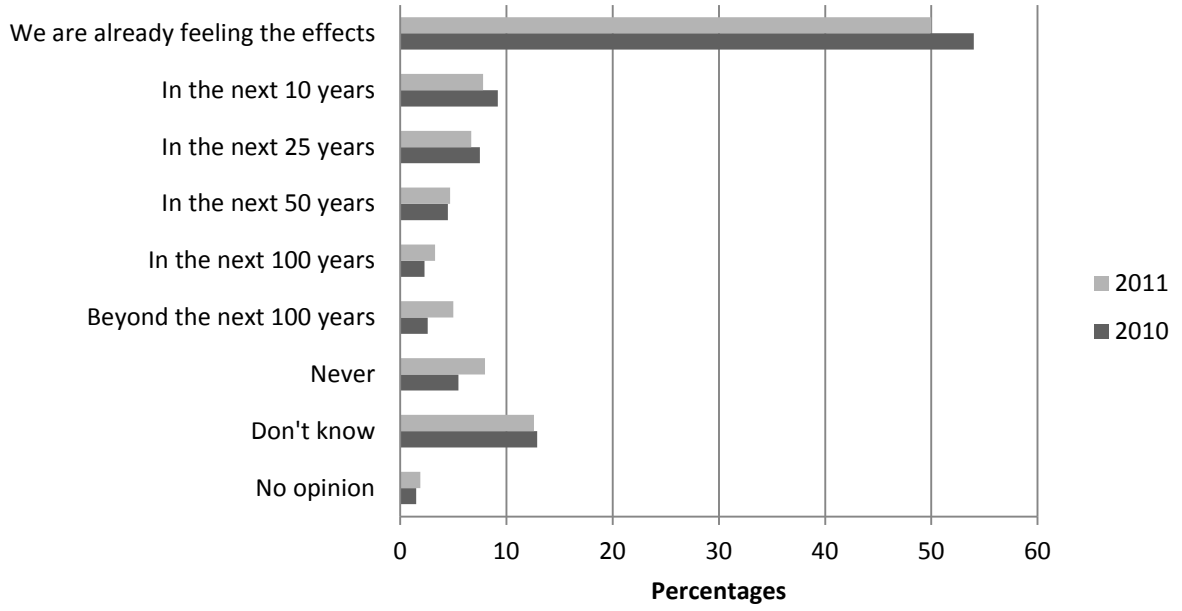

Figure 3. Perceived Temporal Immediacy of Climate Change Threat and Impacts

The overall similar but yet differing response distributions indicate that 2010 respondents were more likely to report that they were already experiencing the effects of climate change, with relative frequencies for the next three response options higher for 2010 respondents. Thus 54% (2010) and 50% (2011) of respondents believed that they were already feeling the effects of climate change, while a further 16.7% (2010) and 14.5% of (2011) respondents thought that they would be feeling these effects within the next 10 to 25 years. Gallup polls in the United States saw a dramatic increase in response to an item introduced in 1997 asking, "When will the effects of global warming begin to happen?", with 60% of respondents answering that the effects had already begun by the time of the 2007 survey (Nisbet & Myers, 2007). It is also noteworthy that 5.5% of Australian respondents opted for the 'Never' response option in 2010 compared with 8.0% of 2011 respondents. This and the symmetric but alternating differences in distribution of responses overall would suggest that temporal psychological distancing more strongly characterised the 2011 respondent sample.

A number of further items in the survey addressed the now well-documented finding that the perceived threat and seriousness of environmental problems, including climate change, tend to be minimised for respondents' local and national region, but with their 'vision' becoming increasingly clearer and less distorted as the spatial and temporal focus

become more distant and global (e.g., Lima & Castro, 2005; Uzzell, 2000, 2004). The phenomenon has been called *environmental hyperopia*, or farsightedness in the context of such environmental threat, with risk perception and appraisal becoming more accurate and less blinkered with greater geographic and temporal distance (Uzzell, 2000, 2004). Such distorting perceptions are self-serving in the context of climate change exposure and risk, as such perceptions tend to 'distance' the problems and risk, and minimize one's own perceived vulnerability. Australia presents an interesting case in that it could be argued that the relatively high current and predicted exposure of Australia to the impacts of climate change, along with the noteworthy incidence of extreme weather events in Australia over the 18-month period preceding the 2011 survey, would reduce protective 'farsightedness' or 'hyperopia' with respect to the local Australian context. Australian survey findings nonetheless do show a modest but clear hyperopia effect with respect to the threat and seriousness of climate change.

Two further survey items relating to this matter were questions #8, "**If nothing is done to reduce climate change in the future, how serious a problem do you think it will be <u>for Australia</u>?**"and #9, "**If nothing is done to reduce climate change in the future, how serious a problem do you think if will be for <u>the world</u>?**" The perceived seriousness of the climate change problem increases modestly but significantly as the question framing moves from a national reference to a global consideration. Seventy-eight percent of respondents gave a problem rating of 'very serious' or 'somewhat serious' for Australia, whereas 81.8% of respondents gave those ratings for 'the world' in 2010 with the corresponding figures being 72.0% and 76.2% for 2011. Hence Australian respondents appear to be viewing their own exposure to the threat of climate change as 'very serious', but 'somewhat less serious' than that of countries elsewhere in the world, even though Australia is deemed to be, in fact, considerably more exposed than other inhabited continents (e.g., CSIRO-BoM 2007, 2009; Department of Climate Change, 2010; Steffen, 2009).

All four items in question #13 can also be seen to relate to the psychological distancing and risk perception distortion reflected in the phenomenon of environmental hyperopia. In each instance where items stated that climate change impacts would be felt more seriously by distant countries, the differences between 2011 and 2010 respondents are initially small but increasingly diverge across the scale with 8.1% of 2011 respondents, as compared with 8.5% of 2010 respondents, either 'strongly agreeing' or 'tending to agree' that "**Climate change will mostly affect areas that are far way from here**". Similarly only 19.4% of 2011 respondents as compared with 22.7% of 2010 respondents either 'strongly agreed' or 'tended to agree' that "**Climate change will mostly affect developing countries**". (See Figure 5). In other words, 2010 respondents were less likely to underestimate the risk of the climate change threat to their own country. Differences were also marked for the remaining two items (#13b, d) relating to threatened local consequences of climate change. Sixty-one percent of 2010 respondents as compared with 53% of 2011 respondents either 'strongly agreed' or 'tended to agree' that "**My local area is likely to be affected by climate change"** (See Figure 4). In the case of the statement "**Climate change is likely to have a**

big impact on people like me", 43.5 % of 2011 respondents and 45.6% of 2010 respondents either 'strongly agreed' or 'tended to agree'.

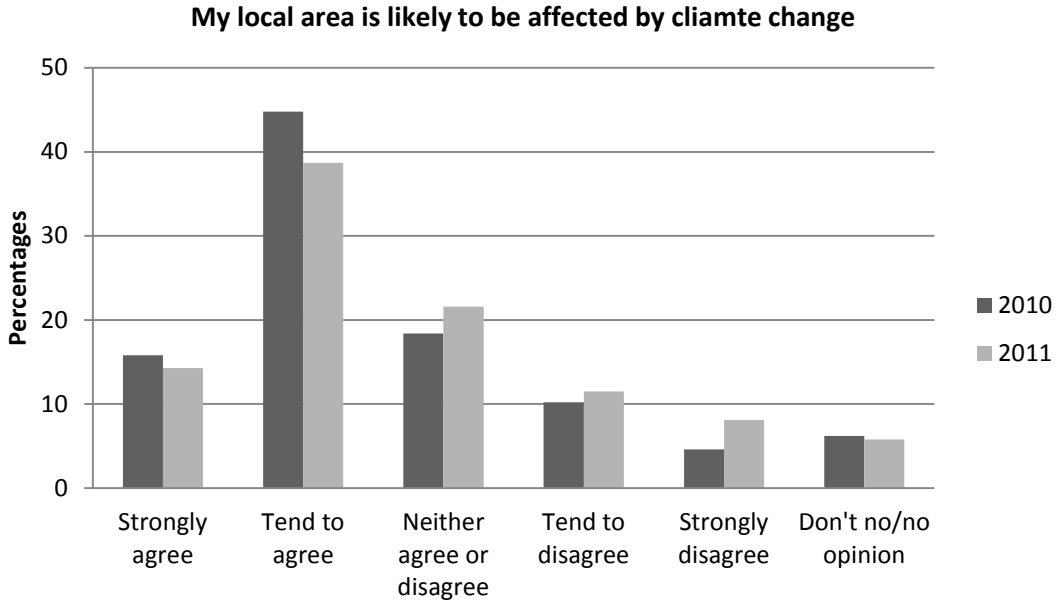

Figure 4. Spatial Distancing of Climate Change Effects: My Local Area

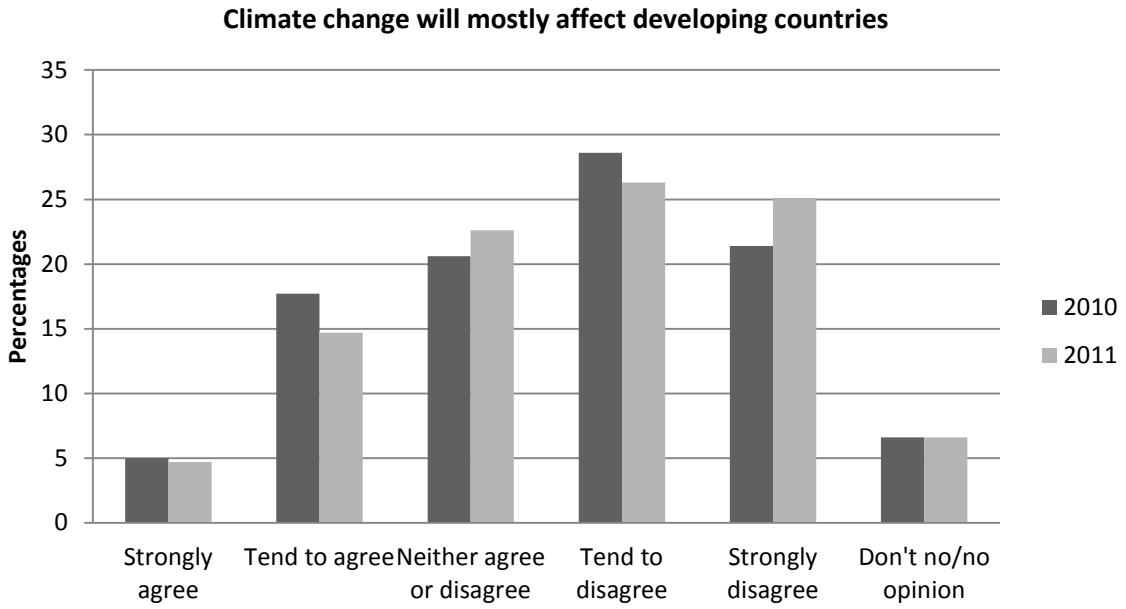

Figure 5. Spatial Distancing of Climate Change Effects: Developing Countries

Responses to these survey items indicate that there clearly does exist a hyperopia or psychological distancing effect with respect to the geographic and temporal 'distance' of climate change, but our 2010 survey findings suggest that this effect is specific to particular individuals and was less marked in the Australian context than in Britain, at least in 2010, when our respective collaborative findings were directly comparable.

OPTIMISM/PESSIMISM

While the surveys did not include a specific focus on optimism/pessimism with respect to the threat and implications of climate change, several survey items did address this consideration. Optimism/pessimism with respect to the environmental future is a variable which arguably constitutes a sensitive psychological impact indicator. It is also the case that Australians were found to be the most pessimistic nation in an 18-nation study undertaken in 2008 regarding environmental problems generally, including climate change (Gifford, Scannell, Kormos, Smolova, Biel, Boncu, et al., 2009). In 2011 survey items indirectly addressing environmental optimism/pessimism were #26 and #28, relating to "**the perceived condition of the natural environment, *in the world today*, and *in your own local region of Australia***" While mean differences in ratings *for the world* showed a slight and significant decrease in positive perceptions ($p < .001$) in 2011 from 2010, perceptions for the condition of the natural environment in one's *local area* did not differ, with ratings across both survey years being more optimistic than pessimistic.

Other questions were those related to climate change risk perception such as (#27), "**How serious a problem do you think climate change is right now?**" Between 2010 and 2011 respective sample proportions decreased slightly in terms of perceived seriousness, going from 45% to 42% of those endorsing either 'very serious' or 'moderately serious' on a 6-point 'very serious' to 'not at all' serious scale. This difference was modest but significant ($p < .01$). The more important finding is undoubtedly that of little change in serious levels of risk appraisal. It is possible that the perceived seriousness of the immediate problem of climate change dipped marginally between 2010 and 2011 given the dramatic nature of more immediate physical environmental issues and extreme weather events over the intervening twelve months.

Survey findings overall would suggest that high levels of perceived risk, concern, and distress at the threat and implications of climate change are being met with encouraging evidence of felt individual efficacy, psychological adaptation, and behavioural engagement, though mixed with strong feelings of sadness and anticipated loss, as well as anger and frustration. The relatively strong temporal pessimism of the Australian public over the mid and longer term horizon vis-à-vis the global community surveyed in 2008 (Gifford et al., 2009) is not really explained, though sample numbers for Australia in this international study were very modest ($n = 110$).

SELF PERCEPTION

Self perception is a fundamentally important variable in survey research in which risk perception and appraisal, place connection, value relevance, political salience, group identity, and personal and issue importance are salient, with the meaning of the concept involving perception as well as presentation to others. Self perception also constitutes an important personality and dispositional variable which is intimately tied up with how others are perceived to be seeing oneself. The 2010 and 2011 surveys included several scales relating to self perception and environmental matters. These were a composite 'Green Identity' scale, (# 18), and a modified 'Connection to Nature' scale (Gosling & Williams, 2010) (#25) (see Appendices C and G). Each of these survey measures were viewed as dispositional scales, with their principal value being not as sensitive measures of change over time, but as possibly important individual difference variables relating to respondent values, self presentation and identity, and felt connection to, and concern about, the natural environment. These variables are possible predictors of other human responses to climate change in correlational and regression analyses and are potential selection criteria in group comparisons. With respect to the 3-item Green Identity scale, it is noteworthy that over 50% of respondents in 2010 and 2011 saw themselves as individuals who were very concerned with environmental issues, and environmentally friendly. Close to 40% of each sample of respondents in 2010 and 2011 saw themselves as identifying with the aims of environmental groups such as Greenpeace and Friends of the Earth. No significant difference was found between the 2010 and 2011 survey samples in their respective mean scores on the Green Identity variable.

The Connection to Nature scale is an established scale that has been modified and used with Australian samples (e.g., Gosling & Williams, 2010; Mayer & Frantz, 2004). Mean scores on this scale, ranging from 6 to 36, were 25.4 for 2010 respondents and 25.9 for the 2011 respondents, with higher scores indicating stronger felt connection. These results would again suggest that the Australian public, by and large, feels a strong connection and bond with their natural environment. For example, 76% of 2011 respondents reported some level of agreement with the statement "**I often feel that I am a part of nature**", while 75% of the 2011 respondents reported some level of agreement with the statement "**My own welfare is linked to the welfare of the natural world**". Again this measure, as with the preceding measure, assists in characterising the Australian public as a whole, and in examining the importance of individual differences with respect to risk perceptions, understandings, and responses to climate change and natural disasters. The scale however is not considered an appropriate or sensitive measure of change in the present context and over the relatively short time period involved.

These findings along with other Griffith survey data suggest that a substantial proportion of the Australian population sees themselves as very pro-environmental and connected to their natural environment. This in turn suggests that a threat and issue such as climate change, and the longer term implications of climate change, would be an important matter to most Australians.

MOTIVATIONAL SELF REPORT

While many survey items were relevant to motivational considerations, two items directly addressing self-reported motivation and willingness, other than behavioural engagement itself were #17 and #34. Item #17 offered two statements to which respondents reported the extent of their agreement or disagreement, "**I am prepared to greatly reduce my energy use to help tackle climate change**", and "**I am prepared to pay significantly more money for energy efficient products**". These statements reflected, in part, the energy futures focus of 2010 survey items relating to our cross-national collaboration with Cardiff University. It is noteworthy that 64% (2010) and 61% (2011) of respondents either 'strongly agreed' or 'tended to agree' with this initial statement. This would suggest strong motivation and little difference between these two samples of respondents, surveyed a year apart. Relative extent of agreement with the second statement, however, indicates that such motivation is contingent upon financial cost, with only 23% (2010) and 24% (2011) of respondents 'strongly agreeing' or 'tending to agree' with the initial 'prepared to pay more' statement. While this latter difference was significant ($p < .05$), sample sizes and the larger set of survey findings would suggest very little difference between respondent groups to these questions of preparedness and willingness to alter lifestyles and/or pay more to achieve effective carbon emission reduction.

COMPOSITE MEASURE OF MOTIVATION

Question #34 asked for extent of agreement with three more direct motivational statements. This composite motivation scale was not used in the 2010 survey. These statements were:

a) "**I want to change my lifestyle in ways that help to address climate change**".

b) "**I am not at all motivated to help reduce climate change**".

c) "**I feel a personal obligation to do what I can to prevent climate change**".

Forty percent of the 2011 respondents either 'strongly agreed' or 'tended to agree' with statement (a), 54% of respondents either 'strongly disagreed' or 'tended to disagree' with statement (b), and 39% of respondents either 'strongly agreed' or 'tended to agree' with statement (c). Overall these motivational items suggested that large numbers of respondents were motivated, wished to do something, and felt some responsibility to take some action to address the threat of climate change. It is important to keep in mind that the corresponding counterposition on each of these agreement rating scales received responses of between 16% and 21%. Respondents were therefore spread across this motivational spectrum, though with a strong weighting in the direction of being motivated do something about climate change. As no direct comparison measures existed in the 2010 survey, no comparisons relating to motivational changes over time with respect to these items could be made.

KNOWLEDGE

Knowledge is an integral component of public understandings of climate change, and a necessary but not sufficient factor in increasing public concern about risks and motivating preventive behaviours. But knowledge can encompass many things, and in the case of global climate change this could be knowledge about climate change science, the causes and consequences of climate change, about politics, policies, and what actions one can take (e.g., Sundblad, Biel, & Gärling, 2009). A starting premise in the current research was that public 'understandings' of climate change were unlikely to coincide with objective knowledge about the phenomenon or threat of climate change from a climate change science perspective. An important reason for this is that public understandings would invariably reflect cultural meanings and symbolic components of this effective risk domain, as well as reflect multiple aspects of the social construction and representation of this phenomenon, 'issue', and 'environmental problem' (e.g., Hulme, 2009; Kitsuse & Spector, 2000; Pidgeon et al., 2003; Wolf & Moser, 2011; Yusoff & Gabrys, 2011). Individual, societal, and scientific understandings also necessarily encompass more than knowledge per se, with these matters briefly discussed in the discussion section of the report (e.g., Irwin, 1995; Irwin & Wynne, 1996; Wynne, 1991). Nonetheless many surveys addressing public responses to climate change do not address public understandings as such, and simply include a self-report level of knowledge item, or less often an objective knowledge scale (e.g., Kellstedt et al., 2008; Reynolds, Bostrom, Read, & Morgan, 2010; Roser-Renouf & Nisbet, 2008; Sundblad et al., 2009). Such self-report measures have been justly criticised as both confounding different kinds of knowledge and being subject to all of the vagaries and self-presentation biases of self report (e.g., Nisbet & Wilson, 1977; Schwarz, 1999). For comparison purposes and for other conceptual, measurement and indicator reasons, the 2010 and 2011 Griffith surveys included both a single-item self-reported climate change knowledge item (#21) and a 10-item objective measure of knowledge about climate change science (#35). With few notable exceptions, Australian surveys of public responses to climate change have not used a similar objective measure of climate change knowledge (e.g., Ashworth et al., 2011; Fielding, 2009).

OBJECTIVE KNOWLEDGE

The pragmatic constraints of a national survey required a straightforward climate change knowledge measure relating to aspects of climate change science frequently found in the media and popular science coverage, and similar or equivalent to content in existing objective measures used by other researchers. The survey employed ten statements (#35) about the science and consequences of climate change which respondents were asked to designate as true or false, with a 'don't know' option also offered in each case. These statements were based on the work of Sundblad et al., (2009). (See Table 4)

Table 4. *Objective knowledge questions and distribution of responses*

	Statement	Year	True %	False %	Don't know %
a.	The projected average sea level rise provided by the IPCC for the remainder of this century (2011-2099) is between 18-59 centimeters	2010	35.5	10.2	54.3
		2011	30.1	13.3	56.6
b.	Australia is one of the most exposed nations with respect to projected impacts of climate change	2010	44.3	24.1	31.6
		2011	40.5	27.0	32.5
c.	Climate change will increase the risk in Australia for diseases transmitted by water and mosquitoes over the next 100 years	2010	39.8	23.3	37.0
		2011	39.5	25.9	34.6
d.	Globally, the current burning of fossil fuels accounts for 80-85% (CO^2) emissions added to the atmosphere	2010	47.1	15.0	37.9
		2011	41.7	18.7	39.6
e.	Methane is emitted mainly from fossil fuels	2010	16.9	49.8	33.3
		2011	20.2	41.5	38.0
f.	Climate change is mainly caused by the hole in the ozone layer	2010	20.6	57.8	21.6
		2011	21.3	54.9	23.8
g.	Australia produces about 5.5% of the planet's carbon emissions	2010	23.4	17.8	58.7
		2011	24.0	25.4	50.7
h.	Australia's average temperature has increased by approximately 1°C from 1910 to 2002	2010	59.4	12.9	27.6
		2011	55.7	14.3	30.0
i.	The change in global temperature for the last 100 years is greater than for the last 1000 years	2010	46.8	14.9	38.3
		2011	43.2	18.5	38.2
j.	The number of weather-related disasters around the world has doubled since the mid 1990s	2010	47.4	15.6	37.0
		2011	49.8	16.7	33.5

Note: The correct answer for each item is highlighted in the table.

Results from the ten objective knowledge statements showed that Australian respondents had a high degree of uncertainty when it came to the underlying and widely disseminated popular science. This is reflected in part by the high percentage (between 22% and 59%) of respondents who reported 'don't know' when answering the ten knowledge statements. Nonetheless, the modal response was the correct response for eight of the ten statements (with #35a and #35g being the exceptions).

Participants were also asked to rate their level of certainty with respect to the correctness of the answers they gave to the ten objective knowledge questions (#36). A number of researchers have examined such confidence levels in the context of climate change (Malka, Krosnick, & Langer, 2009; Sundblad et al., 2009). Thirty-five percent of respondents gave a certainty rating of 5 or 6 on a 6-point scale in 2010 (from 1 *uncertain* to 6 *certain*), as did 38% in 2011. The mean certainty rating was 3.82 in 2010 and 3.96 in 2011 suggesting a relative confidence in one's own knowledge though with some uncertainty with respect to at least a few of the statements.

Objective knowledge scores were obtained by assigning a value of +1 to correct answers, -1 to incorrect answers (to penalize indiscriminant guessing), and zero to non-committal (don't know) answers. Scores were summed to produce a final score with a potential range from -10 to +10. Respondent mean scores on *objective knowledge* about climate change science accounts and projections decreased over the 12-month period of the research, with a mean score of 2.7 in 2010 compared with 2.2 in 2011. This represents an appreciable and significant difference in mean scores ($p < .001$). It is possible that the contested and confusing nature of climate change media coverage and communications adversely influenced public understandings of climate change science over this period, and that continued lobby efforts by conservative interest groups (e.g., Bacon, 2011; Boykoff, 2011; Washington & Cook, 2011) increased public confusion and uncertainty about a number of matters relating to the science and projected impacts of climate change, and eroded respondents' confidence in their own knowledge and the correctness of objective knowledge survey answers. However, it is also possible that these two independent groups of respondents in 2010 and 2011 simply differed in their average objective knowledge levels in ways that are not representative of their respective populations.

Mean score differences, due to the way in which scores were calculated, in fact underestimated the appreciable difference in objective knowledge sores between the 2010 and 2011 samples. The 2010 respondents were more frequently correct with respect to eight of the ten true/false statements, with these percentages being quite substantial in a number of cases. For example, while 49.8% of 2010 respondents correctly indicated that the statement "Methane is mainly emitted from fossil fuels" was false, only 41.5% of 2011 respondents correctly indicated that this was the case. Similarly, for statements (a) and (d), the proportion of 2010 respondents who correctly identified these statements as true was 5.4% more than was the case for 2011 respondents. However, with respect to one of the two statements for which 2011 respondents performed better, "Australia produces 5.5% of the planet's carbon emissions," 25.4% of 2011 respondents correctly identified that this was a false statement, whereas only 17.8% of 2010 respondents did so. This latter difference finding could well reflect the media emphasis on Australia's relative carbon emissions contribution in the 12 months preceding the 2011 survey. What these findings do suggest, in addition to an average correct identification of true and false statements of 43.4%, is that these two respondent samples did differ modestly in terms of objective knowledge with respect to climate change, with this being particularly true for male respondents who evidenced appreciable lower objective knowledge scores in 2011.

SUBJECTIVE KNOWLEDGE

Respondents were first asked (#21) to rate, "**How much do you feel you know about climate change?**" on a 6-point scale (from 1 *nothing* to 6 *a lot*). The percentage of respondents who selected the most knowledgeable rating, 'a lot' went from 8.1% in 2010 to 11.1% in 2011. Across the two most knowledgeable ratings on this 6-point scale this difference was very modest and nonsignificant, as were mean comparisons. More importantly, such subjective knowledge reports do not correlate strongly with objective

knowledge scores, as noted by many (e.g., Roser-Renouf & Nisbet, 2008). Interestingly this correlation between objective knowledge and subjective knowledge was $r = .19$ for the 2010 survey findings, and $r = .12$ for the 2011 results, suggesting that the discrepancy between objective knowledge and subjective knowledge was modestly greater for the 2011 respondents. A quite noteworthy findings in both the 2010 and the 2011 surveys was that female respondents, were more objectively knowledgeable than male respondents, but quite modest in their self-reported knowledge levels. Male respondents on the other hand had lower objective knowledge scores overall, but reported higher knowledge levels than females.

A more informative window on the importance and influence of objective knowledge of climate change is provided in the results of the overall correlational analyses reported in Appendices E and F. (Also find further consideration of issues surrounding climate change knowledge in the discussion section).

PERCEIVED SCIENTIFIC CONSENSUS AND TRUST

PERCEIVED SCIENTIFIC CONSENSUS

An arguably important temporal comparison was with respect to whether Australian public views had changed with respect to perceived scientific consensus on the reality of climate change (#24). In 2010, 57.8% of respondents agreed that there was general agreement among scientists, with 31% viewing this as strong agreement. In 2011 these same figures were 59.4% and 34.6% respectively. Overall mean differences between 2010 and 2011 on this single-item rating scale were nonetheless quite modest, though in line with perceived scientific agreement increasing ($p < .05$). This reflected the fact that in 2011 12.8% of respondents reported considerable perceived disagreement among scientists, whereas this figure was 11.4% in 2010.

TRUST

Two survey questions relating to trust appear in survey question #10b and #10e. Respondents were asked to indicate the extent to which they agreed or disagreed with the statement (#10b), "**I trust the Australian government to take appropriate action against climate change**". In 2010, 15.7% of respondents either 'strongly agreed' or 'tended to agree' with this statement. In 2011, 23.3% either 'strongly agreed' or 'tended to agree'. This suggests a marked and significant ($p < .001$) shift in opinion. However, it is noteworthy that 31.0% of respondents in both 2010 and in 2011 'strongly disagreed' with this statement, while 24.5% (2011) and 33.7% (2010) 'tended to disagree'. Clearly when examining *trust in the Australian government* with respect to the specific issue of *taking appropriate action against climate change*, there was a very evident absence of trust on the part of the majority of respondents, but this did move from 64.3% disagreement with the statement of trust in 2010 to 55.4% disagreement in 2011, again suggesting a marked and significant change ($p < .001$) in the direction of greater trust.

A somewhat more indirect statement was posed in survey item #10e, framed as confidence in science, "**I am confident that science will find an answer to climate change before it becomes a big problem**." In 2010, 21.8% of respondents either 'strongly agreed' or 'tended to agree' with this statement. In 2011, 25.7% of respondents either 'strongly agreed' or 'tended to agree'. Similarly while 43.5% of respondents 'strongly disagreed' or 'tended to disagree' with this statement in 2010, the corresponding disagree figure in 2011 was 36.5%, again suggesting a marked and significant shift ($p < .001$). This survey item could be seen as a measure of increased optimism as well as an indicator of trust in science, and no doubt the item captures both of these constructs.

One of the more interesting findings in 2010 and subsequently in 2011 were the dramatic differences in the extent to which respondents reported trusting differing sources with respect to environmental matters generally (#22). In 2010, 49.3% of respondents reported trusting scientists either 'completely' or 'strongly', with this figure falling to 4.5% for media sources, and 8.2% for government sources. In 2011, 53.5% reported trusting

scientists either ‘completely’ or ‘strongly’ with this figure being 5.1% for media sources, and 9.4% for government sources. Hence this appreciable trust in scientists evidenced a modest and significant increase from 2010 to 2011 ($p < .001$). These findings are contrary to a prevailing public stereotype of eroded confidence and increased scepticism with respect to ‘science’, and particularly climate change science.

As interesting is the fact that the extreme ‘not at all’ response for trust increased over this intervening twelve months from 3.0% to 4.7% for scientists as sources about the environment, from 19.8% to 23.5% for media sources, and from 16.4% to 26.8% for government sources. These intriguing findings, significant in each instance ($p < .001$), are of clear public engagement and policy relevance. The research literature is unequivocal with respect to the importance of trust with respect to the effectiveness of risk communications, public perceptions of environmental threats generally, and source credibility (e.g., Earle, 2010; Earle & Cvetkovich, 1995; Bauer & Gaskell, 2002; O’Riordan, 1995).

A further survey question posed in 2010 and 2011 related to the perceived accuracy of information provided in the stories written and broadcast by news organisations about climate change (#31). Responses to this question are particularly interesting given that so much of public understandings and responses to climate change are founded on and informed by indirect and virtual media representation and coverage. Again, responses indicate very strongly that respondents viewed media-disseminated information about climate change as profoundly unreliable. In 2010, only 11.5% of respondents thought that most media information was accurate, with this figure increasing somewhat to 14.3% in 2011. Consistent with this, just over 30% of respondents in both 2010 and 2011 judged that ‘very little’ media-reported information about climate change is accurate.

COMPOSITE MEASURE OF TRUST

Results indicated no significant difference in respondents’ levels of trust for the 12-month period between 2010 ($M = 12.03$) and 2011 ($M = 11.99$). This seemingly discrepant finding may reflect the rather different aspects of trust examined in this composite measure e.g., trust in the Australian Government to take appropriate climate change action, and trust in media, and Government statements relating to the seriousness of climate change.

INDIRECT EXPOSURE

A number of survey questions in 2010 and 2011 related to media use and exposure. Implicit in this research addressing public risk perceptions and responses to climate change were a number of research matters relating to the social construction and representation of climate change, virtual and vicarious exposure to the threat of climate change through media coverage, and the use of media for information search, clarification, uncertainty reduction, sense making, and risk appraisal. Of parallel interest and consideration was the extent to which respondents indicated that they did not trust the media as a reliable source on environmental matters. An additional and important caveat with respect to these matters and survey questions is the extent to which respondents were mindful of and able to report accurately and objectively on their exposure to, and selective use of, multiple media and social sources (e.g., Nisbett & Wilson, 1977; Schwarz, 1999).

Question #23 (2011) asked, "**To what extent do you use day-to-day media coverage to inform your own views on climate change and other environmental issues?**" Twenty-three percent of respondents reported using day-to-day media coverage 'a great deal' or 'substantially'. This would seem to be an underreporting of the importance of media exposure and use in today's media-dominated and dependent world. The question framing, however, in terms of *use*, and the specific reference to "climate change and other environmental issues" may well have influenced this result. As this specific question was not asked in 2010, direct comparison findings cannot be made.

In 2010 as well as in 2011 respondents were asked (#32), "**How closely are you following news about the environment these days?**" This question also asks, indirectly, about the salience and importance of environmental news and topics, and respondents' felt need and motivation to seek out, and attend to, such media coverage of environment-related subject matter and issues. Again, this self-report data would suggest that, for most respondents, such news and media coverage is not a matter of pressing interest or concern. Nonetheless 33.2% of respondents in 2010 and 32.6% in 2011 reported rather closely following news about the environment, with no evident change in such behaviour over this 12-month interval. The percentage of respondents reporting very little monitoring of such environmental news was 18.8% in 2010 and 19.1% in 2011, essentially just under one fifth of the sample in both years.

COMPOSITE MEASURE OF INDIRECT EXPOSURE

In 2011 a refined survey question was used to better establish the extent to which respondents appeared to be exposed to the threat of climate change through 'indirect' sources including the media, by providing a spectrum of possible sources and asking about the relative frequency of exposure or intentional use in "obtaining information about climate change" (#52). Table 5 gives details of responses. Clearly, television is the primary source and medium reported, with 55% of respondents reporting using this medium more than twice. Those types of information sources indicated as being used more than twice in order of proportional responses, following television, were newspapers (45%), conversations with

friends and family members (at 35%, and 34%, respectively) and news sites on the internet, and radio (at 31% and 30%). The current use of the internet and social networking sites is of course noteworthy (e.g., Krotoski, 2010, 2012), but primary social interaction through everyday conversations remains very important. It is also not surprising that magazines and journal articles are used much more than are books or formal education or lecture venues. It is likely that documentary and commercial films with climate change themes and emphases are more important than this self-reporting would suggest (e.g., Hachten & Scotton, 2007).

Table 5. *Frequency of Use of Various Indirect Sources of Climate Change Information*

	Never %	Once or Twice %	More than twice %
a.TV news, TV current affairs, or TV documentaries	12.0	33.1	54.9
b.Radio	37.8	31.8	30.4
c.Newspapers	22.4	32.5	45.1
d.Magazine or journal articles	50.0	29.5	20.5
e.Books	72.2	19.6	8.2
f.Lectures, talks, formal education	79.1	14.1	6.8
g.Information brochures, leaflets, flyers	52.1	36.5	11.4
h.Films (e.g., *An Inconvenient Truth, The Day after Tomorrow*)	50.0	35.6	14.4
i.Social networking sites, blogs, or self-broadcasting sites on the internet	67.9	20.6	11.4
j.News sites on the internet	39.5	29.9	30.7
k.Government sources (e.g., CSIRO, Bureau of Meteorology)	47.0	32.1	20.9
l.Conversations with family members	24.8	41.5	33.7
m.Conversations with friends	23.5	41.5	35.0

The change in the context and formatting of this question did not allow for direct comparison with 2010 findings, but there is no evidence to suggest from our data that media use or exposure changed appreciably between 2010 and 2011.

A more apparent though not documented phenomenon is that the media backdrop, public discourse, and public understandings of and responses to climate change and climate change coverage underwent changes over the 12-month period that is the focus of this report. There appeared to be an increasing focus on what needs to be done to address climate changes rather than on whether new and consequential changes were taking place. There is ubiquitous evidence from around the world that we are entering an era in which contemporary global climate change is very real and brings with it profound consequences and adaptation challenges. As well, public exposure to climate change is not limited to the specific sources mentioned in the survey questions but relates to a more extended information environment and media-saturated world in which climate change has become an integral theme of images, advertisements, texts, talking heads, mass transit billboards and posters, and an energy consumption and carbon emission consciousness which is not so much figure but ground, context, and assumptive world, moving forward into a largely unknown future. Hence this seemingly indirect and virtual exposure is, in myriad ways, very 'direct' and 'real'.

It must be kept in mind that *direct* exposure to, and experience of, a phenomenon and ongoing environmental condition, threat, and stressor such as climate change is not directed,

mindful, or motivated in any particular way. Exposure through multiple-media channels, however, tends to be self-selected, under individual operational and attentional control and cessation, and frequently motivated by interest, information search, and both active and passive engagement (e.g., Miller, Rainie, Purcell, Mitchell, & Rosenstiel, 2012; Mitchell & Rosenstiel, 2012). It is also clear that media coverage of specific threats and consequential environmental events can involve a fair bit of automatic attention and monitoring, and in many instances fixation. It is likely that such exposure and engagement is very psychologically real and consequential in terms of emotional and cognitive processing, particularly if the matter is of personal interest, importance, or possible consequence.

DISTRESS

Psychological impacts and experienced distress are much neglected areas of climate change research, and indeed with respect to the stress of environmental change (e.g., Aldwin & Stokols, 1988; Doherty & Clayton, 2011; Reser, Morrissey, & Ellul, 2011; Stokols, Misra, Runnerstrom, & Hipp, 2009). Few extant measures can be readily transferred from research domains such as those addressing the chronic stress of living near degraded or contaminated environments, or recurrent natural or technological disaster threat (e.g., Lima, 2004; Rogan, O'Connor, & Horwitz, 2005; Santiago-Rivera, Morse, Haase, McCaffrey, & Tarbell, 2007). A substantial review of the measurement of key behavioural science constructs in climate change research reveals few that address this domain (Roser-Renouf & Nisbet, 2008). Although considerable discussion and speculation has taken place with respect to the psychological impacts of climate change in the context of rural and remote mental health, very little systematic research has been undertaken (e.g., Morrissey & Reser, 2007).

CLIMATE CHANGE AND PSYCHOLOGICAL DISTRESS

Experienced psychological distress due to the threat, implications, and perceived current consequences of climate change, as with climate change concern, is an important and putative *psychological impact* of climate change, which may well have been affecting communities around the world for several decades (e.g., APA Taskforce on Climate Change, 2009; Berry, Kelly, Hanigan, Coates, McMichael, & Welsh et al., 2008; Costello, Abbas, Allen, Ball, Bellamy, & Friel et al., 2009; Coyle & Van Susteren, 2012; Doherty & Clayton, 2011; Fritze, Blashki, Burke, & Wiseman, 2008; Page, & Howard, 2010; Reser et al., 2011; Searle & Gow, 2010; The Climate Institute, 2011). Climate change distress is defined for the purpose of this research as experienced apprehension, anxiety, sorrow, or loss due to the threat and projected consequences of climate change, for oneself, humanity, and/or the natural world. Such distress might well take the form of preoccupation, heightened worry and fear, and/or pessimism with respect to being able to adequately address this profound environmental and social problem and issue. In the present research context, and in the absence of an established psychosocial impact assessment literature specific to climate change, this construct and measure has not been given a strong or diagnostic clinical gloss. Rather, what has been conceptually specified and measured is the extent to which respondents report experiencing, at times, noticeable distress at the prospect and implications of climate change, either through media coverage or possible direct encounters with the perceived environmental consequences of climate change. Affective responses to climate change may lie on a continuum from concern, to moderate distress, to a state of severe distress which interferes with daily functioning and well-being. We would view the distress that is captured in our provisional scale as relating to the mid-range of such a continuum.

MEASURE OF PSYCHOLOGICAL DISTRESS IN THE CONTEXT OF CLIMATE CHANGE

For the purpose of the Australian survey, psychological distress in the context of climate change was operationalised with a 7-item measure (#38). Participants were asked to rate their extent of agreement with statements on a 6-point scale, from 1 (*strongly disagree*) to 6 (*strongly agree*). The scale contained items such as, "**At times I find myself thinking about and worrying about what the world will really be like for future generations because of climate change**" (see Appendix C and H). The distress items were designed to be particularly sensitive to subclinical levels of distress at the prospect and implications of global climate change. This scale achieved a Cronbach's alpha of .93 indicating high reliability. The mean scores on the psychological distress scale were 21.9 in 2010 and 21.5 in 2011 (possible range 7-42), with higher scores indicating greater distress. This was a very modest yet significant difference ($p < .05$). Averaged results across all respondents indicated moderate levels of reported distress when thinking about, and otherwise responding to, the threat and implications of climate change. Given the cumulative impact nature of psychological distress in the context of climate change, the fact that the 12-month period preceding the 2010 survey and the 12-month interval between surveys encompassed myriad environmentally stressful events across Australia, and the arguable adaptation benefits of cumulative adversity for many (e.g., Seery, Holman & Silver, 2010), this absence of noteworthy change in an initially elevated mean climate change distress score is not surprising. Rather, the message from these results is that the measure itself appears to be both robust and reliable. The results are consistent with other psychological measures in the survey, and the ongoing environmental stress of the threat and physical impacts of climate change continues to be reflected in these convergent measures of psychological impact. An additional five items were included in the 2011 survey to further refine and develop the scale. With respect to the introduced items in 2011, sadness at ecosystem and species loss because of climate change appeared to be a particularly strong additional element of climate change distress.

It is important to reflect on the self-reported increases in levels of concern over the past several years for 53% of survey respondents in 2011. Such evident changes in concern levels, and by implication distress levels for some, are important in terms of being able to measure and monitor important psychological variables relating to public risk perceptions and responses to the threat of climate change over time. Such changes can also constitute and reflect arguable psychological impacts of the threat of climate change over time. Perhaps most importantly, the more enduring of such psychological changes in individuals' thinking and feeling about climate change, and in their risk perceptions, appraisals and understandings of climate change, are in fact *psychological* adaptations and adjustments to the threat of climate change. The extent to which reported concern levels have increased or decreased for many respondents also constitutes both a measure of change, and reflects the self-evaluative and reported nature of such psychological responses and impacts. It is arguable that concern levels for many were already very high, making such increases all the more noteworthy and meaningful, and perhaps elevating climate change concern into climate change distress for some respondents.

PSYCHOLOGICAL ADAPTATION

A principal focus in this research, and the funding which supported the research, relates to adaptation to climate change. Climate change science and Intergovernmental Panel on Climate Change (IPCC) definitions and specifications of adaptation in the context of climate change are nonetheless very system-focused whether by way of natural biophysical systems or human infrastructure, organisations, and institutional systems. This present, more psychological research undertaking has addressed the very neglected construct and convergent processes of *psychological* adaptation as they relate to human risk perceptions and responses to the threat and unfolding physical environmental impacts of climate change and associated extreme weather events (e.g., Reser, Bradley, & Ellul, 2012a; Reser & Swim, 2011). Adaptation as a multifaceted construct and convergent, multi-level, set of organism-environment processes has been an integral and foundational construct and perspective within psychology and the social sciences since the inception of these respective disciplines (e.g., Bateson, 1972; Lazarus, 1966, 1991; Piaget, 1955; Pribram, 1969, White, 1974), yet the crucial relevance of these social science-based perspectives on adaptation processes is only beginning to be fully appreciated (e.g., Agrawal, Orlove, & Ribot, 2012; APA, 2009; Lever-Tracy, 2010). Importantly, psychological adaptation also invokes and involves psychological *impacts*, and both the benefits and costs of environmental changes and human adaptations.

So, what is psychological adaptation to climate change? *Psychological* adaptation to climate change encompasses those intra-individual processes (e.g., risk appraisal, motivational responses, coping strategies, decision-making) relating to psychological responses, changes, and adjustments to the *threat and implications of climate change* as well as to *direct experience with what are perceived to be the unfolding impacts* of climate change. Psychological adaptation also encompasses extra-individual behavioural responses and adjustments (e.g., community engagement and involvement, mitigation, information seeking) to the threat and perceived physical environmental impacts of climate change, which are typically mediated by intra-individual psychological processes and responses. The nature of psychological adaptation requires this brief clarification, because such within-individual responses and changes are not always recognised as crucial aspects of climate change adaptation (e.g., Reser et al., 2012a; Reser & Swim, 2011). Yet considerable policy attention is paid to how public perceptions, attitudes, values, motivations, decisions, and understandings might be more effectively influenced and changed, leading to behavioural and lifestyle changes (Whitmarsh, O'Neill, & Lorenzoni, 2011). All of these changes, whether or not they are influenced by strategic interventions or risk communications, are psychological adaptations to climate change.

As with psychological distress in the context of climate change, no appropriate climate-change specific or psychological scales that measured psychological adjustments, adaptations or impacts to the threat of climate change were available at the time of our first survey. While emerging social science and psychological research has been closely examining public climate change attitudes, perceptions, beliefs, intentions, and behaviours (e.g., Brechin, 2010; Brulle et al., 2012; Leiserowitz et al., 2010a, 2010b, 2011a, 2011b), this

research has not, by and large, been framed in adaptation terms, and the focus has been more strongly on mitigation and behavioural change. Perhaps the closest construct, set of processes, and perspective available within psychology and currently being employed in the climate change arena is that of coping (e.g., Grothman & Patt, 2005; Homburg, Stolberg, & Wagner, 2007; Van Zomeren, Spears, & Leach, 2011). However, coping typically relates more particularly to specific and acute stressors and situations rather than being a more ongoing response, state, and set of processes for maintaining an acceptable and long term transactional congruence between individual and environmental press and change (e.g., Lazarus & Launier, 1978; Reser et al., 2012a). Convergent arguments suggest that the ongoing environmental stressor status of global climate change and the more encompassing nature and status of psychological adaptation processes make a climate change specific and sensitive measure of psychological adaptation a very strategic and possibly crucial contribution to the field.

It is noteworthy that across the non-psychological social science literature, and even in health reports addressing the implications and impacts of climate change, adaptation continues to be defined in exclusive overt action and behaviour terms, institutional and structural terms, or in medical model and physiological functioning terms, with no reference to psychological adaptation and underlying psychological processes and adaptation costs and impacts (e.g., Hughes & McMichael, 2011; Reser et al., 2012a; Reser & Swim, 2011).

MEASURE OF PSYCHOLOGICAL ADAPTATION

Question #40 constituted a provisional 11-item psychological scale and measure of psychological adaptation in the context of climate change, with all items addressing self-reported changes in how respondents are thinking, feeling, understanding and acting in response to the threat of climate change. As no existing climate change adaptation scales have addressed this matter of conceptualising and measuring psychological adaptation to the threat of climate change (e.g., Hamilton & Kasser, 2009; Homberg et al., 2007), this scale was developed for the purpose of the survey and subsequent monitoring purposes. The final operational scale for 2011 included seven of the original items used in 2010. The 2011 scale cronbachs's alpha was highly reliable at .85.

Respondents' mean scores on psychological adaption suggested a modest decrease over the 12-month period, from $M = 24.45$ (2010) to $M = 24.05$ (2011), $p < .05$ (possible range 7 – 42). Averaged results across all 2010 and 2011 participants indicated that substantial self-reported changes in thinking, feeling, and generally responding to the threat of climate change reflect dynamic psychological adaptation processes were taking place. Fifty-seven percent of respondents in 2010 and 55.9% in 2011 agreed that they had, "**changed the way they think about the seriousness of environmental problems because of climate change**", and 55.7% of respondents in 2010 and 49.5% in 2011 indicated that, "**climate change has forced me to change the way I think about and view how we live in and use our natural environment in Australia**". The items in this initial prototype scale have had a stronger focus on thinking and risk as analysis rather than risk as feeling, a matter to be addressed in further refinements of this measure (e.g., Slovic et al., 2004; Slovic, 2010).

An additional four items were included in the 2011 survey and are being used to further develop the scale. Responses to these new items suggest that respondents are becoming more aware and thinking about how they or their family can reduce their carbon footprint as well as how their daily activities may be affecting the natural environment and the problem of climate change. These additional scale items addressed possible psychological responses to media exposure, managing uncertainty, psychological adaptation through behavioural engagement, and enhanced mindfulness of personal and household carbon footprint. All additional items were strongly associated with psychological adaptation as measured by the existing scale, and an averaged 57% of respondents agreed with these item statements at varying levels.

The comparison of psychological adaptation scores for respondents in 2010 and 2011, did not suggest an appreciable difference in mean adaptation scores over this 12-month period. However, the nature of these processes indicates a high probability that these adaptation processes have been assisting Australians in their sense making and adjustments to climate change for some time. It might also suggest that a greater time period and additional strategic measures might be necessary to further pinpoint and track these dynamic, ongoing, and complex processes within the context of multiple environmental stressors.

These 2011 findings confirm the importance and dimensionality of psychological adaptation to climate change, the psychometric sensitivity and utility of the measure, and the multiple dividends of including such a parameterr and measure in climate change survey research such as the present exercise. These results also constitute further evidence that psychological adaptation to climate change is taking place, and that these diverse but convergent ways in which individuals are coming to terms with climate change constitute an important but neglected consideration and set of adaptation processes. Correlation, multiple regression, and structural equation modelling analyses in this report indicate just how central these psychological adaptation processes are in mediating the influence of multiple other psychological variables on behavioural engagement, and indeed the likely influence of behavioural engagement on self-regulation and emotion management.

BEHAVIOURAL ENGAGEMENT

The behavioural inventory was adapted from a similar listing of behaviours engaged in by survey respondents in North America, based on the work of Krosnick, at Stanford University and the Woods Institute for the Environment, and the ABC News polls (Krosnick, 2008) (#29). This listing of behaviours inventory is similar to many being used in U.S. national surveys (e.g., Leiserowitz et al., 2010a, 2010b; Roser-Renouf & Nisbett, 2008; Steg & Vleck, 2009) but adapted to the Australian context, while still allowing for meaningful comparisons. It is important to stress that this survey component relates to actual behaviours, not behavioural intentions, and that this is a self-report checklist. Behavioural engagement is particularly important in the context of this research as such ecological or 'environmentally significant' behaviours in terms of environmental sustainability, energy conservation, and carbon emission minimization are both a logical and strategic outcome variable, which relates directly to climate change adaptation and adjustment, as well as to climate change mitigation (Gardner & Stern, 2002). Equally, taking action in the context of climate change has as much to do with the psychological significance of behaviours as it has to do with the environmental significance of behaviours in terms of addressing anthropogenic greenhouse gas emissions (e.g., Reser & Swim, 2011; Stern, 2000).

Hence a composite measure of behavioural engagement provides a robust and conventional parameter which can serve as the predicted outcome variable in regression or structural equation modelling examining the predictors and mediators of individual level adaptation and mitigation. It is noteworthy that from a psychological perspective, climate change adaptation and mitigation are interrelated in multiple ways with each influencing the other. For example taking action with respect to climate change can have multiple psychological dividends including emotion management and experienced self-efficacy (Reser et al., 2012a). Additionally, behavioural engagement can be an excellent indicator of motivations, barriers, and the relative success of policy initiatives. Behavioural checklists do tend to have a strong pro-environmental and climate change mitigation focus, including the inventory used here, however the present collaborative research undertaking and the comparison benefits of using standardised survey items determined this selection of specific scale items. The listing of action possibilities was developed independently of more recent rank orderings of the environmental significance of such behaviours in terms of relative contribution to greenhouse gas emissions (e.g., Gardner & Stern, 2008).

MEASURE OF BEHAVIOUR

For the 2011 survey the instructions and response format of the behaviour engagement items were changed to ascertain both opportunity, in the case of not engaging in the behaviours, and the presence or absence of climate change as a contributing reason or motivation for the behaviours engaged in. Hence, all of the same behaviour options were presented as in 2010, but this became more than a checklist, as for each behaviour respondents provided this additional information. The objective was to achieve a behavioural engagement inventory and measure that was specific to actions within the context of climate

change. This change meant that the 2011 behavioural engagement findings were not directly comparable with the 2010 findings; however, this resulted in the research program having a more sensitive, climate change-related measure for future data collections.

In 2010, respondents were asked to indicate what action they were currently taking to reduce their carbon footprint. Participants were presented with a list of 15 pro-environmental behaviours and were asked to indicate those activities that reflected their current behaviour and actions (#29). Respondents were also able to tick the response option 'other' or 'nothing' if applicable. (Refer to Figure 6).

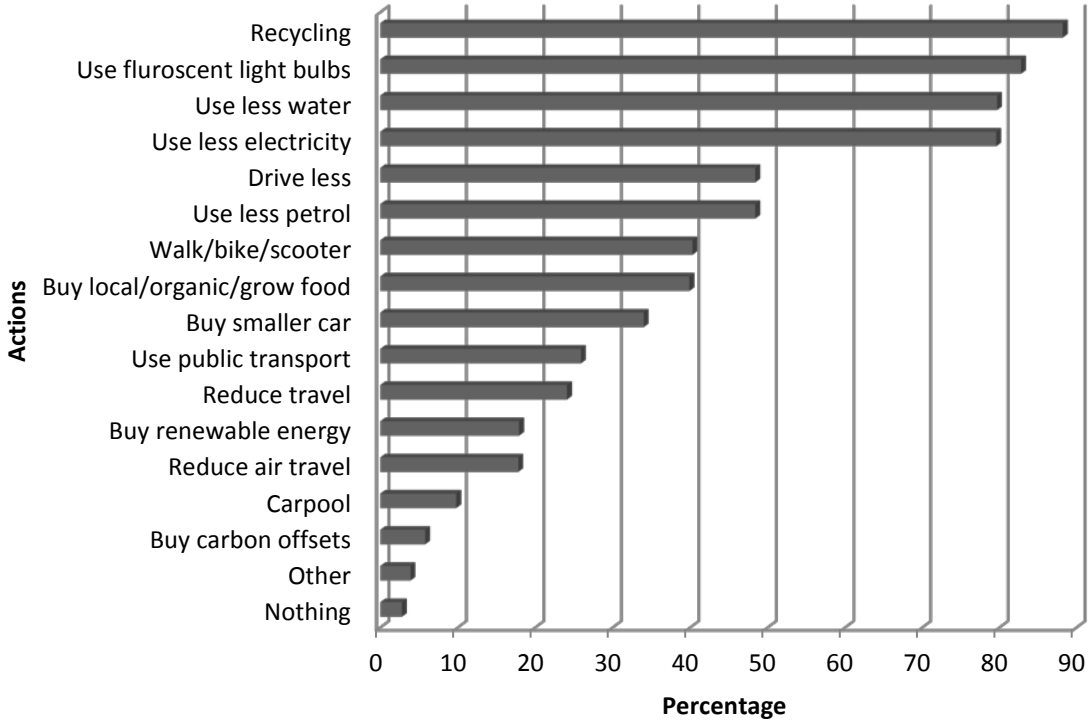

Figure 6. Action Taken to Reduce Carbon Footprint (2010)

Although the same items were used in 2011, the response format was changed to include four response categories; no, I am not engaging in this behaviour, "because of no opportunity to do so", or "for some other reason"; or they could answer, yes, I am engaging in these behaviours, "not because of climate change at all", or, "partly because of climate change". The computed score for 2011 was based on the behaviours that people reported engaging in (at least) partly because of climate change (possible range 0 – 16) with higher scores indicating greater behavioural engagement in carbon reducing actions. The mean score for 2011 was 3.41, i.e., 3.4 of the behaviours from the provided listing were engaged in at least partly because of climate change. It is interesting that for six of the 16 behaviours, a greater number of respondents reported engaging in the behaviour at least partly because of climate change. These behaviours were using less electricity, using compact fluorescent light bulbs, using less water, buying energy from renewable sources, recycling, and buying carbon offsets. See Appendix B, (#29). In the case of *all* behaviour categories a substantial

proportion of respondents (8% - 50%) reported engaging in the behaviour partly because of climate change. (Refer to Figure 7).

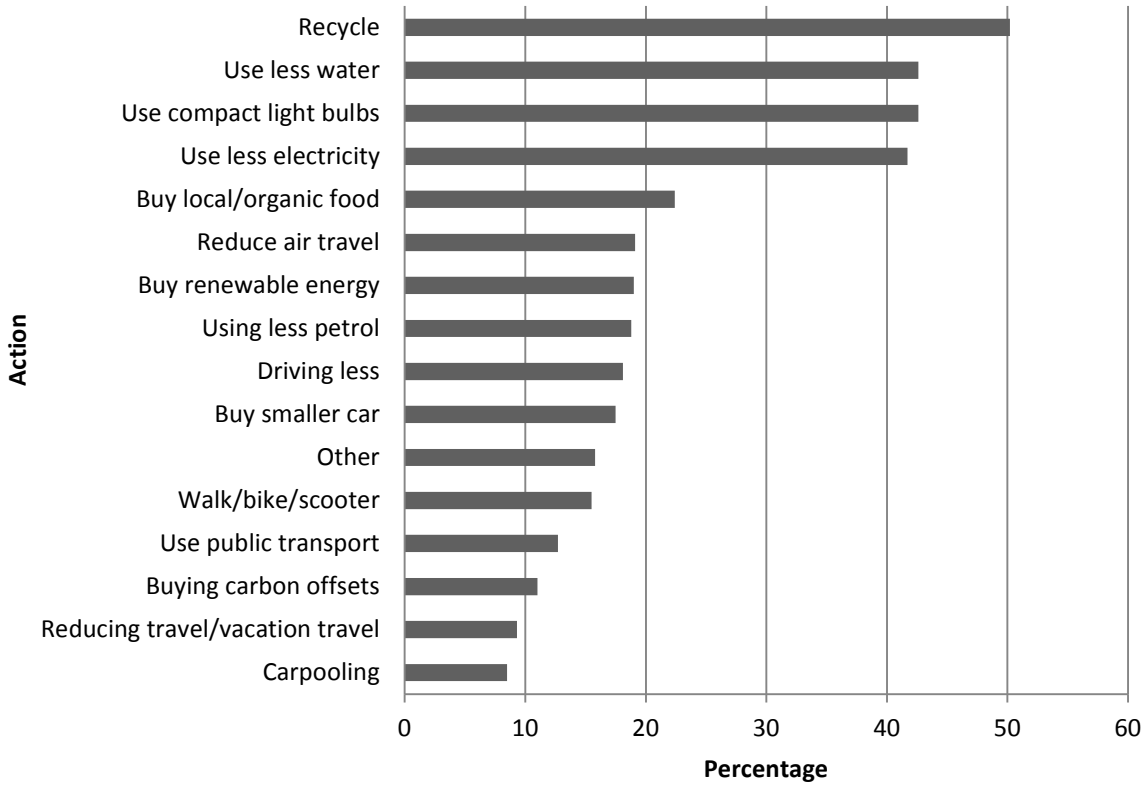

Figure 7. Actions Taken to Reduce Carbon Footprint at Least Partly Because of Climate Change

When the two figures are compared it looks as if there has been a decrease in the number of respondents engaging in carbon reducing behaviour from 2010 to 2011 (e.g., 88% of respondents in 2010 were recycling compared with 50% in 2011). However not all respondents were engaging in recycling behaviour because of climate change. Thus, for the 2011 data it was possible to more specifically determine who was engaging in carbon reducing behaviours, at least partly because of climate change.

When the rank orderings across the 12-month periods are compared, the first four categories remain the same, with many respondents engaging in recycling, using fluorescent light bulbs, less water, and reduced electricity consumption. For 2011 respondents, buying organic food, using renewable energy, and reducing air travel ranked higher than they did in the previous year. Least favoured in both surveys were carpooling and buying carbon offsets.

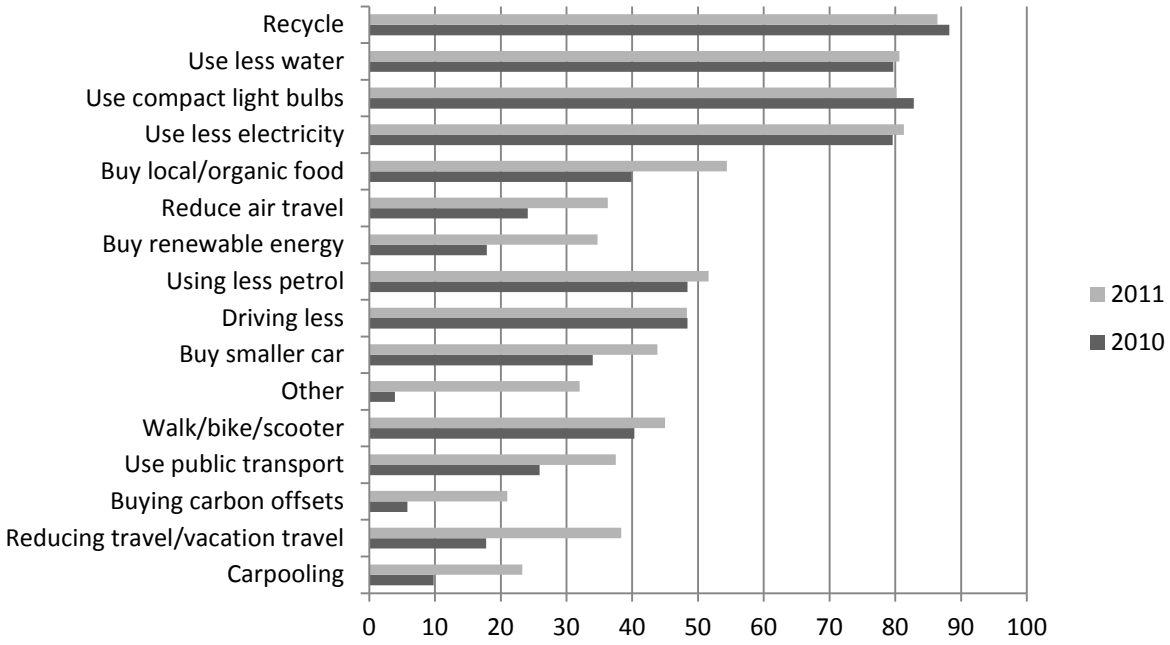

Figure 8. Actions Take to Reduce Carbon Footprint in 2010 and 2011

Figure 8 shows the percentages of respondents who indicated that they were engaging in actions to reduce their carbon footprint in 2010, and for respondents who indicated that they are engaging in carbon reducing behaviour in 2011, irrespective of whether this was due to climate change. Results indicated that a large proportion of respondents reported engaging in recycling behaviours, with these figures being 86.4% in 2011 and 88.2% in 2010, and who used compact florescent light bulbs, the figures being 80.2% in 2011 and 82.8% in 2010. A larger proportion of respondents engaged in buying local organic food in 2011 - 54.6% compared with 39.9% in 2010, reducing air travel - 38.3% in 2011 compared with 17.8% in 2010, and buying renewable energy - 34.7% in 2011 compared with 17.9% in 2010.

The response options used in the 2011 survey enabled the calculation of the number of research participants who engaged in each behavior for climate change reasons *as a proportion of* all those who reported having an opportunity to do so. This is important because many people may lack opportunity (e.g., if they currently never travel by air, they can hardly be expected to reduce their air travel), and hence the reported numbers of people engaging in the behaviours may under-estimate the number who would do so if the opportunity arose. When these proportions were calculated, proportions of people who both had the opportunity *and* reported in fact engaging in the behavior varied from 51.9% (recycling) to 12.8% (reduce travel/vacation travel). Relatively high proportions were found for using energy efficient light bulbs (44.9%), conserving water (44.2%) and using less electricity (43.5%), while relatively low proportions were found for reducing air travel (14.6%), carpooling (19.1%), using public transport (20.1%), and buying carbon offsets (20.2%).

Results reported above are consistent with findings from past research showing that large numbers of people are engaging in pro-environment behaviours. At least half of these

people report doing so (at least partly) for climate change-related reasons. Moreover, our research indicates that the proportion of people engaging in the majority of these carbon footprint-reducing behaviours was larger in 2011 than in 2010, while only two behaviours (recycling, and use of energy efficient light bulbs) were less widely practised in 2011 than in the preceding year. While these are pleasing findings, it is also true that not all behaviours were practised to a similarly high degree; most obviously, home-based conservation behaviours were more widely practised than, for example, travel-related behaviours. By identifying those behaviours that are infrequently engaged in, the findings help identify potential targets for future interventions. Foremost among these are behaviours related to energy-inefficient motor vehicle use. Of course not all individuals or groups of people engaged in these behaviours to the same extent, and later sections of this report (including the correlation matrix in Appendix E) offer insights into possible reasons for these differences.

The new operational definition and calculation of behavioural engagement was used in the correlation, regression, and structural equation modeling analyses which follow. This more sensitive measure of behavioural engagement is one of the study's many important contributions to research in this field. It represents a major improvement over simpler checklists used in most previous research (e.g., Homburg et al., 2007; Stern, Dietz, Abel, Guagnano, & Kalof, 1999; Vainio & Paloniemi, 2011). Use of this measure suggested the existence some differences in our 2011 findings when compared to 2010. Because of the different measures involved, comparisons over time involving behavioural engagement must be made with caution.

NATURAL DISASTERS AND EXTREME WEATHER EVENTS

Public risk perceptions**,** understandings, and responses to natural disasters and extreme weather events have been, along with climate change, a principal focus of this research program. A considerable amount of data was collected in mid-2010 on natural disaster risk perceptions and appraisals, including cumulative experience of natural disaster warning and impact events, and relative ratings and rankings of concern across differing natural disasters and other environmental and non-environmental threats, as well as personal and household impacts of natural disasters. An important objective in having climate change and natural disasters as a dual focus was to explore possible similarities and differences between climate change, and natural disasters and extreme weather events, as salient risk domains, and in terms of public understandings and psychological response and impacts. Our research report and monograph covering the 2010 baseline survey and data collection provided a detailed report and discussion of these disaster-related research findings (Reser et al., 2012b). Given this previous coverage, many findings and discussion from this earlier report are not re-addressed in the present report. In addition, a number of 2010 survey items were not included in the 2011 survey, such as the relative ranking of concern about differing types of disaster risk, as these items were not considered critical to the continuing monitoring exercise. As well, some measures, such as those addressing the impact of events, were redesigned in 2011 to more sensitively explore the psychological impacts of such exposure and experience. Hence, direct comparison figures are not available for a number of natural disaster items found in the 2010 and 2011 surveys.

We have nonetheless included a section in this report which addresses public risk perceptions**,** understandings, and responses to natural disasters and extreme weather events. This is because, the 2011 survey included a somewhat different constellation of survey items and scales addressing these matters, and also because a number of research questions and issues were clarified while analysing 2010 results. These expanded and nuanced research questions included:

- What is the nature and extent of possible interrelationships between climate change and natural disasters and extreme weather events in public understandings and cultural risk domains?
- Does prior direct experience with natural disasters influence belief or acceptance of climate change?
- Does perceived direct experience with an environmental event or change associated with climate change influence belief or acceptance of climate change?
- Does this depend upon the nature of that experience and encounter? – and the individual?
- How does direct exposure and experience compare with, and possibly interact with, virtual exposure and experience?

- Does the public see a causal association between climate change and more recent natural disasters and extreme weather events?

A further reason for closely examining public risk perceptions**,** understandings, and responses to natural disasters and extreme weather events in mid-2011 was that the preceding 12 months encompassed what became known as Australia's 'Summer of Disasters', with most Australians being either directly or indirectly exposed to multiple dramatic and in the case of some, extremely consequential, extreme weather events and natural disasters (Bureau of Meteorology [BOM], 2010, 2011a, 2011b, 2012; CSIRO, 2012). During this same period multiple and dramatic extreme weather events were taking place across the globe (National Oceanic and Atmospheric Administration, 2009, 2010, 2011), with a number of these extensively covered by international media. Hence, the Griffith data set covering national survey responses in 2010 and 2011 constitutes a very extensive national database reflecting the cumulative natural disaster experience of 7443 Australian respondents, including, for 4347 individuals, their disaster experience between mid 2010 and mid 2011.

RELATIVE CONCERN LEVELS WITH RESPECT TO NATURAL DISASTERS AND CLIMATE CHANGE

In both 2010 and 2011 the relative concern ratings of differing environmental threats were strongly determined by regional exposure and vulnerability. Table 6 provides mean rating scores and a posthoc ranking of natural disasters common to Australia and the threat of climate change for both 2010 and 2011. All mean ratings were significantly different across the two years ($p < .001$). It is interesting that water scarcity was given the highest concern rating across both surveys, notwithstanding that 2010 was the wettest year on record for Australia (BOM, 2011a), reflecting no doubt very recent experience with the Millennium drought and water shortages across Australia, including for major municipalities. Heatwaves were given the second highest concern rating in 2010, again likely reflecting their status as the most lethal of natural disasters in terms of actual deaths, and the heatwave events which dramatically affected South Australia and West Australia in 2009. Climate change was the environmental threat which received the third highest concern rating in 2010, with this moving to fourth highest threat in 2011. Bushfires elicited higher concern ratings than Floods or Cyclones in both 2010 and 2011, with these latter two threats receiving fifth and sixth highest mean concern ratings in both 2010 and 2011. Hence the rank ordering of the environmental threats did change modestly across these two survey periods, as did the relative salience and active threat status of these risks over the distinctively different but equally eventful periods preceding each survey. It is noteworthy that notwithstanding the salience and dramatic nature of natural disaster and extreme weather events over this period of time, the threat of climate change was eliciting concern ratings very comparable to these major natural disaster threats. Equally noteworthy is the fact that all of these threats were receiving very high concern ratings across both surveys, reflecting the reality and risk status of these events across Australia.

Table 6**.** *Relative Concern Ratings for Natural Disasters and Climate Change*

	2010		2011	
	Mean	Rank	Mean	Rank
Water scarcity	5.10	1	4.66	1
Heatwaves	4.64	2	4.36	2
Impacts of climate change	4.44	3	3.99	4
Bushfires	4.29	4.	4.11	3
Floods	4.05	5	3.87	5
Cyclones	3.73	6	3.30	6

DIRECT EXPERIENCE WITH DISASTERS: 2010 AND 2011 FINDINGS

In 2010, respondents were asked, "**Have you ever experienced a natural disaster warning or natural disaster impact situation?**" with no time frame provided. If respondents answered 'yes', they were then asked to indicate the type of event(s), and the approximate number of times they had experienced each type of event. The objective was to document both the nature and extent of such experience over time, as well to record the self-reported situational and psychological impact of the event(s). This assessment of direct experience was notionally over the respondent's lifetime and was not confined to local region. Thirty-seven percent of 2010 respondents (1158 individuals) indicated that they had had one or more such experiences. Table 7 presents the relative proportions of respondents (i.e., out of 3096 individuals) reporting prior first-hand experience(s) across differing types of natural disaster events, including the reported number of such experiences.

Table 7. *Disaster Event and Frequency for Survey Respondents in 2010*

	Cyclone		Bushfire		Drought		Flood		Other	
	Freq	%	Freq	%	Freq	%	Freq	%	Freq	%
Experienced the event on one occasion	233	7.5	283	9.1	193	6.2	222	7.2	108	3.5
Experienced the event twice	170	5.5	167	5.4	134	4.3	162	5.2	43	1.4
Experienced the event three times	87	2.8	55	1.8	84	2.7	73	2.4	16	0.5
Experienced the event four times	37	1.2	13	0.4	21	0.7	33	1.1	4	0.1
Experienced the event five times or more	132	4.3	75	2.4	103	3.3	131	4.2	15	0.5
Total	659	21.3	593	19.1	535	17.2	621	20.1	186	6.0

*Note: Percentages are for all 3096 respondents.

It is noteworthy that 14% of respondents experienced cyclone events more than once, 13% experienced flood events more than once, and 10% bushfires more than once. In the case of cyclone and flood events, over 4% of respondents in each case experienced such disaster events more than five times. Each of these specific natural disaster categories had

close to 20% of this national sample reporting direct experience with such an event. So the extent of direct experience by a largely urban national sample is quite remarkable.

The relative instances of disaster events are no doubt somewhat more complex than Table 7 might suggest. Clearly some disaster events tend to merge, as with cyclonic rain and flooding, and extended drought and bushfires. It is likely, though, that most multiple manifestation events are simply counted once by respondents, with floods accompanying a cyclone in Northern Australia, for example, being entered as a single cyclone event. As well, over a respondent's lifetime, it is likely that a number of events, however dramatic, might not be fully recalled in the context of an online survey, though evidence would indicate that accuracy of recall over shorter time periods is generally very good (e.g., Norris, Smith,& Kaniasty, 1992). This would suggest that the actual incidence of such events and associated direct experience is in fact greater than what these figures would imply. As well, the research team quite deliberately included severe warning situations as very real, direct experience events, as such warning situations can be quite terrifying and disruptive to community life, and can certainly have long term psychological and social impacts (e.g., Reser, 1996; Reser & Morrissey, 2008).

In 2011, respondents were asked (#45), "**Have you experienced a natural warning or natural disaster impact situation in the past 12 months?"** Twenty-nine percent of respondents (1237 individuals) reported having had one or more disaster experiences in the past 12 months. Respondents who reported having had such experience(s) were then asked to indicate the type of event(s) and the approximate number of times they had experienced each type of event over the past 12 months (#46). Table 8 presents the reported number of times these respondents had experienced each of the provided event categories over the preceding year, including an 'other' category.

Table 8. *Disaster Event and Frequency for 2011 based on the **previous 12 months***

	Cyclone		Bushfire		Drought		Flood		Other	
	Freq	%	Freq	%	Freq	%	Freq	%	Freq	%
Experienced the event on one occasion	293	6.7	148	3.4	250	5.7	752	17.3	77	1.8
Experienced the event twice	74	1.7	28	0.6	21	0.5	158	3.6	23	0.5
Experienced the event three times	20	0.5	7	0.2	6	0.1	29	0.7	11	0.2
Experienced the event four times	4	0.09	6	0.1	0	0	9	0.2	7	0.2
Experienced the event five times or more	1	0.02	3	0.07	2	0.05	7	0.2	8	0.2
Total	392	9.0	192	4.4	279	6.4	955	22.0	126	2.9

Respondents were then asked whether they had experienced a natural disaster warning or natural disaster impact situation *prior to* the past 12 months (#47), providing a rough comparison figure for 2010 data (See Table 9). In 2011, 36.2% of respondents (1573 individuals) respondent 'yes' compared with 37.4% of respondents in 2010, indicating that these two samples were very similar in terms of prior disaster experience. Respondents, who replied yes, were again asked to indicate the type of event(s) and the approximate number of times they had experienced each type of event, including the previous 12 months (#48). Due to the sequencing of questions relating to both the 12 months and cumulative lifetime experience the figures in Table 9 may not include the disaster experience for those individuals whose *only disaster experience* took place in the *preceding 12 months*. Hence this table may well under-represent the total cumulative disaster experience for the 2011 cohort respondents.

A number of these findings are noteworthy. The fact that 29% of the 2011 sample, 1237 of 4347 respondents, reported direct experience of a disaster warning situation or an impact event *in the preceding 12 months* is arguably exceptionally high. The percentages of respondents reporting direct disaster experience over their lifetime, 37.4% in 2010 and 36.2% in 2011, are very similar figures, and undoubtedly reflect the fact that those 2011 respondents who experienced such events in this 12 month period, that is between mid-2010 and mid-2011, were drawn from the same sampling regions and catchments as were the 2010 respondents.

Table 9. *Disaster Events and Frequencies for 2011 based on the number of times that respondents experienced each type of event* ***during their lifetime, including the past 12 months***

	Cyclone		Bushfire		Drought		Flood		Other	
	Freq	%	Freq	%	Freq	%	Freq	%	Freq	%
Experienced the event on one occasion	328	7.5	480	11.0	545	12.5	575	13.2	157	3.6
Experienced the event twice	138	3.2	329	5.5	246	5.6	291	6.7	58	1.3
Experienced the event three times	89	2.0	117	2.7	115	2.6	155	3.6	27	0.6
Experienced the event four times	63	1.4	44	1.0	37	0.8	73	1.7	10	0.2
Experienced the event five times or more	158	3.6	105	2.4	129	3.0	173	4.0	51	1.2
Total	776	17.7	1075	22.6	1072	24.5	1267	29.2	303	6.9

It is noteworthy that 10.2% of the 2011 respondents had experienced cyclone events more than once, 16% had experienced floods more than once, and 11.6% had experienced bushfires more than once. In the case of cyclones and flood events, 3.6% and 4.0% of respondents respectively had experienced such disasters more than five times. Overall it appeared that prior to mid-2010-2011 the 2011 respondents had somewhat less direct

experience with natural disasters, particularly with cyclones, but that for many the events of the subsequent 12 months definitely changed this amount of experience.

These cumulative disaster event experiences for the independent survey samples in 2010 and 2011 are in themselves interesting descriptive compilations of the extent of disaster experience across different event categories. While this 12-month period saw Cyclone Yasi and the extensive Queensland and Brisbane floods, Cyclone Yasi affected a relatively small population as it crossed the coast between Townsville and Cairns at low tide. An exceptionally large number of Australians experienced flooding during and following this period, particularly in the Northern Territory, Queensland, New South Wales, and Western Victoria, with much of this flooding linked to cyclone activity and systems. Perhaps most interesting in Table 10 is the third column, where natural disaster experience for this 12 month period is segregated from that for those years preceding mid-2010 to mid-2011. For this 12-month period and for this respondent group, direct flooding experience eclipses other disasters event categories at 22.0%, followed by direct cyclone experience at 9.0%. It is sobering to appreciate that the proportion of survey respondents *of this national sample* reporting direct disaster experience over these four major disaster event categories between mid-2010 and mid-2011 approached one quarter of the sample for flooding, and one tenth of the sample for cyclones, and that a very substantial number of respondents reported experiencing one or more of these four categories of events *five times or more* over this 12-month period.

Table 10. *Cumulative Disaster Experience*

Cumulative Disaster Event Experience			2010-2011
Proportional frequencies	**2010 %**	**2011 %**	**Past 12 months %**
Cyclone	21.3	17.7	9.0
Bushfire	19.1	22.6	4.4
Drought	17.2	24.5	6.4
Flood	20.1	29.2	22.0
Other	0.6	6.9	2.9

These Australian data and recent findings can usefully be compared with recent findings from North America. Two recent reports from the Yale Project on Climate Change Communication (Leiserowitz et al., 2012a, Leiserowitz, Maibach, Roser-Renouf, & Hmielowski, 2012c) provide an interesting set of touchstones. National surveys (n = 1008, n = 1061) addressing extreme weather events and climate change were undertaken in March and September of 2012, nine months and fifteen months following the mid-2011 Australian survey, and in each case following multiple extreme weather events across the United States. In March of 2012, 82% of American respondents reported that they had “personally experienced an extreme weather event or natural disaster in the past year”. These events included: extreme high winds, extreme rainstorms, extreme heatwaves, drought, extreme cold temperatures, extreme snowstorms, tornadoes, floods, hurricanes, and bushfires. These two national surveys in 2012 found that a growing majority of Americans agree that climate change (global warming) is affecting weather in the United States (69% in March, 74% in

September), and that this is typically framed as climate change making extreme weather events worse, rather than necessarily *causing* extreme weather events. Nonetheless about half of these respondents reported 'unusual' weather events in their local area over the past year, with 61% of respondents recalling unusual weather events occurring elsewhere in the United States. It must be kept in mind that the framing of the questions was somewhat different from the items in our survey. Respondents were presented with a list of 'extreme weather events and natural disasters' and were asked whether they had "personally experienced each of the extreme weather events or natural disasters listed below?" The findings nonetheless indicated that the survey reporting of personal experience with extreme weather events and natural disasters was well over twice that reported in Australia the previous year, though the wording of the corresponding Australian survey item was in terms of 'disaster warning or impact situations'. It is not clear why these reported findings are so different. Perhaps it is the case that Australian respondents would not consider a number of the provided categories as 'natural disasters' e.g., extreme high winds, extreme rainstorm, extreme cold temperature. There is also the widely accepted stereotype that Australians are pretty tough and resilient, they 'just get on with it', and everyone accepts that they live in a harsh land of "drought and flooding rains", and in any case and ultimately "she'll be right". Had our respondents been provided with these North American labels and categories, that would have operationally defined 'disaster' for them, they might well have used these categories and responded differently.

PRIOR EXPERIENCE AND IMPACT OF EVENTS

Respondents in 2011 were asked additional questions based on 'the most personally significant extreme weather or natural disaster event that they had experienced'. The first question was an open-ended item which asked (#49a), "**What was the event or situation?"** Fifty-seven percent of all respondents (n = 2472) provided a response. Examples of the types of events reported included: Cyclone Yasi, the Brisbane floods, bushfires in East Gippsland, a severe storm/super cell at the Gap in Brisbane, Canberra bushfires, flash floods in Toowoomba and the Lockyer Valley, Black Saturday bushfires in Victoria, and drought (multiple locations).

Respondents were then asked (#49b), "**When did this event take place?"** Notably, 45% of those respondents with such prior direct experiences reported having had their experience in the preceding 12 months, again suggesting that this particular 12-month period was rather extraordinary, not discounting a possible recency effect. See Figure 9. Just over 10% of respondents reported an incident that happened more than 20 years ago.

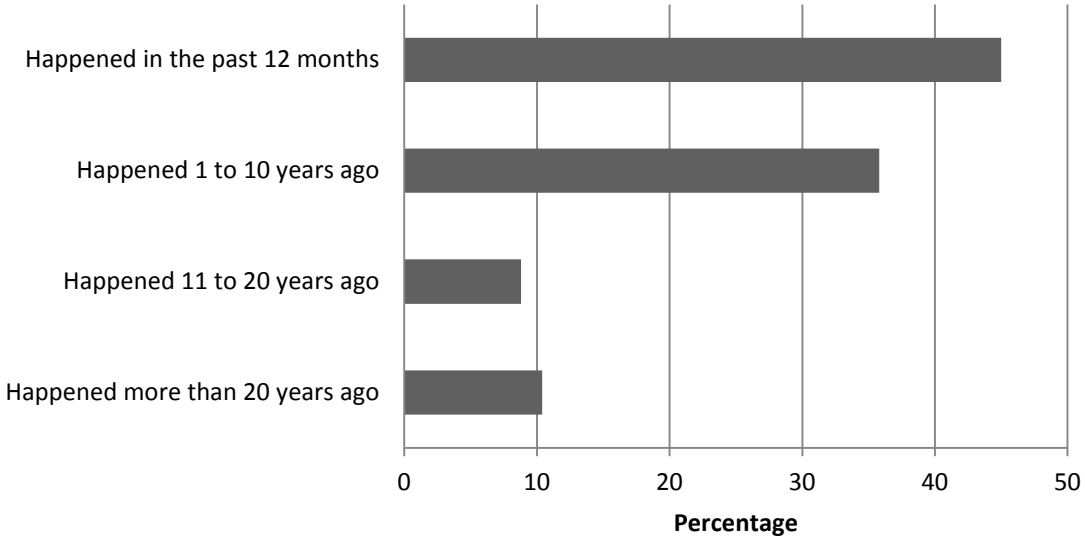

Figure 9. Time Frame of 'Most Personally Significant' Natural Disaster Event (*n* = 1892)

Respondents were then asked to indicate the personal impact of this event by indicating 'yes' or 'no' to six questions. The items were based on the work of Elal and Slade's (2005) Traumatic Exposure Severity Scale (TESS) which measures the range of the experience, and the distress associated with the event (See Figure 10). The Exposure Severity Scale developed for the 2011 survey is arguably a good deal more sensitive than the corresponding scale used in 2010 - hence direct comparisons are not possible. It is clear that those natural disaster events characterised as being most 'personally significant' were reasonably traumatic for many. Thirty-six per cent of these individuals had a family member or close acquaintance who was physically injured or trapped, and 22% suffered damage to their home. It is also noteworthy that 11% of these individuals reported that they had thought, at one or more points that they were going to die. Such an experience is a very important indicator of the emotional intensity and psychological impact of such an event (e.g., McDermott, Lee, Judd, & Gibbon, 2005; Mills, Edmondson, & Park, 2007; Norris, Friedman, Watson, Byrne, Diaz, & Kaniasty, 2002; Wahlström, Michélsen, Schulman, & Backheden, 2008).

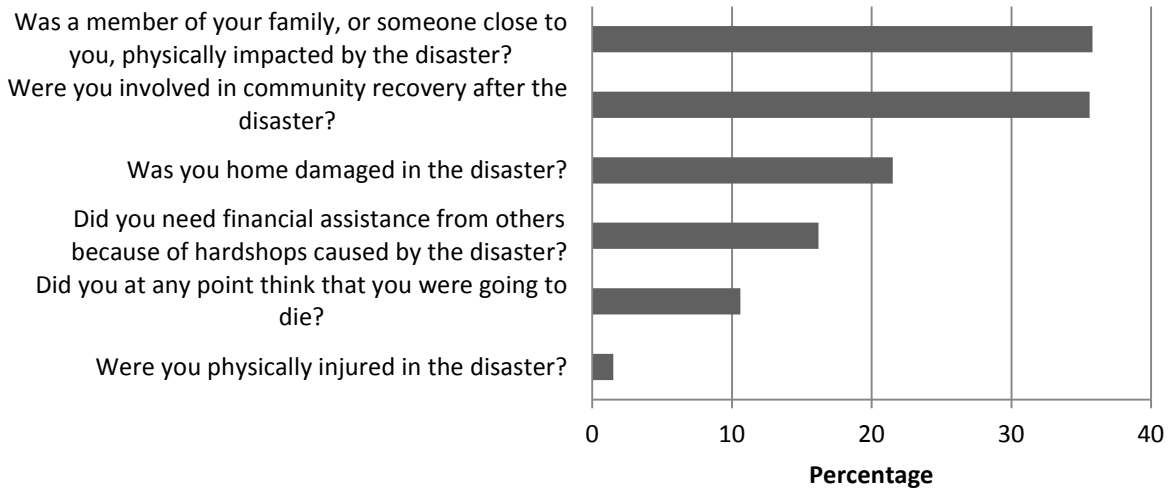

Figure 10. Impact of Event

The following two questions were asked both in 2011 and in 2010, but with altered wording in each instance. In 2010 the items were based on the preceding question, "**Have you ever experienced a natural disaster warning or natural disaster impact situation?**", whereas in 2011 the questions were based on the '**most personally significant extreme weather or natural disaster situation'**. The wording of the actual items were also slightly different in 2010, with respondents being asked to indicate, "**How much property damage/anxiety stress did you experience *in this or these situations?"*** rather than **in this situation**. Therefore caution is required when interpreting Figures 11 and 12 as in 2010 respondents were asked to indicate the amount of property damage and anxiety or stress they had in the context of *more than one* natural disaster event, whereas in 2011 respondents provided information based on *one* particular significant event. The number of respondents answering this item in 2010 was 1157, with the corresponding figure being 1904 in 2011.

In 2011, survey respondents were asked to rate the amount of stress they experienced in their nominated 'most personally significant' event. Nineteen percent of both 2010 and 2011 respondents indicated that the amount of anxiety and stress experienced in these situations was 'considerable' or appreciable. When asked how vulnerable they thought the region where they lived was to natural disasters (# 50) 55.4% of the 2011 respondents thought that their region was vulnerable, with 32.7% reporting that they thought it was 'very' or 'reasonably' vulnerable. This latter figure was somewhat greater in 2010 (37.5%), no doubt reflecting the fact that the year leading up to the 2010 survey was also characterised by multiple extreme weather events and by widespread drought, and a multi-region high bushfire risk that had been affecting much of Australia for several months prior to the survey. Again, differences across these samples in terms of objective exposure and vulnerability of respondents' specific residential circumstances might account for these differences.

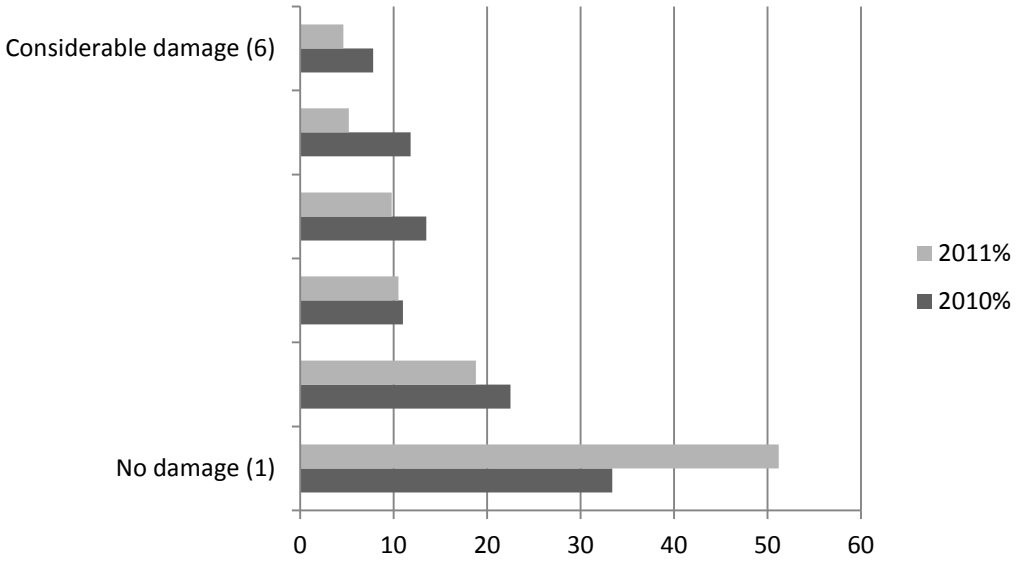

Figure 11. Extent to which Experienced Natural Disasters Have Caused Property Damage

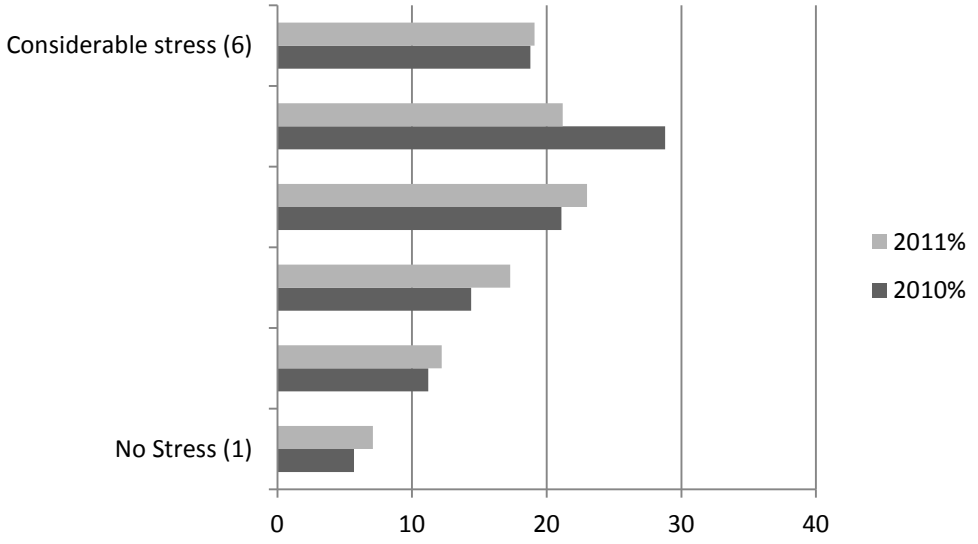

Figure 12. Extent to which Experienced Natural Disasters Have Caused Stress

RESIDENTIAL EXPOSURE AND VULNERABILITY

The geographic stratification of the survey sample was based on selecting regions and communities across the spectrum of natural disaster and climate change threats and judged relative exposure. These considerations overlapped to the extent that climate change impacts for particular regions would be expected to manifest as extreme weather or natural disaster events, both chronic and acute, such as drought or cyclone intensity. There are cogent reasons for sampling based on the representativeness of settings as well as the representation of participants (e.g., Winkel et al., 2009), and in this respect Australia encompasses substantial geographic and distance diversity challenges. Clearly there is a difference between objective exposure and/or vulnerability to the threat and/or impacts of climate change and extreme weather events, and subjective or perceived risk exposure and vulnerability (e.g., Breakwell, 2007; Malone & Engle, 2011; Zahran, Brody, Peacock, Vedlitz, & Grover, 2008). In the context of public risk *perceptions* and *appraisals*, as distinct from formal risk *assessments* (e.g., Gifford, 2007), it is arguable that subjective exposure is the more substantive issue and concern, though it is important to investigate whether the risk perceptions of residents in a particular region accurately reflect objective risk exposure and assessment. These matters are frustrated by the fact that there do not currently exist accurate risk or vulnerability maps as such for Australia as a whole relating to natural disaster threat and/or climate change impacts. It is nonetheless possible to identify 'disaster-prone' regions and communities for specific types of recurrent events, such as cyclones, floods, bushfires, and drought.

The above matters are all germane to this national survey exercise. Where one resides in Australia can make particular threats and events more local and immediate, or more distant, both in psychological terms as well as in objective physical distance terms (Spence, Poortinga, & Pidgeon, 2012; Uzzell, 2000). It might be expected that individuals residing in areas that have designated 'seasons' for recurrent events such as cyclones, floods, or bushfires, would see such threats as more relevant, familiar, and 'real' than would those living at considerable distance from such phenomena. Similarly, individuals living in areas characterised by specific and recurrent threats might well be expected to have greater prior life experience of such events and conditions, with risk perceptions and responses, and experienced vulnerability, being substantially influenced by such exposure and experience (e.g., Sattler, Kaiser, & Hittner, 2000; Siegel, Shoaf, Afifi, & Bourque, 2009; Zahran et al., 2008).

COMPOSITE MEASURE OF RESIDENTIAL EXPOSURE AND VULNERABILITY

Respondents' mean scores on *residential exposure/vulnerability* decreased very marginally over the 12-month interval between surveys, from $M = 10.6$ (2010) to $M = 10.2$ (2011). This was a modest albeit significant difference ($p < .001$). Reference to Appendices E and F assist in examining quite meaningful interrelationships between residential exposure and many other research variables. These include, for example, substantial positive correlations with climate change concern ($r = .45$), risk appraisal ($r = .43$), psychological

adaptation (r = .40), belief in climate change (r = .38), felt responsibility (r = .37), self-efficacy (r = .36), direct experience (r = .35), and climate change distress (r = .35).

DIRECT EXPERIENCE WITH CLIMATE CHANGE

The phenomenon, threat, and typically media-presented nature of climate change exposure and experience has required a careful consideration of the nature of direct and indirect exposure and experience, and the mediating roles of sense-making processes, interpretive lenses, and assumptive worlds in perceived climate change encounters. The spectrum of climate change experiences would arguably run from direct, first-hand experience with local (or while travelling) manifestations and consequences of climate change, to indirect, second or third-hand 'encounters' through friends or relatives - or via the virtual information environment. But to the extent that an important and ongoing aspect of climate change is its background threat and risk character, in addition to intermittent acute extreme weather events, then important questions necessarily encompass multi-media *exposure* and experience as well as direct *encounters*, and the more general status of virtual experience. Importantly, the nature and status of environmental changes or events, and one's own personal experience, can be strongly determined by perceptions and beliefs. Ultimately *belief in climate change* (in terms of cognitive and emotional acceptance) may be quite as powerful as *seeing/experiencing*, and these would appear to be powerfully interacting processes, particularly in the regional and global contexts of wild weather, extreme events, and continuous discussion and speculation of what is happening to the world in which we live.

The matter of belief or acceptance of climate change is arguably a primary consideration. We again use the term acceptance in preference to belief as the issue and reality for many is whether or not our always dynamic global climate system has undergone distinctive and adverse system change over the past several hundred years because of human induced increases in greenhouse gases. If we accept that we are living in a world of increased risks and fragility in the context of climate change, this can appreciably alter how we make sense of what is happening around us. If, however, one does not accept that the world's climate system has become less stable and predictable because of the cumulative impacts of human activities on atmospheric gas concentrations, then the world and its seasons and weather are seen through different eyes and levels of concern. And of course it is difficult to ascertain the situation with respect to a phenomenon and convergent set of issues and considerations such as climate change, and have an informed and self-convincing view, with reference to only one's own knowledge and direct experience.

Direct experience with climate change was assessed through the question, "**Have you experienced any noteworthy changes or events in the natural environment over the past ten years which you think might be due to climate change?**" (#41) This question was slightly modified from the question wording in 2010 which was framed, "in your *local* natural environment". Thirty-six percent of respondents answered "yes" in 2010, with this figure being 37% in 2011. In 2010, respondents were additionally asked whether they had had a perceived climate change encounter elsewhere in Australia or the world, with the total percentage of respondents with perceived direct climate change experience being 45%, taking into account individuals who reported both local and more distant experiences. Participants

from 2011 were then asked to provide detailed information in an open-ended follow up question asking what these changes or events were, and why they held particular significance or meaning. A further question introduced in 2011 asked participants to briefly describe the 'thoughts and feelings that they had at the time they saw or experienced the environmental change or event'. These two questions explored the psychological nature and significance of direct encounters with the perceived impacts of climate change. A greater percentage of 2011 respondents answered the two open-ended survey questions relating to the significance and/or meaning of the event (#42), and described their thoughts and feelings about the environmental change or event (#43), than the original 37% who indicated that they had experienced changes and events in the natural environment due to climate change in total. Forty-five percent of the 2011 sample gave a response to both items (#42 and #43). This figure is identical with the 45% of respondents in 2010 who affirmed having had personal experience with environmental changes seen to be associated with climate change either in their local environment, or elsewhere in Australia or the world.

Content analyses were undertaken with respect to responses to these two open-ended questions, "what was the experience?", and "what thoughts or feelings did you have at the time?" A sub-sample of the first 500 participants who answered yes to question #41 was selected for this purpose. Twelve principal response categories emerged for question #42, "**If you have experienced any environmental change or event over the past few years that has made a strong impression on you, can you tell us what this was, and why it was of particular significance or meaning for you?**" (See Table 11). Responses were allocated to more than one category where appropriate. The most frequently reported types of changes or events were, extreme weather (e.g., heatwaves, storms, high winds), environmental changes (e.g., beach erosion, changes to flora and fauna), and water scarcity, with water scarcity being much more salient in 2010 than in 2011. In 2011, as in 2010, many respondents wrote at length when responding to these open-ended questions and items, providing many examples, observations, and reflective comments.

Table 11. *Categories of Environmental Events or Changes Directly Experienced and Thought to be due to Climate Change* (2011)

Response category	Count	%
Natural disasters (e.g., floods, drought, bushfires, cyclones, earthquakes)	260	35.4
Seasonal changes (e.g., changing weather patterns, colder, hotter, humidity)	221	30.1
Extreme weather (e.g., heatwaves, storms, hailstones, dust storms)	87	11.8
Environmental changes (e.g., flora, fauna, erosion, degradation)	61	8.3
Water scarcity	52	7.1
Increased rainfall	25	3.4
Sea level rise	7	.8
Instability/unpredictability	6	.8
Ice melt, loss of snow	5	.7
Increased pollution	4	.5
Volcanic eruptions	4	.5

Note: Percentage figures are based on the total number of responses for 500 respondents (734).

The types of changes and events which respondents mentioned are interesting and informative. While many responses were undoubtedly loosely associated with perceived changes in seasonal patterns, only 30% of respondents who reported having a probable climate change encounter specifically mentioned such seasonal changes. The types of changes and events most frequently reported were those relating to extreme weather events and natural disasters (e.g., floods, drought, and bushfires, as well as cyclones and earthquakes), with these followed closely by reference to changing extremes and patterns of temperature changes. A number of respondents also included reference to their judgment that natural disasters were becoming more frequent and intense. This closely reflects the corresponding finding that survey respondents' understandings of climate change in 2010 and 2011, as reflected in their response to other survey items, were strongly framed in terms of extreme weather events. This is hardly surprising given that there are few alternative ways for the average individual to more concretely think about or talk about the nature or manifestations of climate change.

> *#42. No one event, with the possible exception of Black Saturday, but the seemingly endless series of floods, fires cyclones, tropical storms, droughts and earthquakes makes it hard to believe that we are not experiencing the early effects of global climate change. As a parent I am deeply concerned with the world we are leaving our children, as a human being I am heartbroken for those that have lost their lives, family members, friends and homes.*
> *#43. I think that anyone who was in Victoria on Black Saturday and had experienced the preceding heat wave knew that an ill wind was blowing but no one was prepared*

for the full scale of the disaster. After the event we were in a state in mourning and there was a deep sense that this was a beginning, we had our first casualties of climate change.
(Female, Melbourne metro, 33 years)

#42. The heat and bush fires that raged through Victoria that "Black Saturday". I have never seen such fire storms and am certain they are a directly related to climate change. I lost friends in that fire storm and some friends lost their houses. I saw the hills around Melbourne burn and this was frightening.
#43. We have had hot days in summer before but the 40 degree days that preceded the bush fires were horrible and then the bush fires raging for days and the smoke that covered the city, it was very frightening. A sense of no control anywhere and that anything could happen. I personally think this changed a lot of people's minds about climate change. I started to worry more after that time.
(Female, Victoria – regional, 33 years)

Whilst respondents shared personal stories of their direct experience with natural disasters (e.g., Brisbane/Toowoomba floods, Black Saturday), it was clear that media exposure was also having a powerful effect, with participants reporting on local, national, and global disasters, such as the Japanese tsunami, the Christchurch earthquakes, and the Pakistan floods.

#42. The increase in the number of severe weather occurrences, such as the bushfires, cyclones and floods in Australia, flooding in Pakistan and other Asian regions, and tornadoes in the US have made me realise that these are not isolated events and are connected. I have not been affected directly from these, but seeing the images on television and in print does cause me concern about human impact on the planet. There's also the indirect impact of higher food prices.
#43 Sadness, distress, and a yearning to be able to put it all right
(Female, Sydney metro, 35 years).

#42. Ever since moving to Brisbane 3 years ago, natural disasters are constantly in the news. Brisbane floods, Christchurch multiple earthquakes, Haiti earthquake, Japan tsunami. Either I was not reading the news as much or they seem to be a lot more frequent
#43. Flood was way too close to home. Although the mortality rate from it was not comparable to Japan's loss. Immense sadness fell on me. All the lives lost, the suddenness of it all.
(Male, Brisbane – metro, 26 years)

Seasonal changes closely followed natural disasters as the most cited environmental change or event associated with climate change in 2011. Examples of seasonal changes reported by participants included: changing weather patterns, heat, warmer, colder, intensity

of sun, humidity, milder weather, ice and snow. Interestingly, weather and seasonal changes constituted the most cited category in 2010 (e.g., unpredictable weather changes, rising temperatures, changing seasons), followed by extreme weather and natural disasters. This finding is not so surprising considering the extreme weather events and natural disasters that occurred between November 2010 and February 2011 in Australia (Bureau of Meteorology [BOM], 2011a, 2011b; 2012) when 99% percent of Queensland was disaster declared due to cyclone and associated Monsoon flooding, with the remaining states and the Northern Territory experiencing a spectrum of severe weather events and other natural disasters (e.g., bushfires) (BOM, 2012). (Also refer to Appendix A).

> *#42. It's not much of a big thing, but animals such as snakes out in the middle of winter makes you think twice about the impact on the climate and how the seasons seem to be getting mixed up. More rain, less rain. More heat, less heat.*
> *#43. I believe that nature will always correct itself. But with the roundabout way the seasons are acting, I feel that climate change might have shifted into a more permanent state, creating a more difficult task for nature to correct or override.*
> *(Female, Sydney – regional, 19 years)*

Item #43, "**Can you briefly tell us what thoughts and or feelings you had at the time you saw or experienced this particular environmental change or event?**" was also content analysed, with 23 thematic categories identified (See Table 12). The top five response categories that emerged were sadness, concern, worry, being scared, and/ shocked. For some respondents it was clear that the climate change-related environmental change or event that they witnessed had a strong emotional and psychological impact, and in a number of cases appeared to trigger a genuinely *transformative* experience with respect to the reality and immediacy of climate change, and for many the full implications of this global change.

Table 12. *Emergent Categories for Thoughts and Feelings associated with Direct Experience of Climate Change* (2011)

Response category	Count	%
Sad	72	14.0
Concern,	61	11.9
Worry	41	8.0
Scared, fear, panic	37	7.2
Shock, horrified	34	6.6
Pessimism, hopelessness, discouraged,	34	6.6
Awe, dread, strange	32	6.2
Wanting to do something	29	5.6
Realisation	24	4.7
Uncertainty	23	4.5
Helpless	15	2.9
Frustration	14	2.7
Loss	14	2.7
Distress	14	2.7
Anger, annoyed	14	2.7
Indifferent	13	2.5
Empathy	12	2.4
Due to natural cycles	9	1.7
Adaptation	6	1.2
Vulnerability	5	1.0
Resignation	4	.8
Disbelief	3	.6
Aware	3	.6

Note: Percentage figures are based on the total number of responses for 500 respondents (513).

Clearly, worries and concerns, fears, and sadness were common responses. Other specific cognitive and emotional domains mentioned were hopelessness, dread, and uncertainly. Of particular interest was the extent to which responses reflected some suggestion of a strong realisation or transformative 'moment' with respect to the reality and immediacy, and/or the full implications of climate change.

> *#42. Summer is hotter now and goes for longer, I am thinking of moving to a cooler climate because of this as I do not cope well with the heat and humidity.*
> *#43. Realisation that climate change (global warming) is a reality and we need to do something URGENTLY to reverse this or at least slow it down*
> *(Female, Brisbane metro, 58 years)*

#42. Simply the heatwaves we have been dealing with, the temps are well above the norm.
#43. Wow, how are our kids going to deal with this in 30 years!!!
(Female, Melbourne metro, 37 years)

#42. The nature of the soil has changed significantly in my local area... as a kid in a Australia when we used to take holidays at the beach we used to get excited the closer we would get, as when we stopped for breaks we could see the soil getting sandier. Where I live now (for the past 30 years) I have noticed the soil change to be more like "close to the beach" soil. I do live relatively close to the beach, but the soil change is significant to me. Soil which used to be black and rich is now sandy and thin. Over the past few years, like when the drought broke here in Feb 2010, the soil reverted back to its normal state for a few weeks... then it dried out again.
#43. I thought that scientists who were warning us about global warming were right and I felt that I had direct evidence of it right in front of me.
(Male, Canberra, 55 years)

These qualitative responses reflect an acceptance that climate change is occurring, with acknowledgment from many that the changes and events noted were well outside of what might be expected in terms of historical or personally experienced climate variability. Responses could be generally characterised as reflecting, along with acceptance and resolve, frustration, pessimism, and real sadness. As well, worries and anxieties, genuine alarm and fear, and a clear sense that things will likely get worse characterised the responses of many. These qualitative responses strongly support the conclusion from the quantitative data that both media coverage, and personal, direct experience confirmation and validation of the unfolding impact of climate change are having strong, personally significant, psychological impacts on survey respondents.

Responses to these open-ended items in 2011 concerning direct experience with climate change would suggest that many people are beginning to alter how they think and feel about climate change. It is important to appreciate that 'disasters' have different types and modes of impacts and causalities: (1) those who have been directly impacted, (2) witnesses to the disaster and aftermath, and (3) those indirectly exposed through contact with victims, the scene, and the images and imagined consequences of the disaster via the media, general public, friends and family (Laurendeau, Labarre, Senecal, 2007). As we become more exposed to a 24-hour news culture which often delivers pervasive and powerful media coverage of unfolding disaster events, there is ample potential for people who have not been directly exposed to the immediate threat to feel anxiety, fear and uncertainty as these images affect how they think, feel, and behave (Laurendeau, Labarre, Senecal, 2007; Lorenzoni, Leiserowitz, Doria, Poortinga, & Pidgeon, 2006; Stokols et al., 2009). This is particularly important for vulnerable populations such as children and the elderly (Marshall, Bryant, Amsel, Suh, Cook, & Neria, 2007; Neria, DiGrande, & Adams, 2011; Silver, 2011).

It is clear from previous research that individuals may experience a considerable level of personal concern, distress, powerlessness, and frustration in the face of adverse and

widespread changes to local, known, natural landscapes (Higginbotham, Connor, Albrecht, Freeman, & Agho, 2006; Khanna, 2008, Kidner, 2007; Rogan et al., 2005). This was evident in the open-ended responses to items #42 and #43 in which some respondents reported feeling worried and helpless in the face of cumulative and adverse changes to their familiar landscape.

> *#42. The drought in Victoria meant that our dams were declining in capacity over a number of years and it was a valuable resource which we can't do without, it was looking as though they were all going to dry up.*
> *#43. I was really worried about our water supplies, wondering whether it would ever rain again and wondering what future my children would have.*
> (*Male, Victoria – regional, 53 years)*

In summary the qualitative responses overall clearly reflected an acceptance that climate change was occurring, with acknowledgement from many that the changes and events noted were well outside of what might be expected in terms of historical or personally experienced climate variability. Responses could also be generally characterised as reflecting, along with acceptance, resolve to address, and some measure of pessimism, anxiety and distress, a clear sense that things will likely get worse. Qualitative responses supported the conclusions from the quantitative data that both media coverage and personal validation of the unfolding impact of climate change are having strong psychological, emotional impacts on the respondents sampled.

EXAMINING THE IMPLICATIONS OF DIRECT AND INDIRECT EXPERIENCE WITH NATURAL DISASTERS AND PERCEIVED IMPACTS OF CLIMATE CHANGE

A logical and interesting empirical question salient to this climate change research was to ask whether perceived direct experience with an environmental change or event deemed to be a likely consequence of climate change was associated with or reflected in differential mean scores across other core measures in the survey. Respondents were divided into two groups on the basis of having or not having had such self-reported direct experience with climate change (See Table 13 and 15). Results indicated significant and noteworthy differences across all core variables initially selected. As well, discrepancies with respect to mean score differences on psychological adaptation, distress, climate change concern, and risk perception were quite marked, with *all* mean scores much higher for those who had had personal encounters with events of changes perceived to be likely consequences of climate change. Importantly, this included climate change belief. Differences between all of these core measures were significant at $p < .001$. Note that those reporting such direct encounters evidenced objective knowledge scores that were considerably higher than those without such experience.

Similarly, it was possible to examine whether perceived direct experience *with a natural disaster warning or impact event* was associated with or reflected in differential mean scores across other core measures in the survey (See Table 14 and 16). Again these comparison scores were not reflective of the nature or extent of such direct experience, but

whether or not respondents had had such personal experience. What is particularly surprising is that in only three instances were significant differences and meaningful effect sizes found, with the magnitude of the mean difference scores being very modest. It might be expected that respondents with such disaster experience would be more aware of, sensitive to, or concerned about the threat of climate change, given other survey evidence that climate change was being understood, in part, by many respondents in terms of its foreshadowed extreme weather event manifestations. Given the nature and extent of such disaster experience on the part of our Australian respondents, this was a particularly likely expectation. Yet a comparison of Tables 13 and 15 suggests that personal encounters with possible evidence and impacts of climate change were far more consequential, and more psychologically as well as statistically significant, than was direct personal experience with natural disaster events. It should be clarified that reported direct experience with a natural disaster or extreme weather which was perceived to be a manifestation of climate change was regarded as a 'climate change encounter', and coded as such.

Table 13. *Comparison of Mean Scores on Core Climate Change Variable for Respondents who Had and Had Not Directly Experienced Climate Change Impacts* (2010).

	Observed Range	Yes (*n* = 1936)	No (*n* = 1702)	*d*
Objective knowledge	-7-10	3.7***	1.9	.64
Belief in climate change	4-20	17.8***	14.4	.91
Climate change concern	7-32	26.5***	20.8	.98
Residential exposure/vulnerability	3-17	12.0***	9.5	.79
Risk perception	5-30	21.5***	16.9	.86
Distress	7-42	25.5***	19.0	.86
Self-efficacy	5-28	20.4***	16.8	.76
Personal responsibility	4-20	14.1***	11.6	.76
Adaptation	8-48	32.9***	25.2	.99
Behaviour	0-15	7.3***	5.7	.55

Note: Asterisks are placed to the right of the higher group mean. Differences between means are expressed as: $^{**}p < .01$ $^{***}p < .001$

Table 14. *Comparison of Mean Scores on Core Climate Change Variables for Respondents who Had and Had Not Directly Experienced Natural Disaster or Disaster Impact Situation* (*2010*).

	Observed Range	Yes (*n* = 1157)	No (*n* = 1939)	*d*
Objective knowledge	-7-10	2.8	2.6	
Belief in climate change	4-20	15.8	15.9	
Climate change concern	7-32	23.3	23.4	
Residential exposure/vulnerability	3-17	11.8***	9.9	.55
Risk perception	5-30	19.0	18.9	
Distress	7-42	22.2	21.7	
Self-efficacy	5-28	18.5	18.3	
Personal responsibility	4-20	12.7	12.7	
Adaptation	8-48	29.8***	28.0	.22
Behaviour	0-15	6.6**	6.3	.12

Note: Asterisks are placed to the right of the higher group mean. Differences between means are expressed as: $^{**}p < .01$ $^{***}p < .001$

The findings for the 2010 data set were remarkable enough for us to make sure that close consideration was given to these results in 2011, with the assistance of the qualitative items previously discussed. It was thought that replication of these findings would underscore and confirm the robustness of this direct personal experience effect, and shed further light on those psychological dynamics and processes involved, particularly relating to sense-making, significance, and motivational responses. The findings for 2011 eloquently attest to the fact that this is a very strong and consistent finding.

Table 15**.** *Comparison of Mean Scores on Core Climate Change Variable for Respondents who Had and Had Not Directly Experienced Climate Change Impacts* (2011).

	Observed Range	Yes (*n* = 1605)	No (*n* = 2742)	*d*
Objective knowledge	-7-10	3.7***	1.4	80
Belief in climate change	4-20	18.2***	14.0	1.19
Climate change concern	7-32	26.7***	19.7	1.17
Residential exposure/vulnerability	3-17	11.8***	9.3	.76
Risk perception	5-30	22.4***	16.8	1.05
Distress	7-42	26.1***	18.8	.95
Self-efficacy	5-28	21.0***	16.7	.86
Personal responsibility	4-20	14.5***	11.4	.89
Adaptation	8-48	28.3***	21.6	1.00
Behaviour	0-15	5.2***	2.4	.72

Note: Asterisks are placed to the right of the higher group mean. Differences between means are expressed as: $**p < .01$ $***p < .001$

Table 16. *Comparison of Mean Scores on Core Climate Change Variables for Respondents who Had and Had Not Directly Experienced Natural Disaster or Disaster Impact Situation* (2011).

	Observed Range	Yes (*n* = 2443)	No (*n* = 1904)	*d*
Objective knowledge	-7-10	2.5**	2.0	.16
Belief in climate change	4-20	15.7*	15.4	.07
Climate change concern	7-32	22.5*	22.0	.07
Residential exposure/vulnerability	3-17	11.6***	9.2	.73
Risk perception	5-30	19.1*	18.7	.08
Distress	7-42	21.7	21.4	
Self-efficacy	5-28	18.5*	18.1	
Personal responsibility	4-20	12.7*	12.4	.07
Adaptation	8-48	24.8***	23.5	.18
Behaviour	0-15	3.6*	3.3	.07

Note: Asterisks are placed to the right of the higher group mean. Differences between means are expressed as: $*p < .05$, $**p < .01$, $***p < .001$. The 2011 figure was calculated on the basis of respondents indicating 'yes' to item #45 or #47.

It is clearly necessary to address why it is that direct experiences with natural disasters do not seem to have the same significance or influence as direct encounters with climate

change, notwithstanding the well-documented psychological and material impacts of natural disasters. This is particularly so given that the types of changes and events mentioned in this latter case are often extreme weather events or natural disasters. There are a number of reasonable and arguably cogent explanations for this general and surprising finding. There is the simple reality that repeated exposure and experience can attenuate more dramatic psychological responses for many if not the majority of those residing in extreme weather prone circumstances. Theoretical explanations here include habituation, an extended General Adaptation Syndrome (e.g., Selye, 1951; 1978) model going from alarm to resistance to exhaustion in bodily and psychological response to severe and prolonged stressors; allostatic load (e.g., McEwen, 2004); a 'finite level of worry' (e.g., Weber, 2006); and optimal level theory (e.g., Arkes & Garske, 1982; Bell et al., 2001). Related to these explanations is the 'normalization bias' described by Mileti and O'Brien (1993) among others (e.g., Paton, Johnston, Bebbington, Lai, & Houghton, 2001).

There is also a cogent cumulative adverse experience argument coupled with optimism bias, which includes a presumed inference on the part of those who have experienced such repeated events, that if they've been able to cope with these previous events, they can deal with any such future occurrences, and such individuals are likely to persist in this biased optimism with respect to their personal invulnerability (e.g., Seery et al., 2010; Taylor & Brown, 1988; Taylor & Shepperd, 1998). Basically these perspectives would argue that most measures of cumulative disaster exposure and experience over time reflect very diverse circumstances and experiences, with high optimism and self efficacy scores ultimately associated with more modest adaptation levels and responses. Such measures, in this case of cumulative disaster experience and adaptation over time, are arguably very different from whether or not one has had a personal encounter with what was perceived as a probable manifestation of climate change. And, of course, many of these latter reported encounters were indeed with extreme weather or disaster events, *but viewed as a likely consequence of climate change*.

In many ways this finding with respect to the significance and influence of perceived direct experience of climate change is one of the most important findings of this research. These results indicate that close to one half of Australian respondents across two very large national surveys believe they that have had direct personal experience with climate change. When compared with respondents who have not had this experience, those respondents reporting such encounters scored dramatically differently across virtually all of the core response measures used in this research, and evidenced far stronger acceptance, concern, distress, felt responsibility, self-efficacy, motivation, and behavioural engagement. Careful analyses from multiple vantage points would indicate that these differences are not simply a reflection of believing is seeing, but a powerful combination of direct experience, personal confirmation, and a realisation that the more indirect, virtual, and psychologically distanced phenomenon and threat of climate change is actually a very real and current reality in one's own local, known, and personal environment and place.

PERCEIVED CAUSAL CONNECTION BETWEEN CLIMATE CHANGE AND NATURAL DISASTERS

Notwithstanding the very clear differences in significance and influence between direct experience with natural disasters and direct personal experience with events or changes associated with climate change, these risk domains appear to be interconnected in multiple ways. A particularly important connection relates to causal attributions and explanations. In both 2010 and 2011 respondents were asked (#44), "**Overall, how much do you think climate change is influencing the frequency and intensity of weather events like storms and droughts?**"(possible range from 1 *Not at all* to 6 *A good deal*). See Figure 13. The overall mean ratings for 2010 and 2011 were 4.14 and 4.09 respectively. These finding suggest respondents are beginning to connect climate change with extreme events and natural disasters. Recent findings based on a national sample in the U.S. found 74% of Americans 'strongly' or 'somewhat agree' with the statement, "Global warming is affecting weather in the United States" (Leiserowitz et al., 2012a). The survey was conducted in March 2012 and then repeated in August/September, with results showing that the percentage of respondents who agreed with this statement had increased in the period between the two surveys.

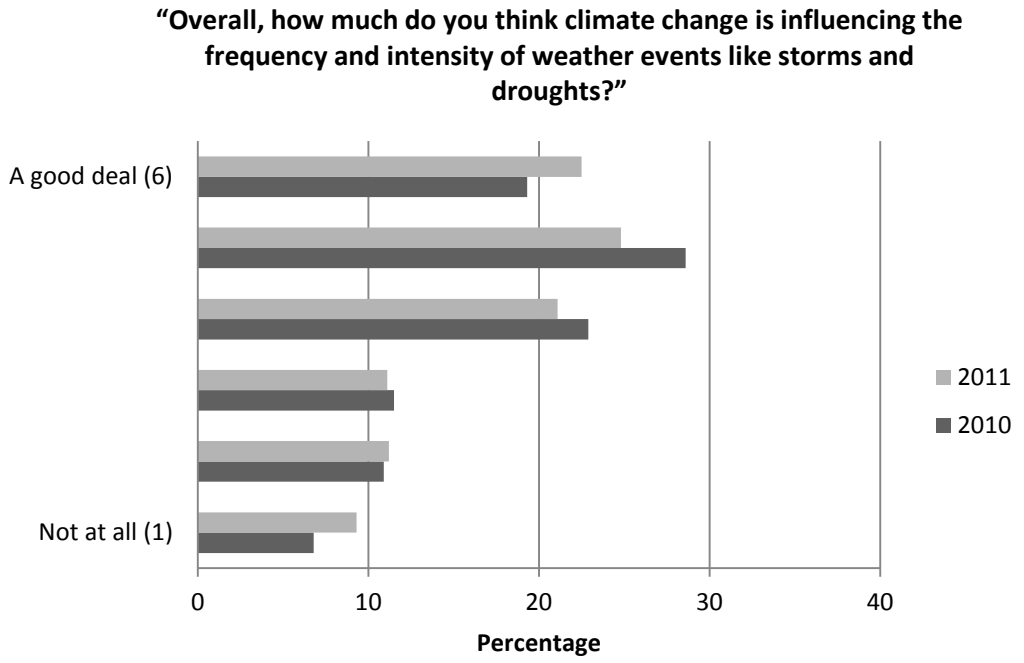

Figure 13. Perceived nexus between Climate Change and Extreme Weather Events

POLITICAL AND POLICY CONSIDERATIONS AND PARTY IDENTIFICATION

In both the 2010 and 2011 surveys, participants were asked to report their current voting preference/intention (#72), "**How would you vote if there was an election tomorrow**". Table 17 provides a direct comparison of the responses from the two samples. Clearly, over the twelve month intervening period, there was a modest shift by respondents away from Labor, the Greens, and the National Party, and a modest shift toward the Liberal Party. There was also a shift away from mainstream parties in general, suggesting some disaffection and possibly conflicted voter preferences across the board. As a considerable body of evidence suggests, there has been substantial voting intention volatility among Australian voters over the past several years, with the matter of climate change and carbon emission control policies constituting a central, highly-charged and contested component of the wider political debate (e.g., Ashworth et al., 2011; Fielding, Head, Laffan, Western, Hoegh-Guldberg, 2012; Levinston &Walker, 2010, 2011; Reser et al., 2012b).

Table 17. *Voting Intentions, 2010 and 2011*

Party	2010 % of respondents	2011 % of respondents
Greens	14.5	12.1
Independent	7.9	7.8
Labor	29.6	24.8
Liberals	33.6	36.0
National	3.4	2.8
Other	11.0	16.5

While the 2010 survey did not have a strong focus on political affiliation, policy or voting preferences, the single 2010 survey item relating to one's voting intention was broadened to three items in 2011 (# 71, #72 and #73). Added were items regarding political party affiliation/identity, and the salience and importance of the Labor government's proposed carbon tax legislation. These two new questions provide a more nuanced picture of climate change political issue considerations. The decision to add a party identification item was based on the realisation that stated voting intention is becoming as much an indicator of voter disaffection and disappointment as it is of genuine support for party platforms. As well, convergent literatures within the social sciences argue that party identification is a more stable and determining factor than is voting intention in a specific election, as it can be integral to self-perceptions as a responsible and engaged citizen, as well as reflecting one's values and worldview (e.g., Brechin, 2010; Dunlap & McCright, 2008; Krosnick, Holbrook, Lowe, & Visser, 2006; McCright, 2011; McCright & Dunlap, 2011a, 2011b).

In terms of party identification, the proportions of 2011 Labor- and Liberal-leaning respondents were very close, at 30% and 31%, respectively. Those identifying with the Greens constituted 11.5% of the 2011 sample, those identifying as Independents 6.5%, while the 'other' category garnered 18% of respondent selections. This would suggest that, in mid-2011, Australians' political views and identifications were quite diverse, with many respondents (18%) not identifying with or having strong preference for any established party.

Not surprisingly in 2011, there was a close alignment between respondents' voting intentions and party identifications with approximately five out of six respondents (83.4%) answering identically to both questions, X^2 (25) = 13,201, $p < .001$. Of those who responded differently to the two questions, the largest groups were: (a) respondents who identified with Labor but intended to vote Liberal (114 respondents or 2.6% of the sample), (b) people who identified with Labor but intended to vote independent (86 respondents or 2.0%), and (c) respondents who identified with "other" parties but intended to vote Liberal (99 respondents or 2.3%).

When asked to report the way in which the Labor government's planned tax on carbon emissions had changed their voting intention, 7.6% of respondents indicated that the tax had made them *much* more likely to vote Labor, 7.6% were *slightly* more likely to vote Labor, 38.9% reported that their voting intentions were unchanged, 10.6 % were slightly *less* likely to vote Labor, and more than one-third of the sample, 35.4%, were *much less* likely to vote Labor. Thus, on the basis of these mid-2011 results, the introduction of the carbon emission tax appeared likely not only to have cost Labor votes but also to cost them government. Closer analysis, however, suggests that the electoral damage caused by the introduction of this tax would not be as great as first seems. When responses to this carbon tax question were cross-referenced with respondents' voting intentions, the carbon tax-induced swing from Labor was shown to come primarily from non-Labor voting respondents. Specifically, responses indicated that the tax would induce 8.7% of Labor voters to be more likely to vote Labor and 8.0% less likely to vote Labor. Among Green voters, the corresponding percentages were 3.6% and 1.9%. In these two sub-groups of the sample (only) therefore, the tax was likely to increase Labor's electoral appeal. Any such effect was, however, considerably outweighed by opposite effects among intending Liberal voters (0.9% more likely to vote Labor versus 21.1% less likely), National voters (0% versus 2.0%), independent voters (0.7% versus 3.6%), and other party voters (1.3% versus 9.3%). Thus, the issue of a tax on carbon emissions, like the climate change issue itself, seems to have polarised members of the community, rather than causing substantial numbers to "change sides".

Political party identifications and preferences were powerful predictors of responses across multiple other measures. Since the pattern of association was similar for party identification and voting intention, associations involving only the former are shown. Table 18 presents differential responses across selected composite variables by party identification.

Table 18. *Differences in Mean Scores on Composite Climate Change Variables by Political Party Identification*

Question 71. How would you describe your current political party identification or preference?									
	Year	**Labor**	**Liberal**	**National Party**	**Greens**	**Independent**	**Other**	***Full Sample Mean***	***F****
Residential Exposure and Vulnerability	2011	10.72 [b]	9.33 [c]	10.55 [b]	11.77 [a]	10.15 [bc]	10.01 [bc]	10.24	43.89
Trust	2011	13.64 [a]	10.72 [bc]	9.94 [c]	13.39 [a]	11.17 [b]	11.07 [b]	11.99	121.67
Objective Knowledge	2011	2.94 [b]	1.27 [cd]	1.12 [d]	3.96 [a]	1.97 [c]	1.82 [cd]	2.22	80.12
Green Self-Identity	2011	10.49 [b]	9.34 [d]	9.14 [d]	12.27 [a]	10.03 [bc]	9.77 [cd]	10.14	101.12
Belief in Climate Change	2011	16.78 [b]	13.75 [d]	13.63 [d]	18.35 [a]	15.09 [c]	15.36 [c]	15.57	125.06
Climate Change Concern	2011	24.44 [b]	18.99 [d]	18.06 [d]	27.63 [a]	21.20 [c]	21.77 [c]	22.24	172.56
Risk Perception	2011	20.13 [b]	16.72 [d]	15.68 [d]	22.69 [a]	18.09 [c]	18.90 [bc]	18.88	97.75
Distress	2011	23.03 [b]	18.88 [cd]	17.63 [d]	27.05 [a]	20.85 [c]	20.81 [c]	21.51	89.40
Psychological Adaptation	2011	25.37 [b]	21.95 [d]	21.18 [d]	29.26 [a]	23.72 [c]	22.65 [cd]	24.05	95.76
Behaviour	2011	4.10 [b]	2.23 [c]	2.08 [c]	6.15 [a]	3.04 [c]	2.89 [c]	3.41	92.61

Note. Cell means with different superscripts within rows are significantly different from each other (Bonferroni $\alpha < .003$)

***All *F* values significant at $p < .001$

Respondents identifying with the Greens perceived their **residential exposure and vulnerability** to the impacts of climate change to be greatest, with those identifying with Labor having the second-highest perceived exposure/vulnerability mean rating. Those identifying with the National Party had the third highest perceived exposure rating, not significantly below that of Labor-preferred respondents, with this likely to partly reflect the rural residential circumstances of many National Party supporters. Rather dramatic differences appeared on the measure of **trust**, with those respondents identifying with Labor and Green parties evidencing much more trust than did those identifying with other or no party. Of particular note is the fact that respondents identifying with the Greens had the highest **objective knowledge** mean score, with Labor supporters having the next highest, albeit significantly lower, mean score. Respondents identifying with other parties or no party had markedly lower objective knowledge scores. This suggests that 'objective' knowledge is not divorced from ideologies, world views, or party positions on contested and politically loaded issues such as climate change.

Respondents identifying with the Liberal and National Party evidenced the lowest scores on **Green self-identity**, though scores across all respondent groups were arguably high, no doubt reflecting a reasonable level of social desirability as well as actual self-perceptions. **Belief or acceptance** of climate change evidenced expected differences across the main respondent groups in terms of party identification. Green supporters scored higher than did other groups, followed by those identifying with Labor, no party, and the Independents. Respondents identifying with the Liberal and National Parties evidenced significantly lower belief/acceptance scores. Again it should be noted that these are relative mean scores, with overall levels of belief/acceptance of climate change being quite high, consistent with the convergent picture of the survey findings as a whole. Climate change **concern** ratings followed the same pattern as the preceding. Respondents identifying with the Greens Party had the highest mean concern score, with Labor supporters next, followed by no party and Independent Party supporters. Again, the mean climate change concern scores of Liberal and National Party supporters were lowest, though underlying mean concern levels for all groups were at least moderately high.

Tables 19 to 21 present further examples of patterns of survey responses that differed by political party identification. As shown in Table 19, 94% of survey respondents who identified with the Greens, compared to 83% of Labor supporters and 62% of Liberal/National supporters, reported that they believed the world's climate is changing. Table 20 shows that a majority of Greens supporters attributed this change mainly or entirely to human activity and more than one-third of Labor supporters thought likewise, while only one-sixth of Liberal/National supporters endorsed this view. Table 20 shows that three-quarters of Greens supporters and 60% of Labor supporters thought that the effects of climate change were already evident, compared to only one-third of Liberal supporters. National, Independent and other-aligned respondents expressed views between those of Labor and Liberal supporters.

Table 19**.** *Belief that the World's Climate is Changing by Political Party Identification*

Question 71. How would you describe your current political party identification or preference?							
		Labor %	**Liberal %**	**National Party %**	**Greens %**	**Independent %**	**Other %**
As far as you know, do you personally think the world's climate is changing?	Yes	83.1	61.7	61.9	94.2	70.9	71.3
	No	10.5	30.0	28.6	3.4	21.3	17.7
	Don't know	6.4	8.3	9.5	2.4	7.8	11.0

Table 20**.** *Beliefs about the Causes of Climate Change by Political Party Identification*

		Question 71. How would you describe your current political party identification or preference?					
		Labor %	**Liberal %**	**National Party %**	**Greens %**	**Independent %**	**Other %**
Thinking about the causes of climate change, which of the following best describes your opinion?	Climate change is entirely caused by natural processes	3.8	9.8	16.7	1.6	8.2	6.8
	Climate change is mainly caused by natural processes	8.6	22.1	23.8	2.8	15.2	12.9
	Climate change is partly caused by natural processes and partly caused by human activity	46.7	41.7	36.5	40.8	51.8	43.0
	Climate change is mainly caused by human activity	31.1	15.2	13.5	46.1	19.1	23.0
	Climate change is entirely caused by human activity	5.3	2.7	1.6	7.6	0.7	4.2
	I think there is no such thing as climate change	2.2	6.8	5.6	0.4	3.2	5.6
	Don’t know	1.5	1.3	2.4	0.4	0.7	2.7
	No Opinion	0.6	0.5	-	0.2	1.1	1.9

Table 21. *Beliefs about the Timing of Climate Change Effects by Political Party Identification*

		Question 71. How would you describe your current political party identification or preference?					
		Labor %	**Liberal %**	**National Party %**	**Greens %**	**Independent %**	**Other %**
When, if at all, do you think Australia will start feeling the effects of climate change?	We are already feeling the effects	60.3	32.7	40.5	75.7	46.5	49.5
	In the next 10 years	8.7	7.5	6.3	8.0	8.5	6.4
	In the next 25 years	6.4	8.0	3.2	7.0	7.4	5.1
	In the next 50 years	4.4	6.4	5.6	3.0	4.3	3.1
	In the next 100 years	2.7	4.9	5.6	1.2	5.0	2.1
	Beyond the next 100 years	3.8	7.7	6.3	0.8	4.3	4.9
	Never	3.9	13.7	17.5	1.2	7.8	8.2
	Don’t know	9.0	16.2	13.5	2.6	13.8	17.9
	No opinion	0.7	2.9	1.6	0.4	2.5	2.9

An issue that sharply divided the sample was the **perceived importance** of climate change. More than 75% of Greens supporters viewed climate change as extremely or very important. This compares with more than half of respondents who identified with Labor, and less than one-quarter of Liberal and National supporters. Question #32, which asked about the **perceived seriousness** of the climate change problem, yielded similar results. More revealing perhaps were the **subjective ratings** of climate change **knowledge**. National Party (18.3%) and Greens (16.3%) supporters claimed to know "a lot" about the issue, with between 9% and 11% of all other groups claiming similarly high levels of knowledge. Proportions that reported knowing "a lot", or close to it, ranged from 34% of Liberals to 50% of Greens supporters. Referring back to Table 18, it can be seen that the objective knowledge test results suggested that Greens respondents were best informed and that National Party supporters knew least about climate change science. This contrast between the objective knowledge possessed, and the self-rated knowledge claimed, by National Party supporters (and, presumably, many other survey participants) serves to underscore the ongoing need for climate change education and objective knowledge measures.

Almost half of the National Party supporters (49%) **rated their local environment** as very good or excellent, compared to 45% of Liberals, 33% of Labor supporters, and 28% of respondents who identified with the Greens. To some extent these differences may be explained by systematic differences in the group members' regions of residence, but an unknown proportion may also be due to selective and (politically-) biased perceptions. This last point is further illustrated in the responses given to Question #41, pertaining to **experiences of natural environmental changes** or events that may be due to climate change. More than half (56%) of Greens, compared to 44% of Labor supporters and about one-quarter of Liberal/National Party supporters, reported having experienced such changes or events. In this case, differential attributions, rather than differential exposure, would appear to play the major role in shaping the pattern of party-aligned responses.

The associations between political preferences and climate change beliefs, attitudes and behaviours observed in the current study are consistent with findings from past research conducted both in Australia (e.g., Fielding et al., 2012) and internationally (e.g., Dunlap & McCright, 2008). Together, this research provides compelling evidence that, compared to more politically liberal people, political conservatives are less likely to believe in, have concerns about, and take action to adapt to or mitigate the effects of climate change. Moreover, there is evidence from recent research conducted in the U.S. (e.g., Hamilton, 2010; McCright, 2011) indicating that political views qualify the effects of other variables on climate change beliefs and concerns. More specifically, this U.S. research shows that both political ideology and party identification moderate the relationships between perceived understanding of climate change and educational achievement, on the one hand, and climate change beliefs and concerns, on the other, with these relationships being positive for liberals and weaker or even negative for conservatives.

As shown in Table 22, similar moderating effects were evident in our 2011 Australian data. Most strikingly, the relationship between self-rated knowledge and beliefs and concerns was positive in the sub-sample of Labor/Green supporters, and negligible among respondents

who identified with the Liberal and National Parties. Interestingly, the same effect was not observed with scores on the climate change knowledge quiz. Here, there is a positive relationship between objective knowledge and climate change beliefs and concerns regardless of political identification.

Table 22. *Moderating Effects of Political Party Identification on the Relationship between Education/Climate Change Knowledge and Climate Change Beliefs and Concern*

Correlations[a] between	**Political Party Identification[b]**		Significance of the difference between the correlations (*z*)
	Greens and Labor (N = 1770)	Liberal and National (N = 1456)	
Educational Attainment and Belief in Climate Change	.14***	.05**	2.53*
Educational Attainment and Concerns over Climate Change	.12***	.05*	1.98*
Self-Rated Climate Change Knowledge and Belief in Climate Change	.27***	.01	7.44***
Self-Rated Climate Change Knowledge and Concerns over Climate Change	.33***	-.05*	10.95***
Objective Climate Change Knowledge and Belief in Climate Change	.34***	.40***	1.95
Objective Climate Change Knowledge and Concerns over Climate Change	.34***	.42***	2.61**

[a] Kendall tau-b correlation coefficients.
[b] Excluded from these analyses were all respondents whose political identification was with an independent or other party (N = 1050), all who specified an "other" level of educational attainment (N = 19), and all who did not respond to one or more of these survey items (N = 52).
* $p < .05$. ** $p < .01$. *** $p < .001$.

These political item responses suggest that party identification is a very powerful predictor and mediator of psychological responses to climate change, including understandings of climate change, psychological impacts of climate change, and behavioural engagement with respect to climate change. There is, of course, not necessarily a direct causal linkage from party identification to the spectrum of variables explored in this national survey. It is very possible, and indeed likely, that many survey participants' responses to the threat of climate change have led them to identify with, and to prefer, particular party platforms relating to the issue of climate change. Our survey data, along with overwhelming evidence from other researchers, suggest that climate change constitutes a very salient and potent political, social, and environmental issue, with more than two-thirds of respondents rating climate change as important overall (#25).

Before concluding this brief discussion of associations between climate change views and political affiliations, further reference is warranted to the responses to the item pertaining to the impact of the carbon emission tax upon personal voting intentions (#75). For the purpose of analysis, respondents were divided into groups based on their responses to this question. Differences between these groups on selected climate change variables are summarised in Table 23. As shown, a clear gradient is apparent in the scores on all these composite variables. Of the many highly significant between-group differences, particular note should be taken of the finding that people who became much more likely to vote Labor because of the introduction of the carbon tax scored higher on the objective knowledge quiz than did those who reported being much less likely to vote Labor because of the tax (means = 3.98 and 0.89 respectively, $p < .001$). Also striking is the monotonic decline in carbon-footprint mitigating behaviors, as responses to #75 shift from increased to decreased likelihood of supporting Labor because of the tax. Although not shown in Table 23, but consistent with the pattern of responses reported above, compared to those who were *swayed away from* Labor by the introduction of the carbon tax, members of the sample who were *attracted to* Labor for this same reason were more likely to (a) believe that the world's climate is changing, (b) believe that this change is due human activity, (c) believe that the effects are already being felt, (d) regard the issue of climate change to be important and serious, (e) attribute changes and events in the natural environment to climate change, and (f) (justifiably, based on the results of our objective knowledge quiz) rate their climate change knowledge as high.

Table 23**.** *Differences in Mean Scores on Composite Climate Change Variables by Response to the Introduction of a Tax on Carbon Emissions*

		Question 73. How, if at all, has the Labor Government's plan to introduce a tax on the emission of carbon changed your voting intention?						
	Year	**Much more likely to vote Labor**	**Slightly more likely to vote Labor**	**No difference whatsoever**	**Slightly less likely to vote Labor**	**Much less likely to vote Labor**	***Full Sample Mean***	***F****
Residential Exposure	2011	11.73[a]	11.00[b]	10.56[bc]	10.27[c]	9.38[d]	10.24	45.79
Trust	2011	15.52[a]	14.58[b]	12.82[c]	12.48[c]	9.57[d]	11.99	366.11
Objective Knowledge	2011	3.98[a]	3.92[a]	2.70[b]	2.43[b]	0.89[c]	2.22	143.56
Green Self-Identity	2011	11.94[a]	11.68[a]	10.37[b]	9.67[c]	9.30[c]	10.14	111.43
Belief in Climate Change	2011	18.51[a]	18.23[a]	16.57[b]	15.86[c]	13.15[d]	15.57	246.44
Climate Change Concern	2011	28.11[a]	27.37[a]	23.93[b]	22.63[c]	17.88[d]	22.24	339.30
Risk Perception	2011	22.72[a]	21.90[a]	19.75[b]	19.37[b]	16.28[c]	18.88	143.07
Distress	2011	27.41[a]	26.78[a]	22.67[b]	21.98[b]	17.68[c]	21.51	179.35
Psychological Adaptation	2011	30.67[a]	28.76[b]	24.40[c]	23.54[c]	21.35[d]	24.05	171.27
Behaviour	2011	6.34[a]	5.79[a]	3.79[b]	3.14[b]	1.93[c]	3.41	147.86

Note. Cell means with different superscripts within rows are significantly different from each other (Bonferroni $\alpha < .005$)

***All F values significant at $p < .001$.

DEMOGRAPHIC ANALYSES

A focus of the following analyses was to examine possible changes across 2010 and 2011 for the main composite variables. Whilst we would not expect change for all of the variables measured in 2010 (e.g., dispositional variables), we did however expect some change after what was an eventful year with respect to extreme weather in Australia. The following section breaks down the samples into demographic sub-groups and explores the changes across the main variables in 2010/2011. Further analyses were conducted to explore differences between demographic sub-groups for the new variables introduced in 2011. Results for theses new composite variables are noted at the end of each of the following demographic sections. The majority of differences reported in this section were significant at the $p < .001$ level. Refer to Appendix D for further information.

GENDER DIFFERENCES

Female respondents evidenced significantly greater scores on residential exposure, green identity, and connection to the natural environment than did males in both 2010 and 2011. In both years, females had higher levels of *objective* knowledge, whilst males indicated higher levels of *subjective* knowledge. Female respondents also reported higher levels of trust, belief in climate change, importance, self-efficacy, personal responsibility, climate change concern, risk perception, distress, and psychological adaptation in both 2010 and 2011. Compared with males, females also reported greater carbon reducing behaviours in 2010, however, a significant difference was not found between males and females in 2011. Males reported greater exposure to media in 2010, however no difference in indirect exposure was found in 2011. Compared with males, females reported greater exposure to the perceived impacts of climate change in both 2010 and 2011. Males, on the other hand, reported greater prior experience with natural disasters in 2010, but not in 2011.

In relation to the climate change variables introduced in the 2011 survey, female respondents evidenced greater scores on normative influence, collective efficacy, pessimism, help seeking and neuroticism than did males. Males reported greater scores on denial than did females. There was no gender difference on the coping subscale named positive reframing.

AGE GROUP DIFFERENCES

Perceived residential exposure was higher for respondents aged 35-54 in 2010, however no age differences were found in 2011. Connection to nature scores were greater for respondents aged over 55 years in both 2010 and 2011, whilst green identity was greater for respondents aged 35-54 years in 2010 only. Respondents aged <35 reported greater trust in both 2010 and 2011 than did older respondents. *Objective* knowledge was higher in 2011 for younger respondents, whereas *subjective* knowledge was greater for participants aged over 55. These results replicate survey findings in 2010. Respondents aged <35 had higher scores on belief in climate change, reported personal importance, climate change concern, risk perception, self-efficacy, personal responsibility, and distress in both 2010 and 2011, as

compared with all other age groups. Psychological adaptation was higher for participants aged <35 in 2011, in contrast to 2010, when respondents aged 35-54 had significantly greater scores. Participants aged 55 and over reported engaging in greater carbon-reducing behaviours in 2010; however, no significant differences were found in 2011 between the three age groups. Respondents aged less than 35 reported greater experience with the perceived impacts of climate change in 2011 compared with all other groups, whereas no significant differences were found in 2010. Participants aged over 55 reported greater experience with natural disasters compared with the other groups, both in 2010 and 2011. No differences were found for media/indirect exposure across the three age groups, either in 2010 or 2011.

Normative influence, neuroticism, collective efficacy, and help seeking were higher for respondents aged <35 than other age groups. Participants aged 55 and over evidenced greater levels of pessimism and positive reframing than were found in the other age groups. No differences were found across age cohorts with respect to denial.

EDUCATION

Similar to the 2010 findings, respondents who indicated they had completed a trade or other certificate qualification reported greater levels of residential exposure/vulnerability to the impacts of climate change and natural disasters than did those who had completed high school or tertiary education. This former group also indicated a higher level of connection to the natural environment in 2011, differing from the results in 2010 when those with a tertiary education evidenced greater scores. Green identity was higher for respondents with a tertiary education in both 2010 and 2011. *Objective* and *subjective* knowledge was greater in both 2010 and 2011 for respondents with a tertiary education as was media/indirect exposure, belief in climate change, importance, climate change concern, risk perception, distress, self-efficacy, responsibility, direct experience with climate change, psychological adaptation, and behaviour. Respondents with a tertiary education indicated a greater level of trust in 2011, whereas no differences were found in 2010.

Respondents who indicated they had completed a high school qualification had greater levels of neuroticism and denial than those respondents who had completed a trade/certificate qualification or tertiary studies. Higher scores were found for normative influence, collective efficacy, and help seeking among those with a tertiary education, and respondents with a trade/certificate level of education had higher scores on positive reframing. No significant differences were found for pessimism between the three education groups.

PARENTAL STATUS

No significant differences by parental status were found for residential exposure, connection to nature, green identity, subjective knowledge, and media exposure. Respondents indicating that they had no children/grandchildren had higher levels of trust, objective knowledge, belief in climate change, importance ratings, climate change concern,

risk perception, distress, self-efficacy, personal responsibility, and direct experience with the perceived impacts of climate change in both 2010 and 2011. Psychological adaptation and behavioural engagement were greater for respondents indicating that they had no children in the 2011 data, however, no significant differences were found in 2010. Respondents indicating that they did have children and/or grandchildren evidenced greater scores on prior disaster experience in 2011, however, this difference was not found for 2010 respondents.

Respondents who indicated that they were not a parent/grandparent evidenced higher scores on neuroticism, collective efficacy, and help seeking. Parents, on the other hand, scored higher on pessimism and positive reframing. There were no differences between the two groups for normative influence and denial.

RESIDENTIAL STATUS

Rural respondents reported greater levels of residential exposure, exposure to natural disasters, connection to the environment, and green identity in both 2010 and 2011. *Objective* knowledge was not significantly different for urban and rural respondents in 2010 or 2011; however *subjective* knowledge was greater for rural respondents in 2010. Media/indirect exposure was greater for urban respondents in 2011, whereas no difference was found in 2010. As well, no differences were found between urban and rural in 2010 or 2011 across the variables of importance, self-efficacy, responsibility, direct experience with climate change, or psychological adaptation. Urban residents reported greater levels of trust, belief in and concern for climate change in both 2010 and 2011. Risk perception, distress, and behaviour were greater for urban respondents in 2011, with these differences not found in 2010.

Respondents from an urban setting had significantly higher scores on normative influence and on collective-efficacy, than did rural residents. Rural respondents on the other hand had higher scores on pessimism and positive reframing than did urban respondents. Significant differences were found on neuroticism, and denial.

VOTING INTENTION

Significant differences were found between respondents intending to vote Green or Labor at the next Federal Election and respondents intending to vote for another party. In both 2010 and 2011 respondents intending to vote Green/Labor scored higher on: residential exposure, connection to nature, green identity trust, *objective* and *subjective* knowledge, media exposure, belief in climate change, importance, concern, risk perception, distress, self-efficacy, personal responsibility, direct experience with the perceived impacts of climate change, psychological adaptation, and behaviour. There was no difference found by voting intention for either direct experience or exposure to natural disasters, either in 2010 or 2011.

Respondents indicating that they would vote Green/Labor at the next Federal Election had significantly greater scores on neuroticism, normative influence, collective efficacy, pessimism, help seeking and positive reframing than did respondents who intended to vote

for another party. Denial was significantly higher for respondents intending to vote for another party than it was for respondents intending to vote Green or Labor.

COUNTRY OF BIRTH

Appendix B gives a breakdown of countries where respondents indicated they were born. No significant differences were found with respect to perceived residential exposure/vulnerability for residents born in Australia as compared with those indicating they were born elsewhere. For residents indicating they were born overseas, higher scores were found for connection to the natural environment in both 2010 and 2011. Green identity was also stronger, however, this was only evident for respondents in 2011. No differences were found for *objective* knowledge across 2010 and 2011. Respondents born overseas had greater scores on *subjective* knowledge, however this was only found in 2011. Participants who were not born in Australia evidenced higher trust scores, importance, distress, and greater media exposure in both 2010 and 2011. This group reported greater belief and concern about climate change, and greater risk appraisal, self-efficacy, personal responsibility, direct experience with the perceived impacts of climate change, psychological adaptation, and carbon reducing behaviors in 2011, with no such differences found in 2010. This interesting set of findings, as yet, has no clear explanation. Respondents born in Australia reported greater experience with natural disasters in both 2010 and 2011.

Respondents indicating that they were born in Australia had greater scores on neuroticism, pessimism, and denial than did those respondents who indicated they were born elsewhere. Participants not born in Australia had higher scores on normative influence, collective-efficacy, help seeking, and positive reframing.

INCOME

No significant differences were found between groups that varied by income levels on any of the following composite measures: trust, *objective* knowledge, *subjective* knowledge, belief in climate change, importance, climate change concern, distress, self-efficacy, responsibility, psychological adaptation, and disaster exposure and experience. Respondents indicating an income of less than $60,000 evidenced greater levels of residential exposure, green identity, connectedness to nature, and risk perception in both 2010 and 2011. This income group reported more carbon-reducing behaviours in 2010, however, this was not the case in 2011 compared to other income groups. Respondents earning over $100,000 reported a greater exposure to climate change media/indirect exposure in 2011 only. Respondents earning less than $60,000 per annum reported greater changes to their environment due the perceived impacts of climate change in 2011, with this result not found in 2010.

Very few differences between income groups were found for the new composite measures. However, respondents with an income of less than $60,000 displayed higher scores on neuroticism, pessimism, and positive reframing than did the other two income categories.

BIVARIATE CORRELATIONS

The inclusion in the current survey of multi-item scales to measure psychological and climate change variables, allowed for a sensitive and meaningful examination of interrelationships between variables. Appendix E provides a correlation matrix of key variables measured in the 2011 survey. While there is considerable information in such a table, a brief examination of the interrelationships involving one central variable, **belief** in, or acceptance of, climate change sheds light on what our findings suggest.

Our composite measure of belief demonstrated strong associations with each of concern (r = .83), risk appraisal (r = .63), distress (r = .60), self-efficacy (r = .62), felt responsibility to act (r = .65), psychological adaptation (r = .57), objective knowledge (r = .58), and perceived direct experience with climate change (r = .45). All of these correlations are significant at $p < .001$. These strong and positive associations reveal much about the factors involved in public risk perceptions, understandings, and responses to climate change. Clearly, acceptance of the reality of climate change would be expected to be strongly related to climate change concern and risk appraisal, which it is. In addition, and not surprisingly, climate change acceptance is also strongly associated with climate change distress. Less expected is the finding that belief in climate change is strongly related to self-efficacy and felt responsibility. It makes sense but is also very useful to know that acceptance of climate change has a strong association with psychological adaptation to climate change (r = .57), and a somewhat weaker one with behavioural engagement (r = .48). Finally, belief in climate change appears to reflect a moderately strong association with objective knowledge about climate change.

The correlations reported in Appendix E offer insight into many other relationships. For example, it is noteworthy that climate change distress is strongly related to self-efficacy (r = .65) and psychological adaptation (r = .75), suggesting that distress can be a powerful motivating force, but also reflects psychological costs and impacts. The finding that distress is more closely related to adaptation than is any other variable, and that it is more highly correlated with behavioural engagement than is belief, and less highly correlated with this outcome than is adaptation, helps confirm the likely causal sequence from belief in climate change, through distress and then adaptation, to engagement in carbon-mitigating behaviors.

The size and direction of these 2011 bivariate correlations were broadly similar to those obtained in the 2010 survey (See Appendix F). For example, in both years, belief in climate change and concern over climate change were highly correlated, rs = .82 (2010) and .83 (2011), suggesting that the two are difficult to empirically separate. The key variable of psychological adaptation was correlated with belief at r = .59 (2010) and .57 (2011), with concern at r = .73 and .71, with distress at r = .78 and .75, and with felt responsibility at r = .69 and .68. These, and dozens of other very similar pairs of correlations, provide evidence as to the stability of most of the relationships under investigation. In contrast, variables that were measured differently in 2010 and 2011 yielded more discrepant correlations. Engaging in carbon mitigating behavior, for example, was measured differently in the two years. Compared to 2010, its measurement in 2011 more precisely tapped whether behaviours were

motivated at least partly out of a desire to reduce climate change impacts. As expected, we found that the 2011 behaviour measure was more highly correlated than was the corresponding 2010 measure with each of belief in climate change (r = .34 in 2010 versus r = .48 in 2011), concern (rs = .44 vs. .58), distress (rs = .42 vs. .52), self-efficacy (rs = .50 vs. .55), felt responsibility (rs = .48 vs. .58), and psychological adaptation (rs = .53 vs. .57). Similarly, the broader operationalisation of indirect (media) exposure used in 2011, compared to that used in 2010, resulted in the 2011 measure being more highly correlated with other climate change variables such as belief (r = .17 in 2010 versus r = .45 in 2011), concern (rs = .21 vs. .47), distress (rs = .23 vs. .41), self-efficacy (rs = .20 and .37), felt responsibility (rs = .23 and .39), psychological adaptation (rs = .32 vs. .43), and behaviour (rs = .28 vs. .33). In these cases, we argue, the differences between the 2010 and 2011 correlations are due mainly to improvements in the measures than to historical changes in the relations between the variables.

Appendix G reports the correlations between variables measured for the first time in 2011 and the core climate change variables measured in both survey years. Here it can be observed that neuroticism was, in general, positively correlated with climate change belief, concern, motivation, adaptation and behavioural variables. Relationships between the variables, normative influences and collective efficacy, both of which were introduced into the survey in 2011 showed similar, albeit much stronger, positive relations with the climate change variables. In contrast, the correlations with a predisposition towards fatalism and pessimism were more weakly associated with the other climate change variables. Finally, the three new coping variables correlated highly and in the expected directions with the climate change variables. For example, in line with expectations, coping through each of help-seeking and positive-reframing were positively correlated, and coping through denial and avoidance were negatively correlated, with such climate change variables as belief, concern, self-efficacy, adaptation and behavior. Importantly, none of these new-to-2011 variables correlated higher than .71 with any of the existing climate change variables, suggesting that, with no more than 50% of their variance overlapping, each of the new variables contributes something unique to our understanding of psychological aspects of climate change.

REGRESSION ANALYSES

The first set of regression analyses sought to predict the key climate change variables of *Belief* (acceptance), *Distress*, *Adaptation*, and *Behaviour* from four "exposure" variables (residential exposure, lifetime exposure to natural disasters, indirect exposure (through media and personal channels) , and direct exposure to events attributed to climate change). Results are summarised in Table 24.

Table 24**.** *Predicting Climate Change Belief, Distress, Adaptation and Behaviour from Four Exposure Variables*

Predictors (β)	**Criterion**			
	Belief	Distress	Adaptation	Behaviour
Residential exposure	.27 ***	.24***	.25***	.18***
Lifetime disaster exposure	-.13***	-.14***	-.07***	-.09***
Indirect exposure	.12***	.24***	.38***	.22***
Direct climate change exposure	.34***	.29***	.25***	.23***
R^2	***.28****	***.28****	***.39****	***.19****

* $p < .05$. ** $p < .01$. *** $p < .001$.

Three points are particularly noteworthy. First, *Adaptation* ($R^2 = .39$) was more fully explained by the four exposure variables than were the other climate change criterion variables. Behaviour ($R^2 = .19$) was the least well explained. Second, in general, *Direct exposure* to climate change-attributed events explained more variance in the criteria than did the other predictors, although *Indirect exposure* was the most powerful independent predictor of *Adaptation*. This finding can be explained by partial construct overlap between *Indirect exposure* and *Adaptation*, in that the act of seeking out media coverage or personal accounts of climate change events can be interpreted as both *Indirect exposure* and *Adaptation*. Third, in the context of these regression analyses, *Lifetime disaster exposure* was negatively associated with the criteria (thereby demonstrating a statistical suppressor effect). Given this last finding, *Lifetime disaster exposure* was not included in the predictor set in subsequent analyses.

The finding that the exposure variables predicted *Belief* is consistent with the view that acceptance of the reality of climate change results from (direct or indirect) personal experience, or that when it comes to climate change, "seeing is believing". To test whether the data also support the opposite view (that is, "believing is seeing"), a binary logistic regress analysis was conducted in which *Belief* was regressed, at step 1, on *Lifetime disaster exposure* and *Indirect exposure*, and, at step 2, on *Direct climate change exposure*. Support for the "believing is seeing" position would be provided if *Direct climate change exposure* explained incremental variance in *Belief*, after controlling for the other two exposure variables. Results supported this position, *Belief Exp(B)* = 1.35, $p < .001$.

The next set of regression analyses examined whether (a) the three exposure variables predicted each of *Concern*, *Risk Perception*, *Distress*, *Self-Efficacy*, *Felt Responsibility*, *Adaptation*, and *Behaviour*, (b) whether *Belief* explained significant amounts of additional variance in these outcomes, and (c) whether, consistent with the notion that *Belief* mediates the effects of the exposure variables, the step 1 beta coefficients for the exposure variables were reduced following the step 2 inclusion of *Belief* in the equations.

(a)Results of this set of hierarchical analyses are summarised in Table 25. It can be seen that all three exposure variables significantly and uniquely predicted all of the climate change variables, (b) *Belief* explained significant amounts of additional variance in these outcomes, and (c) the exposure variables' beta coefficients were, in general, substantially reduced following the entry of *Belief*. However, none of the regression coefficients for the exposure variables were reduced to the point of non-significance, a finding that suggests that their effects were partially, rather than fully, mediated through *Belief*. And in one case (the effect of *Indirect exposure* on *Adaptation*) the findings suggest a strong direct effect, and little if any indirect effect via *Belief*. As noted above, this may be due to partial overlap of these constructs.

Also of note from Table 25, and consistent with the zero-order correlations, *Belief* was a highly significant predictor of *Concern* ($\beta = .73$, $p < .001$). Indeed, these two climate change variables were so strongly correlated that, as revealed by a series of subsequent regression analyses, inclusion of both variables as predictors in the same equations resulted in only one being significant while the other often displayed a weak relation in the direction opposite to that of its simple correlation. To avoid problems of multicollinearity, analyses were conducted, and are reported, with only *Belief* (not *Concern*) included as a predictor.

Table 26 presents the results of two further hierarchical regression analyses predicting *Adaptation* and *Behaviour*, respectively. The table shows that the initially strong effects of the exposure variables weakened when other (more proximate) predictors of the two criteria entered the equations. The same was true of *Belief*, suggesting that this variable acts as a mid-way marker between the exogenous variables and outcomes such as *Adaptation* and *Behaviour*. When all variables had entered the questions, the strongest unique predictors of *Adaptation* were *Distress* and *Indirect exposure*, whilst those for *Behaviour* were *Felt responsibility* and *Adaptation*.

Table 25**.** *Predicting Climate Change Variables from Three Exposure Variables and Climate Change Belief*

Step	Predictors (β)	Criterion						
		Concern	**Risk Perception**	**Distress**	**Self-Efficacy**	**Felt Responsibility**	**Adaptation**	**Behaviour**
1	Residential exposure	.30 ***	.30***	.21***	.24***	.25***	.23***	.15***
	Indirect exposure	.15***	.15***	.28***	.16***	.17***	.38***	.21***
	Direct climate change exposure	.32***	.29***	.23***	.25***	.26***	.25***	.22***
	R^2 Change	*33****	*30****	*.27****	*.22****	*.24****	*.38****	*.18****
2	Residential exposure	.13 ***	.18***	.10***	.11***	.11***	.14***	.07***
	Indirect exposure	.07***	.09***	.13***	.11***	.11***	.34***	.17***
	Direct climate change exposure	.08***	.13***	.18***	.08***	.07***	.12***	.10***
	Belief	.73***	.48***	.46***	.52***	.55***	.38***	.37***
	R^2 Change	*.40****	*.17****	*.15****	*.20****	*.22****	*.10****	*.10****
	R^2	***.73****	***47****	***42****	***.42****	***.46****	***.49****	***.28****

* $p < .05$. ** $p < .01$. *** $p < .001$.

Table 26. *Predicting Climate Change Adaptation and Behaviour from Exposure and Other Climate Change Variables*

Step	Predictor	Criterion	
		Adaptation	Behaviour
1	Residential exposure	.23***	.15***
	Indirect exposure	.38***	.21***
	Direct climate change exposure	.25***	.22***
	R^2 Change	*38****	*.18****
2	Residential exposure	.14 ***	.07***
	Indirect exposure	.34***	.17***
	Direct climate change exposure	.12***	.10***
	Belief	.38***	.37***
	R^2 Change	*.10****	*.10****
3	Residential exposure	.05***	.00
	Indirect exposure	.23***	.10***
	Direct climate change exposure	.04***	.05***
	Belief	.01	.08***
	Risk Perception	.08***	.03
	Distress	.38***	.14***
	Self-Efficacy	.13***	.13***
	Felt Responsibility	.16***	.26***
	R^2 Change	.20***	.11***
4	Residential exposure		-.01
	Indirect exposure		.05**
	Direct climate change exposure		.04***
	Belief		.08***
	Risk Perception		.01
	Distress		.06**
	Self-Efficacy		.11***
	Felt Responsibility		.23***
	Adaptation		.20***
	R^2 Change		.01***
	R^2	***.69****	***41****

* $p < .05$. ** $p < .01$. *** $p < .001$.

Numerous additional analyses were performed on these data, in part to test theory-based predictions and thereby increase understanding of the unique contributions of climate change "process" variables to the explanation of key outcomes. To illustrate, one such set of analyses drew on Ajzen's (1991) Theory of Planned Behaviour, which predicts that all behaviours are a joint function of three factors: attitudes to the behaviour, normative influences, and perceived behavioural control. Using our measures of *Distress, Normative*

influences and *Self-efficacy* as proxies for Ajzen's three predictors, standard regression analyses were performed to predict climate change *Adaptation* and *Behaviour*. Findings indicated that *Distress* ($\beta = .51$, $p < .001$), *Normative influences* ($\beta = .15$, $p < .001$), and *Self-efficacy* ($\beta = .24$, $p < .001$) explained a highly significant 63% of the variance in *Adaptation*. Meanwhile, *Distress* ($\beta = .24$, $p < .001$), *Normative influences* ($\beta = .17$, $p = .001$), and *Self-efficacy* ($\beta = .29$, $p < .001$) explained a more modest 36% of the variance in climate change mitigating behaviours. Thus, in support of the theory, all three factors were found to be highly significant, unique predictors of both these climate change outcomes.

MULTIVARIATE MODELS PREDICTING CLIMATE CHANGE BELIEFS AND BEHAVIOURS

The final stage of the data analysis involved a path analysis to model the relationships between eight of the key composite variables: *Belief in (= Acceptance of) climate change, Concerns over climate change, Risk perception, Distress, Self-efficacy, Felt responsibility to act, Adaptation,* and *Behaviour* (see Table 27). The criterion variable was the number of carbon footprint-reducing behaviours currently enacted (*Behaviour*), with the other variables posited as either distal or proximate predictors of this criterion behaviour. Selection of the variables, and the order in which these predictors were hypothesised to have their effects, were derived from established theory (e.g., Ajzen, 1991; Bandura, 1997; Mischel & Shoda, 1995), past research (e.g., Gosling & Williams, 2010; Kellstedt et al., 2008; Malka et al., 2009; McCright, 2010; Whitmarsh & O'Neill, 2010), results from the analyses of the 2010 data (Reser et al., 2012b), and from inspection of the current data set.

Table 27**.** *Variables Included in Path Model Predicting Climate Change Behaviours*

Level	Variable	No of Items	Questionnaire Item Numbers	Illustrative Item
1	Belief in CC	4	6, 7, 10a, 12	10a. I am certain that climate change is really happening.
2	Concern	7	5, 8, 9, 14, 15, 19f, 27	5. How concerned, if at all, are you about climate change...?
	Risk perception	5	55a-55e	55a. Climate change will have a noticeable negative impact on my health ...
	Distress	7	38a-38g	38a. I experience some distress each time I see or read media coverage of the likely impacts and consequences of climate change.
	Self-efficacy	5	11a, 11d. 30a, 30b, 30c	11a. I can personally help to reduce climate change by changing my behaviour.
	Felt responsibility to act	4	11c, 11d, 17a, 17b,	11d. It is my responsibility to help to do something about climate change.
3	Adaptation	8	32, 33, 40a, 40c, 40d, 40e, 40f	40a. I have changed the way I think about the seriousness of environmental problems because of climate change.
4	Self-reported behaviour	1	29a – 29o	29. What actions are you currently taking to reduce your carbon footprint? - using less electricity/ - using compact florescent light bulbs/ etc

Our aims were: (a) to determine the overall goodness-of-fit of an initially hypothesised model based on the 2010 findings, (b) to compare the fit of this model with that of several competing models, (c) through a process of incremental improvement in model fit, to derive a theoretically defensible best-fitting model, and (d) to assess the direct, indirect and total contributions of each predictor to the explanation of the higher level variables.

All modelling of the 2011 data was performed using AMOS v20 (Arbuckle, 1995) and maximum likelihood estimation procedures. All variables were treated as observed, with composite scores calculated in the manner specified elsewhere in this report. The fit of all models was assessed by the same set of indices. These were the Root Mean Square Error of Approximation (RMSEA, where a good fit is indicated by values less than .05 and a satisfactory fit by values between .05 and .08), the Non-Normed Fit Index (NNFI, a good fit is indicated by values greater than .95 and a satisfactory fit by values greater than .90), the Comparative Fit Index (CFI, which is interpreted as for the NNFI), and the Root Mean-Square Residual (RMR, with cut-offs for good and satisfactory model fit similar to those for the RMSEA) (Byrne, 2001; Kline, 2011; Tabachnick & Fidell, 2013). The chi-square statistic was not relied upon because of its tendency to be inflated when sample sizes are large. However, the χ^2 per degree of freedom (normed chi-square, or CMIN) was interpreted, with cut-offs for good and satisfactory model fit of 2.0 and 5.0. The relative fit of nested models was assessed using the chi-square difference test ($\Delta\chi^2$ test). The relative fit of any *non*-nested models was assessed using Akaike's Information Criterion (AIC, where smaller values indicate a better fit). Model parsimony was assessed using the Parsimony Normed Fit Index (PNFI, where smaller values indicate a better fit).

The hypothesised model was based on findings from the 2010 study. It comprised four levels. The single exogenous variable, at level 1, was belief in the existence of climate change (*Belief*, which is deemed to be equivalent to accepting climate change as an established phenomenon and condition). Placing this variable at level 1 recognises that a belief in climate change is a necessary precondition for holding concerns, perceiving risk, experiencing distress, feeling efficacious towards, and/or experiencing a personal responsibility towards, climate change. Thus, *Belief* was hypothesised to predict five level 2 mediating factors: extent of concern regarding climate change (*Concern*), perceived risk of climate change impacts (*Risk perception*), distress and related negative emotions associated with the threat of climate change (*Distress*), self-efficacy in relation to climate change (*Self-efficacy)*, and felt personal responsibility and willingness to act in relation to climate change (*Responsibility)*. These variables were, in turn, expected to predict the level 3 mediator of psychological adaptation to climate change (*Adaptation*), which in turn was proposed to directly predict the criterion, *Behaviour*. In addition to their indirect effects, the two behaviourally-oriented level 2 variables, *Self-efficacy* and *Responsibility*, were expected to directly predict *Behaviour*. This model, which fitted the 2010 data quite well, gave focus to the powerful role of *Adaptation* as a mediator of the effects of *Distress* and *Responsibility* on *Behaviour*.

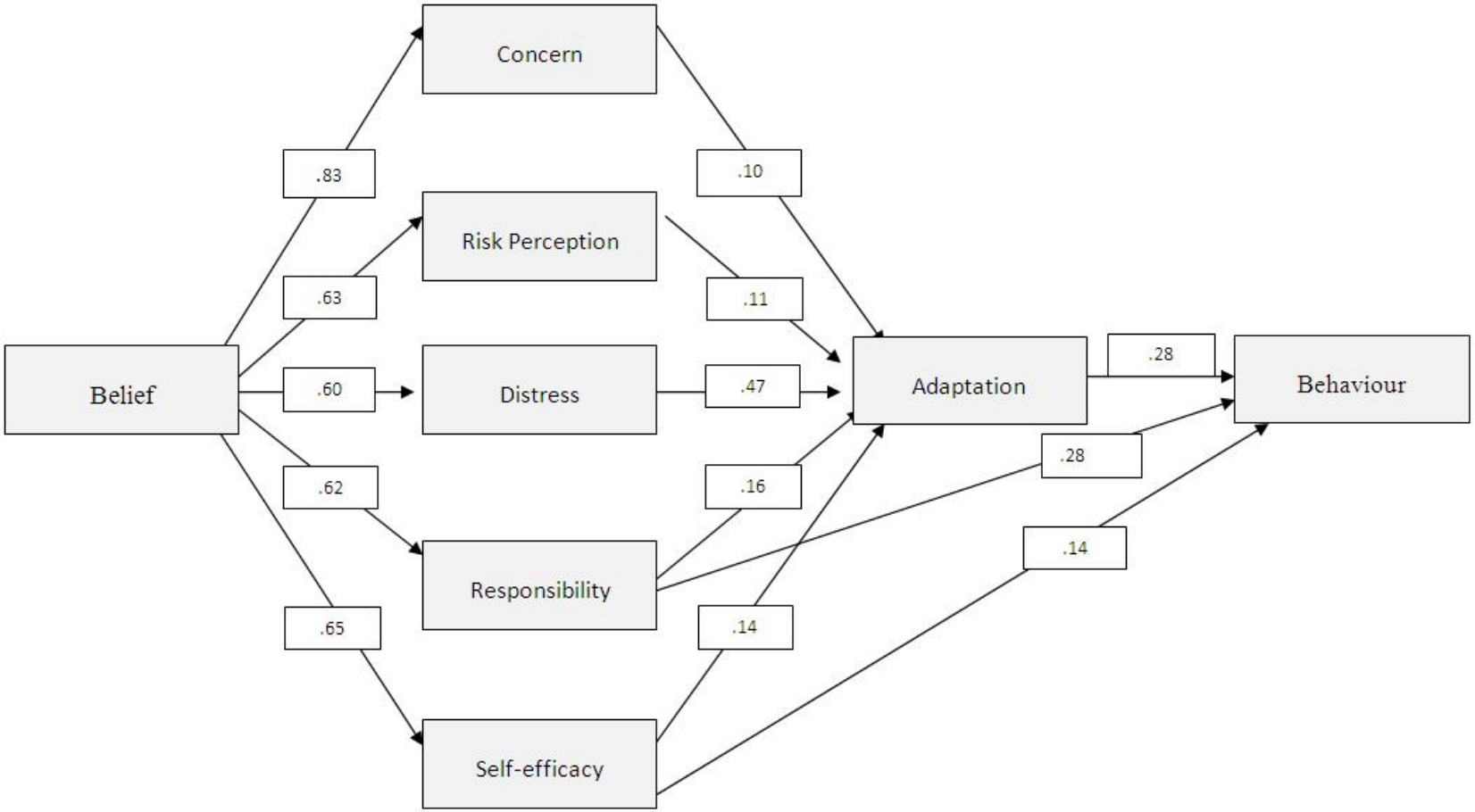

Figure 14. Model 1: Hypothesised Model of Antecedents of Climate Change Behaviours

(Standardised parameter estimates on lines. All parameters shown were significant at $p < .001$)

Using the procedures described above, this initial model did not fit the 2011 data well, χ^2 (15) = 8,496, RMSEA = .361 (90% CI = .354 - .367), NNFI = .45, CFI = .71, RMR = 6.98, AIC = 8,538, and PNFI = .38. Figure 14 presents the model, together with standardised parameter estimates. As expected, all specified paths were highly significant ($p < .001$), and as was the case in 2010, the paths from *Belief* to all second-level variables, and that from *Distress* to *Adaptation*, were particularly strong. *Adaptation*, in turn, was a powerful predictor of *Behaviour*. These findings thus confirm a major conclusion drawn from the 2010 analyses, namely, that an important psychological metaprocess appears to run from internal cognitive state (*Belief/acceptance*) through affect (*Distress*) and then through attentional, motivational and behavioural tendencies (*Adaptation*) eventually to direct action in response to climate change (*Behaviour*). Despite the poorer fit of the model in 2011 than in 2010, this process, or central spine of the model, remains intact.

The major differences between the 2010 and 2011 parameters estimates related to (a) the path between *Responsibility* and *Adaptation* (which was stronger in 2010 than in 2011), (b) the path between *Responsibility* and *Behaviour* (stronger in 2011), and (c) the path between *Self-efficacy* and *Behaviour* (stronger in 2010). Examination of the modification indices from the 2011 analysis indicated that model fit could be improved by the inclusion of additional structural parameters. Modifications to the model were thus conducted as guided by past theory and research findings and the current set of parameter estimates and modification indices. In a stepwise manner, paths that had not been estimated but were shown to be associated with likely improvements to model fit were added to the model, and relationships between variables that were associated with non-significant path estimates were deleted from the model. The sequence of model modifications made, and the extent of model improvement associated with each, can be summarised, in order of execution, as follows:

- addition of a path from *Efficacy* to *Responsibility,* resulting in a significant improvement in model fit, $\Delta\chi^2$ (1) = 2772, $p < .001$
- addition of a path from *Risk perception* to *Distress,* resulting in a significant improvement in model fit, $\Delta\chi^2$ (1) = 1038, $p < .001$
- addition of a path from *Concern* to *Distress,* resulting in a significant improvement in model fit, $\Delta\chi^2$ (1) = 876, $p < .001$
- addition of a path from *Concern* to *Self-efficacy,* resulting in a significant improvement in model fit, $\Delta\chi^2$ (1) = 1450, $p < .001$
- deletion of a path from *Belief* to *Self-efficacy,* resulting in no significant change in model fit, $\Delta\chi^2$ (1) = 0.24, *ns,* but greater parsimony
- addition of a path from *Risk perception* to *Concern,* resulting in a significant improvement in model fit, $\Delta\chi^2$ (1) = 1411, $p < .001$
- addition of a path from *Responsibility* to *Distress,* resulting in a significant improvement in model fit, $\Delta\chi^2$ (1) = 174, $p < .001$

- addition of a path from *Distress* to *Responsibility*, resulting in a significant improvement in model fit, $\Delta\chi^2$ (1) = 122, $p < .001$

- deletion of the path from *Responsibility* to *Distress,* resulting in no significant change in model fit, $\Delta\chi^2$ (1) = 0.78, *ns*, but greater parsimony

- addition of a path from *Efficacy* to *Distress,* resulting in a significant improvement in model fit, $\Delta\chi^2$ (1) = 144, $p < .001$

- addition of a path from *Concern* to *Responsibility*, resulting in a significant improvement in model fit, $\Delta\chi^2$ (1) = 389, $p < .001$

- deletion of a path from *Belief* to *Responsibility,* resulting in no significant change in model fit, $\Delta\chi^2$ (1) = 0.61, *ns*, but greater parsimony

- addition of a path from *Concern* directly to *Behaviour,* resulting in a significant improvement in model fit, $\Delta\chi^2$ (1) = 71, $p < .001$

- addition of a path from *Risk perception* to *Efficacy*, resulting in a significant improvement in model fit, $\Delta\chi^2$ (1) = 36, $p < .001$.

After these fourteen changes had been made, the model fit was very good, χ^2 (7) = 15.2, RMSEA = .016 (90% CI = .004 - .028), NNFI = .99, CFI = 1.00, RMR = .108, AIC = 73.2. and PNFI = .91. The fit was better than that of all competing models, including that originally hypothesised, although parsimony was compromised. Details of this best fitting model are given in Figure 15.

Several features of this model are noteworthy. First, *Behaviour* was directly and positively predicted by four variables (*Adaptation, Responsibility, Concern,* and *Self-efficacy*). Second, as expected, *Adaptation* was uniquely and positively predicted by all five level 2 predictors, with *Distress* evidencing the strongest effect. *Belief* directly predicted *Concern, Risk Perception* and *Distress*, but it did not have a significant direct effect on the two action-oriented level 2 variables (*Self-efficacy* and *Felt responsibility to act*). A particularly potent pathway was indicated from *Belief*, through *Concern,* then *Distress,* and then *Adaptation,* to *Behaviour*.

While these conclusions follow directly from our analyses, some cautionary remarks are in order. In particular, we emphasise that the findings are based on a single cross-sectional, self-report study that used a volunteer sample of Australian residents, that assessed only one subset of all possible variables, and that measured each of these variables in only one of many possible ways. Different findings may be obtained using different research designs, variables, measures, and samples. In addition, the models developed and tested, while fitting the current data set well, may have taken advantage of random variation present only in the current sample. Model fit may be different in other data sets. Finally, the models suggest linear associations between the variables; they do not include possible non-linear or reverse effects, and they cannot be taken to imply causality.

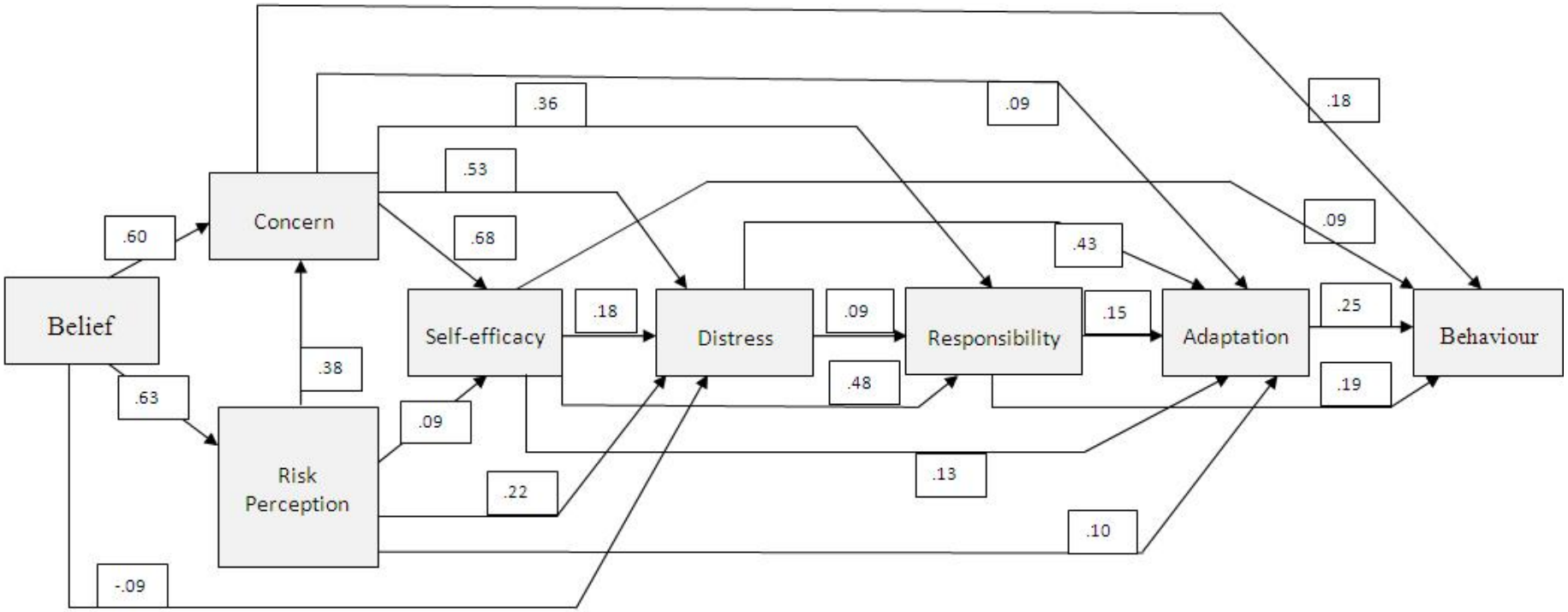

Figure 15. Model 2: Final Model of Antecedents of Climate Change Behaviours

(Standardised parameter estimates on lines. All parameters shown were significant at $p < .001$)

REFLECTIONS AND FINAL CONSIDERATIONS

The survey findings over this 2010-2011 twelve month period, based on comparison findings of independent respondent samples, suggest, overall, a similar and consistent picture in 2011 to that found for 2010 with respect to virtually all core dependent or outcome measures. This is itself an important finding, in keeping with longer term and reflective reviews of public perceptions, attitudes, and policy responses over time with respect to 'climate change' (Brechin, 2010; Brechin & Bhandari, 2011, Krosnick & MacInnis, 2011; Leiserowitz et al., 2012b; Lever-Tracy, 2010; Pew Research Centre, 2012). The 2011 findings also constitute a strong confirmation and validation of the 2010 Griffith survey findings, and are generally very consistent with a number of social science driven national surveys undertaken across this same period of time in Australia (e.g., Ashworth et al., 2011; Leviston & Walker, 2010, 2011). However this 2011 national survey has also documented a spectrum of modest changes in views and responses suggested by comparisons with the 2010 findings. These measured changes may well be indicative of a more encompassing residence, demographic-based, and dynamic landscape of risk perceptions, understandings, and concerns. Documented differences in views, the levels of confidence and certainty with which they were held, and specific policy positions were surprising in some instances, and more typically in the direction of slightly reduced climate change risk perception and concern levels, particularly for individuals dismissive of some aspects of the climate change threat.

All of the above reported findings for the 2011 survey, and comparisons with 2010 survey findings, are based on the responses of independent but comparable samples of respondents who completed these sequenced national surveys in 2010 (n = 3096) and 2011 (n = 4347). These currently reported comparisons reflect the repeated cross-sectional design nature of this component of our research program. A separate publication will address comparisons across this 12-month period for those additional 1037 respondents who participated in the 2011 survey as part of the within-subjects (longitudinal) component of the research program. This latter database allows for the measurement and documentation of within individual changes in risk perceptions, understandings, and responses to climate change and extreme weather events.

2010 AND 2011 FINDINGS AND COMPARISONS

The 2011 survey findings strongly support and validate our previous Australian and international survey findings of continuing high public acceptance, concern, perceived importance, and personal engagement with the threat and issue of climate change. The independent survey sample of respondents in July/August 2011 remained, on the whole, very accepting of the reality of climate change, very concerned about its implications for Australia and the world, and appeared to be actively engaged in a reflective and emotional coming to terms with just what climate change might mean and require in terms of individual, community, and in some instances, state and national policy responses. This engagement and these psychological and behavioural adaptation changes were no doubt influenced by the extreme weather events taking place in Australia over this 12-month period, as has evidently

been the case around the world (e.g., Leiserowitz et al., 2012a; Lewandowsky, 2012; Pew Research Center, 2012). Our data, and the research of others, also indicate that there has been a noteworthy underlying stability with respect to public risk perceptions, understandings, and responses to climate change and extreme weather events over the past decade (Borick & Rabe, 2012; Brechin & Bhandari, 2011; Romm, 2012; Villar et al., 2011).

In this report of our findings for the 2011 survey, we have provided our assessment of what these most recent findings appear to be saying, independently and in comparison with the 2010 findings. While salient differences have been given particular attention in this report, continuing and stable patterns over time are of equal importance and interest. These current findings will also be more fully interpretable when we have concluded our analyses of that cohort of respondents who completed surveys in both 2010 and 2011. In terms of our objective to systematically measure and monitor important psychological responses, changes, and impacts over time in the context of climate change, these 2010 and 2011 data collections, using comparable procedures and measures, represent only two points in time. Further comparable data collections are necessary to clarify and confirm currently indicative changes which may well be taking place in this Australian human landscape in relation to climate change.

While public risk perceptions, understandings, and responses to the phenomenon and threat of climate change have fluctuated modestly with particular media coverage, extreme weather events and consequences, and political debates, acrimony, and inaction (e.g., Brechin & Bhandari, 2011; Pew Research Center, 2012), the more remarkable and consistent story is that the great majority of individuals surveyed continue to be concerned, engaged, and actively adapting to what is looking more and more to be a profoundly changing global environment. To the extent that surveys such as the present are incorporating psychological measures and in-depth examinations and monitoring of the psychological and social impacts of climate change, a much clearer picture is emerging of the nature and interdependence of climate change adaptation and mitigation processes at an individual level, of adaptation costs and benefits, and the nature of the longer term psychological impacts which accompany this coming to terms with a dramatically changing natural world.

HOW COMPARABLE WERE THE 2010 AND 2011 COHORTS?

While the 2010 and 2011 samples contained approximately equal proportions of males and females, the demographic make-up of the two cohorts differed significantly in several other respects. Specifically, compared to the 2010 sample, the 2011 sample was on average: (a) somewhat younger, (b) more highly educated, (c) more likely to live in a (sub)urban location, both currently and over their life-time, (d) more likely to reside at a greater distance from a site frequently affected by an extreme weather event or natural disaster, (e) more likely to intend to vote for the Liberal party or no major political party, and (f) more likely to have a gross annual household income in excess of $100K. Whereas the latter two differences may be at least partly due to population changes over the twelve-month period between the two surveys, the first four differences tap stable population characteristics, and suggest that the two differed in systematic and potentially important

ways. As already reported (See Appendix D), responses to many of our 2011 climate change items varied with these demographic factors. The question thus arises: Are the obtained 2010 versus 2011 differences in climate change variables attributable to mean inter-cohort differences in participant age, education, residential status, income, and/or voting intention?

The extent to which differences in climate change variables are due to differences in the demographic composition of the two samples can be gauged by examining whether the obtained 2010 versus 2011 climate change differences hold when controlling for relevant demographic variables. Results of several analyses of this kind are summarised in Table 28. As can be seen, the tendency for scores on *Residential Exposure*, *Objective Knowledge*, *Belief*, *Distress* and *Adaptation* to be higher in 2010 than in 2011 generally held true even when demographic differences between the two samples were statistically controlled. Major exceptions were (a) the higher scores in 2010 than 2011 in residential exposure, and in objective knowledge, were not evident among Labor/Green voters, and (b) suburban residents were not more distressed, and were not displaying higher levels of adaptation, in 2010 than in 2011. These exceptions aside, it seems that the obtained differences between the 2010 and 2011 cohorts in climate change beliefs, attitudes and behaviours were not substantially due to differences in the demographic make-up of these two samples.

Table 28. *Examination of Differences in Climate Change Variables While Controlling for Relevant Demographic Factors*

Climate Change Variable	Effect Originally Obtained (as per Appendix C)	Effect Obtained When Controlling for Demographic Factor(s)
Residential Exposure/ Vulnerability	Mean scores for exposure/ vulnerability were higher in 2010 than in 2011 ($p < .001$, Cohen's $d = .11$, $\eta^2 = .003$).	* Effect holds ($p < .001$, $\eta^2 = .003$), controlling for age, education, income and distance to extreme weather/disaster events. * Effect holds, when the analysis is limited to just (sub)urban respondents ($p < .001$, $d = .10$), or to just rural residents ($p = .021$, $d = .10$). * Effect is stronger when the analysis is limited to just Liberal/National Party voters ($p < .001$, $d = .20$), but does not hold when limited to just Labor/Greens voters ($p = .769$, $d = .01$).
Objective Knowledge	Mean knowledge scores were higher in 2010 than in 2011 ($p < .001$, Cohen's $d = .15$, $\eta^2 = .005$).	* Effect holds ($p < .001$, $\eta^2 = .007$), controlling for age, education, income and distance to extreme weather/disaster events. * Effect holds when the analysis is limited to just (sub)urban residents ($p < .001$, $d = .16$), or to just rural residents ($p < .001$, $d = .15$). * Effect is strengthened when the analysis is limited to just Liberal/National Party voters ($p < .001$, $d = .26$), or but is weak when limited to just Labor/Greens voters ($p = .096$, $d = .06$).
Belief in Climate Change	Mean belief scores were higher in 2010 than in 2011 ($p = .001$, Cohen's $d = .08$, $\eta^2 = .001$).	* Effect holds ($p < .001$, $\eta^2 = .002$), controlling for age, education, income and distance to extreme weather/disaster events. * Effect holds when the analysis is limited to just (sub)urban residents ($p = .002$, $d = .09$), or to just rural residents ($p = .080$, $d = .08$). * Effect holds when the analysis is limited to just Liberal/National Party voters ($p < .001$, $d = .19$), or to just Labor/Greens voters ($p < .001$, $d = .15$).
Climate Change Distress	Mean distress scores were higher 2010 than in 2011 ($p = .049$, Cohen's $d = .05$, $\eta^2 = .001$).	* Effect holds ($p = .002$, $\eta^2 = .001$), controlling for age, education, income and distance to extreme weather events. * Effect no longer holds when the analysis is limited to just (sub)urban residents ($p = .292$, $d = .03$), but it holds when limited to just rural respondents ($p = .021$, $d = .10$). * Effect holds when the analysis is limited to just Liberal/National Party voters ($p = .002$, $d = .11$), and when limited to just Labor/Greens voters ($p = .036$, $d = .08$).
Psychological Adaptation	Mean adaptation scores were higher in 2010 than in 2011 ($p = .024$, Cohen's $d = .05$, $\eta^2 = .001$).	* Effect holds ($p = .006$, $\eta^2 = .001$), controlling for age, education, income and distance to extreme weather events. * Effect no longer holds when the analysis is limited to just (sub)urban residents ($p = .241$, $d = .03$), but it holds when limited to just rural respondents ($p = .021$, $d = .10$). * Effect holds when the analysis is limited to just Liberal/ National Party voters ($p = .009$, $d = .10$), or when limited to just Labor/Greens voters ($p = .015$, $d = .09$).

BELIEF AND ACCEPTANCE

As discussed at several points in the preceding report, belief or acceptance of climate change is a core matter when considering public risk perceptions, understandings and responses to climate change. Such acceptance is itself integral to risk perception, sense making, risk appraisal, motivational responses generally, and specific psychological adaptation responses and behavioural engagement (Reser, 2012). But belief in the reality of such a profound and consequential threat as climate change encompasses more than a rational acceptance, as there is a necessary and emotion-laden acknowledgement and addressing of what is a very frightening and challenging set of changes to the world as we know it, and what all of this might imply for one's personal world and circumstances as well as for global communities, at individual and cultural levels (e.g., Langford, 2002; Pyszczynski, Greenberg, Solomon, & Maxfield, 2006; Reser, 2010; Weissbecker, 2011). And of course we live in a world of multiple threats and concerns, with many of these more serious threats and risks being continually questioned and minimised in the service of self-protection, and in conjunction with the necessary reality-testing of multiple conspiracy and other theories, and often unwarranted worries and concerns (e.g., Furedi, 2005; Hamilton, 2010; Hulme, 2009).

'Beliefs', 'values', 'risk' perceptions, and 'knowledge' all provide differing conceptual and disciplinary windows on public understandings of a phenomenon and threat such as climate change, often reflecting rather different assumptions, constructs, and interests (e.g., Sarewitz, 2011; Schwartz, 1992; Wolf & Moser, 2011). The construct of 'belief' within social psychology has had a somewhat troubled past, both in specification as well as measurement, as its broad scope covers more specific tenets about matters both real and ideal, as well as more encompassing world views and belief systems (e.g. Kruglanski & Higgins, 2007). From a philosophy-based perspective, belief refers "to the attitude we have, roughly, whenever we take something to be the case or regard it as true" (Schwitzgebel, 2011). 'Public beliefs' about the phenomenon and threat of climate change has its own difficulties, as the implicit reference in much conversational and research discussion is often not about the truth or reality of the phenomenon, but about the science, the politics, and the respective credibility of various sources, or media representations about this changed and changing condition of atmospheric global weather systems. But 'belief' or acceptance, in the context of climate change, is nonetheless fundamental to human understandings and behaviour, risk perceptions and responses, and successful public engagement in the context of risk communication and effective adaptation and mitigation policies and initiatives.

There is a simple but pervasive problem with most recent discussions and debates about public disbelief and scepticism about the reality of global climate change. The scientific discussion about 'global climate change' over the past three decades and more has been about anthropogenically-forced or human-induced climate change, through greenhouse gas emissions related to human activities over at least the past several hundred years. Therefore the appropriate and reasonable gloss for 'climate change' in almost all contemporary discussions or media coverage about climate change should be *anthropogenic climate change*, (i.e., this currently changing global climatic regime reflecting a system destabilisation caused by an increase in atmospheric greenhouse gases due to post-industrial

human activities). While it should be unnecessary to talk about this integral human causal contribution when discussing contemporary climate change, the contested reality of contemporary climate change, and whether or not it is due in large part to a collective human carbon footprint, have become largely constructed and artificially separated issues (e.g., Hulme, 2009; McCright & Dunlap, 2011a, 2011b; Petttenger, 2007). Within the discourse context of the IPCC, authors have been at pains to contrast the underlying importance and incompatibility of the definitions of climate change used by science and policy organisations (e.g., Pielke, 2004), and to argue that, from a pure science perspective, climate change should be defined broadly as "any change in climate over time whether due to natural variability or as a result of human activity" (pp. 31). The cogent argument for this, however, has very little to do with, and indeed effectively ignores, the actual meaning and currency of 'climate change' in everyday language and media coverage, and indeed the specification of climate change in the 1992 Framework Convention on Climate Change.

All of this matters in the context of a survey such as the present one, as findings such as those reported here relating to public acceptance and 'belief' are inevitably challenged by some with the argument that acceptance of 'climate change' (glossed as ever-changing global climate patterns) does not imply belief in a human causal role or 'forcing'. We are nonetheless dealing with public understandings, and inherent degrees of both scientific and public uncertainties, with some respondents being unsure about just what 'climate change' does mean and imply, in both general conversation and in the context of a survey such as the present one (e.g., Marx, Wever, Orlove, Leiserowitz, Krantz, Roncoli, & Phillips, 2007; Trenberth, 2010; Zehr, 2000). Hence we have been at pains to both document and probe these public understandings of and psychological responses to 'climate change', using convergent and standardised items and measures where possible, while being mindful of the political and contested nature of the issues and research findings. In the end we feel that our findings with respect to respondent acceptance of the reality of contemporary, anthropogenic, 'climate change' are very robust and strong. Where discrepant findings have been reported in the Australian context (e.g., Leviston & Walker, 2010, 2011), we would argue that these are an artefact of both question framing and response option provision, and that social science-based survey findings in Australia, Europe, and North America are very supportive of and consistent with the findings and interpretation of the present report. The recent and extensive coverage of public acceptance of climate change based on the research of Jon Krosnick at Stanford University is but one of many examples of a 'correction' to media coverage of such findings (e.g., Boykoff, 2011; Brechin & Bhandari, 2011; Jordan, 2012; Krosnick & MacInnis, 2011; Krosnick, Villar, & MacInnis, 2011; Leiseroweitz et al., 2012a, 2012b; Pew Research Center, 2012; Romm, 2011; Shwartz, 2010; Villar et al., 2011). (See Figure 16).

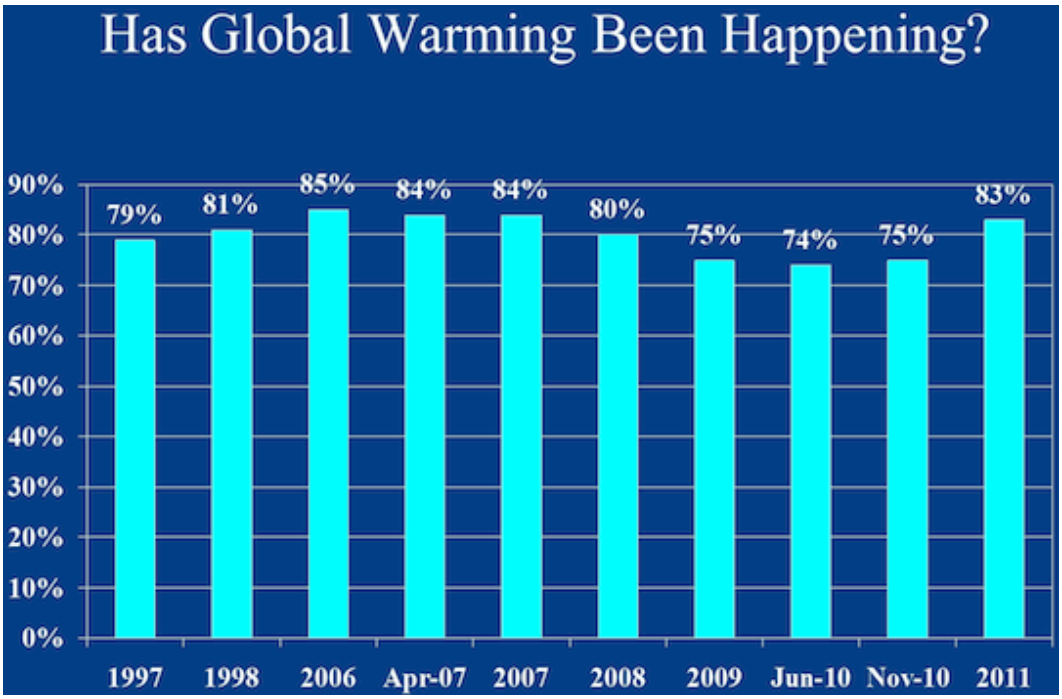

Figure 16. Survey of Americans Who Believe in Global Warming

(Romm, 2011)

A now extensive literature documents that the majority of research respondents in those nations where in-depth social-science based research has taken place accept that anthropogenic climate change is real, is likely to be very consequential in the future, and indeed is currently having very visible and consequential environmental impacts in many parts of the world (e.g., Brechin, 2010; Brechin & Bhandari, 2011; Leiserowitz et al., 2012a, 2012b, 2012c, 2012d; Krosnick & MacInnis, 2011; Lorenzoni & Hulme, 2009; Lorenzoni & Pidgeon, 2006). In the 2010 national survey exercise in Australia, undertaken in partnership with a similar survey exercise in Great Britain, 74% of respondents indicated that they accepted that the world's climate is changing (78% in GB), 54% of respondents believed they were already feeling the effects of climate change, and 45% of this national sample reported having direct experience with an environmental change or event which they felt was a consequence of climate change in Australia or elsewhere in the world (Reser et al., 2012b). The findings for out 2011 national survey were identical with this except that the proportion of respondents reporting that they were already experiencing the effects of climate change was 50%. Ashworth et al., (2011) report that 78% of their 2010 respondents believed that climate change was real, and that 63% of their respondents believed that climate change was already happening in Australia. A majority of respondents in nine of 15 countries surveyed in a recent worldwide review of perceptions of climate change believe that climate change is already affecting them (Brechin & Bhandari, 2011).

CAUSAL ATTRIBUTIONS AND ACCOUNTS

At an everyday 'lived experience' level people around the world are trying to make sense of the seemingly ubiquitous media coverage and threat of climate change, and appraise

its real nature and implications. This is not easy as what is being referred to in any particular situation or conversation is actually quite complex and fluid, and often simply unclear (e.g., climate change as phenomenon, threat, consequences, political and social issue). As well, the immediate threat and environmental consequences of climate change, while very media salient, and ubiquitously 'present', are arguably temporally and geographically 'distant' from most individuals' lives. But such a global threat, and its media, humanitarian, and political salience and presence, require mindful attention and consideration. Fundamental to human sense-making are the obvious questions of what is it, why is it happening, is human agency involved, if so who is responsible, and what can be done about it? But in the case of contemporary 'climate change' the phrase, construct, and underlying phenomenon is already formally and informally designated and defined as being partially and pivotally caused by human activities, i.e., that which is being referred to and discussed is almost invariably anthropogenic or human-forced climate change. In the context of the Framework Convention on Climate Change, *climate change* "refers to a change of climate that is attributed directly or indirectly to human activity that alters the composition of the global atmosphere and that is in addition to natural climate variability observed over comparable time periods" (Intergovernmental Panel on Climate Change (IPCC), 2007, p. 6). In the context of everyday conversations, television coverage, and newspaper headlines, 'climate change' also means a much more consequential and longer term change in global weather patterns 'precipitated' by human activities, lifestyles, and industries, which is a matter of serious scientific and elevated public concern.

This matter of what climate change means and refers to in public discourse and everyday conversation is quite important for multiple reasons, as embedded causal attributions strongly influence risk perceptions, motivations, felt responsibility, individual and collective efficacy, and behavioural engagement (e.g., Bandura, 2006; Hilton, 2007; Pelletier, 2002). A recent overview of national and international survey research and a further international study also documents the importance of causal attributions and thinking to public support for climate change policies (Bostrom, O'Connor, Bohm, Hanss, Bodi, Ekstrom et al., 2012). Did survey respondents understand that the 'climate change' being referred to was human-forced climate change? This would certainly appear to be the case, that is, in almost all instances some level of human causality and agency was presumed by the phrase and this seems to be entirely consonant with and validated by how respondents answered such questions, and whether or not they personally accepted that such 'climate change' was really happening.

The finding that 90% of Australian survey respondents in 2010 accepted some level of human causality (89.3% for British respondents), when required by the question asked and the response options given, to really think about this (Reser et al., 2012b), provides an important insight into both human risk perceptions and understandings. In addition to informing respondents' explanations of climate change, such human causal attributions immediately raise issues of responsibility, accountability, and guilt, as well as human agency more generally, and the possibility that if humans are partly responsible for this problem they may well be able to do something about it.

This matter of human causality also raises an interesting and important question with respect to the status of this seeming 'disaster': Is it 'natural' or 'technological', or what has become an increasingly common hybrid of both, as in the case of the products of biotechnology (e.g., Baum, Fleming, & Davidson, 1983; Haque & Etkin, 2007)? This ascribed status has multiple implications in terms of human accountability and agency, as well as fundamental sense and meaning making in a capricious and risk filled world (e.g., Callan, Ellard, & Nicol, 2006; Lerner, 1980; Reser & Muncer, 2004). Our findings are clearly indicating that climate change does appear to be a risk domain that shares elements of natural and technological causation and nature, and that in this respect climate change straddles the often problematic distinction between natural and technological disasters and stressors (e.g., Bell et al., 2001; Cuthbertson & Nigg, 1987; Cutter, 1993). This complexity relates not only to the role of human-generated greenhouse gas emissions, however, as a spectrum of human interventions, such as the creation of vulnerabilities to natural disasters by the location of human settlements and suburbs, can be seen, both pre and post disaster, as events and sets of outcomes involving substantial human agency and commission (Berkes, 2007; IPCC, 2012; Malone & Engle, 2011).

RISK PERCEPTIONS, APPRAISALS, AND CONCERNS

There exist convergent but nonetheless quite distinct theoretical and research literatures addressing environmental risk perception, threat appraisal, and environmental concern (Reser, 2010). Diverse sources addressing *environmental risk perception* can be found in environmental psychology, geography, disaster preparedness and response, and natural resource management, among other disciplinary perspectives (e.g., Bell et al., 2001; O'Riordan, 1995; Renn & Rohrmann, 2000; Zube, 1991). Within psychology and the health sciences a focus on *threat appraisal* reflects a more specific and personal consideration of immediate and personal situation threat as distinct from extended environmental threat, and threat appraisal is an integral feature of stress and coping models and perspectives (e.g., Folkman, 2011; Taylor, 2009). The 'environmental concern' literature is more characteristic of environmental and social psychology approaches in which the focus is less on the external nature or state of the environmental threat and more on the nature and intensity of one's psychological response to perceived threats *to* the natural environment (e.g., Hansla, Gamble, Juliusson, & Garling, 2008; Schmuck & Schultz, 2002). This coupled psychological appraisal and response to risk is part cognitive and analytical, and part emotional and feeling-focused (Etkin & Ho, 2007; Loewenstein et al., 2001; Slovic, 2000, 2010; Sundblad et al., 2007). In the context of climate change, concern can and often does refer to both a concern for and about the natural environment in terms of the impacts of climate change on existing natural ecosystems and environments, and concern about how the cascading physical environmental impacts and manifestations of climate change might affect human communities and one's self, family and local community (e.g., DeGroot & Steg, 2007; Schultz, 2000; 2001; Snelgar, 2006). Finally, the construct of climate change concern is of course also interlinked with notions of *subjective exposure* and *perceived and experienced vulnerability*, and is often found in the now extensive and largely nonpsychological climate

change literature in which these often very psychological considerations are addressed and explored.

The present Australian survey research attempted, with modest success, to navigate these parallel research and practice literatures, and to use existing items and scales that differentially addressed environmental risk perceptions on the one hand and experienced concern about the threat and implications of climate change on the other. Ultimately, principal emphasis has been placed on what the findings were able to say about *experienced* climate change concern and vulnerability, notwithstanding that this could be concern for oneself (egocentric), concern for others (altruistic), or concern for the natural environment (ecocentric). This emphasis is nonetheless important and strategic as such concern is a sensitive and readily measured *psychological* impact of the ongoing *threat* of climate change, and it directly influences psychological health and well being. Such concern can directly mediate and be mediated by psychological adaptation and behavioural engagement, and in association with other variables can strongly contribute to other psychological impacts such as distress, frustration, and pessimism (Doherty & Clayton, 2011; Dunlap & Jones, 2002; Reser et al., 2011, 2012a).

Notwithstanding the seeming ever-fluctuating public concern levels with respect to the threat and impacts of 'climate change' around the world, there again exists a more consistent and coherent evidence base suggesting that public concern about climate change remains relatively constant and high, both in Australia and overseas. But the highly charged political context of climate change nationally and internationally (e.g., Dunlap & McCright, 2008; Hoegh-Guldberg, Fielding, Head, Laffan, & Western, 2010; Villar & Krosnick, 2010), and the multiple challenges of specification and measurement of these public understandings and responses, have ensured that the documentation and monitoring of public risk perceptions and concerns with respect to climate change, as with belief, have been less than satisfactory, and reported findings rarely comparable. There also exists a considered view that a more general 'attenuation of risk' in the context of climate change has taken place over the past several years, especially in countries where the impacts of climate change are perceived to be less evident, with this seeming lessening of concern interpreted as reflecting a number of convergent factors (e.g., oversaturated and sensationalised media coverage, the influence of the 'climate gate' email leaks from the University of East Anglia, the problematic glacial melting forecasts made by the International Panel on Climate Change, and the severe northern hemisphere winter of 2009-2010). Recent evidence, however, from North America and Europe (Borick & Rabe, 2012; Krosnick, 2010; Leiserowitz et al., 2010a, 2010b, 2011a, 2011b) suggests that this apparent temporary decrease in public concern, as with acceptance/belief, appears to be returning to more stable levels of high public concern and decreasing uncertainty and scepticism (e.g., Brulle et al., 2012; Eurobarometer, 2009; Furedi, 2010; Leiserowitz et al., 2012a, 2012b; Pew Research Center, 2012; Spence, Pidgeon, Poortinga, & Venables, 2010).

THE LOCAL AND THE GLOBAL, AND PSYCHOLOGICAL DISTANCING

The acknowledgement but 'distancing' of the impacts and immediacy of climate change through global media coverage and intertwined processes of social construction, social representation, protection motivation, and emotion management, has been addressed by many researchers (e.g., Garcia-Mira, Real, & Romay, 2005; Spence et al., 2012:Uzzell, 2000, 2004; Weber, 2006). However, it is highly unlikely that a threat and risk domain of this magnitude, consequence, and symbolic currency can either be exorcised or effectively sanitised through defensive strategies at individual or cultural levels. A convergent and complementary explanation is that, for many people, global climate change, unlike more specific and identifiable acute weather events and specific threats, is a de facto environmental and ambient stressor, and by nature and definition not always within individuals' immediate focal attention or perceptual field, but essentially constituting a pervasive and background risk domain and continuing source of anxiety, somewhat independent of geographic location and current objective exposure (e.g., Bell et al., 2001; Evans & Cohen, 1987; Reser & Swim, 2011). Climate change is a quintessentially local *and* global phenomenon, environmental threat, and risk domain.

An important aspect of the survey which begins to tell us something about local area, and risk proximity, exposure, and vulnerability are the findings related to natural disasters and extreme weather events, and, indirectly, to climate change risk exposure. Results clearly indicate that relative salience and reported concern levels relating to particular extreme weather reflect regional exposure and event histories. However, the unprecedented geographic extent of some common disasters for Australia, particularly drought and flooding rain, is undoubtedly increasing the extent of direct experience with natural disasters for many Australians. The fact that Queensland was extensively flooded in the Wet Season of 2009-2010, for example, prior to the 2010 survey, and then again in 2010-2011, along with many other regions of Australia, in 'the summer of disasters', prior to the 2011 national survey, suggests that levels of perceived climate change risk and levels of concern are being given particular local meaning and salience for many Australians (BOM, 2010, 2011a, 2012). To the extent that these seeming changes in weather patterns, and extreme event intensity and geographic coverage, are being linked to the influence of climate change, this global phenomenon and threat becomes much less geographically, temporally, and psychologically distant. Having said this, familiarity and long experience with extreme weather events and natural disasters can also provide a ready and normalising explanation and account for otherwise marked but incremental environmental and weather pattern changes and events which are plausibly associated with unfolding climate change impacts.

Evidence pertaining to these issues comes from additional analyses conducted on the responses of the 2010 and 2011 Queensland residents. While the year between these two surveys was marked by several extreme weather events, these events were not experienced uniformly by all parts of Queensland. Specifically, residents of far north Queensland, Toowoomba-area, and the riverside suburbs of Brisbane were directly exposed to more severe weather and weather impacts during this year than were residents of, for example, the Sunshine Coast and other (upper and outer) parts of Brisbane. Changes in respondents' ratings of their residential exposure and vulnerability varied accordingly. Thus, for example,

the mean score on the *Residential Exposure* scale for Toowoomba region residents was a relatively low 9.8 in 2010 and a significantly higher 11.0 in 2011. Similarly, the mean on this scale increased from 9.8 in 2010 to 11.6 in 2011 for respondents residing within five kilometres of the Brisbane River. In contrast, mean scores changed more modestly for residents of upper/outer Brisbane 9.7 (2010) and 10.3 (2011) and for residents of the Sunshine Coast 10.9 (2010) and 11.2 (2011). However, while mean scores on measures of exposure and experience varied in ways consistent with local and recent weather events, scores on broader climate change variables (for example, climate change *Belief, Concern. Perceived risk, Felt responsibility to act*) did not. A partial exception was in relation to climate change *Distress*, which increased by 0.8 in Toowoomba and by 0.1 in "lower" Brisbane from 2010 to 2011, whereas it *de*creased during this year by 0.8 on the Sunshine Coast and by 1.2 in upper/outer Brisbane. Together, these results suggest that the recent and direct experience of extreme weather events has some, geographically-limited, impact upon perceptions of and responses to climate change.

The most recent national survey data from the Yale Project on Climate Change Communication (Leiserowitz et al., 2012c) provides very consistent and compelling findings from the United States with respect to public risk perceptions and understandings relating to climate change and extreme weather events. Following a record-breaking year of 14 'weather and climate disasters' in the U.S., with each resulting in more than one billion dollars in damages, 82% of survey respondents reported that they had personally experienced one or more types of extreme weather or natural disaster in the past year. A large majority of these American respondents believe that climate change made a number of high profile extreme weather events worse, with these including the unusually warm winter of December and January, 2011 and 2012 (72%), record high summer temperatures in 2011 (70%), the drought in Texas and Oklahoma in 2011 (69%), and the Mississippi River floods in the spring of 2011 (63%).

A number of convergent considerations seem particularly relevant to the preceding discussion. First, dramatic or strange weather events that occur locally have greater significance and a greater personal impact than do those that occur at a distance. Second, large, and possibly increasing numbers of people are experiencing extreme weather events at close range. Third, place connection and identity are particularly important influences when considering the psychological impacts of environmental degradation and individual pro-environmental motivation. Fourth, recent and local extreme weather events have been shown to have a strong priming effect with respect to views on climate change. Each of these factors no doubt contributes to the unfolding dynamic in which we see local communities increasingly viewing regional natural disasters and extreme weather events through the prism of global climate change, which offers both a coherent and credible causal narrative, as well as some, albeit limited, avenues for adaptation and mitigation.

PUBLIC UNDERSTANDINGS

The nature and importance of public understandings of climate change have been a central focus of this research, but this focus has been, necessarily, more indirect and

convergent than we would have preferred. A national survey such as that undertaken is not the ideal method for addressing anything as complex and essentially epistemological as individual or collective understandings, nor is there currently the requisite conceptual clarity in areas of environmental risk perception, threat appraisal, environmental knowledge, or psychological responses to climate change to adequately address these long standing issues. In addition the reality is that 'climate change' is an ever-changing referent as phenomenon, threat, objective and projected consequences and implications, and socially constructed and represented media product and risk domain. For any and possibly all of the above reasons, research in this area has tended to restrict itself to addressing and measuring self-reported, and less frequently, objectively assessed, knowledge of climate change science accounts of climate change processes and associated causes and impacts (e.g., Malka et al., 2009; Reynolds et al., 2010; Sundblad et al., 2007; Wolf & Moser, 2011).

This is often undertaken with scant attention paid to the multiple and convergent types of knowledge involved in the fostering and undertaking of ecological behaviour, such as declarative, procedural, effectiveness, and social knowledge (e.g., Kaiser & Fuhrer, 2003). Nonetheless our pragmatic attempt to differentiate and measure respondents' subjective and objective knowledge of science accounts of climate change, and to explore psychological responses to risk perceptions of climate change and natural disasters, acknowledging analytic, emotional, and more general meaning components and aspects of this phenomenon and threat, have been a qualified success. The risk domain of climate change for Australian respondents is coming into clearer view, and we have hopefully advanced the case and provided a research platform and set of indicators for documenting changes in these public risk perceptions, understandings, and psychological responses over time, all of which are arguably matters integral to psychological and behavioural adaptation.

While this has been one of the few national studies to address and objectively measure knowledge of climate change science accounts, along with subjective respondent judgments, we are convinced that such objective knowledge of climate change science is but one component of more personal, experience-based, culturally informed, and emotion and meaning-based understandings of the phenomenon and threat of climate change. While our focus has been more attentive to the sense seeking and sense making individual in the context of this seemingly profound threat, it is clear that 'climate change' is a socially constructed and socially represented phenomenon, risk domain, 'environmental problem', and environmental, social, and political issue, in which intertwined social, cultural and contemporary information environments and technologies all play important and interdependent roles (e.g., Burr, 2003, Pettenger, 2007; Spector & Kitsuse, 2000). But we would argue that our examination of risk perceptions and psychological responses to climate change and other environmental threats does provide a more balanced and strategic starting point and data base than self-reported knowledge when considering strategies for public engagement, the enhancement of psychological coping and adaptation strategies, and the measurement and monitoring of important changes in individual and community understandings of and responses to climate change.

DIRECT AND INDIRECT EXPOSURE AND EXPERIENCE

Our research focus on the threat and phenomenon of climate change and natural disasters has required us to consider the implications of the extensive media coverage of climate change and natural disasters over the past several years, and indeed the past decade, and the global nature of much of this coverage, as well as the real-time and very different nature and diverse modes of media access and delivery. It has been difficult to conceptually or theoretically demarcate direct and indirect exposure and experience, considering that the research and reality being addressed encompass the media-mediated, represented, and communicated threat, as well as unfolding environmental phenomena relating to extreme weather events, natural disasters, possible climate change manifestations, and the respective environmental impacts of all of the above. We have nonetheless presumed indirect and virtual exposure with respect to *all* respondents in the case of both climate change and natural disasters by way of media coverage and risk communications, which we have regarded as *indirect or virtual exposure and experience*, and we have relied on and distinguished self-report of direct personal in-situ experience of these phenomena as *direct personal experience*. The matter of exposure is challenging, as one can be *exposed* to a threat or risk, an ongoing stressor, and/or a more imminent and discrete environmental phenomenon or event. Again we have had to rely on self report, and judged status of such reports, in our coding of survey responses.

However what we have seen as rather remarkable is the way in which respondents' perceived direct experience with environmental changes or events associated with climate change appears to have changed these individuals' perceptions, understandings, and responses to the threat of climate change. These are some of the strongest and most intriguing findings we are reporting. And clearly it is the meaning and significance of the experience and encounter that seems to be particularly influential, though there is little doubt that this significance is not unrelated to the natural environment context in which the encounter took place, and to active sense-making, uncertainty-reducing, and confirmatory and validating processes taking place. Yet it is this direct, experiential, encountering of a changing environment and environmental systems which appears to occasion the very marked differences we have recorded across virtually all of our response variables for those with and without such direct experience. What gives these findings particular credibility and interest is that arguably analogous and often substantial direct experience and encounters with natural disasters and extreme weather events does not appear to convey or impart similar significance or influence.

We have developed a number of convergent explanations for this effect and these findings, briefly discussed in this report and more extensively canvassed in a related paper (Reser et al., 2012a). A compelling explanation is that such direct experience gives one's prior indirect virtual exposure and experience a conferred importance, relevance, and personal meaning and reality that it did not previously have. This explanation and argument would suggest that it may not be simply the single encounter and experience itself that makes such a difference, but rather what such an experience does to one's previous and cumulative indirect and virtual exposure and experience. Further examination of our rich qualitative data

base, along with some further research, will hopefully provide a more informed and refined analysis of present findings, but these results nonetheless suggest that our transactions with our objective biophysical environments and human settings are enmeshed with our transactions and exposures relating to our 'information environment' in nuanced ways, with some level of experiential and environmental validation involved. There are many implications here relating to climate change risk perceptions, subjective exposure, experienced vulnerability, and uncertainty which would be very worthwhile to pursue.

CLIMATE CHANGE, EXTREME WEATHER EVENTS, AND DISASTERS

An important focus of this research was the extent to which climate change and extreme weather events are perceived and understood by the Australian public as interrelated phenomena and risk domains. In a broader theoretical and conceptual sense this focus could be seen as relating directly to public risk perceptions and understandings, relative salience and risk, and sense making and perceived causal interconnections. But there are multiple practical and strategic reasons why this seemingly simple empirical question and issue is more complex and particularly important. There exists substantial cumulative wisdom and an extensive research literature relating to disaster preparedness and prevention, risk perception and communication, psychological and social response and recovery, and adaptive capacity and resilience (e.g., National Research Council, 2009; Norris et al., 2002a, 2002b; Reyes & Jacobs, 2006; Tierney, Lindell, & Pervy, 2001). To what extent can this body of knowledge and best practice be generalised to the threat of climate change? The more salient and observable manifestations of global climate change are in terms of extreme weather events and natural disasters. Given the global, and complex, and abstract nature of climate change as a phenomenon and threat, it is very understandable that individuals and communities might well be understanding and adapting to this extensively communicated threat in terms of what is more familiar, local, and directly, virtually, and/or vicariously experienced (e.g., Stewart, 2009, 2010). This is certainly how this phenomenon and risk has been presented to the public through media headlines, images, and general coverage. Engaging the public with respect to climate change adaptation and mitigation has posed a considerable challenge for climate change science and policy makers (e.g., Whitmarsh et al., 2011), yet there has been great reluctance and indeed censure when suggesting that causal linkages might be made between any particular natural disaster or extreme weather event and global climate change (e.g., Stott et al., 2010).

The present research findings provide ample evidence that our survey respondents, and by inference the Australian public, do see and understand climate change largely in terms of extreme weather events and natural disasters, as well as in terms of profoundly consequential environmental and landscape changes. This is particularly evident in our open-ended, qualitative research findings, and in respondents' descriptions and explanations of their personal encounters and experiences with events and changes which they think might be associated with and/or evidence of climate change. We must seriously ask ourselves how else would most individuals be able to make psychological and adaptive sense out of the complexity of climate change, but through such analogical thinking and personal and local

experience. An ongoing further examination of our 2010 and 2011 data will provide further insights with respect to the possibly overlapping or intersecting risk domains of climate change and natural disasters. Preliminary analyses suggest that the risk domain and cultural meanings associated with climate change include attributes of both natural and technological disasters, with possible implications relating to human agency and responsibility, dread risk, and the implications of an ongoing, chronic, environmental stressor and dramatically altered global and personal environment (e.g., Slovic, 2000, 2010).

A number of authors have recently suggested that there is considerable merit in both applying some of the distilled wisdom from over four decades of psychological and social science research on disaster preparedness and response, and more strategically utilising the psychological reality that public perceptions and understanding of the threat of climate change are strongly coloured and informed by direct and virtual exposure to and experience with extreme weather events and natural disasters (Morrissey & Reser, 2007; Spence et al., 2012). Such personal experience with acute weather events, and ongoing environmental stressors relating to deteriorating environmental conditions, typically in the context of one's own residential region, provides for a more personal, experiential, and localised understanding of what the manifestations of climate change are likely to be like (e.g., Baldwin & Chandler, 2010; Luginaah, Taylor, Elliot, & Eyles, 2002; Moyano, Paniagua, & Lafuente, 2008). Such personally meaningful environmental experience can help make this abstract and geographically and temporally distant, and hence psychologically distant issue and threat, more concrete, immediate, and real. Such strategies for 'bringing the biosphere – and climate change – home' have been framed differently by different authors (e.g., Thomashow, 2002; Whitmarsh et al., 2011), but the suggestion makes considerable practical as well as psychological sense.

> Highlighting the links between local events and climate change may encourage people to engage with the issue and to take action to mitigate potential impacts. Indeed personal experience is thought to be a key driver of perceptions, and the perceived likelihood of a risk is found to increase if it has recently been experienced or can readily be imagined. Relating local events to climate change may also have perceptual and behavioural impacts to the extent that these help to make the issues less distant and more tangible (Spence, Poortinga, Butler, & Pidgeon, 2011. p. 1).

> My views on climate change, for example, owe in part to the physical experience of the hottest and driest summer ever recorded in Arkansas. I spent the summer out of doors working on a small farm and quite literally felt the heat without relief, day after day. I learned that heat has a certain smell and feel to it that I experienced bodily for months on end. When rains and cooler weather finally arrived in late fall, that feeling came like salvation. Subsequently, I have had more than a passing interest in the abstractions of climate change, I suspect because I felt what it might be like. (Orr, 2007, p. 1).

A very substantial issue and at times frustration in the present research context has been the product of two very different perspectives and views. These are a meteorological and climate change objective science position that it is very difficult to attribute any particular

extreme weather event or natural disaster to climate change (e.g., Field, Barros, Stocker, Qin, Kokken, & Ebi et al., 2012; Peterson, Stott & Herring, 2012; Pielke, 2004; Trenberth, 2011), and a social and behavioural science perspective which places particular importance on how individuals, communities, and cultures are making sense of, attributing causality, and ultimately understanding perceived associations and connections between similar and possibly interacting phenomena, the threat, phenomenon, and risk domain of 'climate change' and the threat, 'nature', and risk domains of extreme 'weather' and 'disasters' (e.g., Swim, Stern, Doherty, Clayton, Reser, Weber, Gifford, & Howard, 2011; Lever-Tracy, 2010). Clearly the culturally and socially constructed phenomenon, 'environmental problem', and associated implications of global climate change are complex, abstract, and contested, and for many, geographically, temporally, and psychologically distant from their personal experience, knowledge, and known regional environments (Hulme, 2009; Whitmarsh et al., 2011). Yet the public's exposure to this media-presented phenomenon and projected climatic, environmental, and human consequences is ubiquitous, continuous, and powerful, albeit mainly indirect and virtual. And there is no question but that many of the manifestations of unfolding climate change will be and already are in the form of changing extreme weather event and natural disaster patterns, intensities, and environmental and human impacts and consequences.

From social science, human science, and psychological perspectives there is no impediment to, and indeed it is entirely reasonable to ask, whether the world's publics are perceiving and understanding the threat and phenomenon of climate change in extreme weather event and natural disaster or technological disaster terms, in short 'is there a climate change signal' in more recent global, or national and regional extreme weather in natural disaster events. The answer, intuitively, logically, theoretically, and increasingly empirically is that there is an extremely high probability that publics around the world are perceiving and understanding climate change in extreme weather terms, and, conversely, extreme weather, weather and seasonal changes, and natural disasters in climate change terms. It is certainly the case that our national survey data over two consecutive years is very strongly suggesting the increasing intersection of natural disaster, technological disaster, and climate change risk domains. Unfortunately there has been surprisingly modest published research on the nature of global climate change as a risk domain (e.g., Thomalla et al., 2006). However there is little doubt that dynamic and powerful social and cultural processes are at play with respect to the 'social construction' and 'social representation' and social amplification and attenuation of risk of this environmental threat, phenomenon, problem, and set of intertwined issues (e.g., Whitmarsh et al., 2005; Pidgeon et al., 2003; Wagner & Hayes, 2005).

Clearly this hard-line position on the part of meteorology and climate change science has been changing over the past 12 months, with multiple journal articles and meteorological society reports arguing that Meteorological Bureaus and other scientific reporting should acknowledge and address both the current science and public understandings of climate change in a more pragmatic way, and in a way which accepts the need for 'near real time' causal accounts and explanations in current State of the Climate reports (e.g., Field et al., 2012; Nature Publishing group, 2011; Peterson et al., 2012; Stott , Stone & Allen, 2004).

> Currently, attribution of single extreme events to anthropogenic climate change remains challenging (Seneviratne et al., 2012). In the past it was often stated that it simply was not possible to make an attribution statement about an individual weather or climate event. However, scientific thinking on this issue has moved on and now it is widely accepted that attribution statements about individual weather or climate events are possible, provided proper account is taken of the probabilistic nature of attribution (Nature Publishing Group, 2011, as cited in Petersom, Stott, & Herring, 2012, p. 2).).

But what has not been as clearly stated and acknowledged is that with respect to public risk perceptions and understandings, 'the climate change signal' is now very strong for many natural disasters and extreme weather events in virtually all those regions of the world where this has been explored through in-depth social science research (e.g., Leiserowitz et al., 2012c; Leiserowitz et al., 2012a). And newspaper, new media, and popular science headlines and images around the world repeatedly proclaim this interconnection between climate change and the increased frequency and intensity of extreme weather events (e.g., Gillis, 2010; Flannery, 2005; Miller, 2012; Smith & Joffee, 2009, 2012). Many studies have documented the thoughts, feelings, and images which are associated with climate change. The majority of these invariably relate to natural disasters and extreme weather events and their environmental and human impacts (e.g, Leiserowitz, 2005, 2006; Lorenzoni et al., 2006; Stewart, 2010).

There is, however, a very important difference between natural disaster and extreme weather events associated with climate change and those taking place or discussed independent of climate change. Extreme events *viewed as manifestations and epiphenomena of anthropogenic climate change* are perceived and understood as partially human-induced and caused, and hence as hybrid natural and technological events and phenomena which invoke additional and troubling symbolic and cultural meaning system associations, and guilt and responsibility implications, as well as constituting an ongoing and threatening altered condition of the global environment (e.g., Adam, 1998; Bauer & Gaskell, 2002; Baum et al., 1983; Evans & Stecker, 2004; Furguson & Branscombe, 2010; Oltedal, Moen, Klempe, & Rundmo, 2004; Shore, 1996). It is interesting and noteworthy that Hurricane Sandy has been termed the '#Frankenstorm' on Twitter, suggesting public awareness and cultural meaning system associations in the case of this hybrid phenomenon and threat, part natural, 'technological' (i.e., human created and caused).

THE 2010-2011 PERIOD INCLUDING THE 'SUMMER OF DISASTERS'

An important and fortuitous opportunity in the context of the mid-2011 survey was to examine the extent and influence of the multiple extreme weather events and natural disasters that took place in Australia in the preceding 12 months and following the mid-2010 national survey. It is rarely the case that a major research program with a particular natural disaster and extreme weather monitoring focus is underway and able to be strategically employed in such a context. It was also the case that the several years preceding these surveys were also characterised by a number of quite dramatic international disaster events which received

extensive media coverage in Australia, as well as the memory-searing events of Black Saturday and the Victorian bushfires. From a purely methodological perspective, this was an exceptional opportunity, but also a serious challenge, as these dramatic events and their media coverage constituted a particularly salient and directly relevant 'history' event and confound when interpreting our findings for this 12-month period. Nonetheless this will be a continuing and quintessential matter and challenge as research programs around the world begin to come to terms with issues of measurement, monitoring, and the documentation of changes and impacts in the human landscape in the context of climate change. This will also be core business in the context of climate change adaptation.

The somewhat remarkable story with respect to comparisons between the 2010 and 2011 survey findings was that there were few variables or indicators which evidenced substantial contrasts between the responses of survey participants in mid-2010 and mid-2011. This was in spite of the fact that the 2011 sample reported quite exceptional direct experience with extreme weather events over the preceding 12 month period. Twenty-eight percent of the 2011 sample reported direct experience of a disaster warning situation or an impact event during this 12-month time frame. And 10% of these 2011 respondents thought at one or more points in time that they might be killed. Our current explanation for these findings includes several distinct points:

- Extreme events in Australia preceding this 12-month period were quite exceptional, including the Millennium Drought, Black Saturday, and extensive flooding across much of Australia in the preceding summer.
- Media coverage of climate change over this period of time was polemic, often quite biased (e.g., Bacon, 2011), and very emphatic (though typically contradictory with respect to headlines) in repeated statements relating to there being no climate change signal in these extreme weather events.
- International media coverage of unprecedented extreme weather events and both technological and natural disasters around the world, put events in Australia 'in perspective', making them somewhat less noteworthy or exceptional.
- Through all of this, Australians were in fact coping with very major state and national disasters in arguably adaptive and resilient ways, not discounting devastating personal, household, and community losses across the nation.
- In the context of successive years of very extreme and unusual weather events and patterns, it would not be expected that a 12-month window of documented changes would pick up on or be able to provide a clear and fine-grained picture of the dynamic changes taking place that would relate to public risk perceptions, understandings and psychological responses and impacts to the threat, phenomenon, and meta-narrative of climate change. This requires systematic examination over a longer time period.

It is important to keep in mind the larger global context, backdrop, and contemporary information environment against which we are attempting to discern important changes and impacts. Events in North America, for example, in the calendar year of 2011, were certainly as exceptional as anything occurring in Australia, and arguably far more so. And a number of

survey research undertakings not so dissimilar from our own have documented a quite remarkable picture of events and collective experience.

> In 2011, Americans experienced a record-breaking 14 weather and climate disasters that each caused $1 billion or more in damages, in total costing approximately $53 billion, along with incalculable loss of human life. These disasters included severe drought in Texas and the Great Plains, Hurricane Irene along the Eastern seaboard, tornadoes in the Midwest, and massive floods in the Mississippi River Valley. In the period of January through March 2012, Americans also experienced record warm temperatures, with temperatures across the contiguous United States 6.0 degrees F above the long-term average. In March alone, 15,292 warm temperature records were broken across the United States. (Leiserowitz et al., 2012b)

As we complete the writing of this report, the Eastern seaboard of the United States, including New Jersey and the city of New York are just getting back on their feet after the 'superstorm' of Hurricane Sandy. The costs and impacts of this hurricane, because of its track along the coast and intensive coastal development including major cities, have been unprecedented (Gorman, 2012). But perhaps more important than these economic and societal costs has been the global significance of much of New York City being inundated by a disaster associated with climate change. News coverage around the world is suggesting that this is a clear 'significance' tipping point with respect to the reality of climate change, its actual implications, and the need for a commensurate and committed response on the part of world governments.

> "Though you can't make a direct link between Australia's killer floods and climate change, they do hold a warning for the future: Scientists predict such extreme weather events will increase both in intensity and frequency as the planet warms. Raging floodwaters have swamped thousands of homes and businesses in Queensland, leaving at least 25 people dead and dozens more missing since late November. Rail lines and highways have been washed away in what is shaping up to become Australia's costliest natural disaster. The flooding follows a spate of severe natural disasters in the past year. While the most deadly was Haiti's earthquake, extreme weather also killed thousands of people across the globe, including a scorching heat wave that choked Russia in the summer and devastating floods that engulfed more than 60,000 square miles (150,000 square kilometers) in Pakistan. . . " (Ritter, 2011).

> "A deluge in Pakistan has upended the lives of 20 million people. It was preceded by floods in the United States that battered New England, then Tennessee, then Arkansas, then Oklahoma. Summer heat waves baked the eastern United States, parts of Africa and eastern Asia, and Russia, which lost millions of acres of wheat and thousands of lives in a drought worse than any other in the historical record. Seemingly disconnected, these far-flung disasters are reviving the question of whether global warming is causing more extreme weather…" (Gillis, *New York Times*, 2010, p. 1)

PSYCHOLOGICAL IMPACTS, DISTRESS, HEALTH AND WELL BEING

Our research findings with respect to psychological concern and distress in the context of climate change reflected the increasing salience of this health and well being issue and psychosocial impact considerations, and at the same time a dramatic dearth of evidence-based findings. (Reser & Morrissey, 2008). Australia has received considerable global attention in this regard as various framings of psychological distress in the context of environmental change and degradation have been developed here, in a variety of contexts (Albrecht, 2005, 2011) and have recently been applied to the threat and impacts of climate change (e.g., Fritz et al., 2008; Searle & Gow, 2009; Higginbotham, Connor, & Baker, 2012; Reser et al., 2011). A challenge and distinguishing feature of our own research in this context of distress has been that our immediate focus has been less diagnostic, treatment, or epidemiology-focused, and more measurement and broader impact focused. While due consideration was given to available measures (e.g., Higginbotham et al., 2007; Searle & Gow, 2010), it was ultimately necessary to design a research program and climate change-specific prototype measure. Our findings suggest that the development and establishment of a number of further suitable, sensitive, and climate change-specific, measures and indicators relating to important psychological considerations and adaptation and impact processes is quite possible. Such measures can play a crucial role in addressing the current gap in knowledge relating to psychological considerations generally in the context of climate change and more specifically to psychological adaptation and psychological impacts.

Some of the strongest and most important findings of the present research relate not only the extent of psychological distress being experienced by respondents through their virtual and literal exposure to, and perceived direct encounters with, the threat and phenomenon of climate change, but also to how the psychological and behavioural impacts of this distress are mediated by psychological adaptation, and how the respective contributions of prior variables in the structural equation model appear to be mediated by psychological distress. That experienced psychological distress at the media coverage and implications of climate change, and its associated environmental stress, was found to be the strongest predictor of psychological adaptation in the present study is both remarkable and compelling. The picture here appears to be not just one of an important area of adverse climate change impacts which is not being systematically documented and monitored, but the very strong motivating role being played by this angst and distress, for many, in terms of psychological adaptation and behavioural engagement. However it is clear from our analyses that psychological adaptation is not mediating the influence of experienced climate change distress for other respondents, and other less adaptive coping strategies are being engaged in dealing with the threat of climate change, such as avoidance, dismissal, and denial.

Further research is obviously necessary to more adequately document the dynamics of stress and coping and psychological adaptation in the context of climate change, along with documentation and monitoring of associated psychological impacts including adaptation costs (e.g., Reser et al., 2011, 2012). Our 2011 longitudinal survey research has specifically addressed these matters, and this data is currently being analysed. It is noteworthy that there has been considerable recent interest in the adverse psychological and mental health impacts

of the threat and unfolding physical environmental impacts of climate change, both internationally and in Australia (e.g., Agho, Stevens, Taylor, Barr, & Raphael, 2010; Australian Psychological Society [APS], 2010; Berry et al., 2008; Berry, Hogan, Owen , Rickwood, & Frayar, 2011; Berry, Bowen, & Kjellstrom, 2010; Coyle & Van Susteren, 2012; Doherty & Clayton, 2011; Gow, 2009; Higginbotham et al., 2012; Psychologists for Social Responsibility, 2012; Searle & Gow, 2010; Swim et al., 2011; The Climate Institute, 2011; Weissbecker, 2011).

An important focus of the current research program has been to examine and document the psychological impacts of the threat of climate change. A detailed consideration of these matters is incorporated in the companion research report/monograph (Reser et al., 2012b). It was anticipated, on the basis of other convergent arguments, literatures, and emerging evidence that these psychological impacts would be occurring (Doherty & Clayton, 2011), that they might well be as closely linked to the social representation and risk communication of climate change as they would be to the unfolding physical manifestations and impacts of climate change, and that they would be related in various ways to psychological adaptation processes and behavioural engagement. An important premise of the research was that it is important to be able to measure, monitor, and document these psychological impacts over time, as these impacts are likely to have clear health implications, and clear implications with respect to climate change adaptation and mitigation policies and interventions.

Many of the survey variables and measures related to psychological responses and impacts. *Changed* risk perceptions and understandings of climate change would arguably be seen as potential impact indicators. Elevated levels of climate change concern, preoccupation, uncertainty, frustration, distress, and pessimism, for example, could be seen as important aspects and indicators of psychological and mental health and well being impacts. Psychological adaptation to climate change can also be seen as an important impact domain as well as a suite of responses and adjustments to the threat and manifest environmental impacts of climate change, with such impacts implicating inevitable costs as well as benefits of adaptation. Ultimately behavioural engagement or non-engagement can also be seen as an additional and crucially important domain of psychological impacts, itself linked with internal self-regulation and emotion-focused coping. Hence a psychosocial impact assessment framework and thinking has been an integral part and foundation of the national survey program.

While many of the survey results reported support the proposition that the threat and phenomenon of climate change are currently impacting, individually and convergently, on the health and well being of Australians, a number of findings are particularly noteworthy. An initial and important finding is simply that it is possible to use a number of meaningful indicator measures to monitor psychological impacts associated with perceptions of, exposure to, and experience with the threat and physical environmental impacts of climate change. A second and major finding across these two national survey exercises is that reported levels of particular indicator variables are arguably quite high, with these including the perceived risk of climate change, concern about climate change and its implications, subjective exposure

and vulnerability, and climate change distress. These findings are not suggesting widespread or dramatic mental health impacts, but they are indicating *that the threat* of climate change is significantly impacting on perceived environmental quality and quality of life, and perceived physical environmental manifestations of climate change, are a cause of preoccupation, concern, and pessimism for many. This is not to dismiss, of course the finding that genuine distress at the implications of climate change appeared to be a reality for possibly 20% of survey respondents. These findings and underlying argument are consistent with current social science and psychological thinking with respect to the nature and status of climate change as a powerful environmental stressor, that is, as an ongoing and background threat and stressor rather than a more immediate and short-lived acute stressful event, such as an extreme weather event or natural disaster occurrence (e.g., Evans & Stecker, 2004; Reser & Swim, 2011).

Qualitative responses overall clearly reflected an acceptance that climate change was occurring, with acknowledgment from many that the changes and events noted were well outside of what might be expected in terms of historical or personally experienced climate variability. Responses could also be generally characterised as reflecting, along with acceptance, resignation and pessimism, real sadness. As well, worries and anxieties, genuine alarm and fear, and a clear sense that things will likely get worse captured the responses of many. Qualitative responses strongly supported the conclusion from the quantitative data that both media coverage and personal validation of the unfolding impact of climate change were having strong psychological, especially emotional, impacts on survey respondents. This accords with a growing body of evidence within Australia that the threat of climate change is impacting quite substantially on the psychological health and wellbeing of Australians (e.g., Agho et al., 2010; Fritz et al., 2008, Berry et al., 2011; Fritz et al., 2008; Gifford et al., 2009; Searle & Gow, 2010; Hughes & McMichael, 2011; The Climate Institute, 2011; Reser et al., 2011), with these findings resonating strongly with the international literature (e.g., Doherty & Clayton, 2011).

As our research has also examined risk perceptions and responses to natural disasters, it has been possible to pull together a more complete picture of how climate change and natural disasters are interlinked features of the current Australian landscape and environment, and together comprise a major component of the more encompassing environmental risk domain. These interconnections in public risk perceptions and understandings of course matter in terms of disaster preparedness and response, in terms of psychological adaptation to climate change, and in terms of cumulative environmental stress.

The question of psychological impacts then is not simple. There is a strong case that the threat of climate change, particularly as communicated and represented by multi-media sources, is having adverse psychological impacts for the majority of respondents. The current and cumulative impact of the threat of climate change on perceived quality of life and environment, and mental health, appears to be mild to moderate for most of these individuals, arguably reflecting, in part, the *somewhat* distant, global, and abstract nature of this threat, phenomenon, and personal consequences. But awareness of this threat and danger would also appear to be having appreciable psychological adaptation and adjustment, behavioural

engagement, and resilience-conferring 'impacts'. If this is the case, it is a very positive finding. An important caveat is that there appear to be strong and convergent psychological distancing factors in play by way of protection motivation processes and information processing biases which can together result in less adaptive responses to what is undoubtedly a global emergency. Indeed the 18 nation findings from Gifford et al. (2009) would suggest that Australians are actually the most pessimistic nation, in the longer term, of those surveyed in their unprecedented international study. This possibly reflects the increasingly evident exposure and vulnerability of the Australian continent to the potential ravages of climate change.

PSYCHOLOGICAL ADAPTATION

In this research we have purposefully addressed what has been a crucially neglected consideration in climate change science discussions of adaptation, *psychological* adaptation (e.g., Reser et al., 2012a; Reser & Swim, 2011). As adaptation, a core construct and set of convergent processes within psychology, covers a spectrum of considerations and applications, and an encompassing suite of levels of analysis, it was important to conceptually specify and operationalise psychological adaptation in the context of climate change as an initial and clarifying course of action. The conceptual and operational definition employed has strong resonance with existing use and applications within psychology, and the social sciences more generally.

> Psychological adaptation in the context of climate change refers to those within individual adjustments and changes in risk perception, threat appraisal, and associated cognitive, emotional, and motivational responses to the threat and perceived physical environmental impacts of climate change, as well as to altered behavioural responses and engagements associated with such changed thinking, feeling, and motivational responses. Psychological adaptation also and necessarily refers to those underlying psychological processes mediating and moderating such individual change (e.g., emotion management, self perception, self-efficacy, protection motivation, coping strategies), as well as to the achieved state of relative balance with respect to own needs and environmental press and/or threat (Reser et al., 2012a).

Our findings strongly suggest that psychological adaptation plays crucial interlinking and mediating roles with respect to other psychological variables, including behavioural engagement, and very likely physical and emotional well being, reflecting the fact that adaptation, essentially intra and extra individual adjustments to environmental press, both constitutes and fosters greater person-environment congruence (e.g., Bell et al., 2001). Importantly, this would suggest that psychological adaptation is a powerful mediator of individual level behavioural adaptation and mitigation. A very promising finding is that climate change distress appears to be partly mediating how other variables are related to psychological adaptation, and that psychological adaptation is integrally tied up with the psychological impacts of the threat of climate change. This also would make logical and theoretical sense in that effective psychological adaptations would reduce and minimise the effects of environmental threats and stressors, and would complement and selectively reduce

the need for continual behavioural adjustments, but might understandably be associated with some adaptation costs as well as benefits, with these psychological costs constituting associated and adverse psychological impacts.

Finally, and very importantly, behavioural engagement would appear to be not only a partially mediated outcome of psychological adaptation, but itself an integral part of psychological adaptation with respect to 'taking action', concretely 'doing something', and feeling that one is responsibly being part of the solution as well as the problem. Our qualitative findings very strongly point to just such psychological benefits and 'psychological significance' in the context of carbon-reducing behaviour engagements. The Structural Equation Modelling undertaken is providing a coherent way of framing and understanding the interrelationships among these core variables and processes, and a template and platform for undertaking further research relating to specific variables and relationships.

DOCUMENTING CHANGES AND IMPACTS

While a primary objective of this research program has been to develop and establish a database and research platform for measuring, documenting, and monitoring important changes and impacts taking place in the human landscape associated with the threat and unfolding physical environmental impacts of climate change, the research to date has primarily set things in motion and ideally provided both avenues and procedures for moving forward, and multiple examples of the value of and need for this important psychological and social-science driven and informed data base. Notwithstanding the brief time period which intervened between the national surveys, both the period leading up to the initial survey in mid-2010, and in the ensuing twelve months leading up to the 2011 survey, were dramatic and dynamic periods in Australia and across the world. The data sets reported in our companion research report (Reser et al., 2012b) provide a realistic overview of what kinds of changes can be examined, and the relative value and sensitivity of particular indicators and measures over a time period such as this. The present reports have examined and documented these changes solely with respect to independent respondent samples in the context of two cross-sectional studies, reflecting and maximising both our respondent numbers and comparison opportunities with other similar survey research, but subsequent publications will also report on our longitudinal, within-subject findings relating to changes over this 12 month period.

MEDIA COVERAGE OF CLIMATE CHANGE AND PUBLIC RESPONSE TO CLIMATE CHANGE

An important aspect of the social construction and social representation of climate change (e.g., Smith & Joffe, 2012; Deaux & Philogene, 2001) relates to media coverage of this phenomenon, threat, the intertwined environmental, political, and social issues involved, and climate change science. As well, what has become an almost equally ubiquitous topic, is public responses to climate change, including belief and scepticism, perceived climate change science consensus, policy support, and, interestingly, social science survey results relating to

all of the preceding. With respect to media treatment of climate change, the contested political policy debate surrounding climate change and the influence of the media in their treatment and coverage of climate change, have been classic and invaluable areas of media studies and public understandings of science research (e.g., Boykoff, 2011, 2008; Carvalho, 2007; Smith, 2005). A number of important international studies have argued cogently that media coverage of the political debate surrounding climate change has powerfully influenced public risk perceptions, understandings, and responses to this risk and convoluted issue (e.g., Brulle et al., 2012; Carvalho & Burgess, 2005). Australian research has shown Australian media coverage to be particularly biased in its coverage of climate change. Between February and July 2011, when the Griffith survey was launched, negative coverage of the proposed carbon policy across 10 major newspapers eclipsed positive coverage by 73% to 27% (Bacon, 2011). There is little question but that our survey responses to climate change have been influenced to a considerable degree by media coverage. We have not systematically tracked such coverage over the period of our research, though others have (e.g., Bacon, 2011; Lewandowsky, 2012). What we have included in our survey questions was an attempt to measure respondent media consumption, with these findings suggesting that close to one third of respondents in 2011 were obtaining information about climate change from radio, internet sites, and conversations with family members and friends, with 55% of respondents using television news, current affairs, and documentaries, and 45% relying on newspapers for climate change coverage. In 2009 climate change outcompeted all other topics for media attention, and remained highly salient in 2011 (Bacon, 2011).

A parallel phenomenon which has in many ways dogged our research has been what we would consider to be very problematic media coverage of the climate change survey research which has been undertaken in Australia over the period of our research, and in particular media coverage of research findings relating to Australian public risk perceptions, understandings, beliefs, and responses to climate change. The reality is that the survey 'research' landscape in Australia, as in most western countries, is very mixed, with many commercial polling organisations as well as academic and other research institutions involved in both regular and intermittent survey undertakings, with climate change being a frequent area of interest (e.g., ANUpoll, Lowy Institute Poll, Newspoll, The Climate Institute). It is also the case that there have been a number of more extensive and in-depth national surveys undertaken in Australia over the past several years with a strong and specific focus on climate change (e.g., Ashworth et al., 2011; Leviston & Walker, 2010, 2011; Reser et al., 2012 b, 2012c). Media coverage of such survey findings is typically based on press releases from the researchers' institution, conference presentations, or journal-based or less formal online articles, in such e-publications as *The Conversation*. Actual research findings are not only reported but also interpreted by researchers, and then journalists, and editors, with newspaper headlines often carrying very misleading statements. Journalist – and lobbyists, understandably, have shown keen interest in findings related to where the Australian public might be with respect to climate change beliefs and climate change policy or legislation support, given the highly politicised and contested nature of climate change as a political issue in Australia.

It is arguably the case that Australian media coverage of Australians' acceptance of climate change has been seriously biased, as Bacon (2011) and others have documented, and that an aspect of this biased coverage is a misrepresentation of public acceptance of climate change, with repeated reference to an ostensible 40% non-acceptance of climate change figure for Australians, most recently given wide coverage on the ABC televised special, *I can change your mind on climate change* (26 April 2012)(e.g., Reser, 2011a,2011b, 2012).

This misreading and effective misrepresentation of public beliefs, concern, and policy support of course matters with respect to political assessments and policy support prognoses. But such misrepresentation also matters for the majority of Australians who not only accept the reality of climate change, and accept that it is already taking place in Australia, but who are concerned and/or distressed by the nature and implications of what is viewed by many as an unfolding global disaster (e.g., Spratt & Sutton, 2008; The Climate Institute, 2012). When millions of Australians hear that a major research study or national survey finds that 40% of Australians do not accept human-induced climate change, they are understandably rocked by supposed scientific evidence that a very substantial proportion of fellow Australians do not share their own assessment of the science and the risk, or their own genuine concern. In psychological terms the matter is one of disconfirmation and nonvalidation of what our findings tell us is a matter of clear belief and acceptance for 74% of our survey respondents, a matter of real concern for two thirds of survey respondents, and a very personally important issue and matter for close to 50% of our respondents, with well over 70% of respondents thinking that climate change will be a serious problem in the future if nothing is done to address the problem. Media pronouncements of 'science' findings running very contrary to these beliefs and concerns would logically foster confusion, frustration, and pessimism, and erode commitment, motivation and both personal and collective efficacy. Hence, when such information is disseminated, coupled with a credible source, this constitutes another way in which media coverage and social representations of the Australian public's views on climate change can adversely impact that same public.

ENDNOTE

A final endnote seems appropriate in the context of this three year research program to date and this second report. In Australia as in much of the developed world there are continuing high levels of climate change acceptance and concern, and arguably quite genuine climate change adaptation and behavioural engagement. It is also the case that the threat of climate change would appear to be having appreciable psychological impacts, in terms of concern, preoccupation, some psychological distress for many, and a relatively high level of pessimism in the longer term. At the same time, these perceptions, understandings, and impacts seem to have motivated many individuals to both adjust their perspective and response to the threat and implications of climate change and to engage with the threat, associated issues, and needed behavioural and lifestyle changes. But our findings over this short period are not at present showing an increasing of these already high levels of acceptance and concern, despite what were actually two 'summers of disasters' and the environmental and human impact of what was a major drought which persisted for between a

decade and 15 years across broad stretches of the continent. Indeed, a number of measures appear to show very modest decreases from 2010 to 2011 with respect to reported concern and apprehension about climate change. Somewhat paradoxically, despite small but discernible declines in climate change concerns between survey years, the extent to which respondents engaged in many pro-environmental behaviours increased slightly from 2011 to 2010.

There are of course many factors to take into account in addition to recent and extreme weather events, not only in Australia, but in other regions of the world. These include a changing though still highly charged political landscape, heavily biased media coverage, especially across the six month period preceding the 2011 survey administration, and very normal protection motivation responses on the part of individuals and nations when unfolding environmental changes and dire science prognoses are strongly suggesting that Australia and the world will be facing very serious and life-affecting challenges. Such responses are particularly found when what is at risk are not only cherished aspects of familiar local and global natural environments, but life support systems and livelihoods as the world alters. As well of course, we found quite high levels of climate change specific risk appraisal, concern, and preoccupation, but in a complex world with multiple other risks and environmental stressors. Many social scientists have made the point that there does exist an understandable component of 'finite worry' in our contemporary world. In this respect our current readings on the Australian public are suggesting the need to carefully document and monitor important psychological changes in public perceptions, understandings, responses, and impacts in the context of climate change, as these are not only an integral aspect and contributing component to human well being and quality of life in the context of unprecedented changes and stressors, but also to effective adaptation and mitigation measures and policies.

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APPENDIX A: LOCAL HISTORY EVENTS JAN 2009 – JUNE 2010

Date	Location	Event	Death toll	Injured	Property impacts
Jan/Feb 2009	South Eastern Australia VIC SA TAS NSW	Severe Heatwave	404	Increased admissions to emergency wards	Widespread power outages. Disruptions to trains services
Jan 2009	Northern QLD	Severe floods	1		Residential and commercial properties damaged
Jan 2009	Onslow WA	Cyclone Dominic Category 2			Minor structural damage
Feb 2009	Victoria	Black Saturday Bushfires	173	414	Homes destroyed – 2,298 Business destroyed - 61
March/ April 2009	Tamworth - NSW	Severe floods			Residential and commercial properties damaged
May 2009	South East QLD/ Northern NSW	Severe floods	1		
Aug 2009	Victoria	Severe thunderstorm and wind event			Residential and commercial properties damaged
Sept 2009	NSW and QLD	Extensive dust storm covering much of the continent		Increased demand for emergency services	Severe disruption to flights and ferry services. Road closures. Schools closed.
Dec 2009	Wallal WA	Cyclone Laurence Category 5		1	Considerable damage to properties.
Jan 2010	Kuri Bay WA	Cyclone Magda Category 3			Minor damage to infrastructure
Jan 2010	Cairns Gulf Country	Cyclone Olga Category 1			Minor damage to infrastructure
Feb-Mar 2010	Western, Southern Qld, Northern NSW	Severe floods			Major damage to infrastructure
March 2010	West and Northwest Victoria, Melbourne	Severe thunderstorms		Over 7500 calls to Emergency services	Widespread damage across the city. Flooding, hail and wind damage to homes and buildings
March 2010	Perth and Southwest WA	Severe thunderstorms		Increased demand for emergency services	Over 150,000 properties lost power. Hail, rain and severe winds resulted in considerable damage.
March 2010	Mackay and Whitsundays QLD	Cyclone Ului Category 3	1		Large areas of sugar cane destroyed. Structural damage. Many boats damaged or destroyed
March 2010	Cape Shield NT	Cyclone Paul Category 2			Minor damage to infrastructure, Disruptions to power, phone and sewerage
June 2010	Lennox Head-NSW	Tornado		Several injuries	Homes damaged or destroyed – 30+

(Australian Emergency Management Institute, 2012; Bureau of Meteorology, 2010, 2011a, 2011b, 2012; Centre for Research on the Epidemiology of Disasters [CRED], 2012)

DISASTER/EXTREME WEATHER EVENTS IN AUSTRALIA JULY 2010 – JUNE 2011					
Date	**Location**	**Event**	**People killed**	**People affected**	**Property impacts**
Sep-2010	Northern Victoria, South Australia	Storms and floods			
Oct-2010	Southeast Queensland	Floods			Wivenhoe Dam spills for the first time since 2001
Oct-2010	Riverina and Southwest slopes of New South Wales	Floods			
Nov 2010 – Jan 2011 (49 days)	Queensland (75% of the state)	Floods	35	200,000 5,900 people evacuated	3,572 commercial properties damages. 3,600 homes damaged.
Dec 2010	Gascoyne River, WA (*Many locations broke their highest annual daily rainfall records)*	Flood		Several towns evacuated	Crops destroyed, cattle drowned. Widespread damage to homes, roads and infrastructure
Dec-2011	New South Wales, Adelaide Region	Floods			
Jan 2011	Bowen, Qld	Cyclone Anthony (Category 2)			
Jan 2011	Victoria (Multiple locations) *Record rainfall West and North-West Vic 13 – 14th Jan*	Floods		5,000 people affected	To be advised
Feb 2011	Perth, WA (multiple locations)	Bushfires		4 people injured	72 homes destroyed, 32 houses damaged
Feb 2011	Melbourne, Vic *More than 65% of Vic recorded daily rainfall totals in the 99th percentile for Feb 4-5th.*	Severe storm	1	90 people affected, 6,000 people evacuated	20 buildings damaged
Feb 2011	Ayr, Cairns, Townsville, Qld (Multiple locations)	Cyclone Yasi (Category 5)	1	10,000	1,000 homes damaged
Mar-2011	Northeastern Tasmania, NSW Southcoast, Gippsland	Flood			
Jun-2011	Northcoast NSW	Flood			

(Australian Emergency Management Institute, 2012; Bureau of Meteorology, 2010, 2011a, 2011b, 2012; Centre for Research on the Epidemiology of Disasters [CRED], 2012)

APPENDIX B: 2011 COMPLETE SET OF SURVEY ITEMS AND DESCRIPTIVE STATISTICS

Q1. What do you think will be the most serious problem facing the world in the future if nothing is done to stop it? (open-ended response)

Q2. How favourable or unfavourable are your overall opinions or impressions of the following energy sources for producing electricity currently?

	Year	5. Very favourable	4. Mainly favourable	3. Neither favourable or unfavourable	2. Mainly unfavourable	1. Very unfavourable	Never heard of it	No opinion/ Don't know			
		%	%	%	%	%	%	%	*M*	*p*	*r*
a.Biomass (e.g., wood, energy crops)	2011	18.0	28.5	28.3	8.6	4.2	4.8	7.7	3.54	***	.13
	2010	8.6	28.2	26.7	12.8	5.7	10.0	8.0	3.26		
b.Coal	2011	5.4	16.3	26.3	27.3	19.8	0.2	4.8	2.58	***	.09
	2010	2.0	13.9	24.4	34.4	22.2	0.2	3.0	2.37		
c.Gas	2011	11.3	40.7	26.3	13.6	4.2	0.1	3.8	3.43	.33	.01
	2010	9.3	43.8	26.3	14.8	3.7	0.1	2.0	3.41		
d.Hydro-electric power	2011	33.4	42.0	13.7	3.7	1.2	1.8	4.2	4.09	*	.03
	2010	35.4	44.7	11.0	3.4	1.5	1.3	3.0	4.14		
e.Nuclear power	2011	8.3	15.2	15.5	18.1	39.1	0.3	3.6	2.33	***	.10
	2010	11.9	19.1	17.3	16.8	30.9	0.4	4.0	2.63		
f.Oil	2011	3.2	12.7	26.7	31.4	21.5	0.3	4.2	2.42	***	.09
	2010	1.5	9.6	24.7	34.7	26.5	0.4	3.0	2.23		
g.Sun/ Solar power	2011	65.8	25.1	4.7	1.8	1.2	0.0	1.3	4.55	***	.08
	2010	72.5	22.6	2.8	0.7	0.6	0.1	1.0	4.67		
h.Wind power	2011	55.0	29.3	7.8	3.7	2.5	0.1	1.6	4.33	***	.10
	2010	63.7	27.3	5.0	1.8	1.2	0.0	1.0	4.52		

Note: The Mann-Whitney *U* test was used in the following analyses.

Abbreviations and definitions. *M* = Mean (based on only those response options that are numbered), *p* = probability, *r* = effect size of the Mann-Whitney U test.

* $p < .05$. ** $p < .01$. *** $p < .001$.

Q3. From what you know or have heard about using nuclear power for generating electricity in Australia, on balance, which of these statements, if any, most closely reflects your own opinion?

	Year	%	*M*	*p*	*r*
5. The benefits of nuclear power far outweigh the risks	2011	14.7	2011 – 2.45	***	.12
	2010	20.4	2010 – 2.84		
4. The benefits of nuclear power slightly outweigh the risks	2011	13.5			
	2010	16.0			
3. The benefits and risks of nuclear power are about the same	2011	9.4			
	2010	10.1			
2. The risks of nuclear power slightly outweigh the benefits	2011	12.6			
	2010	13.7			
1. The risks of nuclear power far outweigh the benefits	2011	39.7			
	2010	28.7			
None of these	2011	1.2			
	2010	0.9			
Don't know	2011	8.9			
	2010	10.1			

Q4. Do you favour or oppose the construction of nuclear power stations in Australia?

	Year	%	*p*	*r*
Favour	2011	27.3	***	.08
	2010	36.9		
Oppose	2011	57.4		
	2010	47.9		
Don't know	2011	15.3		
	2010	15.2		

Q5. How concerned, if at all, are you about climate change, sometimes referred to as 'global warming'?

	Year	%	*M*	*p*	*r*
4. Very concerned	2011	24.6	2011 – 2.77	**	.03
	2010	26.2	2010 – 2.84		
3. Fairly concerned	2011	39.2			
	2010	40.1			
2. Not very concerned	2011	22.2			
	2010	21.7			
1. Not at all concerned	2011	12.4			
	2010	10.3			
Don't know	2011	0.6			
	2010	1.1			
No opinion	2011	0.9			
	2010	0.5			

Q6. As far as you know, do you personally think the world's climate is changing?

	Year	%	*p*
Yes	2011	74.2	.73
	2010	73.9	
No	2011	18.2	
	2010	18.2	
Don't know	2011	7.6	
	2010	7.8	

Q7. Thinking about the causes of climate change, which, if any, of the following best describes your opinion?

	Year	%	*M*	*p*	*r*
1.Climate change is entirely caused by natural processes	2011	6.6	2011 – 3.07	**	.04
	2010	4.9	2010 – 3.14		
2.Climate change is mainly caused by natural processes	2011	13.8			
	2010	12.6			
3.Climate change is partly caused by natural processes and partly caused by human activity	2011	43.9			
	2010	45.8			
4.Climate change is mainly caused by human activity	2011	25.2			
	2010	27.6			
5.Climate change is entirely caused by human activity	2011	4.1			
	2010	4.2			
I think there is no such thing as climate change	2011	4.2			
	2010	2.7			
Don't know	2011	1.5			
	2010	1.9			
No opinion	2011	0.8			
	2010	0.4			

Q8. If nothing is done to reduce climate change in the future, how serious a problem do you think it will be <u>for Australia</u>?

	Year	%	*M*	*p*	*r*
4. Very serious	2011	34.4	2011 – 2.97	***	.08
	2010	40.0	2010 – 3.13		
3. Somewhat serious	2011	37.7			
	2010	37.9			
2. Not so serious	2011	18.9			
	2010	16.8			
1. Not serious at all	2011	9.1			
	2010	5.3			

Q9. If nothing is done to reduce climate change in the future, how serious a problem do you think it will be for the world?

	Year	%	*M*	*p*	*r*
4. Very serious	2011	44.9	2011 – 3.14	***	.06
	2010	49.4	2010 – 3.30		
3. Somewhat serious	2011	31.3			
	2010	32.4			
2. Not so serious	2011	16.5			
	2010	13.7			
1. Not serious at all	2011	7.3			
	2010	4.5			

Q10. To what extent do you agree or disagree with each of the following statements about climate change?

	Year	5. Strongly agree %	4. Tend to agree %	3. Neither agree or disagree %	2. Tend to disagree %	1. Strongly disagree %	No opinion %	Don't know %	*M*	*p*	*r*
a.I am certain that climate change is really happening	2011	33.2	36.2	11.8	9.7	7.3	0.6	1.2	3.80	.97	
	2010	30.8	40.6	12.2	10.1	4.7	0.3	1.2	3.84		
b.I trust the Australian Government to take appropriate action against climate change	2011	4.3	19.0	18.8	24.5	30.9	1.0	1.4	2.40	***	.07
	2010	2.6	13.1	17.2	33.7	30.6	1.2	1.5	2.21		
c.The seriousness of climate change is seriously exaggerated	2011	17.3	21.4	17.5	20.6	20.7	0.4	2.0	2.94	*	.03
	2010	12.2	23.6	17.8	26.0	17.9	0.4	2.2	2.86		
d.It is uncertain what the effects of climate change will be	2011	13.4	42.1	18.9	15.2	7.9	1.1	1.4	3.39	.67	
	2010	9.8	46.0	20.1	15.4	5.7	1.1	1.9	3.40		
e.I am confident that science will find an answer to climate change before it becomes a big problem	2011	4.2	21.5	31.9	24.7	11.8	2.6	3.4	2.81	***	.07
	2010	2.7	19.1	29.3	30.2	13.3	1.9	3.3	2.66		
f.There is enough common sense and goodwill in society to prevent climate change having any serious impact	2011	4.2	16.1	22.9	29.0	23.3	2.3	2.0	2.47	***	.04
	2010	2.8	15.6	20.1	34.0	24.0	1.7	1.8	2.37		

Q11. To what extent do you agree or disagree with each of the following statements about climate change?

	Year	5. Strongly agree %	4. Tend to agree %	3. Neither agree or disagree %	2. Tend to disagree %	1. Strongly disagree %	No opinion %	Don't know %	*M*	*p*	*r*
a.I can personally help to reduce climate change by changing my behaviour	2011	19.2	42.9	17.8	10.2	7.2	1.4	1.2	3.58	.17	
	2010	18.1	47.1	17.7	10.0	5.4	0.7	1.0	3.64		
b.I personally feel that I can make a difference with regard to climate change	2011	14.4	36.3	22.3	15.1	9.4	1.4	1.2	3.32	**	.032
	2010	9.5	38.4	25.4	17.9	6.5	1.1	1.2	3.27		
c.I feel a sense of urgency to change my behaviour to help reduce climate change	2011	11.9	26.4	27.5	18.7	13.6	1.1	0.8	3.04	.80	
	2010	8.6	27.0	32.6	20.8	9.3	1.1	0.6	3.05		
d.It is my responsibility to help to do something about climate change	2011	19.3	39.1	22.4	8.7	8.6	1.1	0.9	3.53	.46	
	2010	16.4	43.7	24.3	7.9	5.9	1.0	0.8	3.58		

Q12. When, if at all, do you think Australia will start feeling the effects of climate change?

	Year	%
1.We are already feeling the effects	2011	50.0
	2010	54.0
2.In the next 10 years	2011	7.8
	2010	9.2
3.In the next 25 years	2011	6.7
	2010	7.5
4.In the next 50 years	2011	4.7
	2010	4.5
5.In the next 100 years	2011	3.3
	2010	2.3
6.Beyond the next 100 years	2011	5.0
	2010	2.6
Never	2011	8.0
	2010	5.5
Don't know	2011	12.6
	2010	12.9
No opinion	2011	1.9
	2010	1.5

Q13. To what extent do you agree or disagree with each of the following statements about climate change?

	Year	5. Strongly agree %	4. Tend to agree %	3. Neither agree or disagree %	2. Tend to disagree %	1. Strongly disagree %	No opinion %	Don't know %	*M*	*p*	*r*
a.Climate change will mostly affect areas that are far away from here	2011	1.5	6.6	19.6	33.1	32.1	3.2	3.8	2.06	.10	
	2010	1.4	7.1	17.7	39.5	28.0	1.8	4.4	2.09		
b.My local area is likely to be affected by climate change	2011	14.3	38.7	21.6	11.5	8.1	1.9	3.9	3.42	***	.08
	2010	15.8	44.8	18.4	10.2	4.6	1.0	5.2	3.61		
c.Climate change will mostly affect developing countries	2011	4.7	14.7	22.6	26.3	25.1	2.2	4.4	2.44	**	.04
	2010	5.0	17.7	20.6	28.6	21.4	1.3	5.3	2.53		
d.Climate change is likely to have a big impact on people like me	2011	12.7	30.8	27.8	13.1	9.7	1.6	4.3	3.25	**	.0004
	2010	12.7	32.9	29.4	13.5	6.0	0.9	4.5	3.35		

Q14. Considering any potential effects of climate change that might affect <u>you personally</u>, how concerned, if at all, are you about climate change?

	Year	%	*M*	*p*	*r*
4. Very concerned	2011	19.6	2011 – 2.64	**	.04
	2010	19.6	2010 – 2.72		
3. Fairly concerned	2011	38.7			
	2010	42.2			
2. Not very concerned	2011	24.0			
	2010	25.7			
1. Not at all concerned	2011	15.6			
	2010	10.7			
Don't know	2011	1.5			
	2010	1.3			
No opinion	2011	0.6			
	2010	0.5			

Q15. Considering any potential effects of climate change that there might be on <u>society in general</u>, how concerned are you about climate change?

	Year	%	*M*	*p*	*r*
4. Very concerned	2011	25.3	2011 – 2.78	**	.04
	2010	25.8	2010 – 2.87		
3. Fairly concerned	2011	39.3			
	2010	42.8			
2. Not very concerned	2011	19.4			
	2010	20.9			
1. Not at all concerned	2011	13.8			
	2010	8.7			
Don't know	2011	1.5			
	2010	1.3			
No opinion	2011	0.7			
	2010	0.5			

Q16. If you were to vote on the following matters today, how do you think you would?

	Year	1.Definitely vote against %	2.Probably vote against %	3.Probably vote in favour %	4.Definitely vote in favour %	I would not vote %	No opinion %	Don't know %	*M*	*p*	*r*
a.Whether to build new nuclear power stations in Australia	2011	41.3	17.6	16.4	13.8	2.8	1.8	6.3	2.03	***	.15
	2010	26.6	21.2	23.3	17.8	2.1	1.6	7.3	2.36		
b.Whether to build new wind farms in Australia	2011	3.5	4.8	28.0	58.5	1.4	1.3	2.5	3.49	***	.11
	2010	1.2	3.1	23.8	68.3	0.7	0.9	1.9	3.65		
c.Whether to build new coal-fired power stations in Australia	2011	24.6	31.1	20.2	6.9	3.1	4.0	10.0	2.11	*	-.03
	2010	23.4	37.9	19.4	4.7	1.8	2.8	9.9	2.06		
d.Whether to spend taxpayers' money on Australian projects designed to tackle climate change	2011	15.0	14.5	31.5	26.5	3.0	2.7	6.9	2.79	***	.09
	2010	9.9	12.2	37.7	29.7	2.1	2.2	6.1	2.98		
e.Whether to adopt current government proposals to reduce carbon emissions	2011	27.7	16.1	23.3	17.5	3.2	3.2	9.1	2.36		
	2010	Data not collected									

Q17. To what extent do you agree or disagree with the following statements?

	Year	5. Strongly agree %	4. Tend to agree %	3. Neither agree or disagree %	2. Tend to disagree %	1. Strongly disagree %	No opinion %	Don't know %	*M*	*p*	*r*
a.I am prepared to greatly reduce my energy use to help tackle climate change	2011	19.0	42.1	18.8	11.5	6.4	1.0	1.2	3.57	.34	
	2010	18.0	46.2	16.9	12.0	5.6	0.5	0.8	3.60		
b.I am prepared to pay significantly more money for energy efficient products	2011	5.2	18.3	18.9	25.8	29.5	0.6	1.6	2.43	*	.03
	2010	3.6	19.6	20.7	29.7	24.6	0.5	1.3	2.47		

Q18. Green identity scale

To what extent do you agree or disagree with each of the following statements?

	Year	5. Strongly agree %	4. Tend to agree %	3. Neither agree or disagree %	2. Tend to disagree %	1. Strongly disagree %	No opinion %	Don't know %	*M*
a.I think of myself as someone who is very concerned with environmental issues	2011	16.3	40.9	27.0	10.9	3.7	0.7	0.6	3.56
	2010	13.8	41.0	27.7	13.2	3.2	0.6	0.4	3.50
b.Being environmentally friendly is an important part of who I am	2011	16.3	40.7	26.3	11.4	3.8	0.9	0.6	3.55
	2010	14.3	41.3	28.1	11.5	3.7	0.7	0.4	3.51
c. I identify with the aims of environmental groups such as Greenpeace and Friends of the Earth	2011	9.8	28.1	28.2	16.9	13.1	2.2	1.6	3.05
	2010	11.0	30.5	28.4	16.9	9.7	1.9	1.5	3.17

Q19. How concerned are you that each of the following environmental threats might directly affect you, your family, or your local environment in the foreseeable future?

	Year	6. Very Concerned %	%	%	%	%	1. Not at all concerned %	*M*	*p*	*r*
a.Bushfire	2011	25.6	23.4	19.0	10.6	11.6	9.8	4.11	***	.05
	2010	26.9	25.7	20.6	10.2	9.9	6.7	4.29		
b.Cyclones	2011	14.7	13.2	16.8	16.2	20.1	18.9	3.30	***	.13
	2010	16.9	19.7	21.4	15.4	14.6	12.0	3.73		
c.Floods (Coastal & Inland)	2011	19.7	21.3	20.9	13.4	13.3	11.3	3.87	***	.05
	2010	20.1	24.3	22.2	14.6	11.1	7.7	4.05		
d.Heatwaves	2011	26.2	27.2	21.2	12.2	7.8	5.3	4.36	***	.10
	2010	32.6	30.3	19.0	8.8	5.8	3.6	4.64		
e.Water scarcity	2011	36.0	27.6	17.3	9.3	5.8	4.1	4.66	***	.17
	2010	49.6	28.8	12.0	5.3	2.9	2.1	5.10		
f.Impacts of climate change	2011	22.1	22.7	19.9	13.1	11.4	10.7	3.99	***	.13
	2010	27.6	28.4	22.2	9.3	6.7	5.7	4.44		

Q20. How important is the issue of climate change to you personally?

	Year	%	*M*	*p*	*r*
6. Extremely Important	2011	16.3	2011 – 3.96	***	.06
	2010	18.1	2010 – 4.14		
5	2011	26.2			
	2010	29.6			
4	2011	25.2			
	2010	24.9			
3	2011	11.9			
	2010	10.9			
2	2011	10.4			
	2010	8.8			
1. Not at all important	2011	10.0			
	2010	7.7			

Q21. How much do you feel you know about climate change?

	Year	%	*M*	*p*	*r*
6. A lot	2011	11.1	2011 – 4.09	.43	
	2010	8.1	2010 – 4.07		
5	2011	25.5			
	2010	27.6			
4	2011	35.8			
	2010	37.8			
3	2011	18.3			
	2010	17.1			
2	2011	7.4			
	2010	8.0			
1. Nothing	2011	1.9			
	2010	1.3			

Q22. How much do you trust what these different sources say about the environment?

	Year	6. Completely				1. Not at all				
		%	%	%	%	%	%	*M*	*p*	*r*
a.Scientists	2011	14.1	39.4	25.5	10.4	5.9	4.7	4.31	***	.04
	2010	8.8	40.5	30.0	11.6	6.1	3.0	4.25		
b.Media	2011	0.8	4.3	18.9	26.6	25.9	23.5	2.57	**	.03
	2010	0.3	4.2	21.7	26.0	27.9	19.8	2.64		
c.Government	2011	1.4	8.0	21.9	23.1	18.8	26.8	2.70	***	.08
	2010	0.6	7.6	27.3	26.8	21.2	16.4	2.90		

Q23. To what extent do you use day-to-day media coverage to inform your own views on climate change and other environmental issues?

	2011	
	%	*M*
6. A great deal	5.8	3.48
5	17.5	
4	30.9	
3	20.5	
2	15.4	
1. Not at all	9.9	

Q24. How much agreement do you think there is among scientists that climate change is happening?

	Year	%	*M*	*p*	*r*
6. Nearly all agree	2011	11.9	2011 – 3.69	*	.03
	2010	8.5	2010 – 3.61		
5	2011	22.7			
	2010	22.5			
4	2011	24.8			
	2010	26.8			
3	2011	16.1			
	2010	17.4			
2	2011	11.7			
	2010	13.4			
1. Considerable disagreement	2011	12.8			
	2010	11.4			

Q25. Connection to nature composite scale

Please answer each of these questions in terms of the way you generally feel when being in or thinking about the natural environment.

	Year	6. Strongly agree %	%	%	%	%	1. Strongly disagree %	*M*
a.I often feel that I am a part of nature	2011	15.7	27.0	33.0	16.7	7.1	3.2	4.20
	2010	14.8	25.6	29.7	17.1	9.2	3.7	4.09
b.I often feel close to the natural world around me	2011	14.7	27.3	32.6	15.8	6.4	2.5	4.21
	2010	14.8	27.1	28.6	17.0	9.0	3.6	4.11
c.I often feel a personal bond with things in my natural surroundings, like trees, wildlife or the view on the horizon	2011	17.9	26.3	27.6	16.2	8.3	3.7	4.18
	2010	16.8	26.5	25.6	15.6	10.7	4.9	4.08
d.I often feel connected to nature	2011	15.3	26.1	30.1	17.1	7.9	3.5	4.14
	2010	14.9	26.5	27.1	16.8	10.5	4.3	4.05
e.My own welfare is linked to the welfare of the natural world	2011	21.0	26.3	27.9	15.4	6.4	3.0	4.32
	2010	21.2	27.1	25.5	14.9	7.7	3.6	4.28
f.I recognise and appreciate the intelligence of other living things	2011	32.0	34.8	22.6	7.0	2.2	1.4	4.83
	2010	32.6	35.7	19.8	7.4	2.8	1.6	4.83

Q26. How would you rate the condition of the natural environment in the world today?

	Year	%	*M*	*p*	*r*
6. Excellent	2011	1.0	2011 – 3.33	***	.05
	2010	1.0	2010 – 3.44		
5	2011	8.9			
	2010	11.9			
4	2011	36.2			
	2010	38.6			
3	2011	34.8			
	2010	30.9			
2	2011	14.8			
	2010	14.0			
1. Very poor	2011	4.3			
	2010	3.7			

Q27. How serious a problem do you think climate change is right now?

	Year	%	*M*	*p*	*r*
6. Very serious	2011	17.3	2011 – 3.97	**	.04
	2010	19.4	2010 – 4.10		
5	2011	24.8			
	2010	25.2			
4	2011	24.2			
	2010	24.8			
3	2011	14.4			
	2010	13.7			
2	2011	10.3			
	2010	10.2			
1. Not at all serious	2011	9.1			
	2010	6.7			

Q28. How would you rate the condition of the natural environment in your own local region of Australia?

	Year	%	*M*	*p*	*r*
6. Excellent	2011	5.1	2011 – 4.11	.55	
	2010	6.0	2010 – 4.12		
5	2011	31.4			
	2010	32.0			
4	2011	40.7			
	2010	38.5			
3	2011	16.6			
	2010	16.3			
2	2011	5.0			
	2010	5.7			
1. Very poor	2011	1.2			
	2010	1.6			

Q29. Behaviour composite scale

What actions are you currently taking to reduce your carbon footprint? (In 2010, respondents were asked to tick any of the response categories that applied. In 2011, respondents were asked to respond in one of the following four ways: Select 1 if you have had no opportunity to engage in this behaviour, select 2 If you could have engaged in this behaviour but did not for some other reason, select 3 if you have engaged in this behaviour, but your reasons for doing so had nothing to do with climate change, or select 4 if you engaged in this behaviour at least partly because of climate change).

Behaviour			No, I am not engaging in this behaviour		Yes, I am engaging in this behaviour	
	Year	%	1. Because of no opportunity to do so %	2. For some other reason%	3. Not because of climate change at all %	4. Partly because of climate change%
a.Using less electricity	2011		4.1	14.6	39.6	41.7
	2010	79.6				
b.Using compact florescent light bulbs	2011		5.2	14.6	37.6	42.6
	2010	82.8				
c.Using less water	2011		3.8	15.7	38.0	42.6
	2010	79.7				
d.Buying energy from renewable sources/hydro/wind/solar power	2011		36.8	28.5	15.7	19.0
	2010	17.9				
e.Driving less	2011		24.9	26.9	30.2	18.1
	2010	48.4				
f.Using less petrol	2011		23.0	25.4	32.8	18.8
	2010	48.4				
g.Buying/using smaller/more fuel efficient car	2011		29.8	26.4	26.3	17.5
	2010	34.0				
h.Carpooling	2011		55.5	21.2	14.8	8.5
	2010	9.8				
i.Walking/bicycling/scootering	2011		27.8	27.2	29.5	15.5
	2010	40.3				
j.Reducing travel/vacation travel	2011		27.0	36.7	27.0	9.3
	2010	24.1				
k.Using trains/buses/subways/other public transport/mass transit	2011		38.5	24.1	24.8	12.7
	2010	25.9				
l.Recycling	2011		3.3	10.3	36.2	50.2
	2010	88.2				
m.Buying local food/organic food/growing own food	2011		16.6	28.8	32.2	22.4
	2010	39.9				
n.Buying carbon offsets	2011		45.5	33.6	10.0	11.0
	2010	5.8				
o.Reducing air travel	2011		37.3	34.4	19.2	19.1
	2010	17.8				
p.Other (please specify)	2011		41.1	26.8	16.2	15.8
	2010	3.9				
q.Nothing	2011					
	2010	2.8				

Q30. Please click the response that best indicates your level of agreement with each statement below.

	Year	6. Strongly agree %	%	%	%	%	1. Strongly disagree %	*M*	*p*	*r*
a.I believe my actions have an influence on climate change	2011	12.4	23.3	28.4	13.7	12.0	10.3	3.79	.12	
	2010	9.3	22.2	32.7	16.2	11.1	8.5	3.77		
b.I believe my actions have a positive influence on how I feel and think about climate change and environmental problems generally	2011	14.0	28.7	29.8	13.9	7.6	6.0	4.10	.19	
	2010	11.6	31.8	32.5	13.4	6.4	4.4	4.16		
c.My actions to reduce the effects of climate change in my community will encourage others to reduce the effects of global warming through their own actions	2011	9.1	18.1	27.0	18.4	15.0	12.4	3.51	.12	
	2010	6.3	20.8	29.2	19.9	14.0	9.8	3.56		
d.Human beings are responsible for global warming and climate change	2011	17.3	23.2	22.5	12.0	11.1	13.9	3.82	***	.05
	2010	18.9	25.5	23.2	12.4	10.2	9.8	4.01		

Q31. How much of the information provided in the stories written and broadcast by news organisations about climate change would you say is accurate?

	Year	%	*M*	*p*	*r*
6. Most of it	2011	2.7	2011 – 3.21	*	.03
	2010	1.5	2010 – 3.15		
5	2011	11.6			
	2010	10.0			
4	2011	32.3			
	2010	31.2			
3	2011	22.9			
	2010	26.3			
2	2011	18.0			
	2010	20.5			
1. Very little of it	2011	12.4			
	2010	10.4			

Q32. How closely are you following news about the environment these days?

	Year	%	*M*	*p*	*r*
6. A great deal	2011	9.9	2011 – 3.79	.86	
	2010	8.9	2010 – 3.79		
5	2011	22.7			
	2010	24.3			
4	2011	28.6			
	2010	28.3			
3	2011	19.7			
	2010	19.8			
2	2011	13.1			
	2010	13.3			
1. Not at all	2011	6.0			
	2010	5.5			

Q33. How often do you find yourself thinking about the issue of climate change?

	Year	%	*M*	*p*	*r*
6. A great deal	2011	7.9	2011 – 3.54	.98	
	2010	6.5	2010 – 3.54		
5	2011	18.7			
	2010	20.2			
4	2011	27.9			
	2010	28.2			
3	2011	19.1			
	2010	18.9			
2	2011	17.5			
	2010	18.5			
1. Not at all	2011	8.9			
	2010	7.8			

Q34. Motivation composite scale

To what extent do you agree or disagree with the following statements concerning your responses to climate change?

	Year	6. Strongly agree %	%	%	%	%	1. Strongly disagree %	*M*
a.I want to change my lifestyle in ways that help to address climate change	2011	15.6	24.5	25.9	14.1	9.4	10.4	3.92
	2010							
b.I am not at all motivated to help reduce climate change	2011	6.9	8.9	11.8	18.5	25.7	28.1	2.69
	2010							
c.I feel a personal obligation to do what I can to prevent climate change	2011	16.3	22.8	24.9	15.5	10.2	10.4	3.88
	2010							

Q35. Objective knowledge composite scale

	Year	True %	False %	Don't know %
a)The projected average sea level rise provided by the Intergovernmental Panel on Climate Change (IPCC) for the remainder of this century (2011-2099) is between 18 - 59 centimeters	2011	30.1	13.3	56.6
	2010	35.5	10.2	54.3
b)Australia is one of the most exposed nations with respect to projected impacts of climate change	2011	40.5	27.0	32.5
	2010	44.3	24.1	31.6
c)Climate change will increase the risk in Australia for diseases transmitted by water and mosquitoes (i.e., diarrhoea, dengue fever) over the next 100 years	2011	39.5	25.9	34.6
	2010	39.8	23.3	37.0
d)Globally, the current burning of fossil fuels accounts for 80-85% of carbon dioxide (CO^2) emissions added to the atmosphere	2011	41.7	18.7	39.6
	2010	47.1	15.0	37.9
e)Methane is emitted mainly from fossil fuels	2011	20.2	41.5	38.0
	2010	16.9	49.8	33.3
f)Climate change is mainly caused by the hole in the ozone layer	2011	21.3	54.9	23.8
	2010	20.6	57.8	21.6
g)Australia produces about 5.5% of the planet's carbon emissions	2011	24.0	25.4	50.7
	2010	23.4	17.8	58.7
h)Australia's average temperature has increased by approximately 1°C from 1910 to 2002	2011	55.7	14.3	30.0
	2010	59.4	12.9	27.6
i)The change in global temperature for the last 100 years is greater than for the last 1000 years	2011	43.2	18.5	38.2
	2010	46.8	14.9	38.3
j)The number of weather-related disasters around the world has doubled since the mid 1990s	2011	49.8	16.7	33.5
	2010	47.4	15.6	37.0

Note: The highlighted text indicates the correct responses to the knowledge statements. For items #35 a, b, c, d, h, i, and j the correct answer was true, for items e, f, and g the correct answer was false.

Q36. How certain are you about the correctness of the answers you have given to the above true/false statements?

	Year	%	*M*	*p*	*r*
6. Certain	2011	11.6	2011 – 3.96	***	.05
	2010	10.6	2010 – 3.82		
5	2011	26.0			
	2010	24.4			
4	2011	30.7			
	2010	27.8			
3	2011	16.6			
	2010	17.4			
2	2011	8.9			
	2010	13.3			
1. Uncertain	2011	6.2			
	2010	6.4			

Q37. Perceived control of climate change composite scale

	Year	6. Strongly agree %	%	%	%	%	1. Strongly disagree %	*M*
a.It is hard to imagine that individuals like myself can make a difference with respect to a global phenomenon such as climate change	2011	14.6	21.9	24.4	16.2	14.8	8.1	3.19
	2010							
b.World governments and scientists, working together, can greatly influence the longer term impacts of climate change	2011	24.4	30.7	22.2	9.4	6.5	7.1	4.35
	2010							
c.The progression and consequences of climate change are now past the point of turning things around and exercising human control	2011	4.6	11.0	23.6	24.4	22.5	13.9	3.91
	2010							
d.Individuals making changes in their everyday behaviours can collectively make a real difference in addressing the challenges of climate change	2011	19.9	29.4	25.9	11.3	6.8	6.6	4.25
	2010							
e.Greenhouse gas concentrations have now gone past the tipping point and there is very little that can be done to protect human communities from the impacts of climate change	2011	2.9	7.1	20.2	27.4	26.5	15.9	4.15
	2010							
f.While human technologies may have contributed to the current climate change problem, scientific knowledge provides a reasonable prospect for correcting this human carbon footprint	2011	7.5	25.7	35.3	18.3	7.3	5.9	3.90
	2010							
g.The impacts of climate change are inevitable now so there's not much point trying to do anything about it	2011	4.0	6.1	14.0	19.0	26.0	30.9	4.50
	2010							
h. While human societies and governments have limited control over climatic processes and extreme weather events, there is much that can be done to reduce the effects of climate change and protect human communities	2011	18.4	27.2	27.6	13.9	7.4	5.6	4.18
	2010							
i.There is little point in me taking action against climate change because so many others will not	2011	6.5	9.0	16.7	20.3	22.8	24.6	4.18
	2010							
j.When considering the challenges of climate change it is important to look for things that I can address and change in my everyday life.	2011	21.4	28.9	27.5	12.4	4.9	4.9	4.35
	2010							

*Means were calculated after reverse-scoring negatively-worded items.

Q38. Distress composite scale

Some people may be finding this global threat to be particularly distressing. This may not be the case for you and it is important that you respond in the context of your own personal experience and feelings. Please indicate the extent to which each of the following statements reflects your own response to the threat of climate change

	Year	6. Strongly agree %	%	%	%	%	1. Strongly disagree %	*M*
a.I experience some distress each time I see or read media coverage of the likely impacts and consequences of climate change	2011	8.8	16.6	25.2	17.0	17.5	14.8	3.38
	2010	5.6	18.0	27.6	17.7	19.2	11.9	3.37
b.At times I find myself thinking about and worrying about what the world will really be like for future generations because of climate change	2011	13.1	19.8	23.2	15.1	15.0	13.8	3.59
	2010	12.9	24.7	22.9	13.9	14.5	11.1	3.74
c.I experience some guilt over the fact that my family and friends' lifestyles and consumption patterns are in part responsible for the unfolding impacts of climate change	2011	6.0	13.6	22.2	19.6	19.6	19.0	3.10
	2010	5.1	16.4	22.7	18.9	19.9	16.9	3.17
d.It upsets me that there seems to be so little that I can do to address environmental problems such as climate change	2011	5.5	13.0	24.3	22.9	17.8	16.5	3.16
	2010	6.0	16.8	26.3	20.3	17.8	12.9	3.34
e.At times I feel some personal responsibility for the problems and unfolding impacts of climate change	2011	4.1	9.9	21.2	20.2	20.6	24.0	2.85
	2010	2.8	9.4	21.4	19.9	23.8	22.6	2.79
f.The threat of climate change is affecting my quality of life and my assessment of environmental quality more generally	2011	3.2	7.1	19.9	21.4	24.6	23.7	2.72
	2010	1.7	7.7	19.2	23.1	27.3	21.1	2.70
g.I feel some sense of loss because of climate change impacts that are becoming apparent in my local area	2011	3.5	7.3	18.6	22.1	24.5	23.9	2.71
	2010	3.1	9.0	18.0	22.9	26.4	20.7	2.77
h.The more I learn about the threat of climate change, the more anxious I become	2011	5.0	10.7	21.2	19.3	20.4	23.3	2.91
	2010							
i.I feel uneasy and apprehensive about what may happen in the near future due to the impacts of climate change	2011	7.0	13.6	23.1	18.0	18.5	19.7	3.13
	2010							
j.It saddens me to think that we may lose particular areas and species from our natural environment because of climate change	2011	24.1	24.7	20.1	11.4	8.6	11.1	4.11
	2010							
k.I experience some distress when I think about the uncertainties and unknowns associated with climate change both for people and the environment	2011	9.4	16.5	22.5	19.0	16.2	16.4	3.35
	2010							
l.At times, I feel overwhelmed when thinking about the future impact of climate change	2011	7.5	13.2	19.6	17.0	19.2	23.5	3.02
	2010							

Q40. Adaptation composite scale

Please indicate the extent to which each of the following statements describes your response to the threat of climate change

	Year	6. Strongly agree %	%	%	%	%	1. Strongly disagree %	*M*
a.I have changed the way I think about the seriousness of environmental problems because of climate change	2011	8.3	21.8	25.8	16.3	15.5	12.3	3.54
	2010	7.4	23.5	26.4	16.8	15.8	10.1	3.59
b.Increasingly I find myself less likely to attend to media reports, articles and discussions about the nature or impacts of climate change	2011	8.9	17.9	23.8	23.2	17.1	9.1	3.51
	2010	8.2	17.7	22.9	23.2	19.2	8.7	3.46
c.I have seriously thought about alternative places to live because of the increasingly evident impacts of climate change	2011	3.8	6.2	11.0	13.1	24.7	41.1	2.28
	2010	4.0	7.0	10.2	11.0	25.5	42.2	2.26
d.Climate change has forced me to change the way I think about and view how we live in and use our natural environment in Australia	2011	7.8	17.6	24.1	17.3	16.0	17.1	3.33
	2010	9.0	22.0	24.7	14.3	16.6	13.2	3.53
e.I have often discussed my thoughts and feelings about climate change with others over the past several years	2011	13.2	19.6	22.3	15.8	16.1	13.0	3.59
	2010	11.1	22.3	20.6	15.1	17.9	13.0	3.54
f.I tend to think differently these days about what is acceptable and sustainable and not acceptable with respect to consumer products and packaging, and consumption in general	2011	15.5	26.0	25.9	14.6	10.0	7.9	3.99
	2010	18.0	31.0	23.8	12.2	8.9	6.0	4.19
***When considering the challenges of climate change it is important to look for things that I can address and change in my everyday life**	2011							
	2010	18.8	30.4	23.7	12.6	7.9	6.7	4.20
g.Media images of climate change consequences from around the world have changed my appreciation of how soon we are likely to experience the impacts of climate change	2011	6.5	16.9	25.0	20.2	16.1	15.3	3.32
	2010							
h.My response to the possible consequences of climate change has moved from a sense of uncertainty and concern to an acceptance that profound changes are taking place and that I must act accordingly	2011	8.5	19.7	26.4	18.2	13.5	13.7	3.50
	2010							
i.In recent years I have thought more about what I and my family might do to reduce our carbon footprint	2011	14.1	24.9	24.7	13.0	11.9	11.5	3.82
	2010							
j.I am increasingly aware of how my daily activities might be affecting the natural environment and exacerbating the problem of climate change	2011	11.7	22.7	26.3	15.3	12.4	11.5	3.71
	2010							

*Note: This item appeared in 2010 only.

Q41. Have you experienced any noteworthy changes or events in the natural environment over the past ten years which you think might be due to climate change?

	Year	%	*p*	*r*
Yes	2011	36.9	***	.79
	2010[1]	35.7		
No	2011	63.1		
	2010[1]	64.3		

[1] In 2010 the question read "Have you experienced any noteworthy changes or events in *your local* natural environment over the past ten years which you think might be due to climate change?"

Q42. If you have experienced any environmental change or event over the past few years that has made a strong impression on you, can you tell us what this was, and why it was of particular significance or meaning for you? (Open-ended response)

Q43. Can you briefly tell us what thoughts and/or feelings you had at the time you saw or experienced this particular environmental change or event? (Or perhaps a prior change or event that was significant to you) (Open-ended response)

Q44. Overall, how much do you think climate change is influencing the frequency and intensity of weather events like storms and droughts?

	Year	%	*M*	*p*	*r*
6. A good deal	2011	22.5	2011 – 4.09	.61	
	2010	19.3	2010 – 4.14		
5	2011	24.8			
	2010	28.6			
4	2011	21.1			
	2010	22.9			
3	2011	11.1			
	2010	11.5			
2	2011	11.2			
	2010	10.9			
1. Not at all	2011	9.3			
	2010	6.8			

Q45. Have you ever experienced a natural disaster warning or natural disaster impact situation in the past 12 months?

	Year	%
Yes	2011	28.5
No	2011	71.5

Note: The percentage figures for the following tables are based on the total sample of *n* = 4347 for the 2011 data collection and *n* = 3096 for 2010.

Q46. If yes, please indicate the type of event(s) and the approximate number of times you have experienced each type of event over the past 12 months.

		Cyclone		Bushfire		Drought		Flood		Other	
	Year	Frequency	%	Frequency	%	Frequency	%	Frequency	%	Frequency	%
Experienced the event on one occasion	2011	293	6.7	148	3.4	250	5.7	752	17.3	77	1.8
	2010										
Experienced the event twice	2011	74	1.7	28	.6	21	.5	158	3.6	23	.5
	2010										
Experienced the event three times	2011	20	.5	7	.2	6	.1	29	.7	11	.2
	2010										
Experienced the event four times	2011	4	.09	6	.1	0	-	9	.2	7	.2
	2010										
Experienced the event five times or more	2011	1	.02	3	.07	2	.05	7	.2	8	.2
	2010										

Q47. Have you experienced a natural disaster warning or natural disaster impact situation prior to the past 12 months?

	Year	%
Yes	2011	36.2
	2010	37.4
No	2011	63.8
	2010	62.6

Note: In 2010 the question read "Have you ever experienced a natural disaster warning or natural disaster impact situation?"

Q48. If yes, please indicate the type of event(s) and the approximate number of times you have experienced each type of event during your lifetime, including the past 12 months.

		Cyclone		Bushfire		Drought		Flood		Other	
	Year	Frequency	%	Frequency	%	Frequency	%	Frequency	%	Frequency	%
Experienced the event on one occasion	2011	328	7.5	480	11.0	545	12.5	575	13.2	157	3.6
	2010	233	7.5	283	9.1	193	6.2	222	7.2	108	3.5
Experienced the event twice	2011	138	3.2	239	5.5	246	5.6	291	6.7	58	1.3
	2010	170	5.5	167	5.4	134	4.3	162	5.2	43	1.4
Experienced the event three times	2011	89	2.0	117	2.7	115	2.6	155	3.6	27	0.6
	2010	87	2.8	55	1.8	84	2.7	73	2.4	16	0.5
Experienced the event four times	2011	63	1.4	44	1.0	37	0.8	73	1.7	10	0.2
	2010	37	1.2	13	0.4	21	0.7	33	1.1	4	0.1
Experienced the event five times or more	2011	158	3.6	105	2.4	129	3.0	173	4.0	51	1.2
	2010	132	4.3	75	2.4	103	3.3	131	4.2	15	0.5

Note: In 2010 the question read "Have you ever experienced a natural disaster warning or natural disaster impact situation?" The percentages listed for 2011 may be underestimated due to the nature of item #47 which asked respondents to report if they had experienced a natural disaster warning or natural disaster impact situation prior to the past 12 months? If respondents answered 'no' to this question, they may not have responded to this item which asks about their lifetime experience, including the last 12 months.

Q49. We would now like to ask you some questions based on the most personally significant extreme weather or natural disaster situation you have experienced.

(The following questions were additional questions for the 2011 survey and were not asked in 2010).

(a) **What was this event or situation?** (1892 respondents answered this open-ended response option)

(b) **Please indicate when this event took place** (*n* = 1892)

	Frequency	%
Happened in the past 12 months	852	45.0
Happened 1 to 10 years ago	678	36.0
Happened 11 to 20 years ago	166	9.0
Happened more than 20 years ago	196	10.0

Traumatic Exposure Severity Scale.

		Response	Frequency	%
(c)	Was a member of your family, or someone close to you, physically impacted by the disaster (e.g., physically injured, trapped, cut-off from others for a period of time)?	Yes	679	35.8
		No	1219	64.2
(d)	Were you physically injured in the disaster?	Yes	29	1.5
		No	1871	98.5
(e)	Did you need financial assistance from others because of hardships caused by the disaster?	Yes	307	16.2
		No	1590	83.8
(f)	Were you involved in community recovery after the disaster (e.g., volunteer at an emergency shelter, clean-up efforts, providing support, emergency worker)?	Yes	676	35.6
		No	1224	64.4
(g)	Was your home damaged in the disaster?	Yes	409	21.5
		No	1492	78.5
(h)	Did you at any point think that you were going to die?	Yes	202	10.6
		No	1696	89.4

The next two questions were asked in 2010 and in 2011 In 2010 respondents were first asked, "Have you ever experienced a natural disaster warning or natural disaster impact situation?", respondents then indicated the type of event and approximate number of times they had experienced such an event. Respondents were then asked the following two questions. The wording differed slightly in 2010 with respondents asked to indicate how much property damage/anxiety stress did you experience in this or these situations. In 2011 the next two questions were based on the most personally significant extreme weather or natural disaster situation.

(j) Overall how much property damage did you experience in this situation?
(*n* = 1157 in 2010, *n* = 1904 in 2011)

	Year	%	*M*
6. Considerable damage	2011	4.6	2011 - 2.13
	2010	7.8	2010 - 2.71
5	2011	5.2	
	2010	11.8	
4	2011	9.8	
	2010	13.5	
3	2011	10.5	
	2010	11.0	
2	2011	18.8	
	2010	22.5	
1. No damage	2011	51.2	
	2010	33.4	

(k) Overall how much anxiety and stress did you experience in this situation?
(*n* = 1157 in 2010, *n* = 1904 in 2011)

	Year	%	*M*
6. Considerable stress	2011	19.1	2011 – 3.96
	2010	18.8	2010 – 4.12
5	2011	21.2	
	2010	28.8	
4	2011	23.0	
	2010	21.1	
3	2011	17.3	
	2010	14.4	
2	2011	12.2	
	2010	11.2	
1. No stress	2011	7.1	
	2010	5.7	

Q50. How vulnerable do you think the region where you live is to natural disasters (e.g., floods, droughts, cyclones, and bushfires)?

	Year	%	*M*	*p*	*r*
6. Very vulnerable	2011	14.2	2011 – 3.64	***	.05
	2010	15.0	2010 – 3.78		
5	2011	18.5			
	2010	22.5			
4	2011	22.7			
	2010	22.2			
3	2011	16.3			
	2010	13.9			
2	2011	18.1			
	2010	18.2			
1. Not vulnerable	2011	10.3			
	2010	8.2			

Q51. How vulnerable do you think the region where you live is to impacts of climate change?

	Year	%	*M*	*p*	*r*
6. Very vulnerable	2011	9.9	2011 – 3.54	***	.06
	2010	10.4	2010 – 3.72		
5	2011	18.1			
	2010	22.6			
4	2011	25.6			
	2010	26.1			
3	2011	20.2			
	2010	18.1			
2	2011	14.9			
	2010	14.6			
1. Not vulnerable	2011	11.2			
	2010	8.2			

Q52. Indirect exposure composite scale (A different format was used to measure indirect exposure in 2011, for this reason 2010 results are not reported here).

How often in the past six months have you obtained information about climate change from each of the following sources?

	Year	Never %	Once or Twice %	More than twice %
a.TV news, TV current affairs, or TV documentaries	2011	12.0	33.1	54.9
b.Radio	2011	37.8	31.8	30.4
c.Newspapers	2011	22.4	32.5	45.1
d.Magazine or journal articles	2011	50.0	29.5	20.5
e.Books	2011	72.2	19.6	8.2
f.Lectures, talks, formal education	2011	79.1	14.1	6.8
g.Information brochures, leaflets, flyers	2011	52.1	36.5	11.4
h.Films (e.g., An Inconvenient Truth, The Day after Tomorrow)	2011	50.0	35.6	14.4
i.Social networking sites, blogs, or self-broadcasting sites on the internet	2011	67.9	20.6	11.4
j.News sites on the internet	2011	39.5	29.9	30.7
k.Government sources (e.g., CSIRO, Bureau of Meteorology)	2011	47.0	32.1	20.9
l.Conversations with family members	2011	24.8	41.5	33.7
m.Conversations with friends	2011	23.5	41.5	35.0

Q53. Climate change normative influence composite scale (These items were not measured in 2010)

The next few statements relate to how your views on climate change compare to the views of others. Please indicate the extent to which you agree or disagree with each of the following statements.

	Year	6. Strongly agree %	%	%	%	%	1. Strongly disagree %	*M*
a.People important to me would approve if I helped to increase public awareness of climate change	2011	14.8	24.3	27.7	15.0	10.0	8.2	3.94
b.My friends take positive steps to reduce their contributions to climate change	2011	6.6	19.0	30.6	23.5	12.5	7.8	3.60
c.People who are close to me (e.g., partner, friends) accept that climate change is happening	2011	15.2	26.3	25.8	14.1	9.4	9.2	3.96
d.People who are important to me are not at all concerned about climate change	2011	9.2	14.9	19.1	20.8	21.4	14.6	3.74
e.My friends do not believe in climate change	2011	6.8	10.0	19.2	24.4	23.4	16.3	3.96
f.Climate change is not an important issue for the people I associate with	2011	8.9	14.8	22.8	20.6	18.6	14.3	3.68

Q54. What percentage of your friends and wider social group do you think believe that human carbon emissions contribute to climate change?

(0 – 100%) of my friends and wider social group believe this.

Q55. Perceived risk composite scale

Please indicate the extent to which you agree or disagree with each of the following statements.

	Year	6. Strongly agree %	%	%	%	%	1. Strongly disagree %	*M*
a.Climate change will have a noticeably negative impact on my health (over the next 25 years).	2011	8.9	14.2	24.8	18.1	17.4	16.5	3.30
	2010	6.2	15.4	28.8	18.5	18.9	12.2	3.35
b.Climate change will have a noticeably negative impact on my economic and financial situation (over the next 25 years)	2011	20.6	25.3	24.3	12.7	8.0	9.2	4.10
	2010	11.6	28.5	25.9	13.8	12.8	7.3	3.90
c.Climate change will have a noticeably negative impact on the environment in which my family and I live	2011	15.6	22.0	25.1	15.1	11.5	10.8	3.83
	2010	13.9	28.1	25.8	13.0	12.0	7.3	3.97
		6. High risk%					**1.No risk**	
d.In your opinion, what is the risk of climate change exerting a significant impact on public health in your state?	2011	9.5	16.5	28.5	18.6	16.3	10.6	3.52
	2010	7.5	22.6	30.4	18.7	13.8	7.0	4.02
e.In your opinion, what is the risk of climate change exerting a significant impact on economic development in your state?	2011	18.7	26.2	26.7	13.1	8.3	7.0	4.13
	2010	11.2	30.5	28.1	14.5	10.1	5.6	4.13
f.In your opinion, what is the risk of climate change exerting a significant impact on the environment in your state?	2011	16.6	23.5	27.0	13.6	10.6	8.7	3.96
	2010	15.3	32.0	24.9	12.1	9.9	5.8	3.95

Q56. Has your level of concern about climate change increased, decreased or remained the same over the past several years (i.e., since 2008/2009)? (This item was measured on a 6-point scale in 2010 and included the wording "In the last Australian census conducted during the 2007/2008 financial year people were asked about their level of concern about climate change. "Has your level of concern about climate change increased, decreased or remained the same since 2007/2008?" Therefore a direct comparison has not been made with 2010)

	2011 %	*M*
7. Increased substantially	11.5	4.70
6	18.2	
5	23.7	
4	34.6	
3	4.5	
2	2.9	
1. Decreased substantially	4.6	

Q57. If your level of concern about climate change has changed, could you briefly explain why and how it has changed? (Open-ended response item, *n* = 2826)

Q58. Coping composite scale (New measure introduced in 2011)

If you think about how you are responding to and dealing with the prospect and consequences of climate change, to what extent would you say you are using or relying on each of the following strategies?

	Year	6. Strongly agree %	%	%	%	%	1. Strongly disagree %	*M*
a.Avoid thinking about climate change	2011	4.8	9.8	21.2	22.4	23.0	18.7	2.95
b.Seek out others for comfort	2011	1.4	4.6	16.1	21.9	27.1	29.0	2.44
c.Ask friends with similar experiences what they are doing	2011	3.4	14.2	25.2	19.7	18.8	18.8	3.07
d.Manage how my feelings are influencing my actions	2011	5.4	16.7	31.5	18.1	13.2	15.1	3.38
e.Concentrate on ways that climate change could be addressed	2011	8.2	22.4	28.3	15.3	13.2	12.6	3.59
f.Take time to figure out what I am feeling	2011	4.3	12.3	26.4	20.6	17.9	18.5	3.09
g.Step back from the situation and be objective	2011	10.5	22.6	29.1	16.5	11.1	10.1	3.74
h.Tell others how I feel about climate change	2011	10.3	20.1	25.1	18.9	14.6	11.0	3.61
i.Refuse to believe that climate change is occurring	2011	5.8	6.0	11.2	16.4	23.2	37.3	2.43
j.Focus on the positive aspects of the problem	2011	7.1	18.7	32.0	20.7	11.0	10.5	3.59
k.Think about the best way to deal with the prospect of climate change	2011	11.0	26.9	30.5	14.2	8.8	8.6	3.91
l.Take my mind off climate change by doing other things	2011	4.5	9.8	22.0	22.9	20.7	20.1	2.94
m.Acknowledge my emotions about climate change	2011	7.2	16.8	31.7	19.7	12.2	12.3	3.50
n.Look for the good in what is happening	2011	8.1	18.6	31.0	19.6	11.8	10.9	3.59
o.Pretend that climate change is not happening	2011	2.0	3.7	9.4	16.2	24.7	44.1	2.10
p.Get advice from someone about what can be done to address climate change	2011	5.6	13.5	25.8	21.7	16.5	16.9	2.05

Q59. Is there anything you would like to say about your views on climate change or natural disasters which the survey has not addressed? Please use the space below to tell us what you would like to say (open ended response option, *n* = 2682)

Q60. Neuroticism composite scale (New measure in 2011)

Here are a number of characteristics that may or may not apply to you. Please indicate the extent to which you agree or disagree with each statement.

I see myself as someone who …

	Year	5. Agree strongly %	%	%	%	1.Disagree strongly %	*M*
a.is depressed, blue	2011	4.1	15.4	13.2	15.7	51.6	2.05
b.is original, comes up with new ideas (filler item)	2011	18.0	43.2	26.9	9.5	2.3	3.65
c.is relaxed, handles stress well	2011	20.6	39.0	20.3	15.6	4.5	2.44
d.can be tense	2011	8.4	47.4	22.2	15.2	6.9	3.35
e.worries a lot	2011	9.6	29.0	24.4	23.3	13.8	2.97
f.is generally trusting (filler item)	2011	33.9	42.4	13.6	7.2	2.9	3.97
g.is emotionally stable, not easily upset	2011	26.9	39.5	19.6	11.1	2.9	2.24
h.can be moody	2011	6.9	35.3	24.9	20.8	12.0	3.04
i.remains calm in tense situations	2011	20.7	43.2	22.1	11.8	2.3	2.32
j.is outgoing, sociable (filler item)	2011	22.5	37.2	20.8	14.7	4.7	3.58
k.gets nervous easily	2011	6.3	20.8	25.1	29.4	18.4	2.67
l.likes to reflect, play with ideas (filler item)	2011	23.4	44.5	25.2	5.6	1.3	3.83

*Means were calculated after reverse-scoring negatively-worded items.

Demographic data for new respondents in 2011

Gender (*n* = 4347)

	Frequency	%
Male	1988	45.7
Female	2359	54.3

Q61. In what year were you born? (*n* = 4335)

Age range	Frequency	%
15-17	3	.1
18-24	365	8.4
25-34	856	19.7
35-44	924	21.4
45-54	985	22.7
55-64	1055	24.3
65-74	144	3.3
75 and older	3	0.1

Q62. Please indicate the highest level of education you have completed (*n* = 4347)

	Frequency	%
Year 10 or less	516	11.6
Year 11	204	4.7
Year 12	674	15.5
College certificate or diploma	961	22.1
Trade qualification/apprenticeship	458	10.5
Undergraduate degree	929	21.4
Postgraduate degree	534	12.3
Other (please specify)	71	6.8

Parental status:

Q63. Do you have children? (*n* = 4347)

	Frequency	%
Yes	2795	64.3
No	1552	35.7

Q64. Do you have any grandchildren? (*n* = 4347)

	Frequency	%
Yes	952	21.3
No	3422	78.7

Q65.0Which of the following best describes the residential circumstances that you have had most of your life? (*n* = 4347)

	Frequency	%
Urban	624	14.8
Suburban	2626	60.4
Country town	637	14.7
Rural	268	6.2
Rural residential	174	4.0

Q66. How would you describe your current residential circumstances? (*n* = 4347)

	Frequency	%
Urban	708	16.3
Suburban	2540	58.4
Country town	601	13.8
Rural	228	5.2
Rural residential	270	6.2

Q67. What is the name of the closest city or town to where you currently reside (open-ended response format)

Q68. Approximately, how far in kilometres is your house from the town centre or central business district (CBD)?

	Frequency	%
0 – 25 kms	3451	80.3
26 – 50 kms	680	15.8
51 – 100 kms	130	3.1
101 – 250 kms	30	0.7
Over 150 kms	6	0.1

Q69. How close do you live to areas frequently affected by extreme weather events or natural disaster? (*n* = 4330)

	Frequency	%
0 – 25 kms	1349	31.7
26 – 50 kms	594	13.7
51 – 100 kms	651	15.0
101 – 250 kms	489	11.3
Over 150 kms	1247	28.8

Q70. Approximately, how many kilometers do you live from the nearest Australian coastline? (*n* = 4214)

	Frequency	%
0 – 25 kms	2390	56.7
26 – 50 kms	806	19.1
51 – 100 kms	427	10.2
101 – 250 kms	377	8.9
Over 150 kms	214	5.1

Q71. How would you describe your current political party identification or preference? (*n* = 4331)

	Frequency	%
Labor	1370	30.2
Liberal	1349	31.1
National party	126	2.9
Greens	497	11.5
Independent	282	6.5
Other	770	17.8

Q72. How would you vote if there was a Federal election tomorrow? (*n* = 4339)

	Frequency	%
Labor	1077	24.8
Liberal	1564	36.0
National party	120	2.8
Greens	526	12.1
Independent	337	7.8
Other	715	16.5

Q73. How, if at all, has the Labor government's plan to introduce a tax on the emission of carbon changed your voting intention? (*n* = 4336)

	Frequency	%
It has made me much more likely to vote Labor	331	7.6
It has made me slightly more likely to vote Labor	329	7.6
It has made no difference whatsoever to my voting intentions	1685	38.9
It has made me slightly less likely to vote Labor	458	10.6
It has made me much less likely to vote Labor	1533	35.4

Q74. What is your country of birth? (*n* = 4347)

	Frequency	%
Australia	3206	73.8
Oceania and Antarctica	122	2.8
North-West Europe	458	10.5
Southern and Eastern Europe	118	2.7
North Africa and Middle East	27	0.6
South-East Asia	235	5.4
North-East Asia	49	1.1
Southern and Central Asia	37	0.9
North America	47	1.1
South America	14	0.3
Sub-Saharan Africa	34	0.8

Q75. If born outside of Australia, for how many years have you lived in Australia?

Not reported here

76. For how many years have you lived in the general area that you are now living? (n = 4332)

	Frequency	%
0 – 10 yrs	1978	45.7
11-20 yrs	938	21.6
21 – 30 yrs	722	16.7
31 – 40 yrs	374	8.6
41 – 50 yrs	193	4.5
50 + yrs	127	2.9

Q77. Please indicate your approximate annual combined household income (before tax) (n = 4347)

	Frequency	%
$40,000 or less	1052	24.4
$40,001 - $60,000	745	17.1
$60,001 - $80,000	657	15.1
$80,001 - $100,000	650	15.0
$100,001 - $150,000	850	19.6
$150,001 - $200,000	266	6.1
Greater than $200,000	127	2.9

Q78. **Have you completed a survey over the last two years addressing environmental issues and / or climate change? (*n* = 4347)**

	Frequency	%
Yes	706	16.2
No	3641	83.8

APPENDIX C: COMPOSITE MEASURES

Variable	Illustrative item	No. of items	2011 Item nos.	Year	Observed Range	*M*	*SD*	α	*p* 2010 vs. 2011	*d*
Residential Exposure and Vulnerability	How vulnerable do you think the region where you live is to the impacts of climate change?	3	50, 51, 69	2011	2-17	10.24	3.56	.64	***	.11
				2010	3 - 17	10.64	3.57	.66		
Objective Knowledge	Australia's average temperature has increased by approximately 1°C from 1910 to 2002.	10	35a - j	2011	-10 - 10	2.22	3.17	-	***	.15
				2010	-7 - 10	2.69	2.91	-		
Connection to Nature	I often feel close to the natural world around me.	6	25a - f	2011	6 - 36	25.86	6.50	.93	**	.06
				2010	6 - 36	25.44	6.92	.94		
Green Identity	I think of myself as someone who is very concerned with environmental issues.	3	18a - c	2011	3 - 15	10.14	2.78	.84	.76	
				2010	3 - 15	10.16	2.74	.85		
Trust	I trust the Australian Government to take appropriate action against climate change.	4	10b, 22a - c	2011	4 - 23	11.99	3.89	.77	.65	
				2010	4 – 23	12.03	3.45	.73		
Media Exposure	How often in the past six months have you obtained information about climate change from… newspapers?	13	52a - m	2011	0 - 26	10.45	6.05	.88	-	
				2010						
Belief in Climate Change	I am certain that climate change is happening.	4	6, 7, 10a, 12	2011	4 - 20	15.57	4.45	.87	**	.08
				2010	4 - 20	15.90	4.16	.85		
Control–Pessimism	The progression and consequences of climate change are now past the point of turning things around and exercising human control.	3	37c, e, g	2011	3-18	12.56	3.27	.73		
Control-Collective Efficacy	World governments and scientists, working together, can greatly influence the longer term impacts of climate change.	3	37b,f h	2011	3-18	12.44	3.37	.76		
Climate Change Normative Influence	My friends take positive steps to reduce their contributions to climate change.	6	53a – f	2011	6 – 36	22.89	6.82	.87	-	
Coping-Help-Seeking	If you think about how you are responding to and dealing with the prospect and consequences of climate change, to what extent would you say you are using or relying on each of the following strategies? Seek out others for comfort; Get advice from someone about what can be done to address climate change ...	3	58b, g, p	2011	3 - 18	8.71	3.49	.79	-	
Coping-Positive Reframe	If you think about how you are responding to and dealing with the prospect and consequences of climate change, to what extent would you say you are using or relying on each of the following strategies? Focus on the positive aspects of the problem; Look for the good in what is happening...	3	58g, j, n	2011	3 - 18	10.92	3.39	.72		
Coping-Deny	If you think about how you are responding to and dealing with the prospect and consequences of climate change, to what extent would you say you are using or relying on each of the following strategies? Avoid thinking about Climate change; Refuse to believe that climate change is occurring... climachange; refuse to believe that climate change is occurring;...	3	58a, i, o	2011	3 - 18	7.47	3.34	.71		

Variable	Illustrative item	No. of items	2011 Item nos.	Year	Observed Range	*M*	*SD*	α	*p* 2010 vs. 2011	*d*
Motivation to address Climate Change	I want to change my lifestyle in ways that help to address climate change	3	34a – c	2011	3 - 18	12.11	4.03	.85	-	
Traumatic Exposure Severity Scale	We would now like to ask you some questions based on the most personally significant extreme weather or natural disaster situation you have experience…Were you physically injured in the disaster?	8	49c - k	2011	2 – 18	7.30	3.30	.58	-	
[1]Neuroticism	I see myself as someone who…is depressed, blue	8	60a – l	2011	8 – 40	21.09	6.31	.85	-	
Climate Change Concern	How concerned, if at all, are you about climate change, sometimes referred to as 'global warming'?	7	5, 8, 9, 14, 15, 19f, 27	2011	7 - 32	22.24	7.23	.95	***	.16
				2010	7 - 32	23.34	6.61	.95		
Risk Perception	Climate change will have a noticeably negative impact on my health (over the next 25 years).	5	55a - e	2011	5 - 30	18.88	6.22	.89	.66	
				2010	5 - 30	18.94	5.90	.90		
Distress	At times I find myself thinking and worrying about what the world will really be like for future generations because of climate change.	7	38a - g	2011	7 - 42	21.51	8.60	.93	*	.05
				2010	7 - 42	21.90	8.31	.93		
Felt Personal Responsibility and Willingness to Act	I feel a sense of urgency to change my behaviour to help to reduce climate change.	4	11c – d, 17a - b	2011	4 - 20	12.56	3.87	.84	.13	
				2010	4 – 20	12.69	3.54	.82		
Cumulative Prior Adverse Experience	…please indicate the type of event(s) and the approximate number of times you have experienced each type of event during your lifetime, including the past 12 months…cyclone, bushfire, drought, flood, other	5	48a-e	2011	0 - 25	5.0	4.3	.58	.10	
				2010	0 – 22	5.3	4.2	.58		
Self-efficacy	I can personally help to reduce climate change by changing my behaviour.	5	11a - b, 30a -c	2011	5 - 28	18.27	5.66	.90	.41	
				2010	5 - 28	18.38	5.13	.89		
Adaptation	I have often discussed my thoughts and feelings about climate change with others over the past several years.	7	32, 33, 40a,c,d, e,f	2011	7 – 42	24.05	7.50	.85	*	.05
				2010	7 – 42	24.45	7.60	.87		
[2]Behaviour	What actions are you currently taking to reduce your carbon footprint? (e.g., Recycling, using less water)	15	29a – o	2011	0 - 16	3.41	4.0	-	***	.88
				2010	0 - 15	6.43	2.89	-		

[1] This scale included four filler items (#60b, f, j, l) which were not included in the final measure.
[2] The 2011 behaviour scale had a different response format to the 2010 measure. The score for 2011 is made up of behaviours that people are engaging in partly because of climate change.
Note: α – refers to Cronbach's index of internal consistency, *d* - refers to Cohen's measure of effect size, *M* = mean, SD = standard deviation.

APPENDIX D: MEAN SCORES ON KEY CLIMATE CHANGE VARIABLES FOR DEMOGRAPHIC SUB-GROUPS

Climate Change Variable		Gender		Age group (years)			Educational Attainment			(Grand) Parental Status		Residential Status		Voting Intention		Country of Birth		Income (household $000 p.a.)		
	Year	M	F	< 35	35 - 54	55+	HS	Trade /Cert	Uni	Yes	No	Urban	Rural	Green/ Labor	All other	Aus	Non-Aus	<$60	$60- $100	>$100
N ≤	2011	*1988*	*2359*	*1224*	*1909*	*1202*	*1427*	*1447*	*1473*	*2812*	*1535*	*3248*	*1099*	*1603*	*2736*	*3206*	*1141*	*1797*	*1307*	*1243*
	2010	*1455*	*1641*	*819*	*1301*	*976*	*1087*	*1070*	*939*	*2098*	*984*	*2190*	*906*	*1358*	*1738*	*2309*	*777*	*1345*	*955*	*730*
Residential Exposure/Vulnerability	2011	9.8	10.6 ***	10.1	10.3	10.2	10.1 b	10.4 **	10.2	10.3	10.1	9.9	11.3 ***	11.1 ***	9.7	10.2	10.2	10.6 ***	10.2 a	9.8 a
	2010	10.2	11.1 ***	10.5 b	10.9 ***	10.4 b	10.4 b	10.9 ***	10.6	10.7	10.6	10.2	11.7 ***	11.1 ***	10.3	10.7	10.7	10.9 ***	10.6	10.3 a
Connection to Nature	2011	25.5	26.2 ***	25.1 a	25.8 a	26.7 ***	24.9 b	26.5 ***	26.2	25.9	25.8	25.5	26.9 ***	27.3 ***	25.0	25.5	26.7 ***	26.5 ***	25.3 b	25.3 b
	2010	24.7	26.1 ***	24.5 b	25.7	25.9 ***	24.6 a	25.8	26.1 ***	25.4	25.5	25.0	26.6 ***	26.5 ***	24.6	25.2	26.3 ***	26.1 ***	25.3 b	24.7 b
Trust	2011	11.7	12.2 ***	12.9 ***	11.9 a	11.3 a	11.6 b	11.7 b	12.6 ***	11.7	12.5 ***	12.2 ***	11.4	14.0 ***	10.8	11.7	12.7 ***	11.9	12.0	12.1
	2010	11.6	12.4 ***	12.8 ***	12.0 b	11.5 a	12.0	11.9	12.1	11.8	12.5 ***	12.2 ***	11.7	13.0 ***	11.2	11.9	12.3 **	12.2	12.0	11.9
Objective Knowledge	2011	1.9	2.5 ***	2.5 ***	2.2 a	1.9 a	1.8 a	2.1 a	2.7 ***	2.1	2.5 ***	2.2	2.2	3.5 ***	1.5	2.2	2.3	2.2	2.2	2.3
	2010	2.6	2.8 *	3.1 ***	2.7 b	2.4 a	2.4 b	2.6 b	3.1 ***	2.6	3.0 ***	2.7	2.6	3.3 ***	2.2	2.7	2.8	2.7	2.7	2.8
Subjective Knowledge	2011	4.3 ***	3.9	4.0 b	4.1 b	4.3 ***	3.9 a	4.1 a	4.3 ***	4.1	4.1	4.1	4.1	4.2 ***	4.1	4.0	4.2 ***	4.1	4.1	4.2
	2010	4.2 ***	4.0	4.0 b	4.1	4.2 **	3.9 a	4.1 a	4.2 ***	4.1	4.1	4.0	4.1 *	4.2 ***	4.0	4.1	4.1	4.1	4.1	4.1
Green Identity	2011	9.8	10.4 ***	10.0	10.2	10.2	9.8 a	10.3	10.4 ***	10.1	10.1	10.1	10.3 *	11.1 ***	9.5	10.0	10.4 ***	10.3 ***	10.0 b	10.0 b
	2010	9.7	10.5 ***	10.0 b	10.3 *	10.1 b	9.8 a	10.3	10.4 ***	10.1	10.2	10.1	10.3 *	10.9 ***	9.6	10.1	10.3	10.4 ***	10.1 b	9.9 b

Climate Change Variable		Gender		Age group (years)			Educational Attainment			(Grand) Parental Status		Residential Status		Voting Intention		Country of Birth		Income (household $000 p.a.)		
	Year	M	F	< 35	35 - 54	55+	HS	Trade /Cert	Uni	Yes	No	Urban	Rural	Green/ Labor	All other	Aus	Non-Aus	<$60	$60- $100	>$100
Media Exposure	2011	10.4	10.5	10.6	10.3	10.5	9.1 a	10.4 a	11.8 ***	10.5	10.4	10.6 **	10.0	11.5 ***	9.8	10.2	11.3 ***	9.8 a	10.6 a	11.2 ***
	2010	1.6 **	1.4	1.5	1.5	1.5	1.3 a	1.5 a	1.7 ***	1.5	1.5	1.5	1.5	1.7 ***	1.3	1.4	1.6 *	1.5	1.5	1.4
Belief	2011	14.9	16.1 ***	16.4 ***	15.5 a	14.9 a	15.1 b	15.3 b	16.3 ***	15.2	16.1 ***	15.7 ***	15.1	17.6 ***	14.4	15.4	16.1 ***	15.7	15.4	15.6
	2010	15.2	16.5 ***	16.5 ***	16.1 b	15.1 a	15.8 b	15.9 b	17.0 ***	15.7	16.4 ***	16.1 ***	15.5	17.1 ***	14.9	15.8	16.1	15.8	16.0	16.0
Importance of Climate Change	2011	3.7	4.2 ***	4.1 ***	4.0 a	3.8 a	3.8 b	3.9 b	4.2 ***	3.9	4.1 **	4.0	3.9	4.7 ***	3.5	3.9	4.1 ***	4.0	3.9	3.9
	2010	3.9	4.4 ***	4.2 ***	4.2	4.0 a	4.1 b	4.1	4.3 **	4.1	4.2 *	4.2	4.1	4.6 ***	3.8	4.1	4.3 *	4.2	4.1	4.1
Climate Change Concern	2011	20.9	23.3 ***	23.5 ***	22.2 a	21.0 a	21.5 b	21.9 b	23.3 ***	21.8	23.0 ***	22.4 **	21.7	26.0 ***	22.0	21.9	23.1 ***	22.5	22.1	22.0
	2010	22.0	24.5 ***	24.3 ***	23.8	22.0 a	22.9 b	23.1 b	24.2 ***	23.0	24.1 ***	23.5 *	22.9	25.5 ***	21.7	23.2	23.7	23.4	23.5	23.2
Risk Perception	2011	17.8	19.8 ***	19.9 ***	18.9 a	17.8 a	18.3 b	18.9	19.4 ***	18.5	19.5 ***	19.0 **	18.4	21.2 ***	17.5	18.7	19.4 **	19.1 *	18.9	18.5
	2010	18.0	19.8 ***	19.8 ***	19.2 b	17.8 a	18.6 b	18.9	19.4 *	18.8	19.3 *	19.0	18.9	20.2 ***	17.9	18.9	19.1	19.2 *	19.0	18.5 a
Distress	2011	20.5	22.4 ***	23.6 ***	21.2 a	19.9 a	20.7 b	21.1 b	22.7 ***	21.0	22.5 ***	21.8 **	20.8	24.7 ***	19.6	21.0	23.0 ***	21.7	21.5	21.3
	2010	20.7	23.0 ***	23.2 ***	22.3 b	20.3 a	21.3 b	21.7 b	22.8 ***	21.6	22.5 **	22.0	21.7	24.1 ***	20.2	21.7	22.7 **	22.2	22.0	21.6
Self-efficacy	2011	17.3	19.1 ***	19.0 ***	18.3 a	17.4 a	17.7 b	18.1 b	19.0 ***	18.1	18.6 ***	18.3	18.1	20.6 ***	16.9	18.0	18.9 ***	18.3	18.2	18.3
	2010	17.4	19.2 ***	18.8 ***	18.6	17.7 a	17.9 a	18.4	18.9 ***	18.2	18.7 *	18.4	18.4	19.7 ***	17.4	18.3	18.5	18.5	18.4	18.2

Climate Change Variable		Gender		Age group (years)			Educational Attainment			(Grand) Parental Status		Residential Status		Voting Intention		Country of Birth		Income (household $000 p.a.)		
	Year	M	F	< 35	35 - 54	55+	HS	Trade /Cert	Uni	Yes	No	Urban	Rural	Green/ Labor	All other	Aus	Non-Aus	<$60	$60- $100	>$100
Personal Responsibility	2011	11.9	13.1 ***	13.0 ***	12.5 b	12.2 b	12.1 b	12.4 b	13.1 ***	12.4	12.8 **	12.6	12.5	14.3 ***	11.5	12.4	13.0 ***	12.6	12.4	12.6
	2010	12.1	13.3 ***	13.1 ***	12.8 b	12.2 a	12.3 b	12.6 b	13.2 ***	12.6	13.0 **	12.7	12.6	13.8 ***	11.9	12.6	12.8	12.7	12.6	12.8
Direct Experience with Climate Change	2011	.32	.41 ***	.39 *	.38	.34	.32 b	.36 b	.42 ***	.35	.40 ***	.37	.37	.50 ***	.29	.35	.42 ***	.40 *	.36	.34 b
	2010	.42	.47 ***	.47	.46	.42	.41 b	.46	.47 **	.43	.50 ***	.44	.47	.53 ***	.39	.44	.47	.48	.45	.42
Cumulative Prior Disaster Experience.	2011	5.0	5.0	4.1 a	5.1	5.6 ***	4.5 b	5.4 **	5.0	5.2 **	4.5	4.6	5.8 ***	4.9	5.0	5.2 **	4.5	5.1	5.0	4.9
	2010	6.1 ***	4.5	4.2 a	5.4	5.9 ***	4.8 b	5.6 *	5.4	5.3	5.0	4.8	6.1 ***	5.1	5.4	5.4 **	4.6	5.4	5.3	4.9
Psychological Adaptation	2011	23.6	24.4 **	24.5 *	23.9	23.9	22.7 a	24.1 a	25.3 ***	23.9	24.4 *	24.1	23.9	27.0 ***	22.3	23.7	25.1 ***	24.3	23.8	24.0
	2010	23.7	25.1 ***	24.2	24.9 *	24.1	23.3 a	24.7 a	25.5 ***	24.4	24.6	24.3	24.7	26.4 ***	23.0	24.3	25.0 *	24.7	24.4	24.3
Behaviours	2011	2.9	3.8 ***	3.7 **	3.4	3.1 b	3.0 b	3.4	3.8 ***	3.4	3.5	3.5 *	3.2	4.9 ***	2.5	3.3	3.7 **	3.5	3.3	3.4
	2010	6.2	6.6 ***	6.1 a	6.4	6.6 **	6.2 b	6.5	6.7 ***	6.4	6.4	6.5	6.3	6.9 ***	6.1	6.4	6.6	6.7 ***	6.2 b	6.1 b
Neuroticism	2011	20.3	21.7 ***	22.6 ***	21.1 a	19.6 a	21.7 ***	21.1 b	20.5 b	20.5	22.2 ***	21.1	21.1	21.8 ***	20.7	21.3 ***	20.5	21.9 ***	20.9 a	20.1 a
Normative Influence	2011	21.8	23.8 ***	23.5 ***	23.0	22.2 b	22.5 b	22.6 b	23.6 ***	22.7	23.2	23.0 *	22.5	25.7 ***	21.2	22.7	23.5 ***	23.1	22.6	22.9
Control-Collective Efficacy	2011	12.1	12.7 ***	12.8 ***	12.4 b	12.1 b	12.1 b	12.3 b	13.0 ***	12.3	12.6 *	12.5 *	12.2	13.8 ***	11.6	12.4	12.6 *	3.5	3.2	3.3
Control-Pessimism	2011	12.1	12.8 ***	12.1 a	12.6 a	13.0 ***	12.5	12.7	12.5	12.7 ***	12.2	12.5	12.8 **	12.8 ***	12.4	12.7 ***	12.2	3.4 *	3.2	3.2

Climate Change Variable		Gender		Age group (years)			Educational Attainment			(Grand) Parental Status		Residential Status		Voting Intention		Country of Birth		Income (household $000 p.a.)		
	Year	M	F	< 35	35 - 54	55+	HS	Trade /Cert	Uni	Yes	No	Urban	Rural	Green/ Labor	All other	Aus	Non-Aus	<$60	$60- $100	>$100
Coping-Help Seeking	2011	8.3	9.0 ***	9.3 ***	8.6 a	8.2 a	8.5 b	8.6 b	9.1 ***	8.6	8.9 **	8.8	8.6	9.6 ***	8.2	8.6	9.1 ***	3.6	3.4	3.4
Coping-Positive Reframe	2011	10.9	10.9	10.3 a	11.0 a	11.5 ***	10.5 a	11.2 ***	11.0	11.1 ***	10.6	10.8	11.2 **	11.1 **	10.8	10.8	11.2 **	3.5 *	3.3	3.4
Coping- Deny	2011	7.6 **	7.3	7.5	7.5	7.4	7.8 ***	7.5 a	7.1 a	7.5	7.5	7.5	7.5	6.4	8.1 ***	7.5 *	7.2	3.4	3.3	3.3

Note: See Appendices C and H for information on the composite measures.

Media Exposure was measured differently in 2010; therefore the measures are not directly comparable.

Psychological adaptation was measured in 2010 with an 8-item measure; however a 7-item measure was used for comparison purposes in this report.

Voting intention was based on item #72, "How would you vote if there was a Federal Election tomorrow?"

[a] This group mean is significantly ($p < .05$) different from each of the other two means.

[b] This group mean is significantly ($p < .05$) less than the largest group mean.

Asterisks are placed beneath the highest group mean. Differences between means are expressed as: * $p < .05$. ** $p < .01$. *** $p < .001$. The absence of asterisks in a column indicates that these means do not differ significantly.

APPENDIX E: 2011 CORRELATION TABLE

	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21
1. Cum. Prior Disaster Exp.	.01	.002	.04	.01	.01	.01	.10***	.02	.13***	.13***	-.06**	.06*	.12***	.07**	.20***	.09***	-.01	.13***	.04***	.01
2. Belief in Climate Chance		.83***	.63***	.60***	.62***	.65***	.57***	.48***	.38***	.29***	.56***	.58***	.11***	.46***	.23***	.45***	.13***	-.12***	.11***	.36***
3. Climate Change Concern			.75***	.75***	.75***	.79***	.71***	.58***	.45***	.39***	.63***	.59***	.13***	.58***	.28***	.47***	.17***	-.13***	.10***	.40***
4. Risk Perception				.66***	.60***	.61***	.63***	.46***	.43***	.34***	.46***	.49***	.10***	.45***	.27***	.44***	.16***	-.13***	.08***	.29***
5. Distress					.65***	.67***	.75***	.52***	.35***	.40***	.53***	.45***	.15***	.54***	.31***	.41***	.11***	-.16***	.09***	.29***
6. Self-efficacy						.81***	.66***	.55***	.36***	.43***	.56***	.46***	.16***	.59***	.26***	.37***	.15***	-.11***	.10***	.32***
7. Responsibility							.68***	.58***	.37***	.42***	.56***	.49***	.14***	.64***	.28***	.39***	.15***	-.09***	.11***	.35***
8. Adaptation								.57***	.40***	.53***	.48***	.46***	.36***	.65***	.49***	.43***	.05***	-.03	.14***	.30***
9. Behaviour									.28***	.34***	.38***	.36***	.19***	.49***	.31***	.33***	.12***	-.06***	.08***	.29***
10. Residential Exp/vulnerability										.29***	.24***	.33***	.12***	.32***	.21***	.35***	.12***	.01	.03*	.20***
11. Connection to Nature											.24***	.27***	.38***	.62***	.32***	.29***	.06***	.09***	.08***	.17***
12. Trust												.40***	.12***	.38***	.20***	.31***	.07***	-.16***	.11***	.39***
13. Objective Knowledge													.12***	.36***	.22***	.35***	.08***	-.07***	.12***	.31***
14. Subjective Knowledge														.36***	.35***	.16***	-.16***	.11***	.14***	.09**
15. Green Self Identity															.33***	.33***	.10***	.02	.09***	.28***
16. Media Exposure																.28***	.001	-.001	.19***	.14***
17. Direct Experience CC																	.09***	-.04***	.09***	.20***
18. Gender																		-.14***	-.003	.03
19.Age																			-.12***	-.03
20. Education																				.03*
21.Voting Intention																				

Note: * = $p < .05$, ** $p < .01$, *** $p < .001$. Coding for gender: Males (1), Females (2). Education: School (1), Post school or trade (2), University (3). Political: Labor/Green (1), Other (0). Direct experience with climate change; No (0), Yes (1).

APPENDIX F: 2010 CORRELATION TABLE

	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21
1. Cum Disaster Experience	-.02	-.02	.02	-.001	.01	-.004	.10***	.07*	.16***	.17***	-.13***	.01	.15***	.10**	.18***	.08**	-.19**	.15***	.06*	-.04
2. Belief in Climate Change		.82***	.60***	.62***	.60***	.62***	.56***	.34***	.38***	.33***	.48***	.52***	.16***	.47***	.17***	.27***	.15***	-.14***	.08***	.26***
3. Climate Change Concern			.73***	.78***	.73***	.76***	.70***	.44***	.46***	.45***	.55***	.53***	.21***	.61***	.21***	.28***	.19***	-.13***	.08***	.28***
4. Risk Perception				.71***	.59***	.57***	.62***	.37***	.45***	.40***	.43***	.44***	.19***	.45***	.19***	.26***	.15***	-.13***	.05**	.19***
5. Distress					.66***	.68***	.77***	.42***	.42***	.51***	.49***	.47***	.26***	.59***	.23***	.28***	.14***	-.14***	.07***	.024**
6. Self-Efficacy						.79***	.66***	.50***	.38***	.51***	.49***	.40***	.24***	.61***	.20***	.24***	.18***	-.09***	.08***	.22***
7. Responsibility							.66***	.48***	.36***	.45***	.48***	.43***	.22***	.63***	.23***	.24***	.17***	-.09***	.09***	.27***
8. Adaptation								.52***	.45***	.63***	.37***	.45***	.44***	.70***	.33***	.30***	.10***	-.01	.12***	.22***
9. Behaviour									.26***	.42***	.24***	.30***	.25***	.48***	.28***	.18***	.09***	.07***	.08***	.13***
10. Residential Exp/vulnerability										.34***	.23***	.31***	.16***	.33***	.15***	.21***	.13***	-.01	.03	.11***
11. Connection to Nature											.25***	.28***	.40***	.62***	.22***	.21***	.10***	.07***	.09***	.13***
12. Trust												.31***	.14***	.34***	.13***	.15***	.14***	-.14***	.01	.26***
13. Objective Knowledge													.19***	.36***	.19**	.19***	.04*	-.09***	.11***	.19***
14. Subjective Knowledge														.39***	.25***	.14***	-.11***	.06**	.11***	.08***
15. Green Self Identity															.27***	.24***	.15***	.01	.08***	.22***
16. Media Exposure																.18***	-.05**	-.01	.11***	.10***
17. Direct Experience CC																	-.01	-.05**	.04*	.11***
18. Gender																		-.14***	.02	.01
19.Age																			-.05**	-.05*
20. Education																				.03
21.Voting Intention																				

Note: * = $p < .05$, ** $p < .01$, *** $p < .001$. Coding for gender: Males (1), Females (2). Education: School (1), Post school or trade (2), University (3). Political: Labor/Green (1), Other (0). Direct experience with climate change; No (1), Yes (2).Slight differences may be found between the results reported here and the results found in the 2010 final report (Reser et al., 2012). This is due to the comparative nature of this report

APPENDIX G: CORRELATIONS BETWEEN VARIABLES MEASURED IN BOTH 2010 AND 2011 AND VARIABLES MEASURED IN 2011

Variables Measured in both 2010 and 2011[a]	Correlations with Variables Measured in 2011 only						
	Neurot-icism	Normative Influence	Collective Efficacy	Fatalism/ Pessimism	Help-Seeking Coping	Deny - Coping	Positive Reframe Coping
Gender	.11***	.14***	.10***	.07***	.10***	-.05**	-.003
Age	-.18***	-.07***	-.08***	.10***	-.11***	-.01	.14***
Educational Attainment	-.08***	.07***	.11***	-.002	.07***	-.09***	.06***
Voting intention	.09***	.32***	.31***	.06***	.19***	-.25***	.05***
Residential Exposure/vulnerability	.11***	.36***	.30***	.002	.30***	-.26***	.17***
Prior Adverse Experience of CC	.10***	.39***	.32***	.01	.29***	-.28***	.13***
Prior Adverse Exper-ience of Disasters	-.08***	.04	.02	.07**	.02	-.09***	.10***
Indirect Exposure	-.01	.30***	.23***	.02	.37***	-.24***	.27***
Connection to Nature	-.02	.34***	.32***	.06***	.32***	-.29***	.32***
Trust	.14***	.48***	.54***	-.03	.42***	-.28***	.11***
Objective Knowledge	.10***	.49***	.46***	.04*	.31***	-.39***	.14***
'Green' Self-Identity	.03*	.49***	.43***	.08***	.43***	-.38***	.28***
Belief in CC	.17***	.63***	.58***	-.02	.43***	-.47***	.16***
CC Concern	.21***	.71***	.67***	.02	.55***	-.46***	.19***
Risk Perception	.27***	.60***	.54***	-.03	.51***	-.33***	.21***
Distress	.25***	.57***	.54***	-.11***	.62***	-.27***	.21***
Self-Efficacy	.10***	.62***	.63***	.10***	.53***	-.38***	.24***
Felt Responsibility to Act	.12***	.64***	.61***	.08***	.53***	-.42***	.21***
Psychological Adaptation	.11***	.59***	.53***	-.01	.61***	-.40***	.34***
Behaviour	.07***	.48***	.41***	.08***	.41***	-.36***	.15***
Variables measured in 2011 only							
Neuroticism	-	.10***	.09***	-.11***	.17***	.07***	-.07***
Normative Influence		-	.55**	.09***	.50***	-.48***	.21***
Collective Efficacy			-	.09***	.41***	-.36***	.20***
Fatalism/ Pessimism				-	-.06***	-.24***	-.01
Help-Seeking Coping					-	-.15***	.42***
Deny Coping						-	-.03*
Positive Reframe Coping							-

[a] All variables listed in this column, except Indirect exposure and Behaviour, are measured using the same items and scoring as in 2010. See Appendix E and F for further information.

Note: $p < .05$, ** $p < .01$, *** $p < .001$.

APPENDIX H: MEASURES

Behaviour was measured in 2010 using a list of 15 carbon-reducing behaviors and actions. The behavioural inventory was adapted from a similar listing of behaviours engaged in by survey respondents in North America, based on the work of Jon Krosnick, at Stanford University and the Woods Institute for the Environment, and the ABC News polls (Krosnick, 2008). Respondents were asked to tick any of the 15 actions that applied, or they could indicate doing 'nothing' or 'other'. Although the same items were used in 2011, the response format was changed to a 4-point scale. Response options were: "no, I am not engaging in this behaviour, because of no opportunity to do so" (1), or "for some other reason" (2); or they could answer, "yes, I am engaging, not because of climate change at all" (3), or, "partly because of climate change" (4). The score for 2011 is made up of the sum of the behaviours that people are engaging in *partly because of climate change* (possible range 0 – 16). Higher scores indicate greater behavioural engagement in carbon reducing actions.

Belief in, or acceptance of, climate change was measured using four items which related to the world's changing climate, causal attribution (e.g., human activity, natural causes), certainty, and immediacy of climate change impacts. Scores were summed, with a possible range of 4 - 20. The same measure was used in 2010. Higher scores indicated a greater acceptance of anthropogenic climate change. This scale had a Cronbach's alpha of .87, similar to that found in 2010 ($\alpha = .85$).

Climate change normative influence was measured in 2011 with six items, three of which were modified from Tikir and Lehmann (2011), with the remaining items developed by Graham Bradley and the School of Applied Psychology, Griffith University. The scale included items such as, "My friends take positive steps to reduce their contributions to climate change". Participants were asked to rate their agreement on a 6-point Likert scale ranging from 1 *strongly disagree* to 6 *strongly agree*. Three of the items were reverse scored. Scores were summed (possible range 6 - 36) with higher scores indicating greater perceived normative social influence on the topic of climate change. The measure achieved a Cronbach's alpha of .87.

Climate change concern was measured with seven items relating to general levels of concern, as well as more specific concerns as to the consequences of climate change. The measure also included items relating to concern and perceived seriousness of the problem at a local and global level, as well as at personal and societal levels. The scale contained items such as, "Considering any potential effects of climate change that might affect you personally, how concerned, if at all, are you about climate change?" The same measure was used in 2010. Scores were summed (possible range 7 - 32), with higher scores indicating greater levels of concern. The scale achieved a Cronbach's alpha of .95 in both 2010 and 2011.

Connection to the environment was measured with six items adapted from Mayer and Frantz's (2004), and Gosling and William's (2010) connectedness to nature scale. The scale was designed to measure the extent to which participants feel part of the natural world and

included items such as, “I often feel close to the natural world around me”. Participants were asked to rate their agreement on a 6-point Likert scale ranging from 1 *strongly disagree* to 6 *strongly agree*. Scores were summed (possible range = 6 - 36) with higher scores indicating a stronger orientation towards a connection to the natural environment. The measure achieved a Cronbach’s alpha of $\alpha = .93$, similar to that found in 2010 ($\alpha = .94$).

Control was measured using 10 items developed by Joseph Reser and the research team based at Griffith University. Responses to the items were factor analysed with four items eliminated. Two factors were found and labeled *pessimism* and *collective efficacy*. Both factors included three items. The subscale pessimism included items such as, “Greenhouse gas concentrations have now gone past the tipping point and there is very little that can be done to protect human communities from the impacts of climate change”. Collective efficacy contained items such as, “While human technologies may have contributed to the current climate change problem, scientific knowledge provides a reasonable prospect for correcting this human carbon footprint”. Responses were on Likert scale, ranging from 1 *strongly disagree* to 6 *strongly agree.* Scores were summed (3 – 18), with higher scores indicating a greater level pessimism and self-efficacy respectively. Cronbach’s alphas were .73 for pessimism and .76 for collective efficacy.

Coping with climate change was measured with 16 items adapted from Duhachek’s (2005) multidimensional coping scale. The original measure included eight dimensions of coping: action, rational thinking, emotional support, instrumental support, emotional venting, avoidance, positive thinking, and denial. Duhachek reported an overall three-factor model consisting of active coping, expressive support seeking and avoidance. Participants in the current study were asked to think about how they were responding to and dealing with the prospect of climate change, and what strategies they were relying on, such as, “Pretend that climate change is not happening”, or “Focus on the positive aspects of the problem”. Respondents rated their agreement on a 6-point Likert scale ranging from 1 *strongly disagree* to 6 *strongly agree*. A factor analysis was conducted with seven items eliminated. The final three factors included three items each. These were were labeled, help seeking (possible range 3 - 18), positive reframing (possible range 3 - 18), and deny (possible range 3 - 18). Higher scores indicated a greater level use of each coping strategy. The scales achieved Cronbach’s alphas of .79, .72, and .71, respectively.

Distress in the context of climate change was previously measured in 2010 with a seven item scale designed by the research team. An additional five items were included in the 2011 survey, however, due to the comparative nature of this report, only the original seven items were used in the composite scale described in this report. The scale contained items such as, “It upsets me that there seems to be so little that I can do to address environmental problems such as climate change”. Participants were asked to rate their extent of agreement with each of the statements on a 6-point Likert scale, from 1 *strongly disagree* to 6 *strongly agree*. The items were designed to be particularly sensitive to subclinical levels of distress at the prospect and implications of global climate change. Scores were summed (possible range = 7 - 42), with higher scores indicating greater experienced distress. This scale achieved a Cronbach’s alpha of .93 in both 2010 and 2011.

Green identity was measured using three items developed by the team at Cardiff University (Spence, Venables, Pideon, Poortinga, & Demski, 2010: Whitmarsh & O'Neill, 2010). The 2011 scale was identical to the measure used in 2010. The scale contained items such as, "I identify with the aims of environmental groups such as Greenpeace and Friends of the Earth". Participants were asked to rate their agreement on a 5-point Likert scale, from 1 *strongly disagree* to 5 *strongly agree*. The response options also included, 'no opinion' and 'don't know', with the latter two categories re-coded to the mid-point before scores were summed (possible range = 3 - 15). Higher scores indicated a greater perceived pro-environmental self identity. The measure achieved a Cronbach's alpha of .84, similar to 2010 (α =.85).

Indirect exposure (*media* exposure) was measured using items developed by Graham Bradley and students from the School of Applied Psychology, Griffith University. Participants were asked to respond to the question, "How often in the past six months have you obtained information about climate change from each of the following sources". Respondents indicated either 0 = *never*, 1 = *once or twice*, or 2 = *more than twice* from a list of 13 information resources (e.g., books, information brochures, Government sources). Scores were summed (possible range 0 - 26) with higher scores indicated a greater degree of indirect exposure to information about climate change. The measure achieved a Cronbach's alpha of .88. This measure was not included in 2010; therefore a direct comparison cannot be made.

Motivation (*perceived responsibility and willingness to act*). Motivation towards climate change was measured with three items developed and tested by Graham Bradley (author) and students from the School of Applied Psychology, Griffith University. This measure was not included in 2010. The scale included items such as, "I want to change my lifestyle in ways that help to address climate change", with one item reverse scored. Participants were asked to rate their agreement on a 6-point Likert scale ranging from 1 *strongly disagree* to 6 *strongly agree*. Scores were summed (possible range = 3 - 18) with higher scores indicating a greater willingness and motivation to act on the issue of climate change. The measure achieved a Cronbach's alpha of .85.

Neuroticism or emotional lability was measured using the 8-item neuroticism subscale, taken from The Big Five Inventory (BFI) (John & Srivastava, 1999). Four filler items were included in the survey, but were not analysed. This measure was introduced in 2011 and therefore comparable data was not collected in 2010. Participants were asked to rate their agreement or disagreement to each statement on a 5-point Likert scale from 1 *disagree strongly* to 5 *agree strongly*. The scale included items such as, "Gets nervous easily" and "Can be moody". Three of the items were reverse scored. Scores were summed (possible range 8 - 40), with higher scores indicating a greater level of neuroticism. This scale achieved a Cronbach's alpha of .85 in 2011.

Objective knowledge about climate change was measured with ten items adapted from Sundblad et al., (2007, 2009) and Joseph Reser from Griffith University. The same items were used in 2010. The scale included statements such as "Australia's average temperature

has increased by approximately 1°C from 1910 to 2002". The survey employed ten statements about the science and consequences of climate change which respondents were asked to designate as true or false, with a 'don't know' option in each case. Knowledge scores were obtained by assigning a value of +1 to correct answers, -1 to incorrect answers (to penalize indiscriminant guessing), and zero to non-committal ("don't know") answers, and summing these to produce a final score with a potential range of -10 to 10.

Perceived control of climate change was measured with ten items developed by Joseph Reser and the research team and introduced in the 2011 data collection. The scale contained items such as, "The impacts of climate change are inevitable now so there's not much point trying to do anything about it". Participants were asked to rate their agreement on a 6-point Likert scale ranging from 1 *strongly disagree* to 6 *strongly agree*, with five items reverse coded. Scores were summed (possible range = 10 - 60) with higher scores indicate a stronger sense of perceived control over climate change. The measure achieved a Cronbach's alpha of .81.

Psychological adaptation in the context of climate change was first measured in 2010 with eight items developed by Joseph Reser and the research team. In this comparative study, the final measure included seven of the items used in 2010. Additional items were included in 2011, although they were not analysed or discussed in the context of this report. The scale contained items such as, "I tend to think differently these days about what is acceptable and sustainable and not acceptable with respect to consumer products and packaging, and consumption in general". Participants were asked to rate their extent of agreement to items on a 6-point Likert scale from 1 *strongly disagree/not at all* to 6 *strongly agree/a great deal*. Scores were summed (possible range 7 - 42), with higher scores indicating a greater level of psychological adaptation. The scale achieved a Cronbach's alpha of .85 in .2011 and .87 in 2010.

Residential exposure/vulnerability was measured using a three item measure developed by the research team in 2010. On two items, participants were asked to rate how vulnerable their own residential region is to natural disasters and how vulnerable it is to the impacts of climate change using a 6-point Likert scale from 1 *not vulnerable* to 6 *very vulnerable*. On the third item respondents were asked to indicate how close they live to areas frequently affected by extreme weather events or natural disasters, which was measured using a 5-point Likert scale 1 (0 – 25 kms) to 5 (over 250 kms). Scores were summed (possible range 3 - 17), with higher scores reflecting a greater vulnerability and exposure to natural disasters and the impacts of climate change. This scale achieved a Cronbach's alpha of .66 in 2010 and .64 in 2011, an acceptable level of reliability for a 3-item scale.

Responsibility and willingness to act was measured using a four item measure developed by Cardiff University. The scale included items such as, "I feel a sense of urgency to change my behaviour to help to reduce climate change". Participants were asked to rate their agreement or disagreement to each statement on a 5-point Likert scale from 1 *strongly disagree* to 5 *strongly agree*. The response options also included, '*no opinion*' and '*don't know*', with the latter two categories recoded to the scale mid-point before scores were

summed (possible range 4 - 20). Higher scores indicated a greater level of felt responsibility and willingness to act to help tackle climate change. The scale had a Cronbach's alpha of .82 in 2010, similar to the .84 figure found in 2011.

Risk perception was measured using a five item scale adapted from Kellstedt et al.'s (2008) Climate Change Risk Perception Scale. The original scale contained six items; however, one of the items was excluded as it detracted from scale reliability. The same items from 2010 were used in 2011. Respondents were asked to indicate their level of agreement to the threat of climate change from a health, financial and environmental welfare perspective. For example, items included: "Climate change will have a noticeably negative impact on the environment in which my family and I live". Participants were asked to rate their agreement on a 6-point Likert scale ranging from 1 *strongly disagree/no risk* to 6 *strongly agree/high risk*. Scores were summed (possible range 5- 30), with higher scores indicating greater levels of perceived risk. This scale had a Cronbach's alpha of .90 in 2010 and .89 in 2011.

Self-efficacy was measured with a five item scale specific to climate change. Respondents were asked to indicate their extent of agreement with a number of statements, which included two items from Kellstedt et al.'s personal efficacy for global warming scale (Kellstedt et al., 2008), and three items developed by Cardiff and Griffith University. The scale included items such as, "My actions to reduce the effects of climate change in my community will encourage others to reduce the effects of global warming through their own actions", which was measured on a 6-point Likert scale from 1 *strongly disagree* to 6 *strongly agree*, and, "I can personally help to reduce climate change by changing my behaviour", which was rated on a 5-point Likert scale from 1 *strongly disagree* to 5 *strongly agree*. The response options for two of the items included, '*no opinion'* and '*don't know*', with the latter two categories recoded to the scale mid-point before scores were summed (possible range 5 - 28). Higher scores indicated a greater level of personal self-efficacy towards climate change. Cronbach's alpha was .89 in 2010, and .90 in 2011.

Traumatic exposure severity to natural disasters was measured with an eight item measure. Five of the items were adapted from Elal and Slade's (2005) Traumatic Exposure Severity Scale (TESS), with the additional items compiled by the research team. Respondents were asked to provide information based on the most personally significant extreme weather or natural disaster situation they had experienced. The scale included items such as, "Was a member of your family, or someone close to you, physically impacted by the disaster" (e.g., physically injured, trapped, cut-off from others for a period of time). Respondents were asked to indicate 1 (*yes*) or 0 (*no*) to six of the items, and to rate their agreement on a 6-point Likert scale to the remaining two items from 1 *no damage/no stress* to 6 *considerable damage/considerable stress*. Scores were summed (possible range 2 – 18), with higher scores indicating a greater severity and exposure to the extreme weather or natural disaster event.

Trust was measured using a four item scale, which was based on previous research (ABC News, 2007; Spence et al., 2010). The scale included items such as, "How much do you trust what different sources say about the environment", with respondents rating their

agreement on a 6-point scale ranging from 1 *not at all* to 6 *completely*. Respondents were also asked rate their agreement on a 5-point scale ranging from 1 *strongly disagree* to 5 *strongly agree* to the item, "I trust the Australian Government to take appropriate action against climate change". Scores were summed (possible range 4 - 23), with higher scores indicating a greater level of trust. Cronbach's alpha in 2010 was .73, and .77 in 2011, indicating a reliable measure.

APPENDIX I: COMPARING CAUSAL ATTRIBUTIONS AND BELIEFS

Item	Griffith University AU 2010 N = 3096 2011 N = 4347	CSIRO AU 2010 N = 5036 2011 N = 2522	Newspoll AU 2010 N = 1200 2011 N = 1201	Ipsos Eureka AU 2010 N = 1050	Cardiff University UK 2010 N = 1822	Krosnick U.S. 2010 N = 1000	Leiserowitz U.S. 2010 N = 2030 2011 N = 1000
Belief in climate change causes	Thinking about the causes of climate change (cc), which, if any, of the following best describes your opinion?	Given what you know, which of the following statements best describes your thoughts about climate change?	Do you personally believe that climate change is . . . ?[3]	Which best describes your opinion about the causes of climate change?	Thinking about the causes of climate change, which, if any, of the following best describes your opinion?	(Assuming it's happening) Do you think a rise in the world's temperature is being (would be) caused mostly by natural causes, or about equally by things people do and natural causes?[4]	Assuming global warming is happening, do you think it is . . .
Response options and results	CC is entirely caused by natural processes 4.9%, **6.6%** CC is mainly caused by natural processes 12.6%, **13.8%** CC is partly caused by natural, partly by human activity 45.8%, **25.2%** CC is mainly caused by human activity 27.6%, **45.8%** CC is entirely caused by human activity 4.2%, **4.1%** I think there is no such thing as cc 2.7%, **4.2%** Don't know 1.9%, **1.5%** No opinion 0.4%, **0.8%**	I think that cc is happening, and I think that humans are largely causing it 50.4%, **42.8%** I think that cc is happening, but it's just a natural fluctuation in Earths temperatures 40.2%, **45.3%** I have no idea whether cc is happening or not 3.8%, **4.5%** I don't think that cc is happening 5.6%, **7.4%**	Entirely caused by human activity 24%, **14%** Partly caused by human activity 70%, **58%** Or, do you believe climate change is not caused by human activity at all 5%, **5%** Uncommitted 1%, **1%**	Climate change is entirely caused by natural processes 5% Climate change is mainly caused by natural processes 9% CC is partly caused by natural processes and partly caused by human activity 41% CC is mainly caused by human activity 26% CC entirely caused by human activity 10% There is no such thing as CC 3% Don't know 5%	CC is entirely caused by natural processes 5.6% CC is mainly caused by natural processes 12.2% CC is partly caused by natural, partly by human activity 46.3% CC is mainly caused by human activity 24.3% CC is entirely caused by human activity 6.5% I think there is no such thing as cc 2.2% Don't know 2.5% No opinion 0.4%	Natural causes 25% Both equally 45% Things people do 30%	Caused mostly by natural changes in the environment 35%, **33%** Caused by both human activities and natural changes (volunteered) 6%, **6%** Caused mostly by human activities 50%, **50%** None of the above because global warming isn't happening 7%, **8%** Other 2%, **2%** Don't know 1%, **1%**

Note: The 2010 percentage figure is displayed first followed by the 2011 percentage figure.

[3] Asked only of those who believe climate change is occurring.

[4] Respondents who said that they thought the earth's temperature probably had not been increasing heard this question beginning with the phrase, "Assuming it's happening", and heard "would be" instead of "is being" (Global Warming Poll, 2010).

GLOSSARY

This research and report reflects a psychological and social science perspective in addressing public risk perceptions, understandings, and responses to the threat of climate change. There is no question but that language use and meaning issues have frustrated interdisciplinary collaborations and communication in this profoundly important area of research. We have therefore attempted to provide a working glossary for readers of this report who have only a passing familiarity with some of the language and terminology which has been used. But, to the extent possible, we have attempted to use a relatively jargon-free and reader-friendly language in the reporting and interpretation of the research findings. A particular challenge, however, has been that differing disciplines are at times using identical words and language but invoking very different levels of analysis and making very different assumptions about a number of core constructs and processes which are at the heart of much climate change science research, particularly where this involves the 'human dimensions' of global climate change. These terms and underlying constructs include climate change adaptation, mitigation, vulnerability, resilience, and other core constructs, variables, and processes. Such terms and constructs have been given particular emphasis in this glossary, hopefully allowing readers to better appreciate and understand important commonalities as well as differences in such language use and meaning as one moves from the natural and physical sciences to the social and behavioural sciences.

Acceptance: While survey items reflect the prevailing use of 'belief' in this climate change research context, *acceptance* of the reality of this current phenomenon and risk arguably better reflects and captures the cognitive and emotional processes and responses involved in public responses to climate change, and the risk representation and communication nature of most social representations of climate change (Authors).

Acute environmental hazard or disaster: Acute environmental disasters are sudden, extreme, environmental phenomena or life-changing events, such as cyclones, bushfires, or tsunamis, which occur with little or no warning and impact a large number of people (Bell, Greene, Fisher, & Baum, 2001).

Acute (environmental) stress: An immediate state of arousal during which a person feels that he or she does not have the resources available to meet the environmental demands placed upon him or her (APA, 2009).

Adaptation (conventional climate change science context): Adaptation with respect to human systems is understood and conceptualised in very structural terms by the IPCC. "Adaptation is the adjustment in natural or human systems in response to actual or expected climate stimuli or their effects, which moderates harm or exploits beneficial opportunities" (IPCC, Parry et al., 2007, p. 27). "Adaptation strategies for human settlements, large and small, include assuring effective governance, increasing the resilience of physical and linkage infrastructures, changing settlement locations over a period of time, changing settlement form, reducing heat-island effects, reducing emissions and industry effluents as well as improving water handling, providing financial mechanisms for increasing resiliency,

targeting assistance programmes for especially impacted segments of the population, and adopting sustainable community development practices" (IPCC, Parry et al., 2007, p. 381). "Adaptation in the context of human dimensions of global change usually refers to a process, action or outcome in a system (household, community, group, sector, region, country) in order for the system to better cope with, manage or adjust to some changing condition, stress, hazard, risk, or opportunity" (Smit & Wandel, 2006, p. 282).

Adaptation (psychological): Psychological adaptation in the context of climate change refers to those within individual adjustments and changes in risk perception, threat appraisal, and associated cognitive, emotional, and motivational responses to the threat and perceived physical environmental impacts of climate change, as well as to altered behavioural responses and engagements associated with such changed thinking, feeling, and motivational responses. Psychological adaptation also and necessarily refers to those underlying psychological processes mediating and moderating such individual change (e.g., emotion management, self perception, self-efficacy, protection motivation, coping strategies), as well as to the achieved state of relative balance with respect to own needs and environmental press or threat. Psychological adaptation in the context of climate change can also encompass community and societal changes in how the phenomenon and threat of climate change is perceived, understood, and responded to in terms of shared understandings and collective behaviour change and adjustment, and the respective sense-making social psychological processes involved such as social comparison, social construction, social representation, and the social amplification of risk (Reser, Bradley, & Ellul, 2012).

Adaptive capacity: "The ability of a system to adjust to climate change (including climate variability and extremes) to moderate potential damages, to take advantage of opportunities, or to cope with the consequences" (IPCC, 2007, p. 869).

Adaptive capacity (psychological): Having the ability and resources (psychological, social, community, economic, etc.) to adjust to, adapt to, and cope with the impacts of climate change (APA, 2009).

Adjustment: Changing one's situation or life circumstances to achieve a desired outcome in relation to one's perception of threats and changing circumstances, particularly through direct action and/or alteration of one's immediate environment. Often adjustment is contrasted with adaptation, with the former emphasizing external changes and the latter emphasizing internal responses (APA, 2009).

Anticipatory coping: See 'proactive coping'.

Anthropogenic: Made by people or resulting from human activities. Usually used in the context of emissions that are produced as a result of human activities (APA, 2009). See 'forcing'.

Appraisal: Within psychology appraisal refers to subjective sense making and evaluation by an individual or group of individuals, of a situation, threat, or response options. *Threat appraisal* is, for example a core construct and process in stress and coping models in

personality and social psychology and *environmental risk appraisal* is a core process in environmental psychology. This latter phrase and construct differs from *environmental risk assessment* which is a more formal and systematic process undertaken by experts (e.g., Gifford, 2007).

Attitude: A general and enduring positive or negative feeling and evaluation about some person, object, or thing, often including a motivational disposition (Bohner & Dickel, 2011; Petty & Cacioppo, 1981).

Attribution: "Ascription of an effect to a cause" (Oxford English Dictionary, 2002).

Attribution theories: Theoretical approaches concerning individuals' explanations for why an event occurred and/or who was responsible for causing it. These theories examine the kinds of information people use to determine causality, the kinds of causes they distinguish, and the rules and psychological processes that lead from information to inferred cause. (APA, 2009)

Behavioural engagement: Behavioural involvement in an activity or course of action, as distinct from a motivation or intention to take a particular action (Authors).

Belief: "Trust, confidence, faith; mental acceptance of a statement, fact, doctrine, thing, etc., as true or existing; the thing believed; a proposition or set of propositions held to be true" (Oxford English Dictionary, 2002).

Beliefs: "As used by social psychologists, beliefs represent people's information about themselves and about their social and non-social environment. A belief associates an object with a certain attribute. Beliefs are formed as a result of direct experience, on the basis of second-hand information received from various sources, and by means of logical or quasi-logical inference from other information about the object" (Ajzen, 1996, p. 89). Beliefs are typically understood as more fundamental and important working perceptions and assumptions about the nature of the world and its phenomena than are opinions or attitudes (Authors).

Chronic (environmental) stress: Chronic stress is a long lasting state of arousal during which a person typically feels that he or she doesn't have the resources available to meet all of the demands placed upon him or her (APA, 2009).

Chronic environmental stressor: Continuous stressful events or prolonged and adverse environmental conditions such as drought or a contaminated housing estate or mining region are viewed as chronic or ongoing stressors and are not event-specific. Ambient stressors are a type of chronic stressor particularly characteristic of environmental stressors. Ambient stressors can represent regional conditions of the environment, such as pollution or toxicity, that affect a large number of people but that may not be considered acute because they approximate low level background noise and may go unnoticed either because they are subtle or because people habituate to them (e.g. Adeola, 2000; Edelstein, 2002). Climate change can be understood as an ongoing environmental stressor encompassing periodic acute stressor events (Reser & Swim, 2011).

Climate: The mean and variability of, for instance, temperature, precipitation, cloud cover, and wind or broadly the state of the atmosphere (gaseous envelope surrounding the earth), hydrosphere (water on the surface of the earth), cryosphere (snow, ice, and permafrost on and beneath the surface of the earth and ocean), land surface, and biosphere (ecosystems and organisms living in the atmosphere, land, and oceans) (APA, 2009).

Climate change: In IPCC current usage climate change refers to any change in climate over time, whether due to natural variability or as a result of human activity. This usage differs from that in the Framework Convention on Climate Change, where *climate change* refers to a change of climate that is attributed directly or indirectly to human activity that is in addition to natural climate variability observed over comparable time periods (IPCC, 2012).

Climate change concern: Dictionary definitions of concern or 'being concerned' make reference to descriptors such as being interested, involved, troubled, and anxious (e.g., OED). In a psychological context and with respect to the threat of climate change, concern relates to the cognitive and emotional accompaniments of climate change threat exposure and appraisal, such as moderate preoccupation, and ongoing worry and anxiety (Authors).

Climate change distress: Climate change distress is defined for the purpose of this research as experienced apprehension, anxiety, sorrow, or loss due to the threat and projected consequences of climate change, for oneself, humanity, and/or the natural world. Such distress might well take the form of preoccupation, heightened worry and fear, and/or pessimism with respect to being able to adequately address this seemingly profound environmental and social problem and issue (Authors).

'Climate change', 'global climate change' (social science): The shared risk perceptions and understandings that people have of what 'climate change' is, including both the threatening changes in global climatic patterns and diverse impacts, the consequences of such changes, and other implications for known natural and human environments, as represented and communicated by multimedia, through interpersonal communications, and through direct experience (Authors).

Collective coping: Social-based coping strategies such as community responses to deal with the experience or prospect of drought (APA, 2009).

Collective efficacy: A collective's or group's perception of its ability and capacity to meet environmental demands (APA, 2009).

Connectedness to nature: A sense of personal emotional bond with the natural environment (APA, 2009).

Coping: "Coping is a process integral to adaptation and development. Coping is often defined as 'constantly changing cognitive and behavioral efforts to manage specific external and/or internal demands that are appraised as taxing or exceeding the resources of the person' (Lazarus & Folkman, 1984, p. 141). Closely related terms include stress, stressor, stressful life events, defense, challenge, threat, adversity, risk, resilience, mastery, vulnerability, thriving, hardiness, and social support" (Skinner, 2001, p. 2761).

Coping appraisals: Appraising or evaluating the coping responses one might make to the stressor in terms of, for example, self-efficacy, the ability to carry out the coping response, or response efficacy, the likelihood that the response will have the desired outcome (APA, 2009).

Coping responses: Behaviours, cognitions, and regulatory mechanisms that a person uses to respond to a stressor. Coping responses may be aimed at managing and resolving a stressor or at ameliorating its negative emotional or bodily effects, for example by re-appraising the significance or personal relevance of a threat or by confronting the perceived cause of the problem (APA, 2009).

Coping resources: Properties of individuals (e.g., self-efficacy), their social environment (e.g., social support), and physical environment (e.g., privacy affordances) that enable individuals and communities to respond to stressors (Authors).

Distancing, discounting: The tendency to reduce the importance of a threat or outcome with greater perceived 'distance' (temporally, socially, geographically, and probabilistically) (APA, 2009).

Dread risk: A particular type of risk associated with "perceived lack of control, dread, catastrophic potential, fatal consequences, and the inequitable distribution of risks and benefits." (Slovic, 1987) This perceived characteristic of risk domains, such as nuclear radiation and technological hazards, is thought to constitute a fundamental dimension in human perception of and response to various risk domains.

Environmental hazards, disasters: "Environmental hazards are defined as extreme events or substances in the earth and its ecological system that may cause adverse effects to humans and things they value. Environmental hazards include geophysical and meteorological phenomena such as earthquakes, droughts, and hurricanes, often called 'natural hazards', as well as pollution problems and other 'technological' hazards. Most scholars agree that an event does not become a hazard until humans are exposed to it, and thus that hazards result from the interaction of humans and extreme events" (Liverman, 2001, p. 4656).

Environmental hyperopia: A now well-documented form of far-sightedness with respect to environmental risk and environmental problems, with many people perceiving environmental problems to be more serious at a distant and global level. Unfortunately this inverse distance effect is paralleled by an inverse relationship between felt responsibility and self-efficacy on the one hand and distance, with distant and global problems tending to be viewed as the responsibility of others and not something which an individual can do much about in their own local region or country (Uzzell, 2000). Global climate change is arguably a classic instance of such environmental hyperopia, with the magnitude of the problem acknowledged at a global level but with this perceived risk minimized at a local level.

Environmental impacts (geophysical and biophysical): The expression 'environmental impacts' while encompassing the projected or actual consequences of interventions, human uses, or naturally occurring events for both natural and human environments, tends to be used

primarily in the context of direct or indirect causal impacts on natural environments. When speaking of global climate change, what is often being referred to are the projected or unfolding geophysical and biophysical environmental impacts of changing climate patterns (Authors).

Environmental impacts (human settings): The physical environment also encompasses human made and designed 'built environments' or 'human settings' including all human modified physical environments. The projected impacts of global climate change will undoubtedly have dramatic impacts on human settlements and infrastructure throughout much of the world (Authors).

Environmental impacts (psychosocial): Psychosocial impacts refer to the consequences of an introduced intervention or natural change in an environmental system or setting, which is being experienced at individual, institutional, or community levels. Such impacts can be primary (first-hand) and immediate in terms of direct local weather related encounters and experiences, or secondary, in terms of longer term impacts resulting from and mediated by climate-driven changes in regional geophysical or biophysical environments and ecosystems, such as altered growing seasons or water scarcity. What differentiates psychological impacts from conventional social impacts is that these impacts are individual level, experience-based consequences and emotional responses such as pessimism or optimism, psychological mediated conditions such as panic attacks or subjective well being, as well as a spectrum of experiential states ranging from concern, to enthusiasm, to vigilance, to enjoyment, to enhanced appreciation or understanding (Reser & Bentruperbäumer, 2001).

Environmental psychology: The study of the transactions between individuals and their physical settings. In these transactions, individuals change their environments, and their behavior and experiences are changed by their environments. Environmental psychology includes theory, research, and practice aimed at making the built environment more humane and better understanding and improving our relationship with the natural environment (Gifford, 2007; Gifford, Steg & Reser, 2010).

Environmental risk: "The product of a hazard and the likelihood of it occurring, using a simple formula that defines a risk as the product of the probability an event and its severity measured in terms of the population exposed, and the nature of the consequences" (Liverman, 2001, p. 4656).

Environmental significance: A shortened reference to environmentally significant behaviour (below). From a psychological perspective, 'environmental significance' typically refers to perceived or judged consequences for the natural environment.

Environmentally significant behaviour (ESB): Environmentally significant behaviour is an expression used to identify and distinguish those individual behaviours and actions that can make a substantive difference in terms of reducing adverse human impacts on the natural environment (e.g., Gardner & Stern, 2002, 2008).

Environmental stress: Adverse individual and community impacts as a result of both acute and chronic environmental stressors, including multiple and interacting stressors in the extended environment (e.g., noise, crowding, traffic congestion, pollution, contamination, natural and technological disaster events, and environmental threat) (APA, 2009).

Environmental stressor: In the context of human considerations and psychology an environmental stressor refers to any force or event in the human or natural environment that may cause a person to experience stress. Some examples of environmental stressors include: noise, air pollution, crowding, traffic congestion, terrorism, natural disasters and extremes of temperature. Studies on the effect of different environmental stressors on people indicate that they can impact people's behavior, mood, cognitive function, physical health and/or psychological well-being (Authors).

Exposure: The condition of being exposed to or vulnerable to risks, especially to severe weather or other forces of nature (Authors). "The presence of people; livelihoods; environmental services and resources; infrastructure; or economic, social, or cultural assets in places that could be adversely affected."(IPCC, 2012, p. 3)

Extreme weather events: "Extreme weather events are meteorological, hydrological, climatological, or related incidents that cause widespread damage, either in terms of human lives, property damage, or both. These events range in effect and scope. Some examples of extreme events can be listed as winter weather, heat waves, floods, drought, dust storms, wildfires, tropical cyclones, hurricanes, and tornadoes. These events are relatively commonly occurring events. What makes them extreme is the severity of their impact" (Simpson, Weissbecker & Sephton, 2011, p. 58)

Forcing: Any imposed mechanism that forces climate to change. Natural forcing of climate change results from volcanic eruptions and solar variability; human-made or anthropogenic forcing of climate change comes from behaviours that influence the emissions of greenhouse gases (APA, 2009).

Global warming: Literally one of the more salient and consequential impacts and mediating processes of current global climate change, but used by many, particularly in North America, as a synonymous expression for global climate change (APA, 2009).

Habituation: A decrease in response to repeated stimulation. Response decrements due to altered sensitivity of receptors are often termed receptor adaptation (APA, 2009).

Human dimensions of global change: The common name for a number of international organisations which have a shared research focus on the human impacts *on* and *of* changing natural and human environments across the world. These include the International Human Dimension Programme on Global Environmental Change (IHDP) established by the International Council for Science in 1996, and the Board on Environmental Change and Society: Division of Behavioral and Social Science and Education within The National Academies. These umbrella organisations and others have fostered research and policy

initiatives addressing human aspects of global climate change for well over the past two decades (Authors).

Hybrid disaster: A hybrid disaster is a disaster which is characterized by characteristics of both natural and technological disasters and typically the result of both natural and human causes. A hybrid disaster can occur when a natural disaster results in greater damages as a result of human causes or when a technological disaster results in greater impacts as a result of an accompanying natural event or process, as in the case of Fukushima. Some phenomena and risk domains appear to have both natural and human causal elements, as in the case of contemporary climate change, considered by many to be a global disaster.

Intergovernmental Panel on Climate Change (IPCC): The main international body established in 1988 by the World Meteorological Organization and the United Nations Environment Program to assess climate change science and provide advice to the international community. The IPCC is an international group of scientists who summarize the current understanding of climate change and predict how climate may evolve. The purpose of the IPCC reports is to give policy makers and other interested parties an in-depth, authoritative view of the state of scientific knowledge about climate change, making possible more-informed climate-related decisions. The IPCC does not recommend specific policies, but is restricted to describing scientific knowledge and its limitations (APA, 2009).

Knowledge: An important aspect of knowledge is coming to understand, and the fact of understanding, or the state of being aware and informed of something (Oxford English Dictionary, 2002). Knowledge is more than the content of what is known, and more than what can be accessed or communicated. While a particular aspect of knowledge, such as understanding a particular branch of learning, or public understanding of science, is often emphasised in discussions of climate change knowledge, knowledge of climate change can constitute or include important aspects of experiential learning, tacit knowledge, emotional knowledge, symbolic associations, and cultural knowledge. Public knowledge and understandings of 'climate change' can incorporate, but may be very different from knowledge of climate change science, or climate change science accounts and explanations of climate change (Routledge, 2000).

Meaning making: "A coping strategy that involves trying to see the positive or meaningful aspects of the stressful situation, especially with severe or chronic stressors. It is sometimes referred to as cognitive reappraisal" (Aldwin & Yancura, 2004, p. 507).

Mitigation: With regard to climate change, any human action that reduces the sources of or enhances the sinks of greenhouse gases. Emissions can be decreased by a variety of means such as lowering energy demands, making existing energy systems more efficient, increasing the contribution of renewable forms of energy production, and afforestation or stopping deforestation (APA, 2009).

Primary appraisal: Individual judgments of the degree of threat, harm, or challenge represented by the potentially stressful event (Lazarus & Folkman, 1984; Taylor & Aspinwall, 1996, p. 79).

Proactive coping: "The process of proactive coping involves anticipating and/or detecting potential stressors and acting in advance either to prevent them altogether or to mute their impact. As such, proactive coping blends activities typically considered to be *coping* (activities undertaken to master, reduce or tolerate environmental or intrapsychic demands perceived as representing potential threat, existing harm, or loss) with those considered to be self-regulation (the processes through which people control, direct, and correct their own actions as they move toward or away from various goals). Proactive coping combines these two processes by examining people's emotions, thoughts, and behaviours as they anticipate and address potential sources of adversity that might interfere with the pursuit of their goals" Aspinwall, 2011, p. 334-335).

Protection motivation: Protection motivation is an umbrella term for a number of psychological processes and convergent theoretical formulations that address how psychological responses to threat and risk tend to serve protective or defensive functions. Protection motivation theories give particular attention to threat appraisal and coping appraisal, i.e., to ascertaining how severe or likely a threat is, and to what can be done about it, with what prospect of success. Protection motivation is the result of the threat appraisal and the coping appraisal. The theory argues that people are highly motivated to appraise threats, and what can or cannot be done, in functional and self-serving ways that allow individuals to manage anxiety, uncertainty, and fear, whether or not such responses are ultimately adaptive or maladaptive. Protection motivation approaches are in many ways similar to and draw from both psychodynamic and more cognitive stress and coping and self regulation approaches in psychology, and they have recently been used to address human responses and adaptations to the threat of climate change (Authors).

Psychological adaptation: Psychological adaptation in the context of climate change refers to those within individual adjustments and changes in risk perception, threat appraisal, and associated cognitive, emotional, and motivational responses to the threat and perceived physical environmental impacts of climate change, as well as to altered behavioural responses and engagements associated with such changed thinking, feeling, and motivational responses. Psychological adaptation also and necessarily refers to those underlying psychological processes mediating and moderating such individual change (e.g., emotion management, self perception, self-efficacy, protection motivation, coping strategies), as well as to the achieved state of relative balance [equilibrium, congruence] with respect to own needs and environmental press and/or threat. Psychological adaptation in the context of climate change can also encompass community and societal changes in how the phenomenon and threat of climate change is perceived, understood, and responded to in terms of shared understandings and collective behaviour change and adjustment, and the respective sense-making social psychological processes involved such as social construction, social representation, and the social amplification of risk (Reser et al., 2012).

Psychological vulnerability: Psychological vulnerability relates to one's subjective experience of being exposed to or susceptible to particular risks or dangers, and hence can be closely interconnected with risk perception and threat appraisal. Psychological vulnerability

can also refer to one's lack of defences or resilience to environmental stressors and susceptibility to adverse psychological impacts (Authors).

Psychosocial impacts: The psychological and social consequences of an introduced intervention or natural change in the environment. Psychosocial impacts occur at the level of individual or shared experience (e.g., of households or community) and entail consequences such as distress or anxiety, heightened environmental concerns, and optimism or pessimism about the future (APA, 2009).

Psychosocial environmental impact assessment (PSIA): Psychosocial impact assessment is a more inclusive framing and formal evaluation of how proposed interventions potentially affecting biophysical environments, human-designed environments, and social environments impact on people and individual and community experience and behaviour (Reser & Bentrupperbäumer, 2001; 2005).

Psychological preparedness: Psychological preparedness is a psychological state of awareness, anticipation, and heightened vigilance, and readiness - an internal, primed, capacity to anticipate, identify and manage the requirements of an emergency situation and one's own psychological response and those of others in an emergency situation (Reser & Morrissey, 2008).

Public understandings: Public understandings are lay understandings, explanations, and causal accounts of particular risks, events, phenomena, or wider societal or environmental changes. Public understandings encompass more than opinions, attitudes or specific knowledge and include shared beliefs, values, cultural assumptions, and symbolic associations and meanings (Authors).

Resilience (Psychological): Individual, collective, or group patterns of successful adaptation (in the context of significant risk or adversity.) Enduring the temporary upheaval of loss or potentially traumatic events well, with no apparent disruption in ability to function, and moving on to new challenges with apparent ease. Resilience typically arises from the operation of common human adaptation processes rather than from rare or extraordinary processes (APA, 2009).

Resilience (Climate change, disaster context): Within the climate change science and non-psychological disaster preparedness and response literatures, resilience is a system attribute, typically with no reference made to psychological considerations or individual level analysis, although at times used in the context of social systems. "The ability of a system and its component parts to anticipate, absorb, accommodate, or recover from the effects of a hazardous event in a timely and efficient manner, including through ensuring the preservation, restoration, or improvement of its essential basic structures and functions." (IPCC, 2012, p. 3). "Resilience is the ability of a social system to respond and recover from disasters and includes those inherent conditions that allow the system to absorb impacts and cope with an event, as well as post event adaptive processes that facilitate the ability of the social system to re-organize, change, and learn in response to a threat" (Cutter et al., 2008, p. 599).

Risk: A situation or event in which something of human value (including human lives, social stability, and well being) has been put at stake and where the outcome is uncertain (APA, 2009).

Risk appraisal: Individual or public subjective evaluations of the magnitude, probability, or personal or household vulnerability to a perceived risk (APA, 2009).

Risk assessment: A more formal and objective assessment of risk by experts, against established criteria, to an environment, environmental attribute, or community or group of people (e.g., Gifford, 2007; O'Riordan, 1995).

Risk perception: Subjective belief (whether rational or irrational) held by an individual, group, or society about the chance of occurrence of a risk or about the extent, timing, or consequences of its effect(s) (APA, 2009). "The awareness or impression of a risk to health or the environment adopted by the public and/or media and/or pressure groups. It may or may not relate to scientific risk assessment, but it is important in influencing policy makers and regulators and hence is a driving force in risk management" (Calow, 1998, p. 644).

Secondary appraisals: Individual assessment of one's ability to manage a stressor (Taylor & Aspinwall, 1996, p. 81).

Self efficacy: "Perceived self-efficacy is concerned with people's beliefs in their capabilities to exercise control over their own functioning and over environmental events"(Bandura, 2001, p. 13820).

Sense making: Sense making is a fundamental motivational imperative in human behaviour, and of particular relevance to risk perception, threat appraisal, public understandings, and adaptation to a profound threat such as climate change. Core considerations in *making sense* of a phenomenon such as climate change relate to causal accounts or explanations, the role of human agency, world views, and what these projected environmental changes mean in terms of human and environmental consequences. Fostering public engagement with climate change requires an appreciation that the world's publics are attempting to make personal and collective sense of this complex phenomenon, threat, and set of issues, and that such sense making, and changed ways of thinking about, feeling about, and understanding climate change, are powerful aspects of psychological and social adaptation to climate change (Authors; Wagner & Hayes, 2005).

Social adaptation: Continually adjusting group or community level responses to concerns and perceptions of threats and changing circumstances. Examples include group level sense-making, adjusting explanations, responsibility attributions, meta-narratives, shared accounts, and social constructions of climate change as a risk domain (APA, 2009).

Social amplification of risk: The intensification of perceptions of risk and its management via communication processes including the way that risk signals (images, signs, symbols) are disseminated via psychological, social, institutional, or cultural processes (APA, 2009).

Social impact assessment (SIA): "SIA can be defined as the process of assessing or estimating the social consequences likely to follow specific policy actions or project development, particularly in the context of national, state or provincial government policy legislation. Social impacts include all social or cultural consequences to human populations of any public or private actions that alter how people live, work, play, relate to one another, organise to meet their needs and generally cope as members of society" (Burdge & Vanclay, 1995).

Social representation(s): "Systems of values, ideas and practices" that "enable individuals to orientate themselves in their material and social world and to master it" and "enable communication to take place amongst members of a community by providing them with a code for social exchange and a code for naming and classifying unambiguously the various aspects of their world and their individual and group history." Social representations are built on shared knowledge and understanding of common reality. In the context of climate change, social representations include media coverage, articles, books, magazines, documentary and popular culture films, research findings, collective knowledge, and public discourse about climate change and its nature, causes and consequences (APA, 2009).

Stress: A process that occurs when there is an imbalance between environmental demands and response capabilities of the organism (Evans & Cohen, 1987, p. 573; Lazarus, 1966; Lazarus & Launier, 1978).

Stressor: "Conditions of threat, demands, or structural constraints that, by the very fact of their occurrence of existence, call into question the operating integrity of the organism" (Wheaton, 1996, p. 32).

Symbolic coping: The process of appropriating the novel and unfamiliar in order to make it intelligible and communicable. This includes sense-making such as naming the novel and attributing characteristics which allow the phenomenon to be talked about. In this understanding symbolic coping is the collective activity of a group struggling to maintain the integrity of its worldview which is also crucial for social identity (APA, 2009).

Threat appraisal: Evaluating the extent to which an upcoming situation exceeds the perceptions of abilities or resources needed to cope. Threat appraisals differ from challenge appraisals where one anticipates that one has sufficient abilities and resources needed to cope and differs from harm/loss appraisals that occur after an event occurs (APA, 2009).

United Nations Framework Convention on Climate Change: An international environmental treaty set out to reduce emissions of greenhouse gases in order to combat global climate change. It was agreed upon at the Earth Summit, staged in Rio de Janeiro, Brazil, in June 1992 (APA, 2009).

Values: "Values are and represent important individual and collective investments and judgments about what in this world and in this life is truly important, worthwhile, and meaningful – indeed what 'has value' and what are 'core values' and guiding principles for human society. Values, as distinct from other beliefs and attitudes, have been conceptualised

and understood as more fundamental and enduring convictions, having strong emotional and/or moral overtones, and as providing for shared world views, social and moral orders, and ethical, justice, and legislative considerations". Values are often discussed in the context of climate change, but personal and societal environmental values are rarely distinguished from political ideologies and world views. (Reser & Bentrupperbäumer, 2005, p. 128-129; Schmuck & Schultz, 2002).

Vicarious exposure and experience: Exposure through empathy and/or identification with others who are experiencing or who have experienced extreme or tragic events, either through direct interpersonal communication and observation, or through observation of media coverage of crucial events and crises (Authors).

Virtual exposure and experience: Exposure and indirect experience through multi-media coverage of an extreme event and others' experience, and felt empathy, sympathy, or identification with victims (Authors).

Vulnerability (climate change science context): "Vulnerability is the degree to which a system is susceptible to, and unable to cope with, adverse effects of climate change, including climate variability and extremes. Vulnerability is a function of the character, magnitude and rate of climate change and the variation to which a system is exposed, its sensitivity and its adaptive capacity" (IPCC, Parry et al., 2007, p. 27).

Vulnerability (social science use and meaning): The extent to which systems and individuals are susceptible to, and unable to cope with, adverse effects of climate change. Vulnerability is a function of the characteristics of climate change impacts (e.g., its magnitude and rate of change) and variation in systems and individuals (e.g., degree of exposure to climate change impacts, individual and community adaptive capacity, and connectedness to communities) (APA, 2009).

Worldview: "An integrated set of beliefs about what is real, what is knowable, what is valuable, and what it means to be human, typically learned as part of a cultural socialization" (Clayton & Myers, 2009, p. 212).

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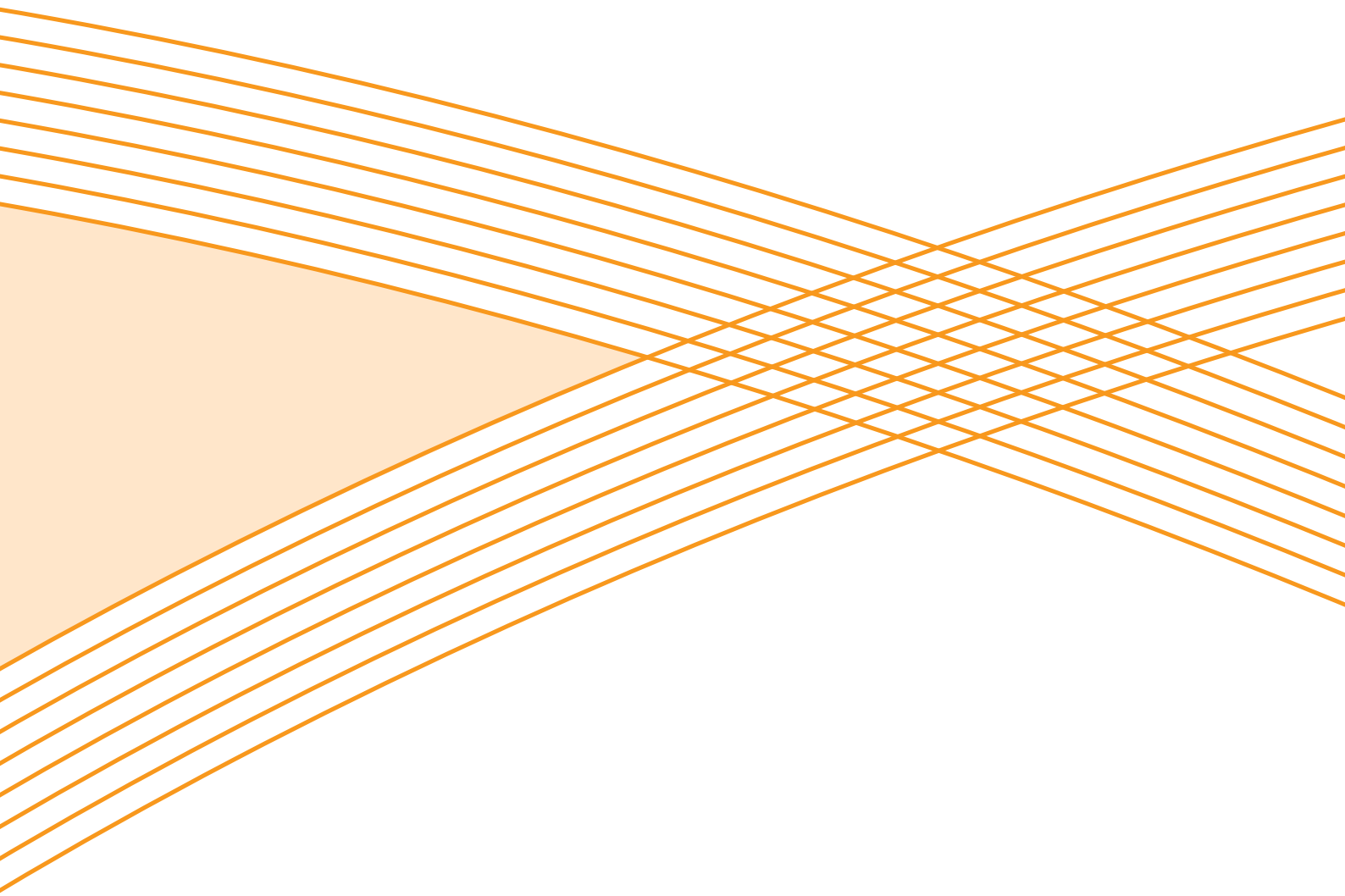

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